


REGIONAL CONNECTOR TRANSIT CORRIDOR PROJECT
Contract No. E0119

Construction Approach

Task No. PH2.7.9.01 (Deliverable No. PH2.7.9.01.01)

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May 2, 2012

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1.0 PURPOSE

This report provides an approach to the construction of the Los Angeles Regional Connector Transit project. This approach has been used to support the project configuration in the Preliminary Engineering (PE) as of March 30, 2012. Specifically, the construction approach described herein illustrates the practical constructability of the major project elements as shown on drawings and in accordance with specifications and contract terms and conditions. Likely construction methods are described, though these may change as construction means and methods are the responsibility of the eventual design/build Contractor.

A list of reference reports/documents is provided in the Appendix.

1.1 General Approach

This report focuses on a constructible approach to building the project, meeting the requirements of the EIS and the intended project revenue date for the Regional Connector.

The Record of Decision (ROD) allows for the start of construction no matter the method of construction. ROD indicates the project has completed all environmental reviews per NEPA and CEQA and therefore can start construction.

It is envisioned that an early NTP for the D/B Contractor could begin in Jan 2013, to begin his own utility relocations and to begin design work. Third party utilities would relocate those designated utilities on the contract drawings so that the D/B contractor would have a clear path to a “shovel in the ground date” of Aug 23, 2013.

All work within the project schedule is predicated on 3rd party utilities being completed, as the project is assumed to kick off at all locations at the same time.

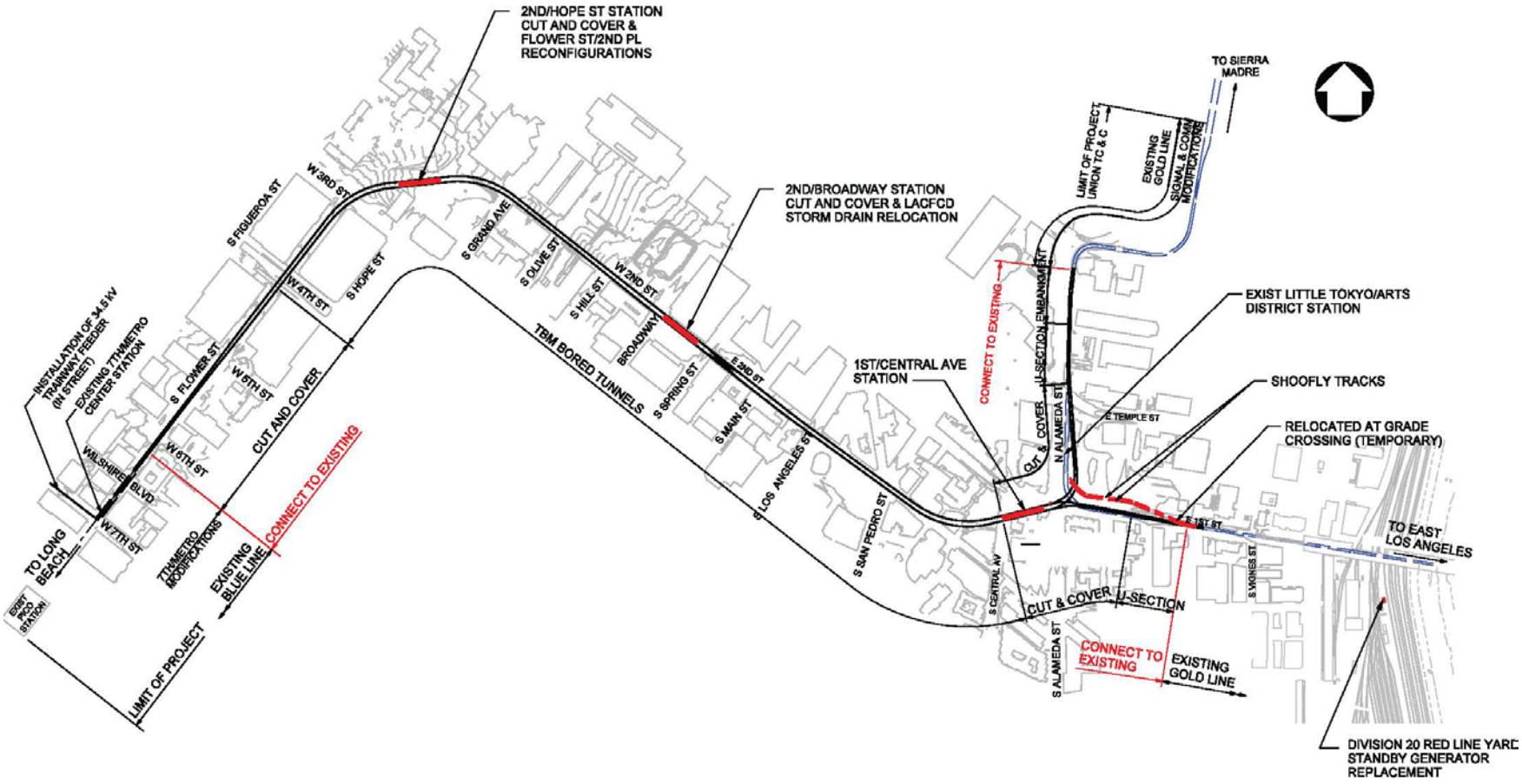
Once the advanced works for utilities are completed, the Contractor will begin the major effort for station construction with support of excavation pile installation, followed by decking installation, hanging/supporting utilities from the deck and then into cut cover box excavation, followed by concreting, finishes and systems.

The Earth Pressure Balance Machine (EPBM) tunnel boring machine will be mobilized at the same time work begins in the stations and cut cover sections, thus trying to time the completion of the station excavation so the EPBM “walks thru the station”. The approach at the 2nd Broadway Station is the EPBM “mines thru the station”, due to the complexity of relocating the storm drain.

Once the tunnels are driven, the contractor will construct the cross passages, concrete the stations and install finishes, along with systems.

The approach is based upon a “single contract scenario”, thus maximizing when work can be done, and eliminates potential major interfaces between contractors, resulting in claims against the Owner.

Figure 1-1: Project Map



2.0 UTILITIES

The contract drawings indicate those utilities which interfere with the construction of the LA Regional Connector project. Some advance utility work by an independent METRO Advance Utility Relocation Contractor can occur between January 2012 and August 2012, during the period the 3rd parties are also doing their relocation work.)

It is critical and thus identified, that to begin work in the ground, 3rd party utilities must be moved before the D/B Contractor can begin his work. Some advanced utility work by the D/B Contractor can occur, between January 2013 and August 2013, during the period 3rd parties are also doing their relocation work.

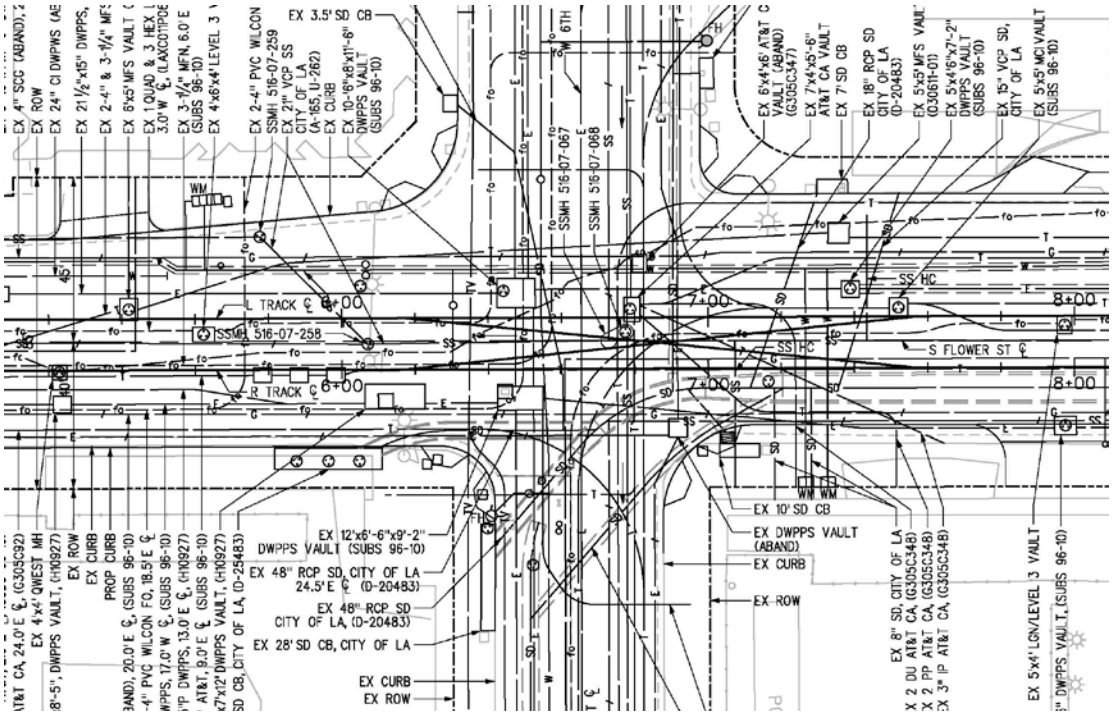
2.1 Utility As-Built Information

The Preliminary Engineering effort identified those utilities within the project corridor, gathering information from various utility owners. Potholing / test pits have been done to identify particularly those utilities that reside within the top 6 ft of excavation, thus determining the relevant information for the mitigation measure of “raised decking”, which allows more utilities to be hung, less to be relocated. See Figure 2-1 for an example.

2.2 Utility Work – Existing Composite Plans/Rearrangement Plans

The Preliminary Engineering effort has identified through composite utility plans, the total utility picture within a definitive geography of the project. This information has been gathered through the process of meeting with individual utility companies.

Figure 2-1: Existing Utilities



The Preliminary Engineering effort then depicts the contract work to be performed and the potential conflicts it may have with the project work. With the overlay of the support of excavation piles, the final structure configuration and the decking system, it can then be determined which utilities are needed for relocation, and those that can be supported. See Figures 2-2, 2-3, and 2-4.

Figure 2-2: Utility Relocation

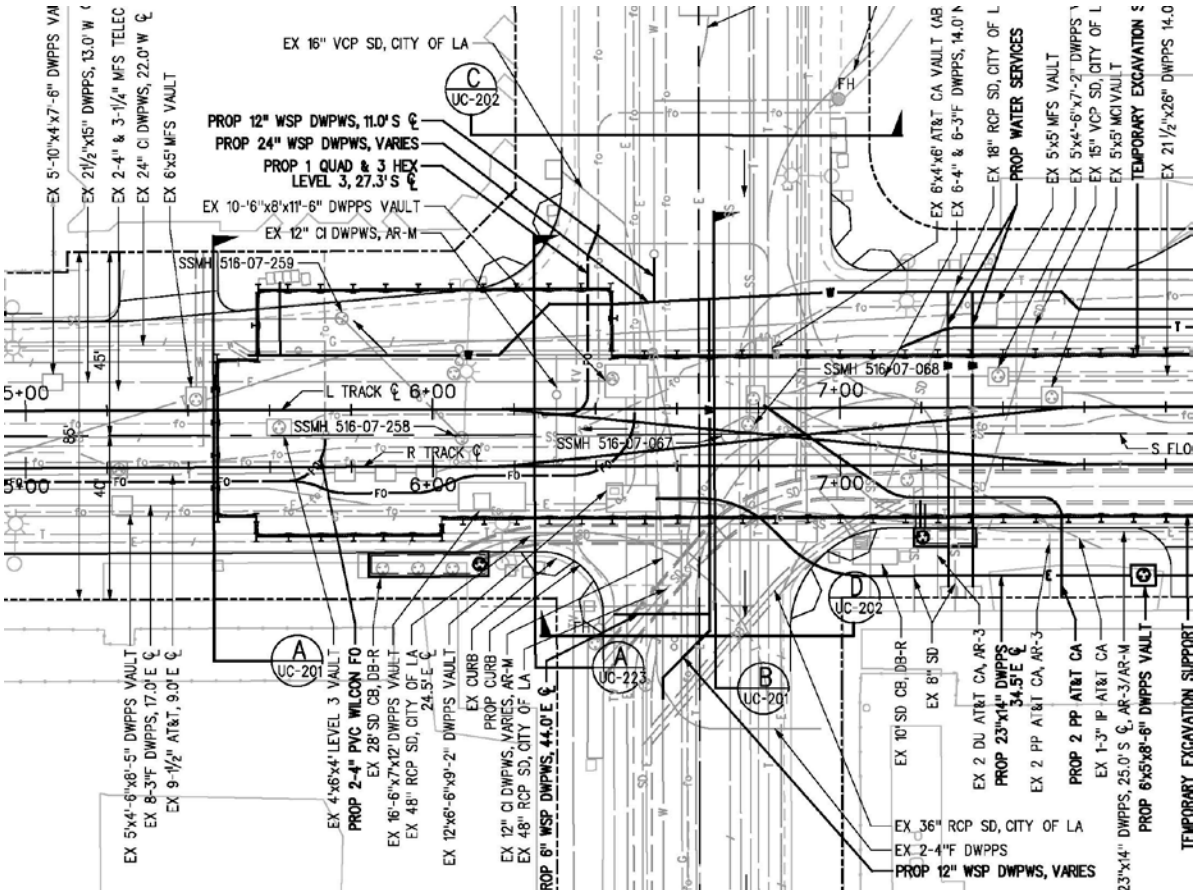


Figure 2-3: Utility Cross Sections

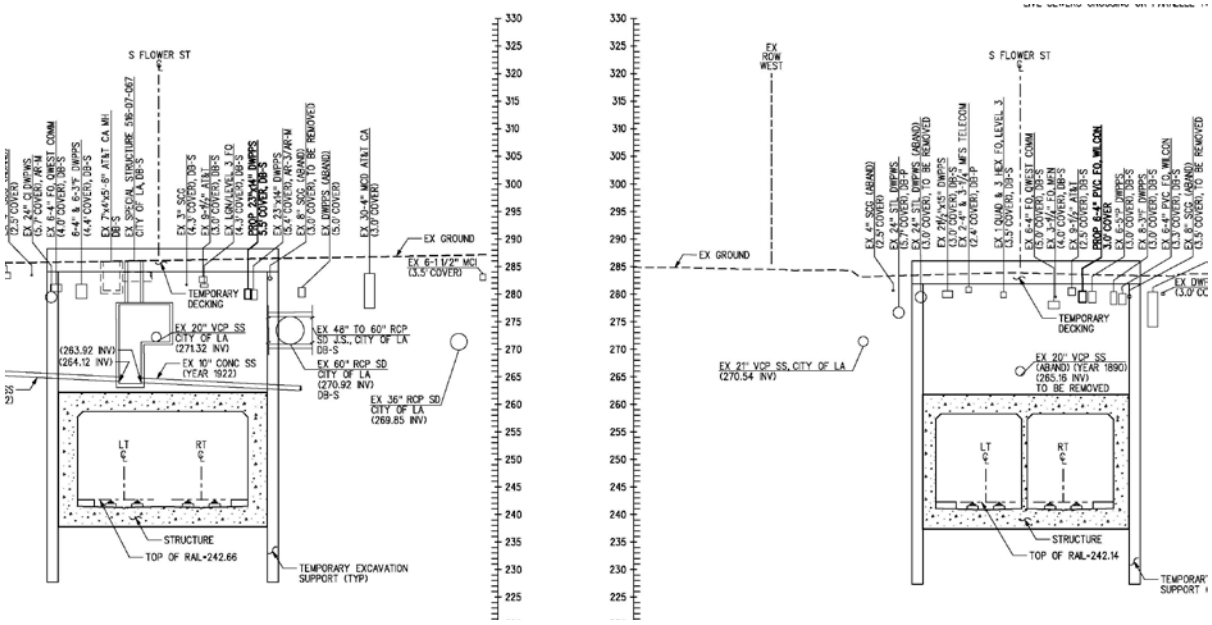
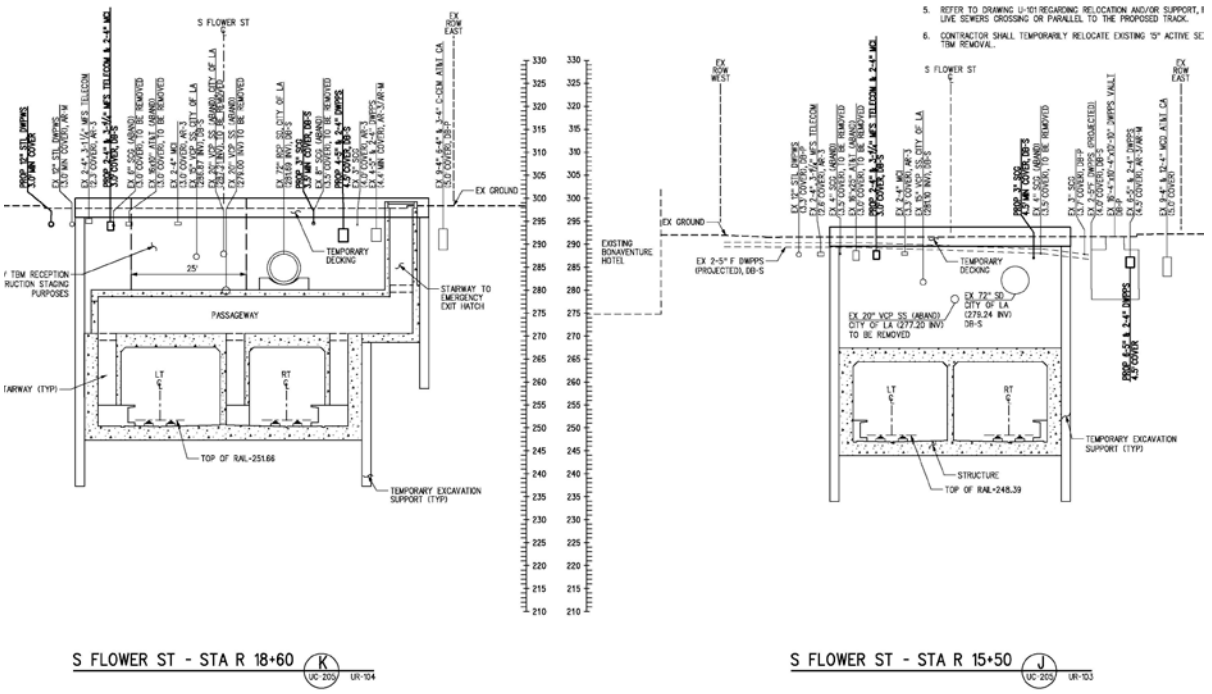


Figure 2-4: Utility Cross Sections



The following notations on the drawings indicate who will perform the work and by what method:

AR-3 = 3rd party relocation
AR-M = Advanced Utility Relocation by Metro
DB-R = relocation by D/B contractor

DB-S = support tin place by D/B contractor
Abandon = D/B contractor to abandon in place

2.3 Temporary Power for Construction

In addition to those relocations or supported in-place utilities, some new utilities will be needed for the project particularly, but not limited to, the 13.4 KV power at Mangrove Site to power the EPBM. It has been identified that 6 KVA for one EPBM or 10 KVA for two EPBM's would be needed, based upon whether the D/B contractor uses one EPBM or two EPBMs. See Figure 2-5.

