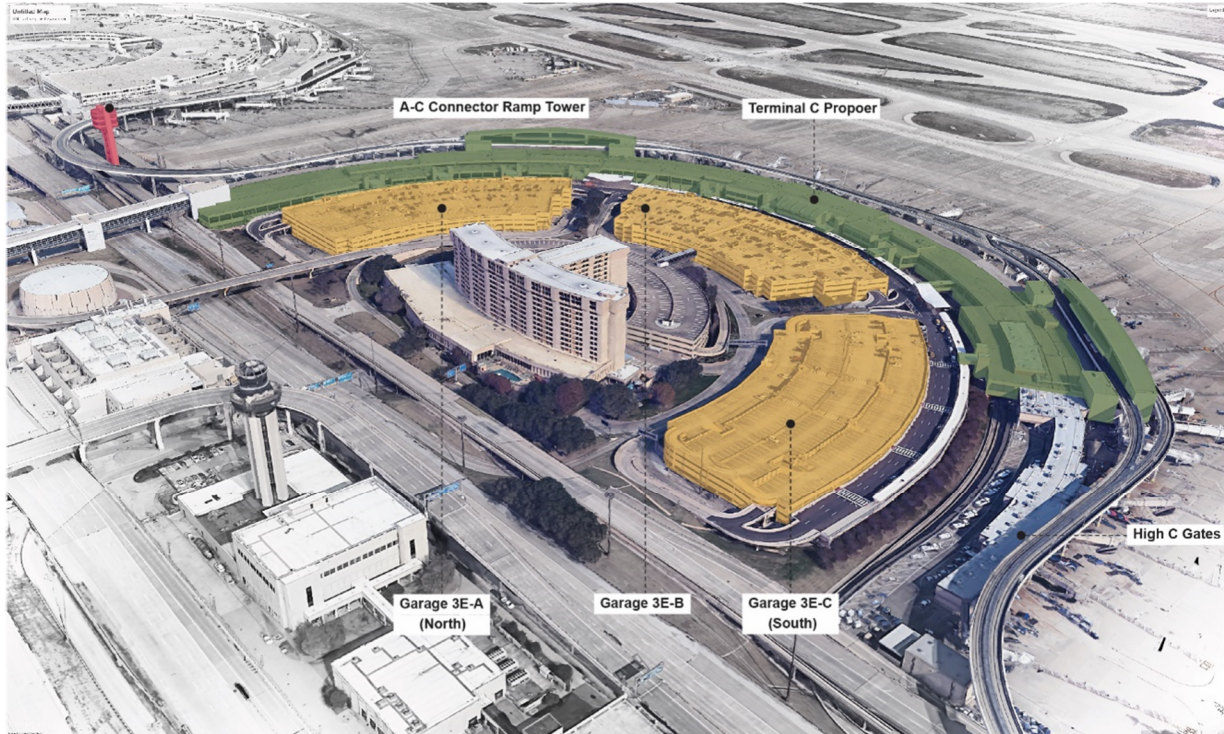


**Executive Summary**

**Existing  
Conditions  
Assessment**

# Executive Summary

## Introduction



The purpose of this report is to summarize the findings and recommendations recorded and documented in the Terminal C Renovation 35% Executive Summary and Existing Conditions Assessment Report. The conclusions and recommendations provided through technical evaluation, analysis and assessment demonstrate that over 80% of systems and infrastructure serving Terminal C operations require near-term or immediate replacement to extend the life of the facility. In short, immediate action is needed to mitigate against further unexpected failures and disruptions that are known to have downstream impacts to safety and security, operational reliability, customer care and experience. **Without immediate action, DFW risks the real potential of critical systems failing, which could have severe operational and customer service impacts throughout Terminal C.**

The Design Team was tasked to conduct an evaluation of the existing terminal, roadway, and garage facilities, systems, and infrastructure. The purpose of this assessment is to determine which components do not meet building and life safety codes, do not meet operational or customer experience finish and design standards, or are beyond their useful life expectancy in the professional opinion of the Design Team and are recommended to be replaced. Standards used in this evaluation are:

## **DFW Standards**

- DFW Design Criteria Manual
- DFW Terminal Restroom Design Guidelines
- DFW Green Building Standards
- Applicable building codes and DFW amendments

## **American Standards**

- CRE Finishes, Furniture & Equipment Design Standards

Terminal C was constructed in 1972 and over the past 48 years has experienced numerous changes as the single operator, American Airlines experienced growth in operational demand. The Terminal facility assessment includes infrastructure and assets from the very north end of the terminal through column line 109. The remaining Terminal C footprint is accounted for in the current High C's Project (Gates 35 – 39) which are currently contracted for demolish and rebuild.

The Existing Conditions Assessment was completed by Architectural and Engineering consultants specializing in various types of infrastructure, who utilized appropriate means of investigation methodology to collect sufficient data to yield a professional opinion and recommendation. Given the age of the facility, methods for condition assessment investigation were evaluated with Airport and Airline stakeholders prior to performing assessments. This was necessary to establish known conditions and thus ensure that the chosen method(s) avoid triggering potentially irreversible failure of any elements presently deemed to be in very poor condition or worse.

The condition assessments examined 60 various asset types currently serving the day-to-day operations and services provided within the Terminal. The Findings and Recommendations in this report were not developed through a sampling methodology. The condition assessment evaluated 100% of the assets listed in the Existing Conditions Assessment Matrix. Those assets are categorized within the respective technical disciplines and evaluated by relevant technical experts regarding condition and appropriate next step: preventative maintenance or maintenance and repair, or full replacement. With respect to maintenance records and practices reviewed, the technical assessment determined that recommendations for replacement are due to deterioration and degradation resulting from age that well exceeds the expected lifespan.

## **Findings**

As anticipated and now confirmed, the majority of Terminal C assets have exceeded the end of useful life (EUL), which is the industry-standard age at which the system is no longer considered reliable for business continuity and operational performance.

Within each category, the number evaluated and recommended for replacement in the next 1-2 years appears below. Shaded areas denote >50% elements requiring immediate replacement.

