



CITY OF PHOENIX
AVIATION DEPARTMENT
PHX-DVT-GYR

Design Manual
October 2018

Kyle Kotchou, Deputy Aviation Director
Design and Construction Services Division

Bobbie Reid, Deputy Aviation Director
Facility Services Division

TABLE OF CONTENTS

SECTION I: POLICIES	12
Chapter 1: Introduction	12
1-1 General.....	12
1-1.1 Purpose of the Design Manual	12
1-1.2 Document Precedence	12
1-2 City of Phoenix Airports	13
1-2.1 Phoenix Sky Harbor International Airport (PHX).....	13
1-2.2 Phoenix Deer Valley (DVT)	14
1-2.3 Phoenix Goodyear Airport (GYR).....	14
Chapter 2: Airport Compatibility	15
2-1 General.....	15
2-1.1 Airport Operations	15
2-1.2 Environment.....	16
2-1.3 Architecture	16
2-1.4 Signage Standards	16
Chapter 3: Security and Safety	17
3-1 General.....	17
3-1.1 Introduction	17
3-1.2 Coordination with City’s Homeland Security Bureau.....	17
3-1.3 Security and Safety of Passengers.....	17
3-1.4 Security Boundaries	17
3-1.5 Airside Operations Area (AOA).....	18
3-1.6 Landside Operations	20
3-1.7 Life Safety and Code Standards.....	21
Chapter 4: Design & Construction Strategies for Contractors.....	22
4-1 General.....	22
4-1.1 Quality Control Plan at Outset	22
4-1.2 Alternative Configuration Analysis.....	22
4-2 Sustainable Design and Site Development	23
4-2.1 Sustainable Design and Construction Practices	23
4-2.2 Constructability Review	23
4-2.3 Maintainability and Operability	24
4-2.4 Value Engineering	24
Chapter 5: Procurement and Purchasing Practices	26
5-1 General.....	26
5-1.1 Full and Open Competition	26
5-1.2 Brand Name or Equal Requirements.....	26
5-1.3 Proprietary Specifications	26
5-2 City of Phoenix Equal Opportunity Department.....	26
5-2.1 SBE- DBE Participation	26
Chapter 6: Codes, Regulations and Standards.....	28
6-1 General.....	28
6-1.2 Accessibility	28

6-1.3 Other Considerations	32
6-1.4 Leadership in Energy and Environmental Design (LEED)	32
6-1.5 COP Aviation Department CADD Data Standards	33
6-1.6 BIM (Building Information Modeling)	34
SECTION II: PROCEDURES	35
Chapter 1: Introduction	35
1-1 Procurement of Design and Construction Services	35
1-1.2 Design-Build	35
1-2 The Airport’s Management Team	35
1-2.1 Project Management	35
1-3 Team Organization by Process.....	36
Aviation Department Organization	36
1-3.1 Project Team Organization.....	37
Chapter 2: Pre-Design Phase	38
2-1 Introduction	38
2-1.1 Project Kickoff Meeting.....	38
2-1.2 Contractor’s Project Management Services.....	39
2-1.3 Contract Negotiations	40
2-2 Project Administration	41
2-2.1 As-built Documentation	41
2-2.2 Verification of Existing Conditions	41
2-2.3 Contractor’s Invoicing and Monthly Report.....	41
2-2.4 The Program Management Information System (Unifier)	42
2-2.5 Project Documentation and Control	42
2-2.6 Contractor’s Quality Control/Quality Assurance Plan.....	42
2-2.7 Sustainable Design Requirements.....	43
2-2.8 PROJECT COST ESTIMATING.....	43
2-2.9 Building Information Model (BIM)	44
2-2.10 WORK BREAKDOWN STRUCTURE, WBS	47
2-2.11 WORK BREAKDOWN STRUCTURE, WBS	47
2-2.12 Scheduling	52
2-3 Environmental Standards and Permitting.....	52
2-3.2 Environmental/Site Assessment for Asbestos and Other Hazardous Materials.....	52
2-3.3 Sustainable Design and Construction Standards	54
2-3.4 Environmental Permitting.....	55
2-4 Air Quality Program.....	60
2-4.1 NEPA and General Air Quality Conformity.....	60
2-5 Remediation Sites	60
2-5.1 Environmental Remediation Sites	60
2-6 Signage Standards	61
2-6.1 Signage Coordination	61
2-6.2 Signage Types	61
2-6.3 Americans with Disabilities Act (ADA) Standards	61
2-6.4 Signage Permit	62
2-6.5 Other Signage Standards.....	62
2-7 Technology Requirements	62

2-7.1	Coordination with Aviation Technology Department	62
2-7.2	Technology Division Protocols	62
2-8	Federal Aviation Administration (FAA) Projects	63
2-8.1	Airport Improvement Program (AIP) Funded Projects.....	63
2-8.2	Capital Management Division	63
2-8.3	Project Coordination	64
2-8.4	Advisory Circulars.....	64
2-8.5	Project Filing.....	65
2-8.6	Additional Information.....	65
Chapter 3:	Design Phase	66
3-1	Working with the Airport Team	66
3-1.1	Airport Stakeholders	66
3-1.2	Stakeholder Identification and Participation	66
3-1.3	Airport Director’s Decisions Group	66
3-1.4	Project Technical Review Team.....	66
3-2	Programming Phase	68
3-2.1	Program Validation	68
3-2.2	Programming Report.....	69
3-3	Schematic Design Phase – 30% Submittal	70
3-3.1	Description	70
3-3.2	Sustainable Design Strategy.....	71
3-3.3	Conceptual Design Alternatives	72
3-3.4	Evaluation of Alternatives	72
3-3.5	Refinement of Schematic Design	73
3-3.6	Scheduling	73
3-3.7	Submittal Requirements	73
3-3.8	Cost Estimating.....	74
3-3.9	Permitting Requirements.....	75
3-3.10	Schematic Design Submittal Review	75
3-3.11	Unifier Requirements	76
3-4	Design Development Phase – 60% Submittal	77
3-4.1	Description	77
3-4.2	Submittal Requirements	78
3-4.3	Scheduling	79
3-4.4	Cost Estimating.....	79
3-4.5	Permitting Requirements.....	80
3-4.6	Design Development Submittal Review Facility review	80
3-4.7	Unifier Requirements	80
3-5	Construction Documents Phase – 95% Submittal.....	81
3-5.1	Description	81
3-5.2	Submittal Requirements	81
3-5.3	Scheduling	82
3-5.4	Cost Estimating.....	82
3-5.5	Construction Documents Phase – 95% Submittal Review	82
3-5.6	Permitting.....	83
3-5.7	PDD Submittals to Monitor	83

3-5.8 Unifier Requirements	83
3-6 GMP/Bid Documents – 100% Submittal	84
3-6.1 Description	84
3-6.2 100% Documents Submittal Review	84
3-6.3 Unifier Requirements	84
GMP Negotiation Phase	85
3-6.4 Description	85
3-7 Conformed Documents	85
3-7.1 Description	85
3-7.2 Conformed Documents Review	85
3-8 Pre-construction	87
Chapter 4: Construction Phase	88
SECTION III: DESIGN STANDARDS	89
Chapter 1: General Design Guidelines	89
1-1 Using the Design Standards	89
1-1.1 Organization	89
1-2 Construction Classification.....	89
1-3 Issues Related to Accessibility.....	89
1-3.1 Updating Existing Facilities.....	89
1-4 Economy of Construction, Maintainability, Operability	92
1-5 Sustainable Design	92
1-5.1 Sustainable Site Development	92
1-5.2 Green Building Design	94
1-5.3 Construction Practices	94
1-5.4 Recycling Program.....	94
1-6 Minimum Useful Building Life.....	100
1-7 Cohesive Architectural Statement	101
1-7.1 Influences of Existing Architecture	101
1-8 Quality of Passenger Experience.....	101
1-8.1 Airport Design Objectives.....	101
1-8.2 Passenger Level of Service	102
1-9 Architectural Building Zones	103
1-9.1 Facilities Space Program.....	103
1-9.2 Additional Design Criteria for Passenger Terminal Areas	103
1-10 Passenger Amenities.....	109
1-10.1 Amenities Planning.....	109
1-11 Safety and Terminal Operations	112
1-11.2 Security.....	112
1-12 Flexibility of Facilities	117
1-13 Revenue Production	117
Chapter 2: Base Building.....	118
2-1 General.....	118
2-1.1 Coordination with Related Capital Programs.....	118
2-2 Architecture	118
2-2.1 General	118
2-2.2 Codes, Regulations and Standards.....	118

2-2.3	Terms, Definitions and Acronyms	118
2-2.4	Materials of Domestic Origin and Standardized Nature	118
2-2.5	Asbestos and Lead Prohibited	119
2-2.6	Products with Volatile Organic Compounds	119
2-2.7	Specifying Attic Stock	119
2-2.8	Material Guidelines by CSI Division.....	119
2-3	Conveying Equipment [Division 14]	135
2-3.1	Codes, Regulations and Standards	135
2-3.2	Terms, Definitions and Abbreviations.....	136
2-3.3	Elevators.....	136
2-3.4	Escalators (and surge areas).....	139
2-3.5	Moving Walk Systems	140
2-3.6	Baggage Conveying Systems	141
2-3.7	Electrical for Baggage Systems.....	142
2-4	Mechanical (Plumbing Division 22, Heating, Ventilation and Air Conditioning Division 23)	147
2-4.1	Codes, Regulations and Standards	147
2-4.2	General	147
2-4.3	Security.....	147
2-4.4	Heating, Ventilation & Air Conditioning.....	149
2-4.5	Plumbing	167
2-4.6	Utility Meters	174
2-4.7	Fire Suppression Systems.....	174
2-4.8	Special Provisions for the Sky Train System	175
2-5	Electrical [Division 26].....	177
2-5.1	Codes, Regulations and Standards	177
2-5.2	Terms, Definitions and Abbreviations.....	177
2-5.3	General Provisions	177
2-5.4	Electrical Drawings	179
2-5.5	Scope of Work	179
2-5.6	Distribution and Utilization Voltages	180
2-5.7	Energy Conservation in Electrical Systems.....	180
2-5.8	Equipment Rooms.....	181
2-5.9	Equipment Pads	182
2-5.10	Design Direction and Electrical Calculations	182
2-5.11	Interior Lighting.....	186
2-5.12	Conduit and Raceways	190
2-5.13	Installation Guidelines.....	192
2-5.14	Cable Tray.....	192
2-5.15	Medium or High Voltage Conductors and Cables (Over 600 Volts)	193
2-5.16	Conductors and Cable (Below 600 Volts).....	194
2-5.17	Low Voltage Open Wiring Systems (Below 50 Volts)	195
2-5.18	Electrical Boxes and Cabinets.....	195
2-5.19	Underground Pull Boxes and Manholes.....	196
2-5.20	Wiring Devices.....	196
2-5.21	Service Entrance-Rated Switchgear and Switchboards.....	197

2-5.22	Distribution Switchboards.....	198
2-5.23	Panel Boards.....	199
2-5.24	Motor Control Centers	201
2-5.25	Overcurrent Protection	201
2-5.26	Safety Switches	202
2-5.27	Grounding	203
2-5.28	Telecommunication Grounding System.....	203
2-5.29	Dry-Type Transformers (600 Volts or less).....	203
2-5.30	Medium Voltage Distribution Design Considerations (35 kV and 15 kV Class)....	204
2-5.31	Lighting Fixtures and Lamps.....	206
2-5.32	Programmable Lighting Control System	208
2-5.33	Lightning Protection System	209
2-5.34	Uninterrupted Power Supply/Systems	210
2-5.35	Life Safety Emergency and Standby Emergency	211
2-5.36	Special Electronic Systems - General Provisions	215
2-5.37	Fire Alarm Systems.....	215
2-6	Special Systems	219
2-6.2	Premises Wiring Distribution Systems	219
2-6.3	Contractor Responsibilities	222
2-6.4	Contractor Responsibilities	222
2-6.5	Aviation Department Responsibilities.....	222
2-6.6	Coordination Requirement:	222
2-6.7	System Interfaces.....	223
2-6.8	Telecommunication Systems	223
2-6.9	Security.....	224
2-6.10	Information (Network) Systems.....	230
2-6.11	Common Use Systems FUTURE, NOT CURRENTLY USED	235
2-6.12	Building Management Systems.....	235
2-6.13	Passenger Information and Paging System (PIPS)	236
2-6.14	Multi User Flight Information Display System MUFIDS	238
2-6.15	Radio Systems	240
2-6.16	Lightning Detection System	241
2-6.17	Parking Systems - Future, NOT USED AT THIS TIME	242
2-6.18	Automated Vehicle Identification System (AVI or AVITS).....	243
2-6.19	Computer Aided Dispatch (CAD) - Future, NOT USED AT THIS TIME.....	243
2-6.20	Digital Signage- Future, NOT USED AT THIS TIME.....	244
2-6.21	Cable Television System- Future, NOT USED AT THIS TIME.....	244
Chapter 3:	Fit-Outs.....	245
3-1	General.....	245
3-1.1	Purpose of this Chapter.....	245
3-1.2	Codes, Regulations and Standards.....	245
3-2	Architectural	245
3-2.1	Introduction	245
3-2.2	General Design Requirements – Tenant Shell Spaces.....	245
3-3	Structural.....	246
3-4	Mechanical & Electrical Services.....	246

3-4.1	General Design Criteria for Tenant Spaces	246
3-4.2	Metering.....	247
3-4.3	Mechanical	247
3-4.4	Electrical	248
3-5	Finishing Food & Beverage Shell Space.....	249
3-6	Finishing Retail Shell Space	250
3-7	Finishing Airlines Shell Space	250
3-8	Finishing Ground Transportation Shell Space	250
Chapter 4:	Landside Civil.....	251
4-1	General.....	251
4-1.1	Code Requirements.....	251
4-1.2	Terms, Definitions and Abbreviations.....	251
4-2	Environmental Requirements	251
4-2.1	Environmental/Site Evaluation for Asbestos and Other Hazardous Materials.....	251
4-2.2	Wildlife	251
4-3	Site Work and Exterior Utilities.....	252
4-3.1	Security Site Planning	252
4-3.2	Survey Control and Data Collection	252
4-3.3	Site Preparation [Division 31]	254
4-3.4	Construction Materials.....	255
4-3.5	Construction Staging	255
4-3.6	Utilities	255
4-3.7	Storm Drainage	260
4-3.8	Roadways	263
4-3.9	Bituminous Concrete Paving	263
4-3.10	Concrete Paving	264
4-3.11	Sidewalks.....	265
4-3.12	Curb and Gutter	266
4-3.13	Chain Link Fences and Gates	266
4-3.14	Traffic Signals	266
4-4	Landscaping.....	267
4-4.1	Codes and Standards.....	267
4-4.2	Security Considerations.....	267
4-4.3	Plant Material.....	268
4-4.4	Decomposed Granite	268
4-4.5	Planting	268
4-4.6	Planting Irrigation.....	270
4-5	Bridges.....	272
4-6	Electrical Systems.....	273
4-6.1	Electric Utility Routing.....	273
4-6.2	Utility Transformer, Sectionalizing Switch, C/T Cabinet, and Meter Installation Locations	273
4-6.3	Utility Transformer and Sectionalizing Switch Pad Sizing and Requirements	273
4-6.4	Site Lighting.....	273
4-6.5	Power Distribution	274
4-7	Special Systems	274

4-8	Signage Section	274
Chapter 5:	Airfield Civil	275
5-1	Site & Civil	275
5-1.1	General Requirements	275
5-1.2	Critical Design Aircraft.....	275
5-1.3	Survey Control.....	275
5-1.4	Site Preparation.....	276
5-1.5	Geotechnical Investigation.....	276
5-1.6	Project Reporting Shall Utilize 1 of 2 Methods:	277
5-1.7	Construction Means and Methods.....	277
5-1.8	Site Demolition.....	277
5-1.9	Erosion and Sediment Control	278
5-1.10	Geometrics	278
5-1.11	Line of Sight.....	278
5-1.12	Gradients and Slopes	278
5-1.13	Storm Drainage	279
5-1.14	Hydrology	279
5-1.15	Computation, Collection, and Disposition of Runoff	279
5-1.16	Utility Markings	281
5-1.17	Water Mains.....	281
5-1.18	Sanitary Sewers	281
5-1.19	Electrical/Phone/Telecommunications	281
5-1.20	Miscellaneous Site Elements.....	281
5-1.21	Bollards.....	282
5-1.22	Runway Exits	282
5-1.23	Aprons	282
5-1.24	Pavement Design.....	282
5-1.25	Pavement Marking	283
5-1.26	Removal of Airfield and Taxiway Pavement Markings (lead paint)	284
5-1.27	Access Roads	284
5-1.28	Security Fencing and Vehicle Gates	284
5-1.29	Passenger Boarding Bridges	284
5-2	Electrical	285
5-2.1	Introduction – Airfield Lighting	285
5-2.2	Apron Lighting	285
5-2.3	Runway and Taxiway Lighting Systems	286
5-2.4	Other Project Requirements	293
5-3	Special Systems	293
Chapter 6:	Parking Garages and Parking Facilities.....	294
6-1	General.....	294
6-1.1	Code Requirements.....	294
6-1.2	Preferences and Approvals	294
6-2	Architectural	296
6-2.1	Code Requirements.....	296
6-3	Structural.....	296
6-3.1	Code Requirements.....	296

6-4	Mechanical	296
6-4.1	Code Requirements	296
6-5	Electrical	296
6-5.1	Code Requirements	296
6-5.2	Conduit and Raceways	297
6-5.3	Special Considerations	298
6-5.4	Wire and Cable	299
6-5.5	Electrical Boxes and Cabinets	299
6-5.6	Underground Pull Boxes and Manholes	299
6-5.7	Grounding	300
6-6	Signage Section to update	300
6-6.1	Code Requirements	300
6-7	Special Systems	300
6-7.1	Code Requirements	300
Chapter 7: Non-Terminal Buildings		302
7-1	General	302
7-1.1	Code Requirements	302
7-1.2	General Design Parameters	302
7-1.3	Site Coverage/ Setback Requirements	302
7-1.4	Signage	302
7-2	Architectural	302
7-3	Structural	303
7-4	Mechanical	303
7-5	Electrical	303
7-6	Special Systems	303
SECTION IV: APPENDICES		304
Appendix A: Standard Details		304
Appendix B: Abbreviations, Acronyms and Definitions		307
B.1	Civil Abbreviations:	307
B.2	Structural Abbreviations	307
B.3	Airport/Aviation Department Definitions	308
B.4	Airport/Aviation Acronyms	312
B.5	Mechanical Abbreviations and Acronyms	315
B.6	Electrical Abbreviations and Acronyms	319
Appendix C: Technology Specifications		323
Appendix D: Project Deliverables		324

Suggested Revisions to the Design Manual

To suggest a revision to this manual please open the revision form that is attached to the PDF version of the Design Manual (see the “attachments” tab on the left side of this screen, sometimes displayed as a paperclip). Review the request with your Owning Division’s (e.g. Facilities, Planning Environmental, & Capital Management, etc.) Deputy Director and have them submit the form to the DCS & Facilities Deputy Director via email, respectively at kyle.kotchou@phoenix.gov and bobbie.reid@phoenix.gov.

SECTION I: POLICIES

Chapter 1: Introduction

1-1 General

1-1.1 Purpose of the Design Manual

1-1.1.1 The purpose of this Design Manual is to identify general Policies, Procedures and Design Standards for the development of the airport's facilities in order to achieve consistency in all design and construction projects. An electronic copy of the Design Manual and other supporting documentation will be provided to all Contractors providing architectural and engineering design services to the City of Phoenix Aviation Department.

1-1.1.2 This Manual provides the Contractor with:

- A.** An overview of the philosophy of the City of Phoenix Aviation Department concerning the design of new, renovated or reconstructed facilities
- B.** The processes and level of effort required to satisfy the City of Phoenix Aviation Department's performance standards for professional services
- C.** The design standards for selection of materials and systems to be utilized in the project

1-1.1.3 Consultants provide design services through three basic methods at the Aviation Department:

- A.** Through qualifications based selection for projects managed by the Design and Construction Services (DCS) Division of the Aviation Department.
- B.** When retained by a tenant or tenant's contractor to provide specific design services for tenant funded improvements. Tenant funded improvement projects are managed by the Aviation Department's Tenant Improvement Coordinator.
- C.** When retained to perform design services through a Design-Build Contract for work to be constructed under a Job Order Contractor (JOC) as part of a JOC project funded by the City of Phoenix (projects up to \$2 million and authorized by the City Engineer), or a single or two step Design-Build Contract.

1-1.2 Document Precedence

The requirements of this manual are not intended to supersede the requirements of Federal, State, local guidelines, applicable codes and standards, nor to instruct the Contractor to use less than the highest level of professional judgment. Where the instructions or direction established herein is in conflict with applicable codes, standards and requirements or is not consistent with the Contractor's professional judgment, the Contractor shall promptly identify the conflict and notify the City of Phoenix Aviation Department in writing for resolution.

1-2 City of Phoenix Airports

The City of Phoenix Airport System is comprised of three airports: Phoenix Sky Harbor International Airport (PHX), Phoenix Deer Valley Airport (DVT), and Phoenix Goodyear Airport (GYR). More general information regarding these airports can be found at:

www.phxskyharbor.com

1-2.1 Phoenix Sky Harbor International Airport (PHX)

Phoenix Sky Harbor International Airport (PHX) is one of the top ten busiest airports in the United States. Continual Aviation Department activity has dictated major investments in the terminals, roadways, and airfield in order to meet the growing needs of the traveling public. PHX serves more than 100,000 passengers, with 1,500 flights per day, and a daily economic impact that surpasses \$90 million for the Phoenix metropolitan area. We take pride in meeting the needs of our region's thriving population and planned improvements will add to our ability to remain America's Friendliest Airport™.

In ten years, five million people are projected to live in the Valley and six million by 2020. In 2007, PHX served about 42 million passengers and PHX continues to examine development alternatives for the Airport Development Program in anticipation of future growth in passenger activity. Although passenger levels declined due to the economic recession of 2008-10, PHX is expected to reach pre-recession passenger levels by the middle of the decade. PHX will need more passenger terminal space and parking, improved access roads, airfield improvements, and options for moving people and airplanes around the Airport more quickly. To keep pace with the Valley's growth, the Phoenix Airport System has planned and budgeted significant improvements to PHX which are defined by the Airport Development Program.

As a major commercial airport, PHX has three parallel runways capable of handling large commercial jet traffic up to a Boeing 747-sized aircraft. The longest runway, 8/26 is 11,489 feet long and is located directly north of the terminal core. This runway is commonly referred to as the "north runway". The second longest runway, 7L/25R, is 10,300 feet long and is located directly south of the terminal core. This runway is commonly referred to as the "center runway". The shortest runway, 7R/25L, is 7,800 feet long and is located to the south of Runway 7L/25R. This runway is commonly referred to as the "south runway". The north and center runways are connected by three "cross-field" taxiways identified (east to west) as Taxiways R, S, and T respectively. Taxiway R is located just east of Terminal 4 and Taxiways S and T and located to the immediate west of Terminal 4 (and east of Terminal 3).

PHX has three terminals – Terminal 2, Terminal 3 and Terminal 4 – each with its own parking garage, shops, restaurants, and access to ground transportation. There is no Terminal 1 and the facility that formerly held this designation has been demolished. Terminal 4 is the largest terminal and the carriers located in this facility handle more than 75% of the total traffic at PHX. PHX's easily accessible Rental Car Center houses all the airport rental car company counters and fleets. A multi-colored "Rental Car Shuttle" provides free transportation from the airport curb at the baggage claim level to the Rental Car Center, just west of PHX. There is convenient parking for 8,859 vehicles and a free shuttle system provides travel between the terminals.

1-2.1.1 PHX is constructing the PHX SkyTrain which will ultimately connect the terminals, Rental Car Center, and the East Economy Parking Lot with the regional Metro Light Rail station at 44th and Washington Streets. The PHX Sky Train is an automated people mover system that

will move on a dedicated guideway. Stage 1, which will be completed by the first quarter of 2013, is 1.7 miles long and will connect the 44th Street Metro station, the East Economy Garages, and Terminal 4. Stage 1A will extend the line to Terminal 3, and later stages will extend the SkyTrain to the Rental Car Center by 2020, thereby completing the 4.9-mile system.

1-2.2 Phoenix Deer Valley (DVT)

Phoenix Deer Valley Airport (DVT) serves as a reliever airport to PHX and experienced more than 368,000 takeoffs and landings in 2010. The Airport encompasses approximately 914 acres of property and is located 15 miles north of downtown Phoenix northeast of the Interstate 17 and Loop 101 interchange. South side access is from Deer Valley Road. North side access is via Airport Road and Seventh Street. DVT has two fixed-based operators and is home to more than 1,277 aircraft.

There are two parallel runways at DVT. The longest runway is 7R/25L at 8,208 feet and is commonly referred to as the “south” runway. The “north” runway is 7L/25R and is 4,500 feet long.

1-2.3 Phoenix Goodyear Airport (GYR)

1-2.3.1 Phoenix Goodyear Airport (GYR) is one of the busiest single-runway airports in the United States. A former US Navy training facility, the Airport is located entirely within the City of Goodyear and is 2.2 miles south of Interstate 10 on Litchfield Road. GYR hosts multiple aircraft maintenance and refurbishment activities, aircraft storage, and a fixed base operator. GYR is also classified as a reliever airport for PHX. GYR’s runway, 3/21, is 9,800 feet long.

Chapter 2: Airport Compatibility

2-1 General

This chapter addresses several areas of concern regarding the maintenance of cohesive development at the airports owned and operated by the City of Phoenix. The Aviation Department reserves the right to express judgment and render final decisions should elements of concern arise in the following areas:

2-1.1 Airport Operations

2-1.1.1 The Aviation Department is responsible for the safety and efficiency of aviation and airport operations at the facilities it owns and operates. In this respect, the operation and development of each airport shall be in compliance with applicable Federal regulations and be consistent with accepted airport standards. Structures and facilities shall not pose a hazard to aircraft operations, interfere with established Federal Aviation Administration ground or air control procedures nor impede the safe flow of aircraft, airport traffic flow, passenger movement or surface access during airport operating hours.

2-1.1.2 The Aviation Department must safely conduct airport operations during the construction phase of the project and throughout the occupancy of the completed facility. Careful planning and review is critical involving construction in the following areas:

- A.** The Airport Operations Area (AOA) & Aircraft Movements
- B.** Passenger check-in
- C.** Checked Baggage Screening
- D.** Security screening
- E.** Passenger departures
- F.** Passenger arrivals
- G.** Access Roadway System
- H.** FAR Part 139 Compliance

2-1.1.3 The Contractor is responsible to ensure that the continued operational needs of airport operations, airlines, tenants and concessionaires are satisfied through the design of the work. The Contractor shall ensure the continuity of utility services, maintenance of vehicular, pedestrian and vehicular access as well as security and safety requirements.

2-1.1.4 Consideration must also be given to flow of cargo, baggage, mail, goods and supplies. Design shall be efficient to minimize the consumption of utilities in the re-sale and service activities. This section does not represent a compressive list of items and the consultant has the responsibility to coordinate all items of the design with the general goals outlined.

2-1.1.5 The Contractor should also be aware that the Aviation Department is implementing requirements which will affect the Contractor 's operations during construction for both airside and landside projects. See Environment below for additional information.

2-1.2 Environment

2-1.2.1 The City of Phoenix Aviation Department must comply with all federal, state and Maricopa County environmental laws and regulations. All construction design and environmental engineering design efforts must conform to federal, state and county environmental laws and regulations as well as the Aviation department's environmental management policies. The Contractor is required to identify specific laws, regulations and policies which govern the design of improvements related to the work of the project and to fully coordinate the design and permitting requirements of the project working with the Aviation Department.

2-1.2.2 The City of Phoenix Aviation Department has adopted the Green Guide; a new design and Aviation construction performance standard for horizontal projects not covered by LEED. The Green Guide is a LEED-like document with checklists that will enhance project's sustainability and energy performance. Additional information is provided in SECTION I: Chapter 4.

2-1.3 Architecture

The City of Phoenix Aviation Department prefers that the design of new facilities at each airport be compatible with the existing architectural design characteristics. Major aesthetic issues such as views and sight lines of buildings should be considered. The scale and proportions of existing elements should be honored. Structures and facilities should be designed within the context of their entire surrounding area and the planned future development of the area. The Contractor must review the possible impacts of the proposed new facilities to existing conditions, services and systems to mitigate conflicts and provide appropriate interface with the surrounding facilities. More discussion of this subject is included in SECTION III: DESIGN STANDARDS.

2-1.4 Signage Standards

2-1.4.1 The Planning & Environmental Division is responsible for creating and updating a Signage & Wayfinding Master Plan for the airport. The Facilities and Services Division is the signage owner for the airport by installing and maintaining the signs. The Design and Construction Services Division may implement for the Facilities and Services Division the design and installation of signs through its development projects.

An updated Signage & Wayfinding Master Plan was completed in June 2011. The Master Plan is to be used as the design basis of future implementation projects across all Airport facilities, and also to maintain the system standards, as signs are added as a result of operational changes at the Airport.

2-1.4.2 The Contractor, working in coordination with the PM, will be required to coordinate signage required in the final design with the requirements of the Aviation Department's Signage Coordinator and the Airport's Signage Program (excluding airfield signs). This program includes internally produced signs, professional produced signs and temporary construction signs

2-1.4.3 The Aviation Department has implemented the best management practices adopted from the AAAP & ACI Airport Signage Subcommittee on airport signage for its own Signage Program.

Chapter 3: Security and Safety

3-1 General

The Contractor shall adhere to the requirements, standards and practices outlined herein.

3-1.1 Introduction

The objective of the Aviation Department's safety policy is to achieve an accident-free project; therefore, safety considerations must be an integral part of each project. The realization of the objective is possible only through planning and maintaining safety awareness in all phases of day-to-day work operations during design and construction. Specific safety requirements and standards governing Contractor s must be included in each design and construction contract.

3-1.2 Coordination with City's Homeland Security Bureau

3-1.2.1 Homeland Security is responsible for any terrorist threats against the airlines. The city of Phoenix recognizes its important role as the state's largest cadre of responders and has worked to integrate communication between emergency management, police and fire personnel to form the Phoenix Homeland Security Bureau (PHSB). This prepares the city to respond to both natural and terrorist crises.

3-1.2.2 The Contractor will work with the Aviation Department to assess whether a project should be reviewed by the PHSB to provide input concerning design features and organization.

3-1.3 Security and Safety of Passengers

3-1.3.1 Security and other requirements make construction at airports unique from other locations. The most important issue affecting construction at the airport is the security and safety of passengers. It will affect many conditions of the design process. Some of the issues affecting security and safety are outlined below. For a more complete overview of safety concerns, refer to the [Aviation Department's Airport Construction Safety Manual](#) a current version of which may be obtained from the project manager. The Safety Manual will be reissued with all design and construction documents.

3-1.4 Security Boundaries

The City of Phoenix Aviation Departments airports are subdivided into airside and landside areas which establish boundaries for secure and non-secure areas of the airports site. The following definitions for airside and landside are extracted from the TSA Design Guidelines published in June of 2006.

3-1.4.1 AIRSIDE

The airside of an airport is the movement area of an airport that includes adjacent terrain and buildings or portions thereof, access to which is controlled. Typically, the airside is beyond the security screening stations and restricting perimeters (fencing, walls or other boundaries) and includes runways, taxiways, aprons, aircraft parking and staging areas and most facilities which service and maintain aircraft. For operational, geographic, safety, or security reasons, other facilities such as tenant and cargo facilities may be located within the airside as well. As the airside generally includes security areas to which certain requirements apply under 49 CFR 1542;

e.g., the Aircraft Operations Area (AOA), Security Identification Display Area (SIDA) and other Secure Areas, the airside, by nature, must be nonpublic.

3-1.4.2 LANDSIDE

Excluding terminals, the landside of an airport is that area of an airport and buildings to which both traveling passengers and the non-traveling public has unrestricted access. Typically, the landside facilities include patron and other public parking areas, public access roadways, rental car facilities, taxi and ground transportation staging areas, and any on-airport hotel facilities. Since the landside includes all non-airside areas (other than the terminal(s)), its location is determined by the airside and perimeter boundary. Since the landside is not directly affected by the operation of aircraft, it generally has less stringent security requirements than the airside. However, some clear area and communication requirements may still affect landside design and layout, such as an airside fence/boundary, aircraft approach glide slopes, communications and navigational equipment locations and non-interference areas, and heightened security in the terminal area.

3-1.5 Airside Operations Area (AOA)

3-1.5.1 SECURITY AND ACCESS

The City of Phoenix Aviation Department operates in strict compliance with *TSA Regulation – 49 CFR Part 1542* prohibiting unauthorized persons, vehicles or equipment in the AOA. The TSA and/or the Aviation Department may subject violators to arrest and/or fines.

3-1.5.2 SECURITY IDENTIFICATION DISPLAY AREA (SIDA)

A. Fenced areas must remain fenced at all times. Temporary fences and/or gates installed during construction shall remain closed and locked unless continuously staffed by an appropriately trained and badged individual. Duplicate keys for locked gates must be given to Airside Operations. Guards must maintain radio or telephone communication with operations in case of an emergency.

B. All gate guards are contracted through Security Operations.

C. Security between landside areas and the SIDA must be maintained at all times. Access doors and other points of entry have alarm systems and must not be opened by unauthorized personnel.

D. An airport may not issue, to any person, any identification media that provides unescorted access to any SIDA unless the person has successfully completed the Criminal History Records Check (CHRC) process and the security training in accordance with a TSA approved curriculum specified in the security program.

E. Anyone operating a motor vehicle within the AOA, unless properly escorted, must attend the Airfield Driver's Training Program and successfully complete the testing process. A prerequisite for obtaining an airfield driver's permit is a current and valid driver's license.

F. Company logos must be clearly visible on all vehicles operating within the AOA.

3-1.5.3 SAFETY IN THE AOA

FAR Part 139 requires an elevated level of safety when working in this environment. Activities which occur in close proximity to the Safety Areas protecting aircraft on runways and taxiways must be properly planned and monitored. Unplanned and accidental incursions into these Safety Areas create unacceptable levels of hazard to aircraft operations. General requirements regarding AOA safety are as follows:

A. The City of Phoenix Aviation Department is responsible for overseeing the development of construction safety plans in accordance with FAA Advisory Circular 150-5370-2F (Operational Safety during Construction) available at the website “FAA.gov” for current version, and for ensuring appropriate training for new construction Contractor s working or driving on airports. These plans should be well coordinated with all airport stakeholders and should include:

- A complete and thorough training program for all construction personnel that will have access to the AOA including AOA driver training
- A Construction Safety Plan that clearly indicates where the temporary movement boundaries will be for each phase of construction
- Ensure all haul routes are clearly designated and properly signed and marked
- Ensure vehicles are marked/lighted inside the AOA
- Provide airport escorts when required
- Hold weekly safety training during construction meetings with tenants and Contractors

3-1.5.4 PRIOR NOTICE

A 48-hour prior notice (with a 24-hour cancellation) to the Airside Operations Superintendent (602-273-2795) is required at PHX for the movement of major pieces of equipment or materials, the interruption of essential services, any impact to any security fence or airport perimeter, and issuance of all required “Notice to Airmen” (NOTAMs). Airport Operations Personnel will coordinate the issuance of any NOTAM on behalf of the project.

3-1.5.5 AIRFIELD DRIVER’S LICENSE

Anyone operating a motor vehicle within the secured area at PHX shall have a valid airfield driver's license issued by the Aviation Department Security Operations Division. To qualify for a license, an individual must make an application (Attachment 8), attend a Security and Airfield Driver’s Training Program and pass a written examination. Contact the Aviation Department Safety Operations Division (602-273-3302) to make the necessary arrangements and to obtain the Airfield Driver Permit Application and Study Guide booklet.

3-1.5.6 CERTIFICATE OF INSURANCE

A. In addition to the airfield driver's license, the Contractor(s) must have Vehicle Insurance for Airside Access. The Certificate must include the following:

- A.1.** The City of Phoenix Aviation Department, 3300 Sky Harbor Boulevard, Phoenix, Arizona 85034, should be named as the Certificate Holder.
- A.2.** The City of Phoenix Aviation Department should be named as an additional insured.
- A.3.** Vehicles covered by the policy (vehicle liability); i.e., owned, non-owned, hired.
- A.4.** Provide required amount of coverage. Any company needing vehicle access at PHX is required to carry \$5M in automobile liability or excess liability.
- A.5.** Certificate must include a policy number. Binders are not accepted.
- A.6.** Certificate must include an expiration date. The preceding items must all be met before vehicle access to the AOA will be permitted. For more information on insurance see Attachment 9.

3-1.5.7 SECURITY BADGES

A. All Contractor personnel assigned to any project requiring airside access (except for escorted in-transit material supplies), shall make application for a security badge and wear it at all times.

All design and construction employees shall have a fingerprint criminal history records check. All individuals not requiring airside access must obtain badges for non-airside access. Application for security badges is made by contacting the Aviation Department Operations Security and Badging Office (602-273-2036). A photo identification badge is made for each employee. There are charges for the badge and for FBI fingerprinting required for the issuance of badges. Results of fingerprinting can take a month or more to receive. Refunds are provided when the need is completed and the Badge returned. All individuals not requiring airside access must then obtain badges for non-airside access. Each person must submit a completed application signed by the company's authorized signer, provide two types of valid identification with a color photo. Check with the badging office for current fees. Badging at Phoenix Deer Valley and Phoenix Goodyear Airports are coordinated at the respective airports and are subject to the individual requirements for each project that are established at preconstruction meetings.

B. Attendance at a 3-hour security and airfield field drivers (if necessary) training seminar is mandatory before the issuance of a security badge.

C. TOOLS CARDS

Any Contractor needing to use tools in the secured SIDA must accept responsibility for these tools by obtaining a tool card from the Aviation Security Operations Division (602-273-3301).

3-1.5.8 AIRCRAFT SAFETY

A. The Contractor may require access to an area that is in close proximity to aircraft and is subject to jet blasts equivalent to wind velocities exceeding 75 miles per hour.

B. A high degree of care is necessary to control debris and dust so it does not affect aircraft or accumulate on aprons, taxiways and runways, or become a visual obstruction or nuisance. Small particles of debris referred to as foreign object debris or FOD is a hazard to aircraft due to the potential for damage when ingested into aircraft engines.

C. The Contractor must take whatever measures during design and construction necessary to prevent the accumulation of FOD on the airfield. In addition, the Contractor shall, through the specifications, require dust control measures at all times during the construction of the project, to the satisfaction of the Aviation Department.

3-1.5.9 NOTICE OF VIOLATIONS (NOV)

Due to safety and security precautions necessary at the Aviation Department, failure of the Contractor to adhere to the prescribed requirements may jeopardize the health, welfare, and safety of customers and employees. If the Contractor is found in noncompliance with any security, airfield, or badging/licensing requirement, the Aviation Department retains the right to issue a NOV for each offense. A NOV is issued for violations of the Airport's rules and regulations. Financial and other penalties are possible when an NOV is issued. For additional information contact an Airport Safety Coordinator (Oscar 31 - 602-273-3302).

3-1.6 Landside Operations

3-1.6.1 SECURITY AND SAFETY

A. Although the landside operations areas are not in the SIDA, the movement of equipment or materials and construction still affect the security and safety of the traveling public. It is the Contractor's responsibility to plan for the requirements of site access, security, parking and Contractor staging as part of the design process.

B. The Contractor shall, working with the Aviation Department, meet with Landside Operations (602-273-3326) to coordinate construction issues that affect traffic movement, traffic barricades and street or lane closures, parking, equipment delivery and staging, passenger safety, and other issues.

3-1.6.2 TRAFFIC

A. Any construction activity affecting the normal flow of vehicular and/or pedestrian traffic at the airport requires a submittal to Airport Operations. The submittal shall include a detailed traffic plan, including signage requirements and vehicular/pedestrian impact. Before proceeding with construction, Airport Operations must approve the traffic barricade plan. These plans must be submitted to the Operations Manager at least 48-hours in advance of work beginning. Any cancellations need to be made at least 24-hours in advance.

B. For specific traffic control requirements refer to the Aviation Department - Airport Construction Safety Manual a current version of which may be obtained from the project manager and the City of Phoenix, Street Transportation Department Traffic Barricade Manual (latest revisions available at <http://www.phoenix.gov/>).

C. The Contractor should note that the Aviation Department's non-peak period is currently from 11 PM to 5 AM and is different from the data provided in the City's Traffic Barricade Manual.

3-1.6.3 PARKING

A. The Contractor should be aware that construction employees will not be permitted to park their personal vehicles in airport parking garages or other parking areas intended for passengers and other airport users. Illegally parked vehicles may be subject to citation/towing at the owner's expense.

B. A limited number of parking cards may be available for the Contractor to purchase and use for such activities as deliveries, unloading of equipment and management parking. The parking cards are purchased on a monthly basis and are available at the sole discretion of the Parking Operations Superintendent (602-273-2795).

3-1.6.4 LIMITED STAGING AREAS

The Contractor should be aware there is limited area available for staging at either Landside or Airside. The Contractor shall arrange for the bulk storage of materials off airport property. Approval from the Business & Properties Division (602-213-2730) is required for the use of any available staging areas at the airports.

3-1.7 Life Safety and Code Standards

It is the City of Phoenix Aviation Department's policy to provide facilities that meet or exceed all current life and fire safety codes and standards. In keeping with this policy, the Contractor should make every effort to select materials, systems and equipment for use in proposed facilities that meet these standards.

Chapter 4: Design & Construction Strategies for Contractors

4-1 General

During the early phases of design, the elements which establish the final parameters that shape the design are formulated. These parameters should be examined critically and the Contractor is encouraged to use the techniques outlined below, as appropriate, during the conceptual and schematic phase of the project development.

4-1.1 Quality Control Plan at Outset

4-1.1.1 CONTRACTOR'S QUALITY CONTROL PROGRAM

A. Contractor's must establish a Quality Control Program for their activities on all projects (projects of limited scope and/or scale may be exempt). The Contractor shall prepare a quality control plan covering all phases of the design effort to be submitted for the Aviation Department's review and acceptance prior to beginning design work. The organization of this plan shall be of a scope and character as to provide control over all activities of the design and preparation of construction documents and shall be managed by a qualified individual who has been appointed by the Contractor's management. See SECTION II: PROCEDURES for more details concerning the quality control plan and its implementation.

B. Contract documents developed by the Contractor must include requirements for the Contractor to establish project quality control and quality assurance programs and to perform inspection and testing on specified work items including the work of Subcontractors. Within the program, the Contractor must be required to establish measures that shall ensure conformance to applicable specifications and drawings with respect to materials, workmanship, construction, finish, functional performance and identification.

4-1.1.2 CONTRACTOR'S QUALITY CONTROL PROGRAM

4-1.1.3 All Contractor's must establish a Quality Control Program which covers:

- The Owner's Project
- The Contractor's means and methods

4-1.1.4 The Contractor Quality Control Program must identify surveillance and testing requirements of the elements identified in the technical provisions of the contract specifications and shall specify all activities to be performed by the Contractor as quality control or quality assurance. This measure applies to the activities associated with the Contractor's means and methods as well as the condition and performance of the finished project.

4-1.2 Alternative Configuration Analysis

Early in the Design Phase of the work, the Contractor should consider and identify alternative concepts which may satisfy the project requirements and shall prepare alternative layouts and/or program data illustrating these alternatives as part of the Programming and/or Schematic Design Phase process.

4-2 Sustainable Design and Site Development

4-2.1 Sustainable Design and Construction Practices

The Aviation Department has adopted sustainable design and construction practices which include but are not necessarily limited to the following topics:

4-2.1.1 DESIGN GUIDELINES

4-2.1.2 Includes requirement for application of LEED Standards to design approach; refer to SECTION I: Chapter 6 for more information

4-2.1.3 Design and Construction Green Guide; refer to SECTION I: Chapter 6 for more information

4-2.1.4 Project design life and building systems must be validated with an approved Life Cycle Cost Analysis. Life Cycle Cost Analysis will be performed with publically available models such as DOE 2 eQUEST for energy systems or AGI-32 for lighting placement analysis.

4-2.1.5 Encourages the incorporation of design applications which enhance the overall building performance in the desert environment including concepts of shading, use of natural light and orientation whenever possible

4-2.1.6 Minimum energy utilization

4-2.1.7 Reduction in water consumption

4-2.1.8 Provides access and infrastructure for tenants to maximize recycling of waste products from general building maintenance activities and tenant operations.

4-2.1.9 CONSTRUCTION GUIDELINES

4-2.1.10 Construction materials recycling program is to be developed and submitted at the pre-construction meeting.

4-2.1.11 Construction pollution prevention plans(Storm Water SWPPP or other environmental plans and permits) are to be submitted at the pre-construction meeting.

4-2.1.12 Documented building systems commissioning either fundamental or enhanced, will be determined prior to construction and approved by the Aviation Department. A commissioning Plan outline will be submitted at the pre-construction meeting for review and approval.

4-2.1.13 Construction equipment (California Type IV equipment or agreed upon alternative and well maintained equipment)) for the work will be listed and submitted

4-2.1.14 Construction equipment idling policy will be developed and submitted at the pre-construction meeting.

4-2.2 Constructability Review

4-2.2.1 Constructability is the process of review and application of ideas and methods that will result in a product that can be built most cost-effectively and in the shortest period of time without sacrificing quality for LEED projects, constructability review will be completed by the

Commissioning agent prior to final construction documents. . The review also includes the requirements governing the Contractor's construction techniques and practices which are to be managed to minimize impact to the site and immediate environment. The process takes into account schedule, materials, access and staging, required construction equipment, available manpower resources, work methods and required standards throughout the design phases of the project.

4-2.2.2 The process promotes an awareness of the elements of constructability throughout the design and construction documents phase of the work and encourages the elimination of ambiguities, inconsistencies and other inherent problems that could lead to preventable difficulties for the Contractor.

4-2.2.3 Responsibility for the constructability of the design rests with the Contractor and shall be considered during the early stages of design and continues through the completion of contract documents.

4-2.3 Maintainability and Operability

4-2.3.1 A primary consideration in design of all facilities and utility systems is the anticipated normal operation and maintenance requirements. New facilities must be compatible with existing airport maintenance activities and procedures.

4-2.3.2 All design work shall be reviewed for maintainability with regard for the following subjects:

- A. Life cycle costs to include operation and maintenance over the life of the structure.
- B. Equipment standardization
- C. Impact on existing airport engineering and maintenance resources
- D. Training requirements
- E. Development of operations and maintenance manuals
- F. Clear identification of requirements for warranties and guarantees
- G. Requirements for system testing
- H. Clearances for maintenance and replacement of equipment
- I. Necessary spare parts and specialized tools
- J. Specialized equipment required to routinely maintain newly installed work
- K. Maintainability in a feasible and economical manner

4-2.3.3 Refer to SECTION III: DESIGN STANDARDS for more specific information.

4-2.4 Value Engineering

4-2.4.1 When applicable, the City of Phoenix Aviation Department values and encourages the informal application of value engineering principles on all projects. Value engineering at the most basic application includes consideration of alternative design solutions, alternative material and/or innovative construction methods. The Aviation Department requires the Contractor to consider design alternatives as part of the Concept Development process in the Schematic Design Phase (See SECTION II: Chapter 3 – Design Phase). If in the course of the project, cost cutting to conform to project budget is necessary, the Contractor will perform analysis using Total Cost of

Ownership (TCOO) tools, taking into consideration long-term operational costs, particularly on MEP systems, in the analysis for Aviation Department

4-2.4.2 In addition, the Contractor shall consider the issues related to “Green Building” design concepts including the application of techniques and environmental policy required or noted elsewhere in this manual.

4-2.4.3 While not applicable for every project, formal value engineering workshops may be conducted during the design phase of any project when deemed appropriate by the Aviation Department. The Contractor should review such opportunities in advance with the PM to determine if a formal value engineering workshop is warranted. Where Value Engineering is reviewing energy using systems total cost of ownership analysis will be performed and used as a factor

Chapter 5: Procurement and Purchasing Practices

5-1 General

The Contractor shall fully adhere to the following policies:

5-1.1 Full and Open Competition

The Aviation Department is committed to acquiring contract supplies and services by full and open competition through the use of established procedures in accordance with established policies. Contractors are encouraged to strive for open competition for required materials and services as well.

5-1.2 Brand Name or Equal Requirements

When it is determined to be impractical or undesirable to develop a generic specification, three brand names should be specified to convey the general style, type, character and quality of the article desired. Unless otherwise provided for in the specification, the naming of certain brands, makes or manufacturers does not restrict vendors to these specific brands or manufacturers named. To the extent possible, the characteristics of the item being requested that are the most important to the Aviation Department, including salient features, should be identified. Any article that the Aviation Department, in sole discretion, determines to be the equal of that specified, considering quality, workmanship, economy of operation and suitability for the purpose intended, may be accepted. The burden of proof of product equality lies with the supplier or installer of the product and not with the Aviation Department.

5-1.3 Proprietary Specifications

In certain instances, a specific product, because of performance, maintenance or compatibility characteristics may be identified as the only acceptable product for a particular use in a project. In all such cases where a sole product is specified, prior approval for use of the product must be obtained from the Aviation Department.

5-1.4 Environmental Preferable Products as necessary to fulfill LEED or other policy, Environmental Preferable Products will be researched and their defining characteristic (recycled content, etc.) specified.

5-2 City of Phoenix Equal Opportunity Department

5-2.1 SBE- DBE Participation

5-2.1.1 Disadvantage Business Enterprise (DBE) means a small business concern that has successfully completed the DBE certification process and been granted DBE status by the Arizona Unified Certification Program. The City of Phoenix Equal Opportunity Department (EOD) manages the Disadvantaged Business Enterprise Program Plan. The responsibility for the City's program is delegated to the Equal Opportunity Director. The Design & Construction Services Division of the Aviation Department has a part-time DBE Compliance Liaison to administer project goal setting procedures, and to monitor and report those goals.

5-2.1.2 Federal Aviation Projects

5-2.1.3 The City of Phoenix, as a recipient of funding from the U. S. Department of Transportation (USDOT), Department of Homeland Security and other departments, complies with the requirements of 49 CFR Part 26 in administering the Disadvantaged Business Enterprise (DBE) Program Plan. The responsibility for the City's program has been delegated to the Equal Opportunity Director.

5-2.1.4 In accordance with the regulation, the City established the procedures for the administration of the DBE program in the areas of:

5-2.1.5 Annual Goal Setting Procedures

5-2.1.6 Project Goal Setting Procedures

5-2.1.7 Pre-Bid Procedures

5-2.1.8 Bid Opening Procedures

5-2.1.9 Waiver Procedures

5-2.1.10 Monitoring Procedures

5-2.1.11 Reporting Procedures

5-2.1.12 For FAA funded projects, an assessment of DBE certified firms is performed in advance of the advertisement of the work and must be reviewed and approved by EOD. Contractor's and Consultants must perform and document their efforts of outreach to both small and disadvantaged businesses.

5-2.1.13 City of Phoenix SBE Programs

5-2.1.14 Small Business Enterprise (SBE) - The Small Business Enterprise (SBE) Certification Program certifies firms to participate in incentive programs available for small business owners located in Maricopa County who want to do business with the city of Phoenix.

Chapter 6: Codes, Regulations and Standards

6-1 General

6-1.1.1 The following section lists a number of codes, regulations and standards to be used by the Contractor in the development of design for the project. While this section attempts to provide a thorough survey of applicable codes and standards, it is the Contractor's responsibility to research and apply all required codes and regulations to the final design whether or not listed herein.

6-1.2 Accessibility

6-1.2.1 The City of Phoenix Aviation Department requires that its facilities and services be designed to accommodate disabled individuals.

6-1.2.2 The City of Phoenix Aviation Department requirements are based on the Americans with Disabilities Act Architectural Accessibility Guidelines (ADAAG) incorporated by the Arizona ADAAG, the American National Standards Institute (ANSI), and other related building codes pertaining to accessibility for persons with disabilities. This manual provides further discussion of accessibility issues of concern to the Aviation Department in SECTION III and standard details for parking and restroom applications in Appendix A.

6-1.2.3 The Mayor's Commission on Disability Issues-Architecture and Design Committee (MCDI-ADC) has charged its architect and design committee to provide public input on City-funded capital improvement projects. The Contractor should be aware that the Aviation Department will determine which projects are to be submitted to MCDI-ADC for review.

6-1.2.4 Current Adopted Codes

6-1.2.5 The Contractor is strongly encouraged to contact and coordinate design activity with building officials or, depending on the type of project, the Arizona Department of Transportation (ADOT) during all phases of the project for Code information and interpretations. It is far better to avoid design and construction problems that arise because of lack of coordination with building safety departments and other municipal/state/federal agencies.

6-1.2.6 For the latest update of additional code information, the Contractor should refer to:

6-1.2.7 [City of Phoenix](http://www.phoenix.gov/DEVPRO/bldproc2.html) at <http://www.phoenix.gov/DEVPRO/bldproc2.html>

6-1.2.8 The Aviation Department will discourage explanations concerning design and construction problems due to Code issues that were not previously worked out between the Contractor and the Building Officials or ADOT. It is the Contractor's responsibility to ensure that all design work is in full compliance with applicable Codes, Regulations and Standards.

6-1.2.9 EXCEPTIONS TO APPLICABLE CODES

6-1.2.10 Unless otherwise directed by the City of Phoenix Aviation Department, all airport terminal structures shall be designed to conform to IBC Type I Construction.

6-1.2.11 Unless otherwise directed by the Aviation Department, all airport terminal floor areas shall be designed for 100 pounds per square foot live load, regardless of initial Occupancy

Classification, to insure area can be used for Group “A” Assembly Occupancy if required at a future time.

6-1.2.12 PHOENIX CONSTRUCTION CODE

6-1.2.13 Building plan reviews are conducted to help ensure compliance with the Phoenix Construction Code. A complete Code package set includes both the adopted code and the Phoenix Amendment package. For code adoption effective dates, please go to the <http://phoenix.gov/pdd/devcode/buildingcode/index.html>.

6-1.2.14 OTHER APPLICABLE CODES, REGULATIONS AND STANDARDS – latest adopted version as applicable.

- ASME A17.3 Safety Code for Existing Elevators and Escalators with Phoenix Amendments
- ASME A18.1 Safety Code for Platform Lifts and Stairway Chairlifts
- International Building Code with Phoenix Amendments
- International Code Council Performance Code with Phoenix Amendments
- International Energy Conservation Code f3
- with City of Phoenix amendments
- International Existing Building Code with Phoenix Amendments
- International Fire Code (IFC) with Phoenix Amendments
- International Mechanical Code with Phoenix Amendments
- International Residential Code with Phoenix Amendments
- ASME A17.1 Safety Code for Elevators and Escalators with Phoenix Amendments
- National Electrical Code/NFPA-70 with Phoenix Amendments
- ADA Accessibility Guidelines for Buildings and Facilities (ADAAG) as incorporated in the Arizona ADAAG.
- ADOT Bridge Practice Guidelines
- ADOT Bridge Hydraulics Guidelines
- ADOT Roadway Design Guidelines
- ADOT Traffic Design Guidelines
- ADOT Construction Manual – latest adopted version
- ADOT Standard Specifications, Road and Bridge Construction – latest adopted version
- ADOT Standard Plans and Specifications for Highway Construction
- COP Green Building Code
- A Policy of Geometric Design of Highway and Streets (Green Book), American Association of State Highway and Transportation Officials (AASHTO)
- Access to Airports by Individuals with Disabilities, Federal Administration, Advisory Circular 150/5360-14
- American Concrete Institute 318 Building Code Requirements for Structural
- American Concrete Institute 530/ASCE 5/TMS 402 Building Code Requirements for Masonry Structures
- Airport Layout Plan for Phoenix Sky Harbor International Airport
- American Association of State Highway Officials (AASHTO)

- American Institute of Steel Construction (AISC) Steel Construction Manual
- American Iron and Steel Institute (AISI) S100 North American Specification for the Design of Cold-Formed Steel Structural Members with the following Standards for Cold-formed Steel Framing: S200-General Provisions, S211-Wall Stud Design, S212-Header Design, and S213-Lateral Design
- American National Standards Institute (ANSI), various applicable publications.
- American Society for Testing and Materials, (ASTM), various applicable publications.
- American Society of Civil Engineers (ASCE), APM Standards Part 1, Part2, Part 3 and Part 4
- American Society of Mechanical Engineers (ASME), various applicable publications.
- APM System Facilities Design Criteria Handbook – September 8, 2003
- Arizona Department of Environmental Quality Engineering Bulletins
- 2012 International and Uniform Plumbing Code with the most
- American Society of Civil Engineers (ASCE) SEI 7, Minimum Design Loads for Buildings and other Structures
- Asbestos Hazard Emergency Response Act (AHERA)
- Aviation Construction Safety Manual a current version of which may be obtained from the project manager.
- Canadian Standards Association (CSA) Listed and Labeled if UL not available
- City of Phoenix Supplement to the MA Standard Specifications and Details
- City of Phoenix Supplement to Maricopa Association of Governments, City of Phoenix
- City of Phoenix, Hydraulics Manual
- City of Phoenix, Storm Water Policies and Standards
- City of Phoenix, Traffic Barricade Manual
- Department of Transportation, 14 CFR Parts 91, 107, 108, 121, 129, 135, 139, and 191
- Department of Transportation, 49 CFR Parts 1500, 1510, 1520, 1540, 1542, 1544, 1546, 1548, and 1550
- Drainage Design Manual for Maricopa County, Arizona, Volume I Hydrology, Volume II Hydraulics and Volume III Erosion Control
- Electronic Industries Association (EIA)
- FAA Advisory Circular 70/7460-2 Proposed Construction or Alteration of Objects that May Affect Navigable Airspace
- FAA Circular 5370-13, Airport Design
- FAA Part 77, Objects Affecting Navigable Air Space
- FAA Part 139
- Federal Aviation and Transportation Security Act, November 2001 and latest amendments
- Fixed Guideway Transit and Passenger Rail Systems (NFPA 130)
- Guide For Emergency Evacuation of Elevators (ASME A17.4)
- Highway Capacity Manual, Transportation Research Board (TRB)
- IAPMO's Mechanical Code, with COP adopting ordinance
- Illuminating Engineering Society (IES) Lighting Handbook

- Institute of Electrical and Electronics Engineers (IEEE)
- Insulated Cable Engineers Association (ICEA)
- L+E AVIATION DEPARTMENT AT SYSTEM FDCHB
- Life Safety Code, (NFPA 101)
- Lighting Protection Institute, L.P.I. 175
- Lightning Protection Code, (NFPA 780).
- Manual on Uniform Traffic Control Devices for Streets and Highways
- Maricopa Association of Governments (MAG) Uniform Standard Specifications and Details for Public Construction
- Maricopa County Environmental Health Services Division Drinking Water Program
- Maricopa County, Drainage Design Manual
- National Electric Safety Code (ANSI C2).
- National Electrical Code (NFPA 70 and 72)
- National Electrical Manufacturers Association (NEMA), various applicable publications.
- National Electrical Testing Association, (NETA).
- National Fire Protection Association, (NFPA), various applicable publications.
- NFPA 130, Fixed Guideway Transit and Passenger Rail Systems – latest edition as applicable
- NUSIG (National Uniform Seismic Installation Guidelines)
- Occupational Safety and Health Administration (OSHA)
- PHX Airport Facilities Standards
- PHX Airport Signage and Graphics Standards
- Railroad Design Criteria
- Roadside Design Guide, American Association of State Highway and Transportation Officials (AASHTO)
- Safety Code for Elevators and Escalators (A17.1 WITH ADDENDA) Salt River Project Design Guidelines and Specifications for Bridge Crossings of Salt River Project Canals
- SMACNA (Sheet Metal and Air Conditioning Contractors National Association)
- Standard Guidelines for the Collection and Depiction of Existing Subsurface Utility Data, CI/ASCE 38-02
- State of Arizona Fire Code
- Test of Class 1E Electric Cables, Field Splices, and Connections for Nuclear Power Generating Stations, (IEEE 383).
- Transportation Security Administration (TSA) Regulations Rule – 49 CFR part 1542
- Uniform Standard Details for Public Works Construction, Maricopa Association of Governments
- Uniform Standard Specifications for Public Works Construction, Maricopa Association of Governments
- U.S. Department of Transportation (DOT/FTA) Accessibility Code (ICC/ANSI A117.1) – latest edition
- Underwriters Laboratories, Inc. (UL), various applicable publications.

6-1.3 Other Considerations

All City of Phoenix Aviation Department projects shall meet applicable Department of Homeland Security (DHS), Transportation Security Administration (TSA), and Federal Aviation Administration (FAA) public safety and aviation facility security requirements that may apply to specific areas of the airport complex.

6-1.4 Leadership in Energy and Environmental Design (LEED)

6-1.4.1 City policy requires new building construction and renovations to achieve LEED certification. For all other projects [The Design and Construction \(DCS\) Green Guide](#) has been developed for “horizontal” construction projects, i.e. non-building design and construction, where LEED does not apply. Other sustainable design standards such as Envision may be requested for consideration by the Aviation Department.

6-1.4.2 It is the intent of the City of Phoenix to use these Standards to affect overall project design and construction to meet Sustainability project design objectives. The actual level of Leadership in Energy and Environmental Design (LEED) to be met for the project, i.e., Certified, Silver, Gold or Platinum, will be determined by the PM and Project Stakeholders on a project by project basis before design commences. Documentation shall be provided by using the latest applicable version of LEED at the start of every project’s conceptual design. U.S. Green Building LEED templates will be used. by the Contractor to validate compliance with LEED standards.

6-1.4.3 The Contractor will stamp and sign a City of Phoenix approved document verifying to the City (building owner) that the minimum LEED point requirement for the selected level or performance has been met. The LEED approach allows the Contractor various options for meeting minimum LEED points. Additionally, the Aviation Department is specifically interested (regardless of other LEED program prerequisites or other points achieved) in:

- Landscape & Exterior Design to Reduce Heat Islands, (non-roof)
- Landscape & Exterior Design to Reduce Heat Islands, (roof)
- Water Efficient Landscaping (reduce by 50%)
- Water Use Reduction (20% reduction)
- Optimize Energy Performance
- Energy System Commissioning
- Construction Waste Management, (divert 50%)
- LEED Accredited Professional

6-1.4.4 The Aviation Department will be consistent with the sustainability initiatives developed by the City of Phoenix for “vertical” or building construction through the implementation of LEED. [The Design and Construction \(DCS\) Green Guide](#) has been developed for “horizontal” construction projects, i.e. non-building design and construction, where LEED does not apply. Like LEED, this is a performance-based system where credits are earned for satisfying criteria to address specific environmental impacts. Other sustainable rating systems may be suggested for review by the Aviation Department.,

6-1.4.5 These Sustainable Performance Standards encourage the review of new technologies and initiatives for consideration into the project. The Contractor shall consider these requirements to ensure optimal project development.

6.1.4.5 Life Cycle Cost Analysis, Energy consuming systems, selection, and pavement design will utilize publicly available Life Cycle Cost tools and will be submitted to The Aviation Department the project management for review and final product selection .

6-1.5 COP Aviation Department CADD Data Standards

6-1.5.1 All Computer Aided Drawing and Design (CADD) data created for the Aviation Department must be developed and submitted according to the specifications documented in this Standard. This includes data prepared both internally by City of Phoenix employees and by outside organizations for work performed on behalf of Airport tenants and consultants to the Aviation Department. The objective is to standardize design deliverables so that data and drawing files received from these multiple sources can easily be integrated into the Aviation Department's Geographic Information System (GIS).

6-1.5.2 Each submitted CADD drawing file will become part of the permanent archive. The drawing serves as a critical source for updating information within the Aviation Department's GIS. These drawings make up the baseline for future work at Aviation Department facilities. The availability of standardized data products and drawing files for use on future projects maintains the value of the original data creation effort.

6-1.5.3 CADD drawings are the primary source of data to both initially populate and update the Aviation Department's GIS over time. During the initial creation of the GIS, data ETL (Extract, Transform, Load) scripts will be used to move data from CADD submittals into the GIS database. This process will only be successful if CADD data and drawings are developed according to a consistent standard that has as its end goal absorption into the GIS in mind.

6-1.6 BIM (Building Information Modeling)

The Aviation Department is a strong proponent for utilizing BIM on its projects. Having a project built “virtually” first assists in minimizing field errors and added field costs. Section II §2-2.10 provides BIM Standards.

SECTION II: PROCEDURES

Chapter 1: Introduction

The information provided herein is offered to assist the Contractor in understanding the level of effort necessary to fulfill his/her professional responsibilities, the City of Phoenix Aviation Department's expectations as required under the final negotiated contract, and the procedures the Contractor will be required to employ so as to work in harmony with the Aviation Department's project team and project management system.

The scope of services and procedures as outlined may be modified under the provisions of the final executed contract between the City of Phoenix (COP) and the Contractor. This document is offered as a guide only and should not be considered in any way to modify or conflict with the terms and scope stipulated in the executed contract.

1-1 Procurement of Design and Construction Services

1-1.1.1 The City of Phoenix's Aviation Department is responsible for managing and operating the COP owned Airports in addition to managing the design and construction of aviation projects.

1-1.1.2 The Street Transportation Department's Planning, Design and Programming Division's Contract Procurement Section (hereafter referred to as Contract Procurement Section) with assistance from the Design & Construction Services (DCS) Division of the Aviation Department, is responsible for the procurement process of design and construction services for the Airport Development Program.

1-1.2 Design-Build

1-1.2.1 In the Design-Build project delivery method there will be a contract which provides for design phase services and a contract construction services. As the project Owner, the City will prepare a program of the functional requirements for the project with the assistance of a design criteria consultant. A Letter of Interest is publicly advertised, and then a Request for Qualifications (RFQ) information packet is issued.

1-1.2.2 The Design-Build teams prepare their qualification proposals, which are evaluated and short listed. The short listed teams then prepare a separate technical and price proposal which are then evaluated resulting in the final selection of the Design-Build team.

1-1.2.3 The design and construction phases may occur sequentially, or may be fast-tracked where design and construction occur concurrently. During fast-tracking, as elements of the project are designed, construction of those elements begins immediately while the remainder of the design is completed.

1-2 The Airport's Management Team

1-2.1 Project Management

1-2.1.1 The Design and Construction Services Division (DCS) of the COP Aviation Department is responsible for managing the design and construction of all projects at COP owned airports. In order to provide the Contractor with a single point of contact for communication and coordination

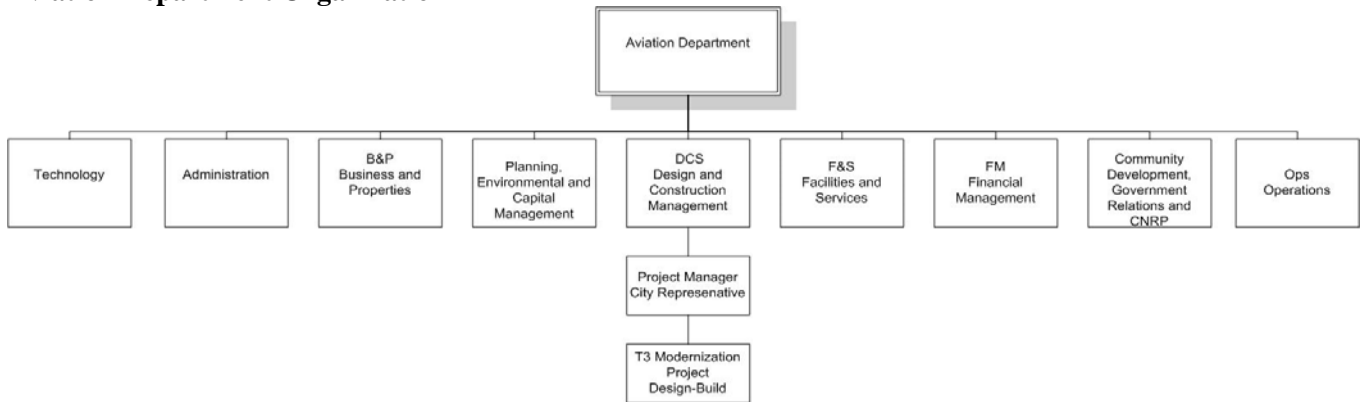
of the services to be provided for a project at the Aviation Department, DCS will assign a Project Manager (PM). The responsibilities of the PM are to manage and oversee the Contractor’s activities and services, facilitate the Contractor’s access to the Aviation Department’s Client (or Owing) Divisions (stakeholders) and the other resources of the COP as well as managing the construction phase of the project.

1-2.1.2 Of the various Client Divisions associated with the Aviation Department, the one most frequently consulted during the design phase is the Facilities & Services Division (FACILITIES AND SERVICES FACILITIES AND SERVICES) which is responsible for building and grounds maintenance, electrical, mechanical and energy maintenance, sign shop and key shop. Operations, Technology and Business and Properties are the next most frequently consulted Owing Divisions for whom DCS performs projects. Other divisions will become involved depending on the subject and the function of the facilities under consideration.

1-3 Team Organization by Process

The relationship between the Contractor and various elements of the project team during the life of the project may vary depending of the phase of project development. The following diagrams indicate the relationship between the Contractor, PM, and others which may become involved following NTP for the design phase services contract through the closeout of construction.

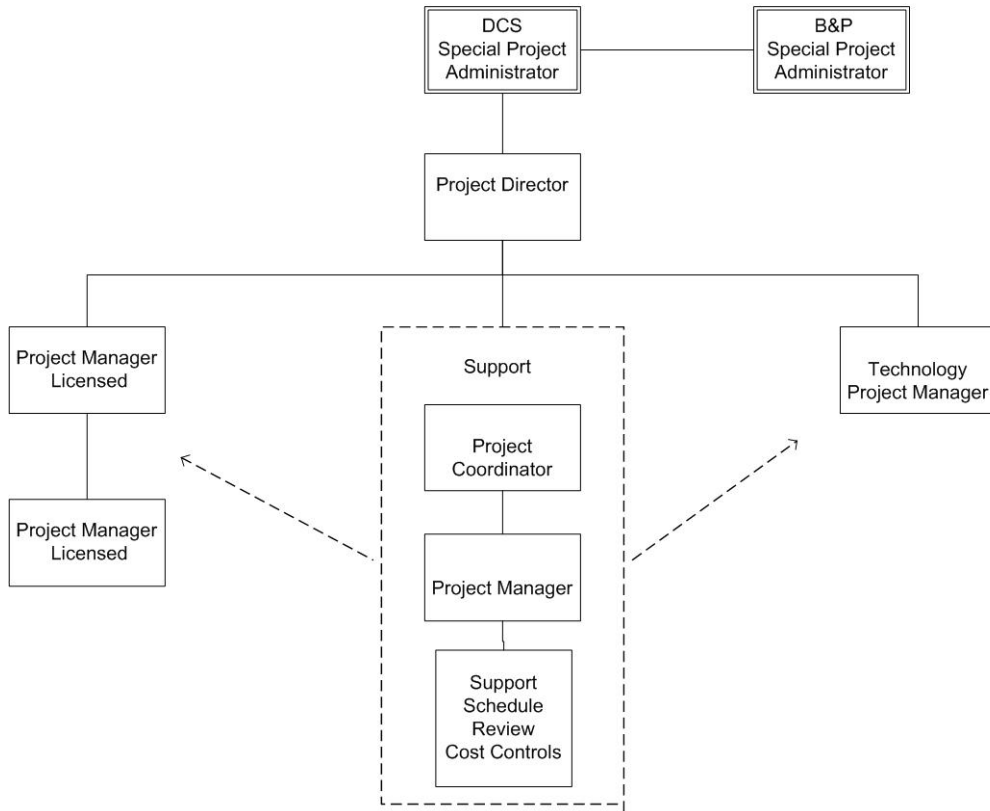
Aviation Department Organization



During the project, the PM serves as the single point of contact between the Contractor and the Aviation Department. As the design process moves forward, the PM will oversee and guide the work of the Contractor, assisting with communications, scheduling of meetings and review sessions with the Aviation Department’s Client Divisions and others as required.

1-3.1 Project Team Organization

T3 Modernization Project



Prepared September 11, 2013

Chapter 2: Pre-Design Phase

2-1 Introduction

This initial phase of project development provides the opportunity and forum necessary for the Contractor to become familiar with the Aviation Department's requirements for the project including services to be provided by the Contractor as well as the applicable administrative and regulatory constraints of the project.

2-1.1 Project Kickoff Meeting

2-1.1.1 The Aviation Department's PM will schedule a "kickoff meeting" to be attended by the Street's Contracts Officer, the Contractor and key individuals representing the airport's team. The Contractor will be provided:

- A.** A detailed project scope including the Project Goals and Special Requirements Statement
- B.** A project schedule identifying major completion milestones from NTP to the completion of construction and occupancy
- C.** A list of special considerations effecting the Contractor's scope and time requirements
- D.** Source of funding
- E.** Summary of sustainable design goals and life cycle cost analysis requirements
- F.** Issues related to codes and other regulatory requirements
- G.** Access to related documents including programming data, utility maps, master plans, record drawing of related facilities, etc.
- H.** The Street's Boilerplate Contract for Contractor's review
- I.** Instructions to the consulting team members so they can apply for necessary badging/keys/parking permits, etc.
- J.** Depending on the type of project, the Aviation Department will notify the Contractor of additional meetings beyond meetings with the Aviation Department's project team the Contractor will be required to attend including:
 - J.1.** City Council Meetings
 - J.2.** City of Phoenix Planning and Development Services Department (PDD)
 - J.3.** Mayor's Commission on Disability Issues (MCDI)
 - J.4.** Other City committee meetings

2-1.1.2 The Street's Contracts Officer will brief the Contractor concerning:

- A.** The Boilerplate Contract
- B.** Issues involved with the Contractor's fees for professional services.
- C.** Allowances which may be incorporated into the contract
- D.** Allowable costs
- E.** Required insurance and minimum limits

- F. Due date for Contractor's proposal
- G. Tentative negotiation schedule
- H. City's policy and expectations related to SBE participation.

2-1.2 Contractor's Project Management Services

2-1.2.1 As the City of Phoenix Aviation Department enters into a contractual relationship with the Contractor, it is with the expectation that the services of the Contractor and his team will provide the degree of professional support and response necessary to achieve the Aviation Department's full objectives. The Aviation Department's PM will expect the following minimum level of effort from the Contractor where not clearly excluded or delineated otherwise in the executed contract.

- A. Development of a project work plan
- B. Development of a detailed design schedule
- C. Design Schedule monitoring and updating of proposed and actual schedule
- D. Preparation of Monthly Progress Reports
- E. Management of sub-consultant's work progress, invoices and insurance
- F. Hold regularly scheduled progress meetings including scheduling and construction meetings, coordinating participant's attendance, recording of meeting minutes and action items including preparation, distribution and corrections as required. Meeting minutes should be distributed within 72 hours following a meeting.
- G. Maintaining, coordination and monitoring of document control files and library.
- H. Development of a Quality Control Plan
- I. Conducting Quality Control reviews
- J. Contractor's cost estimator will meet with the City's estimator during each phase of design to reconcile cost estimates.
- K. Preparation of Life Cycle Cost Analysis (LCCA) or review of same by subcontractor(s)
- L. Assembly and review of all applicable codes and standards which may influence or affect the design of the project including applicable LEED and other Sustainable Design and Site Development Standards
- M. Organize and participate in facility tours to examine successful design solutions including technology integration, operational efficiencies and observation of effective use of materials and finishes.
- N. Provide complete and thorough design documentation for each phase of design as outlined in SECTION II: Chapter 3
- O. Answer questions and issue addenda during bidding
- P. Prepare Conformed Documents for construction
- Q. Issue inspection reports including comments rendered by PM and other Aviation Department staff
- R. Perform substantial completion and final completion inspections
- S. Prepare Record Drawings and certify compliance with LEED requirements

2-1.3 Contract Negotiations

2-1.3.1 During the project kickoff meeting a [Design Services Checklist](#) will be provided for the Contractor's reference. This checklist outlines various services which may be included in the final executed contract, but does not limit the services to be provided nor is it to be considered all-inclusive of the services required to complete the work. In the event, there is a conflict between the services required under the final negotiated contract and those listed in the [Design Services Checklist](#), the final contract language shall govern. The Contractor is solely responsible for providing a complete and thorough design for the project.

2-1.3.2 The Contractor shall prepare a detailed proposal in accordance with the information gathered at the Project Kickoff Meeting and will submit it to the PM for transmittal to the Street's Contracts Officer with particular attention to the submittal date noted at the Kickoff Meeting. The proposal shall include:

- A. A detailed scope of work
- B. Detailed cost proposal with task/man-hour cost matrix including prime and sub consultants.
- C. Proposed schedule
- D. Reiteration of construction budget

2-1.3.3 Following a review of the Contractor's proposal by the Aviation Department's negotiation team, a meeting shall be held with the Street's Contracts Officer to review the Aviation Department's comments and negotiate terms and fees for the work.

2-1.3.4 The Contractor revises and resubmits the proposal until it is acceptable to the Street's Contracts Officer and the PM.

2-1.3.5 The Street's Contracts Officer submits the contract to City Council for formal approval of the Contractor selection and contract amount. The Contracts Officer also prepares a contract for signature by all parties.

2-1.3.6 The Contractor shall provide a project directory list for the prime and sub- consultants indicating the following:

- A. Contact person
- B. Company
- C. Telephone/Fax
- D. Street and Mailing Address if different
- E. E-mail address

2-1.3.7 Upon final approval of the contract by the City Council and recording by the City Clerk, the Street's Contracts Officer will issue an NTP to the Contractor.

2-1.3.8 A Design Services Checklist will be provided for the Contractor use at the "kickoff meeting".

2-1.3.9 A Consultant/Contractor Kickoff Process document is available from the Aviation Department and may be requested at the time of the NTP.

2-2 Project Administration

2-2.1 As-built Documentation

The Aviation Department may provide the Contractor with available as-built documentation and information including survey documentation and other airport layout data as required, however, the Aviation Department is not responsible for the accuracy of such information and it is the Contractor's responsibility to verify all information as noted below.

2-2.2 Verification of Existing Conditions

2-2.2.1 Depending on the project and its scope, verification of existing conditions may require work by an Arizona Registered Land Surveyor including topographic surveys, location of utilities, and verification of actual building dimensions when necessary. It shall be the Contractor's responsibility to verify all existing conditions related to the project under consideration including but not limited to:

- All site related information including existing grades and elevations
- Soil characteristics with respect to drainage and load bearing capacity
- Property boundaries and extent of surface improvements
- Underground features including all utilities
- Accuracy of as-built drawings for building structures regarding use of spaces, column locations, existing structural capacity, mechanical systems, electrical systems and other features which may require analysis and modification during the design of the proposed project
- Accurate existing building scanning's.
- Environmental condition of the property including asbestos.

2-2.2.2 Depending on the size and location of the project, aerial mapping may be a desirable method for acquiring topographic data:

2-2.3 Contractor's Invoicing and Monthly Report

2-2.3.1 The Contractor may submit invoices for services on a monthly basis. Invoices must be prepared in the form and according the requirements of the COP and as determined with the PM.

2-2.3.2 The Contractor will be required to prepare a Monthly Progress Report which will document the status of the project scope, schedule, and budget to be submitted with monthly invoices. Generally, the report will provide the following information:

- A.** Minutes of all meetings in the past month
- B.** Work accomplished in the previous month – information exchanged, and decisions made.
- C.** Work to be accomplished in coming month – a list of subjects or items identified for further discussion and/ or action.
- D.** Outstanding/Resolved Issues – information on any items that need to be tracked separately; then day to day items.
- E.** Updated Schedule – indicating dates of proposed work sessions, review meetings, and progress in relation to design and construction milestones based on the Project Schedule.

F. Budget Status – last statement of estimated probable construction cost and progress on activities to maintain budget if required.

2-2.4 The Program Management Information System (Unifier)

2-2.4.1 The Oracle Unifier™ System provides an automated flexible Internet system based program which supports project management, project controls, and integrated workplace management capabilities forming the basis of the airport’s financial, design and construction business process. Modules currently available on line for work at the Aviation Department provide access by authorized users to the following information and capabilities:

- Business Process Automation
- Cost Management Information
- Schedule Management Information
- Document and Communications Management
- Resource Management
- Task Management

2-2.4.2 Most information previously transmitted by paper copies is now entered into Unifier as the project develops including the management and tracking of correspondence, meeting minutes, submittals, requests for information, project change requests, construction change orders, project status, estimates, project plans, and other project related documents.

2-2.4.3 The COP will provide training and online access to Unifier software. The Contractor must provide computer hardware, suitable web browser software and high speed network connectivity to access the Unifier system.

2-2.5 Project Documentation and Control

2-2.5.1 The Contractor will be required to adopt the filing system format used in Unifier and must coordinate submittals for the project with the Unifier Document Manager System.

2-2.6 Contractor’s Quality Control/Quality Assurance Plan

2-2.6.1 As part of basic services, the Contractor will be required to prepare and submit for review and approval a Quality Control/Quality Assurance Plan (QA/QC). This plan must address the Contractor’s organization and methodology for performing the services specified in their Contract with the City of Phoenix.

2-2.6.2 The plan must, at a minimum, address how the Contractor will manage the following issues:

- Contractor’s team organization and how communication and coordination will occur between design disciplines
- The items of work subject to review at each design phase and how Contractor will perform independent technical reviews of the team’s work, including design calculations, drawings, specifications, and coordination of the work
- Method of documenting the results of independent technical reviews and how the results are presented to the design team at each phase of development
- Team’s approach to responding to comments and reconciling action to be taken

- How Contractor will audit team's response to assure appropriate action has been taken

2-2.7 Sustainable Design Requirements

The Contractor is expected to accommodate all of the Aviation Department's requirements with regard to the design of building and site development improvements in conformance with the current Sustainable Design and Site Development Standards.

2-2.8 PROJECT COST ESTIMATING

2-2.8.1 Introduction

- A. The Contractor will provide all cost data based on meaningful relevant and scalable historical data coupled with as much quantitative scope and itemized components of the project to make for a meaning discussion and review.
- B. The cost estimate will include all possible costs. This will include cost from:
 - Programming
 - Concept preparation
 - Design and engineering
 - Cost development using Total Cost of Ownership tools where warranted
 - Procurement
 - Demolition, site preparation and hazard materials removal
 - Construction
 - Testing
 - Equipment installation and furnishing
 - The commissioning process
- C. The Contractor will break out and detail the cost estimate to follow the same adopted work breakdown structure (WBS) shown in Section 2-2.11.
- D. The Contractor will include in the cost estimate sufficient contingency amounts. The contingencies are broken into the following amounts:
 - Programming and design phase amount
 - Construction phase which includes specifics related to site conditions, geotechnical, and unknowns from in-building remodel circumstances.
 - Owner side contingency amounts include possible end-user added scope, late requests by Facilities Division and maintenance group, and allowance for management changes.

2-2.8.2 Budgeting Levels

The Contractor will use a consistent level of details to compile the estimate to mirror the level of details shown in the scheduling process. The Contractor will use level 1, 2, or 3 to provide the appropriate details in cost as below:

- A. Level 1 is the highest level as a summary of costs at the executive level for decision making and presentation for approval and funding request.

- B. Level 2 will have a management level for knowledge-based discussion, procurement process and possible bid strategies.
- C. Level 3 is required before any negotiation.

2-2.8.3 Budgeting Steps

The Contractor will follow prudent steps for cost estimating to ensure the project stays on track with project controls of earned value system. This will ensure all participants are fully aware of the total project cost; this includes upper management, end-user, and stakeholders.

Whether it is a program budget at level 1 or detailed level 3 project estimate, the Contractor will assemble as much as possible all quantifiable data to compile the project estimate. Whereas at level 1, this must include to the maximum extent data with current pricing, or supportable prediction for future pricing trend when the project is planned to start after more than 18 months. And at detail level 3, a project estimate must include quantity take-off and pricing by specialists. Each item will include a WBS reference, quantity and pricing.

- Variance reporting during any updating
- Alternates

2-2.9 Building Information Model (BIM)

2-2.9.1 BIM, Intro and Basics

The Contractor must provide a building information model (BIM) as a collaborative tool that the City of Phoenix Aviation Department intends to use. With BIM users' experience of viewing and exchanging of project information is enhanced. BIM expands the use of project and design data with use of 3D-data visualization. It would also integrate with 4D-data of schedule information to show sequence of build. 5D-data is also added to provide progress in cash flow and project expenditures. BIM adds the ability of sharing by multiple project participants. As a collaboration tool, for different stakeholders at different phases of the life cycle of a facility, BIM users can insert, extract, update or modify project information as per the role of that participant. BIM and data integration will reduce conflict in design and in construction RFI's (request for information), and changes and claims.

It is the aim of the City of Phoenix Aviation Department to implement BIM as a facility management tool. The Design & Construction Services Division and the Facilities & Services Division will cooperate to acquire and further support the development of all BIM data from future City projects.

2-2.9.2 BIM Development

The Contractor in developing BIM must take information from many sources, design and construction team. Hence integrating the data to expand its usage must follow set established standards for its development. The BIM technology continues to evolve, and this exhibit refers to Level of development (LOD) to describe the model elements and model content criteria (as established by the AIA Document E202, BIM protocol exhibit). The LOD determines the level of involvement for each project stakeholder from project conception through project turnover. The contents of LOD are detailed in a later exhibit.

2-2.9.3 BIM Objectives and Functionalities

The Contractor must implement a BIM that will comply with the following:

A. BIM Set Up

- The BIM model must be capable of being transferred between project stakeholders to minimize duplication of effort, and maximize opportunity of the single entry by the functional party in charge.
- To achieve transferability and collaboration, the Contractor must use the standard WBS coding (work breakdown structure), as adopted by Aviation Department and approved by the City; see relevant Section 2-2.11.

B. BIM in Design

- The Contractor will conduct conflict resolution analysis during design to eliminate design clashes, resulting in a well-coordinated model prior to construction.
- The Contractor and the City PM team will use BIM visuals for project concept presentations, 3D design reviews, and any other design discussion to achieve the best decision making for the City.
- The Contractor will prepare accurate design documents and construction documents derived from the model to establish basis of design within the traditional standard of care provisions that govern the design of the project.
- The Contractor will implement a process in which BIM software utilizes the model and energy attributes to determine the most effective engineering methods based on design specifications.

C. BIM in Construction

- The Contractor will use BIM to conduct coordination review of key systems, equipment clearances, working with construction team, facility management team, and specialty trade contractors during construction.
- The Contractor will identify concerns with phasing on the airport campus.

D. Other Functionalities

- The Contractor will use BIM to develop an accurate Record Model and As-Built Model to be used for integration into the Aviation Department, and Sky Harbor International Airport facility management system(s) within the traditional standard of care provisions that govern the design and construction of the project.
- The Model will include and/or link all approved submittals, shop drawings, O&M Manuals, building control drawings, construction photos, inspection reports, and commissioning data as required.

2-2.9.4 BIM -- Level of Development (LOD)

A. LOD 100, Schematic Design

The LOD 100 model consists of overall building massing designed to perform whole building type analysis including building orientation, square foot costs. LOD 100 also pertains to 2D representation of elements as required by the 2D Construction Documents which may include drawings, narratives, and hand-built models.

B. LOD 200, Design Development

The LOD 200 model consists of generalized systems including approximate quantities, sizes, shapes, location, and orientation. The LOD 200 mode(s) are used for analysis of defined systems and general performance objectives. LOD 200 model(s) include attributes and parameters defined by the Aviation Department or the Owner Requirements document.

C. LOD 300, Construction Documentation

Model will include elements equivalent to traditional construction documents and shop drawings. LOD 300 models are well suited for estimating as well construction coordination for clash detection, scheduling, and visualization purposes. LOD 300 model(s) include attributes and parameters defined by the Aviation Department or the Owner Requirements document.

D. LOD 400, Construction Administration/Shop Drawings

Model elements are modeled as specific assemblies which are accurate in terms of quantity, size, shape, location, and orientation. LOD 400 model(s) are virtual representations of the proposed elements and considered to be suitable for construction, fabrication, and assembly. This LOD is most likely used by specialty trade contractors and fabricators to build and fabricate project components including MEP systems.

E. LOD 500, Project Completion/ Record Drawings/ As-Built Conditions

Model elements represent the project as it has been constructed, including as-built conditions. The model is configured to be the central data storage for integration into the building maintenance and operations system(s). LOD 500 Model(s) will include completed parameters and attributes specified in the Owner Requirements document. At the completion of construction, the BIM model(s) will be finalized, linked, and cross referenced.

F. LOD 510, 520, 530, 540

Model elements represent the project as it has been constructed, including as-built conditions. LOD 510, LOD 520, LOD 530, and LOD 540 models will contain LOD 100, LOD 200, LOD 300, LOD 400 facility and geometry data respectively and will be configured to contain the Operations and Maintenance manuals, warranty information, submittal information, and/or any other documents as applicable or required.

G. LOD 550, Owner Reserved

Reserved, LOD 550 model elements will not be generated during planning, design, or construction.

2-2.9.5 BIM Submittal Requirements

- Initial submittal
- BIM Project Execution. To include as a minimum
 - a. Project Information
 - b. Key Project Contacts
 - c. Organizational Roles and Staffing
 - d. Project BIM Objectives and Project BIM Uses
 - e. Designing the BIM Execution Process
 - f. The Airport Facility Attribute Data Requirements

- g. Collaboration Procedures
- h. Technological Infrastructure
- i. Model and Database Structure
- j. Quality Control Procedures
- k. Project Deliverables

- Viewing capability
- Monthly updates
- Final at end of construction (this one to be provided later)
- **See BIM Implementation Plan for final scope and submittal requirements.**

2-2.10 WORK BREAKDOWN STRUCTURE, WBS

The following provide a standard WBS (Work Breakdown Structure) for Aviation projects. The system follows a simple multi-level where the top identifies: Division, Facility, Contract Number (AV11000127); then Procurement Type, Contract Type, Cost Classification, and Cost Element; and then Facility Name in Title, Contract, Level / Zone, System, Sub-System, Element, Sub-Element, and BIM; all shown in Tables below.

The number of possible combinations using this system is practically infinite, it approaches 5.5×10^{16} .

The second level below identifies:

The table below is at detail level 2 & 3:

2-2.11 WORK BREAKDOWN STRUCTURE, WBS

The following provide a standard WBS (Work Breakdown Structure) for Aviation projects. The system follows a simple multi-level where the top identifies: Division, Facility, Contract Number (AV11000127); then Procurement Type, Contract Type, Cost Classification, and Cost Element; and then Facility Name in Title, Contract, Level / Zone, System, Sub-System, Element, Sub-Element, and BIM; all shown in Tables below.

<u>Project Code WBS</u>				
AV				Division
	11			Facility
		00		TBD
			0127	Contract number
				AV11000127
<u>Group Code WBS</u>				
CT				Procurement type
	DB			Contract type
		00		Cost classification
			ARC001	Cost element
				CT.DB.00
				CT.DB.00.ARC001
<u>Estimate/ Schedule WBS</u>				
11				Facility name in title
	0127			Contract
		AA		Level / zone
			01	System

AA			Sub-system
11			Element
AA	AA01AA11AA		Sub-element
1111	AA01AA11AA.1111		BIM item

The number of possible combinations using this system is practically infinite, it approaches 5.5×10^{16} .