Figure 2-5: EPBM Power Needs

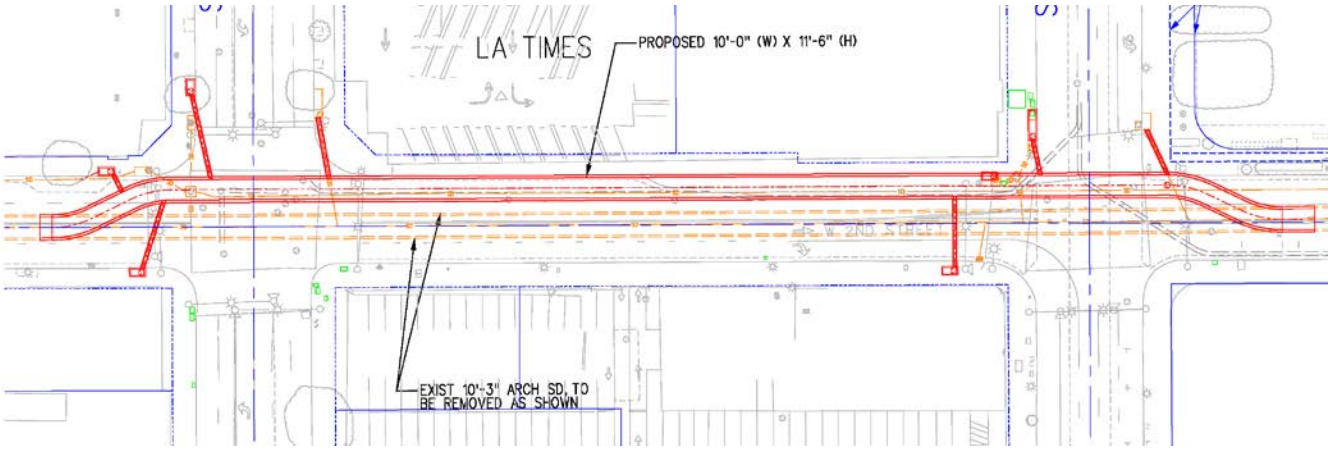
Mangrove Site																		
EPBM Excavation Method																		
Estimated Construction Power Demand																		
													Power Factor = 0.8					
		1 EPBM Quanity	Unit		Demand			Diversity Factor	bhp		KW		KVA					
Site Surface Support																		
Shop equipment, allow		2	EA	@	70	KW	@	100%			140		175					
Change house, allow		1	EA	@	30	KW	@	50%			15		19					
Yard lighting, allow 1000W lamps per locat		40	EA	@	1	KW	@	100%			40		50					
Office trailer, allow 10KW per trailer		4	EA	@	10	KW	@	100%			40		50					
Water treatment, assume 2500 hp motors		1	EA	@	100	hp	@	100%	100		75		93					
Alimak personnel hoist		1	EA	@	50	hp	@	50%	50		19		23					
Compressor(s) & Air Handling		2	EA	@	500	hp	@	60%	1000		448		560					
Shaft pump & water handling		1	EA	@	125	hp	@	100%	125		93		117					
Muck conveyance, assume muck cars, die		0	EA	@	10	KW	@	100%			-		-					
			EA	@		hp	@	100%	-		-		-					
			EA	@		hp	@	100%	-		-		-					
			EA	@		hp	@	100%	-		-		-					
	Subtotal								1275		870		1087					
	Design Contingency	20%							255		174		217					
	Subtotal including contingency								**1530**	**bhp**	**1044**	**KW**	**1304**	**KVA**				
Tunneling																		
EPBM & trailing gear, assume 6.7M											2000	KW	2500	KVA				
	Design Contingency	10%									200		250					
	Subtotal including contingency										**2200**	**KW**	**2750**	**KVA**				
Sub-Surface Support		6400	LF															
SB Heading																		
Lighting, allow 1 lamp per 25'		269	EA	@	150	W	@	100%			40		50					
Pumps, allow 1 pump per 1000'		9	EA	@	30	bhp	@	100%	270		201		252					
Ventillation, allow 1 fan per 2000'		4	EA	@	200	bhp	@	100%	800		597		746					
NB Heading																		
Lighting, allow 1 lamp per 25'		269	EA	@	150	W	@	100%			40		50					
Pumps, allow 1 pump per 1000'		9	EA	@	30	bhp	@	100%	270		201		252					
Ventillation, allow 1 fan per 2000'		4	EA	@	200	bhp	@	100%	800		597		746					
	Subtotal								2140		1676		2096					
	Design Contingency	10%							214		169		212					
	Subtotal including contingency								**2354**	**bhp**	**1845**	**KW**	**2308**	**KVA**				
Estimated power requirement, including contingency									**3884**	**bhp**	**5089**	**KW**	**6362**	**KVA**				

Contractor will also need temporary power at each station & cut/cover location to perform excavation and concrete works.

2.4 Utility Work – Relocated Storm Drain at 2nd and Broadway

During the Value Engineering study workshop of June 2011, it was identified that a major risk to the project schedule could be the construction of the existing storm drain that runs through the 2nd Broadway Station cut / cover and how best to support it in place. The existing storm drain is a large concrete horseshoe-shaped structure (a driven tunnel). See plan in figure 2-6.

Figure 2-6: Drainage Plan



The construction sequence of the work is critical to the project, along with the tie-in during the storm drain low flow season, and how it affects the station excavation and the EPBM drives. The following sequence depicts the nature of the work.

a. Utility Companies perform relocations, re-route around areas obstructing soldier piles and relocation of the Storm Drain
b. Install Instrumentation and perform Pre-Construction Surveys prior to construction
c. Construct EPBM soft eye at Station " ends"
d. Set up MOT (MAINTENANCE OF TRAFFIC) on south side to install soldier piles
e. Saw cut pavement/trench to install soldier , header beam over piles and pre-trench for deck installation
f. Install soldier piles on south side of station
g. Set up MOT (MAINTENANCE OF TRAFFIC) on north side to install soldier piles
h. Saw cut pavement / trench to install soldier , header beam over piles and pre-trench for deck installation
i. Install soldier piles on north side
j. Install flush decking on weekends (Fri 10 pm to Mon 5 am) in 56 ft increments, temporarily ramping down after each weekend installation. Also install temporary ramps to building driveways.
k. Excavate thru the deck on the north side to invert of utilities for Contractor to hang in place
l. Excavate thru the deck on the south side to invert of utilities for Contractor to hang in place
m. Install soldier piles / sheeting and excavate for new manholes for Storm Drain Diversion to the north
n. Install soldier / sheeting to create supported space for new Storm Drain line
o. Construct new Storm Drain line, tie –in to new diversion manhole.

See Figures 2-7 and 2-8.

Figure 2-7: Excavation Support of Relocated Storm Drain

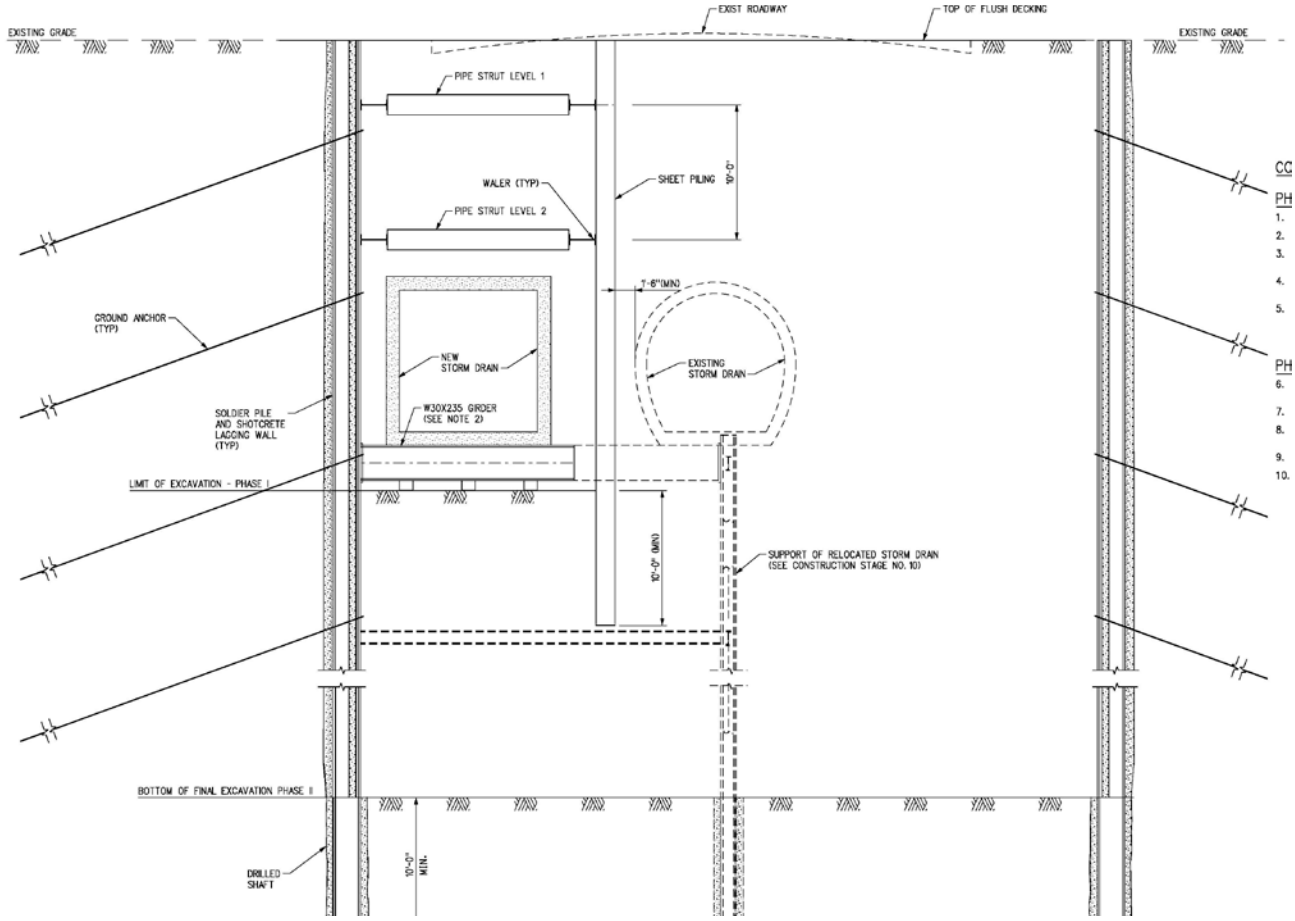
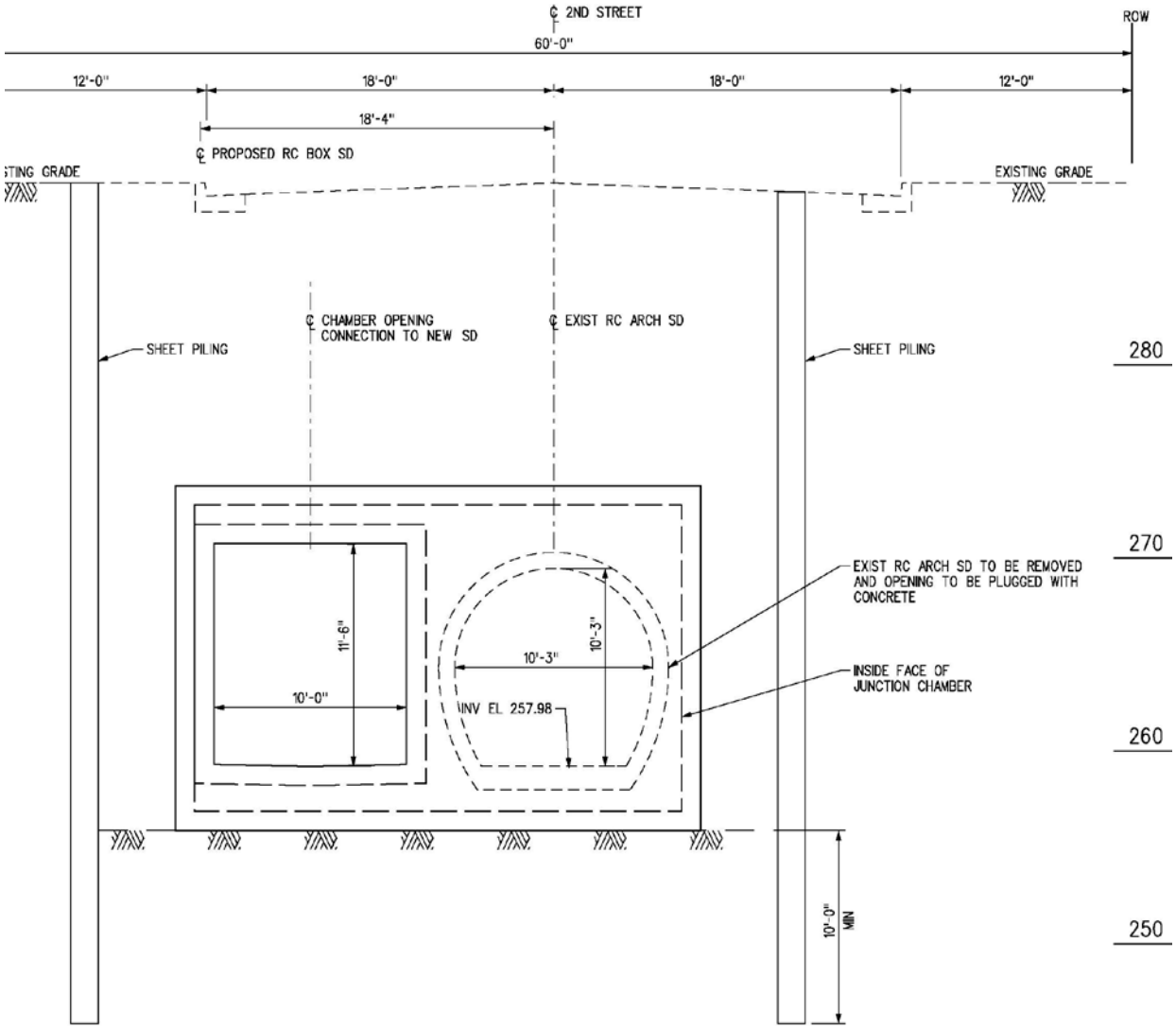


Figure 2-8: Temporary Support of Relocated Storm Drain Junction



3.0 STATIONS

All station construction will be performed by cut / cover methods, namely utility relocations, soldier pile installation, decking beam and precast slab, hung utilities, excavation with timber lagging and steel struts.

3.1 Excavation Logistics

The following volumes of excavation are predicted, based on quantity takeoffs from the Estimate:

Flower St	=	126,000 BCY
2nd / Hope Station	=	114,000 BCY
2nd / Broadway Station	=	151,000 BCY
SEM Crossover	=	11,000 BCY
1St / Central Station	=	85,000 BCY
"Y" Connection	=	22,000 BCY
1st St C/C STA 82+00 to STA 83+71	=	7,000 BCY
Alameda C/C STA 82+00 to STA 88+20	=	32,000 BCY
Mangrove EPBM Launch Box	=	19,000 BCY
EPBM	=	197,000 BCY

3.2 Construction Method – Cut/Cover Construction

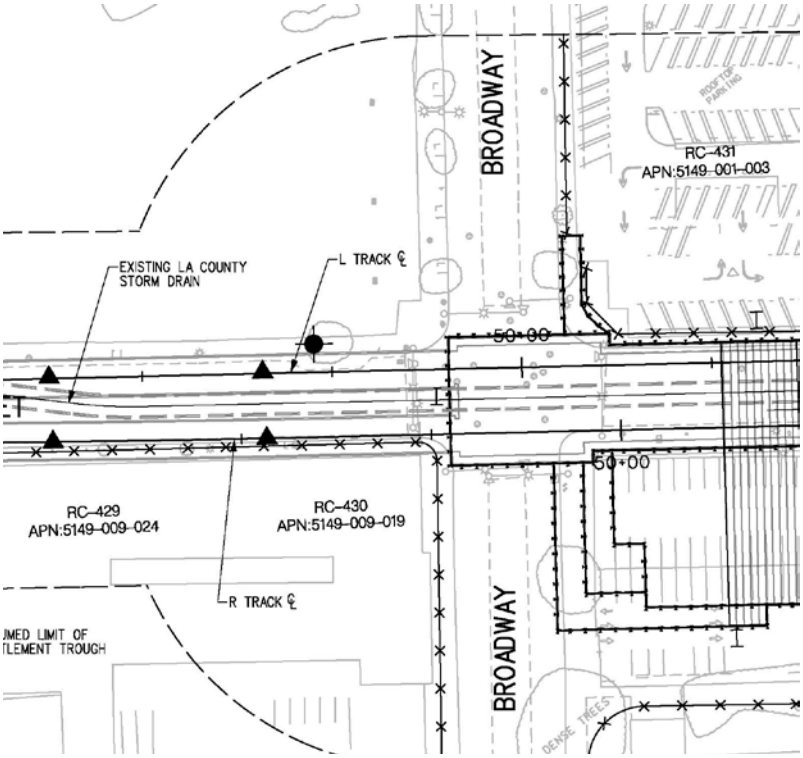
Construction begins with 3rd party utility relocation, thus paving the way for the D/B contractor to enter the site and begin work.

The following sequence depicts normal construction methods for cut & cover construction

Anticipated Construction Sequence

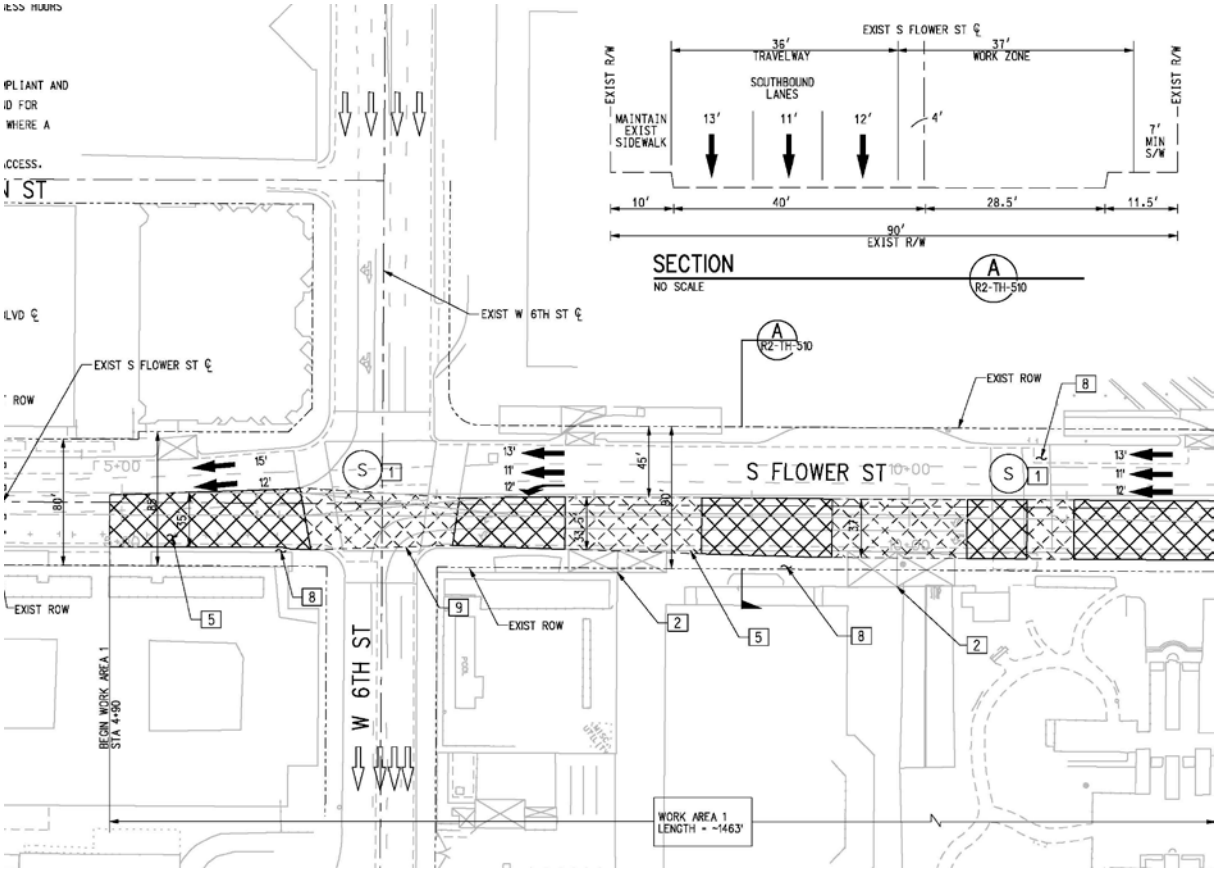
a. Utility Companies perform relocations as depicted to facilitate installation of auger piles and deck beam installation
b. Install Instrumentation and perform Pre-Construction Surveys prior to construction (See Figure 3-1)

