West Texas A&M University

Facility Condition Assessment

Panhandle Plains Historic Museum

March 14th, 2025

Alpha™
Facilities Solutions

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EXECUTIVE SUMMARY

Introduction

West Texas A&M University - Panhandle Plains Historic Museum 2025 entered into a contract with ALPHA Facilities Solutions, LLC (ALPHA) to provide facility condition assessment to forecast facility needs and justify funding requirements. The project was completed by a team consisting of engineers, architects, and construction professionals. Data collected during the Facility Condition Assessment phase of the project was input into Asset Planning and Performance Software (APPS) in order to estimate current and future funding requirements for facility sustainment. This predictive approach to asset management is known as Capital Planning and is used to anticipate funding and maintenance needs many years into the future.

The scope of work included the following:

1. Identify and document current and forecasted conditions of approximately 217,171 square feet of facilities.
2. Identify and document current site needs.
3. Identify and document remaining service life of major building systems to include envelope; architectural finishes; roofs; electrical; plumbing; and heating, ventilation, and air conditioning (HVAC).
4. Provide Rough Order of Magnitude (ROM) cost estimates for building system renewal and site repairs.
5. Forecast facility renewal requirements based on lifecycle analysis of existing systems over the span of the next 20 years for each facility.
6. Provide a Facility Condition Index (FCI) measurement to illustrate the relative condition of all facilities.
7. Preform an abbreviated accessibility survey and provide a preliminary capital-planning budget for addressing accessibility related deficiencies.
8. Perform a preliminary energy assessment.
9. Perform a HVAC system assessment, lighting assessment and envelope assessment study.

Acknowledgement

Finally, the ALPHA Team would like to take this opportunity to thank West Texas A&M University for allowing ALPHA to help achieve its goals. We would also like to thank the facility team and their staff for investing a substantial amount of their valuable time to work with us on this project; their knowledge of the facilities was superb and their contributions were invaluable.

Facility Condition Assessment Approach

Asset Planning and Performance Software (APPS) was used to document facility conditions, to determine current requirements, and to forecast future requirements for facilities within the Panhandle Plains Historic Museum. Parametric cost models contained within APPS were assigned to most buildings while new cost models were developed in instances where an appropriate cost model did not exist. New cost models developed by the ALPHA Team are also contained within APPS. System and component life cycles used within the cost models are based on average service life as shown in the Preventive Maintenance Guidebook: Best Practices to Maintain Efficient and Sustainable Buildings published by Building Owners and Managers Association (BOMA) International. When life cycle information is not provided by BOMA, we used our experience and professional judgment to suggest appropriate average service life for those components and systems. Unit costs, which are used to calculate renewal requirements, are also built into the cost models. Life cycles and unit costs have been adjusted on a location-specific basis as appropriate or as requested by museum personnel.

Although there are many factors that are important to obtain a successful outcome for a facility condition assessment, three provide the foundation for establishing a reliable cost model for each building. Those three factors are related to the following basic building information:

- Gross area
- Date built
- Building/location name

The gross area of a building, also known as gross square footage (GSF), is one of the basic building blocks for determining current replacement value (CRV) and generating system renewal costs, which are major components of a parametric-based effort. The date built for each facility provides the basis for establishing life cycles for many, and in some cases, all major building systems. Finally, although not critical to the outcome of the project, agreeing upon a building/location naming convention that is meaningful to all stakeholders enhances the usefulness and readability of the facility condition assessment report. Please note that GSF for each building was provided by the museum and generally was not validated as part of this project. It should be noted that some building names may have changed at the direction of the museum from what was indicated in documentation initially provided.

In order to determine basic building information, the ALPHA Team met with designated museum personnel to discuss museum-specific information such as building construction/renovation programs and building naming conventions. Scaled floor and site plans were generally not available, so square footages associated with additions and site features were obtained from a combination of sources to include museum records, satellite imagery, and professional judgment.

It is worth noting that, although most concealed systems may appear to be functional, the risk of failure increases with time when they have exceeded the average service life as predicted by BOMA. Consequently, this effort assumes that replacement of concealed systems that have exceeded the average service life as predicted by BOMA is appropriate. Based on the availability of resources and the tolerance for risk or potential out-of-service conditions, the museum may elect to defer immediate replacement of concealed systems that have exceeded average service life as appropriate.

Building condition requirements and site infrastructure requirements are documented within Asset Planning and Performance Software and based on estimated quantities, RS Means, and client supplied data when available.

Prioritization of Needs

Finally, all needs contained within APPS have been assigned a default priority based on importance to mission performance. Therefore, systems whose failure might render a building not suitable for occupancy have been ranked with a higher priority than those systems that have minimal or no impact on a facility's suitability for occupancy. For example, replacement of an HVAC system might take priority over replacement of flooring. Although additional priorities are available within APPS, priorities used for this project are:

- High
- Medium
- Low

Needs contained within APPS have been ranked in terms of urgency in order to aid in the prioritization for allocation of funds. The priorities of applicable systems for this project are as follows:

High

- Additional Access - Drinking Fountains / Public Telephones
- Conveying Systems (Accessibility)
- Electrical - Branch Wiring
- Electrical - Communications and Security
- Electrical - Lighting
- Electrical - Other Electrical Systems
- Electrical - Service & Distribution
- Entrances / Exit
- Fire Protection - Sprinklers
- HVAC - Controls & Instrumentation
- HVAC - Distribution Systems
- HVAC - Heat Generating Systems
- Parking / Accessible Route
- Roofing
- Toilet Rooms
- Plumbing - Sanitary Waste
- Plumbing - Domestic Water Distribution

Medium

- Conveying
- Exterior Enclosure - Exterior Doors
- Exterior Enclosure - Exterior Windows
- Plumbing - Plumbing Fixtures
- Interior Construction - Interior Doors

Low

- Exterior Enclosure - Exterior Walls
- Interior Construction - Fittings
- Interior Finishes - Ceiling Finishes
- Interior Finishes - Floor Finishes
- Interior Finishes - Wall Finishes
- Pedestrian Pavements
- Site Development
- Vehicular Pavements

Building Performance Metrics

As part of the FCA process, a facility condition index (FCI) was calculated for each facility. The FCI is used to quantify a facility's physical condition at a specific point in time and is calculated using the expired system replacement costs (costs associated with systems that are beyond average service life) and the current replacement value (CRV) of the building. Expired system replacement costs consist of work that is necessary to restore the facility to a condition equivalent to its original (like new) state.

The FCI can be helpful in several ways to include:

- Comparing the condition of one facility to a group of facilities
- Tracking trends (the extent of improvement or deterioration over time)
- Prioritizing capital improvement projects
- Making renovation versus replacement decisions

The FCI is calculated as shown in the example below.

Example 1: Total expired system replacement costs (Requirements) = $3,000,000

Current Replacement Value (CRV) = $10,000,000

$$FCI = \frac{\$3,000,000}{\$10,000,000} = .30$$

It is important to note there is no recognized standard for what constitutes an acceptable or unacceptable FCI. For example, the International Facility Management Association (IFMA) indicates that building condition is often defined in terms of the FCI as follows:

1. Good - 0% to 5%,
2. Fair - 5% to 10%,
3. Poor - 10% to 30%, and
4. Critical - greater than 30%

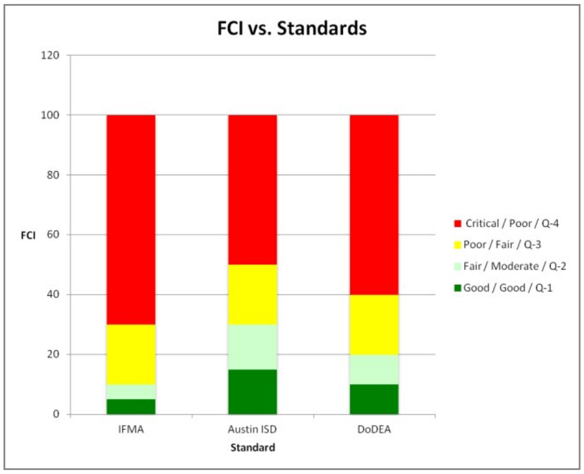


Figure 1. FCI Standards

The Renovate Versus Replacement Question

A question that often arises is at what point does it make sense to replace a facility rather than to renovate it? Again, there is no industry standard, but conventional thinking is that replacement of a facility should be seriously considered when the FCI rises above 50%. However, the FCI is not the only consideration when making renovation versus replacement decisions. One consideration that should be taken into account is whether a facility is functionally adequate for the intended use. Another consideration revolves around the magnitude of needed renovations. For example, when cost of renovation reaches or exceeds 50% of the replacement cost of the facility, requirements to meet Americans with Disabilities Act (ADA), Life Safety and possibly other codes may be triggered. When the requirement to meet current building codes or civil rights statutes, such as those mentioned above are triggered, additional costs will be incurred. Although it is not possible to predict what the additional costs will be until project requirements are identified and cost estimates are prepared, it has been our experience that additional cost can be expected to range from 5% to 20% depending upon the age of the facility.

Categorization of Costs

At this point, it is appropriate to review the different types of costs associated with facility renovation and construction and how they apply to this project. According to the American Institute of Architects (AIA), facility capital costs are normally subdivided into three major categories - site costs, hard costs, and soft costs. Site costs are normally associated with the owner's initial land acquisition and development costs for a project and are not a consideration in the context of this project. Hard costs are associated with direct construction costs while soft costs can be defined as any indirect costs incurred in addition to the direct construction costs. Soft costs include a variety of costs such as design fees, legal fees, taxes, insurance, owner's administration costs, and financing costs. Cost data produced by the parametric cost models within APPS includes hard costs including consideration of renewal costs, which accounts for the additional cost associated with replacing an existing building system versus constructing the system in a new facility. Cost information within this report does not include soft costs.

It is important to remember that cost models are intended to produce rough order of magnitude (ROM) costs for purposes of developing a baseline from which to establish an FCI for each facility and to facilitate capital planning. It is not unusual for those new to the parametric cost estimating/life cycle analysis process to have expectations that are not completely in alignment with what the process is intended to yield. For example, the parametric cost estimating/life cycle analysis process generates ROM budgeting-level costs while costs that are more detailed are derived during formal preliminary design and final design cost estimating processes.

As a point of interest, *APPA: Leadership in Educational Facilities* published a paper citing research conducted by the *Building Research Board of the National Research Council* indicating, “Underfunding of maintenance and repair is a widespread and persistent problem.” The council concluded, “That an appropriate total budget allocation for routine maintenance and capital renewal is in the range of two to four percent of the aggregate current replacement value (CRV) of those facilities (excluding major infrastructure). When a backlog of deferred maintenance has been allowed to accumulate, spending must exceed this minimum level until the backlog has been eliminated.

Facility Condition Assessment

Facility-related data contained in this report was developed at the building level, which in turn, was rolled up at the campus level. Likewise, site infrastructure requirements were rolled up at the campus level. All data was then rolled up to provide an aggregate view of District facilities. Data within this report has been grouped as follows:

- Museum

This report includes the following content, which is found at campus and/or Executive Summary levels:

- Facility Description: Summary of Findings
- Current Needs (2025)
- Forecasted Needs (2030)
- Current and Forecasted Needs: Summarized by Reporting Period
- Current and Forecasted Needs: Summarized by System
- Need Priorities (High - Medium - Low)

Appendix B - Supplemental Information provides additional information the reader may find useful.

Site and Infrastructure Condition Assessment

A site infrastructure assessment was included in the scope of work for this project. The site infrastructure assessment is a visual evaluation of the site systems. The teams walked each site to determine the general condition of the systems and categorized them as follows:

- Good condition
- In need of repair
- In need of replacement

Estimated quantities were calculated by digitizing marked-up Google Earth aerial photographs. Google Earth Aerial photographs were used in lieu of site plans.

The site assessment was performed and the subsequent results grouped by location. Findings for each location were divided as follows:

- Pedestrian Pavements
- Vehicular Pavements
- Site Development

Please note that not all locations have all of the various infrastructure systems present.

We determined unit pricing for the various deficiency requirements by referencing 2025 RSMeans Building Construction Cost Data and Assembly Cost Data when available; industry sources were used as a supplemental source for unit pricing when needed.

Facility Condition Assessment Findings

At the time of the assessment there was one permanent building located at West Texas A&M University. In the six years since the previous assessment performed by ALPHA, construction cost has dramatically increased. This increase has led to a drastic increase in the Current Replacement Value of the museum, and similarly, has increased the total cost of backlog and project needs.

The team entered all accessible spaces in the permanent buildings to include classrooms, administrative, restrooms, mezzanines, and mechanical rooms. This data was input into your capital forecast solution. Additionally, please note the following:

- The team did not enter any "permit - required confined spaces" as defined by the Occupational Safety & Health Administration.
- Building systems are assessed based on the predominant material type and condition.
- There was no invasive testing performed on concealed systems to justify extending the useful life. These concealed systems were given an assessment considering current age and additional information from Client provided escorts.
- Life safety systems are assessed based on visual inspections, client provided information, and current inspection tags. ALPHA follows the Building Owners and Manager's Association's recommended life cycles for capital renewal forecasting purposes.

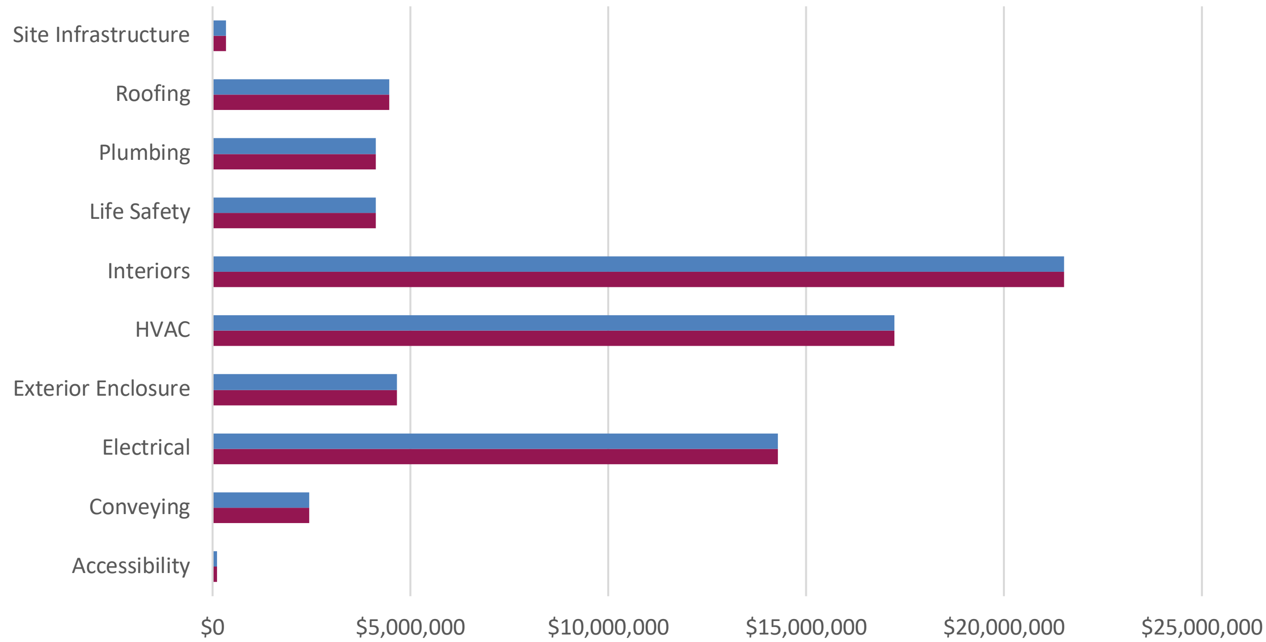
The table below contains building-specific information regarding current and forecast Facility Condition Indices. A comprehensive list of expired systems and those expected to expire between now and the Year 2045 is shown in the Current and Forecasted Needs Summarized by System table.

