SHSU BIM-FM Requirements: Table of Contents

- Section 0 – Executive Summary ...2
- Section 1 – Strategy and Objectives ...3
- Section 2 – FM-BIM Execution Plan ...6
    - Exhibit 2.A – Grading Fields and Procedures ...13
    - Exhibit 2.B – Sample Project Schedule ...16
    - Exhibit 2.C – Close-Out Procedures ...17
- Section 3 – FM Data Requirements ...19
    - Exhibit 3.A – RAM with Mapping ...53
    - Exhibit 3.B – Facilities Data Integrator ...58
    - Exhibit 3.C – Asset Type Matrix ...60
    - Exhibit 3.D – FM Model Criteria ...80

Section 0 - Executive Summary

Building Information Modeling (BIM) and Facilities Management (FM) Data Requirements

Section 1 – Strategy and Objectives

Knowing the strategy and objectives of Sam Houston State University (SHSU) in Building Information Management for Facilities Management (BIM-FM) is important for all project delivery teams (AEC + CxA) in order to satisfy the expectations and project requirements. The strategy and objectives section states that the BIM-FM process and documentation was undertaken by SHSU in order to provide direction and to equip project teams for facilities management data specification, collection, validation, and ultimately handover to SHSU. Handover deliverables shall be in a digital format and support operational objectives and efficiencies, such as import to the asset management (CMMS - Computerized Maintenance Management System) system FAMIS.

Section 2 – FM BIM Execution Plan (FM-BEP)

Developing and communicating a clear plan for carrying out BIM-FM is necessary for each project team. The FM BIM Execution Plan (also referred to as a FM-BEP) section provides an outline and framework for planning how BIM-FM is to be accomplished at the project level. The overall intent is to allow and require project delivery team members to communicate to SHSU how they intend to meet the BIM-FM requirements. Each member of the AEC team shall submit a plan per the stated requirements in this section. The Facilities Data Integrator (FDI) receives each plan and reviews it according to the contracted section requirements for that team member. This plan outlines items such as: company roles, contact information, AEC team collaboration procedures, information exchange schedules, quality control procedures, and others. Submitted execution plans enable the Facilities Data Integrator (FDI), an agent of the owner (SHSU), the ability to better guide and manage teams to accomplish BIM-FM deliverables. The BEP allows teams to demonstrate how they will comply with the prescriptive requirements as well as the performance based requirements. This leaves room for project delivery teams to impose their own means and methods where prescriptive requirements do not exist.

Section 3 - FM Data Criteria

The FM Data Criteria is the largest section of the BIM-FM Requirements documents. It is a detailed specification and guide to understanding how project information shall be organized and delivered to SHSU. This is the most prescriptive part of the BIM-FM process due to the specific and structured data requirements for SHSU's configuration of FAMIS. This section outlines what data is to be collected (i.e., what do we need), in what format (i.e., how do we need it delivered), division of responsibility (i.e., who is to collect specific information), and deliverable schedules (i.e., when are the milestone deliverables over the project's duration). This level of detail is required in order to properly communicate and contract these requirements with the project delivery team members in each standalone contract with the owner (i.e., AE, CM, CxA, others). In the absence of this level of detail, confusion will be present and the process for BIM-FM will break down. This section introduces a role called the Facilities Data Integrator (FDI) to the project delivery team who is chosen by the owner to manage and ensure correct execution of BIM-FM data requirements and process across the entire project delivery process. This section references attachments and specific SHSU roles for providing the latest version of facilities-specific data to be incorporated into projects.

Section 1: Strategy and Objectives

Explanation of the BIM Strategy and Objectives

Sam Houston State University (SHSU) desires to use technology to improve construction projects and the way they are handed over, keeping in mind operational objectives and efficiency. The strategy and objectives of SHSU in Building Information Modeling for Facilities Management (BIM for FM) is important for all project delivery teams (AEC + CxA) in order to satisfy expectations and project requirements. This section describes the reasoning behind BIM for FM process and documentation undertaken by SHSU, and explains the intent to provide direction and to equip project teams for facilities management data specification, collection, validation, and ultimately handover to SHSU. Handover deliverables shall be in a digital format and support operational objectives and efficiencies, such as import to the asset management (CMMS - Computerized Maintenance Management System) system using FAMIS. Through the establishment of BIM for FM requirements, SHSU will obtain consistent and useful handover deliverables (digitally formatted) that support operations and maintenance for many years to come. SHSU's purpose in standardization is to facilitate and produce a repeatable process at the Huntsville campus that can be employed on capital projects of various sizes.

The intent of this document is not to add unreasonable scope upon individual project team members, but rather to provide a method and format for capturing useful project information that is already being managed throughout the planning, design, construction, and commissioning phases. In some cases, project team members will realize efficiencies by following these guidelines and having a consistent project repository of facility data and associated documents. For other team members that already use a thorough system for tracking project spaces, equipment, and documents, this guideline will have little impact upon their current project workflows other than to specify the owner's requirements. By SHSU investing in the development of this process, they will be able to contract for these requirements in the course of the normal project delivery process, reduce change orders, reduce rework, and allow project team members the opportunity to align their project delivery processes and data management processes in advance of the performance of work. This alignment is intended to eliminate rework situations and streamline the project delivery process for digital data and documents for handover and integration by the Facilities Data Integrator (FDI) into the owner's operations and maintenance systems, namely FAMIS.

