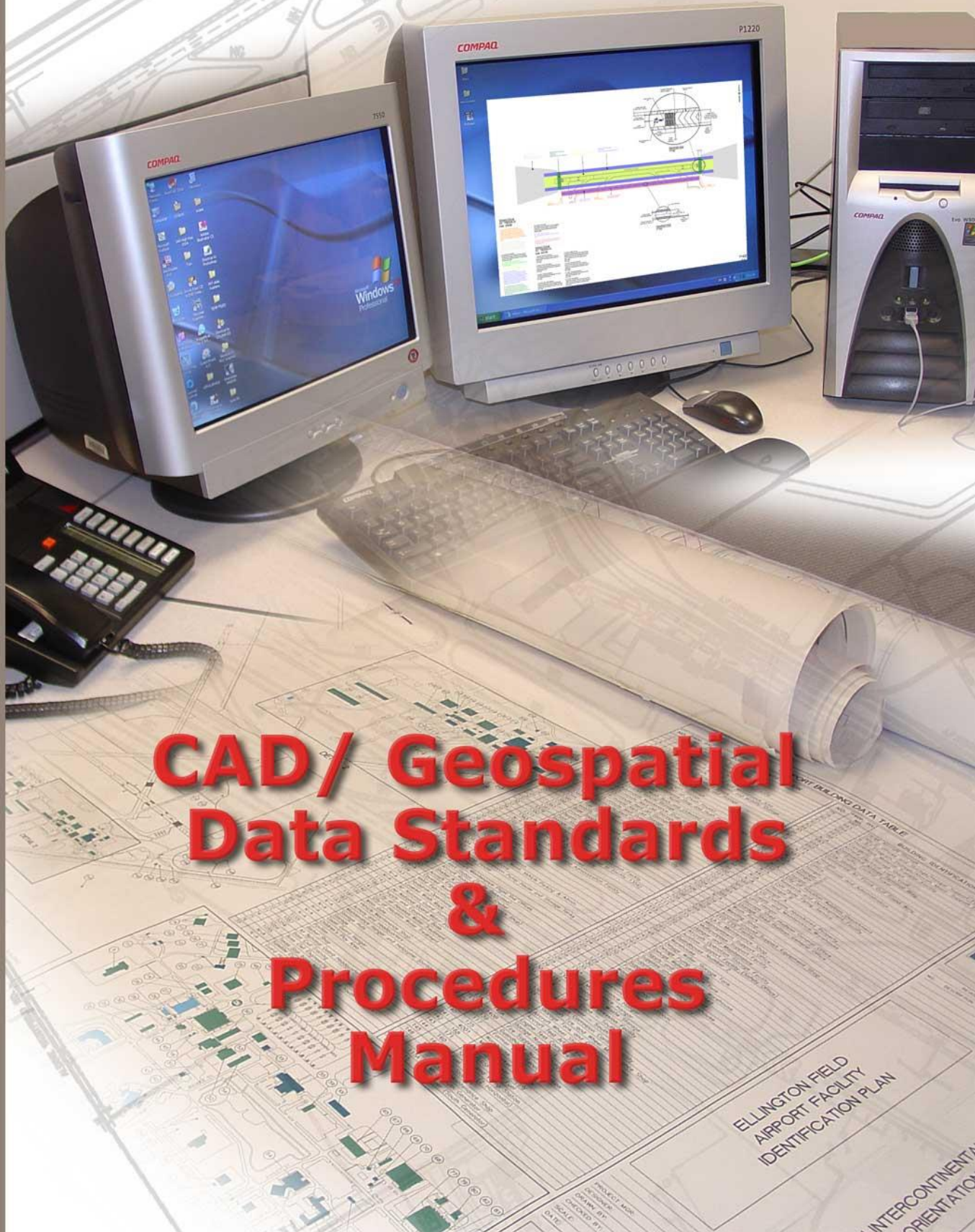


Houston Airport System

HOUSTON AIRPORT SYSTEM



CAD / Geospatial Data Standards & Procedures Manual

ELLINGTON FIELD
AIRPORT FACILITY
IDENTIFICATION PLAN

INTERCONTINENTAL
ORIENT ATION

ASIS CAD and Geospatial Data Standards and Procedures
December 2013 Release 3.3

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Section 1: *General Information*

1.1 Introduction

The Houston Airports (HAS) has developed an enterprise Airport Spatial Information System (ASIS) which supports all departmental business functions with property, facilities and infrastructure documentation and data. This manual provides guidance for HAS departments, design consultants, and other contractors (hereafter called contributors) in preparing design and record drawings (CAD files), and in developing and delivering airport geospatial data.

Adherence to this manual is required for development and dissemination of Computer Aided Design (CAD) drawings and geospatial data. This work includes, but is not limited to

- Capital Improvement Projects (CIP), Tenant Improvement Projects (TIP) and other Design, Bid and Construction business processes
- Airport Planning, IT/Security, Operations, and Maintenance processes

Development and submittal guidelines are presented separately for CAD drawings and geospatial data. HAS uses CAD drawings and geospatial data as integral components of ASIS.

Strict adherence to ASIS drawing and data standards and procedures is required to enforce compatibility between various projects, disciplines, and information systems.

These guidelines provide directions to the consultant only on matters directly related to setup and production of ASIS documents. It is not the intent of this manual to be a training guide for AutoCAD, ArcGIS or other geospatial software and associated products. HAS assumes, and requires, drawing and data contributors to be proficient with the information systems software required within this ASIS standard.

1.2 References

ASIS is an enterprise-ready information system and every attempt has been made to conform to industry CAD and GIS standards.

For CAD drawings the HAS adopted the U.S. *National CAD Standards* for their CAD standards and procedures manual. The National CAD Standard (NCS) is published by the National Institute of Building Sciences.

Airport infrastructure projects use the City of Houston graphical standards. A copy of the City of Houston graphical standards can be obtained online at the City of Houston Public Works and Engineering website.

HAS follows the NCS CAD Layering Guidelines without exception. The NCS and this document lists layers by discipline. These lists can be supplemented with project defined layers. Any additions to the layer list must be approved by HAS. Refer to Section 5.2 for process and forms need to submit a change request.

