PHX DVT GYR

● CITY OF PHOENIX AVIATION DEPARTMENT

Technology Standard

Domain: GIS		Number: v1.1	Standard Title: GIS Data Standards	
Original Approval		11/03/2021	Last Updated/Approved	11/04/2021
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Owner		Aviation Department - Technology Division		

PURPOSE

All Geographic Information System (GIS) or Building Information Modeling (BIM) or Computer Aided Drawing and Design (AutoCAD) data created for the City of Phoenix, Aviation Department (AVN) must be developed and submitted according to the specifications documented in this Standard. The standard applies to any work that involves GIS data preparation for the Aviation Department. The objective is to standardize design deliverables so that data and drawing files received from multiple sources can easily be integrated into the AVN's GIS environment.

The GIS Data Standards document designed to give guidance on the formatting of GIS data required by AVN GIS Team (AVN GIS). AVN GIS has created these standards to not only unify all data deliverables, but to also enhance data through added fields and attribution. AVN GIS has published the GIS standards document at https://www.skyharbor.com/business/TenantsAndContractors/gis-standards, revisions to the document will be done on an annual basis, AVN GIS will also revise the standards on an as needed basis. Any work that involves providing GIS and/or AutoCAD data deliverables to the AVN should visit the above link to download the latest standards and follow them to produce the deliverables, the standards document can be distributed to 3rd parties that are performing the work.

The standards document provides general information about coordinates, different coordinate systems, and map projections. More importantly this document specifies the coordinate system and coordinate system metadata standards that are to be used for all spatial data developed within the projects that deliver GIS and/or AutoCAD data.

COORDINATE SYSTEM DEFINITION

Coordinates are the numeric representation of the location of spatial features on the Earth's surface. Each set of coordinates is defined by their coordinate system. A coordinate system is a set of rules that define the parameters for the coordinates contained within. To ensure data accuracy, all coordinates for features must be calculated utilizing the same rules (coordinate system) so as to ensure not only overall data accuracy, but accuracy in relation to other coordinates and features within the same system.

All spatial data developed for AVN will be developed in
NAD_1983_2011_StatePlane_Arizona_Central_FIPS_0202_Ft_Intl, using NAVD 88 for vertical

measurements, NAD 83 for horizontal measurements, and international feet as the units of measurements.

OVERVIEW OF THE STATE PLANE COORDINATE SYSTEM

All spatial data developed for the GIS Implementation Project will be in the State Plane Coordinate System (for detailed specifications see Section 4 - Specifications). This section will therefore give an overview of State Plane Coordinate System. The State Plane Coordinate System is also known as SPCS, SPC, State Plane, and State. It was originally designed by the U.S. Coast and Geodetic Survey in the 1930s to provide a basis for large scale mapping in the United States. The State Plane Coordinate System divides the United States and its territories into more than 120 sections called zones. Each state is covered by one or more zones. A Conformal projection is used to define geometric properties and depending on the individual shape of each state, different projection surfaces (method of construction) are used. For states that are longer east-west, such as Tennessee, a Lambert Conformal Conic projection is used. For states that are longer north-south, a Transverse Mercator (Cylindrical) projection is used. One exception to this rule is the state of Alaska which is projected using an Oblique Mercator projection to accommodate the angle of the Alaskan panhandle. When State Plane was originally introduced it was based on a network of geodetic control points known as North American Datum of 1927 (NAD 1927 or NAD 27). The advances in technology have increased the capabilities for measurement accuracy and that, together with the need for compatibility with global positioning satellite systems, made it necessary to update datum specifications. The new redefined and updated datum is called North American Datum of 1983 or NAD 83 and the State Plane Projections based on NAD 83 are called SPCS 83. Some changes have been also made in the number and size of certain zones, detailed information about all zones can be found from the National Geodetic Survey (NGS) website at http://www.ngs.noaa.gov. Unit of measure the standard unit of measure for SPCS 83 is the meter. Most states, however, support both meters and feet. In this case the feet-to-meter conversion is legalized and documented.

SPECIFICATIONS
Coordinate System

All data presented to AVN must be spatially referenced per the coordinate system listed below in Table 1.