Figure 3-1: Instrumentation for Building Protection



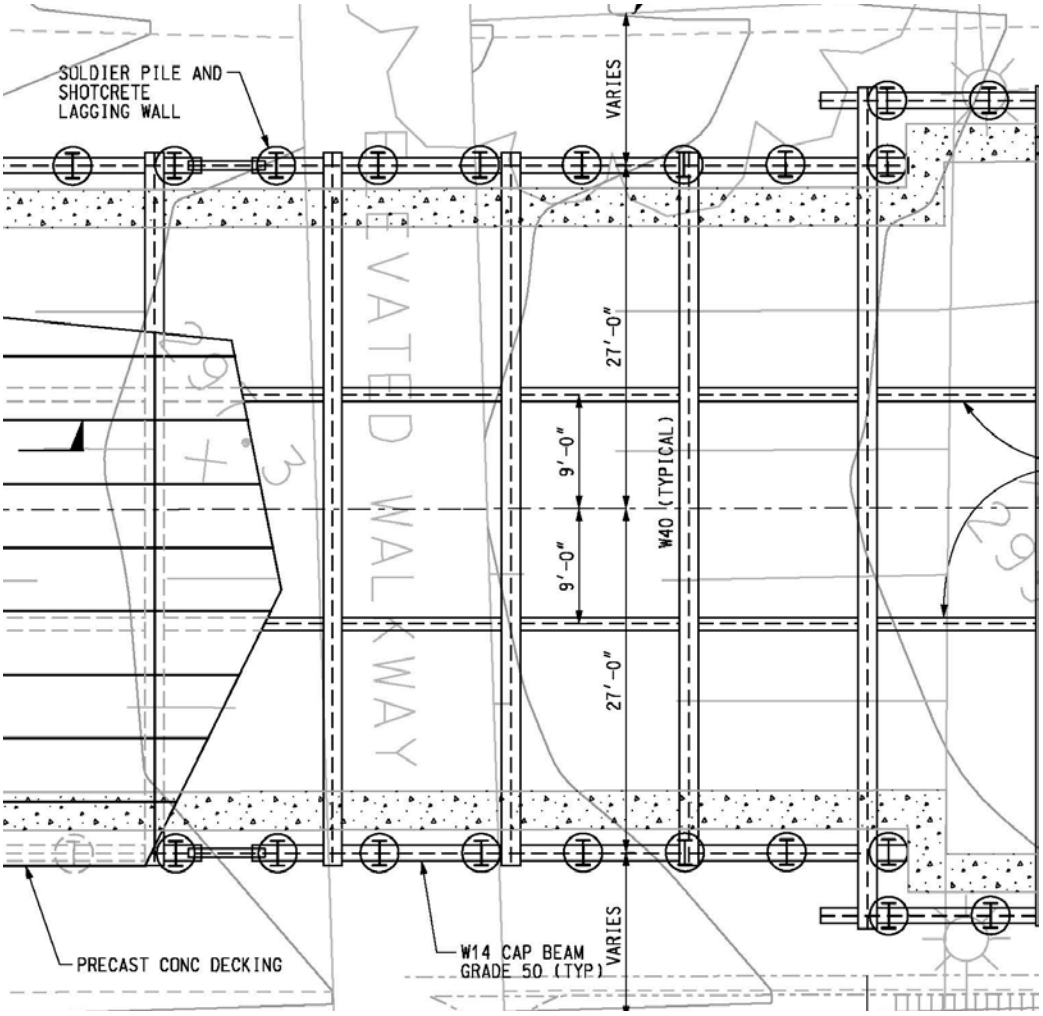
c. Set up MOT (MAINTENANCE OF TRAFFIC) on east side to install soldier piles
d. Saw cut pavement / trench to install soldier, header beam over piles and pre-trench for deck installation
e. Install soldier piles on east side
f. Set up MOT (MAINTENANCE OF TRAFFIC) on west side to install soldier piles
g. Saw cut pavement / trench to install soldier, header beam over piles and pre-trench for deck installation
h. Install soldier piles on west side (See Figure 3-2 for Flower Street.)

Figure 3-2: Stage Construction/Traffic Handling (Flower Street)



i. Install raised decking on Flower Street on weekends (Fri 10 pm to Mon 5 am) in 56 ft increments, temporarily ramping down the deck to existing street after each weekend installation. Also install temp ramps to building driveways. (See Figure 3-3)

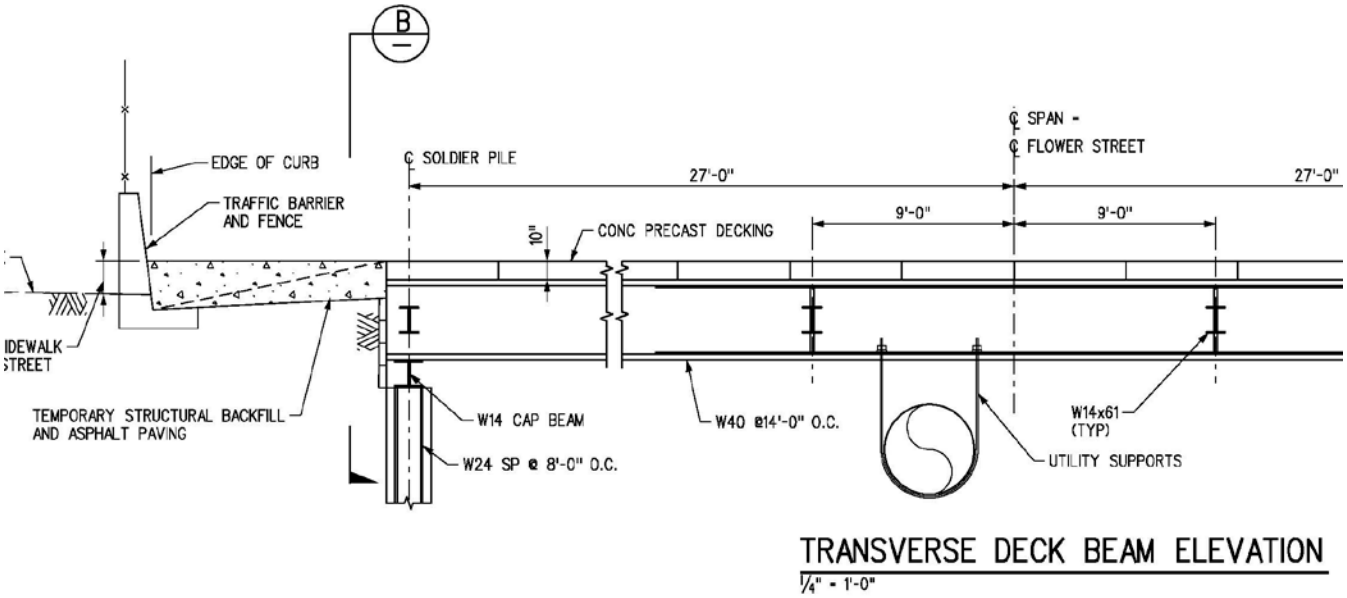
Figure 3-3: Flower Street Decking

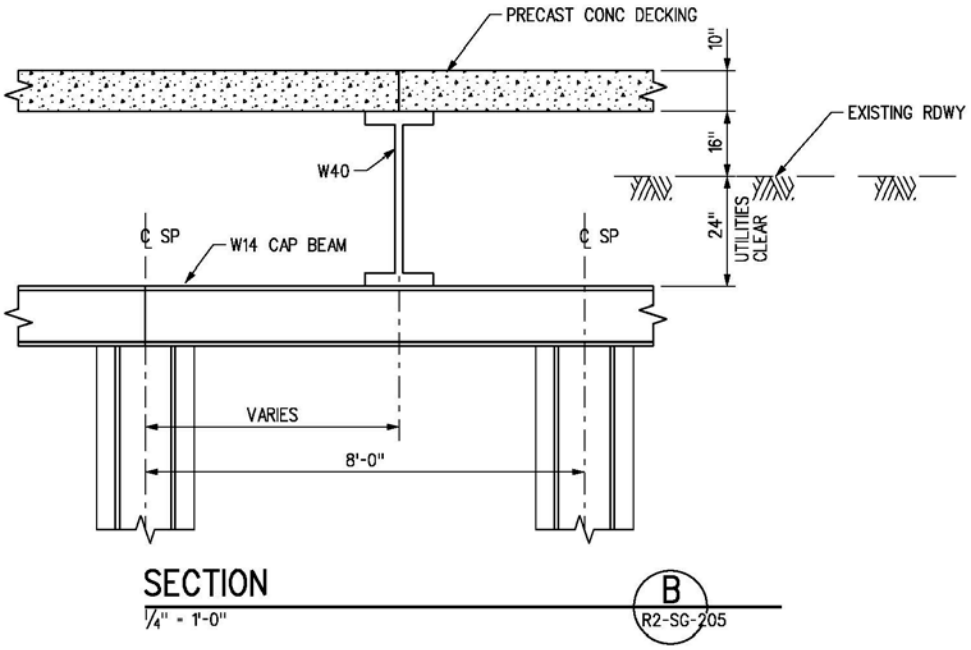


j. Excavate thru the deck on the west side to invert of utilities for Contractor to hang in place

k. Excavate thru the deck on the east side to invert of utilities for Contractor to hang in place (See Figure 3-4)

Figure 3-4: Flower Street Deck Structure Cross Section

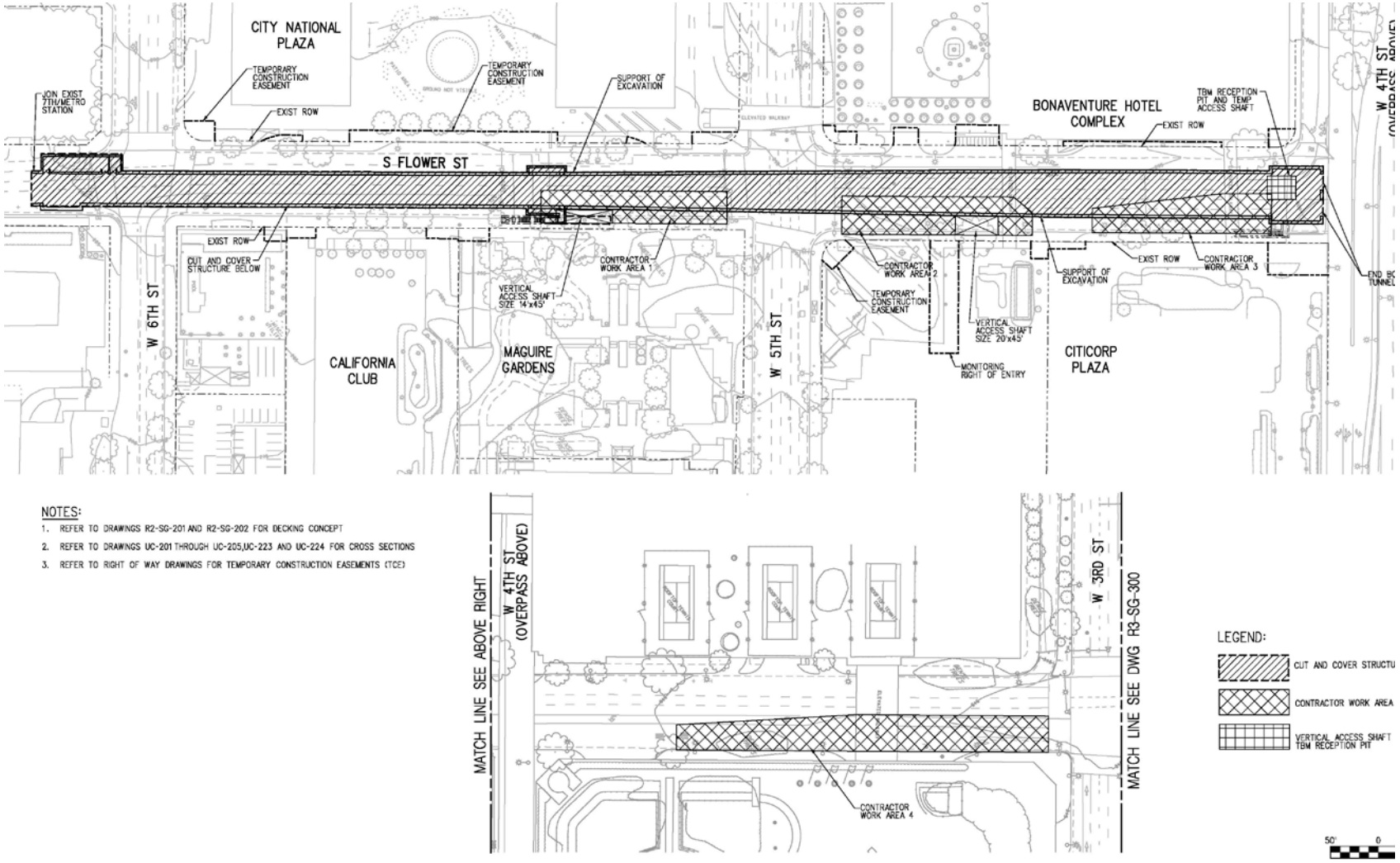




l. Set up MOT (MAINTENANCE OF TRAFFIC) on east side for remainder of excavation and concrete of station.

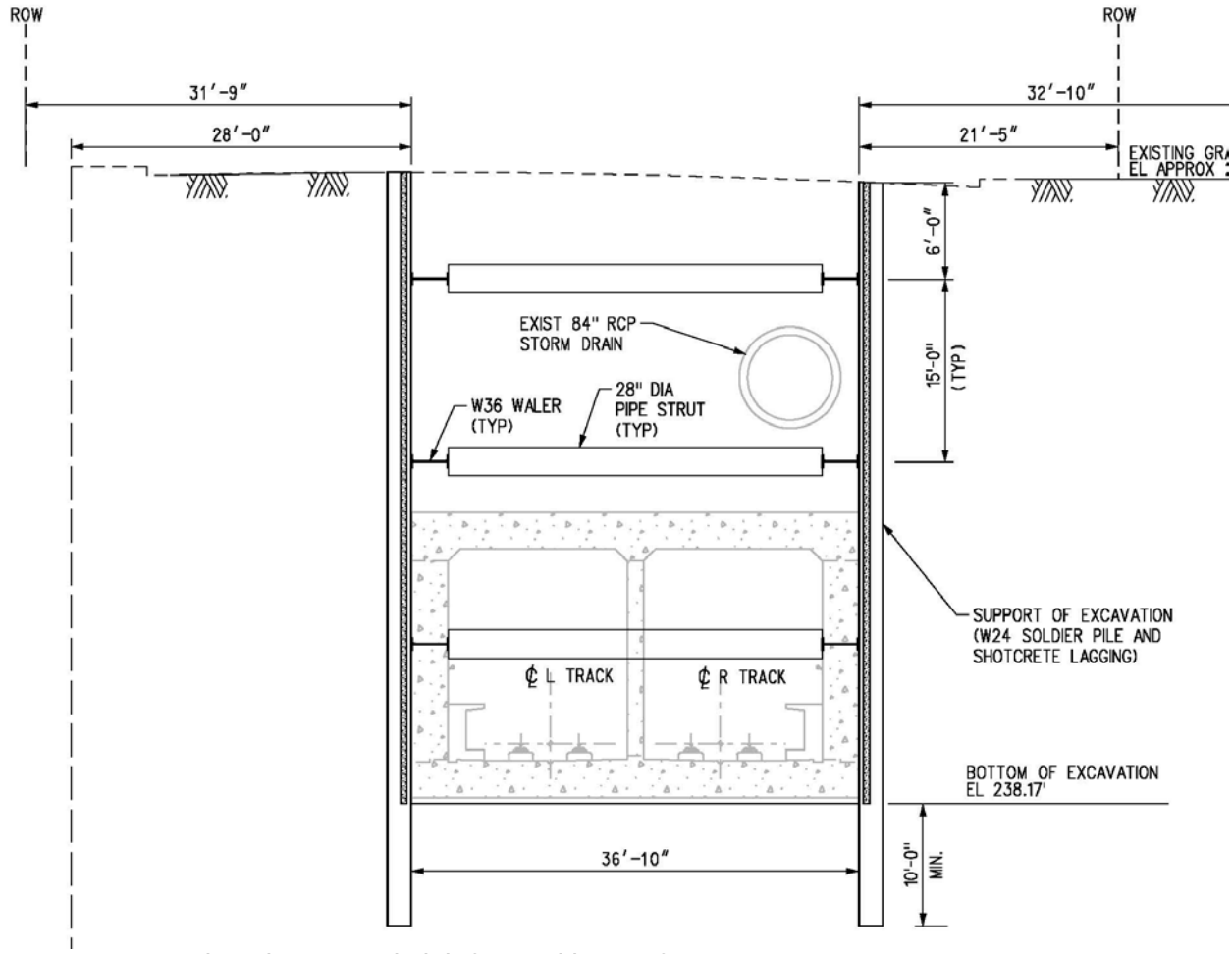
m. Set up contract facilities on the deck and laydown areas, including temporary power, air / water / phone / ventilation / discharge lines for the project (See Figure 3-5)

Figure 3-5: Flower Street Cut and Cover Work Area



n. Excavate to 1st bracing level
o. Install / weld on beam seats to receive struts
p. Install struts and pre-load if needed.
q. Excavate to 2nd level and so on to invert (See Figure 3-6)

Figure 3-6: Flower Street Excavation Support



r. Place invert mud slab for working surface
s. Install invert waterproofing membrane
t. Place 2nd invert mud slab for waterproofing membrane protection layer
u. Install rebar , screed system, form bulkheads to place invert concrete
v. Concrete Walls
w. Concrete Mezzanines
x. Concrete Roofs
y. Backfill
z. Remove Decking System / Place permanent utilities
aa. Restore Street

3.3 2nd/Hope Station

The 2nd /Hope Street Station is an underground LRT station and is diagonally oriented between 3rd Street and 2nd Street, Flower Street and Hope Street. The platform level is approximately 93 feet below the plaza level adjacent to Hope Street and General Thaddeus Kosciuszko Way (GTK Way). The station's center platform is accessed from a center concourse level.

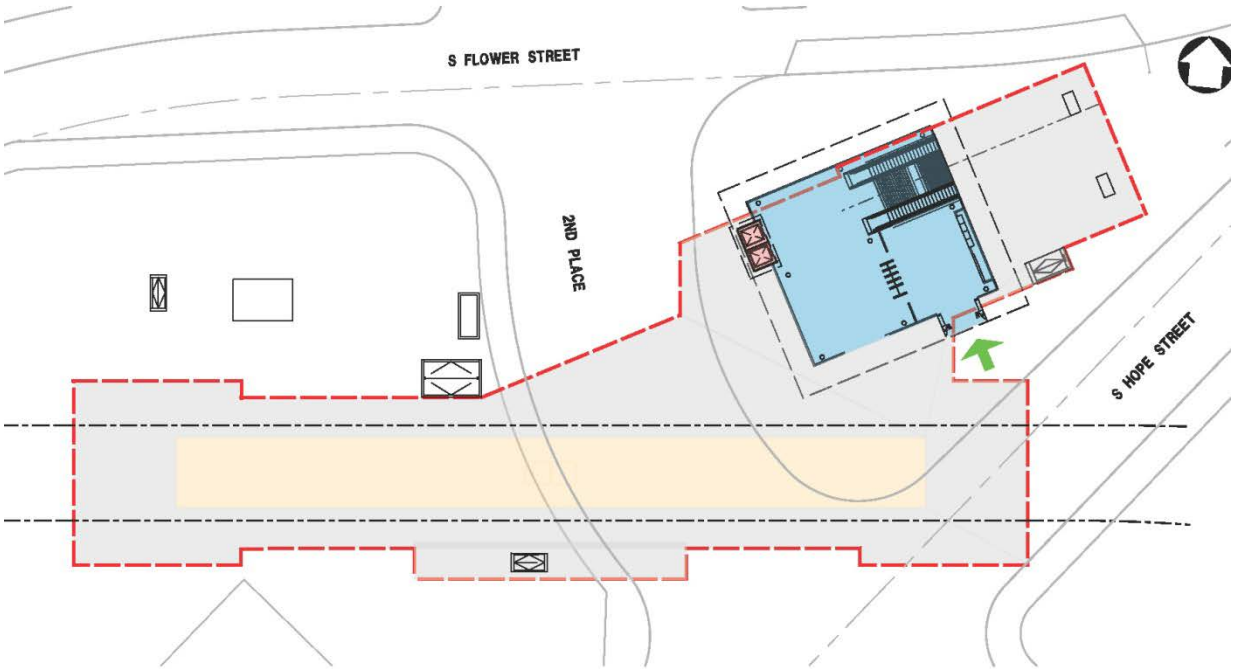
Based on an open cut method of construction, both the existing surface street of West GTK Way and the 2nd Place Bridge will be demolished and only the 2nd Place Street will be reconstructed as an at-grade surface street connection to Flower Street. The ancillary areas, station ventilation shafts and access hatches will be located west of 2nd Place and remotely located from the primary station plaza area so as not to interfere with patron circulation.

