



ADVANCED DESIGN DOCUMENT

George Bush Intercontinental Airport

PN 673C – Terminal A Curbside Improvements

TABLE OF CONTENTS

EXECUTIVE SUMMARY	1
INTRODUCTION	2
1.1 PURPOSE	2
1.2. STATEMENT OF NEED.....	2
2. PROJECT DESCRIPTION.....	3
2.1. EXISTING CONDITIONS	3
3. AREA DEVELOPMENT PLANS	11
3.1 EXISTING AND PROPOSED CURBSIDE CAPACITY	11
3.2 PROJECT RELATIONSHIPS TO ESTABLISHED AIRPORT PLANS / MASTER PLAN	13
3.3 ENVIRONMENTAL CONDITIONS	18
3.4 PROJECT ALTERNATIVES / CONSTRUCTION PACKAGING	18
3.4 TRAFFIC CONTROL	18
3.5 PUBLIC SAFETY	18
3.6 UTILITY COORDINATION	18
4. PROJECT ALTERNATIVES	19
4.1 PROJECT ALTERNATIVES.....	19
5. RECOMMENDATION.....	24
6. DESIGN STANDARDS OR GUIDELINES	25
7. PRELIMINARY PROJECT SCHEDULE.....	29
9. PRELIMINARY PROJECT DELIVERY METHOD	30
10. COORDINATION WITH OTHER PROJECTS.....	30
11. PRELIMINARY PROJECT FILE STRUCTURE.....	30

TABLE OF FIGURES

Figure 2.1: IAH Terminal A - Existing Ingress and Egress	3
Figure 2.2: IAH Terminal A - Existing Arrivals	4
Figure 2.3: North Arrivals - Existing Conditions	4
Figure 2.4: West Arrivals - Existing Conditions	5
Figure 2.5: West Parking - Existing Conditions	5
Figure 2.6: South Arrivals - Existing Conditions	6
Figure 2.7: West Arrivals and Helix - Existing Conditions	6
Figure 2.8: South Electrical Yard - Existing Conditions	7
Figure 2.9: IAH Terminal A - Existing Departures	9
Figure 2.10: East Departures - Existing Conditions	9
Figure 2.11: East Departures - Existing Conditions	10
Figure 2.12: Proposed Arrivals Mode Split	12
Figure 2.13: Proposed Departures Mode Split	12
Figure 3.1: IAH Terminal A - Proposed East Arrival	13
Figure 3.2: IAH Terminal A - Detailed Terminal Restripe	14
Figure 3.3: IAH Terminal A - Detailed East Departure Lanes	15
Figure 3.4: IAH Terminal A - Garage A to A/B Bridge Connections	16
Figure 3.5: East Departures and Arrivals - Section View	17
Figure 3.6: Terminal A to AB Garage Bridge - Typical Section	17
Figure 3.7: Utility Coordination	18
Figure 4.1: IAH Terminal A – Project Alternatives	19
Figure 4.2: Garage Bridge Connection Option A - One-Way Bridge Structures	21
Figure 4.3: Garage Bridge Connection Option B - Single Bridge Structure	22

ABBREVIATION LIST

ADD – Advanced Design Document
ADBBD – Advanced Design Bid Document
AOC – Airport Operations Center
APGS – Automated Parking Guidance System
EOC – Emergency Operations Center
HAS – Houston Airport System
IAH – George Bush Intercontinental Airport
LOS – Level of Service
MDF – Main Distribution Frame
NIC – Not In Contract
ROM – Rough Order of Magnitude
TNC – Transportation Network Companies
UPS – Uninterrupted Power Supply
PHOP – Peak Hour Originating Passengers
POV – Privately Owned Vehicles
RAC – Rent a Car

EXECUTIVE SUMMARY

The recommendation of the Advanced Design Bid Document (ADBDB) is that expansion of additional curbside and roadway capacity is needed to address current deficiencies as well as to support ongoing growth at IAH. These planning recommendations serve as the basis for this ADBDB and propose the following curbside capacity improvements:

- Demolishing the East and West helices at the Terminal A parking garage, including relocation of generator and trash collection from base of west helix to adjacent parking area.
- Constructing a new Bridge connector between the A-B Garage, and the Terminal A garage
- Constructing a new Structure for departures at the East curbside to accommodate 2 additional unloading lanes
- Constructing a New at-grade arrivals curbside on the East side (includes reconfigure T/A Valet)
- Constructing a new at-grade Transportation Center at the West side of Terminal A
- Widening/Restriping the South Terminal Road to accommodate 3 lanes of traffic

Without the proposed improvements stated above, curbside and roadway capacity, which is currently strained (near failing at an LOS F) under existing conditions, will fail with significant congestion, delay, and queues as IAH continues to grow. The Advanced Design Bid Document supports the recommended improvements outlined above and proposes the additional optional considerations listed below:

- Provide 2 additional entry lanes to the A/B garage
- Relocate/dedicate receiving/delivery within the west parking area
- Covered Canopy between Terminal A and A/B Garage
- Covered Canopy at Expanded West Curbside
- Construct a second T/A to A/B Garage bridge connector for redundancy.

In addition, the projects listed below will be necessary in conjunction with the curbside capacity improvements, but are not included in the scope of the ADBDB:

- Expand A/B garage APGS system to passenger area of A Garage
- Temporary off-premise parking is required if the bridge connecting Terminal A and A/B Garage is not constructed before removal of the helices. Over 800 spaces would be displaced during construction.

Goals: If implemented as outlined, these improvements shall help the airport to achieve the following:

- Achieve a Level of Service “C” or better for current and forecasted Terminal A curbside and roadway conditions (33 total gates, 24 O&D)
- Improve transportation mode organization and allow for greater flexibility to accommodate changing passenger preferences today and into the future

INTRODUCTION

1.1 PURPOSE

This ADBD provides an understanding of the overall project requirements and schedule to ensure the project will be carried out within the budget and scope intended by HAS.

1.2. STATEMENT OF NEED

Curbside Capacity Needs and Future Growth:

The table below outlines the recommended curb length required based on PHOP demand. Additionally, average vehicle occupancy, average vehicle length, mode share percentage and dwell times are provided. Note that the occupancy, length, and mode share represent accepted averages and are not specific to IAH Terminal A. High and low case scenarios were considered, however, the central case mode share assumptions (in the table below) have been used to inform the Capacity needs for this project.

Peak Hour Vehicles (Departures)	1174				
Peak Hour Vehicles (Arrivals)	1162				
Assumptions			Central Case		
	Avg. Veh. Occupancy	Avg. Veh Length (Ft)	Mode Share - Arrivals	Mode Share - Departures	Dwell Time (Mins)
Private Car Curbside	1.1	25	54%	60%	2.4
Taxi	1.1	25	9%	9%	1.9
TNC	1.1	25	14%	15%	1.9
Ecopark Shuttle	3	30	4%	3%	2.7
Off-airport Parking Shuttle	3	30	4%	3%	2.7
Hotel & Other Shuttles	3	30	5%	6%	2.7
RAC Shuttle	3	40	3%	1%	2.7
On-airport Parking (Walk)			7%	8%	0
Total linear feet curb length required			1,610	1,605	

2. PROJECT DESCRIPTION

2.1. EXISTING CONDITIONS

The existing Terminal A Parking garage currently houses 2 levels of parking. These parking spaces are currently reserved for Employees only. The Terminal A/B parking garage contains 8 levels of passenger parking, including Valet and tall vehicle accessible parking spaces.

The current egress/ingress is detailed in the figure below:

IAH Terminal A – Existing Ingress and Egress

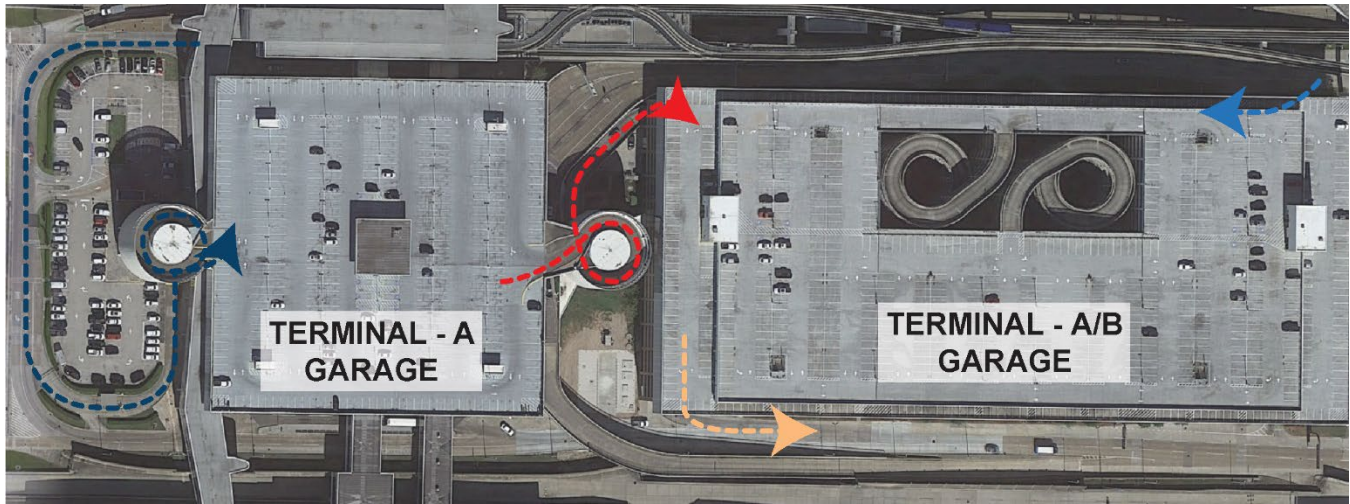


Figure 2.1

EXISTING INGRESS		EXISTING EGRESS	
	Public uses Terminal A/B Parking Garage		Employees use east helix to exit through Terminal A/B Parking Garage
	Employees use west helix for Terminal A Parking Garage		Employees & public vehicles exit through Terminal A/B Parking Garage

Terminal A currently has Arrivals curbside in 3 locations:

- North Arrivals Curbside – Passenger Pick-up (Privately owned vehicles)
- West Arrivals Curbside – Parking Shuttles
- South Arrivals Curbside – Hotel Pick-up, Taxis, Ride App, Rental Car Shuttles, Charter Buses

The Airport infrastructure is closely spaced. This limits the opportunity to widen the existing roads to provide additional capacity.