Table 1: AVN GIS COORDINATE SYSTEM DEFINITION	
Arizona State Plane Coordinate System – Central Zone	
Projection	Transverse Mercator
False Easting	7000000.000000
False Northing	0.000000
Central Median	-111.916667
Scale Factor	0.999900
Latitude of Origin	31.0000000
Angular Unit	Degree
Linear Unit	International Foot (1ft = 0.3048)
Datum	D NAD 1983 2011
Spheroid	GRS 1980
Semimajor Axis	6378137.00000000000000000
Semiminor Axis	6356752.314140356100000000
Inverse Flatting	298.257222101000020000
Well Known Identifier	102991
Latest well-known identifier/ EPSG	6405
Well-Known Text	["NAD_1983_2011_StatePlane_Arizona_Central_FIPS_0202_Ft_Intl",GEOGCS["GCS_NAD_1983_2011",DATUM["D_NAD_1983_2011",SPHEROID["GRS_1980",6378137.0,298.257222101]],PRIMEM["Greenwich",0.0],UNIT["Degree",0.0174532925199433]],PROJECTION["Transverse_Mercator"],PARAMETER["False_Easting",700000.0],PARAMETER["False_Northing",0.0],PARAMETER["Central_Meridian",-111.9166666666667],PARAMETER["Scale_Factor",0.9999],PARAMETER["Latitude_Of_Origin",31.0],UNIT["Foot",0.3048],AUTHORITY["EPSG",6405]]
Vertical Measurements	
Vertical Datum	NAVD 88
Vertical Unit	International Foot (1ft = 0.3048)
GIS Working Extents	
Sky Harbor Operating Extent	minimum x = 659,876 minimum y = 879,224 maximum x = 683,999 maximum y = 890,782
GIS Non-Working Extents	
Sky Harbor Non-Operating Extent (Maricopa County)	minimum x =264,353 minimum y =551,866 maximum x =966,560 maximum y =1,109,342

DELIVERABLES

The preferred standard for GIS data deliverables to AVN is a File Geodatabase Format
The following guidelines shall be applied to all GIS Deliverables that will be submitted to AVN.

- Required Fields: All datasets will have the Required Fields found in Table 2 be added and populated before delivery.
- Z Enabled: All data must be Z enabled with proper elevations (See Table 2)
- Isolated Layers: AVN requires certain standard layers to be extracted from the CAD data and saved as its own Feature Class (See Data Library for layers and details in GIS Support Guide on page 9)
- Project Area Polygons: AVN requires a Polygon Feature Class named PROJECT_AREAS which will hold polygons capturing the entire extent of a project's Construction Boundaries.
- Data Transformations (Preexisting / Historical Data): If data requested by AVN is in a coordinate system other than what is found in Table 1; AVN requires that the data must be transformed to match Table 1 parameters, this requirement applies to any historical or preexisting datasets.
- AutoCAD Report: Please provide a simple spreadsheet with CAD Layer Identifiers (See GIS Support Guide on page 9)
- Preferred GIS File Formats accepted: Esri ArcGIS 10.6.1 or higher (**All data must be projected into the State Plane coordinate system and spatially referenced (see Table 1), resulting in their correct placement on the earth's surface when viewed in Esri products such as ArcMap, ArcCatalog, and ArcPro**)
  - File Geodatabase (FGDB) Feature Class
  - Shapefile
  - Lines, points polygons, annotation, and polylines
  - Multi-patch Feature Classes
  - Layers/Symbology/SLPK-Scene Layer Package
  - Data must have *Ground to Grid Correction*
- If AutoCAD is the main export, please apply the *Ground to Grid Correction* of the State Plane coordinate system (See table 1). A "mother" or base drawing minus the X-refs or layout view is required if AutoCAD data is the choice of format.
  - Need As-built quality data
  - To scale with base-points
  - Spatially referenced
  - PDF layouts for project reference
  - Provide projection file

Additional Required Fields & Preloading Attribution

Table 2: Required Fields

AVN requires the addition of certain fields and attribution to all GIS deliverables. See Table 2. These fields are required to preserve data integrity and serve additional internal purposes. The following fields need to be added to all GIS deliverables:

| Table 2: Required Fields				
Required Fields				
Field Name	Field Type	Example Attributes	Description	Applicable Domain
Airport	Text	See Domain: PHX, DVT, GYR	Airport Idenifier	CodeAirportName
LEVELID	Text	See Domain: L1, L2…	Floor Identifier (**See GIS SUPPORT PACKAGE: BUILDING NAVIGATOR**)	CodeLevelId
PRJ_Name	Text	AV0000087	Should be populated with Project Name or Identifier i.e. AV000025	NA
PRJ_Contractor	Text	Stantec	Name of Engineering Firm Performing Work	NA
PRJ_Percent	Integer	30, 60, 90	Should be populated with the current % the plans/as-builts are e.g. 30, 60, 90	NA
PRJ_Comp_Date	Date	10/15/2021	Should be populated with the date the construction was completed regardless of %	NA
PRJ_DWG_NAME	Text	APKGGATE.dwg	Name of CADD file data was extracted from	NA
PRJ_DWG_LYR	Text	C-BLDG-OUTL	Using CAD file naming conventions. Identifies what the Layer Name is in Drawing File	NA
SSI_DATA	Text	Yes/No	Yes or No: Is this Sensitive Security Information under 49 CFR 1520	NA
Width	Double	15.5	Width of Feature (In inches)	NA
Depth	Double	22.3	Depth of Feature (In inches)	NA
Length	Double	36.3	Length of Feature (In inches)	NA
Height	Double	24.6	Height of Feature (In inches)	NA
Diameter	Long Integer	12.6"	Diameter of Feature (In inches)	NA
Rotation	Double	125	Rotation of Feature (North Azimuth in degrees)	NA
Max_Elevation	Double	1102.5	Top of Feature Elevation (In Feet)	NA
Base_Elevation	Double	1100	Base of Feature Elevation (In Feet)	NA
X_Coordinate	Double	660855.2493	In Feet	NA
Y_Coordinate	Double	884749.2913	In Feet	NA
GUID	Global ID	{DA55CC45-4F63-4652-AD7D-00124D09C4F5}	Global ID created for Replications etc.	NA