Category	Number of asset types evaluated	Number recommended for immediate replacement	Engineering Opinion given for immediate replacement
Life Safety/Code	2	2	Code compliance
Structural	1	0	No structural problems observed.
Architectural/Interiors	7	4	Exceed EUL
Equipment	4	2	Below acceptable level of service
Fire Alarm	5	4	Code compliance, exceeds (EUL), operational necessity
Fire Protection	5	4	Exceed EUL, operational necessity
Plumbing	5	5	Exceed EUL, operational necessity
Mechanical (Terminal)	4	4	Exceed EUL, operational necessity
Mechanical (Skylink)	2	0	Follow preventative maintenance
Electrical	7	6	Exceed EUL, code compliance
Telecom	11	7	Operational necessity
Technology	5	4	Operational necessity
Security	2	2	Exceed EUL, operational necessity
<b>Total</b>	<b>60</b>	<b>44</b>	

Category	Number recommended for replacement in < 6 years
Equipment (4)	1
Telecom (11)	2
Technology (5)	1
<b>Total (60)</b>	<b>4</b>

For those systems not recommended for immediate replacement, the following are recommended for replacement within the next 2-5 years which falls within the 6-year duration for design and construction of the program. This is important and means that additional assets and systems will exceed useful life and need replacement during the Terminal renovation program duration. The remaining 12 assets not recommended for replacement are newer installations and are recommended for continued preventative maintenance or some minor repairs to maintain reliability.

## Recommendation

It is a commonly held belief that being the last of the legacy terminals and therefore having the oldest systems, fixtures and finishes of any terminal at DFW, Terminal C is in need of numerous immediate along with near term replacements aimed at providing operational reliability. The engineering conditions

assessment has confirmed that this is indeed the case.

Not only is this facility over 48 years old, but its functional spaces are still of the pre-deregulation era. It measures the highest throughput of any terminal yet offers the lowest level of passenger experience, yields the least amount of revenue generating space and is served by unreliable systems which are in constant need of maintenance as many of them are near or past the end of useful life.

## Assessment

Upon closer examination, the scope of recommended replacement is very heavily weighted among critical systems upon which the facility relies to ensure reliability of life safety systems and operational systems as well as the health and well-being of passengers:

Category	Number of Critical System/Asset Types Evaluated	Replacement needed within 6-Year TRIP Program Duration	% replacement recommended
Life Safety/Code	2	2	100%
Mechanical	4	4	100%
Plumbing	5	5	100%
Security	2	2	100%
Technology	5	5	100%
Electrical	7	6	86%
Telecom	11	9	82%
Fire Alarm	5	4	80%
Fire Protection	5	4	80%
Equipment	4	3	75%
<b>Total</b>	<b>50</b>	<b>44</b>	<b>88%</b>

The probability of failure and disruption increases with time and continued utilization. The cascading effect of system failures undermines operational reliability and business continuity. As of October 2020, Terminal C is nearly 49 years old. Terminals A, C and E are of similar age and were renovated between 2010 and 2015 to extend remaining useful life, operational reliability, and economic vitality.

You will note in the Existing Conditions Assessment Matrix with this report that replacements are segmented into various timescales over the next 10 years, in accordance with industry standards. Again, due to the magnitude of aged and operationally unreliable assets, the majority of assets need to be replaced within the 6-year program duration to complete the renovation.

The majority of needed replacements are premised upon a project timeline commencing at the conclusion of this effort. Urgency given to avoid delays in proceeding with the Terminal C program mitigates against a compounding threat of operational instability.

Based on the evaluations performed, it is the Design Team's recommendation that items listed as needing **Replacement** in the 1-5 year horizon should be included in the scope of work of the Terminal C Renovation Project. There are no replacements recommended in years 6-10.

Items listed as needing **Preventative Maintenance** or **Maintenance & Repair** should occur on scheduled or as-needed basis.

In addition to the physical condition of the three garages serving Terminal C, consideration should also be given to the growth projections calculated within the DFW Parking Master Plan (PMP). Due to the passenger activity growth outpacing the modality interrupters and innovations, the PMP estimates that Terminal C will need to increase its current 5,100 total spaces by 1,400 spaces for a total of 6,500 spaces in the next 20 years. Per the findings of this Existing Conditions Assessment, Garage C has outlived its useful life and is recommended to be replaced. Current planning can achieve an increase in parking spaces at Garage C with a five-level replacement garage at 1,900 spaces, an overall increase of 400 total spaces for the terminal. Additional floors can add approximately 370 spaces per level, however, would need 10 levels to meet the full 1,400 space growth requirement. Consideration should be given to increase parking capacity across all garages at Terminal C for the life of the garages beyond 20 years, which would likely include replacement of one or both existing structures.

## Conclusion

DFW Airport must take immediate action to avoid the inevitable and catastrophic consequences that will occur with aged and degraded systems that no longer offer reliability and cannot be resolved without replacement. This is evidenced by recent experiences with major system failures involving the electrical service at Terminal C. Again, immediate action is needed to mitigate against further failures and disruptions that will have downstream impacts to safety and security, operational reliability, customer care and customer experience. Those consequences with highest probability of occurrence would not only be a disruption, but could render Terminal C, or parts thereof, incapable of operating and meeting its primary purposes and uses of an Airport terminal: passenger processing, checkpoint processing, gate operations and airline operations.

A planned and comprehensive renovation of Terminal C addressing the recommendations and findings outlined by the technical professionals could extend the life of this important facility for 30 more years with reliable operations and experiences upon which DFW Airport's global reputation for excellence is established. **As stated earlier, without immediate action, DFW risks the real potential of critical systems failing, which could have severe operational and customer service impacts throughout Terminal C.**

# Supporting Information

## GOALS AND OBJECTIVES

The primary objective for the Terminal C Renovation project accomplishes the validation of the previously delayed DFW TRIP 2015 design to re-life the facility to provide another 30 years of operation. A second objective identifies business case opportunities to be considered to serve a changing passenger environment now and in the future. This validation includes the review and assessment of existing conditions of the building systems and associated infrastructure in conjunction with recent and projected passenger activity demands. The project updates the planning assumptions and recommendations as necessary to reflect modifications in market trends and business objectives.

The outcome of this validation effort is expected to produce this Basis of Design Manual, a set of 35% construction documents including drawings and specifications for Terminal C, a set of 10% documents for all Garages (replacement of Garage C, renovation of Garages A&B), phasing plans, a total-cost-of-ownership analysis, and a construction cost estimate. These documents are to be utilized by DFW Design, Code, and Construction to advance to 100% design and establish the funding needed to proceed with the full renovation of Terminal C.