Existing Curbside Layouts

IAH Terminal A – Existing Arrivals

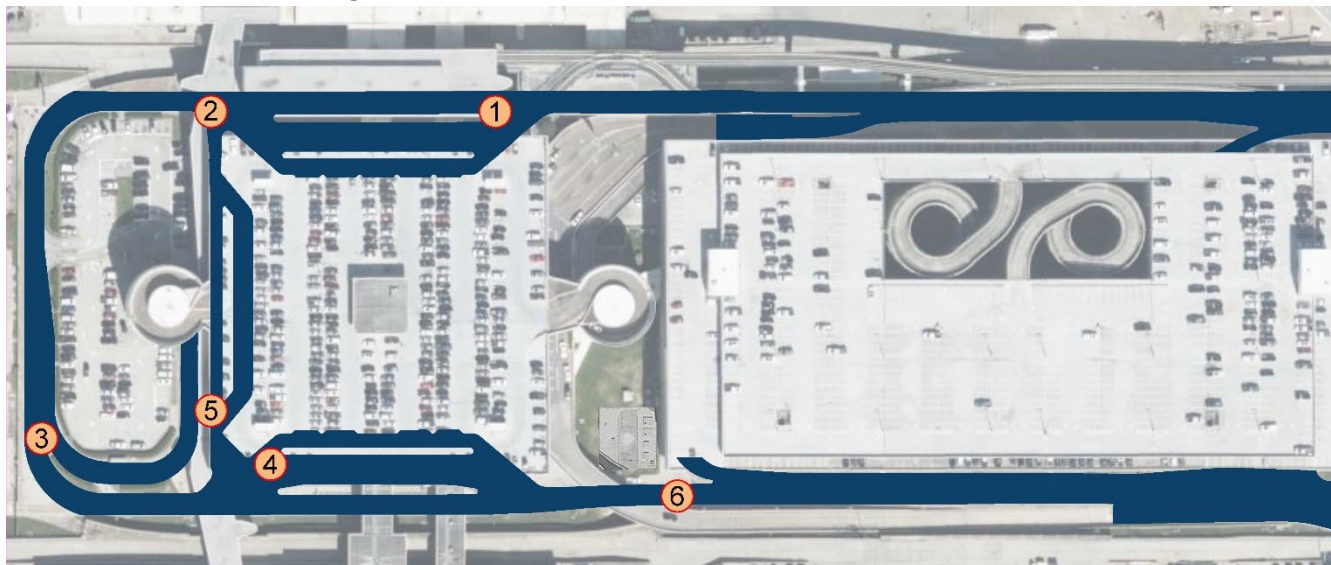


Figure 2.2

Existing Conditions / Lanes

North Arrivals – Existing Conditions



Figure 2.3

North Arrivals

The North arrivals includes 5 lanes of POV curbside capacity.

West Arrivals – Existing Conditions

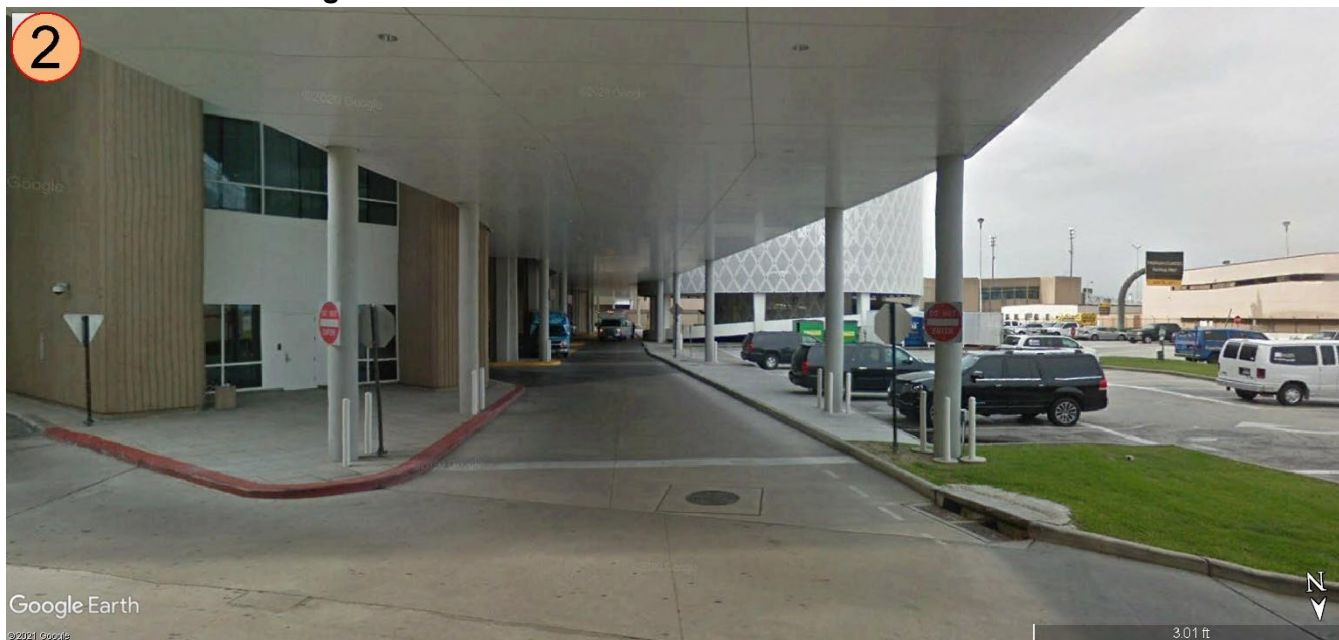


Figure 2.4

West Arrivals and Loading

The West arrivals includes 3 lanes of delivery loading, hotel shuttles and passenger vans.

West Parking – Existing Conditions



Figure 2.5

West Parking

The existing parking lot on the West side of Terminal A is currently utilized as a ½ Limo, ½ lot. The space adjacent to the helix has been set aside for Trash storage and pick-up.

South Arrivals – Existing Conditions



Figure 2.6

South Curbside

The south arrivals curbside is also used for shipping and receiving. Shipping and receiving activities are limited to off-peak hours so as not to worsen existing curbside deficiencies. The south arrivals curbside includes five lanes.

West Arrivals and Helix – Existing Conditions

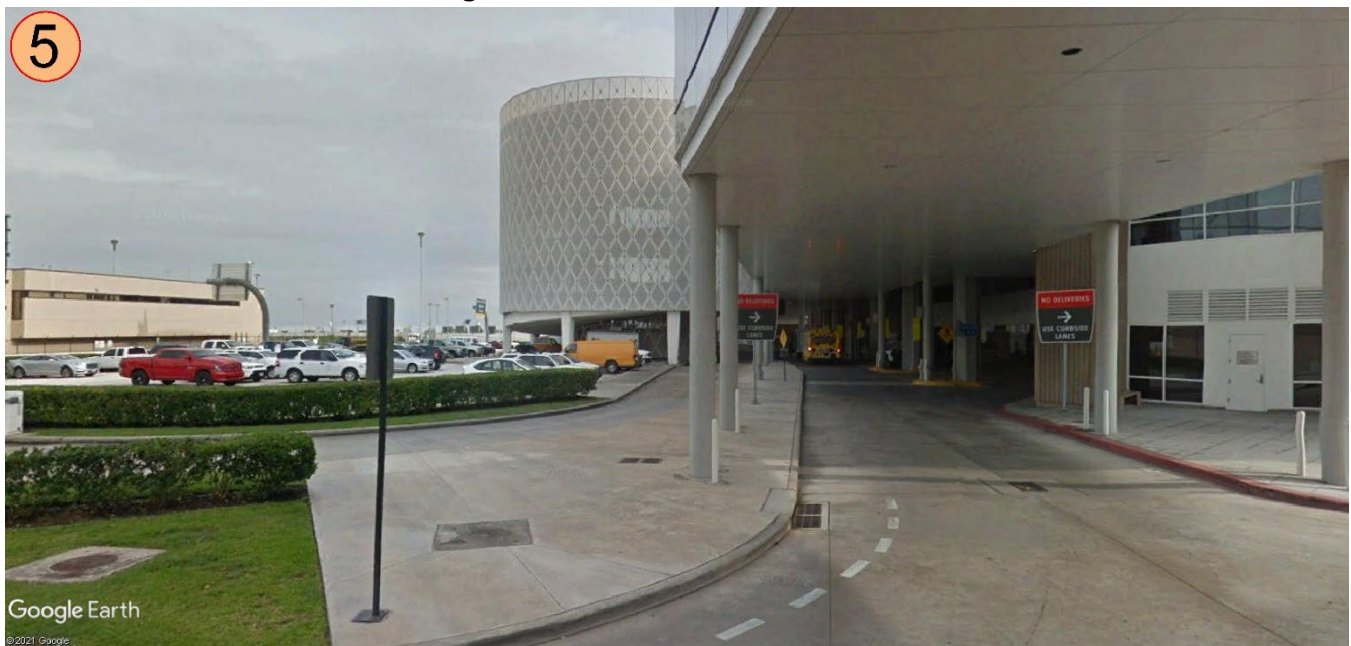


Figure 2.7

George Bush Intercontinental Airport Terminal A Curbside Improvements

West Helix

An existing natural gas generator and electrical distribution equipment is located on Level 1 of the West helix. The generator will be replaced with a new generator as the existing generators age exceeds the typical expected life. The replacement generator will include an outdoor enclosure and be located West of the Terminal with new underground conduits to new electrical distribution equipment located in a new electrical room in the Terminal. The self-enclosed will be supplied from an adjacent outdoor diesel tank with sufficient fuel storage to meet the airport run time requirements. The existing generator supports the airport operations center (AOC) and emergency operations center (EOC) and supporting systems. The original UPS system that was supported by the generator failed previously and the existing generator was not adequate to support the replacement UPS system required to support the AOC and the previous load additions in the Stratus equipment room. The Terminal A vault replacement project included provisions for connection of the Terminal A switchgear to a future generator to be installed East of the Terminal C Garage; however, this project precedes the installation of the future generator and replacement of the existing generator is required. The new generator will need to be sized to support the AOC, EOC and other critical loads designated by HAS. The existing Terminal A MDF room includes an automatic transfer switch for connection to a portable generator. Sizing the generator to support the MDF is recommended to support the AOC and EOC and should be reviewed by HAS.

South Electrical Yard – Existing Conditions



Figure 2.8

Electrical Equipment Yard:

New transformers and switches, serving Terminal A, were recently installed adjacent to the AB Garage between Terminal A and the AB Garage. The yard includes electrical utility equipment including two utility transformers and two utility switches. The yard also includes provisions for a future HAS owned transformer and switch to be connected to a future generator located with the HAS electrical distribution equipment adjacent to the Terminal C West Garage.

George Bush Intercontinental Airport Terminal A Curbside Improvements

The electrical utility transformers and switches include protective bollards as required by the utility to protect the equipment and a drive lane for service truck access. Existing underground conduits route from the utility transformers to the Terminal A main switchgear on the baggage level and from the utility switches to the utility manhole South of the South Terminal Road.