Table 1. Facility Description: Summary of Findings: West Texas A&M University

Name	Year Built	Area (SF)	Total Needs 2025	Current Replacement Value	2025 FCI %	Total Needs 2030	2030 FCI %
Panhandle Plains Historic Museum	1932	217,171	$72,843,707	$152,651,336	48	$72,843,707	48
SUBTOTAL	***-***	***217,171***	***$72,843,707***	***$152,651,336***	***48***	***$72,843,707***	***48***
Site and Infrastructure (excluded from FCI calculations)			$332,340			$332,340	
Accessibility (excluded from FCI calculations)			$114,287			$114,287	
TOTALS		**217,171**	**$73,290,334**	**$152,651,336**		**$73,290,334**	

Note: The cumulative FCI for the West Texas A&M University facilities assessed is 48 while the cumulative FCI in 5 years is estimated to be 48 assuming current sustainment levels.

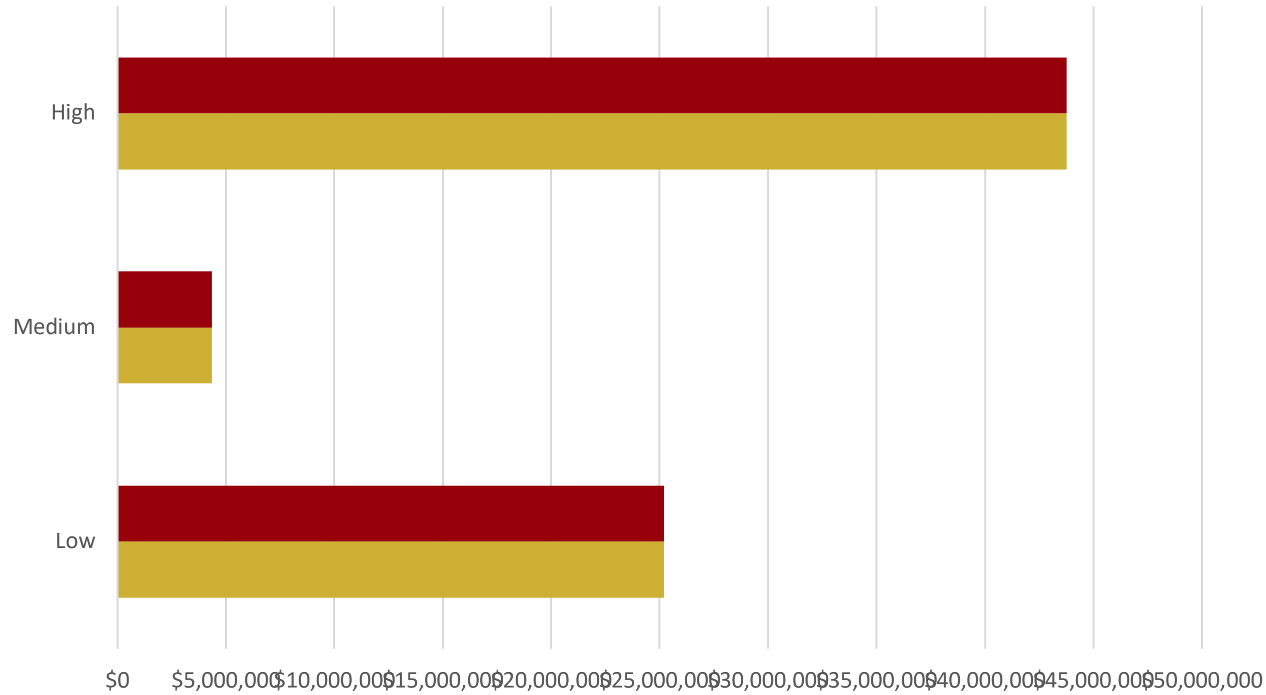
Figure 2. Comparison of 2025 Current Needs vs. 2030 Forecasted Needs by System Group: West Texas A&M University



	Accessibility	Conveying	Electrical	Exterior Enclosure	HVAC	Interiors	Life Safety	Plumbing	Roofing	Site Infrastructure
2025	$114,287	$2,437,500	$14,291,571	$4,658,626	$17,232,543	$21,510,542	$4,132,279	$4,119,209	$4,461,438	$332,340
2030	$114,287	$2,437,500	$14,291,571	$4,658,626	$17,232,543	$21,510,542	$4,132,279	$4,119,209	$4,461,438	$332,340

Note: Forecasted Needs (2030) include Current Needs (2025)

Figure 3. Comparison of 2025 Current Needs vs. 2030 Forecasted Needs by Priority: West Texas A&M University



	Low	Medium	High
2025	$25,188,029	$4,347,096	$43,755,210
2030	$25,188,029	$4,347,096	$43,755,210

Renewal Forecast

The renewal forecast below shows the current maintenance and repair backlog and projected facility sustainment requirements over the next 20 years. Please note the renewal forecast does not include potential costs associated with seismic evaluation; seismic retrofitting; hazardous material inspection, evaluation, and mitigation, including asbestos abatement; and NFPA 101 and ADA upgrades. The renewal forecast is shown below:

Figure 4. Current and Forecasted Needs: Summarized by Reporting Period Current +10 Years: West Texas A&M University

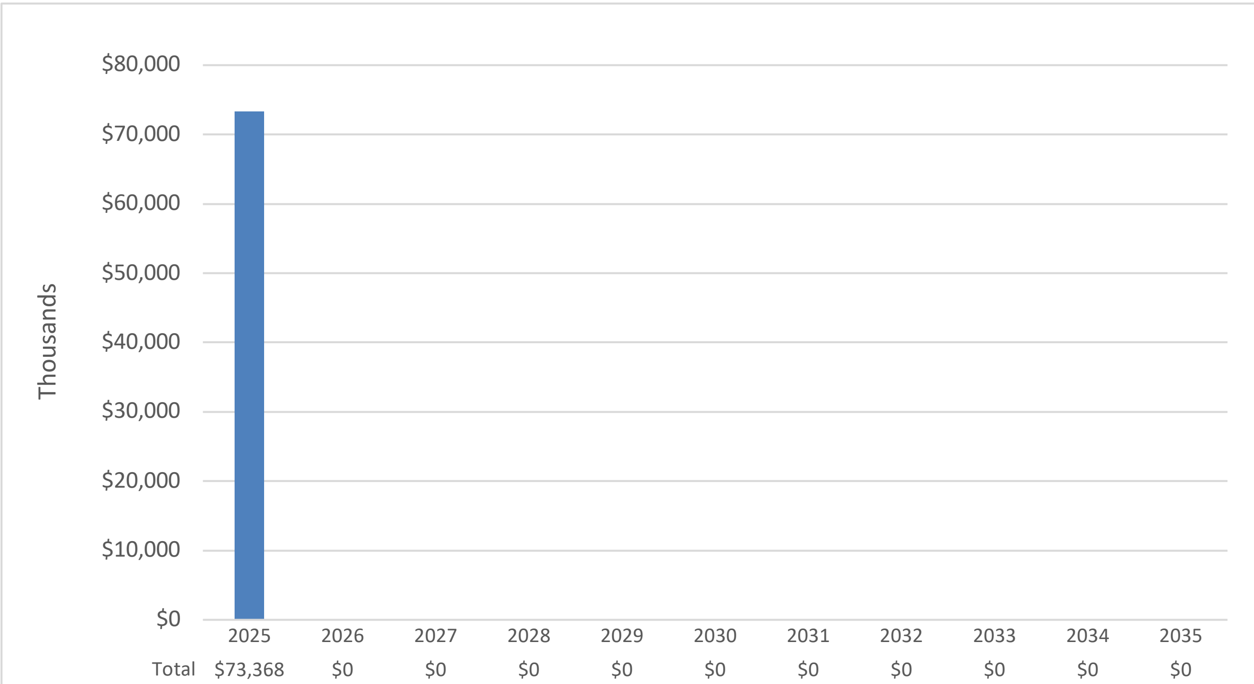


Figure 5. Current and Forecasted Needs: Summarized by Reporting Period Years 11-20: West Texas A&M University

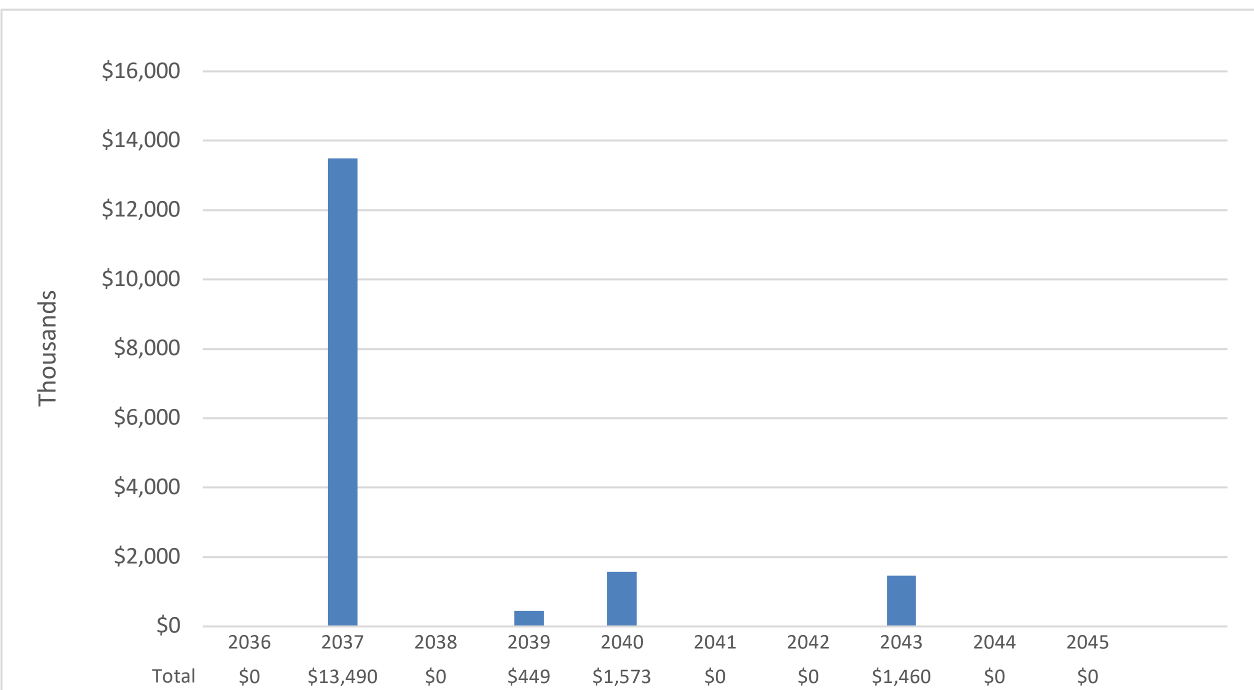


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Table 2. Current and Forecasted Needs Summarized by System (Current + 5 years): West Texas A&M University

System	2025	2026	2027	2028	2029	2030
Cumulative Needs by Year	***$73,290,334***	***$73,290,334***	***$73,290,334***	***$73,290,334***	***$73,290,334***	***$73,290,334***
Needs by Year	***$73,290,334***	***$0***	***$0***	***$0***	***$0***	***$0***
Exterior Enclosure	**$4,658,626**	**$0**	**$0**	**$0**	**$0**	**$0**
Exterior Walls (Finishes)	$3,345,147	$0	$0	$0	$0	$0
Exterior Windows	$1,140,682	$0	$0	$0	$0	$0
Exterior Doors	$172,797	$0	$0	$0	$0	$0
Roofing	**$4,461,438**	**$0**	**$0**	**$0**	**$0**	**$0**
Roof Coverings	$4,461,438	$0	$0	$0	$0	$0
Interior Construction	**$2,019,332**	**$0**	**$0**	**$0**	**$0**	**$0**
Interior Doors	$0	$0	$0	$0	$0	$0
Specialties	$2,019,332	$0	$0	$0	$0	$0
Interiors	**$19,491,210**	**$0**	**$0**	**$0**	**$0**	**$0**
Ceiling Finishes	$5,803,797	$0	$0	$0	$0	$0
Floor Finishes	$10,636,475	$0	$0	$0	$0	$0
Wall Finishes	$3,050,938	$0	$0	$0	$0	$0
Conveying	**$2,437,500**	**$0**	**$0**	**$0**	**$0**	**$0**
Conveying Systems	$2,446,064	$0	$0	$0	$0	$0
Plumbing	**$4,119,209**	**$0**	**$0**	**$0**	**$0**	**$0**
Domestic Water Distribution	$1,761,546	$0	$0	$0	$0	$0
Plumbing Fixtures	$596,117	$0	$0	$0	$0	$0
Sanitary Waste	$1,761,546	$0	$0	$0	$0	$0
HVAC	**$17,232,543**	**$0**	**$0**	**$0**	**$0**	**$0**
Controls and Instrumentation	$1,145,660	$0	$0	$0	$0	$0
Distribution System	$15,887,428	$0	$0	$0	$0	$0
Heat Generation	$199,455	$0	$0	$0	$0	$0
Fire Protection	**$4,132,279**	**$0**	**$0**	**$0**	**$0**	**$0**
Sprinklers & Standpipe	$4,132,279	$0	$0	$0	$0	$0
Electrical	**$14,291,571**	**$0**	**$0**	**$0**	**$0**	**$0**
Branch Wiring	$4,785,476	$0	$0	$0	$0	$0
Lighting	$4,785,476	$0	$0	$0	$0	$0
Service Distribution	$1,436,106	$0	$0	$0	$0	$0
Communications and Security	$2,052,242	$0	$0	$0	$0	$0
Exit Signs and Emergency Lighting	$1,232,272	$0	$0	$0	$0	$0
Site Infrastructure	**$332,340**	**$0**	**$0**	**$0**	**$0**	**$0**
Pedestrian Pavements	$129,250	$0	$0	$0	$0	$0
Site Development	$101,590	$0	$0	$0	$0	$0
Vehicular Pavements	$101,500	$0	$0	$0	$0	$0
Accessibility	**$114,287**	**$0**	**$0**	**$0**	**$0**	**$0**
Additional Access - Drinking Fountains / Public Telephones	$17,921	$0	$0	$0	$0	$0
Entrances / Exit	$10,130	$0	$0	$0	$0	$0
Parking / Accessible Route	$2,841	$0	$0	$0	$0	$0
Toilet Rooms	$74,831	$0	$0	$0	$0	$0

Table 3. Current and Forecasted Needs Summarized by System (Years 6 - 10): West Texas A&M University

System	2031	2032	2033	2034	2035
Cumulative Needs by Year	***$73,290,334***	***$73,290,334***	***$73,290,334***	***$73,290,334***	***$73,290,334***
Needs by Year	***$0***	***$0***	***$0***	***$0***	***$0***
Exterior Enclosure	**$0**	**$0**	**$0**	**$0**	**$0**
Exterior Walls (Finishes)	$0	$0	$0	$0	$0
Exterior Windows	$0	$0	$0	$0	$0
Exterior Doors	$0	$0	$0	$0	$0
Roofing	**$0**	**$0**	**$0**	**$0**	**$0**
Roof Coverings	$0	$0	$0	$0	$0
Interior Construction	**$0**	**$0**	**$0**	**$0**	**$0**
Interior Doors	$0	$0	$0	$0	$0
Specialties	$0	$0	$0	$0	$0
Interiors	**$0**	**$0**	**$0**	**$0**	**$0**
Ceiling Finishes	$0	$0	$0	$0	$0
Floor Finishes	$0	$0	$0	$0	$0
Wall Finishes	$0	$0	$0	$0	$0
Conveying	**$0**	**$0**	**$0**	**$0**	**$0**
Conveying Systems	$0	$0	$0	$0	$0
Plumbing	**$0**	**$0**	**$0**	**$0**	**$0**
Domestic Water Distribution	$0	$0	$0	$0	$0
Plumbing Fixtures	$0	$0	$0	$0	$0
Sanitary Waste	$0	$0	$0	$0	$0
HVAC	**$0**	**$0**	**$0**	**$0**	**$0**
Controls and Instrumentation	$0	$0	$0	$0	$0
Distribution System	$0	$0	$0	$0	$0
Heat Generation	$0	$0	$0	$0	$0
Fire Protection	**$0**	**$0**	**$0**	**$0**	**$0**
Sprinklers & Standpipe	$0	$0	$0	$0	$0
Electrical	**$0**	**$0**	**$0**	**$0**	**$0**
Branch Wiring	$0	$0	$0	$0	$0
Lighting	$0	$0	$0	$0	$0
Service Distribution	$0	$0	$0	$0	$0
Communications and Security	$0	$0	$0	$0	$0
Exit Signs and Emergency Lighting	$0	$0	$0	$0	$0
Site Infrastructure	**$0**	**$0**	**$0**	**$0**	**$0**
Pedestrian Pavements	$0	$0	$0	$0	$0
Site Development	$0	$0	$0	$0	$0
Vehicular Pavements	$0	$0	$0	$0	$0
Accessibility	**$0**	**$0**	**$0**	**$0**	**$0**
Additional Access - Drinking Fountains / Public Telephones	$0	$0	$0	$0	$0
Entrances / Exit	$0	$0	$0	$0	$0
Parking / Accessible Route	$0	$0	$0	$0	$0
Toilet Rooms	$0	$0	$0	$0	$0

