

Peter Dahl
Construction Management Option
Pedestrian Walkback Tunnel,
Finishes Package
Washington Dulles International Airport
Primary Faculty Consultant: Riley
Due Date: Wednesday, October 8th, 2003



Technical Assignment #1

Existing Site Conditions

Executive Summary

The construction of any tunnel is unique, but when you put that tunnel underneath a fully operating airport what you get is a challenge. Fully operational terminals, airline gates, mobile lounge docks and taxiways surrounding the project make for a job site that requires the utmost in project safety, communication and planning. Only through the process of analyzing the basic requirements and then looking at the unknown variables can the project team carry out a successful project.

The Metropolitan Washington Airports Authority has chosen to take this project one step at a time, from the design, to the construction of the shell of the tunnel, to the finishing out of the tunnel, to the integration of the tunnel to the existing concourses. Further projects are on their way including the extension of the tunnel to Concourse A, and the installation of the underground automated people mover system. MWAA will certainly encounter some of the same processes used for that project, so it would be worth the additional effort now to consider the best methods for the job.

Current construction projects all over the airport are occurring with little or no interference with flights and other airport operations. Design and phasing of these projects is key in order to maintain a fully operational airport among millions of dollars in construction.

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Project Schedule Summary

Before the groundbreaking for the new Connector B building could begin, the existing Mobile Lounge Dock, which transported passengers from Concourse B to the other terminals, would need to be demolished as well as the existing concrete apron inside the future building's footprint.

At the same time, the tunnel will be prepped to meet OSHA standards. A proper ventilation system will be installed as well as other safety precautions for work in the confined space. Once the tunnel is ready for work, the 4' high curb walls will be poured. These curb walls will be the framework for the moving walkways as well as supporting the precast planks for the slab. MEP rough-in will commence shortly after the curb walls have started.

The earthwork process for the Connector B would consist of 6 main activities. First, due to the rock on site, a rock grinder needs to perform a production grind at a lift of 6 to 8 feet deep. The ground-up rock fragments are backfilled into the trenches created by the rock grinder. Once the entire zone is ground, the soil can be excavated from the hole and hauled to the airport's soil bank. Once a section of the earth wall approximately 6-8 feet in height is excavated, tie backs can begin to be installed. A layer of shotcrete will be sprayed before the tieback is stressed, after which another layer of shotcrete is applied. This completes the earthwork cycle.

The foundation process will consist of pouring the 6' thick mat slab. Seeking a challenge (and also for structural reasons), the entire slab area of 170' x 80' will be poured at once. The below grade walls will be 4' thick and poured in 2 lifts, dividing each lift into 15 separate pours.

In the tunnel, the topping slab will be poured after the precast planks are set. The walls will be framed up and roughed-in with MEP components. The suspended ceiling will be installed, as well as the lengthy process of installing the 6 moving walkways. Once the walkways are nearly complete, the finishes in the tunnel can go in to match the rest of the airport's public spaces.

The steel superstructure for Connector B will establish the frame for the 2 stories above grade. Once complete, the building enclosure and subsequently the building finishes will be installed.

The completion of the project is currently in late December, however the owner is currently looking into accelerating the project to have the tunnel in operation for the 2004 Thanksgiving holiday.


ID	Task Name	Duration	Start	Finish	Predecessors
1	Pedestrian Walkback Tunnel, Finishes Package	4431 days	Mon 1/4/88	Mon 12/27/04	
2	Design Conception	0 days	Mon 1/4/88	Mon 1/4/88	
3	Request for Proposals	0 days	Mon 7/8/02	Mon 7/8/02	
4	Procurement	50 days	Mon 7/8/02	Fri 9/13/02	3
5	Construction Notice To Proceed	0 days	Mon 10/21/02	Mon 10/21/02	4
6	Sitework	40 days	Mon 10/21/02	Fri 12/13/02	
7	Temporary utilities, services for airport	40 days	Mon 10/21/02	Fri 12/13/02	
8	Demolition	20 days	Mon 10/21/02	Fri 11/15/02	
9	Connector B	571 days	Mon 10/21/02	Mon 12/27/04	
10	Procurement, Permits & Planning	100 days	Mon 10/21/02	Fri 3/7/03	5
11	Install Seismic Monitoring Equipment	20 days	Mon 3/10/03	Fri 4/4/03	10
12	Excavation	120 days	Mon 4/7/03	Fri 9/19/03	8,11
13	Foundation & Matte Slab	40 days	Mon 9/22/03	Fri 11/14/03	12
14	FRP Concrete Slabs, Walls	60 days	Mon 11/17/03	Thu 2/5/04	13
15	Steel Superstructure	30 days	Fri 2/6/04	Thu 3/18/04	14
16	Enclosure	100 days	Fri 3/19/04	Thu 8/5/04	15
17	Finishes	100 days	Fri 8/6/04	Thu 12/23/04	16
18	Occupancy	0 days	Mon 12/27/04	Mon 12/27/04	17
19	Tunnel	531 days	Mon 12/16/02	Mon 12/27/04	
20	Prep Tunnel to Meet OSHA Standards	40 days	Mon 12/16/02	Fri 2/7/03	7
21	FRP 4' walls	120 days	Mon 2/10/03	Fri 7/25/03	20
22	Rough-In Mechanical	110 days	Mon 2/10/03	Fri 7/11/03	20
23	Rough-In Electrical	110 days	Mon 2/10/03	Fri 7/11/03	20
24	Place Precast	25 days	Mon 7/28/03	Fri 8/29/03	21
25	FRP Topping Slab	20 days	Mon 9/1/03	Fri 9/26/03	24
26	Frame Walls	60 days	Mon 9/29/03	Fri 12/19/03	25
27	MEP Behind Walls	60 days	Mon 12/22/03	Thu 3/11/04	22,23,26
28	Install Suspended Ceiling	60 days	Fri 3/12/04	Thu 6/3/04	27
29	Install Moving Walkways	160 days	Mon 9/29/03	Thu 5/6/04	25
30	Finishes	120 days	Fri 6/4/04	Thu 11/18/04	28SS+60
31	Occupancy	0 days	Mon 12/27/04	Mon 12/27/04	30


Project: Dulles Summary Schedule
Date: Mon 10/6/03


External Tasks


External Milestone


Deadline


 Task

 Milestone

 Summary

 Project Summary

 Split

 Progress

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Project Delivery System

While this project has aspects of design-build, it more closely resembles a traditional design-bid-build system. Design is continuing on some finishes after award of the contract, but based on the organizational structure it is a traditional approach. Due to the owner being Metropolitan Washington Airports Authority (MWAA), an owner that does not have experience nor the personnel for managing construction, a representative is contracted for a set period of time to manage all of MWAA's projects. The owner's representative for construction is Parsons Management Consultants (PMC), and PMC Design for managing the design process. The contracts between MWAA and PMC are both fee based.