Existing underground conduits are also routed from the Terminal A main switchgear to the equipment yard and capped for future extension to the future HAS owned transformer for generator power to the Terminal A main switchgear to provide backup power to high priority loads in Terminal A. The Terminal A equipment yard designated locations for the future transformer and switch can be relocated within the area between Terminal A and the AB garage and coordinated with the curbside improvements and with the existing underground conduits.

The Terminal A equipment yard planning includes a privacy fence around the yard which will be removed or modified to coordinate with the new arrivals configuration.

The Terminal A equipment yard modifications included relocation of the area storm drains which will be modified and coordinated with the new curbside drives.

The area East of Terminal A includes a utility vault exhaust doghouse which will no longer be required and will be removed. The existing underground concrete air pathway for the exhaust and the existing utility vault air intakes at the perimeter of Terminal A will also be demolished. Existing air intakes for building systems will be modified as required to coordinate with the new configuration.

The area East of Terminal A includes a lift station which will remain and require access. The controls will be relocated where required to coordinate with the new layout and to a location and preferred by the owner for aesthetics.

The area East of Terminal A includes existing underground piping and manholes which will be modified where required to coordinate with the new area design.

East Helix:

The East helix sits directly above an enclosed connector, which serves as a passageway between the A/B Garage and the Terminal A building. Currently, passengers that park in the A/B garage ride the elevators to the ground level and walk across the enclosed space to the baggage claim area (located on the ground floor of Terminal A building). The passengers can then utilize the elevators/escalators to the ticketing station on the Second Floor of the Terminal A building.

IAH Terminal A – Existing Departures

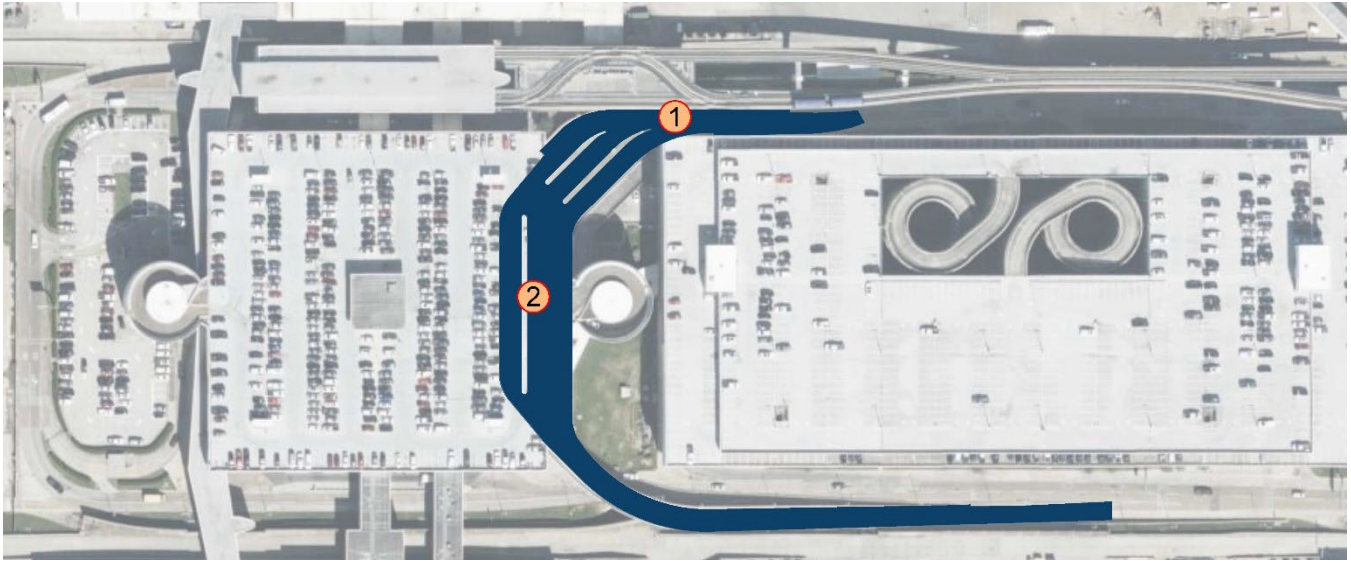


Figure 2.9

Existing Conditions / Lanes

East Departures – Existing Conditions



Figure 2.10

East Departures – Existing Conditions

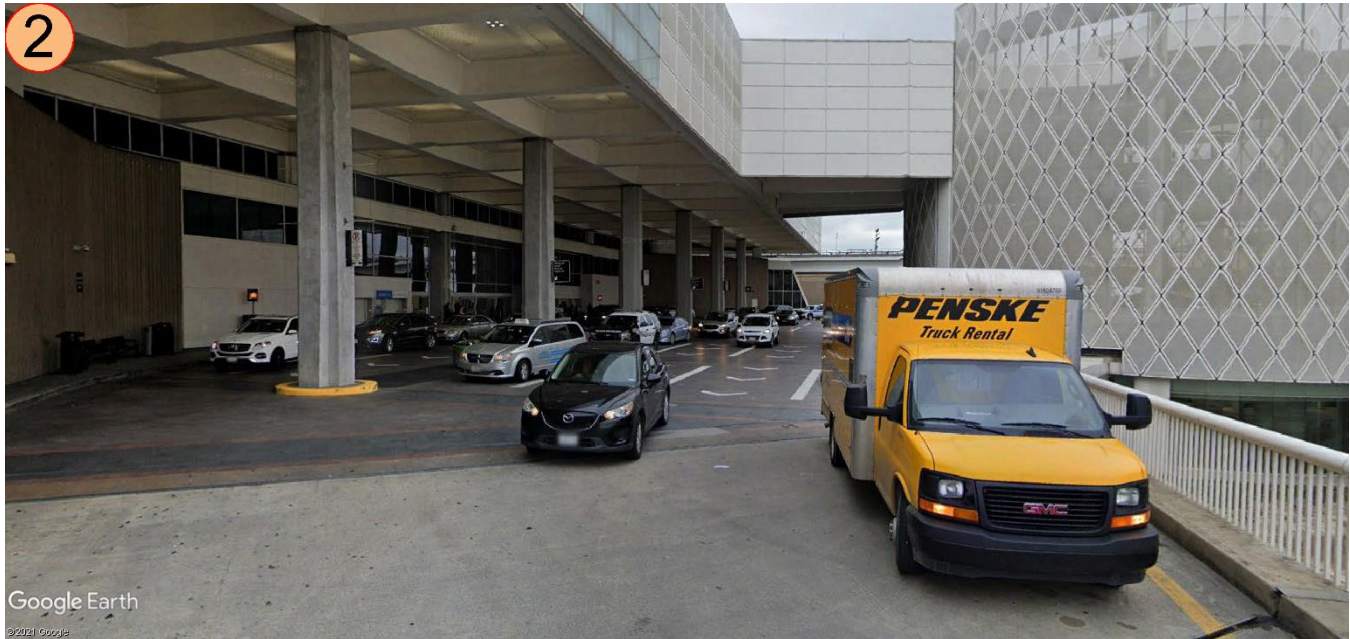


Figure 2.11

East Departures

The current curbside departure hosts 2 unloading lanes (1 inner and 1 outer) and 3 moving/by-pass lanes. There is also a partial lane at the furthest east position but the lane is interrupted by the helix connection and protective planters at the mid point of the lane.

3. AREA DEVELOPMENT PLANS

3.1 EXISTING AND PROPOSED CURBSIDE CAPACITY

The two tables below outline the forecasted demand for each transportation mode as well as provide the recommended transportation mode split and an alternative mode split for consideration.

Forecasted need and recommended transportation mode share:

	Existing Curbside (LF)	Proposed ADD 2021 (Jacobs) (LF)	Transportation Mode / LF Demand	Variance (LF)
North Arrivals	630	630	POV / 490 LF ⁴	140
South Arrivals	590	590	POV / 485 LF ⁴	105
East Arrivals	-	310	TNC / 250 LF	60
West Arrivals	380	980	Shuttle / 210 LF Taxi / 175 LF	595
East Departures	300	1130 ³	All modes / 1,605 LF ¹	-475
	1900	3,640	3,215	425

¹ 1235 LF required with double parking

² 1330 LF if existing inner curbside is preserved. Reference page 17 for proposed lane configuration for additional information.

³ POV is split between North and South Arrivals. Total requirement for POV is 975 LF.

Alternate Forecasted need and recommended transportation mode share: (Option to consolidate POVs)

	Existing Curbside (LF)	Proposed ADD 2021 (Jacobs) (LF)	Alternative Transportation Mode / LF Demand	Variance (LF)
North Arrivals	630	630	Shuttle / 210 LF	420
South Arrivals	590	590	TNC / 250 LF	340
East Arrivals	-	310	Taxi / 175 LF	135
West Arrivals	380	980	POV / 975 LF	5
East Departures	300	1130	All modes / 1605 LF ¹	-475
	1900	3,640	3,215	425

Passenger and vehicle demand are based on estimates prepared by HAS. Mode split and curbside demand are based on assumed passenger transportation mode splits by vehicle segment (POV, Shuttle, Taxi, TNC, etc.) and may vary from the actual mode split by vehicle segment. Assumptions were calculated at both mid and high demand scenarios. The high demand scenario was used for these recommendations.