BIM DATA SPECIFICATIONS

BIM data is a required deliverable for all projects, please contact AVN GIS to determine if a project qualifies for an exception

Specifications

Provide BIM data in one of the preferred acceptable formats
- o Revit (include any RPK files)
- o Industry Foundation Classes (IFC)

- **Approved 60%, 90% and 100% permit set drawings** be sent to AVN GIS as soon as available.
  - o *Layers to include at a minimum: Interior Walls, Exterior Walls, Structural Columns, Windows, Doors, and Building Footprint.*

- **As-builts** should be sent to AVN GIS as soon as completed, Floor Plan/Structural layers must be separate from full Overview Plans.
  - o *Layers to include at a minimum: Interior Walls, Exterior Walls, Structural Columns, Windows, Doors, and Building Footprint.*

- **Modeling Space**
  - o **Rooms**: The **Net Square Footage (NSF)** must be modeled for each functional room and space. Rooms must be represented and broken down into functional areas (e.g., Holding Room, Office Space, TSA Room, etc.) as defined by GIS Support Guide on page 9. A physical area may contain several functional areas that are treated as individual rooms, if two rooms have different functional space classifications, even though they are within the same physical area, they must be modeled as two separate spaces. For example, a security checkpoint area within a lobby that is not enclosed by walls must be defined as two separate non-overlapping spaces. **(see image 1)**
  - o AEs should consult with their BIM authoring application vendor to learn the recommended method for measuring room square footages as they apply to current BOMA Standards per the property type.
  - o Please contact AVN GIS for additional clarification and examples.

Image 1:
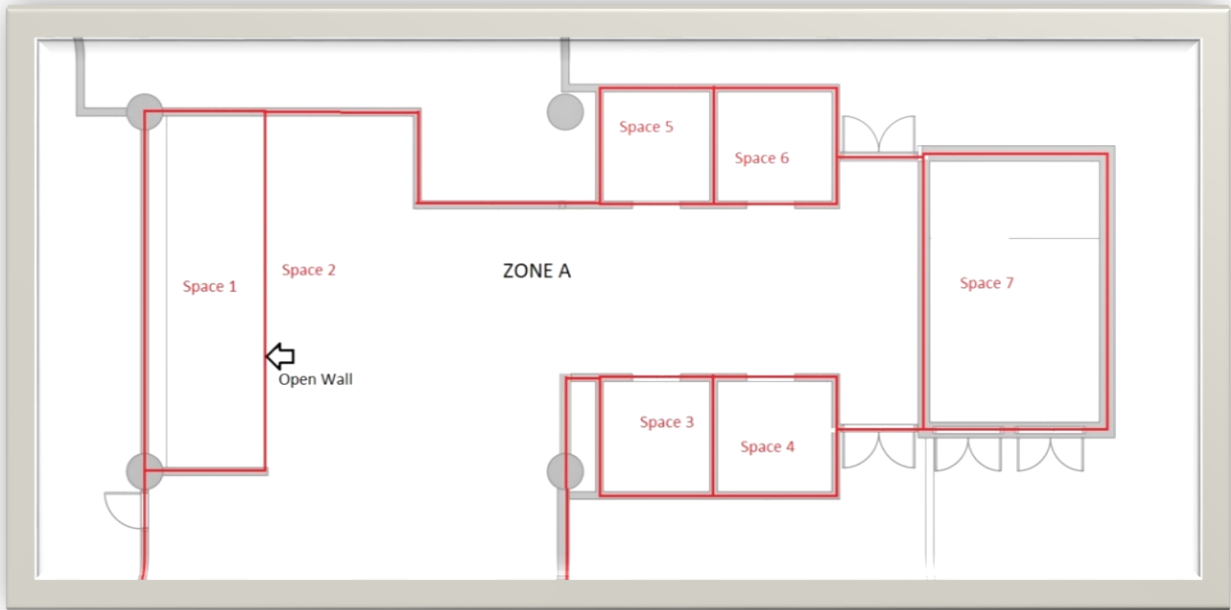
Project & Data Updates

As projects progress, As-builts grade data (in FGDB) are to be sent to AVN GIS as soon as they are completed. AVN GIS requires updated data at certain phases (percentage of Completion) of the Project's timeline. Specifically, these intervals will coincide with certain percentages of completion. See **Table 4** for details.