## HISTORY

**Terminal:** The A and B sections of Terminal C, originally named 3E, opened in 1974 with the inauguration of the airport. It was the same design and construction as the other ‘legacy’ terminals 2E, 2W and 4E (now called A, B and E) and was constructed in phases beginning in 1972. It is one of American’s two terminals for mainline domestic operations at DFW. It has undergone various changes since its initial construction, most of which have resulted in additional gates to accommodate American’s growing hub.

**High C Gates:** The C section, commonly referred to as the ‘High C gates’ was opened in 1988 as a temporary gate addition to address an immediate shortfall in gate capacity.

This was permitted by the Airport Board as a “temporary” structure to be removed or replaced within seven years; however, they remained in use until earlier this year. This structure is being replaced under a separate project.

**Terminal Roadways:** The original DFW Airport roadway design incorporated a relatively non-conventional traffic pattern comprised of left exits mixed with right-side on-ramps, and weaving merges that remains largely in place today. At the terminal complexes this roadway system includes a counterclockwise “outer carousel” roadway between the infield site and the terminal parking structures that serves inbound and outbound traffic to and from the terminal, parking structures, and hotel. From the Outer Carousel roadway, cross-links to the upper and lower level Curbside Roadways provide ingress and egress to and from the parking structures and the terminal.

**Terminal Parking:** There are four parking structures on the Terminal C site. Garage Section A (circa 1998), Section B (circa 1996) and Section C (circa 1986) make up the Terminal garages. Additionally, there is an Infield Parking Garage shared by the terminal and hotel. An elevated pedestrian bridge between the Infield garage and the B section garage links the parking structures as well as the hotel and terminal.

**Hyatt Hotel:** The Hyatt Regency Hotel located on the “infield” site between the garages and International Parkway, was built in 1979, and refurbished periodically since. Neither the hotel nor the hotel garage are included in this scope of work.

## PAST PROJECTS

In 2007, DFW International Airport and American Airlines began a planning process to address renovation of Terminals A, B, C and E in response to deferred maintenance issues, facility operational reliability issues, code compliance issues, congested security checkpoints and a customer experience inferior to that of Terminal D. This became the TRIP program, which launched design and construction in 2009 and is now complete in Terminals A, B and E. A 30% construction document package was produced for Terminal C in 2015 (TRIP 2015), however was postponed allowing for the opportunity to evaluate more strategic terminal development options as well as re-evaluate the scope of work that would be appropriate for Terminal C.

In 2018, American launched a Terminal C Re-Living Study (CFIX) to review current conditions, operational issues, and previous TRIP-recommended improvements, with the purpose of redefining an appropriate scope of work to refurbish and improve Terminal C for another 5 years of useful life (2025) or another 15 or more years of useful life (2035).

The timing of this work has occurred during the time of the COVID-19 pandemic; therefore, the use of pre-pandemic condition information is to be used to predict post-pandemic behaviors.

## EVALUATION METHODOLOGY

The evaluation of the components is based on visual inspection by subject matter experts, capacity analysis modeling and calculations, systems testing, and/or historical data. Criteria included functionality, age, and physical condition of the assets being reviewed. The findings are separated into one of three categories:

- **Preventative Maintenance Needed** – Treatment activities performed at planned intervals such as cleaning, replacing air filters, etc.
- **Maintenance and Repair Needed** – Treatment activities due to component use and age such as circuit breaker replacement in a control panel, wall repair, finish replacement, etc.
- **Replacement Needed** – Treatment activities for replacement of large components and systems as they reach the end of their useful lives (EUL), such as water heater replacement, exterior glazing replacement, telecommunications redesign and replacements, etc.



The following table provides a summary of the findings by component type. A full list of the detailed assessment can be found in the Appendix.

This report was prepared by registered architects and engineers based upon readily visible conditions and in accordance with the standard of care. The report and its contents may not be used for regulatory approval, permitting or construction.

**DFW Terminal C Renovation 35%**  
Existing Conditions Assessment



Preventative Maintenance	Maintenance & Repair	Replacement		
		1-2 years	2-5 years	6-10 years