For spatial data, the HAS developed a database model based on industry standards and current business requirements. The key element of standardization is the requirement that all ASIS data and applications must be fully compatible with ESRI ArcSDE. In addition, HAS ASIS is compatible with FAA AC 1500-5300-18B –

General Guidance and Specifications for submission of Aeronautical Surveys to National Geodetic Society (NGS): Field Data Collection and Geographic Information (GIS) Standards. HAS will not adopt the FAA GIS guidelines verbatim, but ASIS is interoperable with FAA standards.

1.3 Contacts

Question regarding compliance with HAS ASIS standards should be submitted to either:

Bill Zrioka
Division Manager, ASIS
Email: William.Zrioka@houstontx.gov
Phone: 281.233.1364

Or,

Vince Hamilton, PMP
Senior GIS Project Manager
Email Vince.Hamilton@houstontx.gov
Phone 281.233.1930

Ha Tu
Systems Support Analyst
Email: ha.tu@houstontx.gov
Phone: 281.233.1965

1.4 User Requested Changes to ASIS Standards

Proposed changes and additions to these standards must be documented on the ASIS Standards Change Request form provided in Section 5. This must be used for either permanent modifications or one-time changes to the standards. Changes include but are not limited to drawing organization, sheet organization, drafting convention, term and abbreviations, symbols and layering. Requests for change must be approved prior to any (interim and/or final) deliverables being submitted to HAS. City of Houston civil/infrastructure CAD graphic standards must be followed without exception.

1.5 Release Notes

This document is Release 3.3 of the HAS ASIS Standards. Release 1 was published and distributed to consultants in October 2004. Release 2 was first issued in July 2005 and reissued in October 2005 and December 2005. Release 3 was issued in November 2006. Release 3.1 was released in September 2008.

The major changes from Release 1 to Release 2 were the adoption of the latest version of the NCS, and the reorganization of established HAS layers to conform to the NCS layering guidelines changes.

The December 2005 release (Release 2) provides an update to the interim hardcopy document deliverable requirement (Section 2.2.1) by increasing sheet size submittals from half size (11x17) to full size (22x34) and clarifies electronic deliverable formats.

The November 2006 release (Release 3) is a major revision adding a new section dealing with geospatial data policy and guidelines. Changes have been made to Sections 1 and 2, adding overview and background information that relates to CAD sections of this manual that have undergone changes as well. The most significant CAD standard change is the removal of HAS specific disciplines in favor of a strict adherence to the National CAD Standards. HAS now publishes an AutoCAD file (.dws) with all currently maintained CAD layers.

The September 2008 release (Release 3.1) revises the feature metadata submittal table to omit the Mapping Source and Attribute Source metadata fields; it also revised the Creator, and Source Contact metadata fields to include Description examples; and the Process Contact field to include “into ASIS” in the description.

The latest release (Release 3.2 - October 2013) modifies the contact information in Section 1.3, clarifies the AutoCAD deliverables to include contiguous files, and updates the GIS deliverable file format to the ESRI File Geodatabase.

Section 2: ASIS General Requirements

2.1 Tools - Software / Data Interoperability Requirements

Type	Product	Version/Format	File Extension
CAD Software	AutoCAD	The Release will be decided at the project kickoff	.DWG
Word Processing	Microsoft Word	The Release will be decided at the project kickoff	.DOC
Scanned Record Documents	Not applicable	The Release will be decided at the project kickoff	.TIF
Digital Record Documents	Adobe Acrobat	The Release will be decided at the project kickoff	.PDF
File Compression	WinZip	The Release will be decided at the project kickoff	.ZIP
Tabular Data / Results	MS. Excel or pre-approved table formats	The Release will be decided at the project kickoff	.XLS
Spatial Data Exchange	ESRI File Geodatabase	The Release will be decided at the project kickoff	.FGB

If a contributor chooses to use a tool or tools other than those listed above, it will be the consultant's responsibility to translate the files into the correct tool(s) prior to transferring files to other contributors and the Houston Airports. All translated files must meet all guidelines specified within this manual.

Contributors are responsible for keeping their files virus-free by ensuring that their virus scan programs are current and up-to-date with the latest virus scanning information and support files. All disks received from any source will be scanned prior to use. External non-HAS contributors will provide a Scan Log along with all electronic deliverables.

2.1.2 Use of Add-On Programs

Add-on programs, such as Autodesk Architectural Desktop, Autodesk Building Systems, Autodesk Civil Design, Autodesk Field Survey, Autodesk Land Desktop, ESRI Survey Analyst, are acceptable provided the resulting drawings and/or data are consistent with the Houston Airports standards. It is the contributor's responsibility to purge excess information created by these programs prior to transferring and distributing files.

2.1.3 Data Quality and File Back-Up Procedure

Contributors are responsible for performing a regular back-up procedure and to submit a Quality Assurance and Control Plan and provide ASIS programmer and/or department data managers with assurances that data and file security policy and procedures are in place and followed.

2.2 ASIS Deliverables

For external projects, the prime consultant is solely responsible for CAD file, PDF documents, and data deliverables.

2.2.1 Consultant's Design and Record Drawing Hardcopy Deliverables

Interim (as required by the HAS project team– typically, the consultant is required to submit major milestones, including construction bid documents)

- Letter of transmittal
- Index of Drawings Spreadsheet (refer to Section 5.3)
- Hard copy requirements as established in the contract and discussed in the project kick-off meeting

Final

- Letter of transmittal
- Project directory report of all the files including any Sub-Consultant files that will be included on the CD-ROM or DVD
- Index of Drawings Spreadsheet (refer to Section 5.3)
- Hard copy requirements as established in the contract and discussed in the project kick-off meeting

2.2.2 Consultant's Record Drawing CAD Deliverables

The consultant is responsible for adhering to all components of HAS CAD document submittal standards. Refer to Section 3, CAD File Organization, for detailed instructions and standards pertaining to the delivery of electronic files.

Interim (as required by the HAS project team– typically, the consultant is required to submit major milestones, including construction bid documents)

- XLS** file containing the Directory Tree
- DWG** for both model and sheet files (organized per Section 3)

Final

CAD Electronic Project Files – The entire project including any sub-consultant electronic files are required as a final deliverable. Electronic files include all formats used to produce final deliverables (i.e., .DWG, .XLS, and .DOC). All AutoCAD reference files used for the project will be delivered in the coordinate system specified in the appropriate Surveyors Hand Book. Section 3.4 describes the CAD file directory structure and file organization required by HAS. Project files will be written to a CD-ROM or DVD. Disk organization and labeling requirements are described in Section 3.2.