The project was designed by Earth Tech, an engineering firm, who subcontracted the architectural design to Giuliani Associates. The reason for this backward approach was due to the construction of the tunnel's shell. Earth Tech was brought onto the project early to design the tunnel shell, and only later was Giuliani Associates contracted to design the exterior of the connector buildings and the aesthetics of the project. The contract between MWAA and Earth Tech is lump sum, as is the subcontract that Earth Tech holds with Giuliani Associates.

Hensel Phelps Construction Company (HPCC) is the general contractor for the project. HPCC bid on the project in September of 2002 after receiving a Request For Proposal two months earlier in July. HPCC has a lump sum contract with MWAA, and will hold multiple lump sum subcontracts with each subcontractor for the job.

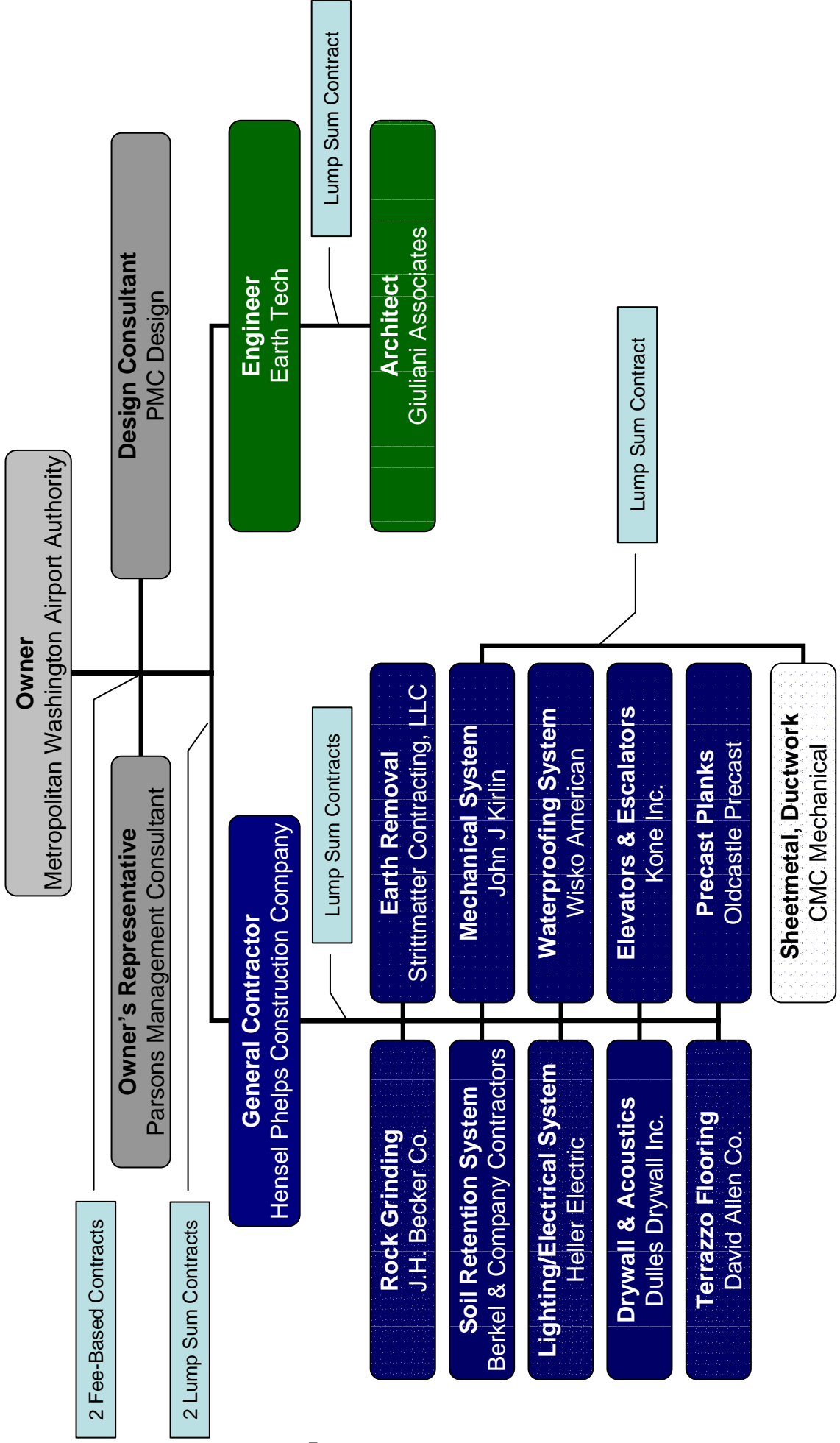
Key Contacts:

Parsons Management Consultants:
Leslie Pereira
(703) 572-1260
Leslie.Pereira@MWAA.com

Hensel Phelps Construction:
Matt Krstolic
(703) 572-1810
mkrstolic@henselphelps.com

Project Organizational Chart

Pedestrian Walkback Tunnel, Finishes Package



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Project Cost Evaluation

Note: Below is an approximate summary of current costs on the project. They are approximate values and therefore should not be relied upon for accuracy beyond the scope of this project.

Actual building construction costs (not including the tunnel shell due to a confidentiality request by the owner):

Total: **\$19,000,000**
Unit Cost: **\$400/SF**

Current total project costs (not including the tunnel shell or design fees due to a confidentiality request by the owner):

Total: **\$24,500,000**
Unit Cost: **\$515/SF**

Approx. Tunnel Electrical Costs:

Total: **\$735,000**
Unit Cost: **\$32.67/SF**

Approx. Tunnel Mechanical Costs:

Total: **\$402,000**
Unit Cost: **\$17.87/SF**

Approx. Connector Electrical Costs:

Total: **\$1,365,000**
Unit Cost: **\$54.60/SF**

Approx. Connector Mechanical Costs:

Total: **\$938,000**
Unit Cost: **\$37.52/SF**

Design costs: Unable to provide due to its sensitivity to the owner

RS Means Estimate

Using RS Means gives a unit cost of approximately \$95.30/SF. While this is for a bus terminal, it is the closest building the publication contains data for. There are several key reasons why this unit cost is so different. It does not include site work or general conditions, any conveying systems (i.e. elevators, escalators, power walks), no basement, and only one story. It is also described for a maximum of 22,000 SF building, steel frame and face brick with concrete block back-up. If using this unit cost, this building would accumulate to approximately \$4.5 million. This is clearly absurd, therefore a more detailed means of estimation would be needed for an accurate estimate.