TERMINAL					Comments
<b>Life Safety/Code</b>					
Accessories			X		Full replacement is needed to bring handrails, missing guardrails, and door hardware up to building code requirements.
Accessibility			X		Replace items not in compliance as part of the renovation scope. While Terminal C complies with exiting and general building code directives on most levels, the Tunnel Level has multiple egress, life safety, and accessibility violations including uneven floors and non-compliant stair access. The Tunnels cannot be brought up to code compliance without a significant amount of renovation. It is the recommendation of our professional team that all occupied spaces, including storage, will need to be relocated from this area. There are several accessibility issues that will need to be addressed throughout the terminal during the renovation project. Most will be corrected inherently with the new design layouts, however any associated with existing spaces to remain will also need to be addressed. Stair handrails & guardrails, door hardware, floor space clearances, accessible parking, and passenger loading zones are a few of the items that will need to be addressed as described by the Design Team's subject matter experts.
<b>Structural</b>					
General Structural Components	X				Terminal C is a "horseshoe-shaped" four-level concrete and steel structure originally built in the early 1970's. The terminal has been expanded several times with significant expansions between 1983 and 1991. There were no visual indications that the integrity of the primary existing structure has been significantly comprised during its service, from the limited exposed structure observed during on-site reviews. In the professional opinion of the Design Team, this structure will retain its serviceability for another 30 years with proper maintenance – in part, because unlike parking garage structural elements, the majority of the terminal structure is not directly exposed to weather and hence has not incurred deterioration from water infiltration as exhibited and described for Terminal C Garage C. This evaluation of Terminal C's primary structure is consistent with observations and evaluations made during TRIP for other DFW terminals of similar age and structural systems.
<b>Architectural/Interiors</b>					
Utility Corridor finishes	X				The Tunnel Level is finished with unpainted Cast-In-Place concrete floors, walls and ceiling. Demising walls at the Mechanical Rooms, Elevator shaft and Machine Room are unpainted CMU. It is recommended that the Tunnel Level is cleaned and minor repairs corrected. Regular maintenance and cleaning of the Utility Corridor is recommended to maintain the space for another 30 years.
Exterior Walls		X			Exterior precast concrete walls are recommended to be cleaned and cracks repaired where necessary. Regular maintenance and cleaning, as well as periodic assessments of the panels is recommended to maintain the exterior concrete panels for an additional 30 years. Untreated damage that allows water infiltration could lead to accelerated deterioration of the concrete if not addressed.
Curb		X			Concrete curbs at the Upper and Lower Level roadways are recommended to be cleaned, repaired, and/or repainted where necessary. The scope of the project shall address proper loading zones. Regular maintenance and cleaning is recommended to maintain the concrete curbs. Untreated damage that allows water infiltration could lead to accelerated deterioration of the concrete if not addressed.
Support spaces			X		Full replacement of finishes and fixtures due to exceeding EUL and to meet building code, accessibility, DFW and American standards, and renovation scope.
Public Spaces			X		Full replacement of finishes and fixtures due to exceeding EUL and to meet building code, accessibility, DFW and American standards, and renovation scope.
Exterior Glazing			X		Full replacement due to exceeding EUL, to meet DFW standards, and renovation scope. Exterior glazing at public areas shall be replaced with electrochromic glass.
Roof			X		Full replacement due to exceeding EUL, to meet DFW standards, and renovation scope.
<b>Equipment</b>					
Baggage Handling System	X				On-going system project outside of the project scope will replace most BHS components. The inbound claim areas are also undersized, with a level of service "D" or below, per IATA standards. The Design Team is exploring methods to upgrade the level of service provided. Partial replacement to meet renovation scope will be required. Regular maintenance of the new system is expected to allow it to serve 15-20 years before needing to be replaced.
Aircraft Gating			X		Gate C08 does not support 200' wingspan aircraft. Modifications will impact Gates C02 through C10 which including ramp markings, fuel pits, fixed walkway configurations, existing location of AVDGS units, and other miscellaneous scope items. Gates C15/C16 and C21/C22 are each paired where there is a single terminal door for two gates. Separating these gates will require two new terminal doors for C15 and C21 and a new fixed walkway connecting the terminal to the relocated passenger boarding bridges.
Fixed Walkways		X		X	There are 3 generations of fixed walkways on Terminal C. The original brown walkways need metal repairs and require new paint. The Skylink era walkways are in fair condition and will need some minor repairs. The TRIP era walkways are less than 10 years old and in good condition. Regular maintenance and repair is expected to allow the original fixed walkways to extend their lives another 3-5 years before needing to be replaced. The Skylink and TRIP fixed walkways can last another 10-15 years if properly maintained.