Table 4. Current and Forecasted Needs Summarized by System (Years 11 - 15): West Texas A&M University

System	2036	2037	2038	2039	2040
Cumulative Needs by Year	***$73,290,334***	***$86,780,608***	***$86,780,608***	***$87,229,784***	***$88,802,490***
Needs by Year	***$0***	***$13,490,274***	***$0***	***$449,176***	***$1,572,706***
Exterior Enclosure	**$0**	**$2,675,036**	**$0**	**$0**	**$181,142**
Exterior Walls (Finishes)	$0	$2,491,619	$0	$0	$0
Exterior Windows	$0	$0	$0	$0	$181,142
Exterior Doors	$0	$183,417	$0	$0	$0
Roofing	**$0**	**$0**	**$0**	**$0**	**$0**
Roof Coverings	$0	$0	$0	$0	$0
Interior Construction	**$0**	**$9,411,810**	**$0**	**$0**	**$0**
Interior Doors	$0	$2,194,876	$0	$0	$0
Specialties	$0	$7,216,934	$0	$0	$0
Interiors	**$0**	**$1,403,429**	**$0**	**$449,176**	**$0**
Ceiling Finishes	$0	$0	$0	$0	$0
Floor Finishes	$0	$1,403,429	$0	$449,176	$0
Wall Finishes	$0	$0	$0	$0	$0
Conveying	**$0**	**$0**	**$0**	**$0**	**$0**
Conveying Systems	$0	$0	$0	$0	$0
Plumbing	**$0**	**$0**	**$0**	**$0**	**$1,391,564**
Domestic Water Distribution	$0	$0	$0	$0	$0
Plumbing Fixtures	$0	$0	$0	$0	$1,391,564
Sanitary Waste	$0	$0	$0	$0	$0
HVAC	**$0**	**$0**	**$0**	**$0**	**$0**
Controls and Instrumentation	$0	$0	$0	$0	$0
Distribution System	$0	$0	$0	$0	$0
Heat Generation	$0	$0	$0	$0	$0
Fire Protection	**$0**	**$0**	**$0**	**$0**	**$0**
Sprinklers & Standpipe	$0	$0	$0	$0	$0
Electrical	**$0**	**$0**	**$0**	**$0**	**$0**
Branch Wiring	$0	$0	$0	$0	$0
Lighting	$0	$0	$0	$0	$0
Service Distribution	$0	$0	$0	$0	$0
Communications and Security	$0	$0	$0	$0	$0
Exit Signs and Emergency Lighting	$0	$0	$0	$0	$0
Site Infrastructure	**$0**	**$0**	**$0**	**$0**	**$0**
Pedestrian Pavements	$0	$0	$0	$0	$0
Site Development	$0	$0	$0	$0	$0
Vehicular Pavements	$0	$0	$0	$0	$0
Accessibility	**$0**	**$0**	**$0**	**$0**	**$0**
Additional Access - Drinking Fountains / Public Telephones	$0	$0	$0	$0	$0
Entrances / Exit	$0	$0	$0	$0	$0
Parking / Accessible Route	$0	$0	$0	$0	$0
Toilet Rooms	$0	$0	$0	$0	$0

Table 5. Current and Forecasted Needs Summarized by System (Years 16-20): West Texas A&M University

System	2041	2042	2043	2044	2045
Cumulative Needs by Year	***$88,802,490***	***$88,802,490***	***$90,262,825***	***$90,262,825***	***$90,262,825***
Needs by Year	***$0***	***$0***	***$1,460,335***	***$0***	***$0***
Exterior Enclosure	**$0**	**$0**	**$0**	**$0**	**$0**
Exterior Walls (Finishes)	$0	$0	$0	$0	$0
Exterior Windows	$0	$0	$0	$0	$0
Exterior Doors	$0	$0	$0	$0	$0
Roofing	**$0**	**$0**	**$0**	**$0**	**$0**
Roof Coverings	$0	$0	$0	$0	$0
Interior Construction	**$0**	**$0**	**$0**	**$0**	**$0**
Interior Doors	$0	$0	$0	$0	$0
Specialties	$0	$0	$0	$0	$0
Interiors	**$0**	**$0**	**$1,460,335**	**$0**	**$0**
Ceiling Finishes	$0	$0	$0	$0	$0
Floor Finishes	$0	$0	$0	$0	$0
Wall Finishes	$0	$0	$1,460,335	$0	$0
Conveying	**$0**	**$0**	**$0**	**$0**	**$0**
Conveying Systems	$0	$0	$0	$0	$0
Plumbing	**$0**	**$0**	**$0**	**$0**	**$0**
Domestic Water Distribution	$0	$0	$0	$0	$0
Plumbing Fixtures	$0	$0	$0	$0	$0
Sanitary Waste	$0	$0	$0	$0	$0
HVAC	**$0**	**$0**	**$0**	**$0**	**$0**
Controls and Instrumentation	$0	$0	$0	$0	$0
Distribution System	$0	$0	$0	$0	$0
Heat Generation	$0	$0	$0	$0	$0
Fire Protection	**$0**	**$0**	**$0**	**$0**	**$0**
Sprinklers & Standpipe	$0	$0	$0	$0	$0
Electrical	**$0**	**$0**	**$0**	**$0**	**$0**
Branch Wiring	$0	$0	$0	$0	$0
Lighting	$0	$0	$0	$0	$0
Service Distribution	$0	$0	$0	$0	$0
Communications and Security	$0	$0	$0	$0	$0
Exit Signs and Emergency Lighting	$0	$0	$0	$0	$0
Site Infrastructure	**$0**	**$0**	**$0**	**$0**	**$0**
Pedestrian Pavements	$0	$0	$0	$0	$0
Site Development	$0	$0	$0	$0	$0
Vehicular Pavements	$0	$0	$0	$0	$0
Accessibility	**$0**	**$0**	**$0**	**$0**	**$0**
Additional Access - Drinking Fountains / Public Telephones	$0	$0	$0	$0	$0
Entrances / Exit	$0	$0	$0	$0	$0
Parking / Accessible Route	$0	$0	$0	$0	$0
Toilet Rooms	$0	$0	$0	$0	$0

PANHANDLE PLAINS HISTORIC MUSEUM

Table 6: Facility Description: West Texas A&M University - Panhandle Plains Historic Museum

Summary of Findings

Construction Type	Three-Story Structure with Basement
Roof Type	Modified Bitumen
Ceiling Type	Suspended Acoustical Tile and Painted
Lighting	LED
HVAC	Air Handlers with Chilled Water and Steam from Central Plant
Elevator	Yes
Fire Sprinkler	Yes
Fire Alarm	Yes

Name	Year Built	Area (SF)	Total Needs 2025	Current Replacement Value	2025 FCI %	Total Needs 2030	2030 FCI %
Panhandle Plains Historic Museum	1932	217,171	$72,843,707	$152,651,336	48	$72,843,707	48
Site Information			$332,340			$332,340	
Accessibility			$114,287			$114,287	
TOTAL			$73,290,334			$73,290,334	

CONDITION SUMMARY:

- The Panhandle Plains Historical Museum (PPHM) is the largest history museum in Texas, with a collection of more than three million artifacts. From its original building constructed in 1932, five additions have been added, the latest being the Conservation Wing in 1983. The Museum Annex, constructed in 1951, was added to the complex in 1973.
- The facility was generally in poor condition. Many of the major building systems have exceeded recommended useful life. Several systems, including high priority systems, are in need of repair and/or replacement due to deterioration and damage.
- For any repair or renovation work, attention should be taken for the potential disturbance of hazardous materials. We did not perform an environmental study for this project, but it is likely that a facility of this age has issues. Likely areas of concern include 9" x 9" vinyl composition floor tiles, mastic used for all flooring, caulking used for windows, gypsum plaster wall systems, and thermal insulation in mechanical rooms. There also could be more areas of concern not observed by our assessment team.

CONDITION SUMMARY:

- HVAC and Envelope recommendations in the following preliminary energy report assume that demolition has already taken place. Additional HVAC components for recommended upgrades have been added to the 20-year capital needs table to include boilers, pumps, expansion tanks, air separator, chilled and hot water piping, air handlers, VAV boxes, duct work, humidifiers and controls. These components build the HVAC sub systems of Controls and Instrumentation, Distribution and Heat Generation.

Conveying

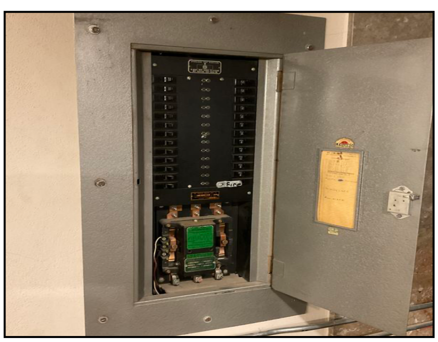
The museum is equipped with three passenger elevators, each serving different sections of the facility. The elevator added in 1966 underwent updates to comply with the Americans with Disabilities Act in 2000, enhancing accessibility for all visitors. Meanwhile, the elevator in the Petroleum Wing was installed in 1982, and the annex elevator dates back to 1951. While all elevators are currently functional, they have exceeded their recommended useful life.

Conveying

The museum is equipped with two freight elevators, one of which was incorporated during the expansion in 1996, while the other was introduced in 1981 alongside the establishment of the Petroleum Wing. Although both elevators are currently functional they were observed to be in fair condition.

Electrical

Museum lighting was upgraded from incandescent, halogen, and fluorescent to LED between 2008 and 2010, retaining the original fixture types. The electrical branch wiring system is beyond its recommended life cycle.



Electrical

In areas that have not undergone renovations since 2000, the majority of service panels, switchboards, panel boards, and cable infrastructure have surpassed their anticipated lifespan. A significant portion of this equipment has been noted to be quite aged and in a state of disrepair.

Exterior Enclosure

The exterior metal and glazed doors have surpassed their anticipated lifespan. The hardware associated with the metal doors has been noted to be in a deteriorating state, whereas the hardware for the glazed doors is in moderate condition and will require replacement or repair to ensure functionality. Although the overhead door is showing signs of aging, it remains operational.

Exterior Enclosure

The curtain wall window system in the Petroleum Wing is currently in a moderate state of repair and is need of replacement have exceeded its recommended useful life.

Exterior Enclosure

The exterior windows have exceeded their expected lifespan. Only a few have been updated, while most have remained unchanged since 1974. These windows are constructed from single-pane aluminum, which significantly lacks energy efficiency.

Exterior Enclosure

The exterior wall finishes were in fair condition. It was noted that many parapets require re-grouting or re-caulking, and there are signs of chipping in various areas. Additionally, the expansion joints at the connections between buildings are in need of repair.

Fire Protection

The facility sprinkler system is outdated, and a chemical system must be updated to best protect historical artifacts within the facility.

Fire Protection

In sections of the facility that were not renovated in 2000, the wiring for the fire alarm system has surpassed its anticipated lifespan. Additionally, the State’s Fire Marshal Office conducted an inspection report on 01/14/25. 149 violations were notated of mixed severity. Violations included, but not limited to, no evacuation diagrams noted to be present in the building – multiple areas throughout the ceiling on all levels with exposed wiring in old junction boxes – partial sprinkler system in the Basement and 1st Level. The entire building is required to be sprinklered. Based on these findings and the exceeded life cycle the fire alarm and protection system is noted to be in poor condition.

Interiors

Vinyl composition tile (VCT) flooring has surpassed its anticipated lifespan, constituting roughly 41% of the total flooring, with 65% of that being 9" x 9" tiles. All carpeting has also exceeded its expected lifespan, particularly in the older library, where it appears to be adhered to the underlying 9” x 9” tiles, exhibiting visible damage in the office areas on the second and third floors. The carpeting in display areas is showing significant signs of wear and tear, while a small section of carpet squares installed last year remains in good condition. The stone, wood, and laminate flooring in the display areas on the second floor are all in fair to poor condition.

Interiors

In sections that have not undergone renovation since 2000, the acoustic ceilings are observed to be in fair to poor condition, with numerous tiles exhibiting cracks that necessitate replacement. Additionally, several areas show signs of staining due to leaks from the roof or piping, and there are instances of sagging tiles within the grid system.

Interiors

The wall structure predominantly consists of gypsum and has been noted to exhibit numerous instances of cracking and deterioration. It is recommended that these walls be repaired and repainted to restore their integrity. Additionally, the wall coverings applied in certain areas of the basement and second floor are experiencing significant failure, as evidenced by visible peeling and blistering in multiple locations.

Plumbing

In areas that were not updated in 2000, the plumbing fixtures are still functional; however, they have surpassed their anticipated lifespan. In the areas that underwent renovations in 2000, the plumbing fixtures remain in good condition.

Roofing

The roofing system seems to be an older installation, with around half of the surface recently treated with a white mastic coating. Throughout the roof, several soft spots have been observed, indicating potential weaknesses. Additionally, water ponding presents a concern, as the roof lacks adequate slope towards the drainage points in multiple areas.

Table 7. Expired Systems 2025: West Texas A&M University – Panhandle Plains Historic Museum

Building	System Category	System	Priority	2025 Needs
Panhandle Plains Historic Museum	Conveying	Conveying Systems	Medium	$2,437,500
Panhandle Plains Historic Museum	Electrical	Branch Wiring	High	$4,785,476
Panhandle Plains Historic Museum	Electrical	Communications and Security	High	$2,052,242
Panhandle Plains Historic Museum	Electrical	Exit Signs and Emergency Lighting	High	$1,232,272
Panhandle Plains Historic Museum	Electrical	Lighting	High	$4,785,476
Panhandle Plains Historic Museum	Electrical	Service Distribution	High	$1,436,106
Panhandle Plains Historic Museum	Exterior Enclosure	Exterior Doors	Medium	$172,797
Panhandle Plains Historic Museum	Exterior Enclosure	Exterior Walls (Finishes)	Low	$3,345,147
Panhandle Plains Historic Museum	Exterior Enclosure	Exterior Windows	Medium	$1,140,682
Panhandle Plains Historic Museum	Fire Protection	Sprinklers & Standpipe	High	$4,132,279
Panhandle Plains Historic Museum	HVAC	Controls and Instrumentation	High	$1,145,660
Panhandle Plains Historic Museum	HVAC	Distribution System	High	$15,887,428
Panhandle Plains Historic Museum	HVAC	Heat Generation	High	$199,455
Panhandle Plains Historic Museum	Interior Construction	Specialties	Low	$2,019,332
Panhandle Plains Historic Museum	Interiors	Ceiling Finishes	Low	$5,803,797
Panhandle Plains Historic Museum	Interiors	Floor Finishes	Low	$10,636,475
Panhandle Plains Historic Museum	Interiors	Wall Finishes	Low	$3,050,938
Panhandle Plains Historic Museum	Plumbing	Domestic Water Distribution	High	$1,761,546
Panhandle Plains Historic Museum	Plumbing	Plumbing Fixtures	Medium	$596,117
Panhandle Plains Historic Museum	Plumbing	Sanitary Waste	High	$1,761,546
Panhandle Plains Historic Museum	Roofing	Roof Coverings	High	$4,461,438
			TOTAL	**$72,843,707**

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Site and Infrastructure Assessment Findings

Site General Condition

The following site conditions and/or deficiencies were observed during the assessment.