Full Size Record Drawing Set – The entire record drawing set must be delivered as individual sheets in Portable Document Format (PDF) produced directly from AutoCAD. The “Record Drawing” stamp must be displayed on each sheet but does not have to be signed or filled out.

PDF files must be named using sheet naming standard followed by sheet tile (e.g., I0600S02.01 - Cargo Area Demolition Plan). These will be loaded into the HAS document management system using the spreadsheet of the index also to be provided as a deliverable from the consultant.

The completed and signed cover sheet with the “Record Drawing Stamp” must be scanned from the original hardcopy to produce a PDF file. Scanning resolution (typically 400 dpi or better) and quality must be suitable for high quality full size paper reproduction.

2.2.3 Geospatial Data and Metadata Deliverables

All GIS data must be delivered on CD-ROM/DVD in ESRI’s File Geodatabase format.

Guidelines for ASIS geospatial data and metadata deliverables are described in Section 5. Contributors should note that project specific data submittal requirements and specifications will be provided by the HAS project manager with input from departmental stakeholders.

HAS projects must conform to all HAS requirements for mapping, survey, and data development in the ASIS Mapping and Survey Guidelines. Contributors are required to develop data collection and submittal plans with project and departmental leaders.

Record drawing submittals described in Section 2.3 are a record of the construction work performed and are created from the red line drawings developed during construction. ASIS geospatial data submittals are the actual surveyed as-is (existing features) and as-built (newly constructed features) record of the location, configuration, characteristics and condition of Airport property, infrastructure, facilities, and environment.

2.2.4 Method of File Transfer

Interim files are to be transferred using the following acceptable formats: Specific Project web site via File Transfer Protocol (FTP), e-mail, CD-ROM, and DVD. Verify with HAS staff concerning what media is the best for transfer. The final delivery of the files is on CD-ROM or DVD as described in Section 2.2.2

When sending files via email or other media that requires file compression, the consultant will use WinZip to compress the files.

A letter of transmittal must be included to identify and describe the files being transferred. The letter of transmittal will include a list of each file name, drawing number and revision.

The appropriate Houston Airports project manager will receive deliverables along with the deliverable checklist. Refer to Section 5.1 for checklist.

2.3 Record Drawings

Record Drawings must be prepared by the design consultant from information provided by the construction contractor on the *Record of Work* mark-ups.

On completion of the record drawing conversion, the consultant must insert the *Record Drawing Signature Block* (provided by HAS as .dwg block) in the lower right hand corner of the cover sheet. Each sheet (excluding the cover sheet) will have the *Record Drawing Stamp* in the title block area. The prime consultant architect and/or engineer must complete the requested information on each line of the *Record Drawing Signature Block*. In addition, the revision block of every sheet must reflect the Record Drawing status and all prior revisions listed should be deleted from the revision block.

To preserve the integrity of the signed original cover sheet, the cover sheet must be prepared per instruction in Section 2.2.2 of this manual.

2.3.1 Record Drawing Signature Block

RECORD DRAWING

THE UNDERSIGNED CERTIFIES THE INFORMATION SHOWN ON (Contractor's firm name)'S "RECORD OF THE WORK", SIGNED BY (Contractor's authorized individual), DATED (Certification date), FURNISHED BY (Name of contractor) TO THE CITY OF HOUSTON DEPARTMENT OF AVIATION PDC/ CONSTRUCTION DIVISION, IS CORRECTLY INCORPORATED INTO THIS RECORD DRAWING. THE UNDERSIGNED IS NOT RESPONSIBLE FOR CONTENT, ACCURACY OR COMPLETENESS OF (Contractor's firm name)'S "RECORD OF THE WORK".

_____ Date
(Name of Design Firm) (Date)

_____ Authorized person
(Printed name and signature of person whose seal appears on Drawings)

2.3.2 Record Drawing Stamp to be placed on each sheet in the title block area or in the title block itself.

RECORD DRAWING

Section 3: CAD File Organization

3.1 Overview

The file organization is essential to eliminate confusion and errors associated with electronic file coordination between the consultants and HAS. The prime consultant will provide a CD-ROM to HAS, readable on all CD-ROM drives at the completion of the project.

All electronic files submitted on CD-ROM, or other approved media, must be organized using the file naming and directory tree structure convention provided herein.

3.2 File Interchange

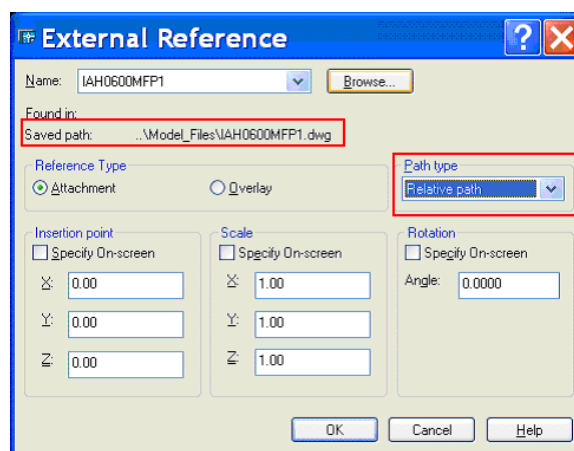
The preferred method for file sharing between consultants and the HAS is CD-ROM. However, due to time sensitive material, it is often necessary to use FTP or e-mail. If FTP or e-mail is used, a zip file must be created with the directory structure as described in Section 3.4 - Directory Structure.

The prime consultant will verify that all CAD files are created and stored with the “relative path” method. Relative paths are partially specified folder paths that assume the current drive letter or the folder of the host drawing. Refer to Section 3.3 - Relative Path for more details.

All CD-ROM’s delivered to HAS will be labeled with the project name, HAS project number, CIP number, prime consultant name, address, telephone number, e-mail address, and submittal date.

3.3 Relative Path (only applies to model files)

All externally referenced files will use the “relative path” method. Sheet files must be delivered bound per Section 3.4.3. HAS expects model files to be delivered in model directories as illustrated in Section 3.4.6. Model file deliverables can use relative referencing.