George Bush Intercontinental Airport Terminal A Curbside Improvements

Forecasted need and recommended transportation mode share:

Proposed Arrivals Mode Split

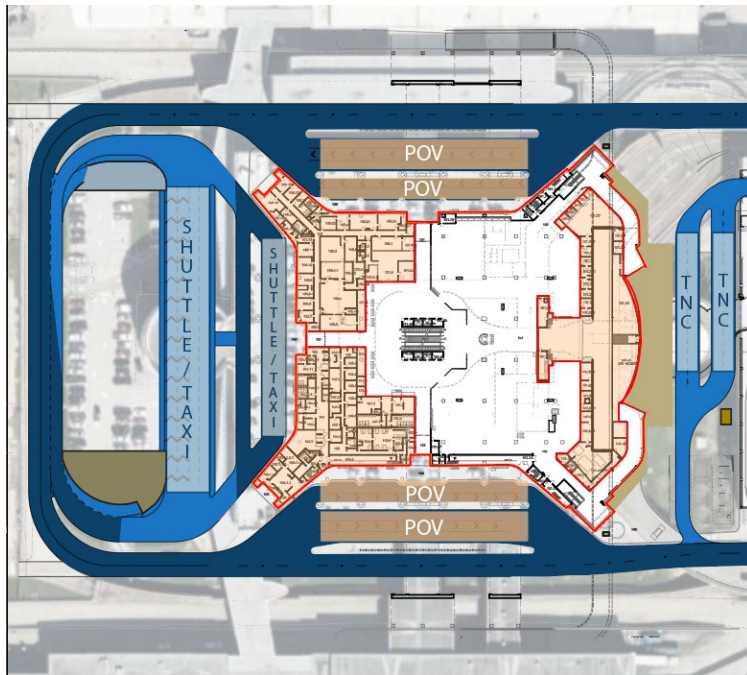


Figure 1.12

Proposed Departures Mode Split

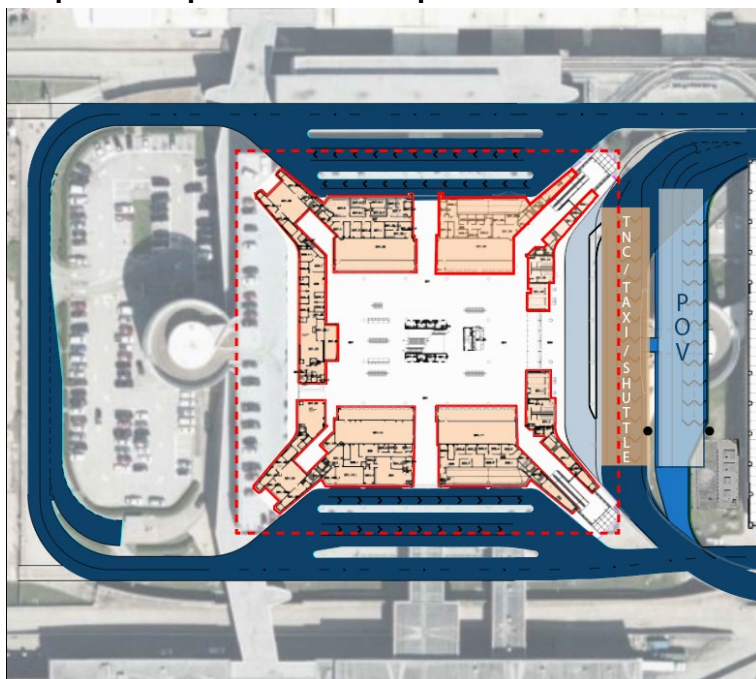


Figure 2.13

3.2 PROJECT RELATIONSHIPS TO ESTABLISHED AIRPORT PLANS / MASTER PLAN

Known Master Plan developments would not impact proposed curbside improvements depicted in this section

IAH Terminal A – Proposed Arrivals Improvements

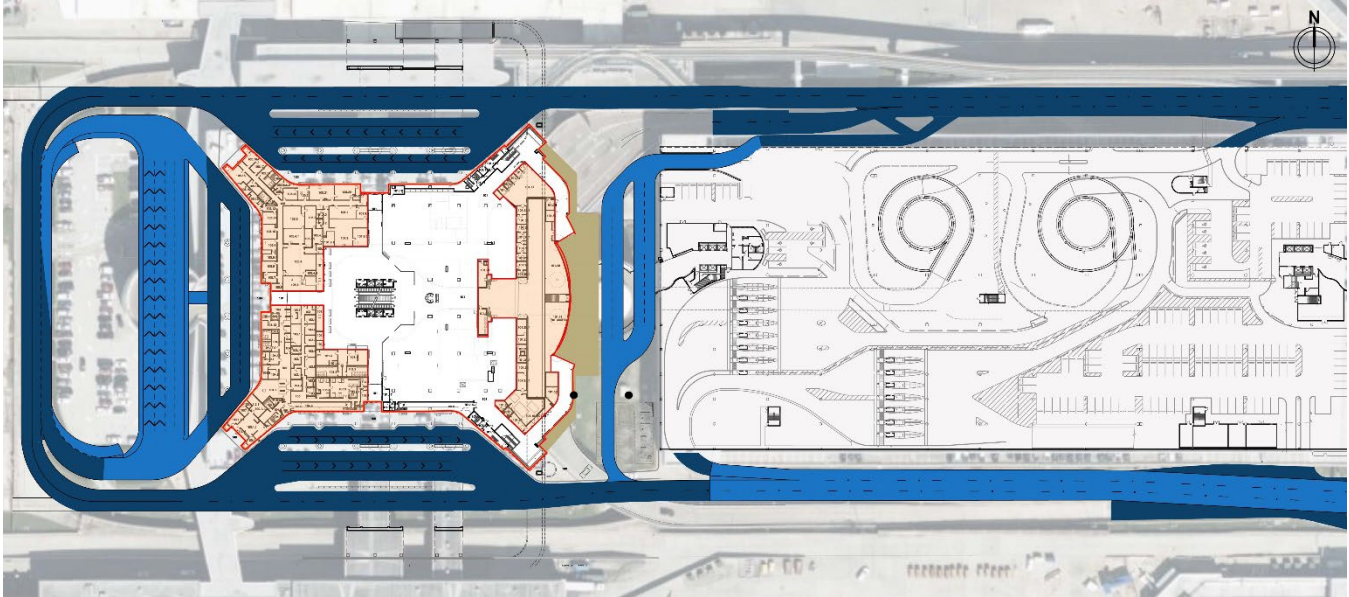
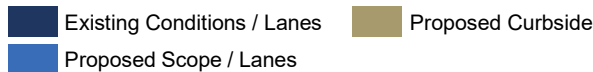


Figure 3.1



This improvement proposes to demolish the East and West helices leading to and from the Terminal A garage and utilizing the gained ground space to propose new curbside along the East side of the Terminal building, and additional curbside along the West side.

East Curbside

The removal of the East helix and the enclosed walkway that connects the A/B garage to the Terminal A building will allow for the construction of a new at-grade curbside at the arrivals level. We propose to add 2 loading lanes, and 2 through lanes of new curbside. We also propose to stripe a pedestrian cross walk between the Garage and the Terminal buildings.

This improvement will also require:

- Modifications to building face (Terminal A building & AB Garage)
- Sidewalk and passenger refuge area
- Reconfiguration of T/A Valet in the AB Garage.

This new curbside will offer additional options to allow for re-distribution of various modes of transportation within Terminal A arrivals. Current calculations for the revised curbside as proposed would provide an overall level of service “B” for arrivals. (based on recommended transportation mode splits shown on p. 11)

West Curbside

On the West side, we propose to add 4 additional lanes around the existing West helix, and the existing Limo parking lot. These 4 lanes will comprise of 2 loading lanes and 2 bypass lanes. The configuration of these added lanes will create a circular loop with the existing West terminal road, providing efficient circulation of traffic ideal for Ground Transport and TNCs. The existing middle through lane is also suitable for Ground Transportation. Alternatively, POVs can utilize the west curbside.

This improvement proposes to keep in place the 3 lanes of curbside that currently exists at West arrivals.

This improvement will also require:

- Relocation of the Generator currently housed at the base of the west helix (within west parking)
- Relocation of trash collection currently located at base of west helix (within west parking)

The construction of the additional curbside will impact the existing trash operations. To remedy this, we propose an exit and an entrance into the existing parking lot on the North and South loop roads for trash pick-up services.

IAH Terminal A –Proposed South Terminal Rd. Restripe

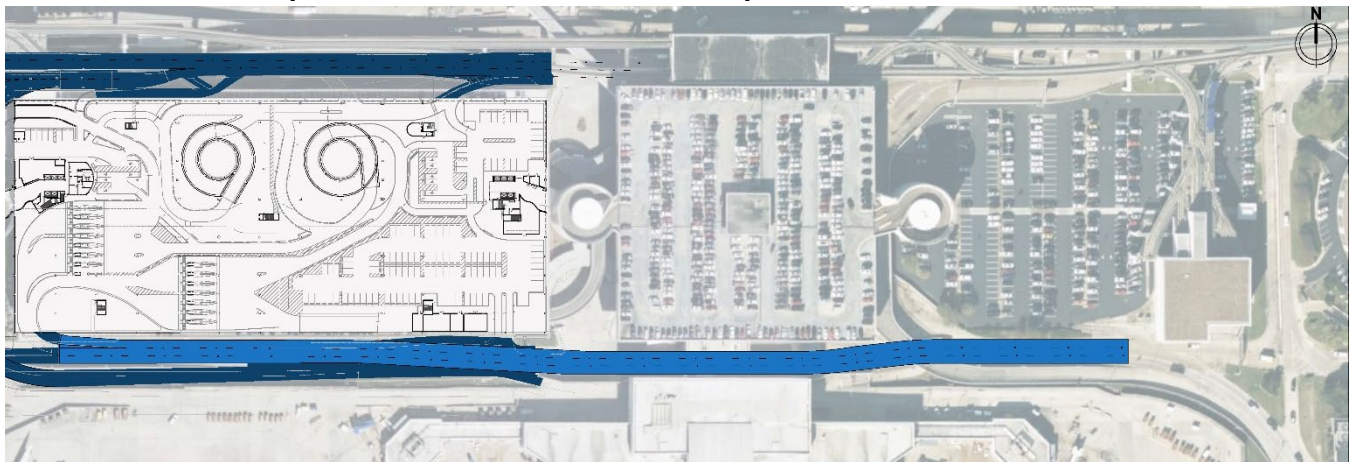


Figure 3.2

- Existing Conditions / Lanes
- Proposed Scope / Lanes

This improvement proposes to widen and/or re-stripe the existing South Terminal Road to accommodate 3 continuous lanes of traffic from the A/B garage exit, to the Airport Exit split just West of the Marriot Hotel.

The existing roadway does have 3 lanes of traffic in certain spots, but for the most part, the third lane has been striped off for an additional shoulder or refuge. The current footprint appears wide enough to carry 3 lanes of traffic. Ongoing survey activity will determine if the roadway needs to be widened in any locations.