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Project Cost Evaluation Continued

Using D4 Cost Estimating software, the following results were obtained:

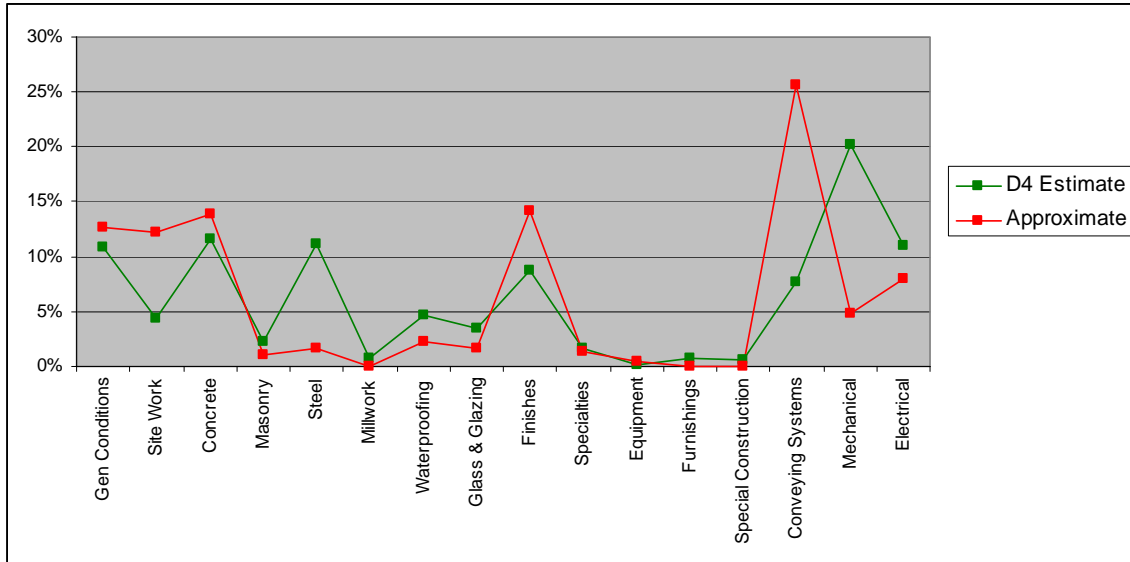
General Conditions:	11% @ \$685,029
Site Work:	4% @ \$277,929
Concrete:	12% @ \$727,482
Masonry:	2% @ \$146,035
Steel:	11% @ \$702,979
Millwork:	1% @ \$48,589
Waterproofing:	5% @ \$297,164
Glass & Glazing:	4% @ \$221,859
Finishes:	9% @ \$546,628
Specialties:	2% @ \$102,011
Equipment:	1% @ \$10,471
Furnishings:	1% @ \$42,744
Special Const.:	1% @ \$33,313
Conveying Sys.:	8% @ \$482,744
Mechanical:	20% @ \$1,269,514
Electrical:	11% @ \$691,689
Total:	\$6,286,000

While this estimate is extremely different from the actual cost of the project, it is understandable due to the large percentage of the Dulles contract taken up by the moving walkways, between \$6-\$7 million dollars. The following graph shows a comparison of an estimate of the distribution of the assumed actual costs to the distribution of the D4 Estimate costs.

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Project Cost Evaluation Continued(2)



As demonstrated by the graph, the conveying systems throw the percentage off greatly, rendering the D4 results ineffective in creating a reasonable estimate.

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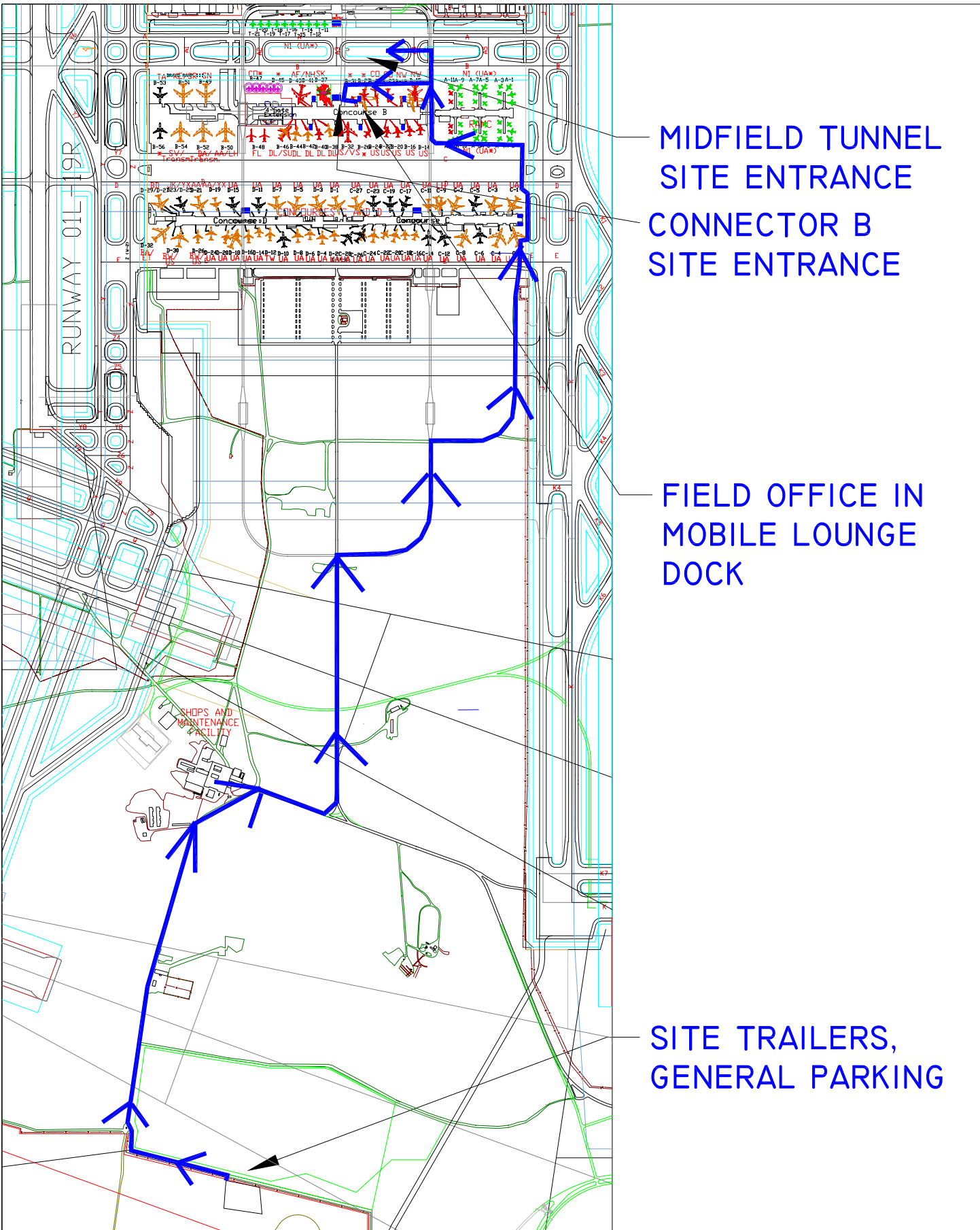
Site Plan