3.4 Directory Structure

3.4.1 Directory Structure – Overview

The consultant is responsible for organizing CAD files into directories that ensure HAS' ability to accept, process and distribute source files.

All submittals must use the directory hierarchy prescribed by HAS (see Section 3.4.6 – Directory Tree. The first two levels in the tree are always an Airport Facility folder and inside that folder are Project Directory folders.

Project Directory naming convention is the facility code concatenated with the project code (for example see Section 3.6). Within the project directory structure, sub-directories will be used to further organize files by discipline and support files. Sheet files, model files, and scanned sheet files are stored in separate subdirectories inside each Discipline Name directory.

3.4.2 Model Files

The Model File directory must be used for all files containing information pertinent to more than one drawing in a particular reference file. These files will not contain borders or any information specific to a sheet. Model files are only required if the design area will not fit on one sheet file.

3.4.3 Sheet Files

The Sheet File directory must only contain sheet files related to the project. These files must be arranged so that HAS can plot all the drawings in this directory and produce a complete set of project documents without needing to add or remove any drawings. The Consultant must bind cross reference (xref) files into the sheet file. Drawings in the sheet file directory **must not** use xrefs.

3.4.4 Scanned Sheet Files PDF format)

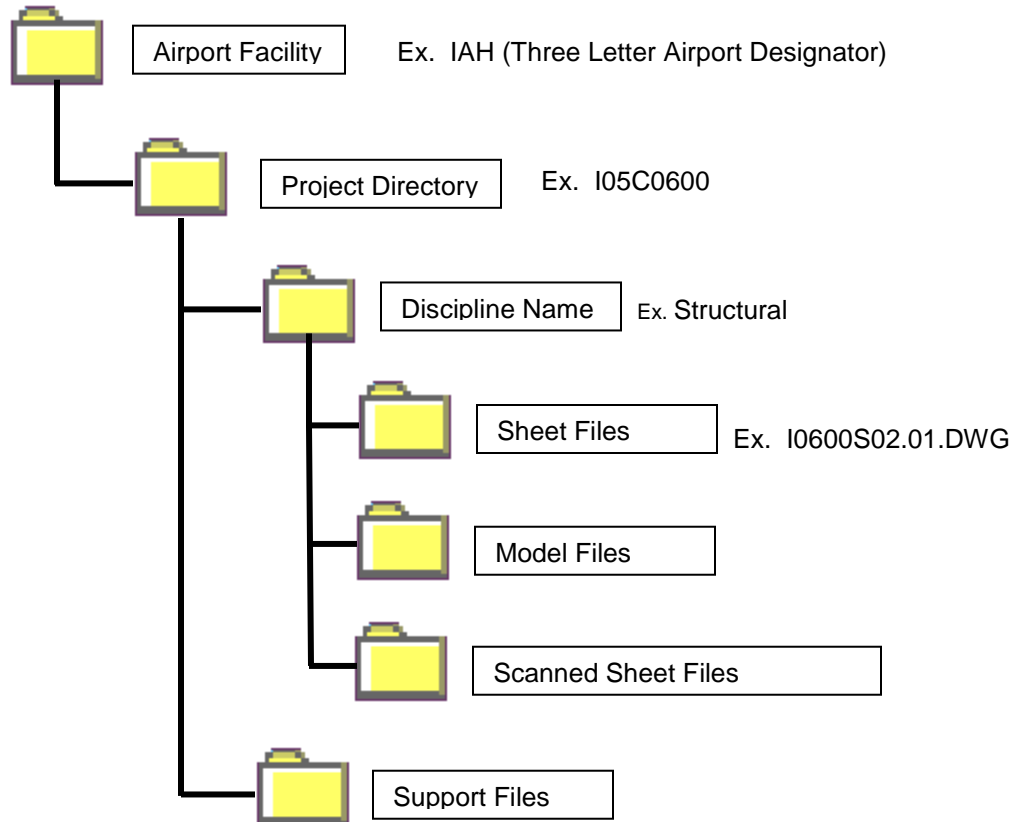
The scanned sheet file directory will be used to store all sheet files in a deliverable/completed state. All scanned sheet files must be created in "Record State". Scanned files are to be delivered in PDF format and named according to sheet number and title block. PDF files must be arranged so HAS can plot all the drawings in this directory and produce a complete set of project documents without needing to add/remove any drawings.

3.4.5 Support Files

The Support Files directory must be used for any files not included with the basic AutoCAD installation that are required to view/plot the design files in their complete intended form. These files include but, are not limited to: Plot Style Tables, Fonts, Line Type Shapes and Object ARX Enablers and any OLE documents (*.doc, *.xls).

3.4.6 Directory Tree

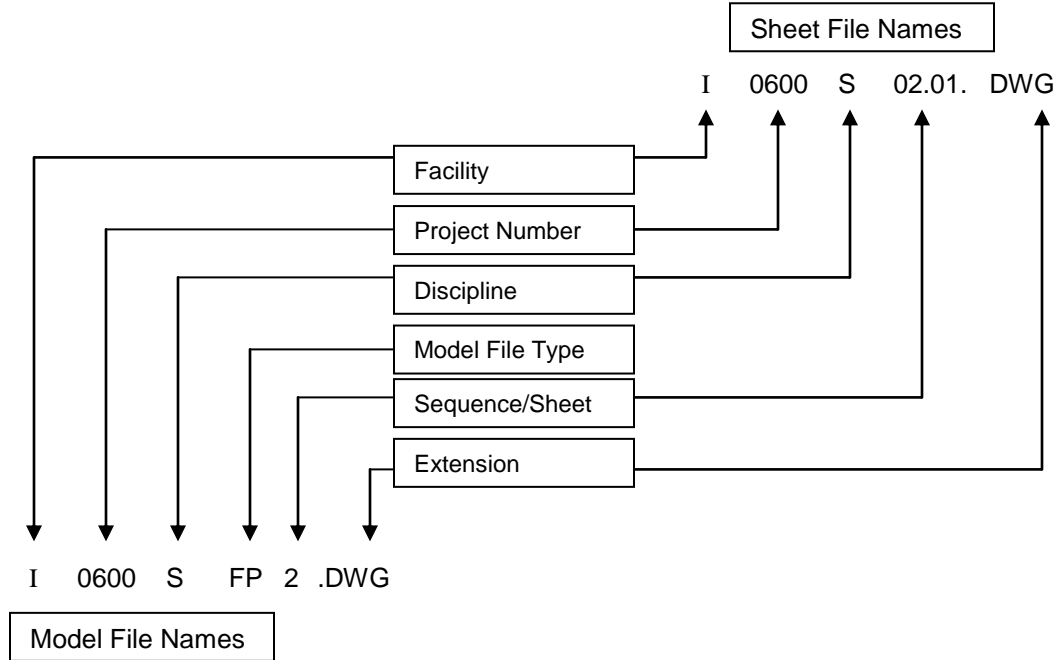
Example – Drive:\IAH\I05C0600\Structural\I0600S0.01.DWG