The second level below identifies:

LEVEL 2 CODES			
<u>Level</u>	<u>Code</u>	<u>UM</u>	<u>System Description</u>
2	AA01	BSF	Substructure
2	AA02	BSF	Superstructure
2	AA03	BSF	Exterior Closure
2	AA04	BSF	Roofing
2	AA05	BSF	Interior Construction
2	AA06	BSF	Interior Finishes
2	AA07	BSF	Conveying Systems
2	AA08	BSF	Plumbing
2	AA09	BSF	H.V.A.C.
2	AA10	BSF	Fire Protection Systems
2	AA11	BSF	Electric Power & Lighting
2	AA12	BSF	Electrical Systems
2	AA13	BSF	Equipment
2	AA14	BSF	Furnishings
2	AA15	BSF	Special Construction
2	AA16	BSF	Building Demo
2	AA17	SSF	Sitework
2	AA18	SSF	Site Improvements
2	AA19	SSF	Site Civil/Mechanical Utilities
2	AA20	SSF	Site Electrical Utilities
2	AA21	SSF	Open Category
2	AA22	SSF	Open Category
2	AA23	SSF	Open Category
2	AA24	SSF	Open Category
2	AA25	SSF	Open Category
2	AA27	SSF	Airfield Electrical
2	AA28	SSF	Other Airfield
2	AA30	SSF	Design Costs
2	AA32	SSF	General Conditions

The table below is at detail level 2 & 3:

LEVEL 2 & 3 CODES			
<u>LEVEL</u>	<u>Code</u>	<u>UM</u>	<u>System Description</u>
1	AA		location / zone
2	AA01	BSF	Substructure
3	AA01AA	CY	Standard Foundations
3	AA01AB	CY	Wall Foundations
3	AA01AC	CY	Column Foundations & Pile Caps

3	AA01AD	CY	Other Standard Foundations
3	AA01AF	CY	special foundation conditions
3	AA01AG	CY	Pile Foundations
3	AA01AH	CY	caissons
3	AA01AI	CSF	Underpinning
3	AA01AJ	DY	Dewatering
3	AA01AK	CY	Raft Foundations
3	AA01AL	CF	Pressure Injection Grouting
3	AA01AM	CY	Other Special Foundation Conditions
3	AA01BA	SF	Slab On Grade
3	AA01CA	LF	Trenches
3	AA01DA	CY	Basement Excavation - Backfill - Shoring Sys
3	AA01EA	SF	Basement Walls
2	AA02	BSF	Superstructure
3	AA02AA	SF	Floor Construction
3	AA02BA	SF	Roof Construction
3	AA02CA	VLF	Stair Construction
2	AA03	BSF	Exterior Closure
3	AA03AA	SF	Exterior Walls
3	AA03AB	SF	Exterior Skin
3	AA03AC	SF	Insulation & Vapor Barrier
3	AA03AD	SF	Interior Skin
3	AA03AE	SF	Parapets
3	AA03AF	SF	Exterior Louvers & Screens
3	AA03AG	SF	Sun Control Devices (Exterior)
3	AA03AH	LF	Balcony Walls & Handrails
3	AA03AI	SF	Exterior Soffits
3	AA03AJ	SF	Exterior Fencing
3	AA03AK	SF	Other Exterior Walls
3	AA03BA	SF	Exterior Windows
3	AA03CA	EA	Exterior Personnel Doors
3	AA03DA	EA	Exterior Specialty Doors
2	AA04	BSF	Roofing
2	AA05	BSF	Interior Construction
3	AA05AA	SF	Partitions
3	AA05BA	EA	Interior Personnel Doors
3	AA05CA	EA	Interior Specialty Doors
3	AA05DA	EA	Interior Specialties
3	AA05EA	LF	Casework
2	AA06	BSF	Interior Finishes
3	AA06AA	SF	Wall Finishes
3	AA06BA	SF	Flooring & Floor Finishes
3	AA06CA	SF	Ceiling & Ceiling Finishes
2	AA07	BSF	Conveying Systems
3	AA07AA	STP	Elevators
3	AA07BA	VLF	Moving Stairs & Walks
3	AA07CA	LF	Material Handling Systems
2	AA08	BSF	Plumbing
3	AA08AA	EA	Plumbing Fixtures
3	AA08BA	LF	Domestic Water Supply

3	AA08CA	LF	Sanitary Waste & Vent System
3	AA08DA	LF	Rainwater Drainage System
3	AA08EA	EA	Plumbing Equipment
3	AA08FA	EA	Special Plumbing Systems
2	AA09	BSF	H.V.A.C.
3	AA09AA	BTU	Energy Supply
3	AA09BA	BTU	Heat Generating System
3	AA09CA	BTU	Cooling Generating System
3	AA09DA	BSF	Distribution Systems
3	AA09EA	EA	Terminal & Package Units
3	AA09FA	EA	Controls & Instrumentation
3	AA09GA	BSF	Systems Testing & Balancing
3	AA09HA	BSF	Special Mechanical Systems
3	AA09IA	BTU	Heat Generating Systems By FSA/DEPT
3	AA09JA	LF	Cooling Generating Systems by FSA/DEPT
3	AA09KA	LF	Distribution Systems by FSA/DEPT
3	AA09LA	EA	Terminal & Package Units by FSA/DEPT
3	AA09MA	EA	Controls & Instrumentation by FSA/DEPT
3	AA09NA	BSF	System Test & Balance by FSA/DEPT
3	AA09OA	BSF	Special Mechanical Systems by FSA/DEPT
2	AA10	BSF	Fire Protection Systems
3	AA10AA	BSF	Water Supply (Fire Protection)
3	AA10BA	EA	Sprinklers
3	AA10CA	LF	Standpipe Systems
3	AA10DA	EA	Fire Extinguishers
3	AA10EA	EA	Special Fire Protection System
2	AA11	BSF	Electric Power & Lighting
3	AA11AA	KVA	Service and Distribution
3	AA11BA	LF	Lighting & Branch Wiring
2	AA12	BSF	Electrical Systems
3	AA12AA	EA	Communication, Security, & Alarm Systems
3	AA12BA	BSF	Special Electrical Systems
2	AA13	BSF	Equipment
2	AA14	BSF	Furnishings
3	AA14AA	BSF	Furnishings
2	AA15	BSF	Special Construction
3	AA15AA	EA	Vaults
3	AA15BA	EA	Interior Swimming Pools
3	AA15CA	EA	Special Purpose Rooms
3	AA15DA	BSF	Pre-Engineered Buildings
3	AA15EA	EA	Washracks
3	AA15FA	BSF	Exterior Utility Buildings
3	AA15GA	BSF	Other Special Construction
2	AA16	BSF	Building Demo
3	AA16AA	CF	Selective Building Demolition
3	AA16BA	CSF	Hazardous Selective Building Demolition
2	AA17	SSF	Sitework
3	AA17AA	SSF	Site Clearing
3	AA17BA	CF	Site Demolition & Relocation
3	AA17CA	CY	Site Earthwork

3	AA17DA	SSF	Site Cleanup
3	AA17EA	SSF	Other Site Preparation
2	AA18	SSF	Site Improvements
3	AA18AA	SF	Roadways
3	AA18BA	SF	Non-Roadway Paving
3	AA18CA	SF	Walks, Steps, Ramps, & Terraces
3	AA18DA	SSF	Site Development
3	AA18EA	SF	Landscaping
3	AA18FA	SF	Special Construction
3	AA18GA	SF	Other Site Improvement
2	AA19	SSF	Site Civil/Mechanical Utilities
3	AA19AA	LF	Water Supply & Distribution Systems
3	AA19BA	LF	Sanitary Sewer Systems
3	AA19CA	LF	Storm Sewer Systems
3	AA19DA	LF	Industrial Waste Systems
3	AA19EA	LF	Heating Distribution Systems
3	AA19FA	LF	Cooling Distribution Systems
3	AA19GA	LF	Natural & Propane Gas Distribution Systems
3	AA19HA	LF	Building Fuel Distribution Systems
3	AA19IA	LF	Other Civil/Mechanical Utilities
2	AA20	SSF	Site Electrical Utilities
3	AA20AA	EA	Substations
3	AA20BA	LF	Exterior Electrical Distribution
3	AA20CA	EA	Exterior Lighting
3	AA20DA	EA	Exterior Communications & Alarm Systems
3	AA20EA	EA	Exterior Security Sensors & TV Monitoring Systems
3	AA20FA	PTS	Cathodic Protection
3	AA20GA	EA	Other Electrical Utilities
2	AA21	SSF	Open Category
2	AA22	SSF	Open Category
2	AA23	SSF	Open Category
2	AA24	SSF	Open Category
2	AA25	SSF	Open Category
3	AA26AA	SF	Airfield Pavements
2	AA27	SSF	Airfield Electrical
3	AA27AA	EA	Runway Lighting
3	AA27BA	EA	Taxiway Lighting
3	AA27CA	EA	Apron And Pad Lighting
3	AA27DA	EA	Control Tower
2	AA28	SSF	Other Airfield
3	AA28AA	LF	Airfield Markings
3	AA28BA	SF	Airfield Revetments
3	AA28CA	SF	Aircraft Arresting Systems
3	AA28DA	SF	Jet Engine Blast Deflectors
2	AA30	SSF	Design Costs
3	AA30AA	BSF	Programming - Preliminary Design
3	AA30BA	BSF	25% Documents -Schematic Design - 25% Concept Specifications
3	AA30CA	BSF	50% Documents - Design Development - 50% Specifications
3	AA30DA	BSF	75% > 90% Construction Documents
3	AA30EA	BSF	90% > 100% Construction Documents

2	AA32	SSF	General Conditions
3	AA32AA	HRS	Staffing
3	AA32BA	DYS	Support Materials & Equipment
3	AA32CA	DYS	Support Vehicles
3	AA32DA	BSF	Utility Development
3	AA32EA		Quality Control
3	AA32FA		Project Close Out

2-2.12 Scheduling

2-2.12.1 The PM will maintain a Project Schedule as defined in Exhibit __ of the Design Phase Contract.

2-2.12.2 The Contractor shall be required to submit a detailed design schedule for the PM’s use and shall be required to periodically update this schedule to reflect changes in the flow, duration and completion dates of design activity as required for completion of the work in accordance with the established milestones of the Project Schedule.

2-3 Environmental Standards and Permitting

The Aviation Planning & Environmental Division (P&E) develops environmental site assessments, interacts with other governmental agencies and tenants regarding environmental approvals ~~matters~~ and permits, and manages prevention and mitigation processes such as the Storm Water Pollution Prevention Program.

2-3.1.1 The Contractor must, with the PM’s concurrence, work in close coordination with P&E to identify hazardous materials which may be discovered during construction of the project to insure proper disposed or encapsulation in a manner prescribed through various federal, state and local regulations.

2-3.1.2 The Contractor will be provided and must review the following documents for more information on the process of survey, removal and disposal of hazardous materials:

A. [Construction Drawing Review Checklist](#) – Includes a discussion of items governing asbestos/lead abatement, environmental permitting, abandoned fuel lines / wells / drilling and hazardous waste.

B. [Hazardous Material Protocol](#) – Provides a form documenting phone numbers and contact names for the Contractor with the City of Phoenix and DCS upon discovery of hazardous materials during excavation or demolition activities.

C. [Environmental Points of Interest](#) – This is an aerial photo of the airport and its immediate surrounding area indicating known environmental hotspots.

2-3.1.3 The Contractor is responsible for coordinating the design solution to ensure that the requirements for all environmental reviews, approvals and permitting are maintained and secured so as not to delay the progress of the project which may result if a permitting requirement is not satisfied at the time of construction.

2-3.2 Environmental/Site Assessment for Asbestos and Other Hazardous Materials

2-3.2.1 CONTAMINATED SITES

A. In the case of property already owned by the City, redevelopment plans should consider past land use that may have resulted in site contamination. For example, pre-existing features such as dry wells or underground chemical or petroleum storage tanks, should be evaluated to determine if their use has resulted in any environmental or health and safety problems. If so, mitigation may be required to prepare a site for redevelopment, or the project design may be altered to minimize environmental impacts.

B. The following components shall be included in the Environmental/Site Assessment. This list is not intended to be complete and must be coordinated with requirements included in SECTION I: Chapter 2, 3, 4 and 6, along with other applicable sections of the Design Manual. The Contractor shall address any environmental issues that have potential to impact the construction or demolition process ensuring they are addressed in the Specifications and Plans for the project or as otherwise directed by P&E. If the Contractor discovers asbestos-containing material or other hazardous materials at any time during the project, they must immediately alert the PM and COP Fire Department.

2-3.2.2 All design work shall be accompanied by an Environmental/ Site Assessment of the project that includes but is not limited to the following components:

A. HAZARDOUS MATERIALS SURVEY

Conduct a hazardous materials survey of the site to identify Asbestos Containing Materials (ACM), lead-based paint, polychlorinated biphenyls (PCBs), and other hazardous materials present in the building and structures, pavement and/or in the underground utilities on site. Coordinate with the Aviation Department Environmental Section for survey, testing, possible removal and/or disposal of any hazardous materials prior to any construction/demolition activities.

B. HAZARDOUS MATERIALS INVENTORY

Prepare a hazardous materials inventory statement for materials to be stored in the structure. Prior to storing such materials, provide the hazardous materials inventory statement to the COP Fire Department 72 hours prior to storage.

C. PETROLEUM CONTAMINATED SOIL

Conduct a site investigation to identify potential petroleum contaminated soil (PCS) and/or groundwater on site. Contact the Aviation Department Environmental Section to coordinate proper remediation and disposal requirements.

D. AIR QUALITY PERMITS

Prepare an application for an air quality permit to construct and operate any regulated stationary emission source (such as, boiler, fuel tank, emergency generator, etc.) where applicable. Contact the Aviation Department Environmental Section to coordinate permitting requirements.

E. POLYCHLORINATED BIPHENYL PRODUCTS

Conduct a survey of all electrical equipment for polychlorinated biphenyl (PCB) before the demolition/construction process starts. Contact the Aviation Department Environmental Section to coordinate proper handling and/or disposal of any equipment containing PCBs.

F. STORM WATER POLLUTION PREVENTION PLAN

Prepare a Construction Storm Water Pollution Prevention Plan (CSWPPP) including associated erosion and sediment control requirements for construction activities.

G. WATER QUALITY DISCHARGE PERMIT

Prepare an application for a water quality discharge permit for any regulated process water to be generated during construction and/or as a part of the facility's future operations as noted in 2-3.4.1 below. Contact the Environmental Section to coordinate permitting requirements.

H. UNDERGROUND OR ABOVE GROUND STORAGE TANKS

Conform to requirements in 2-3.4.4 below for installation and removal of Underground Storage Tanks (USTs)/Above Ground Storage Tanks (AST).

I. WETLANDS ASSESSMENT

Prepare a wetlands assessment and determination along with any required nationwide and/or Army Corps of Engineers 404 permit for proper mitigation activities.

J. ENVIRONMENTAL CONCERNS

The Contractor should meet with P&E to discuss necessary action to address all and any other environmental concerns.

K. Demolition and Construction Waste Plan. Prepare using Aviation Demos Construction Waste Plan.

2-3.3 Sustainable Design and Construction Standards

2-3.3.1 DESIGN STANDARDS AND GUIDELINES

The City of Phoenix Aviation Department has adopted standards governing design approach which includes but may not be limited to the following topics:

A. Facilities shall be designed to meet LEED standards including requirement for the application of LEED Standards for:

- LEED NC (New Construction) for new facilities
- LEED EB (Existing Building) for major reconstruction and remodeling
- Actual level of LEED design shall be determined on a project by project basis in advance of design and approved by the Aviation Department, PM and but is typically Silver LEED.
- Refer to Appendix K LEED for additional information

B. Pavement Project Design Life and or, Building, Energy Systems must be validated with a Life Cycle Cost Analysis using Aviation Life Cycle Cost tool kit and approved by the Aviation Department

C. The adopted LEED design criteria should be fully coordinated with the results of LCCA studies when applicable.

D. The PM Contractor will incorporate building design applications which enhance the overall building performance in the desert environment including concepts of shading, use of natural light and orientation whenever possible

E. Design for minimum energy utilization

F. Design for reduction in water consumption

G. Design -Collection areas to maximize recycling of waste products from building tenant operations.

H. Includes Energy Systems Commissioning

I. Outlines required LEED procedures for contractors.

J. The Project Manager must ensure the Contractor maintains an awareness of the importance of Constructability Reviews regarding the maintainability and operation of all design proposals

2-3.3.2 CONSTRUCTION STANDARDS AND GUIDELINES

The Aviation Department has adopted standards that govern construction practices which includes but may not be limited to the following topics:

A. Facilities shall be constructed to meet at least minimum LEED standards (as follows):

- LEED NC (New Construction) for new facilities
- LEED EB (Existing Building) for major reconstruction and remodeling
- Refer to Appendix K, LEED for additional information

B. Construction Waste Management and Materials Recycling Program

- Recycle or salvage for reuse a minimum weight (determined by project) of the waste generated on-site
- Achieve waste reduction through recycling efforts, including demolished construction material, throughout the construction process

C. Building Commissioning - a systematic and documented process that:

- The owner's operational needs are met
- Building systems perform efficiently singly and as a whole
- Building operators are properly trained
- Owner's manual is compiled

D. Construction Equipment and Construction Operations

- Require-use of California Type IV equipment
- Maintain construction equipment idling policy
- Reduce use of project generators
- Require regular equipment maintenance with documentation

2-3.4 Environmental Permitting

Environmental permits are required on virtually every project conducted at one of the City of Phoenix Aviation Department's airports. These permits are required by various federal, state and local regulations. Compliance with these regulations is necessary to ensure the protection and safety of the community, environment, airport, workers and passengers. Contact the Aviation Department Environmental Section to coordinate environmental permitting requirements.

2-3.4.1 STORMWATER

A. For any project that will disturb greater than one acre of soil, the construction activity will require authorization under the Arizona Pollutant Discharge Elimination System (AZPDES) General Permit for Discharge from Construction Activities to Waters of the U.S. – Permit No. AZG2008-001 (referred to as the Construction General Permit). This program is administered by the Arizona Department of Environmental Quality (ADEQ). In addition to storm water discharge, this permit will typically cover non-storm water construction related discharges such as dewatering (discharges related to dewatering that contain contaminants are subject to additional requirements).

B. A copy of the AZPDES Construction General Permit must be kept at the construction site at all times.

C. The applicant must submit a Notice of Intent (NOI) to ADEQ a minimum of five business days prior to start of construction (earlier submittal is recommended). If the project has the potential to discharge to a municipal separate storm sewer system (MS4), a copy of the NOI should be forwarded to the owner/operator of the MS4 at the time of submittal of the NOI to ADEQ. A copy of the NOI is to be provided to the Environmental Section.

D. The applicant must prepare Construction Storm water Pollution Prevention Plan (CSWPPP) prior to submittal of the NOI and implemented prior to construction. A copy of the CSWPPP must be kept on the construction site at all times in addition to inspection records. An additional copy shall be provided to the Environmental Section.

E. The applicant must submit a Notice of Termination (NOT) within 30 days of achieving final stabilization on all portions of the construction site. If the project has the potential to discharge to an MS4, a copy of the NOT should be forwarded to the owner/operator of the MS4 at the time of submittal of the NOT to ADEQ

F. A Storm Water Pollution Prevention Plan is used to describe a process through which a facility thoroughly evaluates potential pollutant sources at a site and selects and implements appropriate measures designed to prevent or control the discharge of pollutants in storm water runoff.

F.1. Sources - Sources of pollution potentially affecting the quality of storm water discharges associated with industrial activities that are covered under the MSGP-2010 need to be identified.

F.2. Implementation - Implementation of practices to minimize and control pollutants in storm water discharges from these industrial activities are to be described.

F.3. Compliance - Compliance with the terms and conditions of the MSGP-2010 must be ensured.

2-3.4.2 DUST CONTROL

A. When the construction activity will require a Dust Control (Earthmoving) Permit, a Permit from the *Maricopa County Air Quality Department is required. The permit will define the Dust Control Plan to be implemented.

B. The Maricopa County Air Quality Department's Dust Compliance Division is responsible for protecting the public from airborne particulate matter [PM-10 and PM-2.5].

C. To facilitate and encourage strict compliance with the Maricopa County Air Pollution Control Regulations pertaining to fugitive dust control, the Contractor must submit required documentation at the preconstruction meeting prior to conducting any earth moving or dust generating activities under the Contract. An additional copy will be provided to the Environmental Section.

2-3.4.3 CONSTRUCTION DEBRIS

Remove all surplus and/or waste material from the site. The disposal of material off-site shall be in a lawful manner and at a site, such as a licensed landfill, having current approval to conduct solid waste disposal activities.

If the project includes a construction debris landfill for disposal of construction material, an ADEQ permit will be required. Construction debris landfills are subject to the Aquifer Protection Permit requirements and disposal requirements of the Arizona Administrative Code (A.A.C) R-18-8-511 and 512.

2-3.4.4 UNDERGROUND STORAGE TANKS

A. General - All underground storage tanks shall be designed, installed, operated, and tested in accordance with local, state, federal, American Petroleum Institute (API) and National Fire Protection Association Standards (NFPA regulations). All new installations of underground storage tanks (UST) containing fuels, oils or chemicals, designated hazardous by the EPA or the State of Arizona, shall have an approved secondary containment system for both the tank and connecting piping. All USTs must be provided with a minimum 30-year manufacturer's warranty. All UST installations shall have the proper leak detection, inventory control and overflow alarm mandated by applicable federal, state, and local laws.

B. Tank Construction - All USTs for petroleum products storage must be double walled and corrosion resistant, compatible with the stored product, as approved by the PM. All associated product piping must be double-wall corrosion resistant coated steel or double-wall fiberglass. Cathodic protection shall be provided for any portion of the tank and piping which is not fiberglass and shall be in accordance with standards published by the API and the National Association of Corrosion Engineers.

C. Leak Detection System - The UST system must have a liquid or vapor leak detection system that provides continuous monitoring of any part of the UST, including the piping and the annular (interstitial) space.

D. Alarm - The alarm output of the monitor shall provide two separate digital voltage signals to indicate the presence of leaked fluid and a high level alarm to prevent overflow. It shall also be capable of producing an audible or visual alarm to alert local personnel of potential tank overflow situations at the fill port area.

E. Overflow Protection - The UST must be equipped with a device, such as a overfill warning alarm and an overflow protection device to prevent spills. A spill containment system shall be used around the fill pipe.

F. Vapor Recovery - A Phase II vapor recovery system is required for all gasoline and aviation gasoline tanks.

G. Pressure Test - The UST system shall be pressure tested after it is placed in the ground and before backfilling, in accordance with the manufacturer's instructions and the NFPA. Pipe testing shall be conducted separately from the tank testing. Primary piping shall be capped at both the tank connection and connections to the associated system to facilitate testing. The PM shall be present during the testing of the UST, piping, and connections. Testing shall be under the pressure recommended by the manufacturer. Leak detection method shall use a soapy solution or vapor sensor on all joints to check for bubbling leaks. Before secondary containment is installed, the PM designated construction representative shall be present for the primary piping testing.

H. Installation Procedures - All tanks and leak monitoring equipment shall be installed in accordance with procedures recommended by the manufacturer, the American Petroleum Institute, the National Fire Protection Association and Underwriters Laboratories, Incorporated. Written documentation shall be delivered to the PM upon complete installation and testing of an UST, certifying that the tank and related equipment has been installed in accordance with the noted procedures. All USTs shall be installed, repaired, and maintained by ADEQ Certified Tank Service Providers. Provide copies of all documentation to the Environmental Section to allow for the completion of air quality and UST permits.

I. Installation Approval - The design and installation of the UST system shall be approved in writing by an accredited Corrosion Specialist of the National Association of Corrosion Engineers

or a Professional Engineer. The written approval must identify the precise storage location and the product or products stored.

2-3.4.5 REMOVAL OF UNDERGROUND STORAGE TANKS (UST)

A. General - Out-of-service underground storage tanks shall be closed in place or removed and disposed of as directed by the PM in accordance with current federal and state regulations.

B. Extent of Removal - Removal shall include all supply, return and vent pipelines, storage tank, contaminated soils, and miscellaneous equipment adjunct to the operation of the storage tank, such as pumps, electrical wiring, etc. Closure shall include all piping and miscellaneous equipment.

C. Removal Coordination: Removal shall be coordinated with the PM, COP Fire Department and the Environmental Section to ensure compliance with all regulations and governing agencies. Tanks must be removed by an ADEQ Certified Tank Service Provider.

D. Tank Disposal - The removed tank shall be disposed of in accordance with the state and federal regulations, and proper supporting manifest certificate and other required documents shall be provided to the PM. An additional copy of the documentation shall be provided to the Environmental Section to ensure compliance with permitting requirements.

E. Contamination – As a part of removal coordination, the site shall be assessed for the possibility of soil and groundwater contamination from the tank.

F. Approved Manner - If the site assessment indicates that contamination has occurred, the contaminated soil/materials shall be removed and/or disposed of as required by state and federal regulations. Contact the Environmental Section to coordinate the appropriate remediation of any contamination.

2-3.4.6 ABOVE GROUND STORAGE TANKS (AST)

A. General - All above ground storage tanks shall be designed, installed, operated, and tested in accordance with local, state, federal, API and NFPA regulations. All ASTs must be provided with a minimum 30-year manufacturer's warranty. All above ground storage tanks containing fuels, oils or chemicals designated hazardous by the EPA or the State of Arizona shall be designed, installed, tested, and operated in accordance with local, state, and federal requirements and codes. All above ground storage tanks and associated piping shall be double wall or have an approved secondary containment system. All permanent or temporary tanks containing materials other than water shall have an approved barrier installed to protect the tank from vehicular damage. Tanks shall be installed by a Certified Tank Service Provider. Contact the Environmental Section to coordinate permitting requirements for air quality, SPCC and associated notification regulations.

B. AST Overflow Protection - Regardless of the type of fill port and/or fill adapters that are acceptable to the user/operator, a high level or overfill warning alarm shall be provided.

2-3.4.7 HAZARDOUS MATERIALS STORAGE

A. General - Space with provisions for hazardous materials storage shall be designed in accordance with federal, state and local laws, codes, and requirements. Request shall be made to the PM and COP Fire at least 72 hours prior to use, change or storage.

B. Placards- On all buildings, structures, and temporary or permanent tanks in which hazardous materials are stored, dispensed or handled, the design shall include a permanent reflective placard to be mounted on the tank or the exterior of the building. For above ground storage tanks, adhesive backed placards may be used. COP Fire shall determine the hazard rating of the material and the distance at which hazard ratings on the placards shall be visible. Sign and lettering size

shall be based on this distance, as specified in NFPA 704, Standard System for the Identification of the Hazards of Materials for Emergency Response. Above ground storage tank placards shall provide the following information: Material, product name, hazard rating of the material in accordance with NFPA 704.

C. For buildings, only NFPA 704 hazard rating placard shall be used. Placards shall be installed on buildings as specified by COP Fire.

2-3.4.8 BATTERY CHARGING INSTALLATION AND STATIONARY LEAD ACID BATTERY SYSTEMS

All projects must comply with federal, state and local battery charging installation and lead acid battery systems laws, codes, and requirements.

2-3.4.9 AIR QUALITY

All projects must comply with federal, state and local air pollution control laws, codes, and requirements.

A. Dust Control Permits

Any project that disturbs one-tenth (1/10) acre or more is required to obtain a Maricopa County Air Quality Department Dust Control Permit prior to any disturbance. A copy of the dust control plan and dust control permit must be on-site during the project. Provide a copy of the dust control plan and dust control permit to the Environmental Section.

B. Non-Title V Synthetic Minor Air Quality Permit

Maricopa County Air Quality Department requires air quality permits to construct or operate any regulation stationary emission source. This includes, but is not limited to, boilers, emergency generators and fuel tanks. Contact the Environmental Section to coordinate permitting requirements and thresholds for any equipment that may require an air quality permit.

C. Asbestos Surveys and National Emission Standards for Hazardous Air Pollutants (NESHAP) Notification

Maricopa County Air Quality Department requires that an AHERA-certified building inspector inspect materials that will be disturbed during renovation or demolition activities within the previous 12 months. Asbestos surveys are required for all activities that disturb any materials except unpainted wood, metal or glass. These activities include, but are not limited to, disturbing or cutting walls, saw cutting pavement, disturbing ceiling tiles, floor tiles, concrete, curbing asphalt, and equipment, removing or cutting any painted material, caulk, mastics or other binding agents. NESHAP Notifications are required prior to any demolition activities and may be required prior to any renovation activities. Contact the Environmental Section to coordinate asbestos surveys/inspections and NESHAP notifications prior to disturbing any regulated material.

2-3.4.10 FLOOD PLAIN

When work is required within a flood plain, as shown on Federal Emergency Management Agency (FEMA) Flood Insurance Rate Maps and/or Flood Boundary and Floodway Maps, the Contractor's shall determine the effect of the activity on the flood plain and/or floodway. If necessary, the Contractor's shall prepare documentation suitable for submittal to FEMA for the appropriate map revision/amendment and obtain the map revision/amendment from FEMA.

2-3.4.11 CAR AND BUS WASH FACILITIES (RECYCLE WASH WATER)

Car wash and bus wash facilities shall be provided with a self-contained, closed loop (zero discharge) recycling system for recycling the wash water. Backflow prevention devices, as required by the PM, shall be installed at incoming water lines.

2-4 Air Quality Program

2-4.1 NEPA and General Air Quality Conformity

Maricopa County is designated as a non-attainment area for PM-10 (larger particulates such as dust) and ozone, and designated a maintenance area for carbon monoxide under the National Ambient Air Quality Standards (NAAQS). Non-attainment areas are regions where the federal air quality regulations have been exceeded and are bound by specific requirements to improve air quality. One of these requirements is that the Aviation Department must complete Air Quality Conformity analysis for all construction projects. The intent of this regulation is to ensure that any federally funded or approved projects do not contribute to the non-attainment status of Maricopa County.

A. Project Purpose and Need statement must be submitted to the Planning & Environmental Division during the design phase of the project to ensure compliance with the National Environmental Policy Act (NEPA) air quality requirements.

B. Project Detail statement shall be submitted to the Environmental Section during the design phase to ensure the project does not exceed maximum emission thresholds. The project detail shall include the following:

- Duration of project
- Overall size of the project (acres)
- Quantity of on-site cut/fill (cubic yards)
- Quantity of off-site cut/fill (cubic yards)
- Haul distance (miles)
- Pavement marking (gallons)
- Terminal upgrades (area – square feet)
- Commercial vehicle staging areas (square feet)
- New airfield work (non-runway) (area – square feet)

Additional information may be requested to complete the air quality conformity analysis, including types of construction vehicles and time running and/or potential changes in aircraft emissions due to changes in typical duration of aircraft on the airfield.

2-5 Remediation Sites

2-5.1 Environmental Remediation Sites

A number of remediation sites are present on Aviation Department property. The remediation sites are present due to a regulatory requirement, either from the U.S. Environmental Protection Agency (US EPA) or the Arizona Department of Environmental Quality (ADEQ). The parties that are responsible for these remediation sites may be subject to fines, regulatory actions, or court actions if the remediation systems are damaged or inoperable. Construction crews or project occupants may be exposed to remediation site vapors or contaminated soils if proper precautions are not planned.

A. Infrastructure - These remediation sites have the following infrastructure items: monitor wells, process wells, injection wells, process piping, electrical conduit, electrical service, and natural gas service. Care must be taken in the design phase and construction phase to not impact this infrastructure.

B. Submit your design drawings to the Environmental Section for an evaluation of whether your project may impact (or be impacted by) a remediation site.

2-6 Signage Standards

2-6.1 Signage Coordination

The Contractor, working in coordination with the PM, will be required to identify and coordinate signage requirements in the design with the Aviation Department's Signage Coordinator and the Airport's Signage Program (excluding airfield movement area signs). This program includes internally produced signs, professional produced signs and temporary construction signs which are both internal and external to buildings, both illuminated and non-illuminated, both dynamic and static, and both wayfinding and regulatory in nature.

2-6.2 Signage Types

The Aviation Department has implemented some of the best management practices adopted from the American Association of Airport Executives. (AAAE) for its own Signage Program that encompasses the following:

2-6.2.1 Internally Produced Signs - Signs that can be completed internally by the Aviation Sign Shop within the Facilities & Services Division. However, construction projects which have signage are expected to incorporate the identification, design, fabrication, and installation of these type sign types as part of the scope of the project.

2-6.2.2 Professional Produced Signs - Signs that are complex or those that cannot be completed internally due to the size, quantity, fabrication method, etc. These are signs that are produced and installed by an outside signage Contractor

2-6.2.3 Temporary Construction Signs - Temporary signage for construction and maintenance activities for navigation on the roadways and within the terminals and parking areas that are produced and installed by an Aviation-contracted consultant as part of the Improving Phoenix Program.

A. Refer to the [Signage Standards Manual](#) for more information on Signage design, layout, fabrication, and installation. **Contact the Aviation Sign Program Coordinator of Facilities & Services at 602-273-4510 for information regarding the Signage Standards Manual**

B. Refer to "Dust" which is the airport program to inform the public of construction activities, for more information on the POD Program and the signage they provide.

2-6.3 Americans with Disabilities Act (ADA) Standards

It is important for the Contractor to incorporate the latest ADA Standards which apply to signage including text size, font characteristics, contrast, etc., which may supersede the requirements of the Aviation Signage Manual.

2-6.4 Signage Permit

All signage must be submitted for a Signage Permit from the Facilities & Services Division. Tenants must apply for signage changes and additions through the Tenant Improvement (TI) process submitted through their assigned Business and Properties contact.

2-6.5 Other Signage Standards

In addition to the signs governed by the Signage Standards Manual, there are other standards and sources of signs used at the airport that the Contractor must consider in completing the design for signage which include:

2-6.5.1 City of Phoenix Barricade Manual (traffic control)

2-6.5.2 Airport Safety Manual (temporary signs for airfield work)

2-6.5.3 FAA Advisory Circular AC150/5340-1

2-7 Technology Requirements

2-7.1 Coordination with Aviation Technology Department

2-7.1.1 It is the Contractor's responsibility to ensure that the project's technology systems are fully coordinated with DCS and the Aviation Department Technology Division. The Contractor will coordinate all required activities associated with the Technology Division through the PM.

2-7.1.2 The Contractor, working in coordination with the PM should review project requirements with the Technology Division at the outset of the Programming Phase and maintain close coordination with their representatives as the design of the various systems proceeds. These systems include, but may not be limited to, the following:

- Passenger Information Paging System (PIPS)
- Flight and Baggage Information Displays (FIDS & BIDS)
- Interface with the Local Area Network (LAN)
- Parking Revenue Control System
- 800 MHz radio system
- Closed Circuit Television (CCTV) Systems
- Passenger Assistance Locations (PALS)
- Audio Visual (A/V) Systems
- Access to or use of Intranet or Internet websites
- GIS
- Access Control Alarm Management System (ACAMS)

2-7.2 Technology Division Protocols

The following documents are available from Aviation and will be provided by the project manager. The Contractor must ensure that the project team understands and has reviewed the following documents and policies of the Technology Division:

2-7.2.1 "[Technology Change Management](#)" required for planning, coordinating or monitoring changes that impact Aviation technology environment

2-7.2.2 [“Telecommunications Closet Access Privilege Procedure”](#) - Authorizes project team members entry and exit access to Aviation telecommunications closets

A. [“Telecommunications Closet Access Request Form”](#) – submittal required

2-7.2.3 [“Fire Alarm Notification Procedures”](#) –refer to “Fire Alarm/Sprinkler System Shutdown/Work” handout provided by the DCS PM.

2-7.2.4 [“Fire Sprinkler Inspection and Test Procedures”](#) –

Prior to working on sprinkler system

A. POD & POD coordinator notified 48 hours prior to testing

B. Aviation Communication Center notified prior to fire alarm and Ansul tests

C. Lead User Technology Specialist-Energy Systems Maintenance Section notified prior to sprinkler and fire alarm work

D. Schedules attendance of Aviation Energy Systems Maintenance and/or Aviation Mechanical Maintenance group, electrical Subcontractor, Honeywell, other related Subcontractors

2-7.2.5 The procedures detailed in the document, “Fire Alarm/Sprinkler System Shutdown/Work” shall be adhered to and initiated prior to commencing work in the field.

2-7.2.6 [“Electronic and Safety and Security Design Guidelines”](#) – to be reviewed with team members including:

A. Electronic safety and security

B. Access controls

C. Intrusion detection

D. Video surveillance

E. Fire detection and alarm

F. Audio systems

2-8 Federal Aviation Administration (FAA) Projects

2-8.1 Airport Improvement Program (AIP) Funded Projects

Where project funding includes FAA Airport Improvement Program (AIP) grants or grant applications, the Contractor shall coordinate completion schedules and composition of design packages with the PM to ensure timely and accurate submittals to FAA for design and construction phase services.

A stipulation of receiving AIP or any other Federal funding is that National Environmental Policy Act (NEPA) processing must be completed ~~conducted~~ by the Airport and NEPA clearance obtained from the FAA prior to start of construction. NEPA will be conducted by the Planning & Environmental Division. A copy of the NEPA clearance will be forwarded onto the Capital Management Division and Project Manager overseeing the project. Any mitigations or constraints on the project must be strictly adhered by the City of Phoenix designer and contractor.

2-8.2 Capital Management Division

Administration of FAA Projects is the responsibility of the Capital Management Division (CMD) and all activities must be coordinated through that office. The Contractor, in coordination with the

PM, should meet with CMD as soon after being notified of the assignment as possible. Managing the work for FAA has many time and sequence critical tasks which must be carefully managed.

Planning & Environmental Division (P&E)

The Planning and Environmental Division (P&E) is responsible for a project's federal National Environmental Policy Act (NEPA) clearance, conformity with the Airport Layout Plan, and submits the project's required 7460 Obstruction Evaluations and Construction Safety Plan. The Contractor, in coordination with the PM, should meet with P&E as soon after being notified of the assignment as possible. Managing the work for FAA has many time and sequence critical tasks which must be carefully coordinated.

2-8.3 Project Coordination

2-8.3.1 The Contractor will, in coordination with the PM, schedule and conduct such pre-design, pre-bid and pre-construction conferences as required to ensure that the sponsor (the Aviation Department), the FAA, and other interested parties are aware of required design, safety, and construction requirements.

2-8.3.2 In addition to coordinating the required approvals from the FAA, the Contractor is responsible for monitoring and ensuring that project schedule is maintained and required submittals are made in a timely and accurate manner. Contractor shall prepare such studies, engineer's reports and other supporting documentation for design review submittals required by the FAA including.

- Development of the Engineers Report
- Daily Construction Reports
- Final Engineers Report at completion of construction

2-8.4 Advisory Circulars

2-8.4.1 A partial list of commonly used Advisory Circulars is provided for quick reference. The Contractor should always confirm that it is the latest version in use before taking final action. These latest issue of circulars may be obtained from the website "FAA.gov".

- [AC150/5100-14](#) Architectural, Engineering and Planning Consultant Services for Airport Grant Projects
- [AC150/5200-18](#) Airport Safety Self-Inspection
- [AC150/5210-5](#) Painting, Marking, and Lighting of Vehicles Used On an Airport
- [AC150/5210-20](#) Ground Vehicle Operations on Airports
- [AC150/5300-3](#) Pre-Design, Pre-Bid and Pre-Construction Conferences for Airport Grant Projects
- [AC150/5300-13](#) Airport Design
- [AC150/5340-1](#) Standards for Airport Markings
- [AC150/5345-55](#) Specification for L-893, Lighted Visual Aid to Indicate Temporary Runway Closure
- [AC150/5370-2](#) Operational Safety on Airports during Construction
- [AC150/5370-10](#) Standards for Specifying Construction of Airports
- [AC150/5380-5](#) Debris Hazards at Civil Airports

2-8.5 Project Filing

The Contractor should assist the PM with setting up hard copy FAA files for the project utilizing the “[FAA Project File System checklist](#)”, in addition to loading the files into Unifier under the Project Document Manager.

2-8.6 Additional Information

In addition the following documents and procedures for FAA projects may be found at the website “FAA.gov”:

- [FAA Safety Plan Checklist](#)
- [FAA Construction Handbook](#)
- [FAA Airfield Visual Aid Safety Placard](#)
- [FAA Project Checklist](#)
- [FAA Advisory Circular Checklist](#)
- [NOTAM Example](#)
- [FAA Closeout Checklist](#)

Chapter 3: Design Phase

3-1 Working with the Airport Team

3-1.1 Airport Stakeholders

3-1.1.1 The design of the project assigned to the Contractor will be reviewed by several groups and representatives of appropriate divisions of the Aviation Department. Stakeholders will make a significant contribution to determining the functional requirements of the new or renovated facilities.

3-1.2 Stakeholder Identification and Participation

3-1.2.1 The PM is responsible for identifying and scheduling Stakeholder participation in the development of the project. Stakeholders are those entities within the Divisional structure of the Aviation Department which have a vested interest in the scope, schedule and budget of every new project. Stakeholders may represent the original project sponsors or entities responsible for maintenance and operation of the completed facility, coordination during construction and the oversight of design and construction standards at the subject airport site. Key Stakeholders in virtually every project are the Business and Properties Division, the Planning and Environmental Division and the Facilities and Services Division. The Airport tenants are also Stakeholders and need to participate. These tenants may include the TSA, the FAA, the airlines and the retail tenants.

3-1.2.2 It is critical that the Contractor work with the PM to provide Client or Owing Divisions and other Stakeholders appropriate participation in the refinement of the Project Scope and Budget.

3-1.2.3 The Contractor will support the PM to provide the appropriate opportunities for Client or Owing Divisions and other Stakeholders to review and comment on each phase of design to ensure the goals and special needs of the project are fully understood and resolved.

3-1.3 Airport Director's Decisions Group

3-1.3.1 The weekly Airport Director's Staff meetings review issues important to the quality of airport services and cohesive, unified facility development.

3-1.3.2 The Contractor should be aware that presentations are typically made at the completion of each design phase for the approval of the Director's Staff. The PM will require the Contractor to prepare materials covering the subject of the presentation for advance submittal and to make the required presentation assisted by Aviation staff as appropriate.

3-1.3.3 The Contractor should consult with the PM to develop a complete understanding of the issues associated with the presentation. The prepared presentation materials should be of a suitable quality in order to illustrate the issues associated with the review.

3-1.4 Project Technical Review Team

3-1.4.1 During the design phase, the documents produced by the Contractor are subject to the review of the Project Technical Review Team (review team). The purpose of this review team to

provide a technical review of the design documents submitted at the completion of the Schematic, Design Development, Construction, GMP/Bid, and Conformed Document phases of design.

3-1.4.2 Depending on the complexity and type of project, members of the review team may be assigned from the Facilities & Services, Planning & Environmental, and Design & Construction Services Divisions. DCS will strive to ensure a reviewer representing each discipline involved in the design is available for technical reviews.

3-1.4.3 Depending on the project and its intended function, DCS may require review by the Mayor's Commission on Disability Issues – Architecture and Design Committee, at the Design Development and 95% Construction Documents submittal to insure the project satisfies the needs of airport users. Sustainability Reviews Projects required to meet LEED or DCS Green Guide Standards must schedule sufficient time through the Aviation Department project manager to allow staff to review submittals. Technical analysis(Life Cycle Cost Analysis , lighting and building modeling) where needed will accompany the submittal Unifier.

3-1.4.4 It is the Contractor 's responsibility to manage the schedule for the work and complete each design phase in accordance to the Project Schedule. When the consultant notifies the PM that work is ready for review, the PM will meet with the Contractor to verify the work for the associated phase of completion is ready for review. The Contractor will upload the design submittal to Unifier and distribute copies to the review team.

3-1.4.5 Reviews should be completed within the scheduled review period, typically 14 calendar days from date of submittal, unless otherwise determined by the PM. Therefore, the PM will establish the dates for response for each design review and monitor the progress of the review team to avoid delays in design progress. The review team will review each design submittal and submit their comment to the Contractor. The Contractor will enter all the comments into Unifier.

3-1.4.6 Once the comments have been entered in Unifier, the Contractor should provide written responses to the review team and will uploaded the responses into Unifier with 7 days of receipt of comments from the review team.

3-1.5 Facilitated Review

3-1.5.1 After

3-2 Programming Phase

3-2.1 Program Validation

3-2.1.1 Before the schematic design phase can effectively begin, the program for the project must be developed and refined to ensure the goals and objectives of the City and the project stakeholders are clearly understood and defined.

3-2.1.2 It is the PM's responsibility to identify and schedule meetings for the involvement of the appropriate stakeholders in the programming process. The Contractor will assist the PM with facilitation of this process as indicated below:

- A.** The PM will schedule a meeting with the Contractor, stakeholders and for a preliminary programming meeting. The meeting will focus upon the process of refining and documenting the specific requirements of each stakeholder for the design work to proceed in an orderly fashion. The Contractor shall record meeting minutes, distribute for review and comment.
- B.** The Contractor shall then prepare a plan to conduct meetings and/or charrettes with stakeholders to acquire the necessary detailed data to prepare a Programming Report.
- C.** The Contractor shall incorporate applicable issues from the Project Goals and Special Requirements Statement, if any, into the programming requirements.
- D.** When the program has reached the preliminary draft level of completion, the assumptions made should be reviewed to ensure the program is compatible with existing planning constraints and considerations for economy to include the following considerations:
 - Review the target objectives with stakeholders to verify specific program goals and objectives.
 - Review Master Plan & ALP, (maybe permits and approvals if applicable)
 - Test program assumptions for collocation
 - Test the program assumptions for site movement
 - Test the program assumptions for technology integration
 - Test the program assumptions for security concepts
 - Test the program assumptions for zones and vertical circulation
 - Review intra-relationships within each Aviation Department Division and agency to assist in schematic design.
 - Economize sharing of spaces
 - Transfer functions to future expansion
- E.** Test project site for airport compatibility
 - Verify that building height is compatible with Part 77 Height Limitations
 - Verify that improvements do not encroach on Building Restriction Line
 - Verify that improvements do not block required sight lines from ATCT
 - Check for utility conflicts
 - Acquire site approval from P&E Division
 - Check for landside traffic impacts (verify roadways can accommodate increased traffic and vehicular loads)

3-2.1.3 Upon completion of the validation process, the Contractor shall prepare a summary of findings to be submitted to the PM which shall, along with any modifications requested by the PM, be included in the final Programming Report outlined below.

3-2.2 Programming Report

3-2.2.1 The findings of work sessions conducted with stakeholders shall be included in a draft report for the stakeholder's review and concurrence that project scope, schedule and budget goals are clearly understood and defined. In preliminary form, the program should allow the functional aspects of the client's goals to be weighed against other considerations such as budget, schedule and external constraints. More detailed programming requirements will be defined during the schematic design phase when spatial relationships begin formulation.

3-2.2.2 The Programming Report shall identify environmental issues which must be addressed in the design of the project including, depending on the project, soil contamination, asbestos and other hazardous materials treatment and disposal issues.

3-2.2.3 Include a written plan for implementation of project LCCA, LEED and other Sustainable Design Strategies as appropriate.

3-2.2.4 The Contractor shall complete the report including the Program Validation Summary addressing scope, schedule and budget and submit to the PM for review and comment.

3-2.2.5 PM will review report for completeness. Contractor may be required to reissue the report to incorporate the PM's comments. The PM will then distribute the Programming Report to the appropriate stakeholders.

3-2.2.6 The PM will schedule a review meeting with the stakeholders at which time the Contractor shall make a presentation of the Programming Report and answer questions from the attendees.

3-2.2.7 Based on the comments of the stakeholders and others as required, the PM may request the Contractor make adjustments or corrections to the Programming Report or, if acceptable as submitted, issue a NTP to the Contractor to proceed with the Schematic Design Phase.

3-2.2.8 The Contractor shall make a presentation of the final Programming Report to the Airport Executive Team.

3-2.2.9 Refer to the project document "Minimum Requirements for Programming Phase Checklist" for additional information.

3-3 Schematic Design Phase – 30% Submittal

3-3.1 Description

3-3.1.1 During the Schematic Design Phase, the Contractor will be required to provide and organize services to support the PM’s requirements related to the Aviation Department’s project review and approval procedures.

3-3.1.2 The PM will schedule Schematic Design Phase “Expectations” meeting(s) addressing scope, schedule and budget between the Contractor, stakeholders, and others as needed. The Contractor will lead the group discussion and assist with the identification of special issues and methods to measure success. These meetings shall include but not be limited to the following groups or subjects depending on the type of project:

A. B&P Division

- Building planning and spatial arrangement
- Quantity and organization of lease areas and lease line location
- Location and mix of lease space
- Evaluation of project design alternatives

B. FACILITIES AND SERVICES Division

- Key Shop - Supplies and maintains keys and locks at the airport
- Electrical Maintenance - Maintains the electrical needs of both airside and landside
- Mechanical Maintenance - Maintains doors, conveyors, and HVAC systems, plumbing and fire protection
- Energy Maintenance - Responsible for life safety equipment and access control equipment
- Sign Shop - Maintains signs in and around the Aviation Department
- Sustainable Design parameters including LEED and other sustainability standard requirements

C. P&E Division – Review the following where applicable

- All environmental permitting requirements
- Hazardous materials abatement and disposal requirements
- Dust Control and Prevention
- Signage Master Plan
- Vehicular roadway design and vertical clearances
- Conducts air quality conformity analysis
- Evaluates the need for a vapor barrier
- Identifies location of environmental infrastructure (wells, piping, vaults, equipment) associated with environmental releases and remediation projects.

D. Technology Division – Review the following where applicable

- Role of the Aviation Technology Project Coordinator (ATPC) and other members of the Aviation Department Technology Team for Communications, Data and Special Systems

E. Operations

- TSA Requirements
- Security System
- Police and Fire Liaison
- Baggage system design

F. Pardon Our Dust (POD) Program

- Overview of the role of the POD Program Coordinator
- Temporary signage during construction

3-3.1.3 The Contractor will record and distribute meeting minutes and conduct follow up meetings with stakeholders and user groups as required for providing a clear understanding of special concerns related to the design program.

3-3.2 Sustainable Design Strategy

3-3.2.1 LEED REQUIREMENTS

The Contractor shall prepare a LEED Strategy report outlining the overall approach for attaining LEED points sufficient to gain the required rating. A copy shall be submitted to the Aviation Department project manager for review and approval. The strategy will include but is not limited to:

- LEED Category based breakdown of the project outlining general strategies
- For large projects, a breakdown of the projects into appropriate programs to be certified separately (i.e. Building Construction, Interior Fit-out, Tenant Finish-out etc.)
- Tentative LEED Score sheet including potential extra points.
- List of assumptions
- Identification of a Commissioning Agent
- Plan for integrating LEED evaluation throughout the design and construction process
- Coordinate the application of LEED criteria with the results of the Life Cycle Cost Analysis pavement or building energy use as noted below

3-3.2.2 OTHER SUSTAINABLE DESIGN CONSIDERATIONS

A. For projects in which LEED is not attainable, the Contractor will review the DCS Green Guide or other sustainable design standard and prepare a strategy for Aviation Department review and approval

B. The Contractor shall identify and incorporate design applications which Reduce materials use and increase longevity of the project.

C. Design for minimum energy utilization

D. Consider reduction in water consumption

E. Maximize access to and areas for recycling of waste products including those from building tenant operations

F. Coordinate incorporation of the in the Life Cycle Cost Analysis outlined below

3-3.2.3 LIFE CYCLE COST ANALYSIS

A. Another critical item in determining the design requirements for the project is the intended life of the structure and energy consuming systems.

B. The Contractor will be required to prepare a written plan for the evaluation of alternative designs or equipment using publically available life cycle cost analysis (LCCA) techniques as applicable to the project submittal requirements for each phase of design required to illustrate compliance with the conclusions reached during the LCCA should be programmed and specifications developed for the contractor phase of work.

3-3.3 Conceptual Design Alternatives

3-3.3.1 The first step in Schematic Design is the development of concepts which explore alternative solutions to the design. Alternatives shall explore items such as alternative site arrangements, alternative spatial and functional layouts, alternative design applications and energy consumption alternatives, depending on the type of project, and the needs established during the Programming Phase. Once alternatives have been agreed upon, an evaluation system will be developed to rank each alternative as to how well it solves the Program objectives and elements. The number one ranked concept shall then become the basis of the Schematic Design Phase of work.

3-3.4 Evaluation of Alternatives

3-3.4.1 Using the information assembled during the Programming Phase and previous discussions with the PM and stakeholders, the Contractor will begin conceptual development of the project. The purpose of conceptual development is to begin the visualization of the project's components, their relationship to each other and to the airport site and adjacent facilities.

3-3.4.2 The conceptual development of the project should explore alternative solutions to satisfy the project requirements. Alternate concepts should be presented in a manner to permit a direct comparison of the advantages and disadvantages of one approach to another. Each alternative should be illustrated in plan and section. The goal of the comparison outlined above is to allow the ranking of the alternatives for the selection of a preferred alternative which will be subject to further development in the Schematic Design Phase.

3-3.4.3 The preferred alternative should be evaluated for conformance with Part 77 imaginary surface requirements and maintenance of Air Traffic Control Tower (ATCT) sightlines where applicable.

3-3.4.4 When the Schematic Design of the project has reached the point where a preferred concept is chosen, a Director's Staff presentation may be required. The Contractor will work with the PM to identify and prepare materials to be submitted in advance of the presentation once a meeting date has been agreed upon. The Contractor will be prepared to assist the PM with an explanation of the process for developing and ranking concept alternatives along with any refinements of the preferred concept. Specific attention should be given to whether the conditions set forth in the Project Goals and Special Requirements Statement has been satisfactorily met, and if not, the reasons stated. Comments received from the Director's Staff meeting, should then be incorporated into the schematic documents.

3-3.5 Refinement of Schematic Design

3-3.5.1 Following the activity outlined above, the PM will direct the Contractor to begin development of the Schematic Design Deliverables. The Contractor, in coordination with the PM, will be required to schedule update meetings with stakeholders and others as necessary to keep all interests apprised of the projects progress and adherence to the Program and stakeholder expectations.

3-3.5.2 The Contractor, in coordination with the PM should schedule early meetings with P&E to review environmental and permitting requirements for the project and coordinate the development of strategies for resolving environmental issues and permitting. The PM must ensure P&E has a representative scheduled for all project meetings where these issues will be addressed.

3-3.5.3 During the Design Development Phase, the Contractor will be required to present the proposed design solutions to several issues of great concern to FACILITIES AND SERVICES. During the Schematic Design Phase, details of floor plan development should take into account the space required to accommodate the following areas of special concern as further outlined in SECTION III: DESIGN STANDARDS:

- A. ADA compliance and incorporation of the Aviation Department's standard details for handicapped access
- B. Amenities Location Plan
- C. Proposed Architectural Joint Systems
- D. Shop Fabricated Millwork (built-in furnishings should be avoided)
- E. Public restroom layouts, including plumbing chase access
- F. Passenger elevator cab details
- G. Janitorial Closets

3-3.5.4 The Contractor should initiate discussions with the PM and FACILITIES AND SERVICES to identify building equipment and services to be operated with emergency and standby power during a building power failure.

3-3.6 Scheduling

3-3.6.1 The requirements for the Project Schedule are detailed in Exhibit ___ of the Design Phase Contract.

3-3.6.2 At the start of the Schematic Design Phase, the Contractor shall submit a complete detailed Design Schedule which conforms to the constraints of the Project Schedule provided by the PM. The schedule should include all milestone dates, phase sequencing if appropriate, stakeholder reviews, design reviews and other events which influence the development process and affect completion of each design phase.

3-3.6.3 If the project has fallen behind schedule, the submit a written plan to bring the progress of the work back into conformance with the Project Schedule.

3-3.7 Submittal Requirements

3-3.7.1 Refer to Exhibit ___ Project Deliverables of the Design Phase Contract, for detailed delivery requirements.

3-3.7.2 DRAWINGS

The Contractor is reminded of the obligation to adhere to the Aviation Department CADD Data Standards including sheet formatting and size. Deviations from the standard will require written approval in advance of submittal.

3-3.7.3 SUSTAINABLE DESIGN DOCUMENTATION

- LEED Design Requirements
- Other Sustainable Design Requirements
- Sustainable Site Development Requirements
- Copy of final LCCA Report for HVAC, lighting controls, EDS vertical transportation and for all energy using systems.

3-3.7.4 SPECIFICATIONS

Prepare a Table of Contents for the proposed specifications and include an outline narrative of each section and a tentative product list.

3-3.7.5 DESIGN CALCULATIONS

Prepare a bound submittal of all design calculations to a level appropriate for the 30% level of design completion showing preliminary load assumptions for the following depending on the type of project:

- Provide the necessary information required to comply with LEED and other Sustainable Design Requirements for review and approval from the Aviation Department
- Provide the information necessary to illustrate results of LCCA and how requirements are accounted for in the schematic documents
- Engineering Calculations for Structural, Mechanical and Electrical Systems

3-3.7.6 For purposes of planning and locating tenant shell space of any type of use, placement above electrical and communications rooms is strictly prohibited. The Contractor shall verify that this requirement has been met at each design submittal.

3-3.7.7 Refer to the project document “Minimum Requirements for Schematic Phase Checklist” and other parts of this section for additional information.

3-3.8 Cost Estimating

3-3.8.1 Refer to Exhibit __ Project Deliverables of the Design Phase Contract, for detailed estimating requirements.

3-3.8.2 The Contractor will begin preparation of the Schematic Phase Cost Estimate. Should the estimate exceed the established construction budget, the Contractor will as have noted previously, attach a plan to bring the project into conformance with the construction budget.

3-3.8.3 Should the Aviation Department employ the services of a third party cost estimator, the Contractor shall be required to reconcile this estimate with that of the third party estimator.

3-3.8.4 Should the reconciled estimate exceed the established budget, the Contractor must attach a written proposal to bring the project into conformance with the construction budget. See Section Section 1 Chapter 6-1.4.4 Value Engineering

3-3.9 Permitting Requirements

3-3.9.1 Depending on the type of project, the PM may schedule a design progress review meeting with P&E. They will review the design's conformance with environmental permitting and hazardous materials remediation requirements that were identified during the "Expectations Meeting" at the beginning of the Schematic Design Phase. The Contractor should be prepared to review the design approach and how the proposed solution will satisfy all environmental permitting requirements.

3-3.9.2 The PM, Contractor, , will schedule preliminary review meetings with the COP Planning and Development Department (PDD) to review status of design and required building permits. See list of Permits at the end of the Construction Documents – 95% Submittal Phase.

3-3.9.3 TYPES OF PERMITS

The following is a partial list of the types of permits which may be required for a project depending on its location and the type of construction required:

- Building Construction – includes elevator, fire protection systems, etc.
- Site Planning (includes landscaping)
- Demolition– includes National Emission Standards for Hazardous Air Pollutants (NESHAP) for renovation and demolition activities
- Deferred permits for phased construction work or items that have final design required by the Contractor
- Signage
- Maricopa County Dust Control – obtained by Contractor performing the work
- Arizona Construction General Permit – including Construction Storm water Pollution Prevention Plan (CSWPPP)
- Maricopa County Air Quality Synthetic Minor Permit
- Arizona Department of Environmental Quality (ADEQ)
- Federal Administration (FAA)
- United States Army Corps of Engineers Section 404 Permit

3-3.10 Schematic Design Submittal Review

3-3.10.1 Upon notification from the Contractor that the project is ready for the Schematic Phase Submittal, the PM should schedule a final review meeting. The PM will verify that the Contractor has incorporated the project's requirements, including items from the Program Report, comments of the Directors Staff meeting (if applicable), and issues arising from the stakeholders in the working charrettes during the development of the Schematic Design.

3-3.10.2 Once the incorporation of all design requirements has been verified, the Contractor proceeds with the review of the Project Technical Review Team (review team) as prescribed in Section 3-1.4. The purpose of this review team to provide a technical review of the design documents submitted.

3-3.10.3 The PM, after verifying the Contractor has responded to the review comments, issues a NTP to the Contractor and copies the Stakeholders that work is ready to move to Design Development Phase.

3-3.10.4 The Contractor shall make a presentation of the Schematic to the Airport Executive Team for their approval. The focus of this particular presentation should be on the key items of scope, schedule and budget. Presentations to Stakeholder's, City Management and City Council may also be scheduled.

3-3.11 Unifier Requirements

3-3.11.1 The Contractor should remember that all submittals are made in Unifier and organize the work according to the requirements of this process.

3-4 Design Development Phase – 60% Submittal

3-4.1 Description

3-4.1.1 The Design Development Phase refines the scope of work previously approved in the Schematic Design Phase.

3-4.1.2 The PM will schedule a Design Development update session with the Contractor, stakeholders and the Executive Team to confirm user groups' requirements including but not necessarily limited to the following:

- A.** All proposed building finishes including color boards and material samples
- B.** Door hardware and finishes
- C.** Complete furniture, fixture and equipment selections
- D.** Systems and office furniture types and brands
- E.** Audio visual and whiteboard requirements
- F.** Casework elevations
- G.** Telecomm/data location and coordination with furniture
- H.** Headcount locations and seating charts
- I.** Break areas and water cooler locations
- J.** Furniture mock-ups as required
- K.** Details of design to obtain LEED or DCS Green Guide Points or other sustainable design standard as agreed upon by the Aviation Department.

3-4.1.3 PM schedules a separate meeting with the Contractor and Facilities and Services for input on building materials, electrical and mechanical systems as well as other issues related to the operations and maintenance of the project. The Contractor shall record meeting minutes and distribute to attendees for review and comment. This may require more than one meeting and the Contractor shall be prepared to present, at a minimum, the design approach to the following issues where applicable:

- A.** ADA compliance and incorporation of the Aviation Department standard details as provided in SECTION III: DESIGN STANDARDS. The Contractor shall be prepared to make a presentation to the Mayor's Commission on Disability Issues-Architecture and Design Committee (MCDI-ADC) should the PM determine that a presentation is required.
- B.** Amenities Location Plan illustrating the proposed location of, at a minimum, the applicable amenities listed in SECTION III: DESIGN STANDARDS.
- C.** Provide details or manufacturer's data sheets of all proposed Architectural Joint Systems including performance characteristics as outlined in SECTION III: DESIGN STANDARDS
- D.** Provide preliminary layout and details of all millwork items illustrating solutions to items outlined in SECTION III: DESIGN STANDARDS.
- E.** Provide floor plans and preliminary details of all public restroom layouts, proposed plumbing fixtures, toilet accessories, location of plumbing chase access, illustrating conformance with the Aviation Department standard details and other items outlined in SECTION III: DESIGN STANDARDS.

F. Provide preliminary plans and details of all elevator cabs illustrating solutions to items outlined in SECTION III: DESIGN STANDARDS.

G. Provide floor plans and preliminary details of janitorial closets illustrating solution to issues outlined in SECTION III: DESIGN STANDARDS.

H. Prepare a list of materials and suggested quantities proposed for specification and purchase from the Contractor for Attic Stock as outlined in SECTION III: DESIGN STANDARDS.

I. Provide a complete list of all equipment to be activated with emergency power during a building power failure.

Provide the LCCA for all energized systems product selection.

3-4.1.4 The Contractor will assist PM in briefing stakeholders and others, as appropriate related to the progress of the design.

3-4.1.5 The Contractor prepares Design Development deliverables, confirms satisfaction of life safety and other code requirements and refines site design, refines building design and refines systems designs. Refer to Submittal Requirements below for more information.

3-4.1.6 Compatibility with issues outlined in 3-2.1.2, E.

3-4.1.7 If a presentation was made at the Directors Staff meeting during Schematic Design, a follow-up presentation may be required to confirm acceptance of the proposed solutions. The Contractor shall prepare all advance submittal exhibits and assist the PM with the presentation as required.

3-4.1.8 The PM will schedule a meeting at 60% completion of the Design Development Phase to assess and agree on constraints related to the following items:

A. Confirmation of construction phasing

B. Identification of long lead items and determination of a procurement strategy for same

C. Refinement of project phasing requirements

3-4.1.9 Prior to the Design Development Submittal, the Contractor will schedule a joint coordination meeting with the entire team. The PM shall be invited to attend the meeting. This meeting will address and resolve all outstanding coordination issues prior to the 60% Submittal.

3-4.1.10 As the project design approaches 60% completion, the Contractor requests the PM to schedule a Design Development presentation with stakeholder and others, Specific items for review include but are not necessarily limited to:

A. Drawings

B. Draft Specifications

C. Hardware and equipment cut sheets

D. Confirmation of incorporation of all FACILITIES AND SERVICES design requirements

E. Narrative that summarizes the project development to date including areas where additional information is required

3-4.2 Submittal Requirements

3-4.2.1 DRAWINGS

All design drawings shall be at 60% level of completion per Project Deliverables and Design Development Checklist referenced below

3-4.2.2 SPECIFICATIONS

All divisions should be in rough draft format. Include such further information as required to illustrate conformance with:

- LCCA as applicable
- LEED Design Requirements
- Other Sustainable Design Requirements
- Sustainable Site Development Requirements

3-4.2.3 DESIGN CALCULATIONS

Prepare a bound submittal of all final design calculations including LEED, structural, mechanical and electrical design. Include any additional information required to illustrate conformance to the conclusions of the LCCA and return on investment for HVAC, lighting, controls, conveyors, and vertical transportation.

3-4.2.4 For purposes of planning and locating tenant shell space of any type of use, placement above electrical and communications rooms is strictly prohibited. The Contractor shall verify that this requirement has been met at each design submittal.

3-4.2.5 Refer to project deliverables in Exhibit B of the Contract for detailed delivery requirements.

3-4.2.6 Refer to the project document “Minimum Requirements for Design Development Phase Checklist” for additional information.

3-4.3 Scheduling

3-4.3.1 The requirements for the Project Schedule are detailed in Exhibit __ of the Design Phase Contract.

3-4.3.2 The Contractor will submit an updated Design Schedule. If the schedule exceeds the time allowed by the Project Schedule, the Contractor must submit a written proposal to bring the Design Schedule into conformance with the Project Schedule.

3-4.4 Cost Estimating

3-4.4.1 Refer to Exhibit __ Project Deliverables of the Design Phase Contract, for detailed estimating requirements.

3-4.4.2 The Contractor will begin preparation of the Design Development Phase Cost Estimate. Should the estimate exceed the established construction budget, the Contractor will as noted previously, attach a plan to bring the project into conformance with the construction budget. In addition, the Contractor will be required to reconcile the cost estimate with the estimate of the third party estimator and should the total cost exceed the established budget, prepare a proposal to conform to the construction budget. See Section VALUE ENGINEERING.

3-4.4.3 As in the Schematic Phase, should the Aviation Department employ the services of a third party cost estimator, the Contractor shall be required to reconcile his estimate with that of

the third party estimator. Should the reconciled estimate exceed the established budget, the Contractor must attach a plan to bring the project into conformance with the construction budget.

3-4.5 Permitting Requirements

3-4.5.1 The PM, Contractor will meet with the COP Planning and Development Services Department (PDD) to review decisions made in the Schematic Phase Permitting Coordination Meeting, review permitting strategy and confirm number of permit packages required based on project phasing requirements.

3-4.5.2 The Contractor will attend such meetings as scheduled by the PM with Fire Marshal and Utilities.

3-4.6 Design Development Submittal Review

3-4.6.1 Upon notification from the Contractor that the project is ready for the Design Development Phase Submittal, the PM should schedule a final review meeting to verify that the Contractor has incorporated the project's requirements, including comments from the Directors Staff meeting (if applicable), comments from the PTRT Schematic Phase Review and issues arising from the stakeholders in the working charrettes during the Design Development Phase.

3-4.6.2 Once the incorporation of all design requirements has been verified, the Contractor proceeds with the review of the Project Technical Review Team (review team) as prescribed in Section 3-1.4. The purpose of this review team to provide a technical review of the design documents submitted.

3-4.6.3 The PM, after verifying the Contractor has responded to the review comments, issues a NTP to the Contractor and copies the Stakeholders that work is ready to move to Construction Document Phase.

3-4.6.4 The Contractor shall make a presentation of the Design Development to the Airport Executive Team for their approval. The focus of this particular presentation should be on the key items of scope, schedule and budget. Presentations to Stakeholder's, City Management and City Council may also be scheduled.

3-4.7 Unifier Requirements

3-4.7.1 The Contractor should remember that all submittals are made in Unifier and organize the work according to the requirements of this process.

3-5 Construction Documents Phase – 95% Submittal

3-5.1 Description

3-5.1.1 The Contractor finalizes all drawings, coordination of systems, and selection of materials, finishes, construction details, site logistics plan (Contractor staging)) LEED or other sustainable design standard and specifications.

3-5.1.2 The Contractor assists PM at periodic meetings with stakeholders to verify all project elements are accounted for, final selection of colors, materials, hardware, utility issues and adequacy of construction staging/lay down areas.

3-5.1.3 The Contractor shall make a presentation to the Mayor’s Commission on Disability Issues-Architecture and Design Committee (MCDI-ADC) if a follow-up meeting was indicated from discussion during the Design Development Phase presentation.

3-5.1.4 The Contractor will record and distribute meeting minutes for each session.

3-5.1.5 The Contractor will work with the PM and the Aviation Department Facilities & Services Division to ensure that adequate provisions are included in the contract documents for Demonstration, Commissioning, Training and O&M Manuals.

3-5.1.6 Prior to the Construction Documents Phase – 95% Submittal, the Contractor will schedule a joint coordination meeting with the entire team. The PM shall be invited to attend the meeting. This meeting will address and resolve all outstanding coordination issues prior to the 95% Submittal.

3-5.1.7 The Contractor and PM to finalize details related to value engineering activities and pre-purchase of long lead or special equipment needs.

3-5.2 Submittal Requirements

3-5.2.1 DRAWINGS

All design drawings shall be at 95% level of completion per Project Deliverables and Design Development Checklist referenced below.

3-5.2.2 SPECIFICATIONS

All divisions in final draft format along with sustainability standard specifications.

3-5.2.3 DESIGN CALCULATIONS

Update any calculations required as a result of recent changes to system design or loading.

3-5.2.4 For purposes of planning and locating tenant shell space of any type of use, placement above electrical and communications rooms is strictly prohibited. The Contractor shall verify that this requirement has been met at each design submittal.

3-5.2.5 Refer to project deliverables in Exhibit B of the Contract.

3-5.2.6 Refer to the project document “[Minimum Requirements for Construction Documents Phase Checklist](#)” for additional information.

3-5.3 Scheduling

3-5.3.1 The requirements for the Project Schedule are detailed in Exhibit __ of the Design Phase Contract

3-5.3.2 The Contractor will submit an updated Design Schedule. If the schedule exceeds the time allowed by the Project Schedule, the Contractor must submit a written proposal to bring the Design Schedule into conformance with the Project Schedule.

3-5.4 Cost Estimating

3-5.4.1 Refer to Exhibit __ Project Deliverables of the Design Phase Contract, for detailed estimating requirements.

3-5.4.2 The Contractor will prepare the Construction Documents Phase – 95% Submittal Cost Estimate. Should the estimate exceed the established construction budget, the Contractor will as noted previously, attach a plan to bring the project into conformance with the construction budget. SEE VALUE ENGINEERING In addition, the Contractor will be required to reconcile the cost estimate with the estimate of the third party estimator and should the total cost exceed the established budget, prepare a proposal to conform to the construction budget. Previous LCCA utilized in the design phase to reduce long-term operational and maintenance costs will be factored into the decision process.

3-5.4.3 As in the previous Phase, should the Aviation Department employ the services of a third party cost estimator, the Contractor shall be required to reconcile his estimate with that of the third party estimator. Should the reconciled estimate exceed the established budget, the Contractor must attach a plan to bring the project into conformance with the construction budget.

3-5.4.4 In addition to the reconciled estimate, the Contractor shall submit, to the PM, an estimate at Construction Documents Phase-95% Submittal which provides a summary presented in the Construction Specifications Institute's (CSI) Division Master Format. This will be used by the COP EOD to assess the amount of Contractor DBE participation during the Construction Phase.

3-5.5 Construction Documents Phase – 95% Submittal Review

3-5.5.1 Upon notification from the Contractor that the project is ready for the Construction Documents Phase – 95% Submittal, the PM should schedule a final review meeting to verify that the Contractor has incorporated the project's requirements, including comments from the PTRT Design Development Phase Review, PDD Permit Review and issues arising from the stakeholders in the working charrettes during the Construction Documents Phase.

3-5.5.2 Once the incorporation of all design requirements has been verified, the Contractor proceeds with the review of the Project Technical Review Team (review team) as prescribed in Section 3-1.4. The purpose of this review team to provide a technical review of the design documents submitted.

3-5.5.3 The PM, after verifying the Contractor has responded to the review comments, issues a NTP to the Contractor and copies the Stakeholders that work is ready to move to GMP/BID Documents – 100% Submittal.

3-5.5.4 The Contractor shall make a presentation of the Design Development to the Airport Executive Team for their approval. The focus of this particular presentation should be on the key items of scope, schedule and budget and reduction of operating costs. Presentations to Stakeholder's, City Management and City Council may also be scheduled.

3-5.6 Permitting

3-5.6.1 The Contractor assists PM as required for special permitting such as Arizona Pollutant Discharge Elimination System (AZPDES) and preparation of Construction Stormwater Pollution Prevention Plan (SWPPP).

3-5.6.2 Upon notification by the PM for the work to proceed to 100% completion, the Contractor will prepare and submit 95% Documents to PDD for building permit review.

3-5.6.3 The Contractor will coordinate with the PM to provide any additional information or design modifications not already incorporated in the documents as required for acquisition of permits.

3-5.6.4 POTENTIAL TYPES OF PERMITS

- Building Construction – includes elevator, fire protection systems, etc.
- Site Planning (includes landscape)
- Demolition – includes National Emission Standards for Hazardous Air Pollutants (NESHAP) for renovation and demolition activities
- Deferred Permits for phased work, or items that have final design by the Contractor
- Signage
- Maricopa County Dust Control – obtained by the Contractor performing the work.
- Arizona Construction General Permit – including Construction Storm Water Pollution Prevention Plan (CSWPPP)
- Maricopa County Air Quality Synthetic Minor Permit
- Arizona Department of Environmental Quality (ADEQ)
- Federal Aviation Administration (FAA)
- United States Army Corps of Engineers Section 404 Permit

3-5.7 PDD Submittals to Monitor

- Site Plan
- Drainage & Grading
- Water & Sewer
- Fire Line
- Landscape
- Re-plat (if used)

3-5.8 Unifier Requirements

3-5.8.1 The Contractor should remember that all submittals are made in Unifier and organize the work according to the requirements of this process.

3-6 GMP/Bid Documents – 100% Submittal

3-6.1 Description

3-6.1.1 It is critical that the documents used for bidding the work of the program be as close to 100% complete as possible. Plans placed for bidding which are incomplete will likely create questions for clarification which will require the issuance of Bid Addenda. The 100% documents must be complete, incorporating all of the 95% review comments, and satisfactorily answering questions raised by the Project Technical Review Team and the PDD Building Permit Review.

3-6.1.1 At this time, all LEED or other sustainable design standards scorecards and specifications developed for the contractor will be presented in final form.

3-6.1.2 The Contract for Construction Services will be negotiated with the Contractor for a Guaranteed Maximum Price (GMP). This is the submittal be used to begin that process.

3-6.2 100% Documents Submittal Review

3-6.2.1 When the Contractor has resolved all the issues arising from the 95% Review and advanced the level of completion of the work to the 100% level of completion, the PM should schedule a final review meeting to verify that the Contractor has resolved all PTRT review comments and comments from the PDD Building Permit Review.

3-6.2.2 Once the incorporation of all design requirements has been verified, the Contractor proceeds with the review of the Project Technical Review Team (review team) as prescribed in Section 3-1.4.

3-6.2.3 The PM, after verifying the Contractor has satisfactorily addressed all outstanding issues from 100% and other previous reviews, the Contractor to prepare the package for the use of the Contractor for bidding and preparation of final GMP Pricing.

3-6.2.4 The Contractor shall make a presentation of the final Programming Report to the Airport Executive Team for their approval if changes were made following the 95% approval.

3-6.3 Unifier Requirements

3-6.3.1 The Contractor should remember that all submittals are made in Unifier and organize the work according to the requirements of this process

GMP Negotiation Phase

3-6.4 Description

3-6.4.1 When the Construction Documents-100% Submittal for the Work (or designated portion thereof) is complete the Contractor shall coordinate preparations for issuance of Bid Documents with the PM. The Contractor will distribute the Construction Documents for competitive bidding.

3-6.4.2 During the bidding period, the Subcontractors may submit questions. The Contractor will issue Addendum to answer questions and to modify or clarify the Construction Documents when required.

3-6.4.3 The Contractor prepares estimates for self-performed work, the Contractor's contingency and fees for the work which will become part of the GMP. The PM may also call upon independent third party estimators when appropriate.

3-6.4.4 In addition, negotiation of the Contractor's General Conditions, Contingency and Fee is completed and may include other terms and conditions of the Contract which may be subject to negotiation.

3-6.4.5 Following completion of negotiation, the Contractor will prepare Conformed Documents incorporating all the addendum items issued during bidding and including such items as may have resulted from negotiation of the GMP.

3-7 Conformed Documents

3-7.1 Description

3-7.1.1 Following Construction Procurement for the project, the Contractor will incorporate all addenda and other information required into the bid documents to clearly identify the package as the "Conformed Documents".

3-7.1.2 All modifications to the bid documents must be clouded and numbered with a description of the addition, deletion or change entered into the revision block on each sheet including the date as required.

3-7.1.3 During the bidding of the work, additional comments may also have been received from the Permitting Review process and must be incorporated into the Conformed Documents. It must be confirmed that each of these additional items has been included in the contract and GMP before the Conformed Documents are issued.

3-7.2 Conformed Documents Review

3-7.2.1 When the work is completed and verified by the PM, the Contractor will upload the submittal to Unifier for review and comments. The Project Technical Review Team and/or CMAR should review the Conformed Documents and enter their comments in Unifier. Once the comments have been entered, they will be forwarded to the Contractor for incorporation in the Conformed Documents.

3-7.2.2 The PM, after verifying the Contractor has satisfactorily addressed all outstanding issues from Conformed Documents Review, the Contractor to prepare the package for construction.

3-8 Pre-construction

3-8.1.1 The Contractor will hold a Pre-Construction Meeting and assist the PM with briefing on the necessary procedures and processes required to work in the airport environment at Phoenix Sky Harbor International Airport including but not necessarily limited to the following:

- Use of Building Information Modeling (when available) to enhance project constructability using “virtual” tools to identify construction conflicts before unnecessary costs are incurred
- Use Unifier as collaboration software to enhance communication and the exchange of information during construction
- Review requirements for conformance with Sustainable Site Development Standards
- Review requirements for conformance with procurement tracking and documentation protocol for LEED or other sustainable design standard and specifications as selected in the Design Phase
- Review requirements for the Contractor’s Quality Control/Quality Assurance Program addressing the Owner’s finished project and the Contractor’s Means and methods

3-8.1.2 The City will review the Contractor’s Schedule of Values

3-8.1.3 The City’s will review the Project Schedule and meet with the Contractor to review any issues or concerns regarding the information provided therein and return Aviation-Department’s comments to the Contractor.

3-8.1.4 The City will review Contractor Submittal Schedule for submittals to be review by the City. The City will provide concurrence or request changes/modification by the Contractor.

3-8.1.5 The City will review Contractor’s QA/QC Program provide comments to the Contractor.

3-8.1.6 The Pardon Our Dust Program Representative, as required, will brief the Contractor’s team on the role of the Pardon Our Dust Program during the construction of the project.

Chapter 4: Construction Phase

[Reserved]

SECTION III: DESIGN STANDARDS

Chapter 1: General Design Guidelines

1-1 Using the Design Standards

1-1.1 Organization

1-1.1.1 These Design Standards are provided to inform the Contractor of general requirements for the design of projects at the City of Phoenix Aviation Department Airports and to identify special requirements which may be unique to particular project types. The Design Standards are organized so that general issues of project design are dealt with first, followed by more specialized applications related to specific project types.

1-1.1.2 Generally, the requirements for the design of building structures cited in Chapters 1 & 2 apply to all projects to be designed within the PHX Terminal Area including passenger terminals and support facilities. The requirements may to some extent apply to projects at other COP owned airports but the extent of application will vary from location to location based on existing local conditions. Projects of a more specialized nature are treated separately in later Chapters where additional requirements related to these specialized projects are included which may modify or expand the requirements for the basic standards in Chapters 1 & 2.

1-2 Construction Classification

All airport facilities designed to support or provide for passenger processing and airline operations now or in the future shall conform to Type I construction as defined by the International Building Code. This provides unlimited area and height for Group A Assembly Occupancy with mixed uses required to support passenger terminal operations thereby assuring maximum flexibility for future changes in use of terminal space.

1-3 Issues Related to Accessibility

1-3.1 Updating Existing Facilities

1-3.1.1 The Aviation Department has invested considerable resources in conforming existing terminal facilities with current ADAAG requirements and the additional requirements established by the City of Phoenix and the Mayor's Commission on Disability Issues-Architecture and Design Committee (MCDI-ADC). The Contractor shall be responsible for evaluating the implications of planning, hardware selection and specifications to avoid repeating the mistakes of the past. In addition, this awareness must be maintained during that time when Contractor submittals are being reviewed and approved. Often times, what appears on the surface to be a simple substitution, has extenuating consequences.

1-3.1.2 The following items are of particular concern to the City of Phoenix:

A. FAMILY RESTROOMS / Adult Changing Station

In response to the traveling public's needs and with the support of the Mayor's Commission on Disabilities Issues (MCDI), Aviation/DCS developed the "adult changing station" concept. Family Restrooms with Adult Changing Stations are required in terminals, concourses, and other

transitional areas. Refer to Appendix A for details showing overall height, dimensions, cleanable changing surfaces, grab bars, clearances, etc., as approved by the MCDI in December of 2003. PHX uses the “unisex toilet room” required by the IBC/chapter 11 as the main vehicle to incorporate adult changing stations into new projects.

Existing spaces provided with plumbing services are adapted for this same use in terminal renovations. All family restrooms have an adult changing station, an accessible toilet and lavatory. Wherever space and plumbing provisions allow it, an ADA shower is added as well.

B. RESTROOM PROTRUSIONS

All protrusions in excess of 4” must be avoided in restrooms, and are allowed only in recesses or wherever a fixture or a trash container creates a sheltered condition that keeps users from running into them. *Aviation uses large wall-mounted toilet paper dispensers (TPD) that cannot be placed under the toilet’s side grab bar, because they block the space and cause injuries on the user’s legs.* These must be placed *over* the grab bar, while keeping the dispensing opening at no more than 48” above finished floor (AFF). A clearance of no less than 12” must be left between the bar and the TPD, in order to allow the user to slide his/her arm under it to grab a hold of the vertical bar. The vertical bar is required in ADA stalls by the 2003 International Code Council/ American National Standards Institute (ICC/ANSI) and the 2004 ADA/ABA Guidelines.

C. PARAPHERNALIA SHELF

The City of Phoenix Amendments to the IBC code, Sec 1109.2, include the installation of a “paraphernalia shelf” (PS) in all accessible toilets. Aviation requires a stainless steel folding unit, placed at 18” from the center line of the toilet, under the back wall’s grab bar, with the hinged edge located at no more than 15” AFF. Preferred shelf dimensions are 5” wide by 14” long. In its closed position, the shelf must not interfere with the grab bar.

D. PROTRUSIONS AT TERMINALS, CONCOURSES, AND OTHER PATHS OF TRAVEL

Common protrusions in existing facilities include Defibrillator Boxes, Fire Extinguishers, Custodial Communication Boxes (8”x6”x10” metal hinged boxes with a lock, used by Terminal Services custodial personnel), and Backlit Advertising Signs. New facilities must specify semi-recessed defibrillator boxes, which protrude less than 4”. For protrusion correction in existing facilities, metal boxes painted to match the defibrillator’s color are installed beneath them, maintaining a minimum clearance of 27”. The same concern applies to fire extinguishers, custodial phones and older backlit advertisement signage. The B&P Division now requires compliance with ADAAG Sect 4.4 on renewed advertising signage contracts. In order to prevent accidents, metal boxes as described above must be used for temporary correction.

E. ELECTRIC DRINKING FOUNTAINS

Drinking Fountains must be installed in pairs; one for standing users, and the other (next to it) for wheelchair users. *DRINKING FOUNTAINS MUST BE INSTALLED IN RECESSES that won’t interfere with the accessible pathway;* even if their dimensions and clearances otherwise meet ADAAG requirements. The MCDI and Aviation require the use of *HI-LOW* sets, with spouts at no more than 41” and 36” max AFF, respectively.

Bottle Filling Stations must meet the minimum guidelines within the specification supplements.

F. ELEVATORS

The Mayor's Commission on Disabilities Issues and the Aviation Department do not accept minimum elevator car dimensions that won't allow for the inclusion of a 60" diameter wheelchair turnaround in its interior, as per ADAAG Fig. 3 (a) –even if other parts of the ADAAG permit it, such as Fig. 22. Wheelchair users (esp. those using the common electric types) are unable, after they enter the cab, to turn around the chair to face and operate the controls, unless adequate turnaround dimensions are provided.

G. AREAS OF RESCUE ASSISTANCE

Both the MCDI and the Aviation Department require the provision of Areas of Rescue Assistance *wherever* other means of vertical transportation are available to the public, when accessible exit ramps are not provided. This requirement cannot be waived on grounds of an automatic sprinkler system provision.

H. SIDEWALK CURB-CUT / USES & DIMENSIONS

Aviation is in the process of eliminating curb-cuts along all terminal sidewalk curbs. Per building code and accessibility guidelines, the maximum allowable cross-slope is 2%. Walking on a sidewalk across curb-cuts forces pedestrians to traverse cross-slopes of 8.33% and more which poses a serious safety concern. Curb-cuts should only be used at the end of sidewalks, and in other places of low pedestrian circulation where their replacement for a safer sidewalk access solution is physically impossible. Wherever curb-cuts are allowed, their minimum dimensions approved by Aviation are (for a typical change in elevation of 6 inches), a six ft. (6') long ramp, five ft. (5') wide – with 6 ft. by 6 ft. wings, and a 5 ft. wide landing at the top (same width as the ramp), with a minimum depth of 4 ft., which is the dimension recommended by ADAAG Fig 4.

I. RAISED CROSSWALKS

PHX is in the process of implementing the use of Raised Crosswalks (RXWs) at all existing terminal crossings that run between sidewalks and medians. For a typical 6" high curb elevation, the following RXW dimensions are recommended: 10 ft. wide walking surface – 10 ft. wide (5%) slopes on either side. The total horizontal dimension for a RXW section is 30 ft. Street surface drainage is provided at each end of the crosswalk by means of two 3" cast iron pipes, running horizontally inside respective 6" x 6" concrete curbs, placed next to the sidewalk curbs. These drainage curbs run the full 30 ft. of the RXW's width, thus avoiding unsafe 'open gutter' situations, and are painted yellow for visibility/safety. The top of the concrete walking surface has a maximum cross slope of 1/4" per foot, and has 12" wide white striping, placed at 24" o/c.

J. UNIVERSAL PARKING STALL

The City of Phoenix Zoning Ordinance Sec. 702 A.6 unifies the ADA Accessible and Van Parking stall requirements into one Universal accessible layout. The official adoption of this layout enables the City to charge fines and take action against parking violations. The typical "Universal Parking" layout consists of two 11 ft. wide by 18 ft. long stalls, placed on either side of a 5 ft. wide striped area. This striped area connects with a 3 ft. wide (minimum) accessible path for circulation, which runs along the front end of the stalls. Thus, the parking group of two stalls becomes 18 ft. long by 27 ft. wide. A wheel-stop keeps vehicle overhangs from encroaching into this min. 3 ft. wide sidewalk, which runs in front of the stalls for visibility/safety. The City ordinance offers other possible layouts, depending on location and quantity. For safety reasons, pedestrian paths are not allowed to run behind parked vehicles. Likewise, accessible paths **must not go across vehicular drives to reach facilities or cores of vertical transportation.**

K. FUTURE DOJ & DOT ACCESSIBILITY CHANGES

All applicable elements of the design shall comply with ADA regulations. Furthermore, the design professional is to request direction from the owner regarding all-anticipated or forthcoming changes to ADA law as has been made public by the DOJ, DOT, or other authority having jurisdiction.

1-4 Economy of Construction, Maintainability, Operability

1-4.1.1 New facility design shall, adhere to firm design principals incorporating a respect for economy of construction, ease of maintenance, and operability.

- A.** Build attractive, flexible structures using permanent, hard-wearing, and easy to maintain materials and incorporating state of the art building management systems.
- B.** Minimize staffing requirements for operation and maintenance of the facility.
- C.** Minimize the number of security checkpoints needed.
- D.** Provide common holdrooms to minimize construction expenditures as well as operation and maintenance costs.
- E.** Minimize need for taxiway construction while providing easy access to the existing runways.

1-5 Sustainable Design

1-5.1 Sustainable Site Development

1-5.1.1 AIRSIDE [The Design and Construction \(DCS\) Green Guide](#) was developed by the Aviation Department for “horizontal” construction projects, i.e. non-building design and construction, where LEED does not apply. Like LEED, the DCS Green Guide is a performance-based system where credits are earned for satisfying criteria to address specific environmental impacts.. Other sustainable rating systems may be suggested for review by the Aviation Department.

1-5.1.2 These Sustainable Performance Standards encourage the review of new technologies and initiatives for consideration into the project. The Contractor shall consider these requirements to ensure optimal project development.

6.1.4.5 Life Cycle Cost Analysis: Pavement design will utilize publically available Life Cycle Cost tools for pavement such as AirCost and submitted to the Aviation Department project management for review and final product selection.

1-5.1.3

1-5.1.4 LANDSIDE City policy requires new building construction and renovations to achieve LEED certification. For all other projects [The Design and Construction \(DCS\) Green Guide](#) has been developed for “horizontal” construction projects, i.e. non-building design and construction, where LEED does not apply. Other sustainable design standards such as Envision may be requested for consideration by the Aviation Department.

1-5.1.1 It is the intent of the City of Phoenix to use these Standards to affect overall project design and construction to meet Sustainability project design objectives. The actual level of Leadership in Energy and Environmental Design (LEED) to be met for the project, i.e., Certified, Silver, Gold or Platinum, will be determined by the PM and Project Stakeholders on a project by project basis before design commences. Documentation shall be provided by

using the latest applicable version of LEED at the start of every project's conceptual design. U.S. Green Building LEED templates will be used by the Contractor to validate compliance with LEED standards.

SECTION IV: 1-5.1.3 Life Cycle Cost Analysis, Energy consuming systems selection, and pavement design will utilize publically available Life Cycle Cost tools and submitted to the Aviation Department project management for review and final product selection.

1-1.1.4 The Contractor will stamp and sign a City of Phoenix approved document verifying to the City (building owner) that the minimum LEED point requirement for the ~~above~~-selected level or performance has been met. The LEED approach allows the Contractor various options for meeting minimum LEED points. Additionally, the Aviation Department is specifically interested in (regardless of other LEED program prerequisites or other points achieved) in the following:

- Landscape & Exterior Design to Reduce Heat Islands, (non-roof)
- Landscape & Exterior Design to Reduce Heat Islands, (roof)
- Water Efficient Landscaping (reduce by 50%)
- Water Use Reduction (20% reduction)
- Optimize Energy Performance
- Energy System Commissioning
- Construction Waste Management, (divert 50%)

LEED Accredited Professional

1-1.2 Green Building Design

1-1.3 Construction Practices

1-1.3.1 SITE DEVELOPMENT The Contractor will develop the following for submittal at the pre-construction meeting:

1-1.3.2 Construction materials recycling plan

1-1.3.3 Construction pollution prevention plans (Storm Water SWPPP or other environmental plans and permits)

1-1.3.4 Construction equipment (California Type IV equipment or agreed upon alternative and well maintained equipment) for the work will be listed and submitted.

1-1.3.5 Construction equipment idling policy

1-1.3.6 The Contractor will submit documentation and acknowledgement show conformation with the sustainable design specifications chosen in the design phase and the appropriate sustainable design standard checklist for the construction phase for review and approval.

1-1.3.7 For building or other systems commissioning, either Fundamental or Enhanced, the Contractor will develop for review and approved by the Aviation Department a plan outlining the Contractors role in the commissioning process.

1-1.4 Recycling Program

1-1.4.1 RECYCLED CONSTRUCTION PRODUCTS

Consideration should be given to the use of recycled products in construction applications. Construction documents shall, at a minimum encourage the use of construction materials that utilize recycled products.

1-1.4.2 RECYCLING PROGRAM

Construction documents shall note a Contractor's responsibility to provide a submittal of a plan to the Aviation Department outlining provisions for a recycling program to be implemented during construction at the construction site. Plan shall include provisions for recycling of all construction waste materials for which recycling is available as well as collection and recycling of paper and other waste materials from the Contractor's field office and construction site work areas.

Guiding Principles

This section is intended to assist Architects, Project Managers, and other design team members in complying with The City of Phoenix goal to divert 40% of the solid waste from the airport activities. The direction called for waste reduction and source separation to become the fundamental strategies of solid waste management. The Sky Harbor Solid Waste Management Plan (SWMP) details the waste and recycling program elements for the Phoenix airports. Review the SWMP for current standards and programs.

- Integrated collection areas that include recycling components and equipment can assist in the reduction of landfill-bound waste, prolong the life of landfills, and promote environmentally sound practices.

Interior storage of solid waste and recyclable materials

Convenience

- Designers should make recycling, organics and trash collection services all equally easy to use. Chutes should not be used for organics collection due to the cleaning challenges.
- A place for compost a collection bin should be located at the waste collection site or upper floor near trash chutes and transportation should be made available in back hallway for transporting waste via elevator..
- It is good practice to provide 20% to 35% excess capacity for seasonal variation and other surges in volume.

A Janitor closets on each floor, large enough to store a two or three-barrel dolly, will help facilitate collection and/or separation of discards of food scraps around the building. Additionally, a small work room near the loading dock for additional sorting may prove useful, should management choose to sort discards at the dock. Spillage of liquids and discarded food might occur in this room. A wash station for cleaning organics carts and bins, connected to a sanitary sewer and closed off when not in use (to prevent seepage from inflow of rain water), would be a useful feature.

Tallow (grease, cooking oil) containers: Do not store within solid waste enclosures. Tallow containers (normally only used at food facilities) should not be stored within the building and be provided with acceptable secondary containment. And roofed to avoid pollution.

COMPACTORS; CARDBOARD BALER, ROLL-OFF AND FRONT-LOAD

1. All proposed compactor equipment and locations to be reviewed for compatibility by the contracted hauler and approved by the City.
2. PLEASE NOTE: Prior to determining compactor size, review rate, health code, and operational restrictions, including but not limited to issues below:
 - All compactors should include an ozonator to reduce odors. Care should be taken to choose an appropriate compactor size to avoid excessive haul fees on smaller units
 - Compatibility: all compactor units should be similar or identical in model and size to be interchangeable and for ease of service where applicable. Stationary Compactors should be used where possible to increase the efficiency of the loads serviced.
 - All compactors should be designed with industrial or heavy commercial use in mind, sizing the cylinder and motors to provide a long service life. Custom designed units are strongly discouraged due to the inability to ensure a quality product that has been proven over a lengthy period.
 - Typically between 32 and 40 cubic yards
 - Vehicle Access: review with FACILITIES AND SERVICES and current waste service provider to determine required space needed to safely remove and return the compactor.
 - Vertical Loading Clearance: review with FACILITIES AND SERVICES and current service provider and compactor manufacturer to determine the minimum height needed to safely service the compactor without overhead obstructions.
 - Stress Pad: To be oriented to allow collection vehicle to completely rest upon it and made of concrete.
 - FACILITIES AND SERVICES to approve all equipment purchases prior to final selection.
 - Signage appropriate should be dual language as required to ensure safe and consistent use by all trained employees..
 - Cardboard balers location should be equipped with power shut disconnect, height clearances, and dock space to maneuver the baled cardboard off of the dock.
 - Baler will need a safety footprint of at least 64in x 200in (does not include space for baled cardboard maneuvering).
 - The baler will also need at least a 12-foot clearance above the unit itself.
 - Power disconnect will be determined by baler model, and the locations of the disconnect will be determined by the baler spacing to the wall. .
3. Front-load Containers may be used where the expected solid waste collection is low, Typically 4-8 cyd. The enclosure should include space for the collection of 3 separate materials, trash, recycle and compost. Review with FACILITIES AND SERVICES prior to final selection and design .