PBB Utility Systems			X		In the professional opinion of the subject matter experts on our design team, gate C16's passenger boarding bridge has exceeded its useful life and is recommended to be replaced. Other than programming alterations that will affect gating placement, utilities serving the PBBs are in various states of use and wear and are recommended to be replaced where needed.
<b>Fire Alarm</b>					
Primary Power Source	X				The primary power source is provided through redundant primary feeders from the commercial power supply. In addition to the redundant primary power supply, secondary power for the fire alarm system is provided by standby batteries located in or adjacent to the fire alarm control panels and remote power supply panels. No change required. The batteries are expected to be serviced each year and replaced every 5 years and will be replaced with this project.
Control Panels & System Cabling			X		The fire alarm system in Terminal C is the Honeywell XLS 1000 platform, which has reached its serviceable end of life. Full replacement to meet life safety code, DFW standards, and renovation scope.
Device & Notification Layouts			X		In our experienced opinion, the visible fire alarm notification coverage is insufficient in several areas on all three levels and in the tunnel beneath the terminal. A lack of audibility is a concern in several spaces, including the baggage handling, AOA and Gate House areas. Elevator recall is a life safety function required by national and state codes and is not present on several elevators throughout the terminal. It is the professional opinion of the Design Team engineers to replace and/or expand these systems to meet life safety code, DFW standards, and renovation scope.
PA/VE			X		The existing public address system is not fully deployed to all areas of Terminal-C, and it does not currently provide voice evacuation function. This system is not currently designed to provide Voice Evacuation emergency messaging to all areas required throughout Terminal C and needs renovation and expansion in order to meet DFW code requirements for Voice Evacuation. The professional engineers on the Design Team recommend this system be incorporated into Terminal C.
Skylink Stations & Ramp Tower			X		The fire alarm equipment in Skylink stations is controlled and monitored through existing Edwards fire alarm control panels and power supplies. The fire alarm system in the Terminal A/C connector is controlled and monitored by a Honeywell XLS-1000 fire alarm control panel, which is networked to the Honeywell EBI server. Full replacement to extend Honeywell XLS-3000 system throughout.
<b>Fire Protection</b>					
Valve Rooms			X		Each valve room consists of multiple wet, dry, and preaction fire sprinkler risers and domestic system risers. A 10-inch lead-in supplies both the domestic and fire sprinkler systems. Full replacement is recommended due to system has reached the end of its practical service life. In optimal conditions the typical service life of a sprinkler conditions is 75 years. However, demonstrated progressive corrosion of the internal pipe walls have significantly shortened the useful life of these systems in Terminal C. In a previous study of fire protection systems throughout DFW Airport, the corrosive action has been attributed to two factors – Microbial Induced Corrosion (MIC) and air/water interface iron oxide formation. These factors affect both wet-pipe and dry-pipe systems. As in the previously refurbished Terminal buildings, total replacement is warranted due to the steadily increasing frequency of system impairments required to repair pin-hole leaks, and the corresponding elevated maintenance costs.
Wet & Dry Pipe Systems			X		It is the professional opinion of the Design Team engineers that overall fire protection system piping terminal-wide has reached the end of its practical service life. In optimal conditions the typical service life of a sprinkler conditions is 75 years. However, demonstrated progressive corrosion of the internal pipe walls have significantly shortened the useful life of these systems in Terminal C. In a previous study of fire protection systems throughout DFW Airport, the corrosive action has been attributed to two factors – Microbial Induced Corrosion (MIC) and air/water interface iron oxide formation. These factors affect both wet-pipe and dry-pipe systems. As in the previously refurbished Terminal buildings, total replacement is warranted due to the steadily increasing frequency of system impairments required to repair pin-hole leaks, and the corresponding elevated maintenance costs.
Precision & Standpipe Systems			X		Six existing preaction sprinkler systems are located at CBIS areas (3), north and south MCRs, and American MER. Trapped sections of pipe retain water, which in an oxygen rich environment utilizing compressed air, can readily produce Microbiologically Influenced Corrosion (MIC), creating pinhole leaks in the steel pipe over time. As in the previously refurbished Terminal buildings, total replacement is warranted due to the steadily increasing frequency of system impairments required to repair pin-hole leaks, and the corresponding elevated maintenance costs.
Skylink System	X				An electric fire pump is provided to supplement the fire water supply to the fire sprinkler systems in each Skylink station. Each fire pump is nominally rated for 1,000 gpm at 70 psi. The two fire booster pumps were replaced in early 2013. This system is expected to function another 42 years with regular maintenance and repair before needing to be replaced.
Fire Department Connections			X		There is one Fire Department Connection (FDC) serving each Valve Room and Fire Hose Standpipe, for a total of 15 FDC's distributed along the terminal landside arrivals level. This requires that fire fighter responders know in advance precisely which system needs pressure augmentation in an active fire event. It is recommended to replace stand-alone FDCs with an interconnected system and update connection to 5-Storz.