3.5 File Names

In accordance with the HAS standards, each file will be assigned a unique name. There are two distinct types of CAD files – MODEL files and SHEET files. A naming convention has been established for each type. Refer to section 4.4 -*Drawing File Assembly*, for a discussion of the characteristics of both MODEL and SHEET files.

All sheet file names will contain the facility code, project number, discipline and sheet number.



All Model file names will contain the facility code, project number, discipline file type code and sequence number.

3.6 CAD File Abbreviation Codes

The following is a list of abbreviation codes to be used in file names, directory naming and the media labeling.

3.6.1 Facility Codes

I	George Bush Intercontinental Airport
H	William P. Hobby
E	Ellington Field
W	West Side Mitigation Area
L	Lake Houston Property

3.6.2 Project Reference / Directory Code (YYCNNNN)

YY	Project Calendar Year
C	Project Type (See Section 3.6.3)
NNNN	Project Number assigned by HAS

3.6.3 Project Type Code

A	Maintenance and Support (for HAS use only)
C	Capital Improvement Project (CIP)
T	Tenant Improvement Project (TIP)

3.6.4 Sheet Sequence Numbering

Refer to *National CAD Standards* for a complete list

3.6.5 Model File Type Codes

Refer to *National CAD Standards* for a complete list

Section 4: CAD Drawing Standards

4.1 Overview

The purpose of this section is to provide the guidelines and procedures for HAS CAD projects submitted to HAS. Drawing standards are used to promote the consistent and coordinated development of design drawings. The standards outlined herein are in compliance with the *National CAD Standards*.

4.2 Point of Origin

Insertion Point

To ensure proper alignment and insertion of drawing data, all consultants on the project team will use a common XYZ point of origin. This point of origin is based on a monument point established in the HAS Surveyors Handbook and described in detail in the *HAS Mapping and Survey Guidelines*.

4.3 Sheet Layout

The HAS requires consultants to follow NCS guidelines for sheet layout.

4.4 Drawing File Assembly

To ensure consistency between and within the project, all contributors must follow the same drawing file assembly convention. This section defines HAS convention for file types, sheet layout and use of view ports. Refer to Section 3 - File Organization for additional aspects needed for this section.

4.4.1 File Types

There are two distinct types of CAD files – MODEL files and SHEET files.

MODEL files otherwise known as reference files, describe a subset of design geometry and its physical components. If the project is a terminal or building, walls, doors, outlets, roads, etc. would be in the model file. All model files are drawn full scale (1"=1") in model space. Text, dimensions and symbols are the only elements that will be adjusted based on scale factor.

SHEET files contain one or more scaled views of Model files arranged within a border and title block. In some rare instances, a model file will fit entirely on one sheet. However, a Model file will still be used to ease the sharing of data between consultants. Sheet files are not to be used as reference files. Sheet files are only used for the plotting presentation of the model.

4.5 Symbols

All projects submitted to HAS will use a common set of drafting symbols established by the *National CAD Standards*, *City of Houston* and the *Houston Airports*. These standard symbols are provided to consultants by HAS.

Any additions or exceptions to the symbols provided by HAS, or the COH, should be requested through the HAS project manager, using the CAD Change Request Form (Section 6.2).

4.6 Annotation

4.6.1 General

All design drawing text will be in upper case. All text will be uniform in size on the final plot. There are three approved text sizes. Customized fonts are only accepted if the plotted result has the same appearance as the HAS approved fonts styles. Any customized fonts must be included in the support directory (refer to Section 3.4 Directory Structure).

4.6.2 General/Keyed Notes

General Sheet Notes are notes that communicate information applicable to a specific sheet. If a general note applies to multiple sheets, the note must be on all applicable sheets. General notes specified on a "General Notes" sheet will be applicable to all sheets.

All sentences should be punctuated and ended with a period. References to a specific drawing or detail **must** identify the detail and or sheet number. Keyed notes should be numbered, not lettered.

General notes and Keyed Notes should be located at the top right hand side of the sheet. Terms should not be abbreviated or end with punctuation marks.

Refer to the current NCS standards.

4.6.3 Abbreviations

Refer to the *National CAD Standard* and the *FAA Glossary of Acronyms* for all approved abbreviations.

4.6.4 HAS Approved Text Styles

Small Text All drawing notes and dimension text, title key scale
Style Name = General
Font = ROMANS
Width Factor = 1.0
Size = 3/32"

Medium Text Subtitle text, keyed notes, general notes
Style Name = Medium
Font = ROMAND
Width Factor = 1.0
Size = 1/8"

Large Text Sheet numbers, sheet titles, title key number and descriptions
Style Name = Large
Font = ARIAL BOLD
Width Factor = 1.0
Size = 1/4"

4.7 Dimensions

All dimensions use the same text as described in Section 4.6.4 Text Styles. Extension lines should not cross other dimensions and notes. Refer to the NCS UDS 04.19-27.

4.8 Border/Title Block

All projects will use a Master Title Block file for information referenced in each sheet. The Title Block file will be referenced into each SHEET file. The title will always be inserted at full scale (1" = 1") on layer 'XREF-N' where N is the filename. The lower left corner of the title block is to be located at 0,0. Sheet specific information will be input through the use of an attribute block.

Standard sheet sizes for all HAS projects are 11" x 17", 22" x 34", 30" x 42". HAS will provide the prime consultant with an AutoCAD template file for each size sheet. **Do not explode title blocks.** If this occurs HAS will request that the consultant replace the exploded blocks and redeliver their electronic copies. These border files are provided to consultants by the HAS.