SHSU requires BIM to be used in a way that supports project success and advancing operational and maintenance workflows. Some specific BIM uses that the project team will be required to support include but are not limited to: 1) coordinated record set / as-built 3D Models, 2) coordinated Facilities Management Navisworks models designed for identifying building systems, and 3) FM data set production (for use in COBie data set compilation) with associated documents to be imported to FAMIS by the Facilities Data Integrator (FDI). The process established and confirmed by SHSU does not require each project delivery team member to be a 3D modeling subject matter expert, an FM data subject matter expert, or a COBie subject matter expert. Instead, the project team members are required to provide elements of the facilities management data set requirements over the life of the project in an open-standard format or in a manner that enables the Facilities Data Integrator (FDI) to extract the same information using industry standard tools and software. These project details will be documented and confirmed by the approval of the BIM Execution Plan (BEP) elements for each team member. BEP revisions may be required as team members are added and as the overall plan evolves for the project team members. One of the FM Data Integrator's roles is to manage the overall BIM-FM Data process and oversee the compilation (i.e., integration) of

the FM Data while ensuring that configuration control is maintained for revisions and changes over the lifecycle of the project. Thus, team members are expected to provide the same type of project information they normally produce for use at specific points in the project lifecycle. These are outlined along with the specific details of the role of FM Data Integrator in other sections of the specifications. The BIM Execution Plan (BEP) will outline and document the project specific processes to be employed and will provide a mechanism for owner review and approval of the FM Data process via submittals for review and approval by the FDI. In this manner, additional services are not expected from the project delivery team members because SHSU is not asking for new deliverables but rather, the same information in a modified format in advance of contracting and work production to eliminate the occurrence of rework.

Description of Existing Infrastructure and other Operational Interfaces

SHSU currently uses FAMIS 2 as its computerized maintenance management system (CMMS), but will soon be transitioning to FAMIS 360. FAMIS supports the import of COBie (Construction Operations Building Information Exchange) data, which is an industry recognized open standard data format. COBie is one "tool" that is used in this process to organize and format the FM Data for use. The data structure (ex, Asset Groups) from FAMIS will help guide the assembly of COBie data at SHSU. These data structure rules have guided and informed the development of these requirements, and when followed correctly, will ensure project teams have built the COBie data-set in a manner that is consistent with SHSU CMMS requirements and data structures.

SHSU currently uses 3D models as a tool in facilities management. By requiring project teams to coordinate and share building models, allowance is made for immediate and future needs of the university. Therefore, all 3D Facilities Models (i.e., models from the AE (design intent) and the CM (as-built)) shall be provided in an acceptable format (see the FM data specifications) and not in any other proprietary or subscription based software. Additional requirements can be found in the FM data specifications.

As the construction industry and technology advances, SHSU will make incremental changes to the BIM for FM requirements over time. The current specifications represent the first generation of FM Data specifications and changes are expected to be accepted and processed that will integrate future technologies and workflow changes over time. However, these must be evaluated by SHSU for adoption from the industry and integrated into the project delivery strategy and handover requirements in light of how SHSU does FM work and how they want to receive and process project information (data), documents, and models.

Explanation of SHSU Expectations

The FM data specifications developed for and applied to this project are an evolving guideline for capturing BIM data at SHSU. However, a specific set of requirements does apply to this contract per the identified Exhibit. With each new building, this specification may require the attention of a Facilities Data Integrator (FDI) to ensure current requirements are appropriate and/or are updated for additional scope that was unforeseen at the writing of the current publication. This updating process will continue to "build-out" and enhance the overall FM Data specifications in a way that creates a more robust specification based upon project scopes and building/project types at SHSU. The first generation FM Data specifications have been formulated to capture as much institutional information as possible based upon past FM Data projects conducted. It should be noted that each owner has a varying array of interests and requirements that are driven by their perception of the value to the FM process.

Thus, these requirements are likely to be modified over time as more operating experience is gained in the use of FM Data and associated documents.

The FM Data Integrator shall also assess each project teams' ability to perform the scope of the BIM and FM data requirements and provide specific recommendations for implementing requirements on a project by project basis. The role and responsibility of FM Data Integrator is outlined in other sections of this guide. However, the general responsibility is to manage the BIM process and the FM Data on projects and to ensure the correct execution of these BIM for FM Data guidelines. The role of the FM Data Integrator can be performed by different parties within the project delivery team during construction or within SHSU (i.e., internal direct staff or a third party consultant) throughout a project's life cycle.

SHSU expects that all large scale projects will use the current BIM for FM requirements and produce an FM data-set for import into the CMMS. However, the Director of Facilities Management will determine expectations in regard to these requirements on projects under five million ($5M) dollars. Project team members will each be expected to contribute to the project's FM Data requirements where appropriate, contracted, and as explained through this specification.

Specific information regarding responsibility and accountability are detailed in other sections of this specification. However, some of the general expectations include but are not limited to the following: 1) the party responsible for space planning will be expected to provide a schedule of spaces with use categories and associated space attributes, 2) the A/E in the design phase will be expected to provide square footage information, equipment locations, and scheduled equipment design information, 3) the construction contractor will be responsible for providing equipment manufacturer, model, asset attribute information, and associated documents as the submittal process is completed. The construction contractor will be expected during construction to assign documents (drawings, submittals, O&M's, and others) to equipment and serial numbers via the FM Data format as well. The contractor will produce a coordinated model prior to field installation.