**DFW Terminal C Renovation 35%**  
Existing Conditions Assessment



Preventative Maintenance	Maintenance & Repair	Replacement		
		1-2 years	2-5 years	6-10 years

**Comments**

Plumbing					
Support restrooms			X		All Ramp level landside and airside water closets, lavatories, hand sinks, and urinals do not comply with the new high efficiency water standards. The ramp level plumbing fixtures, including the urinals, lavatories, and water closets, located between column lines 17-18 A-Y, 41-42, A-Y and 81-82 A-Y, do not comply with TAS requirements. Most of the existing toilets and urinals located on the airside leak and do not flush properly due to the years of usage and wear. Replace damaged and improperly working fixtures. Reusing forty (40) to fifty (50) year old piping is not feasible nor recommended due to extensive labor to remove, clean, inspect, categorize, store, and reinstall. Restroom fixtures across the terminal – both public and non-public – are damaged, partially blocked, and use more water than modern water-efficient fixtures. Removal of the restroom fixtures to accommodate a new restroom layout would require installing code compliant fixtures.
Public restrooms			X		New restroom and concession layouts across the terminal will require that much of the pipe be resized and relocated to meet the new fixture counts and locations. Reusing forty (40) to fifty (50) year old piping is not feasible nor recommended due to extensive labor to remove, clean, inspect, categorize, store, and reinstall. Restroom fixtures across the terminal – both public and non-public – are damaged, partially blocked, and use more water than modern water-efficient fixtures. Removal of the restroom fixtures to accommodate a new restroom layout would require installing code compliant fixtures.
Grease Waste			X		Grease waste is continuously a problematic system with leaks and blockages plaguing the system. Some of the grease waste piping is not properly sloped and some is located where inaccessible due to baggage handling and other equipment. Grease interceptors are not sized to meet current concession demands. Some of the grease systems are being bypassed by the concession tenants (who provide their own stand-alone systems) due to the problems with the grease interceptors (for example, Gate C-17). There are odor issues on the landside near Gate C-17 that are assumed to be related to the grease interceptor issues. Full replacement to address slope, capacity, and interceptor compatibility issues.
Roof Drains			X		The roof drain dome strainers are not secured to the roof drain bases and need adjustments throughout the roof area of Terminal C. The secondary roof drains, where they exist, are not 2" above the roof tile as required by code. Most of the secondary roof drains that do exist are connected to the primary drain line (which is not in compliance with current codes). Full replacement is recommended with the replacement of the roof system.
Sanitary & Storm Piping			X		The piping systems have not only significantly passed the expected service life of thirty (30) years, the continuous modifications from expansion and building updates (including new concessions) has resulted in a mixture of different systems and materials of construction, including the presence of residential-grade components in some areas. Sewer system issues can be diagnosed based on four sources: presence of leaks, strange liquid color, odors, and presence of mold growth. All of these conditions were observed within Terminal C. The above ground sewer and grease waste piping is improperly sloped which does not allow for proper drainage. This condition has created the blockages found during the camera scoping of the piping. The roof drains are not properly sized nor configured to efficiently remove water from the roof. Should a primary drain be blocked (due to debris or other), much of the roof does not have proper secondary drains to prevent the accumulation of excess water on the roof. Although copper piping does not suffer from the same corrosion potential as black steel or cast iron, the water piping has signs of oxidation, especially where insulation has been removed. Many water valves are inoperable increasing the risk that the system cannot be locally and sufficiently isolated should a pipe failure (leak) occur. Heating water piping and valves are likely fouled due to mineral deposits in the water system. It is the professional opinion of the design team engineers that the systems mentioned above be replaced in full in the Terminal C Renovation project.
Mechanical					
Air Handling System			X		The Air Handling Units (AHU) are mostly early-1970's vintage variable-volume (VAV) units with chilled water/heating water coils. They are predominantly located on the Third Floor, but several are located on Ramp Level (such as C-AHU26). Newer AHUs were added with expansion projects constructed in the early 1980's and again in 2005 when Skylink was added. A Heating, Ventilation, and Air Conditioning (HVAC) project was done in mid 1980s to resheave fans to adjust airflow on some of the original AHUs. The American Society of Heating, Refrigeration, and Air-Conditioning Engineers (ASHRAE), the global organization that sets standards and guidelines for the HVAC industry, lists that the median life expectancy for air handling units is between twenty-five (25) and thirty (30) years, with components such as fans and coils having life expectancies of twenty-five (25) years and twenty (20) years, respectively. The large air handling units for Terminal C exclusive of the Skylink areas have been in service forty (40) to fifty (50) years. The result is the air handling units leak air and water, have obsolete components that are difficult to procure, fans and motors that require continuous servicing and repair, and coils that are fouled or damaged reducing their capacity and efficiency to properly cool or heat the space, resulting in higher energy costs. It is the recommendation of the professional engineers on the Design Team that these systems are replaced with this project.
Skylink Air Handling System		X			The existing Skylink air handling systems, installed during the ~2005 Skylink construction, are generally in good shape, with only signs of expected wear and some signs of damage. During discussion with maintenance, it is understood that these systems operate as expected with no current major concerns. Recommend similar approach to TRIP - relifing AHUs through replacement of fan with fan-wall, replacing coils, and replacing damaged components. Retrofit new controls. This system is expected to function another 10-15 years with regular maintenance and repair before needing to be replaced, per expected service life of 25-30 years for AHUs..
Hydronic System			X		The existing chilled water and heating water distribution system in Terminal C is significantly undersized for modern Terminal needs. This problem will be compounded with the conversion of the new "High C Gates" expansion from direct expansion (DX) HVAC equipment to chilled water/heating water. The smaller piping results in much higher velocities in the system mains at the required flows, which require the Energy Plaza pumps or additional tertiary pumps to deliver much higher pressure. This increased pressure results in many issues, such as considerably more energy consumption and increased risk of pipe leaks. Properly wrapped and maintained steel piping can last fifty (50) years, which is the age of these systems. Piping that is exposed to the environment can shorten the life to as little as twenty (20) years or less. Although much of the chilled and heating water piping is in a conditioned environment, some are located in unconditioned or exterior spaces. Where insulation and jacketing are missing, there are already signs of corrosion and rust. Valves, which have not been exercised over time, are already corroded and inoperable. These valves would not be able to properly isolate a break in the system should a failure occur which would require a much larger loss of service and damage from the break. It is the recommendation of the professional engineers on the Design Team that these systems are replaced with this project.
Glycol			X		The glycol system, like the hydronic systems, is also extremely undersized. Unlike the hydronic distribution with many submains and branches, the glycol system is primarily the undersized mains. Increasing the size of the glycol mains should also include replacement of the runout branches to the PCA and Bridge Cool units. It is the recommendation of the professional engineers on the Design Team that this system is replaced with this project.
BAS Controls			X		Pneumatically operated controls systems, as is installed in Terminal C, have been obsolete for many years. In addition to the inherent inefficiencies and lack of feedback from these systems, they are also prone to system failures such as loss of loop control as the pneumatic tubing is disconnected, breaks, or erodes. This was observed throughout Terminal C, with many dampers and valve operators not connected to the system. Also, with digital replacing pneumatic over the last thirty years, replacement of system components is becoming much more difficult. ASHRAE lists the median life expectancy of a pneumatic control system between fifteen (15) and twenty (20) years, of which many of these components triple that. It is the recommendation of the professional engineers on the Design Team that the pneumatic control system is replaced with this project.
Skylink Boiler	X				Boilers serving the Skylink track freeze protect are located within the mezzanine mechanical rooms of the Skylink stations. This equipment appears to be in good condition. It is assumed this equipment, maintained regularly, will have an expected life span of 35 years, which means approximately 20 years of remaining life as it was installed in 2005.