As seen by the following site plans, the project is spread out over a large area. With the trailers over 3 miles from the actual construction site, it is extremely beneficial that a field office was able to be established under an operating mobile lounge dock. Even the Tunnel and the Connector B structures are difficult travel back and forth. While the two sites will eventually be connected, until that time, all workers must drive between the two sites amongst baggage carts, mobile lounges, airplanes, and other airport traffic. All of these factors have a big impact on each worker's productivity in a day, and therefore requires careful planning of where the work is that needs to be done.

The existing conditions of the midfield tunnel staging area are shown, along with temporary storage areas and ramps to reach tunnel level. It should be noted that materials can be stored within the specified zones, however the height limits must be consulted in order to keep vision lines clear between the control towers and the runways, taxiways and service roads.

The existing conditions of the connector show the Mobile Lounge Dock #7 and adjacent facilities. As seen on the demolition plan, these will need to be demolished before excavation can begin. During the excavation and foundations phases, the site will be very constricted. This is due to the active gates on either side of the project. The construction fence is set on top of Jersey Barriers to protect the site, and also to protect the planes adjacent to the site. Even though there are no pedestrians, extra precautions must be taken for airline personnel, and even passengers at times, that may be on the apron in the vicinity of the construction site.

As seen on the steel erection phase, the site will become much more spacious due to the smaller above grade footprint. Considerations must be made to ensure steel is on site in order, and due to the variability in driving times on the airport, this layout will allow for storage of steel onsite. This will decrease the chance of a steel delivery not getting to the site on time and holding up work. Materials such as drywall, masonry and framing members will be stored inside the building to protect from the environment and free up space on the site.