Section 2 - BIM Execution Plan (BEP)

The objective of this section is to provide a project specific plan on how the BIM for FM requirements and deliverables will be accomplished. Each member of the AEC team shall submit a plan, to the Facilities Data Integrator (FDI), conforming to the requirements set forth in this section and other parts of the BIM specifications. The intent is for the BIM Execution Plan (BEP) to clearly identify how the project team members will comply with the BIM for FM Data requirements as well as how they will cooperate and coordinate with the other team members.

Following the review of individual BIM Execution Plans, the Facilities Data Integrator (FDI) shall coordinate a meeting to provide a Team BIM Execution Plan (BEP). The Team Execution Plan shall provide considerable detail on deliverable schedules, review points and process, grading, and handover requirements. For more information on aspects of the team execution plan, see other sections and exhibits to the BIM for FM requirements.

The submittal process is employed to allow team members to respond to the requirements on two main fronts. First, the BIM and FM requirements have certain aspects that are prescriptive. That is, SHSU requires certain elements of the requirements in a particular content, format, and timeframe from specific team members. See the requirements for further details. Secondly, the BIM and FM requirements have certain aspects that are performance based. That is, the owner desires and requires certain outcomes and results to be achieved. However, the owner does not want to impose means and methods of deliverable or result production that are unreasonable. Thus, the team member, for these elements of the BEP, is allowed to propose and describe their plan, approach, and means/methods for achieving the requirements and desired outcome. This is intended to provide reasonable flexibility for the team members in order to allow for workflow and deliverable production efficiency when and where an owner's need for a prescriptive requirement does not exist.

The following outline is a "framework" only and the team members are encouraged to add additional sections and subsections to the plan as needed. The framework below is intended to communicate the minimum content required (not the maximum). We recognize that many project delivery team members have prepared and executed multiple BEP's in the past. The intent in this specification is to launch the BEP development process and not to limit the BEP contents to this document. Team members are encouraged to add information to the extent needed to clearly communicate their implementation intent and plans. Several different BEP formats have been developed in the industry and this specification and framework is not intended to be a limiting factor in the team members' efforts to communicate and seek approval from the owner for the BEP. As the BEP is incrementally developed by the team members, additional details and clarifications are expected to be required to clarify how team members will interact and deliver on the entire set of requirements. It is expected that the BEP will have multiple revisions as the team iterates to a completed project and meets the overall requirements. The intent is also to eliminate rework on elements of the BEP that are approved. Team members are expected to consider downstream team members in the process and take every reasonable measure to minimize and eliminate rework. The

FM Data Integrator will assist in this determination and will be the primary party representing the owner in the BEP approval process.

Section A: Project Information

Project Data

1. Project Owner:
2. Project Name:
3. Project Location & Address:
4. Contract Type/Delivery Method:
5. Concise Project Description: [number of facilities, general size, etc.]
6. Additional Project Information: [unique BIM project characteristics and requirements]
7. Project / Contract Numbers: [Contract Number, Task Order, Project Number, etc.]
8. Project Schedule / Phases / Milestones: [include BIM milestones, pre-design activities, major design reviews, stakeholder reviews, and other major events which occur during project lifecycle]

Project Schedule

Project Phase / Milestone	Estimated Start Date	Estimated Completion Date	Project Stakeholders Involved
X% Schematic Design			
X% Design Development			
X% Construction Documents			
Buy-out			
Submittals			
Install			
Close-Out			
Handover			

Key Project Contacts

List of lead BIM contacts for each organization on the project.

Role	Organization	Contact Name	Location	E-Mail	Phone
Project Manager(s)					
BIM Manager(s)					
Discipline Leads					
Other Project Roles					

Section B: Project Goals

Acknowledgment of BIM and FM Data Requirements

1. Identify Major BIM and FM Data Goals / Objectives: [state major BIM & FM data goals, actions to implement, evidence the goal has been achieved, and participants involved]

Section C: BIM Uses

Acknowledgment of BIM and FM Data Requirements

1. Identify Major BIM uses on the project: [state major BIM use cases, their author, other users, and file types (if applicable)]
2. Identify Project Assets: [see 'SHSU Asset Requirements Matrix' and indicate project assets]
3. Identify Elements to by Modeled and the responsible party to model such elements along with Level of Detail on each element.
4. Identify other areas of particular interest in BIM that require clarity: [origin point, scale, model maintenance, other CAD/BIM Guidelines applicable, design coordination, field coordination, etc.]

Section D: BIM Use Staffing

Organizational Roles / Staffing

1. BIM for FM Roles and Responsibility:

2. BIM Use Staffing: [for each BIM & FM use selected, identify the team within the organization(s) who will staff and perform that use and estimate the personal time required. This helps the owner understand the level of effort (i.e., staffing plan) expected by the team members in delivery of the requirements.