Table 4: Update Intervals	
Update Interval Percentages	
Percent Completion	Delivery Date
60% Plans	ASAP
90% Plans	ASAP
100% Plans	ASAP

SUBMITTING DATA DELIVERABLES

Delivery Guidelines & Contacts

- AVN will facilitate storing project deliverables in Unifier (Master Repository).
  - o **AutoCAD Files**
  - o **Plansheets**
  - o **All 2D, 2.5D & 3D, 4D (BIM)**
- AVN GIS will facilitate storing and maintaining all GIS related project deliverables.
  - o **Feature Classes**
  - o **File Geodatabases**
  - o **Shapefiles**

- o **Multipatch Feature Classes**
- o **Layers/Symbology/SLPK**

Delivery of data will be via e-mail, City of Phoenix File Transfer Protocol (FTP), or external drive. All data deliverables will be provided directly to both Design and Construction Division (DCS) and AVN GIS. All AutoCAD Master Drawings and plan sheets should be delivered directly to DCS. All GIS deliverables should be sent directly to AVN GIS**.**

Once data is ready to be submitted to AVN, please inform both AVN GIS and DCS that you are ready to make a submission. Use the contact information below to start the delivery process.

Exceptions for TI and JOC Projects Only:
All the exceptions to current GIS standards will be evaluated by GIS Manager on a case-by-case basis and a waiver will be issued if approved. All the exception requests must be submitted in writing to AVN GIS for evaluation during the start of the project initiation process.

QUALITY CONTROL

All data to be entered into the AVN's GIS environment be subjected to a quality control process to ensure that it is compliant with the standards. The submitter will perform an electronic, pre-submission quality control check of each spatial data deliverable. A report documenting the results of the quality control process shall be submitted with each spatial deliverable to the AVN.

RESOURCES/RELATED DOCUMENTS

AVN has developed a set of standards that define the specifications and format of geographic information that is to be received and used by the AVN.

• Adherence to these specifications is governed by airport policy - https://www.faa.gov/documentLibrary/media/Advisory_Circular/150-5300-18B-chg1-consolidated.pdf

• Computer Automated Design & Drafting Data Standards - (http://www.nationalcadstandard.org).

• National Geodetic Survey website - http://www.ngs.noaa.gov/

• Esri Essential 3D Analyst vocabulary - https://desktop.arcgis.com/en/arcmap/latest/extensions/3d-analyst/essential-3d-analyst-vocabulary.htm

• BOMA Standards - https://www.boma.org/BOMA/BOMA-Standards/Home.aspx

GIS SUPPORT GUIDE

AVN GIS will provide a support package including data library definitions, contact AVN GIS.

Project Limits Polygon

1st tab of the SUPPORT PACKAGE shows the project boundaries. The Project Limits Polygon layer will represent the full extent of all work performed. Attribution to be added to each Project Area Polygon is listed. Please create a single Project Limits Polygon for each individual project, the Project Limits Polygon layer will represent the full extent of all work performed, attribution to be added to each Project Area Polygon is listed. Please create a single Project Limits Polygon for each individual project.

Data Library

2nd tab of the SUPPORT PACKAGE shows the list of Feature Classes that are currently maintained in AVN GIS Database. These Feature Classes will need to be created from the projects AutoCAD data and loaded with the Required Fields.

Building Navigator

3rd tab of the SUPPORT PACKAGE illustrates how building layers are named. The tables also illustrate how different buildings interpret the levels.

CAD Dictionary Report

4th tab of the GIS SUPPORT PACKAGE demonstrates a brief report that should be delivered with any CAD data.

Common Domains

5th tab of the SUPPORT PACKAGE shows the most common domains used in Space Use Feature Classes.

BIM Disciplines

6th tab of the SUPPORT PACKAGE provides the most common disciplines expected in BIM deliverables. However, all data captured in the CAD data should be submitted regardless of whether its listed or not.

FAA 18B Feature Classes

7th tab of the SUPPORT PACKAGE lists all the current 18B Feature Classes. If work is performed on any FAA regulated areas, the Feature Classes must adhere to FAA guidelines.