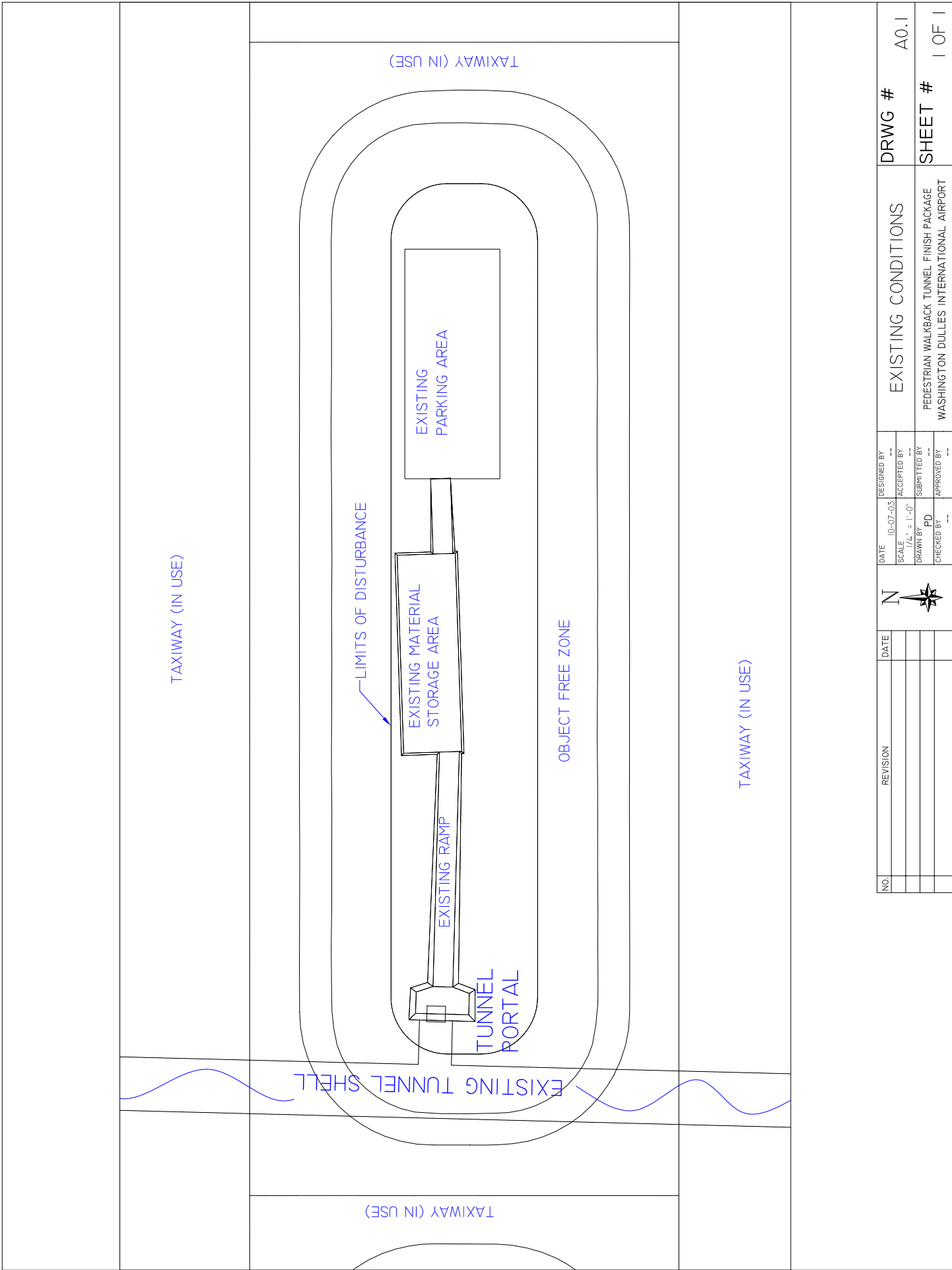
MIDFIELD TUNNEL
SITE ENTRANCE

CONNECTOR B
SITE ENTRANCE

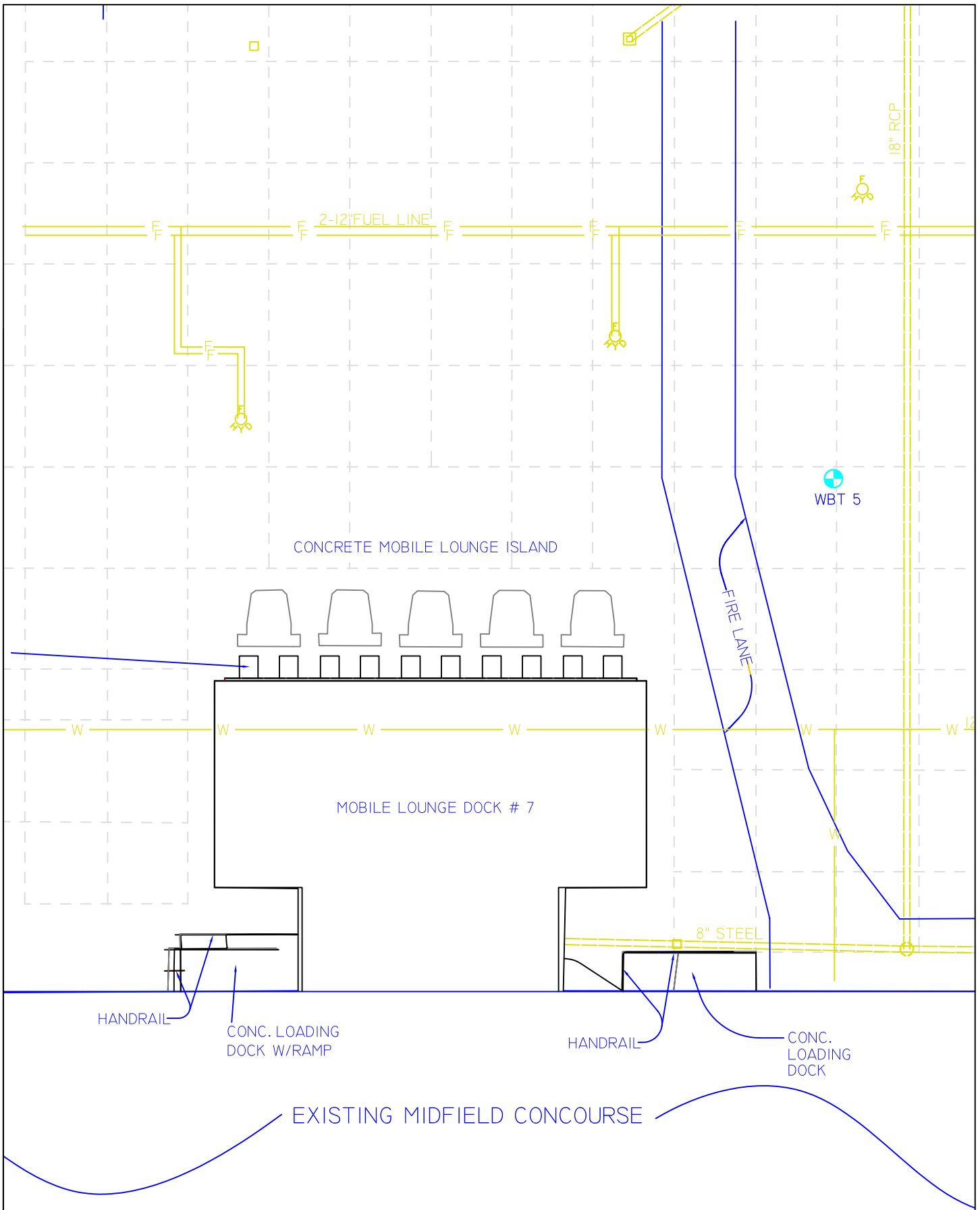
FIELD OFFICE IN
MOBILE LOUNGE
DOCK


SITE TRAILERS,
GENERAL PARKING

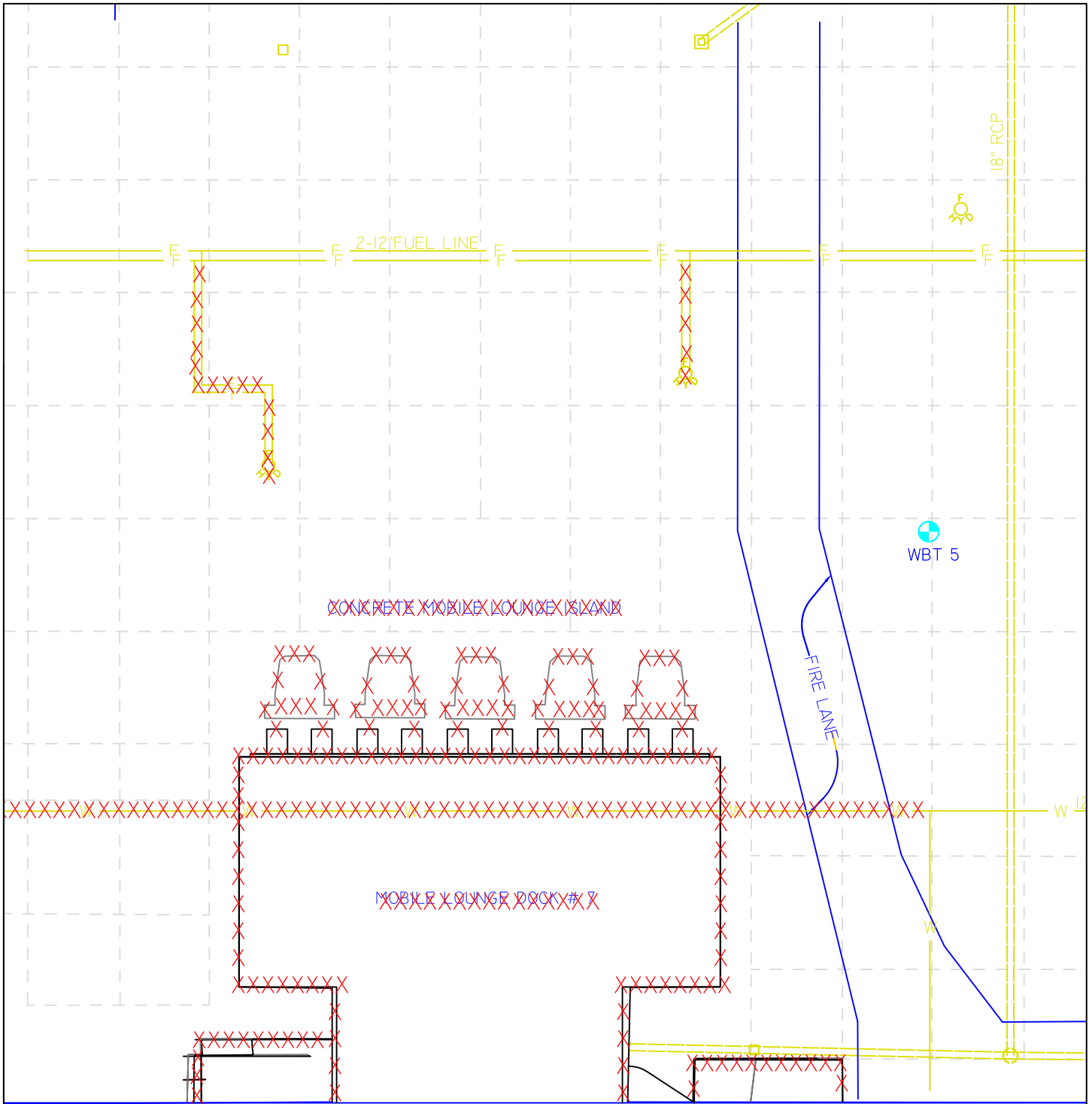
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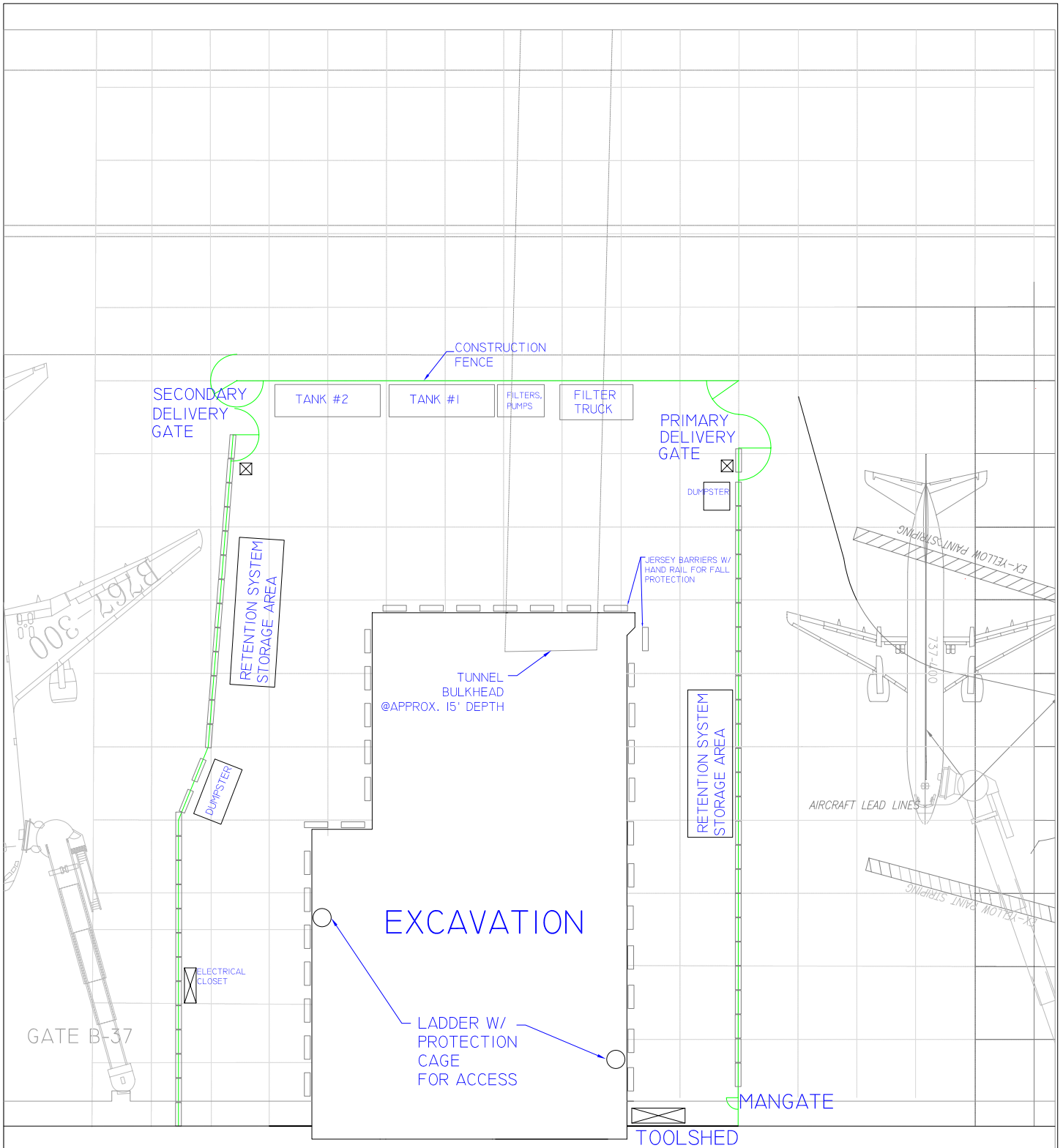
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			CHECKED BY: --	APPROVED BY: --	WASHINGTON DULLES INTERNATIONAL AIRPORT	SHEET #
						1 OF 1



NO.	REVISION	DATE		DATE 10-07-03	DESIGNED BY --	EXISTING CONDITIONS	DRWG # A0.2
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				CHECKED BY --	APPROVED BY --		