BIM for FM Use	Organization	Number of Total Staff for Use	Estimated Worker Hours	Location(s)	Lead Contact
COBie					
Field Coordinated Model					
FM Model					

Section E: Collaboration Procedures

1. Collaboration Strategy: [describe how the project team will collaborate. Include items such as communication methods, document management and transfer, file naming structure, and record storage, etc.]
2. Meeting Procedures: [the following are examples that should be considered]

Meeting Type	Project Stage	Frequency	Participants	Location
BIM for FM Requirements Kick-Off				
BIM for FM Execution Plan Demonstration				
Design COBie				
Construction COBie				
Any other BIM meetings that occur with multiple parties				

3. BIM for FM Delivery Schedule of Information Exchanges for Submission & Approval: [document the exchange of COBie and Model data that occurs during the project:]

Information Exchange	File Sender	File Receiver	One-Time or Frequency	Due Date or Start Date	Native File Type
Design COBie	Architect	Contractor	One-Time	NTP	.xls

Section F: Process for Data Verification – QA/QC

1. Overall Strategy for Quality Control: [describe the strategy to control the quality of the data and model delivered]
2. Quality Control Checks:[the following check should be performed to assure quality]

Checks	Definition	Responsible Party / Parties	Software Program(s)	Frequency
Visual Check	Ensure that the model and data have not excluded field items and requirements have been followed			
COBie Compliancy Check	Ensure that the COBie standard has been followed in the building of Facilities Data			
Standards Check	Ensure that the BIM for FM Format Requirements have been followed (naming standards, all data points collected, etc.)			
Accuracy	Ensure that all Facilities Data provided is 100% accurate			

3. Accuracy and Tolerances:
    a. *Note: At any time during the project where the data errors grow to a point above 10% of the entire data set; the owner reserves the right to take appropriate corrective action such as having another party finish the BIM for FM deliverable at the expense of the responsible party in error. The FDI's role is to take preliminary steps to preclude this action. However, if timely completion of the FM data process is delayed by an unreasonable amount of time, the owner may direct such corrective actions be taken.*

Section G: Technological Infrastructure Needs

1. Software [List software that COBie data and Model will be created and maintained in]
2. Modeling Content (conforming to SHSU Asset Requirements Matrix)

Project Deliverables [list the BIM for FM deliverables for the project and the format in which the information will be delivered]

BIM for FM Submittal Item	Stage	Approximate Due Date	Format	Notes
Record Model				
Coordination Model				
FM Model				
COBie				
COBie Docs				

Section H: Process for Data Collection

1. Describe methods for collecting data during the project and how the team member intends to coordinate and collaborate with the Facilities Data Integrator (FDI).

Section J: Field Coordination

1. Describe methods to be used for managing field coordination during the project and how the Contractor intends to coordinate and collaborate with subcontractors and their models in field installation.

2. Attach documents intended for use in guiding coordination efforts. Guidelines should be at a minimum to the detail of BIM Forum MEP Spatial Coordination Requirements for BIM and have 1inch and above conduit modeled.

Section K: Update of the BEP

1. Provide Plan for revising BIM Execution Plan at each stage.

It is expected that the Design & Construction team provide additional documents (as needed) to coordinate BIM uses not detailed in this document. Those documents can be attached as Appendix to this document.

Attachments to Section 2 – BIM Execution Plan (BEP)

These are not attachments to the BEP but are critical parts of the requirements that must be considered in the development of and updates to the BEP.

- Exhibit 2.A - Grading Fields and Procedures
- Exhibit 2.B - Sample Project Schedule
- Exhibit 2.C – Close-Out Procedures

Coordinate the BEP development with each of the following and all parts of Exhibit E.

Section 3 – FM Data Requirements

- Exhibit 3.A – Responsibility Assignment Matrix (RAM) with Timeline (XLS File)
- Exhibit 3.B – Facilities Data Integrator (FDI) Role
- Exhibit 3.C – Asset Type Matrix
- Exhibit 3.D – FM Model Criteria

Exhibit 2.A - Grading Fields and Procedures

1. Explanation

The Facilities Data Integrator (FDI), shall provide ongoing evaluation (i.e., grading) of BIM for FM deliverables. The following provides an example of what aspects of the data deliverable shall be considered when grading. Also provided are methodologies, though not strictly required to be followed, for grading purposes.

Much of the successful grading is dependent upon a clear schedule being created during the BIM Execution Plan stage. This project schedule, should be mostly contributed to by the AEC team, however, the FDI is ultimately responsible for the final schedule that the AEC team will be held to. This schedule shall be reviewed and approved by the Owner as part of the BIM Execution Plan approval process.

2. Required Data Categories

At the beginning of the project, the owner will determine the data categories that should be imported to their CMMS. Those categories will allow the data to be consistently sorted and categorized in the owner's CMMS across multiple projects. The "Required Categories" section of the grading standard will measure how many of the owner's specified categories have been included in the data set. Example: Are the project AHU's, VAV's, and major shut-off valves present within COBie? This specific part of the review does not confirm that the ten AHU's in the project have all been incorporated into COBie; rather, that AHU's are being collected, in general.)

Required categories of data are determined at project setup according to the specifications and correspond to the different tabs in the COBie format standard. The grade will be assigned according to the number of categories completed in the appropriate tabs. Only categories in compliance with the specifications will count towards the number of scheduled categories required per month.

$$\textbf{Grade} = \frac{\textbf{number of categories completed to date}}{\textbf{number of categories scheduled to date}}$$

3. Required Fields

At the beginning of the project, the owner will determine, with the help of the FDI, the data points of information that should be imported to their CMMS for each category, as described above. Those project data points will provide the O&M personnel the right information to efficiently and successfully steward the building for it's useful life. The "Required Fields" section of the grading standard will measure whether or not the owner's specified data points have been included in the data set. Example: If the project's AHU's, VAV's, & Shut-off valves are present within COBie, then are their data fields populated to match the current data schedule requirements? This specific part of the review does not confirm that any AHU's in the project have been incorporated into COBie; rather, that if AHU's are being collected, that their required data fields (model #, serial #, belt size, etc.) are being populated.)