**DFW Terminal C Renovation 35%**  
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Preventative Maintenance	Maintenance & Repair	Replacement		
		1-2 years	2-5 years	6-10 years

					Comments
<b>Electrical</b>					
Oncor primary and Back-up power Main System			TBD		The Oncor equipment is original to the building (1971) but it had upgrades during the years. Oncor confirmed that the equipment is still reliable. The visual observation confirmed a fair condition. Requested evaluation report from Oncor.
Distribution Equipment			X		The electrical systems were evaluated by examining the available record documents and through visual observation of the equipment serving the Terminal, the Skylink, the Garage and the AC Ramp Tower. Upon installation, all electrical equipment begins to deteriorate due to absorption of moisture, daily temperature cycles, collection of dust, condensation, mechanical wear of circuit breaker contacts and contactors, weakening of operating springs, deterioration of insulating materials, and rusting of switchgear enclosures. The expected service life of the equipment is based on manufacturers' historical data and recommendations. The industry accepted service life for electrical equipment is 25 – 30 years. It is the recommendation of the professional engineers on this project that the electrical systems have extended beyond their useful life and should be replaced.
Lighting & Lighting Controls			X		The Terminal power distribution equipment is past the expected service life, since this equipment is original to the 50-year-old terminal and represents a potential hazard to the electrical system. Systems which have exceeded manufacturer's service life include: all switchboards, panelboards, transformers connected downstream of the Oncor Vaults A and B and are recommended to be replaced.
Wiring Devices, Raceways, & Branch Circuits			X		Lighting systems in all areas consist of fluorescent fixtures and outdated lighting control components not compliant with the current energy code and replacement with energy efficient fixtures and controls is recommended by the professionals on the Design Team.
BHS Power			X		Existing wiring devices throughout the terminal seem to be in fair condition. However, they are at or near their life expectancy. Raceways were observed in the unfinished, back of the house spaces. They mainly consist of electrical metallic tubing in interior spaces and rigid galvanized steel in exterior spaces. Most of the raceways observed are in fair condition. Parts of existing raceways can be reused to minimize additional penetrations at floor structure and at fire rated construction. It is recommended that the wiring devices, most of the raceways and branch circuits are replaced throughout the renovation as they are nearing the end of their life expectancy.
Skylink	X				It has been mentioned that a very brief loss of power can cause the baggage handling systems or parts of the baggage handling system to shut down and may take a significant amount time to bring all systems back online. A static switch similar to what has been installed at Terminal E is recommended.
Admirals Club	X		X		The Skylink power distribution components seem to be in good condition and is approximately 15 years old and the recommendation is to keep the system as is. This system is expected to function another 15 years with regular maintenance and repair before needing to be replaced.
<b>Telecom</b>					
DFW Comm Rooms, Backbone, & Horizontal Cabling	X				There are electrical panels/equipment in (5) areas that serve the Admirals Club. Most of the electrical equipment if not all of it is original to the Admirals Club and are in fair condition. This system is expected to function another 3-5 years with regular maintenance and repair before needing to be replaced. There are panels and a transformer in the COMMs ROOM and do not meet code requirements for workspace clearances per the current NEC. Currently several panels that serve the Admirals Club that are located in a mechanical room that is on the roof outside of the Admirals Club space. The lighting equipment is located in the COMMs ROOM and in a hall closet across from the kitchen. The lighting control panels appear to be at the end of their life expectancy and should be replaced. Light fixtures in this space are not as energy efficient as current LEDs. Also cove lighting appears to be of Neon or Cold Cathode lighting system and is outdated. Lighting throughout space is at the end of its life expectancy. It is understood that the Admirals Club will be renovated with this project and its systems are recommended to be replaced due to the renovation scope.
American UPS		X	X	X	Protect in place. Partial replacement with Category 6A cabling where affected by renovation scope. Protect Category 6 and 6A cables in place where not affected. This system is expected to function another 20 years with regular maintenance and repair before needing to be replaced.
American Phone System		X			Replace MER UPS system due to exceeding EUL. Replace those within AA TRs on a case by case basis. The TR UPS systems are expected to function another 5 years with regular maintenance and repair before needing to be replaced.
American Main Equipment Room			X		With confirmation that all circuits have migrated to the American Cisco Voice system, legacy system shall be decommissioned and removed.
American Comm Rooms			X		The American Main Equipment Room located on Level 3 contains the American core network and technology systems within the terminal. This room is in general disrepair, has been subject to water leaks, and is in dire need of renovation of systems such as UPS power and environmental control system.
American Backbone Pathway and Cabling			X		The American Telecommunications Rooms within Terminal C are located on the Ramp and Concourse levels. Any rooms located on the Concourse Level should be relocated to the Ramp level to make better use of the Concourse real estate. Rooms currently on the Ramp level may require renovation in place. The legacy backbone fiber to these rooms should be updated to the current American standard single mode fiber.
American Horizontal Pathway and Cabling			X		Replace with 4" conduit or with bus typology.
DFW & American Public & Private WIFI	X				Replace with Category 6 cabling.
American Access Control & CCTV			X		Some replacement to meet renovation scope. This system is expected to function another 3-7 years with regular maintenance and repair before upgraded with emerging technology.
DFW Cellular Radio DAS		X		X	Replace to meet current American system requirements and to meet renovation scope.
DFW Public Safety DAS			X		Cell DAS remotes currently installed above ceilings are to be relocated to DFW Comm Rooms. This system is nearing end of life, with an anticipated remaining useful life of 2-5 years. This system is owned and maintained by a cellular provider consortium, so it is unclear if the cost to upgrade the system would be a program cost or if the cost would be absorbed by the consortium. Further coordination with DFW and the consortium is needed.
<b>Technology</b>					
DFW MATV Headend, Backbone & Horizontal Distribution			X		Expand partial system to fully deploy within Terminal C to meet renovation scope.
American MATV Headend, Backbone & Horizontal Distribution			X		Replace fiber and fiber transmitters to support the connections to the MCRs in the terminal. Replace fiber optic distribution system and horizontal distribution system to meet the capacity demands of Terminal C.
Concessions DBS Headend, Backbone & Horizontal Distribution			X		Replace fiber transmitter to support the connection to the Terminal C MER. Headend at Terminal A is adequate to support both Terminals. Replace fiber optic distribution system in a star configuration and serve from each of the American TRs. Replace with twisted pair based distribution that allows the MATV to be distributed over Category 6 cable.
CNN SMATV Headend, Backbone & Horizontal Distribution			X		Replace fiber and fiber transmitters to support the connections to the MCRs in the terminal. A new SADS distribution system will be engineered for the terminal. New horizontal distribution will be provided from DFW communications rooms to the various spaces that need it.
EVIDS				X	Replace CNN feed to be derived from the DFW MATV system. New horizontal distribution will be provided from DFW communications rooms to the various spaces that need it.
<b>Security</b>					
Access Control System			X		Terminal C has EVIDS monitors deployed around the terminal building. These monitors typically have a 2-5 year manufacturer warranty for 24x7 use and are refreshed as needed by the Owner. It is recommended these are replaced throughout with this project.
Security Surveillance System			X		The existing access control system is past end of life, therefore the existing system in Terminal C is scheduled to be replaced within the next 2-3 years. As a result, DPS will expect the terminal to be brought up to the current TRIP security standards for the legacy terminals. In our experienced opinion, this will trigger hardware changes for most doors, the replacement of a number of doors and the addition of access control treatment to approximately 50 doors. Approximately 200 cameras will need to be added to support the upgrade, along with all new conduit infrastructure. In addition, the existing BHS will need to be integrated with the new access control system, potentially requiring PLC upgrades and the replacement of bat-wing doors and chop doors. The replacement of BHS doors will likely trigger improvements to the smoke separation and the associated fire alarm integration.
			X		Full replacement due to system exceeding EUL, to meet DFW standards, and renovation scope.

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Preventative Maintenance	Maintenance & Repair	Replacement		
		1-2 years	2-5 years	6-10 years