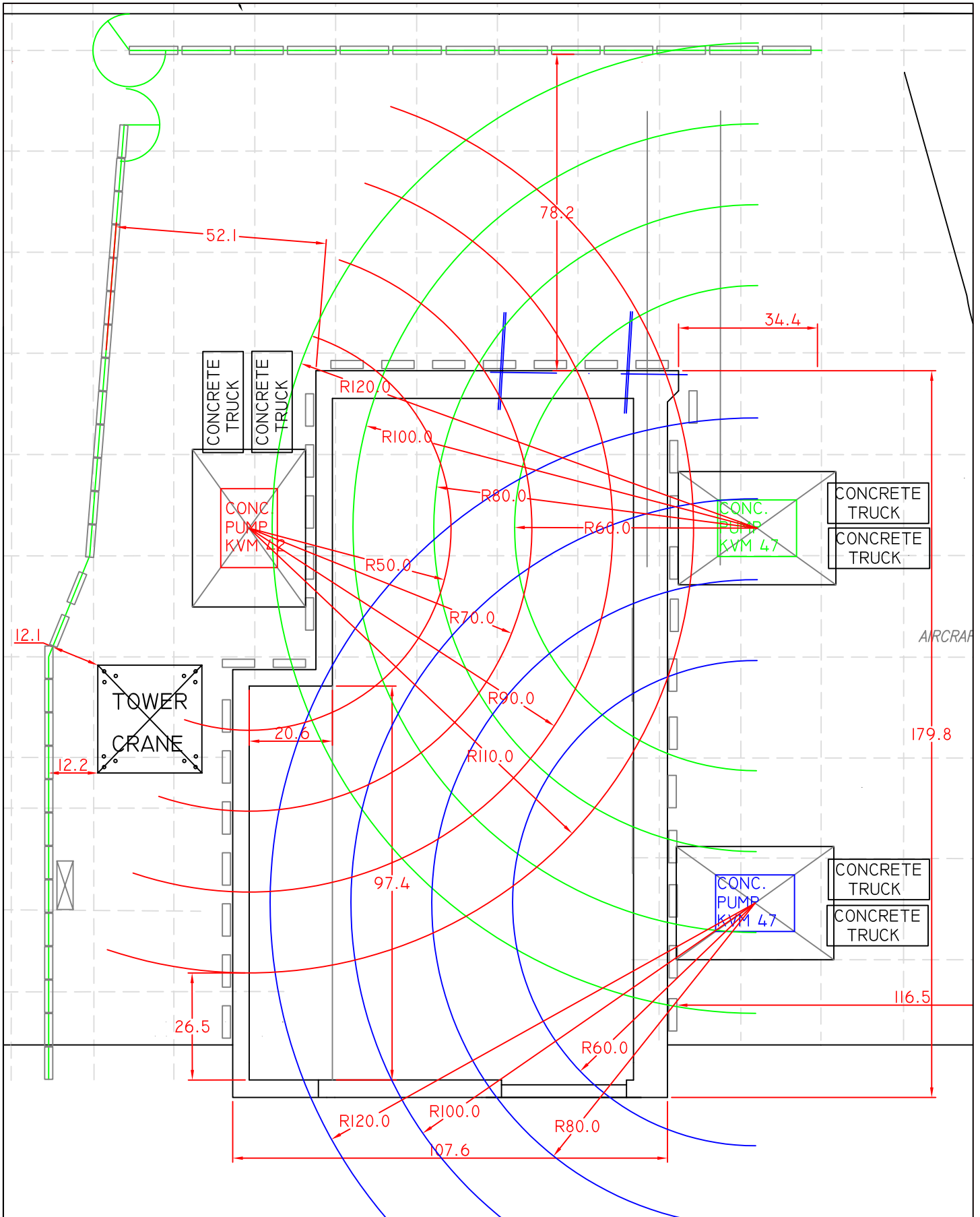


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						WASHINGTON DULLES INTERNATIONAL AIRPORT	

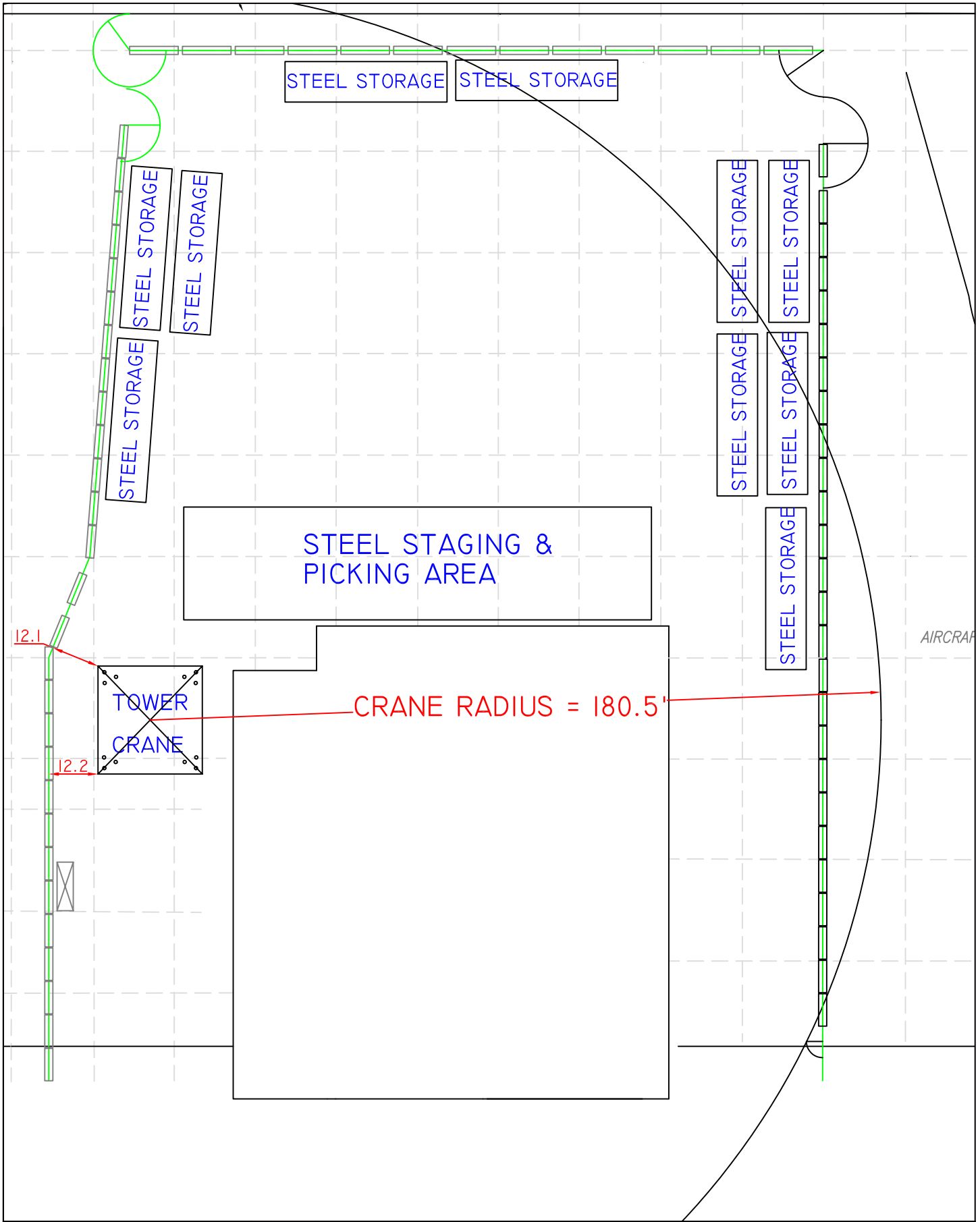


EXISTING CONCOURSE B

NO.	REVISION	DATE	DATE	DESIGNED BY	EXCAVATION PHASE	DRWG #
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NO.	REVISION	DATE	DESIGNED BY	DRWG #
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			APPROVED BY	
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FOUNDATIONS PHASE <small>THESIS 2003-2004 PEDESTRIAN WALKBACK TUNNEL FINISH PACKAGE WASHINGTON DULLES INTERNATIONAL AIRPORT</small>				SHEET # I OF I