A schedule will be created that depicts the required amount of data points for each category in each tab at specified intervals. Only cells in a populated row will count for or against the grade given. This grade is not intended to simply measure the quantity of cells filled, rather to compare the amount of cells actually populated with those that should be populated.

$$\textbf{Grade} = \frac{\textbf{number of completed cells}}{\textbf{number of required cells}}$$

4. Quantity

At the beginning of the project the owner, with the assistance of the FDI, will conceptually estimate the number of rows of information per tab that will be in the final COBie spreadsheet. This number will be divided into a per month requirement that is loaded into the deliverable schedule. By requiring a quantity of rows delivered per month, the owner can insure that the deliverable is being continually progressed by team members at an appropriate interval.

The Quantity grade, then, will measure the quantity of populated rows in each tab of the COBie spreadsheet. Unlike the *Required* grading standard, rows do not need to be fully populated to add to the *Quantity* count, because that aspect is graded elsewhere. The number of required rows to be completed per tab per month will be taken directly from the schedule.

$$\textbf{Grade} = \frac{\textbf{number of rows completed to date}}{\textbf{number of rows scheduled to date}}$$

5. Quality Control / Quality Assurance

5.1 – Format Requirements

Format requirements are found in the BIM for FM Specifications, and dictate how certain columns in COBie will be populated. These format requirements allow the project to integrate into the owner's CMMS, providing consistent names, abbreviations, and descriptions. The Format section of the grading measures whether the naming formats provided in the owner's specifications have been accurately followed in the building (compilation) of the COBie data. The columns that require formatted entries will be the only graded items.

A grade will be assigned as a percentage; formula as follows:

$$\textbf{Grade} = \frac{\textbf{number of graded cells} - \textbf{number of cells formatted incorrectly}}{\textbf{number of graded cells}}$$

5.2 – COBie Format Requirements (Version 2.24)

It is very important that the data provided be in COBie 2.24 standard if it is to be successfully imported to the owner's CMMS. The COBie grading portion measures the ability of the data-set to conform to the COBie 2.24 standard. Example: (Cells that cross-reference data on another tab must have precisely the same name; so a type being referenced from the component sheet should have the perfect character match as the corresponding type name in the type sheet.)

A grade will be assigned as a percentage; formula as follows:

$$\textbf{Grade} = \frac{\textbf{number of graded cells} - \textbf{number of cells in error}}{\textbf{number of graded cells}}$$

5.3 - Accuracy (Sample)

It is necessary that all information entered into COBie accurately reflects the field conditions. If data accuracy is inconsistent, O&M objectives will be frustrated and the deliverable will be of little value to the owner. The Accuracy grade will measure the correctness of the data. Cells containing inaccurate information will be marked as an error.

The BIM Execution Plan shall address field data accuracy procedures. Field data shall be independently verified and/or sampled to ensure accuracy. This can be accomplished by a variety of means. One example is to have the Cx Agent verify as they perform equipment checkout and testing. Another example is that the FDI can conduct field data sampling. Experience has shown that a reasonable measure of independent field verification of the AEC data deliverables is in the best interest of the owner. This verification does not relieve the AEC team members from their responsibilities to provide correct information.

A grade will be assigned as a percentage; formula as follows:

$$\textbf{Grade} = \frac{\textbf{total number of data points checked} - \textbf{total number of errors}}{\textbf{total number of data points checked}}$$

SHSU - SAMPLE PROJECT SCHEDULE

		Total	Month 1	Month 2	Month 3	Month 4	Month 5	Month 6	Month 7	Month 8	Month 9	Month 10	Month 11	Month 12	Month 13	Month 14	Month 15	Month 16
			Dec-13	Jan-14	Feb-14	Mar-14	Apr-14	May-14	Jun-14	Jul-14	Aug-14	Sep-14	Oct-14	Nov-14	Dec-14	Jan-14	Feb-15	Mar-15
1-Contact	Required Categories	8	2				4	6	7	7	8	8	8					
	Required Fields/Columns	14	14				14	14	14	14	14	14	14					
	Proposed Quantity (Rows)	*300*	10				25	40	50	60	75	90	105					
2-Facility	Required Categories	1	1															
	Required Fields/Columns	5	5															
	Proposed Quantity (Rows)	1	1															
3-Floor	Required Categories	3	3															
	Required Fields/Columns	6	6															
	Proposed Quantity (Rows)	*4*	4															
4-Space	Required Categories	65	65															
	Required Fields/Columns	10	10															
	Proposed Quantity (Rows)	*100*	100															
5-Zone	Required Categories	5		2	3	5												
	Required Fields/Columns	6		6	6	6												
	Proposed Quantity (Rows)	*50*		20	30	50												
6-Type	Required Categories	80		20	40	80	5	10	16	32	48	64	80					
	Required Fields/Columns	17		6	6	6	17	17	17	17	17	17	17					
	Proposed Quantity (Rows)	*100*		25	50	100	5	10	20	40	60	80	100					
7-Component	Required Categories	100		25	50	100	20	5	10	20	40	60	80	100	100	100	100	
	Required Fields/Columns	12		7	7	7	5	3	4	5	6	7	8	9	10	11	12	
	Proposed Quantity (Rows)	*1500*		375	750	1500	300	75	150	300	600	900	1200	1500	1500	1500	1500	
8-System	Required Categories	20		5	10	20												
	Required Fields/Columns	6		6	6	6												
	Proposed Quantity (Rows)	*25*		5	15	25												
11-Job	Required Categories	100												20	40	60	80	100
	Required Fields/Columns	13												13	13	13	13	13
	Proposed Quantity (Rows)	*200*												40	80	120	160	200
														PM -->				
12-Document	Required Categories	10		1	1	1	2	2	2	2	2	2	3	4	5	6	8	10
	Required Fields/Columns	10		10	10	10	10	10	10	10	10	10	10	10	10	10	10	10
	Proposed Quantity (Rows)	*1200*		20	40	100	130	160	190	220	250	280	380	500	650	800	1000	1200
				Drawings -->			Submittals -->			Submittals -->			Model Viewpoints -->		O&M -->		Cx -->	
13-Attribute	Required Categories	400								40	80	120	160	200	240	280	340	400
	Required Fields/Columns	8								8	8	8	8	8	8	8	8	8
	Proposed Quantity (Rows)	*500*								50	100	150	200	250	300	350	425	500
14-Coordinate	Required Categories	1														1	1	
	Required Fields/Columns	9														9	9	
	Proposed Quantity (Rows)	*50*														25	50	