4.8.2 Title block Information

The following information must be filled in on all drawings:

- Airport Name
- Design Consultant's Name/Logo
- Date of Issue
- Revision Information
- Drawing Title
- Design Consultant's Seal and Signature
- HAS Approval Signature
- Project Number
- C.I.P. Number
- A.I.P. Number
- HAS Number
- Sheet Number

4.8.3 Revision Block

Revisions before "Issue For Construction" (IFC) will use alpha characters starting with the letter 'A'.

The "Issue for Construction" will use the number '1', and all alpha designations prior to "Issue for Construction" will be deleted at this point. Any subsequent issues will use sequential numbers.

The "Addendums" will use the number following the previous issue number. Any subsequent issues will use sequential numbers.

The "Record Drawing" will use the number '1', and all designations will be deleted at this point.

4.8.4 Drawing Title

The Drawing Title will consist of up to four lines of information describing the drawing sheet. The first line will be the Facility name provided by HAS and must be consistent throughout the document package. The second line will be a description of the Project. The remaining two lines will be a description of the drawing sheet.

4.8.5 Design Consultant's Seal and Signature

There is space provided for one seal on the Title Block. In the event that two seals are required, the second seal will be placed as close as possible to the first seal, within the border of the title block.

The Architect/Engineer will sign and seal the original plots of all drawings over the affixed seal of their certificate number. Any issuances other than "Issue for Bid", "Issued for Permit" or "Issue for Construction" will have the following note in lieu of an engineer's seal:

ARCHITECT/ENGINEER'S NAME (as it appear on Seal)
TEXAS REGISTRATION XXXXXX
FOR REVIEW ONLY,
DESIGN DOCUMENTS DEPICTED HERE IN ARE INCOMPLETE AND MAY
NOT BE USED FOR REGULATORY APPROVAL, PERMIT OR
CONSTRUCTION
DATE (M/D/YR)

4.8.6 Sheet Numbering Conventions

The sheet number will be the same as the sheet file number without the facility designator, project number, or project designator. Refer to Section 3.5 File Names and current NCS

4.9 Layers, Line Types and Colors

4.9.1 General

An effort has been made to establish a format that is flexible enough to accommodate established practices of the various consultants while maintaining consistency from discipline to discipline and within the industry. The guidelines are intended to be open ended.

Additional layers may be created to accommodate the unique requirements of a particular discipline. Furthermore, some disciplines may not require the full use of all layer designations. In some cases the use of only the Discipline and Major Group designators will be sufficient to organize layer information in a meaningful way.

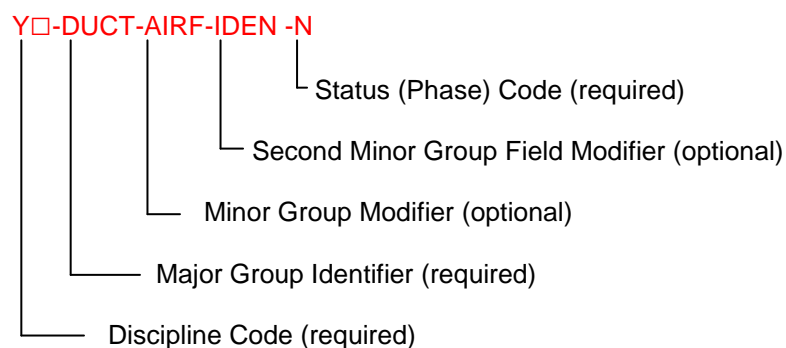
In all instances, the consultant is to adhere to the established HAS layer format. All discipline layer name conventions are based on the *National CAD*

Standards. Project specific layer names, not included in the *National CAD Standards* or in Section 4.10 of this document, must be approved by HAS and must adhere to the *National CAD Standards* layering guidelines.

All colors and line types will be assigned “Bylayer”. No colors / line types will be hard coded to entities. All civil infrastructure disciplines will adhere to the City of Houston graphics criteria that can be obtained at: <http://documents.publicworks.houstontx.gov/document-center/>. All other disciplines must adhere to the HAS drawing criteria provided herein.

4.9.2 Layer Naming Convention

HAS follows the NCS CAD Layering Guidelines (NCS CLG-4-8).



Layer Naming Notes:

- 1) NCS guidelines allow users to combine any discipline codes with any major group identifier to create a new layer name.
- 2) NCS lists use of Status Code as optional. **For HAS projects the Status Code field is required.** If the layer name is missing a status code, HAS assumes the layer contains data pertaining to existing assets.

CAD layer naming is a key component of the Airport’s spatial data management system. HAS CAD layering guidelines must be adhered to without exception.

The HAS recognizes that consultant may require new CAD layers to accomplish project objectives. New layer names must adhere to the NCS CAD Layering Guidelines and must be approved in advance by HAS. HAS will normally approve most requests for new minor groups and new combinations of existing major and minor groups. Request for new major groups are more difficult to justify. Before approving a new major group, HAS will need to make sure that group is not redundant and that it should become a permanent part of the HAS CAD layering guidelines

4.10 HAS Disciplines & Layer Names

All layer names must be fully compliant with the National CAD Standards. External contributors (non HAS employees) can link to the HAS Planning, Design and Construction (PDC) web site and download the latest CAD layer list (as CAD standard file), symbol libraries and title sheet templates.

4.11 Tri-Services Plot Table

All Houston Airports projects will use the Plot table described in the Tri-Service Plot table in the *National CAD Standards*.

Section 5: *Geospatial Data Development and Submittal Requirements*

5.1 Overview

Houston Airports has developed divisional and system-wide information systems with the purpose of maintaining a complete and accurate inventory of all property, facilities, infrastructure and environmental assets at each airport campus and property holdings. These inventory systems contain information about the location, physical character, status and condition of HAS assets. Every division and department collects and maintains data in a consistent and compatible format. The HAS adopted a geospatial information management approach that requires accurate asset (feature) location and attribute data.

The enterprise repository for geospatial information is the Airport Spatial Information Systems (ASIS). ASIS is a collection of data, documents, information management systems and decision support applications. All departmental applications that require and/or produce geospatial data are compatible with the ASIS specifications.

ASIS geospatial data development and submittal guidelines must be followed for all information developed for the HAS.

During all phases of work, contributors must coordinate with and obtain discipline specific requirements from the HAS staff member(s) responsible for departmental asset inventories.