CHUTE DESIGN:

1. General: Special care must be taken to assure recyclable material, such as corrugated cardboard, does not hang up in chutes and to minimize contamination by trash. Chutes are used for their convenience because they help keep stairwells and elevators clean.
2. Number and Size of Chutes:
 - a. Two chutes are required; one for garbage, one for mixed recyclable.
 - b. Diameter(square) to be 24 inches minimum to allow for large cardboard items and to reduce blockage of trash bags.
3. Doors:
 - a. Provide 16-inch square chute doors (intended to be a smaller dimension than the 24-inch chute square chute) to prevent users from dumping large items which may hang up in chute.
 - b. Provide temporary “shut-off door interlock” at each end of chute to prevent disposal being added from above when waste is added at the lower level.
4. Insulation: Provide around each chute to reduce noise as needed.
5. Sanitary systems to be provided to minimize nuisance conditions:
 - Placement of a manufacturers built-in water cleaning system, where appropriate to drain directly to the sanitary sewer under the compactor.
 - Use of a deodorizer device, (ozonator) to reduce odor.
 - Include positive, mechanical air ventilation EXAMPLE of at least six (6) room volumes per hour or as designed for specific use by registered engineer. Fan switch shall be located at a convenient location near trash bins located near the upper room.
6. Conform to all Equipment Manufacturer's requirements.
7. Review all selections with FACILITIES AND SERVICES prior to final acceptance

Design Guide Loading Dock Requirements

Loading Dock Requirements – This section applies to loading docks located adjacent to or under buildings. The type and volume of waste and recycling materials determine the type, size, and number compactors or of containers requiring space and, therefore, the size of dock area needed.

1. Dock Space Requirements
 - a. MSW (municipal solid waste, trash); compactor should be appropriately sized for use and durability
 - b. Recycling: compactor should be appropriately sized for use and durability

c. Food waste: minimum 2-yard cart that is easily serviced from the drive depending on the need of the area.
 d. Space for consolidation of packing materials for buildings associated with materials handling or shipping and receiving functions. Includes wood crating, pallets and tallow bins should be located at each dock. A ramp may be needed to move the items from the upper level to the drive level of the dock.

Dock Requirements for Compactors – use most recent guide and requirements from compactor manufacturer that has been selected to determine the following:

- compactors overhead clearance
- Power
- Distance in front of compactor required for loading and unloading
- Concrete pad for compactors
- Loading docks should be equipped with bumper pads to avoid dock damage
- Compactor should be on a level surface or placed on ramp to assist with servicing; if placed on an incline, roll-away protection is required
- Guide rails (required) and ramps or liquid collection tray (optional) are required for assisting hauler with compactor placement; hauler must be contacted before designing any guide rails for container

Cart Lifters

- Placement and size of mechanical handling equipment is required
- Cart lifter style and size is determined by type and size of custodial collection cart in use
- Additional rear, side, and overhead clearances are required for cart lifters
- Placement of cart lifters requires a smooth, flat surface
- FACILITIES AND SERVICES to review and approve all cart lifters

Ramps

- Pedestrian ramps that allow collection staff to access loading docks and collection sites and are wide enough for custodial carts are required
- Airline ground crew and custodial access to compactors is required. Sufficient space is required to move material from ramp level to dump location. This may require ramps to move carts.
- Handrails and safety barriers are to be included as required
- Safety interlocks may be required for safe operation of cart lifters, refer to current safety standards

Ventilation

- Partially or fully enclosed dock areas must have adequate ventilation, separate from building systems, and include a sprinkler system as required by code

Drain

- A floor mount drain should be installed by the compactors and connected to a sanitary drain line as required by code. Compactors will be designed to have liquids drain from the interior of the collection box and discharge to the drain.

Special Considerations

Dock space may be required for the following:

- Placement and storage of bottled gases, placement of pallets compost collection bins or other items as required.

Purchase Requirements

- Prior to purchase, Designer to meet with Facilities and Services for compactor standards.
- Alternative (custom designed units are not recommended) compactors must meet Aviation guidelines for appearance, functionality, and custodial service standards. Alternative containers must be reviewed with FACILITIES AND SERVICES prior to final selection.

Liquid Collection Stations

- Security checkpoints should be equipped with a liquid collection location convenient to the entrance for passengers. The location should be determined to allow all passengers to easily see and pass the location for disposal liquid and recycle opportunities. All location should be reviewed and approved by facilities prior to placement and purchase. The liquid collection should include:
 - o Signage easily identifying the location from a distance 28" high by 24" wide, that is on wheels. The identifying sign will be above 38" water collection station and be easily transportable.
 - o Minimal sizes include 46" wide 38" high 7" deep for liquid collection
 - o Permanent plumbing drain should be included in the design
 - Other areas may be designated as liquid collection which may include:
 - o Food eating areas
 - o Baggage claim

Recycling in tenant spaces

- Restaurants should be designed with sufficient space to include waste collection and sorting. This should include:
 - o Space for 3 collection bins – Recycle, Compost and Trash. Minimum bin size should be the 23 gallon Slim Jim size. Minimum space requirements are 40” wide, 20” deep and 36” tall. More than one location may be needed for compost collection. Larger space should also include a collection location for cardboard in totes prior to transportation to collection areas.
 - o Signage and training material space should be included and placed above the 3 bins to educate on the current waste diversion guidelines and activities.
- Retail space should be designed with sufficient space to include waste collection and sorting. This should include:
 - o Space for 3 collection bins – Recycle, Compost and Trash. Minimum bin size should be the 23 gallon Slim Jim size. Minimum space requirements are 40” wide, 20” deep and 36” tall. Space should also include a collection location for cardboard in totes prior to transportation to collection areas.
 - o Signage and training material space should be included and placed above the 3 bins to educate on the current waste diversion activities.
- Tenant space should be designed with sufficient space to include 3 bin sort station for staff. Waste collection areas or custodial closets should provide adequate space for waste collection or sorting to ensure clean material.

Public space collection containers

Public Area Bins

- Standard set is three sections (Mixed Recycle, Compost & Waste) for centralized collection in areas accessible by the public. 3 bin sort station
- Review all selections with FACILITIES AND SERVICES for durability, size of the receptacle and ease of service by custodial staff.
- Bins should be designed to provide a minimum of 15 years of service

1-6 Minimum Useful Building Life

1-6.1.1 New building components and building structural systems should be designed, where practical, for a minimum useful life of up to 50 years, assuming there is proper maintenance and capital repair to the facility. Major building systems should employ quality materials, equipment and hardware to maintain a realistic life cycle cost benefit for their application.

1-6.1.2 Where a structure is not intended to serve a useful 50-year life span, the design life objective should be established through evaluation of program requirements and Life Cycle Cost Analysis (LCCA). The Contractor shall review and coordinate the findings of evaluation with the PM. Final recommendations must be approved by PM and DADs. The LCCA must include assessment of items such as Arizona Power System rebates and rate reductions.

1-6.1.3 It has been the trend in past years that the general interior finishes and materials of terminal building public space, and particularly concessions applications, are renewed or even

replaced every 8-10 years. Given the recent changes in the airline industry concerning reduced cost of operation, the use of more durable long life materials should be considered when selecting interior finishes and materials.

1-6.1.4 Wooden truss systems and heavy timber construction exposed to weather are discouraged.

1-7 Cohesive Architectural Statement

1-7.1 Influences of Existing Architecture

1-7.1.1 The architectural aesthetic of major existing building projects undertaken by the Phoenix Aviation Department illustrates a desirable level of architectural continuity in the application of regional native themes used for ornamentation. Future projects should evaluate the use of these or similar treatments which will enhance the sense of continuity between the major building components of the airport terminal complex. Smaller buildings serving in a supporting role should maintain a secondary role in the aesthetic fabric of the airport's terminal area.

1-7.1.2 In light of the current emphasis on sustainable and green building design practices, the Contractor should give consideration to the following:

- Avoid replicating past design practices which run contrary to the best practices of sustainable design
- Evaluate the application of design concepts suited to the desert environment
- Incorporate natural lighting where possible
- Consider the use of roof or building overhangs to shade openings and reduce direct solar impact when feasible

1-8 Quality of Passenger Experience

1-8.1 Airport Design Objectives

1-8.1.1 Quality of customer experience and establishing a clear focus based on passenger satisfaction should dictate the design criteria for terminal development at the Aviation Department's Airports. This section outlines some fundamentals which influence customer experience and enumerates the basic issues to be considered in the design of new or renovation of existing facilities. Not every item will necessarily apply to every project but the applicable items should be weighed and taken into consideration when evaluating conceptual alternatives.

- A.** Offer first-class departure and arrival experience for passengers
- B.** Create high-quality service for the traveling public
- C.** Create a terminal building reflecting Arizona's quality of life
- D.** Provide natural and simple passenger and vehicular flows
- E.** Create open and uncrowded spaces
- F.** Limit walking distances to 300 feet (distance to be verified) whenever feasible
- G.** Minimize walking distances for passengers moving horizontally on a single level or vertically between levels

- H.** Use clear and simple wayfinding and general information systems as outlined in the approved Signage & Wayfinding Master Plan and approved by the Signage Program Manager
- I.** Offer quick, convenient access to and from all modes of ground transportation including private vehicles, commercial ground transportation, and people movers
- J.** Furnish quick, easily accessible ticketing and check-in facilities for enplaning passengers and baggage claim facilities for deplaning passengers
- K.** Avoid vehicular traffic crossings for passenger and commercial traffic
- L.** Accommodate meters and greeters without impeding passenger flows

1-8.2 Passenger Level of Service

1-8.2.1 During the Programming Phase of the project, the facility requirements to satisfy passenger processing demand must be analyzed to ensure sufficient capacity will be provided to achieve the desired level of passenger service. The results of this analysis are dependent on the accuracy of the assumptions made regarding passenger arrival rates, split between carry-on and checked baggage, O&D versus transfer passengers, processing rates and other factors which govern the results of such calculations. The functions discussed below should be assessed to determine the correct quantity, size or dimensions and reviewed in detail with the PM and stakeholders.

- A.** Balance ticket counter, e-ticket and curbside check-in positions to ensure adequate check-in facilities at the design peak hours to minimize waiting time.
- B.** Analyze queuing for ticketing to provide adequate area to accommodate the maximum queue without disrupting passenger flow adjacent to queuing areas.
- C.** Review latest Transportation Security Administration (TSA) processing rate and configuration data for passenger screening checkpoints and provide sufficient lanes to accommodate the TSA protocol for all modes of screening. Analyze queuing for passenger screening to provide adequate area to accommodate the maximum queue without disrupting adjacent passenger flow.
- D.** Provide easy access to concessions and other terminal amenities without forcing passengers to backtrack or deviate from the most efficient path to their final destination whenever feasible.
- E.** Unless otherwise directed by the Aviation Department, design hold rooms to accommodate a 90% load factor based on the selected design aircraft for each gate.
- F.** Evaluate plans using peak hour passenger flows to identify pinch points of passenger movement and remove constraints to eliminate the condition.
- G.** Unless available data indicates a different conclusion or otherwise directed, size outbound baggage system and baggage claim facilities to accommodate baggage at the rate of 1.3 checked bags per passenger times 90% load factor.
- H.** Unless available data indicates a different conclusion or otherwise directed, provide sufficient room for passengers in baggage claim around each claim device to accommodate the design aircraft at an 90% load factor which assumes all passengers arrive at baggage claim before the baggage. Calculate area, in addition to baggage claim unit footprint, at 15 square feet per passenger. Do not encroach on adjacent public circulation areas to accommodate passenger accumulation in the baggage claim area.
- I.** When feasible, use modeling software to illustrate and calculate level of service performance

1-8.2.2 The Contractor shall evaluate the Level of Service Standards adopted by the International Air Transport Association (IATA) governing conditions of passenger crowding for waiting and

queuing operations when considering design conditions for processing departing and arriving passengers.

1-9 Architectural Building Zones

1-9.1 Facilities Space Program

1-9.1.1 The requirements and design criteria for building structures are generally enumerated in detail in the in the Facilities Space Program. The most complex of building types encountered at an airport are those structures which house passenger processing facilities for scheduled airline service. This document serves as the guide to the Contractor charged with keeping the planning of individual terminal functions and areas in balance with the project requirements and construction budget. The design should conform to the specific requirements of this document and when deviation is deemed necessary, the Contractor should request written approval from the PM with an explanation of the issues which cause the deviation.

1-9.1.2 Typically, the terminal floor areas specified in the Facilities Space Program which are used for passenger processing, are derived from the peak traffic volumes which the design should accommodate. While the basis of these derived values may be based on historic data, the required floor areas indicated must be organized to resolve the functions and related passenger flows involved with each function. As alternatives for the arrangement of passenger processing functions are developed, they should be evaluated by applying the design peak hour passenger volumes to each proposal.

1-9.2 Additional Design Criteria for Passenger Terminal Areas

The following terminal functions are areas of particular concern to the Aviation Department and the basic issues which require resolution are described in general terms.

1-9.2.1 CURBSIDE

A. The required length of curb frontage for a terminal facility is based on the number of people arriving and departing the terminal area at/from the curb in the peak design period (typically referred to as the Peak Hour/Average Day/Peak Month of the design year) distributed across the various modes of transportation by which passengers may arrive and depart. This is accomplished by evaluation of the number of various vehicles using the curb in a given peak period based on their individual length, required maneuvering area and the dwell time to transact loading or unloading of occupants.

B. The passengers' arrival at, and departure from, the curb of the enplaning and deplaning roadways should be a positive experience for the passenger and create the expectation for an enjoyable experience while using the terminal. The following is a partial list of considerations which should be used to analyze and insure the curb front sidewalk depth is sufficient:

- Providing adequate sidewalk depth (curb to terminal wall) to accommodate the various activities and avoid conflicts between passenger circulation and adjacent activities is critical.
- Curbside check-in facilities should set back far enough from the curb so that passengers have room to queue without standing in the drop-off lane and far enough from the curb to avoid interference with circulation along the curb while providing space for vehicle doors and people getting out of cars at the curb.
- Taxi starter podiums and queuing should not block through circulation.

- Provide ADAAG required handicapped access along the curb (use the Aviation Department standard detail which is more restrictive than ADAAG). Provide clearance between top edge of ramp and terminal (accounting for obstructions such as security bollards) to provide adequate clear circulation width along the sidewalk parallel to the curb and access to terminal entrances.
- Avoid use of post mounted signs along curb whenever possible. Where required, located post mounted signs far enough back from curb line to avoid contact with open vehicle doors.

C. The Aviation Department has adopted the practice of using raised crosswalks to minimize the number of curb cuts required for handicapped access. The Contractor shall employ raised crosswalks wherever the crossing of an active roadway is required between the curb frontage adjacent to the building and an island curb is required. Slope pavement in the direction of vehicular travel to maintain 30 feet of run in a 6-inch rise.

D. Since activities and services related to the curb require the use of supporting hardware and devices, storage should be provided for the following;

- Sky Cap carts
- Luggage carts
- Bag tubs for curbside check-in
- Moveable bollards
- Wheel chairs

E. Consideration must be given to locating designated exterior smoking areas which will generally be near points of building access. These areas should be clearly identifiable and located at least 20 feet from entrance doors to eliminate smoke from entering the building. Provide containers for proper disposal of spent smoking materials.

1-9.2.2 CURBSIDE CHECK-IN

While not every airline is interested in providing curbside check-in to its passengers, the ability to implement the service along the Departure Curb frontage should be provided. This includes provision of adequate space for queuing, airline check-in operations and a dedicated baggage belt to the appropriate baggage screening area for the subject airline.

1-9.2.3 TICKETING

A. The ticket lobby is a space which must be organized to permit a variety of functions to occur simultaneously, including passenger queuing at ticket counters and access to e-ticket devices, while maintaining pedestrian traffic flow along a path on either side of the queuing area parallel to the ticket counter. The general standards outlined below are for ticket lobbies with ticket counters parallel to the enplaning roadway curb and offer a starting point for design analysis. Deviation from dimensions shown is acceptable where operating conditions warrant:

- Provide a minimum depth of ticket lobby of 45' from ticket counter front to nearest obstruction along the outer wall which may include entrance vestibules, areas set aside for public seating or space (including queuing) for e-ticket machines. Subdivide this minimum depth as follows:
- Provide a minimum width of 15 feet for lateral circulation across the lobby frontage (adjacent to exterior wall) to permit 2-way pedestrian movement with bags from one end of the lobby to the other.
- Provide minimum depth of 20 feet for passenger queuing.

- Provide a minimum depth of 10 feet for lateral circulation between queuing area and ticket counters.

B. While the depth of passenger queuing at the ticket counter is determined by the parameters outlined above, the width of the passenger queuing area is defined by the ticket counter frontage an airline maintains through their lease with the airport. As e-ticketing and check-in become more common, airlines have begun experimenting with reduced counter frontage which tends to reduce the traditional area available for passenger queuing. This must be evaluated during the planning of ticket lobby to ensure adequate queuing will be available for each airlines peak hour operational requirements.

C. Other considerations for planning of the ticket lobby area include but may not necessarily be limited to the following:

- Public seating (see PUBLIC SEATING below)
- Wheel chair storage
- Storage/staging for baggage tubs used at ticket counters
- Storage for and access to luggage carts where applicable

1-9.2.4 CONCESSIONS

A. Access to concessions is a critical factor in assuring optimum revenue benefits from concessions sales. The Contractor must evaluate concession location alternatives for Stakeholder review and comment including the required distribution of concessions opportunities between the secure and non-secure public areas of the terminal.

B. The Contractor must consider the location and layout of service counters for smaller food concessions to ensure that queuing of patrons does not accumulate in a manner that will congest and interfere with adjacent terminal circulation requirements.

Waste collection should be reviewed based on recycling guidelines noted above.

1-9.2.5 SECURITY CHECKPOINTS

A. All passenger screening checkpoints must be designed in close collaboration with the TSA using the latest guidelines for hardware requirements and dimensions. The passenger demand at screening checkpoints should be verified from peak hour departure forecast data and TSA passenger processing rates to ensure adequate number of lanes for this function.

- While the opening configuration of the checkpoint(s) may not use all the floor area ultimately required, the initial checkpoint planning should be based on the number of lanes required to meet the ultimate design requirement.
- Analyze the impact on passenger processing time when staffing is reduced by one and two lanes during the peak hour condition and insure the plan includes adequate queuing area to accumulate passengers entering the checkpoint during periods when the TSA may not fully staff the operation to meet the desired wait time.
- Consider the impact on adjacent terminal functions should TSA checkpoint processing rates be reduced in the future requiring additional lanes to satisfy existing demand. Avoid limiting checkpoint expansion by placing stairwells or restrooms adjacent to the checkpoint.
- Plan location for Recycling and Liquid Collection Centers around entrance to Checkpoint Queuing areas. Provide means of draining liquid from cups and bottles prior to disposal. (see possible use of liquid collection stations as previously noted)

1-9.2.6 HOLDROOMS

A. Size of hold rooms is a function of the design aircraft served at each particular gate and should be resolved in the Facilities Space Program. Planning of hold rooms should accommodate the following minimum requirements as a starting point:

- Provide seating for 80% of passengers at 90% load factor applied to the design aircraft allowing 18 sf/person, minimum for seating area to assure adequate space for carryon baggage and circulation.
- Seating should be laid out to meet the minimum standards for clearances around non-fixed seating in the building code but special consideration should be given to row spacing to accommodate carry-on baggage placed on the floor adjacent to seating.
- Provide standing room for 20% of passengers at 90% load factor at 13 sf/person
- Provide dedicated, unobstructed egress path from loading bridge access/egress point to public circulation concourse of a width of 6 feet minimum
- Provide dedicated area for check-in podium and queuing area
- In hold rooms where column placement requires multiple columns in the seating area, additional area may be required to achieve the desired seat capacity.

B. Other hold room planning considerations:

- Provide means of accessing electrical power for use of portable electronic devices
- Provide induction loops in floor in hold room seating areas to facilitate access to public address messages by the hearing impaired that have compatible hearing devices
- Plan for location and functional requirements of Instant Video Interpreting Service (VIS) Monitors which provide sign language interpretation services for the hearing impaired
- Hold rooms will have sufficient space to accommodate the three bins used for collecting trash, compost and recycle.

1-9.2.7 BAGGAGE CLAIM

A. Arrival at baggage claim completes the travel experience in the terminal for many passengers. Depending on the location of the arrival gate and the operational characteristics of the airline handling the passenger's baggage, the passenger may have to wait for the arrival of baggage. During peak operating periods, it is likely that all the passengers on the flight who checked baggage may be waiting around the baggage conveyor by the time the first bag is delivered. In addition, meter/greeters must also be accommodated in the area. Adequate space in baggage claim area is required to comfortably accommodate this queuing function and still have room for passenger circulation through and around baggage claim to other functions and services.

- The Aviation Department prefers sloped bed carousels for baggage claim utilizing remote feed underground inbound baggage conveyors for bag delivery. Overhead feeds will be considered when necessary.
- Refer to Facilities Space Program for size of carousels (length in linear feet).
- Maintain a minimum of 30 feet between adjacent carousels.
- Maintain a minimum of 15 feet from a carousel to an adjacent wall or edge of adjacent public circulation area.

- Provide a minimum IATA Level of Service C for baggage claim waiting area during peak passenger arrival period and sized for 100% of passengers claiming bags plus a 15% meter/greeter ratio.
- Plan location for public seating for use by those waiting for passengers claiming bags (see PUBLIC SEATING below).

1-9.2.8 PUBLIC RESTROOMS

A. The quality and quantity of public restrooms is critical in providing an acceptable experience for the Aviation Department passengers. Of particular concern is the quantity of restroom facilities available to deplaning passengers in the hold room area and before baggage claim. Restroom requirements should be based on evaluation of the peak passenger arrival schedule. The nature of this event places a demand well above the provisions of current plumbing codes and must be considered when forecasting requirements for toilets and urinals accessible to arriving passengers.

B. The Contractor will be required to meet with the FACILITIES AND SERVICES Division during the design process to address the design response to the items listed below during the design process. While the question of quantity may have been addressed above, the quality of the facility is a matter of architectural detail. The Aviation Department has adopted the following general planning criteria for new or renovated public restrooms:

- Public restrooms must conform to the ADAAG including Arizona and COP modifications which exceed ADAAG.
- The Contractor should select vandal resistant, easily maintained, finishes for all walls, accessories and hardware used in public restrooms.
- Typically, the Aviation Department prefers tile for wall (on tile backer board) and floor finishes but alternatives may be discussed. All restroom floors require a waterproof membrane underlayment which must be turned up the wall behind wall tile.
- Toilet partitions shall use floor to ceiling mounted pilasters. Provide braced steel reinforcing above ceiling for installation of pilasters to ensure secure mounting.
- Doors to toilet compartments shall use continuous hinges.
- Toilets should be wall-mounted.
- Modesty partitions are required between urinals and should be provided with continuous support along both sides where mounted to the wall. Attachment points on wall shall be backed with continuous steel reinforcing to ensure secure mounting.
- Prepare a submittal for FACILITIES AND SERVICES review of all proposed anchorage and mounting details for wall mounted accessories and hardware.
- Analyze feasibility of using electric hand dryers either in addition to or in lieu of paper towels.
- Locate towel dispensers (or hand dryers) between each pair of lavatories to avoid water on floor between lavatories and remote towel dispenser locations.
- Do not locate public restrooms over electrical rooms or comm. rooms.
- Provide at least one floor drain in each public restroom, with trap primer attached to toilet flush valve. FACILITIES AND SERVICES to specify trap primer used. Add floor drains where restrooms are divided into adjoining spaces for toilets, urinal and lavatories.
- Full and complete access to utility chases is required for maintenance staff. Provide minimum 30" clear fixture to fixture utility chases when renovating existing restrooms and 36" clear fixture to fixture clearance for new installations.

- Provide waterproof membrane floor protection in all plumbing chases turned up wall 6" all around.
- Provide at least one floor drain in each plumbing chase.
- Refer to Plumbing and Electrical sections for additional requirements related to other provisions in chase including access to electric power, water supply and isolation valves.
- Planning for larger banks of restrooms should make provision to allow ½ of the restrooms to remain in operation while the remaining ½ is closed for maintenance.
- Design large restroom so that half of the restroom can remain open during maintenance.

1-9.2.9 In addition to public restrooms, PHX requires provisions for Family (Unisex) Restrooms. Provide a minimum of one Family Restroom for the terminal and one Family Restroom per concourse. Family Restrooms at PHX include a dedicated adult changing space of 30" x 60". Refer to the Family Restroom Layout in SECTION IV, Appendices, and Standard Details for additional information.

Fixtures will meet Water Sense water consumption standards and good engineering practice for supply and drainage lines.

1-9.2.10 JANITORIAL CLOSETS

A. While not necessarily always the case, janitorial closets are typically co-located with restrooms. Because of the nature of their use, they are subject to significant wear and tear. The following items must be accommodated for the finishing of all new or renovated janitorial closets:

- Use stainless steel mop sinks with tamper proof screws on strainer. Fiberglass is prohibited.
- Install tile backer board substrate to 4 feet above finished floor with liquid applied membrane floor and wainscot to 4 feet high. Other options may be considered by FACILITIES AND SERVICES if equal in performance.
- Install floor drain in all janitorial closets.
- Provide mechanical ventilation of all janitorial closets.
- The floor will be the same level inside the closet as it is outside. This will accommodate the easy entrance and exit of custodial carts and liquid collection units if needed.
-

1-9.2.11 PUBLIC SEATING

Generally, the Aviation Department considers public seating to be desirable when properly planned in locations which allow it to be used without impairing other terminal functions. Public seating is specifically mentioned above related to the ticket lobby and baggage claim. It should also be considered in other areas of the terminal including not tenant areas of concessions areas and the concourse. Public seating should accommodate the following:

- Public seating must be modular and employ replaceable seats and backs to permit repair of damaged units
- The intersection of the seat and back should remain open to discourage to accumulation of debris
- Seating must be easy to get in and out of particularly for the elderly

- Seating area must provide adequate and convenient access to electrical power for the use and charging of portable electronic devices

1-10 Passenger Amenities

1-10.1 Amenities Planning

1-10.1.1 Terminal amenities provide those additional design considerations which round out and complete the functional requirements and services necessary for a high-quality passenger experience in using the terminal facilities. There are several issues that must be addressed in the process of planning and design for terminal amenities including:

- A.** Locating amenities where they can be readily seen and accessed
- B.** Allocating sufficient space for the amenities and user access without interfering with adjacent building functions or passenger flow
- C.** Designing or selecting fixtures and hardware which is of sufficient strength to remain serviceable during heavy use
- D.** Selecting finishes which resist scratching and damage due to contact with baggage and luggage carts

1-10.1.2 The Contractor shall prepare a complete amenities layout for review by the PM and Stakeholders including FACILITIES AND SERVICES. This must be accomplished in accordance with the procedures outlined for the Design Development Phase in Section II.

1-10.1.3 The following items provide a summary of various passenger amenity items considered to enhance the passenger's experience, level of service and security while using the terminal. This is not an all-inclusive list nor is it to be construed as minimum standard requirements. It is offered to encourage the Contractor to evaluate the needs of passengers depending on the type of facility under design and to provide for such amenities as the budget and conditions allow.

1-10.1.4 PASSENGER SHELTERS AND CANOPIES

A. When a project involves expansion of existing roadways or curb frontage to serve passengers departing from or arriving at the airport, protection from the elements should be considered including the introduction of canopies along the curb to provide covered drop-off and pick-up where applicable.

1-10.1.5 SEATING (see also PUBLIC SEATING above)

- A.** Passenger or meter/greeter multi-seat units or possibly benches
- B.** Café or lounge seating with tables and chairs close to passenger screening
- C.** Café or lounge seating with tables and chairs adjacent to hold rooms in the concourse

1-10.1.6 BAGGAGE ASSISTANCE

- A.** Baggage cart dispensers
- B.** Baggage valets (Skycaps) at the departure curb and baggage claim

1-10.1.7 HANDICAPPED ASSISTANCE

- A.** Wheel chair staging/wheel chair assistance

1-10.1.8 COMMUNICATIONS

- A. Public telephones (incl. TDD/TDY phones)
- B. General public paging
- C. Courtesy phones
- D. Visual paging
- E. Wireless and conventional internet access

1-10.1.9 EMERGENCY NOTIFICATION AND RESPONSE

- A. Emergency alarm annunciation and paging
- B. Dynamic, changeable message signage providing evacuation information
- C. Police and medical emergency call stations
- D. Automated External Defibrillators (AED)
- Do not locate AED units behind seating. These devices are best located adjacent to circulation areas
- Select semi-recessed AED units which limit projection to maximum 4” from wall to conform with ADAAG requirements

1-10.1.10 FACILITY MAINTENANCE

- A. Waste receptacles/recycling containers
- B. Cigarette disposal units at designated smoking areas

1-10.1.11 FLIGHT INFORMATION

- A. Flight information displays (FIDS)
- B. Baggage information displays (BIDS)
- C. Real time flight information kiosks (Flight Tracker)

1-10.1.12 AIRPORT INFORMATION

- A. Airport directory (you are “here” maps)
- B. Passenger information desks (staffed)
- C. Airport wide customer assistance “hotline” phones

1-10.1.13 ADVERTISING

- A. Commercial advertising displays – coordinate with B&P for coordination with the latest advertising contract requirements.
 - Advertising is generally wall mounted. Kiosks are typically discouraged.
 - Use semi-recessed display cabinets projecting no more than 4” from wall to conform with ADAAG

1-10.1.14 CONCESSIONS

- A. Brand name retail outlets
- B. Souvenir/gift shops
- C. Small news or sundries shop
- D. Retail kiosks
- E. Food and beverage shops
- F. Food and beverage kiosks

1-10.1.15 VENDING

- A. Flower vending
- B. Prepaid telephone cards
- C. Food and beverage vending
- D. Vending of various electronic items and other merchandise

1-10.1.16 ENTERTAINMENT

- A. Video games
- B. Points for audio/video access

1-10.1.17 BUSINESS SERVICES (24 hour services)

- A. Fax, copier and printer access
- B. USPS, UPS, FedEx, DHL automated services and drop boxes
- C. Automated teller machines (ATM)
- D. Prepaid phone card vending machines
- E. Drink, snack vending
- F. Shoe shine
- G. Small conference rooms with appropriate equipment

1-10.1.18 DESIGNATED SMOKING AREAS

- A. Plans should include provisions for sheltered exterior areas for smokers. Designated smoking areas should be located away from pedestrian traffic areas, as well as a minimum of 20 feet from facility entry/exit doorways to eliminate smoke intrusion into the building environment. The Aviation Department requires that the location of these facilities should consider conditions such as wind on the migration of smoke which may suggest a distance of greater than 20 feet is required to eliminate smoke contamination of the adjacent building space.
- B. Provide disposal units for spent smoking materials.

1-10.1.19 SERVICE ANIMAL RELIEF AREAS

The ACAA (Air Carrier Accessibility Act) has mandated all US airlines and airport operators to jointly provide Service Animal Relief Areas at convenient areas of terminal facilities and immediate adjacencies. Their location must be coordinated with airport authorities, carriers, TSA, CBP (Customs & Border Protection), and in consultation with local service animal training consultants. Size, sun-shading, screening, etc. may vary with the capacity and location of the facilities being served. Under certain conditions, this provision might be required within secure areas. Gravel or stone are recommended to maintain hygienic floor and ground-cover conditions, as well the provision of water, signage, trash disposal, and ADA accessibility.

1-10.1.20 Nursing Rooms

The airport has incorporated Nursing Rooms for the traveling passengers which provide a secure, private and restful room for women to breastfeed or pump breast-milk. All stations are required to include comfortable seating, sink with counter, and electrical outlet appropriately placed.

1-11 Safety and Terminal Operations

Safety and security are always primary considerations during construction in an operating passenger terminal facility. Passengers and airport employees should not be exposed to any hazards involved in the project demolition or construction. Security should be maintained by isolating the work area from the secure areas of the airport complex. The Contractor must provide phasing plans that will protect the public and employees from danger. Some inconveniences are to be expected in any renovation project but the following principals should be followed:

- A. Barriers will be provided to separate construction and public areas
- B. Emergency exiting requirements will not be compromised by construction barriers or activity.
- C. If existing circulation paths are disrupted by construction, alternative circulation needs to be provided to maintain access to all areas of the passenger terminals.

1-11.2 Security

1-11.2.1 CRIME PREVENTION THROUGH ENVIRONMENTAL DESIGN (CPTED)

A. Natural Surveillance

Foster open environment and eliminate areas of concealment through use of glazing, placement of amenities, style of fencing materials, and architectural elements.

- A.1. Provide open lines of sight.
 - A.2. Design long and straight pathways.
 - A.3. The prudent use of landscape materials should ensure clear sight lines at grade level and should not create areas of concealment or provide a climbing path to the upper levels of buildings.
 - A.4. Eliminate structural hiding places.
 - A.5. Minimize number of supporting columns to reduce cover for criminals.
 - A.6. Provide stairwells and elevators with exterior walls having transparent material.
 - A.7. Provide good lighting and minimize shadows.
- The application of lighting should be uniform, consistent and contain overlapping zones of coverage. Special situations (e.g., CCTV surveillance, parking garages) will require further lighting analysis.
- ##### B. Natural Access Control
- B.1. Define access to site, parking areas, and accompanying structures.
 - B.2. Sufficiently size the main entrance to a site, parking area, or structure.
 - B.3. Provide signage and natural barriers to inform legitimate users of appropriate directions and the rules pertaining to the areas.
 - B.4. Minimize park-n-ride and parking structure access points.
- ##### C. Territorial Reinforcement
- C.1. Provide clear border definition of controlled space.
 - C.2. Provide clearly marked transition zones.
 - C.3. Use the physical design, signage, or other elements to reinforce the sense of proprietorship within an area.

C.4. Design space to increase perception of natural surveillance (through placement of windows, lines-of-sight, and walkways).

C.5. Locate gathering spaces where they can be easily monitored and where access can be controlled.

C.6. Plan for concentric security zones and space transitions

1-11.2.2 SECURITY SITE PLANNING (SEE LANDSIDE CIVIL)

1-11.2.3 ARCHITECTURAL DESIGN FEATURES

A. Facade

- The building will be designed so that it facilitates easy recognition of entrance and exit locations.
- Contractors should strive to construct building facades with materials that resist fire and produce little or no toxic fumes or minimal debris in an attack.
- Facade materials will be attached in a manner that will reduce the amount of secondary debris.
- Masonry or pre-cast concrete panels should be reinforced and securely fastened to the building frame.
- If possible, the design should prevent indirect damage that destroys the entire facade.
- On sides of the building that face likely directions of attack the Contractors should minimize using weaker materials and/or openings. (Minimize fenestration in these areas).
- Overhanging design features should also be avoided where increased blast loading may be experienced from forces captured underneath structural elements.

B. Entrances

- Entrances will be well marked so there is no doubt as to where to enter.
- Aesthetically pleasing painted arrows and/or other aesthetically pleasing signage will be designed to aid patrons.
- Walkways, aesthetically pleasing barriers, and landscaping will be designed to assist in safely funneling people to entranceways.
- The Contractors should consider locating entrances to the buildings, including service entrances and loading docks, away from uncontrolled public spaces whenever possible. This reduces the opportunity for a direct attack on an entrance.
- Agencies should also consider locating exterior entrances where there is no direct access to key assets, such as power or communications centers, within a building.
- The sizes of doorways should be appropriate for the access management techniques used at that site. Doorway sizes will meet all codes including NFPA 130 and be coordinated with Aviation Department and COP Fire Marshal.

C. Egress

- In addition to complying with life safety code, the Contractors will consider automated systems
- Evacuation indicators, e.g., luminous signage and arrows, directional lighting and sound to assist persons in evacuation events.

D. Stairways: escalators & elevators

- Elevators will be designed to accommodate current and future security technology integration into the elevator car and logic control systems. This will include electronic access control

devices, video and audio surveillance devices, emergency call stations integrated into the security system, and possibly hazardous materials sensors.

- Elevator entrance doorways into the elevator cars should be situated so that they are in open view.
- Design stairs, escalators and elevators as open as code permits.
- The ideal solution is a stair, escalator or elevator waiting area that is totally open to view from the building or parking area interior or exterior.
- If a stair must be enclosed for code purposes or weather protection, glass walls can reduce or eliminate the incidence of both personal injury attacks and various types of vandalism.
- Potential hiding places below stairs should be closed off. Elevator lobbies and stairs in open parking garages should be open to the parking areas except at roof levels where glass enclosures may be provided for weather protection.
- Whenever possible, elevators, escalators, and stairs should be located on the perimeter to permit natural surveillance from exterior public areas utilizing glass-backed elevators and glass at stairwells and elevator lobbies.

E. Signage

- The Contractor will use signs as an effective tool for access management and for assisting people unfamiliar with the buildings and areas. They will be used to direct public users to proper areas of the building, warn against unauthorized entry into nonpublic spaces, and indicate emergency evacuation routes.
- Signage will also be designed to inform and instruct visitors on proper and improper activities within facilities.
- In some cases, the Contractors may consider reducing or eliminating signage for key assets, to hinder their discovery by potential aggressors.
- All signs will be designed to be legible and easily discernable to all passengers, including those with disabilities.
- Emergency exit signs will be designed with lighting elements, to make them visible in the dark.
- Signs in public areas will be designed to resist tampering or destruction.
- For signs placed on walls or other surfaces, they will be specified so that the installing Contractors will avoid mounting them in a way that allows items to be hidden on, in, or between the sign and the surface.
- The Contractor will consider the use and placement of electronic signage that can provide customized instructions in both text and graphic form.
- Efforts should be made to determine if the "safety and security missions" can make use of such signage designed into the project for other purposes.

F. Public toilets and service areas

- Will be located as close to public entrances as possible to improve accessibility and convenience in order to increase use, which increases the perception of safety.
- A maze type entry system or doors placed in a locked open position will increase convenience and safety. This will make it easy for normal users to determine who is in the restroom by merely glancing around the privacy screen or wall. Abnormal users will feel at a greater risk of detection because they will not have the typical warning associated with noise from opening and closing doors.

- Fixtures will be to Water Sense standards. [Appendix K](#)

G. Loading docks and shipping & receiving areas

- Delivery vehicles pose a particularly high threat to maintenance facilities, because of their large payload and authorization to enter sites.
- For these reasons, the Contractors will consider separate delivery entrances with a dedicated access road that admits vehicles directly to receiving areas or loading docks (and away from vulnerable assets) wherever possible.
- If a dedicated roadway is not practical, a designated route through the site would serve the same purpose.
- The results would be that any delivery vehicle parked inappropriately, or seen driving outside the designated route, would be noticed more easily and generate the appropriate response.

1-11.2.4 STRUCTURAL CONSIDERATIONS FOR BLAST MITIGATION

A. Ancillary Buildings and Structures

Provide adequate standoff between buildings and/or fortify exterior walls to contain the blast, fire, etc.

A.1. Standoff distances are distances between a building, or other asset, and a secured perimeter barrier established to protect the asset from criminal or terrorist activity including an attack with explosives.

A.2. Use non-combustible materials whenever practical.

A.3. Maximizing the available standoff distance will result in the most cost-effective solution.

A.4. Maximizing standoff distance also ensures that there is opportunity in the future to upgrade buildings to meet increased threats or to accommodate higher levels of protection.

A.5. There is no ideal stand-off distance; it is determined by the type and level of the threat, the type of construction, and desired level of protection. See Unified Facilities Criteria *4-010-01,000 Minimum Antiterrorism Standards for Buildings*, and 0001 2000.16 *DOD Antiterrorism Standards*. If parking within the standoff distance is needed, the Contractors should consider parking access control measures.

A.6. The Contractors should refer to existing Aviation Department guidelines for design guidance on this subject. The documents include:

- Blast Effects Analysis; Terminal 4. Gabor Lorant, Skilling, Ward, Magnusson, Barkshire. January, 2003.
- Checkpoint C blast design criteria.

A.7. The Contractors can also use the following documents for design guidance.

- Protecting Buildings from Bomb Damage: Transfer of Blast-Effects Mitigation Technologies from Military to Civilian Applications; National Research Council
- Structures to Resist the Effects of Accidental Explosions; Chapter 2.
- Explosives Safety Standards; Air Force Manual 91-201.

B. Roofing Systems

B.1. Access to roof

- If possible, eliminate all external roof access by providing access from internal stairways or ladders, such as in mechanical rooms, which will be secured.

- Roofs with HVAC equipment should be treated like mechanical areas and secured.

C. Exterior Walls

C.1. Simple geometries with minimal ornamentation

- Generally, simple geometries, with minimal ornamentation (which may become flying debris during an explosion) are recommended.
- If ornamentation is used, it is recommended that it consist of lightweight material such as plastic, which is less likely to become a projectile in the event of an explosion than, for example, brick, stone, or metal.

D. Cladding and Finishes

- Substitute strengthened building elements and systems when stand-off distances cannot be accommodated.
- Use ductile materials capable of very large plastic deformations without complete failure.
- Consider use of sacrificial exterior wall panels to absorb blast.
- Consider reinforced concrete wall systems in lieu of masonry or curtain walls to minimize flying debris in a blast.
- Reinforced wall panels can protect columns and assist in preventing progressive collapse, because the wall will assist in carrying the load of a damaged column.

E. Doors, Windows, Glazing and Finishes

E.1. Window and door systems on the exterior facade of a building should be designed to mitigate the hazardous effects of flying glass during an explosion event. A door system includes the door, frame, and anchorage to the building.

E.2. As part of a balanced design approach, exterior doors in high-risk buildings should be designed to withstand the maximum dynamic pressure and duration of the load from the design threat explosive blast.

E.3. The Contractors may reduce the number of windows around sensitive or valuable assets, to make those assets less visible to the public and to minimize damage in the event of an attack. For facilities with large fenestrated areas, the Contractors may compensate by incorporating standoff distances and orienting the windows away from unsecured areas.

E.4. The Contractors will coordinate with the Aviation Department the use of windows and frames constructed of materials that resist easy destruction, and that prevent flying glass shards in an explosion. For example, tempered glass or polycarbonate composites that shatter cleanly (such as those found in automobile windows) may prove safer than conventional annealed glass that breaks into dangerous shards.

E.5. The Contractors may also consider other window treatments, including adhesive films, coatings, and blast curtains that limit the depth of in-room damage from shattering window glass.

E.6. The Contractor should integrate the features of the glass, connection of the glass to the frame (bite), and anchoring of the frame to the building structure to achieve a "balanced design." This means all the components should have compatible capacities and theoretically would all fail at the same pressure-pulse levels. In this way, the damage sequence and extent of damage are controlled.

E.7. Coordinate with the Aviation Department to specify type of glazing required for protection.

1-12 Flexibility of Facilities

1-12.1.1 In order to ensure that airport and airport terminal facilities do not become outmoded prematurely, there are several subjects that must be reconciled for any new proposal. Each of the following items can be expanded into several others depending of the subject under consideration. The Contractor is encouraged to use this as a basis for more in-depth evaluation of proposed concepts and/or alternatives.

- A.** Offer capacity necessary to meet projected demands.
- B.** Provide adequate curb length for enplaning and deplaning passenger traffic.
- C.** Protect incremental expansion potential of landside and airside without obstructing passenger flows and airline operations.
- D.** Maintain land use compatibility to permit expansion of the future passenger terminal complex and the airfield when needed.
- E.** Provide flexibility of future passenger terminal use by using the maximum required floor loads for Group “A” Assembly Occupancy throughout.
- F.** Avoid use of interior bearing/shear walls which limit the ability to reallocate adjacent floor areas for changes in function configuration.
- G.** Build centralized mechanical systems, with easy accessibility for maintenance and expansion that will permit partial capacity in case of system breakdowns.
- H.** Provide access for ease of future replacement of large HVAC equipment.

1-13 Revenue Production

1-13.1.1 Alternative forms of revenue must be developed by airports because it is no longer acceptable to place increased charges on the airlines. In the 1990’s, retailing in airports was revolutionized in Europe and in the United States. These funding sources have become vital in providing improvements to terminal facilities. Consequently, shopping has become an expected part of the traveling experience as we are compared to our international counterparts. Recognition of the passengers’ needs, wants, and values through detailed and ongoing research is an essential ingredient in assessing the likely demand and economic feasibility of new commercial developments. We are approaching an era that requires support for an entrepreneurial management ethic in management to lead a culture of innovation and a willingness to take risks regarding revenue enhancement. The terminal concepts should include scenarios for enhancement of commercial revenue opportunities.

- A.** Create the maximum amount of concession space feasible for both passenger service and revenue production.
- B.** Maximize exposure of outbound and inbound passengers to concessions.

Chapter 2: Base Building

2-1 General

2-1.1 Coordination with Related Capital Programs

2-1.1.1 Several related capital programs are already under construction or in various stages of development. The Contractor should ensure that the latest information regarding the scope of these projects is used when planning development adjacent to any portion of one of the projects. These programs are:

- A.** Central Phoenix/East Valley LRT Project 44th St Station (under construction)
- B.** Sky Train Facilities Project (under construction)
- C.** West Terminal (early planning)
- D.** Possible Environmental Remediation
- E.** New Taxiway U and V (early planning)
- F.** Widening of Sky Harbor Blvd at Terminal 3
- G.** I-10 Widening (under development)
- H.** TSA Security Master Plan (under development)
- I.** Communication upgrade and control center (under design)
- J.** Premises Distribution System (under construction)
- K.** Consolidated Airport Operations and Facilities Center (early planning)

2-2 Architecture

2-2.1 General

The purpose of this section is to introduce the Contractor to the philosophy and practices for material selection, use, application and specification at the Aviation Department. The information provided herein is offered as a guide and is not intended to limit the creative latitude of the Contractor. While some items are referenced to establish minimum requirements this in no way is intended to determine maximum requirements. The Contractor is encouraged to develop the proposed design to the full extent feasible providing the best value for the money invested within the limits of the established scope, budget and schedule.

2-2.2 Codes, Regulations and Standards

Refer to SECTION I: Chapter 6 for applicable codes, regulations and standards.

2-2.3 Terms, Definitions and Acronyms

Refer to SECTION IV: APPENDIX B

2-2.4 Materials of Domestic Origin and Standardized Nature

The Contractor, when selecting materials, should consider using products of domestic origin and standardized nature. Avoid where possible, custom products or products difficult to obtain or install.

2-2.5 Asbestos and Lead Prohibited

The Contractor should be aware that the use of asbestos and lead containing building materials is prohibited on COP projects. Many products still contain these materials in quantities below current maximum allowable standards for asbestos and lead. The Contractor shall endeavor to identify available materials which eliminate even trace amounts of asbestos or lead and review these alternative selections with FACILITIES AND SERVICES for possible use in the final project.

2-2.6 Products with Volatile Organic Compounds

2-2.6.1 Where construction activity occurs adjacent to or near spaces inhabited by airport employees, tenants or passengers, the City of Phoenix Aviation Department requires the use of products containing low levels of Volatile Organic Compounds (VOC) or better, no VOC content.

2-2.6.2 Where construction occurs in areas of good ventilation away from normally inhabited spaces, products whose performance is enhanced by VOC content are preferred. An example might be the sealer for a concrete floor in an aircraft maintenance hangar or vehicle maintenance area.

2-2.7 Specifying Attic Stock

2-2.7.1 The City of Phoenix Aviation Department does not maintain significant storage facilities for attic stock for general project maintenance and prefers the use of materials readily available in the local market using standard rather than custom colors and patterns. The current standard PHX carpet is stocked and installed by a local carpet Contractor rather than the Aviation Department maintaining attic stock for this material.

2-2.7.2 The Contractor must, in coordination with the PM, provide the owner with recommended list of attic stock and quantities (spare parts see pg. 70 3-+4.1.3H) schedule a meeting during the Design Development Phase with FACILITIES AND SERVICES to review the requirements for attic stock quantities of any material which may be a candidate for procurement from the original supplier during construction.

2-2.8 Material Guidelines by CSI Division

2-2.8.1 TERMITE CONTROL

A. All termite treatment products will be from the City's Parks Department approved product list and used according to the manufacturer's specifications. Other products may be used with prior approval by the City and with a 10-year warranty provided. All approved products shall treat soil, substrates, footing and foundation stem walls.

2-2.8.2 CONCRETE [Division 03]

A. Exposed Concrete

A.1. Exposed concrete will receive at least a Class "E" finish requiring that all fins or projections be removed and all voids patched with grout to provide a consistent texture.

A.2. Floors shall have a concrete sealer that will be fluid applied, low VOC, high solid, high gloss sealing compound applied to hardened concrete that meets the static coefficient of friction of minimum 0.6 for horizontal or 0.8 for ramps or more stringent requirements of the

code, ADA and/ designer shall provide owner with joint plan and finish for approval or OSHA

A.3. Concrete floors shall have a concrete hardener to improve floor durability and abrasion resistance

B. Minimum 15 mil plastic vapor barrier is preferred under all slabs on grade per ASTM E1745, Class A.

2-2.8.3 MASONRY [Division 04]

A. The intent of this Section is to emphasize the Aviation Departments concern regarding tendency for lack of attention to the detailing and specification of masonry claddings and features. Every effort should be taken by the Contractor to completely specify and detail masonry, veneer applications, joints and fastening systems to protect against moisture infiltration, efflorescence, cracking caused by improper structural back-up with goal to minimize maintenance.

B. Design Requirements

B.1. All materials, design, construction and quality of masonry shall comply with the adopted building codes with the City of Phoenix Amendments and Supplements, including the appropriate chapters for masonry and masonry veneer.

B.2. Alternative materials shall have International Code Council Evaluation Service and City of Phoenix Testing Laboratories approval prior to submittal to City Engineer for consideration.

B.3. Concrete Unit Masonry: Exterior masonry walls shall be integral color, split-face, Sonora, vertical scored or other available textured concrete masonry units. Smooth finished exposed aggregate concrete masonry units (e.g., burnished, ground face, honed, or polished block) may be used for accent features (i.e., banding). Colors shall be approved by Aviation Department and be aesthetically compatible with other buildings at the City of Phoenix Aviation Departments three airports.

B.4. Standard moisture controlled units, 8" x 8" x 16" nominal dimensions

B.5. Bracing as required for wall height

B.6. No lightweight block shall be exposed to the weather.

B.7. All joints exposed to the weather shall be "round tooled".

B.8. Mortar shall not contain sodium chloride (NaCl).

B.9. All exposed CMU and stone masonry shall be water proof seal-coated.

B.10. Graffiti proofing product, approved by the PM, should be applied to all exposed masonry surfaces that would be considered vulnerable to vandalism.

B.11. Stone: Specifications shall require samples, mock ups, when appropriate. Natural Stone Material shall comply with the appropriate ASTM Standards in accordance with their nature and make, and reference thereof incorporated into the project specifications.

B.12. Existing Masonry Buildings: The structure of all existing masonry buildings for City of Phoenix use shall be certified by a Structural Engineer for the intended occupancy. Full documentation shall substantiate such certification and be submitted to the City Engineer/his representative for review.

C. Screening

All service areas shall be screened from public view. All mechanical equipment at grade shall be screened. Coordinate at grade screen walls with landscape materials for cohesive design.

C.1. Masonry screen walls and other fencing should be of appropriate design and material to fulfill their function while maintaining harmony with the surrounding architecture and of the facility it is serving. Perimeter security fencing shall be chain-link with barbed wire, refer to Section 32 31 13.

C.2. Where possible, integrate building design elements or wall materials for visual screening of equipment, dumpsters, or unsightly storage yards.

C.3. Use split face concrete masonry screen walls to conceal visual clutter from view including such items as on-grade mechanical units, electrical transformers, trash dumpsters, above ground storage tanks, and emergency generators.

D. Parapet Wall Cap

D.1. The tops of all masonry walls shall receive a watertight cap, i.e., sheetmetal or precast concrete, to prohibit moisture infiltration and efflorescence.

D.2. Where metal caps are used, they shall be anchored to resist wind uplift equal to the required roofing design.

D.3. Where metal is used, finish color shall complement adjacent masonry.

E. Landscape Planters

E.1. Completely line inside face with bentonite type waterproofing membrane that is water tight. Provide weep holes as appropriate and install per manufacturers details.

F. Weep Holes

F.1. Weep holes at brick cavity walls shall at minimum be polyethylene plastic tubing, 1/4 inch diameter x 4 inch long.

G. Independent Reviewer

G.1. Aviation reserves right to hire independent masonry Contractor's to review submittals, procedures, and installation. Installation items subject to review include, but are not limited to, foundations, flashing, weeps, cavities, joints, tolerances, and cleaning,

2-2.8.4 METALS [Division 05]

All materials, design, construction and quality of metals shall comply with the adopted building codes, and City of Phoenix Amendments and Supplements, including the appropriate chapters for metals and fabrications.

A. Metal Fabrications

This section applies to all metal fabrications used that have a visual aesthetic impact at both interior and exterior uses. Architect shall exercise care in design and detailing of metal fabrication so that they strictly comply to all applicable codes, are relatively easy to construct and have finishes that can be maintained and do not create potential hazards due to inconsistent heights, surface textures, harsh protrusions, razor like edge cuts or blend with adjacent surfaces or finishes that could create a special hazard to the visually impaired and physically handicapped.

A.1. Exterior exposed metal fabrications shall have a spray applied epoxy-polyamide type paint primer.

A.2. Fixed ladders shall meet current OSHA Standards.

A.3. Exterior stairs shall be steel stairs with precast treads.

A.4. At the top and bottom of stair landings, a contrasting color and texture to the normal stair treads shall be used to facilitate the visually impaired.

A.5. Metal bollards shall be a minimum of 6-inch diameter, round, concrete filled and be directly or sleeve set a minimum of 1/3 the exposed height below the finished adjacent surface.

- Where facility does not permit embedment below finish slab, bollard shall be welded to 12-inch square by 1/2" thick steel plate and securely anchored into supporting slab.

Prime and Paint bollards with flat black epoxy. Apply horizontal banding of 4-inch wide yellow reflective tape hazard marking on 4-inch centers with manufactured 3M or equal product. .

Bollards installed on airside ramps or aprons need to be (Cored and Poured) metal bollards shall be a minimum of 6-inch diameter, round, concrete filled and be a minimum of 1/3 the exposed height below the finished adjacent surface. Bollard Cover Specs:

Diameter: 7.1" inside diameter/7.35" outside diameter

Length: 52", 60" & 72" outside height

Wall thickness: .125" wall thickness HDPE

Material: HDPE

•

B. Standard Metal Stairs

B.1. Tread / Riser Relationship

Stairs with ascent angles of 30 degrees provide safe and comfortable vertical movement and are the least tiring to use by most people. This angle also corresponds to the standard escalator ascent angle. Regardless the approach adopted adjacent to escalators, care shall be taken to meet the requirements of IBC and NFPA 101 regarding stair details

B.2. Unless otherwise specified, follow recommendations of NAAMM Metal Stair Manual.

B.3. Stairs will be fabricated of steel channel stringers with integrally formed risers and steel pan treads for 1-1/2" concrete fill.

B.4. Landings will be metal pan deck with concrete fill.

B.5. Design components to allow for expansion and contraction without buckling, excessive opening of joints, or overstressing of welds and fasteners.

B.6. Tread surfaces should be slip resistant and uniform in color and material over the full width and depth.

B.7. One-piece step units provide the most durable stair design and should be utilized for public area stairs.

B.8. Where the tread material is separate from the stair structure, it shall be mechanically anchored to the stringers at each side.

B.9. Where stairs are exposed to weather, runnels shall be provided and treads shall be sloped for drainage.

B.10. All stairs will have handrails on both sides. When public stairways are provided with runnels (cleaning gutters), the runnels may not encroach on the nominal stairway width. Contractor s should therefore give careful consideration to the relationship between the gutter and the handrail on public stairs.

B.11. Conform to applicable barrier free design requirement of the State of Arizona, Americans with Disabilities Act (ADA), and ANSI 117.1

C. Pipe & Tube Railings

C.1. Aluminum metal and other aluminum fabrications exposed to the elements must have a manufactured applied protective coating.

C.2. All railing systems utilizing an intermediate cable railing systems shall be an approved, manufactured system which complies with the adopted building codes pertaining to stairways and guardrails. Regardless of the deflection, the cable system must comply in all aspects. If allowed, structural calculations and maintenance recommendations shall be submitted for approval.

C.3. All coatings to metals shall be shop applied and not field-applied.

C.4. Control of Corrosion: Prevent galvanic action and other forms of corrosion by separation of dissimilar metals. Provide means for insulating metals to protect material from direct contact with incompatible materials.

C.5. Architect's dimensioned drawing shall define and detail locations and extent of handrails and railings.

C.6. Material sizes, types, finishes and shapes shall be defined. Wall cladding must be sheet goods not rolled goods standard sizes.

C.7. Detail bends, returns, bracket and miscellaneous connections of handrails and railing to building structure.

C.8. Provide secure backing to support anticipated loads.

C.9. Define locations of any removable sections.

C.10. Define locations of expansion joints.

D. Architectural Expansion Control

D.1. This Section specifies exterior and interior building joint systems, within and without fire barriers that accommodate movement resulting from one or more causes including thermal changes, seismic forces, or wind sway. PHX has had a history of problems with existing joint systems associated with pedestrian and vehicular traffic joints. The Contractor shall exercise diligence in identifying the conditions and locations of various joints and the appropriate architectural joint system. The Contractor shall prepare a presentation during the Design Development Phase to review proposed joint systems including performance characteristics with FACILITIES AND SERVICES before proceeding with final detailing of these applications.

D.2. Provide factory-fabricated architectural joint systems capable of withstanding the types of loads and range of movement, and the other functions for which they are designed including those specified below, without failure. The Contractor should assess likely wheel loadings on joints from baggage carts, concessions palates and other wheeled devices. Types of typical joint failure include those listed in Appendix X3 of ASTM E 1399. This includes:

- Joints to support vehicular and pedestrian traffic joint.
- Exterior joints to maintain weather closure.
- Joints in Fire-Resistive-Rated Assemblies to maintain integrity of smoke barrier.
- Joints in Acoustically Rated Assemblies to inhibit passage of airborne noise.
- Seismic Joints to remain in place on exposure to seismic activity.
- Other joints in surfaces of architectural finishes serving as finish closure.
- If custom-designed units are required, provide engineered documentation from manufacturers defining specific properties of joint.

- Indicate locations and types of architectural joint systems, with adequately dimensioned plans and details.
- Provide a copy to PHX of the engineered calculations for building structure stating maximum anticipated movements at location of each joint including temperature performance evaluation. Provide PHX with manufacturer's written verification that each specified joint and design detail is capable of accommodating anticipated movement.
- Joint movement design, depending on system selected, should not exceed +/- 50-percent of the nominal width of the joint.
- Joints utilizing elastomeric components should not exceed 25 to 35-percent nominal width of the joint.
- Avoid systems in which the elastomeric element is smooth and solid, which may, during joint contraction cycle, protrude above finish surface and cause tripping hazard.
- Joints and or joint covers shall be designed to conform to applicable barrier free design requirement of the State of Arizona, Americans with Disabilities Act (ADA), and ANSI 117.1 where pedestrian traffic is accommodated.
- Clarify purpose of each joint system to satisfy specific joint conditions for movement, appearance, moisture penetration, air infiltration, fire resistance, and seismic capacity.
- Verify joint system cyclic movement capacity according to ASTM E 1399.
- Verify fire-rated joint systems meet latest edition of UL 263 or UL 2079. Regardless of fire rating, joints should limit or prevent smoke penetration.
- Provide three-dimensional illustrations where architectural joint system makes transition of planes or changes direction.
- Detailed sections, indicating basic configuration, junction, and installation of each type of joint system (floor, deck, wall, ceiling, or soffit) are required. Sections should include all fire barriers, water stops, moisture barriers, drain tubes, retainers, or back seals behind covers.
- Define type of wearing surface (plain, serrated, abrasive, or abrasive inserts) if not specified or uniform throughout.

E. Railings and Balustrades

E.1. Railings and balustrades will meet code requirements for clear opening, height, and vertical and horizontal loading.

E.2. Railings and balustrades will meet the requirements of ADAAG Section 4.9.4 Handrails.

E.3. Standard Interior Metal Railings: Non-public areas will have steel railings with finish selected by the project Contractor

E.4. Ornamental Interior Metal Railings: Public areas will have custom railings selected by the project Contractor.

2-2.8.5 WOOD PLASTICS AND COMPOSITES [Division 06]

A. Architectural Wood Casework

Shop fabricated and finished architectural woodwork fabricated and installed to Architectural Woodwork Institute (AWI) standards including but not limited to:

- Casework, cabinets and countertops utilizing high pressure decorative laminate (HPDL) finishes.
- Shelves
- Standing and running trim.

- Hardware.
- Paneling
- Closets and storage shelving
- Finishing
- Draw guides need to be heavy duty

A.1. The Aviation Department indicates a preference for durable and maintainable finishes such as brushed stainless steel on countertop surfaces. Use of high pressure plastic laminate is discouraged for use with passenger processing fixtures at ticket counters and gate check-in podiums

A.2. All millwork shall have all exposed edges and sides finished, including but not limited to, the underside of the bottom cabinet shelf to be a hardboard finish to prevent water/moisture damage to the base millwork.

A.3. Vertical and horizontal corners shall be detailed to avoid chipping or damage to corners from contact with baggage or baggage carts.

A.4. Indicate elevations, profiles, sections, and view of woodwork fabrications at scale large enough to permit checking for design conformity, typically $\frac{3}{4}'' = 1'-0''$ for full sections, and $3'' = 1'-0''$ for details.

A.5. Show sizes, thicknesses, quantities, markings, materials, wood species, finishes or surface graining direction, component profiles, fastening methods, jointing details, hardware, finishes and accessories for each item.

A.6. Indicate dimensions necessary for fitting woodwork and appliances to fixed walls. Be responsible for details and dimensions not controlled by Project Conditions.

A.7. Locate built-in equipment, indicated cut-out locations for plumbing fixtures, electrical and mechanical devices and other items occurring in woodwork.

B. Modular Design Preferred

B.1. Whenever practical, the Aviation Department prefers modular construction to facilitate replacement of damaged units. Modular design should be executed to simplify component replacement and avoid the removal of items to access the one needing replacement.

2-2.8.6 THERMAL AND MOISTURE PROTECTION [Division 07]

A. Fully weatherproof and seal exterior joints, penetrations, openings

To ensure optimum energy efficiency and for pest control purposes, all exterior joints around windows and door frames, openings between walls and foundation, between walls and roof/ceiling, and between wall panels; openings at penetrations of utility services through walls, floors and roofs; and all other such openings in the building envelope shall be caulked, gasketed, weather stripped or otherwise sealed.

B. Exterior Insulation and Finish Systems

B.1. Exterior Insulation and Finish Systems (EIFS) may be considered for exterior wall applications.

B.2. Location of this material should be avoided in areas lower than 3'-6" above finish floor where damage from baggage carts and concession provisioning carts can occur.

C. Thermal Transmittance

During the design of new or expanded structures, all requirements for thermal transmission shall be determined through the energy modeling methods as required for the design of HVAC in the

State of Arizona and shall take into account all of the components of a complete building structure working together as a system. For small renovation work where elements are replaced and there is not mechanical design components associated with the task, the Contractor may use the following minimum insulation values for conditioned space:

- Exterior walls: R19 (Note: very difficult to obtain in masonry walls. The Contractor shall propose a wall assembly including masonry, windows, shading, etc. that will create a system approaching R-19.)
- Interior walls adjacent to unconditioned space: R19
- Roofs - R30 (R19 acceptable for evaporative cooled space.)

D. Roof System

- PHX prefers single ply membrane -with a minimum 20-year warranty.
- Roofing color must not affect airport operations.
- Roof must be water tested and standing water must drain evaporate within hours, define test method.
- Metal roofing systems are permitted in applications which do not require frequent access for equipment maintenance. Penetrations through metal roof systems should be minimized.
- Single ply roofing systems (minimum 72 mil thickness) may be considered in applications where access is not required to the roof for maintenance of mechanical equipment. Provide traffic pads as required. Single ply applications are prohibited where items such as spent cigarettes may be discarded onto the roof surface.
- Roof Slope: Minimum roof pitch shall be ½" per foot.
- In addition to conforming to roofing manufacturer's specifications and recommendations, roofing details shall conform to the National Roofing Contractors Association Standards and sheet metal flashing details in accordance to SMACNA.
- Anchor points shall be provided for all roofing structures that require fall protection. Traffic pads to be provided at equipment access service points.
- Traffic pads shall be provided on all roofs which have rooftop equipment that will require servicing.
- While not prohibited, use of spray-on foam roofs require specific approval. The top coating shall be a hard surface to withstand foot traffic, ultra violet rays, and incorporate traffic pads.
- Metal copings shall be installed on all parapets. Mortar caps are discouraged.
- Inverted roofs shall not be allowed.
- Glass guttering systems shall not be allowed.
- All roofing material shall have a minimum of 80% SRI (solar reflective index) with Energy Star Certified roof products ~~Rating~~ for the entire roofing system of a given facility. "Cool roof" coatings and/or systems are desired.
- Manufacturer's or sheet metal curbs are preferred for mounting of all rooftop equipment. Weather resistant wood sleepers may be used for retrofit purposes only and requires specific approval.
- Curbs shall not be closer than 30" to each other or to parapet or other walls.
- Skylights shall be curb-mounted, triple glazed, and have proper fall protection.
- Pitch pockets be avoided wherever possible.
- All sheet metal, flashing, metal roofing, etc. shall comply with the latest issue SMACNA.

E. Solar Shading

- When glazed areas are shaded by solar grilles or louvers, provisions for access to wash windows is required and must be incorporated into the design details.

2-2.8.7 DOORS AND WINDOWS [Division 08]**A. Doors: General**

A.1. Hardware selection including door locks will be coordinated with the existing master keying system through the Facilities & Services Division.

A.2. Interior doors will be institutional quality with heavy duty, ADA compliant hardware

A.3. Interior doors will meet fire resistive and sound attenuation requirements where applicable

A.4. Security access controls will be coordinated with security requirements as required for the location

B. Metal Doors and Frames**B.1. Exterior doors**

- All exterior doors and frames are to be hollow metal of commercial quality conforming to ASTM A-366 and following Standard Gauges. Exterior Frames: 14 gauge Exterior Doors: 16 gauge
- All exterior doors shall be weather stripped to achieve minimum air infiltration.
- Doorways should be recessed wherever possible to create passive solar shading and protection from the elements.
- All metal doors shall be flush 1³/₄" thick and shall conform to ANSI/SDI 100 Standards.

B.2. Exit Enclosure Doors

- Doors will be solid core wood or metal as selected by the project Contractor set in 16 gauge hollow metal frames.
- Create section for Boarding Bridge doors to Jet way. Should be light weight aluminum frame, ie; special-lite door. Please consult City of Phoenix Facilities and Services, Building Maintenance.
- Typical door size will be 3'-0" wide x 7'-0" tall x 1-3/4" thick.
- Doors will meet ADA requirements for swing and lever type hardware.
- Doors will meet fire resistive and sound attenuation requirements for interior partitions.
- Door locks will be coordinated with the master keying system.

B.3. Public Area and Office Doors

- Doors will be solid core wood or hollow metal as selected by the project Contractor, and set in 16-gauge hollow metal frames
- Typical door size will be 3'-0" wide x 7'-0" tall x 1-3/4" thick
- Doors will meet ADA requirements for swing, lever type hardware and minimum dimensions from jamb to wall.
- Doors will meet fire resistive and sound attenuation requirements for interior partitions
- Door locks will be coordinated with a master keying system

B.4. Service Area Doors

- Doors will be hollow metal with finish as selected by the project Design Consultant, and set in 16 gauge hollow metal frames. Doors for this level of use must be extra sturdy.
- Typical door size will be 3'-0" wide x 7'-0" tall x 1-3/4" thick
- Doors will meet ADA requirements for swing and lever type hardware
- Doors will meet fire resistive and sound attenuation requirements for interior partitions
- Door locks will be coordinated with a master keying system

C. Wood Doors

C.1. All interior wood doors shall be flush 1 3/4" thick, solid core. All wood doors shall conform to AWI standards.

C.2. Plastic laminate surfaced doors are generally prohibited because they do not provide an acceptable level of serviceability in the airport environment. Use of plastic laminate surfaced doors must be approved in advance by FACILITIES AND SERVICES.

D. Overhead Coiling Doors

D.1. Overhead coiling doors and grilles, including service fire doors, counter fire doors, smoke control doors, rolling grilles, shall be products of manufacturers regularly engaged in manufacturing items of type specified and must be current production.

D.2. PHX does use side closing closures (specified).

D.3. Install items under direct supervision of manufacturer's representative or trained personnel.

D.4. Overhead coiling doors must be capable of withstanding the effects of gravity loads and uniform win-load pressures of the area, acting inward and outward, without deformation of door components. Door must be capable of operating under design wind load. Door, components and operator must withstand a minimum of 10,000 complete cycles without failure.

E. Aluminum-Framed Entrances and Storefronts

- Doors will be compatible with the aluminum storefront system.
- Door size will be selected by the project Contractor.
- Doors will meet ADA requirements for swing and lever type hardware.

E.1. Exterior Aluminum Windows and Storefronts: All glazing shall be insulating units, low "E" coating, medium gray tint or bronze tint. Curtain walls shall be glazed using insulating low E glass.

E.2. Windows frames to be commercial grade aluminum, thermally isolated to improve performance improved, bronze anodized finish, operable and fixed as required for the facility function.

E.3. Storefronts should be recessed wherever possible to create passive solar shading and protection from the elements.

E.4. Provide assemblies as a complete unit produced by one manufacturer, including hardware, accessories, and mounting.

E.5. Laminated or tempered glass shall be installed in areas subject to public access, except where fire separation requirements dictate wire glass or other construction. The use of Plexiglas panels in lieu of glass is not acceptable. Make sure the design allows access for re-glazing by exterior glazing wherever practicable.

F. Automatic Entrance Doors Basis of Design Product: Stanley Dura-Guard.

F.1. Sliding Glass Doors: All main entrance doors to terminals for passengers will be automatic sliding glass doors in a vestibule configuration. All sliding glass doors shall provide for push away for emergency operation.

F.2. All sliding automatic entrance doors to have auto reset feature to automatically reset doors after a breakaway occurrence.

F.3. Glazing for sliding glass doors shall be 3/4" tempered, medium gray tint or bronze tint as selected by Aviation, if not shielded from the elements by a canopy or structure.

G. Automatic Bi-Parting Doors

G.1. Doors will be a manufactured bi-parting system with finish selected by the project Contractor.

G.2. Door size will be selected by the project Contractor.

G.3. Doors will have emergency swing hardware suitable for the location.

H. Fire-Rated Door Assemblies

H.1. Provide assemblies complying with NFPA 80 that are identical to door and frame assemblies tested for fire-test-response characteristics per UL 10b, and that are labeled and listed for fire ratings indicated by UL, FM, ITS/Warnock Hersey, or another testing and inspecting agency acceptable to authorities having jurisdiction.

H.2. For units exceeding sizes of tested assemblies, provide certification by a testing agency (acceptable to authorities having jurisdiction) that doors comply with all standard construction requirements and are tested and labeled

H.3. Fire-rated door assemblies

I. Door Hardware

All hardware for all doors shall be "Heavy Duty".

I.1. Hinges shall be ball bearing with replaceable pins. Hinges shall be minimum 4 1/2", brushed stainless steel, finish 26D

I.2. PHX prefers 2 pair butts per door (4 hinges) shall be used on all doors including doors over 84" height and 36" width. No pivot hinges shall be specified.

I.3. All door closers shall be installed on non-public side of door wherever possible. PHX prefers use of manufacturer LCN. Door closers shall provide for 120 degrees opening swing.

I.4. Doors at locations where they are subject to substantial wear from weather and normal use, such as doors used by carts, shall be equipped with stainless steel armor-plates. Plates shall be minimum 36 inches high, stainless steel, and 26D brushed finish with countersunk screw heads. Typical installations would occur at food service access, hallways, or high traffic locations. Use swirl finish unless otherwise directed by the PM and FACILITIES AND SERVICES.

I.5. Mortised locks shall not be used except where specifically approved.

I.6. Panic exit devices on pair doors shall be designed so they cannot be operated from the exterior to gain forced entry.

I.7. The use of astragals and coordinators is discouraged.

I.8. Where practicable, use series of single hung doors or removable mullions.

I.9. All hardware shall, including thresholds, conform to ADA requirements.

I.10. Deactivation of automatic door hardware shall not require the use of ladders, removal of panels, etc.

I.11. Latch sets shall be used on all interior office room doors except where specifically required by program to be lockset. Lever-handle trims shall be used for latch and lock set openings. All PHX conference rooms shall be lockable.

I.12. Lever-operated extension flush bolts shall be set for maximum 5 psi activation. PHX preference for flush bolts at exterior opening only.

I.13. Exit devices shall be pressure checked at 30 psi at stair exits locations. PHX inspects quarterly.

I.14. All automatic door installations shall conform to the American National Standards Institute (ANSI) requirements for power operated pedestrian doors and power assist and low energy power operated doors and ADA requirements and shall conform to all applicable local building and fire codes.

I.15. All power-operated automatic sliding doors shall be designed using belt drive or direct drive, no linear drive or chain drives will be acceptable.

I.16. All power-operated automatic door installers shall have successfully completed the course of instruction as a Certified Inspector of Power-operated automatic pedestrian door by the American association of Automatic Door Manufactures (AAADM).

Keys/ Locks

I.17. Keying Requirements: Provide construction cores and keys during the construction period. Each keyable lock shall have a permanent type construction core installed. Construction control and operating keys and cores shall not be part of the owner's permanent keying system or furnished on the same keyway (or key section) as the owner's permanent keying system. The hardware dealer, prior to occupancy will furnish permanent cores and keys (prepared according to the accepted keying schedule) to the Owner.

I.18. All cylinders shall be Sergeant interchangeable cores to match Owner's existing system.

I.19. All permanent keys and blanks shall be blank on both sides except for the keyway identifier. Permanent keys shall be stamped with the applicable key mark for identification, provided by the owner. Cores shall be marked on the face of the plug with the keyway identifier (i.e. LE =E) plus a number (i.e. E1001). This identification is to be supplied by the Owner.

I.20. Designer to specify the quantity of keys in the following quantities:

- 2 each change keys each combination used (to Owner).
- 2 each key blanks for balance of cores keyed (to Owner).
- 6 each Construction master keys (to Contractor)
- 1 each Control key (to Contractor)

I.21. Specify that the Contractor or Contractor's Agent will install permanent cores and return the construction cores to the hardware dealer.

I.22. Utilization of electromechanical locks in combination with Key Pads is acceptable and Pin or Biometric.

I.23. Specify that the Contractor shall comply with the Aviation Department's Operations Division requirements during the construction period. No Contractor shall place an unauthorized lock on site. The installation and utilization of keys/locks will be processed through the Aviation Departments Facilities.

J. Windows

J.1. Available natural light will be maximized

J.2. Natural and artificial lighting will be used to enhance volumetric space

J.3. Dynamic lighting will be considered and where applicable, utilized to enhance the passenger experience

J.4. Windows will have glazing suitable for the location and to meet fire resistance and sound attenuation requirements

J.5. The Aviation Department prefers exterior glazed window applications for one and two-story installations and interior glazed above two-stories.

J.6. All windows shall be an insulated window system and constructed with low-e glass. Contractors should demonstrate how they have addressed in their designs consideration of solar orientation, shading of windows, and control of heat gain. When windows are shaded by solar grilles or louvers, such devices shall be hinged or removable to provide access for window washing. Energy Star qualified windows, doors, and skylights.

J.7. All windows and exterior doors shall be weather stripped to achieve minimum air infiltration.

J.8. Minimum glazing requirements:

- Wire reinforced glazing is prohibited
- Tempered in safety glass openings, thickness per code
- Tempered one-way glass in special openings, thickness per code

J.9. Glazed Partitions & Storefronts shall be a manufactured aluminum system with finish selected by the project Contractor. Glazing will be tempered glass

J.10. Curtain walls and storefront systems shall be glazed using insulating glass.

J.11 Certain windows require blast criteria get from Operations.

2-2.8.8 FINISHES [Division 09]

A. Exposed Concrete

A.1. Exposed concrete will be specified to receive a Class “E” finish requiring that all fins or projections be removed and all voids patched with grout to provide a consistent texture.

A.2. Floors will have a concrete sealer that will be fluid applied, low VOC, high solid, high gloss sealing compound applied to hardened concrete that meets the static coefficient of friction of minimum 0.6 for horizontal or 0.8 for ramps or more stringent requirements of the code, ADA and/or OSHA

A.3. Floor shall have a hardener to improve floor durability and abrasion resistance

B. Gypsum Board Assemblies

B.1. Tenant areas will be unfinished on the tenant space side for later installation of tenant improvements

B.2. All Gypsum Board shall be at minimum Type X, 5/8-inch thick

B.3. All Gypsum Sheathing Board shall be at minimum Type X, water-resistant core, 5/8-inch thick.

B.4. The Aviation Department uses a “fine” texture at light soffits, restroom ceilings, food preparation ceilings and walls where application of wall covering is scheduled.

B.5. Levels of Gypsum Board Finish: Specify the following minimum levels of gypsum board finish per GA-214.

- Level 1 for ceiling plenum areas, concealed areas, and where indicated, unless a higher level of finish is required for fire-resistance-rated assemblies and sound-rated assemblies, embed tape in joint compound.
- Level 2 where panels form substrates for tile and where indicated, embed tape in joint compound and apply first coat of joint compound.
- Where Level 3 gypsum board finish is indicated, embed tape in joint compound and apply first and fill (second) coats of joint compound
- For Level 4 gypsum board finish, embed tape in joint compound and apply first, fill (second), and finish (third) coats of joint compound over joints, angles, fastener heads, and accessories. Touch up and sand between coats and after last coat as needed to produce a surface free of visual defects and ready for decoration.
- Where Level 5 gypsum board finish is indicated, embed tape in joint compound and apply first, fill (second), and finish (third) coats of joint compound over joints, angles, fastener heads, and accessories; and apply a thin, uniform skim coat of joint compound over entire surface. Touch up and sand between coats and after last coat as needed to produce a surface free of visual defects, tool marks, and ridges and ready for decoration.

B.6. Gypsum Board Ceilings

- Exposed grid, suspended ceiling systems should be used in open office areas, private offices, conference rooms, cafeterias and hallways whenever possible. Gypsum board and metal stud framed ceilings shall be installed as required to meet local building codes in such areas as restrooms and kitchens. Unique architectural applications may be utilized in high visibility areas.
- Gypsum board ceilings will be provided in vestibules and restrooms

B.7. Minimum Standards for metal stud and drywall

- Isolate non load bearing walls from adjacent structure and provide control joints as required
- Minimum framing: 20 gauge galvanized 3 5/8" steel studs at 16" o.c. with horizontal bridging as required
- Drywall: —"Type X" gypsum board full height on both sides, moisture resistant in wet areas
- Insulation: 3" sound attenuation fiberglass batt insulation for sound rated walls
- In the event plywood is used behind gypsum board for impact resistance purposes or as a backer board for wall support, the plywood must be fire treated.

C. Gypsum Board Shaft-Wall Assemblies

- **C.1.** Shaft-walls will be a manufactured assembly with a 2 hour fire rating

D. Tile

This section specifies ceramic, porcelain and quarry tile, marble thresholds, waterproofing membranes for thin-set application, and crack isolation membranes.

D.1. Detail in conformance with Tile Council of North America, Inc. (TCNA), and current edition.

D.2. The Aviation Departments prefers materials that minimize width of floor joints to 1/8 inch.

D.3. Specified products shall comply with current edition of American Society for Testing and Materials (ASTM) as follows:

- C241 – abrasion resistance of stone subjected to foot traffic.

- C1028 – determination of the static coefficient for friction for ceramic tile and other like surfaces by the horizontal dynamometer pull meter method.

D.4. Tile size, color and finish will be selected by the project Contractor.

D.5. Control joints will be provided per manufacturer's standards.

D.6. Setting bed will be polymer (latex) modified Portland cement mortar; grout will be Portland cement grout.

D.7. All perimeter edges, intersections and control joints shall be sealed.

D.8. Matching cove and corner shapes shall be provided at floor transitions.

E. Resilient Flooring

E.1. Vinyl composition tile will be standard grade with pattern extending through the entire thickness of the tile

F. Resinous Matrix Terrazzo Flooring

F.1. Color and terrazzo dividers will be selected by the project Contractor.

F.2. Floor finish for all Terrazzo surfaces will be approved by Facilities and Services prior to application.

G. Carpeting

G.1. It should be noted that the Aviation Department has a preference for hard surface floors wherever possible.

G.2. Carpet specification shall acknowledge high-traffic use.

G.3. The use of flooring material ~~carpeting as a floor finish~~ is closely controlled and any deviations from authorized applications identified in these standards must be approved on a case-by-case basis by the Facilities Review Committee.

G.4. Guarantee/Warranty: In addition to five-year material and workmanship guarantee, carpet shall be warranted against delaminating, shrinkage, and manufacturer's flaws.

G.5. Wear: Manufacturer shall guarantee that, excluding stairs, no part of the carpet wearing surface shall wear more than 10% by weight in ten years. Crush resistance should show an 85% recovery rate.

G.6. Soil Protection: All specified carpets shall have stain resistant and soil prohibiting characteristics incorporated in the milling process of the fibers/carpets. No post-installation treatments are acceptable. Carpeting, including the backing, shall be moth, vermin, and mildew resistant.

G.7. Specifications shall include provisions for out-gassing.

G.8. Specify that seaming diagrams will be provided for approval prior to installation. Seams should be avoided at pivot points, across areas that receive heavy foot traffic and seams that will run directly into a doorway.

G.9. Glue-down carpet square, minimum 32 oz wt., is recommended for high traffic areas and in areas with modular furniture, and in accordance with ADA.

H. Wall Coverings

H.1. Wall coverings will be specified as Class A fire rated

H.2. Substrate surfaces will be primed/sealed prior to wall covering installation

H.3. Designer to provide high impact wall covering at all areas that will receive impact from baggage carts

I. Column Covers

I.1. Column covers will be designed as non-load bearing prefabricated units, non-combustible and impact resistant and bases protected.

J. Acoustics

J.1. Active acoustical controls will be provided to reduce noise and enable the public address system to work effectively. Designer to provide a Sound/Noise management plan for approval by P.M.

J.2. Sound rated walls will be designed to meet the following minimums:

- Office to office: 45 STC
- Office to corridor, waiting, and lobby: 50 STC
- Office to mechanical, toilet: 55 STC
- Corridor, lobby, waiting to mechanical and toilet: 55 STC

J.3. Acoustic control systems shall be Class A and conform to the fire resistive requirements of the occupied space

J.4. Acoustical grid system shall be supported directly from the structure above and meet all load requirements

K. Painting and Coating

K.1. Paint on Concrete will be specified as follows:

- Painted finish columns will receive a Class “D” finish with Portland cement plaster to fill all voids and provide a smooth finish.
- Paint will be one coat of vinyl block filler and two coats of premium latex interior wall paint
- All coats will be roller applied

K.2. Paint on Gypsum Board will be specified as follows:

- Paint will be one coat of primer for sheetrock and two coats of premium latex interior wall paint
- All coats will be roller applied

K.3. Paint on Un-Galvanized Steel will be specified as follows:

- Paint will be one coat of metal primer over factory primer and one coat of alkyd enamel
- All coats will be roller or brush applied

2-2.8.9 SPECIALTIES [Division 10]**A. Toilet Compartments**

A.1. Restrooms will be provided with toilet compartments and modesty screens with finishes selected by the project Contractor submitted to FACILITIES AND SERVICES for approval.

A.2. Toilet partitions shall use floor to ceiling mounted pilasters. Provide braced steel reinforcing above ceiling for installation of pilasters to ensure secure mounting.

A.3. Doors to toilet compartments shall use continuous hinges.

A.4. Modesty partitions are required between urinals and should be provided with continuous support along both sides where mounted to the wall. Attachment points on wall shall be backed with continuous steel reinforcing to ensure secure mounting.

A.5. Prepare a submittal for FACILITIES AND SERVICES review and approval of all proposed anchorage and mounting details for wall mounted accessories and hardware.

B. Queue Control Devices

B.1. Queue control will be provided by portable post and fabric rail systems.

B.2. Provisions for ADA access will be provided.

C. Telephone: Communications

C.1. Telephones in public areas will be free standing and wall mounted manufactured systems as selected by the project Contractor.

C.2. ADA requirements are provided in ADAAG Section 4.31 Telephones.

D. Signage System

D.1. Wayfinding signage standards for terminals and roadways are provided in the most recent Phoenix Sky Harbor International Airport Signage Standards and Guidelines Manual dated. Warranty on signage must be a min of 5 years inside or outside.

D.2. Tenant signage must conform.

- Sign types not in standards, must be approved by P.M.

E. Toilet, Bath and Laundry Accessories

E.1. Toilet accessories will be provided for at all toilet facilities.

E.2. Toilet accessory finishes will be selected by the project Contractor and approved by FACILITIES AND SERVICES .

E.3. All specific accessories will meet ADAAG Standards with Arizona Amendments and COP requirements.

2-2.8.10 EQUIPMENT [Division 11]

No current requirements

2-2.8.11 FURNISHINGS [Division 12]

A. All public seating shall conform to the following requirements:

A.1. Seat and back units must be individually replaceable by FACILITIES AND SERVICES staff when damaged. Damaged units must be easily repaired by the Aviation Department or returnable to manufacturer for repair or replacement.

A.2. Seat backs must be open at bottom for ease of cleaning and to avoid collection of trash at the back of the seat unit.

A.3. The Aviation Department prefers seating units supported on a jury base which projects far enough behind the unit to keep seat backs from coming in contact with wall finishes behind seating.

A.4 Seating in Public Spaces require intergraded electrical charging stations fixtures.

A.5 Warranty required.

A.6 FACILITIES AND SERVICES must approve seating selections.

2-2.8.12 SPECIAL EQUIPMENT [Division 13]

No current requirements

2-3 Conveying Equipment [Division 14]**2-3.1 Codes, Regulations and Standards**

Refer to SECTION I: Chapter 6 for applicable codes, regulations and standards.

2-3.2 Terms, Definitions and Abbreviations

Elevator, escalator and moving walkway terminology detailed within these design criteria shall be superseded by applicable definitions in ASME A17.1 should any conflict arise.

2-3.3 Elevators

2-3.3.1 DESIGN OBJECTIVES

2-3.3.2 The Contractor will be required to meet with the FACILITIES AND SERVICES FACILITIES AND SERVICES Division during the design process to address the design response to the items listed below during the design process:

- A. Elevator cab flooring should be a hard impervious material. Commercial grade vinyl or rubber carpet is prohibited.
- B. Provide COP required minimum 5 feet diameter turning circle for wheel chair inside elevator cab in additional to other ADAAG requirements.
- C. Elevators should be provided in pairs, at a minimum, to provide redundancy.
- D. Elevators are provided to assist the least able travelers and should be easily located by passengers particularly from the approach to escalators.
- E. Conflicts between crossing flows of passengers should be avoided
- F. The design will include high usage heavy-duty elevators to be used for 24 hours a day use in transportation terminals. The passenger elevators will have a rated net passenger capacity of 4,000 to 4,500 pounds exclusive of dead weight of an empty car.
- G. LED fixtures for interior illumination required.
- H. Wiring and electrical interconnections shall comply with the governing codes of Division 16 - Electrical. Insulated wiring shall have flame retardant and moisture proof outer covering and shall be run in conduit, tubing or electrical wire ways.

2-3.3.3 AVAILABILITY

- A. All elevators will be designed for 97 percent availability based on stipulated operational times for the facility.

2-3.3.4 PASSENGER ELEVATOR DESIGN

- A. Elevator drive motors sized at 20 horsepower (HP) and larger must be rated for soft-start operations and be supplied with the applicable soft-start and variable frequency drives.
- B. Type - Passenger /Class A
- C. Capacity – 4500 pounds, net passenger capacity.
- D. Rated Speed – 200 fpm minimum, full load up direction.
- E. Vertical Rise (Maximum Vertical Rise for Machine Room Less Elevator) = 250'-0"
- F. Power Supply - 208 volts 3 phase or 480 volts, 3 phase, 60 Hz
- G. Sills Nickel Silver
- H. Cart Protection – Cars to be designed with ~~elastic~~ stainless steel bumpers 6 to 8 inches above cab floor to protect interior finish from baggage carts
- I. Doors: all doors shall be single speed center opening and shall be a minimum 42" total opening width.

2-3.3.5 FREIGHT ELEVATOR DESIGN

Designer to coordinate with facilities for actual requirements for each freight elevator.

- A. Type - Freight
- B. Prefer checker plate floor and wall finishes
- C. Class - C2 loading to be determined based upon intended elevator use.
- D. Capacity – Minimum 5,000 pounds' capacity
- E. Rated Speed - TBD
- F. Vertical Rise - As required
- G. Power Supply - 208 volts 3 phase, 480 volts, 3 phase, 60 Hz
- H. Clear Door Opening – To be determined
- I. Inside Net Platform – To be determined
- J. Clear Inside Height – 8'-4" elevator operation minimum

2-3.3.6 All elevators shall utilize a selective-collective control system that will perform as follows:

- A. Power operated doors operate automatically in response to calls, governed by safety controls.
- B. Firefighters Service – will be in accordance with the requirements of the Elevator Code by providing controls to operate and recall elevators to a designated floor in fire or other emergency condition.
- C. In addition to the Fireman's Phase I emergency recall key switch stations at elevator landings, a Fireman's Phase II key switch in each elevator cab shall provide exclusive control of elevator movements to emergency personnel. The key switch station shall be provided on each elevator cab control panel as indicated.

2-3.3.7 HOISTWAY DOOR INTERLOCKING DEVICE

All freight elevator hoist way doors shall be equipped with approved hoist way-unit-system hoist way door interlocks.

2-3.3.8 OPERATIONAL CONTROLLER UNIT

- A. The design will provide cabinet type PLC based car controller. The equipment will be designed with built-in internal diagnostics, which are readily accessed and interpreted without priority codes. No decaying memory will be permitted. There shall be no propriety programs, hardware or software.
- B. Complete operation and maintenance information shall be included wiring diagrams, layouts.
- C. A solid-state elevator starter shall be installed. The starter shall contain current limiting soft start and fault detection, phase reversal and phase loss detection.

2-3.3.9 ELEVATOR CARS

- A. Framing of cars shall be of stainless steel or galvanized material.

2-3.3.10 HOISTWAY ENTRANCES

- A. Design passenger and freight hoist way entrances of the size, frame type and finish, as required. The hoist way entrances will include doors, doorjamb, sills, hardware, transom panels and accessories.
- B. Sight guards (of the same finish as the doors) will conceal unfinished material or construction.

C. All entrances shall be a minimum of 428" in width for public passenger elevators and shall utilize heavy duty door operator systems to improve reliability of the equipment.

D. Extruded stainless steel sills shall be utilized for all entrances.

2-3.3.11 SAFETY DEVICES

A. All elevator safety devices shall be designed in accordance with ASME A17.1-effective date as designated by FACILITIES AND SERVICES FACILITIES AND SERVICES .

2-3.3.12 SIGNAL EQUIPMENT

A. Shall be designed in accordance with ASME A17.1- (A17.1-04 WITH A17.1a-2004 ADDENDA AND A17.1s) Signal equipment at landings shall be in accordance with the requirements of ADAAG 4.10.3 and 4.10.5. Comply with ADAAG Requirements for Life Safety Features in Car.

2-3.3.13 FIXTURE PANEL DEVICES

A. Shall be designed in accordance with ASME A17.1 – (A17.1-04 WITH A17.1a-2004 ADDENDA AND A17.1s) and ADAAG 4.10.12.

B. Specify on car control with faceplate for each doors opening. If elevator has front and rear openings, elevator shall have two operating panels, but only one speakerphone and one service cabinet. All operating controls shall be vandal resistant.

2-3.3.14 EMERGENCY CAR OPERATION, EMERGENCY FEATURES

A. Stand-By Lighting and Alarm during a power failure, car lighting, car alarm, and exhaust blower shall be supplied with emergency power over the same feeders supplying normal power to the elevator controllers. In addition, a car mounted battery unit to operate the alarm bell and lighting will be included.

B. Stand-By Power Transfer

2-3.3.15 REMOTE MONITORING AND CONTROL OF CAR OPERATION

A. The elevator control equipment shall have remote control capabilities for both emergency and routine operation. Remote operation will originate from the Owner's operations office.

B. Utilize serial link, LAN or Ethernet connection using TCP/IP protocol between the elevators and SCADA system for the following functions:

- TBD

2-3.3.16 ELEVATOR ENVIRONMENTAL OPERATIONAL REQUIREMENTS

A. The elevators shall be capable of operating as specified while exposed to the following climatic and environmental conditions:

A.1. EXTERIOR INSTALLATIONS

Elevators that open directly to street level or are otherwise exposed to the outdoor environment will operate in temperatures ranging from minus 10 to 120 degrees F (dry bulb) (FACILITIES AND SERVICES FACILITIES AND SERVICES 4-15-11) while exposed to sunlight, rain and airborne dust. Elevators exposed to rain, whether direct or indirect (pedestrian's clothing or umbrellas), shall continue to safely operate and function without interruption of service. Motor area within hoistway shall be kept within manufacturers recommended range.

A.2. INTERIOR INSTALLATIONS

Elevators will operate in temperatures ranging from 25 to 85 degrees F (dry bulb) and all conditions of relative humidity while exposed to airborne dust. ALL ELEVATORS MACHINE/CONTROLLER ROOM SPACES ARE TO BE MAINTAINED BETWEEN 55 TO 90 DEGREES FAHRENHEIT. RELATIVE HUMIDITY TO BE MAINTAINED AT 95% OR LESS CONDENSING

A.3. ELEVATOR EQUIPMENT ROOMS

Machinery will operate in temperatures ranging from 25 to 85 degrees F (dry bulb) and all conditions of relative humidity while exposed to airborne dust. Machine rooms containing elevator controls shall incorporate suitable cooling and air handling systems to satisfactorily manage climatic conditions required for critical microprocessor and related components. ALL ELEVATORS MACHINE/CONTROLLER ROOM SPACES ARE TO BE MAINTAINED BETWEEN 55 TO 90 DEGREES FAHRENHEIT. RELATIVE HUMIDITY TO BE MAINTAINED AT 95% OR LESS CONDENSING. Controller area within equipment room shall be kept within manufacturers recommended range. Elevator Machine rooms shall remain exclusive to elevator equipment.