IAH Terminal A – Proposed Departures Improvements

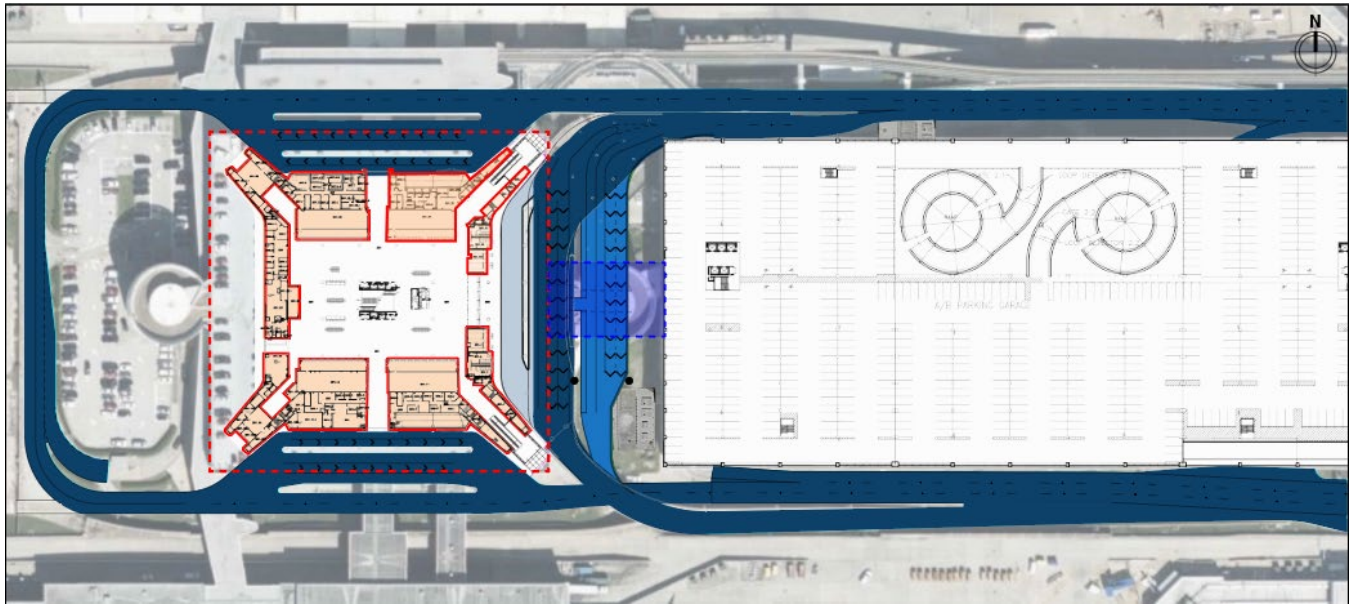


Figure 3.3



Demolishing the East helix will provide additional room for this improvement, which proposes to construct a new bridge structure at the departures level to create additional capacity for departures curbside operations.

As part of this improvement, we propose to:

- Retire the inner unloading bay, and convert that area to passenger holding and additional curb side bag check
- Re-stripe the existing outer lanes, to accommodate 2 unloading lanes, and 2 by-pass lane.
- Configure the new curbside structure to accommodate 4 additional lanes (2 inner unloading lanes, and 2 outside by-pass lanes)

Retiring the inner-most curbside will improve the traffic circulation by limiting the number of lane options as the vehicles approach the departures to two (2) instead of three (3). However, the option to retain the existing inner curbside is available with advance signing, and clear lane designations.

Despite retiring the inner most curbside, these improvements will approximately double the existing curbside capacity at the departures level.

Current calculations for the expanded departures curbside, as proposed, would provide an overall level of service “C” for Departures. (based on recommended transportation mode splits shown on p. 11)

IAH Terminal A – Proposed A/B Garage to A Garage Bridge Connection

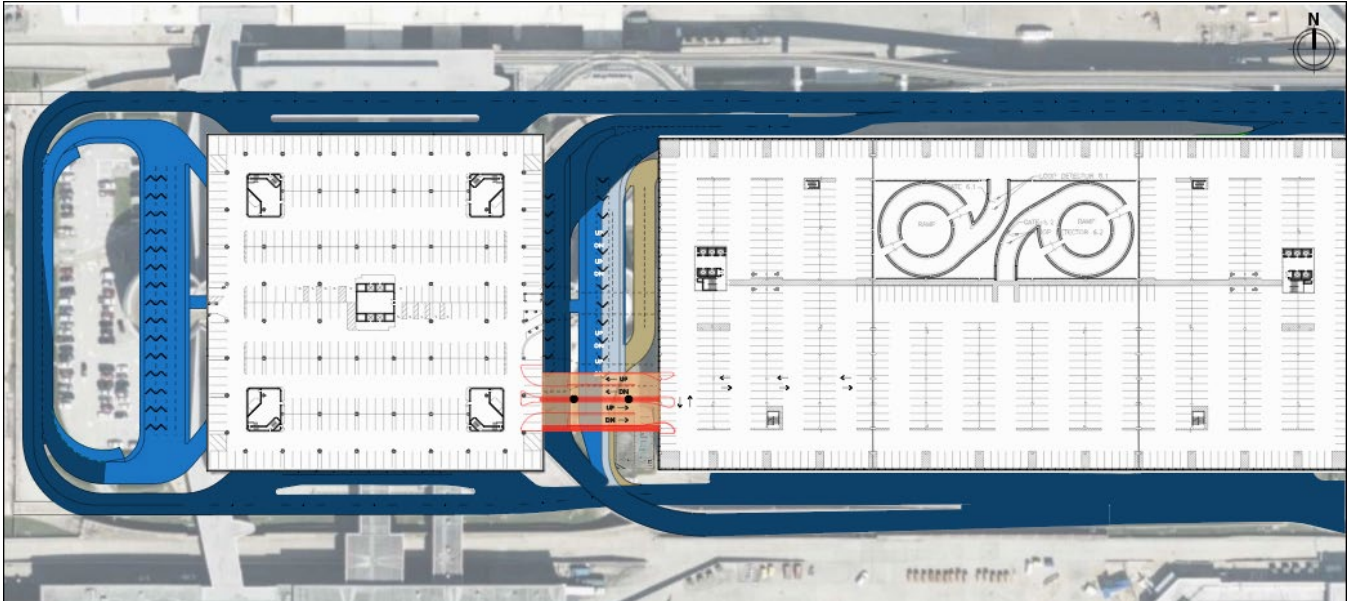


Figure 3.4



The removal of the East and West helices will cut-off access to the garage floors above the Terminal A building. This improvement proposes to construct a new ramp structure to facilitate circulation between Terminal A and Terminal A/B garages. Since the helices provided vertical access between the Terminal A garage floors, the new ramp structure will be designed to provide access to both parking floors over Terminal A building. A single bridge structure provides some flexibility for placement, allowing for the construction of the connecting bridge before the removal of the east helix. This allows for the helix to remain operational during the construction of the T/A – AB connecting bridge. This option also proposes fewer column locations and therefore fewer conflicts at ground level. Furthermore, the proposed garage bridge connection, illustrated in Figure 3.4, would result in a loss of only 7 parking spaces.

East Departures and Arrivals – Section View

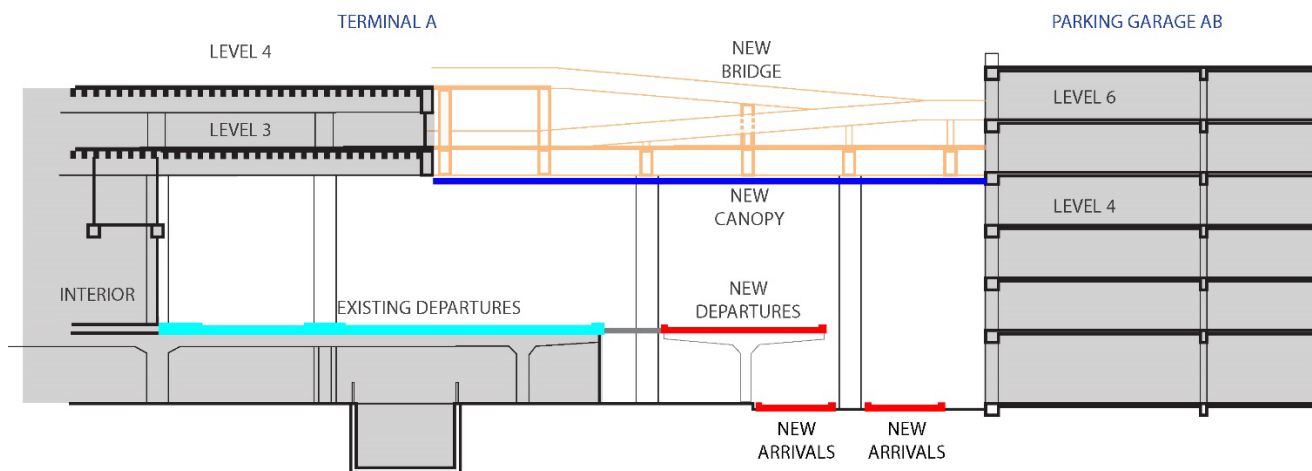


Figure 3.5

The proposed bridge structures will be wide enough to provide 4 lanes of traffic (2 to-and-from each garage level over the Terminal A building) as well as 2 sidewalk paths (also to each of the garage levels).

Terminal A to AB Garage Bridge - Typical Section

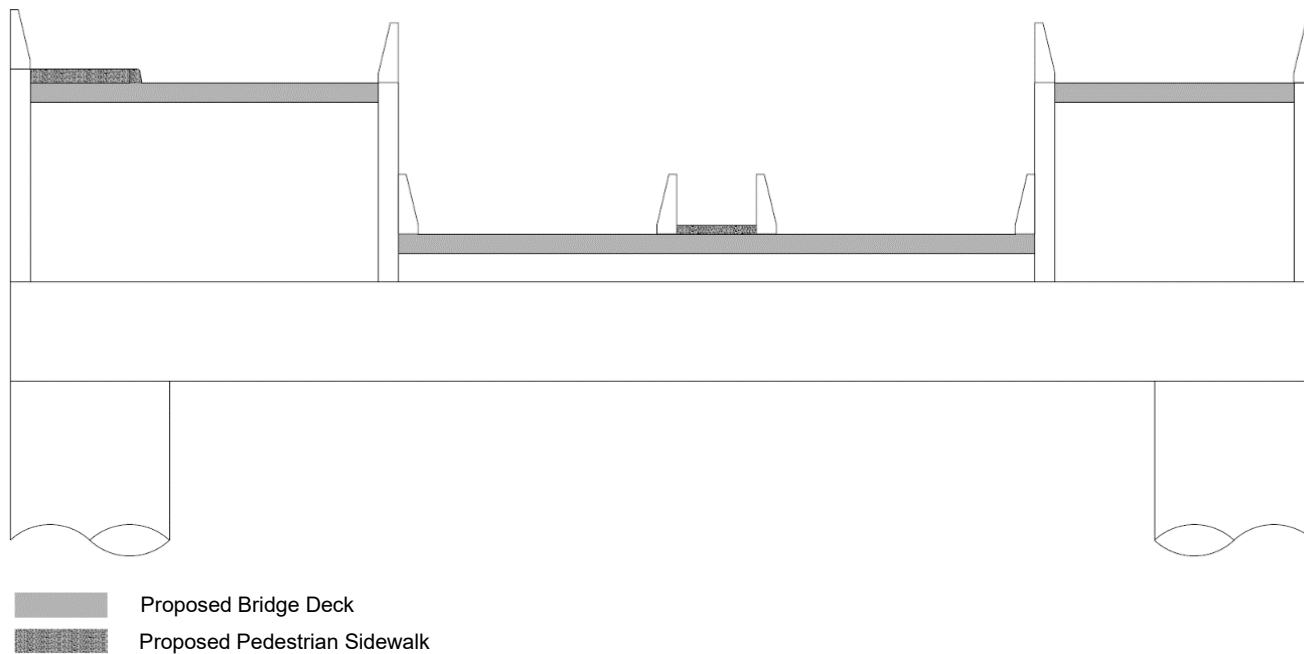


Figure 3.6

The existing Terminal A garage is reserved for employee parking only. However, it is anticipated that the Level 3 parking of the Terminal A building will convert to additional passenger parking. Level 4 would remain as airport/airline parking.