- A portion of the handrails were in poor condition and in need of replacement as rusted railing was observed.
- A portion of the concrete stairs were in poor condition and in need of replacement as areas of broken, damaged and/or heaving steps were observed.
- A portion of the asphalt pavements were in poor condition and in need of resurfacing as longitudinal cracking, transverse cracking, and degradation were observed throughout the pavement.
- A portion of the concrete sidewalks were in poor condition and in need of replacement as multiple areas of broken, damaged, and/or heaving pavement were observed.
- A portion of the concrete curbing was in poor condition and in need of replacement as areas of broken, damaged, and/or heaving curbing was observed.

Site Improvements

A site infrastructure condition assessment was included in the scope of work for this project. The site infrastructure assessment is a visual evaluation of the site systems. The teams walked each site to determine the general condition of the systems and categorized them as follows:

- Good condition
- Poor condition and in need of repair
- Poor condition and in need of replacement

Estimated quantities were calculated by digitizing marked-up Google Earth aerial photographs. Google Earth aerial photographs were used in lieu of site plans. The site assessment was performed, and the subsequent results grouped by location. Findings for each location were divided as follows:

- Pedestrian Pavements
- Vehicular Pavements
- Site Development

Please note that not all locations have all of the various infrastructure systems present. We determined unit pricing for the various deficiency requirements by referencing 2025 RS Means Building Construction Cost Data and Assembly Cost Data when available. Industry sources were used as a supplemental source for unit pricing when needed.

A site infrastructure condition assessment was included in the scope of work for this project. The site infrastructure assessment is a visual evaluation of the site systems. The teams walked each site to determine the general condition of the systems and categorized them as follows:

- Good condition
- Poor condition and in need of repair
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Estimated quantities were calculated by digitizing marked-up Google Earth aerial photographs. Google Earth aerial photographs were used in lieu of site plans. The site assessment was performed, and the subsequent results grouped by location. Findings for each location were divided as follows:

- Pedestrian Pavements
- Vehicular Pavements
- Site Development

Please note that not all locations have all of the various infrastructure systems present. We determined unit pricing for the various deficiency requirements by referencing 2025 RS Means Building Construction Cost Data and Assembly Cost Data when available. Industry sources were used as a supplemental source for unit pricing when needed.

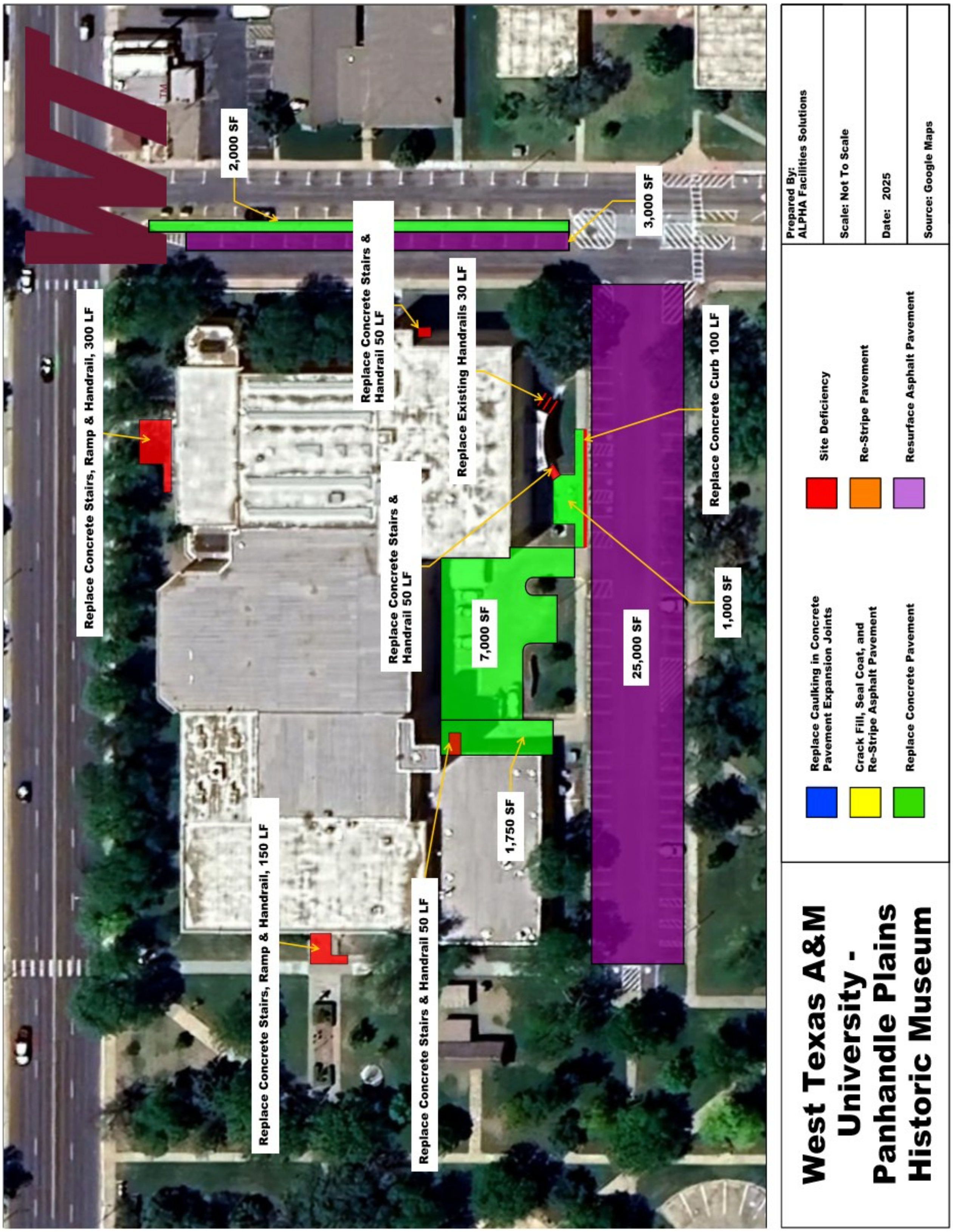
Site Utilities

No Site Utility observations were performed.

Table 8. Summary of 2025 Site and Infrastructure Deficiencies: Panhandle Plains Historic Museum

Asset Description	Corrective Action	Notes	Priority	Current Needs	Year
Pedestrian Pavements	Replace Concrete Pavements; 4” Thick	11750 SF @ $11 Per SF	Low	$129,250	2025
Site Development	Replace Concrete Stairs	600 LF @ $160 Per LF	Low	$96,000	2025
Site Development	Replace Existing Handrail	215 LF @ $26 Per LF	Low	$5,590	2025
Vehicular Pavements	Resurface Asphalt Pavements	28000 SF @ $3.5 Per SF	Low	$98,000	2025
Vehicular Pavements	Replace Concrete Curb	100 LF @ $35 Per LF	Low	$3,500	2025
			Total 2025 Needs	**$332,340**	

Figure 6. Site and Infrastructure Deficiencies Markup: Panhandle Plains Historic Museum

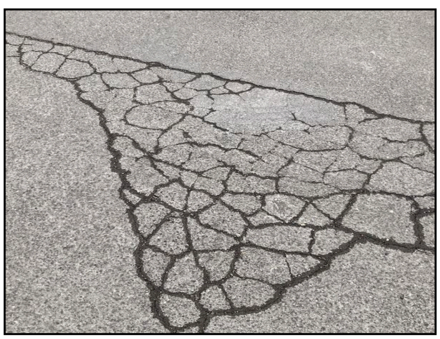


Site Infrastructure

A portion of the concrete curbing was in poor condition and in need of replacement as areas of broken, damaged, and/or heaving curbing was observed.

Site Infrastructure

A portion of the handrails were in poor condition and in need of replacement as rusted railing was observed.



Site Infrastructure

A portion of the asphalt pavements were in poor condition and in need of resurfacing as longitudinal cracking, transverse cracking, and degradation were observed throughout the pavement.

Site Infrastructure

A portion of the concrete sidewalks were in poor condition and in need of replacement as multiple areas of broken, damaged, and/or heaving pavement were observed.

Site Infrastructure

A portion of the concrete stairs were in poor condition and in need of replacement as areas of broken, damaged and/or heaving steps were observed.

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West Texas A&M University

Panhandle Plains Historic Museum

Abbreviated Accessibility Survey Findings

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Abbreviated Accessibility Survey Findings

The purpose of performing an abbreviated accessibility survey is to provide preliminary capital-planning budget for addressing accessibility related deficiencies. This work effort is considered a preliminary effort that may be followed by a formal ADA accessibility survey in the future. The scope of work included the following:

- The approach to performing the abbreviated accessibility survey is based on elements of the ADA section of the ASTM-E2018 Baseline for Property Condition Assessment (PCA) standards and other industry recognized accessibility guidance documents. This survey is subject to representative sampling and not intended to replace a Tier III: Full Accessibility Survey.
- The Abbreviated Accessibility Survey checklist was used in the field as part of the data collection protocol. For those areas where the assessor finds the answers noncompliant with the standard, a recommended correction and budget estimate are provided.

Table 9. Summary ADA Compliance: West Texas A&M University - Panhandle Plains Historic Museum

Asset Description	Corrective Action	Notes	Priority	Current Needs	Year
A. Parking / Accessible Route	Demo access aisle pavement markings, 2 stalls.	$796.25 Per stalls Quantity - 2	High	1592.5	01/01/2025
A. Parking / Accessible Route	Install accessible parking signs with post, 2 each.	$503.75 Per each Quantity - 2	High	1007.5	01/01/2025
A. Parking / Accessible Route	Install pavement markings for parking space, 2 stalls.	$120.74 Per stalls Quantity - 2	High	241.48	01/01/2025
C. Entrances / Exit	Hire architect-engineering firm to determine scope of work and estimate of costs, 1 lump sum.	$10000 Per lump sum Quantity - 1	High	10000	01/01/2025
C. Entrances / Exit	Install ADA sticker on door, 1 each.	$130 Per each Quantity - 1	High	130	01/01/2025
E. Elevators / Lifts	Install a new infrared entrance door sensor, 1 each.	$731.25 Per each Quantity - 1	High	731.25	01/01/2025
E. Elevators / Lifts	Install ADA compliant two way communication device, 3 each.	$1462.5 Per each Quantity - 3	High	4387.5	01/01/2025
E. Elevators / Lifts	Install braille door jamb markings, 1 each.	$113.75 Per each Quantity - 1	High	113.75	01/01/2025
E. Elevators / Lifts	Install hall lanterns with audible and visual capabilities, 1 set.	$2518.75 Per set Quantity - 1	High	2518.75	01/01/2025
E. Elevators / Lifts	Replace hallway call buttons, 1 set.	$812.5 Per set Quantity - 1	High	812.5	01/01/2025
F. Toilet Rooms	Demolish wood door and frame, 4 each.	$82.88 Per each Quantity - 4	High	331.5	01/01/2025
F. Toilet Rooms	Hire architect-engineering firm to determine scope of work and estimate of costs, 1 lump sum.	$10000 Per lump sum Quantity - 1	High	10000	01/01/2025
F. Toilet Rooms	Install 36" wide phenolic partition door, 4 each.	$2093 Per each Quantity - 4	High	8372	01/01/2025

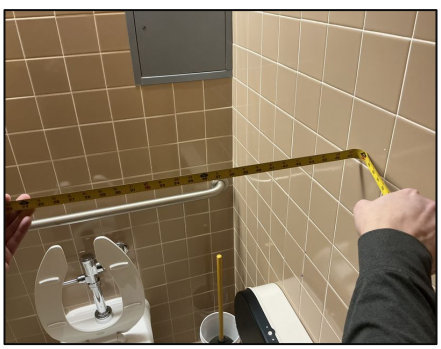
F. Toilet Rooms	Install combination audible/visual fire alarm notification device, 4 each.	$406.25 Per each Quantity - 4	High	1625	01/01/2025
F. Toilet Rooms	Install piping insulation, 12 each.	$211.25 Per each Quantity - 12	High	2535	01/01/2025
F. Toilet Rooms	Install pull handle, 2 each.	$786.5 Per each Quantity - 2	High	1573	01/01/2025
F. Toilet Rooms	Install required side grab bar (1 - 42"), 8 each.	$365.63 Per each Quantity - 8	High	2925	01/01/2025
F. Toilet Rooms	Install wood door and frame, 4 each.	$4462.25 Per each Quantity - 4	High	17849	01/01/2025
F. Toilet Rooms	Re-install or replace ISA sign at toilet room entrance, at a location compliant with ADA requirements, 6 each.	$113.75 Per each Quantity - 6	High	682.5	01/01/2025
F. Toilet Rooms	Replace non-compliant lavatory handles including faucet, 8 each.	$1121.25 Per each Quantity - 8	High	8970	01/01/2025
F. Toilet Rooms	Replace wall mounted lavatory with accessible lavatory, 4 each.	$3750.5 Per each Quantity - 4	High	15002	01/01/2025
F. Toilet Rooms	Replace wall mounted water closet, 2 each.	$2483 Per each Quantity - 2	High	4966	01/01/2025
I. Additional Access - Drinking Fountains / Public Telephones	Demolition of existing fountain, 3 each.	$162.5 Per each Quantity - 3	High	487.5	01/01/2025
I. Additional Access - Drinking Fountains / Public Telephones	Install dual level drinking fountain, 3 each.	$5811 Per each Quantity - 3	High	17433	01/01/2025
				$114,286.73	

Accessibility

Accessible toilet rooms must be on an accessible route, identified with the International Symbol of Accessibility (ISA) featuring raised and Braille lettering, centered on an 18” x 18” clear floor space beyond the door swing, mounted 48"–60" above the floor.

Accessibility

Corridor doors must be less than 32" wide with lever/loop hardware (no grasping/pinching/twisting) at 34"–48" height.



Accessibility

Toilet rooms require audible/visual fire alarms. Toilet stalls need wheelchair-accessible doors (less than 32" wide), grab bars on back and side walls, a toilet centerline 16”–18" from the side, and 60" x 56" clear area.

Accessibility

Sinks must have 27" wheelchair clearance, one-hand operable handles (no grasping/pinching/twisting), and insulated exposed pipes. Hire an architect-engineering firm to scope work and estimate costs. Install: pull handle, audible/visual fire alarm, 36" phenolic partition door, 42" side grab bar, accessible lavatory with compliant faucet, piping insulation, and new water closet. Demolish and replace wood door/frame. Reinstall/replace ISA sign per ADA standards.

Accessibility

When the main entrance is inaccessible, there must be an alternate accessible entrance. The accessible entrance must be identified with the International Symbol of Accessibility. Hire architect-engineering firm to determine scope of work and estimate of costs. Install ADA sticker on door.

Accessibility

Accessible drinking fountains must be present. The area under drinking fountains must be no less than 17" but no greater than 25" deep. The operable parts of drinking fountains must be no higher than 44" above the floor. The operable parts of drinking fountains must be usable with one hand without pinching, grasping, or twisting of the wrist. The spout outlet of drinking fountains must be no higher than 36" above the floor. The spout outlet of drinking fountains must be at least 15" from the rear and no more than 5" from the front of the drinking fountain. Demolition of existing fountain. Install dual level drinking fountain.

Accessibility

Sufficient van accessible parking spaces must be provided with respect to the total number of accessible spaces. Accessible van parking spaces must be at least 8' wide with an access aisle of at least 8' wide. Accessible spaces must be marked with the International Symbol of Accessibility, and van spaces must have signs reading 'Van Accessible'. Install pavement markings for parking space. Demo access aisle pavement markings. Install accessible parking signs with post.