2-3.3.17 NOISE LEVELS

A. Steady-state noise produced by elevators or associated equipment (excluding entrance door operations) are to be specified not exceed 65 dBA in public spaces. Noise produced by the operation of the elevator door shall not exceed 65 dBA 3 feet or more from the elevator door inside or outside of the elevator cab.

2-3.3.18 ELEVATOR RELIABILITY REQUIREMENTS

A. Designer to specify that the elevator reliability requirements are based on the following parameters:

- System operating time: 20 hours/day
- Operating hours per year: 7,300
- 90 percent of full load capacity for peak periods of 2-hour duration, twice per day
- 50 percent of full load capacity during off peak periods
- The service design life of each elevator shall be 30 years

2-3.3.19 SEISMIC CRITERIA

The elevator equipment shall be designed in accordance with Seismic Zone requirements determined by the architect. IN ADDITION, APTA REQUIRES THAT ELEVATOR SYSTEMS TO BE DESIGNED AT A SEISMIC ZONE 2 CRITERIA, AS A MINIMUM.

2-3.4 Escalators (and surge areas)

2-3.4.1 All escalators used for passenger circulation shall be specified as High Traffic Grade (or Transit Grade) units. Public Transportation Grade rated 20 hrs./day runtime, 264lbs. (120kg) per step. Transit Grade rated same runtime, 320lbs. (145kg) per step. Must have remote monitoring capable and sleep mode features, and 3 step run out.

2-3.4.2 The Contractor shall plan the location of escalator approaches and landings to avoid cross-traffic and obstructions which may create unsafe congestion for pedestrians in the process of mounting or dismounting from the escalator.

2-3.4.3 Escalator drive motors sized at 20 horsepower (HP) and larger must be specified for soft-start operations and be supplied with the applicable soft-start and variable frequency drives.

2-3.4.4 DIMENSIONS

A. Escalator dimensions should be based on a compilation of manufacture's data furnished by all potential escalator suppliers. All provisions of space, clearances and support in station structure as well as dimensioning and interface of cladding, railing, floor joints and other finishes shall be coordinated with this data. Must be approved by P.M. and FACILITIES AND SERVICES FACILITIES AND SERVICES .

2-3.4.5 DETAILING

A. Use of glass balustrades is permitted but locations proposed must be reviewed with FACILITIES AND SERVICES FACILITIES AND SERVICES . Glass balustrades must be detailed to eliminate damage from baggage carts and concession provisioning carts or palates. If glass balustrade, it will be ½" (12mm) thickness. Otherwise, it should be stainless steel solid inclined balustrade with high deck.

B. The Contractor should examine alternatives to escalator runs which connect more than one-level per section.

C. Avoid locating escalators with glass balustrades adjacent to walls where trash can be trapped between rail and wall making cleaning difficult.

D. Where handrails are adjacent to walls, provide durable, scratch resistant wainscot treatment to protect wall finish. Painted drywall is not acceptable for this application.

2-3.5 Moving Walk Systems

2-3.5.1 All moving walkways used for passenger circulation shall be specified as High Traffic Grade (or Transit Grade) units and must have sleep mode feature.

2-3.5.2 The Contractor shall plan the location of moving walkway approaches and landings to avoid cross-traffic and obstructions which may create unsafe congestion for pedestrians in the process of mounting or dismounting from the moving walkway.

2-3.5.3 Moving walkway drive motors sized at 20 horsepower (HP) and larger must be specified for soft-start operations and be supplied with the applicable soft-start and variable frequency drives.

2-3.5.4 DIMENSIONS

A. Moving walkway dimensions should be based on a compilation of manufacture's data furnished by all potential escalator suppliers. All provisions of space, clearances and support in station structure as well as dimensioning and interface of cladding, railing, floor joints and other finishes shall be coordinated with this data. Must be approved by P.M. and FACILITIES AND SERVICES FACILITIES AND SERVICES .

2-3.5.5 DETAILING

A. Use of glass balustrades is permitted but locations proposed must be reviewed with FACILITIES AND SERVICES FACILITIES AND SERVICES . Glass balustrades must be detailed to eliminate damage from baggage carts and concession provisioning carts or palates.

B. Avoid locating moving walkways with glass balustrades adjacent to walls where trash can be trapped between rail and wall making cleaning difficult.

C. Where handrails are adjacent to walls, provide durable, scratch resistant wainscot treatment to protect wall finish. Painted drywall is not acceptable for this application. Code minimum required.

2-3.6 Baggage Conveying Systems

This section covers and includes the furnishing and installing of airline baggage handling system as hereinafter described. Refer to Division 1 for general project requirements.

A.1. Sloped Plate Claim Devices shall be constructed of articulating contoured pallets forming a continuous rotating sloped surface operating continuously at 90 feet per minute. Provide a minimum useable width of 59 inches. Unit shall be fed via belt conveyor(s) and circumference of make-up units shall be protected.

A.2. Transport Conveyors provide a system designed to move baggage of various shapes and sizes. System is comprised of several types of conveyor sections operating together to adapt to airport layout-

- To accurately stage and index baggage, provide a queue conveyor designed with high-grip belts to insure a positive means for tracking and little or no product slippage during rapid starts and stops.

A.3. Diverter

- Provide motorized sortation devices to redirect baggage from one conveyor to another for sortation. Equipment shall be capable of diverting baggage as large as 150 pounds at a rate of up to 80 bags per minute.
- Provide associated 45-degree merge cycling conveyors to accurately insert baggage from one conveyor line into the baggage flow of another.
- “T” junctions are prohibited.
- Provide lock-out system to accommodate maintenance.

A.4. Check-In

Where baggage scales are to be accommodated, either initially or in the future:

- Include retractable dispatch equipment at ticket counter between bag scale and takeaway conveyor. Unit shall accommodate ticket agents with an ergonomic, efficient method of dispatching checked luggage into the baggage system.
- Provide an integrated check-in scale and induction conveyor shall be utilized at ticket counters to handle outbound baggage. Scale shall be designed to hold and accurately weigh baggage, then move baggage for proper staging onto a takeaway transport conveyor.

A.5. Other

- Provide mezzanines, catwalks and other specialty products to offer a safe and sturdy work area for accessing elevated conveyor sections complete with OSHA approved non-slip surface walking surface, toe boards and handrails.
- Provide access to belt drives and other devices, which may require periodic maintenance.
- Position mezzanines and catwalks to provide access to areas that may have bag jams.
- Provide all necessary ladders or stairs to safely access elevated platforms.

- Provide integrated draft curtains with ticket counters and baggage claim devices to prevent public view while blocking airflow between public and non-public areas. Design curtains to allow baggage to easily pass through while providing a necessary barrier.
- Coordinate all required fire and security doors.
- Provide non-slip rungs on ladders
- **Draft Curtain will have a 50% overlap.**

2-3.7 Electrical for Baggage Systems

2-3.7.1 BAGGAGE SYSTEM

A. Introduction: This section discusses the requirements for the electrical distribution equipment and controls system equipment for a baggage system. Specifications and requirements for belts, drive train, supports, physical size of equipment, etc. will be covered on a project by project basis. Special coordination with the Aviation Department PM and airport staff will occur at each major project milestone and/or project submittal.

B. The baggage system, in general, consists of (2) separate systems. The first system sorts, scans, and delivers a bag from passenger check-in to the carrier where it is hand-delivered and loaded onto the aircraft. The second system sorts and delivers the bags from the aircraft to the baggage pickup carousel. For purposes of this document, each system will be referred to as the outgoing and incoming baggage system. Whether a bag is initially checked in at PHX or at another airport, the bag is issued a 10-digit IATA tag or bag ticket. As the bag moved through each baggage system (outgoing or incoming), bar code readers are required to read each 10-digit IATA tag and monitor the bag's position or location in the baggage system. Terminal 3 does not have 2 separate sorting inbound and outbound systems

C. The outgoing baggage system consist of (4) main sections or ~~lines~~. Should not call section (Lines) This is misunderstood

C.1. The first line encompasses the baggage check-in system. Bags enter the main baggage system on line 1 at the passenger check-in and ticketing. Bags that are checked in and that are on line 1 proceed to be sorted prior to entering line 2.

C.2. Line 2 is also known as the baggage scanner portion of the baggage system. Bags enter line 2 and are divided and sorted and scanned through an EDS scanners.

C.3. Bags that failed the scan must be scanned and inspected by hand. These bags are removed from its current baggage line by VSU (Verti-Sort) (not HSD) and diverted to line 3. Bags that are processed through line 3 are scanned by the barcode scanners and are intercepted by a TSA representative. Once the bag has been scanned by a TSA representative, it is placed back on line 3 where it is merged back onto line 2 using a merger. 2 types of operations will occur within this section (place bags back to line 2 or place bags (clear) to line 4

C.4. Once the scanning process is complete, the bags move onto line 4. Line 4 sorts and sends the bags, based on IATA barcode information, to the respective carrier/flight carousel. From there, a baggage handler from the carrier will load the bags onto the baggage car by hand.

D. The incoming system consist of (2) main sections or lines.

D.1. Bags enter the incoming baggage line (line 1) are brought in by hand from the aircraft.

Bags are placed on a conveyer which scans the bags in order to track and deliver the bag to its

proper destination. Communications with the ticketing systems are performed to determine whether a bag must reenter the outgoing baggage system or continue on to the baggage pickup carousel. Bags which are going on to another destination are automatically moved from the incoming line and sent to the outgoing line. These bags are rescanned and move through the outgoing baggage system. Transfer TX line will on go to EDS outbound. Not a separate system for sorting inbound bags

D.2. Line 2 sorts and delivers the bags to the proper carousel for passenger pickup. Airlines will deliver bags to proper carousels for passenger pickup

E. Design of Power Distribution to Baggage Lines: Power is distributed to baggage lines through motor control centers. The power distribution to baggage systems motors starts at a distribution style switchboard. Power is then distributed to a Motor Control Center (MCC) or Motor Control Panel (MCP) where motor drives, starters, and controllers are located. Refer to the electrical design standards in Section III of this design manual for distribution switchboard requirements.

F. Motor Control Centers (MCC) or Motor Control Panel (MCP): MCC shall be designed as they will be used and operated in the field. The MCC shall be 600-volt class suitable for operation on a three phase, 60 Hertz system. The system operating voltage shall be 480 volts, 3-phase, and 4-wire unless otherwise required by the conveying systems manufacturers. All MCC/MCP bussing shall be copper. Each MCC shall be specified or designed with the following options: **Critical subsystems are to be separated by MCC's. Complete systems will be standalone MCC's.**

F.1. The enclosure shall be constructed with galvanized sheet steel and conform to the NEMA standards for a type 1A enclosure. All doors and enclosing panels shall be gasketed.

F.2. The MCC/MCP shall be UL listed and meet all applicable NEMA and ANSI standards. MCP will be equipped with 2/110 volt A/C power for UPS units (Uninterruptable Power Supply) **110 Volts AC power for UPS units need individual circuits.**

F.3. The baggage system power distribution design shall utilize "off the shelf" parts and equipment from Eaton/Cutler Hammer, Square D, or Allen Bradley. The MCC/MCP shall comply and meet the applicable requirements (for MCC/MCP and its components, panels, transformers, disconnects, over current devices, etc.) as noted in the electrical portion of Sections I and II.

F.4. Designs shall show a 4-inch housekeeping pad for the MCC/MCP.

F.5. The MCC/MCP design should include a Main Circuit Breaker (MCB). The MCB shall be a shunt trip type with a 120-volt coil.

F.6. The MCC/MCP shall be equipped with a packaged microprocessor based metering system. The design document specifications shall include the following metering features:

- AC Amperes in each Phase, 1% Accuracy (or better).
- AC voltage, Phase to Phase, Phase to Neutral, 1% Accuracy (or better).
- Watts, 1% Accuracy (or better).
- Reactive Power, 1% Accuracy (or better).
- Power Factor, 1% Accuracy (or better).
- Frequency, 1% Accuracy (or better).
- Watt Demand, 1% Accuracy (or better).
- Watt Hours, 1% Accuracy (or better).

F.7. B) Alarm Functions (the MCC MCB shall trip or the MCC shall be in alarm if one or more of the following events occur):

- Voltage phase loss: voltage (rms) is less than 75% of the nominal line voltage (for any phase).
- Current phase loss: the smallest phase value is less than 1/16 of the largest phase value.
- Line voltage phase unbalance. This preprogrammed value is to be determined by the design engineer to a value no greater than 35% of the nominal current.
- Voltage phase reversal.
- Over voltage
- Under voltage
- Time delay for the trip and/or alarm settings: no greater than 8 seconds.

F.8. The MCC enclosure design shall not include more than (6) motor controller or drive compartments in each vertical structure.

F.9. Motor starter and drives shall be draw-out type. Specify the MCC with a guide rail system. Draw-out drives and starters shall be equipped with equipment stab shrouds. Stabs and wiring to stabs shall not protrude into the bus compartment. Exceptions must be coordinated and approved through the Aviation Department PM.

F.10. Drives shall be front access only. Alternate designs or MCC arrangements shall be considered and approved by the Aviation Department PM.

F.11. The MCC shall be design or specified with copper bussing (including the neutral and ground busses) with a minimum ampacity of 600-Amps. All bus bars shall be designed to span the full length of the MCC.

F.12. The neutral bus, if required, shall be fully sized. Each MCC section shall be rated no less than 50% of the full bus rating. Calculations supporting the section rating shall be submitted with the design documents.

F.13. The bus and equipment must be braced for 42,000 amps rms symmetrical, unless a higher rating is required per the design.

F.14. The MCC shall be specified with interlocks to prevent the opening of a door unless the disconnect switch is in the off position.

F.15. The specifications shall include descriptive name plates which follow the Aviation Department typical electrical equipment naming convention and standards.

G. Motor Drives and Motor Starters: Motor drives and/or starters shall utilize “off the shelf” parts and equipment from Eaton/Cutler Hammer, Square D, Allen Bradley, ABB, and Toshiba. The following describes the specification and design requirements for motor drives and motor starters:

G.1. Motor Drives:

- Power line noise shall be limited to a voltage distortion factor and line notch depth as defined in IEEE Standard 519, Guide for Harmonic Control and Reactive Compensation of Static Power Converters.
- The VFD shall not emit either conducted or radiated RFI in excess of the limitations set forth in FCC Rules and Regulations.
- The VFD shall be sized appropriately to be capable of supplying up to 150% of rated full load current for one minute at maximum ambient temperature.
- Each VFD shall have a HAND/OFF/AUTO selector switch for motor control.
- The VFD shall have an input line current rating equal to 100,000-amps, RMS (minimum). If required, specify current limiting fuses to achieve this rating.

- The VFD must be capable of input voltage fluctuations of +/- 10% and input frequency variations of +/- 2%.
- The controller output shall match the requirements of the motor; at a minimum, the drive output should vary over a range between 46 to 460-volts and 6-60 Hz (10:1 speed range).
- Input line reactors are not permitted unless approved by the Aviation Department PM. Drives shall be based on a 24-pulse design.
- Drive selector switch should be specified with lock-out, tag-out capabilities. Motor Starters:
- Motor starters shall be magnetic combination type, NEMA ICS 2; AC general-purpose Class A induction motors. Specify the rating, corresponding to the horsepower rating, for each motor.
- Specify with a disconnect switch in a common enclosure. The disconnect switch shall have lock-out, tag out capabilities.
- Specify with indicating lights. GREEN signifies the motor is running; RED signifies the motor is not running. Indicating lights shall be "push to test" type.
- Specify the motor starters with auxiliary contacts, as required.
- **Electrical motors will be rated for two horsepower and up.**

H. Baggage System Controllers: The baggage system is operated by means of standalone microprocessor based programmable controllers. The controllers communicate with each other and with the central ticketing system. A programmable controller shall consist of a micro-based processor with integral power supply, input modules, and output modules (isolated and common based); Human-Machine Interface (HMI) screens, interface equipment to interface with the SCADA system. Provisions shall be made for remote processor to processor communication equipment, disc drive and printer. I/O modules shall plug into mounting racks connected to the processor and power supply via multi-conductor cables.

2-3.7.2 The following list serves as a general guideline for the design of baggage system programmable controllers:\

New Baggage Handling Systems will be integrated into Front End graphics and local workstations.

A. The processor shall be capable of performing control relay, timer, counter, bit manipulation shift register, jump, master control relay logic functions, and a minimum of 256 timers and counters (up/down). Shift register coils shall be specifiable length in units of 16 bits long, shift right or left, and be chainable.

B. The processor shall be available with special functions consisting of comparison, addition, subtraction, multiplication, division, and move functions. Comparison, arithmetic, and conversion functions shall handle data up to at least 4 BCD digits.

C. The processor shall have a battery backed memory module to store ladder diagram programs and holding register data. The memory module shall be available with a capacity to control the equipment. If the memory size requirements are significantly different, then adjustments will be made during the pre-construction phase.

D. A rechargeable, sealed battery shall be provided within the processor to retain program memory and discrete I/O states during the loss of AC power. The battery shall retain these memories for 1000 hours during power loss. The battery shall be trickle-charged by the processor's power supply to maintain back-up capability. A "Battery OK" light shall be provided to indicate the condition of the battery.

- E.** The processor shall have indicating lights to indicate: 1) that power supply voltages are within tolerances; 2) that the processor is scanning memory and controlling outputs; and 3) that a processor fault condition exists.
- F.** The processor shall control a form C relay operating in conjunction with the fault light, to activate an alarm or initiate a shutdown sequence.
- G.** The processor shall have a key operated switch to select either a "RUN" mode (programming prevented) or a "Program" mode (programming allowed, outputs disabled). "RUN" mode shall also allow modification of any or all-numerical holding registers (i.e., timer or counter presets) with processor "on-line".
- H.** The processor shall have an RS-232C port for communication with an SCADA computer for programming and diagnostics.
- I.** The processor shall contain a power supply to provide all DC power necessary for the processor.
- J.** Power supply configurations shall be available for operation from 100-130 VAC, 50/60 Hz.
- K.** Upon power-up, the processor shall check for proper DC voltages (including the battery) and calculate static and dynamic error codes.
- L.** Upon loss of AC power, the processor shall disable all outputs and recalculate error codes. All latching relays and numerical holding registers shall retain last known data (retentive).
- M.** Fault checking shall include, as a minimum, the following:
- M.1.** User Memory Check
 - M.2.** Executive Memory Error
 - M.3.** Watchdog Timer
 - M.4.** Real Time Clock Slow/Fast
 - M.5.** I/O Bus Errors
- N.** Each analog input/output shall be digitally scaled to assure the highest level of accuracy. Analog inputs shall have 12-bit accuracy with overflow and have both linear and BCD values available. Analog outputs shall have 12-bit accuracy.
- O.** All modules shall be enclosed in a rack. Integral assist-handles shall be provided for removing and inserting the modules into the rack.
- P.** Light-emitting diodes shall provide a visual indication of the status of all discrete inputs and outputs.
- Q.** Field voltages shall be isolated from processor voltages by optical isolators.
- R.** I/O modules shall be designed to function in harsh industrial environments and shall meet IEEE Surge Withstand Standard 472 and NEMA ICS 2-230.45.
- S.** The edge connectors on each module shall be nickel-gold plated.
- T.** Any I/O module shall be able to be placed in any rack position.
- U.** Racks shall have locking bars or screws to assure that modules stay firmly in place.
- V.** 120VAC and 24VDC discrete I/O Modules shall have 300-volt terminals, with captive hardware able to accept two #14 AWG wires, for field wiring connections.
- W.** Modules shall be removable from the racks without disturbing the field wiring.
- X.** All analog and discrete I/O needs to be kept separate in panel.

Y. All analog and discrete points that exist in the rack need to be terminated at the appropriate terminal strip. This will provide ready spares if needed. Provide 10 -percent spare terminal strips for expansion.

Z. All discrete 120 V outputs shall be run through an interposing relay to isolate the module and backplane. Relay shall have an indicator to show when energized.

AA. All analog I/O shall be fused, and shall have a blow fuse indicator in the fuse block.

BB. All 120 V discrete inputs shall have individual fuse or breaker on power being supplied to the switching device.

CC. All unused slots in the rack shall have unused slot covers.

DD. All wire shall be routed in panel duct of sufficient size.

EE. Panel duct shall not be closer than 2.5" from the terminal strips.

FF. All wires shall have machine printed sleeve type labels on both ends.

GG. Acceptable manufacturers include Rockwell Automation, ABB, and Siemens. Other manufacturers shall be approved on a case by case basis.

2-3.7.3 IATA 10-DIGIT BAR CODE READERS:

A.1. The bar code readers must be fully compatible with the carrier's baggage handling equipment and International Air Transportation Association (IATA) standards. Manufactures: Cognex and S.I.C.K

2-3.7.4 UNINTERRUPTABLE POWER SUPPLY (UPS) BACKUP:

A.1. UPS backup shall be provided for critical systems that are susceptible to brownouts and voltage sags. Devices such as Explosive Detection System (EDS) scanners should be appropriately backed up on a UPS. The power distribution design and specifications should include UPS backup for critical devices.

2-4 Mechanical (Plumbing Division 22, Heating, Ventilation and Air Conditioning Division 23)

2-4.1 Codes, Regulations and Standards

Refer to SECTION I: Chapter 6 for applicable codes, regulations and standards.

2-4.2 General

2-4.2.1 TERMS, DEFINITIONS AND ABBREVIATIONS

Refer to SECTION IV: APPENDIX B

2-4.3 Security

2-4.3.1 UTILITIES & UTILITY OPENINGS

A. Do not mount plumbing, electrical fixtures, or utility lines on the inside of exterior walls, but, when this is "unavoidable" mount fixtures on a separate wall at least 6 inches from the exterior wall face.

B. Avoid placing plumbing on the roof slab.

C. Avoid suspending plumbing fixtures and piping from the ceiling.

- D.** Reduce the number of utility openings, manholes, tunnels, air conditioning ducts, filters, and access panels into the structure.
- E.** Locate utility systems away from likely areas of potential attack, such as loading docks, lobbies, and parking areas.
- F.** Protect building operational control areas and utility feeds to lessen the negative effects of a blast.
- G.** Design operational redundancies to survive all kinds of attack.
- H.** Use lockable systems for utility openings and manholes where appropriate.
- I.** Infrequently used utility covers/manholes can be tack-welded as an inexpensive alternative to locking tamper-resistant covers.
- J.** When at all possible, utility openings will be designed to be secured in cabinets or enclosures that are physically locked and are monitored by the intrusion detection system and tamper alarm switches. If they must be in the open, they must be designed to be secured by a heavy-duty padlock at a minimum and preferably an intrusion detection system.
- K.** The security video surveillance system will be designed so that these critical infrastructure components can be observed and the video streams can be automatically analyzed by the intelligent scene analysis "engine".
- L.** External utility lines for all services and systems need to be protected and monitored to prevent tampering.
- M.** Keep utilities away from perimeters and conceal and protect all utilities to the greatest extent possible.

2-4.3.2 HVAC SECURITY

The effective design of heating, ventilation, and air conditioning (HVAC) systems can significantly reduce the potential for chemical, biological, and radiological (CBR) agents being distributed throughout buildings. These design standards are not meant to assume comprehensive protection against this threat.

- A.** The Contractor will consider measures to limit airborne contamination within structures. This will include planning for accommodating future detection technologies.
- B.** The HVAC design will integrate or interface with the electronic security management system.
- C.** For the purposes of design, chemical, biological, and radiological weapons are assumed to be improvised weapons containing airborne agents employed by terrorists. The design standards are not meant to assume comprehensive protection against this threat. They will provide the means to reduce the potential for widespread dissemination of such agents throughout a building in the event of an attack.
- D.** During an interior bombing event, smoke removal and control are of paramount importance. Incorporation of a smoke removal system as part of the HVAC System and operational parameters should be considered in all designs. The Contractor shall provide alternatives for review by and direction from FACILITIES AND SERVICES FACILITIES AND SERVICES prior to final HVAC System configuration.
 - D.1.** The Contractor should consider the fact that, if window glazing is hardened, a blast may not blowout windows, and smoke may be trapped in the building. In the event of a blast, the available smoke removal system may be essential to smoke removal, particularly in large, open spaces.

D.2. This equipment should be located away from high risk areas (e.g., garages and loading docks). The system controls and power wiring to the equipment should be protected, and the system should be connected to emergency power to provide smoke removal. Smoke removal equipment should be provided with standalone local control panels that can continue to individually function in the event the control wiring is severed from the main control system.

E. Air vents may also be used to gain access to the building if not properly located and secured. The Contractor's will design the HVAC systems to reduce the potential for break-in or utilization as a weapon delivery system. Some techniques that can be used include:

E.1. Designing vent shafts to have minimally sized openings

E.2. Securing doors and grates on ventilation systems accessed for maintenance

E.3. Locating vents away from areas with public access such as sidewalks, wherever possible

E.4. Elevate fresh-air intakes to a minimum height of 12 feet in order to reduce the potential for hazardous materials entering a building from a ground-level outdoor release.

E.5. Installing actuated louvers over vent openings that open only while the fans are running. Intakes can also be covered by screens so that objects cannot be tossed into the intakes or into air wells from the ground. Such screens should be sloped to allow thrown objects to roll or slide off the screen, away from the intake.

E.6. Monitoring vent openings with alarms and intrusion/tamper detectors to alert Aviation Department of the presence of humans or chemical substances

E.7. Installing sensors in vents to detect foreign substances in the ventilation systems

E.8. To prevent widespread dispersion of a contaminant release, areas with greater occupancy densities should have their HVAC systems isolated and the areas maintained at a negative pressure relative to the rest of the building, but at positive pressure relative to the outdoors. Physical isolation of these areas (sealed floor to roof-deck walls, sealed wall penetrations) are critical to maintaining the pressure differential. It requires special attention to ensure airtight boundaries between these areas and adjacent spaces. Isolating separate HVAC zones minimizes the potential spread of an airborne hazard within a building, and reduces the number of people potentially exposed if an internal release occurs.

E.9. Zone separation provides a limited benefit against an external release. Isolation of zones requires full-height walls between each zone and its adjacent zone and hallway.

E.10. The Contractor's will consider tying the HVAC system into the security system in order to provide the Aviation Department with system control to regulate airflow and pressures within a facility on an emergency response basis.

E.11. Ducted returns offer limited access points to introduce a CBR agent and may be considered by the Contractor's. The return vents can be placed in conspicuous locations, reducing the risk of an agent being secretly introduced into the return system.

E.12. Buildings should be designed to minimize interaction between air-handling zones. This can be partially accomplished by limiting shared returns.

E.13. Consideration should be given to installing low leakage dampers to minimize flow pathway. From a protective standpoint, dampers that respond quickly are preferred over dampers that might take 30 seconds or more to respond.

2-4.4 Heating, Ventilation & Air Conditioning

2-4.4.1 DESIGN CONSIDERATIONS

- A.** All installations shall be designed for total system energy efficiency and conservation. HVAC systems should be designed based on a life-cycle cost analysis. Energy Compliance documentation compliant with the most current ~~either COM Check~~ or ASHRAE 90.1 shall be provided at the completion of the Construction Documents. A comprehensive energy analysis shall be performed for all buildings 10,000 sq. ft. or more in area, using computer simulation programs such as TRACE, DOE2, or others approved for use by the federal government. The computer simulation and/or compliance program shall be used to perform the energy analysis and evaluation of alternative building methods, materials, orientations, lighting and HVAC systems.
- B.** All systems shall be designed so that they are easily adaptable to the future growth of the facility.
- C.** All design considerations shall comply with the most current ASHRAE Standards.
- D.** For buildings and their associated mechanical systems requiring 10 tons of refrigeration, but less than 100 tons, shall utilize several smaller unitary packaged or split systems units.
- E.** For buildings and their associated mechanical systems requiring 100 tons of refrigeration or more, shall when feasible, utilize high-efficiency, , water-cooled chiller systems.
- F.** Where economically feasible and design permits, an energy recovery ventilation system (i.e. heat wheel) or run-around coil to capture and reuse cooling energy from exhaust air in buildings with central air distribution shall be provided.
- G.** Central Station air handling units to be designed with 100% Outside Air economizers.

2-4.4.2 COMPONENT STANDARDS

- A.** All equipment to be rated at Air Conditioning and Refrigeration Institute's (ARI) conditions and shall be listed by a nationally recognized testing agency.
- B.** Unitary air conditioners (packaged air conditioning units) and heat pumps should be selected based on the most current LEED criteria for SEER (units less than 5.4 tons) and EER (units over 5.4 tons) ratings. All equipment must be Energy Star rated.
- C.** Electrical Motors: All electric motors exceeding 1,000 operating hours annually will be energy efficient and shall be rated NEMA Premium energy efficient

2-4.4.3 EQUIPMENT PLACEMENT

- A.** To minimize safety hazards and to provide for ease of accessibility for maintenance and repair, major air conditioning and heating equipment components (compressors, air handlers, heaters, etc.), shall not be located in areas immediately above hard ceilings. If the design suggests that major equipment is to be located above hard ceiling areas, approval of the Facilities Review Committee is required. In all cases, an adequate permanent work platform shall be provided for maintenance functions.
 - A.1.** Roof-mounted equipment must be curbed. Roof-mounted equipment shall not be located closer than six feet from roof edge. Safe access (i.e. fixed ladder, permanent ladder) must be provided for all roof-mounted equipment.
 - A.2.** Equipment may not be placed in a space in such a manner that the maintenance, repair or removal of the equipment requires an alteration to a doorway, roof, ceiling, floor, wall or adjacent equipment.
 - A.3.** Multi-storied facilities shall be designed with a minimum of one air handler per floor wherever possible.

A.4. Ladder-up type posts shall be provided at permanent access ladders that do not have handrails projecting above the work surface.

A.5. Central air distribution is to be accomplished by variable air volume systems with variable fan speed controllers rather than constant volume systems for the same system static pressure. This approach reduces energy use during part load conditions and takes advantage of each zone's operational characteristics.

A.6. Designs shall consider economizer cycle (free cooling) by using "plate & frame" heat exchangers for systems with cooling tower capacity exceeding 100 tons and energy management and temperature control system (EMTCS) for automated valve control.

A.7. Designs shall avoid multi-zoned packaged air conditioning units unless deemed feasible and appropriate for the function of the facility and must be approved by FACILITIES AND SERVICES FACILITIES AND SERVICES ..

A.8. Evaporative Cooling shall be evaluated and installed where deemed practical. Evaporative coolers shall be UL or ETL listed as required by the Mechanical Code.

2-4.4.4 AIR DISTRIBUTION SYSTEM

A. Air shall be supplied to the occupied space by low-velocity ducts whenever possible.

B. To minimize air circulation fan horsepower, ductwork shall be designed for the lowest practical total pressure drop.

C. Presently, jet way pressurization is being accomplished from airflow in one direction (from the plane) towards the terminal and then exhausted. The configuration should be considered to isolate any cotangent on the plane from the terminal. Contractor must take into account the PC Air pressurization when figuring terminal balance calculations.

D. Design flow to tenant spaces shall be 100 cfm negative air relative to the common area.

E. There shall be positive pressure at the entrance doors to the terminal. Systems design shall include the separation of exterior and interior spaces. i.e. vestibule doors air curtains

2-4.4.5 ACCESSIBILITY OF VALVES, CONTROLS, ETC.

A. All valves, dampers, etc., shall be located so that ready access can be had for operation, repair and maintenance.

B. Specifications will instruct workers to arrange all conduit and wiring to provide clearance for removal of access doors, and to locate valves and unions in piping to allow service with minimum of dismantling and inconvenience.

2-4.4.6 EXTERIOR DESIGN CONDITIONS: Outdoor design temperatures shall be: at a minimum, and subject to change based on the most current Engineering/ASHRAE data:

A. Summer - 115°F Dry Bulb, 76°F Wet Bulb (FACILITIES AND SERVICES FACILITIES AND SERVICES 2011)

B. Winter - 34°F Dry Bulb

C. Re-evaluate design conditions for HVAC equipment to be installed within close proximity to the ramp area of terminal concourses.

2-4.4.7 INTERIOR DESIGN CONDITION: Interior design temperatures shall be at a minimum, and subject to change based on the most current Engineering/ASHRAE data:

A. Cooling - 72°F Dry Bulb

B. Heating - 74°F Dry Bulb

C. Evaporative cooling – Min. of 1 air change/2 minutes

2-4.4.8 VENTILATION RATE

A. The number of air changes per hour (total air circulated) shall meet current Code(s). The ventilation systems shall be designed to provide cross ventilation. The outside air requirement shall meet current Code(s).

B. Outside air intakes shall be located at the roof level. Sidewall outside air intakes in exterior vertical walls is not allowed.

2-4.4.9 DESIGN VELOCITIES FOR AIR DISTRIBUTION SYSTEMS

A. Design velocities shall be selected to provide the required system performance and to minimize pressure loss and energy consumption, air-borne noise generation, draft, and the intake of dust particles. Refer to American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc. (ASHRAE) Applications Handbook for applicable Noise Criteria (NC) rating standards under various occupancy conditions. Primary considerations for design velocities in air distribution systems are described below:

- Sheet Metal Ducts

Sheet metal supply-and return-air duct sizes shall be determined in accordance with the requirements prescribed for low-velocity air-distribution systems in the duct design chapter of ASHRAE, latest edition).

- Air Outlets and Intakes

Supply registers shall be selected for throw and noise criteria. Throw must be consistent with room architecture).

- Variable Air Volumes (VAV)s

VAVs shall be selected for required airflow, pressure, and noise criteria.

- Diffusers

Diffusers shall be selected for throw and noise criteria.

- Exhaust and Return Grilles

Exhaust and return grilles shall have a capacity based on maximum velocity of 500 feet per minute (fpm) over gross area.

- Transfer Grilles

Transfer grilles shall have a maximum velocity of 250 feet per minute (fpm) over gross area.

- Transfer Louvers

Transfer louvers shall have a maximum velocity of 250 feet per minute (fpm) over gross area.

- Isolation Dampers

Isolation dampers shall have a maximum velocity of 2,000 fpm over gross area; damper areas will be determined by the Contractor.

- Bypass Dampers

Bypass dampers shall have a maximum velocity of approximately 500 fpm over gross area; damper areas will be determined by the Contractor.

- Noise Criteria

Sound control for environmental control systems shall be designed according to the procedures outlined in the noise and vibration chapter of these criteria and the Sound and Vibration Control chapter of the Handbook of HVAC Applications (ASHRAE, latest edition).

2-4.4.10 GENERAL PROVISIONS

A. Equipment: The identification numbering shall be coordinated with and provided by the Aviation Department’s Facilities Division and shall be incorporated into the construction document during the design process. The design of identification numbering shall include, but not be limited, to the following:

- Identification for HVAC Piping and Equipment
- Air Handlers and associated Adjustable Frequency Drives
- Fan Coil Units
- All Fans
- VAV’s
- ~~Circulating~~ All Pumps
- Water Pumps
- Water Chillers
- Cooling Towers

B. Electrical Motors:

Motors 3/4 HP and larger except as otherwise noted shall be designed for 480 volt, 3 phase, 60 hertz power supply.

Motors 1/2 HP and smaller shall be designed for 120 volt, single phase, 60 hertz power supply.

Only motors that are copper wound and conform to all applicable requirements of NEMA, IEEE, ANSI and NEC standards will be specified. Motors shall be approved by Underwriters' Laboratories (UL) for the service specified with a minimum safety factor of 1.15 for drip-proof motors to 200 HP. TEFC motors shall have a service factor of 1.0.

Motors which are controlled by an adjustable frequency drive (AFD) are to be coordinated with the AFD manufacturer (Refer to Variable-Air-Volume Changeover Bypass System – Spec. Section 23 36 19).

C. AFD motors shall have a minimum “Premium” efficiency rating

<u>HP</u>	<u>Efficiency</u>
5 - 20	90%
21 - 50	92%
51 - 125	93%

2-4.4.11 AIR DISTRIBUTION SYSTEM DESIGN

A. All air-distribution duct systems shall be designed based on recommendations and in accordance with information contained in the latest edition of the Handbook of Fundamentals (ASHRAE). Supply duct sizes shall be selected for an equal pressure drop or static regain method as appropriate. Air-distribution ductwork for ancillary area ventilation systems shall be so arranged that air is not exhausted into or obtained from station public occupancy areas. All sheet metal ducts shall be constructed of galvanized steel with airtight joints. All ducts shall be sufficiently stiffened and supported to avoid sagging and vibration. In general, the ductwork fabrication shall be in accordance with Low Pressure or Medium Pressure Duct Construction

Standards (Sheet Metal and Air-Conditioning Contractors National Association, Inc. (SMACNA) as appropriate. Computer and server rooms are preferred to utilize under floor supply air distribution. Under floor air distribution for office environments can be considered as alternative to traditional overhead distribution. The Aviation Department has a basis of design established for raised floor system. Prior approval must be obtained from the Aviation Department for the design or use of this system.

B. Pressure Losses

The designer shall provide pressure loss calculations, and specify that the Contractor will verify the pressure loss of equipment according to the Handbook of Fundamentals (ASHRAE, latest edition). The static pressure differential across any supply or return air shall not exceed 0.15 inches' water gauge when the system is operating at full capacity (applies but is not limited to diffusers and grilles).

C. Supply Air Registers and Diffusers

All supply air registers and diffusers shall be selected to provide the required throw and spread with the least amount of draft and noise. All registers shall be provided with adjustable and double-deflection louvers. Volume dampers shall be located in the branch ductwork as far upstream from the outlet as possible; key-operable dampers accessible through the face of the register shall not be allowed. Ceiling diffusers may be the square, rectangular, circular, or linear type, but in all instances, shall have adjustable throw. Close coordination with the architectural and lighting designs shall be required.

2-4.4.12 PLUMBING PIPING AND PUMPS

A. Provide drains at low points and vents at high points of systems.

B. Piping located above electrical equipment rooms or equipment is prohibited. Where deemed unavoidable, condition must be approved in advance by FACILITIES AND SERVICES . If unavoidable designs will provide 20-gauge galvanized drip pan with drain line to floor drain.

C. Drains:

<u>Average Line Size</u>	<u>Drain Valve Size</u>
2-1/2" or smaller	3/4"
3" or larger	2"

D. Air Vents:

Install automatic air vents where required and at all high points of each system.

E. Flexible Connections:

Flexible connections must be pressure and temperature rated appropriately and be stainless steel braided hose type at final connections to all pumps and required areas.

In buildings that are to be constructed in stages under separate contracts, the designer shall provide sleeves and block-outs the designer shall be provide for structures to accommodate fan, piping, and ductwork installation by later-stage Contractor's. The locations and sizes of the sleeves and block-outs shall be accurately dimensioned to facilitate the subsequent piping and ductwork installation under later-stage contracts and shall be coordinated with other items such as raceways, sprinklers, lighting fixtures, etc. Pipe sleeves in exterior walls shall be sized to provide sufficient space for watertight sealing around carrier pipes.

2-4.4.13 HVAC DUCTS AND CASING

A. ALL HVAC ductwork types, materials, construction, sealants, accessories, components, leakage, etc. per the most current SMACNA/LEED requirements.

2-4.4.14 HVAC WATER TREATMENT

A. The Contractor shall include a requirement in the specifications that the products proposed by the Contractor must be approved by FACILITIES AND SERVICES FACILITIES AND SERVICES prior to use for water treatment

B. All new chilled water or evaporative cooling systems shall be equipped with water softening and MIOX systems. Systems must also be equipped with capable of communicating with existing BAS (Building Automation System).

2-4.4.15 VARIABLE-AIR-VOLUME CHANGEOVER BYPASS SYSTEM [Spec Section 23 36 19]

A. Provide adjustable frequency drives (AFD's) for various fans.

B. The Aviation Department prefers ABB as a basis of design for adjustable frequency drives. Prior approval must be obtained from the Aviation Department for any other manufacturer.

2-4.4.16

2-4.4.17 HVAC FANS

A. Factory assembled and tested central station type air handling units. Units shall be of fan wall technology/design.

A.1. All fans shall be performance certified, listed and labeled per the current Air Movement and Control Association International, Inc. (AMCA) Standard.

A.1. Specified fan performance curves shall be in accordance with current AMCA standards.

A.2. Sound power level data shall be in accordance with current AMCA Standards.

A.3. Design air handling units with N+1 redundancy. System will deliver design CFM if (1) motor or VFD is disabled.

A.4. Each fan "cube" to have a back draft damper on the inlet of each fan.

A.5. No motors larger than 10 HP

A.7. TEAO motors with permanently sealed, 400,000 hour bearings.

A.8. Each fan/motor assembly shall be dynamically balanced to meet current AMCA standard

A.9. Each fan/motor to have its own micro-VFD.

A.10. Provide an overhead hoist rail when motor mounting plate height is 6 feet or higher

B. Access

B.1. Provide hinged double-skin access doors to all filter sections, mixing box sections and fan sections.

B.2. Specify that door hinges and locking hardware shall be adjustable on both sides of door.

C. Condensate Drain Pans

C.1. Drain pans shall be factory installed in all cooling coil sections. All drain pans shall be coated with Pan Crete or equal to inhibit corrosion. constructed of stainless steel.

D. Water Coils

D.1. Design for coils shall be 6 row with 8 fins per inch (minimum) with a face velocity not exceeding 500 fpm. Water coil capacities, pressure drops, and selection procedures shall be certified in accordance with ARI Standard 410.

D.2. Design and specification for all coils shall be seamless 5/8" O.D. copper tubes, 0.020" minimum tube wall thickness with aluminum plate fins of .008" minimum thickness. All coils shall be constructed with .025" brazed, replaceable return bends.

D.3. Headers shall be constructed of seamless copper.

D.4. Specify that coils shall be cartridge type for slide-out removal.

E. Filter Section

E.1. Designs for the filter section to be factory fabricated as part of air handling unit. Filters shall be arranged for side loading into filter manufacturer's frames. Design consultant shall consult FACILITIES AND SERVICES FACILITIES AND SERVICES for the most current Pre and Final Particulate filter specifications

E.2. The Contractor shall specify equipment configurations which use standard size filters which are readily available. Filter sizes must be reviewed and approved by FACILITIES AND SERVICES FACILITIES AND SERVICES during design.

E.3. Air Purification System - design, performance and installation of an air purification system intended for use as part of another manufacturer's air handling unit or mounted on the duct as shown on the plans, details and equipment schedules shall be Global Plasma Solutions as the Basis for Design.

F. Energy Recovery

F.1. The Contractor shall evaluate the use of Energy Recovery Units including recovery from building exhaust systems for the design of all new building projects. Present recommendations to FACILITIES AND SERVICES FACILITIES AND SERVICES for review and approval before proceeding with design.

G. Smoke Purge of Concourse

G.1. The Aviation Department does not require smoke management above code requirements, however there is a need to have a system which can be used to provide 100% change of air utilizing the HVAC equipment after a smoke event. The Contractor shall review the requirements for this system with FACILITIES AND SERVICES FACILITIES AND SERVICES and Fire Marshal to identify related code requirements for this type of system in order to coordinate and design final system configuration.

2-4.4.18 COMPUTER ROOM AIR CONDITIONERS

A.1. All computer room AC systems shall be designed for 100% redundant capability (N+2) including automatic transfer to backup system when primary system fails.

A.2. All computer room AC systems shall be integrated into the current Building Automation System.

2-4.4.19 AIR-COOLED PACKAGED/SPLIT SYSTEM AIR CONDITIONING/HEAT PUMP EQUIPMENT

A. Approved manufacturers:

- Carrier
- Mitsubishi
- Sanyo

- Trane
- - York

B. Disposable Filter

B.1. Provide 2" deep pleated, disposable filter of current contracted filter specifications medium efficiency in a standard commercial size.

2-4.4.20 HVAC INSULATION (Duct Pipe & Equipment)

A. Specify Rectangular Duct Liner: Meeting ASTM C1071 with air surface coated with acrylic coating treated with EPA-registered anti-microbial agent proven to resist microbial growth as determined by ASTM G21 and G22.

2-4.4.21 COMMON MOTOR REQUIREMENTS FOR PLUMBING EQUIPMENT

A.1. Specify that the circulating pumps for the chilled and condenser water systems be base or vertical mounted pumps and shall be designed in cast iron and bronze fitted construction. The pump internals shall be capable of being serviced without disturbing piping connections or motors. Pump shaft shall be of 416 stainless steel without sleeves. Pumps shall be fitted with replaceable wear rings.

A.2. As designs dictate, pumps shall be either single or double suction. Pumps shall be arranged so that they can be serviced without any removal of the piping system. This shall include any disconnection of piping from the pumps. Pumps shall have the following characteristics:

A.3. Design Maximum Pump Speed: 1,800 RPM.

A.4. Operating Efficiency at design flow rate: Within 5 percent of maximum efficiency.

A.5. Specify pump type: Centrifugal, non-overloading over the entire pump curve.

A.6. Designs for all floor-mounted equipment be placed on reinforced concrete housekeeping pads at least 4 inches high.

B. Impeller

B.1. The impeller shall be of the enclosed type, dynamically balanced and keyed to the stainless steel shaft and secured with a suitable locknut. Use bronze impellers.

C. Seal

C.1. All pumps shall have a cartridge type mechanical seal.

C.2. Condenser pumps shall have a stationary member of silicon with a rotating member of tungsten.

C.3. All other pumps shall have a stationary member of carbon with the rotating member of silicon.

D. Bearing

D.1. The pump bearing frame assembly, as well as the motor, shall be furnished with bearings with readily accessible lubrication fittings and 200,000-hour design rating (minimum).

2-4.4.22 HVAC AIR CLEANING DEVICES

A. Design consultant shall consult FACILITIES AND SERVICES for the most current Pre and Final Particulate filter specifications.

-Ionization Units are acceptable but must be approved by the City.

2-4.4.23 COMMON MOTOR REQUIREMENTS FOR HVAC EQUIPMENT**A. Summary**

- Section includes general requirements for single-phase and polyphase, general-purpose, horizontal, small and medium, squirrel-cage induction motors for use on ac power systems up to 600 V and installed at equipment manufacturer's factory or shipped separately by equipment manufacturer for field installation.

B. General

1. Comply with requirements in this Section except when stricter requirements are specified in HVAC equipment schedules or Sections.
2. Comply with NEMA MG 1 unless otherwise indicated.
3. Motors 3/4 HP and larger, except as otherwise noted shall be designed for 3 phase, 60 hertz power supply.
4. Motors 1/2 HP and smaller, except as otherwise noted, shall be designed for 120 volt, single phase, 60 hertz power supply.

C. Motor Characteristics

1. Duty: Continuous duty at ambient temperature of 104 deg F and at altitude of 3300 feet above sea level.
2. Capacity and Torque Characteristics: Sufficient to start, accelerate, and operate connected loads at designated speeds, at installed altitude and environment, with indicated operating sequence, and without exceeding nameplate ratings or considering service factor.

D. Polyphase Motors

1. Description: NEMA MG 1, Design B, medium induction motor.
2. Efficiency: Premium efficient, as defined in NEMA MG 1.
3. Service Factor: 1.15.
4. Multispeed Motors: Variable torque.
 - For motors with 2:1 speed ratio, consequent pole, single winding.
 - For motors with other than 2:1 speed ratio, separate winding for each speed.
5. Rotor: Random-wound, squirrel cage.
6. Bearings: Regreasable, shielded, antifriction ball bearings suitable for radial and thrust loading.
7. Temperature Rise: Match insulation rating.
8. Insulation: Class F.
9. Code Letter Designation:
 - Motors 15 HP and Larger: NEMA starting Code F or Code G.
 - Motors Smaller than 15 HP: Manufacturer's standard starting characteristic.
10. Enclosure Material: Cast iron for motor frame sizes 324T and larger; rolled steel for motor frame sizes smaller than 324T.

E. Polyphase Motors with Additional Requirements

1. Motors Used with Reduced-Voltage and Multispeed Controllers: Match wiring connection requirements for controller with required motor leads. Provide terminals in motor terminal box, suited to control method.
2. Motors Used with Variable Frequency Controllers:
 - Windings: Copper magnet wire with moisture-resistant insulation varnish, designed and tested to resist transient spikes, high frequencies, and short time rise pulses produced by pulse-width modulated inverters.
 - Premium-Efficient Motors: Class B temperature rise; Class F insulation.
 - Inverter-Duty Motors: Class F temperature rise; Class H insulation.
 - Thermal Protection: Comply with NEMA MG 1 requirements for thermally protected motors.

F. Single-Phase Motors

1. Motors larger than 1/20 hp shall be one of the following, to suit starting torque and requirements of specific motor application:
 - Permanent-split capacitor.
 - Split phase.
 - Capacitor start, inductor run.
 - Capacitor start, capacitor run.
2. Multispeed Motors: Variable-torque, permanent-split-capacitor type.
3. Bearings: Prelubricated, antifriction ball bearings or sleeve bearings suitable for radial and thrust loading.
4. Motors 1/20 HP and Smaller: Shaded-pole type.
5. Thermal Protection: Internal protection to automatically open power supply circuit to motor when winding temperature exceeds a safe value calibrated to temperature rating of motor insulation. Thermal protection device shall automatically reset when motor temperature returns to normal range.

A. Roof Exhaust Fans

A.1. Specify that roof exhaust fans shall be of the centrifugal, belt-driven type. Construction of the fan housing shall be of heavy gauge aluminum.

A.2. The fan wheel shall be all-aluminum of the centrifugal blower type featuring backward inclined blades and a tapered inlet shroud. Wheels shall be statically and dynamically balanced. Inlet cone shall be aluminum and of the centrifugal blower type. Motor and drives shall be enclosed in a weather tight compartment, separate from the exhaust airstreams. Motors shall be of the heavy duty, permanently lubricated, sealed ball bearing type. Drives shall be of the cast iron type, keyed to the fan and motor shafts. Fan shaft shall be of steel construction, turned, ground and polished. Drive belts shall be of the oil-resistant, non-static, non-sparking type with life expectancy of over 24,000 hours. Bearings shall be flanged and of the permanently lubricated, permanently sealed, ball bearing type capable of over 200,000 hours bearing life.

2-4.4.24 AIR TERMINAL UNITS

A.1. Specify relief air fans shall be of the tubular centrifugal type with airfoil wheels. The housing shall be constructed of continuously welded heavy gauge steel to assure no air leakage.

A.2. Specify the wheel shall be of the non-overloading airfoil centrifugal type. Wheels shall be statically and dynamically balanced. The wheel cone and fan inlet cone shall be carefully matched and shall have precise running tolerances for maximum performance and operating efficiency.

A.3. Specify turned, precision ground and polished steel shafts shall be sized so the first critical speed is at least 25% over the maximum operating speed for each pressure class.

A.4. Specify bearings shall be heavy duty, grease-lubricated, self-aligning ball bearing or roller-pillow-block type. Extended lubrication lines shall be provided with external grease fittings. Bearings shall be selected for a minimum average of 200,000 hours' life at maximum operating speed for each pressure class.

A.5. Fan performance shall be based on tests conducted in accordance with AMCA Standard 210 test code for air moving devices, and fans shall be licensed to bear the AMCA Certified Ratings Seal.

2-4.4.25 AIR CURTAINS

A.1. . Unit shall be U.L. listed. Basis of design – subject to compliance with requirements: Berner International, Mars Air Products, Powered Aire, Inc.

A.2. Comply with the current AMCA for airflow, outlet velocity, and power consumption as well as current applicable NSF 37.

A.3. Where required, the electric heater assembly shall be replaceable and have and a built-in selector switch for heater operation.

2-4.4.26 HYDRONIC PIPING SPECIALTIES

A. Designs for hydronic piping will be to furnish a water chilling unit, complete with all controls, wiring, piping, accessories, connection, etc., all mounted on a raised concrete base with vibration isolators. Each unit shall be certified by ARI, in accordance with the latest issue of Standard 550590, current ASHRAE 15, 147, ASHRAE/IESNA 90.1, ASME, and NFPA 70.

B. The Contractor shall present chiller equipment selection recommendations to FACILITIES AND SERVICES for review and approval in advance of final design. Chiller equipment shall meet all required LEED credits. Use Adjustable Frequency Drives on chillers. and primary pumps.

- Use non-ozone depleting refrigerants and/or refrigerants without a current phase out date by the EPA.

C. Specify that compressor motor and auxiliary motors larger than 1/2 HP shall be suitable for operation at 460 volt, 3 phase, 60 hertz power. Controls and auxiliary motors smaller than 1/2 HP shall be suitable for operation at 120 volt, 1 phase, 60 hertz power.

D. Specifications for cooler shall be two-pass. Condenser shall be two-pass End bells and tube sheets shall have a factory applied epoxy coating to reduce galvanic corrosion.

E. Units shall be a complete factory package including a centrifugal compressor motor on a steel sub-base, cooler, condenser, refrigerant flow control devices, and/or transfer unit and refrigerant storage receiver, and control center with related unit mounted controls.

F. The compressor shall be a single-stage centrifugal type powered by an open-drive electric motor.

-Semi-hermetic motors may be acceptable on package units only, but must be approved by the City.

G. Unit lubrication oil shall be force-fed to all bearings, gears and rotating surfaces by an oil pump which operates prior to startup, continuously during operation and during coast-down.

H. Heat Exchangers: Evaporator and condenser shells shall be fabricated from rolled carbon steel plates with fusion welded seams.

I. Safety Controls: The control center shall include safety logic to protect the chiller from any damaging malfunctions.

J. Basis-of-Design: York International Corporation, open drive chiller

L Alternate subject to compliance with requirements:

1. Carrier Corporation
2. McQuay International
3. Trane

M. Variable Frequency Controller

M.1. Controller shall be factory mounted and wired on the chiller

M.2. Cooling: Air, refrigerant, or water cooled. Water cooled units shall be cooled with chilled water using modulating control valve to prevent condensation and hard piped connections.

N. BAS Interface: Factory-installed hardware and software to enable the BAS to monitor, control, and display chiller status and alarms.

N.1. ASHRAE 135 (BACnet) communication interface with the BAS shall enable the BAS operator to remotely control and monitor the chiller from an operator workstation. Control features and monitoring points displayed locally at chiller control panel shall be available through the BAS.

2-4.4.27 COOLING TOWERS

A. Induced-Draft, Cross-Flow Cooling Towers

A.1. Designs will have utilized induced-draft, vertical discharge, cross-flow, two-cell cooling tower that is factory fabricated and assembled.

A.2. Fan: Cast aluminum alloy, propeller type with closely fitted fan cylinder and venturi inlet. Fan cowl shall be covered with a removable fan guard. Fans shall be controlled via variable frequency drive.

A.3. Design for Hot-Water Distribution System: Evenly distributes water over fill material.

A.4. Hot-Water-Basin Control Valves: Manufacturers standard butterfly or globe valves arranged to balance flow to each distribution basin and shut flow off during servicing.

A.5. Materials for casing will be stainless steel.

A.6. Collecting Basin: Type 304 Stainless Steel with removable stainless-steel strainer with openings smaller than nozzle orifices.

A.7. Frame material: Type 304 Stainless Steel

A.8. Fill Material: PVC; resistant to rot, decay, and biological attack; with maximum flame-spread rating index of five according to current ASTM E 84; and fabricated, formed, and installed by manufacturer to ensure that water breaks up into droplets.

A.9. Drift-Eliminator Material: PVC; resistant to rot, decay, and biological attack; with maximum flame-spread index according to ASTM E 84.

A.10. Louver Material: Type 304 Stainless steel.

A.11. Water-Level Control: Electric float switch and solenoid-operated, makeup water valve.

A.12. Presently the cooling tower blow down is not recovered. Methods should be considered to recover, treat and reuse the cooling tower blow down water.

A.13. Basis of Design: Marley Cooling Technologies

A.14. Alternate subject to compliance with requirements

1. Baltimore Aircoil Company
2. Evapco

2-4.4.28 HYDRONIC PIPING

A. General (Subject to American Recovery and Reinvestment Act) All raw materials, pipe, fittings and accessories to be of American origin.

A.1. Designer to utilize schedule 40 black steel, ASTM A53, beaded, 150 psi SWP, malleable iron screwed fittings 2" or smaller; Schedule 40 black steel, beaded, 150 psi SWP, welded long radius fittings for 2-1/2" through 10"; standard weight, ASTM A53, 150 psi SWP, welded long radius fittings for 12" and above.

A.2. Pipes shall not be run through server rooms, electrical rooms, elevator machine rooms, IDF rooms, MDF rooms, etc.

B. Fittings and Accessories

B.1. Designer to specify that unions be: 2-1/2" and larger, 250 psi SWP, black steel forged slip-on or weld neck.

B.2. Globe Valves: 125 psi SWP, all bronze, screwed, 2" and smaller, rising stem, union bonnet.

B.3. Ball Valves: 1/4" through 2", 250# WOG, bronze, buna-n seats and seals, screwed ends.

B.4. Butterfly Valves: Lug type, 150 psi, bubble tight, meehanite or ductile iron body with alignment lugs, aluminum-bronze disc, 304 stainless steel stem with bronze bushings.

B.5. Check Valves: 2" and smaller, 125 psi SWP, bronze body and cap, screwed horizontal lift check with composition disc; 2-1/2" and larger, iron body, aluminum-bronze plates, 316 stainless steel shaft and spring butterfly type Nordel seats.

B.6. Plug Valves: 2" and smaller, 150 psi SWP, semi-steel body, screwed, lubricated tapered plug, 100% port area.

B.7. Strainer: Y-type, 125 psi SWP, gray cast iron, bronze Monel or stainless steel perforations.

B.8. Specify Automatic Air Vents: Cast iron, 125 psi, accessible with manual vent.

C. Specify Flexible Piping Connectors as: Stainless steel braided hose assemblies. Braid shall be terminated with a stainless collar and fully restrain the unit at operating pressures. End connections 2" and smaller shall be threaded, 2-1/2" and larger shall be carbon steel plate flanges. The manufacturer's name shall be affixed to each unit.

D. Expansion Joints and Compensators: Expansion compensators for steel pipe 1/2" through 2-1/2" shall be multiple stainless steel bellows, externally pressurized with carrier in steel shroud, anti-torque limit and stop.

E. Expansion Joints: For steel pipe 3" and larger use Flexonics controlled flexing expansion joints with stainless steel bellows and stainless steel liner, nickel-steel neck and control rings, plate steel flanges.

F. Specify Balance Valves: 2" and smaller, 125 psi, brass screwed, stainless wafer; 2-1/2" and larger, positive shutoff, non-rising stem, integral pointer.

G. Specify Dielectric Nipples or Couplings: Provide dielectric nipples or couplings at all points where copper or brass pipe or equipment is joined to ferrous pipe and equipment.

H. Pipe Unions or Flanges

Designs must facilitate easy removal for servicing, unions or flanges shall be provided on both the inlets and the outlets of all apparatus, isolation valves, control valves, and accessories.

Wherever two pipes made of dissimilar metals are connected, a dielectric union shall be used to isolate the two pipes from each other. Dielectric unions and flanges may also be required for cathodic protection.

I. Valves

Designs must provide that isolation valves be provided on both sides of such apparatus as chillers, pumps, heating coils, control valves, multiple installations, and piping branches. The installation of all valves shall be designed to give a neat appearance and provide easy grouping with all parts accessible for operation and maintenance. Valve stems shall be horizontal wherever possible.

J. Piping Accessories

Designs must assure the trouble free operation of all piping systems, specified units will include all required piping accessories. These accessories should include strainers, vent cocks, dirt-and-drip legs with drain-and-flush connections, expansion tanks, liquid flow indicators, balancing cocks, relief valves, pressure and temperature gauges, etc. All piping accessories requiring maintenance or replacement of parts shall be installed in accessible places. All dials of gauges and indicators shall be of sufficient size and arranged to be easily seen and read.

K. Chilled Water Sub metering

Sub metering of chilled water is desired for operational and maintenance use but would not be used for the billing of tenants based on consumption.

L. Pipe Expansion Joints

Designs using pipe expansion joints shall be avoided wherever possible. Pipe systems shall be arranged to have sufficient offsets and expansion loops to accommodate thermal expansion and vibration. Pipe expansion joints may be used only where pipe expansion loops are impractical. All such expansion joints shall be of stainless steel or Monel metal. They shall be the double-compensating type with an anchor at the middle. These shall be guided on both sides in strict accordance with the manufacturer's recommendation. All expansion joints shall be flanged to facilitate easy and quick replacement.

M. Flexible Pipe Connectors

Specified use of flexible pipe connectors to connect piping to heating and cooling apparatus shall be restricted to cases where providing piping offsets for flexibility is impractical. Where flexible pipe connectors are used, such as on resiliently mounted air-handling units and pumps, these flexible pipe connectors shall be of stainless steel or Monel construction with flanged ends for quick and easy dismantling from the pipe systems. They shall be of sufficient length to provide an overall stiffness less than the resilient mounts used for supporting the apparatus.

N. Pipe Supports, Hangers, Guides, and Anchors

Pipe supports, hangers, guides, and anchors shall be designed to assure proper alignment of all pipes for operating conditions. The forces caused by the motion of the fluid; the weight of the fluid, piping, valves and insulation and thermal expansion/contraction shall be considered as appropriate. All hangers and supports shall be so arranged as to prevent the transmission of vibration from the piping to the structure. Anchors and guides shall be designed to allow pipes to expand and contract without a build-up of excessive stress. Pipe rollers shall be used with all hangers where pipe movement due to expansion or contraction exceeds 0.5 inch. Spring hangers of constant or variable load types, as the case requires shall be used when piping is connected to vibrating equipment and where supporting vertical pipes.

O. Drain System

No mechanical equipment drain shall be connected directly into any drain system. Indirect drain connectors with an air gap shall be used. Oil separators shall be installed where required by code.

2-4.4.29 AIR-COOLED REFRIGERANT CONDENSERS

A. Piping

Schedule 40 galvanized steel pipe conforming to ASTM A-120 or Type M copper.

Pipes shall not be run through server rooms, electrical rooms, elevator machine rooms, IDF rooms, MDF rooms, etc.

B. Fittings

Same as piping.

C. Unions

Specify 150 psi galvanized forged steel with bronze-to-steel seat, bronze unions if copper is specified.

2-4.4.30 Boilers

A. High efficiency boilers shall be used.

2-4.4.31 HEATING WATER PIPING

A. Pipes shall not be run through server rooms, electrical rooms, elevator machine rooms, IDF rooms, MDF rooms, etc.

2-4.4.32 AIR DUCT ACCESSORIES [Spec Sect 23 33 00]

A. Fire Dampers

A.1. Designs for fire dampers shall be provided in ducts which pass through fire-rated floors, walls, and barriers. All fire dampers shall be Underwriters Laboratories, Inc. (UL) listed.

A.2. Each combination fire smoke damper shall be 1-1/2-hour fire rated under UL Standard 555, and shall further be classified by Underwriters Laboratories as a Leakage Rated Damper for use in smoke control systems under the latest version of UL555S, and bear a UL label attesting to same.

A.3. As part of the UL qualification, dampers shall have demonstrated a capacity to operate (to open and close) under HVAC system operating conditions, with pressures of at least 4" w.c. in the closed position, and 4000 fpm air velocity in the open position.

A.4. Designer to specify that in addition to the leakage ratings already specified herein, the dampers and their actuators shall be qualified under UL555S to an elevated temperature of 450°F. Electric actuators (two position) shall be installed by the damper manufacturer at time of damper fabrication. Damper and actuator shall be supplied as a single entity which meets all applicable UL 555 and UL555S qualifications for both dampers and actuators. Actuators are to be 24Volt and controlled by the fire alarm system as approved by the Facilities department.

A.5. Fusible Link: Each combination fire smoke damper shall be equipped with a fusible link which shall melt at 165°F causing damper to close and lock in a closed position.

B. Back Draft and Relief Dampers

Designer must utilize back draft or motorized shutoff dampers on exhaust fans where more than a single fan discharges into a common exhaust. Weighted relief dampers shall be used in exhaust ducts and openings where a positive pressure is required to be maintained by a forced air supply and relief exhaust. All back draft and relief dampers shall be the multi-bladed gravity type with neoprene cushioning on blade edges.

C. Turning Vanes

All elbows shall have a full centerline radius at least 1.5 times the width of the duct. Where full-radius curves are not feasible, elbows shall be provided with turning vanes. All turning vanes shall be the double radius type.

D. Access Doors

Specify that access doors shall be provided in ducts and plenums to service fans, dampers, fire dampers, turning vanes, coils, filters, etc. Access doors in plenums shall be hinged and furnished with latches operable from both inside and outside, and door edges shall rest against neoprene gaskets to form an airtight enclosure. Duct access doors shall rest against felt or neoprene gaskets and shall be hinged or fastened by toggle tabs or wing nuts. Access doors in insulated ducts and plenums shall be insulated using sheet metal-insulation-sheet metal construction.

E. Volume Dampers

Designer to use adjustable, opposed-blade volume dampers for all branch ducts serving multiple outlets. All dampers shall be equipped with locking quadrants with blades sufficiently stiffened at the edges to effectively close off the duct. Under all conditions of operation, they shall be free from vibration.

F. Splitter Dampers

Splitter dampers shall be used in multiple duct fittings for initial balancing in place of individual opposed-blade volume dampers in each branch of the multiple duct fitting. These splitters should be adjustable through locking quadrants and shall be single-bladed. The blades shall have edges sufficiently stiffened to avoid vibration under all conditions of operation.

G. Sound Attenuation

Presently there are sound attenuators installed in the return air duct. Attenuators shall be installed where requested by FACILITIES AND SERVICES to maintain a minimum noise criteria level in the airport to 40dB. The presence of sound attenuators in the return air duct is not desirable. These should be used only where absolutely necessary and as approved by Facilities.

2-4.4.33 HVAC AIR DISTRIBUTION

A. Mixing Units

Each unit shall be pressure independent type, variable air volume and be depicted with the drawings. The entire control assembly shall be constructed of a minimum of 22-gauge galvanized steel. Various configurations of VAV terminal boxes (i.e. series fan powered, parallel fan powered, single terminal, etc) presently are installed at the facility. There is no preference to the particular type of VAV terminal unit to be used. VAV shall be accessible based on manufacturer's installation requirements. Units shall be single duct as scheduled.

The casing shall be of double shell construction meeting SMACNA standards with sandwiched "foamed in place" insulation. Terminals shall be complete with factory furnished system powered actuators, controls, and thermostats.

B. Attenuator

Specify each terminal box shall be provided with a sound attenuation section 1" thick, 1-1/2" pounds per cubic foot internal acoustical-thermal insulation meeting NFPA 90A requirements.

C. Control Device

Specify for assemblies to be pressure independent, suitable for resetting to any airflow between zero and 25% higher than maximum CFM indicated on the drawings and setting minimum CFM.

D. Static Pressure Limits

Specify the differential static pressure of the complete assembly or combined assemblies shall not exceed 0.75" WG for all sizes with inlet velocities of 2,500 fpm or less.

E. Control Motors

Specify that control units to be complete with factory-mounted electronic DDC control motor, suitably sized for proper operation.

F. Electric Heating Coil

Electric heating coils will deliver the specified performance of heating capacity and be furnished with the terminal boxes. Coils shall be UL approved. Heating coils must be removable for repair/replacement.

2-4.4.34 AIR DUCT ACCESSORIES

A. Airflow Measuring Probes

A.1. Designer to provide electronic airflow measuring probes capable of sensing the fan or duct air volume and producing a continuous 4 to 20 mA DC electronic signal, linear and scaled to air volume.

A.2. Probes to have 316 S.S. probe body with solid Kynar sensor assembly, sensor housing, and flow and temperature sensors, manually adjustable.

2-4.4.35 INSTRUMENTATION AND CONTROL FOR HVAC

A. The building automation system will be provided for HVAC. The BAS system shall be a complete stand-alone building automation system, modular in construction and not requiring a central computer or Network Controller for operation or programming. All programming shall be possible from a keypad/display on any field panel or from a remote computer.

A.1. The basic elements of the BAS structure shall be built up of only standard components kept in inventory by the BAS supplier.

A.2. The system shall be a true distributed processing system.

A.3. The BAS system shall utilize only 1 software package, which will have the capability of programming the entire range of controllers.

A.4. The BAS shall possess a fully modular architecture, permitting expansion through the addition of more DDCP units, sensors, actuators, and operator terminals. Expansion beyond this must be able to be done in additional panels or expansion modules without abandoning any initial equipment.

A.5. Distributed Processing: Each DDCP shall be capable of performing all specified control functions in a completely independent manner. No pneumatic devices are to be used (i.e. valve or damper actuators, thermostats, etc.). Only electric actuators are to be used.

B. Networking: All controllers shall reside on a single tier network.

C. Each DDCP unit shall be capable of sharing point information with other such units, such that control sequences or control loops executed at one control unit may receive input signals from sensors connected to other units within the network. Provide a minimum of 20% spare point capacity in all new BAS system panels.

D. Current design basis is Johnson Controls Metasys or Alerton but the Contractor shall provide recommendations to FACILITIES AND SERVICES for review and approval before design.

E. All BAS wiring must be concealed in conduit. Conduit shall be "white" in color 1" rigid minimum.

2-4.4.36 COMMISSIONING OF HVAC

Commissioning is a systematic process of ensuring that all building systems perform interactively according to the design intent and the Airport's operational needs. The commissioning process shall encompass and coordinate the system documentation, equipment startup, control system calibration, testing and balancing, performance testing and training. Commissioning shall be performed per the contract documents or per the current ASHRAE HVAC Commissioning Guidelines and/or LEED NC.

2-4.4.37 TESTING, ADJUSTING AND BALANCING FOR HVAC

The designer will assure the environmental systems including all equipment, apparatus and distribution systems shall be tested, balanced and adjusted in accordance with the Associated Air Balance Council (AABC) and National Environmental Balancing Bureau (NEBB) Procedural Standards for Testing, Balancing and Adjusting of Environmental Systems. Balancing agency shall be independent of Mechanical Contractor.-The specifications must assure the quality of air delivered by the various air handling systems shall be verified by measurements that satisfy the recommendations given in the most current ANSI/ASHRAE National Standard 62-1999, Ventilation for Acceptable Indoor Air Quality.

2-4.5 Plumbing**2-4.5.1 GENERAL DESIGN CONSIDERATIONS**

The Aviation Department prohibits the installation of plumbing hardware in all rooms containing electrical and computer equipment or hardware. The Contractor shall take this requirement into account during the early phases of project design to avoid conflicts between the location of restrooms and food preparation areas with electrical and communications rooms below.

All retail, food and beverage shall have dedicated waste lines with isolated grease traps, all to tie into common use main waste lines. All retail, food and beverage shall have isolation valves for domestic water.

2-4.5.2 JANITOR CLOSETS

- A.** All facilities shall be designed with at least one janitor's closet located adjacent to the restrooms per floor, equipped with mop sink, splash guard, shelving, and any other fixtures as required by the PM. The minimum size of the closet shall be 30 square feet.
- B.** Details for the floor surrounding mop sinks shall be epoxy coated (min 12" return on walls). 4' high stainless steel (S.S.) backsplashes shall be provided on any walls adjacent to mop sinks and extend 12" past the edge of mop sink and all the way down to the floor. Mop sink drains screens shall be equipped with tamper proof screws.
- C.** Specify mop sinks constructed of stainless steel must be used. Mop sinks constructed of fiberglass are not allowed.
- D.** Specify aerator on mop sinks to prevent splashing on walls.
- E.** Floor drains shall be provided in all janitor closets to handle spills.

2-4.5.3 COMMON WORK RESULTS FOR PLUMBING

2-4.5.4 SANITARY WASTE AND VENT SYSTEM

- A.** Designer must assure that the minimum sanitary waste collection line be 4", with adequate access port.
- B.** Waste lines shall be epoxy coated cast iron
- C.** Pipes shall not be run through server rooms, electrical rooms, IDF rooms, MDF rooms, add or above etc.
- D.** Vent lines shall be stainless steel.
- E.** No hub bands shall be 4 clamp hub type.
- F.** For cleanouts please consult FACILITIES AND SERVICES for additional locations for ease of maintenance.

2-4.5.5 FACILITY STORM DRAINAGE

- A.** Piping-no roof or storm drains shall exhaust across pedestrian walkways of landings.
 - A.1.** Specify bell and spigot cast iron, conforming to ASTM A-74-66.
 - A.2.** No-hub cast iron, conforming to CISPI #301. If used for downspouts in columns, wrap with 1" fiberglass.
 - A.3.** Specify drain piping in columns be copper conforming to ASTM B306-81. All drain piping in columns shall be wrapped with 10 mil polyethylene tape, half-lapped to form 20 mil. At pipe penetrations into column, place a 6" x 6" x 3/4" section of bridge bearing neoprene between downspout and concrete.
 - A.4.** Pipes shall not be run through or over server rooms, electrical rooms, IDF rooms, MDF rooms, etc.
- B.** Fittings
 - B.1.** Specify bell and spigot cast iron drainage pattern fittings conforming to ASTM A-74-66.
 - B.2.** No-hub cast iron drainage pattern fittings conforming to CISPI #301.
 - B.3.** Specify cast and wrought DWV copper fittings conforming to ANSI B16.23-69 and B16.29-66.
- C.** No-Hub Couplings
 - C.1.** Specify double band stainless steel couplings with neoprene liner conforming to CISPI 301-72.
- D.** Pitch Roof Drain Leaders
 - D.1.** Pitch roof drain leaders at a uniform slope of 1/4" per foot unless noted otherwise.

2-4.5.6 FACILITY WATER DISTRIBUTION

- A.** Backflow Prevention
 - A.1.** All backflow prevention devices shall be reviewed by Airport Facilities. The Aviation Department has a basis of design established for backflow prevention devices. Prior approval must be obtained from the Aviation Department for the use of this product.
 - A.2.** Tenants are required to install backflow prevention devices on their incoming domestic water supply.
 - A.3.** Provide backflow protection at irrigation, potable water cabinets, and tenant subsystems.
 - A.4.** All backflow prevention devices must be accessible for COP yearly inspection.
 - A.5.** Backflow prevention devices should be selected with ease of maintenance in mind.

A.6. Single check backflow prevention devices must be utilized on domestic water supply to janitorial closets. Device must be installed in closet and visible for inspection rather than in a remote location.

A.7. Designs will provide redundant double check assembly backflow protection at service entrances so that one may be serviced without having to shut off entire building water supply.

A.8. Buildings must maintain a constant water pressure of 70 psi. N + 1 Booster pumps systems must be added as required to maintain this pressure condition.

B. Domestic Water Heaters

B.1. Specify tanks rated at 150 psi working pressure and equipped with dual extruded high density anodes. All internal surfaces of the heater exposed to water shall be glass-lined with an alkaline borosilicate composition that has been fused to steel. Electric heating elements shall be medium watt density screw-in type with Incoloy sheath and ceramic terminal block. Internal power circuit fusing shall be provided. Element operation shall be sequenced with thermostats switched through individual magnetic contactors.

B.2. Tanks should be installed on a stand to elevate the base above the floor to avoid sitting in water accumulated from other sources.

B.3. Tankless water heaters and solar heating should be considered as an option to minimize over sizing of domestic heating water system and to minimize energy consumption.

C. Piping

C.1. Designs for all piping systems shall be designed to meet the requirements of American National Standards Institute (ANSI) B.31 (all applicable sections). All pipe fittings, flanges, valves, and accessories shall comply with ANSI B16 (all applicable sections for dimensional requirements). All piping systems shall be designed and arranged for neat appearance. They shall be properly sloped for drainage and venting, and properly supported, guided, and anchored to provide complete flexibility and to maintain the integrity of all systems without any damage or leaks under all operating conditions. All valves and accessories shall be installed in a systematic manner in places accessible for operation without the use of chains or additional operating platforms. Sleeves and escutcheons shall be provided wherever pipes pass through walls. Flush valves for water closets and urinals should be those standard to City owned buildings in order to keep inventories at a minimum. Flush valve on all disabled access water closets are to be on the wide side of the stall.

C.2. Specify Type "L" hard drawn copper, conforming to ASTM B88, for all water pipe not set in or under concrete or in the ground.

C.3. Color identify all copper piping with size of pipe, manufacturer's trademark, and conform to the following schedule:

- Type "L" Copper Blue

C.4. Designs must assure that pipes shall not be run through server rooms, electrical rooms, elevator machine room, IDF rooms, MDF rooms, etc. The installation of DWV or water lines run above sensitive equipment will not be allowed.

D. Fittings

D.1. Provide wrought copper type fittings conforming to ANSI A40.2 for all connections to copper piping.

E. Shutoff Valves

E.1. Specify valves 2-1/2" and smaller: full port, three-piece ball valve. Valves to be bronze with TFE seats.

E.2. Specify valves 3" and larger: split body, flanged, full port ball valve. Body shall be ductile iron. Valves shall be rated and factory tested for 150 pounds bubble tight operating pressure. Ductile iron with stainless steel seats.

E.3. Provide isolation valves for each bank of fixtures to allow service on one area without closing entire restroom. Valve location needs to be standardized.

2-4.5.7 PLUMBING FIXTURES

A. General:

A.1. Specify all restroom and fixtures must comply with ADA requirements

A.2. Hands free fixtures will be used for lavatories and urinals; the Contractor should consider hard wiring on standby power. The use of disposable batteries is discouraged. Review final configuration with FACILITIES AND SERVICES.

A.3. Waterless fixtures will not be accepted

A.4. Low flow fixtures are required

A.5. All plumbing fixtures must be reviewed and approved by FACILITIES AND SERVICES in advance of specification.

B. WC-1 & WC-1A Water Closet:

B.1. Minimum access between back of fixture shall be 8 inches to allow for cleaning and mopping.

B.2. Designs must use wall mounted fixtures throughout. Avoid locations where dirt and trash can accumulate

B.3. Water closets should be able to accommodate larger users.

B.4. Presently some fixtures utilize dual flush technology. Consider the use of this technology on all projects.

B.5. Fixture: 1.5 GPF, vitreous china, siphon jet action, elongated bowl, floor mounted, 1-1/2" I (most current water efficient valve and china) back spud. WC-1A at handicapped height.

B.6. In wheelchair accessible stalls, the water closet should be located farthest from the stall door and/or closest to the permanent wall to allow for turn-around space.

B.7. Specified Flush Valve: concealed closet flush valve, equipped with solenoid operator, sensor (long range) and override button, four tamper-proof screws, stainless steel wall cover plate (for two-gang electrical box), non-hold-open feature, screwdriver angle stop, adjustable tailpiece, vacuum breaker, elbow flush connection and spud coupling for 1-1/2" concealed back spud. Hard wired not battery operated.

C. Designs for UR-1 Urinal:

C.1. Fixture: 1.0 GPF, vitreous china wash-out urinal with 3/4" back spud, 2" outlet threaded inside.

C.2. Specified Flush Valve: one GPF flush valve, rough brass, for either left or right hand supply, equipped with solenoid operator, sensor, 4 tamper-proof screws and stainless steel wall cover plate (for two-gang electrical box), non-hold-open feature, 3/4" IPS wheel handle angle stop, adjustable tailpiece, vacuum breaker, elbow flush connection and spud coupling for 3/4" concealed back spud.

D. Design for LAV-1 Lavatory:

D.1. Fixture: vitreous china lavatory with dual front overflows and drilled for concealed chair support and a single hole in the deck for supply fitting.

D.2. Specify Supply Fitting: electronic sensor operated, solid brass construction, chrome-plated, equipped with infrared sensor, 6 VDC lithium battery and 1/2 gpm flow capacity. Furnish 1/2" x 3/8" angle stops with brass stems and chrome-plated flexible risers for connection to solenoid. Hard wired not battery operated

D.3. External timing adjustment: Design with Bradley TMA thermostatic mixing valve for each plumbing chase except where the number of lavatories served by a chase exceeds six, in which case furnish one thermostatic mixing valve for a maximum of six lavatories. Furnish two stop, strainer, and check valves with each mixing valve.

D.4. Drain Fitting: grid drain with 1-1/4" tailpiece, chrome finish.

D.5. Specify Supply: 1/2" x 3/8" angle stops with flexible tube risers.

D.6. Trap: McGuire (or equal approved by FACILITIES AND SERVICES) adjustable cast brass P-trap, 1-1/4" inlet, 1-1/2" outlet, escutcheon, chrome finish. Fitted with trap guard for odor control.

E. Designs for LAV-1A Lavatory:

E.1. Fixture: wheelchair lavatory, vitreous china, single-hole punch, front overflow, for concealed arm support. Lavatories shall be wall mounted, with four-inch centers, commercial style or equal, with self-closing valves. Lavatories and showers in public facilities shall be equipped with devices which limit the outlet temperature to a maximum of 105°F. Three-way tempering valves shall be used to maintain outlet temperature.

E.2. Supply Fitting, Trap & Grid Drain: Same as LAV-1.

F. SS-1 Service Sink:

F.1. Fixture: formed stainless steel, 3" outlet with stainless steel dome strainer and lint basket. Use tamper proof screws on strainer.

F.2. Supply Fitting: double faucet with bucket hook, hose end, vacuum breaker, stops in shanks and wall brace.

G. Designs for EWC-1 Drinking Fountain:

G.1. Specify Fixtures: two level stainless steel wall mounted drinking fountain furnished with safety bubbler, flow regulator to maintain constant stream during inlet pressures varying from 20-100 psi, vandal-resistant bottom cover plate, domed strainer, stainless steel wall plate, front push bar and copper water lines with dielectric connection to stainless steel. Furnish 24" x 24" rear access plate. At FACILITIES AND SERVICES request bottle fillers where indicated.

G.2. Bottle Filling Stations - Preference is to co-locate with other drinking fountain, at a minimum wall mounted; preference is in-wall recessed or semi-flush, chilled, hand-free operation preferred. The construction is to be stainless steel with full hinge door for easy access and servicing. Units must be ADA compliant.

G.3. The Aviation Department prefers semi-recessed drinking fountain installation. The Contractor is cautioned to fully resolve ADA requirements for units including projection into the circulation area along walls whenever applicable.

G.4. Remote Water Chiller: air-cooled, hermetically-sealed compressor capable of providing 5.7 GPH of 50°F chilled water with an inlet water temperature of 80°F when chiller is located in a 90°F ambient space.

G.5. Supplies: Chrome-plated loose key stop with stuffing box.

G.6. Trap: cast bronze ground joint swivel P-trap, 1-1/4" x 1-1/4".

H. SK-1 Sink:

H.1. Specify Fixture: single bowl, stainless steel, 21" x 16" x 8" deep bowl, two faucet holes.

H.2. Supply Fitting: side valve, 10" high spout and E3 aerator. 2 gpm at 80 psi.

H.3. Specify Drain Fitting: 3-1/2" drain outlet. Heavy gauge stainless steel body and strainer.

H.4. Supplies: 1/2" x 3/8" angle stops with tube risers.

H.5. Specify Trap: adjustable cast brass P-trap, 1-1/2" inlet, 2" outlet, escutcheon, chrome finish.

I. Specify SK-2 Sink:

I.1. Fixture: double bowl, stainless steel, 14" x 16" x 8" deep (each bowl), two faucet holes.

I.2. Supply Fitting: side valve, 10" high spout and E3 aerator. 2 gpm at 80 psi.

I.3. Specify Drain Fitting: 3-1/2" drain outlet. Heavy gauge stainless steel body and strainer. In-Sink-Erator Badger 5, food waste disposer, 1/2 HP at 120 volt, 1 phase.

I.4. Supplies: 1/2" x 3/8" angle stops with tube risers.

I.5. Trap: adjustable cast brass P-trap, 1-1/2" inlet, 2" outlet, escutcheon, chrome finish.

J. SH-1 Shower:

J.1. Fixture: alcove shower base with PVC shower drain and stainless steel drain plate.

J.2. Specify Supply Fitting: pressure balancing valve with maximum temperature limit stop, single handle control, shower head with arm and escutcheon.

K. Design for SH-1A Shower:

K.1. Supply Fitting: pressure balancing valve with maximum temperature limit stop, single handle control, deluxe hand-held head with chrome-plate hose and sliding wall bar. Shower layout and hardware must be fully ADA compliant.

K.2. Drain Fitting: floor drain with round or square 6" strainer.

2-4.5.8 PLUMBING INSULATION

A. Specify Material: two-piece, heavy density, pre-molded fiberglass insulation with maximum K factor of 0.24 at 75°F mean temperature, minimum 3.75-pound density. Insulation shall have factory pre-sized all service jackets with white finish suitable for finished painting.

B. Specify insulation wall thickness shall conform to the following schedule

B.1. Insulation for hot water supply lines:

- Mains and Horizontal Branches - 1" thickness.
- Drops in Walls and Partitions: 1/2" thickness.

B.2. Insulation for horizontal cold water: 1" thickness.

B.3. Horizontal roof drain leaders and roof drain bodies above grade and inside the building: 1" thickness.

B.4. Insulation for all piping within columns: 1" thickness.

B.5. Condensate Piping: 1" thickness.

2-4.5.9 GREASE INTERCEPTORS

A. For existing terminal facilities, tenants are required to supply and maintain dedicated grease interceptors. Refer to SECTION III: Chapter 3 for additional information.

B. For new terminal facilities, the Aviation Department prefers to provide dedicated grease interceptors for tenants use to control location, access for service and minimizing disruption to closure pavement around terminal. Grease interceptors shall be sized to require service approximately monthly. Dedicated service lines from concession to city drop.

C. Contractor should present design methodology to P.M. ~~FACILITIES AND SERVICES~~ ~~FACILITIES AND SERVICES~~ for review and approval. Do not locate grease interceptor near fresh air intake openings.

2-4.5.10 OIL SEPARATORS

- TBD

2-4.5.11 RESTROOM PLUMBING CHASES

A.1. Designs for plumbing chases must be a 36" minimum clearance wall to wall for new construction projects and 30" wall to wall clearance for renovation projects for chase clearances. 6'-8" head clearance in chases is required. 2'-6"x6'-8" access door into chase is required.

A.2. Specify a minimum of one floor drain in each chase area to dispose of water accumulation from occasional leaks. Larger chases may require additional floor drains.

A.3. A hose bib in each chase location shall be installed for jetting purposes.

B. Designs for conduit and electrical runs must not run through chases in a way which restricts access into or to any of the piping, equipment, etc. located in the chase. Arrange all piping and except for Chase lighting and Jetter-outlet instruct electrician to arrange all conduit and wiring to provide clearance for removal of access doors on equipment and locate valves and unions in piping to allow service with no dismantling and inconvenience. Arrange all piping and conduit installed as close to walls as possible. Vent lines should be installed at least 4' high. Except for chase lighting and e

B.1. No insulation in plumbing chase walls is allowed as it may cause deterioration of insulation due to moisture and interference with accessing pipes, shut off valves, cleanouts, etc. Provide other means of acoustic isolation such as double layer GWB.

2-4.5.12 SEWAGE EJECTORS (INTERIOR BUILDING AND STRUCTURES APPLICATION)

A.1. Submersible pumps will not be allowed. All pumps shall be located outside of the pit.

A.2. Redundancy of N+1 shall be provided for the pumps.

A.3. Pumps and pits shall be sized for future capacity.

Design shall permit ease of access for maintenance activities – vactor trucks, hoses, cleaning, etc.

2-4.5.13 SUMP PUMPS (INTERIOR BUILDING AND STRUCTURES FOR STORM DRAINAGE APPLICATION)

A.1. Submersible pumps are not allowed. All pumps shall be located outside of the pit.

A.2. Redundancy of 2x shall be provided for the pumps.

A.3. Pumps and pits shall be sized for future capacity.

Design shall permit ease of access for maintenance activities – vactor trucks, hoses, cleaning, etc.

2-4.5.14 ROOF DRAINS

- TBD

2-4.5.15 FLOOR DRAINS

- A. Specify floor drain branches be a minimum 3" pipe size.
- B. Trash compactor areas shall be provided with floor drains to allow draining of liquids to lighten the load.

2-4.5.16 CLEANOUTS

- A. Design clean outs with a ninety-degree sweep installed in the waste line manifold behind each urinal are required.
- B. Two-way bull horn cleanouts must be specified and shall be installed in fully accessible locations at a maximum spacing of 50 feet.

2-4.6 Utility Meters**2-4.6.1 UTILITY METERS**

The building designer shall make provision for monitoring consumption of electrical, water and natural gas utilities by tenants. Monitoring of utility consumption shall be accomplished with computer network-capable sub-meters. Consumption metering will not be used for billing purposes but is required by FACILITIES AND SERVICES Facilities and Services to analyze the level of adjustment which may be required from time to time in lease rates, or building modifications.

2-5.6.2 WATER SUB-METERS

Water sub meters shall be installed on all large water loads where a city water meter is not present. Examples of large water loads are: landscape irrigation, cooling towers and evaporative coolers with common supply line. Additionally, domestic water lines connecting piping chases associated with areas such as dual restroom locations (Men & Women, back to back) shall be sub-metered.

2-4.6.2 NATURAL GAS METER INSTALLATION

The Aviation Department currently has a limited natural gas service. All future projects should investigate the feasibility of acquiring additional natural gas for use in food preparation and other cost effective applications.

2-4.7 Fire Suppression Systems**2-4.7.1 INTROUCTION**

- A. This section will describe the general application of materials and systems related to fire protection in general airport building construction and will be completed in the next draft. The codes and standards dealing with this section are referenced in Section I: Policies, Chapter 6.

2-4.7.2 SCOPE All raw materials, pipe, fittings and accessories to be of American origin**2-4.7.3 AUTOMATIC SPRINKLERS**

2-4.7.4 STANDPIPES

2-4.7.5 FIRE EXTINGUISHERS

2-4.8 Special Provisions for the Sky Train System

2-4.8.1 INTRODUCTION

A. The provision of this section are applicable to all projects which extend or may interface with the Sky Train System including all new terminal facilities and renovations to existing facilities served by the Sky Train.

B. This section describes the Fire/Life Safety (FLS) criteria of the project as it is applied to stations, guide ways, and the maintenance facility. The criteria presented are predominantly based on the application of the International Building Code, 2006 Edition with City of Phoenix amendments and NFPA 130, Most recent adopted code.-Edition Fixed Guideway Transit and Passenger Rail Systems. Because the referenced NFPA code has not yet been formally adopted, it is expected that the City will require that a Code Modification will be submitted and approved prior to the beginning of design.

2-4.8.2 OBJECTIVE

A. In the development of the project, the provision of safe and reliable movement of the Aviation Department patrons is of primary consideration. The patrons must perceive the System as safe and secure, if the System is to be successful. It is the objective of the Fire, Life and Safety Program (FLSP) to achieve this goal.

2-4.8.3 POLICY

A. Build to current code

2-4.8.4 SCOPE

A. General

B. Performance Requirements

B.1. Design and install a complete automatic wet fire sprinkler system as required by national and local codes that meets the requirements of the authority having jurisdiction. Systems shall be full and complete with all components specified for each area protected. The system shall be in accordance with current applicable City of Phoenix Fire code and all applicable NFPA standards.-NFPA Standards:

- NFPA 13
- NFPA 25
- NFPA 415
- NFPA 15
- Refer to other NFPA standards that are applicable

C. Piping All piping to have a corrosion resistance ratio greater than or equal to 1.0.

C.1. Sprinkler Drain System: Floor drain shall be properly sized and located to accommodate quantity of water contained in sprinkler piping.

D. Sprinkler Heads

D.1. All heads shall be UL listed and FM approved.

D.2. Specify sprinkler heads using approved upright, pendent, spray type, chrome plated bronze, of proper degree ratings as required, installed where indicated and in conformity to NFPA.

D.3. Semi-recessed sprinklers are to be used in areas with finished ceilings.

D.4. Exterior glazing spray nozzles shall be used on swing arms and shall be Viking Model “M” with high temperature bulb.

D.5. Recessed sprinklers are not allowed.

D.6. Flexible sprinkler heads are not allowed.

E. Valves

E.1. Valves shall be located in several central locations, i.e. fire stairs.

E.2. Control Valves: 2" and Smaller: Design shall include “Zone-Check” type control valves for all tenant spaces.

- OS&Y gate type, threaded bronze, 175 psi WWP, similar to Walworth #873.
- Water type bronze ball valve with Teflon seats and lever handle, 175 psi WWP, similar to Worcester Miser fire valve.

E.3. Control Valves: 2-1/2" and Larger (except as noted):

Specify flanged IBM, OS&Y type, 175 psi WWP, similar to Walworth 871EF or tight-closing, rubber seated cast iron water type butterfly valve, 175 psi WWP with stainless steel shaft, lifetime bearings, high resist disc, and crank actuated operator with position indicator, similar to Pratt #1BV.

- Angle and globe type for sprinklers drain, testing. Threaded bronze, similar to Walworth #58 and #59.

E.4. Specify Check Valves: 2" and Smaller: Threaded bronze, 175 psi WWP, similar to Walworth #406.

E.5. Specify Check Valves: 2-1/2" and Larger (except as noted): Flanged IBBM, 175 psi WWP, similar to Walworth 8883F.

F. FIRE PUMPS

F.1. Split case fire pumps are not allowed. Use open drive fire pumps only.

F.2. Fire pumps shall be electric not engine driven.

F.3. Fire pumps shall have an “OFF-AUTO” keyed switch in the controller.

F.4. Presently there is no level of redundancy for the fire pumps (i.e. one fire pump serves all eight concourses). Designers must consider installing a redundant pump or installing localized redundant pumps at each concourse.

F.5. Flow switch timing has been problematic due to the remoteness of the most remote switch in the system and the sensitivity setting of the switches at varying distances from the pump discharge. Localized fire pumps at each concourse would reduce this problem.

G. CLEAN AGENT SYSTEMS

G.1. Exhaust purge system shall be used to remove discharged clean agent from the space. HVAC unit shall provide supply air to make up the purged exhaust air from the space.

G.2. Prior approval must be obtained from the Aviation Department for any clean agent system product.

H. PREACTION SPRINKLER SYSTEMS

H.1. Prior approval must be obtained from the Aviation Department for the use of any preaction sprinkler system product.

I. EMERGENCY GENERATOR

I.1. The following dry contacts will be monitored by the Building Fire Alarm System and FACILITIES AND SERVICES

- ON-OFF-AUTO (know when not in the AUTO position)
- Low Fuel
- Battery Fault
- Generator Fault
- Generator Run
- ATS (automatic transfer switch) in emergency position

2-5 Electrical [Division 26]

2-5.1 Codes, Regulations and Standards

Refer to SECTION I: Chapter 6 for applicable codes, regulations and standards.