3.3 ENVIRONMENTAL CONDITIONS

An environmental impact report has not been completed by Jacobs. It is recommended that an impact report is to be completed by others prior to any demolition scope.

3.4 PROJECT ALTERNATIVES / CONSTRUCTION PACKAGING

See section 4.0 of this report.

3.4 TRAFFIC CONTROL

Traffic control will be required during construction to maintain operations and ensure existing strained curbside and roadway conditions are impacted to the least extent possible.

3.5 PUBLIC SAFETY

It is anticipated that public safety will not be impacted by any of the alternatives. Should a phased construction approach be considered there would be a reduced impacted impact on operations.

3.6 UTILITY COORDINATION

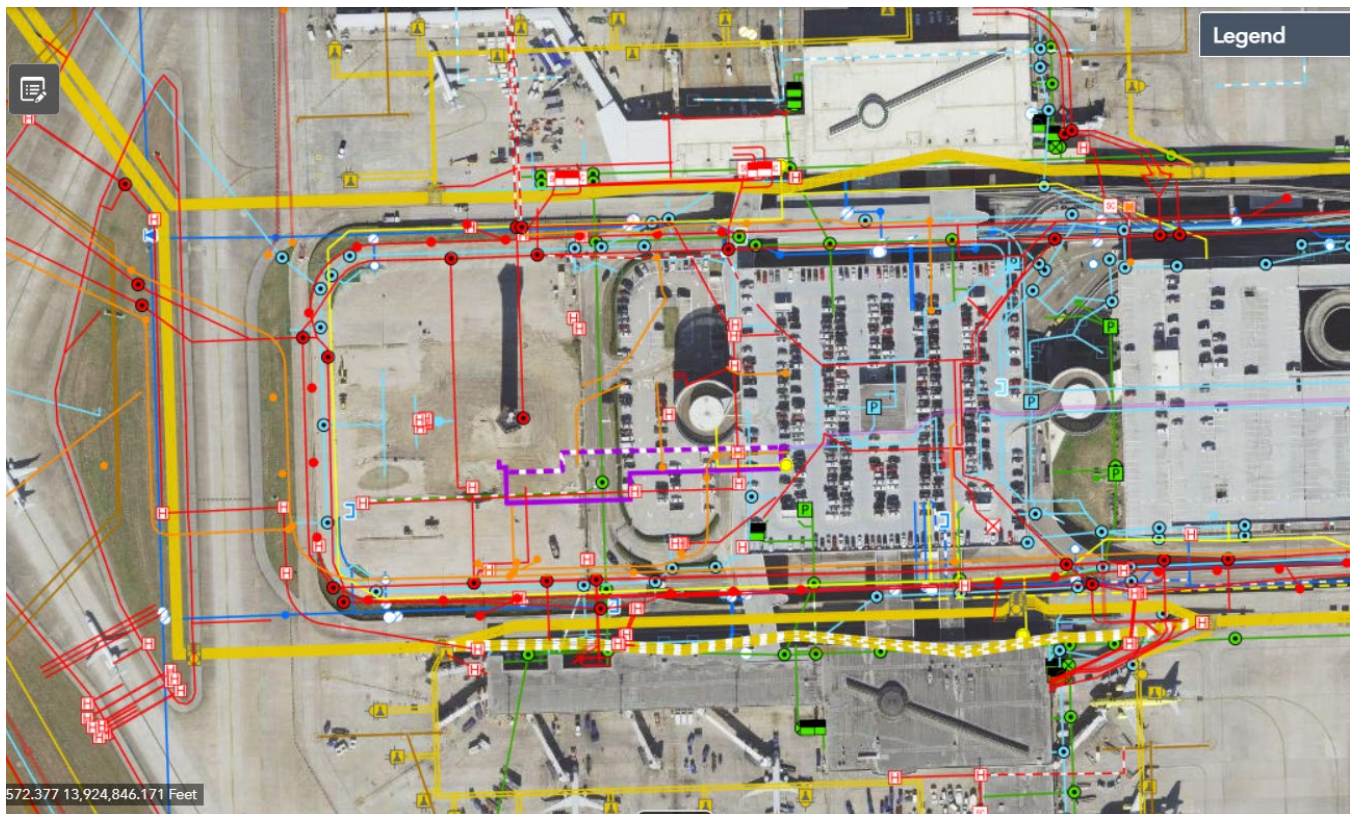
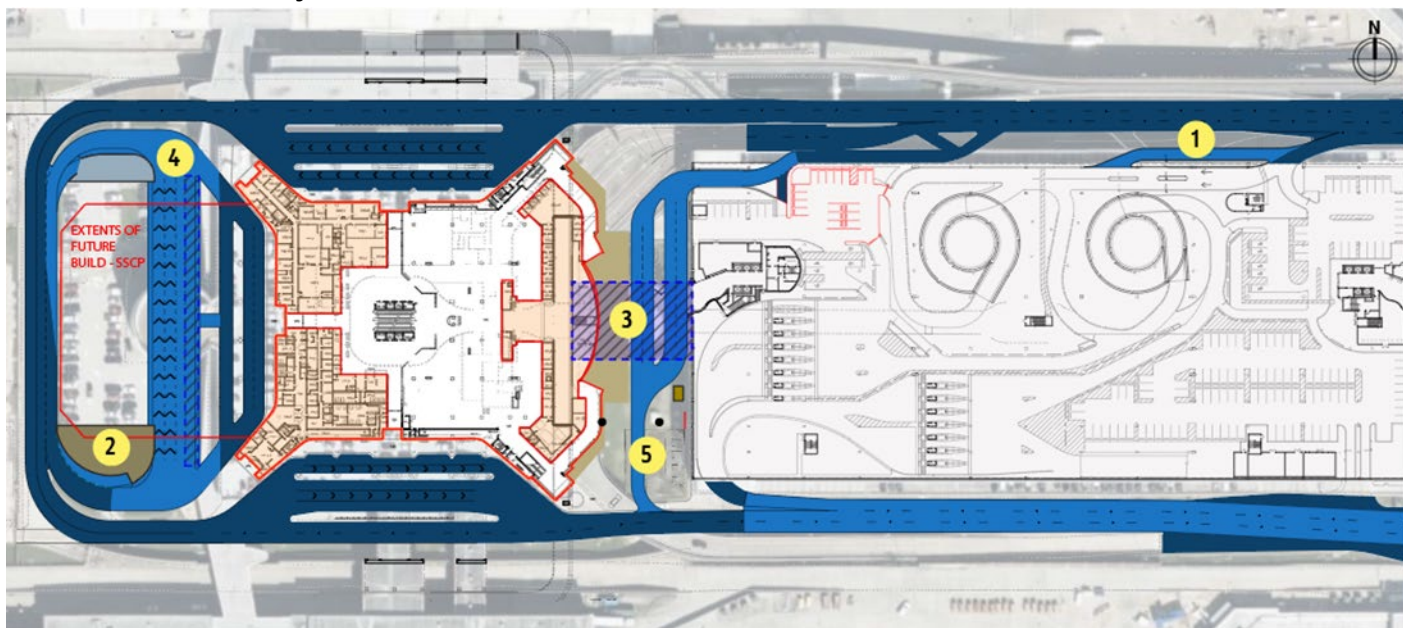


Figure 2.7

4. PROJECT ALTERNATIVES

4.1 PROJECT ALTERNATIVES

IAH Terminal A – Project Alternatives



Existing Conditions / Lanes	Canopy Above	Trash Collection & Generator Pad	Crosswalk
Proposed Scope / Lanes	Proposed Curbside	Future Delivery Loading / Unloading	Columns

ALTERNATIVE 1 - Additional Entry lanes into Terminal A/B Garage

ALTERNATIVE 2 - Relocated Delivery / Receiving Area

ALTERNATIVE 3 – Covered Canopy between Terminal A and A/B Garage

ALTERNATIVE 4 – Covered Canopy at Expanded West Curbside

ALTERNATIVE 5 – Build 2 Garage Bridges

Other Considerations

- Expanded Automated Parking Guidance System (for the area above T/A)
- Updated Cell Phone Lots (improve remote queuing offering)
- Temporary Terminal A – Make-up Parking (if helix removed before bridge installation)

ALTERNATIVE 1 - Additional Entry lanes into Terminal A/B Garage

This Alternative proposes to add 1 additional lane of entry into the A/B garage. The new lane will be constructed outside the Garage building, parallel with the North Terminal Road, and will require a new entry point along the Garage wall. This alternative also includes the construction of an additional ticket dispenser and a covered canopy.

ALTERNATIVE 2 - Relocated Delivery / Receiving Area

In the existing condition, delivery and receiving is located at the South arrivals curbside along with Hotel Pick-up, Taxis, Ride App, Rental Car Shuttles, and Charter Buses. This alternative proposes to relocate this operation to the new Ground Transportation Center on the West side of Terminal A Building.

The delivery vehicles can utilize the same entrance and exit points along the Western loop, as the trash services, to enter the existing parking lot. Providing a safer, and shorter route for loading/unloading activities.

ALTERNATIVE 3 – Covered Canopy between Terminal A and A/B Garage

This Alternative proposes to construct a canopy over the Departure bridge on the East side of Terminal A Building. This will provide a level of service the passengers are accustomed to, after the loss of the existing covered passageway that connected the Terminal A building to the A/B garage.

The canopy that will be constructed on the 3rd level will serve to protect the departing as well as the arriving passengers, from inclement weather, as they walk across the outer loading/unloading lanes to and from the ticketing and Baggage claim locations.

ALTERNATIVE 4 – Covered Canopy at Expanded West Curbside

This Alternative proposes to construct a canopy over the additional curbside lanes along the Western curbside arrivals. The Terminal A north/south connector already provides some coverage at the outermost curbside, but additional coverage is required to protect waiting passengers.

ALTERNATIVE 5 – Garage Bridge Concepts

Although not an alternative, we've studied additional configurations and layouts of the garage bridge structure connecting the Terminal A building to the AB garage to offer as alternatives.