Lower northbound Flower Street will be raised to provide a vehicular connection to the new 2nd Place elevation and to Hope Street, 2nd Street and GTK Way. The connection is required due to the elimination of West GTK Way. Hope Street between 2nd Street and GTK Way will be reconfigured to maintain the connections to the Disney Concert Hall and Broad Museum parking entrances.

3.3.1 Station Entrance

The entrance pavilion and the associated kit of parts to connect to the concourse level, is located at the eastern end of the station adjacent to Hope Street between 2nd Street and GTK Way. This portal contains two elevators, two escalator pairs; one up and one down; and two sets of stairs to accommodate the vertical travel distance of approximately 77 feet between the at-grade plaza entrance and the concourse level. A knock-out panel has been included within the concourse level to provide for a future western portal located adjacent to the corner of 3rd Street and Flower Street. The center-loaded concourse has two elevators and two sets of escalators and stairs to the platform level below.

Figure 3-7: 2nd/Hope Station Outline

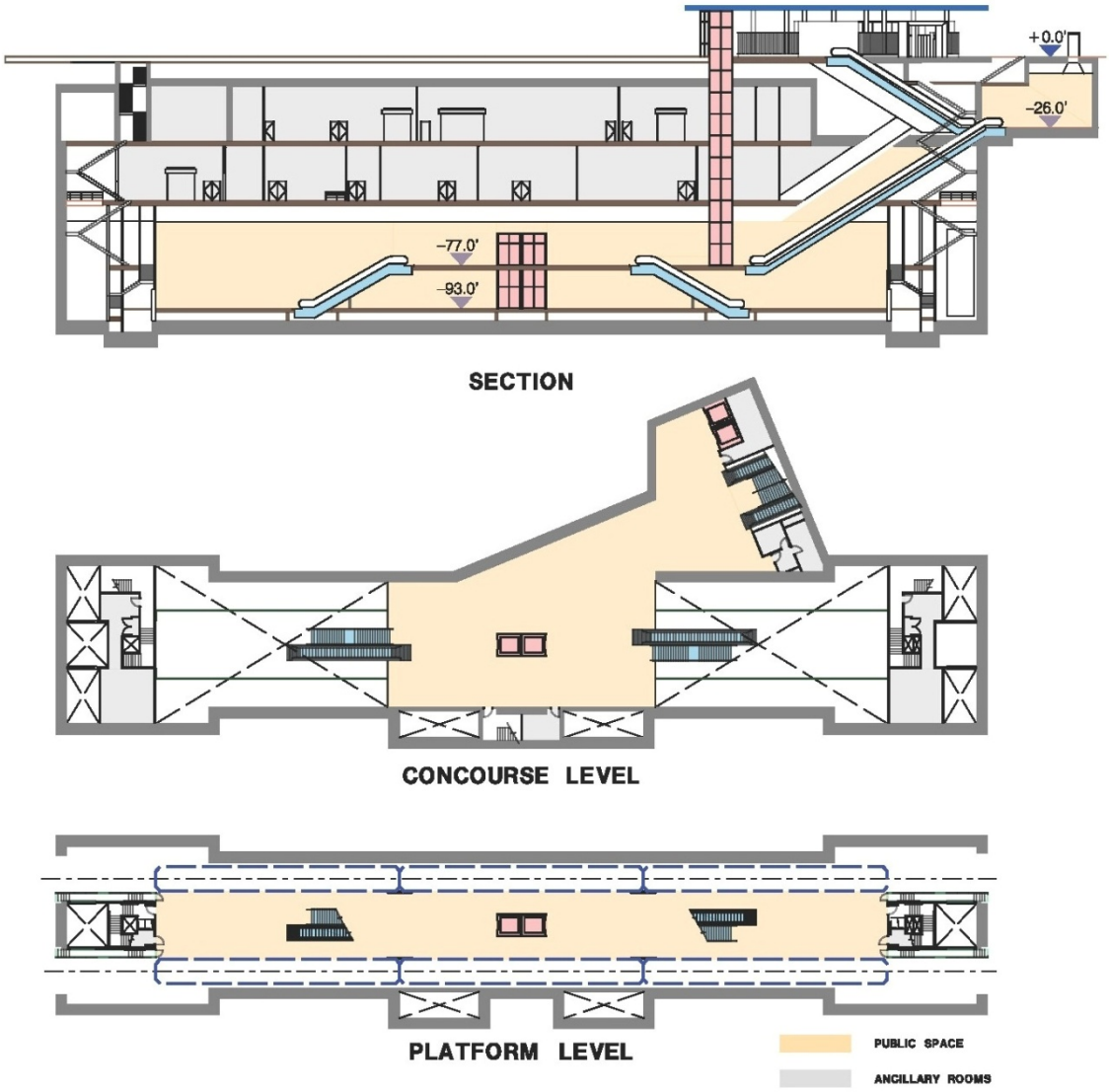


3.3.2 Ancillary Areas

The deep station box between Flower Street and Hope Street allows for the placement of the major ancillary functions above the station box. The double stacked ancillary spaces minimize the amount of fill and reduce the structural roof slab supporting walls.

Emergency exit stairs are located at both ends of the platform level and also from the central concourse level and will terminate within at-grade level exit hatches. All the shafts, access hatches and exit hatches will terminate in areas that are not within the public sidewalks.

Figure 3-8: 2nd/Hope Ancillary Rooms



3.3.3 Construction Method

This station is by far the deepest on the project, a street elevation of approx +365 and an invert of approx + 255 (110 vertical ft). The station begins at STA 29+37 and ends at STA 32+81, with an Ancillary section to the north between 2nd Place and Hope St.

Laydown for the contractor's means, methods and works has been identified on the contract drawings. The anticipated construction area for this station is depicted in Figure 3-9.

Figure 3-9: 2nd/Hope Station Work Area

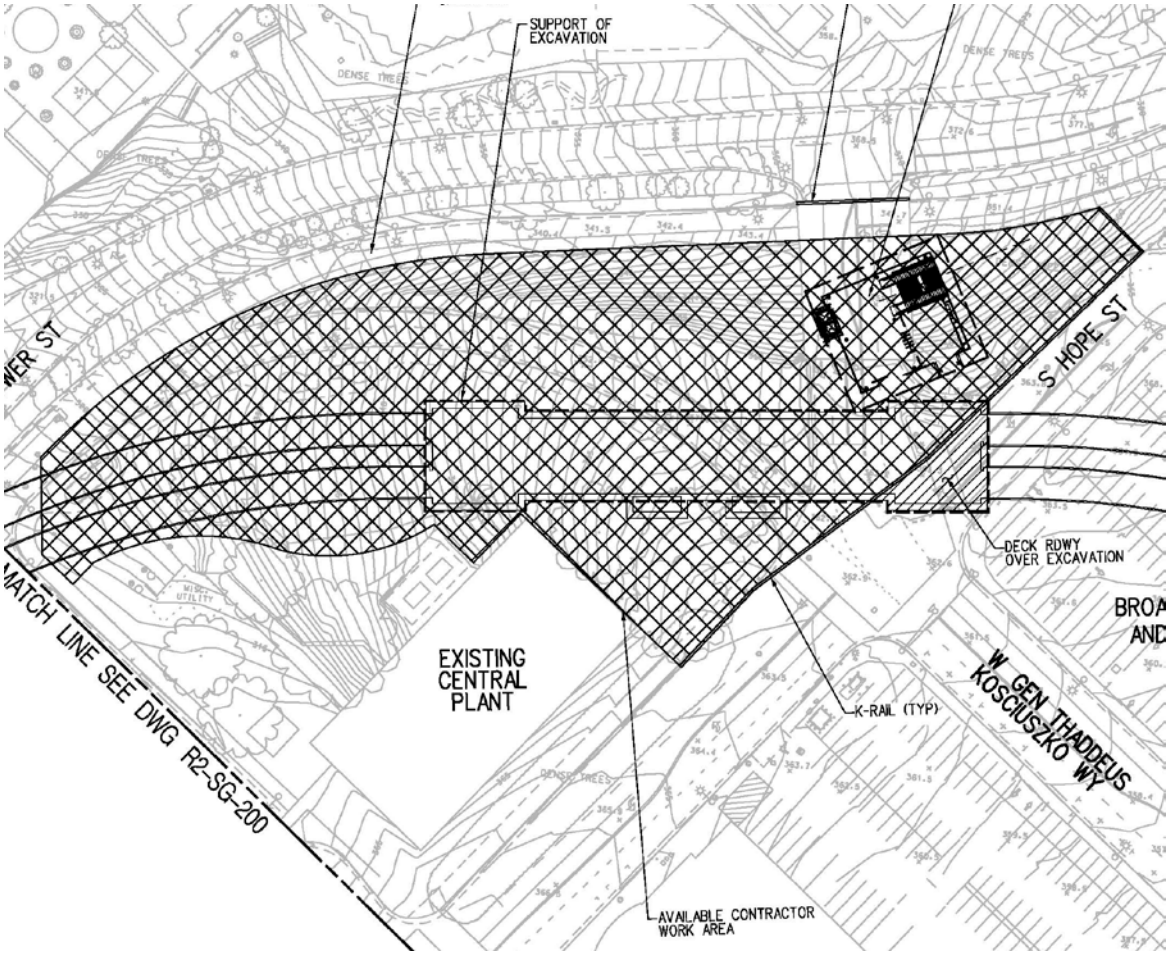
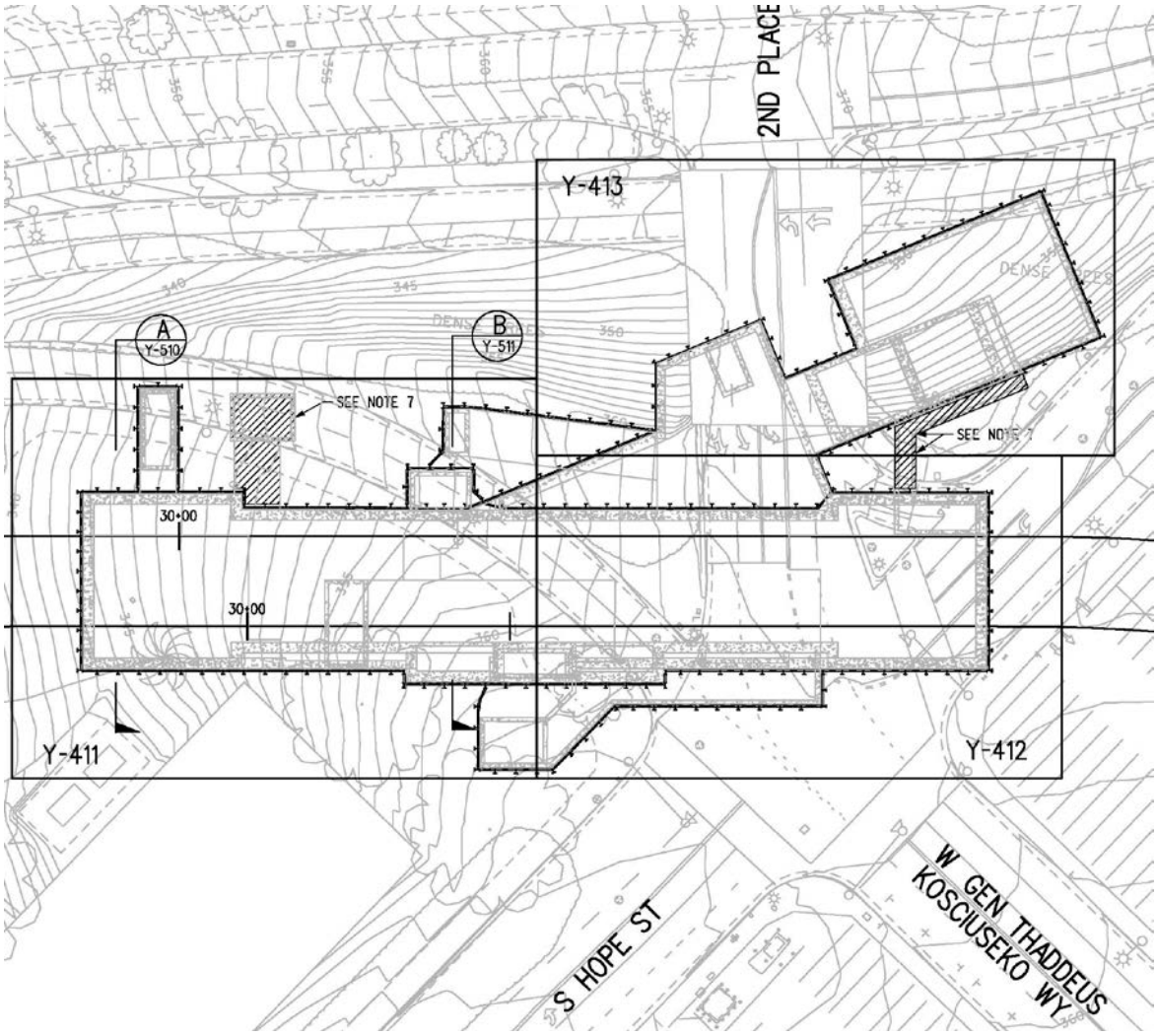


Figure 3-10: 2nd/Hope Station Excavation Support



Anticipated Construction Sequence

a. Contractor will need to demolish portion of 2nd Place bridge to facilitate utility reroutes and the support of excavation of the ancillary open cut. Set up MOT road closures at S Flower & 2nd Place Intersection by bridge
b. Utility Companies perform relocations, re-route around the access ramp from Flower to S Hope St.
c. Utility Companies reroute utilities for EPBM soft-eye at STA 32+81 and utilities in Gen Thaddeus Roadway
d. Install Instrumentation and perform Pre-Construction Surveys prior to construction
e. Perform grouting operation under hot water lines at STA 27+00
f. Contractor to re-grade the area, to build up the low side with temporary retaining wall to create a work space on level ground to south side on the embankment

g. Set up MOT road closures at S Flower & 2nd Place Intersection by bridge
h. Construct EPBM soft eye at STA 29+37 and STA 32+81
i. Install soldier piles on north & south side from STA 29+50 to STA 32+00
j. Install tiebacks from STA 29+50 to STA 31+00
k. Install deck beams and strut system for excavation from STA 31+00 to STA 33+00
l. Hang utilities from deck beams
m. Due to steep grade at north side of ancillary area, there seems to be no area to install tiebacks, this area must be strutted
n. Excavate main station box to facilitate EPBM movement thru the zone, the outer excavations can be done later if schedule is critical for EPBM arrival.
o. During EPBM operations, concrete and finish work can proceed in the Ancillary area
p. After EPBM operations, concrete and finish work can proceed in the Station area

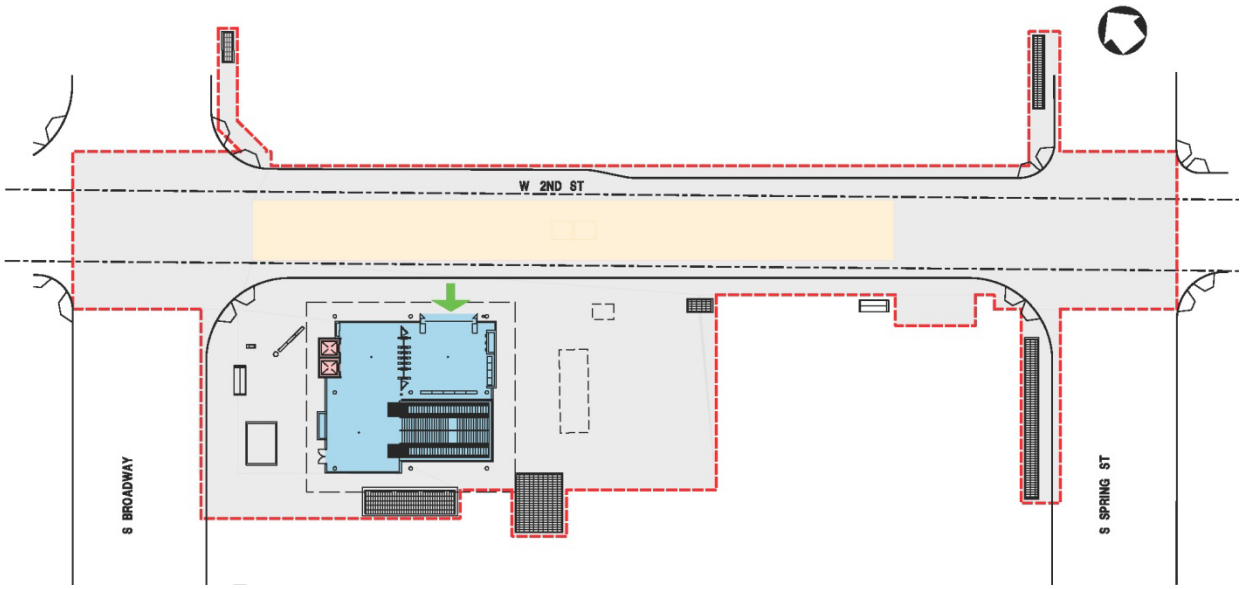
3.4 2nd/Broadway Station

The 2nd & Broadway Station will be bounded by 2nd Street on the north, Broadway on the west , Spring Street on the east and the Los Angeles Times Parking Structure on the north. See Figures 3-11 and 3-12.

3.4.1 Station Entrance

The Station Plaza will incorporate the pavilion entrance elements on the southeast corner of 2nd Street and Broadway using the standard kit of parts with color and texture to reflect elements of design that contribute to the historic value or its surrounding. Emergency exit stair hatches and intake air and exhaust air gratings will be located within the Station Plaza and sidewalk areas to minimize surface intrusions on the eastern half of the station site. A knock out panel is provided on the landing of the plaza to concourse escalator/stair run to not preclude a second entrance oriented toward 2nd and Spring St, which is being included as an Option in the Procurement package.

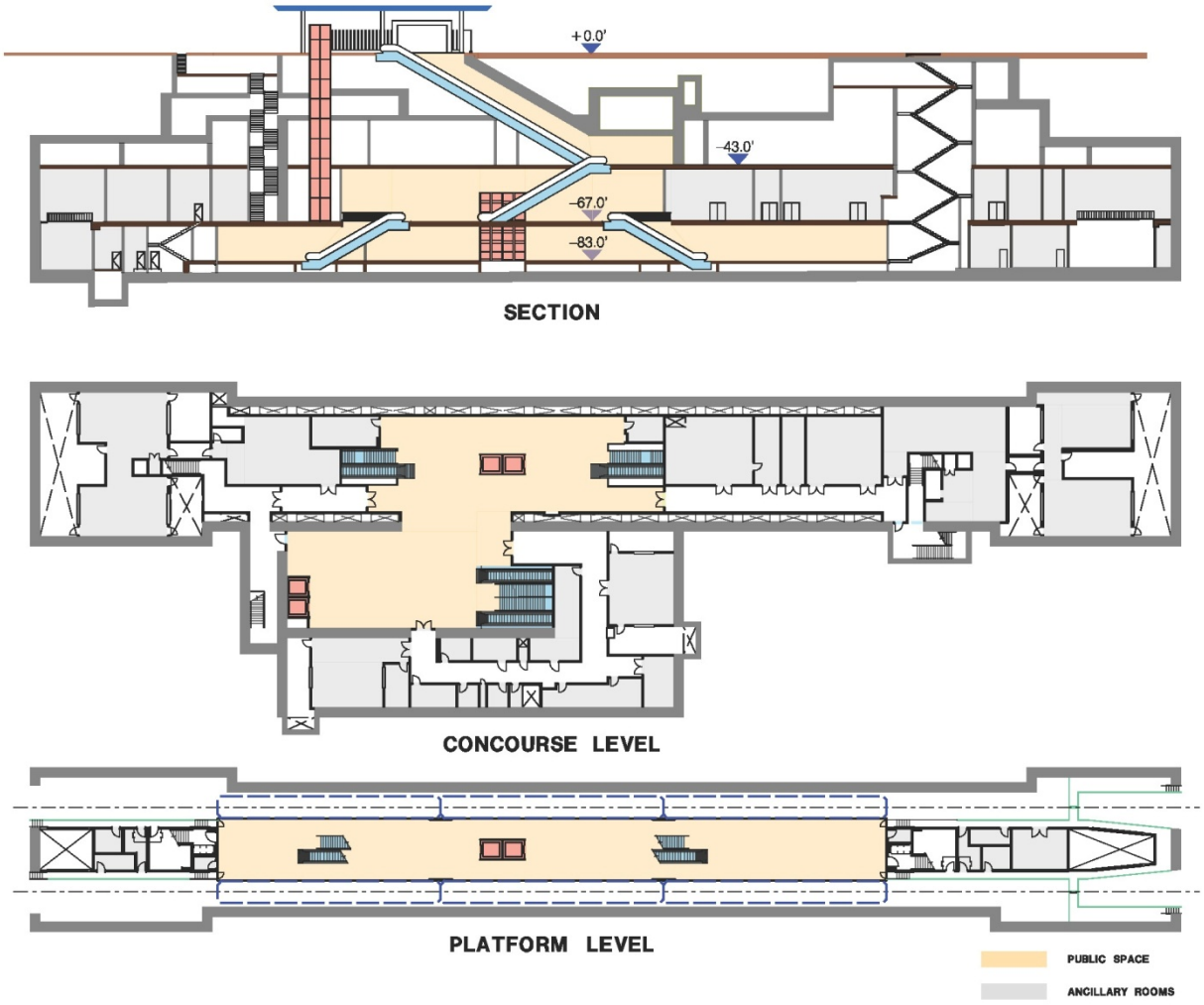
Figure 3-11: 2nd/Broadway Station Outline



3.4.2 Ancillary Areas

The 2nd / Broadway Station platform is approximately 83 feet below the plaza level. The station platform length is 270 feet and the platform width is 25 feet-1½ inches. The public circulation is provided by three pairs of escalators with stairs and two elevators. The emergency exits are provide by two exit stair shafts, one on each end of the platform, and an exit passage through the concourse level to the public entrance at street level. The two level ancillary layout was designed to take advantage of the excavation area above the station box.