5.2 ASIS Geospatial Model - Data Standards.

ASIS geospatial data are maintained in an ESRI ArcSDE Geodatabase. The ASIS Geodatabase supports a wide range of applications and must maintain very detailed and accurate representations of HAS assets.

ASIS Geodatabase model has been developed for all three airports and two additional property holdings. The ASIS Geodatabase model contains a structured collection of feature datasets, feature classes and subtypes, attribute domains and associated geospatial relationship and object tables. Each airport schema is identical, but HAS maintains separate schemas to accommodate airport specific coordinates systems in an ESRI Geodatabase. The fundamental elements of the ASIS geospatial model are feature classes. ASIS feature classes have ESRI required field, ASIS required fields, and feature class specific fields.

Sample ASIS Feature Class

Field name	Data type	Allow nulls	Default value	Domain	Precision	Scale	Length
OBJECTID	Object ID						
ASSET_TYPE	String	No	APRN	ASSET_TYPE			4
ASSET_ID	String	Yes					20
NAME	String	Yes					50
DESCRIPTION	String	Yes					255
ASIS_ID	Long integer	Yes			0	0	38
CADD_LAYER	String	Yes					20
STATUS	Long integer	Yes		STATUS	0		
SHAPE	Geometry	Yes					
TYPE	Long integer	Yes	1		0		
APRON_TYPE	String	Yes		APRON_TYPE			50
TIEDOWNS	Short integer	Yes			0		
PAVEMENT_CLASS	String	Yes					50
SHAPE_Length	Double	Yes			0	0	
SHAPE_Area	Double	Yes			0	0	

- ESRI required field
- ASIS required/standard field
- ASIS feature class specific field

Subtypes of Apron

Subtype field *TYPE*
Default subtype *1*

List of defined default values and domains for subtypes in this class

Subtype Code	Subtype Description	Field name	Default value	Domain
0	UNKNOWN	ASSET_TYPE	APRN	ASSET_TYPE
		STATUS		STATUS
		APRON_TYPE		
1	APRON	ASSET_TYPE	APRN	ASSET_TYPE
		STATUS	0	STATUS
		APRON_TYPE	APRN	APRON_TYPE
2	SHOULDER	ASSET_TYPE	APRN	ASSET_TYPE
		STATUS		STATUS
		APRON_TYPE		

ASIS geospatial data are maintained using specific geometry, spatial topology, and geometric network rules for placement of features. Geometry defines spatial types, simple lines, arcs (curves), polygons, etc. Spatial Topology rules in an ESRI Geodatabase define relationships between features in a single feature class, or subtype, or between feature classes. Geometric network defines the connectivity relationships between features classes. Placement and connectivity rules are strictly enforced and all data submittals must comply with ASIS feature placement rules.

Do not compile data for delivery without first consulting HAS about topology rules specific to your project and without checking your data deliverables for topological errors.

Sample Placement Rules – ASIS Layout Feature Dataset

<i>Lines: (Geometry rule - curves should be drawn as arcs not line segments)</i>	
LT1.	Line intersections must be defined by a vertex/node shared by the intersecting lines.
LT2.	Line segments must not be overlapping or have dangles. If lines are supposed to connect or intersect, they must be snapped to appropriate points or intersections.
LT3.	Use minimal number of coordinates/vertices to define a line.
LT4.	Start and end nodes of adjacent features that are part of the same feature type must be identical.
LT5.	Curves must be created as arcs instead of basic line segments. This enables an easier conversion to and from CAD.
<i>Polygons: (Geometry rule: Polygons edges that curve must use arcs)</i>	
PT1.	Polygons must share all vertices/arc with adjoining polygons.
PT2.	Polygons should not overlap except in a few unique circumstances for example, building overhangs and bridges).
PT3.	Polygons in the layout feature dataset must not have gaps

5.3 ASIS Geodatabase Metadata and Data Quality

HAS considers understanding and tracking the details and history of the data delivered vital and essential. Therefore, metadata is required for all feature classes. ASIS requires metadata for new and modified feature to track location and attribute accuracy and reliability. Data and metadata will be validated by HAS before accepting a delivery.

Data accuracy and completeness requirements are documented in the HAS ASIS Mapping and Survey Guidelines and other departmental or project documents. In general, data are expected to be 100% accurate relative to the source material and methods. Data sources include primary, or direct sources (e.g., survey and field measurements), secondary or indirect sources (e.g., orthophotography and geophysical probes), and tertiary, or historic documentation sources (e.g., reports, record drawings).

Every project is required to provide a data quality assurance and control (QA/QC) plan. The plan must include a detailed explanation of procedures and reports used as verifiable indicators of data quality.

ASIS Feature class metadata is Federal Geographic Data Committee (FGDC) compliant. For external contributors that are developing and submitting data to HAS, the ASIS program manager will provide the feature and feature class metadata along with the appropriate database schemas and data. When data producers create new features or make changes to existing features, feature metadata must be provided in a separate but related object table. All contributors must produce feature metadata.

Required feature metadata submittal

Required Fields	Description	Field Use
Feature_ID	Project unique feature identifier used to join metadata table with feature in the submittal Geodatabase and related tables. For existing ASIS features, the ASIS_ID must be used as the Feature_ID. For new features, the Feature_ID will be a project-assigned unique ID.	Submittal Processing
Feature Flag	Coded value to identify feature as a new asset, a reshaped asset, a spilt asset, or merged asset.	Submittal Processing
Spatial Accuracy	Classification of location accuracy. Classes provided by HAS.	ASIS GDB
Attribute Accuracy	Classification of attributes accuracy. Classes provided by HAS.	ASIS GDB
HAS Project	Number / Name of HAS project or work package that provided data.	ASIS GDB
Creator	Organization that created/edited the data. (Examples: if mapping/attribute source is record Drawings, creator is design firm; surveying company, etc)	ASIS GDB
Source Contact	Person(s) responsible for mapping and logging data or developing source document. (Example: design engineer or surveyor).	ASIS GDB
Source Date	Date of source	ASIS GDB
Process	Description of processing history	ASIS GDB
Process Contact	Person or organization that processed the data into ASIS.	ASIS GDB
Process Date	Date of processing or last edit.	ASIS GDB
Notes	Free text area for notes or comments such as problems remained.	ASIS GDB

Note: The actual database table and data dictionary will be provided to ASIS program manager or departmental data managers during project or task initiation

5.4 Geospatial Data Development

All geospatial data must be delivered as a complete and accurate as-built record of changes to HAS facilities, infrastructure, property and environment resulting from:

- new construction / commissioning
- acquisition
- renovation
- demolition
- decommissioning
- maintenance

HAS requires a 3D survey and attribute inventory of all configuration changes. Geospatial data development is associated with most HAS business process, such as:

- Planning and Design - survey and other mapping techniques to verify and assess as-is conditions.
- Property Management - survey and related data to track land transactions and leases.
- Construction - survey and inventory of all new assets and modifications to existing assets.
- Operations and maintenance – updated inventory data and survey of relocated or newly place assets.