Garage Bridge Connection Option A - One-Way Bridge Structures

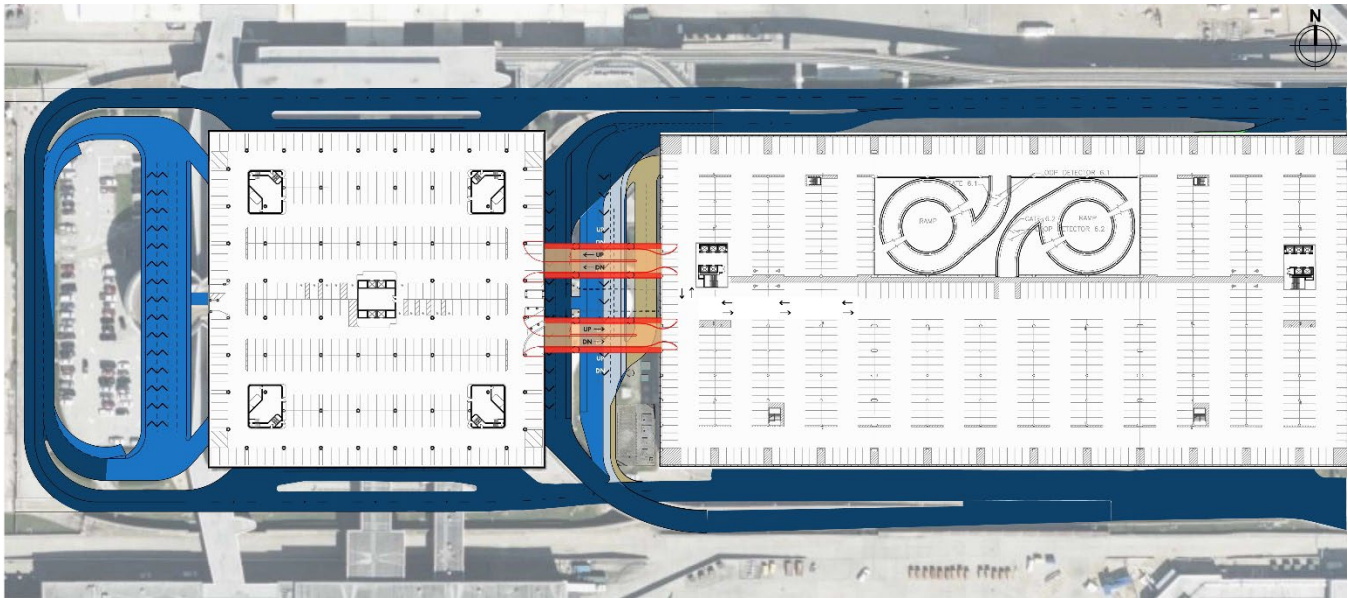


Figure 4.2

Existing Conditions / Lanes	Arrival & Departure	Terminal A Interior
Proposed Scope / Lanes	Proposed Arrival	Columns

This option proposes two (2) one-way structures. One leading traffic from Level 6 of the AB garage to Levels 3 & 4 of the Terminal A garage (Northern structure), and the other bringing traffic from Levels 3 & 4 of the Terminal A garage to Level 6 of the AB garage (Southern structure).

This configuration offers the following benefits:

- Provides a circulatory movement within the parking levels
- Ramp directly adjacent to the AB garage elevator bank is leading away from pedestrian traffic (not towards)
- Narrower structures offer flexibility for single column design. This helps in reducing conflicts and constraints at the ground level.
- Preserves 14-20 parking spaces compared to base scope (loss of 12-18 parking spaces total)

Conversely, this scenario requires the demolition of the helices prior to the construction of the new bridges.

Garage Bridge Connection Option B - Two-Way Bridge Structures

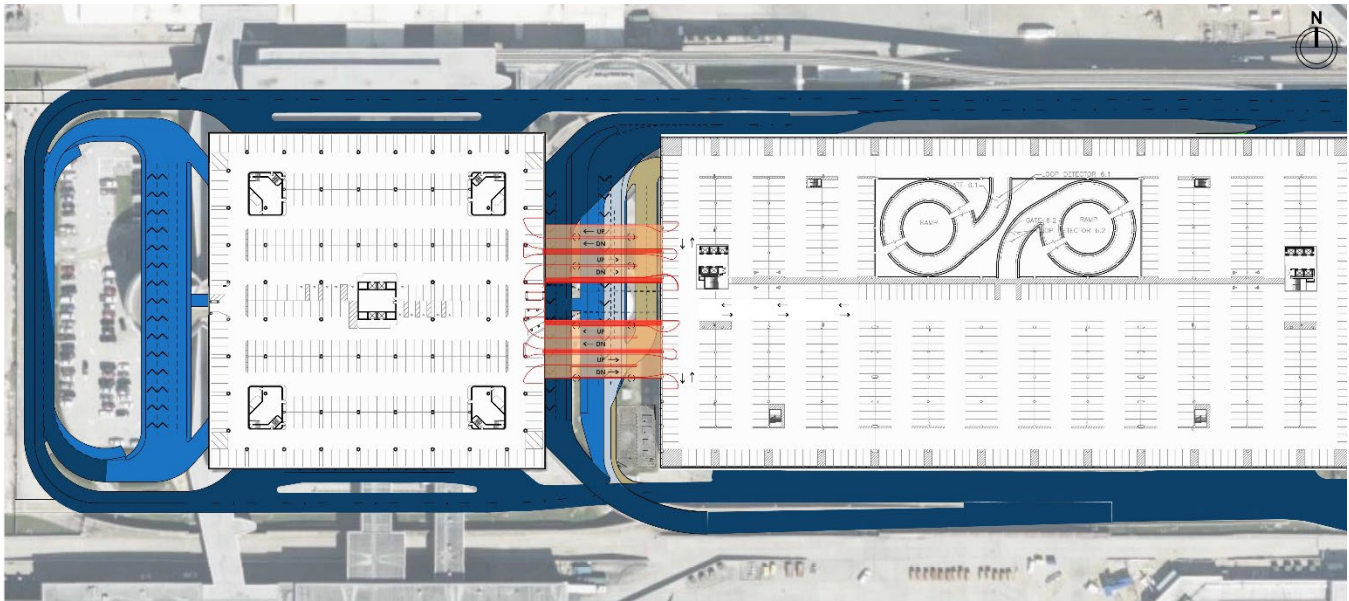


Figure 4.3

Existing Conditions / Lanes	Arrival & Departure	Terminal A Interior
Proposed Scope / Lanes	Proposed Arrival	Columns

The removal of the East and West helices will cut-off access to the garage floors above the Terminal A building. This improvement proposes to construct two new ramp structures to facilitate circulation between Terminal A and Terminal A/B garages. Since the helices provided vertical access between the Terminal A garage floors, the new ramp structures will be designed to provide access to both parking floors over Terminal A building. Furthermore, the proposed garage bridge connection, illustrated in Figure 4.3, would result in a loss of 28-32 parking spaces.

Conversely, this scenario also requires the demolition of the helices prior to the construction of the new bridges.

OTHER CONSIDERATIONS

Automated Parking Guidance System (APGS)

The parking garages above the Terminal A building are currently dedicated for employee parking only, and therefore are not equipped with APGS. We recommend retrofitting the garages with APGS and conveying the count for the available parking spaces as an overflow for Level 6 of the Terminal A/B garage. This will alert parking garage users of the additional parking spaces available off Level 6 of the garage.

Updated Cell Phone Lots

Along with providing additional curbside capacity and strict enforcement at the curbsides to help keep the traffic flowing, we recommend infrastructure upgrades and awareness initiatives for the existing cell phone lots. Either the general population is unaware of their existence, or do not understand its purpose.

Lack of lighting, security and restrooms could be some of the few reasons why cell phone lot usage might have suffered. Additional services to consider includes free Wi-Fi, electric car charging stations, vending machines, and digital signage with relevant flight information.

Temporary Terminal A – Make-up Parking

During the course of construction, the Terminal A garage may be inaccessible for a significant period of time, depending on the selected bridge connection option and position. Currently up to 800 parking spaces are available in the Terminal A garage for employee and airline parking. A temporary parking solution needs to be identified prior to the Terminal A garage going off-line if the bridge cannot be constructed prior to the removal of the East helix.

5. RECOMMENDATION

As identified in previous studies and verified in this document, existing curbside capacities are insufficient for current Terminal A demand and require improvement. Under current conditions, the level of service is an F at the Departures and North arrivals during peak hour demands. Ongoing growth at Terminal A, in passengers and/or gates, will only worsen the current condition. Therefore, curbside capacity improvements are necessary to improve existing conditions and support continued growth at IAH.

At a minimum, and as outlined previously, this report recommends the following improvements be made:

- Demolishing the East and West helices at the Terminal A parking garage, including relocation of generator and trash collection from base of west helix to adjacent parking area.
- Constructing a new Bridge connector between the A-B Garage, and the Terminal A garage
- Constructing a new Structure for departures at the East curbside to accommodate 2 additional unloading lanes
- Constructing a New at-grade arrivals curbside on the East side (includes reconfigure T/A Valet)
- Constructing a new at-grade Transportation Center at the West side of Terminal A
- Widening/Restriping the South Terminal Road to accommodate 3 lanes of traffic

In addition, the following recommended improvements should be considered to provide further curbside relief and improve the overall passenger experience:

- Provide 2 additional entry lanes to the A/B garage
- Relocate/dedicate receiving/delivery within the west parking area
- Increase number of lanes added to West Curbside, including shade/weather canopy
- Construct a grand shade/weather canopy connecting Terminal A to the A/B Garage
- Reconsider transportation mode assignments
- Construct a second T/A to A/B Garage bridge connector.

With the recommended minimum and additional improvements noted, Terminal A curbside will be improved to provide greater level of service to existing demand and support ongoing growth, while providing flexibility for future shifts in traveler transportation mode preferences.