Figure 3-12: 2nd/Broadway Station Ancillary Rooms

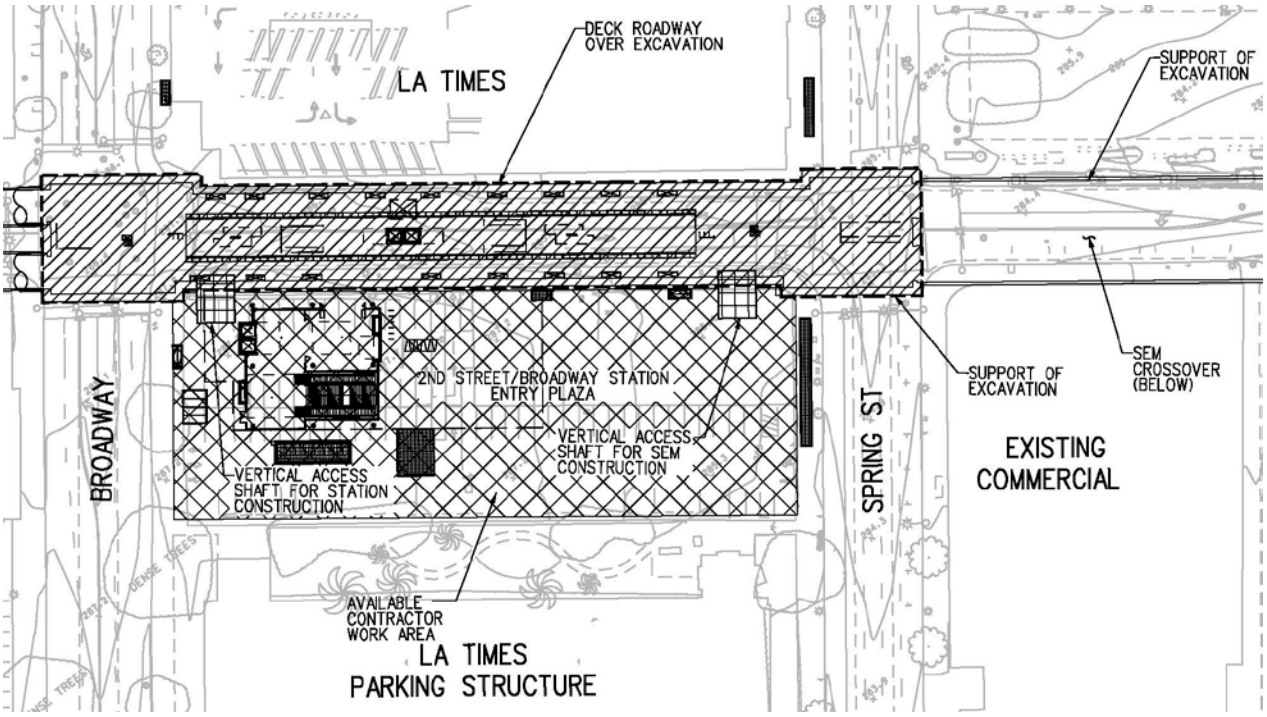


3.4.3 Construction Method

This station is one of the most challenging on the project, with the storm drain and the SEM cavern built into the sequencing. The alignment for this station indicates a street elevation of approx +285 and an invert of approx +195 (90 vertical ft). The station begins at STA 49+50 and ends at STA 53+00, with an ancillary section to the southwest in the vicinity of the LA Times. A sequentially mined cavern crossover (SEM) will be constructed in conjunction with the station concrete, but after both EPBM runs have been made.

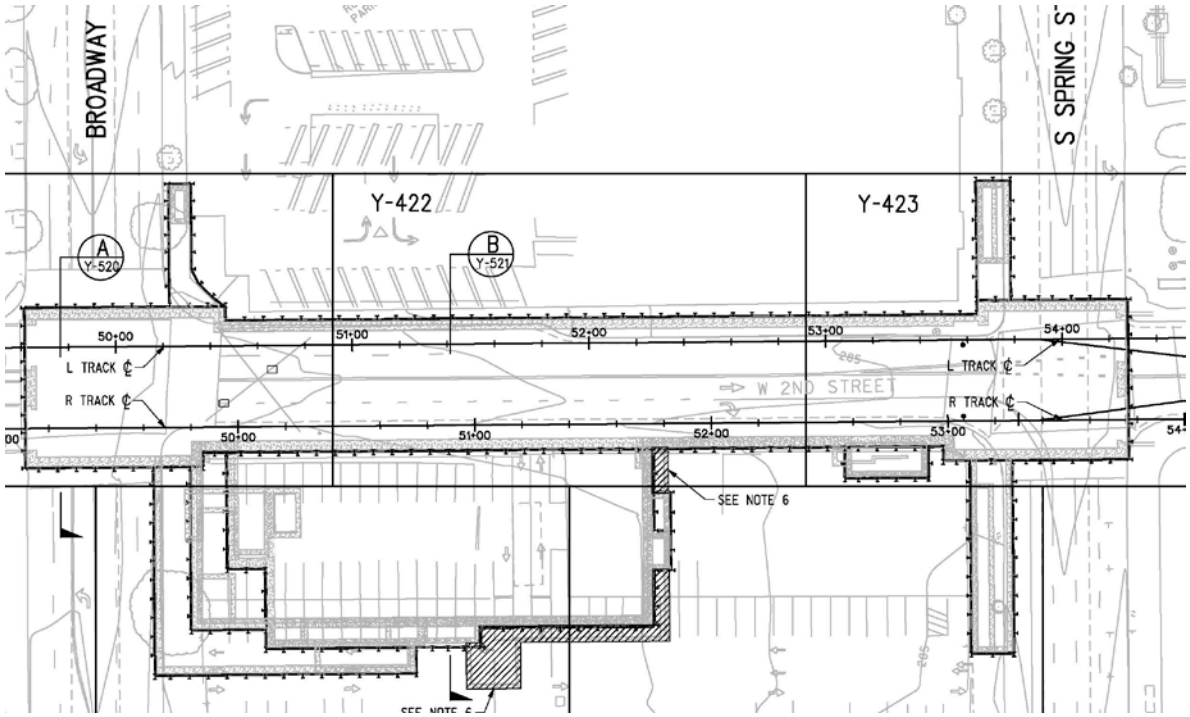
Laydown for the contractor's means & methods and works has been identified on the contract drawings. See Figure 3-13.

Figure 3-13: 2nd/Broadway Station Work Area



The anticipated construction for this station is depicted in Figure 3-13.

Figure 3-14: 2nd/Broadway Station Excavation Support



Anticipated Construction Sequence

a. Utility Companies perform relocations, re-route around areas obstructing soldier piles and relocation of the Storm Drain.
b. Install Instrumentation and perform Pre-Construction Surveys prior to construction.
c. Construct EPBM soft eye @ STA 49+50 and STA 54+00.
d. Set up MOT on south side to install soldier piles.
e. Saw cut pavement / trench to install soldier, header beam over piles and pre-trench for deck installation.
f. Install soldier piles on south side of station.
g. Set up MOT on north side to install soldier piles.
h. Saw cut pavement / trench to install soldier, header beam over piles and pre-trench for deck installation.
i. Install soldier piles on north side.
j. Install flush decking on weekends (Fri 10 pm to Mon 5 am) in 56 ft increments, temporarily ramping down after each weekend installation. Also install temp ramps to building driveways.
k. Excavate thru the deck on the north side to invert of utilities for Contractor to hang in place.
l. Excavate thru the deck on the south side to invert of utilities for Contractor to hang in place.
m. Install soldier piles / sheeting and excavate for new manholes for Storm Drain Diversion to the north.
n. Install soldier / sheeting to create supported space for new Storm Drain line.
o. Construct new Storm Drain line, tie –in to new diversion manhole.
p. Set up and construct two access shaft ways “off the deck – inside Ancillary area” to excavate station.
q. Excavate south side of station box to invert of new Storm Drain, strut to station soldier piles on south side.
r. Begin soldier pile installation and excavation inside south ancillary area.
s. Install extra “pin pile columns rows”, to carry struts from west side to east across station into ancillary excavation area.
t. Excavate within station box to within safe vertical distance of un-mined EPBM tunnels.
u. After 2 EPBM operations, proceed with excavation to top of SEM cavern.
v. Excavate & brace (tiebacks where allowed) station to top of Crossover cavern mined section.
w. Install crown spilling towards crossover cavern.
x. Brace interior section of segments (strut) to excavate “top heading” of the SEM cavern.
y. Demolish tunnel lining segment into EPBM bore.
z. Excavate & brace to invert, install mud slab.
aa. Excavate SEM area to invert and pour mud slab.

bb. Concrete Station, Install finishes and Systems.

3.5 1st/Central Station

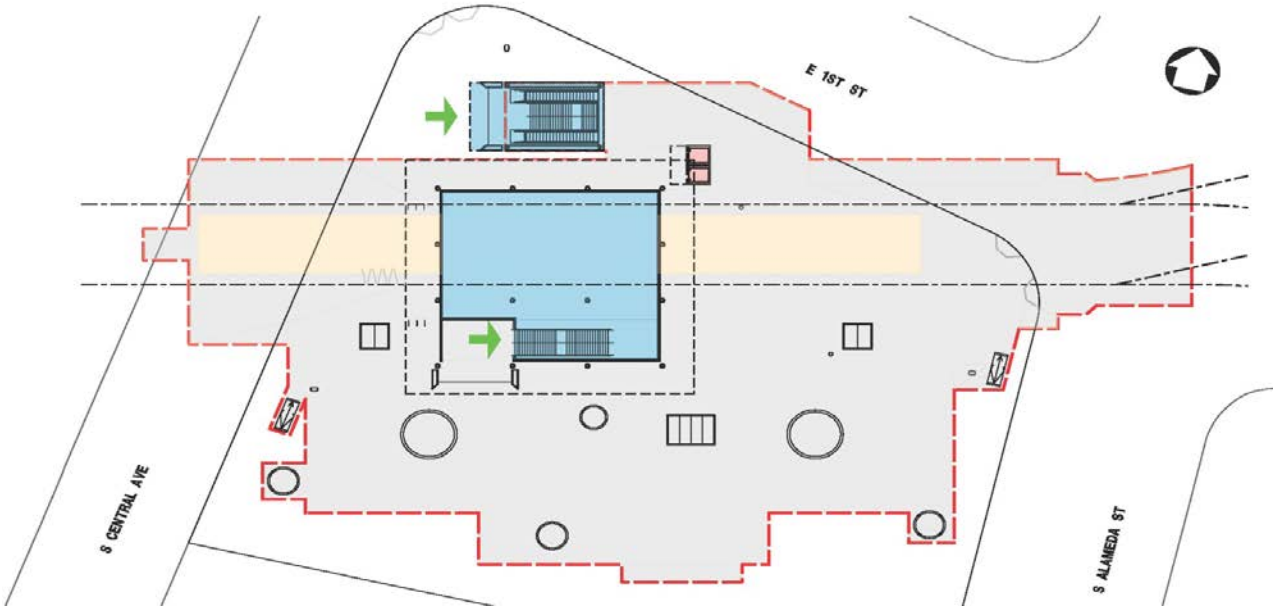
The 1st/Central Avenue station will be located on the south side of 1st Street diagonally between Central Avenue and Alameda Street. This station platform is located approximately 36 feet below the plaza level due to the engineering and community constraints of track alignment. The station alignment and box location was geometrically determined to meet the requirements of the tunnel portal locations on 1st Street and Alameda Street, as well as providing connections to the existing north and east bound Gold Line tracks.. Preservation of the existing Japanese Village Plaza parking structure above the alignment on Central Avenue has also influenced the location of the station box. See Figures 3-15 and 3-16.

3.5.1 Station Entrance

The station entry plaza will utilize selected elements of the pavilion kit of parts. The primary station entrance portal with escalators, stairs and elevators is located on the north side of the station to provide access from the 1st Street historic block, museums, commercial areas and hotels. A secondary entrance stair is located to the south serving other commercial and residential areas. A knock out panel is provided at the concourse level to not preclude a future underground passageway serving the City of LA/Mangrove development site northeast of the station plaza.

The free standing exhaust shafts in the station site are designed to meet the ventilation requirements and as well as sculptural elements for the community which may be utilized for space for cultural and civic displays. The southern part of the plaza is intentionally kept to a minimum to allow future joint development. The 270 feet long LRT standard platform is located approximately 36 feet below the concourse level and is equipped with Metro's standard amenities.

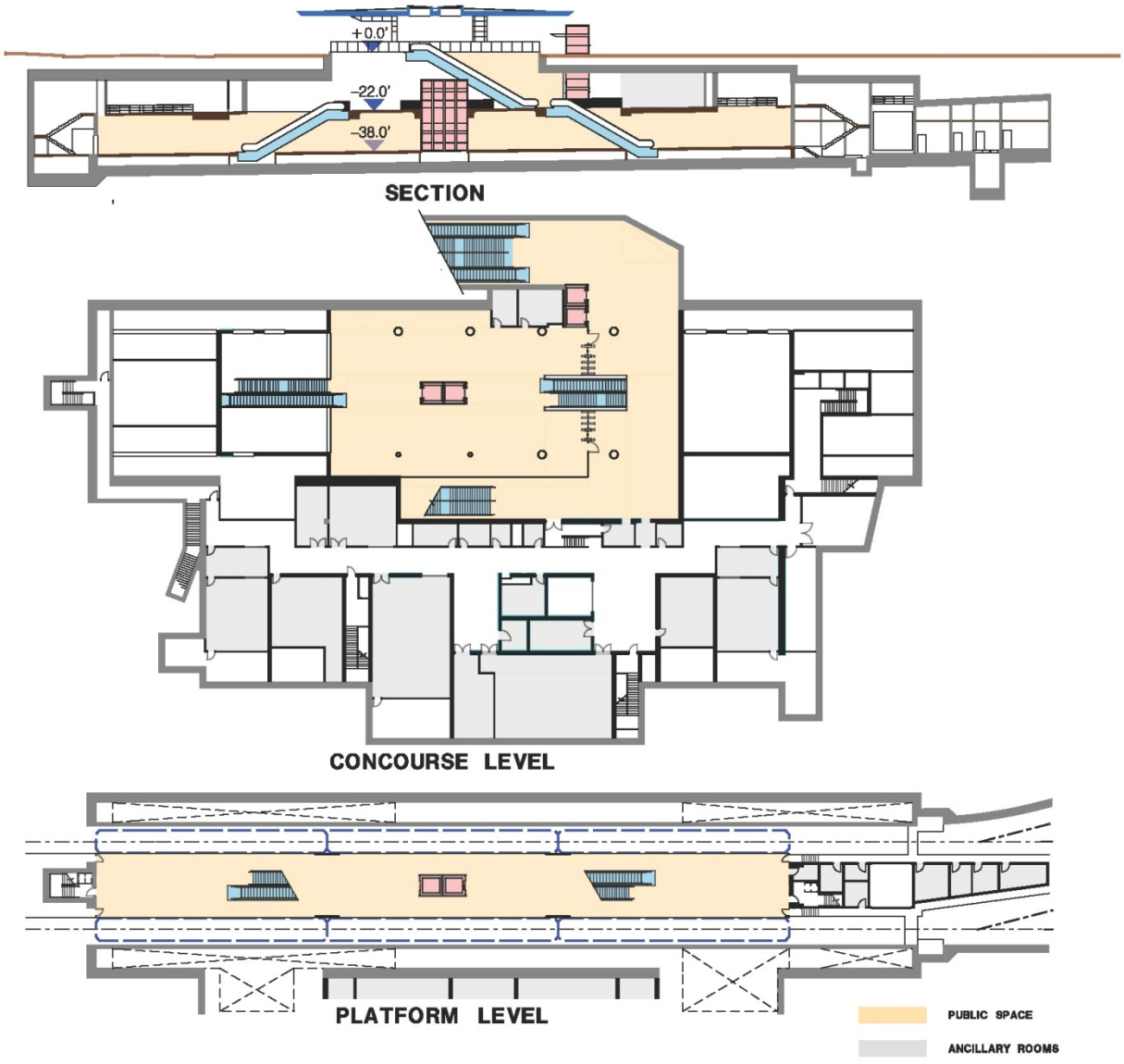
Figure 3-15: 1st/Central Station Outline



3.5.2 Ancillary Areas

The shallow elevation of the station box has also resulted in locating the ancillary space at the south side of the station box on two levels. The emergency exits would be provided from the east and west ends of the station platform as accessible means of egress leading up to the exit hatch on the street level surface.

Figure 3-16: 2nd/Broadway Station Ancillary Rooms



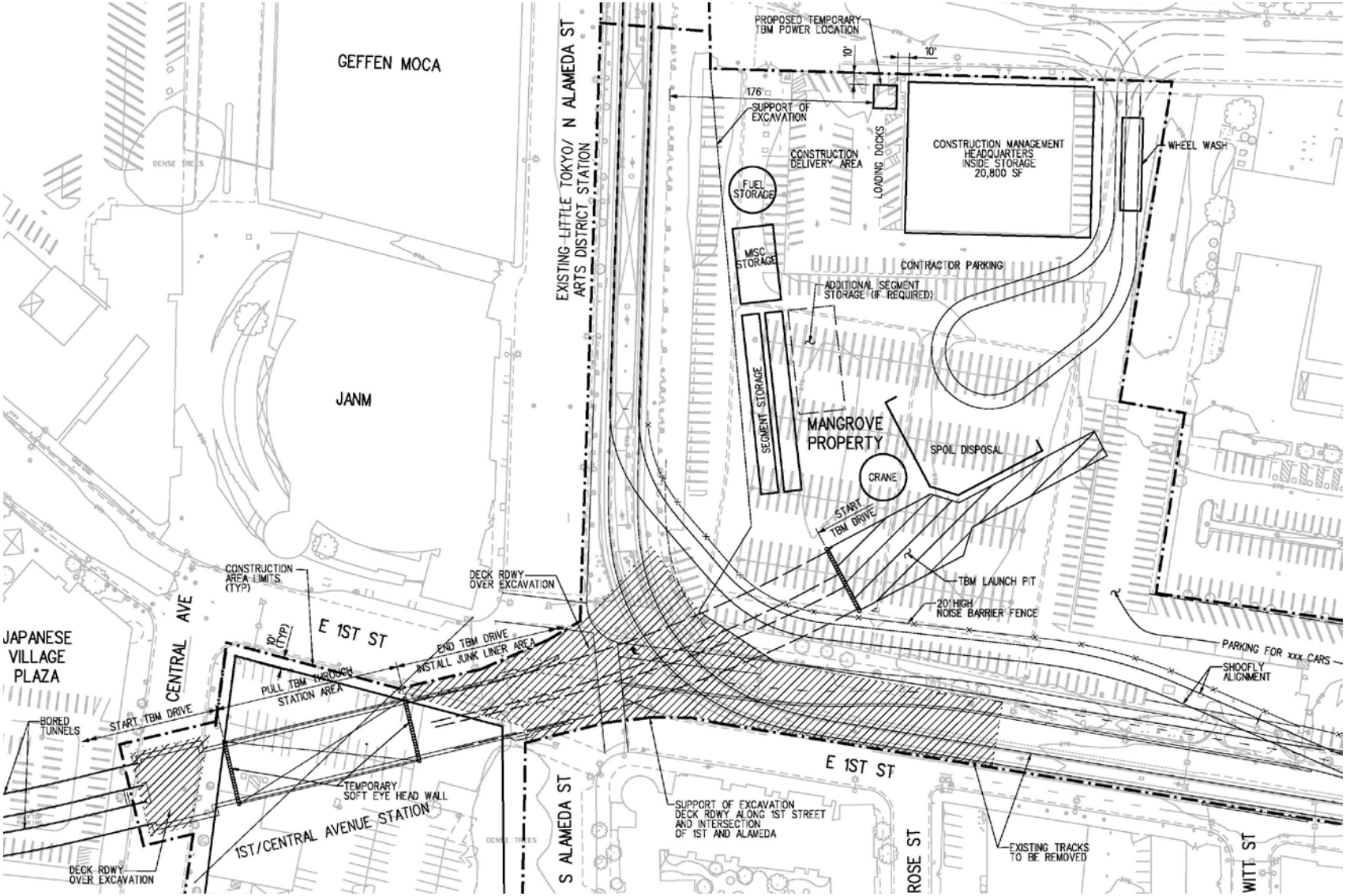
3.5.3 Construction Method

This station also has its challenges, with the complexity of the 1st Alameda Intersection, the proximity to the Gold Line at Little Tokyo/Arts District Station and the need for a Shoo-fly in the Mangrove. The alignment for this station indicates a street elevation of approx +270 and an

invert of approx +220 (50 vertical ft). The station begins at STA 76+45 and ends at STA 80+21, with an ancillary section to the southwest in the vicinity of the LA Times.