Accessibility

Elevator lobbies must have visual and audible indicators of car arrival. Standard raised and Braille markings must be present on both jambs of each hoist way entrance. Elevator doors must have a reopening device that will stop and reopen a car door if an object or a person obstructs the door. Where a clear floor or ground space allows an unobstructed parallel or forward approach, the elevator buttons must be at least 15" and less than 48" above the ground. A two-way emergency communication system within the elevator cab must be usable without voice communication. Install braille door jamb markings. Install a new infrared entrance door sensor. Install hall lanterns with audible and visual capabilities. Replace hallway call buttons. Install ADA compliant two way communication device.

Table 10. Abbreviated Accessibility Survey: West Texas A&M University - Panhandle Plains Historic Museum

Uniformat Code	Building System	Section Name	Item	Answer	Corrective Action
Parking / Accessible Route					
G2040	Site Development	A.1	Are there sufficient accessible parking spaces with respect to the total number of reported spaces?	Yes	
G2040	Site Development	A.1.1	Are accessible parking spaces at least 8' wide with an access aisle at least 5' wide?	Yes	
G2040	Site Development	A.1.2	Are accessible parking spaces located towards the building's accessible entrance?	Yes	
G2040	Site Development	A.2	Are there sufficient van accessible parking spaces with respect to the total number of accessible spaces?	No	Re-Stripe Parking Lot
G2040	Site Development	A.2.1	Are accessible van parking spaces at least 8' wide with an access aisle at least 8' wide?	No	Re-Stripe Parking Lot
G2040	Site Development	A.3	Are accessible spaces marked with the International Symbol of Accessibility? Are there signs reading " Van Accessible" at van spaces?	No	Install ISA Sign(Post)
G2040	Site Development	A.3.1	Are the access aisles for each accessible and van accessible space marked with a "No Parking" sign?	Yes	
G2040	Site Development	A.4	Is there at least one accessible route provided within the boundary of the site from public transportation stops, accessible parking spaces, passenger loading zones (if provided), and public streets and sidewalks?	Yes	
G2040	Site Development	A.4.1	Is the route from the parking area to the building entrance stable, firm, and slip resistant?	Yes	
G2030	Pedestrian Paving	A.4.2	Is the route from the parking area to the building at least 36" wide?	Yes	
G2030	Pedestrian Paving	A.4.3	If the route is less than 60" wide, are passing spaces of at least 60" x 60" present for every 200' of length along the route?	Yes	
G2030	Pedestrian Paving	A.4.4	If there are grates or openings along the route, are the openings no greater than 1/2" in the dominant direction of travel?	Yes	
G2030	Pedestrian Paving	A.4.5	Does the accessible route have a running slope of no greater than 1:20? (i.e. for every inch of height change there are at least 20" of run?)	Yes	
G2040	Site Development	A.4.6	Is an accessible route provided to adjacent related features such as: playgrounds, courts, or fields?	Yes	
G2040	Site Development	A.5	Do curbs on the accessible route have depressed, ramped curb cuts at drives, paths, and drop-offs?	Yes	
G2040	Site Development	A.6	Does signage exist directing you to an accessible building entrance?	Yes	

Ramps					
G2030	Pedestrian Paving	B.1	If there is a ramp from parking to an accessible building entrance, does it meet slope requirements? (1:12 or less)?	Yes	
G2030	Pedestrian Paving	B.2	Are ramps longer than 6' or with a rise greater than 6" complete with railings on both sides?	Yes	
G2030	Pedestrian Paving	B.3	Is the width between railings at least 36"?	Yes	
G2030	Pedestrian Paving	B.4	Is there a level landing for every 30' horizontal length of ramp, at the top and at the bottom of ramps, and at switchbacks?	Yes	
Entrances / Exit					
B2030	Exterior Doors	C.1	Is the main accessible entrance doorway at least 32" wide?	Yes	
B2030	Exterior Doors	C.1.1	Is the height of the threshold not greater than 1/2"?	Yes	
B2030	Exterior Doors	C.1.2	Is the landing in the direction of the door swing a minimum of 60" long?	Yes	
B2032	Exterior Doors	C.1.3	Is the landing in the opposite direction of the door swing a minimum of 48" long?	Yes	
B2030	Exterior Doors	C.1.4	Is the width of the landing on the side to which the door swings extended 24" past the strike edge of an exterior door?	Yes	
B2030	Exterior Doors	C.1.5	Is the width of the landing on the side to which the door swings extended 18" past the strike edge of an interior door?	Yes	
G2040	Site Development	C.2	If the main entrance is inaccessible, is there an alternate accessible entrance?	No	Build Ramp to Accessible Entrance
G2040	Site Development	C.2.1	Is the accessible entrance identified with the International Symbol of Accessibility?	No	Install one 9" x 6" ISA Decal
B2030	Site Development	C.3	Can the accessible entrance be used independently?	N/A	
B2030	Exterior Doors	C.4	Is the door hardware easy to operate (lever or loop type which does not require any grasping, pinching, or twisting) and no less than 34" and not higher than 48" above the floor?	Yes	
B2030	Exterior Doors	C.5	Are main entry doors other than revolving doors available?	Yes	
B2030	Exterior Doors	C.6	If there are two main doors in a series, is the minimum distance between the doors 48" plus the width of any door swinging into the space?	Yes	
Paths of Travel					

C1010	Partitions	D.1	Is the main path of travel at least 36" wide?	Yes	
C1010	Partitions	D.2	Does a visual scan of the main path of travel reveal any obstacles (phones, fountains, etc.) that protrude more than 4" into walkways or corridors?	No	
C1010	Partitions	D.3	Is there a path of travel between building levels that does not require the use of stairs?	Yes	
Elevators / Lifts					
D1010	Elevators & Lifts	E.1	Do the hallway call buttons have visual signals to indicate when a call is registered and answered?	Yes	
D1010	Elevators & Lifts	E.2	Is the “UP” button above the “DOWN” button?	Yes	
D1010	Elevators & Lifts	E.6	Do elevator lobbies have visual and audible indicators of car arrival?	No	Install Visible and Audible Indicators in Lobby
D1010	Elevators & Lifts	E.4	Are there standard raised and Braille markings on both jambs of each hoist way entrance?	No	Install Signs on Both Door Jambs
D1010	Elevators & Lifts	E.5	Do elevator doors have a reopening device that will stop and reopen a car door if an object or a person obstructs the door?	No	Install Automatic Opener
D1010	Elevators & Lifts	E.3	Are there visual and audible signals indicating floor change inside the elevator car?	Yes	
D1010	Elevators & Lifts	E.7	Where a clear floor or ground space allows an unobstructed parallel or forward approach, are the elevator buttons at least 15" and less than 48" above the ground?	No	Change Controls Height
D1010	Elevators & Lifts	E.8	Are elevator control buttons designated by Braille and by raised standard characters (mounted to the left of the button)?	Yes	
D1010	Elevators & Lifts	E.9	If a two-way emergency communication system is provided within the elevator cab, is it usable without voice communication?	No	Install Compliant Emergency Communica tion System
D1010	Elevators & Lifts	E.10	If a lift is provided, can entry and egress be done without assistance?	N/A	
D1010	Elevators & Lifts	E.11	If a lift is provided, is the clear floor space inside the lift at least 30" wide and 48" long?	N/A	
D1010	Elevators & Lifts	E.12	If a lift is provided, are the controls no less than 15" and no greater than 48" above the floor?	N/A	
D1010	Elevators & Lifts	E.13	If a lift is provided, is it identified with the International Symbol of Accessibility?	N/A	

Toilet Rooms					
C1010	Partitions	F.1	Are common-area public toilet rooms located on an accessible route?	No	Widen Pathway
C1010	Partitions	F.16	Is each accessible toilet room identified with the International Symbol of Accessibility?	No	Install Signage
C1010	Partitions	F.17	Is the accessibility sign located so that a clear floor space of 18” x 18”, centered on the standard raised and Braille lettering, is provided beyond the arc of a door swing?	No	Relocate Signage
C1010	Partitions	F.18	Is the height of the standard raised and Braille lettering no less than 48" and no greater than 60" above the floor?	No	Relocate Signage
C1020	Interior Doors	F.4	Are corridor access doors at least 32" wide?	No	Install New Door.
C1020	Interior Doors	F.2	Is the door hardware easy to operate (lever or loop type which does not require any grasping, pinching, or twisting) and no less than 34" and not higher than 48" above the floor?	No	Install Code Compliant Hardware
D5030	Communications and Security	F.3	Are there audible and visual fire alarm devices in the toilet rooms?	No	Install Audible and Visual Fire Alarm
C1010	Partitions	F.5	Are public toilet rooms large enough to accommodate a wheelchair turnaround (60" turning diameter)?	Yes	
D5030	Communications and Security	F.6	In unisex toilet rooms, are safety alarms with pull cords present?	N/A	
C1020	Interior Doors	F.7	Are toilet stall doors wheelchair –accessible (at least 32" wide)?	No	Install New Stall Door
C1010	Partitions	F.8	Are grab bars provided in toilet stalls on the back and side walls of toilet stalls?	No	Install Grab Bar
D2010	Plumbing Fixtures	F.12	Is the center line of the toilet between 16” and 18" from the side walls?	No	Modify Existing Toilet
D2010	Plumbing Fixtures	F.14	Is the height of the toilet seat between 17" and 19" above the floor?	Yes	
C1010	Partitions	F.15	Is the height of the bottom edge of the toilet paper dispenser a minimum of 15” and maximum of 48” above the floor and not located behind a grab bar?	Yes	
C1010	Partitions	F.13	Is the clear area around the toilet a minimum of 60" x 56"?	No	Modify Toilet Stall
D2010	Plumbing Fixtures	F.9	Are sinks provided with clearance for a wheelchair to roll under (27" clearance)?	No	Modify Existing Sink
D2010	Plumbing	F.10	Are sink handles operable with one hand without	No	Modify

	Fixtures		grasping, pinching, or twisting?		Existing Sink
D2010	Plumbing Fixtures	F.11	Are any exposed pipes under sinks sufficiently insulated against contact?	No	Install Pipe Insulation
Guestrooms					
C1010	Guestrooms	G.1	Are there sufficient reported accessible guestrooms with respect to the total number of reported guestrooms? (See Table 2)	N/A	
D2010	Plumbing Fixtures	G.2	Are there sufficient reported accessible guestrooms with roll-in showers with respect to the total number of reported accessible guestrooms? (See Table 2)	N/A	
Access To Goods and Services					
C1010	Partitions	H.1	Are aisles and pathways to goods and services and to one of each type of sales or service counters at least 36" wide?	Yes	
E2010	Fixed Furnishings	H.2	Are the accessible sales or service counters no less than 36" long and no greater than 34" above the floor?	Yes	
C1010	Partitions	H.3	If fitting or dressing rooms are provided, are at least 5%, but no fewer than 1 for each gender, wheelchair accessible?	N/A	
C1020	Interior Doors	H.4	If fitting or dressing rooms are provided, are entry doors to the rooms at least 32" wide?	N/A	
C1020	Interior Doors	H.5	If fitting or dressing rooms are provided, is the door hardware easy to operate (lever or loop type which does not require any grasping, pinching, or twisting) and no less than 34" and not higher than 48" above the floor?	N/A	
C1010	Partitions	H.6	If fitting or dressing rooms are provided, are mirrors a minimum of 18" wide and 54" high?	N/A	
C1010	Partitions	H.7	If fitting or dressing rooms are provided, is the bottom edge of the mirror no greater than 20" from the top of the floor?	N/A	
E2010	Fixed Furnishings	H.8	If fitting or dressing rooms are provided, is a seating bench no less than 42” long and between 20” and 24” deep, affixed to the long wall with a height of no greater than 17" to 19" above the floor?	N/A	
C1010	Partitions	H.9	If fitting or dressing rooms are provided, is the clear space in the room at least 60" x 60"?	N/A	
C1020	Interior Doors	H.10	If fitting or dressing rooms are provided, does a door swing encroach on the minimum 60" x 60" clear space of the room?	N/A	

Additional Access - Drinking Fountains / Public Telephones					
D2010	Plumbing Fixtures	I.1	If drinking fountains are provided, are accessible drinking fountains present?	No	Install Bi-Level Drinking Fountain
C1010	Partitions	I.2	If accessible drinking fountains are present, are the drinking fountains located completely within alcoves or installed in a manner so as NOT to encroach on paths of travel or walkways?	Yes	
C1010	Partitions	I.3	If accessible drinking fountains are provided, is the approach space clear and a minimum of 30" wide and 48" long?	Yes	
D2010	Plumbing Fixtures	I.4	If accessible drinking fountains are provided, is the area under the fountain no less than 17" but no greater than 25" deep?	No	Replace Drinking Fountain
D2010	Plumbing Fixtures	I.5	If accessible drinking fountains are provided, are the operable parts no higher than 44" above the floor?	No	Modify Existing Drinking Fountain
D2010	Plumbing Fixtures	I.6	If accessible drinking fountains are provided, can the operable parts be used with one hand without pinching, grasping, or twisting of the wrist?	No	Adjust Existing Hardware
D2010	Plumbing Fixtures	I.7	If accessible drinking fountains are provided, is the spout outlet no higher than 36" above the floor?	No	Modify Existing Drinking Fountain
D2010	Plumbing Fixtures	I.8	If accessible drinking fountains are provided, is the spout outlet at least 15" from the rear and no more than 5" from the front of the drinking fountain?	No	Replace Drinking Fountain
D5030	Communications and Security	I.9	Is at least one public telephone a TTY configured telephone?	N/A	
D5030	Communications and Security	I.10	If an accessible telephone is provided, is the approach space clear and a minimum of 30" wide and 48" long?	N/A	
D5030	Communications and Security	I.11	If an accessible telephone is provided, is the highest operable part no greater than 48" above the floor?	N/A	
D5030	Communications and Security	I.12	If an accessible telephone is provided, is it identified with the International Symbol of Accessibility?	N/A	

West Texas A&M University

Panhandle Plains Historic Museum

Preliminary Energy Assessment

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Panhandle Plains Historic Museum Building Description

The museum comprises up to seven (7) separate Sections. The names, years for which primary drawings were reviewed and number of floors for these sections are summarized in table below. Note that all sections have a basement. As sections were added, any fenestration between adjoining sections was removed or boarded.

Table 11. Museum Sections

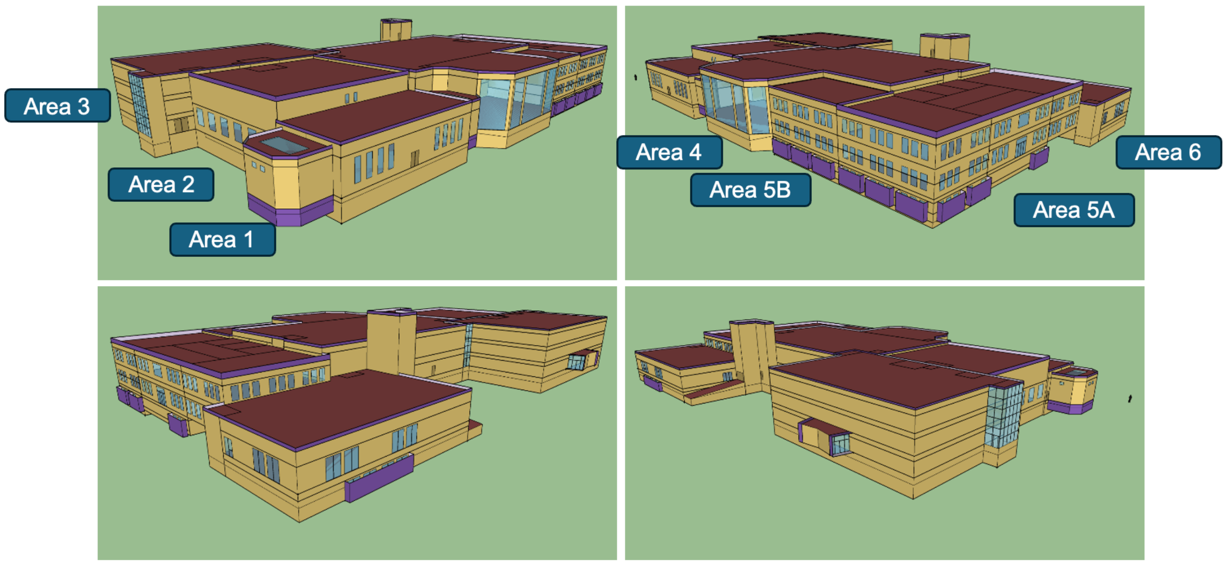
[-]	[yyyy]	[1]
Section	Year of Drawings	Number of Floors
Area 1	1932	B+1
Area 2	1936	B+2
Area 3	1966	B+3
Area 4	1981	B+2
Area 5A	1950	B+2 (2 Tiers each in B and 1st)
Ares 5B	1965	B+2 (2 Tiers each in B and 1st)
Area 6	1982	B+1

Notably, Area 1 (a.k.a. Pioneer Hall) serves as the museum's main entrance and also houses a gift shop. Area 2 features various Texas history exhibits. Area 3 features Pioneer Town on its bottom floor and various art exhibits on its top floor. Area 4 features the petroleum exhibit. Area 5A and Area 5B are referred to as Area 5, but they are distinctly separate sections even though they have an identical architectural appearance. These two sections originally served as a library. Each section still has four (4) tiers of library stacks, which now serve as artifact storage. Most of the exterior windows in these two sections have been boarded on their inside to protect the artifacts. Additionally, Area 5A features a large gun exhibit and a small automobile exhibit. Area 6 serves as the conservancy, as well as an educational laboratory themed around Science Technology, Engineering, Art and Mathematics (STEAM).