6. DESIGN STANDARDS OR GUIDELINES

The following applicable standards must be considered in designing the Terminal A Curbside Improvements:

Texas Architectural Barriers Act, Article 9102, Texas Civil Statutes

George Bush Intercontinental Airport, Houston Surveyors Handbook, June 2007

FAA 150/5300-13 Airport Design

FAA-150/5360-13 Planning and Design Guidelines for Airport Terminal Facilities

- American Association of State Highway and Transportation Officials (AASHTO)
- American Institute of Steel Construction (AISC)
- American Iron and Steel Institute (AISI)
- American Concrete Institute (ACI)
- American Welding Society (AWS)
- ANSI C80.1 Electric Rigid Steel Conduit
- ANSI A14.2 Portable Ladder and Scaffolding
- ANSI A14.7 Mobile Ladder Stands and Mobile Ladder Stand Platforms
- ANSI A17.1 Safety Code for Elevators and Escalators
- ANSI C2-2012 National Electrical Safety Code
- ANSI Z136.1 .2 Safe Use of Lasers and Safe Use of Optical Fiber Communication Systems
- ANSI Z359.1 Fall Protection Code
- ANSI X3T9.5 Requirements for UTP at 100MPS
- ANSI A10.42 Safety Requirements for Rigging

Qualifications and Responsibilities

- ANSI-TIA/EIA 569 TIA Wiring Standards
- ANSI-TIA/EIA 942 Telecommunication

Infrastructure Standard for Data Centers

- ANSI-TIA/EIA 942 Telecomm Wiring - Distribution and Performance Package (Includes BICSI TDM, TIA-526-7, TIA-526-14, TIA-568.0-TIA-568.4, TIA-569, TIA-570, TIA-598, TIA-606, TIA-607, AND TIA-758)
- ANSI-TIA/EIA 862 Structured Cabling Infrastructure Standard for Intelligent Building Systems
- ANSI-TIA/EIA 758 Customer-Owned Outside Plant Telecommunications Infrastructure Standard
- ANSI-TIA/EIA 607 Generic Telecommunications Bonding and Grounding (Earthing) for Customer Premises
- ANSI-TIA/EIA 606 Administration Standard for Telecommunications Infrastructure
- ANSI-TIA/EIA 250 Electrical Performance for Television Transmission Systems
- ANSI-TIA/EIA 526-14 Optical Power Loss Measurement of Installed Multimode Fiber Cable Plant
- ANSI-TIA/EIA 526-7 Measurement of Optical Power Loss of Installed Single-Mode Fiber Cable Plant
- American Society of Mechanical Engineers (ASME) Standards
- ASME A17.1 Safety Code for Elevators and Escalators
- ASTM B663 Specification for Electrodeposited Coatings of Zinc on Iron and Steel

**George Bush Intercontinental Airport
Terminal A Curbside Improvements**

- ASTM A653 Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
- ASTM A123 Specification for Zinc (Hot-Dip Galvanized) Coating on Iron and Steel Products
- ASTM A1011 Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy
- ASTM A1008 Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength
- Low-Alloy, High-Strength
- Low-Alloy with Improved Formability
- ASTM B 3 Standard Specification for Soft or Annealed Copper Wire
- ASTM B 8 Specification for Concentric-Lay-Stranded Copper Conductors
- ASTM B 33 Specification for Tin-Coated Soft or Annealed Copper Wire for Electrical Purposes
- ADA / TAS
- BICSI 5 Outside Plant Design Reference Manual
- BICSI 607 Commercial Building Grounding (Earthing) and Bonding Requirements for Telecommunications
- BICSI 006-2015 Distributed Antenna System (DAS) Design and Implementation Best Practices
- BICSI 568B TIA / EIA 568B - Commercial Building Telecommunications Wiring Standards
- BICSI 569A TIA / EIA 568A - Communications Building Standards for Telecommunications Pathways and Spaces
- BICSI 13 Telecommunications Distribution Methods Manual, latest edition
- BICSI 005-2016 Electronic Safety and Security (ESS) System Design and Implementation Best Practices
- 2012 International Association of Plumbing and Mechanical Officials (IAPMO) with Houston Amendments.
- COH Building Code, Chapter 42 of the Houston Code of Ordinances,
- COH Infrastructure Design Manual, COH Standards Specifications,
- COH code of ordinances, chapter 47 - water and sewers, article XI
- COH Code of Ordinances
- FAA AC 150/5050-8 - Environmental Management Systems For Airport Sponsors
- HAS design standards (consult HAS design manual),
- HAS Telecommunication Standards
- IEEE 1100 Recommended Practice for Powering and Grounding Electronic Equipment
- IEEE 142 Recommended Practice for Grounding of Industrial and Commercial Power Systems
- IEEE 802.3 Standard for Ethernet
- IEEE 802.1 AS Standard for Local and Metropolitan Area Networks - Timing and Synchronization for Time-Sensitive Applications
- IEEE 802.1 AQAT Standard for Local and Metropolitan Area Networks
- IEEE 802.1 QAV Standard for Local and Metropolitan Area Networks-- Virtual Bridged Local Area Networks Amendment
- IEEE C 2 National Electrical Safety Code

George Bush Intercontinental Airport Terminal A Curbside Improvements

- IEEE 383 Standard for Qualifying Electric Cables and Splices for Nuclear Facilities
- ISEA Z358.1) Emergency Eyewash and Shower Equipment
- FAA Advisory Circulars
- NEMA RN-1 Externally Coated Galvanized Rigid Steel Conduit
- NEMA TC2 Polyvinyl Chloride (PVC) Conduit of Types EPC-40
- NEMA TC3 PVC Fittings
- NEMA 250 Electrical Equipment
- NEMA VE-1-2009 Metal Cable Tray Systems
- NEMA VE-2-2013 Cable Tray Installation Guidelines
- NFPA 101-2012, Life Safety Code
- NFPA 30A-2012, Code for Motor Fuel Dispensing Facilities and Repair Garages
- NFPA 88B Standard for Repair Garage
- OSHA, HCFCD and FEMA (later two for drainage and discharge requirements).
- Systemax Structured Cabling Systems performance specifications latest issue and components guide.
- TCEQ REGULATORY GUIDANCE Small Business and Environmental Assistance Division RG- 434 June 2007
- Texas Manual for Uniform Traffic Control Devices (TMUTCD 2011)
- TxDOT Roadway Design Manual
- TxDOT Bridge Design Manual - LRFD
- TxDOT Hydraulic Design Manual
- UL 6 Electrical Rigid Metal Conduit
- UL 514B Conduit, Tubing, and Cable Fittings
- UL 651 Standard for Schedule 40, 80, Conduit
- UL 1651 Standard for Optical Fiber Cable
- UL 2269 Optical Fiber/Communications/Signaling/Coaxial Cable Outlet Boxes
- UL 467 Grounding and Bonding Equipment
- UL 96 Standard for Lightning Protection
- UL 96A Standard for Lightning Protection installation
- 2012 International Building Code (IBC) with local City of Houston Amendments
- 2012 Uniform Mechanical Code (UMC) with local City of Houston Amendments
- 2020 National Electrical Code (NEC) with local City of Houston Amendments
- 2015 International Energy Conservation Code (IECC) with local City of Houston Amendments
- 2012 Uniform Plumbing Code (UPC) with local City of Houston Amendments
- 2012 International Fire Code (IFC) with local City of Houston Amendments
- 2012 Texas Accessibility Standards

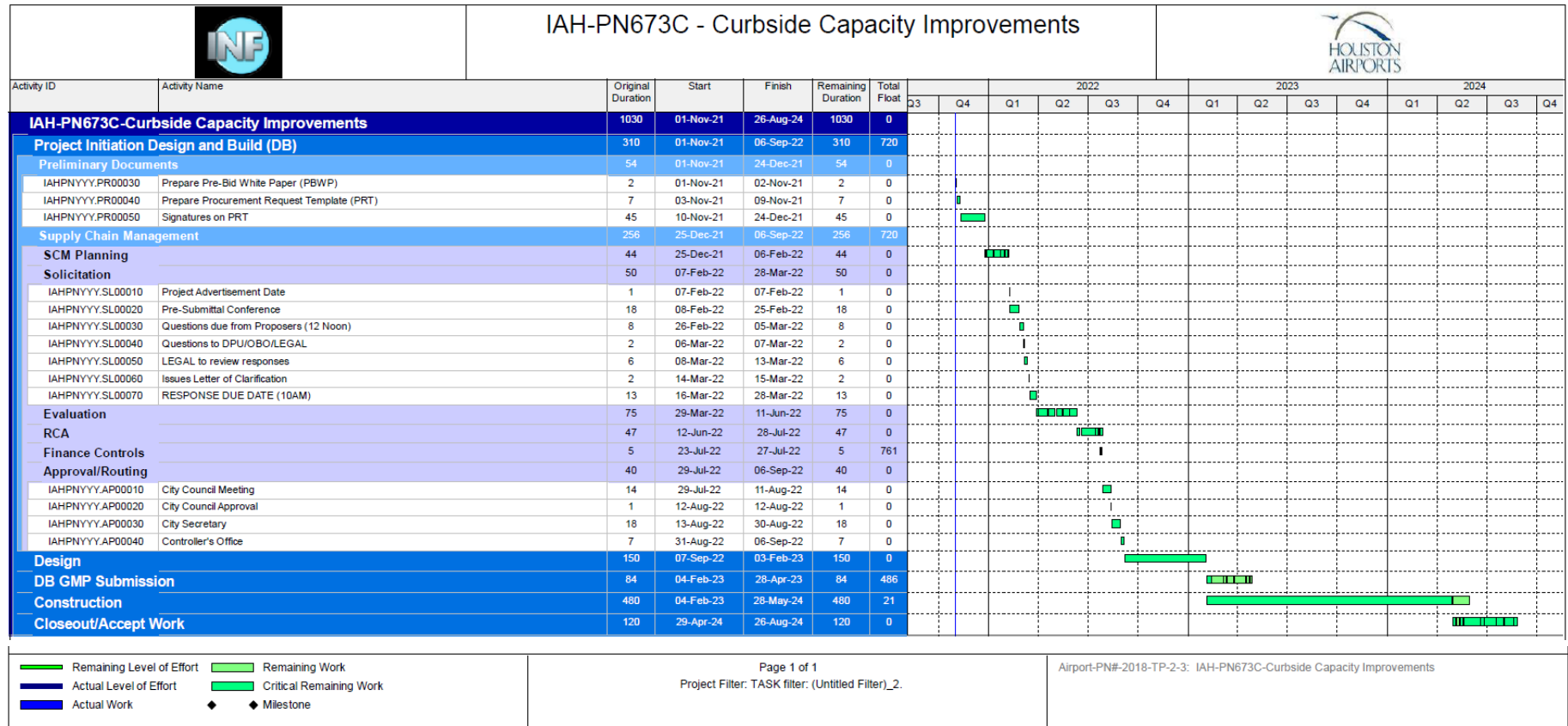
In addition to the above standards, the designer should consider the following:

1. Validate/Optimize functional areas and equipment requirements
2. Perform utilities (water, sewer and storm) availability analysis utilities to confirm the adequacy of these utilities. Perform survey to verify the exact location of the existing systems with points of connection; confirm the adequacy of the utilities

**George Bush Intercontinental Airport
Terminal A Curbside Improvements**

3. Prepare a Utility Development Plan/Utility Repair Plan early in the design phase and should be included in the 50% submittal
4. Obtain all applicable permitting documentation

7. PRELIMINARY PROJECT SCHEDULE



9. PRELIMINARY PROJECT DELIVERY METHOD

Design – Bid – Build

10. COORDINATION WITH OTHER PROJECTS

The entrance systems currently do not have air locks. They will be replaced to increase energy efficiency. Vestibules will be built, which may have an impact on the layout of sidewalks.

Terminal A parking will be relocated during construction. Employee parking will be displaced during construction and potentially afterwards. Phasing of construction will need to be considered when determining parking

11. PRELIMINARY PROJECT FILE STRUCTURE

Project file structure shall align with HAS ITRiP standards.