ASIS geospatial data and metadata deliverables from CIP, TIP, O&M and other HAS projects must conform to all HAS requirements for mapping, survey, and data development. Refer to HAS [ASIS Mapping and Survey Guidelines](#) for details.

In addition to these guidelines, any given project may have project specific data collection requirements. Contributors will coordinate with the HAS divisions and/or departments for project specific requirements.

Projects that collect aeronautical information and/or conduct airport engineering surveys for submittal to the FAA must, in addition to meeting HAS requirements, comply with all FAA Survey and GIS Standards. Refer to FAA ACs 150/5300-16, 17 and 18B for details.

A geospatial data development, quality control, and delivery plans must be completed and approved by ASIS program manager prior to initiation of work. The ASIS Geospatial Data Plan must include but is not limited to:

- Data collection means and methods (ref: ASIS Mapping and Survey Guidelines and FAA and other regulatory requirements)
- QA/QC means and methods
- Data development and submittal work plan

To assure data quality standards have been met and the schema integrity has not been compromised, data development efforts may be required to complete a pilot phase. The pilot result must be approved by ASIS program manager before data collection can progress.

5.5 Geospatial Data Submittal

ASIS data submittal requirements ensure data integrity and support HAS-wide system integration. Data must be submitted in a GIS-formatted 100% compliant ASIS Geodatabase schema, placement and network topology rules, and feature metadata.

No changes can be made to the ASIS Geodatabase schema without consultation with and approval from ASIS program and departmental data administrator(s).

As a general rule, project data deliverables are updates to already developed airport feature classes. Some projects require development of new feature classes, or modification to existing feature classes. If a feature class change is required, project and ASIS staff will jointly develop the data requirements and then ASIS staff will create and issue the revised Geodatabase schema.

Refer to Sections 6.4 and 6.5 for Geospatial data collection initiation and data development project closeout checklists. Contributors must be complete these checklists as objective indicators of successful communication and delivery of requirements and data.

Section 6: Forms

6.1 Consultant's Drawing Delivery Checklist

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Final Deliverables (All of the following are required)

Hard Copies

- As defined in the project kick-off meeting

Electronic Copies Delivered on DVD or CD

- (XLS) completed Index of drawings report (section 5.3)
- Scanned Media for viruses
- (PDF) Cover Sheet with signed Record Drawing Block
- (PDF) Full size (22x34) sheet set (including unsigned cover sheet)
- Verified all files are included (external references, fonts, images, ARX files ect.)

Exceptions Report Indicate all exceptions and reasons for not adhering to the HAS CAD standard below:

HAS USE ONLY		
Note Any Problems or Exceptions and Actions Taken		
Verified by		
Printed Name	Signature	Date

6.2 Proposed Change to HAS CAD & Geospatial Data Standards

Date:	Project (If Applicable):
Requestor:	
Company/Department:	
Phone:	Email:

Section/Sub-Section:
Page Reference:

Reason for Change: *(Check all that apply)*

Existing:

- Incomplete – new layer name, symbol, etc
- Inaccurate
- Redundant
- Conflicting
- Obsolete

New Provision:

- New Convention not covered in the Standards Manual.

Other _____

Detailed Justification: _____

Description of Change: _____

(To be filled out by HAS Representative)

Reviewed by:

ASIS Manager _____ Date : _____

- Approved
- Disapproved

Reason for Disapproval: _____

Change Implemented by: _____ Date: _____

6.4 Geospatial Data Pre-Collection Checklist

ASIS Geospatial Data Collection Document and Information Checklist	
<input type="checkbox"/>	Received File Geodatabase with ASIS domain values and schemas
<input type="checkbox"/>	Received file geodatabase that includes metadata associated with GIS data developed by HAS.
<input type="checkbox"/>	Received the feature class metadata table formatted by HAS for use in collecting featured level metadata.
<input type="checkbox"/>	Airport Spatial Information System (ASIS) CAD and Geospatial Data Standards and Procedures.
<input type="checkbox"/>	FAA Advisory Circular 150-5300, 16,-17 and 18B and any other regulatory standards and models.
<input type="checkbox"/>	HAS ASIS Mapping and Survey Guidelines & Surveyors Handbook
<input type="checkbox"/>	HAS CAD Standard Symbol Library and other template files (.dws, etc)
<input type="checkbox"/>	Approved project plan with schedule for pilot phase and subsequent data collection phases, with plan of collection specifications and methods, and with QA/QC approach

Submitted by:

Contributor's Project Manager _____ Date: _____

Reviewed by:

ASIS Manager _____ Date: _____

6.5 Geospatial Data Submittal Checklist

Geospatial Data Project Completion Checklist	
<input type="checkbox"/>	Completed submittal requirements and all changes have been made and approved.
<input type="checkbox"/>	File geodatabase delivered containing the project updates to ASIS geospatial data.
<input type="checkbox"/>	
<input type="checkbox"/>	QA documentation submitted as defined by project plan.
<input type="checkbox"/>	Contributor as completed a final check for data completeness All Feature class data updates completed. Spatial and attribute data conform to HAS ASIS Geospatial Data Standards Feature data set meets HAS ASIS Mapping and Survey Guidelines Feature data set meets HAS ASIS Topology mapping requirements
<input type="checkbox"/>	Submitted data collection device log files and field notes if required project plan
<input type="checkbox"/>	ASIS project manager and/or departmental manager have given written notice of data acceptance

Submitted by:

Contributor's Project Manager _____ Date: _____

Reviewed by:

ASIS Manager _____ Date: _____