Dimensions

The exterior of the entire museum was modeled in the OpenStudio plugin for SketchUp to facilitate obtaining dimensions. The model is displayed in the figure below.

Figure 7. *Museum Model*



The resulting interior and exterior (where applicable) floor areas and the exterior (only) wall and roof areas are summarized in the table below. Note the total floor area is slightly larger than the reported floor area of 214,000 ft^2 because – following standard energy modeling practice – the model is based on exterior rather than interior wall dimensions.

Table 12. Floor Areas and Exterior Wall and Roof Areas

[-]	[ft^2]	[ft^2]	[ft^2]	[ft^2]	[ft^2]	[ft^2]	[ft^2]
	Floors	Walls	Walls	Walls	Roofs	Roofs	Roofs
Section		Gross	Net	Openings	Gross	Net	Openings
Area 1	11,484.0	5,456.5	5,007.7	448.8	6,152.0	5,712.0	440.0
Area 2	25,202.3	4,244.0	3,724.5	519.5	8,950.7	8,950.7	0.0
Area 3	44,196.7	13,590.3	11,886.1	1,704.2	12,141.0	12,141.0	0.0
Area 4	66,348.1	14,947.2	12,114.6	2,832.6	24,562.0	24,562.0	0.0
Area 5A	35,597.6	9,014.3	6,468.1	2,546.3	11,040.3	11,040.3	0.0
k	15,463.8	2,953.0	2,131.0	822.0	3,092.8	3,092.8	0.0
Area 6	17,234.7	5,993.5	5,153.8	839.7	9,435.4	9,435.4	0.0
Total	**215,527.2**	**56,198.8**	**46,485.9**	**9,713.0**	**75,374.1**	**74,934.1**	**440.0**

Further, the difference between gross area and net area represents the openings, such as windows, glass doors, solid doors and overhead doors. Note that Area 1 also has roof openings, namely two (2) large historical skylights in its east and west wings.

The exterior (only) window and door areas and counts are summarized in the following tables below.

Table 13. Exterior Window Counts and Areas

[-] Section	[-] Opening Type	[ft x ft] Dimension	[1] Count	[ft^2] Total Area
Area 1	FixedWindow	3.08x2.33	3	21.6
Area 1	FixedWindow	3.67x12.25	8	359.3
Area 2	FixedWindow	2.50x5.00	2	25.0
Area 2	FixedWindow	7.67x10.75	6	494.5
Area 3	FixedWindow	0.67x7.25	4	19.3
Area 3	FixedWindow	2.81x4.25	4	47.8
Area 3	FixedWindow	2.81x7.25	4	81.6
Area 3	FixedWindow	4.08x5.67	5	115.7
Area 3	FixedWindow	4.08x5.83	25	595.5
Area 3	FixedWindow	4.75x4.42	4	83.9
Area 3	FixedWindow	4.75x5.67	4	107.7
Area 3	FixedWindow	4.75x5.83	12	332.5
Area 3	FixedWindow	4.75x7.25	2	68.9
Area 3	FixedWindow	6.00x4.25	2	51.0
Area 4	FixedWindow	11.17x31.50	1	351.8
Area 4	FixedWindow	12.92x31.50	2	813.8
Area 4	FixedWindow	17.17x31.50	1	540.8
Area 4	FixedWindow	30.00x31.50	1	945.0
Area 5A	FixedWindow	11.50x2.83	1	32.6
Area 5A	FixedWindow	11.50x7.50	1	86.3
Area 5A	FixedWindow	2.75x7.83	2	43.1
Area 5A	FixedWindow	3.67x3.33	6	73.3
Area 5A	FixedWindow	3.67x4.33	6	95.3
Area 5A	FixedWindow	3.67x7.50	6	165.0
Area 5A	FixedWindow	3.67x8.00	3	88.0
Area 5A	FixedWindow	4.00x3.33	21	280.0
Area 5A	FixedWindow	4.00x4.33	26	450.7
Area 5A	FixedWindow	4.00x7.50	30	900.0
Area 5A	FixedWindow	4.00x8.00	9	288.0
Area 5B	FixedWindow	4.00x3.33	18	240.0
Area 5B	FixedWindow	4.00x4.33	18	312.0
Area 5B	FixedWindow	4.00x7.50	9	270.0
Area 6	FixedWindow	3.00x3.17	1	9.5
Area 6	FixedWindow	3.00x5.17	1	15.5
Area 6	FixedWindow	3.92x10.00	12	470.0
Area 6	FixedWindow	3.92x8.00	8	250.7
Total			**268**	**9,125.5**

Table 14. Exterior Door Counts and Areas

[-] Section	[-] Opening Type	[ft x ft] Dimension	[1] Count	[ft2] Total Area
Area 3	GlassDoor	2.92 x 7.42	4	86.5
Area 3	GlassDoor	3.08 x 7.42	2	45.7
Area 5A	GlassDoor	2.75 x 8.00	2	44.0
Area 6	GlassDoor	2.83 x 8.00	3	68.0
Area 6	GlassDoor	3.00 x 8.67	1	26.0
Area 1	Skylight	22.00 x 10.00	2	440.0
Area 1	Door	2.83 x 8.00	2	45.3
Area 1	Door	3.00 x 7.50	1	22.5
Area 3	Door	4.08 x 8.33	2	68.1
Area 4	Door	3.00 x 7.42	1	22.3
Area 4	Door	3.00 x 8.00	1	24.0
Area 4	Door	4.00 x 8.00	1	32.0
Area 4	OverheadDoor	12.50 x 8.25	1	103.1
Total			**21**	**587.5**

Utility Bills

The museum is primarily cooled and heated via the campus central plant's chilled water and low-pressure steam loops. The chilled water does appear to be metered by a BTU meter in Area 4, but the low-pressure steam does not appear to be metered in any section. At least two (2) electricity meters at the two transformers behind the museum (one behind Area 3, the other behind Area 6) suggest that electricity is being metered as well. There appears to be no natural gas meter.

It should be stated that utility bills were not at the focus of this study and were thus not obtained, incomplete as they might have been. Thus, Key Performance Indicators (KPI) such as Energy Use Intensity (EUI, [kBTU/ft^2/y]), Energy Cost Intensity (ECI, [$/$ft^2$/y]) or Energy Emissions Intensity (EEI, [kgCO_{2e}/ft^2/y]) could not be generated nor compared to peer buildings.

Construction

Description – Opaque

The available drawings suggest that each section was constructed similarly, despite the span of almost 50 years between Area 1 and Area 4. This construction comprises mostly 8” Concrete Masonry Units (CMU) blocks, with some 8” concrete, at the core, a 1” air gap, 3” to 4” of either brick or stone panels on the exterior and drywall on the interior. Further, the roofs appear to be 2” to 6” concrete deck with built-up asphalt on the exterior. The last complete roof replacement took place in 2013, at which point a modified bitumen roof cover atop 2” insulation entirely above deck was specified in the drawings. Depending on the material used, this could represent an R-Value between R-7.5$_{ci}$ and R-13$_{ci}$.

There is no evidence in the drawings that (sufficient) insulation was used for walls or roofs. The museum is located in Randall County, TX, corresponding to ASHRAE Climate Zone 4B. The 2021 International Energy Conservation Code (IECC) in table C402.1.3 requires minimum R-Values of R-14.6$_{ci}$ continuous insulation for above grade mass walls (such as CMU), R-7.5$_{ci}$ continuous insulation for below grade walls and R-30$_{ci}$ continuous insulation entirely above deck for roofs.

In addition, the roof cover must have a three-year aged solar reflectance of greater then 55% and a three-year aged thermal emittance of greater than 75%. A typical modified bitumen roof cover has a solar reflectance of less than 20%, though it does have a thermal emittance of greater than 80%.

Description – Transparent

Each of the sections has windows that represent the standard of the industry at the time of construction. Specifically, Area 1 features multi-light single pane un-tempered glass glazing in steel framing, Area 2 features the same but inserted into glass blocks, Area 3 features single pane un-tempered glass glazing in aluminum framing, Area 4 features extremely thick tempered glass glazing with steel framing on the bottom and top (reinforced with shorter pieces of the same glazing mounted a right angles) and no framing on the sides (adhered directly to the exterior wall construction), Area 5 again features multi-light single pane un-tempered glass glazing in steel framing and Area 6 features single-light double pane tempered glass glazing in aluminum framing. It is very unlikely that any of the framing is thermally broken. Some of the windows, especially in older sections, may be operable.

Such glazing and framing likely has U-Values between U-0.75 and U-1.25. The 2021 International Energy Conservation Code (IECC) in table C402.4 requires maximum U-Values of U-0.36 for fixed fenestration and U-0.45 for operable fenestration.

Notably, Area 1 also features two (2) skylights, one each in its east and west wing. These appear to be in near-original condition and comprise ¼” multi-light single pane un-tempered glass with embedded reinforcing wire mesh, representing a U-Value on the order of U-1.00. These skylights now have “milky” appearance. Again, the 2021 IECC in Table C402.4 requires a maximum U-Value of U-0.50.

In addition to maximum U-Values, 2021 IECC also requires maximum Solar Heat Gain Coefficients (SHGC) between 0.36 and 0.50, which are accomplished through proper coating and/or tinting of glazing material. The simple clear glazing used in all sections today is likely not achieving these SHGC values.

Recommendations

Though none of the walls and roofs meet 2021 IECC requirements, they appear generally in fair condition, with occasional roof leaks addressed when they occur. Also, though none of the windows meet 2021 IECC requirements, they appear generally in fair condition.

Ideally, a renovation of the envelope may need to be coordinated with the architectural historical preservation requirements. For walls, insulation might be added to the interior, for roofs, insulation might be added to the exterior. However, an envelope expert should be consulted to ensure that adding such insulation will be accomplished without adversely affecting the humidity transport characteristics of the envelope. For windows, presuming it is permissible from a historic preservation perspective, they may be replaced with double pane tempered glass glazing and thermally broken aluminum framing.

Lighting

Description – Interior

All museum lighting was upgraded in 2008 from incandescent, halogen and fluorescent to LED, retaining the original fixture types. Notably, spotlights received LED bulbs and troffers received LED tubes. Even the incandescent fixtures in the original library stacks were upgraded. Thus, a lighting inventory was not generated as part of this project.

It is possible that these upgrades were based on simply matching the existing lighting intensity at the time, rather than adapting lighting intensity to exhibit needs. The museum's Curator of Art, Deana Craighead, mentioned that some of the spotlights in the art exhibit may have too high a lighting intensity for proper preservation – or even presentation – of the pictures on display.

Description – Exterior

There appears to be no significant exterior lighting, except for a handful of wall-packs above service doors.

Recommendations

The lighting upgrade took place around 2008. Even though LED bulbs and tubes are advertised as lasting 50,000 hours or more, this often is only true when such bulbs and tubes are not switched. The daily museum opening and closing most likely switches these lights at least twice a day, possibly resulting in reduced life expectancy.

Further, at the time of the lighting upgrade, no advanced lighting controls were installed. These would have included occupancy sensors, daylight harvesting sensors and also a tie-in to the Building Automation System (BAS).

Though a lighting upgrade is not necessary at this point, such would become necessary within the next, say, ten (10) years. At that time, attention should be paid to the proper lighting intensity and color for each exhibit, and to the desired controls.

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West Texas A&M University

Panhandle Plains Historic Museum

HVAC Assessment & Feasibility Study

HVAC General Description

All sections are primarily supported by the campus chilled water loop and the campus low-pressure steam loop. The chilled water is used directly in chilled water coils of Air Handling Units (AHU) or Fan Coil Units (FCU), the low-pressure steam is chiefly converted to hot water and then used in hot water coils of AHU or FCU, but it is also used directly in radiators, notably in Area 5A and Area 5B. Some sections are secondarily supported by split systems (Area 2) or rooftop package units and window units (Area 5A).

The chilled water coil controls were retrofitted between 2000 and 2006, at which point three-way valves were replaced with two-way valves, variable frequency drives were added to the chilled water pumps and pneumatic controls were replaced with digital controls for chilled water for tie-in to the Johnson Controls Metasys Building Automation System (BAS).

However, all hot water coil controls remained equipped with three-way valves, and all other pneumatic controls remained, notably those for hot water and steam, as well as for air distribution by the primarily constant volume multi-zone AHU. The zones of a few variable volume AHU are additionally equipped with Variable Air Volume (VAV) terminal units and Series Fan Powered (SFP) terminal units with hot water or steam heating coils.

Most AHU also have low-pressure steam dispersion tubes for humidification. Each section has its own Chilled Water Pump (CHWP), steam-to-hot water converter and Hot Water Pumps (HWP), as well as corresponding expansion tanks and air separators. In addition, air compressors are ubiquitous to support pneumatic controls.

Only a small fraction of the thermostats are on digital controls. Most of the thermostats are still on pneumatic controls and not tied into the Building Automation System (BAS). The museum’s Curator of Art, Deana Craighead, as well as the Director of Operations, Buster Ratliff, mentioned that temperature and (relative) humidity are being monitored through a network of Hobo data loggers distributed throughout the building. These loggers require a periodic manual download of the recorded data.

The monthly minimum, maximum and average of these data were made available for review. Though not all loggers have data for all months, it is obvious that the temperature and humidity requirements set forth by the Curator of Art are frequently not being met for several months of the year. Notably, temperature is often higher than permissible in the summer months and humidity is often lower than allowable in the winter months and higher than allowable in the summer months.

Recommendations

General

The data from the Hobo data loggers suggest that temperature and humidity control (dehumidification) is insufficient. It is not obvious whether this is due to insufficient cooling, dehumidification, heating and/or humidification capacity, or to mal-functioning thermostats – though likely a combination thereof. A 100% recommissioning effort might shed some light on this, but more likely, a complete redesign addressing the various changes that have occurred since the original construction is needed.

Notably, original cooling and heating capacities are likely no longer applicable. Additionally, such redesign would be mandatory if improvements to the envelope were implemented. And a redesign typically necessitates complete replacement of HVAC equipment.

Further, some of the equipment is approaching 20 years of age and most of the equipment is past 40 years of age. There are parts for repair which are no longer available. The low-pressure steam distribution and condensate collection system is likely past 60 years of age, and it is conceivable that its integrity is compromised, even without signs of overt failure.

In discussion with Darrell Auburg and Ricco Hernandez from SSC – WTAMU's operations and maintenance contractor – it was ascertained that filter changes and belt replacements are performed every six months as necessary. It also became clear that the single motor AHU represent a significant operations risk – a fan motor failure will take down the entire AHU and replacements for the relatively large motors are not easily obtained. Instead, a modern AHU with a fan wall won't be taken down by a single fan motor failure, and replacements for the smaller fan motors are easily obtained. In addition, SCC staff remarked on the challenges of controlling and maintaining a low-pressure steam system and a pneumatic control system in general. For example, the entire low-pressure steam distribution and condensate collection system is always hot and cannot easily be worked on without shutting down the entire building.