2-5.2 Terms, Definitions and Abbreviations

Refer to SECTION IV: APPENDIX B

2-5.3 General Provisions

2-5.3.1 This section of the specifications outlines the provisions of the electrical design work to be performed under this Division.

2-5.3.2 As a minimum, all designs must be in compliance with jurisdictional codes adopted by the City of Phoenix in addition to compliance all applicable articles and sections referenced in SECTION I.

2-5.3.3 Drawings shall be a diagrammatical and include devices such as bends, pull boxes, special fittings where critical importance and clarity to the Contractor and client must be documented.

2-5.3.4 Descriptive understanding of the designs shall be emphasized and materials listed for complete systems shall be called out in notes and shown on schematics.

2-5.3.5 Include schematics, installation diagrams and/or mounting details for all systems and equipment relating to applicable design criteria sections or unique construction or equipment situations that have special installation requirements and are not typical. Any system that requires special coordination or has specific installation requirements set forth by the owner, engineer or manufacturer shall be relayed to the Contractor via detail, notes and/or schematics to insure the proper installation of such systems and devices.

2-5.3.6 The electrical design shall include the following or as applicable:

A. Adequately identify and document the Scope of Work for the project. Establish construction boundaries that match the project design constraints. Document project areas that are NIC.

B. Lighting: illustrate the layout of all luminaires on the lighting plan and show the location of the light fixtures (luminaires) with respect to the project. Specify mounting heights, mounting supports, aiming, controls and switching, power connections, etc. Provide mounting details that may apply. Provide a photometric plan and energy calculations to show compliance with applicable energy codes that may apply. The design shall include a full coordination of the luminaire placements with reflected ceiling plans, diffusers, fire alarm detection and sprinkler heads, mounting heights, etc. Provide a luminaire schedule to document the fixtures that the design is based upon; the schedule shall note the manufacturer, make, model, ballasts, lamps, voltage, and special features. Luminaire, ballast, and manufacturer shall match Aviation Department standards.

C. Power: Designer must show the locations of all receptacle, power, device, motors, mechanical equipment, and specialty equipment on a power plan and show the locations of the devices. Specify mounting heights where applicable. It is recommended that the Contractor provide separate systems and mechanical connection plans to add clarity to the design and presentation of the drawings. Include details that show requirements for installation of atypical devices and equipment. The details may include but are not limited to: equipment mounting details, conduit routing and/or support details, etc. Note the manufacturer and make/model number of special devices that may not be noted within the specifications. If required, include a table or schedule for special devices which indicate the manufacturer's name, model number, devices description, color (if required), and special installation instructions. Show all power distribution equipment locations including all panel boards, distribution panels, and switchboards on the plans.

D. Special Systems: layout the back boxes and mounting boxes for all special system or low voltage devices, including voltage devices, telephone, data, tele/data, television, cable, audio/video, fire alarm, security and CCTV, etc. on the appropriate layout plans. Include riser diagrams to show any pertinent information including devices, outlets, racking, and integration into auxiliary systems. Refer to other sections within the design criteria for additional requirements.

E. Mechanical Power & Equipment: where applicable, provide separate plans to document the electrical connections to equipment from other trades (mechanical and HVAC, plumbing, elevators, escalators, moving sidewalks, automated trains, etc.). Provide an equipment schedule to address the equipment identified and the related electrical characteristics of the equipment. Coordinate equipment placement, orientation, wiring connections, voltage, amps, etc.

F. Branch Circuits: device and equipment branch circuits and their homeruns, and feeders shall be labeled on the drawings. Sizes shall be provided on the plans or in schedules. Specify all wiring 1244 gauge and larger shall be stranded except for equipment bonding/ grounding wire. Upsize the neutral conductor for all 120-Volt and 277-Volt circuits that share a common neutral. Sizes shall meet NFPA 70 for sizes and ampacities. Sizes and lengths shall compensate for voltage drop in accordance with NFPA 70. Provide a multi-pole disconnecting means to simultaneously disconnect multi-wire branch circuits serving pre-manufactured furniture and equipment. For remodel projects, where homeruns or feeders run through existing facility spaces, the Contractor shall walk the routing path and coordinate the constructability aspects with the Aviation Department facilities team members.

G. One-line Diagrams & Schematics: provide one-line diagrams and schematics to thoroughly document the electrical infrastructure and distribution requirements. Provide and document equipment sizes and ratings. Factor in available short circuit interrupting capacity, trip settings, and selective coordination for overcurrent protection devices. Provide load calculations and NEC load justifications for Panel boards, equipment, and loads within the electrical system. Provide

panel schedules and document loads to match the intent of NFPA 70 in terms of loads for lighting, power, motors, continuous equipment, etc. Balance the loads where possible. Provide a minimum of 25% spare capacity (ampacity and mounting space) for all panel boards, switchboards, and switchgear. For renovation projects, notify the PM prior to issuing construction documents if the spare capacity in any panel board, switchboard, or switchgear falls below 25%. Busway or Bus duct type distribution systems shall not be specified.

H. Devices, luminaires, equipment, wire and supports shall be appropriately specified to function in the applicable hazardous or environmental conditions.

I. Conduit quantity and size shall accommodate systems and future expansion. Analysis shall be provided for PM and Aviation Department review and comment. Include in the design separate raceways for each system.

J. Factor in the thermal impact of equipment and devices located outside, including panel boards, circuit breakers, fuses, etc. De-rate per NEC.

2-5.4 Electrical Drawings

2-5.4.1 The electrical drawings shall include (but are not limited to) the following sheets:

A. Electrical Cover sheet

B. (Electrical Legends, Electrical General Notes, Sheet Index, Special Compliance Notes, etc)

C. Electrical Site Plan (if applicable)

D. Lighting Plans (and Photometric Plans if applicable)

E. Power Plans

F. One-line Diagrams (complete and current)

G. Panel Schedules

H. Schedules (luminaire, mechanical equipment, user equipment, etc)

I. Details (Diagrams or Schematics (constructability details/diagrams/schematics that are pertinent)

J. Systems Diagrams (control wiring or specialty diagrams or sequence of operation where applicable)

K. Load Calculations (NEC power loads, fault current, arc flash, voltage drop, IECC calcs, etc)

L. Any additional special information that is required. Note relevant construction methods or additional construction coordination that would be applicable to the project.

2-5.4.2 The electrical drawings shall provide a clear concise set of plans that contains all pertinent information to the project. Sheet numbering to match the Aviation Department drawing standards, easy to follow, and grouped together (such as multiple power plan sheets, etc).

2-5.4.3 Refer to the design guidelines Division 1 for standard file and drawing naming standards instructions.

2-5.5 Scope of Work

2-5.5.1 The Contractor shall prepare design documents which outline the scope of work and applicable systems, devices, materials, to be furnished and installed by the Contractor. As required, include the limits of work or an outline stating the responsibilities of the electrical Contractor and other trades. A detailed table or narrative describing the exact limits of work,

equipment supplier, and coordination responsibilities amongst applicable trades shall be provided in the project specifications. Coordination amongst the other disciplines and divisions shall be determined in the design phase and included in the final design documents. This includes but is not limited to mechanical unit disconnecting means, special system control cabling raceway and supports, special system and fire alarm power distribution and wiring, additional systems and equipment as determined by the design team.

2-5.5.2 Work focusing on a small area shall have a defined area of scope as illustrated on the construction documents. Definitions of the limits of the physical area of work, existing conditions and existing systems shall be documented additionally to the new design information on the construction documents.

A. Define the boundaries of construction. For remodel projects, do not mix the electrical systems for Aviation Department public spaces, Aviation Department secured spaces, and Aviation Department tenant spaces.

2-5.6 Distribution and Utilization Voltages

2-5.6.1 The distribution system designs are primarily based on 480Y/277-volt, 3-phase systems. All subsequent additions to the existing Aviation Department electrical distribution system or any new building services shall be 480Y/277-volt, 3-phase, 4-wire.

2-5.6.2 The Aviation Department facility power distribution systems to PHX facility buildings is fed from power company utility transformers. The utility transformers transform power from the primary side medium voltage to 480Y/277-volt, where it can be utilized by the Aviation Department electrical distribution systems.

A. New facility or building electrical services that require new/additional utility transformers and the corresponding feeds shall be coordinated with the Aviation Department PM and Arizona Public Service (APS).

2-5.7 Energy Conservation in Electrical Systems

2-5.7.1 Lighting systems are to be in full compliance with the local code and meet the current edition of the IECC. Lighting control systems shall be integrated into most current Aviation Department the building lighting control system and shall be capable of reducing the lighting load by one half as well as scheduling and communicating with the automated facilities management system.

2-5.7.2 Base building electrical designs shall include energy efficient step down transformers and harmonic mitigating transformers for the following branch circuit loads:

- A.** Server rooms
- B.** Mission critical rooms
- C.** Workstations
- D.** Training rooms

2-5.7.3 Designs shall utilize energy efficient dry-type transformers (480V to 208Y/120 volt, 3-phase, 4-wire) shall be manufactured by PowerSmiths (or equally performing devices by Eaton/Cutler Hammer or Square D).

A. Designer to specify the minimum rating for each dry-type transformer shall be selected based on harmonic analysis or that the minimum rating be K-4; 80-degree rise; copper windings; 220-

degree C class insulation; NEMA TP-1 compliant; fully ventilated; enclosure-13 shall be rated for the site conditions.

2-5.7.4 Medium voltage or utility step down, pad-mounted transformers shall be evaluated on a project by project basis; acceptable manufacturers include Eaton/Cutler Hammer, ABB or APS approved provider.

2-5.7.5 The installation of electrical sub metering should be evaluated by FACILITIES AND SERVICES whenever significant additions or modifications to the electrical system are made in non-common areas.

A. Electric sub meters

All service entrance sections, major distribution loads and all tenant spaces shall have electrical submeter installed to measure electric loads. Sub meters shall be 100% compatible with the existing Eaton Foreseer energy management system platform, which includes all interface devices, drivers, programming installation and EBI Energy Manager network system points and/or software meter licenses too complete system interface. Sub meters shall be capable to meter Real Power (kWh), Demand (kW), per phase power factor, per phase Volts, Amps, Waats, Reactive Power (kVAh), Apparent Power (kVA).

B. Water sub meters

Water sub meters shall be installed on all large water loads where a city water meter is not present. Examples of large water loads are: landscape irrigation, cooling towers and evaporative coolers with common supply line.

2-5.8 Equipment Rooms

2-5.8.1 Design of equipment rooms shall meet the following criteria:

A. Water or flammable gas piping is prohibited in electrical rooms that contain panel boards, switchboards, motor control centers and communications system equipment. Where impossible to avoid this condition in renovation projects, the Contractor shall review alternatives with FACILITIES AND SERVICES. Acceptable sleeved piping must not be installed within the dedicated equipment space (NEC 110.26(F)).

B. Proper ventilation and/or cooling is required to vent heat in all equipment rooms containing electrical distribution equipment (switchgear, switchboards, and transformers).

C. Proper working clearances, egress path and egress means shall be provided for all rooms in accordance with the NEC and IBC. Refer to the NEC for special requirements for equipment rooms that contain large equipment (1,200 Amps or greater). Coordinate the requirements for panic hardware on egress doors with other trades.

D. Provide a ground bar (external from the equipment) that is dedicated to the electrical room. Bond the ground bar to the grounding system for the building per the uninterruptible power supplies (NEC).

E. Refer to the UPS Section for additional information in regards to additional ventilation and room configuration requirements.

F. Equipment that is to be installed on the floor shall be provided with a 4-inch raised housekeeping concrete equipment pad. Refer to the Equipment Pads section for additional information.

2-5.9 Equipment Pads

2-5.9.1 Equipment pads are to be sized for the electrical equipment which will utilize the pad and be engineered to withstand and distribute the load of the equipment to the floor.

2-5.9.2 Electrical equipment pads shall be designed using 4000 psi grade concrete.

2-5.9.3 Coordinate the requirements and product classification for fly ash, silica fume, aggregate, and water with Division 3. Pads to be poured on existing pads shall bond to the existing pad. Additional design considerations must include approval from the structural engineer. Provide steel re-enforcing as required to maintain the structural integrity of the concrete pad.

A. Equipment pads for exterior pad-mounted service transformers shall be sized, configured, and installed to match the specifications of the specific transformers. Match the orientation of the transformer entry points. Coordinate clearance and utility service pole-stick accessibility requirements. Refer to the applicable APS design and construction specifications for additional information.

2-5.10 Design Direction and Electrical Calculations

2-5.10.1 SUPPLY VOLTAGES

A. Designs will use the nominal electric infrastructure and facility voltages 208Y/120V three phase, 4 wire, and 480Y/277V three phase, 4 wire.

B. Use of 208Y/120 Volts: duplex receptacles, convenience receptacles, miscellaneous equipment, small motors under $\frac{3}{4}$ HP and limited mechanical systems, pumps, limited emergency power, limited lighting, controls, etc.

C. Use of 480Y/277 Volts: lighting, motors over 1 HP, mechanical systems, and distributed power

2-5.10.2 UTILIZATION VOLTAGES

A. The electrical primary side medium voltage and its related distribution will be per APS service standards.

2-5.10.3 SHORT CIRCUIT (FAULT CURRENT) CALCULATIONS

A. The Contractor shall prepare short circuit/available fault current calculations. Calculations shall be in sufficient detail to permit evaluation of the basis of design for the electrical distribution system. Short circuit calculations shall be completed for the electrical distribution system based upon an assumed short-circuit capacity of maximum mega-volt amperes (MVA) available from the power company at the electric service entrance into the unit substation. Results of calculations shall be placed at pertinent locations on a single line drawing of the electrical distribution system and carried through downstream until the RMS available fault current is below 10,000 Amps (10 kA).

B. All equipment must be fully braced for the available short circuit current at the equipment location. Do not reduce the calculation ampacities to distribution points using device let-through (fuse or circuit breaker let-through). Do not series-rate devices or equipment.

C. The Contractor shall take into consideration the contribution of any large motors that will add to the available short circuit if there is a fully bolted fault (the motor will contribute power back into the system while it slows down after the power source has been removed).

2-5.10.4 ARC FLASH CALCULATIONS

A. For new equipment and electrical service installations and existing prepared by Electrical Engineer, the Contractor shall prepare Arc Flash calculations. The analysis shall be completed and submitted in PDF format. The analysis shall be provided to the Aviation Department Engineering & Facilities Team in an as a PDF format.

B. The arc flash analysis shall address the most recent applicable NEC 70E and PPE requirements.

C. All appropriate labels shall be installed (FACILITIES AND SERVICES shall provide templates).

2-5.10.5 VOLTAGE DROP CALCULATIONS

A. Voltage drop calculations shall be completed for maximum loads or long run branch circuits and equipment/panel feeders. Meet NFPA 70 requirements for permitted voltage drop.

B. Motor circuit calculations shall be based on an 80 percent lagging power factor.

C. If conductor sizes are increased to satisfy voltage drop requirements, the short-circuit calculations must reflect the larger conductors. When increasing conductor sizes, the Contractor shall confirm that the increased conductor diameter will terminate properly on the selected over current protection device or landing lug.

D. The branch circuit or equipment ground conductor size shall be increased accordingly.

2-5.10.6 HARMONICS

A. The Contractor shall take into account equipment and system harmonic conditions. During design, coordinate harmonic influencing equipment with other disciplines and provide harmonic mitigation systems to compensate for excessive noise in the electrical system. The Contractor shall take into account any known facility harmonic factors prior to starting new designs.

2-5.10.7 SINGLE POINT FAILURE ANALYSIS AND DESIGNS

A. For new Aviation Department buildings and facilities or replacement of existing electrical service equipment that are critical to the daily operation of the Aviation Department, the Contractor shall evaluate all service and distribution options to avoid a single point failure in the incoming service and the key distribution switchgear sections. Coordinate with APS on the provision of 2-radial primary distribution feeders. Design for two APS service transformers and dual-ended switchgear.

B. For new and existing Aviation Department Central Plants, the Contractor shall address the single point failures in the electrical system to avoid conflicts with downstream power to core chillers and their related support equipment. Provide automated transfer switches (ATSS) rated for the application to switchover power to the equipment. The upstream dual distribution feeds shall have enough spare ampacity and capacity to carry the Central Plant equipment for an extended period of time.

C. For new and existing Aviation Department Data Centers/Core Network Server Rooms that are critical to the daily operation of Aviation Department, the Contractor shall address the single point failures in the electrical system to avoid conflicts with the loss of power to these systems.

The designs and evaluations shall address the supplementary mechanical and uninterruptible power supplies (UPS) systems that are required to keep these areas in operation.

2-5.10.8 SELECTIVE COORDINATION STUDY AND TESTING

A. An electrical selective coordination study may include but is not limited to:

A.1. A selective coordinate study shall be completed to ensure the appropriate over current protection, circuit breaker, and/or fuses trip selection and settings. For example, a fuse or breaker, ahead of a main breaker in a sub-panel, should never trip before the main breaker in the sub-panel trips.

B. Testing:

B.1. All testing requirements shall be outlined and coordinated prior to design completion. Some examples of required testing include, dialing in of adjustable trip circuit breakers, ground fault protection, grounding, etc.

B.2. The Contractor's responsibilities in regards to testing must be specified and shown with the plans.

2-5.10.9 DEMAND FACTORS

A. The Contractor shall use NFPA 70 recognized demand factors for selecting switchboards, switchboard feeder breakers, panel boards, feeders, transformers, and generators.

2-5.10.10 BRANCH CIRCUIT AND RECEPTACLE ALLOCATIONS

A. In the public areas, provide no more than (6) duplex receptacles rated at 180 VA each on a 120-Volt, 20-Amp branch circuit. In ancillary or service areas, no more than (5) duplex receptacles shall be connected to a 120-Volt, 20-Amp branch circuit. In administrative areas, no more than (5) duplex receptacles shall be connected to a 120-Volt, 20-Amp branch circuit.

B. Receptacles specified for general use shall be of the duplex 120V, 20A minimum rating, grounded type. In public areas they shall be spaced not more than 80 feet apart and be located flush in a wall or column. In non-public areas, receptacles shall be spaced not more than 20 feet apart. They shall be supplemented, where needed, for fixed equipment.

C. Design dedicated receptacles for free-standing or large copiers and printers. Provide a separate homerun and do not share the neutral with other branch circuits.

D. Design dedicated receptacles or individual branch circuits for specialty equipment such as critical computers, network servers, security systems, etc. Provide separate homeruns and do not share neutrals.

E. Receptacles located above break room counters or coffee bar areas shall be on individual branch circuits. These devices shall be GFI-rated. Assume each device will have an individual appliance (such as coffee maker, microwave, toaster, etc), unless directed otherwise from the Aviation Department PM.

F. Design for a duplex receptacle within 25-feet of main mechanical equipment to comply with service requirements.

G. Receptacles placed in wet or damp locations or that are located exterior to the building shall be GFI-rated devices and shall come with in-use weatherproof covers.

H. Receptacles shall be connected so that the GFI protection shall not affect downstream receptacles (no feed-thru GFI protection shall be permitted). All GFI devices shall fully comply with the latest edition of the International Building Code (IBC) and shall be UL 943 compliant.

I. Receptacles with other voltages, amperages, and phase arrangements shall be provided in locations as required. Match the cord and plug configurations.

2-5.10.11 LIGHTING CALCULATIONS

A. Calculations of average maintained Illumination levels in interior spaces shall conform to the average illumination calculations method described in the latest edition of the Illuminating Engineering Society (IES) Lighting Handbook. Average values shall not be less than those listed in this chapter and in the document referenced. Average illumination calculations are applicable only if the luminaires are spaced to obtain acceptable Illumination uniformity.

B. Calculations of minimum maintained Illumination levels in tunnels and exterior areas shall employ the point-by-point calculation method as described in the latest edition of the IES Lighting Handbook.

C. Design of egress lighting levels shall be based on a 1 foot-candle minimum or as required by the latest edition of the International Building Code (IBC). Provide the minimum illuminance levels required at the exits and areas of refuge to comply with the latest building codes.

2-5.10.12 SAFETY CONSIDERATIONS

A. Ground fault interrupter (GFI) protection shall be provided on branch circuits that have equipment or outlets for which personnel protection is required by either the NEC or engineering judgment. Ground fault tripping shall be at the Underwriters Laboratories, Inc. (UL) Class A level (5 milliamperes). All GFI devices shall fully comply with the latest edition of the International Building Code (IBC) and shall be UL 943 compliant.

B. Receptacles shall be branched so that the GFI protection shall not affect downstream receptacles (no feed-thru GFI protection shall be permitted).

C. Provide arc-fault protected branch circuits in accordance with the latest edition of the NFPA70.

2-5.10.13 EQUIPMENT

A. Advertising dioramas, CCTV cameras, communications equipment, and convenience outlets will utilize 120V, 20A duplex convenience receptacles.

B. Vending and video game/arcade equipment located in public areas shall have GFI-rated receptacles.

C. The Contractor shall coordinate the final electrical characteristics (voltage, current, phase, over current protection, connection points, equipment orientation, control wiring, etc.) of the equipment during the design phase. Since the equipment (mechanical, user, etc.) may change during the submittal or construction phase, the Contractor shall provide coordination directions (prior to rough-in and purchase of materials) to the Contractor.

2-5.10.14 DISCONNECT SWITCHES

A. Designs for heavy-duty disconnect switches shall be as required by the NEC as a means to disconnect equipment from its feeder when the equipment is not within the sight of either the feeder breaker or motor controller, or where advantageous to separate feeder from electrical loads to be supplied by others. In general, disconnect switches shall be fusible and shall plainly indicate whether they are in the open (off) or closed (on) position. They shall have the means of being locked in the open or off position. Where fuses must be used, they shall be of the current limiting type (UL Class J for 600 amperes and less, Class L for 601 amperes through 6,000 amperes. Motor disconnects shall use a UL Class, motor-rated, time-delay fuse).

2-5.10.15 OVER CURRENT PROTECTION

A. Over current elements: (a) are designed to protect conductors serving emergency equipment motors (fans, dampers, pumps, and so forth), emergency lighting, and communications equipment: and (b) are located in spaces other than the main distribution system equipment rooms, shall not depend upon thermal properties for operation (per NFPA 1 30).

2-5.10.16 HAZARDOUS LOCATIONS

A. Class 1, Division 1: light switches, electrical outlets, lighting fixtures, junction boxes, raceways, conduits, seal offs, etc. shall be specified and installed per NEC Article 500 and its related sections. Refer to the supplemental NFPA materials for additional information and requirements.

B. Class 1, Division 2: light switches, electrical outlets, lighting fixtures, junction boxes, raceways, conduits, seal offs, etc. shall be specified and installed per NEC Article 500 and its related sections. Refer to the supplemental NFPA materials for additional information and requirements.

C. Specify equipment within commercial garages, repair, and storage areas: light switches, electrical outlets, lighting fixtures, junction boxes, raceways, conduits, seal offs, etc. shall be specified and installed per NEC 511 and its related sections. Refer to the supplemental NFPA 30A materials for additional information and requirements.

D. Specified Equipment Aircraft Hangers: light switches, electrical outlets, lighting fixtures, junction boxes, raceways, conduits, seal offs, etc. shall be specified and installed per NEC Article 500 and its related sections. Refer to the supplemental NFPA 30 & 409 materials for additional information and requirements. If aviation maintenance operations include the services for Spray Application, Dipping, and Coating Processes, refer to NEC 516 and NFPA 33 & 34 materials for additional information and requirements.

E. Motor Fuel Dispensing Facilities: light switches, electrical outlets, lighting fixtures, junction boxes, raceways, conduits, etc. shall be specified and installed per NEC Article 500 and its related sections. Refer to the supplemental NFPA 30A materials for additional information and requirements.

2-5.11 Interior Lighting

2-5.11.1 This section defines the minimum requirements for the design and operation of lighting. It is the goal of this section to guide the Contractor to properly select light fixtures (luminaires) that best match the Aviation Department, fit the application, and achieve the required illumination levels in each area, in order to have a safe, reliable, and continuous operation of the Aviation Department facility, as well as to promote public safety and provide environmental comfort for all transit patrons and employees.

- A.** Interior Lighting fixtures shall be LED unless otherwise directed, specify the lighting color and shall be similar to any adjacent locations.

2-5.11.2 These criteria are intended to promote uniformity in the design approach and to aid the Contractor in attaining effective and efficient lighting for each specific area in addition to attaining the aesthetic effects of quality lighting design. Luminaires and lamps shall be selected from those indicated on the standard drawings, or selected by the section Contractor for those areas where luminaires and lamps are not shown on the standard drawings.

2-5.11.3 Comply with LEED standards, IECC, and City of Phoenix requirements that may apply. Circuiting should promote ability to implement automated lighting reductions.

2-5.11.4 DAYLIGHT CONTRIBUTION

A. The use of daylight for energy conservation is preferred. Where daylight is used to supplement electric lighting, an evaluation shall be made to determine lighting zones and their photoelectric control schemes, to minimize required electric lighting.

2-5.11.5 DESIGN REQUIREMENTS

A. The following documents shall be prepared and submitted for approval:

A.1. Illumination level calculations for each facility area. Computer calculations shall be used to determine illumination levels for all rooms 500 square feet or greater, or in specialty areas such as stairs, escalators, moving sidewalks, transit landings, entrances, etc. Photometric calculations shall use a maximum 2-feet x 2-feet grid spacing.

A.2. Lighting layouts shall indicate the mounting methods and luminaire types.

A.3. The lighting layouts shall document the intended switching/control scheme for each luminaire. In large, open areas, the lighting shall have alternate branch circuit wiring and switching controls to allow for the lighting to be reduced during non-peak or reduced-hour operations. Break up or spread out illumination and lighting control zones. An extended benefit of this design approach shall be energy savings, the resting of lamps, extended lamp life, and ease of maintenance. The Contractor shall document in the drawings the required sequence of operations, recommended hours of operation, and lighting controls/switching requirements.

A.4. A luminaire schedule shall be provided to the Aviation Department PM and the Facilities Engineering team during design. Once approved, the luminaire schedule shall be included on the construction documents.

A.5. Provide a legend to indicate symbols, line-types, and colors (if applicable) for all calculations and layouts.

A.6. Provide a table summary of results for each calculation reporting the minimum, maximum, average, average to minimum, and maximum to minimum foot candle levels compared to IESNA standards and building code requirements (if applicable).

2-5.11.6 GENERAL REQUIREMENTS

The following general requirements shall be incorporated in the design of lighting for each facility:

A. The lighting system is to provide the intended quality and quantity of light required for each individual area.

B. Lighting shall sufficiently define the decision/transition points and areas of potential hazard.

C. The lighting system installation shall be designed to minimize initial capital costs as well as frequency and expense of maintenance.

D. Lighting fixture locations shall be positioned for accessibility (for re-lamping and periodic cleaning). Do not mount fixtures over difficult to reach locations, moving sidewalks, stairs, or water.

E. Lighting shall be designed to avoid interference with the airport, FAA, TSA, transit communication, and signal systems.

- F.** Lighting shall be designed to satisfy security requirements and to provide a pleasant environment.
- G.** Lighting shall emphasize directional signage indicating preferred circulation paths and the informational signage that provides for quick recognition of danger and decision points.
- H.** Any required illumination shall be arranged so that the failure of any single lighting unit shall not leave the area in total darkness.
- I.** All lighting must comply with the local energy codes and the latest version of the IECC.
- J.** Lighting and lamping is to provide optimal color rendering for intended occupancy as according to the IESNA guidelines for each area.

2-5.11.7 SECURITY LIGHTING

A. Illumination Guidelines

- Illuminating Engineering Society of North America (IESNA)
- IESNA G-1-03, Guideline on Security Lighting for People, Property, and Public Spaces
- IESNA RP-20-98, Lighting for Parking Facilities
- IESNA 08-5-94, Recommended Lighting for Walkways and Class 1 Bikeways
- IESNA Lighting Handbook, Ninth Edition or most current updated version.

B. Other Considerations

- Illumination levels related to maintenance and storage facilities and other terminal or ground transportation centers need to define and differentiate between task areas, decision and transition points, and areas of potential hazard.
- In addition to quantity of light, it is essential that security illumination be designed to minimize glare and provide uniform distribution.
- Luminaries should be selected, located, and/or aimed to accomplish their primary purpose while producing minimum glare and/or interference with the Aviation Department's operations, task accuracy, closed circuit TV surveillance systems, vehicular traffic and neighboring areas.
- To achieve the objectives of security lighting, attention must be given to both vertical and horizontal luminance, uniformity, the effect of obstructions, the reflectance of surfaces, background contrast, degree of glare, the interaction with electronic surveillance systems, and the effect on the surrounding area.

C. Pedestrian Access Way Lighting

- Recommendations for lighting practices for lighting walkways are discussed in IESNADG-5-94. Pedestrian access way lighting will define pedestrian walkways, crosswalks, ramps, and bridges. The recommended security illumination for pedestrian passageways should be an average of 30 lux (2.8 fc) on the pavement, with a uniformity ratio not greater than 4:1. In areas such as ramps and stairs, illuminances should be an average of 50 lux (4.6 fc), with a uniformity ratio not greater than 4:1.

D. Lighting for Closed Circuit TV Systems

- Security systems are heavily dependent on closed-circuit TV and it is critical that the operational requirements of the TV camera be understood and that the lighting system provides the necessary level of illuminance. This level will be coordinated with TSA, FACILITIES AND SERVICES and the project manager.

E. Control of Lighting Systems

- Lighting control will be designed to use energy efficiently. Automatic control arrangements will ensure efficient utilization of energy and maintenance procedures. All exterior site illumination will be controlled by a photocell, motion detection, or time clock. All lighting controls will have a manual override for regular maintenance.

F. Maintenance

- No security lighting system can remain effective without regularly scheduled maintenance. A planned maintenance program should include immediate replacement of failed lamps, electrical components, photocells, and vandalized or damaged luminaries, and involve regular cleaning of luminaries and shrubbery pruning.

2-5.11.8 LIGHTING CONTROL SYSTEMS

A. The design of the lighting system must be coordinated to support Airport Operations . The lighting system is expected to operate continuously and rely on both automatic and manual controls to provide efficient use of energy and reduce operational costs while satisfying applicable energy codes.

2-5.11.9 EXTERIOR LIGHTING

A. Exterior lamp sources shall be LED, unless directed otherwise (i.e. parking garages). Specify industry standard, common order, lamp types.

B. The lighting and lamp selections shall match the lighting and lamps used in adjacent area lighting. Make sure that lamp color is similar in adjacent locations.

2-5.11.10 This section defines the basic minimum requirements for the design and operation of exterior lighting. It is the goal of this section to create a design that shall provide lighting luminaires that are properly selected and located to achieve the required illumination levels while maintaining code requirements.

2-5.11.11 Comply with, IECC, and City of Phoenix requirements that may apply. Specify full-cutoff light fixtures and comply with the applicable City of Phoenix Dark Sky Ordinances.

2-5.11.12 ILLUMINATION GUIDELINES

A. Illuminating Engineering Society of North America (IESNA) G-1-03, Guideline on Security Lighting for People, Property, and Public Spaces.

B. IESNA RP-20-98, Lighting for Parking Facilities

C. IESNA 08-5-94, Recommended Lighting for Walkways and Class 1 Bikeways

D. IESNA Lighting Handbook, Ninth Edition

2-5.11.13 TEMPORARY AND REMODELING WORK

2-5.11.14 Designs for temporary or remodel work shall incorporate existing conditions which are applicable to the project. The design shall clearly define the Scope of Work and means to which the Contractor shall demolish or remove existing electrical systems. When necessary existing lighting fixtures and or electrical systems shall be removed, relocated and reinstalled. The Contractor shall visit the site and evaluate the existing electrical conditions in sufficient detail as to relay that information to the construction team as it pertains to the Scope of Work for the project.

2-5.11.15 The Design Consultant is to clearly note deficiencies with the existing infrastructure, systems, or devices. The electrical Contractor shall execute construction documents required to upgrade existing installations to meet the requirements for the Scope of Work to be performed.

2-5.11.16 Devices including light fixtures, panel boards, distribution equipment, conduit, receptacles, pin and sleeve devices, etc. shall match existing device manufacturer, color, rating, and dimensions unless otherwise directed by the PM. Lamping for all fixtures shall match standard lamping.

2-5.11.17 For remodel projects, the Contractor shall make provisions for all temporary lighting that may be required during the duration of the construction project.

2-5.12 Conduit and Raceways

2-5.12.1 Specify Raceway Materials: Type Abbreviation Galvanized Rigid Steel Conduit GRS NEMATC-6*and ASTMF-512* PVCC Electrical Metallic Tubing EMT Cable Tray (galvanized rigid steel)

2-5.12.2 The following are requirements and design criteria for conduits used in branch circuit feeders:

2-5.12.3 All conduits shall be sized in accordance with NEC.

2-5.12.4 Conduits shall not be smaller than $\frac{3}{4}$ -inch.

2-5.12.5 PVC rigid, heavy wall schedule 40 conduit shall be specified in all non-classified underground applications. When imbedded in a concrete slab utilize PVC rigid heavy wall schedule 80 conduit. All bends shall be wide-sweep PVC coated galvanized rigid conduit.

2-5.12.6 Specify GRC conduit in all classified, explosion susceptible areas for underground applications.

2-5.12.7 All conduits sized 2-inches or greater shall be specified as rigid galvanized steel or intermediate metal conduit, unless the application is approved by the Aviation Department Facilities and Engineering team during design.

2-5.12.8 Liquid-tight flexible metal conduit, with the overall length not to exceed 4-feet shall be specified for motor and transformer connections, or equipment connections in wet locations.

2-5.12.9 All other conduits shall be EMT.

2-5.12.10 Conduit raceways that cross over expansion joints shall be designed with expansion fittings. XJ fittings shall be with rigid steel or IMC; Carlon type E945 fittings are to be specified for PVC conduit.

2-5.12.11 The Contractor shall label conduits to the devices or equipment which they serve. Branch circuits are to be labeled with the circuit and panel board on every junction box and faceplate for each device.

2-5.12.12 Conduit Colors: The Contractor shall note field coordination colors of conduits in the construction documents: 1) electrical shall remain in the raceway supplier provided color, 2) HVAC control wiring is white, 3) Fire Alarm System is red, and 4) IT/data cabling is orange.

2-5.12.13 Provide conduit seal-offs for all conduits separating hazardous locations.

2-5.12.14 Provide conduit seal-offs for all conduits that enter/exit areas of large temperature differences (i.e. – data centers, etc) for condensation control.

2-5.12.15 The following paragraphs describe conduit materials, special installation methods, conduit identification and specific design requirements for system wide conduits.

2-5.12.16 Conduit types shall be selected by the designer for the different conditions in accordance with the following schedule:

A. Underground installations more than two feet from foundation wall:

A.1. - Rigid steel conduit or schedule 40 plastic conduit;

B. Installations in or under concrete slab, or underground within two feet of foundation:

B.1. - Rigid steel conduit;

C. In slab above grade:

C.1. - Rigid steel conduit;

D. Exposed outdoor locations:

D.1. - Rigid steel conduit with weather tight fittings;

E. Wet interior location:

E.1. - Electrical metallic tubing with weather tight fittings;

F. Concealed dry interior location:

F.1. - Electrical metallic tubing or rigid steel conduit;

G. Exposed dry interior locations:

G.1. - Electrical metallic tubing or rigid steel conduit;

H. Interior locations where physical damage (including vandalism) is possible:

H.1. - Substitute rigid steel conduit where electrical metallic tubing is listed;

I. In transit areas and stations (above, at, or below grade) and trainways below grade:

I.1. - Rigid steel conduit.

J. Flexible conduit shall not be used to extend rigid conduit to fixed pull, junction, or outlet boxes;

K. Install conduits in walls or ceilings where possible;

L. Pull and junction boxes shall be placed only in accessible areas and in a manner that their covers can be removed without requiring other conduits or objects to be moved;

M. Specify all conduits and other raceways in public areas shall be concealed from public view. Under floor raceway locations and sizes for initial and future equipment shall be provided; and

N. Except in ancillary or other nonpublic areas, when installed in stations all conductors shall be entirely enclosed in conduits, or enclosed raceways, boxes, and cabinets. Conductors in conduits or raceways may be embedded in concrete or run in concrete electrical duct banks, but they shall not be installed, exposed, or surface-mounted in those air plenums that could carry high-temperature air during a fire.

O. Only compression type fitting shall be used. “Set-screw” type fittings shall not be specified.

2-5.12.17 Materials manufactured for use as conduits, raceways, ducts and their surface finish materials, when installed in stations above or at grade, shall be capable of being subjected to

temperatures up to 932 degrees Fahrenheit (500 degrees Celsius) for an hour, and shall not support combustion. All conduits in these areas shall be galvanized rigid steel (GRS). When encased in concrete, other materials are acceptable. Raceways shall conform to the National Electrical Code (NFPA 70). They shall also conform to the codes of the National Electrical Manufacturers Association (NEMA), the American National Standards Institute (ANSI), and Underwriters Laboratories, Inc. Expansion fittings shall be provided in all conduit runs where they cross expansion joints, and as required by the NEC for longer runs.

2-5.12.18 CONDUIT FEEDER SCHEDULE

A. The conduit schedule shall identify all feeder conduits to be installed, using symbols and annotations. Conduits that are to enclose circuits installed by others shall be clearly indicated. Installation specifications shall require pull wire and permanent tagging of each conduit access.

2-5.12.19 SCHEDULE CONTENT

A. Conduit and feeder schedules shall include the following Information: Conduit Identification, Conduit size, Circuit Identification, Conduit type, Conduit from Conductor description, Conduit to Conductor quantity, Indication of multiple runs, and Drawing reference.

2-5.12.20 CONDUIT DESIGN APPROACH

A. Raceway designs shall include all required runs between equipment and panel boards in electrical rooms, and so forth, and shall be shown on drawings with cross references to other drawings that detail the conduit routing in ceilings, walls or floor slabs as required in areas where routing is critical. Three inch (3") or larger conduits shall be extended from these secondary distribution points to the associated equipment.

B. In existing conditions and remodel applications, during the design phase, the Contractor shall field walk the site with the Aviation Department PM and shall coordinate all new major conduit feeder runs with the existing building structure and routing paths. Coordinate the constructability approach to the installation of the new distribution feeders. Coordinate the installation of new chases, fur outs, and fire-rated penetrations.

C. Conduit runs that may exceed the below stated 270-degree bend limitation and conduit runs in excess of 100 feet shall be detailed in the project drawings. Details shall include junction box locations, bends and potential obstructions, such as mechanical ducts and piping. Conduit routing and locations of pull boxes and junction boxes shall be subject to change as necessary during construction.

D. Drill and lead ties shall be used for the anchoring of conduit and equipment supports. Hammer anchors shall not be used.

2-5.13 Installation Guidelines

2-5.13.1 CONDUIT BENDS

A. Specify that conduits shall have no more than the equivalent of three 90-degree bends (270 degrees) between an outlet or service point, and pull box, manhole, or outlet box

B. Conduits 2-inches or larger shall have wide sweep radius bends.

C. Conduits for designated fiber or interduct shall have wide sweep radius bends.

2-5.14 Cable Tray

2-5.14.1 Cable tray design is only permitted in pre-designated areas by the PM and Facilities & Services.

2-5.14.2 Trays shall be routed so that cables can easily be accessed, new cables can be routed, and existing cables can be inspected and/or replaced after the installation of the cable tray system.

2-5.14.3 The tray shall be electrically continuous and grounded in accordance per NEC.

A. Designs shall include cable tray expansion fittings over building expansion joints; expansion joints shall be NEMA VE-1 complaint.

2-5.14.4 Cable tray support structures and hangers shall be capable of supporting 5 times the maximum weight when the cable tray is loaded at 100% capacity (factor of safety = 5). The hangers and supports must take into consideration all seismic requirements. Include calculations with the design submittals.

2-5.14.5 Coordinate the routing and size of the cable tray with the other disciplines (mechanical, structural, architectural, etc.) as well as with Division 26 equipment (light fixtures, etc.) to avoid conflicts and issues during construction.

2-5.14.6 Specified cable tray systems shall be basket tray style manufactured by Cooper B-line, P-w and Walker.

2-5.14.7 Specified supports and rods shall be no less than 3/8-inch diameter steel rods. Space the rods so that the design meets or exceeds NEMA 12A for loading plus a 50% factor of safety.

2-5.15 Medium or High Voltage Conductors and Cables (Over 600 Volts)

2-5.15.1 Refer to the medium voltage distribution design for applicable design requirements for medium voltage power distribution.

2-5.15.2 Sizing of wire for applications of 600V or more must bear the UL label and comply with codes and standards stated by NEC, ICEA, and ASTM. In addition, no design shall incorporate aluminum, copper clad, or aluminum alloy wire (Stabiloy) unless approved by Arizona Public Service (Electric Utility) for primary service feeders.

A. The Contractor shall factor in voltage drop where applicable.

2-5.15.3 The design and associated specifications shall include the following design requirements for Medium and High Voltage cable:

A. The cable insulation must be a minimum of 0.175 inches thick.

B. Specified insulation material must be made of high quality thermosetting ethylene-propylene.

C. The wire and insulation must be able to withstand heat, moisture, and ozone, and must also be corrosion resistant.

D. The insulation and wire must be specified and be suitable to withstand continuous operation at 90-degrees Celsius (normal operation), 130-degrees Celsius for emergency operation and at least 250-degrees Celsius for short circuit conditions. All conductors and their insulations shall be rated for their intended application, including being derated for the summer-time ambient temperatures in exterior applications.

E. Base insulation must be rated for use in 15kV applications, or to match the kV design application.

F. All specified wire shall comply with the latest editions of ICEA Pub. # S-68-516, NEMA Pub # WC8,

G. The Contractor shall call out for extra pull lengths for conductors (6-feet minimum) for field installation flexibility at all main equipment, distribution, and pull box locations.

2-5.16 Conductors and Cable (Below 600 Volts)

2-5.16.1 GENERAL

The design shall incorporate wire and sizing and wire type information for all applications. All branch circuit wire 300V and lighting and distribution feeders 600V shall be 600-volt insulated bare the UL Label. Branch circuit feeders and wiring are to be sized in accordance with NEC Article 310.

A. Conductors smaller than #8 American Wire Gauge (AWG) shall be solid wire and conductors #12 or larger shall be stranded. All conductors shall be insulated. All conductors shall be copper.

B. The Contractor shall specify the color coding of control wiring to match the Aviation Department standard for color coding.

C. The wire type shall be clearly noted in the design documents for the Contractor's reference.

D. The Contractor shall factor in voltage drop where applicable.

2-5.16.2 INSULATION

A. Specify that all insulations shall conform to Article 310 of the NEC. Insulations shall be moisture and heat resistant types with temperature ratings corresponding to the conditions of application, but in no case lower than 194 degrees Fahrenheit (90 degrees Celsius). Insulation for general use shall be type THHN/THWN or type XHHW. Wire and cable used in operating vital power circuits to emergency fans, lights, and so forth, shall pass the flame propagating criteria of Type Test of Class 1E Electric Cables, Field Splices, and Connections (IEEE 383). Such tests shall be performed with the wire and/or cables protected as they will be when installed.

B. The insulation and wire must be suitable to withstand continuous operation at 90-degrees Celsius (normal operation), 130-degrees Celsius for emergency operation and at least 250-degrees Celsius for short circuit conditions. All conductors and their insulations shall be rated for their intended application, including being derated for the summer-time ambient temperatures in exterior applications.

C. Low voltage cabling shall be plenum-rated and UL listed for their application.

2-5.16.3 The following conductor and insulation types shall be used in specific applications:

A. All wire that may be exposed to oil or fuel must be of Type XO and rated for this application by ASTM and NEMA.

B. All feeders serving HVAC or A/C units must be of Type XHHW.

C. Sealed armored cable, metal-clad cable, flexible conduits incased in aluminum and PVC jacketing shall not be permitted unless otherwise directed by the PM.

D. Low-voltage control wiring is to be installed in conduit and/or shall be plenum rated.

E. All other wire insulation types shall be THHN/THWN rated.

F. All underground feeders must be of Type XHHW.

2-5.16.4 OTHER

- A. The designs for all kiosk, information pedestal and ticket counters are not to be permitted to be powered using Liquid-tight sealed and jacketed cable and must comply with the requirements of this section.
- B. The use of AC, MC, or flexible metallic Cable and similar is not permitted.
- C. The use of aluminum or copper clad wiring shall not be permitted.
- D. Except as noted all wiring associated with cord and plug applications must comply with Article 400 of the NEC.
- E. Busway or bus duct distribution applications shall not be permitted.
- F. The Contractor shall call out for extra pull lengths for conductors (6-feet minimum) for field installation flexibility at all main equipment, distribution, and pull box locations.

2-5.16.5 Specified conductors for emergency lighting, communication, and so forth, shall be protected from physical damage by moving equipment, baggage handling equipment, fueling equipment, transit vehicles or other normal transit system operations. Provide suitable embedment or encasement for conductors by routing them through areas of low fire potential (light hazard).

2-5.17 Low Voltage Open Wiring Systems (Below 50 Volts)

2-5.17.1 A detail design of low voltage wiring systems is required for fire alarm, telecommunications, cable television, closed circuit television and security systems. Refer to the applicable sections of this document for more information regarding low-voltage wiring requirements.

2-5.17.2 Designs shall be in full compliance with NEC, City of Phoenix Codes and Amendments, and UL and IEEE standards.

2-5.17.3 Specify for all wiring to be concealed in conduit; no open plenum cabling shall be permitted.

2-5.18 Electrical Boxes and Cabinets

2-5.18.1 RACEWAY BOXES

A. Outlet, junction and pull boxes shall be indicated on the drawings where they are required to facilitate the pulling, supporting, or connecting of wires and cable. Junction and pull box locations shall be subject to change as necessary during construction.

B. The Contractor shall be required to consider the dimensional constraints for pull boxes, cabinets, and large wire ways where there exists a limited space constraint.

C. The Contractor shall not specify junction boxes, pull boxes, outlet boxes, etc. that have shared line voltage and low voltage systems without the approval of the PM during the design.

2-5.18.2 OUTLET, PULL, JUNCTION AND FLOOR BOXES

A. Boxes (outlet, pull, and junction) shall conform to Article 314 of NFPA 70. Additionally, boxes consist of hot dipped galvanized steel; specify products that are UL listed from manufactures that are considered to be 'industry standard' and are of specification grade quality.

2-5.18.3 The following is to be considered for specifying boxes to be used in specific applications:

- A. Gasket sealed cast boxes are to be used wet locations where partial or complete submersion under water is a concern. Material composition and box assembly shall be made of corrosion resistant materials.
- B. Size pull boxes with at least 25% spare capacity to allow for future expansion and additional conduits to terminate into the box.
- C. Box dimensions shall be coordinated with other disciplines. Recessed or flush mounted boxes should not be specified that do not fit in walls, above ceilings, floors, slabs, etc.
- D. Specified Line and Low Voltage Applications: all pull boxes, junction boxes, device boxes shall be permanently labeled; include circuit number, cable, origin, etc.

2-5.18.4 The following design criterion applies to floor boxes:

- A. Floor boxes stubbed through fire rated floors and walls shall be fire rated to maintain the fire rating and integrity of the wall or floor.
- B. The Contractor shall x-ray walls and floors prior to core drilling. Core drilling requires a separate Aviation Department Construction Permit.
- C. Floor boxes that contain both line voltage power and low-voltage data are to have partitions separating the separate divisions.
- D. The floor box specifications shall also include the proper cover to match the flooring in that area. Coordination with the architect is required.

2-5.18.5 All boxes shall be UL listed.

2-5.19 Underground Pull Boxes and Manholes

2-5.19.1 Specified underground boxes and manholes shall conform to NFPA 70 and comply with UL and ASTM standards. Boxes and Manholes shall have covers consisting of structural steel and capable of supporting any overhead load that may come in contact with the box or man hole. Specify products that are UL listed from manufacturers that are considered to be 'industry standard' and are of specification grade quality.

2-5.19.2 Concrete boxes specified shall be constructed using 4000psi class concrete, and shall be listed to withstand vehicle and equipment traffic weights. Man hole lids must be spring assist lids, aircraft rated in airfield, all approved by Facilities and Services.

2-5.20 Wiring Devices

2-5.20.1 Specified wiring devices shall be of specification grade quality and designs shall be based on products offered by the following manufacturers:

- A. Hubbell
- B. Bryant
- C. Leviton

2-5.20.2 Color and style of devices are to be selected by the Contractor.

2-5.20.3 The drawings shall specify the correct voltage, amperage rating, number of poles (switches), NEMA configuration, and color of the device.

2-5.20.4 Receptacles in “high-use” areas shall be specified as hospital-grade receptacles; “high-use” areas will be subject to greater abuse and wear.

2-5.20.5 Additionally, outlet box mounting height, mounting method (recessed, surface mount, etc) is to be specified on the drawings.

2-5.20.6 Cover plate style, color and manufacturer shall also be specified on the drawings.

2-5.20.7 Specify that device’s long axis be vertical unless otherwise directed.

2-5.20.8 Design and coordinate device locations and mounting heights.

2-5.20.9 Dimmer switches for light fixtures shall be coordinated with the luminaire, lamping, and ballast or transformer (if fluorescent, magnetic low- voltage or electronic low-voltage) and sized appropriately for the load.

2-5.20.10 Toggle switches serving motor loads (fans, garbage disposers, etc.) shall be motor rated at a minimum of 20A.

2-5.20.11 The mounting plates to all devices shall have a permanent, typed label. Include branch circuit number. Provide a white label with black lettering for normal power and red lettering for emergency power.

2-5.21 Service Entrance-Rated Switchgear and Switchboards

2-5.21.1 ACCEPTABLE MANUFACTURERS

- A. Eaton/Cutler Hammer
- B. Square D
- C. G.E. (General Electric)

2-5.21.2 GENERAL

- A. New Aviation Department electrical service entrance-rated and switchgear equipment shall be located in interior, conditioned spaces. Do not specify exterior-mounted, outdoor-rated equipment. The Contractor is required to coordinate all equipment locations with the project’s Space Planner, Architect, and PM to ensure proper NEC clearances and equipment accessibility requirements.
- B. The Contractor shall evaluate single point failure requirements as noted in other sections of the City of Phoenix Aviation Department Design Manual.
- C. For new electrical service installations, the Contractor shall specify utility dual-fed, dual-ended switchgear lines with redundant electrical system connections. Kirk-key interlock means shall be used to tie the two service sections and the corresponding APS utility transformers together. System redundancy shall be a critical aspect of the electrical design requirements.
- D. Service entrance equipment rated 1,600 amperes and greater shall be "switchgear" built to ANSI standards as opposed to "switchboards" built to UL standards
- E. All front plate mounted devices shall be hinged and have all associated wiring accommodate the full swing of the hinge without damage. Switchgear equipment shall be supplied with an overhead hoist to assist with the O&M requirements.
- F. Specify extra wide pull sections for the installation of incoming conductors. All side wiring gutter covers shall also be hinged. The Contractor shall evaluate the footprint space constraints

for each acceptable equipment manufacturer. Include the space planning for future sections if applicable.

- G.** Specify a 4-inch housekeeping pad for switchgear and switchboards. In Central Plant locations where floor mounted equipment is present, specify 6-inch housekeeping pads.
- H.** Provide meter for load measurement and monitoring. The meter shall have the capability to fully commutate with the building automation system and match existing equipment currently in use. The meters shall be fully rated for the full load amperage on the switchgear and switchboard and the available fault current at the device.
- I.** Service entrance-rated switchgear and switchboards shall be fully bussed. All bussing shall be copper. Switchboards shall be equipped with a full neutral and ground bus.
- J.** Meet applicable available fault current requirements for available interrupting capacity for the equipment and its devices.
- K.** The Contractor shall provide an Arc Flash Coordination Study for all new power distribution and service entrance applications or equipment replacements. The Study shall follow the Aviation Department Facility Standards and shall be provided in an Easy Power Format. Provide electronic and hard copy formats. All related labeling shall be provided and installed and approved by FACILITIES AND SERVICES.
- L.** Where permissible, the Contractor shall specify arc chute, arc flash dissipating switchgear.
- M.** The Contractor shall specify permanent, engraved nameplates on all equipment. The panel name should be coordinated with the existing panel naming convention at the site for clarity and documentation and be approved by FACILITIES AND SERVICES.

2-5.21.3 CIRCUIT BREAKERS

- A.** Switchgear and large switchboard circuit breakers shall be stationary type with static trips, UL listed for 100% continuous current rating, an AIC rating (minimum of 50 k AIC) to match the fault current calculations for the upstream transformer, and adjustable long-time and short-time pick up trip settings.
- B.** For service entrance-rated equipment and switchgear, all circuit breakers 800 Amps or larger shall be draw-out type; motor operated circuit breakers.
- C.** Switchgear and switchboards shall have the provision of switching out the trip units for circuit breakers, rather than a straight replacement of the over current protection device.

2-5.22 Distribution Switchboards

2-5.22.1 ACCEPTABLE MANUFACTURERS

- A.** Eaton/Cutler Hammer
- B.** Square D
- C.** G.E.

2-5.22.2 GENERAL

- A.** New Aviation Department electrical distribution switchboards shall be located in interior, conditioned spaces. Do not specify exterior-mounted or outdoor-rated equipment or equipment that is located on the exterior of the building. The Contractor is required to coordinate all equipment locations with the project's Space Planner, Architect, and PM to ensure proper NEC clearances and equipment accessibility requirements.

- B.** The Contractor shall not locate the Aviation Department facility switchboard placements within Tenant areas or Tenant accessible areas.
- C.** The Contractor shall evaluate single point failure requirements as noted in other sections of the City of Phoenix Aviation Department Design Manual.
- D.** Switchboards shall be of the dead-front, safety type; framework shall consist of a die-formed steel rigidly welded and bolted together to support the entire structure including internal busing, exterior covers and plates and switches and/or circuit breakers. Provide internal pull section(s) for the routing of wire to conduits (branch circuits and feeders).
- E.** The Contractor shall evaluate the footprint space constraints for each acceptable equipment manufacturer. Include the space planning for future sections if applicable.
- F.** Specify a 4-inch housekeeping pad for distribution switchboards. In Central Plant locations where floor mounted equipment is present, specify 6-inch housekeeping pads.
- G.** Provide internal current transformers (CT's) and potential transformers (PT's) for load metering with internal meter for load measurement and monitoring. The meter shall have the capability to fully communicate with the building automation system and match existing equipment currently in use. The meters shall be fully rated for the full load amperage on this switchboard and available fault current at this device.
- H.** Front covers for all switchboards shall be hinged with lock out capabilities. All switches and circuit breakers shall have lock out, tag out capabilities for maintenance purposes.
- I.** Busing (vertical and horizontal) shall be the entire length of the panel board and be fully rated across sections. All bussing shall be copper. Switchboards shall be equipped with a full neutral and grounded bus.
- J.** Meet applicable available fault current requirements for available interrupting capacity for the equipment and its devices.
- K.** The Contractor shall provide an Arc Flash Coordination Study for all new power distribution switchboard replacements. The Study shall follow the City of Phoenix Aviation Department Facility Standards and shall be provided in an Easy Power Format. Provide electronic and hard copy formats. All related labeling shall be provided and installed and approved by FACILITIES AND SERVICES.
- L.** The Contractor shall specify permanent, engraved nameplates on all equipment. The panel name should be coordinated with the existing panel naming convention at the site for clarity and documentation.

2-5.22.3 CIRCUIT BREAKERS

- A.** Switchboard circuit breakers shall be stationary type with static trips, UL listed for 100% continuous current rating, an AIC rating (minimum of 50 k ampere interrupting capacity (AIC)) to match the fault current calculations for the upstream transformer, and adjustable long-time and short-time pick up trip settings.

2-5.23 Panel Boards

2-5.23.1 ACCEPTABLE MANUFACTURERS

- A.** Eaton/Cutler Hammer
- B.** Square D
- C.** G.E.

2-5.23.2 GENERAL

- A.** Panel boards shall be a minimum of 225 Amps and 42-pole mounting positions. The Contractor shall specify lug kits (feed-through or sub-feed). All panel boards that reside on one floor but are powered by an upstream panel on another floor or in another room shall have a main circuit breaker.
- B.** All specified bus bars shall be copper and located in the rear of the panel.
- C.** Available fault current rating of the panel (bus bars, circuit breakers, etc.) shall be dictated by the complete fault current calculation.
- D.** Locks shall be provided on all panel boards. It is desirable that all panel boards shall be keyed the same.
- E.** Specified Panel boards shall be equipped with a full neutral and ground bus.
- F.** Provide an isolated ground bus where applicable.
- G.** All panel boards shall have a door-in-door trim for access to wire ways and lugs. Surface mounted wire ways may have the entire cover hinged in lieu of a second door for access to the wiring.
- H.** The Contractor shall ensure that all required NEC clearances are maintained when locating panel boards on the plans. Panels should be located early in the design process in case there are insufficient clearances in which case the condition can be corrected more efficiently and cost effectively.
- I.** Panel boards shall be mounted such that the top trim is not higher than 6-feet above the finished floor.
- J.** All panel board enclosures shall have blank end-walls. The use of knock-out type end walls is prohibited.
- K.** The Contractor shall specify permanent, engraved nameplates on all equipment. The panel name should be coordinated with the existing panel naming convention at the site for clarity and documentation.

2-5.23.3 PANEL IDENTIFICATION (LABELING)

- A.** Each panel shall be provided with an engraved nameplate indicating the panel name. The panel name should be coordinated with the existing panel naming convention at the site for clarity and documentation and approval by FACILITIES AND SERVICES.

2-5.23.4 PLACEMENT

- A.** Designs for panel boards should allow placement near or central to their loads. They shall be located in the auxiliary electrical rooms; electrical closets or suitable ancillary rooms provided they are easily accessible to maintenance personnel.
- B.** The Contractor shall not locate the Aviation Department facility panel board placements within Tenant areas or Tenant accessible areas.

2-5.23.5 CIRCUIT IDENTIFICATION

- A.** All branch circuits or feeders shall be identified on the drawings with the panel board identity and device protecting the individual circuit or feeder. The Contractor shall provide a complete panel directory on the drawings. In addition, the drawings provide an accurate, typed panel board directory upon completion of the construction.

2-5.23.6 SPARES

A. Panel boards shall be equipped with minimum 25 percent spare bus work and spaces to complete a standard-size panel board.

2-5.24 Motor Control Centers

2-5.24.1 ACCEPTABLE MANUFACTURERS

- A. Allen-Bradley
- B. Square D
- C. Eaton/Cutler-Hammer
- D. G.E.

2-5.24.2 GENERAL

- A. New Aviation Department motor control centers (MCCs) shall be located in interior, conditioned spaces. Do not specify exterior-mounted, outdoor-rated equipment. The Contractor is required to coordinate all equipment locations with the project's Space Planner, Architect, and PM to ensure proper NEC clearances and equipment accessibility requirements.
- B. The Contractor shall evaluate single point failure requirements as noted in other sections of the City of Phoenix Aviation Department Design Manual.
- C. The Contractor shall evaluate the footprint space constraints for each acceptable equipment manufacturer. Include the space planning for future sections if applicable.
- D. Specify a 4-inch housekeeping pad for most applications. In Central Plant locations where floor mounted equipment is present, specify 6-inch housekeeping pads.
- E. Motor control centers shall be designed in accordance with the latest NEMA and UL standards.
- F. Each control center shall consist of one or more vertical sections bolted together to form a rigid, free standing assembly with considerations for future additions.
- G. Top and bottom wiring troughs shall extend the entire length of the control center and intersect with a vertical wiring trough on one side of the control units in each section.
- H. Fully rated horizontal bus bars shall be provided near the top or the bottom and run the entire length of the control center (including future sections).
- I. Design a 1/4-inch x 2-inch ground bus bar running the entire length of the assembly.
- J. Each control unit shall be completely enclosed and isolated from all other units and bus bars. Each control unit shall contain a 150VA, single phase, 120V control transformer.
- K. The motor control center shall be fully rated to handle the available fault current calculated (including the contribution current that the motors will add to the system).
- L. All motor starters and additional requirements shall be coordinated with the mechanical engineer prior to start of design.
- M. The Contractor shall specify permanent, engraved nameplates on all equipment. The panel name should be coordinated with the existing panel naming convention at the site for clarity and documentation.

2-5.25 Overcurrent Protection

2-5.25.1 FUSES

- A. Fuses 601A and larger shall be class "L", current limiting, time-delay, 600V, and 200,000 A RMS symmetrical (Bussmann KRP-C).

B. Specified fuses protecting motor control centers and transformers shall be UL Class "RK-1," current limiting, time-delay, 600 or 250 volt, where interrupting duty is over 100,000 amperes RMS symmetrical (Bussmann LPS-RK or LPN-RK), and UL Class "RK-5," time-delay for up to 100,000 amperes RMS symmetrical (Bussmann FRS-R or FRN-R).

C. Specified fuses protecting motor branch circuits shall be UL Class "RK-5," time delay, 600 or 250 volt, 200,000 amperes RMS symmetrical interrupting rating, sized at 125% of motor nameplate full load amperes (Bussmann FRS-R or FRN-R).

D. Specified fuses shall be fully coordinated throughout the distribution.

2-5.25.2 ACCEPTABLE FUSE MANUFACTURERS

A. Bussmann

B. LittleFuse

C. Gould

2-5.25.3 CIRCUIT BREAKERS

A. Specified circuit breakers shall be molded case, trip-free, quick-make/quick-break, thermal-magnetic type, with handles clearly indicating rating and position, ON, OFF or TRIPPED. Circuit breakers intended for distribution shall incorporate both long and short time pickup adjustments. Circuit breakers shall be bolt-on devices.

B. Circuit breakers shall have an interrupting rating no less than the available calculated fault current.

2-5.25.4 FUSIBLE SWITCHES

A. All devices must have a cover interlocked to prevent opening the door when the switch is energized.

B. Specified fusible switches 800A and larger shall be high pressure type, 100% equipment rated, and have a contact interrupting current of 12 times the rated current when tripped electronically or manually.

C. Specified fusible switches 600A and smaller shall be horsepower rated, quick-make, quick-break, with a minimum contact interrupting current of 12 times the rated current when tripped electronically or manually.

2-5.26 Safety Switches

2-5.26.1 ACCEPTABLE MANUFACTURERS

A. Eaton/Cutler Hammer

B. Square D

C. G.E.

2-5.26.2 GENERAL

A. Specified safety switches shall be heavy-duty type, externally operated, quick-make, quick-break, rated at the voltage and amperage as determined by design.

B. Specified switches shall be NEMA 1 unless mounted outside, in which case NEMA 3R is required or NEMA 4X in corrosive environments.

C. Coordinate all Division 15 requirements in regards to variable frequency drives and the associate shut down and start up.

- D. Where a disconnect cannot be mounted on the wall, note on the drawings for a uni-strut assembly to be installed to accommodate the disconnect device.
- E. NEC required clearances shall be maintained in all disconnect locations.
- F. The Contractor shall specify permanent, engraved nameplates on all equipment. The panel name should be coordinated with the existing panel naming convention at the site for clarity and documentation.

2-5.27 Grounding

2-5.27.1 All panel board cabinets, equipment, enclosures, and conduit systems shall be securely grounded with regard to NEC Article 250 (or as amended by the City of Phoenix). All electrically operated equipment shall be bonded to the grounded conduit system.

2-5.27.2 Any conductive structure that is likely to become energized and is subject to personal contact shall be grounded by one or more methods outlined in NEC Article 250.

2-5.27.3 All grounding conductors shall be installed in conduit with connections that are easily accessed for inspections.

2-5.27.4 Specified conduits and raceways shall have an internal ground wire; the conduit is not an acceptable grounding method or a ground path.

2-5.27.5 Furnish and install grounding electrodes (sized per NEC Article 250) as required.

2-5.28 Telecommunication Grounding System

2-5.28.1 REQUIREMENTS

- A. A low impedance grounding system shall be provided for a signal reference point for communication system equipment and infrastructures.
- B. Specify a telecommunications bonding backbone (TBB) sized per NEC Table 250-66. All bonding conductors shall be #6 AWG minimum (stranded copper with an insulated green jacket).
- C. Multi-story buildings that will require two or more TBBs shall bond them together at the top and bottom floors of the building. When the building height exceeds four floors, every third floor in between shall be bonded together.
- D. System connections shall have an irreversible connection (compression type connector, exothermic weld, etc.).
- E. Grounding conductors shall be noted to be free from loops and have no bends greater than 90 degrees.

2-5.29 Dry-Type Transformers (600 Volts or less)

2-5.29.1 ACCEPTABLE MANUFACTURERS

- A. Eaton/Cutler-Hammer
- B. Square D
- C. G.E.

2-5.29.2 The Contractor is required to coordinate all 75 kVA and larger transformer locations with the project's Space Planner, Architect, and Aviation Department PM to ensure proper NEC clearances and equipment accessibility requirements. Transformers shall not be located in

difficult to access spaces or be blocked by other equipment. Large transformers shall have Aviation Department PM approved future service and accessibility features for large crane or equipment service needs.

2-5.29.3 All dry-type transformers shall be mounted on vibration isolators (floor and trapeze-mounted).

2-5.29.4 Specified transformers must be copper-wound; **no aluminum-wound transformers shall be permitted.**

2-5.29.5 Specified dry-type transformers larger than 45 kVA shall not be permitted to be trapeze mounted, unless allowed by the Aviation Department PM. All suspended transformers shall be readily accessible.

2-5.29.6 Do not stack transformers 45 kVA or less, unless first approved by the Aviation Department PM.

2-5.29.7 Dry-type transformers 112.5 kVA or less shall have a minimum clearance of 12-inches between the transformer ventilation openings and combustible materials; transformers that are completely enclosed shall have a minimum of 6-inches of clearance between the transformer and adjacent materials. Dry type transformers larger than 112.5 kVA shall have a minimum clearance of 12-inches between the transformer and the adjacent structure.

2-5.29.8 Dry-type transformers larger than 112.5 kVA shall be installed in a minimum of a 1-hour fire-rated room.

2-5.29.9 Specified transformers to serve non-linear loads shall be energy efficient types, UL listed, and meet K-4 listings and NEMA TP-1, 80-degree temperature rise. Transformer windings shall be copper.

2-5.29.10 Specified transformer connections shall be made with flexible metal conduit or liquid-tight flexible metal conduit.

2-5.29.11 Voltage regulation shall conform to the NEC.

2-5.30 Medium Voltage Distribution Design Considerations (35 kV and 15 kV Class)

2-5.30.1 OVERHEAD TRANSMISSION AND DISTRIBUTION

A. The Contractor shall not specify overhead medium voltage transmission or distribution means. Where existing overhead medium voltage distribution is reworked, relocated, or retrofitted, all new medium voltage distribution routing shall be done below grade.

B. All medium voltage transmission and distribution work shall be fully coordinated with Arizona Public Service (APS), the Aviation Department PM, and the Aviation Department Facilities and Services team.

2-5.30.2 UNDERGROUND TRANSMISSION AND DISTRIBUTION

A. All medium voltage transmission and distribution work shall be fully coordinated with Arizona Public Service (APS), the Aviation Department PM, and the Aviation Department Facilities and Services team.

B. The Contractor shall coordinate the underground routing path for any new electric service utility lines with the existing underground utilities (electric, street lighting, telephone, fiber, cable,

security and CCTV, irrigation controls, traffic signals, water, storm sewer, fire lines, natural gas, etc.) and the existing site conditions (roads, drives, curbs/gutters, etc.). The Contractor shall be responsible for walking the site to assist with identifying potential site complications.

C. Underground medium voltage distribution is the preferred method for the distribution of medium voltage power. All design work shall comply with current APS Design and Construction Standards.

D. Specified underground transmission and power distribution lines shall be run in conduit. PVC schedule 80 conduit, sized appropriately for the sum total of the conductors, grounded conductor and ground wire (as applicable). Transitions and turns shall be wide radius type PVC coated galvanized rigid conduit.

E. All medium voltage transmission and distribution work shall be fully coordinated with Arizona Public Service (APS), the Aviation Department PM, and the Aviation Department Facilities and Services team.

F. Encase the underground medium voltage transmission and distribution lines with red dyed flowable fill, low-compaction strength (psi) concrete. Flowable fill encasement shall be coordinated with APS during design and specified accordingly.

G. The design shall include pre-cast concrete structures for the purpose of reducing the efforts of pulling medium voltage conductors and/or cabling. Manholes and hand-holes shall be sized according to APS Requirements and specifications. Provide high-strength manhole and hand-hole lids and structures in areas of vehicular or aircraft traffic. Provide load and strength calculations with the design to support manhole and hand-hole strength and size classifications.

H. Manholes shall be specified with fiberglass cable racks, capable of supporting twice the calculated weight of the conductors in the manholes

I. Manhole covers and hand-hole covers must be constructed of high-strength steel. Composite covers may be permitted for hand-holes in protected areas as permitted by the Aviation Department PM and Arizona Public Service (APS).

J. Penetrations into and out of manholes and hand-holes shall be sealed, water tight, with a cabling manufacturer approved sealant.

K. Underground medium voltage cabling shall be shielded type MV cable, 133% insulation class conductors. Cables shall be manufactured for direct burial but will be routed in conduits.

L. Medium voltage cable terminations, connectors (including separable insulated type connectors), and joints (including heat-shrinkable and cold shrinkable type joints) shall be UL listed for its application. Specifications and the materials specified in the design documents shall comply with APS requirements.

M. The design shall indicate that all medium voltage cable splices shall be made in an accessible manhole, hand-hole, or similar location.

N. Cable identification: underground medium voltage cables must be identified by cable tags and colored PVC electrical tape. The design specifications must specify polyethylene cable tags, to identify the voltage and circuit (if applicable) of the conductors. Letters shall not be hand written but type printed on the labels.

O. Specified Cable Termination Cabinets: Cable termination cabinets must be sized appropriately for the sum total of the medium voltage cabling terminating inside the cabinet plus allow for sufficient room for future cable terminations. Termination cabinets shall be specified to provide appropriate turning radii for all cables. Specify a 4" (above grade) concrete housekeeping pad.

The termination cabinet shall comply with Arizona Public Service requirements and specifications.

P. Reclosers: Reclosers shall be electronic automatic type as required by APS.

2-5.31 Lighting Fixtures and Lamps

2-5.31.1 ACCEPTABLE LAMP MANUFACTURERS

- A. Sylvania
- B. GE
- C. Philips
- D. Or approved equal

2-5.31.2 ACCEPTABLE LIGHTING MANUFACTURERS

- A. Hubbell
- B. Lithonia
- C. Cooper
- D. The above luminaire providers supply a wide range of products within their product lines. The Contractor shall obtain Aviation Department PM approval for fixture manufacturers that vary from the acceptable manufacturers.

2-5.31.3 INTERIOR LAMPING

- A. T8 lamps with 4100K color temperature is the current standard for linear fluorescent lamps. Specify standard size and type of lamps, so as to minimize operations and maintenance (O&M) stocking requirements. T5 lamping shall not be permitted.
- B. Fluorescent or LED are preferred over metal halide (MH).
- C. MH fixtures shall have protective lenses that shield the lamp from surrounding area.
- D. All lamps shall be low mercury types.

2-5.31.4 INTERIOR LIGHT FIXTURE BALLASTS

- A. All ballasts shall be electronic program rapid start for fluorescent lights, unless a dimmable ballast is required.

2-5.31.5 INTERIOR LIGHT FIXTURES—DIMMING

- A. Specified dimming ballasts shall be coordinated with the types of lamps that are specified.

2-5.31.6 BATTERY PACKS (EGRESS FIXTURES)

- A. Interior: Specified fluorescent battery packs shall be provided in fixtures for emergency egress illumination when emergency circuiting from a backup generator is not available. The battery packs specified must provide the required lumen output for egress lighting for 90-minutes. For night light and emergency function, the drawings shall indicate the connection of the fixture(s) to an unswitched conductor (connected ahead of any switching) for power monitoring. For fixtures to be switched but having an emergency function, the system must provide an extra phase conductor (unswitched) for constant power monitoring.
- B. Exterior: for exterior egress fixtures, the battery pack shall be remotely mounted inside for temperature considerations.

2-5.31.7 EXTERIOR LAMPS AND BALLASTS, LEDs and Drivers

A. The current Aviation Department Facility Standard is for exterior light fixtures to have either high pressure sodium, LED or fluorescent lamps. Coordinate the exact use and color of lamp or LED shall be types with surrounding locations. Must be approved per location by Facilities and Services.

- Standard color temperature will be as the following rated in degrees Kelvin:
- Boulevard – 2700 K to I-10 to T-2 and east of TW Romeo bridge
- Boulevard – 4000 K T-2 east to TW Romeo Bridge
- Aircraft Ramps – 5000 K
- Garages – 4000 K
- Public lots – 4000 K
- Employee lots – 4000 K
- Tenant lots – 4000 K
- Fleet parking – 4000 K
- Rental Car Center – 4000 K
- Islands for Ground Transportation – 4000 K
- Building exterior (curbside) – 4000 K

B. The Contractor shall coordinate the application of this section with that regarding Security Lighting above and coordinate final lamp selection with the PM and FACILITIES AND SERVICES.

C. All fluorescent lamp ballasts shall be electronic.

D. All exterior luminaire ballasts shall be electronic and shall be designed for 0 degree Fahrenheit operation.

2-5.31.8 SUPPORTS

A. All fixtures shall be supported directly from the structural members of the building (independent of the ceiling system).

2-5.31.9 LUMINAIRE SCHEDULE

A. A complete luminaire schedule shall be provided with each project. The luminaire schedule shall list the brand, a full fixture description, the full specification, lamp type, ballast, mounting and any other pertinent information.

B. Fixture selections shall be coordinated with the Contractor and PM. Where no specific fixture is required or requested, the Contractor shall provide three equal specifications (from three different manufacturers) for a competitive bid. Fixtures with long warranty periods will be considered.

C. Specified light fixture selections must be from name brand equipment providers that have been in business a minimum of 5 years. The Contractor shall not specify light fixtures that come from long-distance or out-of-market equipment providers or which require special order parts or accessories or that contain exotic and difficult to replace parts. Light fixture selections must be able to be serviced with industry standard and common parts.

D. The Contractor shall coordinate the final light fixture selections with the PM.

2-5.31.10 SPECIAL FIXTURE CONNECTION REQUIREMENTS

A. Fixtures installed in an accessible ceiling shall be specified with a twist-lock connection with an SO cord for quick lighting change out.

2-5.31.11 GENERAL

A. Interior and Exterior: all light fixture locations, placements, and orientations shall be well thought out. Do not locate light fixtures in difficult to service locations, such as over equipment, water, escalators, moving sidewalks, and stairwells. Accessibility to light fixtures shall be maintained at all times.

B. Exterior: all exterior lighting adjacent to the Aviation-side of the facility, near service areas, near loading/unloading areas, near or on runways, etc. shall comply with applicable FAA and Aviation Standards.

2-5.32 Programmable Lighting Control System**2-5.32.1 PROGRAMMING MONITORING AND CONTROL**

A. It is the Contractor's responsibility to coordinate with the Aviation Department PM, the operational control and system functionality of the lighting control system, which shall include (but is not limited to) the following:

A.1. Lighting automation panels

A.2. Switches

A.3. Occupancy Sensors

A.4. Photocells

A.5. Daylight Harvesting

A.6. System integration

A.7. Battery Backup

B. The lighting control system and its related programming shall be fully integrated with the existing Aviation Department facility lighting control and central control systems. Any network or system points or licenses shall be provided as a part of the project. The ultimate goal of the Facilities and Services Division is to integrate all automated lighting controls to a common control system

C. Circuiting of branch lighting circuits shall promote the use of automated lighting reduction controls.

2-5.32.2 MANUFACTURERS

The Overall control system at Sky Harbor is an ETC Paradigm system using the ETC Light Designer software which has multiple ways to access and control the system. All existing and future control systems shall be 100% integral into existing lighting control software and are required to be controlled with this ETC system at a zone-by-zone level of control. Acceptable interface protocols are RS232, DMX, and UDP.

All existing and future dimming racks and relay panels shall be upgraded to ETC relay panels with direct ETC control. Some existing systems may simply need to be modified, not replaced.

2-5.32.3 GENERAL REQUIREMENTS

A. The Contractor shall fully coordinate the new system components with the existing Sky Harbor campus lighting control system onsite. The new system must have an 8-hour battery backup in

case of a, power failure. In the event of a total power failure or system crash there must be a provision for a fall back to manual control.

B. The system design must include a complete sequence of operation listed for the new system including the interaction and control of the existing system with the new system.

C. Include BacNet communications interface card in all lighting control panel specifications. **Any network system computer points that are needed shall be provided as a part of the project.**

2-5.33 Lightning Protection System

2-5.33.1 The Contractor shall provide a lightning protection design for all projects, if there is currently no lightning protection system in place. Coordinate the extent of this design requirement with the PM. In instances where there is an existing lightning protection system, this system must be evaluated and upgraded (or replaced) if the extent of work renders the existing system outdated or insufficient. It is the engineer's responsibility to coordinate with the PM all requirements and existing lightning protection systems.

2-5.33.2 SYSTEM COMPONENTS

A. The system shall be composed of (but not limited to) the following items:

A.1. Air terminals:

A.2. Interconnecting conductors

A.3. Grounding and bonding of extended metal objects

A.4. Other System Components

2-5.33.3 DESIGN CONSIDERATIONS

A. Specified air terminals may be of copper or aluminum and shall extend a minimum of 10-inches above the object to be protected. Spacing on ridges or roofs shall not exceed 20-foot on center (or 50-foot on center for flat or gently sloping roofs). Instruction for impalement signage and display of impalement signage must be provided.

B. Specified conductors shall be sized per the NEC, NFPA 780, and IEEE Standards most current adopted revision or edition. The interconnecting conductors must provide a two-way path from each air terminal to ground (while avoiding "U" or "V" shaped pockets. All conductors must be copper.

C. Specified metal bodies permanently affixed to the structure shall be bonded to the main conductor system. Any smaller metal objects shall be bonded if they are within 6-feet of another bonded object or the interconnecting conductors of the lightning protection system.

D. All connections shall be exothermically welded. If connectors are used, bronze equipment is required.

E. Grounding

E.1. Grounding Electrode System

A ground electrode system shall be provided for each power service facility. The grounding electrode system shall consist of buried ground conductors and electrodes interconnected to form a grid and shall be capable of maintaining a resistance to ground of (5) ohms or less.

2-5.33.4 GROUNDING CONDUCTOR SIZING

A. Each of the conductors shall be sized so it can safely pass the maximum ground fault current without melting or fusing before the circuit breakers or protective relays disconnect the source of the fault current.

2-5.33.5 GROUND RODS

A. When ground rods are used as the ground electrode they shall be minimum 3/4-inch diameter, 10-foot length, copper-clad, Type 304 solid stainless steel.

2-5.33.6 CONNECTION TO UTILITIES

A. There shall be no connection between the grounding system and any utility line (including water) outside the dielectric coupling, which is used to isolate facilities from utilities outside the building line.

2-5.33.7 AUXILIARY EQUIPMENT GROUNDING

A. The transformer case and alternating current switchgear enclosures for auxiliary power shall be solidly grounded to the facility ground grid system using copper grounding conductors. The spiral metallic tape covering of medium voltage cables 5 kV and above shall also be solidly grounded at both ends to the facility ground grid system.

2-5.33.8 POWER TRANSFORMER GROUNDING

A. The neutral of the power transformer secondary shall be solidly grounded through a copper grounding conductor bonded to the facility ground grid system. Grounding conductors from the secondary switchboards shall be grounded to the same grounding conductor.

2-5.33.9 DISTRIBUTION TRANSFORMER GROUNDING

A. Specified distribution transformers used for secondary power distribution shall have their secondary neutrals solidly grounded. Neutral conductors from secondary panel boards served by 480-volt transformers shall be grounded to the same conductor to assure single point grounding of neutral conductors.

2-5.33.10 SAFETY GROUND

A. Specified raceways for feeders and power feeders to motors shall contain a separate green safety insulated grounding conductor. The safety grounding conductors for feeder circuits shall each be bonded at one end to the switch board ground bus and at the other end to the ground bus of a panel board or to a motor control center ground bus. Each branch circuit shall have a safety-insulated grounding conductor extended from the ground bus of the panel board or motor control center to the device it is serving

2-5.34 Uninterrupted Power Supply/Systems

2-5.34.1 ACCEPTABLE MANUFACTURERS:

- A. Liebert
- B. APC
- C. Eaton
- D. Emerson

2-5.34.2 UL 1778 Compliant (Uninterruptible Power Supplies):

- A. Liebert

2-5.34.3 SUPPLY VOLTAGES

A. Nominal electric infrastructure and facility voltages shall be 208Y/120V three phase, 4 wire, and 480Y/277V three phase, 4 wire.

B. Specified an internal step-down transformer in the UPS for 480Y/277V input voltage UPS systems.

2-5.34.4 OUTPUT VOLTAGES

A. . Nominal electric infrastructure and facility voltages shall be 208Y/120V three phase, 4 wire, and 480Y/277V three phase, 4 wire.

B. The specified output of the UPS shall have an isolation transformer provided for protection of equipment.

2-5.34.5 SIZING CONSIDERATIONS

A. Refer to the INSTALLATION section for related design considerations and constraints.

B. The UPS shall be sized (in kVA) to support the NEC calculated connected code load in addition to the required spare/future capacity. Coordinate the required spare capacity with the PM and the user.

C. The UPS battery and rack quantity shall be sized after the UPS has been sized (in kVA). The batteries must be able to supply the NEC code power load for a pre-determined set of time. Coordinate the required minimum UPS run time the PM and the user. The battery rack quantity must exceed this minimum run time.

2-5.34.6 INSTALLATION:

A. All NEC clearances must be maintained. Design the space and/or electrical room layout for the largest UPS footprint (worst case scenario). Take into consideration all of the manufacturers listed above.

B. Coordinate the exhaust and venting locations of the UPS with the HVAC engineer to provide maximum cooling and air-flow. Coordinate the room ventilation with the HVAC engineer as for Valve Regulated Lead Acid (VRLA) batteries emit hydrogen and the maximum hydrogen content must not be exceeded in the room. Refer to the IFC Section 608 for requirements.

C. The designer must calculate the amount of electrolyte fluid that will be present in the battery banks for the UPS. If the UPS batteries amount to more than 50 gallons of electrolyte, spill containment will be required. Refer to the IFC Section 608 for requirements.

D. Provisions for emergency shutdown (EPO push button) shall be designed in accordance with the NEC Article 645.10 and 645.11.

2-5.35 Life Safety Emergency and Standby Emergency**2-5.35.1 GENERAL**

A. Emergency power and emergency systems shall be supplied in accordance with the applicable code adopted by the City of Phoenix. Specifically, life safety systems are to be provided in accordance with NEC and the IBC.

A.1. Full power backup is required for Emergency and Emergency Egress lighting, security control rooms, security systems, fire alarm system, and emergency evacuation system. Provide separate transfer switches to separate emergency egress power from emergency critical load power.

B. Any new generator installation, replacement, or upgrade shall be coordinated with the Aviation Department PM, Facilities and Engineering teams, and the Environmental Section. Coordinate all diesel fuel requirements, tank placements, and air quality permits. Generators are to be monitored per Scope 2-5.8.4.i

2-5.35.2 ACCEPTABLE MANUFACTURERS

A. Cummins

B. Caterpillar

- Coordinate purchase of Generator Sets with the Aviation Department PM or other selected vendor.

2-5.35.3 LIFE SAFETY EMERGENCY GENERATORS

A. It is the Aviation Departments policy to avoid placing non-emergency loads on Life Safety generators. Unless required for life safety, the emergency generator shall not back up the following types of backup loads:

B. Server rooms

C. Lighting that is not required for emergency egress

D. Workstations

E. Kiosks and Non-Critical Public Way finding Means

F. Vendor booths

2-5.35.4 The prime rating of the emergency generator shall be designed and sized for the total emergency load plus a 25% factor of safety. The specified generator shall be fully rated for the atmospheric conditions; the generator needs to withstand temperatures in excess of 47-degrees Celsius (116-degrees Fahrenheit). It is recommended the generator be fully rated for constant operation at 55-degrees Celsius (131-degrees Fahrenheit). In order to achieve this, the cooling system may need to be upgraded.

2-5.35.5 Coordination with the generator manufacturer/vendor is required.

2-5.35.6 Designs for life safety generators shall have the following components and options specified:

A. Fully rated for 55-degrees Celsius constant full load operation with Class H insulation.

B. Charging alternator to charge the batteries once the generator has been started.

C. No greater than a 10-second start-up time.

D. Time delay programmed into the generator control system. The life safety emergency generator will remain on and (and powering life safety loads) powering life powering life safety loads for minimum of 5-minutes after power has been restored.

E. The life safety emergency generator shall be powered from a reliable-liquid fuel source: diesel. Provide a minimum of a 24-hour day tank with the generator set. The fuel tank must be double-walled or placed in secondary containment. Natural gas generators shall have a by-fuel propane tank with automatic fuel transfer switch. Tank capacity should allow for a minimum of 24 hour run time.

F. Provide with an engine block heater (coolant)-

G. Provide the batteries with warming blankets. Batteries shall be AGM type

- H.** The life safety emergency generator enclosure shall be exterior rated and sound attenuated unless otherwise instructed.
- I.** Provide a critical sound attenuated muffler.
- J.** Integral dual mode battery charger - The charger shall be capable of providing a 1-amp trickle charge to maintain battery voltage and a 10-amp charge mode for battery charge recovery.
- K.** Provide a by-pass isolation automated transfer switch (ATS) with the generator design. The ATS vendor shall be approved by the Aviation Department PM during the design phase.
- L.** Provide a central control panel, located on the generator, with an emergency power off button, graphic annunciation panel, alarms, and unit controls. The Airport Facilities Management Team shall have the capability of full control of the generator's functions from this control panel.
- M.** Additionally, the generator must have six status points available which will be monitored by the Airport campus-wide fire alarm network. The six points to be monitored include
- Running
 - Trouble
 - Low Fuel
 - Battery Fault
 - Not in Auto
 - Transfer switch position
- N.** An additional communications link from the life safety generator to the central fire alarm control panel is required to alert Fire Response personnel and FACILITIES AND SERVICES to the status of Life Safety emergency generators during an emergency situation
- O.** Locate generator sets away from air intakes and mechanical systems. Generator(s) will be mounted in compliance with APS or requirements set by electrical code. Field coordinate generator locations with the Aviation Department PM.
- P.** Fuel Tanks and fuel fill ports are to be installed with the latest fire code specifications. A minimum of a two-inch cam lock fuel connector shall be used on fuel tanks that are greater than 300 gallons.
- Q.** Shall be equipped with an OSHA 1910 compliant catwalk to allow for safe access to the generator and manways and tank appurtenances mounted on the topside of the fuel tank.
- R.** Perimeter clearance around the generator shall be at least ten feet
- S.** Multiple generators located in close proximity shall have a common ConVault fuel tank with the capability for a mobile fuel station supplying fuel to the generators. (added lines)
- T.** Generators electrical panel shall be equipped with quick connect cam locks or a bus bar for backup portable generator to be installed.
- U.** A pad located close to the quick connect cam lock or bus bar panel shall be designated for a portable temporary generator for emergency needs.

2-5.35.7 STANDBY EMERGENCY ENGINE GENERATOR

- A.** Separate generator backup systems may be required for standby power or non-critical loads. The Contractor shall meet with the PM and FACILITIES AND SERVICES to determine which services require Standby Emergency Power.

- B.** The prime rating of standby generator systems shall be designed and sized for the total load plus a 25% factor for safety and future expansion. In addition, standby generators shall have the following components and options specified:
- C.** Fully rated for 55-degrees Celsius constant full load operation (prime). Alternator shall be class H insulation type.
- D.** Charging alternator to charge the batteries once the generator has been started.
- E.** Time delay programmed into the generator control system. The generator will remain on and after power has been restored.
- F.** Provide a minimum of a 24-hour day tank with the generator set. The fuel tank must be double-walled or placed in secondary containment. Natural gas generators shall have a by-fuel propane tank with automatic fuel transfer switch. Tank capacity should allow for a minimum of 24 hour run time.
- G.** It is recommended to specify standby generators with an engine block heater (coolant) Coordinate this option with the Aviation Department PM during the design phase.
- H.** The standby generator enclosure shall be exterior rated and sound attenuated unless otherwise instructed by the Aviation Department PM and the Aviation Department.
- I.** Fuel Tanks and fuel fill ports are to be installed with the latest fire code specifications. A minimum of a two-inch cam lock fuel connector shall be used on fuel tanks that are greater than 300 gallons
- I.** Provide a critical sound attenuated muffler.
- J.** Integral dual mode battery charger. The charger shall be capable of providing a 1-amp trickle charge to maintain battery voltage and a 10-amp charge mode for battery charge recovery.
- K.** Provide a by-pass isolation automated transfer switch (ATS) with the generator design. The ATS vendor shall be approved by the Aviation Department PM during the design phase.
- L.** Provide a central control panel, located on the generator, with a remote emergency power off button, graphic annunciation panel, alarms, and unit controls. The Aviation Department shall have the capability of full control of the generator's functions from this control panel.
- M.** An additional communications link from the life safety generator to the central fire alarm control panel is required to alert Fire Response personnel to a running standby generator during an emergency situation.
- N.** The conductors from the generator shall be sized at a minimum of 115% of the nameplate rating of the generator. The neutral shall be sized per NEC 220.61. Voltage drop calculations must also be completed,
- O.** Grounding
- O.1.** NEC Article 250.30 NFPA 70E shall be referenced in regards to ground of the generator system.
- P.** Shall be equipped with an OSHA 1910 compliant catwalk to allow for safe access to the generator and manways and tank appurtenances mounted on the topside of the fuel tank.
- Q.** Perimeter clearance around the generator shall be at least ten feet.
- R.** Multiple generators located in close proximity shall have a common ConVault fuel tank with the capability for a mobile fuel station supplying fuel to the generators. (added lines)
- S.** Generators electrical panel shall be equipped with quick connect cam locks or a bus bar for backup portable generator to be installed.

T. A pad located close to the quick connect cam lock or bus bar panel shall be designated for a portable temporary generator for emergency needs.

2-5.35.8 LIFE SAFETY ALARM / EVACUATION CONTROL SYSTEM

A. Design Criteria

A.1. The Contractor shall work closely with the PM and the Aviation Department to coordinate the exact requirements for the life safety alarm and evacuation system. New components or additions to the existing alarm system shall match existing alarm functionality, sound and be fully compatible with the central alarm control system.

A.2. The Life Safety and evacuation alarm system is not to be tied into the central building management system.

A.3. The Life Safety and Evacuation system is microcomputer based, central control unit, that communicates to other smart control units from other systems and annunciation devices such as video display terminals, printers, fire alarm initiating and indicating devices, security sensors, Fire Command Station (FCS), amplifiers, speakers, firefighter telephones and audible/visual signaling devices.

A.4. This system shall have the capability to provide:

- Emergency Signaling and Paging System to transmit evacuation signals and to provide one-way voice communications to all or selected areas of the building.
- Alert Emergency personnel to the area where the call was alerted from.
- Provide evacuation and other instruction to the Airport occupants and personnel so they may find a safe area of refuge.
- Send alert and notification signals (visual and audible) throughout the facility.
- Send alerts and instructions to video display terminals.
- Have the ability to accept alert initiating functions such as for health emergency, terrorist alerts and fire alarm initiating alerts.

2-5.36 Special Electronic Systems - General Provisions

2-5.36.1 The engineer shall specify the other applicable sections for the requirements as well as specific manufacturer information in regards to special electronic systems.

2-5.36.2 The Contractor shall fully coordinate any additional special electronic systems with the Aviation Technology and other stakeholders prior to start of the design.

2-5.37 Fire Alarm Systems

2-5.37.1 ACCEPTABLE MANUFACTURERS

A. The City of Phoenix Buildings Standard states that all occupied buildings shall have an operating Fire Alarm system installed. This directive supersedes minimum fire code requirements and is designed to provide additional protection in buildings that have a code-required fire sprinkler system. Therefore, all Aviation Department buildings shall contain a fire alarm system

B. The fire alarm system shall be an extension of the Honeywell Enterprise Buildings Integrator (EBI) Life Safety Manager. Any and all additional computer points needed for fire alarm

network/system modifications or additions shall be supplied as a part of the project or modification.

2-5.37.2 FIRE ALARM SYSTEM

A. The fire alarm system is comprised of the following items:

- A.1.** Fire-alarm control unit
- A.2.** Manual fire-alarm boxes
- A.3.** System smoke detectors
- A.4.** OSID (Open Space Image Detection) detectors
- A.5.** VESDA (Very Early Smoke Detection Appliance) detectors
- A.6.** Heat detectors
- A.7.** Notification appliances
- A.8.** Magnetic door holders
- A.9.** Remote annunciation
- A.10.** Addressable interface device
- A.11.** Digital alarm communicator transmitter

B. The fire alarm system is non-coded, addressable, and is capable of multiplexed signal transmission. The Fire alarm system is dedicated to fire detection, notification and annunciation and does not control or support other systems not relating to the Fire Alarm Systems.

2-5.37.3 GENERAL FIRE ALARM DESIGN REQUIREMENTS

A. The fire alarm design shall incorporate voice evacuation in parallel with the fire alarm notification communications operations. These communication and notification controls shall be interfaced with the PHX fire command center as approved by FACILITIES AND SERVICES and the fire command.

B. Elevator controls and operations shall report to the PHX fire command center. Coordinate additional controls and programming requirements with the elevator provider.

C. The fire alarm design is to include a layout of fire alarm devices, equipment such as booster panels and control panels, device address and one-line diagram or riser diagram.

D. The design shall include the following items:

- D.1.** Include voltage drop calculations for notification appliance circuits.
- D.2.** Include battery-size calculations.
- D.3.** Include performance parameters and installation details for each detector, verifying that each detector is listed for complete range of air velocity, temperature, and humidity possible when air-handling system is operating.
- D.4.** Include plans, sections, and elevations of heating, ventilating, and air-conditioning ducts, drawn to scale for coordinating the installation of duct smoke detectors and access to them.
- D.5.** Show critical dimensions that relate to placement and support of sampling tubes, detector housings, and remote status and alarm indicators. Locate detectors according to manufacturer's written recommendations.
- D.6.** Include floor plans to indicate final outlet locations showing address of each addressable device. Show size and route of cable and conduits.