Notes:
Zone & System row count based on COBie 2.24 method of one system/zone per row.
See Section 2: BIM Execution Plan with Exhibit 2.A.
Required Categories (see Section 3 FM Data Specificaitons)
Required Fields/Columns (See Section 3 with RAM Exhibit 3.A)
Proposed Quantity (Rows)
Yellow milestone represents AE handover to Constructor

Exhibit 2.C – Close-Out Procedures

End User Review & Acceptance

Test imports of the COBie data and documents may be performed leading up to final acceptance and review. However, once the COBie file has been successfully test imported into _COMPMS_, the Facilities Data Integrator (FDI) shall notify the Owner. The Owner then shall notify each end user to review assets identified as belonging to their respective department (organization). Areas of particular interest in review shall include those items that are shared between multiple end users/departments; ex: large Utility Water Valves should be reviewed by both Facilities Plumbing and Utilities Water Distribution.

This review exercise will ensure that all assets are accepted and are being maintained after handover. This also provides the owner's personnel an opportunity to become familiar with the new assets being added to their stewardship and to establish preventive maintenance (PM) procedures and/or to apply standing PM's to these newly uploaded assets.

Following notification to the owner, each end user shall have thirty (30) calendar days to review assets and schedule a meeting with the Facilities Data Integrator (FDI) and Owner to address any concerns and/or corrective actions that may be needed. If data concerns/issues have not been provided in writing to the Facilities Data Integrator within this 30 day period, acceptance by the end user shall be considered to be confirmed. The Facilities Data Integrator will be responsible to develop and submit a schedule to the Owner for how end user concerns (if any) will be resolved.

Owner Review and Acceptance

Following End User Review and Acceptance, the Owner is responsible to review and provide final comments for the Facilities Data Integrator to address with AEC team. If no comments have been received by the Owner within thirty (30) calendar days of end user acceptance AND completion of final punch list items, Owner acceptance shall be granted to the FDI. This process should generally follow overall project substantial and final completion to ensure that all team members remain engaged in the FM data process.

AEC Team Final Handover

Per the BIM Execution Plan, regularly scheduled COBie data and document submissions will be reviewed and reported on by the Facilities Data Integrator at the agreed upon review intervals.

At the final scheduled COBie report, the Facilities Data Integrator shall provide the AEC team and Owner a final punch list to address all outstanding items in the COBie data to be corrected. If all outstanding items have not been completed within the subsequent fourteen (14) calendar days, the owner may elect to take reasonable corrective actions as outlined in other parts of these specifications.

AEC team members that are contracted for COBie deliverables are responsible to validate (i.e., verify by their own means and methods) their own work prior to regularly scheduled submissions to the FDI. This will greatly shorten Corrective Action reports provided by the Facilities Data Integrator and the meetings allocated to review these

reports with the AEC team on a prescribed and regular basis. The basic premise here is that progressive elaboration and "building up" of the FM data occurs over multiple phases of the project duration.

Final Handover Deliverables Include (but may not be limited to):

- Project team compliance and conformance to the FM Data requirements (the FM Data Specification).
- COBie Version 2.24 file (latest approved version) with all documents in one folder.
- Record Set/As-built models (including all native files and one federated NWD file).
- Facilities Model with saved viewpoints of all COBie components per the FM Data requirements (the FM Data Specification).

Exhibit 3.B - Facilities Data Integrator Role

Role: Facilities Data Integrator (FDI)

Description: Manager of BIM for FM Process on Design/Construction Projects

Overall Responsibility: Ensure correct execution of the SHSU BIM for FM Requirements

Specific Responsibilities Include (but are not limited to):

Planning / Programming Phase

- Determine feasibility of FM data collection for proposed projects.
- Confirm FM data requirements are to be employed on certain design/construction jobs.
- Update (if needed) and provide latest BIM for FM requirements to new projects.
- For unique projects, reconcile the FM requirements and update the FM requirements.
- Setup project responsibilities and roles per Owner's directives and BIM for FM requirements.
- Integrate FM data requirements into the project delivery process for RFQ, RFP, and other contracting processes for the design, construction, commissioning, and other team members.
- Establish budget allocations in the capital budget for FM data functions on the project.
- Review and assess project team members (i.e., AEC teams) for their ability to comply with requirements (via RFQ and RFP activities) and the review of "draft" BIM Execution Plans.
- Other duties as required to implement the SHSU BIM and FM requirements and specifications.