LANDSIDE GARAGE AND ROADWAYS					Comments
<b>Garage A</b>					
Structural					
General		X			Garage built in 1998 is approaching EUL. Repair of worn and damaged areas, including some cracks and spalling, surface finishes, and expansion joint materials are required immediately. Replacement of the garage can be deferred, however another assessment will need to be conducted in approximately 10 years to evaluate the need for any further repairs.
<b>Garage B</b>					
Structural					
General		X			Garage built in 1996 and is approaching EUL. Repair of worn and damaged areas, including some cracks and spalling, surface finishes, and expansion joint materials are required immediately. Replacement of the garage can be deferred, however another assessment will need to be conducted in approximately 10 years to evaluate the need for any further repairs.
Connection to Hyatt			X		Provide accessible path between Hyatt garage, pedestrian sky-bridge, terminal garage, and terminal. Repair and replace finishes within the pedestrian sky-bridge.
<b>Garage C</b>					
Structural					
General Structural Components			X		Replace existing Garage C due to water damage and observed deterioration that has caused many of the current structural issues including damaged concrete surfaces, loose and unsound concrete, corrosion of exposed steel reinforcement and embedded steel components, and expansion joint deterioration. This garage also does not meet the floor-to-floor height needed to allow accessible van parking.
Architectural					
General			X		Garage built in 1986 and is approaching EUL.
Vehicular Access			X		Replace structure to provide adequate clear heights within the garage to allow for ADA van accessibility.
Vertical Circulation (stairs)			X		Resolve blind corners within stairways caused by precast divider walls.
Connection to Hyatt			X		Provide accessible path between Hyatt garage, pedestrian sky-bridge, terminal garage, and terminal. Repair and replace finishes within the pedestrian sky-bridge.
<b>All Garages</b>					
Life Safety/Code					
Accessories		X			Partial replacement is needed to bring handrails up to code requirements. Install barriers to provide adequate head clearance below stairs on the Level 1.
Safety		X			Paint edge of curbs safety yellow to prevent tripping hazards.
Accessibility			X		Realign terminal and garage functions so there is a clear accessible path available that does not exceed a non-accessible path. No accessible loading zone is currently located on site. The Design Team is exploring ways to incorporate a loading zone at Valet.
Structural					
General Structural Components		X			Clean surfaces, repair cracks and spalling, and re-apply paint and/or concrete sealer on exterior and floor surfaces as needed. Floor surfaces should be refinished and restriped every few years to maintain adequate serviceability and function. Untreated damage and cracking that allows water infiltration could lead to accelerated deterioration of the structural components if not addressed.
Architectural					
Precast Façade Panels & Pedestrian Walkways	X				Clean and paint. Regular maintenance and cleaning, as well as periodic assessments of the panels is recommended to maintain the exterior concrete panels for an additional 30 years. Untreated damage that allows water infiltration could lead to accelerated deterioration of the concrete if not addressed.
Pedestrian Entries/Exits - Upper & Lower Levels		X			Provide crossing indicator for pedestrians and vehicular traffic.
Stairs			X		Replace deteriorating metal pan stair assemblies and repair concrete surface at landings on cast-in-place/post-tensioned structure. Replace roofing, drainage assemblies, and lighting of all roof level stair enclosures at a minimum. Clean and repaint structure.
Vertical Circulation				X	The garages do not have elevators; therefore, a person must go into the terminal building before having the ability to change levels. ADA van parking is only available on Level 3 in Garages B and C due to reduced clear heights on other levels within those sections. The Design Team is exploring methods to add elevators to Garages A and B and elevators are to be included in the design of the new Garage C.
Valet Services			X		Develop operational solution with supporting physical presence to support meeting TAS/ADA requirements for passenger loading zones at valet services.
Standpipe Protection		X			Add bent metal plates with reflective adhesive material in front of standpipes to provide protection.
Fire Protection					
Standpipes			X		Replace enclosures with 2.5" fire department angle valve connections with knox locking caps 3'-0" AFF. Existing fire risers need to be replaced.
Fire Extinguishers and Alarm Pulls			X		Add fire extinguishers and associated cabinets and signage. Replace alarm pulls with emergency call boxes and add occupant notification appliances.
Fire Department Connections			X		Replace stand-alone FDCs with an interconnected system and update connection to 5-Storey.
Mechanical/Plumbing					
Roof Drains			X		Replace to meet building code requirements
Trench & Floor Drains		X			Clean all drain assemblies and repair rusted or damaged areas. Replace on an as-needed basis. This system in Garages A & B is expected to function another 20 years with regular maintenance and repair before needing to be replaced.
Exhaust Fans & Ventilation			X		Replace or upgrade existing ventilation systems within utility rooms. Consider replacement with cooling unit for IT/Electrical rooms.
Electrical					
Primary & Distribution Equipment			X		Full replacement due to system exceeding EUL.
Lighting			X		Replace all fixtures with LED, adding fixtures where needed along walkways, vertical circulation, and vehicular entry/exit points. Provide digital control system to meet 2009 IECC. Replace Emergency inverter equipment due to system exceeding EUL.
Wiring & Branch Circuitry			X		Garages A and B have branch panels to serve the 1st level and distribution panels to serve branch panels on the 4 levels above. Panels are in fair condition but are beyond their life expectancy. Garage C only has panels only on Parking Level 1 and are in poor condition. No other panels were found in Garage C. Service for Garage C appears to be fed from Garage B. Full replacement is recommended.
IT/Telecom/Security					
Parking Guidance System				X	Add PGS to create consistency between other on-airport parking structures.
Emergency Call Stations & Security Cameras			X		Add emergency "blue light" call stations at stairwells on all levels. Add security cameras for visual contact with emergency phones for consistency between other airport parking structures and enhanced security. DFW Comm Rooms will be required to support these additional systems.

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Roadways					Comments
Civil					
Upper Carousel Roadway		X			There is approximately 2,400 LF of bridge deck in the upper (arrivals) portion of the roadway. Visual inspection indicates that the deck is in good shape but some areas have exposed reinforcing and the concrete has popped out allowing moisture into the deck. Many of the deck drains are completely stopped up and evidence of efflorescence was seen under the bridge. It is recommended to clean drains. Portions of the exposed joints show that the old neoprene seal has broken allowing water to enter the joint. To be certain of bridge deck conditions, it is recommended to have it cored and tested. To extend the life of the deck, the deck can be milled-off the deck to check for cracks, seal those cracks, replace any bad areas, repair/replace the bridge joints, then add a new asphalt surface. If recommended repairs are made, the roadway can expect to last an additional 10-15 years before another assessment should be conducted. Other exploratory testing beyond visual review, such as borings, should be conducted to analyze the structure.
Lower Carousel & Circulation Roadway			X		Pavement is designed based on traffic loading over a design period. Concrete pavement is traditionally designed over a 30-life span. The traffic loading corresponds to a term called ESAL (Equivalent Single Axle Loading) which consolidates all loading from cars, buses, trucks and others into a single load unit. The current pavements according to DFW Airport staff is 8 inches on lime treated subgrade. According to AASHTO the effectiveness of the lime treated subgrade diminishes over time therefore not considered for support of the current roadway. It is noted that during construction there were sulfates detected in the embankments that reacted negatively to the lime treatment and created a heaving effect that weakened the pavement shortly after construction. The estimated ESALs for 358 million vehicles is approximately 50 million ESALs. The AASHTO Design Guide is several years old but is still used throughout the industry for pavement thickness design. For a likely design on an Arterial Street the Design Guide provides the output for various conditions. In our case the recommendation is for 11.5 inches of continuous reinforced concrete pavement with an ESAL value of 20 million. In short, the pavement design life of our existing 8-inch concrete pavement has been exceeded two-fold and are recommended to be replaced.
Lighting			X		Upgrade lighting to meet current NEC codes, provide uniform lighting along the roadway and at all transition areas, and fixtures should be energy efficient (LED).
Drainage		X			Storm drain modeling shows that the existing storm sewer system has sufficient capacity. Therefore, no pipes will need to be upgraded in size. Address known ponding areas and and repair any damage. ETAM is currently performing a visual inspection to determine remaining lifespan.
Sanitary Sewer			X		24% of the pipes evaluated in the Sanitary Sewer Pipe Condition Assessment performed by DFW have a Condition Rating of 4 (Major structural defects) and above. These pipes have structural defects and will need action either immediately or in the next 4 years, depending on the condition rating.