2-5.37.4 FIRE ALARM AND CONTROL PANEL

A. Specify unit that is field-programmable, microprocessor-based, modular, power-limited design with electronic modules, complying with UL 864 and listed and labeled by an NRTL. The system software and programs shall be held in flash electrically erasable programmable read-only memory (EEPROM), retaining the information through failure of primary and secondary power supplies. The Control Panel must also have an internal real-time clock for time annotation of events on the event recorder and printer.

B. In addition, the Fire Alarm control panel shall also be specified with the following options:

B.1. Alphanumeric Display and System Controls: Arranged for interface between human operator at fire-alarm control unit and addressable system components including annunciation and supervision. Display alarm, supervisory, and component status messages and the programming and control menu.

B.2. Initiating Device, Notification Appliance, and Signaling Line Circuits: NFPA 72, Class A only if required by current fire codes.

B.3. The design shall include no more than 50 addressable devices on each signaling line circuit.

B.4. Initiating Device, Notification Appliance, and Signaling Line Circuits: NFPA 72, Class B.

B.5. The design shall include no more than 50 addressable devices on each signaling line circuit.

B.6. Transmission to Remote Alarm Receiving Station: Automatically transmit alarm, supervisory, and trouble signals to a remote alarm station.

B.7. Primary Power: 24-V dc obtained from 120-V ac service and a power-supply module. Initiating devices, notification appliances, signaling lines, trouble signals, supervisory signals, supervisory and digital alarm communicator transmitters and digital alarm radio transmitters shall be powered by 24-V dc source.

2-5.37.5 FIRE ALARM SYSTEM COMPONENTS

A. System Smoke Detectors:

A.1. Photoelectric Smoke Detectors:

A.2. OSID Detectors

A.3. Duct Smoke Detectors: Photoelectric type complying with UL 268A.

A.4. VESDA Detectors. VESDA piping network shall have a minimum of 1 cleanout/maintenance union per pipe segment. Multiple VESDA detectors shall be networkable through the Xtralis VESDA-Net protocol and interface to the existing PHX fire alarm system.

B. Heat Detectors: including linear type heat detection:

B.1. Combination Type: Actuated by either a fixed temperature of 135 degree Fahrenheit (°F) (57 °C) or a rate of rise that exceeds 15 °F (8 °C) per minute unless otherwise indicated.

B.2. Fixed-Temperature Type: Actuated by temperature that exceeds a fixed temperature of 190 degree Fahrenheit (88 °C).

C. Notification Appliances:

C.1. , Speakers – 70RMS input, 75-dBA minimum rated output.

C.2. Speakers – 70 volt RMS input, 81-dBA minimum rated output.

C.3. Horns: Electric-vibrating-polarized type, 24-V dc. Horns shall produce a sound-pressure level of 90 dBA. Device shall comply with UL 464.

C.4. Specified visible Notification Appliances: Xenon strobe lights comply with UL 1971, with clear or nominal white polycarbonate lens mounted on an aluminum faceplate. The word "FIRE" is engraved in minimum 1-inch- (25-mm-) high letters on the lens.

D. Specified Remote Annunciator:

D.1. Functions shall match those of fire-alarm control unit for alarm, supervisory, and trouble indications. Manual switching functions shall match those of fire-alarm control unit, including acknowledging, silencing, resetting, and testing.

E. Addressable Interface Device (Monitor Module)

E.1. This device shall be NRTL listed for use in providing a system address for alarm-initiating devices for wired applications with normally open contacts. An Integral Relay is required to provide a direct signal for auxiliary functions.

F. Wiring: All wiring for the system shall be in accordance with Articles 760 of the National Electric Code and local electrical codes. Wiring shall be UL listed for use on fire alarm systems and shall conform to the following:

F.1 Extension of fire alarm system shall conform to the existing wiring of buildings fire alarm system.

G. New installation of a fire alarm system shall conform to the following:

G.1 SLC wiring shall = #16 AWG yellow/brown twisted pair

G.2 NAC wiring = #12 AWG red/black

G.3 Speaker wiring = #14 AWG white/black twisted

G.4 Underground wiring = Aquaseal or equivalent waterproof cable shall be used

G.5 All Fire Alarm system wiring shall be installed in a dedicated raceway system. Use of plenum rated cable in lieu of the metal raceway system is not acceptable.

G.6 Conduit (EMT) must be used for wire installation – The minimum acceptable size is $\frac{3}{4}$ inch. No free air wiring or exposed wiring will be acceptable. Any wiring run underground will be run in PVC conduit 1" minimum buried at NEC specified depths. Intermediate Metallic Conduit will be used for installations that are subjected to physical damage. Conduit runs shall not exceed 270 degrees of total bends between pull points.

G.7 Conduit must be red in color. If the conduit is not red in color- acceptable substitutes would be red conduit fittings and red junction box covers. Conduits must be supported per code and penetrations must be properly sealed.

G.8 All fittings must be steel and compression type. No set screw fittings will be accepted.

2-5.37.6 FIRE ALARM SYSTEM OPERATION

A. Specified fire alarm signal initiation shall be by one or more of the following devices and systems:

A.1. Manual stations.

A.2. Heat detectors.

A.3. Smoke detectors.

A.4. Duct smoke detectors.

A.5. Automatic sprinkler system water flow meter switches.

B. The Fire-alarm signal then results in a response from the fire alarm control panel. The fire alarm control panel then initiates the following actions:

- B.1.** Continuously operate alarm-notification appliances.
- B.2.** Identify alarm at the fire-alarm control unit and remote annunciators.
- B.3.** Transmit an alarm signal to the remote alarm receiving station.
- B.4.** Record events in the system memory.
- C.** In addition to direct fire alarm initiation, a supervisory signal alarm is to commence by either the valve supervisory switch or duct smoke detection
- D.** System trouble signal(s) shall provide indication of device, circuit or subsystem failure. A system trouble signal will be initiated by one or more of the following devices and actions:
 - D.1.** Open circuits, shorts, and grounds in designated circuits.
 - D.2.** Opening, tampering with, or removing alarm-initiating and supervisory signal-initiating devices.
 - D.3.** Loss of primary power at fire-alarm control unit.
 - D.4.** Ground or a single break in fire-alarm control unit internal circuits.
 - D.5.** Abnormal ac voltage at fire-alarm control unit.
 - D.6.** Break in standby battery circuitry.
 - D.7.** Failure of battery charging.
 - D.8.** Abnormal position of any switch at fire-alarm control unit or annunciator.

2-6 Special Systems

- A.** The City of Phoenix has developed a Telecommunications Cabling System Standard. The purpose of this standard is to define a set of guidelines for deploying and managing the growing environment in the City of Phoenix. The Telecommunications Cabling System standard is to establish an efficient, logical, cost-effective and strategic foundation for the support of the physical communications layer installed for the city's telecommunications systems.
- B.** Included in the special systems are place holders for future systems to be defined as the Airport moves forward with its technology and programs.
- C.** All work and materials shall be in full accord with the requirements of the Arizona Administrative Code, the State Fire Marshall, the Division of Industrial Safety, the National Electric Code and other applicable City and state laws or regulations. Nothing in the specifications shall be construed to permit work not conforming to these codes and standards.

2-6.2 Premises Wiring Distribution Systems

2-6.2.1 INTRODUCTION

- A.** Premises wiring distribution system (PWDS) refers to the passive infrastructure used by the Airport to extend signaling used for voice, video and data. The industry term uses to describe this triad of signaling is "Telecommunications." The distribution of telecommunications throughout the Airport is to be planned and designed using methods and products defined herein.
- B.** This section of the guidelines is limited to the passive elements of Airport telecommunications which includes the cabling and infrastructure needed to support active telecommunication elements such as fiber optic and electrical transmission equipment. These guidelines are intended to provide high level project planners and architects with a basic understanding the PWDS and the Airport's current plans and designs for telecommunication infrastructure.

2-6.2.2 REGULATORY REQUIREMENTS AND STANDARDS

A. The Airport has selected common industry wide requirements and standards upon which to base the planning and design of telecommunications infrastructure. The primary resources for these standards are:

A.1. NEC: National Electric Code, latest revision as adopted by Phoenix Sky Harbor International Airport (PHX) and the City of Phoenix.

A.2. BICSI: Building Industry Consulting Service International

- Telecommunications Distribution Methods Manual (TDMM)
- ANSI/NECA/BICSI-568-2006 Standard for Installing Commercial Building Telecommunication Cabling.

A.3. TIA/EIA: Telecommunication Industry Association/Electronic Industries Alliance.

- TIA/EIA – 526: Measurement of Optical Power
- TIA/EIA – 568-C: Commercial Building Telecommunication Cabling Standards
- TIA/EIA – 569-B: Commercial Building Standard for Telecommunication Pathways and Spaces
- TIA/EIA – 606-B: Administration Standard for Commercial Telecommunication Infrastructure.
- TIA/EIA – 607-B: Commercial Building Grounding (Earthing) and Bonding Requirements for Telecommunications

2-6.2.3 SYSTEM DESCRIPTION

A. The Premises Wiring Distribution System includes several subsystems which may be designed and installed by various specialists and trades. These subsystems include, but are not limited to:

B. PWDS TELECOMMUNICATION SPACES:

B.1. PWDS Telecommunication Spaces are typically rooms that are designed specifically for support of passive and active telecommunication elements, furthermore telecommunication space is classified for intended use in the overall facility infrastructure. The following list defines telecommunication industry terminology for these rooms and types of equipment that the rooms are intended to support:

C. Telecommunication Entrance Facility (EF):

C.1. The use of an EF is typically limited to support of the transition from outside plant cable to indoor Premises wiring, often associated with the Main Cross-Connect (MC) room. This enclosed architectural space should be planned and provisioned with infrastructure to support cable tray, splice case racking and grounding. Proper design will include doors providing controlled access to the building exterior and access to the MC or other types of Telecommunication rooms. The purpose of an EF is:

- To minimize the extension of outside plant cable into a building, as NEC requires most outside plant cable to be terminated with 50 feet of building entrance due to the type of cable jacket and fire issues.
- Provide a “Mud Room” to reduce cable pulling trade traffic through clean room environment desired for MC room.
- Reduce lightning and EMI migration into the MC equipment room spaces.
- An EF is typically not an environmentally controlled space and typically is not intended to support any active telecommunication electronic equipment, with the possible exception of wall mounted Telco service provider demarcation equipment such as CSU/DSU’s.

D. Main Cross-connect (MC):

D.1. An MC is typically planned for a single location within a building. Formerly referred to as an MDF or Main Distribution Frame, the MC Room is planned as the center of a “star” cable distribution topology, as well as a building node in the Airport wide campus network, where backbone cable is extended out to the building Telecommunication Rooms, and / or other buildings on the campus. The MC will support fiber optic and copper cable terminations, patch panels and cross-connect hardware, and may support telecommunication active equipment such as telephone switches and core switches. These rooms may be planned as hybrids supporting Equipment Room (ER) functionality as well as PWDS passive cable plant. The design size of an MC depends on many variables ranging from build size to building use; therefore, this guideline does not attempt to define appropriate square footage for MCs.

E. Telecommunications Room (TR):

E.1. TR’s were formerly referred to as IDF’s and TC’s. TR’s are architecturally designed spaces which support termination of backbone and horizontal cable need to support a portion of the overall building. Additionally, TR’s often support telecommunication active equipment such as switches and other equipment. TR’s needed to be planned to support horizontal cabling and data outlets which radiate out from the TR. The distance for common copper horizontal cable extended from a TR to a data outlet should not exceed 290 feet, therefore the architect and PWDS Contractor s need to coordinate locations for TR’s to assure proper design support for telecommunications in the building.

F. Equipment Room (ER):

- TBD

G. Telecommunications Enclosure (TE):

- TBD

H. PWDS TELECOMMUNICATION PATHWAYS:

H.1. Ridged Conduit:

H.2. Electromagnetic Conduit:

H.3. Flexible Conduit:

H.4. Ladder Type Cable Tray:

H.5. Wire Basket Type Cable Tray:

H.6. PWDS Firestopping:

I. PWDS BACKBONE CABLE:

I.1. Singlemode Fiber Optic Backbone Cable:

I.2. Multimode Fiber Optic Backbone Cable:

I.3. Twisted Pair Copper Backbone Cable:

J. PWDS HORIZONTAL CABLE:

J.1. Category 6 Unshielded Twisted Pair (UTP) Horizontal Cable:

J.2. Category 6A Unshielded Twisted Pair (UTP) Horizontal Cable:

J.3. Category 5E Unshielded Twisted Pair (UTP) Horizontal Cable:

J.4. Multimode Fiber Optic Horizontal Cable:

K. PWDS CABLE TERMINATION HARDWARE:

K.1. Copper Cable Punchdown Blocks:

K.2. Copper Cable Protection Blocks:

K.3. RJ-45 Copper Cable Patch Panels:

K.4. Fiber Optic Cable Patch Panels:

L. PWDS RACKS AND CABINETS:

L.1. Two Post Racks:

L.2. Four Post Racks

L.3. Equipment Cabinets

M. PWDS GROUNDING AND BONDING:

M.1. Telecommunication Ground Bus Bars

M.2. Ground Wiring

N. PWDS TESTING, ADMINISTRATION AND LABELING:

N.1. PWDS testing requirements

N.2. PWDS administration

N.3. PWDS labeling

2-6.3 Contractor Responsibilities

- TBD

2-6.4 Contractor Responsibilities

- TBD

2-6.5 Aviation Department Responsibilities

- TBD

2-6.6 Coordination Requirement:

A. MUFIDS Coordination:

A.1. The Multi-User Flight Information Display System (MUFIDS) and Work Stations (WS) requires one (1) CAT6 cable for each Digital Direct Controller (DDC) computer that controls one (1) MUFIDS display. The CAT6 cables shall be routed together within the same conduit sized for the entire MUFIDS bank to the existing pullbox located adjacent to the closest TR.

A.2. The Baggage Information Display System (BIDS) requires one (1) CAT6 cable for each Digital Direct Controller (DDC) computer that controls one (1) BIDS display. The CAT6 cables shall be routed together within the same conduit sized for the entire MUFIDS bank to the existing pullbox located adjacent to the closest TR.

A.3. Architectural Coordination:

The PWDS design will require extensive coordination with project architects to define telecommunication space. This coordination shall include size, locations of rooms, layout of room accessories such as wall boards, cabinet and rack rows, lighting, HVAC, fire suppression and other environmental features.

A.4. Power Trades Coordination:

Coordination with power trades shall include placement of calculation of potential power loads, types of power circuits required, outlets, rack power distribution, UPS, lighting and other special requirements.

A.5. Active Network Coordination:

Throughout design, the passive (PWDS) and active network design trades need to coordinate types of cable media required to support active equipment, locations of PWDS outlets and patch panels and other cable to equipment topics.

2-6.7 System Interfaces

TBD

2-6.8 Telecommunication Systems

2-6.8.1 SYSTEM DESCRIPTION

A. PABX, VOIP Phones, Elevator Phones, Special Conference Bridging Systems and Crashnet Phone

B. Pay Telephones

Pay telephones will be provided in the building to provide enhanced customer service to the traveling public. These payphones will be provided by the City of Phoenix Aviation Department's existing pay telephone provider. However, all required infrastructure, including cabling and power will be provided by the project.

2-6.8.2 Emergency Phones (Integrate W/PEDS)

A. Locations

- Provisions for emergency telephones will be provided as required in each applicable area as determined by the Aviation Department and the Contractor and will conform to the requirements of Section 4.31 of "Standards for Accessible Transportation Facilities," U.S. Department of Transportation.
- The emergency telephones will be coordinated with existing Airport units and meet performance requirements of the Airport's existing emergency telephone network and standards.
- The design will incorporate emergency telephones covering elevator waiting areas, stairwell entries, parking structures, maintenance areas, park-n-rides, drop-n-rides, parking lots, and pedestrian bridges.
- Subject to approval by the Aviation Department, if the design accommodates elevator waiting areas and stairwell entrances being adjacent to one another, a single emergency telephone may be used for that location.
- For surface park-n-rides, and other parking areas, a minimum of one emergency telephone will be placed in the design, and then one additional emergency telephone per each 300 spaces. This placement and frequency of emergency phones will be coordinated with the Aviation Department during the concept and preliminary engineering design phase.
- If pedestrian overpasses or underpasses are incorporated into the design, a minimum of one emergency telephone will be provided for each overpass/underpass.
- If the overpass or bridge is isolated from other transit elements, additional emergency telephones may be necessary.
- The Aviation Department will determine the number and placement of emergency telephones in maintenance and storage areas.

B. Network

- The emergency telephone when activated will connect to 911 and also send notification and audible listening capability to the Aviation Department

- Installed Emergency Telephones will be constructed pursuant to a minimum NEMA 3R rating (see below) and be Underwriter Laboratory and FCC approved and ADA compliant. The phones will draw power from the phone line and require no additional power line attachments. The phones will be capable of off-site live monitoring of emergency conversations. The emergency phones will be part of a networked management system that is operated by a PC, XP Windows compatible or newer.

B.1. The software management system will:

- Establish an automatic connection with each phone on a prearranged schedule.
- Phones will be tested at least one time in every twenty-four hours. The connection will be initiated either by the PC or the telephone.
- Print an exception report at designated intervals highlighting use and malfunctions.
- Archive and maintain all reporting both of normal functioning and malfunctions.
- Log and archive all call activity at each phone.
- Identify all call activity by date and time, type of activity, and location of data within memory.
- Establish Automatic Maintenance Monitoring which reports stuck buttons, power interruption, microprocessor testing, call interrupt, handset integrity and functioning, handset off hook notification and phone line current.
- Utilize NEMA 3R enclosures constructed for either indoor or outdoor use to provide a degree of protection to personnel against incidental contact with the enclosed equipment; to provide a degree of protection against falling dirt, rain, blowing sand, and other environmental conditions. All emergency telephone locations will be presented to the Aviation Department for review and acceptance.

2-6.8.3 CONTRACTOR RESPONSIBILITIES

TBD

2-6.8.4 CONTRACTOR RESPONSIBILITIES

TBD

2-6.8.5 AVIATION DEPARTMENT RESPONSIBILITIES

TBD

2-6.8.6 COORDINATION REQUIREMENT

TBD

2-6.8.7 SYSTEM INTERFACES

TBD

2-6.9 Security

2-6.9.1 ACCESS CONTROL AND ALARM MONITORING SYSTEM (ACAMS)

A. Description

The Access Control System (ACS) will be an extension of the Honeywell Enterprise Buildings Integrator (EBI) ACAMS. Access control points will be provided as required throughout the project to control access to the Security Identification Display (SIDA), Sterile, Air Operations

(AOA) and other restricted areas throughout the facilities. These portals will be connected to the ACAMS through intelligent field controllers.

B. Guidelines, Codes and Standards

- 49 CFR Part 1542, Airport Security
- RTCA/DO-230B, Integrated Security System Standard for Airport Access Control
- DOT/FAA/AR-00/52, Recommended Security Guidelines for Airport Planning, Design and Construction
- NFPA 70, National Electric Code
- NFPA 101, Life Safety

C. Design Requirements

C.1. General: The Engineer will work in conjunction with the Aviation Department to review current and pending regulations from, TSA, FAA and other government agencies when designing the ACAMS.

C.2. Access Control: In tandem with Airport requirements the Engineer will develop a plan to control access to the SIDA, Sterile, AOA and other restricted areas by means of signage, and electronic access controls.

Throughout the design process the Engineer will work with Aviation Department to determine the nature and exact location of access control devices.

Effective February 17, 2002, the FAA's Aviation Department rules were transferred to the Transportation Security Administration (TSA), as Chapter XII of Title 49 of the Code of Federal Regulations. Chapter XII includes parts 1500 through 1699. Part 1542 is titled "Airport Security." Section 1542.207 covers access control systems, and section 1542.211 covers identification systems.

TSA's Access Control System requirements as defined in section 1542.207, Access Control Systems must:

- Ensure that only those individuals authorized to have unescorted access to the secured area are able to gain entry;
- Ensure that an individual is immediately denied entry to a secured area when that person's access authority for that area is withdrawn; and
- Provide a means to differentiate between individuals authorized to have access to an entire secured area and individuals authorized access to only a particular portion of a secured area.

The Engineer will follow the guidance and directives detailed within Part 1542 along with other relevant governmental regulations that are in place during the design development phase.

The design of the ACAMS will be based on the following:

- The primary purpose of the electronic ACAMS is to allow access for certain individuals to authorized areas of the Airport while restricting access to other unauthorized individuals. Access to specific doors and gates (referred to as "portals") is determined by the Airport who is enrolling individuals into the ACAMS and who are provided with a security access control credential.

C.3. System Interfaces:

- ACAMS interface to the CCTV system shall function as follows: Upon receipt of an alarm by the ACAMS with CCTV cameras associated with it the ACAMS shall send a command signal to the CCTV system headend matrix switcher defining camera number and the monitor number for which video is to be called up on to assist the operator in assessment and resolution of the ACAMS alarm.
- ACAMS interface to the DVRS shall be as follows: Upon receipt of an alarm by the ACAMS the ACAMS shall send a command signal to the DVRS. This signal shall contain the alarm time stamp to allow the DVRS to store fifteen seconds of pre-alarm and 30 seconds of post alarm video for all cameras associated with the ACAMS alarm.
- ACAMS interfaces to field devices and equipment:
 1. Electrical Door Hardware
 2. Checkpoint Covert Alarms
 3. Moving Walkways
 4. Escalators
 5. Elevators (Including travel cable and key switches)
 6. Fire Alarm

C.4. Delineation of Scope of Work: The Contractor is to perform all required installation for all physical components, wiring, and terminations including all field devices and intelligent controllers. The Airport's security maintenance Contractor, shall be tasked to provide final headend connections, programming, and O&M updates for the system expansion. Depending on the project size the costs for this work may be covered under the Airport's existing maintenance contract or the Contractor is to solicit a cost direct with the security maintenance contractor for the provision of their work and carry this number as a line item on the project bid form.

C.5. Alarm Monitoring: The ACAMS will also be designed by the Engineer to provide alarm monitoring capabilities to detect and report the following portal alarm conditions:

- Door/Gate Forced
- Door/Gate Held Open
- Tamper
- Lost Card
- Stolen Card

C.6. Line Fault Supervision: Specify all ACAMS components will be designed to be "supervised" including wiring, cabling, devices and enclosures so that attempts to tap into or sever communications and monitoring will be detected.

C.7. Performance Characteristics: Sensor technologies will be selected based on their propensity for a high Probability of Detection (PD), low Nuisance Alarm Rate (NAR), low False Alarm Rate (FAR), and low Vulnerability of Defeat (VD).

C.8. Intelligent Controller: Shall be located in equipment rooms and provided with all required modules for a physically complete and functional system expansion. They shall be provided with their own battery backed-up (four hours) power supply. The controller shall be Ethernet based.

C.9. Electric Locks: Locks shall be powered from a 24 VDC battery backed-up (four hours) power supply located adjacent to the intelligent controllers. The power supply shall be in addition to the intelligent controller power supply. Where UPS power is available the battery

back-up time can be reduced to one hour. Where allowed by code the locks shall be fail secure.

C.10. Card Reader: Shall be a 13.56 MHz contactless smart card reader with PIN pad and tamper switch. Communications shall be Weigand protocol.

C.11. Door Position Switch: Recessed door position switches are to be utilized wherever possible.

C.12. Specified Audio/Visual Device: Shall be 24VDC and match existing.

C.13. Signage: In addition to any signage required by code the Engineer shall coordinate signage requirements with the Airport and Architect and include in the design.

C.14. Conduit and Raceways: Conduit must be green in color. If the conduit is not green in color acceptable substitutes would be green conduit fittings and green junction box covers. Conduits must be supported per code and penetrations must be properly sealed.

C.15. Specified Wire and Cabling: All wire and cabling shall be labeled at each end and in intermediate junction boxes. The engineer shall coordinate labeling type and scheme with the Airport and include in the design.

C.16. Installation: The work shall be performed by skilled technicians under the direction of experienced project managers, all of whom shall be factory trained and certified for this work. All wiring for the system shall be in accordance with Articles of the NEC and local electrical codes. Wiring for use on Access Control systems shall conform to the following:

- Card Reader Circuits: 18 AWG stranded 6 conductor shielded pair in overall low smoke PVC jacket. Belden #5304FE or equal.
- Door Contact Circuits: 18 AWG stranded 2 conductor shielded pair in overall PVC jacket. Belden #5300FE or equal.
- Door Strike/ Magnetic Lock Circuits: 18 AWG stranded 4 conductor shielded pair in overall PVC jacket. Belden #5300FE or equal.
- Electronic REX Circuits: 18 AWG stranded 4 conductor shielded pair in overall PVC jacket. Belden #5302FE or equal.
- Push Button REX Circuits: 18 AWG stranded 2 conductor shielded pair in overall PVC jacket. Belden #5300FE or equal.
- Local Audio Visual Annunciation Circuits: 18 AWG stranded 2 conductor shielded pair in overall PVC jacket. Belden #5300FE or equal.
- Multiple cables contained in one composite assembly that serve one portal will be allowed on above grade installations with the approval of the Aviation Access Control Committee. Composite cables will not be allowed in underground installations. The composite cable will be a Belden SCMR type product with individual shields for each of the devices noted above #1-6.
- All Access Control system wiring shall be installed in a raceway system. Use of plenum rated cable in lieu of the metal raceway system is not acceptable.

D. Conduit (EMT) must be used for wire installation- the minimum acceptable size is $\frac{3}{4}$ inch. No free air wiring or exposed wiring will be acceptable. Any exceptions shall be approved by the Aviation Department prior to design. Any wiring run underground will be run in PVC conduit 1" minimum buried at NEC specified depths. For underground wire runs Aquaseal or equivalent waterproof cable shall be used. Intermediate Metallic Conduit will be used for installations that

are subjected to physical damage. Conduit runs shall not exceed 270 degrees of total bends between pull points.

E. Conduit must be green in color. If the conduit is not green in color- acceptable substitutes would be green conduit fittings and green junction box covers. Conduits must be supported per code and penetrations must be properly sealed.

F. All fittings must be steel and compression type. No set screw fittings will be accepted.

G All wiring at the panel must be labeled 6 inches from the termination point with permanent machine generated labels (no hand written labels). Labels will be formatted consistently and conform to existing naming convention. A typical label would be formatted in this manner, ACU#- Building-Floor-Portal-Device.

All Access Control Panels will have their own dedicated 20A, 120Vac electrical circuit derived from an appropriate EMERGENCY power panel. Any substitute for an EMERGENCY circuit shall be approved, in advance, by Aviation.

2-6.9.2 VIDEO SURVEILLANCE SYSTEM

A. Description

A.1. The Video Surveillance System (VSS) will be an extension of the existing Vicon Nova™ cross-point analog matrix system and Verint digital video recording (DVR) system. Fixed and pan/tilt/zoom (PTZ) cameras are to be provided as required throughout the project for surveillance of the SIDA, Sterile, AOA and other restricted access controlled portals as well as other areas as coordinated with the Airport.

B. Guidelines, Codes and Standards

- RTCA/DO-230B, Integrated Security System Standard for Airport Access Control
- DOT/FAA/AR-00/52, Recommended Security Guidelines for Airport Planning, Design and Construction
- NFPA 70, National Electric Code
- NFPA 101, Life Safety

C. Design Requirements

C.1. Specified Video Surveillance: In tandem with Airport requirements the Engineer will develop a plan for placement of cameras. Throughout the design process the Engineer will work with Aviation Department to determine the nature and exact location of cameras. Cabling between the camera and the equipment room shall be coaxial, UTP or fiber optic as determined by location and as coordinated with the Airport. Transmission of video and data signals between the equipment room and the VSS headend shall be via fiber optic transceivers over fiber optic cabling, cabling connection to the existing headend or via the security system network. Analog video and data cabling shall be connected to the existing analog matrix switch and then looped through and connected to video encoders. The existing digital video recording system shall be expanded to record video from each camera for a duration of 30 days at a resolution of 4 CIF and a frame rate of 15 fps. The existing Verint Storage Area Network (SAN) shall be expanded to accommodate the projects storage requirements. Existing spare analog inputs and outputs and Verint LVM licenses shall be provided by the Airport.

Coordination with the Aviation Department is to be performed during the design process to determine the extent of integration with the existing CCTV system, to determine the locations of

monitoring activities, and to determine the amount and configuration of any required headend equipment.

In conjunction with Aviation Department, the Engineer will work to determine the level of integration of video surveillance the design will incorporate into the project. Any existing Airport standards relating to these technologies at the time of design will take precedence over the specifications. As required by the Aviation Department, this system design will be coordinated and integrated with existing equipment, system specifications and configuration.

The VSS will be designed to be capable of transmitting real-time video to the Aviation Department's Communication Center and other users via a fiber optic transmission backbone or security system network.

C.2. System Interfaces:

- VSS interface to the ACAMS shall function as follows: Upon receipt of an alarm by the ACAMS with CCTV cameras associated with it the ACAMS shall send a command signal to the CCTV system headend matrix switcher defining camera number and the monitor number for which video is to be called up on to assist the operator in assessment and resolution of the ACAMS alarm.
- VSS interface to the ACAMS shall be as follows: Upon receipt of an alarm by the ACAMS the ACAMS shall send a command signal to the DVRS. This signal shall contain the alarm time stamp to allow the VSS to store fifteen seconds of pre-alarm and 30 seconds of post alarm video for all cameras associated with the ACAMS alarm.

D. System Installation

D.1. Field Devices and Equipment: Refer to the Aviation Department's Owner Requirement Standards VSS Specification.

D.2. Surge protection: Cameras that may be subject to lightning strikes will be isolated from the remainder of the video system by an appropriate energy limiting device or an optic transmission medium

D.3. CCTV shall be incorporated into the Baggage Handling Systems.

2-6.9.3 Wire and Cabling:

A. Specified wire and cabling shall be labeled at each end and in intermediate junction boxes. Engineer shall coordinate labeling type and scheme with the Airport and include in the design.

2-6.9.4 PASSENGER EMERGENCY DURESS SYSTEM (PEDS)

A. The Aviation Passenger Emergency Duress System (PEDS) utilizes the PDS Infrastructure for connectivity between the head-end equipment and the PEDS camera. The voice connectivity required for the PEDS station shall be achieved by connecting the PEDS device to the closest PDS Trusing One-Cat 6 unshielded twisted pair cable routed within a 1-inch conduit. The camera fiber optic cable and the voice copper cable shall be routed together within the same 1-inch conduit to the PDS TC.

2-6.9.5 CONTRACTOR RESPONSIBILITIES

A. All PEDS Phones Are Code Blue. Programming is done using Code Blue RPD Remote Programming and Diagnostic software. PEDS phones are managed using Code Blue CMS Call Management System Software. Contractor shall verify that the models listed are current and provide design based on expansion of existing system to sole source the listed product.

A.1. Wall Mounted – Interactive Voice Communications Unit – Model CB-2e

A.2. Tall Pedestal – Interactive Communications Unit w/Night Charger –Model CB-1S

A.3. Tall Pedestal – Interactive Communications Unit – CB-5P

A.4. Tall Pedestal – Interactive Communications Unit (Solar Powered) – Model CB-1E

2-6.9.6 CONTRACTOR RESPONSIBILITIES

Not Used

2-6.9.7 AVIATION DEPARTMENT RESPONSIBILITIES

Not Used

2-6.9.8 COORDINATION REQUIREMENT

A. Coordination between the Contractor and Aviation Technology shall be performed for fiber optic cross-connectivity within the PDS TCs. All CCTV Hub rooms are connected to the closest PDS TC via an existing 4-inch conduit. This allows for Airport wide interconnectivity.

2-6.9.9 TSA RULES

Not Used

2-6.10 Information (Network) Systems

2-6.10.1 The NETWORK operates three physically separate Local Area Networks (LAN's). These networks and their uses are listed as follows:

A. Enterprise Network – This is a functional extension of the City of Phoenix metropolitan network. This network supports the Aviation Department administrative workstations, servers, printers and other devices associated with administrative functions at the Airport. Appearances of this network are typically limited to locations where the Aviation Department administrative functions require network support.

B. Premises Distribution System (PDS) Network – This network supports various Airport tenant and subsystem devices such as flight information, building automation, common use departure controls and other LAN-based systems excluding access control. The PDS network is the largest and most widespread of the networks at the Aviation Department.

C. ACAMS Network – The Access Controls and Alarm Management Network is used exclusively to support Airport access control and related security functions. Local area network support for this system is provided by a separate, isolated subset of hardware to ensure stability and reliability.

D. All three networks utilize a traditional multi-tiered Cisco recommended architecture. The enterprise and PDS networks are configured with layer two stackable switches in the access layer, bladed switches at the distribution layer and in the core layer. The ACAMS network utilizes similar layer two stackable switches at the access layer working into a collapsed core distribution / core architecture. All hardware used in all three networks is Cisco.

E. The Aviation Department currently deploys Cisco switches in the access and distribution layers of the network in either a Power over Ethernet (PoE) or non-PoE configuration depending on specific requirements at each location. The Designer is to coordinate with technology for the latest Cisco switch deployed for each installment location. Where multiple switches are required at a location, switches are joined in a stack-wise configuration to allow management of the stack as a single switch. Individual 50cm stackwise cables connect from switch to switch with a longer wraparound one-meter stackwise cable connecting the top and bottom switches in the stack.

F. In locations containing one access layer switch, provide two 1000-base-LX/LH Small Form-Factor Pluggable (SFP) modules in the switch to support 1000-base-LX/LH uplinks to two diversely located distribution switches. Provide similar SFP modules for the opposite end of each uplink at the distribution switches. If existing SFP ports are not available, provide a new high-density 1000-base-X blade in each distribution switch. Access layer switch stacks containing more than one switch shall be configured with one uplink taken from the top switch in the stack and the other uplink taken from the bottom switch in the stack.

G. Access layer switches serving mission critical devices such as common use equipment at ticket counters and gates shall be deployed in a configuration consisting of at least two stacked switches. Power supply redundancy shall be provided with a redundant power supply unit that will substitute for a failed power supply on any single switch in the stack. Odd numbered devices shall be connected to one switch in the switch stack with even numbered devices connected to a different switch. This configuration will allow for continued operation of ticket counters, gates, etc. during failure of an access layer switch.

H. Each terminal at PHX is equipped with two Cisco 6509 distribution layer switches which are part of the PDS network. Projects requiring the addition of access layer PDS network switches will generally interface to these existing distribution switches with uplinks as described above. In cases where new switches are required in other locations on the campus these switch stacks will generally be assigned to ports on an existing terminal distribution switch pair. In special cases where a project forms a new region in the network, access layer switches will be uplinked or to a new pair of Cisco 6509 distribution switches which are in turn uplinked to the network core switches. In cases where new distribution switches are required, PHX Information Technology Division will provide specific information on chassis, power supplies, blades and supervisor engines for these switches.

I. Access layer switches to the ACAMS network will require 1000-Base-LX/LH uplinks to the two ACAMS core switches. This network is operated in a layer two configuration campus wide. Access switch stack configuration shall be as described above for the PDS network.

J. Expansion of the City of Phoenix Enterprise network will not occur as frequently during project work. The Aviation Department Information Technology Division will provide specific direction on switch types, placement and uplink configuration required to expand this network.

K. The Aviation Department Information Technology Division will utilize these lists to assign and configure switch ports on appropriate Virtual LANs. The equipment list(s) will be appended with switch and port assignments, IP address, subnet mask and default gateway information and returned to the Contractor for implementation.

L. Any network connected system that is “Time Aware” shall be synchronized to the Aviation Department network timeservers using Simple Network Time Protocol (SNTP). The Aviation Department Information Technology Division will provide IP addresses for one or more Airport Network Time Protocol Servers. Contractor s shall configure their network equipment to synchronize to the designated servers.

M. The Aviation Department also supports network virtualization using Multi-Protocol Label Switching (MPLS) and Virtual Routing and Forwarding (VRF). Contractor s providing systems that require traffic isolation for reasons of PCI compliance or other factors shall coordinate these requirements with the Aviation Department Information Technology Division.

2-6.10.2 PUBLIC / PRIVATE WIRELESS LAN

A. The Aviation Department operates a single 802.11 wireless LAN network throughout public areas of the terminals. Public internet access is provided without charge on an open Service Set

Identifier (SSID) after accepting a terms of use policy. Contractors with systems requiring private wireless LAN service will be required to provide new access points in any non-public areas where coverage is required. Coordinate any private use of the wireless network and specifics on access point types with the Aviation Department Information Technology Division.

2-6.10.3 TENANT AND SUBSYSTEM USE OF AIRPORT NETWORK

A. DESCRIPTION

A.1. The Aviation Department owns and operates a comprehensive Local area network (LAN) to support Airport sub-systems, tenants and Aviation Department data communications requirements. This network is based on a high capacity, fault tolerant gigabit Ethernet architecture. The network is sub-divided into Virtual Ethernet LANs or VLANs for each tenant, sub-system and Aviation Department user group.

A.2. Tenants, sub-systems and other local area network users are required to coordinate their LAN requirements with Aviation Department Information Technology Division and to observe a number of rules governing the use of VLAN services at the Aviation Department. These rules are intended to ensure network efficiency, security and reliability for the Aviation Department user population.

B. LAYER ONE PROTOCOLS

B.1. Tenant and sub-systems shall connect to their assigned VLAN using one of the following protocols:

B.2. ANSI/IEEE 802.3 10-Base-T Ethernet (Half Duplex)

B.3. ANSI/IEEE 802.3 10-Base-TX Ethernet (Full Duplex)

B.4. ANSI/IEEE 802.3 100-Base-TX Ethernet (Full Duplex)

B.5. ANSI/IEEE 802.3 100-Base-FX Ethernet (Full Duplex Multi-Mode Fiber)

B.6. Network Interface Cards (NICs) shall be configured to support one of the protocols listed above. Auto-negotiation shall not be used. Where practical, one of the full duplex protocols shall be used to improve performance of the connection.

B.7. Gigabit Ethernet protocols are utilized extensively in the backbone for the Aviation Department network. These protocol interfaces are not generally provided for tenant or sub-system interfaces to VLAN services. Any tenant or sub-system provider requiring connection at these speeds must make prior arrangement with the Aviation Department Information Technology Division.

B.8. Networks based on ANSI/IEEE 802.5 (Token Ring) and ANSI/IEEE 802.10 (FDDI) are not supported at the Aviation Department.

B.9. Specified network cabling and terminations at the Aviation Department are certified to Category 6 specifications. Tenants and sub-systems connecting to the Aviation Department VLAN services at Premises Distribution System outlets shall utilize ONLY factory terminated and certified connectorized cables. The wiring pin-out for all cabling at the Aviation Department is according to EIA/TIA 568B specifications.

B.10. Tenants and sub-system VLAN users shall not utilize hubs or switches to increase the number of available Ethernet ports at any location. All active electronic equipment in the network must be provided by the Aviation Department Information Technology Division.

C. LAYER TWO PROTOCOLS

C.1. The following layer two protocols are available for tenant and sub-system use at the Aviation Department:

- ANSI/IEEE 802.3 Ethernet
- ANSI/IEEE 802.3af (Power over Ethernet)
- ANSI/IEEE 802.11b/g (Wireless LAN)

C.2. NetBeui, Decnet and other non-routable protocols shall not be used on the Aviation Department network. In special cases where the use of these protocols is unavoidable (legacy applications), these protocols shall be encapsulated in a protocol that is supported by layer three routers. Protocols such as Netbios may be encapsulated using NetBT.

C.3. All Tenant and sub-system equipment attached to an Aviation Department network shall be configured to use only the layer two protocols required by the application. All other layer two protocols that are not required by the application shall be disabled.

C.4. Systems that rely on flooded broadcast traffic shall not be permitted on the Aviation Department network. Flooded broadcasts will propagate only on the local network segment and will not be transported across the network routers.

C.5. Systems that require synchronous operation on the network such as certain paging microphone station types shall be restricted to operation on a layer two VLAN within the confines of a single network region (i.e.: a single terminal). The Aviation Department network utilizes a layer three routed core which may introduce latencies which are inappropriate for these systems.

D. LAYER THREE AND HIGHER PROTOCOLS

D.1. Tenants and sub-system VLAN users shall be limited to using TCP/IP and UDP/IP as their transport protocols. In the interest of efficiency, the core of the Aviation Department network has been designed around a single protocol to increase efficiency and minimize unnecessary routing traffic.

D.2. IPX, AppleTalk and Decnet protocols are generally not supported on the Aviation Department network in their native form. In cases where these or other non-routable protocols must be used across the network core, Aviation Department Information Technology Division may elect to implement MPLS tunnels. Coordinate these requirements with the Aviation Department Information Technology Division well in advance of any planned deployment.

D.3. Tenant and sub-system VLAN users shall disable all unnecessary protocols that are not required by the application. This shall include routing protocols, unnecessary advertisements and other protocols that are often active in the default configuration of the equipment.

D.4. Subsystem applications shall be developed or modified to utilize either TCP/IP or UDP as their transport protocol. Applications utilizing UDP/IP and requiring guaranteed delivery of data shall utilize a session layer or higher protocol to confirm delivery of data and to manage retransmission in the event the data is not received or is corrupted during transmission. The network also supports UDP Multicast routing.

E. LAYER THREE ADDRESSING

E.1. The Aviation Department Information Technology Division will assign tenants and sub-system users a subnet, subnet mask and default gateway address for each region of the Airport where tenant and sub-system attachments are required. The size of the subnet assigned to each area will be sufficient to support the initial tenant or sub-system requirements and to provide reasonable growth.

E.2. RFC 1918 private addressing is utilized on the network. The tenant or sub-system user must strictly observe the range of addresses assigned for each geographic area of the network

as address summarization is utilized extensively throughout the core and distribution layers of the network.

E.3. All sub-systems using VLAN service shall be statically addressed. Host equipment such as workstations, printers and Ethernet connected technical equipment shall be addressed beginning with the lowest address in the range and working upward. Servers and other system resource equipment shall be addressed starting with the first address below the assigned default gateway address and working downward.

E.4. Tenants using VLAN services may utilize static addressing or dynamic addressing. DHCP services for dynamic addressing of tenant workstations will be provided into a tenant VLAN if requested by the tenant on the VLAN order.

E.5. The Aviation Department Information Technology Division reserves the right to employ access lists or other means to block the use of unauthorized addresses on a tenant or sub-system VLAN.

F. SECURITY

F.1. Tenant VLAN's will generally be restricted to communication with other devices on the same VLAN or VLAN group. Tenant VLANs are considered as hostile networks under the Aviation Department Airport network and data security plan. Access by the tenant to Airport resources outside the tenant's VLAN (i.e.: internet or time servers) must be coordinated with the Aviation Department Information Technology Division. All protocols and IP ranges should be pre-coordinated and approved for use through the Aviation Department Information Technology Division prior to going live on the network.

F.2. Tenants requiring Wide Area Network connections to the internet or off-site corporate networks may implement these services within the confines of their own VLAN. Security on the tenant VLAN is the sole responsibility of the tenant.

F.3. Airport owned subsystems that utilize VLAN service shall generally be prohibited from connecting to services outside of their assigned VLAN. Any proposed dial-up modem, dial-back modem, wide area network or VPN connection outside of the sub-system VLAN shall be subject to review and approval of the Aviation Department Information Technology Division network security staff.

F.4. Modems which access the internet or any service outside of the subsystem shall not be permitted even if the application is separate or external to the primary sub-system application. This shall include web browsers, email and other applications, which may reside on a subsystem workstation.

F.5. All protocols and IP ranges should be pre-coordinated and approved for use through the Aviation Department Information Technology Division prior to going live on the network. Functional specifications, inventory, and points of contacts will remain on file with the Aviation Department Information Technology Division for any systems/tenants that ride the network infrastructure.

G. NETWORK MANAGEMENT

G.1. Tenant equipment on an assigned VLAN will generally not be monitored by the Airport network management system. The Aviation Department Information Technology Division does reserve the right to perform diagnostics and monitor aggregate traffic volumes on switches, ports and other network components that support a tenant VLAN.

G.2. Airport subsystems, which utilize network VLAN service effectively, become part of the Airport's network. Contractors providing these subsystems shall configure all sub-system network equipment and servers with SNMP agents and Management Information Bases

(MIBs) to allow full management and/or monitoring of these components by the Aviation Department network management system.

2-6.10.4 CONTRACTOR RESPONSIBILITIES

2-6.10.5 CONTRACTOR RESPONSIBILITIES

A. Contractors installing new network components will be required to physically install these components and verify that the uplinks are operational. The Aviation Department Information Technology Division will verify connectivity to new network switches and provide full configuration of these units in a manner which is consistent with similar devices located throughout the remainder of the network. Once configured, new switches will also be placed under the Aviation Department network management.

B. Contractors will also be responsible for providing a complete listing of equipment to be supported from each TR switch stack in both hard copy and soft copy format (Microsoft Excel). This listing must include the system the device is associated with, device type, speed and duplex requirements. The listing must also indicate the transport protocol (TCP/IP, UDP/IP or Multicast) used by the device as well as any requirements for special Quality of Service (QoS) Differentiated Service Code Point (DSCP) marking of traffic.

2-6.10.6 AVIATION DEPARTMENT RESPONSIBILITIES

Not Used

2-6.10.7 COORDINATION REQUIREMENT

Not Used

2-6.10.8 SYSTEM INTERFACES

Not Used

2-6.11 Common Use Systems FUTURE, NOT CURRENTLY USED

2-6.11.1 COMMON USE TERMINAL EQUIPMENT (CUTE)

2-6.11.2 COMMON USE PASSENGER PROCESSING SYSTEM (CUPPS)

2-6.11.3 CONTRACTOR RESPONSIBILITIES

2-6.11.4 CONTRACTOR RESPONSIBILITIES

2-6.11.5 AVIATION DEPARTMENT RESPONSIBILITIES

2-6.11.6 COORDINATION REQUIREMENT

2-6.11.7 SYSTEM INTERFACES

2-6.12 Building Management Systems

2-6.12.1 REGULATORY REQUIREMENTS AND STANDARDS

2-6.12.2 BUILDING MANAGEMENT SYSTEM

The Heating, Ventilation, and Air Conditioning (HVAC) system for the new AT facilities as well as various Supervisory Control and Data Acquisition (SCADA) systems will be provided as part

of the MEP design. These systems will be used to perform load shedding during emergency power situations, to monitor the power consumption and operational activities, and to control lighting and HVAC to maximize building efficiencies. The control and data distribution portion of these systems will be coordinated with the communications infrastructure. These systems will be compatible with the industry standard BACnet protocol to allow the data distribution to be performed using the active portion of the common infrastructure.

2-6.12.3 CONTRACTOR RESPONSIBILITIES

Not Used

2-6.12.4 CONTRACTOR RESPONSIBILITIES

Not Used

2-6.12.5 AVIATION DEPARTMENT RESPONSIBILITIES

Not Used

2-6.12.6 COORDINATION REQUIREMENT

Not Used

2-6.12.7 SYSTEM INTERFACES

Not Used

2-6.13 Passenger Information and Paging System (PIPS)

2-6.13.1 REGULATORY REQUIREMENTS AND STANDARDS TO BE DETERMINED

2-6.13.2 SYSTEM DESCRIPTION

A. The Passenger Information and Paging System (PIPS) consists of two major elements. One is the Paging system and the other is the Multi User Flight Information Display System (MUFID) The MUFIDS portion of the system will be described in the MUFIDS Section of this guideline. The Paging portion of the system is an existing Peavey Control Matrix system. Any expansions or additions to the PIPS audio system will be required to use Peavey equipment for the critical components. No substitutions. A sole source justification will be required explaining that it is an expansion of an existing system.

B. System Architecture: The current system is comprised of two (2) Controlmatrix Host rack mounted computers (Q Host) and one (1) Controlmatrix Courtesy Announcement Host Rack mounted Computer (C-Host) and one (1) Controlmatrix Messaging Controller (A Host), each located in the MC of Terminal 2, Terminal 3 and Terminal 4. The systems connect to each other via redundant VLAN of the PHX network, in order to cover all the areas with paging and messaging. The systems also have a Terminal Access Paging Client (TAPC) that connects to the MUFIDS on port 802. This is the interface between the systems which allows messages to be generated from MUFIDS for baggage carousel announcements and other features. The audio transportation method of the system is Cobranet and the Contractor will need to be familiar with this Ethernet transportable audio protocol in order to design it. The PIPS also has some unique features that will be required for all expansions to the system. There is a visual paging component that is part of this system. This component resides in a standalone kiosk which is called a Paging

Assistance Location (PAL). The system also uses a text to speech emulator for general paging messages and courtesy announcements for passengers requested from a user of the PAL.

C. PALs: To allow for “equal access” to all members of the community, Paging Assistance Locations (PALs) will be deployed throughout the public-accessible areas of all the facility buildings. As such, the dissemination of information of the PIPS will be provided both audibly and visually. A PAL is the place where an airport patron will come to either initiate or retrieve a message. With a touch-screen to allow for visual interaction with the PIPS, an Americans with Disabilities Act (ADA)-friendly handset for audible interaction, and the University of Wisconsin-developed ‘EZ-Access’ interface enhancements, the PAL is a multimedia expansion of the traditional, yet limited, ‘white courtesy phone.’ In addition, the Airport has a staffed Communications Center which will interact with the PIPS on a continual basis – from screening of all requested messages and subsequent broadcast both audibly and visually to being the ‘human touch’ when the users of the system need further assistance.

D. A new PAL will be required if there is not one in the area. The Contractor will provide a PAL areas as required in the new area. If additional Visual Paging is required beyond the PAL location, new 40-inch LCD’s for visual paging will be designed into the area by the Contractor for the project. Both PAL and additional LCD’s will be required to match units with upgraded electronics and design elements as required.

E. Microphone Stations: Microphone stations are located throughout the Airport and provide paging and messaging as required. The stations will match the existing Peavey units. Functionality and programming of the unit shall match existing in zone methodology and labeling methodology. Each gate shall be equipped with a podium and jet bridge microphone station. Provide microphone stations as required for customer service locations

F. Speaker Zoning: Speaker zones will be logically laid out to provide coverage of specific areas. Typically the Airport areas will be divided into gate zones and public zones. Speaker zones will be comprised of the same type of speaker and mounting height so delay and equalization will be consistent. Match existing speaker types in areas where existing speaker systems are located otherwise design speakers that provide high intelligibility coverage of new areas. The PIPS is augmenting the Fire Alarm System and the intent of the speaker design is to meet NFPA 72 Common Intelligibility Standards.

G. Ambient Noise Sensing System: Currently there is an ambient noise sensing system installed as a subsystem to the PIP’s. At the time of this document, the system does not work. The Contractor shall make provisions for ambient noise sensing system by providing raceway to the areas and verifying with the Owner if a device is required.

H. Fire Alarm Interface: The PIPS allows the Department to take control of specific zones from the paging system and page into the analog inputs of the Crest amplifiers, bypassing the Cobranet inputs and normal Airport traffic to make fire alarm announcements. This software functionality shall be incorporated into all system modifications.

I. Amplification: System amplification is via Crest CKi series amplifiers. The Contractor will match this type of amplifier as part of the design to allow fire alarm interface software to work correctly. Backup amplification is required as part of the design.

J. PIPS Network: The PIPS network is a redundant VLAN routed from the existing CNSA core switches to each terminal headend PIPS distribution layer switch in the MCs. The MCs connect to TCs over copper cabling. Typical TC’s house Access layer switches which provide connectivity to the Cobranet devices and field devices. The Contractor shall coordinate switch configurations and requirements with Aviation Technology during the design.

2-6.13.3 CONTRACTOR RESPONSIBILITIES

- A.** The Contractor shall coordinate all aspects of the system with the stakeholders. This includes a face-to-face meeting at every design deliverable to review the changes to the system with the stakeholders.
- B.** The Contractor shall clearly identify the coordination required by the Contractor and the City of Phoenix IT department with regard to Premises Wiring systems and network equipment requirements.
- C.** The Contractor shall provide any demonstrations of new equipment as required.
- D.** The Contractor shall investigate the latest requirements of software updates to the PIPS to work with legacy products as well as new products seamlessly.
- E.** The Contractor shall modify the Master Specifications for the System to represent the requirements of the project in their own words.

2-6.13.4 CONTRACTOR RESPONSIBILITIES

- A.** Contractor shall be responsible for all system installation and products except for the Premises Wiring and Network equipment provision. The Contractor will be required to coordinate these details with the City of Phoenix IT department and Aviation Technology.
- B.** Contractor shall be required to coordinate all outages of the system with the Owner because it can affect the Fire Alarm Evacuation System. The system is a critical system used extensively where long term outages will not be accepted. The Contractor shall call special attention to these requirements so the Contractor includes coordination time for all related tasks.

2-6.13.5 AVIATION DEPARTMENT RESPONSIBILITIES

- A.** The Aviation Department will be required to coordinate with the Contractor regarding Premises Wiring and Networking requirements and installation. The construction schedule will be reviewed by the Aviation Department so the installation is not impacted by Premises wiring and networking items.
- B.** The Aviation Department will review the design submittals and provide comments to the Contractor.
- C.** The Aviation Department will have Aviation Technology review submittals from the Contractor in conjunction with the Aviation Department DCS PMs to prevent potential problems with the installation of the system or incompatible products.

2-6.13.6 COORDINATION REQUIREMENT

- A.** Contractor will coordinate the interfaces with the Fire Alarm system or Fire Alarm System Contractor
- B.** Contractor will coordinate the interface with the MUFIDS system or system Contractor

2-6.13.7 SYSTEM INTERFACES

- Fire Alarm Interface
- TAPC – MUFIDS interface
- Network and Cobranet Interfaces

2-6.14 Multi User Flight Information Display System MUFIDS**2-6.14.1 INTRODUCTION**

A. The Multi-User flight information display system (MUFIDS) currently installed at PHX is a subsystem of the PIPS system provided by ARINC. The MUFIDS subsystem software is run by AirVue, an ARINC product.

2-6.14.2 REGULATORY REQUIREMENTS AND STANDARDS

A. In an effort to maintain display equipment quality and functionality for projects that are planned to include MUFIDS displays, the planners and Contractor s need to reference specific PHX and display industry regulations, practices and standards including:

B. VESA: Video Electronics Standards Association:

B.1. VESA -2002-10-Flat Display Mounting Interface Standard, Version 1, Revision1

C. VGA: Video Graphics Array:

D. NFPA 70: National Electric Code, latest revision as adopted by PHX and the City of Phoenix.

2-6.14.3 SYSTEM DESCRIPTION

A. MUFIDS is primarily a display system, posting visual information pertaining to scheduled flights and baggage claim assignments. The current MUFIDS displays are limited to Terminal “core” areas and baggage claim areas, while concourse area are handled by proprietary, airline owned and operated displays. The MUFIDS server room is currently located on the West Mezzanine level of Terminal 3 and is co-located with the PIP/PAL servers. This is the distribution point for all MUFIDS display contents at PHX.

B. Flight Information Video Display Banks:

B.1. The Terminal building are all currently provisioned with 40-inch LCD video banks. The quantities of displays planned for these video banks requires coordination with the MUFIDS software provider (ARINC) and PHX representatives to determine how many flight records will be posted at any given time.

C. Baggage Information Displays (BIDS):

C.1. Baggage Information Displays are typically single screen contents, often posting in a Back-to-Back display with 40-inch LCD video screens.

2-6.14.4 CONTRACTOR RESPONSIBILITIES

Not Used

2-6.14.5 CONTRACTOR RESPONSIBILITIES

Not Used

2-6.14.6 AVIATION DEPARTMENT RESPONSIBILITIES

Not Used

2-6.14.7 COORDINATION REQUIREMENTS

A. Architectural Coordination:

A.1. In planning each of the MUFIDS display locations the design will require coordination with architectural trades for various considerations such as selection of a location that provides optimal viewing for passenger’s flow and placement at logical decision points. Additionally, the type of mount and millwork to be used will require coordination with the architect.

B. Power Trades Coordination:

B.1. MUFIDS displays will require coordination with electrical power Contractors to plan for power load and conditioning requirements, quantity of outlets and locations for outlets.

C. Premises Wiring Coordination:

C.1. Coordination with PWDS design will require coordination similar to electrical power Contractors to plan for circuit media and outlets types as well as quantity of outlets and locations for outlets.

D. Active Network Coordination:

D.1. Planning the addition of MUFIDS displays will require coordination with Aviation Technology and active network Contractors to establish network circuits, determination of port availability and IP address assignments for the new display processors. The signal resources for MUFIDS originate in Terminal 3 server room, therefore extension of desired circuits must be extended from that location to the project display location.

2-6.14.8 SYSTEM INTERFACES

A. Interface to Paging system through Peavey media matrix TAPC interface.

2-6.15 Radio Systems

2-6.15.1 REGULATORY REQUIREMENTS AND STANDARDS

2-6.15.2 SYSTEM DESCRIPTION

A. The Aviation Department operates a public safety trunked radio system in the 821-824/866-869 MHz national public safety band under license WPW5651. Base station equipment for this system is located on the Airport with repeaters that are licensed for 100-watts effective radiated power. Mobiles and portables are licensed to operate in a 32.2 kilometer radius around the base station.

B. Radio coverage in outdoor and other above ground locations is generally adequate without supplemental augmentation. New facilities containing basements, utility tunnels and other sub-grade structures may require coverage augmentation. Augmentation may be also required for radio coverage in areas of buildings where off-air radio coverage may be restricted by the type of building materials used in construction.

C. Locations requiring augmentation of public safety radio, cellular or PCS services shall be provided with an engineered in-building coverage system. This system shall utilize a system of amplifiers, distributed antennas, radiating coaxial cable and fiber-optic distribution to provide coverage to all areas, overcoming structural blockages and other factors.

D. In-building coverage augmentation systems may be equipped with an outdoor donor antenna to indirectly interface with the Airport trunked radio system. Alternatively, these systems may be interfaced through connections directly to the Airport trunked radio base station equipment. Where a direct interface is used, uplink signals from the in-building system shall be interfaced to the base station equipment through voters to avoid de-sensitizing of off-air signals by noise in the uplink path from the in-building system.

E. The preferred technology for in-building coverage utilizes a double star topology with a combination of single mode high return loss fiber and Category 5 or Category 6 cable. A master hub is located at the donor antenna site or trunked radio base station site. Slave hubs at various IDF locations interconnect with the master hub using single mode fiber terminated with high return loss APC style connections.

F. Remote Antenna Units (RAU's) located near omni-directional antennas, directional antennas or feed points to radiating coax interconnect with slave hubs using Category 5 or Category 6 cabling. These cables carry uplink and downlink radio signals at an Intermediate Frequency as well as providing power to the RAUs. The RAU's provide IF to RF conversion in both the uplink and downlink direction.

G. Special attention is called to the fact that in-building coverage may be required for bands outside of the public safety 800 MHz band. In these cases, a separate system of hubs, RAU units and antennas will be required for each band. The basis of design for in building coverage shall be the InterReach Unison solution by LGC Wireless. This is the dominant solution used by most cellular and PCS companies. Information is available at:

http://www.lgcwireless.com/products/InterReach_Unison.asp?s=InterReach_Unison

H. In-building coverage for airlines and other legacy users in the 450 MHz band cannot be supported by the fiber based systems described above due to the limited separation between uplink and downlink frequencies. Where coverage is required in the 450 MHz band, a system of frequency selective repeaters shall be used with one repeater channel for each frequency pair to be supported.

I. In-building coverage for VHF air-to-ground aviation band radios is not possible as these radios operate in simplex mode (transmit and receive on the same frequency). Where this type of radio service is required, provisions shall be made for roof top antennas with close proximity to the airline or tenant base station radio(s). Extension of service from these radios to locations such as ramp airline operations offices shall be made using desktop remote units and wired connections through the Airport Premises Distribution System or using Ethernet connect IP desktop remotes over the Airport PDS Local Area Network.

2-6.15.3 CONTRACTOR RESPONSIBILITIES

Not Used

2-6.15.4 CONTRACTOR RESPONSIBILITIES

Not Used

2-6.15.5 AVIATION DEPARTMENT RESPONSIBILITIES

Not Used

2-6.15.6 COORDINATION REQUIREMENT

Not Used

2-6.15.7 SYSTEM INTERFACES

Not Used

2-6.16 Lightning Detection System

2-6.16.1 REGULATORY REQUIREMENTS AND STANDARDS

Not Used

2-6.16.2 SYSTEM DESCRIPTION

A. The Aviation Department provides lightning alert warnings to airline operations centers and other locations on the Airport using A Vaisala TWX300 lightning warning system. This system

utilizes satellite lightning strike data in combination with existing on-site field mills to provide five lightning alert levels. The basic configuration of this system will not change with construction projects, however, there may be a requirement for additional points of alarm annunciation. Information on this system may be found at:

<<http://www.vaisala.com/weather/products/twx300.html>>

B. Remote annunciation of lightning alerts at sites such as airline operations offices is provided by Vaisala Remote Alarm Displays (RADS). These units provide five levels of lightning alerting using green, amber and red LED indicators in combination with audible alarms. RADS units interconnect with the existing TWX300 Vaisala central equipment using Ethernet terminal server modules over the Airport Premises Distribution System Local Area Network. Each unit will require one 10/100-base-T network connection and 120VAC power.

C. Locations requiring supplemental notification such as outdoor ramp locations may be provided with beacons, horns or other means of notification if desired. These locations shall be provided with a Vaisala 8-circuit relay module and Ethernet terminal server module. Relay units interconnect with the existing TWX300 Vaisala central equipment using Ethernet terminal server modules over the Airport Premises Distribution System Local Area Network. Each unit will require one 10/100-base-T network connection and 120VAC power.

2-6.16.3 CONTRACTOR RESPONSIBILITIES

TBD

2-6.16.4 CONTRACTOR RESPONSIBILITIES

TBD

2-6.16.5 AVIATION DEPARTMENT RESPONSIBILITIES

TBD

2-6.16.6 COORDINATION REQUIREMENT

TBD

2-6.16.7 SYSTEM INTERFACES

TBD

2-6.17 Parking Systems - Future, NOT USED AT THIS TIME

2-6.17.1 REGULATORY REQUIREMENTS AND STANDARDS

2-6.17.2 SYSTEM DESCRIPTION PARKING GUIDANCE SYSTEM

2-6.17.3 SYSTEM DESCRIPTION EMPLOYEE PARKING SYSTEM

2-6.17.4 CONTRACTOR RESPONSIBILITIES

2-6.17.5 CONTRACTOR RESPONSIBILITIES

2-6.17.6 AVIATION DEPARTMENT RESPONSIBILITIES

2-6.17.7 COORDINATION REQUIREMENT

2-6.17.8 SYSTEM INTERFACES

2-6.18 Automated Vehicle Identification System (AVI or AVITS)**2-6.18.1 REGULATORY REQUIREMENTS AND STANDARDS**

Not Used

2-6.18.2 SYSTEM DESCRIPTION

A. Automatic Vehicle Identification (AVI) is utilized at the Airport to manage commercial vehicles such as taxis, buses, courtesy shuttles, limousines and various other vehicles. Vehicles are equipped with Radio Frequency Identification (RFID) tags which are read at various waypoints to record entry and exit to various areas of the Airport and at gated locations. The AVI system provides trip billing information for the Airport and ensures that commercial vehicles servicing the Airport are in good standing.

B. Projects that involve new segments of the roadway system, new parking lots or new curbsides may involve expansion of the AVI system. There are very specific requirements for antennas, readers, structures, gates, detection loops, lane controllers and lane geometry for both gated and non-gated AVI lanes. New AVI sites will also involve re-configuration of existing software.

2-6.18.3 CONTRACTOR RESPONSIBILITIES

Not Used

2-6.18.4 CONTRACTOR RESPONSIBILITIES

Not Used

2-6.18.5 AVIATION DEPARTMENT RESPONSIBILITIES

Not Used

2-6.18.6 COORDINATION REQUIREMENT

A. Contractors for facilities that involve new AVI sites are required to coordinate specific requirements for AVI with the PHX ground transportation staff and technical installation details with Transcore, the system manufacturer.

2-6.18.7 SYSTEM INTERFACES

Not Used

2-6.19 Computer Aided Dispatch (CAD) - Future, NOT USED AT THIS TIME**2-6.19.1 REGULATORY REQUIREMENTS AND STANDARDS****2-6.19.2 SYSTEM DESCRIPTION****2-6.19.3 CONTRACTOR RESPONSIBILITIES****2-6.19.4 CONTRACTOR RESPONSIBILITIES****2-6.19.5 AVIATION DEPARTMENT RESPONSIBILITIES****2-6.19.6 COORDINATION REQUIREMENT****2-6.19.7 SYSTEM INTERFACES**

2-6.20 Digital Signage- Future, NOT USED AT THIS TIME

2-6.20.1 REGULATORY REQUIREMENTS AND STANDARDS

2-6.20.2 SYSTEM DESCRIPTION

2-6.20.3 CONTRACTOR RESPONSIBILITIES

2-6.20.4 CONTRACTOR RESPONSIBILITIES

2-6.20.5 AVIATION DEPARTMENT RESPONSIBILITIES

2-6.20.6 COORDINATION REQUIREMENT

2-6.20.7 SYSTEM INTERFACES

2-6.21 Cable Television System- Future, NOT USED AT THIS TIME

2-6.21.1 REGULATORY REQUIREMENTS AND STANDARDS

2-6.21.2 SYSTEM DESCRIPTION

2-6.21.3 CONTRACTOR RESPONSIBILITIES

2-6.21.4 CONTRACTOR RESPONSIBILITIES

2-6.21.5 AVIATION DEPARTMENT RESPONSIBILITIES

2-6.21.6 COORDINATION REQUIREMENT

2-6.21.7 SYSTEM INTERFACES

Chapter 3: Fit-Outs

3-1 General

3-1.1 Purpose of this Chapter

3-1.1.1 The information provided here is intended to expand the requirements provided in SECTION III: Chapter 2 – Base Building to include special considerations for the various aviation and commercial tenants which may occupy space at the City of Phoenix Aviation Department Airports.

3-1.1.2 This Chapter of the Design Manual is included to provide design standards and criteria for the design of tenant facilities in new or renovated terminal development.

3-1.2 Codes, Regulations and Standards

Refer to SECTION I: Chapter 6 for applicable Codes, Regulations and Standards.

3-2 Architectural

3-2.1 Introduction

A. The purpose of this section is to define the level of expected finish and construction for facilities and systems that are provided by the Aviation Department for all tenant areas in new or renovated terminal facilities. Typically, all improvements provided by the tenant are based on bidding concessions opportunities and these requirements are stipulated in the tenant bid documents based on conditions at the time of bid.

3-2.2 General Design Requirements – Tenant Shell Spaces

3-2.2.1 The Contractor should refer to SECTION III: Chapter 2 – Base Building for System and Finish Material Standards adopted by the Aviation Department. Visual and application compatibility with these systems and materials will be required as part of the completed design.

3-2.2.2 WALLS

Enclosing walls will have finished surfaces on the non-tenant side only. Demising walls between tenants will be provided by the Aviation Department as part of the base building construction. Walls in the base building design before tenant improvements shall be constructed to conform with code requirements where fire rated separation may be required. Demising walls will terminate at the storefront façade. Tenants shall be responsible for completing their respective sides of the demising partition.

3-2.2.3 STOREFRONTS

Neutral piers between tenants will be provided by the Aviation Department and interior façades or storefronts facing public areas will generally be completed by the tenant except as determined otherwise by the Aviation Department. For the purpose of using this document, “storefront” shall be defined as the area measuring the width of tenant frontage between demising walls and between the floor and building structure above, which provides the separation between the tenant-lease space and the public space.

- Because final storefront design and installation is a tenant responsibility, specific requirements for each project are included in the Tenant Bid Documents
- Typically, coiling grilles are prohibited.
- The Aviation Department prefers glass storefronts which maximize transparency at the storefront opening.

3-2.2.4 CEILINGS

Finished ceilings or soffits are not required in tenant shell space, except as required for fire-rated floor, wall or roof assemblies. All overhead sprinkler, electrical, plumbing, or HVAC components will permit the installation of a minimum ceiling height of 9' – 0" unless otherwise instructed.

3-2.2.5 DOORS

Where enclosing walls around tenant areas are provided, hollow metal doors and frames will be required for temporary access until tenant finishing is completed. Where required, door assemblies in fire rated walls are to be fire-rated and labeled in order to comply with all criteria for the fire rating. Doors and door frames shall have a painted finish on both surfaces.

3-2.2.6 FLOOR AND ROOF STRUCTURE

Unless otherwise determined by the Aviation Department, finished flooring is not provided in shell space. Design all shell space floor structure to support 100 lbs. per sq. ft. live load. Provide an allowance of 10 lbs/psf for the design of floor and roof systems in anticipation of tenant provided and installed HVAC equipment and/or systems that may be suspended from the Terminal structure. Use IBC Type 1 Construction for all tenant areas.

3-3 Structural

Refer to SECTION I: Chapter 6 for Codes, Regulations and Standards. Structural codes cited shall apply to all Tenant work.

3-4 Mechanical & Electrical Services

3-4.1 General Design Criteria for Tenant Spaces

3-4.1.1 For purposes of planning and locating tenant shell space of any type of use, placement above electrical and communications rooms is strictly prohibited. The Contractor shall verify that this requirement has been met at each design submittal.

3-4.1.2 The Contractor will be required to meet with the PM and Stakeholders to review the various uses and types of tenants anticipated for tenant shell spaces. Based on this information, the Design Consultant will prepare an estimate of utility requirements for review with the PM and Stakeholders.

3-4.1.3 The area requirements for tenant shell space and types of tenants will be determined by B&P as part of the Terminal Programming Phase of Design. However, it is the Aviation Departments preference that all tenant areas should have access to utility connections required to service food and beverage concessions to permit ease of changing the tenant occupancy mix in the future.

3-4.1.4 All tenant utility requirements shall be designed to include a 20% increase in future demand beyond that of the initial occupancy requirements.

3-4.1.5 For purposes of calculating occupancy, use the following guidelines unless the Aviation Department directs otherwise:

A. Area Designation Occupancy (Sq. Ft/Person)

- Ticket Counter - 50
- Concession Area - 50
- Kitchen (large) - 8 persons
- Dining Area - 50
- Offices – 100

3-4.2 Metering

The Design Consultant and PM shall meet with FACILITIES AND SERVICES FACILITIES AND SERVICES to review and determine if provisions for metering of tenant utilities will be required in new terminal facilities including:

- A. HVAC Use**
- B. Chilled Water Use when applicable**
- C. Electrical Consumption**
- D. Domestic Cold and Domestic Hot Water**
- E. Natural Gas**

3-4.3 Mechanical

3-4.3.1 FIRE SUPPRESSION SYSTEM

Fire sprinkler systems will be complete, with sprinklers installed for “Industrial Ordinary Hazard” occupancy, with the heads turned up. Tenants shall be responsible for revising sprinkler layouts to conform to their architectural layout in accordance with the requirements of NFPA 13. Fire suppression system to be monitored by PHX building fire alarm system.

3-4.3.2 FIRE ALARM SYSTEM

The Aviation Department will provide smoke detectors within the tenant shell space. Installation of additional detectors shall be a tenant responsibility. All smoke detectors must be coordinated with and tied into the central building fire alarm system.

3-4.3.3 FIRE/LIFE SAFETY/SMOKE EXHAUST SYSTEM

Should new or renovated terminal facilities require a code compliant smoke evacuation system, the final design of tenant spaces will be required to coordinate with the design requirements of the main system.

3-4.3.4 MECHANICAL (HVAC)

A. Where feasible, conditioned air supply and return air ducts should be provided to each tenant space. The air supply and return system is sized for the estimated total heating and cooling requirement of the tenant space and is terminated with a capped connection at the perimeter of each tenant space.

B. Chilled water distribution piping systems may be considered for tenant spaces when the central air distribution system is not adequate to supply load requirements. This supply piping should be terminated with a valved and capped connection at the shell space perimeter to serve future air handling units to be provided by the tenant. This option should be agreed to by FACILITIES AND SERVICES FACILITIES AND SERVICES prior to beginning design.

C. Temporary Heat: Temporary electric unit heaters should be provided in all tenant areas with exterior building walls until areas are leased. Tenants shall turn over electric unit heaters prior to construction and/or occupancy.

D. Chilled Water: Chilled water is the source for all building cooling systems. Chilled water supply temperature at air handling units is 43° F with a minimum return temperature of 55.

E. HVAC Summer & Winter Design Conditions: Refer to Mechanical (Plumbing Division 22, Heating, Ventilation and Air Conditioning Division 23)

3-4.3.5 PLUMBING

A. The Aviation Department prohibits the installation of plumbing hardware in or above all rooms containing electrical and computer equipment or hardware. The Design Consultant shall take this requirement into account during the early phases of project design to avoid conflicts between the location of restrooms and tenant areas with electrical and communications rooms below.

B. Tenants are required to install backflow prevention devices on their incoming domestic water supply.

C. Tenants are required to install additional backflow prevention devices on the incoming domestic water line which is connected to a centralized detergent/cleaning fill station.

D. Cold water rough-in piping, terminating at accessible shut-off valves and caps at the perimeter wall, should be provided to each food-and-beverage space. Hot water shall be provided by the tenant. A four-inch sanitary drain connection Y and sanitary vent manifold tap should be provided at intervals acceptable to FACILITIES AND SERVICES FACILITIES AND SERVICES .

E. Grease from main kitchens, other food preparation areas and bars will not be discharged into the public sewer system. Grease interceptors should be of sufficient capacity to limit service requirements to monthly.

E.1. For work in existing buildings, all floor drains and grease interceptors shall be installed and maintained by the tenant. Tenant installed grease interceptors shall be located within the tenant leased space. All discharge from kitchen and bar equipment must pass through a grease interceptor. Proposed system to be approved by FACILITIES AND SERVICES FACILITIES AND SERVICES .

E.2. For new terminal facilities, the Aviation Department prefers to provide grease interceptors for tenants use to control location, access for service and minimizing disruption to closure pavement around terminal. Grease interceptors shall be sized to require service approximately monthly. Design Consultant should present design methodology proposed by FACILITIES AND SERVICES FACILITIES AND SERVICES to FACILITIES AND SERVICES FACILITIES AND SERVICES for review and approval. Do not locate grease interceptor near fresh air intake openings.

3-4.4 Electrical

When evaluating electrical demand as required under General Design Criteria above, the Design Consultant should evaluate power and fuel sources to determine the most desirable energy

applications for food and beverage concessions and make a recommendation to FACILITIES AND SERVICES FACILITIES AND SERVICES prior to starting design. All kitchen equipment shall be installed by the tenant and the tenant shall be responsible for coordinating the tenant design with the actual capacity of electrical supply available for use by kitchen equipment.

3-4.4.1 ELECTRICAL - LIGHTING

A. When applicable, electrical meters and meter enclosures for normal electrical power supply to tenant spaces should be coordinated with FACILITIES AND SERVICES FACILITIES AND SERVICES in dedicated electrical closets. Tenants shall be responsible for installation of circuit breaker and power wiring, installation of metering current transformers (C/Ts), meter wiring from C/Ts to meter enclosures, power taps, and power taps associated wiring from their spaces to the electrical closets.

B. Temporary lighting for construction inspection and subsequent completion of tenant space should be specified and will be chain hung LED-fluorescent industrial fixtures spaced at one fixture per 500 sq. ft. of floor area.

C. Other required temporary fire safety and security equipment should be specified as complete operational systems. These temporary installations shall be completely removed and/or reconfigured as the permanent system as part of work completed by the tenant. Unused temporary lighting shall be returned to the Aviation Department.

D. Tenants shall be responsible for maintaining temporary power, fire safety, and security systems to adjacent, unoccupied tenant areas as part of the configuration of the permanent tenant system.

E. The Design Consultant must coordinate requirements for providing emergency power for tenant life-safety equipment, when applicable, in advance of beginning design.

3-4.4.2 ELECTRICAL LOADS (lighting and power)

A. For general demand calculations, the following standards may be used, however, the Design Consultant must prepare an overall utility demand study for new terminal facilities, including incorporation of allowance for growth as noted previously.

B. Area Designation Electrical Load (w/sq. ft)

- Ticket Counter - 5
- Concession Area - 8
- Kitchen - 50*
- Dining Area - 2
- Offices - 3.5
- For food-and-beverage and restaurant spaces, floor area allocation is 1/3 for kitchen and 2/3 for dining.

3-5 Finishing Food & Beverage Shell Space

Requirements for tenant improvements are determined on a case by case basis at the time of bidding tenant improvement work and applicable standards and requirements are included in the bid documents for each offering.

3-6 Finishing Retail Shell Space

Requirements for tenant improvements are determined on a case by case basis at the time of bidding tenant improvement work and applicable standards and requirements are included in the bid documents for each offering.

3-7 Finishing Airlines Shell Space

Requirements for tenant improvements are determined on a case by case basis at the time of bidding tenant improvement work and applicable standards and requirements are included in the bid documents for each offering.

3-8 Finishing Ground Transportation Shell Space

Requirements for tenant improvements are determined on a case by case basis at the time of bidding tenant improvement work and applicable standards and requirements are included in the bid documents for each offering.

Chapter 4: Landside Civil

4-1 General

4-1.1 Code Requirements

Refer to SECTION I: Chapter 6 for applicable Codes, Regulations and Standards.

4-1.2 Terms, Definitions and Abbreviations

Refer to SECTION IV: APPENDIX B

4-2 Environmental Requirements

4-2.1 Environmental/Site Evaluation for Asbestos and Other Hazardous Materials

Refer to SECTION II: Chapter 2 – Environmental Standards and Permitting

4-2.2 Wildlife

4-2.2.1 WILDLIFE COORDINATOR

A. All Aviation Department expansion plans and future land-use changes should be reviewed by the Airport's Wildlife Coordinator and Airport's associated USDA Wildlife Biologist to ensure that new developments will not inherently threaten the safety of aircraft operations by increasing wildlife attractants at the Airport.

B. PHX's location adjacent to the Rio Salado river bottom attracts wildlife. The Aviation Department's Operation's wildlife personnel shall evaluate all plans in fulfillment of FAR 139.337, Wildlife Hazard Management Plan, and make recommendations for change regarding future airport projects and land-use changes.

4-2.2.2 DISCOURAGING WILDLIFE

A. Every effort will be made to revise or eliminate plans that create attractive wildlife habitat, therefore the wildlife coordinator and wildlife biologist should participate in all land use planning and mitigation efforts sited for Airport property. They will be involved in the initial phases of airport building projects, such as new structures or landscaping changes, to provide input on designs that discourage use by wildlife. They should be consulted on tenant improvement plans and all other facility improvements.

4-2.2.3 MONITORING PROJECTS LOCATED OFF AIRPORT PROPERTY

A. The wildlife coordinator and wildlife biologist should participate in land-use projects or changes, located off Airport property that may adversely impact aircraft operations by attracting hazardous wildlife to the area.

B. The FAA provides technical guidance to airport operators to address land use compatibility issues. Proposed projects that may increase wildlife hazards at the Airport or within the Airport's airspace should be discouraged.

C. Projects already under development that are presumed to attract hazardous species of wildlife, such as the Rio Salado Project, will be monitored. Wildlife hazards, created by land use changes, will be discussed with local planning authorities for collaboration with wildlife control activities.

4-3 Site Work and Exterior Utilities

4-3.1 Security Site Planning

4-3.1.1 Consider that manmade features such as neighboring buildings can provide a vantage point for weapons fire, or storm drains and utility tunnels that could enable someone to gain covert access to the property.

4-3.1.2 Avoid siting critical facilities in a way that vehicles may have direct routes between public roads and critical facilities.

4-3.1.3 The site layout should neither prevent nor complicate access via public roads for emergency vehicles, nor should it inhibit emergency egress for passengers and/or employees.

4-3.1.4 To facilitate reductions in vehicle speeds, the Design Consultants should attempt to ensure there are no unobstructed vehicle approaches that are perpendicular to infrastructure or the perimeter.

4-3.1.5 The Design Consultants should selectively place entrances and exits, barriers of various kinds, lighting and landscape in order to limit access and control flow of vehicles and pedestrians.

4-3.1.6 All access point designs will meet NFPA guidelines and be coordinated with the Aviation Department and COP Fire.

4-3.1.7 Parking area design will incorporate good visibility throughout, and good visibility from surrounding areas into the parking area for patrols by Aviation Department.

4-3.1.8 The planning of landscaping in surface parking areas will consider maximizing visibility and eliminating hiding places and shadows.

4-3.1.9 Consider traffic calming features at entrances and exits on a case-by-case basis to slow the vehicles as they enter and exit to allow adequate time for automobile license plates to be captured by video surveillance.

4-3.1.10 The drive up area should be circular or serpentine in design and, if possible, should provide sufficient stand-off of vehicle traffic from buildings and infrastructure. Utilize barriers (e.g. bollards) to prevent vehicles from driving close to buildings and infrastructure via sidewalks or other non-designated but possible approaches. [See Section 13.16 Fence & Barriers]

4-3.2 Survey Control and Data Collection

4-3.2.1 Survey and data control requirements are currently being reviewed and modified by the City of Phoenix and the Aviation Department as part of the Graphical Information Systems Implementation Project. The criteria contained in this section do not take into account any changes that will be made from the GIS project, but will be updated once the GIS requirements are finalized.

4-3.2.2 Permanent primary horizontal and vertical survey control has been developed for PHX during previous projects. For new projects, additional secondary survey monuments may be

required that will augment the established survey control system. The creation of additional survey control points when performing topographic survey and mapping from aerial photography should be evaluated for each new project.

4-3.2.3 TOPOGRAPHIC SURVEY

A. Designer's topographical field surveys may be required to establish locations and elevations of surface features including paved areas, manholes, drainage inlets, electrical handholes, utilities, and other identifiable surface features within the project corridor and adjacent affected areas. The survey will be conducted to gather detailed data for design purposes and to establish survey control points for the project.

4-3.2.4 AERIAL MAPPING

A. Both high and standard flight level photography of the project area should be evaluated. High accuracy photography is required to provide elevations within one-tenth of one-foot accuracy. Standard flight photography is performed to provide normal mapping accuracy for areas outside of the main project area, which will be used for conceptual planning purposes.

B. High accuracy mapping is done to establish existing locations and elevations of non-paved areas, runway and taxiway edge lighting, signage, visible manholes, drainage inlets, structures, electrical handholes, duct markers, utilities, navigation aids and other identifiable surface features within the project, and adjacent affected areas.

4-3.2.5 ACCURACY

A. The Designer should utilize the national mapping standards and specifications that have been generally accepted throughout the United States including the U.S. Geological Surveys, U.S. Department of Transportation, American Society of Photogrammetry and Remote Sensing (ASPRS) and countless state and other government agencies, have all concluded that: topographic maps will produce spot elevations, whereas, 90% of all spot elevations shall be equal to or less than 1/4 of the map contour interval; 90% of all contours shall be accurate within 1/2 of a contour interval; and Horizontal accuracies shall be 1/40th of the original map scale for all drawn/created planimetric features and 1/100th of map scale for all grid or control points.

4-3.2.6 UTILITY DESIGNATING, LOCATING AND DATA MANAGEMENT

A. The project site and adjacent areas must be reviewed for utility locations using established methods of detection. Depths of utilities will be determined by pot holing or soft digging. Pot holing and soft digging are digging procedures where a small hole is manually or vacuum excavated to the depth of the utility to verify the horizontal and vertical location and depth of the utility in question.

B. In areas where the as-built information is incomplete, field investigation must be conducted by the designer to locate and identify the utilities in question. Existing utilities at ground level should be located when the topographic survey is being accomplished.

C. Existing utilities that are underground may be located using Subsurface Utility Engineering (SUE) in accordance with American Society of Civil Engineers Standard Guidelines for the Collection and Depiction of Existing Subsurface Utility Data, CI-ASCE 38.02.

D. Horizontal and vertical locations of existing utilities such as fiber optic conduits, electrical conduits and lines, communication conduits and lines, waterlines, sanitary sewers, storm drains and catch basins, jet fuel pipelines, and gas lines within the project corridor will be determined in this manner.

4-3.2.7 DESIGNATING

A. Existing underground utilities will be located using geophysical prospecting techniques to determine the existence and horizontal position.

4-3.2.8 LOCATING

A. The use non-destructive digging equipment, such as vacuum excavation, at critical points along a subsurface utility's path to determine the precise horizontal and vertical position will be employed.

4-3.2.9 DATA MANAGEMENT

A. Upon surveying the utility information obtained by designating and locating, the data will be entered into the computer aided design (CAD) system, allowing the examination of project options and thus the substantial reduction in utility conflicts.

4-3.3 Site Preparation [Division 31]**4-3.3.1 REGULATORY REQUIREMENTS:**

- A. Conform to applicable MAG Standards and LEED requirements for disposal of debris.
- B. Conform to applicable Maricopa County Air Pollution Rules and Regulations, Rules 100, 110, 200, 300 and 310 for control of air contaminants.
- C. Designers location of utilities shall be coordinated with EAS Utility if applies, the Aviation Department DCS, Facilities and Services and Electrical. Design of new services is to be determined no later than in the Design Development Phase after loads have been determined for the project.
- D. Some projects will require design of street lights through the Street Transportation Department and costs will be included in the project budget. All utility coordination must be done to prevent any tapping into the Aviation Department Facilities and Services Division established utilities during construction.
- E. All utility information must be forwarded to the Design and Construction Services Division (DCS) to develop and maintain an archive.
- F. Coordinate clearing and excavation Work with utility companies. Call Arizona BLUESTAKE Center prior to conducting any underground work.
- G. Dry Wells – Dry wells should not be installed in the vicinity of the storage of any hazardous materials such as petroleum fuel. In the event a drywell is being considered in any location, during design, the office of the Aviation Department Environmental Section dry well staff shall be notified to review and obtain necessary permits. Additional engineering measures may be required for site preparation in order to protect the drywell from hazardous substances.

4-3.3.2 PROJECT CONDITIONS**A. Traffic:**

- A.1. Plan site clearing operations to ensure minimum interference with roads, streets, walks, and other adjacent occupied or used facilities
- A.2. Do not close or obstruct streets, walks, or other occupied or used facilities without permission from the Aviation Department authorities.
- A.3. Access must be provided for maintenance and emergency vehicles.

B. Protection of Existing Improvements:

- B.1.** Incorporate barricades, coverings or other types of protection necessary to prevent damage to existing improvements indicated to remain in place.
- B.2.** Protect improvements on adjoining Aviation Department properties.
- B.3.** Restore improvements damaged by Work to their original condition as acceptable to the Aviation Department or authorities having jurisdiction.

C. Haul Routes:

The Design Consultants shall identify on the contact plans the construction haul routes on the airport in conjunction with the PM and the needs of the project. The Design Consultants shall include in the specifications the haul route maintenance requirements; the Contractor's requirement to coordinate with other projects/Contractors on shared routes; and restoration requirements. The specifications shall indicate that on-Airport haul roads, between the project site and shared haul routes, shall be maintained by the Contractor and shall be restored to original condition upon completion of use as the haul route at no expense to the Aviation Department. The Design Consultants shall design temporary haul routes with the appropriate drainage, fencing, grading and associated requirements. The Design Consultants shall indicate in the specifications and plans that when it is necessary to cross over curbs or sidewalks, the Contractor shall protect them from damage. Specify the Contractor repair any damaged curbs and sidewalks at no cost to Aviation Department.

4-3.4 Construction Materials

4-3.4.1 In general, all construction materials will conform to the applicable specifications, standards and codes, referenced in Section I, including Federal Specifications for the project. Due to the moderate reactivity of aggregates used for Portland cement concrete (PCC); it will be necessary to add a fly ash component to the mix for longevity of the PCC.

4-3.4.2 USE OF EXCAVATED MATERIALS

A. A determination will need to be made by a geotechnical engineer as to the desirability of the use of excavated materials by crushing that may be feasibly used in the construction of base and paving materials on roadways or use in structural concrete. Fine and coarse aggregates for concrete shall meet the requirements of ASTM C33. Any areas of silts and clays with a high plastic index that are unsuitable for foundation materials shall be removed.

4-3.5 Construction Staging

A. A determination of a site or sites for the Contractor's staging area must be established during the design phase of work. Possible staging locations for access to the site should be reviewed and evaluated. Additional analysis will be required to determine the optimal location for the placement of concrete batch plant facilities should the scale of the project warrant such a facility.

4-3.6 Utilities

4-3.6.1 DESIGN CRITERIA REFERENCES

A. All utility design elements shall be designed in accordance with accepted engineering standards; however, as a minimum, they shall be in conformance to the applicable reference publications in SECTION I: POLICIES, Chapter 6: Codes, Regulations & Standards.

B. Prior to any ground disturbance activities, specify the Contractor must submit an Archeology Request Form to P&E to obtain archeology clearance. P&E will coordinate the results of the archeology analysis with DCS and/or the Contractor. However, if any archaeological materials are encountered during construction, all ground-disturbing activities will cease within 10 meters of the discovery, the Contractor will contact P&E, who will then coordinate and notify the City of Phoenix Archaeology Office immediately.

4-3.6.2 UTILITY BASE MAP

A. The Design Consultant will request plans for 'as built' utilities. The Design Consultant will then prepare a utility base map of existing utilities.

B. The Design Consultant will, through field survey, verify the location of all "as built" utilities and identify any undocumented utilities observed during the field survey.

4-3.6.3 UTILITY SEPARATION

A. Separation distances and/or other extra protection may be required to protect water mains from contamination by sanitary sewer mains. These criteria apply to parallel mains as well as crossings.

B. Design and construction of water mains must be located at least two feet above a sanitary sewer line and with a separation laterally of at least four feet for a gravity sanitary sewer.

C. Design and construction of water mains must be located at least six feet above a sanitary sewer line and with a separation laterally of at least six feet for a pressure or force main sanitary sewer.

4-3.6.4 EXISTING UNDERGROUND UTILITIES COORDINATION

A. Projects requiring the relocation of existing in-use electric utility lines shall be identified and included on the site civil engineering drawings. Prior to pre-design site work, contact Arizona Public Service (APS) for an approved utility locating service to locate all sub-grade electric lines. All electric lines including utility primary and customer secondary electric lines in the vicinity of the work area is to be located and included in the surveyor's notes and measurements. Electric lines in the work area shall be shown on all site civil drawings and plans; identify and distinguish between existing high voltage lines; medium voltage lines and distinguish between 5kV class and 15kV class cable; and low-voltage lines.

B. Existing primary electric utility lines to be abandoned shall be removed in their entirety. As a minimum, existing lines to be deserted shall be identified on the civil site plans and designs; an electrical site plan, designed by a registered professional engineer, is to be included in the site work construction package.

C. Designers must assure that existing primary electric utility lines to be relocated shall not be abandoned in place and replaced by a new electric line. Relocated electric utility lines shall be removed in their entirety and replaced with new cable runs; civil and electrical site plans shall reflect all necessary design work. For relocated electric utility primary lines, coordinate the design efforts for cable/conduit sizing, the location of fuse pull-outs, electric power pole heights, reclosers, connection cabinets, switch cabinets, switch operators, transformers, vaults, etc with Arizona Public Service.

D. Projects requiring the relocation of existing in-use communications utility cables are to be coordinated with the utilities and identified as such on the civil and electrical site engineering drawings. Prior to pre-design site work, an approved utility locating service shall be contracted to

locate all sub-grade communication lines. Coordinate the new work and design requirements with the respective utility company.

E. Designers must assure that relocated or abandoned utility cable duct banks, manholes and/or hand holes are to be removed in their entirety or relocated. All work to existing utility cable duct banks shall be indicated on civil and electrical site plans.

F. The Design Consultant shall require the Contractor to hire a sub-surface blue stake underground utility service locator. The Design Consultant shall state for the Contractor to “Call Before You Dig” and provide a contact number.

4-3.6.5 UTILITY LINE CONNECTIONS AND SHUTDOWNS

A. Work requiring electric or telecommunications utility shutdown is to be coordinated with the respective utility company and affected customers. Coordination with the utility companies during the design phases is to occur to determine the requirements for coordination and notification with the utility company, by the Contractor, on the design or construction documents.

B. Utility shutdowns affecting the airport operations shall be performed during off-peak and non-operational hours unless otherwise determined as necessary by the PM. All shutdowns shall be coordinated with airport personnel, PMs, maintenance staff, and tenants in the affected area(s) at least 10-business days prior to the scheduled shutdown.

4-3.6.6 UTILITY LINE RELOCATION AND ABANDONED UTILITY LINES

A. Projects requiring the relocation of existing in-use electric utility lines shall be identified and included on the site civil engineering drawings. Prior to pre-design site work, contact Arizona Public Service (APS) for an approved utility locating service to locate all sub-grade electric lines. All electric lines including utility primary and customer secondary electric lines in the vicinity of the work area is to be located and included in the surveyor’s notes and measurements. Electric lines in the work area shall be shown on all site civil drawings and plans; identify and distinguish between existing high voltage lines; medium voltage lines and distinguish between 5kV class and 15kV class cable; and low-voltage lines.

B. Existing primary electric utility lines to be deserted shall be removed in their entirety. As a minimum, existing lines to be deserted shall be identified on the civil site plans and designs; an electrical site plan, designed by a registered professional engineer, is to be included in the site work construction package.

C. Existing primary electric utility lines to be relocated shall not be abandoned in place and replaced by a new electric line. Relocated electric utility lines shall be removed in their entirety and replaced with new cable runs; civil and electrical site plans shall reflect all necessary design work. For relocated electric utility primary lines, coordinate the design efforts for cable/conduit sizing, the location of fuse pull-outs, electric power pole heights, reclosers, connection cabinets, switch cabinets, switch operators, transformers, vaults, etc. with Arizona Public Service.

D. Projects requiring the relocation of existing in-use communications utility cables are to be coordinated with the utilities and identified as such on the civil and electrical site engineering drawings. Prior to pre-design site work, an approved utility locating service shall be contracted to locate all sub-grade communication lines. Coordinate the new work and design requirements with the respective utility company.