Design / Construction / Commissioning Phases

- Hold kick-off and orientation meetings detailing BIM for FM requirements.
- Review and assess submitted BIM Execution Plans from AEC project team members.
- Hold meetings for BIM for FM Execution Plan review and project coordination planning including deliverable schedules.
- Adjust AEC team BIM for FM scope, if necessary, and in accordance with Owner's directives and specific or unique project requirements not listed in the latest FM data specifications.
- Monitor progress, assess quality, and confirm accuracy of ongoing data collection and validation process.
- Hold regular project meetings with project team members to discuss the progress and quality of the deliverables and the schedule for incremental deliverable development.
- Conduct payment application reviews of the FM data deliverables for AEC payment process.
- Inspect and evaluate (i.e., grade) deliverables in accordance with BIM for FM requirements and project schedules.
- Integrate owner data into project data set, as applicable for OFOI / OFCI assets.
- Integrate project team data deliverables into latest acceptable COBie format for test uploads to CMMS (FAMIS).
- Conduct several incremental / test uploads to FAMIS to confirm data migration is functional. If not functional, take corrective actions as needed.
- Ensure facility models are setup for O&M facility viewer and integration with CMMS model linking functions.

- Provide necessary minor adjustments to models to make them lighter and user friendly for O&M purposes (ex: transparent ceilings and site ground, contrast colors appropriately, etc).
- Other duties as required to implement the SHSU BIM and FM requirements and specifications.

Qualifications for the Facilities Data Integrator (FDI) Role

- Any team member (Architect, Engineer, General Contractor, Consultant, Commissioning Agent, or Owner's Representative, etc.) that can show successful management of past FM Data (specifically, the COBie 2.24 format) projects that have been imported to a client's (i.e., owner's) CMMS and are currently in use for Asset Management functions.
  - provide references of qualifying projects
  - provide references of owners/clients currently using the imported COBie formatted data for Asset Management

- Any team that can demonstrate understanding of the SHSU BIM for FM requirements and provide an example for how each section is carried out using a sample higher education project of their choice. Samples should include the following, at a minimum:
  - COBie sample files shall successfully import to SHSU FAMIS and include a minimum of the following for sample data sets: 10 contacts, 5 spaces, 1 zone, 5 types, 10 components, 2 systems, 10 documents, and 15 equipment attributes matching the most current SHSU requirements.
  - Ability to complete the SHSU BIM Execution Plan outlining their role as a Facilities Data Integrator on the sample project.

- It is recommended that the Facilities Data Integrator (FDI) chosen for a specific project *not* be someone who already has a substantial responsibility with BIM for FM data production (authorship) on that project. This would typically exclude the AEC team from functioning as the FDI. This criteria allows for objectivity (independent verification) and helps to prohibit a conflict of interest in the evaluation (grading) functions by the FDI. Since the FDI's role is essentially data commissioning, independent quantity and quality verification is desirable since the information will be used in operational workflow processes.

Asset Group / COBie "Type Category"	System
DOOR POSITION SWITCH	ACCESS
EXT RDR	ACCESS
EXTERIOR DOORS, KEYED	ACCESS
INT RDR	ACCESS
LOCK	ACCESS
LOCKBOX	ACCESS
OPENER	ACCESS
SPECIAL ACTION DOORS	ACCESS
MANHOLE	ALL
METER	ALL
TANKS	ALL
CABINET	ARCHITECTURAL
CEILINGS	ARCHITECTURAL
EXT WALLS	ARCHITECTURAL
FIXED PARTITIONS	ARCHITECTURAL
FIXED SEATING	ARCHITECTURAL
FLOORS	ARCHITECTURAL
INT WALLS	ARCHITECTURAL
MISC ARCHITECTURAL	ARCHITECTURAL
OPERABLE PARTITIONS	ARCHITECTURAL
ROOF	ARCHITECTURAL
WINDOW COVERING	ARCHITECTURAL
WINDOWS	ARCHITECTURAL
ELEVATOR	CONVEYING
HOISTS & CRANES	CONVEYING
LIFTS	CONVEYING
ESCAPE PPE	EH&S
FIRST AID DEVICES	EH&S
SPILL EQUIPMENT	EH&S
AUTOMATIC TRANSFER SWITCH	ELEC
BATTERY SYSTEMS	ELEC
BUILDING GROUNDING SYSTEMS	ELEC
DP	ELEC
EQUIPMENT DISCONNECTS	ELEC
EXIT LIGHT	ELEC
EXTERIOR LIGHT FIXTURES	ELEC
GENERATOR	ELEC
HV SWITCH	ELEC
INTERIOR LIGHT FIXTURES	ELEC
LC	ELEC
LIGHTING CONTROL EQUIPMENT	ELEC
LIGHTNING PROTECTION	ELEC
MCC	ELEC
MDP	ELEC
MOTOR	ELEC