All this suggests a complete and wholistic redesign of the HVAC system with a sharp focus on controlling temperature and humidity to modern standards of artifact protection and preservation is highly recommended. In combination with envelope upgrades, such equipment replacement would also offer the opportunity for improved energy efficiency, utility metering, digital controls and a complete Building Automation tie-in. Some energy conservation features to be considered include outdoor air shutoff during unoccupied hours, static pressure reset, outdoor air temperature reset, variable speed drives and 100% OA economizer operation whenever conditions permit.

Space Cooling

The chilled water loop is not far from state of the art, notably on account of variable speed drives for chilled water pumps, two-way control valves for chilled water coils, chilled water mains bypass with control valve and chilled water mains BTU meter.

Unfortunately, these are noted to be outdated end-of-life air handling units that are not state of the art. Instead of constant volume multi-zone air handling units with belt-driven fans, variable volume air handling units with direct drive fan walls should be entertained for an upgrade. These might also have hot-water pre-heating coils to accommodate low-temperature outdoor air and would be paired with Variable Air Volume (VAV) terminal units throughout the building. These terminal units would have hot water re-heating coils. All thermostats would be retrofitted to digital controls and tied to the Building Automation System (BAS).

Space Heating

In space heating for new construction, low-pressure steam (5 to 15 psi(g)) has been all but abandoned in favor of hot water. It is now only found in specialty process heating and in large campuses such as hospitals or universities, often where there is an ancillary use for steam such as sterilization or humidification. The temperature of low-pressure steam ranges from 227.1 °F to 249.7 °F.

In contrast to hot water, low-pressure steam does not require a steam distribution pump as it is “naturally” pressurized for distribution throughout the pipe network by the steam boiler itself. Further, the use of latent heat in low-pressure steam rather than sensible heat in hot water supports high-capacity heating systems. The temperature of the condensate is not significantly lower than that of the low-pressure steam itself, namely near 212 °F.

However, for efficient operation, the steam must not be allowed to condense before it reaches the end use device, such as a radiator, and the condensate at each end use device must be collected and returned to the steam boiler at as high a temperature as possible. This is accomplished through a typically complex condensate collection system, comprising a network of control valves, steam traps, condensate collection pumps and pipes. Both steam and condensate lines require substantial insulation – which has the added benefit of preventing burn accidents. Note, the formation of condensate in the end use device reduces the pressure in it, allowing the steam to flow into the end use device in the first place. The steam flow rate is controlled by a steam control valve upstream of the end use device.

In contrast, a modern modulating condensing boiler can reach efficiencies greater than 95% and operate with hot water at less than 140 °F – substantially lower than the “old standard” of 180 °F. It requires a hot water distribution pump but no condensate collection system. Though insulation is required, it can be much less substantial than for steam. Note, the “condensing” part of a condensing boiler refers to condensation of water vapor in the combustion flue gas and is not related to the hot water. Without such condensation, the latent heat of the water vapor escapes unused through the flue gas stack.

A traditional hot water system used to require three-way control valves because traditional non-modulating boilers required a constant hot water flow rate. A modern modulating boiler can accommodate a variable how water flow rate and thus allows for two-way control valves. The control valves are typically located downstream of the end use device. Further, because control valves act on a warm liquid – rather than a hot vapor – their controllability, longevity and reliability are likely superior.

Consequently, new construction frequently features modulating condensing boilers and a variable flow hot water system operating at less than 140 °F, with a variable speed hot water distribution pump and two-way control valves at the end use devices. Where low-pressure steam and the desire to continue to utilize it exist, it is advisable to convert such steam to hot water at a centralized location in the building, and to thus still support a modern 140 F hot water system throughout the entire building. Such centralization could also enable or simplify control and measurement of the low-pressure steam received by the building.

Humidification

Where humidification is required, high pressure atomization (e.g. MeeFog) efficiently replaces low-pressure steam humidification, with similar integration into air handling units and improved controllability.

HVAC – Specific

Area 1

A retrofit in 2000 appears to have this section cooled and heated by AHU-1 located in Mechanical Room W005 as well as AHU-2 and AHU-4 located in Mechanical Room W009, both in the basement of Area-2. AHU-1 and AHU-2 are single zone constant volume AHU, while AHU-4 is a single zone variable volume AHU.

Hereby, AHU-1 serves the gift shop in the west wing, AHU-2 serves the 1st floor and AHU-4 serves the basement via Series Fan Powered (SFP) terminal unit A.

Both AHU-1 and AHU-2 feature a chilled water cooling coil with two-way valve, a hot water heating coil with three-way valve and a low-pressure steam humidification coil. AHU-4 only features a chilled water cooling coil with two-way valve and a low-pressure humidification coil, because heating is accomplished via the SFP terminal unit.

The equipment is serviceable and except for the AUH clearly shows its age. The steam humidifiers are unlikely to operate as originally intended.

Area 2

The same retrofit in 2000 appears to have this section cooled and heated by AHU-3 and AHU-4 located in Mechanical Room W009 in the basement of Area 2. AHU-3 and AHU-4 are single zone variable volume AHU.

Hereby, AHU-3 serves the 1st floor via Variable Air Volume (VAV) terminal units A though K and AHU-4 serves the basement via Series Fan Powered (SFP) terminal units B through K. Note that AHU-2, AHU-3 and AHU-4 share a common Outdoor Air (OA) duct and that the OS is heated by low-pressure steam Preheat Coil PHC-1.

AHU-3 features a chilled water cooling coil with two-way valve and a low-pressure steam humidification coil, because heating is accomplished via the VAV terminal units. Again, AHU-4 only features a chilled water cooling coil with two-way valve and a low-pressure humidification coil, because heating is accomplished via the SFP terminal units.

The steam converter, hot water expansion tank, hot water air separator and constant speed hot water pump HWP-1 to serve the hot water heating coils of AHU-1, AHU-2 and AHU-3 as well as the VAV and SPF terminal units are located in the same Mechanical Room W009. It is not clear where the chilled water expansion tank, chilled water air separator, Chilled Water Pump CHWP-1 and its Variable Frequency Drive (VFD) are located.

It is further not clear how the 2nd floor is cooled or heated. However, there are two (2) DX split system air conditioners, with their outdoor units located on the roof of Area 1 and their indoor units located above the erstwhile rear entrance of Area 1, now the southern-most space on the 2nd floor of Area 2. It is conceivable that these split systems provide at least cooling.

The equipment is serviceable and except for the AUH clearly shows its age. The steam humidifiers are unlikely to operate as originally intended.

Area 3

The section is cooled and heated via four (4) single zone constant volume Air Handling Units (AHU). Hereby, AHU-1 is located in Fan Room 104 in basement and serves the basement, AHU-2 is located in Fan Room 207 on 1st floor and serves the 1st floor, AHU-3 is located in Fan Room 306 on 2nd floor and serves the 2nd floor and AHU -4 is located in Fan Room 404 on the 3rd floor and serves the 3rd floor.

These mechanical rooms serve as mixing plenums for Return Air (RA) and Outdoor Air (OA), from where the Mixed Air (MA) directly enters the AHU through exposed filters. Each AHU features a chilled water cooling coil with two-way valve and a hot water heating coil with three-way valve, as well as a belt-driven supply air fan.

Additionally, the main entrance on the north face is heated by two low-pressure steam heating fan coil units EH-1 and EH-2.

The steam converter, hot water expansion tank, hot water air separator and constant speed hot water pump HWP-1 to serve the hot water heating coils of AHU-1, AHU-2, AHU-3 and AHU-4, as well as the entrance heaters are located in Pump Room 105 in the basement. The chilled water expansion tank, chilled water air separator, Chilled Water Pump CHWP-1 and its Variable Frequency Drive (VFD) are located here as well.

The equipment is serviceable but clearly shows its age. Notably, fan belt noise is present on almost all AHU.

Area 4

The four (4) multi-zone Constant Air Volume (CAV) Air Handling Units (AHU) are located in three (3) mechanical rooms in the basement, namely one in the northwest corner for AHU-1, one on the east side for AHU-2 and AHU-4 and one in the southeast corner for AHU-3. These mechanical rooms serve as mixing plenums for Return Air (RA) and Outdoor Air (OA), from where the Mixed Air (MA) directly enters the AHU through exposed filters. The OA entering the mechanical rooms can be pre-heated via three (3) hot water heating coils with pneumatically controlled three-way valves, namely OA-1 for AHU-1, OA-2 for AHU-2 and AHU-4 and OA-3 for AHU-3.

The AHU have chilled water cooling coils with digitally controlled two-way valves, but no (pre-)heating coils. However, many but not all ducts corresponding to the zones served by these AHU have hot water Heating Coils (HC) with pneumatically controlled three-way valves. Further, each AHU also has a Steam Humidifier (SH).

The mechanical room for AHU-1 also has two (2) Chilled Water Pumps (CHWP-1 & 2), which are redundant to each other and power by a Variable Frequency Drive (VFD). This mechanical room also houses the tie-in to the main campus chilled water lines. The tie-in includes an exemplary chilled water bypass vale and a chilled water energy meter.

The mechanical room for AHU-3 also has one (1) Hot Water Pump (HWP-1) powered by a Constant Speed Drive (CSD), and the Steam Converter (SC-1).

A retrofit of chilled water coils with two-way valves and digital controls was performed around 2000/2006. This retrofit left up to several feet of chilled water piping near the valves uninsulated. Over the years, significant corrosion has accumulated on these pipes due to moisture condensing from the air.

Most equipment in the mechanical rooms appears to be original from 1981/1982, notably the AHU. However, the pumps have been replaced at least once since then, and the chilled water tie, energy meter as well as the VFD were added around 2000/2006. The equipment is serviceable but clearly shows its age. The multi-zone AHU have a host of pneumatic actuators and linkages whose proper operation would be challenging to verify. The steam humidifiers are unlikely to operate as originally intended.

Area 5

Area 5A

The building was originally cooled by what appears to be an abandoned-in-place quasi-package unit (Curtis FWH-1000-CTAC) located in the mechanical room in the basement. However, this unit only would have cooled the Main Reading Room on the 1st Floor immediately above. The unit would likely have had one or more piston compressors, and it would likely have been liquid-cooled by an abandoned-in-place open-loop cooling tower on the roof. The unit does appear to have had outdoor air. It is rather museum-worthy and museum staff might entertain making it part of a museum exhibit.

The building is now cooled by two (2) window units on the east face of the 1st floor, and five (5) window units each on the east and south face of the 2nd floor. Additionally, there are two rooftop package units, which may have replaced the Curtis FWH-1000-CTAC.

The building was originally heated by a steam boiler. The steam supplied many fin-tube radiators distributed throughout the building. Notably, the library stacks (1st and 2nd tier in the basement and the 3rd and 4th tier on the 1st floor) feature vertical radiators, while the rest of the building features horizontal radiators. The steam boiler has since been removed, and the radiators adjacent to Area 5B may have been abandoned in place, but the remainder of this configuration appears to still be in place and may now be driven by the central campus plant steam loop.

The equipment appears moderately serviceable but clearly shows its age. All controls are manual, and it is not clear how much of the system is actively being controlled or even operated. Notably, steam traps and condensate pumps represent highly stressed components of a steam system.

Area 5B

The building was originally cooled by four (4) abandoned-in-place rooftop package units for the 2nd floor and by one (1) abandoned-in-place air-cooled rooftop chiller feeding several chilled water fan coil units distributed throughout the library stacks (1st and 2nd tier in the basement and the 3rd and 4th tier on the 1st floor). The chilled water pump was also located on the 1st tier.

The building might now be cooled by the central campus chilled water loop, though this would only apply to the fan coil units. It may potentially still utilize the above chilled water pump. It is not obvious how the 2nd floor would receive cooling today, if at all.

The building was originally heated by potentially the central campus steam loop. The steam supplied several fin tube radiators distributed throughout the building as well as the above fan coil units. This configuration appears to still be in place.

The equipment appears moderately serviceable but clearly shows its age. All controls are manual, and it is not clear how much of the system is actively being controlled or even operated. Notably, steam traps and condensate pumps represent highly stressed components of a steam system.

Area 6

The building has two (2) multi-zone constant volume Air Handling Units (AHU) serving four zones each. AHU-1 serves zones Z-1, Z-2, Z-3 and Z-4 in the basement, AHU-2 serves zones Z-5, Z-6, Z-7 and Z-8 on the 1st floor. The AHU are located in one (1) mechanical room in the basement, namely in the northwest corner. The AHU share a common Outdoor Air (OA) duct and have dedicated Return Air (RA) ducts. The OA can be pre-heated via one (1) hot water Heating Coil with pneumatically controlled three-way valve, namely HC-9.

The AHU have chilled water cooling coils with digitally controlled two-way valves, but no (pre-)heating coils. However, each duct for a zone served by these AHU has a hot water Heating Coil (HC) with pneumatically controlled three-way valves. These are HC-1, HC-2, HC-3 and HC-4 for the four zones of AHU-1, and HC-5, HC-6, HC-7 and HC-8 for the four zones of AHU-2. Further, some of the ducts for each zone also have a Steam Humidifier (SH), namely SH-1, SH-2 and SH-3 for Z-1, Z-2 and Z-3, as well as SH-4, SH-5 and SH-6 for Z-6, Z-7 and Z-8. There are two (2) additional Heating Coils HC-10 and HC-11 for the erstwhile Textile Room and Drying Cabinet, respectively.

The mechanical room also has one (1) Hot Water Pump (HWP-1) powered by a Constant Speed Drive (CSD), and a Steam Converter (SC-1). A Chilled Water Pump (e.g. CHWP-1) was not identified, nor a potential Variable Frequency Drive (VFD) for it.

A retrofit of chilled water coils with two-way valves and digital controls was performed around 2000/2006. This retrofit left up to several feet of chilled water piping near the valves uninsulated, possibly to enable future troubleshooting of the retrofit. These piping segments should be re-insulated. Further, it is conceivable that AHU-1 and AHU-2 were designed as Direct Exchange (DX) units at the start and then converted to chilled water during this same retrofit.

In 2020, the STEAM laboratory in the north center of the 1st floor was retrofitted with a Daikin Variable Refrigerant Volume (VRV) system comprising one roof-mounted (1) outdoor unit (HP-1) and two (2) ceiling-mounted indoor units (FC-1, FC-2). This appears to have rendered Zone Z-6 of AHU-2 abandoned in place.

Most equipment in the mechanical rooms appears to be original from 1981/1982, notably the AHU. However, the pump has been replaced at least once since then. The equipment is serviceable but clearly shows its age. The multi-zone AHU have a host of pneumatic actuators and linkages whose proper operation would be challenging to verify. The steam humidifiers are unlikely to operate as originally intended.

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APPENDICES

APPENDICES

Appendix A -Typical System Lifecycles

System and component life cycles used in the cost models for this project were based on average service life as shown in the *Preventive Maintenance Guidebook: Best Practices to Maintain Efficient and Sustainable Buildings* published by Building Owners and Managers Association (BOMA) International. When life cycle information is not provided by BOMA, life cycles have been assigned using ALPHA's professional judgment.