E. Relocated or abandoned utility cable duct banks, manholes and/or hand holes are to be removed in their entirety or relocated. All work to existing utility cable duct banks shall be indicated on civil and electrical site plans.

F. The Design Consultant shall require the Contractor to hire a sub-surface blue stake underground utility service locator. The Design Consultant shall state for the Contractor to “Call Before You Dig” and provide a contact number.

4-3.6.7 EXCAVATION AND TRENCH WORK

A. Civil site plans and civil designs shall incorporate a full interdisciplinary coordination with all trades. Document all utilities located within the area of work. The Contractor shall perform field coordination and is responsible for contacting the utility’s locating service prior to trenching. The Contractor is responsible for obtaining the required digging or trenching permits from the City of Phoenix. The construction documents shall clearly direct the Contractor to the preceding information.

B. Trenching and backfill of buried electric utility cables shall meet the requirements and trenching agreement of Arizona Public Service Company.

C. The project documents (including but not limited to drawings, specifications, and contractual agreements) shall address the following items if the scope of work includes excavation of existing electrical and/or telephone utility cables or excavation around existing electric or telecommunications utility lines or cables:

C.1. Specify there can be no excavation of or around existing electric and/or telecommunications cabling by mechanical means within 18” of the utility line.

C.2. Specify there can be no excavation within 18” of the existing electric and/or telecommunications cabling by mechanical means

C.3. Specify excavation of electric or telecommunications cabling or duct banks shall be coordinated with other trades and other utilities companies. All utilities shall be located prior to digging.

C.4. Specify the Contractor is responsible for obtaining the required digging or trenching permits from the City of Phoenix.

C.5. The Contractor is responsible for notifying the utilities locate service prior to trenching or excavation.

D. Constructing documents showing trenching and excavation for new utilities work shall address the following: The Contractor is ultimately responsible for properly installing all new lines and restoring the topography to its previously existing state:

D.1. Specify the Contractor is responsible for notifying the utilities locate service for utilities locating prior to trenching or excavation.

D.2. The contract documents identify the path or routing of utilities. New utilities routing shall maintain the minimum burial depths and safe distances from other utilities.

D.3. Specify the Contractor or excavation team is responsible for excavation of or around existing electric and/or telecommunications cabling. Excavation by mechanical means is not permitted within 18” of the utility line.

D.4. Soil compaction shall satisfy the minimum requirements set-forth by the utility and the Airport and be dependent on the surface use within the influence area. Compaction is determined by the standard proctor test; samples shall be taken every 100-feet. For cohesive soil, compact at a minimum to 95% (ASTM D 698) modified proctor dry density at +/- 2% of optimum moisture content. For expansive soil, compact to 88% (maximum) modified proctor dry density at 3% of optimum moisture content. Prior to and during compaction, materials shall have a moisture content as required to obtain the specified density. Density tests shall be taken at random intervals where the interval does not exceed 100-feet. Backfill material

must not exceed ½” in diameter unless otherwise coordinated with the utility company and PM.

D.5. Specify the Contractor shall restore trenches to their original grade; excess soil shall be used for compaction in order to comply with the above stated compaction requirements or removed at the direction of the PM. The top 12” of backfill must match the surrounding soil type. The top cover for the trench and surrounding area affected by the work must match the surrounding drive or landscape surfaces.

E. Designs must assure electric duct banks and direct buried cable shall be set a minimum of 24” below finished grade or 36” below finished grade (minimum) is required for primary cables. Maintain a minimum of 12” vertical distance from any other utility line.

F. Designs must assure telecommunications duct banks and/or direct buried cable shall be buried a minimum of 24” below finished grade. Maintain a minimum of 12” vertical distance from any other utility line.

4-3.6.8 BLASTING

A. Blasting used as a method of excavating or trenching is not approved or allowed. Refer to the demolition section for blasting means and methods.

4-3.6.9 UNDERGROUND UTILITY MARKINGS

A. Utilities markings are required for all new and modified existing utility sub-grade installations. Direct buried electric and telecommunications direct bury cable and duct banks require (1) plastic warning strip to be located no less than 12” above the cable or duct bank. Requirements for the location of the warning tape for other trades/utilities is defined elsewhere in this document. The following colors shall be used for traceable and non-traceable utility identification tape:

- Blue -Water Lines
- Green -Sanitary Sewer Lines
- Orange -Telecommunications Lines
- Purple -Storm Water or Reclaimed Sewer Lines
- RED -Electric Lines
- Yellow -Gas or Petroleum Lines

B. Specify non-traceable warning tape for installations of copper telecommunications lines or electric cabling or duct banks. Traceable warning tape is required for all other utility installations. For spare or empty conduit installations for electric or telecommunications cabling, traceable identification warning tape is required.

C. For utilities located within utility easements in areas with no other identifying infrastructure, provide above-grade signage identifying the buried utility line in addition to the buried warning tape. Signs shall be placed on no less than 200-foot and no more than 400-foot intervals.

4-3.6.10 UTILITY STRUCTURES: GENERAL (MANHOLES, ETC)

A.1. Provide flush-grade pull boxes or manholes for communications and electric cabling as required by the utility. Telecommunications and electric cabling shall be run independently and shall not utilize the same pull boxes or manholes. Flush grade pull boxes and manholes shall be pre-fabricated and constructed from 4000 psi (or greater) steel reinforced concrete. Splice box and manhole sizes are to be determined in conjunction with the utility’s standards, utility easements, duct bank size, number of runs, etc.

A.2. The design shall specify that all pull boxes and manholes must be flush and level with the grade. Pull boxes and manholes located in a drive path or in an area with the potential of vehicular traffic shall be rated for such use.

A.3. Pull boxes and manholes located in a drive path or in an area with the potential of vehicular traffic shall be AASHTO 20,000 LB load rated (box and lid). The lid must be constructed of high-strength steel. Lids shall be stamped with a description of the contents (e.g. Electrical, Communications, Telephone, etc.)

4-3.7 Storm Drainage

4-3.7.1 PRECIPITATION-INTENSITY-DURATION

A. Precipitation data shall be based upon NOAA Precipitation – Frequency Atlas II of the Western United States. The only deviation from the NOAA Atlas procedures that are currently recommended is the use of the short-duration (less than 1- hour) rainfall ratios that were published by Arkell and Richards (1986). The depth – duration – frequency (D-D-F) statistics in the NOAA Atlas are shown as a series of isopluvial maps of Arizona for specific durations and return frequencies.

B. Selected isopluvial maps for Maricopa County can be found in the Drainage Design Manual for Maricopa County, Arizona, Volume 1-Hydrology.

4-3.7.2 DESIGN DISCHARGE

A. The maximum expected discharge from drainage areas shall be computed by the designer using the rational method or other applicable procedures as specified in the latest “City of Phoenix Storm Water Policies and Standards”.

B. The rational method shall only be allowed to predict storm water peak flow and runoff volume estimates for the design of storm drains, minor channels and retention storm water storage facilities with contributing drainage areas up to 160 acres.

C. For contributing drainage areas greater than 160 acres, and for channel routing and detention storm water storage facilities design, the HEC-1 methodology described in the Drainage Design Manual for Maricopa County, Arizona, Volume 1-Hydrology shall be used.

4-3.7.3 STORM DRAIN DESIGN

A. All roadway design elements shall be designed in accordance with accepted engineering standards, however, as a minimum, they shall be in conformance to the applicable reference publications in SECTION I: POLICIES, Chapter 6: Codes, Regulations & Standards.

B. Storm drains shall be designed in accordance with the procedures specified in the “City of Phoenix Storm Water Policies and Standards.” A Manning’s “n” value of 0.015 shall be used for street flow on paved streets unless special conditions exist.

4-3.7.4 MINIMUM VELOCITIES

The minimum velocity for storm drains shall be 5 feet per second for the 2-year design flow rate and 3 feet per second for one half of the design flow rate. Storm drains with flow velocities less than five feet per second for the design flow rate or in excess of 15 feet per second shall require approval from the City of Phoenix.

4-3.7.5 MINIMUM PIPE SIZES

A. Minimum pipe sizes shall be:

- A.1. Eighteen inches for main line storm drains
- A.2. Fifteen inches for catch basin connector pipes
- A.3. Six inches for slope drains
- A.4. Six inches for underdrains

B. The proposed storm drain system will be shown in plan and profile along with existing and proposed grades for the pipeline and ground surface above the pipeline.

C. Proposed catch basins and connector pipes will also be shown in profile. All existing utilities, including water and sanitary sewer that crosses the proposed storm drain shall be shown in plan and profile at their proper elevation.

4-3.7.6 MINIMUM PIPE CLEARANCE

A. Minimum pipe cover of fill over storm drains should be at least five feet, unless approved by the Airport, and shall be designed to fall within the allowable ranges identified in the “D” load table shown in the City of Phoenix Storm Water Policies and Standards.

B. Specify horizontal clearance from proposed storm drains to City of Phoenix water and sewer facilities require a minimum of six feet.

C. Specify vertical clearance from proposed storm drains to City of Phoenix water and sewer facilities require a minimum of one foot. Salt River Project utilities require a minimum of two feet clearance horizontally and one foot vertically.

D. Specify clearance with other utilities shall be a minimum of one foot both horizontally and vertically. Refer to section 2.9.9.2 for utility separations for other utilities other than storm drains.

4-3.7.7 CORROSION PROTECTION

A. In all cases, drainage systems shall be designed to include provisions for corrosive protection of facilities against stray currents.

B. Resistivity and pH testing of the soils shall be required to support pipe design in terms of alternate pipe material selection other than reinforced concrete pipe and high density polyethylene.

C. If resistivity readings fall below 1,500 ohms per cubic centimeter, additional readings shall be made at intervals of not less than 25 feet or more than 100 feet until the limits of the area of low resistance soil are fully defined.

4-3.7.8 MANHOLES

A. Manholes shall be designed according to the City of Phoenix Storm Water Policies and Standards. Manholes are required for all mainline storm drain pipe size changes, vertical grade breaks, and horizontal angle deflections greater than five degrees. Manhole spacing shall be as follows:

- A.1. Include manholes for pipe diameters of 30 inches or less every 330 feet
- A.2. Include manholes for pipe diameters of 33 inches to 45 inches every 440 feet
- A.3. Include manholes for pipe diameters of 48 inches and greater every 600 feet

4-3.7.9 UNDERDRAINS AND LOCATION

A. Underdrains shall consist only of perforated concrete or perforated plastic pipe at least six inches in diameter for lengths less than 500 feet and at least eight inches in diameter for lengths greater than or equal to 500 feet.

B. Details for the perforated pipe must show the pipe surrounded by a minimum of four inches of gravel drain material, and placed a minimum of 12 inches below subgrade. The underdrain system shall also be wrapped with filter fabric (minimum weight 4 oz./sq. yd.) by placing the fabric between the gravel drain material and surrounding soil.

C. Designs should include underdrains located in areas where it is anticipated that groundwater may interfere with the stability of side slopes, structure footings and tunnel stability. In general, they may be used, based on geotechnical reports, in the following places:

- C.1.** Along the toe of a cut slope to intercept seepage
- C.2.** Along the toe of a fill on the side from which groundwater emanates
- C.3.** Across the roadway at the downhill end of a cut
- C.4.** Along the periphery of any paved area under which groundwater is likely to collect

4-3.7.10 STORM WATER STORAGE

A. All retention facilities incorporated will be designed to retain the peak flow and volume of runoff from the 100-year, 2-hour duration storm event.

B. This requirement may be waived by the City of Phoenix if there will be no critical drainage problem created by the additional runoff from the proposed development. The finding of no detrimental impact must be documented following the methodologies established in the Maricopa County Drainage Design Manuals, Hydrology and Hydraulics. Required retention basin volume shall be obtained by using the following equation: $V = C [P/12] A$ (7) Where: V = Calculated Volume in Acre-Feet C = Runoff Coefficient P = 100 Year, 2 Hour Rainfall Depth in Inches A = Drainage Area in Acres. An additional 25 percent retention for the design storm event will be required when the storm water storage basin does not outfall to public right-of-way or public drainage easement.

C. Once the retention basins are full, they shall be designed to provide a positive outfall to adjacent streets. The maximum depth of water in a retention basin shall be three feet. Deeper water depths for the design event shall require approval by the City of Phoenix. The maximum depth of the retention basin within ten feet of the right-of-way shall be 18 inches; and within 20 feet of the right-of-way shall be 24 inches.

D. Specify the side slope of the retention basin shall not be closer than two feet from the back of sidewalk and no closer than seven feet from the back of curb when there is not any sidewalk.

E. Specify the maximum side slope shall not exceed three to one for landscaped areas and five to one for irrigated grass areas. Slope stabilization will be provided for all side slopes steeper than five to one.

F. Retention basins shall be designed such that the stored runoff shall be emptied completely from the facility within 36 hours after the runoff event has ended by either, infiltration, controlled bleed-off, dry well or discharge pump to an approved facility.

G. Percolation tests will be provided to obtain permeability rates for use in the design of the retention basin or basins.

H. Should dry wells be required to completely drain the retention basin within 36 hours, the dry wells shall be designed in conformance with Arizona Department of Environmental Quality guidelines. Dry wells are not allowed within City right-of-way. Contact the Aviation Department Environmental Section drywell staff to coordinate permitting requirements.

4-3.7.11 SLOPE PROTECTION

- A. Cut slopes shall be protected with intercepting ditches at the top of slope when significant flow may come from the ground surface above. Slope benches shall be sloped toward a ditch running along the bench.
- B. Slopes shall be protected where necessary against erosion from concentrated drainage with down drains.

4-3.8 Roadways

4-3.8.1 DESIGN CRITERIA REFERENCES

- A. All roadway design elements shall be designed in accordance with accepted engineering standards, however, as a minimum, they shall be in conformance to the applicable reference publications in SECTION I: POLICIES, Chapter 6: Codes, Regulations & Standards.
- B. Design and construction will be in compliance with the Aviation Department's environmental documents that have been approved by the FAA.
- C. It is anticipated that all pavement and associated infrastructure elements will be replaced in-kind. Specifically, the following design criteria are to remain equivalent to the existing conditions or approved by the PM:
 - C.1. Design Speed
 - C.2. Lane Width
 - C.3. Shoulder Width
 - C.4. Horizontal Alignment
 - C.5. Vertical Alignment
 - C.6. Grades: Minimum grade 0.5%. Maximum grade coordinated with PM
 - C.7. Stopping Sight Distance
 - C.8. Cross Slope: Normal Cross Slope should be 2%.
 - C.9. Superelevation
 - C.10. Vertical Clearance
 - C.11. Design Vehicle: Generally shuttle bus. May also be WB-50 or COP Fire vehicle. Coordinate with PM and COP Fire.

4-3.8.2 CONSTRUCTION PHASING AND TRAFFIC CONTROL PLANS

- A. Construction phasing plans and maintenance of traffic plans shall be generated to ensure, to the extent possible, that the existing level of service be maintained during the construction. Details for signage, barricades, detour configurations, etc, shall be in accordance with local and state design criteria.

4-3.9 Bituminous Concrete Paving

4-3.9.1 QUALITY ASSURANCE

- A. Regulatory Requirements: Conform to applicable MAG standards for asphalt paving work on public property. Other approved pavement type alternatives can be considered. Refer to current MAG specs and or C.O.P. supplements.

B. For airside pavements there must be conformance with USDT FAA Advisory Circular AC 150/5320 6D and any supplemental changes issued relating to Airport Pavement Design and Evaluation.

C. Pavement sections for heavy truck traffic areas shall have at least C³/₄ mix for the bottom lifts and then topped with D¹/₂ mix. If budget permits, then the use of rubberized asphalt mixes should be used at least for the top layer. Oil content and add mixtures shall be reviewed with the City of Phoenix Materials Lab prior to bidding this work. Final designs to be approved by FACILITIES AND SERVICES and Streets.

D. Standards: Comply with Asphalt Institute's "The Asphalt Handbook," except where more stringent requirements are indicated.

4-3.10 Concrete Paving

4-3.10.1 QUALITY ASSURANCE

A. Perform work in accordance with ACI-301, Specification for Structural Concrete, latest edition.

B. Standard for measuring, mixing, transporting and placing of concrete shall be in accordance with ACI-304, latest edition.

C. Concrete shall comply with ACI-318, Building Code Requirements for Structural Concrete, latest edition.

D. Airside pavement designs must conform with USDT FAA Advisory Circular AC 150/5320 6 (Current Version) and FAA P-501 Specifications and any supplemental changes issued relating to Airport Pavement Design and Evaluation.

E. Regulatory Requirements: Comply with local governing regulation if more stringent than items specified or drawn.

4-3.10.2 MATERIALS

A. Concrete:

A.1. Comply with Section 32 13 13 for concrete materials, admixtures, curing compound, concrete mix design, sampling, testing, forms, reinforcing steel and steel expansion materials.

A.2. The use of fly ash will be as required by MAG or ADOT requirements or specifications.

B. Expansion Joint Filler:

B.1. Exposed Locations: Joints in concrete pavement to be Delastic preformed joint sealer, or approved equal. **All PCCP joints shall be sealed using preformed compression seals and AC joints shall be filled with Hot Applied, Type 3 Poly Flex Sealant**

4-3.10.3 MIXES

A. In addition to requirements specified in Section 32 13 13, furnish mix design to produce normal weight concrete consisting of Portland cement, aggregate, air-entraining admixture and water to produce following properties:

B. Compressive strength 4,000 psi minimum at 28 days for sidewalks, curbs, and gutters.

C. Provide maximum 2" slump with plasticizer use.

D. Concrete exposed to the weather shall be air entrained.

E. Submit proposed concrete mix designs for each class or use. Contact City of Phoenix Materials Lab at (602) 495-2050 to obtain information relating to approved mix designs

F. ASR remediation is required for all PCCP mixes.

4-3.10.4 INSTALLATION

A. Concrete Placement:

A.1. Specify finished grade of concrete shall not vary from specified grade by more than 1/8" in ten-feet.

A.2. Cracks in exterior finished concrete exposed to view are not acceptable.

A.3. Specifications for vertical finishes remove fins, patch tie holes, and make joint marks flush with surface.

A.4. If concrete does not meet specified 28-day strength (psi), the Contractor shall credit the project 50% of concrete cost if the Aviation Department allows concrete to remain.

B. Joints:

B.1. Specify expansion joints at 60'-0" maximum for pavement and at 30'-0" sidewalks, curbs and gutters unless noted otherwise.

B.2. Specify control joints at 20'-0" maximum for pavements and 6'-0" maximum for walkways, unless noted otherwise.

4-3.10.5 CONCRETE COLOR & FINISH

A. General: Concrete finished surfaces exposed to view to be uniform in color and appearance.

B. The Aviation Department prefers that site concrete be integrally colored and the color is compatible with the surrounding architecture.

C. Light Broom Finish:

D. Heavy Broom Finish:

4-3.11 Sidewalks

4-3.11.1 QUALITY ASSURANCE

A. Standards:

A.1. Conform to applicable MAG standards or C.O.P. supplement.

A.2. Provide Aviation Department standard ADA compliant designs.

B. Restrictions:

B.1. Unit Pavers of all types are not allowed without prior approval from the PM.

B.2. Asphalt sidewalks are not allowed without prior approval from the PM.

B.3. Colored Concrete is not allowed without prior approval from the PM.

C. Requirements:

C.1. Sidewalks adjacent to a terminal or drop-off area shall be properly sized to accommodate typical appurtenances and structures located in these areas, including but not limited to protection bollards, stanchions, bus queuing facilities, signage, curbside check, smoking areas and sloped curb cuts.

C.2. Sidewalks shall provide a minimum 48-inch accessible bypass around obstructions, including curb ramps.

C.3. If saw cut joints must use bevel edge, no visible spalling is allowed and must be removed.

4-3.12 Curb and Gutter

4-3.12.1 QUALITY ASSURANCE

A. Standards:

A.1. Designs must conform to applicable MAG standards or COP supplement to MAG. Other approved curb and gutter type alternatives can be considered.

A.2. Provide Aviation Department standard ADA compliant designs at curb cuts for accessible drop-off areas/crosswalks.

B. Preferences:

B.1. Designs use 6-inch maximum curb heights adjacent to sidewalks and drop-off areas.

B.2. Designs use 8-inch maximum curb heights beyond immediate terminal areas.

4-3.13 Chain Link Fences and Gates

4-3.13.1 DESIGN REQUIREMENTS:

A. Security fencing is any fence used to separate public areas from restricted areas.

B. Design Fence Height: 8 feet minimum. For additional height requirements, verify with Aviation Department Security. Fence shall be 8' plus 1'3 strand barb wire with bottom rail and 3" rip rap at base.

C. Gates require Fire Department Lock Box and Fire Department Permit. Gate Operators require either battery backup or manual release depending on location and required codes.

D. The wheels for the gate shall have wearing cycle that meet shift changes and use requirements that exceed estimated use by at least twice the load count for a 5-year period.

E. Emergency car sensor loops shall be installed for automatic gates unless approved by the City Engineer.

F. Parks and Recreation Department has special types of standard gates for their properties. Some park gates are manual but still require lock box.

G. Card readers, intercom station may be required when designing the fence and gate systems.

H. The size and weight of the gates should be considered when sizing of the operator and provide a large safety factor as to not under size the operator for the gates.

I. Specify extended warranty for large gates that are heavy duty use.

J. For all Fire and Police sites, the commercial heavy use wheels and operator are required.

K. Concrete aprons are required for the approaches for gates.

L. At Airport perimeter and security locations provide fencing and components complying with FAA Advisory Circular AC150-5370-10FB, Item F-162; Standards for specifying fence construction at airports.

4-3.14 Traffic Signals

4-3.14.1 DESIGN REQUIREMENTS:

A. All traffic signal design elements shall be designed in accordance with accepted engineering standards, however, as a minimum, they shall be in conformance to the applicable reference publications in SECTION I: POLICIES, Chapter 6: Codes, Regulations & Standards.

B. The placement of the pedestrian signals' push buttons, to activate the pedestrian phase, must be adjacent to the sidewalk to ensure ADA compliance. It may be necessary to extend the existing or proposed sidewalk to the location of the pole-mounted push buttons to provide access.

4-4 Landscaping

4-4.1 Codes and Standards

4-4.1.1 The following design standards and guidelines should be followed:

- A. American Standard for Nursery Stock (ASNS)
- B. Arizona Nursery Association Recommended Average Tree Size Specifications
- C. Standard Plant Names, American Joint Committee on Horticultural Nomenclature

4-4.2 Security Considerations

4-4.2.1 Ground cover plants

A. Location

- Ground cover plants, including perennial and annual wildflowers, should be used within six (6) feet of the edge of walkways and areas requiring visual surveillance; and within twelve (12) feet of the edge of walkways and areas where children are regular users. The use of trees, pruned up to six (6) feet above ground, may also be used in such areas to provide shade for pedestrians.

B. Height

- The height of groundcover plants should not exceed two (2) feet at maturity. Desert plants with thin stalks over two (2) feet high that still allow for visual surveillance may be used in these areas.

4-4.2.2 Shrubs

A. Location

- In combination with groundcovers and trees pruned up to six (6) feet above ground, shrubs should be used between six (6) and twelve (12) feet from the edge of walkways requiring visual surveillance.

B. Height

- The height of shrubs should not exceed three (3) foot at maturity. Shrubs that exceed a height of three (3) feet due to natural growth, such as oleanders, typically will not be approved. Desert plants with thin stalks over three (3) feet high that allow for visual surveillance may be used in these areas.

4-4.2.3 BARRIER PLANTS [cactus]

A. Location

- Barrier plants have thorns or needles and a dense structure. Barrier plants should be used below and to the sides of windows and adjacent perimeter walls, fences, and other building walls where desirable. Even where walls or windows occur closer than the six or twelve foot zones described in sections 2 and 3 above, barrier plants may still be approved.

B. Height

- Since the purpose of barrier plants is to discourage pedestrian through-traffic, some types of barrier plants may exceed three (3) feet and still are approved.

4-4.2.4 TREES

A. Location

Specify trees of an appropriate number, size and species throughout landscaped area. To provide shade for pedestrians, trees should be located adjacent to walks leading from road frontages and major parking areas to major building entrances and site areas.

B. Height

Specify that trees are to be pruned up to six (6) feet above ground. Conflicts with light standards should be avoided in order to maintain illumination levels.

4-4.2.5 LANDSCAPING ROCK

4-4.3 Plant Material

4-4.3.1 Designers plant selection should include plants that require moderate to low water use and will complement a “xeriscape” design theme. Mature, healthy existing plant material should be preserved or salvaged where practical.

4-4.3.2 All existing trees on a site should be indicated on the construction drawings and appropriate protection in place during construction should be specified.

4-4.4 Decomposed Granite

4-4.4.1 Decomposed granite shall be per subsection 702.4 of the MAG Uniform Standard Specifications for Public Works Construction and shall not contain lumps or balls of clay, cliché, organic matter or calcareous coating and shall be consistent in color.

4-4.5 Planting

4-4.5.1 STANDARDS

A. Specify all plants from the Aviation Department’s latest Preferred Plant Management List and approved by the Aviation Parks Supervisor.

B. Plant names, common and botanical: Comply with AJCHN, Standardized Plant Names or NLA, Technical Glossary of Horticultural and Landscape Terminology.

C. Specified plant materials shall comply with intent of USDT FAA Advisory Circular 150/5200-33A to not be a wildlife attractant.

D. Designer to verify current plant selection list included with this specification guideline by contacting USDA-Wildlife Service’s State Director or a participating Wildlife Biologist at (602) 870-2081.

E. Plant stock shall conform to the code of standards set forth in the current editions of American Standards for Nursery Stock recommended for general use in the Arizona Climate by the American Association of Nurserymen, Inc.

4-4.5.2 SYSTEM DESCRIPTION

A. Design Requirements

A.1. The City of Phoenix, , and the Aviation Department at PHX have developed a landscape plan. It is the intention to follow the concepts of these plans in the use of Southwest Desert plant material to develop a moderate to low water use for a “xeriscape” design theme

A.2. The Design Consultant should carefully consider a “xeriscape” approach where and when appropriate. The Design Consultant should include a landscape architect intimately familiar with Sonoran Desert planting materials and who is registered in the State of Arizona.

A.3. Design concepts should include the use of desert plants that provide shade, variations in color, size, texture, and year-round blossoms. The intent is to display to Phoenix visitors and residents alike, a focus for display of the beauty, and majesty of the desert environment.

A.4. The site/landscape developments for the common areas and within the confines of each project boundary should be consistent in the established design approach and design themes. Primarily, the landscaping should provide a simple, direct statement for a clean, uncluttered Southwest Desert, with controlled slopes, land contouring, and natural ~~orderly~~ plantings.

A.5. Primary emphasis should be placed on designing with low water usage and low maintenance plant materials.

A.6. Considerations should also be made for concerns involving environmental issues with trees and shrub types that will limit the attraction of wildlife specifically birds.

A.7. Use of turf is not encouraged, and should be used only where required or specifically requested by the user.

A.8. Treat vehicular and pedestrian paving, including visitor parking lot areas as landscape elements. Coordinate with electrical engineer for pedestrian scale lighting when appropriate.

B. Landscape Zoning:

B.1. Landscape zones provide a buffer from roadways for pedestrian circulation. There shall be defined transition from roadway to building by means of a landscape zone.

B.2. It is preferred that landscape zones are not integrated with loading and unloading areas.

B.3. Landscape zones should provide access for maintenance vehicles.

B.4. All trees shall be planted according to specifications recommended by the American Nurseryman’s Association.

B.5. Specify plant names by use of botanical names followed by common names. Specifications defining height, spread, and caliper must be provided for all plants used. Mounds can be used as landscape features when space allows, providing there are proper details for planting, irrigation, and appropriate detention nearby. Mounded turf or ground cover areas must be constructed to accommodate on-site runoff retention. Holding of irrigation water applied to the mounds must be illustrated with typical details.

B.6. Trees planted in median strips shall be of a type that permits pruning of mature materials to give a full 10’ clearance at curb side.

C. Plant Materials

C.1. Specified plants must be from the Aviation Department’s Preferred Plant Management List approved by the Aviation Parks Supervisor. It is suggested that plant material specified by the Aviation Department be used as the unifying species, however, other species may be used, provided that they conform to:

- The design theme establishe.
- Are approved by the Aviation Parks Supervisor

- Conform to USDA recommended plant materials identified in this document.

C.2. The Aviation Department prefers thorn-less type trees where there is a wide use of public contact such as parking facilities, walkways, or pedestrian / public right of ways. Cacti or

other native plants which could cause injury to pedestrians should be limited on all public right of ways.

D. Specified plant material sizes shall be as follows:

D.1. Trees are to be 24-inch box size. Minimum caliper size for new trees shall be 3 inch. when available Larger trees may be used, particularly on east and west sides for solar screening and with other special design conditions based on approval by the. Aviation Parks Supervisor Caution shall be used when planting trees under or near power lines or any other overhead structures; size of ultimate growth shall be carefully considered. Trees shall be planted a minimum of four feet from the edge of any buried utility.

D.2. Specified shrubs and other plants are to be at least 5-gallon. However, this may vary as to species, availability, or the standards as to the size the nurseries grow a given plant. Spacing of shrubs must be identified on the plans. Plants must be placed in a manner to prevent overgrowth on roads and walkways. Plants must conform to Arizona Nursery Association standards

D.3. Specified ground covers may be any size established for a species in the nursery industry for sale based on reliable survivability. Turf is may be an acceptable ground cover when included as part of the scope of work . and is approval by the Aviation Parks Supervisor.

D.4.

E. Ground Cover Materials:

E.1. Decorative Rock - decomposed granite, and other fractured rock , or approved equals may be used as ground covers as long as they are applied in the appropriate manner. They must be placed to prevent spilling over sidewalks and they must be applied in a manner to prevent noxious weeds from detracting from the appearance. New market screen control products and /or chemical control must be used. Primary access for the facility shall be an approved surface.

E.2. “Madison Gold” or similar crushed rock is preferred for its better color retention and its likeness to native soil.

- Use ½” to ¾” on flat areas
- Use ¾” on moderate to steep slopes.

F. Erosion Control:

F.1. Turf areas should be graded to prevent runoff on sidewalks or streets and parking areas. Finishing grade of lawn turf areas must be a minimum of 1 ½ inches below top of sidewalk or curbs and grading must slope away from sidewalk or roadways.

F.2. Primary consideration in selecting and designing a surface drainage system involve preventing on-site erosion where the flow of water is concentrated.

F.3. Vegetation may help slow runoff, but proper stabilization will require that some areas be lined with a hard material such as concrete rip rap or crushed rock.

G. Screening:

G.1. All service yards shall be screened from street view. Consider using earth berms and plant material in lieu of masonry walls when screening parking lots, loading and storage areas or similar functions from view.

4-4.6 Planting Irrigation

4-4.6.1 SYSTEM DESCRIPTION

A. Automatic irrigation system is to be installed using City of Phoenix Standards, including electric power to the controller, water service tap, meter, backflow device or any appurtenances required for a complete system. Plans showing all aspects of the system shall be drawn, including power source.

B. Evaluate cost effectiveness of 2-inch or less water meter size.

B.1. The Design Consultant or their design consultants should recognize and design irrigation systems based upon the Premises of “xeriscape” landscaping design.

4-4.6.2 CONCEPTUAL LAYOUT

A. The Design Consultant shall provide a conceptual irrigation system layout as part of the Design Development landscaping plan for budgetary inclusion and general coordination and approval by the Aviation Parks Supervisor. Illustrate source of power. Water meter sizing shall be 2 inch or less and not serve any buildings. The Design Consultant must check with the Aviation Parks Supervisor for plans review at 30%, 60% and 90% completion of final project. For design, a design ‘needs document’ is available from Aviation Parks Supervisor.

4-4.6.3 DESIGN REQUIREMENTS

A. Irrigation system shall take into account site peculiarities and accommodate for expansion and contraction movements so there is no possibility of loosening, weakening or fracturing connection between units and piping. For ease of maintenance and inventory, the City has standardized irrigation components, and the components shall remain consistent with products currently in use.

A.1. Main lines shall be a minimum of 18 inches deep, auxiliary lines shall be 2 inches deeper than the bottom of the head being used.

A.2. Lines bordering curbs, sidewalks or other hard surfaces shall be held 12 inches away to allow for maintenance and access to the lines.

A.3. Sand or rock free dirt shall be used in all trenches as bedding materials for all PVC piping and also used as a covering for all piping. There shall be a minimum depth of 2 inches over the top of all piping.

A.4. Pipe, drip tubing and control wire being routed under walks, roads or other hard surfaces shall be installed in schedule 40 sleeves (2 1/2 times the diameter of pipe). Sleeves may be required based on plans review.

A-4.7 Weed Control

A. A pre-emergent herbicide that controls both broad leaf and narrow leaf weeds will be applied, according to manufacturer’s specifications, after planting and decomposed granite application.

A-4.8 Landscape Warranty

A-4.7.1 LANDSCAPE MAINTENANCE

A. Construction contractor shall maintain all aspects of the landscape project for 6 months after project acceptance including irrigation programming and maintenance, plant care and replacement, and weed control.

A-4.7.2 IRRIGATION SYSTEMS

A. All malfunctioning or defective irrigation parts will be repaired or replaced by the contractor for 1 year after project acceptance.

A-4.7.3 PLANT MATERIAL

A. All non-viable plant material, other than trees, shall be replaced by the contractor, after inspection by the AviationParks Supervisor or their representative, 6 months after project

acceptance. All non-viable trees shall be replaced by the contractor, after inspection by the Aviation Parks Supervisor or their representative, one year after project acceptance.

4-5 Bridges

4-5.1.1 DESIGN CRITERIA REFERENCES

- A.** All bridge design elements shall be designed in accordance with accepted engineering standards, however, as a minimum, they shall be in conformance to the applicable reference publications in SECTION I: POLICIES, Chapter 6: Codes, Regulations & Standards.
- B.** Design and construction will be consistent with the Aviation Department's environmental documents that have been approved by the FAA.
- C.** All vehicular bridges shall be designed in accordance with the current AASHTO LRFD Bridge Design Specifications and the Arizona Department of Transportation Specifications and design manuals.
- D.** All aircraft bridges shall be designed in accordance with the appropriate FAA circulars utilizing Class 5 loading.
- E.** Fracture critical elements are discouraged. The Design Consultant shall obtain approval from the Aviation Department before proceeding with the design of any fracture critical element. As a minimum, a cost/benefit and life-cycle cost analysis that demonstrates the desired benefits of using fracture critical elements shall be performed.
- F.** Treatment of exposed concrete surfaces shall be reviewed by the Aviation Department.
- G.** The minimum vertical clearance to roadways above or below shall be 16'-0". If a lower vertical clearance is desired it must be approved by the Aviation Department.
- H.** "Pedestrian friendly" expansion joints shall be utilized for all bridge structures.
- I.** All bridges shall be detailed to accommodate future deck replacement. Schematic details shall be submitted to the Aviation Department.
- J.** Substructure units shall be designed for the unbalanced loads resulting from future deck replacement.
- K.** The Design Consultant shall obtain approval from the Aviation Department before proceeding with the design of any box girder element. The Design Consultant will be required to submit appropriate justification to the Aviation Department and supply details for secured access to the inside for inspection and fire protection.
- L.** The bridge superstructure cross-section shall be approved by AVIATION DEPARTMENT before proceeding with final design. The cross-section shall be appropriately dimensioned and identify all superstructure materials.
- M.** The use of unpainted weathering steel shall be approved by the Aviation Department. As a minimum, details shall be submitted that demonstrate staining of the concrete elements of the bridge and structures below will be prohibited.
- N.** High Performance Steel: A cost-benefit analysis shall be submitted for approval prior to proceeding with final design.

4-5.1.2 CONSTRUCTION PHASING AND MAINTENANCE OF TRAFFIC PLANS

- A.** Designer to complete construction phasing plans and traffic control plans shall be generated to ensure, to the extent possible, that the existing level of service be maintained during the

construction. Details for signage, barricades, detour configurations, etc, shall be in accordance with local and state design criteria.

4-6 Electrical Systems

4-6.1 Electric Utility Routing

4-6.1.1 Electric utility routing shall be determined by Arizona Public Service (APS). Coordination between the design team and APS shall occur during the pre-design phases to determine the routing of electric utility primary cables.

4-6.1.2 The Design Consultant shall be responsible for visiting and walking the site.

4-6.2 Utility Transformer, Sectionalizing Switch, C/T Cabinet, and Meter Installation Locations

4-6.2.1 Refer to APS construction most recent guidelines for engineers and Contractors to determine the exact placement and working clearance requirements for transformers sectionalizing switch(es), C/T cabinets and meters.

4-6.2.2 Coordinate the distance between and location of underground pull boxes. Place pull boxes at convenient and readily accessible locations.

4-6.3 Utility Transformer and Sectionalizing Switch Pad Sizing and Requirements

4-6.3.1 Refer to APS construction guidelines for engineers and Contractors for the exact size and dimensions of transformer and sectionalizing switch pads.

4-6.4 Site Lighting

4-6.4.1 New lighting for public roadways and thoroughfares shall be designed to the requirements of the City of Phoenix and Arizona Public Service. Lighting in these installations shall be powered from APS owned distribution lines.

4-6.4.2 Designs for new public roadway and thoroughfare lighting must include the following:

A. Photometric plan showing the luminance at finished grade on a 10-foot x 10-foot grid, the maximum to minimum luminance ratio, the average to minimum luminance ratio, and the average to maximum luminance ratio for each plan sheet.

B. The locations of transformers.

C. Design light pole base, light pole, arm, mounting style, and luminaire specifications for each light. If light fixtures do not meet the COP or APS standards, prior approval for use of that fixture must be obtained in writing prior to issuing the design. Fixtures must be dark sky compliant.

D. The roadway light poles shall not be taller than 40-feet in height, including the concrete base, so that the fixture can be reached with traditional Aviation Department O&M service means.

E. The roadway light poles shall be “banner-rated poles” for the display of City of Phoenix or Aviation Department themed decorations.

F. Low-voltage cable routing design, including voltage drop calculations, wire size, conduit size, and fault current calculations (expressed in symmetrical amps).

G. Control methods for new roadway and thoroughfare lighting.

H. The Design Consultant shall provide equally spaced under bridge lighting layouts that will produce uniform illumination levels. All under bridge or under pass lighting shall be rough service type fixtures. The exact fixture selections shall be coordinated with APS and the Aviation Department PM.

4-6.4.3 Designs for site lighting must include the following:

A. Photometric plan showing the luminance at finished grade on a 10' x 10' grid, the maximum to minimum luminance ratio, the average to minimum luminance ratio, and the average to maximum luminance ratio for each plan sheet.

B. Power distribution design, including voltage drop calculations, wire size, conduit size, and fault current calculations (expressed in symmetrical amps).

C. Light pole base, light pole, arm, mounting style, and luminaire specifications for each light. Provide light pole EPA data to the team's structural engineer. All luminaires shall be dark sky compliant.

D. Specify site lighting around buildings or structures, showing emergency egress light fixtures to provide the required luminance outside of the building for safe occupant discharge outside of buildings.

E. For projects that tie multiple Aviation Department site areas together, the Design Consultant shall address the lighting differences between roadway and parking area lighting applications and those applications that involve the Terminal Frontage Lighting and Passenger Unloading and Loading Lighting applications. No one-size-fits-all approach shall be used. In these specialty projects, in addition to standard photometrics plans, the Design Consultant shall submit a vertical illumination software rendering for the City of Phoenix, Aviation Department team, and APS for review. These graphical renderings shall incorporate the color of lamp sources and the placement of the light fixtures within the architectural setting of the environment outside of the Terminal Area.

F. Low-voltage cable and conduit routing plans.

4-6.5 Power Distribution

4-6.5.1 Branch circuit and power distribution to irrigation controllers, outbuildings, and other miscellaneous loads shall meet the requirements stated in the latest edition of the NEC and the City of Phoenix Building Code.

4-6.5.2 Factor in the impact of voltage drop when performing designs.

4-7 Special Systems

4-8 Signage Section

The Design Consultant, working in coordination with the PM, must coordinate signage required in the final design with the requirements of the Aviation Department's Signage Coordinator and the Airport's Signage Program (excluding airfield signs). This program includes internally produced signs, professional produced signs and temporary construction signs.

Chapter 5: Airfield Civil

5-1 Site & Civil

5-1.1 General Requirements

5-1.1.1 This section covers all applicable facilities within the Airport Operations Area (AOA) that shall be planned, designed and constructed in accordance with current Federal Aviation Administration (FAA) standards and criteria. These consist of Federal Aviation Regulations (FAR's) and Advisory Circulars (AC's), current editions. Copies may be obtained from the FAA Southwest Regional Office and U.S. Department of Transportation.

5-1.1.2 In some cases, the AC's offer the Design Consultant a range of criteria, in which case this Design Criteria Manual will establish minimum standards to be used at the airport. If there are design criteria decisions to be made which are not covered in the respective AC or this Manual, the project Design Consultant will make recommendations to the Airport Contact on a case-by-case basis.

5-1.1.3 All environmental regulations and permitting requirements must be followed for projects within the Airport Operations Area (AOA). Refer to Section II: Chapter 2 – Environmental Standards and Permitting (P&E).

5-1.2 Critical Design Aircraft

5-1.2.1 The Critical Design Aircraft (CDA) shall be identified for each project; however, the standard is Airplane Design Group V (ADG) per AC 150/5300-13. Changes from this standard may be made pertaining to any of the following elements:

- Runway Length - The CDA will be furnished by the PM.
- Width, Clearances and Separations of Runways, Taxiways and Parking Aprons - The CDA, or its associated Airplane Design Group per AC 150/5300-13, will be recommended by the Design Consultant based on traffic forecasts furnished by the PM or Tenant Airline.
- Pavement Design - The CDA will be furnished by the PM.

5-1.2.2 Review by the P&E, FACILITIES AND SERVICES FACILITIES AND SERVICES and Operations Divisions of all AOA ADG ADD (Design and Construction Services) standards shall be accomplished prior to final design.

5-1.3 Survey Control

5-1.3.1 Design, construction, or project survey work shall use monuments, benchmarks, or control points that are included in or established by the Authority Survey Control System to be provided by the PM.

5-1.3.2 The survey control for Phoenix Sky Harbor International Airport is based horizontally on the Arizona State Plane Coordinate System which is tied to the North American Datum of 1983 (NAD 83), and vertically on the North American Vertical Datum 1988 (NAVD 88). Data supplied in the manual meets or exceeds 1st order horizontal survey control accuracies and is

equal to or less than 3rd order vertical accuracies as indicated on the individual monument recovery sheet.

5-1.3.3 All monuments are described on monument recovery sheets. Each monument recovery sheet contains "How to reach" descriptions for each control point, coordinates, elevations and pictures of each monument as well as reference sketches. The scale factor given on the recovery sheet is the measure of the linear distortion that has been mathematically imposed on ellipsoid distances so they may be projected onto a plane.

5-1.3.4 Elevations of monuments are based on the North American Vertical Datum of 1988 (NAVD88). Elevations are derived from GPS observations of NGS benchmark stations MARTAIR AZ (a third order vertical monument), CLOVER (a second order vertical monument), GIS58 (a third order vertical monument), and GIS70 (a third order vertical monument). Elevations are in U.S. Survey Feet.

5-1.3.5 The Design Consultant shall use the Phoenix Sky Harbor Airport Survey Control for all design and construction projects. All contract drawing sets must contain the Phoenix Sky Harbor International Airport "Survey Control" Plan Sheet and a 2nd geometric layout sheet containing the specific geometric layout and coordinate data for the project. This drawing shall also include any and all points set by the Contractor for the specific project stating traverse closures and which Phoenix Sky Harbor International Airport control points were used.

5-1.3.6 The consultant is responsible for quality control checking of all new and existing monuments prior to using the monuments in accordance with standard survey practices. The Design Consultant shall promptly notify the PM of damaged and destroyed monuments immediately.

5-1.4 Site Preparation

5-1.4.1 For major structure and facility excavation, no construction will be permitted without adequate knowledge of subsurface conditions as determined by soil investigations, field sampling, laboratory testing, and a written report provided by a qualified geotechnical consultant familiar with the execution of such work.

5-1.5 Geotechnical Investigation

5-1.5.1 The Design Consultant shall develop a program to perform subsurface exploration and laboratory testing in the area of any proposed construction. The Design Consultant shall explain the approach as part of the cost proposal required for the project. The explanation shall include technical issues to be resolved, field and laboratory methods to be used, estimated number and depths of borings, and other field's methods, estimated laboratory testing, and reporting methods.

5-1.5.2 Before performing any field work, the Design Consultant shall prepare a detailed work plan. The plan shall include the results of previous investigations relevant to the project. The work plan shall include proposed boring locations, details of investigation methods, coordination issues, and reporting schedule. The work plan shall be submitted to the PM for review and approval before any fieldwork is performed. All subsurface studies will require an Airport Subsurface Investigation, Excavation, Saw Cutting, Pot Holing, Drilling Construction Activity Notification Permit. The Design Consultant shall prepare and coordinate submittal of this permit with the PM.

5-1.6 Project Reporting Shall Utilize 1 of 2 Methods:

5-1.6.1 Separate Geotechnical Data Report and Geotechnical Baseline Report or Geotechnical Recommendations Report

5-1.6.2 Combined Geotechnical Data and Recommendations Report

5-1.6.3 Report Formatting

A. The selection of method used shall be coordinated with the PM including all other issues relating to report formatting. A draft report or reports, for review and comment, shall be submitted for approval by the PM. The final report shall include resolution of all comments provided by the PM. Investigation methods shall be tailored to the needs of the specific project. Borings are anticipated for each project. Seismic refraction surveys are required for all projects requiring open-cut excavation. Ground water conditions shall be investigated for each project, including significant excavations greater than 15 feet. The requirement for monitoring wells and duration of monitoring period shall be determined on a project by project basis.

B. The coordinates (northing, easting, elevation) of each boring or survey line shall be reported, using current airport standards. Boring logs shall include soil descriptions, blow counts, and all other relevant information. Refusal and its relation to top of rock shall be carefully explained and correlated to seismic refraction survey where available. Technical issues that may require resolution include, but are not limited to:

- B.1.** Nature and extent of unsuitable soils and recommendations for remedial methods
- B.2.** Recommendations for other soil improvement methods, including excavations and replacement, geo-fabrics, and soil stabilization
- B.3.** Pavement recommendations, including California Bearing Ratio (CBR) values, for flexible pavements (if applicable) and the subgrade modulus (K value) for rigid pavements
- B.4.** Foundation recommendations, including allowable bearing pressures, anticipated settlement, and issues relating to eccentric loading and uplift loading
- B.5.** Recommended excavation methods based on seismic refraction results.
- B.6.** Ground water control recommendations.
- B.7.** Detailed recommendations for any other special construction

5-1.7 Construction Means and Methods

5-1.7.1 The Design Consultant shall be sensitive to construction means and methods when developing the design and construction documents. For example, in the area of the terminal, the Design Consultant should evaluate whether pile driving would cause damage to the exterior glazing. Also for example, in areas with existing utilities and sensitive FAA equipment, the Design Consultant should evaluate whether certain demolition equipment would cause equipment failure and recommend any restrictions on construction means and methods.

5-1.8 Site Demolition

5-1.8.1 Site demolition includes clearing, grubbing, grading, drainage, paving, and special site development structures. All site work shall be designed and conducted to improve the overall aesthetics of the Airport and to promote future development. The site shall be prepared preserving the natural character of the terrain by minimum disturbance of existing ground forms, with the objective to develop an attractive, suitable and economical project site. Surface and subsurface

flow from storm water shall be diverted away from buildings and pavements to prevent undue saturation of the subgrade that could damage structures and weaken pavements.

A. Pavement and Structure Demolition

Design Consultants shall be sensitive to the construction means and methods of pavement or structure demolition.

B. Excavation and Embankment

Side slopes on excavation (cut) and embankment (fill) areas outside of runway and taxiway safety areas shall have a slope no steeper than that permitted by OSHA Standards.

5-1.9 Erosion and Sediment Control

- TBD

5-1.10 Geometrics

5-1.10.1 All airfield geometry shall conform to the current Airport Layout Plan (ALP). Detailed geometry not included or referenced on the ALP shall conform to the requirements in AC 150/5300-13 and other relevant AC's. All filets for "Cockpit-over Centerline Steering" will be designed in accordance with AC 150/5300-13.

5-1.11 Line of Sight

5-1.11.1 All runways and runway safety areas shall conform to the line-of-sight criteria of AC 150/5300-13. Taxiways under the control of the Air Traffic Control (ATC) Tower shall be in full view of the tower cab the full length and width. An ATC Tower Line-of-Sight (Shadow) Study shall be prepared to determine the line-of-sight acceptability. Ramp control towers may require line-of-sight studies for aircraft parking areas and taxi lane intersections.

5-1.11.2 ADDITIONAL CONSIDERATIONS:

Line-of-sight considerations may also be required when facilities are planned and designed near, or in the vicinity of, FAA NAVAIDS. Prior to commencement of airfield construction, a "PHX Airport Board Airspace Review Application" shall be completed with appropriate information and exhibits required by the FAA on which FAA can conduct an Aeronautical Study of the proposal – (reference AC 70/7460-2 and FAR Part 77). Non-AOA projects will require an Airspace Form for staging areas, batch plants, construction cranes and other related items. Construction activities (temporary stationary objects) shall be reviewed through the Airports Local Airspace Review Program administered by the Board.

5-1.12 Gradients and Slopes

5-1.12.1 All paved areas on the airfield AOA shall conform to the requirements of AC 150/5300-13, and as supplemented by the following criteria:

- A.** Side slopes on excavation (cut) and embankment (fill) areas outside of runway and taxiway safety areas shall have a slope no steeper than that permitted by OSHA Standards.
- B.** All topography and above ground objects, except those required by function for navigation, shall be clear of the imaginary surfaces of FAR Part 77 and shaped or designed to avoid line-of-sight problems and interferences with Airport navigational instruments and facilities. Objects that are within safety areas shall comply with FAR Part 139.

C. The standard crowns (transverse slope) on runways and taxiways shall be one percent, except where flatter grades are necessary due to intersection transitions, in which case they shall be a minimum of 0.5 percent.

D. All paved runway shoulders and taxiway shall be paved with a minimum of one percent to a maximum of five (5) percent surface gradient. The desirable slope is two (2) percent. The maximum slope shall not be used without approval of the Airport Contact. The edge of pavement to edge of shoulder conform joint shall be at the same elevation (no pavement lip).

E. Pavement gradients on aircraft parking aprons shall be 0.5 percent min., except where conforming or transitioning to existing facilities, and except for fifty (50) feet from Terminal buildings at the gate and parking positions which shall be one (1) percent to conform to NFPA Standard 415 on "Aircraft Fueling Ramp Drainage."

F. Gradients, slopes, and object clearing criteria for "Obstacle Free Zones," "Runway and Taxiway Safety Areas," and "Runway Protection Zones" shall conform to the standards of AC 150/5300-13 for the respective critical aircraft or mix of aircraft.

5-1.13 Storm Drainage

5-1.13.1 Storm drainage design of the Airport in those areas referred to as the AOA shall be governed by AC 150/5320-5. Additional PHX storm drainage design criteria and requirements are located in SECTION II: Environmental Standards and Permitting. The Design Consultant should also review the Drainage Master Plan for the Aviation Department.

5-1.14 Hydrology

5-1.14.1 For drainage areas less than two hundred (200) acres the Rational Method is acceptable for determining the amounts of rainfall and runoff in the AOA to be used as a basis for drainage system designs. The Rainfall Intensity Curves presented in the Weather Bureau Technical Paper No. 40 shall be used. The storm interval as presented in AC 150/5320-5 shall be used.

5-1.15 Computation, Collection, and Disposition of Runoff

5-1.15.1 For projects inside the AOA, the rational method shall be used in the determination of runoff for a drainage area of two hundred (200) acres or less. The Design Consultant shall contact the Airport Contact for the method to be used in determining runoff from drainage areas larger than two hundred (200) acres. The coefficients that are utilized in the rational formula, as well as charts for surface flow time calculations, are presented in AC 150/5320-5. A topographical map shall be prepared of existing conditions, preferable with a two (2) foot contour intervals as well as a detailed plan showing proposed and ultimate layout of the runways, taxiways, aprons, and building areas with the finished contours drawn to a one (1) foot interval or less. With the addition of various basins, storm pipelines and drainage sketched upon the detailed plane, it will become a working drawing for drainage considerations at the site. Open channel calculations will be in accordance with the FAA Manual's procedures utilizing various nomographic solutions presented in AC 150/5320-5. The conveyance analysis and design of culverts in the AOA shall be in accordance with the Arizona Department of Transportation Hydraulic Manual.

A. DRAINAGE OF UNPAVED AREAS ADJACENT TO BUILDINGS

Unpaved areas adjacent to buildings shall be sloped to direct surface water and roof drainage away from buildings at a minimum slope of five (5%) percent in the first ten (10) feet of horizontal distance. Unpaved areas shall be permanently stabilized by methods acceptable to the

Aviation Department to prevent erosion and soil loss. Surfaces paved with concrete or bituminous pavement shall have a slope of not less than 0.5 percent in the direction of drainage, to prevent ponding.

B. DRAINAGE OF UNPAVED AREAS NOT OCCUPIED BY BUILDINGS

Portions of the site not occupied by buildings or pavement shall have adequate continuous slopes to drain toward watercourses, drainage swales, roadways, and storm drainage inlets. Drainage swales or channels shall be sized and sloped to accommodate the design runoff. Sheet flow across sidewalks is allowable. The concentrated runoff shall be carried under walkways in pipes or by suitable sidewalk drains. Swales shall be used to intercept water at the top and bottom of banks where large areas are drained. To provide positive drainage, a slope of not less than two (2%) percent is desirable. Slopes shall be designed to ensure non-erosive runoff velocities. The tops and bottoms of all slopes shall be gently rounded in a transition curve for optimum appearance and ease of maintenance.

C. STORM DRAIN INLETS

Various charts are available in the Drainage Manual that shall be used to determine the capacity and efficiency of the particular type of inlet chosen. When designing inlets, freedom from clogging or from interference with traffic shall take precedence over hydraulic considerations. Pre-cast units may be used for load bearing applications only with the approval of the Airport Contact.

D. PLACEMENT OF MANHOLES AND INLETS

Manholes or combination manholes and inlets shall be placed wherever necessary for clean-out and inspection purposes. Place manholes at changes in direction, junctions of pipe runs, and at intervals of three hundred (300) to five hundred (500) feet in long pipe runs where the size or direction is not changed. The invert of the manhole section shall be rounded to match the inverts of the pipes entering the manhole in order to reduce eddying and resultant head losses. For manholes that are larger than the incoming or outgoing pipes, expansion losses can sometimes be significant. The use of heavy duty manholes may be required in some cases depending on location and shall be coordinated with the Airport Contact. Avoid locating electrical manholes at the bottom of pavement slopes to avoid excessive water infiltration during rain storms.

E. FLOW IN STORM DRAINS AND THEIR APPURTENANCES

Storm drains shall be designed to have a minimum mean velocity of 2.5 feet per second flowing full; velocities greater than thirteen (13) feet per second shall be avoided.

F. DESIGN OF CLOSED STORM DRAINAGE SYSTEM

In the preparation of hydraulic designs, a thorough investigation shall be made of all existing structures and their performance on the waterway in question. The design frequency for all new closed drainage systems shall be 10 years with a combined 100-year emergency overflow as required herein. The total capacity of the drainage facility, including surface flow within limits of available right-of-way or easements, shall be equal to or greater than the runoff of a storm of 100-year design frequency. Shall the 100-year storm runoff exceed the capacity of the above design, then the closed storm system shall be designed based on a minimum 25-year frequency, or larger, to develop a 100-year emergency overflow system. The hydraulic gradient shall be calculated for all storm drain lines and culverts and shall not be designed above the entrance flowline of any inlet. The permissible difference between the hydraulic gradient and top-of-curb is normally two (2) feet.

G. DESIGN AND ANALYSIS OF OPEN CHANNELS

Backwater analysis is to be developed for major channels to establish water surface elevation and to avoid adverse impacts on adjacent properties. All new channels shall be designed using the one-hundred (100) Year Design Frequency HEC-2 Water Surface Profiles Method as presented in the U.S. Army Corps of Engineers, Water Resources Support Center or alternate methodology as approved by the Airport Contact. A 3'-0" freeboard will be incorporated into the design calculations.

H. DESIGN OF CULVERTS

Drainage culverts shall pass storm flow from the upstream side of highway, road or railroad to the downstream side without causing excessive backwater head and without creating excessive downstream velocities. The Design Consultant shall keep the discharge velocities within safe limits (usually 6 feet per second) while selecting the most economical structure that will provide satisfactory service.

5-1.16 Utility Markings

Underground Utility Trenches, Utility Markings, and Manhole/Handhole Covers/LIDS

5-1.16.1 Utility Markings: The design and construction of all Phoenix Sky Harbor International Airport projects shall include the minimum requirement to mark all underground utilities with magnetic tape. The tape should be 3" wide and positioned at a maximum 8"-12" deep below top of ground, or 4" wide and positioned at a maximum 3"-6" deep below the bottom of pavements.

5-1.16.2 All Airport manhole/handhole covers/lids shall include the name "PHOENIX SKY HARBOR INTERNATIONAL AIRPORT" and the type of utility: "ELECTRIC", "STORMWATER", "SANITARY SEWER", "WATER", "GAS", "and TELEPHONE." Lettering shall be Helvetica, medium, capitalized and 1 1/2 inches in height. Airside lids should be security fastened in place.

5-1.17 Water Mains

See SECTION III: Chapter 2 Mechanical and Chapter 4 Landside Civil for information.

5-1.18 Sanitary Sewers

See SECTION III: Chapter 2 Mechanical and Chapter 4 Landside Civil for information.

5-1.19 Electrical/Phone/Telecommunications

See SECTION III: Chapter 3 Electrical and Special Systems for information.

5-1.20 Miscellaneous Site Elements

5-1.20.1 ELECTRICAL STRUCTURE DRAINS

A. An Electrical Structure Drain (ESD) shall be provided for electrical manhole (MH) and handhole (HH) structures where other preferred alternate drainage measures may not be possible to facilitate drainage away from the Electrical and Communications (E/C) Infrastructure Systems.

B. Qualifying Preferred Alternate Drainage Measures are the following:

- Install 6" Polyvinylchloride (PVC) drainage pipe from E/C MH or HH directly into a drainage MH in close proximity provided inverts permit positive drainage.

- Install 6" PVC drainage pipe from E/C MH or HH directly into drainage pipe in close proximity provided inverts permit positive drainage.

C. ESD(s) shall be installed in locations where space is available and where other referenced drainage measures cannot be provided in open areas adjacent to airfield pavement. For proposed E/C ductbank installations the Design Consultant shall provide either adequate space for ESD installations at an E/C structure or design the ductbank plan and profile to allow for the E/C ductbank infrastructure to drain to a low point at a MH or HH where an ESD can be installed.

5-1.21 Bollards

5-1.21.1 All bollards shall be a minimum of six (6) inches in diameter steel pipe; concrete filled and set in concrete to a minimum depth of 3'-6".

5-1.22 Runway Exits

5-1.22.1 HIGH SPEED EXIT TAXIWAY

Locations shall be as shown on the Airport Layout Plan. The geometric layout shall either match existing high speed exit taxiways on the Airport or conform to AC 150/5300-13. Larger-than-standard fillet radii shall be investigated where traffic "back turns" are anticipated.

5-1.22.2 RIGHT ANGLE CONNECTOR TAXIWAY

Right angle intersections shall meet the requirements of cockpit-over-centerline steering and shall conform to the requirements of AC 150/5300-13.

5-1.22.3 RUNWAY AND HIGH SPEED EXIT TAXIWAY GROOVING

All runway and taxiway grooving shall conform to AC 150/5320-1 2C. Slurry from sawing must be vacuumed as part of the sawing operation and disposed of off the Airport property. Final cleanup shall include flushing by water. Where PCCP / AC saw cutting takes place, all slurry shall be immediately vacuumed and disposed of properly. This practice will limit slurry mud and dust contamination or surrounding areas reduced clean-up time for projects.

5-1.23 Aprons

Where holding aprons are included in the project scope, the overall location and geometric layout will be furnished by the Airport Contact. Widths, clearances, fillet radii and other details not furnished shall conform to AC 150/5300-13, or as recommended by the Design Consultant and approved by the PM.

5-1.23.1 AIRCRAFT PARKING

Aircraft parking aprons shall be based on an "Apron Utilization Plan." Apron utilization criteria, including wingtip clearance, shall be approved by the Airport Contact and must be within the maneuvering limits of the Aircraft Characteristics Manual of the Critical Design Aircraft. Aircraft service pits shall be located to minimize impact on Portland Cement Concrete (PCC) pavement joint performance.

5-1.24 Pavement Design

Pavement design for all aircraft worthy pavements shall be based on FAA methodology and meet all requirements in AC 150/5320-6. The Design Consultant should be aware of and take proper steps to avoid Alkali-Silica Reaction in the concrete mix design. Standard sections exist for the

various aircraft pavements encountered at the Airport. Deviation from these standard sections require the submittal of a pavement report prepared by a qualified geotechnical and materials engineering firm and a pavement section design sealed by a professional engineer registered in the State of Arizona and the approval of the PM, DCS, FACILITIES AND SERVICES FACILITIES AND SERVICES and Operations.

5-1.24.1 SUBGRADE

Subgrade treatment should be based on recommendations of soils engineer and existing conditions at the location of the work.

5-1.24.2 SUBBASE

Subbase treatment should be based on recommendations of soils engineer and existing conditions at the location of the work. While use of additives and cost of installation is always a concern, ultimate performance of the pavement design section must be evaluated.

5-1.24.3 BASE COURSE

Treatment of base course should be compatible with the final design section.

5-1.24.4 PAVEMENT TYPE

All airfield pavements shall be Bituminous Concrete or Portland Cement Concrete (PCC) pavement. The Aviation Department prefers PCC for all applications but Design Consultant may suggest alternatives for review by the Aviation Department when deemed beneficial. Portland Cement Concrete is required in all aircraft movement and parking areas

5-1.24.5 MATERIALS TESTING

All paving materials testing requirements shall conform with FAA A/C Standards whether FAA Grant funded or not.

5-1.25 Pavement Marking

5-1.25.1 Pavement marking of runways, taxiways, taxi lanes and other paved areas within aircraft operations areas, with the exception of black markings, shall be waterborne (Latex) paint containing glass beads and shall conform to AC 150/5340-1 H and PART 139 Standards and shall be treated with all compatible coupling agents recommended by the manufacturer. All markings shall have a black border on asphalt & concrete.

5-1.25.2 The Aviation Department requires prior approval of all new pavement marking applications. The Aviation Department maintains and requires use of standard templates for installation of most instructional pavement marking applications. Paint for new markings must be lead free and Contractor must submit a written certification from the paint manufacturer that the paint is completely lead free.

5-1.25.3 Paint shall be lead free waterborne (Latex) meeting the requirements of AC-150/5340-1 and be in accordance with Federal Specification TT-P-1952D, **Type III High-build, 100% acrylic waterborne airfield and traffic marking paint, free of lead, ethylene-based glycol ethers and their acetates, mercury, toluene, hydrolysable chlorine derivatives, hexavalent, chromium and carcinogens. Please see following for corresponding colors and matching number; White-37925, Red-31136, Yellow-33538, Black-37038, and Blue-35180.** Black paint should be used to outline a border at least six inches wide around markings on all light colored pavements **with the exception of aircraft envelopes.** Per the FAA Circular, black paint shall not contain glass beads.

Retro-Reflective Glass Beads shall be manufactured in the United States from virgin materials in a direct melt process with no visible residue, free of lead, other heavy metals, carcinogens and shall meet Federal Specification TT-B-1325D. Phoenix Sky Harbor International Airport (SHIA) uses Type IV, Gradation B Retro Reflective Glass Beads. All Safety Data Sheets (SDS) and Product Sheets shall be assessed/approved by SHIA Environmental Division before use. All layouts shall be assessed/approved by Facilities & Services (Airfield Maintenance) and Airside/Landside Operations Divisions prior to installation. Suppliers of Airport Marking paints and Retro-Reflective Glass Beads shall certify that their product meet previously mentioned Federal Specifications and supplied material shall be accompanied by certifying documents from the manufacturer. COP/SHIA staff reserve the right to delay work activities until the requirements are met. If supplied material is found to contain previously mentioned prohibited material, the supplier and or installer shall be held responsible for all remediation cost.

5-1.25.4 Follow installation requirements of manufacturers of the paint and reflective media to ensure adhesion and embedment.

5-1.26 Removal of Airfield and Taxiway Pavement Markings (lead paint)

Removal of existing pavement markings requires evaluation of paint to determine if material contains toxic components such as lead prior to removal. In the event lead is found, removal methods must conform to latest State and Federal Standards for proper worker protection, containment of waste material and disposal. Coordinate survey, testing and disposal requirements with the Aviation Department Environmental Section.

5-1.27 Access Roads

5-1.27.1 ARFF

A. Turning Radius - The external turning radius of roadway pavement (wall to wall) shall not be less than fifty-seven (57) feet. The internal radius shall be no less than thirty-five (35) feet. At no time will the turn be less than twenty-two (22) feet wide.

B. Grade - The maximum grade change of any portion of a fire apparatus access road shall not exceed ten (10) feet of rise per hundred (100) feet of run.

5-1.27.2 SITE PREPARATION NAVAIDS

Design criteria for NAVAID critical areas shall conform to AC 150/5300-13. FAA NAVAIDS access roads shall be a minimum of ten (10) feet wide. Airport facilities will be checked for compliance with FAA electromagnetic standards. See FAA Advisory Circular AC 70/7460-2.

5-1.28 Security Fencing and Vehicle Gates

Match existing applications when replacing or extending existing fencing unless otherwise directed by the Aviation Department.

5-1.29 Passenger Boarding Bridges

5-1.29.1 The Aviation Department requires Preconditioned Air. Bridges require two separate pieces of cooling equipment- one for the aircraft and one for the bridge to allow cooling of both simultaneously. Potable Water and 400 HZ Ground Power are required at each new Passenger Boarding Bridge (PBB) installation or 90KVA/28VDC.

5-1.29.2 Potable water hoses shall be stored on an auto-retracting hose reel.

5-1.29.3 To avoid abrasion damage to PC Air duct, the unit must not touch pavement.

5-2 Electrical

5-2.1 Introduction – Airfield Lighting

5-2.1.1 Airfield lighting is classified by two areas: 1) Apron area and 2) Taxiway and Runway areas. The following subsections direct the Design Consultant into a best practices approach to Apron, Taxiway, and Runway lighting design. Pertaining to this section, Apron, Taxiway, and Runway lighting design includes power distribution design, lighting controls design, and luminaire selection. Refer to the latest editions of Federal Aviation Administration (FAA) Advisory Circular (AC) 150/5340-30 and the City of Phoenix Airfield Electrical Standards Manual for additional design requirements. The requirements in this section cover all requirements for lighting design on the Apron and Airfield; this section shall take precedence, in these areas, when design requirements overlap with other sections.

A. Refer to the latest edition of FAA AC 150/5340-30 for design elements not covered in this section.

B. Airfield and apron lighting power distribution systems at PHX are 480Y/277V, 3-Phase, 4-wire systems. Airfield lighting Constant Current Regulator (CCR) may be capable of being powered by 3-phase, 480V power, however, some systems utilize single phase CCR. Apron lighting may be powered by 277-volt. Final approval for the lighting circuit voltage must be obtained from the PM prior to commencing design. Modifications or upgrades to the existing airfield lighting power distribution system may involve the installation of an Uninterruptable Power Supply (UPS) and/or generator backup. Design Considerations for these systems include transfer time coordination and reliability of the power source. Calculations supporting the design direction shall be provided to the Aviation Department PM.

5-2.2 Apron Lighting

5-2.2.1 LUMINAIRE TYPE AND MOUNTING:

A. Apron Lighting is provided by high pressure sodium floodlights, all new installs be LED use IESNA RP 37-15 as guide. Flood lights are pole mounted above the building concourse structure; Luminaire and pole height shall be maintained throughout the facility and must comply with FAA regulations.

B. The Luminaire shall be constructed of heavy-gauge aluminum or steel. Luminaire finish must consist of heavy-duty polyester powder coated finish.

C. The Luminaire housing must be lensed, water tight, dust tight, and gasketed (IP55 rated or better). The lensed cover must be easily removed by maintenance personnel and be chained or attached to the housing to prevent accidental drops during maintenance procedures. The lamp and ballast should be accessible through the front cover.

D. Luminaire lamping and ballast: 1000 watt equivalent LED 5000 Kelvin Color Temperature.

E. Light pole Effective Projected Area (EPA) data must be provided to the project structural engineer for analysis and light-pole base design.

F. Luminaires shall be UL listed.

5-2.2.2 LUMINAIRE POWERING AND SWITCHING:

A. Apron flood lighting is to be powered from lighting distribution panelboards, location to match existing buildings and structures. Panels shall be labeled following the naming convention as stated in the Base Design Guidelines for Electrical (Chapter 2).

B. Control of apron flood lighting is accomplished by photocell control to be 7 pin socket style, time clock or building automation system. Apron lighting is to turn on at dusk and remain on until dawn. Override controls should be incorporated into the design for maintenance purposes. Maintenance personnel shall have the capabilities to override the lights on or off. Off override controls shall be provided with lock-out, tag-out capabilities to prevent activation during maintenance procedures.

C. Apron floodlighting electrical feeder sizes must be engineered to account for no more than 2% voltage drop from the lighting distribution panelboard. Feeder sizing should not be the responsibility of the Contractor. The engineer must include detailed feeder calculations showing the feeder distance (from the lighting power distribution panelboard to the load), wire size, conduit size, calculated volts dropped, and the percentage of volts drop for each lighting circuit.

5-2.2.3 LUMINAIRE LAYOUT AND AIMING PLANS:

A. The lighting Design Consultant must provide a photometric plan to the PM for Apron lighting luminance level approval. Light levels should satisfy FAA and IESNA standards for luminance levels. Photometric plans must show the luminance levels, measured in foot-candles (fc) on a 10'x10' grid taken at finished grade and statistics which include the maximum, minimum, maximum to minimum, average to minimum, and average to maximum values for the calculation zone. Photometric plans should be scaled no greater than 1" = 20' for plans.

B. The lighting Design Consultant must provide an apron light fixture aiming schedule which provides the Contractor with tilt and azimuth angles. Tilt angles should represent the angle of inclination above horizontal; 0-degrees means the fixture is aimed straight down and 90-degrees means it is aimed straight up. Azimuth angles represent the aiming of the luminaire along the horizontal plain, where 0 degrees indicates the light fixture is aimed due north and 180-degrees indicates the light fixture is aimed due south. Aiming plans showing light fixtures with negative tilt and or azimuth angles will not be accepted. Provide the aiming coordinates for each fixture with an accuracy within 1-degree.

C. Apron flood lighting should not be aimed toward the control tower, in the direct taxiway path, or in a direction to affect pilots or airline personnel.

5-2.3 Runway and Taxiway Lighting Systems

5-2.3.1 INTRODUCTION

A. Taxiway and Runway lighting systems are integrated into a single lighting control system. Taxiway and runway lighting consist of edge lighting and in-pavement centerline or threshold luminaires are positioned to allow for aviators to pilot their aircraft at night and during periods of low visibility (such as inclement weather). These luminaires are grouped into a single classification called Airfield Ground Lighting. Luminaire types, positions, placement, control methods, and power distribution is governed by the FAA. It is the responsibility of the engineer to familiarize themselves with the FAA standards for Taxiway and Runway lighting control, power distribution, luminaire types, etc. prior to design. Since updates to the FAA standards may occur on frequent intervals, it is important to review the standards referenced in this manual to insure the information contained in this design manual is compliant with the latest FAA regulations. Reference the latest edition of FAA AC 150/5340-30 for updates in the design practices.

5-2.3.2 RUNWAY AND TAXIWAY LIGHTING CONTROLS

A. Taxiway and Runway Lighting is controlled by a computerized airfield lighting control system. The control system is capable of monitoring functionality of the airfield lighting system in addition to providing a control interface.

B. The computerized control system shall be capable of monitoring the regular performance of the system; recording or logging system faults, and monitoring of airfield lighting system Constant Current Regulator for failures. In addition, the system provides confirmation of the airfield lighting settings. System characteristics are determined by the Aviation Department and the Design Consultant and, therefore, the Design Consultant shall carefully coordinate the system parameters with the Aviation Department PM.

5-2.3.3 RUNWAY AND TAXIWAY EDGE AND IN-PAVEMENT LUMINAIRE TYPES

A. There are three (3) types of runway edge and (1) types of taxiway edge and in-pavement luminaires that are commonly used. FAA AC documentation refers to these (4) luminaires and, for clarity, this design guideline uses the same terminology for these (4) luminaires as the FAA Advisory Circulars. The runway and taxiway edge luminaires are classified as the following:

- A.1.** LIRL -Low Intensity Runway Lights
- A.2.** MIRL -Medium Intensity Runway Lights
- A.3.** HIRL -High Intensity Runway Lights
- A.4.** MITL -Medium Intensity Taxiway Lights

B. There are three (3) types of runways used at airports; it is important to understand the difference between the runways and the types of lights that are used for each runway application. The (3) types of runways are comprised of Visual Runways, Non-Precision Runways and Precision Runways. LIRL is used on Visual Runways, which are usually found at small airports. MIRL is typically used on Non-Precision Runways, which are found at small to medium sized airports. HIRL is typically used on Precision Runways, which are usually found at medium to large airports. MITL is used on taxiways and for purposes of this design guideline, is the only luminaire type used as taxiway edge lighting.

5-2.3.4 RUNWAY AND TAXIWAY LIGHTING

A. Runway and Taxiway lighting systems consist of edge luminaires, centerline luminaires, and in-pavement luminaires. These three types of fixtures are used to identify the runways, taxiways, thresholds, runway ends, and taxiway ends: The luminaire type and color for each application is discussed later in the following sections.

5-2.3.5 Runway and Taxiway Guard Lights, Stop Lights, PAPI, and REIL

A. Runway Guard lights, or RGL, are required to notify air traffic (or anyone approaching the runway) that they are entering an active runway. RGL luminaires consist of two (2) yellow alternating lamps. RGL luminaires are unidirectional and, for use at the Aviation Department should be specified as in-pavement and elevated guard lights type luminaires.

B. Precision Approach Path Indicator. (PAPI) luminaires provide a visual indication of the slope of the aircraft's approach. This light fixture must have the capability to be seen up to 5-miles away during the day and up to 20-miles away at night. The Aviation Department utilizes a four (4) box PAPI system have a two(2) box system at DVT(Deer Valley Airport).

C. Runway End Identifier Lights, or REIL, are two (2) flashing lights (white) located at the end of the runway in line with the threshold lights installed per FAA AC 150/5340-30 current edition.

5-2.3.6 OTHER APPROACH SLOPE INDICATORS

A. There are two (2) other approach slope indicator types that are not used at the Aviation Department. These types of slope indicators are Visual Approach Slope Indicator (VASI) and Pulse Light Approach Slope Indicator (PLASI) and must not be specified or used.

5-2.3.7 Runway and Taxiway Luminaire Lamping

A. Runway and Taxiway luminaires can utilize incandescent or quartz-halogen lamps. Airfield lighting at Phoenix Sky Harbor International Airport utilizes LED because they provide better performance and light output at a lower wattage over incandescent lamps.

B. Airfield luminaires utilizing LED light sources may be considered in lieu of luminaires utilizing quartz halogen lamps. The proposed LED airfield luminaires shall be approved by the Aviation Department PM.

5-2.3.8 RUNWAY AND TAXIWAY LUMINAIRE TYPES.

A. The following subsections provide AGL FAA types classifying light fixtures and light fixture bases to be used at the Aviation Department for elevated light fixtures, in-pavement light fixtures, PAPI and REIL luminaires, lighted airfield signs, and light bases.

B. Elevated Light Fixtures:

- B.1.** L-862 Runway edge, high-intensity
- B.2.** L-862ERunway threshold/end, high-intensity
- B.3.** L-861TTaxiway edge (medium-intensity)
- B.4.** L-804 Holding position edge (guard lights)

C. In-pavement Light Fixtures:

- C.1.** L-850C Runway edge, high-intensity
- C.2.** L-850D Runway threshold/end, high-intensity
- C.3.** L-852A Taxiway centerline (for straight portion or caution bar)
- C.4.** L-852B Taxiway centerline (for curved portion)
- C.5.** L-852ETaxiway intersection
- C.6.** L-852G Runway guard light
- C.7.** L-852TTaxiway edge light, flush mounted

D. PAPI and REIL:

- D.1.** L-880 PAPI system with (4) light units
- D.2.** L-849 REIL

E. Lighted Airfield Signs:

- E.1.** L-858Y Direction, Designation and Boundary. Black legend on yellow background
- E.2.** L-858RMandatory Instruction. White legend on red background
- E.3.** L-858LTaxiway and runway location. Yellow legend and border on black background
- E.4.** L-858BRunway Distance Remaining. White legend on black background

F. Light Bases:

- F.1.** L-867 Non-load bearing (used in shoulder areas or other non-traffic areas)
- F.2.** L-868 load bearing (use this for runway and taxiway pavements and other load areas)

F.3. Sizes for bases:

- 10" diameter (L868 only)
- 12" diameter (L867 and L-868)
- 15" diameter (L868 only)
- 16" diameter (L867 only)

5-2.3.9 Power Distribution to AFL:

A. Two types of power sources are utilized at the Aviation Department to power AGL: parallel circuits and series circuits. Parallel circuits are the most common type of circuits providing constant voltage to loads. Parallel circuits are utilized in AGL applications for power distribution to constant current Regulator (CCR), beacons, apron lighting, wind direction indicators and some obstacle lights. Series circuits or constant current circuits are used for runway and taxiway edge, centerline and approach aids.

B. Reference the Base Electrical Design guidelines for additional information pertaining to power distribution to parallel circuits.

C. Power distribution to Constant Current Regulator is by 480-volt power. Coordinate the voltage requirements for beacons, apron lighting, wind direction indicators and obstacle lights.

D. Series circuits are powered from Constant Current Regulator. The constant current Regulator that are specified for the Aviation Department are required to have an output of 6.6A or 20A. Input to the CCR is typically 480-volts, single phase.

E. Isolation transformers are required for airfield lighting powered by a series circuit. One isolation transformer is required for each airfield light.

5-2.3.10 SERIES CIRCUIT DESIGN:

A. The design shall utilize Ferro Resonate type CCR for all series circuits. CCR will be powered from 480-Volt, Single phase circuits. CCR are typically sized from 10kW through 30kW and have output currents of 6.6-Amps; the design should incorporate calculations supporting the sizing of the CCR. The output voltage rating shall be 5kV. All CCR shall be specified with (1) 120-volt control input for control by the Aviation Department's computerized airfield lighting control system.

B. The design should incorporate voltage calculations for each CCR and lighting circuit. The voltage for any series or constant current circuit shall never exceed 5kV. For circuits powered from 30kW CCR, the output current shall be 6.6 amp. Other circuits powered from smaller CCR may have output currents of 6.6-Amps or 20-Amps.

C. Each light shall have an isolation transformer. The transformer should be correctly sized for the light at any voltage input and have a constant current output of 6.6-Amps. All isolation transformers shall be FAA type L-830 (60Hz).

D. Grounding: Series lighting circuits (constant current circuits) are ungrounded systems. However, the design should incorporate a bare #6 CU counterpoise run in parallel to the constant current circuit conductors. Install 10'x3/4" copper clad steel ground rods no greater than every 1000'. Exothermically weld the bare #6 counterpoise to each ground rod. A #6 copper ground wire shall be bonded to the light fixture base and to the #6 counterpoise. All connections shall be of the exothermic weld type. Ground the CCR per the requirements of article 250 in the latest edition of the National Electric Code.

E. Current carrying conductors used in airfield constant current lighting circuits must be FAA L-824 Type C rated for 5000-Volts, #6 or #8 AWG as appropriate. Cabling shall be 7-strand only.

F. Connections from FAA L-824 Type C conductors to the isolation transformers and to the luminaire conductors shall be FAA type L-823 connections in cans shall be “Complete Kits” or approved equal, no heat shrinks in cans.

G. Overcurrent protection shall be provided on the primary side of the CCR. Since this is a constant current system, overcurrent is not required.

H. Conduits and Raceways: For routing in concrete slabs, Galvanized Ridged Conduit (GRC) shall be used or specified on design documents; no exceptions. Other below-grade conduits shall be PVC coated GRC or schedule 40 PVC. GRC conduit shall conform to federal specification WW-C-581 and schedule 40 PVC shall conform with federal specification W-C-1094. Schedule 40 PVC is permitted in all non-paved in-field areas. Concrete encased schedule 40 PVC shall be used in all in-field pavement crossings. All conduit runs under pavements and risers into building shall be GRC; concrete encasement may be required for these conduit runs on a case by case basis and as required by the Aviation Department maintenance staff.

I. Utility Access Points (Manholes/Handholes): Utility access points shall be prefabricated and designed to withstand the appropriate aircraft load at their respective location. Provide loading calculations in the airfield lighting duct bank design documents. Utility access points in the safety areas of runways and taxiways shall be rated for heavy duty aircraft loading, meaning 100,000 lbs ESWL and 250psi tire pressure.

J. Utility access points shall be specified with pulling irons, non-metallic (fiberglass) cable racks, sump pit, and knock-out panels appropriate.

K. Light bases may be used as a hand hole outside of traffic areas. This light base must be FAA type L-867, side D.

L. Utility Access Point and Light Base Grounding: The Design Consultant shall provide grounding to the frame and covers of all point and light base covers, frames, and similar metal components. Grounding is accomplished by a bare #6 CU wire. Connections shall be made by brass compression fittings or exothermic welds (listed for this application).

5-2.3.11 TAXIWAY AND RUNWAY LIGHTING DESIGN – LIGHT TYPES AND LIGHT PLACEMENT

A. Taxiway and Runway lighting installation locations and placement follows the requirements as stated in the current FAA Advisory Circular. Refer to Figures 1 through Figure 112 in the current FAA Advisory Circular for specific airside lighting design requirements; sample calculation templates for series circuits; and design and installation details.

B. Runway Elevated Edge Light:

B.1. FAA Type L-862

B.2. Quartz-halogen lamp to be coordinated

B.3. Clear Yellow or Red lenses are required (as appropriate).

B.4. Mounted 14” above grade on a FAA L-867 light base, size B (12” in diameter), 24” deep.

B.5. Adjustable light bases shall not be used.

B.6. Mount lights as required by the current FAA Advisory Circular

B.7. New Installations: 15% spare lamps and 5% spare lenses.

C. Runway In-pavement Edge Light:

C.1. FAA Type L-850C

C.2. Quartz-halogen lamp to be coordinated all new to be LED

- C.3. Clear Yellow or Red lenses are required (as appropriate).
- C.4. Mounted on a FAA L-868 light base, size B (12" in diameter), 24" deep.
- C.5. Adjustable light bases shall not be used.
- C.6. Mount lights as required by the current FAA Advisory Circular .
- C.7. New Installations: 15% spare lamps and 5% spare lenses.
- D. Medium-Intensity Runway Elevated Edge Light:
 - D.1. FAA Type L-861
 - D.2. Quartz-halogen lamp to be coordinated all new to be LED
 - D.3. Clear Yellow or Red lenses are required (as appropriate).
 - D.4. Mounted 14" above grade on a FAA L-867 light base, size B (12" in diameter), 24" deep.
 - D.5. Adjustable light bases shall not be used.
 - D.6. Mount lights as required by the current FAA Advisory Circular.
 - D.7. New Installations: 15% spare lamps and 5% spare lenses.
- E. Runway Elevated Threshold/End Light:
 - E.1. FAA Type L-862
 - E.2. All new to be LED
 - E.3. Bi-directional red/green lens. The green side shall indicate to the pilot the runway side (landing) and the red lens shall indicate to the pilot the runway the runway end (on takeoff).
 - E.4. Mounted 14" above grade on a FAA L-867 light base, size B (12" in diameter), 24" deep.
 - E.5. Adjustable light bases shall not be used.
 - E.6. Threshold end-lights shall be mounted 10' center to center (the current FAA Advisory Circular , Figure 2).
 - E.7. New Installations: 15% spare lamps and 5% spare lenses.
- F. Runway In-pavement Threshold/End Light:
 - F.1. FAA Type L-850D
 - F.2. Semi-flush, or if approved, flush light.
 - F.3. Quartz-halogen lamp to be coordinated
 - F.4. Bi-directional red/green lens. The green side shall indicate to the pilot the runway side (landing) and the red lens shall indicate to the pilot the runway the runway end (on takeoff).
 - F.5. Threshold end-lights shall be mounted 10' center to center (the current FAA Advisory Circular , Figure 2).
 - F.6. New Installations: 15% spare lamps and 5% spare lenses.
- G. Low Intensity Runway Elevated Threshold/End Light:
 - G.1. FAA Type L-861
 - G.2. Quartz-halogen lamp to be coordinated
 - G.3. Bi-directional red/green lens. The green side shall indicate to the pilot the runway side (landing) and the red lens shall indicate to the pilot the runway the runway end (on takeoff).
 - G.4. Mounted 14" above grade on a FAA L-867 light base, size B (12" in diameter), 24" deep.
 - G.5. Adjustable light bases shall not be used.

G.6. Threshold end-lights shall be mounted 10' center to center (the current FAA Advisory Circular , Figure 2).

G.7. New Installations: 15% spare lamps and 5% spare lenses.

H. Taxiway Elevated Edge Light:

H.1. FAA Type L-861T

H.2. All new to be LED

H.3. Omnidirectional blue lens

H.4. Mounted 14" above grade on a FAA L-867 light base, size B (12" in diameter), 24" deep.

H.5. Adjustable light bases shall not be used.

H.6. Elevated edge lights shall be mounted 10' center to center (the current FAA Advisory Circular , Figure 2)

H.7. New Installations: 15% spare lamps and 5% spare lenses.

I. Taxiway In-pavement centerline Light:

I.1. FAA Type L-852

I.2. Semi-flush, or if approved, flush light.

I.3. Coordinate quartz-halogen lamp.

I.4. Lenses shall be green.

I.5. Mounted on a FAA L-868 light base, size B (12" in diameter), 24" deep.

I.6. New Installations: 15% spare lamps and 5% spare lenses.

J. Runway and Taxiway Signs:

J.1. Signs shall be fully compliant with the current FAA Advisory Circular

J.2. All signs shall be style 5, DVT is not to have separated circuits

J.3. Style 5 signs shall be connected to a separate circuit.

J.4. Lighted sign intensity and illumination ratios shall meet FAA requirements.

J.5. All signs shall be compatible with L-828/L-829 regulators, all shall have curved faces

K. REIL:

K.1. FAA Type L-849

K.2. 240Vac input.

K.3. Local and remote control.

K.4. REIL shall be positioned a PAPI is used.

K.5. REIL shall be positioned, installed per AC 150-5340-30 current edition .

L. PAPI:

L.1. FAA Type L-880 or L-881 (as required), Style A, Class 1

L.2. 240Vac input.

L.3. Local and remote control.

L.4. PAPI luminaire shall have an integral tilt switch.

L.5. Provide with lamp bypass and aiming tool.

L.6. Support legs shall be adjustable by a minimum of 2 inch.

L.7. Internal buck/boost transformer to compensate for a variation of +/- 10% in the in the input voltage.

L.8. It is not desired to interlock the night-time operation of the PAPI system to the runway edge lights.

5-2.4 Other Project Requirements

5-2.4.1 INSTALLATION REQUIREMENTS AND DETAILS:

A. Coordinate with the Aviation Department PM for project specific details and installation diagrams.

5-2.4.2 TESTING AND ACCEPTANCE:

A. The design shall require the Contractor to provide a resistance test of the series circuit primary loop. The resistance shall be no more than no less than 100 Meg ohms.

B. Coordinate additional testing requirements with the Aviation Department PM.

5-3 Special Systems

To be provided

Chapter 6: Parking Garages and Parking Facilities

6-1 General

6-1.1 Code Requirements

6-1.1.1 Refer to SECTION I: Chapter 6 for applicable Codes, Regulations and Standards.

6-1.1.2 All parking garage and parking facility planning (including surface lots) and design elements shall be designed in accordance with accepted engineering standards, however, as a minimum, they shall be in conformance to the applicable publications in SECTION I: POLICIES, Chapter 6: Codes, Regulations and Standards.

6-1.1.3 Critical dimensions for parking garages and parking facilities are governed by City of Phoenix ordinances including ADAAG with Arizona/COP modifications, PDD and police standards “Parking Guidelines and Attachments 2 & 3”, “Accessible Parking Spaces”. Please refer to Appendix A: Standard Details

6-1.1.4 The ADA [Universal Parking Space Design](#) is recommended for all accessible parking spaces. Under this design, *all* accessible spaces are 132 in (3350 mm) wide with a 60 in (1525 mm) access aisle. One advantage to this design is that no additional signage is needed because all spaces can accommodate a van with a side-mounted lift or ramp. Also, there is no competition between cars and vans for spaces since all spaces can accommodate either.

6-1.1.5 1% of project costs must be dedicated to public art.

6-1.1.6 Speeds bumps are not allowed within parking garages and parking facilities.

6-1.1.7 All designs must satisfy latest TSA standards for blast mitigation or offset. Expansion joints shall be reviewed and approved by the FACILITIES AND SERVICES Division.

6-1.2 Preferences and Approvals

6-1.2.1 LEED elements shall be incorporated into parking garage and parking facility design on a project by project basis as approved by the PM.

6-1.2.2 Parking spaces should be oriented 90 degrees to drive aisles unless otherwise approved by the PM. Exceptions may be evaluated on a project by project basis.

6-1.2.3 Parking is allowed on ramps with grades 5% and under, except for ADA compliant parking. ADA compliant parking is not allowed on ramps.

6-1.2.4 Hatched ADA accessible walkways shall be between parking spaces and not between parking space and drive aisles. Prefer ADA accessible walkways have direct access to facility and not cross vehicular aisles. Wheel stops shall be placed to provide required widths of ADA accessible walkways beyond vehicle overhanging.

6-1.2.5 ADA vans need to be included in parking garage and parking facility planning and design. In addition, design vehicles shall be coordinated with project stakeholders to identify the full range of functional interfaces on a project by project basis as approved by the PM. This may

include shuttle bus vehicles if shuttle bus stops are desired within the parking garage/facility or on parking garage/facility access roads.

6-1.2.6 Provisions for shuttle bus stop or Sky Train station facilities shall be included for each parking facility to move customers and/or employees from the parking facility to the terminal as approved by the PM.

6-1.2.7 Provisions for VIP parking spaces, taxi staging, and taxi pick-up facilities shall be considered on a project by project basis as approved by the PM.

6-1.2.8 Parking layout efficiencies shall be reviewed and approved by the PM.

6-1.2.9 Pedestrian routing, including maximum lengths of routes without moving walkways, shall be reviewed and approved by the PM.

6-1.2.10 Provisions for courtesy cart stops for special need travelers and associated storage facilities shall not be required unless otherwise approved by the PM.

6-1.2.11 Provisions for luggage cart rental and storage facilities shall be considered on a project by project basis as approved by the PM.

6-1.2.12 Provisions for finished administrative purposes such as administrative offices, employee restroom, and break room shall be provided at all parking facilities as approved by the PM.

6-1.2.13 Provisions for finished equipment spaces such, an equipment room to house the facility control equipment and a hub room to house head-end equipment shall be provided at all parking facilities as approved by the PM.

6-1.2.14 Provisions for finished public spaces such as public restrooms, and tenant lease spaces (such as newspaper kiosks and coffee shops) shall be considered on a project by project basis as approved by the PM.

6-1.2.15 Vehicular access to the parking garage/facility will be approved by the PM on a project by project basis. Consideration should be given to spacing of access points to the parking garage/facility within the airport roadway network, including restricted access for authorized vehicles such as shuttle busses.

6-1.2.16 Provisions for revenue control entrance and exit plazas within the garage structures shall be considered on a project by project basis as approved by the PM.

6-1.2.17 Helix ramps are acceptable if located exterior to the structure.

6-1.2.18 Provisions for light wells, including the benefits associated with ventilation, shall be considered on a project by project basis as approved by the PM.

6-1.2.19 Provisions for transit stations adjacent to and within parking garage/facilities shall be considered on a case by case basis as approved by the PM. Consideration should be given to sharing vertical circulation elements of the parking garage with the transit facility.

6-1.2.20 Provisions for future vertical expansions shall be considered as approved by the PM.

6-1.2.21 Provisions for separate categories of parking (parking rates) within the parking garage/facility shall be considered as approved by the PM.

6-2 Architectural

6-2.1 Code Requirements

6-2.1.1 Refer to SECTION I: Chapter 6 for applicable Codes, Regulations and Standards.

6-2.1.2 Finished floors of parking garages shall be accessible to finished floors of terminals without a vertical transition when pedestrian connections are provided between parking garages and terminals unless otherwise approved by the PM.

6-2.1.3 Provisions for higher clearance on levels accessed by shuttle buses should be considered and approved by the PM.

6-3 Structural

6-3.1 Code Requirements

6-3.1.1 Refer to SECTION I: Chapter 6 for applicable Codes, Regulations and Standards.

6-3.1.2 Refer to SECTION III: Chapter 2 for additional structural information.

6-4 Mechanical

6-4.1 Code Requirements

6-4.1.1 Refer to SECTION I: Chapter 6 for applicable Codes, Regulations and Standards.

6-4.1.2 Refer to SECTION III: Chapter 2 for additional mechanical information.

6-4.1.3 Air-conditioned spaces shall be considered on a project by project basis as approved by the PM. Consideration should be given to using evaporative cooling as a means of creating a comfort zone at external elevator platforms.

6-4.1.4 Water fountains shall not be required in parking garage/facilities unless otherwise approved by the PM.

6-5 Electrical

6-5.1 Code Requirements

6-5.1.1 Refer to SECTION I: Chapter 6 for applicable Codes, Regulations and Standards.