PKL LIGHT	ELEC
POWER EQUIPMENT	ELEC
PULL BOX	ELEC
SOLAR/PV EQUIPMENT	ELEC
SURGE PROTECTORS	ELEC
UPS SYSTEM	ELEC
XFMR	ELEC
DEFIBRILLATOR	EMERGENCY
EMG LIGHT	EMERGENCY
EMG PHONE	EMERGENCY
EYEWASH	EMERGENCY
FIRST AID	EMERGENCY
FUME HOOD	EMERGENCY
MISC EMERGENCY EQUIPMENT	EMERGENCY
SF SHOWER	EMERGENCY
ANNUNCIATORS	FIRE ALARM
DAMPERS	FIRE ALARM
FIRE ALARM DEVICES	FIRE ALARM
FIRE ALARM PANEL	FIRE ALARM
FIRE INITIATING DEVICES	FIRE ALARM
FIRE DEPARTMENT CONNECTIONS	FIRE SUPPRESSION
FIRE EXTINGUISHERS	FIRE SUPPRESSION
FIRE HYDRANTS	FIRE SUPPRESSION
FIRE SUPPRESSION SYSTEM	FIRE SUPPRESSION
SPRINKLERS	FIRE SUPPRESSION
APPLIANCE	FOOD SERVICE
COLD TABLE	FOOD SERVICE
CONVEYER	FOOD SERVICE
COOK TOP	FOOD SERVICE
COOLER	FOOD SERVICE
FREEZER	FOOD SERVICE
ICE MAKER	FOOD SERVICE
MISC	FOOD SERVICE
OVEN	FOOD SERVICE
VENT HOOD	FOOD SERVICE
WASH STATIONS	FOOD SERVICE
AHU	HVAC
AIR VALVE	HVAC
ATU	HVAC
BOILERS	HVAC
CHILLERS	HVAC
COMPRESSORS	HVAC
CONTROL DEVICES	HVAC
CONTROLLER	HVAC
COOLING TOWER	HVAC
DHUM	HVAC
DXU	HVAC

ERU	HVAC
FAN	HVAC
FCU	HVAC
FILTERS	HVAC
GRILLS	HVAC
HEAT EXCHANGERS	HVAC
HEATERS	HVAC
HUMIDIFIER	HVAC
OAHU	HVAC
PKG UNIT	HVAC
PUMP	HVAC
SENSORS	HVAC
SEPERATORS	HVAC
STRAINER	HVAC
UNIT HEATER	HVAC
VFD	HVAC
WATER VALVES	HVAC
HAND BOXES	IRRIGATION
IRRIGATION SYSTEM	IRRIGATION
CLEAN OUT	PLUMB
DISPOSAL	PLUMB
DRAIN	PLUMB
FAUCETS	PLUMB
FLUSH VALVES	PLUMB
PURIFIERS	PLUMB
RPZ	PLUMB
SINKS	PLUMB
TRAPS	PLUMB
URINALS	PLUMB
WATER CLOSET	PLUMB
WATER FOUNTAIN	PLUMB
WATER HEATER	PLUMB
ANIMAL EQUIPMENT	RESEARCH
BIO HAZARD EQUIPMENT	RESEARCH
INCUBATORS	RESEARCH
LAB EQUIPMENT	RESEARCH
LAB STERILIZER	RESEARCH
RESEARCH EQUIPMENT	RESEARCH
SECURITY CAMERAS	RESEARCH
SECURITY PANEL	RESEARCH
BOLLARDS	SITE
LIGHTING POLES	SITE
SIGN	SITE
TRAFFIC CONTROL	SITE
WASTE EQUIPMENT	SITE

Exhibit 3.D - FM Model Criteria

A valuable part of the BIM process, models provide opportunity to improve communication during planning, design, construction, and operations. Outstanding implications exist for the use of models in facilities management; however, model integration is not currently a common management tool at Sam Houston State University (SHSU). Desiring to always improve, SHSU is committed to the innovative use of tools such as models that help staff to better steward facilities. A continued improvement of operational workflows is an expected result from the use of model deliverables.

The intent of this section is to include the minimum criteria for 3D models as they relate to the BIM for FM Deliverables alone. This section does not replace or lessen modeling criteria in other sections of SHSU specifications or contract requirements related to other BIM Use Cases (applications of BIM for other objectives).

Native Files from As-Built / Field Coordinated Model

The construction contractor shall provide two versions of the native files that support the as-built / field coordinated model at multiple times before project closeout and at substantial completion. These files are the model instances that build the federated coordination models. One version shall be the native files saved from the design / trade software it was created in. The other version shall be the interoperable / sharing formats from the design / trade software it was created in. Examples of interoperable formats include: LandXML, gbXML, DWG, IFC, ASCII, FBX, etc. The intent for design / trade files and interoperable formats is to allow opportunities for integration in future design work, allowing for record update with field changes, and much more.

FM Model

The construction contractor shall provide two versions of the as-built / field coordinated model in re-savable NWD format at multiple times before close-out (per the BIM Execution Plan) and at substantial completion of the project. As-built models shall at a minimum include all components represented in the COBie deliverable for spaces and components (named equipment). Exception to this shall be all building level assets (clocks, seating, faucets, etc.), fire initiating and indicating devices, and BAS sensors.

One version of the NWD provided model shall be the final as-built model per the field coordination effort.

The second version of the NWD model shall be optimized (stripped down and lightweight) for Facilities Management use. Optimization shall allow for easy navigation and viewing of assets. Particular optimization shall include, but not be limited to, ceilings at fifty percent transparency and the hiding of all doors. Also, included shall be the unique color-coding of all building systems (electrical, chilled water, heating water, domestic water, etc.) per the current SHSU coloring schema. The coloring schema shall be documented in the BIM Execution Plan as well.

Each component in COBie shall have a minimum of one saved viewpoint in the model. Exception to this shall be all building level assets (clocks, seating, faucets, etc.), fire initiating and indicating devices, and BAS sensors. These saved viewpoint files shall be attached to the component in the documents portion of COBie.