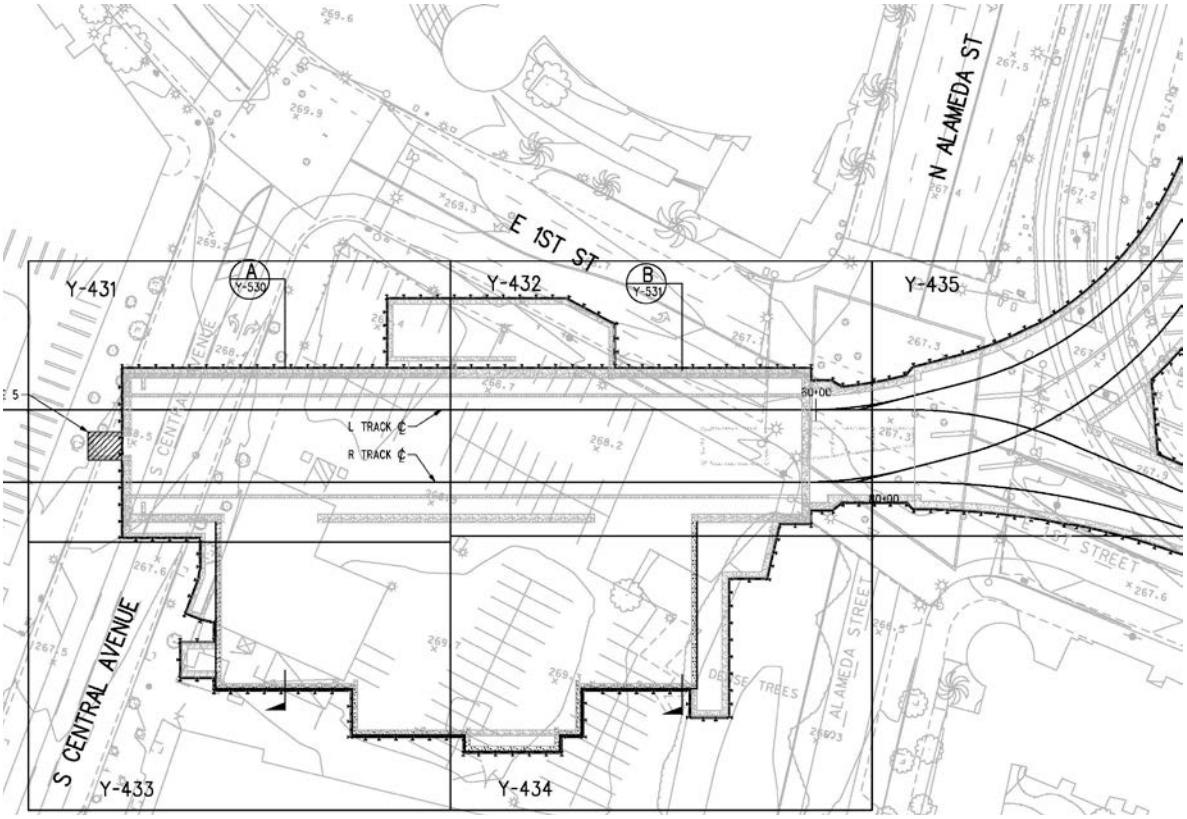
Laydown for the contractor's means and methods and works has been identified on the contract drawings. See Figure 3-17.

Figure 3-17: 1st/Central Station Work Area



The anticipated construction for this station is depicted on Figure 3-18.

Figure 3-18: 1st/Central Station Excavation Support



Anticipated Construction Sequence - 1st & Central Station

a. Set up Site perimeter fencing around station and ancillary excavation.
b. Mobilize trailers and contractor shop & facilities, muck bin, crane pad, set up temporary electric.
c. Install Instrumentation and Pre-Construction Surveys before construction begins.
d. Install soldier piles.
e. Begin excavation, ramp out of excavation pit for trucks.
f. Install tiebacks as excavation proceeds.
g. Excavate station and ancillary prior to EPBM launch.
h. Begin ancillary area concrete operation (invert slab and perimeter walls) during EPBM drive.
i. Utility Companies relocate utilities in Central Ave, not critical to EPBM excavation.
j. Install soldier piles in Central Ave area.
k. Deck over Central Ave area – hang utilities.
l. Utility Companies relocate utilities in Alameda & 1st intersection, not critical to EPBM excavation.

m. Install soldier piles in Alameda & 1st Intersection area, not affecting EPBM.
n. If not maintained in place, relocate 75 in storm drain box, create manhole, install new line & tie – in.
o. Excavate to top of EPBM precast, do not punch in until both EPBM drives are complete
p. Complete EPBM drives, finish excavation under Central and Alameda / 1st Intersection.
q. Concrete station.

4.0 FLOWER STREET

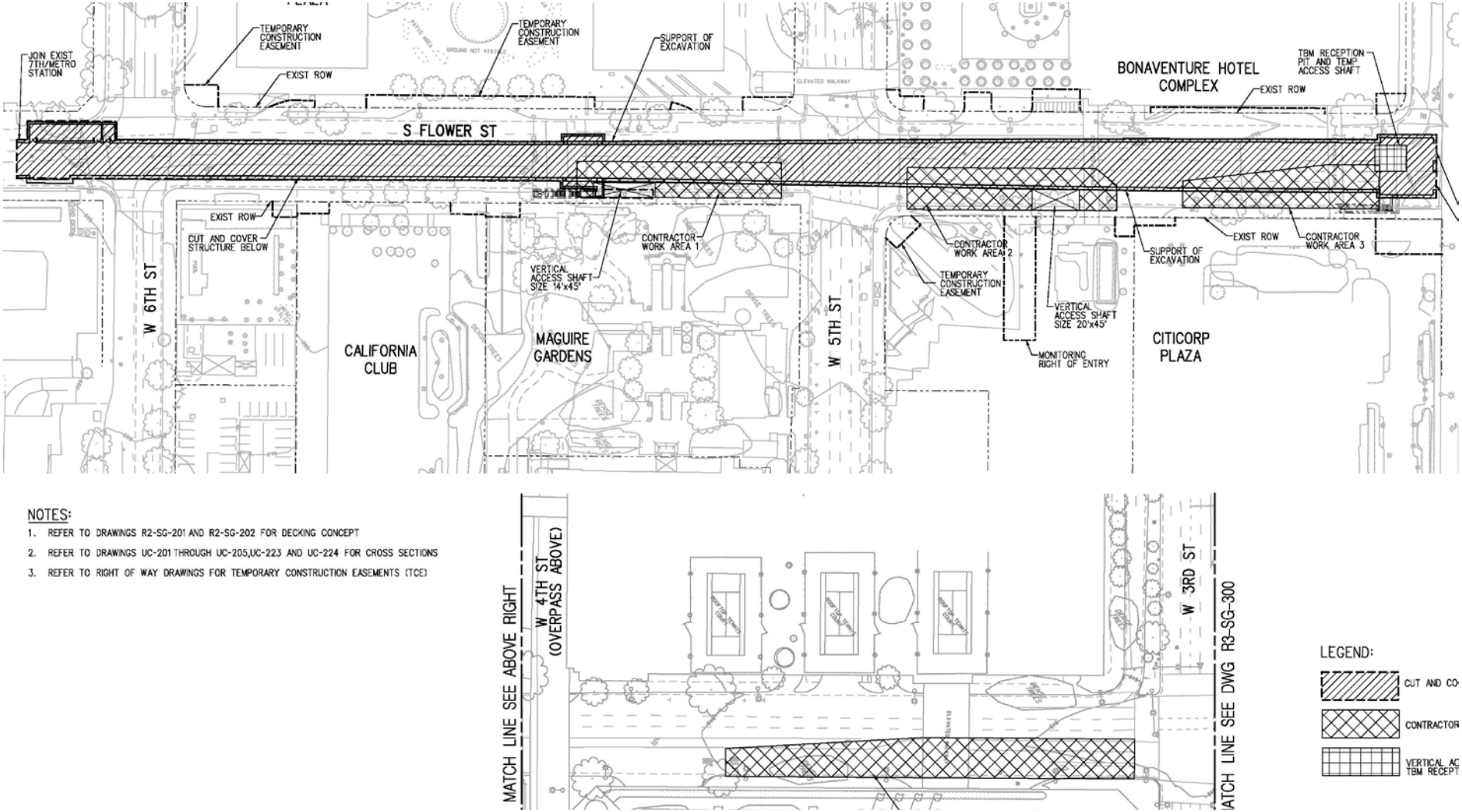
This location also has its challenges, with the complexity of the work in the heart of the business district on South Flower Street, from 4th to Wilshire, abutting the Westin Bonaventure Hotel, Library, California Club, to name a few. The alignment for this area indicates a street elevation of approx +270 and an invert of approx +220 (50 Vertical ft). The project begins at STA 5+50 and ends at STA 19+00, with an assumed EPBM reception pit as part of the cut / cover near STA 19+00.

In addition to relocated or supported-in-place utilities, trenching and street work design and construction for the placement of a new 34.5kV Trainway Feeder duct bank will be required under Flower and 7th Streets. The duct bank will consist of two 5-inch PVC conduits connecting up to a new interface manhole on Flower Street.

Location of existing utilities along Flower and 7th Streets must be verified before the duct bank is installed.

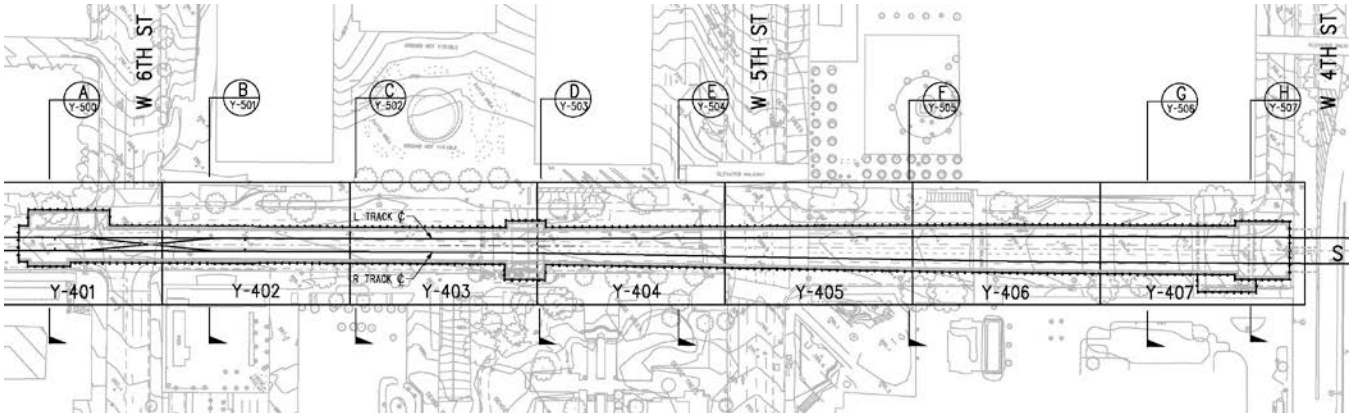
Laydown for the contractor's means and methods and works has been identified on the contract drawings. See Figure 4-1.

Figure 4-1: Flower Street Work Area



The anticipated construction for this station is depicted in Figure 4-2

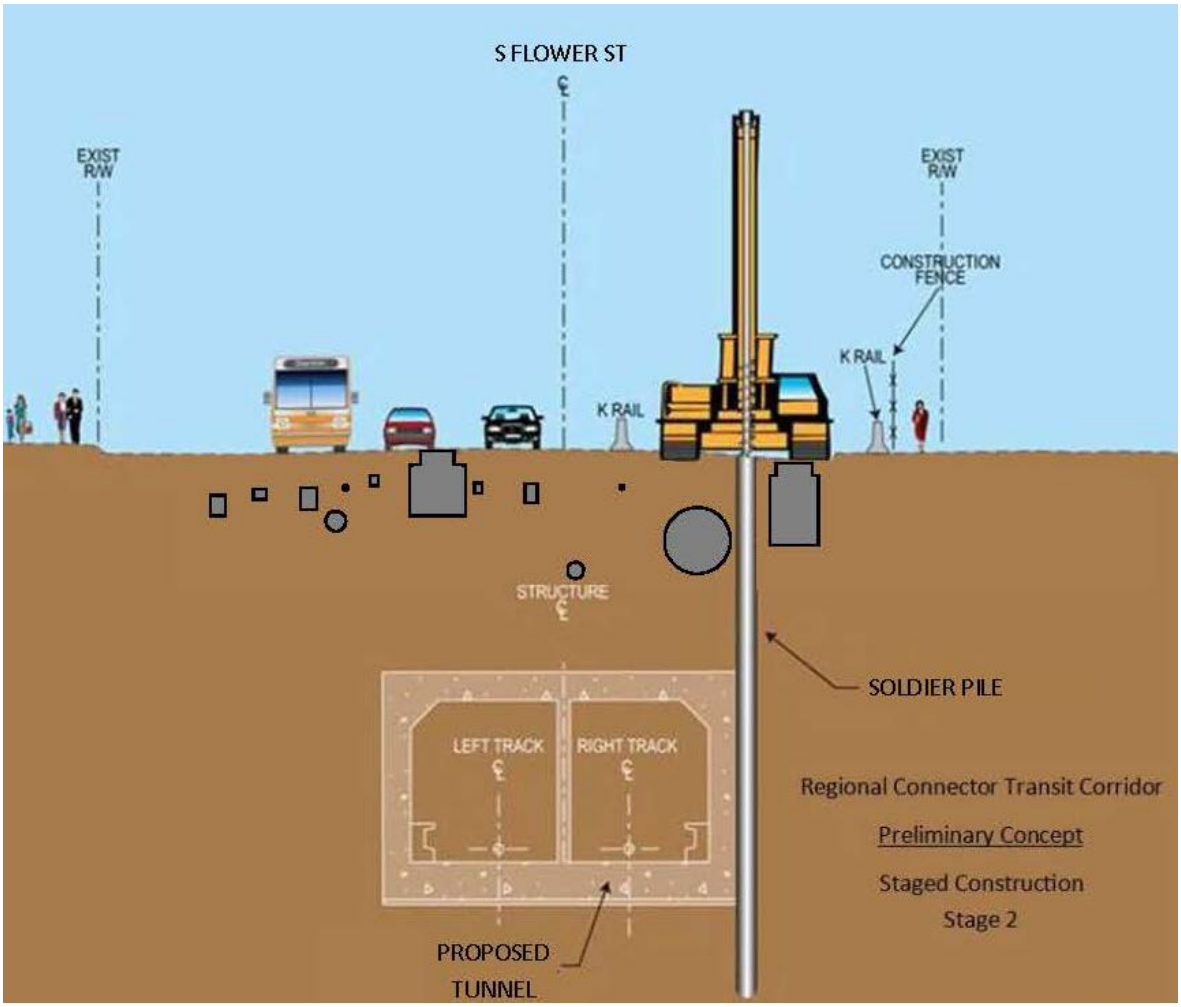
Figure 4-2: Flower Street Excavation Support



Anticipated Construction Sequence

a. Utility Companies perform relocations to facilitate installation of auger piles and soft-eye's at north end of EPBM reception pit.
b. Utility Companies relocate utilities to west side of street, preferably under proposed 3 lanes of traffic to be maintained, thus not interfering with the EPBM reception pit.
c. Utility Companies relocate utilities around the area of the 2 shaft locations thru the deck.
d. Install Instrumentation and perform Pre-Construction Surveys prior to construction.
e. Set up MOT on east side to install soldier piles.
f. Saw cut pavement / trench to install soldier, header beam over piles and pre-trench for raised deck installation.
g. Install soldier piles on east side (See Figure 4-3).

Figure 4-3: Flower Street Excavation Support Cross Section

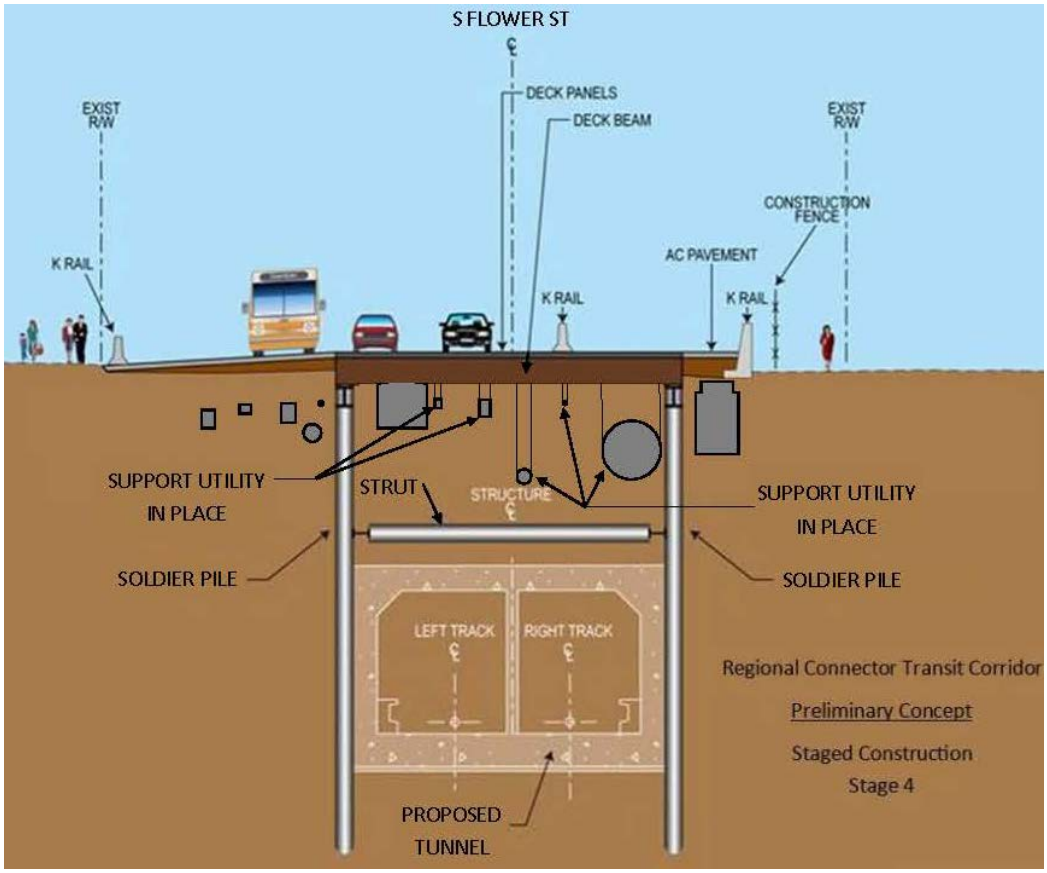


h. Set up MOT on west side to install soldier piles.
i. Saw cut pavement / trench to install soldier, header beam over piles and pre-trench for raised deck installation.
j. Install soldier piles on west side.
k. Install raised decking on weekends (Fri 10 pm to Mon 5 am) in 56 ft increments, temporarily ramping down after each weekend installation. Also install temp ramps to building driveways.
l. Excavate thru the deck on the west side to invert of utilities for Contractor to hang in place.
m. Excavate thru the deck on the east side to invert of utilities for Contractor to hang in place.
n. Set up MOT on east side for remainder of excavation and concrete of station.
o. Create “2 shaft locations” in the deck, each approx 18 ft x 40 ft – to facilitate excavation and concrete operations. Shaft locations should be at approx 25 % of the distance from the excavation limits so that two crews could work multiple

underground headings. Widen out support of excavation piles to east to aid in creating shaft opening as so not to interfere with utilities.

p. Set up contract facilities on the deck and laydown areas, including temporary power, air / water / phone / ventilation / discharge lines for the project
q. Excavate to 1st bracing level
r. Install / weld on beam seats to receive struts
s. Install struts and pre-load if needed. (See Figure 4-4)

Figure 4-4: Flower Street Excavation Support



t. Excavate to 2nd level and so on to invert
u. Place invert mud slab for working surface
v. Install invert waterproofing membrane
w. Place 2nd invert mud slab for waterproofing membrane protection layer
x. Install rebar, screed system, form bulkheads to place invert concrete

4.1 Construction Laydown Area

The contractor will need substantial laydown space to excavate the open cut and concrete the permanent structure. It is envisioned that 3 lanes of traffic would be maintained on the west side of the street, thus giving the contractor area on the east side. It is being considered to provide added laydown space under the overpass on Flower, north of 4th St, on the east side of

the street. Create laydown space / access points thru the deck along the east side of the alignment.