6-5.1.2 Refer to SECTION III: Chapter 2 for additional electrical information.

6-5.1.3 SECURITY LIGHTING

A. Introduction: Refer to the base electrical design guidelines for additional design requirements and criteria that are not covered in this section. This information contained in this section supersedes the design requirements stated in prior sections.

B. Illumination Guidelines

- Illuminating Engineering Society of North America (IESNA)
- IESNA G-1-03, Guideline on Security Lighting for People, Property, and Public Spaces
- IESNA RP-20-98, Lighting for Parking Facilities
- IESNA 08-5-94, Recommended Lighting for Walkways and Class 1 Bikeways
- IESNA Lighting Handbook, Ninth Edition

C. Pedestrian Access Way Lighting and Parking Garage Lighting

C.1. Recommendations for lighting practices for lighting walkways are discussed in IESNADG-5-94. Pedestrian access way lighting will define pedestrian walkways, crosswalks, ramps, and bridges. The recommended security illumination for pedestrian passageways should be an average of 30 lux (2.8 fc) on the pavement, with a uniformity ratio not greater than 4:1. In areas such as ramps and stairs, illuminances should be an average of 50 lux (4.6 fc), with a uniformity ratio not greater than 4:1.

C.2. The Design Consultant shall select fixtures that are durable and suitable for the application intended. Plastic exit signs shall not be specified.

C.3. The Design Consultant shall coordinate the mounting heights of light fixtures that are mounted within the Parking Garage. Avoid fixtures that hang below the maximum vehicle traffic height. Where possible, locate light fixtures out of the paths of travel.

D. Lamp Sources

D.1. The lamp sources for the parking garage light fixtures shall be light emitting diode (LED color and wattage will be determined by area and function. Must be approved by PM and FACILITIES AND SERVICES Electrical.). The recommended luminaire wattage for areas between decking is 250W (maximum).

E. Control of Lighting Systems

E.1. Lighting control will be designed to use energy efficiently. Automatic control arrangements shall include relay based lighting control panels and lighting contactors. Exterior lighting in exposed areas will be controlled by a photocell and a time clock. All lighting controls will have a manual override for regular effective maintenance.

E.2. The lighting system is expected to operate continuously and rely on both automatic and manual controls to provide efficient use of energy and reduce operational costs. Where automated light controls are utilized to save energy, checkerboard branch circuit and switching patterns shall be used so full area coverage is maintained when half of the lights are switched off or powered down.

E.3. Light fixtures that are located along the perimeter of the parking garage area shall be wired separately so that they can be turned off during daytime hours.

F. Maintenance

F.1. No security lighting system can remain effective without regularly scheduled maintenance. A planned maintenance program must be provided for each specified fixture and should include the replacement of failed lamps, electrical components, photocells, and vandalized or damaged luminaires, and involve regular cleaning of luminaires and shrubbery pruning.

6-5.2 Conduit and Raceways

6-5.2.1 The following are requirements and design criteria for conduits used in branch circuit feeders in parking garages:

- A. All conduits shall be sized in accordance with NEC.
- B. Designs shall assure that conduits shall not be smaller than 3/4-inch for branch lighting and power circuits; 3/4-inch for communication conduits.
- C. The Design Consultant shall coordinate the routing and placement of exposed conduits and raceways. Mount conduits tight to structure. Do not route the conduits in vehicle paths.
- D. The Design Consultant shall specify wide sweep radius bends for panel feeds and larger conduits.

6-5.2.2 Galvanized Rigid Conduit (GRC), heavy wall schedule 40, shall be routed in all exposed areas, penetrations through concrete, and conduit routed in concrete slabs.

6-5.2.3 Underground conduits in non-classified areas shall be specified as PVC

6-5.2.4 Flexible metal conduit, with the overall length not to exceed 3-feet shall be specified for light fixture connections.

6-5.2.5 All other conduits shall be EMT.

6-5.2.6 Conduit raceways that cross over expansion joints shall be designed with expansion fittings. XJ fittings shall be used for galvanized rigid steel conduits.

6-5.2.7 The Design- Builder shall label conduits to the devices or equipment which they serve. Branch circuits are to be labeled with the circuit and panel board on every junction box and faceplate for each device.

6-5.3 Special Considerations

6-5.3.1 The following paragraphs describe conduit materials, special installation methods, conduit identification and specific design requirements for system wide conduits.

A. Raceway Materials: Type Abbreviation Galvanized Rigid Steel Conduit GRS NEMATC-6*

6-5.3.2 CONDUIT FEEDER SCHEDULE

A. The conduit schedule shall identify all feeder conduits to be installed, using symbols and annotations. Conduits that are to enclose circuits installed by others shall be clearly indicated. Installation specifications shall require pull wire and permanent tagging of each conduit access.

B. Conduit and feeder schedules shall include the following Information: Conduit Identification, Conduit size, Circuit Identification, Conduit type, Conduit from Conductor description, Conduit to Conductor quantity, Indication of multiple runs, and Drawing reference

6-5.3.3 CONDUIT DESIGN APPROACH

A. Raceway designs shall include all required runs between equipment and panel boards in electrical rooms, and so forth, and shall be shown on drawings with cross references to other drawings that detail the conduit routing in ceilings, walls or floor slabs as required in areas where routing is critical. Three inch (3") or larger conduits shall be extended from these secondary distribution points to the associated equipment.

B. Conduit runs that may exceed the 270-degree bend limitation and conduit runs in excess of 100 feet shall be detailed in the project drawings. Details shall include junction box locations, bends and potential obstructions, such as mechanical ducts and piping. Conduit routing and locations of pull boxes and junction boxes shall be subject to change as necessary during construction.

C. Conduits shall have no more than the equivalent of three 90-degree bends (270 degrees) between an outlet or service point, and pull box, manhole, or outlet box.

6-5.4 Wire and Cable

6-5.4.1 GENERAL

The design shall incorporate wire and sizing and wire type information for all applications. All branch circuit wire 300V and lighting and distribution feeders 600V shall be 600-volt insulated copper and bare the UL Label. Refer to the medium and high voltage section for these applications. Branch circuit feeders and wiring are to be sized in accordance with Article 316 in NFPA 70.

A. Conductors #12 AWG and larger will be stranded conductors. All conductors will be insulated.

B. The Design Consultant shall specify the color coding of control wiring to match the Aviation Department standard for color coding.

C. The wire type shall be clearly noted in the design documents for the Contractor 's reference.

D. The Design Consultant shall complete voltage drop calculations per the NEC for applicable branch circuit and feeder runs.

E. The Design Consultant shall derate the ampacity of conductors, as well as the ampacity of over current devices that are exposed to the elements. Reference NEC 310.16 Correction Factors the ambient derating of conductors.

6-5.4.2 INSULATION

A. All conductor insulation shall conform to NEC Article 310. Insulations shall be moisture and heat resistant types with temperature ratings corresponding to the conditions of application, but in no case lower than 194 degrees Fahrenheit (90 degrees Celsius). Insulation for general use shall be type THHN/THWN or type XHHW.

6-5.4.3 Protection: Conductors emergency and non-emergency lighting shall be protected from physical damage by moving equipment, transit vehicles, or other normal transit system operations. Provide suitable embedment or encasement for conductors by routing them through areas of low fire potential (light hazard).

6-5.5 Electrical Boxes and Cabinets

6-5.5.1 RACEWAY BOXES

A. Outlet, junction and pull boxes shall be indicated on the drawings where they are required to facilitate the pulling, supporting, or connecting of wires and cable. Junction and pull box locations shall be subject to change as necessary during construction.

6-5.6 Underground Pull Boxes and Manholes

6-5.6.1 Underground boxes and manholes shall conform to NEC and comply with UL and ASTM standards. Boxes and Manholes shall have covers consisting of structural steel and capable of supporting any overhead load that may come in contact with the box or man hole. Specify products that are UL listed from manufactures that are considered to be 'industry standard' and are of specification grade quality.

6-5.6.2 Concrete boxes specified shall be constructed using 4000psi class concrete, and shall be

listed to withstand vehicle and equipment traffic weights.

6-5.7 Grounding

- A.** All panel board cabinets, equipment, enclosures, and conduit systems shall be securely grounded with regard to Article 250 of the NEC (and as amended by any local jurisdictional codes).
- B.** Any conductive structure that is likely to become energized and is subject to personal contact shall be grounded by one or more methods outlined in NEC Article 250.
- C.** Furnish and install grounding electrodes (sized per NEC Article 250) as required.

6-6 Signage Section to update

6-6.1 Code Requirements

6-6.1.1 Use City of Phoenix's Aviation Department Signage Standards

6-6.1.2 Wayfinding should be considered for identifying individual parking garages/facilities.

6-6.1.3 Wayfinding should be addressed such as color coded and themed floors in addition to numbering or lettering. Patrons often connect to a visual piece of art work when trying to remember the location of their car.

6-7 Special Systems

6-7.1 Code Requirements

6-7.1.1 Refer to SECTION I: Chapter 6 for applicable Codes, Regulations and Standards.

6-7.1.2 Fire Systems:

- A.** Fire Systems shall be included at all parking facilities.
- B.** Fire sprinklers system equipment must be procured through the Aviation Department's vendor or as approved by the PM. The vendor shall provide and maintain the equipment.

6-7.1.3 Parking Assistance Call Boxes:

- A.** Parking Assistance Call Boxes shall be included at all parking facilities.
- B.** Parking Assistance Call Boxes equipment must be procured through the Aviation Department's vendor or as approved by the PM. The vendor shall provide and maintain the equipment. The current Aviation Department vendor is IEP.
- C.** PEDS must be incorporated in all parking garages/facilities (emergency call boxes that also include info buttons.)

6-7.1.4 The Level of Service (LOS) for elevators, escalators and other vertical circulation elements shall be reviewed and approved by the PM.

6-7.1.5 Parking Revenue Control System:

- A.** Parking Revenue Control System equipment must be procured through the Aviation Department's vendor or as approved by the PM. The current Aviation Department vendor is Scheidt & Bachmann.

B. Revenue control systems may potentially be linked to other systems, including third party electronic tolling systems as approved by the PM.

C. The Level of Service (LOS) for revenue control equipment at entry and exit plazas shall be reviewed and approved by the PM.

D. Provisions for Pay-n-Go machines shall be considered on a project by project basis as approved by the PM.

6-7.1.6 Parking Guidance System and Dynamic Space Counting:

A. Parking Guidance Systems and Dynamic Space Counting shall be included at all parking facilities as approved by the PM.

B. Parking Guidance Systems equipment must be procured through the Aviation Department's vendor or as approved by the PM. The vendor shall provide and maintain the equipment. The current Aviation Department vendor is ParkPro.

C. Dynamic space counting requirements shall be considered, including the type of system and means of connectivity to the traveling public.

6-7.1.7 CCTV:

A. CCTV shall be included at all parking facilities.

B. CCTV equipment must be procured through the Aviation Department's vendor or as approved by the PM. The vendor shall provide and maintain the equipment. The current Aviation Department vendor is Netsian.

6-7.1.8 Minimum Wi-Fi signal strength shall be required within the facility as approved by the PM.

6-7.1.9 Minimum cell phone service signal strength shall be required within the facility as approved by the PM.

6-7.1.10 FIDS shall not be required in garages unless otherwise approved by the PM.

Chapter 7: Non-Terminal Buildings

7-1 General

7-1.1 Code Requirements

Refer to SECTION I: Chapter 6 for applicable Codes, Regulations and Standards.

7-1.2 General Design Parameters

7-1.2.1 All design undertaken by the Design Consultant must meet the criteria and standards set forth below and do not relieve the Design Consultant from the responsibility to meet all functional and legal requirements of the project and perform the required services in a manner to:

- Ensure compatibility with existing facilities and systems, other planned development as identified in the airport master plan while maintaining the quality of the facility and integrity of its systems.
- Ensure the project is efficiently coordinated and communication is maintained at all project phases including minimizing impacts on other airport tenants and airport operations.
- Ensure compliance with airport operations requirements and regulations, including badging and security.
- Ensure compliance with all applicable building codes and state and local laws, regulations and ordinances as outlined herein.

7-1.3 Site Coverage/ Setback Requirements

7-1.4 Signage

All signage shall follow the direction set forth in the Signage & Wayfinding Master Plan. The master plan is to be used as the design basis of future implementation projects across all Airport facilities, and also to maintain system standards.

7-2 Architectural

7-2.1.1 BASIC BUILDING CHARACTERISTICS

All buildings and facilities shall be designed to be ancillary to the Main Terminal complex at the airport. This means that all facilities on the airport shall be “background” structures that do not compete with the Main Terminal buildings or with each other for attention, expression or effect.

7-2.1.2 ARCHITECTURAL CHARACTERISTICS

Essential architectural characteristics include the following:

- Planar: Planar, skin-dominated architecture.
- Massing: Cubic, rectangular, simple massing.
- Overhangs: No emphatic overhangs or cantilevers.
- Shadow Liner: No dramatic shadow lines.
- Exterior Vocabulary: Simple vocabulary of exterior materials and textures.

- **Windows and Other Fenestration:** Windows and other fenestration should be expressed as continuous or nearly-continuous bands or as large surfaces; they should not be expressed as punctures in an otherwise monolithic surface.
- **Exterior Storage:** All outside storage areas, dumpster areas, trash compactors, satellite antennas, fueling islands and similar areas shall be screened from public view.

7-2.1.3 BUILDING HEIGHTS

Building heights shall be compatible with other Airport facilities serving similar functions. Two-story buildings will be permitted when justified by functional requirements, or for taller single level structures such as for service bay heights. Building and other structure heights must be approved by Planning & Environmental through an air space analysis, unless otherwise directed by the PM.

7-2.1.4 MATERIALS

Exterior materials must be compatible with other materials in use at the airport. New materials not previously used may be acceptable provided they are applied in a way which blends with the overall airport environment.

7-3 Structural

Refer to SECTION III Chapter 2 for applicable Structural design criteria.

7-4 Mechanical

Refer to SECTION III Chapter 2 for applicable Mechanical design criteria. Omission of requirements which appear excessive for the design of non-terminal buildings must be approved by the PM in advance of completion of design.

7-5 Electrical

Refer to SECTION III Chapter 2 for applicable Electrical design criteria. Omission of requirements which appear excessive for the design of non-terminal buildings must be approved by the PM in advance of completion of design.

7-6 Special Systems

Refer to SECTION III Chapter 2 for applicable Special Systems design criteria. Omission of requirements which appear excessive for the design of non-terminal buildings must be approved by the PM in advance of completion of design.

SECTION V: APPENDICES

Appendix A: Standard Details

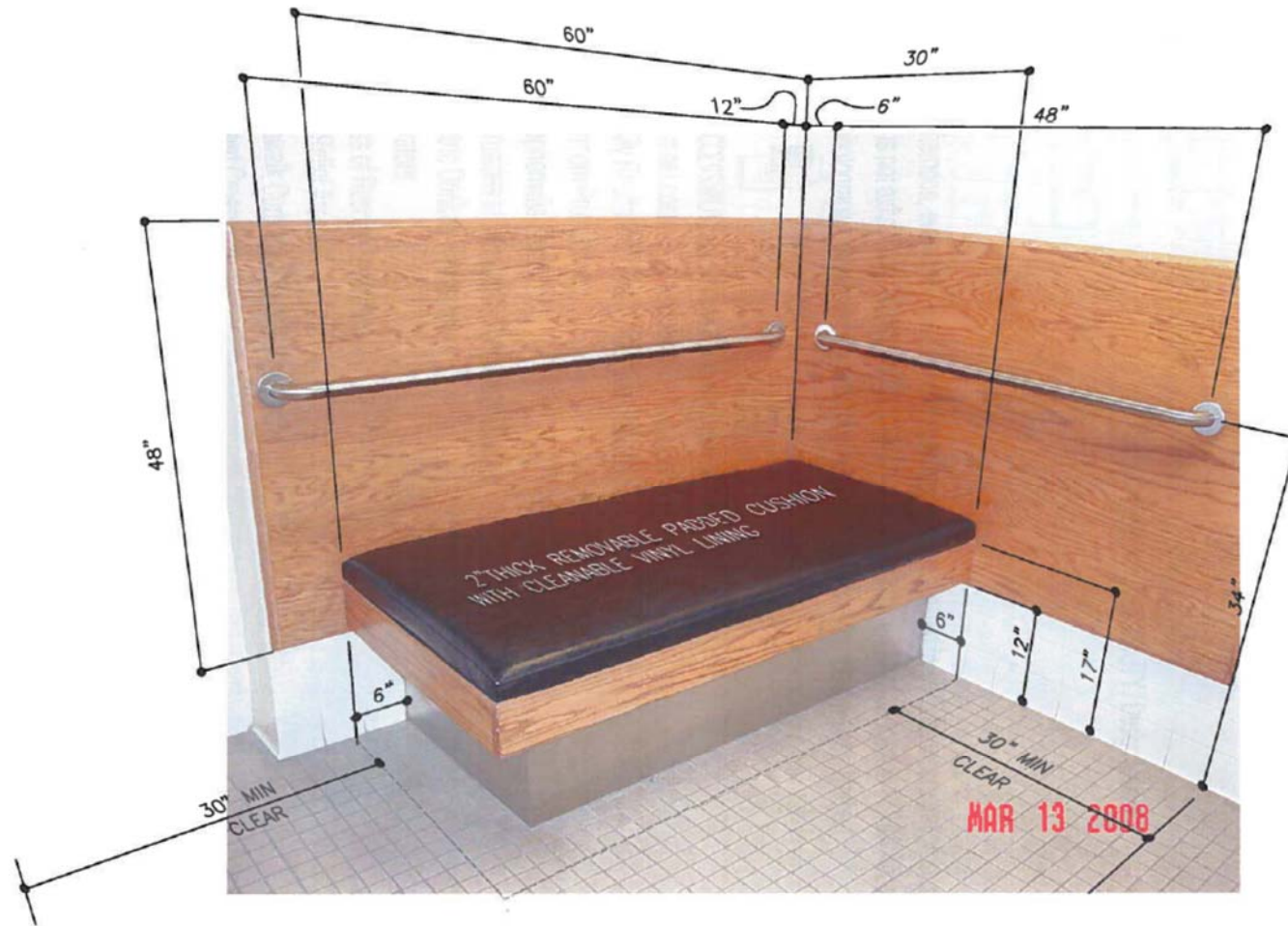
Adult Changing Station Family Assisted Restrooms

Pet Relief Areas

Nursing Rooms



ADULT CHANGING STATION
PHOENIX SKY HARBOR INTERNATIONAL AIRPORT



ADULT CHANGING STATION
PHOENIX SKY HARBOR INTERNATIONAL AIRPORT

Appendix B: Abbreviations, Acronyms and Definitions

B.1 Civil Abbreviations:

- AASHTO - American Association of State Highway and Transportation Officials
- AC – Advisory Circular (Federal Aviation Administration)
- ACI – American Concrete Institute
- ADA – Americans with Disabilities Act
- ALP – Airport Layout Plan
- APS- Arizona Public service
- ADOT - Arizona Department of Transportation
- AT – Automated Train (previously referred to as APM - Automated People Mover)
- CFR – Code of Federal Regulations
- COP – City of Phoenix
- CS/SC – Curve to Spiral/Spiral to Curve
- FAA – Federal Aviation Administration
- FAR – Federal Aviation Regulation
- MAG– Maricopa Association of Governments
- MUTCD – Manual on Uniform Traffic Control Devices
- NAD – North American Datum
- NFPA – National Fire Protection Association
- NGVD – National Geodetic Vertical Datum
- O & M – Operation and Maintenance
- PC – Point of Curvature
- PT – Point of Tangency
- PVC – Point of Vertical Curvature
- PVI – Point of Vertical Intersection
- PVT – Point of Vertical Tangency
- ROW – Right of Way
- R/W – Runway
- SUE – Subsurface Utility Engineering
- SUM – Subsurface Utility Mapping
- SRP – Salt River Project
- ST/TS – Spiral to Tangent/Tangent to Spiral
- UPRR – Union Pacific Railroad

B.2 Structural Abbreviations

- AISC – American Institute of Steel Construction
- ASCE – American Society of Civil Engineers
- ASD – Allowable Stress Design
- ASME – American Society of Mechanical Engineers

- ASTM – American Society of Testing and Materials
- AWS – American Welding Society
- FDCH – Facilities Design Criteria Handbook, March 23, 2007
- IBC – International Building Code
- ICC - International Code Council
- LRFD – Load and Resistance Factor Design
- TMS – The Masonry Society
- Dead Load (D)
- Earthquake (E)
- Fluid (F)
- Flood (Fa)
- Load due to lateral pressure of soil and water in soil (H)
- Impact (Im)
- Live Load (except roof live load) (L)
- Roof Live Load (Lr)
- Ponding (P)
- Rain (R)
- Shrinkage (Sh)
- Thermal (Th)
- Wind (W)

B.3 Airport/Aviation Department Definitions

- Access Control – A system, method or procedure to limit and control access to areas of the airport. FAR 107 requires certain airports to provide for such a system.
- Air Carrier Standards Security Program – The detailed, nonpublic document an aircraft operator regulated under FAR 108, must implement in order to meet FAA’s minimum-security standards. FAA must approve the document in order for it to be valid.
- Adaptive Intelligent Screening – This method of EDS baggage screening involves active communication between the levels of screening and bag handling system so that, in addition to selected bags, other bags are routed to EDS equipment or screened at the highest-level detection equipment on a bag-by-bag basis.
- Airports District Office – The office responsible for approval of airport projects involving federal grants assistance and enforcement of FAR 139 airport certification processes.
- Air Carrier – A person or company undertaking directly by lease, or other arrangement to engage in air transportation, also known as Aircraft Operator.
- Aircraft Loading Bridge – An aboveground device through which passengers move between an airport terminal and an aircraft. (Often referred to by the brand name Jetway)
- Aircraft Operator – A person or company, undertaking directly by lease or other arrangement, to engage in air transportation, also known as Air Carrier.
- Aircraft Stand – A designated area on an airport ramp intended to be used for parking an aircraft.
- Airline – An air transportation system including its equipment, routes, operating personnel, and management.

- Airport Command Post – An area that is set aside to house or facilitate the command and control of a particular activity.
- Airport Operator – Any person or organization operating an airport.
- Airport Ramp – Any outdoor area, including aprons and hardstands, on which aircraft may be positioned, stored, serviced, or maintained.
- Airside – Refers to those sections of an airport beyond the security screening stations and restricting perimeters.
- Air Operations Area (AOA)– That portion of the airport designed and used for landing, taking off or surface maneuvering of aircraft, and adjacent areas, but not including SIDAs or secured areas.
- Aircraft Rescue and Fire Fighting (ARFF) – A term used to identify the facility; operation or personnel engaged such activities.
- Airport Emergency Command Post (EOC) – Location on an airport where coordination and management for airport emergencies occurs.
- Airport Security Coordinator (ASC) – An individual designated by an airport operator to serve as the primary contact for FAA for security-related activities and communications.
- Airport Security Program – The Airport’s written program approved by FAA, which outlines all relevant security policies, procedures and system features that the airport intends to meet.
- Airport Ticket Office – A place at which the aircraft operator sells tickets, accepts checked baggage, and through the application of manual or automated criteria, identifies persons who may require additional security scrutiny. Such facilities may be located in an airport terminal or other location, e.g., curbside at the airport. It would not include skycap operations that only accept checked baggage, nor would it include locations performing the same full range of functions but located off the airport.
- Baggage Claim Area – Space, typically located in the passenger terminal building, where passengers reclaim checked baggage.
- Baggage Makeup Area – Space in which arriving and departing baggage is sorted and routed to appropriate destinations.
- Busy Day/Peak Hour – Calculation method for screening point peak volume.
- Busy Hour Rate – Calculation method for screening point peak volume.
- Boarding Gate – That area from which passengers directly enplane or deplane the aircraft.
- Canine Team – Dog teams used for explosives or other material detection.
- Cargo – Any property carried on aircraft other than stores or baggage.
- Cargo Area - All the ground space and facilities provided for cargo handling. It includes airport ramps, cargo buildings and warehouses, parking lots and roads associated therewith.
- Carry-on Baggage - All property remaining in the possession of passengers that is to be hand carried onto aircraft for transportation.
- Certificate Holder – An aircraft operator subject to FAR 108 holding an FAA operating certificate and engaged in scheduled passenger or public charter passenger operations (or both). The term is also sometimes applied to a —certificated airport, which refers to an airport’s operational certification by FAA pursuant to FAR Part 139.
- Checked Baggage – Any property tendered to or accepted by a certificate holder from a ticketed passenger for transportation in the cargo/baggage hold of an aircraft.

- Civil Aviation Security Division – The FAA office responsible for the Civil Aviation Security activities for an entire FAA region.
- Concourse – A passageway for persons between the principal terminal building waiting area and the structures leading to aircraft parking positions.
- Crisis Management Team – A group of individuals involved in managing a crisis to prevent, or at least contain, a crisis situation from escalating, jeopardizing safety and facilities, attracting unfavorable attention, inhibiting normal operations, creating a negative public image, and adversely affecting the organization's viability.
- Curbside Check-in – An area normally located along terminal's vehicle curb frontage where designated employees accept and check-in baggage from departing passengers. Designed to speed passenger movement by separating baggage handling from other ticket counter and gate activities. Allows baggage to be consolidated and moved to aircraft more directly.
- Downstream – Refers to airport areas beyond security screening checkpoints.
- Explosives Detection System (EDS) – A system designed to detect the chemical signature of explosive materials, where the TSA has tested the system against pre-established standards, and has certified that the system meets the criteria in terms of detection capabilities and throughput.
- Explosive Ordnance Disposal – To render safe either improvised or manufactured explosive devices by the use of technically trained and equipped personnel.
- Explosives Trace Detector – As used in this document, a device that detects tiny amounts of particle and/or vapor forms of explosives. In a different context of passenger scheduling,
- ETD means —estimated time of departure.
- Exclusive Use Area – That part of an AOA for which an aircraft operator has agreed in writing with the airport operator to exercise exclusive security responsibility under an approved security program.
- Foreign Air Carrier Model Security Program – An FAA-approved security program as required by 14 CFR Part 129.25. The FACMSP is the security program most often used by scheduled passenger or public charter foreign air carriers landing in or taking off from the United States.
- Federal Security Director (FSD) – TSA representative who is the local point of contact for Aviation Department security.
- Federal Inspection Services (FIS) (CBP)(U.S.) – APHIS, FWS, INS, PHS, USCS
- General Aviation (GA) – That portion of civil aviation that encompasses all facets of aviation except aircraft operators holding a Certificate of Conveyance and Necessity from the FAA and large aircraft commercial operators.
- Ground Transportation – Staging Area Location where taxis, limos, buses and/or other ground transportation vehicles are staged prior to the terminal.
- Hijacking – The exercising, or attempt to exercise, control over the movement of an aircraft by the use of force, threats, or other actions, which if successfully carried out, would result in the deviation of an aircraft from its regularly scheduled route.
- Hub – An airline terminal and airport used to transfer passengers to and from a large number of connecting flights.

- International Civil Aviation Organization (ICAO) – A specialized agency of the United Nations whose objective is to develop the principles and techniques of international air navigation and to foster planning and development of international civil air transport.
- Identification – Use of methods such as badges, signs or markers to identify persons, vehicles and/or property.
- Incendiary – Any substance that can cause a fire by ignition (flammable liquids, gases, or chemical compounds).
- Interline Baggage – Baggage of passenger's subject to transfer from the aircraft of one operator to the aircraft of another in the course of the passenger's travel. Isolated
- Parking Position – An area designated for the parking of aircraft suspected of carrying explosives or incendiaries to accommodate responding law enforcement and/or EOD personnel in search efforts.
- Landside – That area of an airport and buildings to which the public has access.
- Law Enforcement Officer – An individual authorized to carry and use firearms, vested with such police power of arrest as determined by Federal Law and State Statutes.
- Metal Detector (magnetometer) – An electronic detection device approved for use by the FAA to detect metal on the person of people desiring access beyond the screening point. May be walkthrough or hand-held type.
- Origin & Destination – Airport operational type (as opposed to Transfer/Hub).
- Off-Airport Facility – Refers to a passenger or cargo transport terminal at an urban population center at which processing facilities are provided prior to arrival at airport.
- Perimeter – The outer boundary of an airport, also a boundary that can separate areas controlled for security purposes from those that are not.
- Port of Entry – For Customs and Immigration requirements.
- Positive Passenger Bag Match – A generic term for any FAA-approved method used to match the passenger who has boarded an aircraft to the baggage that the passenger has checked for carriage aboard that aircraft. The intent is to ensure that a passenger's checked baggage is flown only if the passenger is actually on board that flight.
- Public Area – That portion of the airport which includes all public real estate and facilities other than the air operations area and those sterile areas downstream of security screening stations. (See also, —landside).
- Sabotage – The intentional and willful damage or destruction of civil aviation-related goods or property, either on the ground or in the air.
- Standard Busy Rate – Calculation method for screening point peak volume.
- Security Screening – A systematic examination by detection procedures or facilities (electronic or physical search) of persons and property for the purpose of detecting weapons and other dangerous devices and to prevent their unauthorized introduction into sterile areas or onboard aircraft.
- Security Parking Area – An aircraft stand where aircraft threatened with unlawful interference may be parked pending resolution of the threat. Also known as —hot spot.
- Secured Area – That portion of an airport identified in the FAA-approved airport security program in which the most definitive levels of access control and security training are required under FAR 107.201. Generally, this area includes a portion of the landside, and encompasses the passenger handling facilities at and around the passenger terminal. An airport may have

several unconnected secured areas, which may include baggage makeup areas, movement areas, safety areas, etc.

- Security Program – Measures adopted to safeguard civil aviation against acts of unlawful interference.
- Selectee – Persons whose baggage is selected for further scrutiny by any of a variety of criteria and processes.
- Display Area – Those areas of the airport, sometimes smaller than the AOA and often focused near the terminal and the passenger aircraft boarding facilities, which generally require more stringent security provisions than the AOA. This area requires display of airport-issued identity badges, which in turn require detailed employment histories and other checks of individuals who have unescorted access to the area.
- Security Screening Checkpoint – A checkpoint area established to conduct security screening of persons and their possessions prior to their entering a sterile or secured area.
- Sterile Area – That area of an airport, generally within the terminal, to which access is controlled by the inspection of persons and property in accordance with an approved security program. They are typically located where passengers wait to board departing aircraft, or persons wait to meet arriving aircraft.
- Taxiway – A paved surface over which aircraft taxi to and from a runway, a hangar, etc.
- Terminal – A building or buildings designed to accommodate the enplaning and deplaning activities of aircraft operator passengers.
- Threat – A threat is any indication, circumstance or event with the potential to cause loss of or damage to an asset. It can also be defined as the intention and capability of an adversary to undertake actions that would be detrimental to U.S. interest. There are six primary sources of threats: Terrorist, Criminal, Insider, Foreign Intelligence Service, Foreign Military, and Environmental; as defined by the CIA.
- Analytical Risk Management Program Treat Containment Unit – Any of a wide variety of devices intended to be used to contain wholly or in part the blast effects of an explosive device. TCUs may be stationary, or may be part of a system by which an explosive device may be transported.
- Typical Peak Hour – Passengers Calculation method for screening point peak volume.
- Tenant Security Program – An arrangement permitted under FAR 107.113. The airport operator and a tenant (other than an aircraft operator regulated under FAR 108 or 129) may enter voluntarily into an agreement in which the tenant assumes responsibility for certain requirements under FAR 107; however, only the airport operator may provide law enforcement support. Under a Tenant Security Program (TSP) the airport must take on the inspection and compliance role normally performed by the FAA. The FAA, in turn, will oversee the airport's conduct of the program.
- Vulnerable Area – Any facility or area on or connected with an airport, which, if damaged or otherwise rendered inoperative would seriously impair the functioning of an airport.

B.4 Airport/Aviation Acronyms

- BIAP – Airport Border Integrity Antiterrorism Program
- A/C – Advisory Circular
- ACAMS – Access Control and Alarm-Monitoring System
- ACCS – Air Carrier Standards Security Program (ACSSP)

- ADA – Americans with Disabilities Act
- ADO – (FAA) Airports District Office
- ADP – Average Day Peak Month
- AOA – Air Operations Area
- APHIS – Animal and Plant Health Inspection Service (U.S. Department of Agriculture)
- APL – Airport Perimeter Limit
- ARFF – Aircraft Rescue and Fire Fighting
- ASC – Airport Security Coordinator
- ASP – Airport Security Program
- ATC – Air Traffic Control
- ATCT – Airport Traffic Control Tower
- ATF – Bureau of Alcohol, Tobacco and Firearms (U.S.)
- ATO – Airport Ticket Office
- ATSA – Aviation and Transportation Security Act
- AVSEC – Aviation Security Contingency Measures
- BDPH – Busy Day/Peak Hour
- BHR – Busy Hour Rate
- BHS – Baggage Handling System
- BIDS – Baggage Information Display Systems
- BMA – Baggage Makeup Area
- BOCA – Building Officials Code Authority
- CAPPS – Computer-Assisted Passenger Pre-Screening System
- CBP- U.S. Customs and Border Patrol
- CCTV – Closed Circuit Television (System)
- CFR – Code of Federal Regulations
- CP – Airport Emergency Command Post
- DOE – Department of Energy (U.S.)
- ECAC – European Civil Aviation Conference
- EDS – Explosives Detection System
- EOD – Explosive Ordnance Disposal
- EMS – Emergency Medical Services
- ETD – Explosives Trace Detector
- FACMSP – Foreign Air Carrier Model Security Program
- FAR – Federal Aviation Regulation (U.S.)
- FBI – Federal Bureau of Investigation (U.S.)
- FBO – Fixed Base Operator
- FCC – Federal Communications Commission (U.S.)
- FDA – Food and Drug Administration (U.S.)
- FPM- Feet Per Minute

- FSD – Federal Security Director
- FEMA – Federal Emergency Management Agency (U.S.)
- FIDS – Flight Information Display Systems
- FIS – Federal Inspection Services (U.S.) APHIS, FWS, INS, PHS, USCS
- FWS – Fish and Wildlife Service (U.S.)
- GA – General Aviation
- GSEM – Ground Services Equipment Maintenance (Facility)
- GTSA – Ground Transportation Staging Area
- HIRL –High Intensity Runway Lights
- HVAC – Heating, Ventilation and Air-Conditioning
- IATA – International Air Transport Association
- IAB – International Arrivals Building
- ICAO – International Civil Aviation Organization
- ICBO – International Conference of Building Officials
- ID – Identification
- IED – Improvised Explosive Device
- INS – Immigration and Naturalization Service (U.S.)
- IT – Information Technology
- JACC – Joint Agency Coordination Center (FIS)
- K-9 – Canine Team
- LAN – Local Area Network
- LIRL – Low Intensity Runway Lights
- LOS – Level of Service
- LEO – Law Enforcement Officer
- MIRL – Medium Intensity Runway Lights
- MITL –Medium Intensity Taxiway Lights
- MUFIDS- Multi-User Flight Information Display System
- NAVAID – Navigational Aid
- NCIC – National Crime Information Center
- NFPA – National Fire Protection Association
- O&D – Origin & Destination
- PBFM – Passenger and Baggage Flow Model
- RGL –Runway Guard lights
- PAPI– Precision Approach Path Indicator.
- PHS – Public Health Service (U.S.)
- PLASI– Pulse Light Approach Slope Indicator
- PIL – Primary Inspection Lines (FIS)
- PIN – Personal Identification Number
- POE – Port of Entry

- PPBM – Positive Passenger Bag Match
- PSS – Physical Security System
- RF – Radio Frequency
- RFI – Radio Frequency Interference
- RFID – Radio Frequency Identification
- RTCA – Radio Technical Commission for Aeronautics
- SAFR – Systematic Assessment of Facility Risk
- SBCC – Southern Building Code Congress International
- SBR – Standard Busy Rate
- SIDA – Security Identification Display Area
- SOC – Security Operations Center
- SSCP – Security Screening Checkpoint
- TCU – Threat Containment Unit
- TMS – Terminal Management System
- TPHP – Typical Peak Hour Passengers
- TSA – Transportation Security Administration
- TSP – Tenant Security Program
- TPHP – Typical Peak Hour Passengers
- VASI–Visual Approach Slope Indicator
- VPN – Virtual Private Network
- WAN – Wide-Area Network
- Other Applicable Codes, Regulations, Ordinances, Standards, Etc.

B.5 Mechanical Abbreviations and Acronyms

- (E) Existing
- (N) New
- ACP Asbestos Cement Pipe
- ADD Additional, Addition
- ADJ Adjacent
- AFC Above Counter. (Install 4" above splash or counter or at height as indicated on drawings)
- AFD Adjustable Frequency Drive
- AFF Above Finished Floor
- AFG Above Finished Grade
- ALT Alternate
- ASTM American Society For Testing And Materials
- AUX Auxiliary
- AVG Average
- AZ Azimuth
- B, BLDG. Building

- B.S. Black Steel
- BLDG Building
- BLVD Boulevard
- BTUH British Thermal Units Per Hour
- CAB Cabinet
- CALC Calculated, Calculations
- CFM Cubic Feet Per Minute
- CIP Cast Iron Pipe
- CL Centerline
- CO Clean Out
- CONC. Concrete
- CONST. Construction
- CONT. Continued, Continuous, Control
- CTR Center
- CU Copper
- DB Dry Bulb Temperature
- DEG. Degree
- DET. Detail
- DIA. Diameter
- DIM. Dimension
- DIP Ductile Iron Pipe
- DN Down
- DWG Drawing
- E East
- EA. Each
- EDS Environmental Control System
- EL Elevation (Ht)
- ELEC. Electrical
- ENGR. Engineer
- EQ. Equal
- ESMT Easement
- ESP External Static Pressure
- EX. Existing
- EXP. Expansion
- EXT. Exterior
- F Degrees Fahrenheit
- FAA Federal Aviation Administration
- FACP Fire Alarm Control Panel
- FBO Furnished By Other Section

- FF Finished Floor
- FH Fire Hydrant
- FLR. Floor
- FT OR (‘) Foot Or Feet
- FT. FT or (‘) and Foot, Feet
- G Gas
- GA Gauge
- GAL Gallon
- GALV Galvanized
- GPM Gallons Per Minute
- GV Gas Valve, Gate Valve
- HD Head, Heavy-Duty
- HORZ. Horizontal
- HP High Point, Horsepower
- HR Hour
- I.D. Inside Diameter
- ID. Identification
- IN OR (") IN or (“) and Inch, Inches
- INV. Invert
- IP Iron Pipe
- K KIP, 1000 Pounds
- KW Kilowatts
- LT Left
- LTG Lighting
- M.L. Match Line
- MATL Material
- MAX Maximum
- MDL Midway, Middle
- MEAS. Measure
- MECH Mechanical
- MFR. Manufacturer
- MH Manhole
- MIN. Minimum, Minute
- MISC. Miscellaneous
- MSL Mean Sea Level
- MTD Mounted
- N North
- N.I.C Not In Contract
- N.T.S. Not To Scale

- NA Not Available
- NOM Nominal
- O.C. On Center
- O.D. Outside Diameter
- OSA Outside Air
- PD Pressure Drop
- PERP. Perpendicular
- PH Phase
- PIV Post Indicator Valve
- POS Positive
- PVC Polyvinyl Chloride
- QTY Quantity
- RCP Reinforced Concrete Pipe
- REF Reference
- REQD. Required
- RPM Revolution Per Minute
- RT Right
- ROW Right Of Way
- S South
- SCHED. Schedule
- SF Square Foot
- SP Static Pressure
- SPECS. Specifications
- SQ Square
- SQ. FT. Square Feet
- SS Sanitary Sewer, Stainless Steel
- STD Standard
- STL Steel
- STRUCT. Structural
- TEMP. Temperature
- TYP. Typical
- U.F. Under Floor
- U.O.N. Unless Otherwise Noted
- U/G Underground
- UNO Unless Noted Otherwise
- USCFCCC&HR University Of Southern California Foundation For Cross-Connection
Control And Hydraulic Research
- V Volt
- VA Voltampere

- VAV Variable Air Volume
- VERT. Vertical
- W West
- W/ With
- WC Water Column
- XFMR Transformer

B.6 Electrical Abbreviations and Acronyms

- (E) Existing
- (N) New
- A, AMP Amperes
- APS Arizona Public Service
- ADD Additional, Addition
- ADJ Adjacent
- AF Amperes Frame
- AFC Above Finished Counter
- AFF Above Finished Floor
- AFG Above Finished Grade
- ALT Alternate
- ANSI American National Standards Institute
- ASTM American Society For Testing And Materials
- AT Amperes Trip
- AUX Auxiliary
- BC Bare Conductor
- BLDG Building
- C Conduit
- CAB Cabinet
- CALC Calculated, Calculations
- CB Circuit Breaker
- CCTV Closed Circuit Television
- COP City Of Phoenix
- CKT Circuit
- CLR. Clear Or Clearance
- CO Conduit Only
- CONT. Continued
- CT Current Transformer
- CU Copper
- DWG Drawing
- EA Each

- EC Empty Conduit With Pull Wire
- EI Electrical Interlock
- ELEC Electrical
- ELEV. Elevator
- ENGR. Engineer
- F/I Furnish & Install
- FAA Federal Aviation Administration
- FAAP Fire Alarm Annunciator Panel
- FACP Fire Alarm Control Panel
- FBO Furnished By Others
- G/GND Ground
- GFI Ground Fault Interrupting
- GR Ground Rod
- HH Handhole
- HP Horsepower
- ICEA Insulated Cable Engineers Association
- IEEE Institute Of Electrical And Electronic Engineers
- JB Junction Box
- KA Kiloamp
- KV Kilovolts
- KVA Kilovolt-Amperes
- KVAR Kilovolt-Amperes Reactive
- KW Kilowatts
- LED Light Emitting Diode
- LIS Load Interrupter Switches
- LL Line-to-Line
- LN Line, Line-to-Neutral
- LTG Lighting
- M Meter, Metered
- MECH Mechanical
- MH Manhole
- MISC Miscellaneous
- MS Meter Socket
- MTD Mounted
- MVA Mega Volt Amperes
- NIC Not In Contract
- NTS Not To Scale
- NA Not Available
- NC Normally Closed

- NEC National Electrical Code, NFPA 70
- NEG Negative
- NFPA National Fire Protection Association
- NECA National Electrical Contractors Association
- NL Nightlight
- NO Normally Open
- PB Pull Box
- PF Power Factor
- PH Phase
- PNL Panel
- PP Power Pole
- PT Potential Transformer
- PVC Polyvinyl Chloride
- QTY Quantity
- REV Revision
- RGS Rigid Galvanized Steel
- SF Square Foot
- SHT Sheet
- SN Solid Neutral
- SP Spare
- SPECS. Specifications
- SQFT Square Feet
- STD Standard
- SUB Substation
- SW Switch
- SWBD Switchboard
- SWGR Switchgear
- TB Telephone/Terminal Box
- TEL Telephone, Telecommunication
- TL Twist lock
- TPP Telephone Power Pole
- TS Time Switch
- TTB Telephone Terminal Board
- TVSS Transient Voltage Surge Suppressor
- TYP Typical
- UF Under Floor
- UG Underground
- UB Utility Box
- UNO Unless Noted Otherwise

- UNSW Unswitched
- UL Underwriters Laboratory
- UPS Uninterruptible Power System/Supply
- V Volt, Voltage
- VA Voltampere
- W/ With
- WP Weatherproof (NEMA 3R)
- XFMR Transformer

Appendix C: Technology Specifications

The following specifications are available on the Airport website “Shareport” in PDF format. These specifications are available in “Word” format from the Project Manager. The following links only work if used on an Aviation computer that has access to the shareport network.

[16741 – PWDS](#)

[16745 – Local Area Network](#)

[16770 – Paging System](#)

[16781 – MUFIDS](#)

The following specifications are considered Sensitive Security Information and can be obtained from the Project Manager on an as needed basis provided proper clearance has been obtained.

[16200 – ACAMS](#)

[16780 – Video Surveillance](#)

[167xx – AVI System Expansion](#)

Appendix D: Project Deliverables

1 SECTION 1 – GENERAL

1.1 Introduction

This document defines the minimum requirements for drawings and documents prepared by the Designer for the Phoenix Sky Harbor International Airport (Owner). Complex systems or structures may require greater detail or larger scales to adequately define the scope of work.

1.2 Drawing Sizes

All drawings shall be on 30"x42" sheets unless specifically approved otherwise in writing by the Owner. The Owner may accept 36"x24" drawings on small tenant projects only or as required by specific permitting agencies.

1.3 CADD Requirements

All drawings shall be delivered in the currently shipping and software versions of commercial off-the-shelf CADD software packages and shall comply with all the requirements defined in the PSHIA CADD/BIM Data Standards found at <http://skyharbor.com/about/GisStandards.html>.

Prior to the commencement of any document preparation, the Designer is required to review with the Owner's Engineering Department the current CADD Standards and requirements as defined in PSHIA CADD/BIM Data Standards. Any proposed deviations or modifications to the requirements defined in PSHIA CADD/BIM Data Standards including proposed changes to the schematic methodology of file naming, layering, sheet numbering and standard symbols, shall be submitted in writing for the Owner's Engineering Department for approval prior to the start of any production activities (see process for deviation in PSHIA CADD/BIM Data Standards)

1.4 Document Requirements

All documents shall be prepared in Microsoft Office 2002 format. Narrative documents shall be prepared in Microsoft Word 2010____, in Arial true type font and 11 point character size. Specifications shall be prepared in the same format as the Division 0 and 1 through 16 Guide Specifications provided by the Owner. Spreadsheets shall be prepared in Microsoft Excel 2010____ or higher, schedules shall be prepared in Microsoft Project ____ and database documents shall be prepared in Microsoft Access _____. Primavera, Version 6, will be acceptable under specific conditions, but only with the prior written approval of the Owner.

1.5 Cover Sheet

The first sheet in each drawing set shall be the Owner's standard cover sheet which will include the project name and address, the project number, the Designer's and Sub consultant's name, addresses and phone numbers, and other project information. The Owner will supply the PHX cover sheet background to the Designer in electronic format.

1.6 Titleblock Sheet

The Owner will supply the standard title block sheet to the Designer in electronic format. The Designer is responsible for completing all attributes.

1.7 Submittals

- .1 Unless otherwise approved by the Owner in writing, design documents are required to be submitted to the Owner at 30%, 60%, 95% and 100% complete. The Owner will review each submittal and conduct a technical review meeting with the Designer and various Owner Departments. The Designer shall respond to all of the Owner's comments in writing, in a format that includes the original comment, the resolution of the comment and reference to the drawing or specification paragraph(s) that resolves the comment. Comments, responses shall be returned to the Owner within 14 calendar days.
- .2 The 95% submittal is defined as the Designer's 100% complete design, but prior to the Owner's final review.
- .3 All submittals shall be in the quantity and format defined on the Deliverables Matrix PHX____. The 30%, 100%, conformed and record document submissions shall also include all drawings in AutoCadd files on 3.5" diskettes or CD-ROM (see PHX____ for specific electronic requirements). Electronic transfer of files via modem/Internet will be considered by the Owner on a project-by-project basis.
- .4 Each submittal shall be indicated on every document and drawing in a revision block, which documents the status of the drawing or document back to its original issue. At 100%, the revision block shall be cleaned, and the block revised to indicate that the drawings have been issued for construction.
- .5 The 100% submittal shall incorporate all Owner's comments from the 95% submittal and shall be completed prior to issuance of bid documents.

1.8 Bid Documents

The Bid Documents consist of the 100% submittal, plus all addenda, if any, issued during the period that bids are advertised.

1.9 Permit Documents

All documents and drawings prepared by the Designer for submittal to permitting authorities shall be signed and sealed by the Designer's Arizona registered professional engineer and/or architect. Documents and drawings prepared for submission to the City of Phoenix shall first be submitted to the Owner's Engineering Department for application of a permit submission approval stamp. After the Owner has stamped and signed the permit submittal, it will be returned to the Designer for delivery to the City for permitting. Any addenda issued during the bid period, and all Modifications during construction of the Work, shall also be submitted to the City by the Designer for modification to the original permit submittal, according to the same procedures defined for the original permit submittal.

1.10 Executed Contract Documents

The Designer shall compile for the City all Addenda (printed on yellow paper), bid forms from the successful bidder's proposal, the Performance and Payment Bonds and insurance certificates into the Project Manual. This manual will be for the contractual signatures for full execution of the Construction Contracts.

1.11 Conformed Documents

- .1 After the construction contractor has been selected, the Owner will request the Designer to prepare Conformed Documents. The Conformed Documents shall consist of the 100% submittal, updated to reflect all changes made by bid addenda, if any, plus specific information and documents submitted by the successful bidder.
- .2 The Designer shall insert the bid forms from the successful bidder's proposal, the Performance and Payment Bonds, and insurance certificates into the Project Manual.
- .3 The Designer shall incorporate all changes made to the 100% submittal drawings in bid addenda, if any, and re-plot the revised drawings. All such revisions shall be clouded with the appropriate revision number indicated in each cloud. The revision number in the title block on each revised drawing shall be raised to the next number, with the note "Conformed Drawing, issued for Construction" indicated in revision block. If no changes occurred to the drawing, the "conformed drawings" will be Revision 1 to that drawing.
- .4 The Designer shall also incorporate and update all of the 100% submittal specifications which were revised by bid addenda, if any, by lining through deleted text and bolding new text.
- .5 The Designer shall then supply the Owner with the required number of sets of Conformed Documents for execution, and for construction.

1.12 Record Documents

After completion of construction, the Contractor shall provide to the Owner a complete set of as-built drawings and documents that have been redlined to indicate all changes made during the construction of the Project. The Designer shall incorporate all the changes defined on these as-built drawings and documents onto the Conformed Documents to produce a complete set of drawings and documents which reflect the as-built condition. The Designer shall submit the completed Record Documents to the Owner, with drawings submitted on CD-ROM, plus one set of direct MYLAR plots made from the final CD-ROM. Each drawing sheet shall have a "Record Drawing" statement as follows:

RECORD DRAWING

These "record drawings" show significant changes in the Work made during construction. This information provided by the Contractor via "marked-up prints, drawings and other data" has been incorporated into the drawing by the Designer.

The Contractor's Redlined As-Built Drawings are to be turned back over to the Owner with this package. Project Manual documents are to be submitted to the Owner in electronic format on the final CD-ROM. The CADD Layering Matrix shall be submitted in a bound hard copy and electronically on the final CD.

1.13 Design Requirements - Codes and Standards

All design work shall comply with all applicable federal, state and local codes, including the Arizona Codes and ADA. All existing conditions within the area which will be affected by the Work or impacted by construction of the Work, including structures, equipment, systems, devices, materials, etc. shall be upgraded to comply with current codes and the Owner's specifications unless a written variance is issued by the Owner. Proposed variances shall be submitted by the Designer to the Owner in writing on a timely basis requesting Owner's approval of the proposed variance. All such upgrading work shall be clearly identified on the drawings.

1.14 Key Plan

All drawings shall have a properly marked Key Plan and a North directional arrow, except for details, schedules, risers, etc.

1.15 Designer's Qualifications

All design work shall be performed under the supervision of, and signed and sealed by, professional engineers and/or architects registered in Arizona for each appropriate discipline. All fire protection system designs in the terminal complex shall be performed under the supervision of, and signed and sealed by a professional fire protection

engineer (having passed a separate certification exam specifically for fire protection design) registered in Arizona.

1.16 Deliverables Matrix

A typical Deliverables Distribution Matrix is included as PHX____. The project specific Deliverables Matrix will be provided to the Designer through the Owner's Project Manager. The Project Manager will fill in the department, names of staff members, and agencies that are to be provided documents throughout the Project. The Designer will distribute all documents and drawings for submittal to bidders and plan rooms. All other documents and drawings will be reproduced and submitted by the Designer to the Owner for distribution.

2

3 1.17 Verification of Information on Owner's Record Drawings

The Designer shall review the Owner's existing library of Record Drawings to identify all applicable Record Drawings that may apply to the Project. The Designer shall field verify and correct all information shown on these Record Drawings which is applicable to the Project prior to using the drawings in the new design work for the Project. The Designer shall also notify the Owner in writing of all inconsistencies that may be discovered on the Record Drawings, and shall correct these inconsistencies accordingly.

1.18 Verification of Existing Conditions

The Designer shall investigate and verify all existing conditions at the Project site. Existing structures, systems, utilities, infrastructure and all other existing conditions both above and below ground which might affect the design, construction or operation of the Project shall be investigated on site by the Designer and documented by the Designer on the Drawings prepared for the Project. The Designer is responsible for providing all necessary means and methods for this verification, and if the verification requires either destructive means or access to normally restricted or inaccessible areas, the Designer shall advise the Owner in writing and request Owner's written direction.

4

1.19 Designer's Opinion of Probable Construction Cost

5 The Designer shall prepare and submit an updated opinion of probable cost with each Submittal (30%, 60%, 95%), in accordance with the Agreement. This estimate shall be prepared in the standard format required by Owner. The estimate based on the 95% Submittal shall be updated based on Owner's comments and resubmitted as the 100% opinion of probable construction cost. If at any submittal, the estimate indicates that the construction cost will exceed Owner's Budget, the Designer shall notify the Owner in writing with a detailed explanation of the cause of the cost overrun, and recommendations on how to reduce the estimated cost back within Owner's budget for the Project. The Designer shall coordinate with the Owner's Independent Cost Estimator for all estimates as established in the Agreement.

1.20 Analyze Requirements of Governmental Authorities

Identify all the permitting requirements for the construction and operation of the facility and provide the listing to the authority at the 30% design submittal. The Permit Listing shall include a schedule of when the permits will be required for the Project.

6 SECTION 2 - DOCUMENTS

The Designer shall prepare and submit the documents defined in Table 1 for all disciplines. The Designer shall coordinate the work among the various disciplines to ensure that duplication of information is minimized and consistency is maximized among the work produced by the various disciplines.

7 SECTION 3 - DRAWINGS

3.1 Architectural Drawings

The Designer shall prepare and submit, as a minimum requirement, the drawings defined in Table 2. Architectural drawings shall include the following information:

- .1 Wall ratings must be clearly shown on all plans. All specific wall penetrations are to be called out.
- .2 Floor ratings must be clearly shown on all plans. All specific floor penetrations are to be called out.
- .3 All fire rated assemblies and penetrations shall have the rating agency's assembly number identified.
- .4 All building systems shall be fully engineered.

3.2 Mechanical Drawings

The Designer shall prepare and submit, as a minimum requirement, the drawings defined in Table 3. Mechanical drawings shall include the following information:

- .1 Documents shall identify all existing Building Automation System (BAS) raceways, piping, valving, BAS controls, identification, etc. within the area of renovation which does not comply with the Owner's current standards and project specifications, and shall identify the method of correction required.
- .2 All systems shall be fully engineered. Modifications to fire protection systems shall be performed by a registered fire protection engineer (having passed a separate state registration exam specifically for fire protection) and shall include hydraulic calculations if the area affected is within a hydraulically remote area as defined on existing fire protection drawings, or if required by the Building Official.

- .3 Interception, connection and extension of existing piping shall be shown in detail. The practice of simply providing note or arrow showing the relocation is not acceptable.
- .4 Systems plans shall clearly reflect all components necessary to perform function and interface with infrastructure. Items/equipment to be provided by other/separate contract, etc. shall be dashed and clearly shown, and noted as to whom is providing when, etc. as though it is one complete system to ensure all necessary components are specified and connections to/from are provided.

3.3 Electrical Drawings

The Designer shall prepare and submit, as a minimum requirement, the drawings defined in Table 4. Electrical drawings shall include the following information:

- .1 Final renovation floor plans shall reflect all existing devices, circuitry, equipment, etc. within area of renovation and/or lease space. Existing shall be denoted on renovation plans "dashed". Renovation plans shall reflect all electrical devices and associated equipment, circuitry, cabling, etc. that will exist after renovation.
- .2 Existing devices, device plates, equipment, etc. to remain active shall be upgraded or replaced, if necessary, to comply with current Owner's standards and project specifications, and/or be relocated or replaced to comply with applicable codes and standards (including raceway sizing, method of installation, supporting, connector types, identification, fire stopping, expansion fittings, etc.).
- .3 Documents shall identify all existing raceways, circuitry, cabling, identification, etc. impacted within area of renovation that does not comply with Owners standards/project specification and identify method of correction required.
- .4 Fixture schedule shall specify complete manufacturer catalog number, lamp type, ballast, trims, mounting accessories, fusing, etc.
- .5 Interception, connection and extension of existing circuitry shall be shown in detail. The practice of simply providing note or arrow showing relocation is not acceptable.
- .6 All systems shall be fully engineered. Modifications to fire alarm panels, paging, etc. shall clearly specify work required; i.e., power supplies, equipment, etc.
- .7 All mechanical equipment and associated components to be shown; i.e., 120V damper connections, 120V BAS panel connections, disconnects, starters, fire alarm controls, etc.

- .8 Reflect work in a concise manner that will effectively permit project phasing.
 - .9 Systems plans shall clearly reflect all components necessary to perform function and interface with infrastructure. Items/equipment to be provided by other/separate contract, etc. shall be dashed and clearly shown, and noted as to whom is providing when, etc. as though it is one complete system to ensure all necessary components are specified and connections to/from are provided.
 - .10 All systems plans and risers diagrams shall be fully designed including conduit system, conductors, cabling, termination board elevations, outlet details, rack elevations, etc.
 - .11 Conduit for all systems, including the Building Automation System, shall be shown on the plans with a clear indication of who will install it.
 - .12 Design must comply with the requirements of the _____ Code for Building Construction. Provide calculations required by same.
 - .13 Fire alarm systems equipment shall be shown on the plans along with the points of connection to the existing system.
 - .14 Plans to include all new and/or existing fire alarm smoke control devices, damper control relays/devices and door control devices in area of project.
- 3.4 Civil/Structural Drawings

The Designer shall prepare and submit, as a minimum requirement, the drawings defined in Table 5. Table 5 includes requirements for architectural, roadway and airfield civil/structural design. Regardless of the type of work included in the project, the Designer shall include the following information on the drawings:

- .1 Show the project location with respect to overall Airport property and the Airport grid.
- .2 Show all field verified existing infrastructure, including all structures, pavement and utilities (above and below ground), and clearly define what is to be removed, modified or left in place unchanged.
- .3 Show tie-in locations and details for interface between all new work and all existing work, including details defining how to maintain operation of critical utilities and infrastructure during construction.
- .4 Define all information required by permitting authorities, including the City of Phoenix, the Arizona Department of Environmental Protection (ADEP), the Arizona Department of Transportation (ADOT), the Federal Aviation

Authority (FAA), Maricopa County, Arizona, the City of Phoenix and all other authorities with jurisdiction over the project site.

- .5 Show each phase of the Work to define the phasing requirements.
- .6 Clearly define all Work required.

3.5 Landscape/Irrigation Drawings

The Designer shall prepare and submit, as a minimum requirement, the Drawings defined in Table 6. Landscape Drawings shall include the following information:

- .1 Show all landscaping and irrigation required for the Work, including all plants, trees, shrubs, sod, piping and control systems, etc.
- .2 Clearly define the interface between existing and new irrigation system piping and control systems.
- .3 Clearly define the irrigation system zones, piping and control systems.
- .4 Clearly define the type, location and quantity of each plant, shrub, tree, sod, etc. required for the project.

SECTION 4 – RELATED DOCUMENTS

8 4.1 Related Documents

See Tables Below:

Table 1 – Document Requirements – All Disciplines

Table 2 – Architectural Drawing Requirements

Table 3 – Mechanical Drawing Requirements

Table 4 – Electrical Drawing Requirements

Table 5 – Civil Drawing Requirements

Table 6 – Structural Drawing Requirements

Table 7 – Landscaping/Irrigation Drawing Requirements

Table 8 – Work Breakdown Structure (WBS),

Table 8.1, Top Level WBS

Table 8.2, Level 2, WBS at the System Description Level

Table 8.3, Level 3, WBS at the Sub-component Details Level

TABLE 1: SAMPLE DOCUMENT REQUIREMENTS – ALL DISCIPLINES

Document	Description	30%	60%	95%
Front-End Documents				
- Division 0	Furnished complete by Owner with input by the Designer	Preliminary	Complete	Final
- Division 1	Furnished by Owner on CD ROM; to be modified by the Designer for project specifics.	Identify and show sections requiring modifications	Complete	
Specifications				
Division 2 – 44	Required for all equipment, material, devices, finishes, special construction, special testing, etc.; 3 Part CSI format. Block paragraph format not allowed.	Table of Contents for proposed specifications required, outline narrative for each spec including products list.	All specs, edited for project, redlined documents acceptable provided that all requirements are defined.	Final
Calculations				
- Arizona Energy Efficiency Code	As required by Code	Preliminary	Complete	All calculations to be organized into binders with tabs identifying each major
- Design Calculations	All calculations required to support design, including mechanical, electrical, civil, structural, piping, design, ductwork design, electrical design, hydraulic calculations for hydraulically remote areas, and as defined by the Owner.	Preliminary	Complete , In Progress	type of calculation, subdivided into individual equipment and systems.
Schedules				
- Testing	All testing and special inspections required by drawings and specifications, in table format. Identify specification section number, paragraph number, test description, observer (control number and test date by Contractor).	Format started	Outline	Final
- Submittals		Format started	Outline	Final

TABLE 1: DOCUMENT REQUIREMENTS – ALL DISCIPLINES (Continued)

Document	Description	30%	60%	95%
Construction Cost Estimate	Detailed opinion of probable construction cost, broken down by discipline, subdivided into major equipment and systems, in Owner's standard format.	Reconciled with independent estimator	Reconciled with independent estimator	Reconciled with independent estimator
Construction and Operating Permits	Provide technical criteria, written descriptions design data application forms and schedule of required permits		Final	Final
Environmental Permits	Provide technical criteria, written descriptions design data application forms and schedule of required permits	Preliminary Environmental Permit Application	Final Completed Environmental Permit	Complete

TABLE 2: ARCHITECTURAL DRAWING REQUIREMENTS

* Follow drawing sheet identifier convention used in Section 5.2.3 in the PSHIA CADD Data Standards, found at the following link: <http://skyharbor.com/about/GisStandards.html>

Dwg. No.	Title	Scale	General Contents	30%	60%	95%
*	Cover Sheet	NTS	Background provided by Owner. Indicates project name, number, address, designer's name & address, and other project data.	Complete	Complete	Final
*	Legend & Notes	NTS	Defines all legends & symbols used on drawings (PHX Standard legend). List code analysis and building classification. Plus general notes and overall drawing index.	Standard legend & Index	Plus General Notes	Final
*	Map Sheet	1"=40'	Indicates project location, location of staging areas, contractor's office/trailer, etc. Projects located in the AOA require a safety plan per FAA AC150/5370-2C.	Shows project location.	Complete	Final
*	Overall Plan(s)	1"=40'	Shows project location with respect to overall building for all levels affected by project.	Complete	Complete	Final
*	Phasing Plan(s)	1"=40'	Shows all phases of project with notes describing work required on each phase.	Conceptual	Clearly define each phase plus description	Final
*	Life Safety/Egress Plan(s)	1"=40'	Shows all exit/egress means fire rated walls and travel distances with notes.	Conceptual	Complete	Final
*	Existing/Demolition Floor Plans	1/8"=1'	Shows all existing conditions and defines all areas requiring demolition, with details.	Fully verified	Fully verified.	Final
*	Existing/Demolition Reflected Ceiling Plans	1/8"=1'	Shows all existing reflected ceiling details, and defines all ceiling areas requiring demolition.	Fully verified	Fully verified.	Final
*	Floor Plan(s), Enlarged Plans, Roof Plans	1/8"=1'	Shows existing construction (screened), all new construction, including walls, doors, windows, equipment, finishes, millwork and all special requirements, ADA requirements, tenant separation requirements. Plans shall include room schedules with room reference numbers marked at each space. Show column lines, expansion joints and rating for floors, walls and ceilings.	Concept with all new walls, equipment.	Finishes, millwork, dimensions, etc.	Final
*	Reflected Ceiling Plan(s)	1/8"=1'	Shows existing construction (dashed), all new HVAC, fire protection, lighting, sprinklers, finishes.	Concept with layout, lighting, A/C, Finishes, fire protection.	Show all systems in graphic form.	Final
*	Equipment/Furniture Plans	TBD	Shows all equipment & furniture, contractor & Owner provided.	Show major items	Show all items	Final
*	Elevation(s)	1/4"=1'	Elevations of all walls/spaces to define vertical construction.	-----	All spaces & walls	Final

**TABLE 2: ARCHITECTURAL DRAWING REQUIREMENTS
(con't)**

* Follow drawing sheet identifier convention used in Section 5.2.3 in the PSHIA CADD Data Standards, found at the following link: <http://skyharbor.com/about/GisStandards.html>

Dwg. No.	Title	Scale	General Contents	30%	60%	95%
*	Section(s)	1/4"=1'	Building cross section & wall sections to define construction details, finishes.	-----	Cross section/walls	Final
*	Schedule(s)	NTS	Include schedules of rooms, doors, windows, walls, flooring, special construction.	-----	Preliminary	Final
*	Detail(s)	As required	Doors, windows, flooring, fire stopping, special construction.	-----	Major details	Final
*	Miscellaneous	As required		-----	-----	As needed.

TABLE 3: MECHANICAL DRAWING REQUIREMENTS

* Follow drawing sheet identifier convention used in Section 5.2.3 in the PSHIA CADD Data Standards, found at the following link: <http://skyharbor.com/about/GisStandards.html>

Dwg. No.	Title	Scale	General Contents	30%	60%	95%
*	Mechanical Legend	NTS	Legend and all symbols, including PHX standard legend, index of all sheets, all abbreviations.	Sheet index, symbols, legend, general notes	Updated	Final
*	Overall HVAC Plan(s)	1"=40'	Show project location with respect to building, major new & existing infrastructure, ductwork and HVAC systems, piping. Use as background for mechanical plans.	Show major new & existing equipment, tie-ins, concept ductwork, pipe over 4"	Show all piping, chilled water, ductwork.	Final
*	HVAC Phasing Plan(s)	As required	Show phasing, means to keep existing systems active, temporary systems.	Concept	Final	Final
*	Existing HVAC Plan(s)	1/8"=1'	Show all existing ductwork, dampers, controls, thermostats, chilled water piping, cooling towers, etc.	Partially verified	Fully verified	Final
*	HVAC Plan(s)	1/8"=1'	Ductwork layout; location of diffusers, dampers, controls/sensors; coils, fans, piping, chillers, utilities; control system diagrams, valves.	Mechanical equipment room size, location of major equipment, HVAC thermostat locations, conceptual layout of major ductwork and piping systems; preliminary control system diagrams.	Double line layout of ductwork, location of all diffusers, intakes, coils, fans, piping and control system diagrams.	Final
*	Enlarged HVAC Plan(s)	1/4"=1'	Same content as HVAC Plan(s), as required by Scope of Services or for clarity.	Same as HVAC Plan(s).	Same as HVAC Plan(s).	Same as HVAC Plan(s).
*	HVAC Sections	As required	Sections of mechanical equipment rooms.	Preliminary	Complete	Final
*	HVAC Riser Diagrams	NTS	Major equipment and one line interconnection diagram showing all sources of hot, chilled and domestic water, power, control devices and action, cooling/heating flow requirements.	Preliminary	Complete	Final

*	HVAC Details	As required	Diffuser connections, coil connections, ductwork details and supports, piping details and supports, fan details.	-----	In process	Final
---	--------------	-------------	--	-------	------------	-------

TABLE 3: MECHANICAL DRAWING REQUIREMENTS (con't)

* Follow drawing sheet identifier convention used in Section 5.2.3 in the PSHIA CADD Data Standards, found at the following link: <http://skyharbor.com/about/GisStandards.html>

Dwg. No.	Title	Scale	General Contents	30%	60%	95%
*	HVAC Schedules	NTS	HVAC fixture and device schedules, including capacities, motor horsepower, utility requirements.	-----	In process	Final
*	Controls	NTS	Device and wiring diagrams for building automation systems.	-----	In process	Final
*	Plumbing Legend	NTS	Legend and all symbols for plumbing, including PHX standard legend, index of all sheets, all abbreviations.	Complete	Updated	Final
*	Overall Plumbing Plan(s)	1"=40'	Show project location with respect to building, major existing and new infrastructure systems, including all plumbing systems. Use as background for plumbing plans.	Show major new and existing equipment, tie-ins, concept plumbing.	Show all new and modified plumbing	Final
*	Plumbing Phasing Plan(s)	As required	Show phasing, means to keep existing systems active, temporary systems.	Concept	Complete	Final
*	Existing Plumbing Plan(s)	1/8"=1'	Show all existing domestic and sanitary piping systems, fixtures. Identify existing systems to be modified or demolished.	Verified	Complete	Final
*	Plumbing Plan(s)	1/8"=1'	Plumbing system layout, including all domestic and sanitary piping, fixtures, equipment, valves, connections to existing systems.	Major equipment and fixtures, concept piping runs	Double line layout of all equipment, fixtures, piping, tie-ins	Final
*	Enlarged Plumbing Plan(s)	1/4"=1'	Same content as for Plumbing Plans as required for clarity or by Scope of Services	Same as Plumbing Plans	Same as Plumbing Plans	Final
*	Plumbing Riser Diagram	NTS	Major equipment and fixtures, sources of domestic water, destination for sanitary systems, tie-ins to existing	Preliminary	Updated	Final

			systems, domestic and sanitary demands.			
*	Plumbing Details	As required	Equipment, fixtures, connections, specialty fittings, pipe supports, clean outs, tie-ins to existing systems, water heaters.	-----	In process	Final

TABLE 3: MECHANICAL DRAWING REQUIREMENTS (con't)

* Follow drawing sheet identifier convention used in Section 5.2.3 in the PSHIA CADD Data Standards, found at the following link: <http://skyharbor.com/about/GisStandards.html>

Dwg. No.	Title	Scale	General Contents	30%	60%	95%
*	Fire Protection Legend	NTS	Legend and all symbols for Fire Protection Systems, including PHX Standard legend, index of all sheets, all abbreviations.	Complete	Updated	Final
*	Overall Fire Protection Plan(s)	1"=40'	Show project location with respect to building, major existing and new infrastructure systems, including all fire protection system piping, devices and equipment.	Major new and existing equipment, tie-ins, concept piping, device locations	Complete	Final
*	Fire Protection Phasing Plan(s)	As required	Show phasing, means to keep existing systems active, temporary systems.	Concept	Complete	Final
*	Existing Fire Protection Plan(s)	1/8"=1'	Show all existing fire protection system piping, sprinklers, devices. Identify existing systems to be modified or demolished.	Verified	Complete	Final
*	Fire Protection Floor Plan(s)	1/8"=1'	Fire protection system layout, including all piping, sprinklers, devices, valves, connections to existing systems, supports.	Major equipment, concept piping routing, fixtures, zones	Double line layout of all piping, sprinklers, fixtures	Final
*	Enlarged Fire Protection Plan(s)	1/4"=1'	Same content as Fire Protection Plans as required for clarity or by Scope of Services	Major equipment, concept piping routing, fixtures, zones	Double line layout of all piping, sprinklers, fixtures	Final
*	Fire Protection Section(s)	As required	Sections of chase areas and major equipment/piping locations, and as required to define work.	Preliminary	Updated	Final
*	Fire Protection Riser Diagram	NTS	Identifies zones, single line piping diagram, sprinklers,	Preliminary	Updated	Final

			devices, tie-ins to existing systems, demands, utilities.			
*	Fire Protection Details	As required	Equipment, sprinklers, specialty fittings, pipe supports, tie-ins to existing systems.	-----	In process	Final
*	Fire Protection Schedules	NTS	Sprinklers, piping, fittings, devices, pipe supports, equipment, utility requirements demands.	-----	In process	Final

TABLE 4: ELECTRICAL DRAWING REQUIREMENTS

* Follow drawing sheet identifier convention used in Section 5.2.3 in the PSHIA CADD Data Standards, found at the following link: <http://skyharbor.com/about/GisStandards.html>

Dwg. No.	Title	Scale	General Contents	30%	60%	95%
*	Electrical Legend	NTS	Legend and all symbols for electrical systems, including PHX standard legend, index of all sheets, all abbreviations.	Complete	Updated	Final
*	Overall Electrical Plan(s)	1"=40'	Show project location with respect to building, major existing and new infrastructure systems, including all major electrical equipment, devices, wiring, raceways.	Major new and existing equipment, tie-ins, raceways, wiring, devices		
*	Phasing Plan(s)	As required	Show phasing plan, means to keep existing systems active, temporary systems.	Concept	Complete	Final
*	Existing Power Plan(s) Existing Lighting Plan(s) Existing Systems Plan(s) Existing Lighting Protection Plan	1/8"=1' 1/8"=1' 1/8"=1' 1/8"=1'	Show all field verified existing conditions, including all power, lighting, systems (fire, security, CCTV, sound/paging, voice/data, MATV, BIDS/FIDS/MUFIDS, CUTE, radio, and lightning protection systems, etc.). Show all equipment, devices, raceways, wiring, etc. Demolition plans shall show all walls, etc. to be removed, all existing systems to be removed or modified.	Partially verified	Fully verified	Final
*	Power Plan(s) Lighting Plan(s) Systems Plan(s) Lightning Protection Plan(s)	1/8"=1' 1/8"=1' 1/8"=1' 1/8"=1'	Show all lighting, power leads, equipment, devices, systems (fire, security, CCTV, sound/paging, MATV, BIDS/FIDS/MUFIDS, CUTE, radio, lightning protection, etc.). Show all circuited devices, equipment, raceways, wiring, system panels (panelboards, switchboards, generators, UPS systems, switchgear, transformers, fire alarm headend, lighting relay panel, bldg. Automation control panel communications panels, telecom closets, etc.), power one-line diagram, grounding diagram, fire alarm one-line diagram, communication systems one-line diagrams.	Major new and existing equipment locations w/clearances shown, tie-ins, preliminary demand load calculation for normal & emergency power in table form on dwg., Florida Energy Code clcs. In table form on dwg., preliminary lightning protection system, preliminary	Fixture schedule, device layout (receptacles, data/phone, fire alarm, lighting, controls, CUTE, BIDS/FIDS, public address, security system, bldg. Automation system, power system device locations, etc.), switchboard schedules, power loads, lightning and	All devices circuited, all system devices shown, raceway size, feeder size, branch circuit sizes, AIC ratings, panelboard amperage, complete one-line diagrams, complete panel schedules

				system panel locations	grounding one-line diagram	
--	--	--	--	------------------------	----------------------------	--

TABLE 4: ELECTRICAL DRAWING REQUIREMENTS (con't)

* Follow drawing sheet identifier convention used in Section 5.2.3 in the PSHIA CADD Data Standards, found at the following link: <http://skyharbor.com/about/GisStandards.html>

Dwg. No.	Title	Scale	General Contents	30%	60%	95%
*	Enlarged Power Plan(s) Enlarged Lighting Plan(s) Enlarged Systems Plan(s) Enlarged Lightning Protection Plan(s)	1/4"=1' 1/4"=1' 1/4"=1' 1/4"=1'	Same as above except enlarged as required for clarity or by Scope of Services	Same as above	Same as above	Same as above
*	Power Riser Diagram	NTS	One line diagram including all tie-in points, normal and emergency service size (amps/volts/phase), available fault currents at each panel and at transformer, KW metering, power required for each device, normal & emergency in amps, KVA, volts & phase.	Show all major equipment, all power sources, power requirements for all systems	Also show tie-ins and service conditions (volts/phase/amps)	Final

*	Lighting Riser Systems Riser Lightning Protection Riser	NTS NTS NTS	A separate riser diagram is required for each major system included in project. Show all major equipment, devices, panels, power sources on a one line diagram. Include all power requirements (normal and emergency) for each device and equipment item (amps, KVA, volts, phase) and all tie-ins to existing systems.	Show all major equipment, all power sources, power requirements for all systems.	Show tie-ins	Final
*	Feeder Schedules	NTS	Schedule for all feeders, indicating source and termination of each feeder, cable type and size, cable load (volts, amps), cable number.	-----	Preliminary	Final
*	Panel Schedules	NTS	A separate schedule is required for each panel, distribution center, motor control center, etc. on the project, both new and existing if modified on the project. Show branch devices, load descriptions for each circuit, connect load for each circuit and overall panel (amps & KVA), demand load for each circuit and overall panel, MCO/MBO size, AIC rating. Modifications to existing panels shall show all existing conditions and a separate schedule showing panel after modifications	-----	Panel and loading schedules for all panels, distribution centers, MCOs, etc.	Final

TABLE 4: ELECTRICAL DRAWING REQUIREMENTS (con't)

* Follow drawing sheet identifier convention used in Section 5.2.3 in the PSHIA CADD Data Standards, found at the following link: <http://skyharbor.com/about/GisStandards.html>

Dwg. No.	Title	Scale	General Contents	30%	60%	95%
*	Details	As required	Systems details, grounding systems, fire stopping, supports, lightning protection, control/interlock wiring diagrams, conduit trapeze supports, millwork connections, mounting details, lighting/ceiling connections, etc.	-----	Updated standard details	Final

	Calculations	N/A	<p>Furnish complete calculations for the power distribution system from furthest connecting power panel associated with the Project including: demand load analysis (existing & new loads included), feeder sizing, short-circuit/interruption calculations. For life safety circuits and emergency power circuits, provide similar demand load calculations and complete load shedding rankings and requirements</p>	-----	Updated standard details	Final
--	--------------	-----	---	-------	--------------------------	-------

TABLE 5: CIVIL DRAWING REQUIREMENTS

* Follow drawing sheet identifier convention used in Section 5.2.3 in the PSHIA CADD Data Standards, found at the following link: <http://skyharbor.com/about/GisStandards.html>

Dwg. No.	Title	Scale	General Contents	30%	60%	95%
	Computation Book (Civil/Structural)	N/A	<u>All Projects:</u> Contains all computations and tabulations required to substantiate the quantities required for each pay item used on the project; supports the pay item quantities. <u>Roadway Projects:</u> Include standard computation forms as described in the ADOT Basis of Estimates for calculating design quantities for contract pay items.	N/A	N/A	N/A
*	Cover Sheet* *Need determined by project.	NTS	Background provided by Owner, indicates project name, number, address, Designer's name & address, and other project data.	Complete	Complete	Final
*	Legend and Notes	NTS	Define all legends and symbols used on Drawings plus general notes and overall drawing index.	Legend and Index	Plus General Notes	Final
*	Map Sheet	1"=40'	Project Location, Location of Staging Areas, Contractor's Office, etc.	Shows Project Location	Complete	Final
*	Summary of Pay Items	NTS	Plan Sheet indicating all bid items, with total quantities for each bid item.	-----	Preliminary (item numbers with descriptions)	Final
*	Survey	varies				
*	Overall Site Plan	varies 1"=1000' max.	<u>All Projects:</u> Overall layout for project, including survey reference and control points; site access; haul routes; control points; tie-in locations to existing facilities and plan/profile sheet numbers and area covered by each. <u>Roadway and Airfield Projects:</u> Include horizontal alignment, stationing, and show all mainline and crossroads ramps.	Preliminary	Complete	Final

TABLE 5: CIVIL DRAWING REQUIREMENTS (con't)

* Follow drawing sheet identifier convention used in Section 5.2.3 in the PSHIA CADD Data Standards, found at the following link: <http://skyharbor.com/about/GisStandards.html>

Dwg. No.	Title	Scale	General Contents	30%	60%	95%
*	Demolition Plan	Same as plan and profile	Shows all existing conditions and indicates all items requiring removal, relocation and/or other disposition.	Preliminary	Complete	Final
*	Plan/Profiles	H1"=20' or 1"=40' or 1"=50' V1"=2' or 1"=5'	<p><u>All Projects - Plans:</u> survey reference and control points; baseline of survey; property, lease and/or right-of-way (ROW) boundaries; centerline of construction; existing topography; all existing and proposed new above and below ground utilities, including storm sewer, sanitary sewer, water, power, communication, etc.; detention and retention ponds; dimensions for all new work, modifications to existing work and reference to datum.</p> <p><u>Roadway and Airfield Projects - Plans:</u> include stationing with beginning and end stations; curve radii and data (incl. super elev.); horizontal geometrics; widths of pavement, shoulders and ROWs; taper/transition lengths..</p> <p><u>All Projects - Profiles:</u> - existing and final ground lines with grades; all utilities; bench marks; existing ground line w/ elevations; all utilities and structures; high water elevations.</p> <p><u>Roadway and Airfield Projects - Profiles:</u> vertical curve data; drainage structures; mainline storm, sanitary and water pipes; special ditches, cross drains, ditch gradients with flow direction identified.</p>	Preliminary	Updated	Final
*	Special Profiles	H varies: 1"=10' or 1"=20' V varies: 1"=1' or 1"=2'	Ramp profile; intersection profile; curb return profiles; access and frontage road profiles; non-standard super-elevation diagram.	Preliminary	Preliminary	Final
*	Back-of-Sidewalk Profiles	H1"=100' V1"=5' or H1"=20'/ 1"=50' V1"=2'	Cross-street locations and elevations; drainage flow direction arrows; back-of-sidewalk profile grades and vertical curve info; bldg. floor elevations with offset distance; existing driveway locations & details; super-elevation details.	Preliminary	Preliminary	Final

*	Interchange Layout	H1"=200'	Curve data including super-elevation and design speed; coordinate data; fence location; access and/or frontage roads with dimensions and R/W; topography; existing features.	Preliminary	Preliminary	Final
---	--------------------	----------	--	-------------	-------------	-------

* **TABLE 5: CIVIL DRAWING REQUIREMENTS (con't)**

*	Title	Scale	General Contents	30%	60%	95%
*	Ramp Terminal Details	H1"=20'	Preliminary geometrics; radii, transition/taper lengths; ramp and crossroad intersection station and angle; limits of construction; R/W; drainage structures; spot elevations; roadway dimensions.	N/A	Preliminary	Final
*	Intersection Layout/Details	H1"=20'	Geometrics including dimensions, radii, offsets, station pluses and taper/transition lengths; limits of proposed construction alongside roads; storm sewer pipes including sizes; cross drains with structure numbers and pipe sizes; applicable notes.	Preliminary	Preliminary	Final
*	Typical Details		<u>All Projects</u> : foundation details: special details. <u>Roadway and Airfield Projects</u> : Include mainline and crossroad typical; special details; standard notes; traffic data; cross slopes; typical pavement sections.	Preliminary	Complete	Final
*	Cross Section Pattern Sheet	H1"=200'	Interchange layout; access and frontage roads; mainline and ramp stationing; ramp baselines with nomenclature and stationing; cross section location lines.	N/A	Preliminary	Final
*	Cross Sections	H1"=20' V1"=5'	Proposed template with profile grade elevation; R/W; begin and end stationing for project, construction & earthwork, bridge & bridge culvert; special ditch bottom elevation; equivalent stations for ramps & mainline; soil borings; water table; extent of unsuitable material.	Preliminary	Preliminary	Final
*	Clearing & Grubbing Plan	scale same as plan and profile	Limits by station and dimension of selective clearing and grubbing; show extent and type of clearing using standard symbols and notes; may be shown on plan profile sheets	N/A	Preliminary	Final
*	Grading Plan	1"=50' max	Define current and required topography and grade lines over entire project site.	Preliminary	Updated	Final
*	Drainage	H1"=100/ 200' V1"=5'/1" =10'	<u>Plan View</u> - drainage divides & ground elevations; drainage areas & flow directions; high water info; existing structures & pipes; preliminary horizontal alignment; detention and/or retention ponds. <u>Profile View</u> - profile grade & existing ground lines.	Preliminary	Complete	Final
*	Retention/Detention Pond	1"=50'	<u>Plan View</u> - all retention/detention ponds; all inlets, outlets, structures, pipes, edge treatment, etc.	Preliminary	Complete	Final

	Layout & Details		<u>Details</u> - cross sections of pond defining grades, profiles, construction; details of control devices, set points, etc.			
--	------------------	--	---	--	--	--

TABLE 5: CIVIL DRAWING REQUIREMENTS (con't)

Dwg. No.	Title	Scale	General Contents	30%	60%	95%
*	Interchange Drainage Map	1"=100' or 1"=200'	Interchange configurations; preliminary interchange drainage with drainage areas and flow direction arrows; ramp baselines and stationing; right-of-way lines.	Preliminary	Updated	Final
*	Summary of Quantities and Box Culvert Data	N/A	Quantity of boxes; box culvert data sheets; standard notes for summary of quantities sheet; pay item notes.	N/A	N/A	Final
*	Summary of Drainage Structures	N/A	Location, size, length, number, and type of drainage structures.	N/A	Preliminary	Final
*	Drainage Structures	H1"=10' V1"=5'	Profile grade elevation; drainage structures with numbers; underground utilities; specification sections; r/w lines; construction notes; flow arrows; structure numbers and location station.	N/A	Preliminary	Final
*	Lateral Ditch Plan/Profile	H1"=20', 40', 50' or 100'	<u>Plan</u> - existing topography, drainage structures, utilities; roadway centerline; existing and/or survey ditch centerline; proposed ditch centerline with stationing; ditch centerline intersection stations; ditch PI stations with deflection angle; bearings of ditch and mainline centerlines; R/W lines; proposed drainage structures; storm sewer pipes. <u>Profile</u> - benchmark information; existing ground line; proposed ditch profile with grades; high water elevations; existing utilities; proposed drainage structures; storm sewer pipes with size; overland flow or overtopping; typical section.	N/A	Preliminary	Final
*	Lateral Ditch Cross Section	H1"=5' V1"=5'	Existing ground line; survey centerline and elevation; proposed template with ditch bottom elevation; R/W; begin and end ditch and excavation stations; earthwork quantities; existing utilities.	N/A	Preliminary	Final
*	Borrow Pit Soil Survey	V1"=5'	Soil data (classification, mechanical properties, etc.); project specific.	N/A	Preliminary	Final
*	Roadway Soil Survey	V1"=5'	Soil data (classification, mechanical properties, etc.); project specific.	N/A	Preliminary	Final

*	Traffic Control Plans	$\geq 1"=100'$	Site specific traffic control plan; detour plan; phasing plan, ROW - existing & additional, if required; existing utilities.	Preliminary	Preliminary	Final
*	Utility Plan-Profile	varies	Mainline plan-profile; proposed utility horizontal and vertical locations.	N/A	Preliminary	Final

TABLE 5: CIVIL DRAWING REQUIREMENTS (con't)

Dwg. No.	Title	Scale	General Contents	30%	60%	95%
*	Utility Adjustment	same as plan and profile sheets	All existing utilities highlighted; proposed and relocated utilities; disposition of all existing utilities; curb and gutter or edge of pavement; drainage structures; R/W; street names.	N/A	Preliminary	Final
*	Signing and Marking Plans	scale same as plan and profile	Basic roadway geometrics; end stations; conflicting utilities, lighting or drainage; pavement markings; delineators; guide sign worksheet; overhead sign cross section and support structure; sign locations; typical pavement marking sheet; applicable pay items.	N/A	Preliminary	Final
*	Signalization Plans	$1"=20'$	Basic roadway geometrics; conflicting utilities, lighting or drainage; signal pole location; type and location of loops; type and location of signal heads; pedestrian signal; location of top bars; location of pedestrian crosswalks; applicable pay items.	N/A	Preliminary	Final
*	Roadway Lighting Plans	$\geq 1"=100'$	Pole data and legend sheet: each pole by number with location, arm length, mounting height, circuit number, roadway station and offset and luminaire wattage; design value for light intensities and uniformity ratios; legend and title sheet. Plan sheet: basic roadway geometrics; conflicting utilities, lighting or drainage; pay items; pole symbols at correct station location and approximate offset.	N/A	Preliminary	Final
*	Construction Phasing Plans	$1"=100'$ max	Includes general notes; identifies construction phasing, including overall work to be completed in each phase.	Preliminary	Updated	Final
*	Safety and Security Plans	$1"=100'$ max	Includes general notes defining safety and security during construction; identifies type and location of temporary and permanent barricades, gates, guard posts and other security and safety related requirements for each phase of construction in accordance with FAA AC150/5370-2, latest edition entitled "Operational Safety on Airports During Construction".	Preliminary	Updated	Final

*	Maintenance of Traffic Plans	1"=100' max	Defines traffic control requirements for each phase of construction, including type and location of barricades, temporary bypass or detours, direction of traffic flow, requirements for flagmen, etc.	-----	Preliminary	Final
---	------------------------------	-------------	--	-------	-------------	-------

TABLE 6: STRUCTURAL DRAWING REQUIREMENTS

* Follow drawing sheet identifier convention used in Section 5.2.3 in the PSHIA CADD Data Standards, found at the following link: <http://skyharbor.com/about/GisStandards.html>

Dwg. No.	Title	Scale	General Contents	30%	60%	95%
*	Structural Plans and Elevations		All required horizontal and vertical features.	Preliminary	Preliminary	Final
*	General Notes and Standard Details	N/A	<u>See Chapter ___ of ADOT Structures Manual</u>	Preliminary	Preliminary	Final
*	Soil Borings			Preliminary	Complete	Final
*	Foundation Layout			-----	Preliminary	Final
*	Foundation Details			-----	Preliminary	Final
*	End Bent Plan and Elevation		Show substructure elements and sizes, foundation type, and if piles or drilled shafts, show the spacing and the number.	Preliminary	Preliminary	Final
*	End Bent Details			-----	Preliminary	Final
*	Pier Plan, Elevation and Details		Show substructure elements and sizes, foundation type, and if piles or drilled shafts, show the spacing and the number.	Preliminary	Preliminary	Final
*	Finish Grade Elevations			-----	Preliminary	Final
*	Superstructure Plan		Include cross section showing lanes, shoulders, traffic railing, slab thickness, beam type and spacing and web depth for steel girders. Also, if applicable, show construction phases and maintenance of traffic data, outline of existing structure and portion to be removed, and utilities (existing and proposed).	-----	Preliminary	Final
*	Superstructure Section and Details			Preliminary	Preliminary	Final
*	Framing Plan			-----	Preliminary	Final
*	Miscellaneous Details (drainage, utilities, blast protection)		Project specific - box culvert plans, high mast lighting supports; traffic mast arm supports; signal strain poles; rest area structures or buildings; barrier walls (traffic or sound); approach slabs; retaining walls (CIP proprietary and temporary with control plan details; soil profile sheet; general details; geotechnical requirements.	-----	Preliminary	Final
*	Beam Sheets			-----	Preliminary	Final
*	Reinforcing Bar List			-----	Preliminary	Final

*	Sequence of Const			-----	Preliminary	Final
*	Approach Slabs			-----	Preliminary	Final
*	Retaining Wall Sheets		Preliminary control drawings shall be submitted when proprietary or standard cast-in-place walls are proposed.	Preliminary	Preliminary	Final

TABLE 7: LANDSCAPING/IRRIGATION DRAWING REQUIREMENTS

* Follow drawing sheet identifier convention used in Section 5.2.3 in the PSHIA CADD Data Standards, found at the following link: <http://skyharbor.com/about/GisStandards.html>

Dwg. No.	Title	Scale	General Contents	30%	60%	95%
*	Cover Sheet* *Need determined by project.	NTS	Background provided by Owner, indicates project name, number, address, designer's name & address and other project data	Preliminary	Updated	Final
*	Legend and Notes	NTS	Defines all legends and symbols used on Drawings plus general notes and overall drawing index.	Legend and Index	Plus General Notes	Final
*	Map Sheet	1"=40'	Project location, location of staging areas, contractor's office, etc.	Shows Project Location	Complete	Final
*	Summary of Pay Items	N/A	Plan sheet indicating all bids items with total quantities for each bid item.	-----	Preliminary (item nos. with descriptions)	Final
*	Overall Landscaping & Irrigation Site Plan	1"=1000' max	Defines overall landscaping requirements, including location of all plants/trees/shrubs/sod, irrigation systems, controls, etc. using Overall Civil Site Plan as a background.	Define locations for major landscaping, sodding	Define layout of beds and plant types	Final
*	Landscaping Plans/Profiles	1"=40'	Defines locations for all plants, type of plant (common name), quantities of each type of plants in each location, using Civil Plans/Profiles as backgrounds.	Preliminary	Complete	Final
*	Planting Details	NTS	Defines requirements for planting each type of plant or tree on the project.	-----	Preliminary	Final
*	Plant List	NTS	List all plants and trees required on project, with common and scientific names, size of each plant, quantity of each plant, spacing for each plant in tabular form.	-----	Preliminary	Final
*	Irrigation System Plans/Profiles	1"=40'	Defines layout of irrigation system, including definition of all zones, and for each zone, all piping, pipe sizes, material and schedules; tie-in locations; spray head sizes, types and locations; valve sizes, types and locations; control valve sizes, types and locations; using Landscaping Plans/Profiles as backgrounds.	-----	Show tie-in locations and major supply lines.	Final
*	Irrigation System Details	NTS	Defines details for tie-ins to existing piping and control systems; installation details; trenching details; etc.	-----	Preliminary	Final
*	Irrigation System Materials	NTS	Schedule of all materials required for irrigation system, including piping, fittings, valves, spray heads, etc. with quantities and specifications for each type of material.	-----	Preliminary	Final
*	Irrigation System Control Diagram	NTS	One line diagram showing controller, and all control/ communication elements, including tie-ins to existing systems.			

TABLE 7: LANDSCAPING/IRRIGATION DRAWING REQUIREMENTS (con't)

* Follow drawing sheet identifier convention used in Section 5.2.3 in the PSHIA CADD Data Standards, found at the following link: <http://skyharbor.com/about/GisStandards.html>

Dwg. No.	Title	Scale	General Contents	30%	60%	95%
*	Irrigation System Control Layout	1"=40'	Shows all cable runs, all control devices, tie-ins to existing systems, etc. using Irrigation System Plans/Profiles as a background.	-----	Preliminary	Final
*	Irrigation System Control Details	NTS	Shows installation details for control and communication devices, power supply, cable, cable trenches, etc.	-----	Preliminary	Final

Table 8.1, Top Level WBS

Table 8.2, Level 2, WBS at the System Description Level

Table 8.3, Level 3, WBS at the Sub-component Details Level

END