NO.	REVISION	DATE	DATE	DESIGNED BY	STEEL ERECTION PHASE	DRWG #
			10-07-03	--		A0.7
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			DRAWN BY	SUBMITTED BY		
			PD	--		
			CHECKED BY	APPROVED BY		
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Local Market Conditions

Being very close to Washington, D.C. there is a large labor market to pull from. However there are a few issues which must be carefully considered. There is a lot of construction occurring in the area making the seemingly flooded labor market very sparse. Another issue is the lack of skilled labor. It is not as hard to find a laborer as it is to find a carpenter or a pipe fitter. Due to this fact, considerations should be made when estimating costs and also productivity on the project.

Hensel Phelps will be self performing a considerable amount of work for this job, making this issue a priority. Hensel Phelps employs many workers from the Washington, D.C. and surrounding areas, however the firm has many projects ongoing at this time. There is a great demand for their workers, and any down time on a project will hurt not just that job, but all of the firms other jobs in the area. This will require coordination on HPCC's part to maintain a consistent workforce that is most efficient for their projects as a whole.

Washington, D.C. is known as a union labor force, however unions have become less dominant. Most of the work performed on this project will be non-union, however there will be subcontractors which are union.

The Pedestrian Walkback Tunnel project has a 28% Local Disadvantaged Business Enterprise (LDBE) participation requirement. The Request For Proposal (RFP) defines *local* as "within a 100-mile radius of Washington, D.C.'s zero mile marker". This includes any county touched by that radius. The term *disadvantaged business* is defined as "a firm which is not dominant in its field, and which meets the ... size standard(s) for this solicitation." If the 28% is not obtained, the RFP dictates that the contractor must meet the requirement through subcontracts, or through partnering with an owner certified LDBE. Changes after the award of the contract are encouraged to preserve the established 28% through the completion of the project.

A voluntary MBE/WBE participation percentage has been established by the Metropolitan Washington Airports Authority at 28%. If participation is obtained, Exhibit D must be filled out for monitoring purposes, but will not be used to determine to whom the contract is awarded. Most MBEs and WBEs will also qualify as an LDBE.

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Subsurface/Soils

Excavation will amount to about 35,000 CY at the site of Connector B. A geotechnical report was provided to all bidders at the time of bidding. From the report, the following conditions should be anticipated below grade:

- 287-285 AMSL: Portland cement concrete
- 285-284 AMSL: Gray sand with some gravel
- 284-281 AMSL: Reddish brown clay
- ~276-281 AMSL: Decomposed/weathered rock
- ~270-280 AMSL: Bedrock with RQD between 36% and 95%

-Note: An RQD below 75 means the rock is of fair quality at best

It was also noted by the report that the soil had a distinct fuel odor to it. The soil near the site is known to be contaminated due to a fuel line break on a previous phase of the project. All excavated soil will be anticipated as being contaminated, however this should not be an issue due to the use of a soil bank operated by the owner.

Due to the anticipation of the soil having less than ideal qualities, a soil retention system is used on the site. As mentioned in the scheduling report, a system incorporating tiebacks and multiple layers of shotcrete is used. The design is consistent for the depth of the excavation, barring the length of the tiebacks.

On the south face of the excavation, three existing caissons 4'-3" wide support the existing Concourse B. These caissons extend past the depth of the excavation, but are braced midway down to prevent any bowing or possible failure. A similar tieback/shotcrete system is used that incorporates tube steel to embrace the caisson.

The HPCC's contract with MWAA contains a Differing Site Conditions (DSC) clause. It is currently an issue on site due to the east face of the excavation having continued failures due to the clay veins found in the bedrock. While this was detailed in the geotechnical report, the extent of the veins was not and therefore could not be anticipated. The bedrock itself is solid, however it is highly jointed and severely weathered.

Relating to this issue is the additional costs due to the record amount of rainfall in the Washington, D.C. area this year. All groundwater must be removed from the excavation and disposed of. However due to the contamination of the soil, the water must be filtered through an intensive process before being sent to the storm sewer. The added volume of rain adds substantial costs to the dewatering process.

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Client Information

Metropolitan Washington Airport Authority is building this project to allow passengers the choice between a short walk between the Main Terminal and Concourse B (the tunnel will be extended to Concourse A in the future), or being transported via Mobile Lounge. While the Mobile Lounges are not yet obsolete, they are slowly being phased out as an underground automated people mover system is built (tentatively set to be introduced in 2008) to take their place. This underground automated people mover system will run side by side the Pedestrian Walkback Tunnel and closely resemble the same systems at Detroit's International Airport and others.

Even though this is a public entity, cost is not seen as the prime concern. Staying within budget is important, but many other factors must be taken into consideration. Safety is a substantial concern of the owner, even so far as to limit the bidders to those which had the highest safety ratings. Schedule is another principal interest of the owner. If the benefits of having the tunnel open for use on the Thanksgiving holiday weekend outweigh the cost of accelerating the schedule, they will certainly accelerate. Quality is less of an issue, but still important. This is not a temporary fix to a problem, as the Mobile Lounges seemed to be, the owner will operate this facility for a long time and reap the benefits of investing a little bit of extra money into it now. However that is not to say that it will look any different than the rest of the airport, it must blend in with all of the established color schemes and wall and floor textures. The owner has worked hard to establish a solid design with minimal maintenance and this is not something they are willing to compromise on.

From these considerations, success for this project will be timely completion. For the owner to have confidence in the project, it is best to show the current status of the project, and also give updates on the current projected date of completion. If problems arise, they should be discussed and resolved in a timely fashion to ensure no unnecessary delays in the schedule. Many decisions may rely on the owner, but the contractor must do their part to assist the owner in making the correct decision. A project completed safely, a project completed on time and a project completed as specified is the ultimate means of satisfying this owner.