4.2 Deck Beam Installation

a. Pre Fabricate transition ramps, as after every weekend 55 hr period, will require ramps to transition traffic back onto “non raised sections”.
b. Allow for 2 to 3 day full 24 hr intersection closures, as the intersections are larger than 50 ft and thus take more time. The deck must be complete across an intersection in one complete outage.
c. Deck beam installation is expected to be full width, no splice or center pin pile.
d. Install precast concrete slabs and install on neoprene pad.
e. Deck installation is shown from curb to curb, yet support of excavation piles are interior of the deck ends, thus blocking of the deck or another row of piles may be needed to stabilize the deck.
f. Drainage against sidewalk K-rails should be allowed for, so as not to flood sidewalk or driveways from raised deck.

4.3 Reception Pit for EPBM (Earth Pressure Balance Machine)

4.3.1 Anticipated Construction Sequence

a. Utility Companies perform relocations to facilitate installation of auger piles and soft-eye’s at north end of EPBM reception pit
b. Utility Companies relocate utilities around the west side of the EPBM reception pit, so as to create a “ clear path to the surface ” to remove the EPBM
c. Install Instrumentation and required Pre-Construction Survey before construction begins
d. Set up MOT on east side to install soldier piles
e. Install a row of pin piles on center line between EPBM bores, to facilitate (½ deck removal) to take out the EPBM on the west side
f. Saw cut pavement / trench to install soldier, header beam over piles and pre-trench for raised deck installation
g. Install soldier piles on east side (close exit from Parking Garage)
h. Set up MOT on west side to install soldier piles
i. Saw cut pavement / trench to install soldier, header beam over piles and pre-trench for raised deck installation
j. Install raised-decking on weekends (Fri 10 pm to Mon 5 am) in 56 ft increments, temporarily ramping down after each weekend installation. Close exit from Parking Garage for decking installation
k. Excavate thru the deck on the west side to invert of utilities for Contractor to hang in place
l. Excavate thru the deck on the east side to invert of utilities for Contractor to hang in place

m. Set up MOT on east side for remainder of excavation and concrete of EPBM reception pit.
n. Place mud slab and “curved cradle invert” to receive EPBM into the reception pit.

5.0 TUNNELS

The environmental review process resulted in identifying two major project constraints for tunneling: the direction of tunnel driving, and the location for servicing tunnel operations. Tunneling from west to east was deemed to have relatively greater community impact and undesirable site conditions with limited access and very limited space to setup the plant for tunneling (crane, temporary muck storage, segments storage, shops, and the like). Tunneling from east to west is required. As a mitigation of impact to the Little Tokyo community, tunneling is not to be done from the 1st/Central station box excavation as would typically be the case, but from across S. Alameda Street in what is termed "the Mangrove Site."

The initial concept for starting tunneling was to first excavate and deck over the 1st and S. Alameda intersection, then drag/skid the EPBM under the intersection to the tunnel heading at the west end of the 1st/Central Station box. This approach required either relocating or supporting in place several utilities in the busy 1st/S. Alameda intersection. The time to do this utility work was found to be lengthy and had a substantial risk of being delayed by interference among the many utilities and managing traffic around the busy intersection. Since tunneling is a critical path activity on the project, a delay in getting the intersection decked over and excavated to tunnel depth would automatically result in extending the overall project duration.

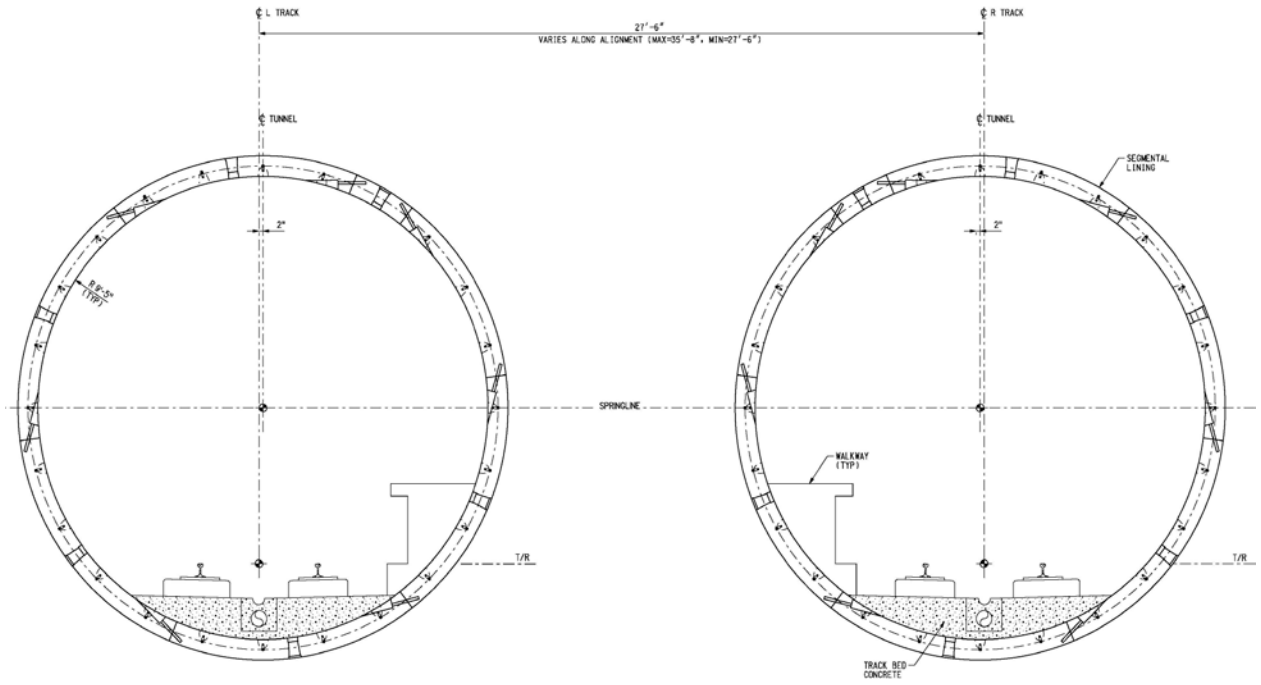
In order avoid the utility and decking schedule risk, the project has adopted for purposes of developing the construction schedule a major risk mitigation, namely to mine under the intersection from the Mangrove property. Tunneling under the intersection avoids excavating the intersection "from the surface in the middle of the intersection." This eliminates the high risk of utilities not being relocated in time. It also takes off the critical path issues with co-ordination with LADOT for lane closures, with supporting in place of a major storm drain, and simplifies staging and co-ordination of the Shoo-fly to maintain Gold Line rail services. The Contractor is not mandated to tunnel under Alameda, but is required to setup the TBM and tunnel service from the Mangrove Site.

The use of 1 EPBM was assumed and this methodology results in a schedule that fits within the project duration. The PE does not preclude the use of 2 EPBM's by the D/B contractor, it is ultimately his means and methods as well as schedule analysis that will dictate 1 or 2 EPBMs. In addition, the D/B Contractor would need to procure additional power (as described in Section 2.3) if he elects to use 2 EPBM's.

The use of pressure faced technology is a project requirement, with the given ground conditions, the EPBM is the technology assumed in this approach, the D/B contractor may elect to use other technology, such as Slurry machines.

Precast segments will be installed with grouting of the annular space, as mining progresses. (See Figure 5-1)

Figure 5-1: Bored Tunnel Cross Section



The "timing of the EPBM advance", with the construction sequence and duration of the cut/cover excavation will dictate whether or not the "EPBM is walked thru or mined thru a cut / cover location".

This approach assumes the following:

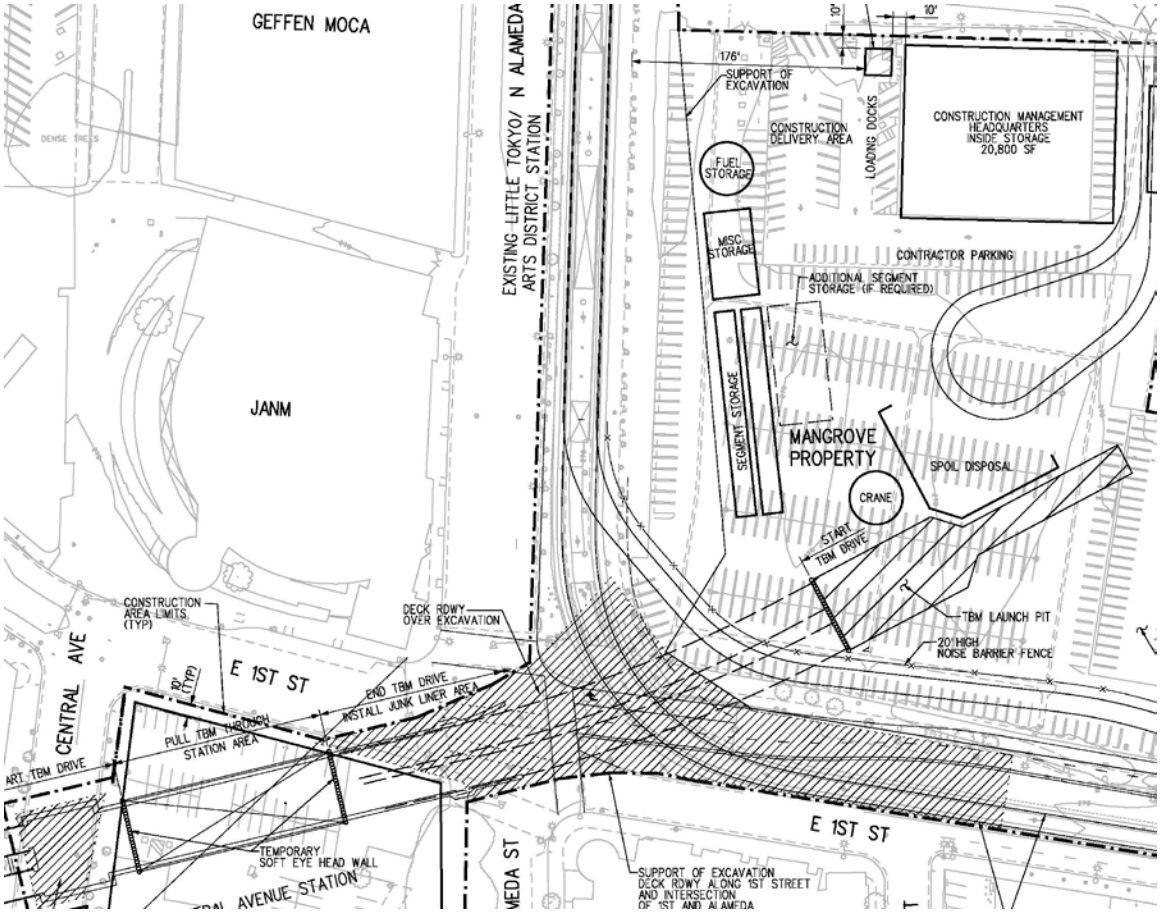
- Mine thru the 1st Alameda Intersection
- Walk thru the 1st Central Station
- Mine thru the SEM and 2nd Broadway Station
- Walk thru 2nd Hope Station
- Mine into a previously excavated reception pit @ STA 19+00 in Flower St.

5.1 Mangrove Site/EPBM Launch/Shoo-fly

The Mangrove site has been dedicated to the EPBM operations location. Per the EIS, this is the only location that can handle EPBM excavated material (muck), and is the only location the D/B Contractor can initially launch and then re-launch the EPBM.

With this purpose a plan was established for a "launch box" within the site, along with a risk mitigation of mining under the 1st / Alameda intersection, so that the complexity of the Shoo-fly construction, massive utility relocation in the intersection, co-ordination of lane closures with DOT, would not hold up the EPBM works. (See Figure 5-2)

Figure 5-2: 1st/Alameda Work Area



5.1.1 Anticipated Construction Sequence – Mangrove Site EPBM Launch

a. Set up Site perimeter fencing.
b. Mobilize trailers and contractor shop & facilities, muck bin, precast laydown, crane pad, set up temporary electric.
c. Utility Companies relocate utilities as called for to facilitate construction.
d. Construct soft-eye inside Mangrove yard, near the vicinity of the “Y- Section”, so that the EPBM can be launched inside the Mangrove site in a 250 ft long deep trench, approx 50 ft deep x 60 ft wide. This trench will facilitate launch of the EPBM and handle 2 – muck trains. Grouting may be needed for the width of the reception pit and for approx 2 EPBM diameters.
e. Construct soft – eye inside the Station area at STA 79+00, so the EPBM can mine from Mangrove, under the Alameda Intersection, and hole –thru into the pre-excavated station area. Jet grout are may be needed for the width of the reception pit and for approx 2 EPBM diameters.
f. Construct a soft – eye inside the station area at STA 77+00, just east of the boundary of Central Ave, so the EPBM can re-launch from here. Jet grout are

may be needed for the width of the reception pit and for approx 2 EPBM diameters.

g. Construct a soft –eye just west of Central Ave at STA 76+40, so that after the EPBM drive is completed, the station excavation from STA 76+40 to STA 77+00 can be completed.
h. Pre-excavation grout thru the soft-eye, under the 72 inch Storm Drain under Alameda intersection, to better stabilize soil before EPBM under this area.
i. Pre-excavation grout to stabilize soil near storm drain and sensitive building structures, construct shafts and grout ground ahead of EPBM arrival.
j. Install Soldier piles in the vicinity of the Y- section (100 LF) before EPBM drive.
k. Install ground monitoring instrumentation and take baseline readings before EPBM mining begins.
l. Perform Building Pre-Construction Surveys before EPBM mining begins.
m. EPBM mine from Mangrove yard just north-east of the soft –eye in the yard thru the intersection under South Alameda and 1st St – utilize junk segments which will be discarded.
n. Hole thru into previously excavated station, drag EPBM across station and re-launch from STA 76+40.
o. Soft eye end panels need to be installed at 2nd Broadway / 2nd Hope and Flower St prior to EPBM arrival.
p. Walk thru Station or mine thru station, depending on progress of station excavation.
q. Mine to the end and remove from reception pit.
r. Truck back EPBM to Mangrove & re-launch.

5.1.2 Anticipated Construction Sequence – Shoo-fly/1st and Alameda Decking

a. Figures 5-3 to 5-6 depict the sequence of construction the vicinity of the Mangrove, Shoo-fly and 1st Alameda Station. (See Figures 5-3 to 5-6)