Table 15. Typical Life Cycles

System	Lifecycle (Years)
Roofing	
Built-up	25
Composition Shingle	20
Metal Panels	25
Modified Bitumen	20
Standing Seam Metal	35
Building Exterior	
Exterior Doors	25
Exterior Walls (Finishes)	10-30
Exterior Windows	30
Interior Finishes	
Interior Doors	25
Ceiling (Acoustical Tile and Grids)	20
Ceiling (Painted)	10
Walls	10
Floors	15
Built-in Equip/Specialties	
Built-in Equip/Specialties	20
Conveying Systems	
Elevators	35
Chair Lifts	15
Plumbing	

System	Lifecycle (Years)
Plumbing Fixtures	30
Domestic Water Distribution	30
Sanitary Waste	30
Fire Protection	
Fire Sprinklers and Standpipe (Piping and Risers)	40
Fire Detection (Activation Devices)	10
Fire Detection (Notification Devices and	15
Fire Detection (Wiring)	30
HVAC	
Cooling Generating	25
Controls	20
Distribution	30
Heat Generating	30
Terminal and Package Units	15
Electrical	
Branch Wiring	30
Lighting	20
Service and Distribution	40
Generators	20
Equipment	
Institutional Equipment	25
Other Equipment	15-25

Appendix B - Supplemental Information

Capital Planning v. Budgeting

While traditional budgets may be perceived as reacting to short-term needs based on the historical performance of facilities and systems, a capital plan anticipates both short- and long-term degradation by employing a facility condition assessment and predictive cost modeling.

- **Budgeting:** Traditional, cost-based, budgeting practices describe a system by which a prior period's budget is adjusted to provide for the fluctuating cost of maintaining facilities. Traditional budgeting issues may include: 1) anticipated needs; 2) organizational growth; 3) the acquisition of new assets; 4) operations and maintenance; 5) deferred maintenance; and, 6) insurance.
- **Capital Planning:** Capital planning differs from budgeting in that it considers a broader range of financial considerations over an extended timeline so as to more effectively predict and manage the fiscal needs of a real estate portfolio. Financial considerations may include the cost of capital, depreciation, organizational risk and return on investment (ROI). Similar in concept to the accounting principle of anticipating the capital depreciation of plant value, a capital renewal plan anticipates and attempts to counteract the ongoing deterioration of facility systems and components in order to extend a facility's life and value.

Facility Condition Index

A Facility Condition Index is considered to be a key building performance metric. As part of the FCA process, a facility condition index (FCI) is calculated for each facility. The FCI is used to quantify a facility's physical condition at a specific point in time and is calculated using the expired system replacement costs (costs associated with systems that are beyond average service life) and the current replacement value (CRV) of the building. Expired system replacement costs consist of work that is necessary to restore the facility to a condition equivalent to its original (like new) state.

Example: Total expired system replacement costs (Requirements) = $3,000,000

Current Replacement Value (CRV) = $10,000,000

$$FCI = \frac{\$3,000,000}{\$10,000,000} = .30$$

Present Value and Nominal Value

In the calculation of FCI sums, monetary values can be discounted to incorporate the time value of money, or be expressed in constant terms, ignoring the effects of inflation and interest. Because the cost of capital can vary significantly according to time, portfolio types, and project programs, all monetary terms in this report are expressed as nominal values.

- **Nominal Value:** Expresses monetary values, without adjusting for inflation or interest (also known as face value or par value).
- **Present Value:** The current worth of a future sum of money or stream of cash flows given a specified rate of return. Future cash flows can be discounted at a client specified discount rate to reflect the owner's internal cost of capital.

Hard and Soft Costs

Unless otherwise stated, the costs indicated in this report represent hard costs only. Because soft costs vary regionally and periodically, provisions for soft cost expenses should be considered in addition to the hard costs indicated. For the purpose of this report, Hard and Soft costs are defined as follows:

- **Hard costs:** Direct costs incurred in relation to a specific construction project. Hard cost may include labor, materials, equipment, etc.
- **Soft cost:** Indirect costs incurred in addition to the direct construction cost. Soft costs may include professional services, financing, taxes, etc.

Building Systems

A building system describes a mechanism, or group of mechanisms that perform a given role to maintain the functionality of a facility. Examples of building systems may include roofing, plumbing or heating, ventilation and air conditioning (HVAC) systems.

Per the Uniformat classification standard, building systems have been grouped as follows:

- Foundations
- Superstructure
- Exterior Enclosure
- Roofing
- Interior Construction
- Interior Finishes
- Conveying Systems
- Plumbing
- HVAC
- Fire Protection
- Electrical

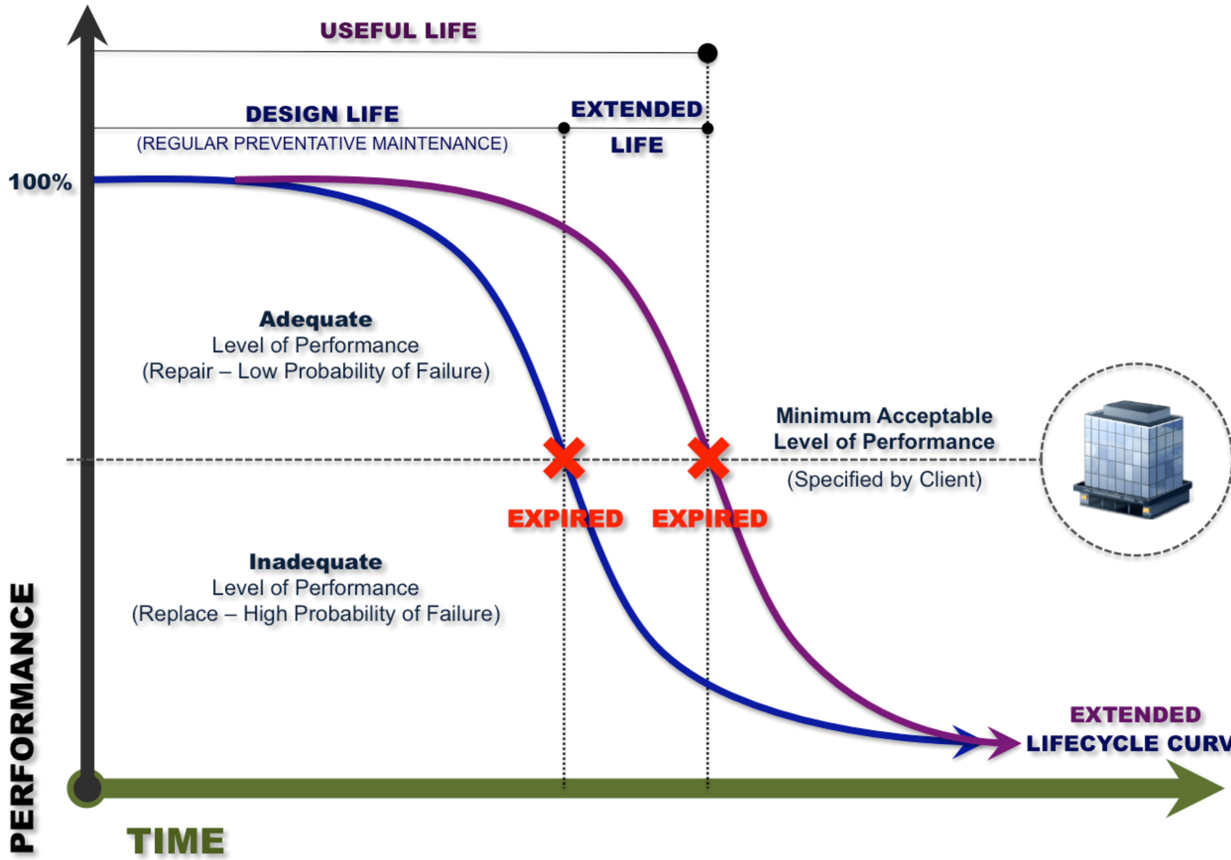
System States

The design life of a building system or component describes the duration for which a system is expected to perform within normal operational parameters. The design life may be shortened for a variety of reasons including, neglect or inadequate maintenance or extended as a result of robust preventative / predictive maintenance. This extended or shortened design life is defined as a system's useful life, and quantifies the duration for which a system, or component, operates within a minimally accepted level of performance.

As illustrated in the figure below, a facility condition analysis will make an appraisal of systems and components and recommend one of a series of actions necessary to ensure the continued functionality of a facility:

- **Missing:** A system or component may be deemed missing if the element absent, but is required for the operation of a facility (Example: ADA requirements for accessible ramps).
- **Extended:** The life cycle of a system or component may be extended beyond its anticipated design life, if the element is deemed to be performing adequately.
- **Expired:** A system or component may be recommended for replacement (at any time) if the element is deemed to be performing inadequately.

Figure 8. System or Component Life Cycle Curve



System Actions

A deficiency describes a condition in which there exists the need to repair an item that is damaged, missing, inadequate or insufficient for an intended purpose. Deficiencies are typically associated with underperforming systems or components, and describe activities that are required to extend their useful life.

- **Repair:** Describes a condition in which it is recommended that the building system or component be serviced to provide additional useful life. Repairs are curative in nature, while maintenance by contrast is preventative.
- **Replace:** Describes a condition in which it is recommended that the building system or component be removed and replaced with a new system or component. Replacement needs may vary according to building type, region, use, and maintenance management.

Multiple building systems are considered “non-renewable” because the replacement of those systems would typically be so costly as to require the replacement of the entire facility (Example: Foundations). Accordingly, there are no deficiencies or costs associated to non-renewable system.

Additionally, per client preferences, many aspects of the built environment may not be part of the scope of a facility condition analysis.

Cost Models

Cost estimation models are parametric equations used to predict the costs or the life cycle of a building system or component. The projections of the cost models are factored into capital plans, budgeting tools and other financial planning mechanisms. The rough order of magnitude cost estimates contained in this report are based on the cost models available within the client's database platform.

It is important to note that there are a variety of cost model equations employed in the building industry and it is not uncommon for prices derived from the client's database platform to vary from external references. If required, adjustments can typically be made to the facility condition data in order to facilitate comparison with external cost models, better reflect local conditions or perform sensitivity analyses.

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Appendix C - Glossary

ACBM: Asbestos-containing Building Material

ADA: Americans with Disabilities Act

AHERA: Asbestos Hazard Emergency Response Act

ALPHA: ALPHA Facilities Solutions, LLC

Alterations: Work performed to change the interior arrangements or other physical characteristics of an existing facility or fixed equipment so that it can be used more effectively for its current designated purpose or adapted to a new use.

ASHRAE: American Society of Heating, Refrigerating and Air Conditioning Engineers

ASTM: American Society for Testing and Materials

BOMA: Building Owners and Managers Association

Budgeting: A system by which a prior period's estimate of income and expenditure is adjusted to account for operational realities in order to provide for the cost of maintaining facilities. Traditional budgeting issues may include anticipated needs, organizational growth, the acquisition of new assets, operations and maintenance, deferred maintenance and insurance.

Building: An enclosed and roofed structure that can be traversed without exiting to the exterior.

Building Addition: An area, space or component of a building added to the existing structure, after the original building's year built date.

Capital Renewal: The planned replacement of building subsystems such as roofs, electrical systems, HVAC systems, and plumbing systems that have reached the end of their useful lives. Without significant reinvestment in building subsystems, older facilities will fall into a state of deteriorating condition and functionality, and the repair and maintenance costs will increase (International Facilities Management Association).

Calculated Next Renewal: The year a system or element would be expected to expire, based solely on the date it was installed and the expected service life of the system.

Condition: Condition refers to the state of physical fitness or readiness of a facility, system or systemic element for its intended use.

Cost Model: Parametric equations used to quantify the condition of building systems and estimate the cost necessary to sustain a facility over a given set of reporting periods. These estimated costs can be presented over a timeline to represent a capital renewal schedule.

Current Replacement Value (CRV): CRV is a standard industry cost estimate of materials, supplies and labor required to replace facility at existing size and functional capability. Please note that the terms Plant Replacement Value and Current Replacement Value have the same meaning in the context of determining Facility Condition Index.

Deficiency: A deficiency describes a condition in which there exists the need to repair a building system or component that is damaged, missing, inadequate or insufficient for an intended purpose.

Element: Elements are the major components that comprise building systems.

Facility: A facility refers to site(s), building(s), or building addition(s) or combinations thereof that provide a particular service or support of an educational purpose.

Facility Condition Assessment (FCA): The process of performing a physical evaluation of the condition of a facility and its systems. The findings of this analysis may be used in conjunction with cost models to estimate the current and future funding streams necessary to maintain a real estate portfolio.

Facility Condition Index (FCI): FCI is an industry-standard measurement of a facility's condition that is the ratio of the cost to correct a facility's deficiencies to the Current Replacement Value of the facilities – the higher the FCI, the poorer the condition of the facility. After an FCI is established for all buildings within a portfolio, a building's condition can be ranked relative to other buildings. The FCI may also represent the condition of a portfolio based on the cumulative FCIs of the portfolio's facilities.

Gross Square Feet (GSF): The size of the enclosed floor space of a building in square feet, measured to the outside face of the enclosing walls.

Hard Costs: Direct costs incurred in relation to a specific construction project. Hard costs may include labor, materials, equipment, etc.

Heating, Ventilation and Air Conditioning (HVAC): A term used to describe building systems responsible for maintaining the temperature, humidity and air quality control.

IFMA: International Facilities Management Association.

Indoor Air Quality (IAQ): A metric used to quantify the air quality within and around buildings and structures, especially as it relates to the health and comfort of building occupants.

Install Year: The year a building or system was built or the most recent major renovation date (where a minimum of 70% of the system's Current Replacement Value (CRV) was replaced).

Inflation: The trend of increasing prices from one year to the next, representing the rate at which the real value of an investment is eroded and the loss in spending power over time.

Interest: The charge for the privilege of borrowing money, typically expressed as an annual percentage rate and commonly calculated using simple or compound interest calculation.

Life Cycle: The period of time that a building, system or element can be expected to adequately serve its intended function.

Maintenance: Work necessary to realize the originally anticipated life of a fixed asset, including buildings, fixed equipment and infrastructure. Maintenance is preventative, whereas repairs are curative.

Mechanical, Electrical and Plumbing (MEP): A term used to describe building systems related to the provision of HVAC, electric and plumbing services to a facility.

Needs: In the context of this report, needs are the backlog of capital renewal requirements.

Next Renewal: The assessor adjusted expected useful life of a system or element as a result of on-site inspection.

Nominal Value: A value expressed in monetary terms for a specific year or years, without adjusting for inflation – also known as face value or par value.

Operations: Activities related to normal performance of the functions for which a building is used (e.g., utilities, janitorial services, waste treatment).

O&M: Operations and Maintenance

Parametric Cost Modeling: Parametric statistics is a branch of statistics that assumes that the data has come from a type of probability distribution and makes inferences about the parameters of the distribution.

Plant Replacement Value (PRV): PRV represents the cost to design and construct a notional facility to current standards to replace an existing facility at the same location. Please note that the terms Plant Replacement Value (PRV) and Current Replacement Value (CRV) have the same meaning in the context of determining Facility Condition Index (FCI).

Present Value (PV): The current worth of a future sum of money or stream of cash flows given a specified rate of return. Future cash flows are discounted at a client specified discount rate.

Real Interest Rate: A net interest rate adjusted to remove the effects of inflation. It is the amount by which the nominal interest rate is higher than the inflation rate.

Repairs: Work to restore damaged or worn-out facilities to normal operating condition. Repairs are curative, whereas maintenance is preventative.

Replacements: An exchange of one fixed asset for another that has the same capacity to perform the same function. In contrast to repair, replacement generally involves a complete identifiable item of reinvestment (e.g., a major building component or subsystem).

Return on Investment (ROI): ROI is a financial indicator used to evaluate the performance of an investment and as a means to compare benefit.

Rough Order of Magnitude (ROM): ROM cost estimates are the most basic of cost estimate classifications.

RSMeans: An independent third-party provider of building industry construction cost data.

Site: A facility's grounds and its utilities, roadways, landscaping, fencing and other typical land improvements needed to support the facility.

Soft Costs: Indirect costs incurred in addition to the direct construction cost. Soft costs may include professional services, financing, taxes, etc.

System: System refers to building and related site work elements as described by ASTM Uniformat II, Classification for Building Elements (E1557-97), a format for classifying major facility elements common to most buildings. Elements usually perform a given function, regardless of the design specification, construction method or materials used. See also, "Uniformat II".

Uniformat II: Uniformat II (commonly referred to simply as Uniformat), is ASTM Uniformat II, Classification for Building Elements (E1557-97) – A methodology for classifying major facility components common to most buildings.

Year Built: The year that a building or addition was originally built, based on substantial completion or occupancy.

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