Figure 5-3: 1st/Alameda Construction Staging Drawing R5-SG 521

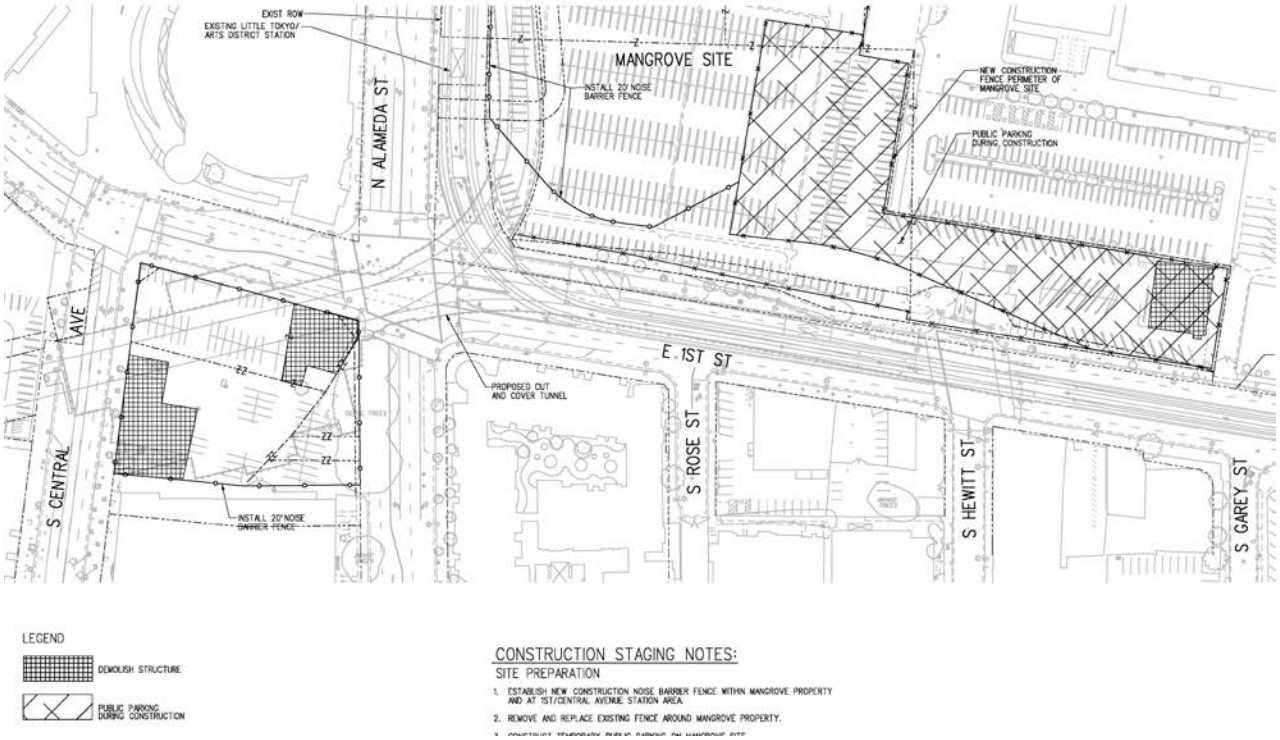


Figure 5-4: 1st/Alameda Construction Staging Drawing R5-SG 522

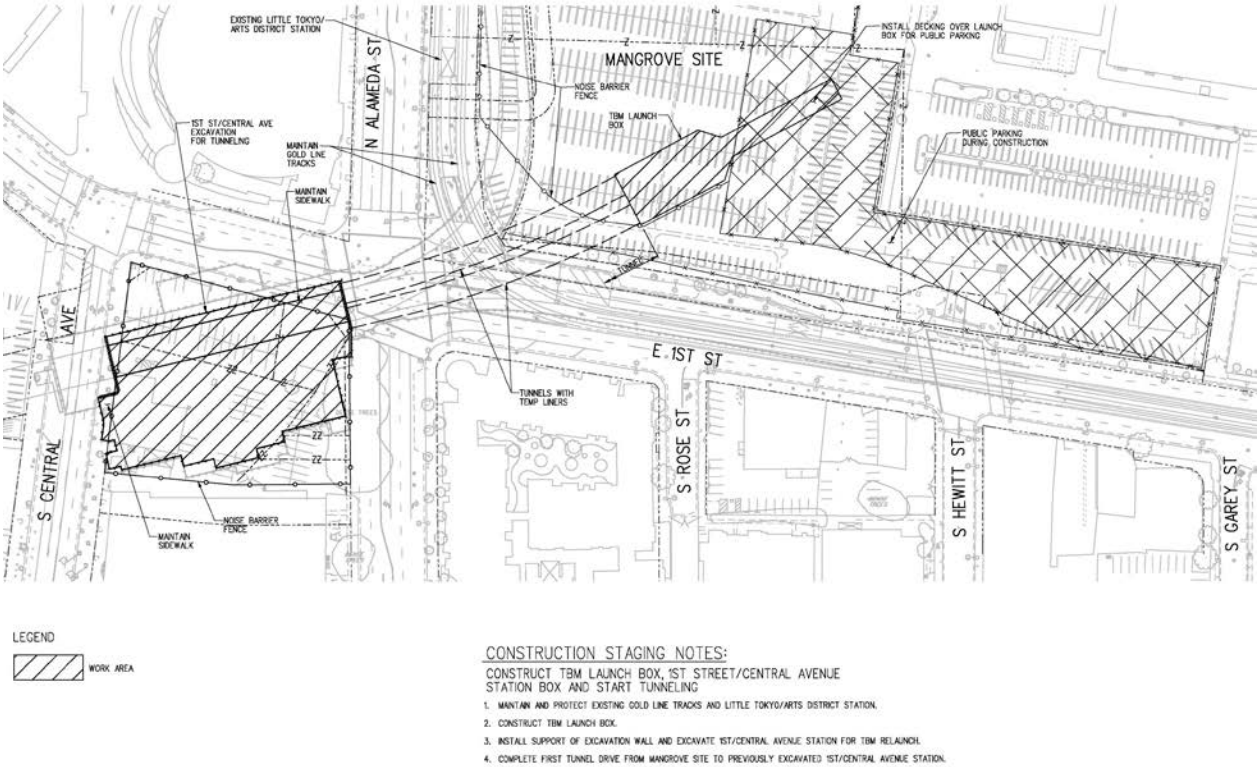


Figure 5-5: 1st/Alameda Construction Staging Drawing R5-SG 523

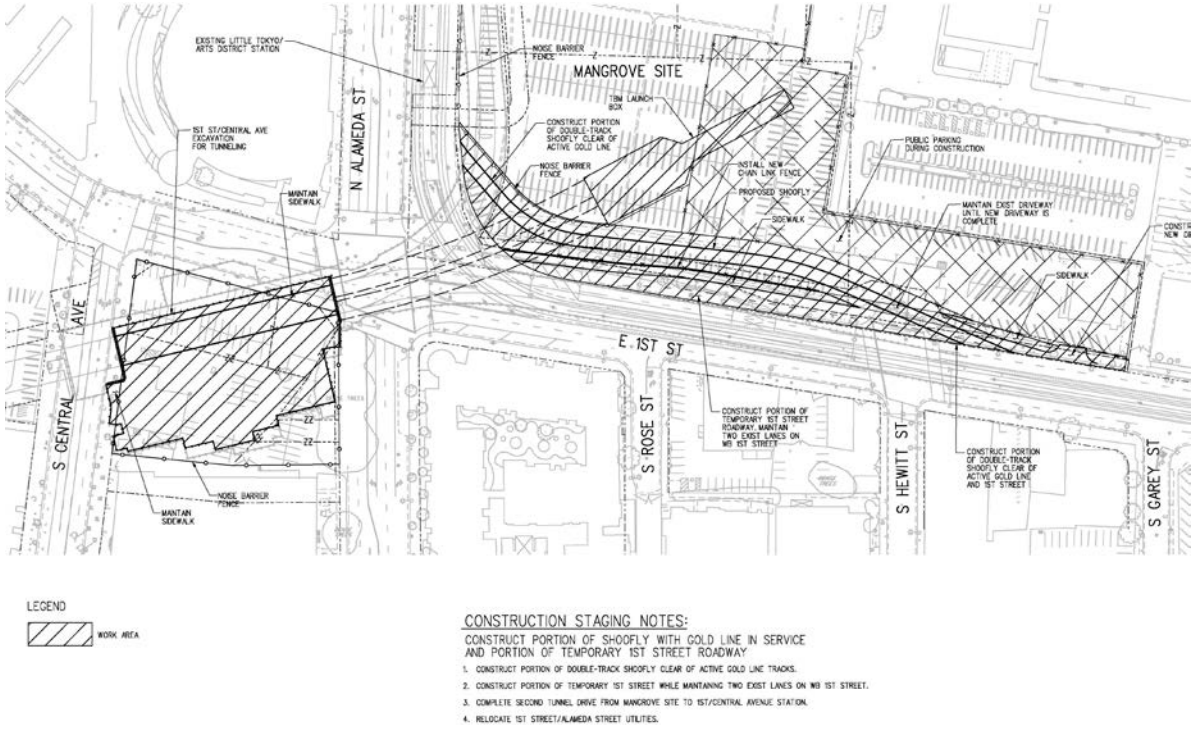
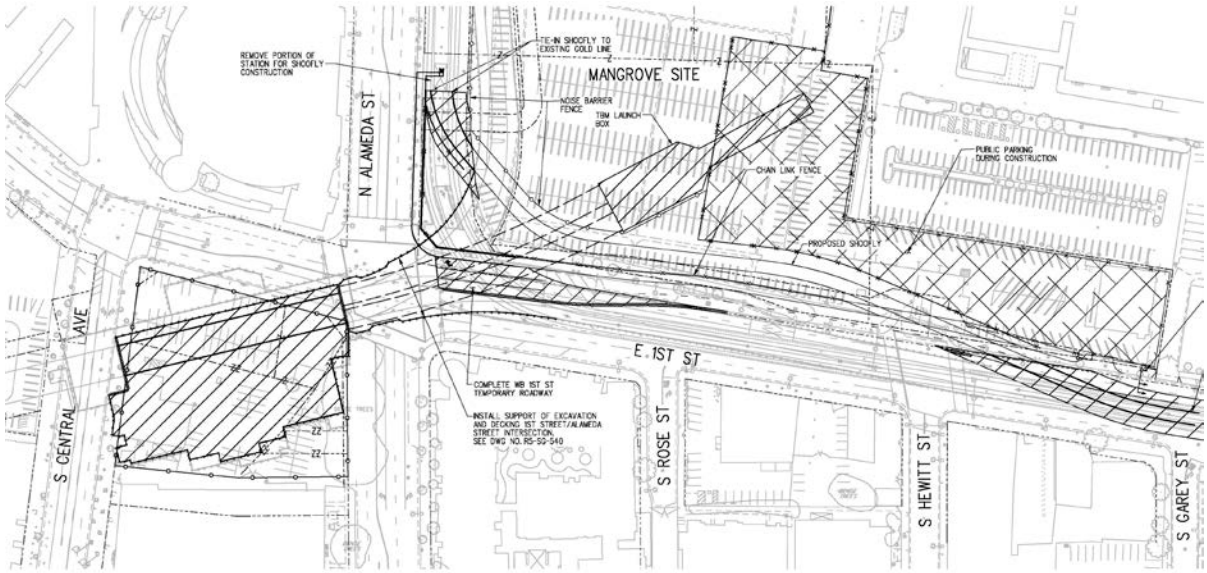


Figure 5-6: 1st/Alameda Construction Staging Drawing R5-SG 524



b. EPBM operation is now independent of the Shoo-fly and the intersection. Eventually the segments installed under Alameda intersection will be removed during cut / cover.
c. Relocate utilities ahead of decking installation in the intersection
d. Install raised decking during EPBM drive
e. Install Shoo-fly during EPBM operations

5.2 Protection of Buildings Adjacent to TBM Tunnels

The Building and Adjacent Structure Protection Report discusses the methods and results of the assessment of the buildings adjacent to the bore tunnels between approximate STA 19+00 and 76+50.

A total of 33 buildings were evaluated using a two-stage procedure: preliminary assessment and second stage assessment. As the result of the preliminary assessment, sixteen buildings were considered unaffected or subject to negligible damage, and seventeen buildings were subjected to second stage assessment using the Boscardin and Cording method. Of these, nine buildings have maximum anticipated damage levels ranging from “Negligible” to “Very Slight”; one building (RC-420) have an anticipated “Slight” damage level; four buildings (RC-450, RC-453, RC-454, and RC-454A) have an anticipated “Moderate” damage level; and three buildings (RC-449, RC-451, and RC-451A) have an anticipated damage level ranging from “Severe” to “Very Severe”.

Detailed analyses were performed for the Higgins Building (RC-436) and Broad Museum (RC-420) in addition to the Boscardin and Cording analysis because of the particular characteristics of these buildings and the adjacent underground excavations. For the Higgins Building, analysis indicates that the building will experience an overall damage level “Negligible” due to the excavations of the bored tunnels and the crossover cavern. The analysis for the Broad Museum indicates that total settlements of up to 0.5 inches can result if tunnel excavation produces a volume loss of 0.5% per tunnel. However by performing bentonite injection through the tailsheild, it is expected that the annular gap between the overcut and the shield can be fully pressurized and the volume losses can be controlled to 0.25% per tunnel. This will limit the total maximum settlement under the building to 0.25 inches and no significant damage is expected to the building.

Ground improvements required in the mixed face zone to mitigate impacts to the LA County Storm Drain will result in a reduced ground loss of 0.5% (instead of 1% as expected for tunnel excavation in unimproved mixed face ground). As a result, the buildings RC-453, RC-454, and RC-454A were reanalyzed using the reduced ground volume loss (0.5%). The analytical results indicate a maximum anticipated damage level “Very Slight” for these buildings. In conclusion, of 33 buildings adjacent to the bored tunnel sections, four buildings (RC-449, RC-450, RC-451, and RC-451A) are anticipated to experience unmitigated damage levels from “Moderate” to “Very Severe”; the remaining buildings are anticipated to experience unmitigated damage level “Negligible” to “Very Slight”.

5.3 Protection of Buildings Adjacent to Cut-and-Cover Excavations

Buildings adjacent to cut-and–cover excavations fall within a damage level range of “Negligible” to “Very Slight” based on preliminary and second stage evaluations, as discussed in Sections 3 and 4. Many of the buildings are founded on deep foundations and are generally not impacted by the cut-and-cover construction. Numerical modeling techniques are able to provide a more realistic prediction of ground movements and the associated structural response; however, they require comprehensive input data with regard to ground conditions, SOE system characteristics, and building properties. At this stage of study, the available information on the ground conditions and existing buildings is limited. For critical buildings and structures, or when the use of simplified methods is not feasible due to the complexity of the building response, advanced modeling techniques are used in the stage 2 analysis.

Twenty buildings adjacent to the cut-and-cover excavations were identified during the preliminary assessment stage; five of these buildings were determined to be outside the approximate limits of the settlement trough. The fifteen remaining buildings were analyzed to evaluate the potential for damage in the first stage assessment. Buildings with maximum estimated settlement that did not exceed 0.25 inch and angular distortion that was less than 1/600 were considered to sustain negligible damage from excavation. There were nine of these buildings.

The remaining six buildings within the approximate limits of the settlement trough with maximum settlement and angular distorting in excess of the mentioned criteria were analyzed in the second stage assessment to evaluate the potential for damage and any ensuing mitigation measures. The results of second stage assessment indicate that five of these buildings are expected to suffer negligible damage according to the project-specified settlement and settlement trough slope criteria. The expected damage level for RC-502 is “Very Slight” according to Boscardin and Cording’s criteria.

6.0 SYSTEMS

6.1 General Requirements

The system wide elements consist of track work, Traction Power, Train Control, Communications, and Fare Collection Systems. The Regional Connector will provide a direct connection from the 7th Street/Metro Center Station to the Metro Gold Line. The alignment will extend underground from the 7th Street/Metro Center Station through Flower Street, curving east under the 2nd Street tunnel and continuing under the intersection of the 1st and Alameda Streets, surfacing to the connections of Metro Gold Line tracks within the 1st Street and the north of Temple Street respectively.

In general, site access dates and/or room access dates for systems site work commencement are essential after the civil work completion such as the provisions of full cable containments, lighting, temporary low voltage power and the like. The prerequisite for each subsystem commencement is shown in the following sections.

Cutover activities occur when systems such as Train Control, Traction Power, Communications and Trackwork are ready to be connected to the existing Metro Blue Line, Gold Line Eastside and Gold Line North (Pasadena). Approved and coordinated cutover plan and schedule shall be provided by Design/Build (DB) Contractor in close coordination with all interface contractors such as ROC (Rail Operations Center), Vehicles, Universal Fare Collection and Metro Operations and Maintenance.

Cutover is basically the staged process of changing and/or interfacing from the existing systems infrastructure in both Blue Line and Gold Line to the new and/or modified system configurations. The cutover process in essence provides a complete, functional and fully operational system for the entire new alignment of the mainline and the standby generator upgrade at the Division 20 (Red Line Yard) for the Emergency Standby Power System (EBPS).

Prior to the work commencement of cutover activities besides the new stations and tunnels, DB Contractor shall provide the cutover plan and schedule in order to minimize the possible impact on the existing Metro Operations, but not be limited to, for the following major areas:

- Shoo-fly Line Cutover
- The 7th/Metro Station Cutover
- Regional Connector to East Gold Line Cutover
- Regional Connector to North Gold Line Cutover
- Standby Generator Upgrade at Division 20 (Red Line Yard)
- Rail Operations Center interfaces
- Radio interface with local fire, police, sheriff and rail group

Gold Line cutover consists of three systems stages: the Shoo-fly Line cutover, the 1st Street cutover, and Alameda Street cutover respectively. Blue Line cutover is composed of one single system cutover phase at the 7th/Metro Station. DB Contractor is required to plan, implement and mitigate all hazards to systems safety that arise from the staged cutover process from the existing system to the fully operational new/modified system. The cutover plan and schedule shall be structured to minimize interference to the current mainline and yard operations.

6.2 Trackwork

It is proposed to use the completed tracks for installation work of system wide cabling, piping, wayside equipment and permanent tunnel lighting. The alternatives for equipment delivery and installation may be considered to construct temporary tracks or use rubber tired machines to gain access to work sites in the early construction stage. It is the common practice to use the permanent track for systems installation. Tracks will have to be surveyed and accepted by those contractors to use the permanent track, who will be responsible for any damage of the track rather than its normal wear and tear.

6.2.1 Access

Site access dates and/or room access dates at different areas are essential for the work commencement from contractors to achieve their work plan and schedule. As the track work contractor will need to mobilize labor, material, and equipment through the tunnels to meet his installation plan and schedule, track work construction will commence after the tunnel and platform construction completion. More often than not, track work will not commence until the civil contractor has completed the entire tunnel sections, including the construction of tunnel invert, cross passages and walkways. The track work contractor will receive a tunnel section completed with ductbanks, temporary power, temporary lighting and temporary tunnel ventilation and track ways through the station boxes complete and free of shoring.

6.2.2 Rail Welding

Workspace and storage space are required for rail welding, stick rail, and the stockpile of complete continuous welded rail (CWR). The CWR stockpile shall be oriented such that rail can be withdrawn from the stockpile onto a rail train through curves that will not overstress the rail. The location of rail stockpiles and the complete CWR strings is key to the success of track work implementation.

Mangrove Site is well suited for rail welding and storage. CWR strings could be arranged and transported to the Mangrove Site where the tunnel entrance of Regional Corridor is located for easy access to the work sites.

6.2.3 Traction Power Sub Station (TPSS)

The prerequisite for traction power system installation is the construction completion of Traction Power Substation (TPSS) room, DWP room, DC Disconnect Switches room, Cable room as well as full cable containments. Cables should be installed and tested in advance of the installation of the traction power equipment. Traction power equipment needs to be installed in rooms that are complete with full cable containments, lighting and temporary power. The cables will be pulled and fire stopped to meet the fire wall classification. The rooms shall be completed with lockable doors. This enables equipment to be installed in a secure, clean and dust proof environment. Large TPSS equipment such as transformers, rectifiers and switchgears, will be delivered and then installed through equipment access hatches. The same access hatches will be used by DWP for their equipment delivery and retrieval.

Cable installation in the tunnels can be scheduled as soon as tunnel cable ways are available. Coiling of large heavy traction power cables is difficult and requires space to do; therefore, it is usually not the practice to pull cables until the entire cable way is available from end to end. However, coiling of cables temporarily may be required in some cutover areas in order to minimize the operations impact.

Overhead Catenary System (OCS) installation can commence as soon as track work, pole and down guy foundations at grade, and retaining walls are complete.

Similarly, work related to the installation of the 34.5 kv trainway cables and vacuum circuit breaker at 7th/Metro TPSS shall be coordinated with metro to mitigate any disruptions to Metro Red/Purple line rail operations.

6.2.4 Train Control and Communications (TCC)

The secure and clean TC&C rooms are required for systems equipment installation and cabling. Civil and structural work in TC&C room needs to be completed with full cable containments, ventilation, lighting and lockable doors so that systems equipment racks erection and cable installation can commence. Pathway leading to the room (corridors, stairs) should be clear of obstructions and elevators (where present) in operation.

7.0 MECHANICAL ELECTRICAL PLUMBING

7.1 General Approach to Electrical

The construction of each station is considered a unique and separate element of work independent of one another. There are three major phases in the installation of the electrical systems: 1) Raceway and wire; 2) Equipment; and 3) Testing & Commissioning. During the Raceway and wire phase "resident crews" will be on site installing electrical concurrent with the structural and finishes work. Additional "as-needed" specialty crews will be installing equipment. A dedicated "Testing & Commissioning" crew will provide these services at the end of the project.

Raceway and wire will be installed by resident crews as work areas become available concurrent with critical structural and finish work. This will support critical work progress.

Equipment installation will be scheduled in advance coordinating with structural work. The facility has been designed to allow for installation of equipment through hatches, rollup doors, etc, but some equipment may be set in unfinished areas and protected for later final installation. Termination of equipment will be performed after installation of the equipment.

7.2 General Approach to Mechanical

The construction of each station is also considered a unique and separate element of work independent of one another. There are three major phases in the installation of the mechanical systems: 1) Duct Work 2) Equipment; 3) Testing & Commissioning.

During the Duct Work "resident crews" will be on site installing duct concurrent with the structural and finishes work. Additional "as-needed" specialty crews will be installing equipment in a separate operation. A dedicated "Testing & Commissioning" crew will provide these services at the end of the project.

Duct Work will be installed by resident crews as work areas become available concurrent with critical structural and finish work. This will support critical work progress.

Equipment installation will be scheduled in advance coordinating with structural work. The facility has been designed to allow for installation of equipment through hatches, rollup doors, etc, but some equipment may be set in unfinished areas and protected for later final installation. Termination of equipment will be performed after installation of the equipment.

7.3 General Approach to Plumbing

The construction of each station is considered a unique and separate element of work independent of one another. There are three major phases in the installation of the mechanical systems: 1) Piping and plumbing; 2) Equipment; 3) Testing & Commissioning.

During the piping and plumbing "resident crews" will be on site installing duct concurrent with the structural and finishes work. Additional "as-needed" specialty crews will be installing equipment in a separate operation. A dedicated "Testing & Commissioning" crew will provide these services at the end of the project.

Piping and plumbing will be installed by resident crews as work areas become available concurrent with critical structural and finish work. Plumbing and piping activities will start early in the project. This will support critical work progress.

Equipment installation will be scheduled in advance coordinating with structural work. The facility has been designed to allow for installation of equipment through hatches, rollup doors, etc, but some equipment may be set in unfinished areas and protected for later final installation. Termination of equipment will be performed after installation of the equipment.

8.0 SCHEDULE

8.1 Key Dates

FTA Record of Decision = March 26, 2012*
FTA Approval to enter Final Design = October 1, 2012
Contractor Limited Notice to Proceed = January 7, 2012
Contractor Full Notice to Proceed = Aug 19, 2013
FFGA = August 15, 2013
Shovel in the Ground / Contractor = August 19, 2013

*Basis of schedule in March 30, 2012 PE

8.2 List of General Assumptions

a. Procure a Single Contract with a Design Build Consortium (Contractor) to construct the project to achieve a revenue operation date of Dec 15, 2019. At this time, a 2 phased opening has not been definitively established, as was conveyed in a meeting on Feb 7, 2012. Further study to determine how this could be accommodated, based on the current sequencing of the work in the schedule.
b. Acquisition of Property & Easements to begin the work.
c. Utility relocations, performed by third parties, completed in advance of August 15, 2013.
d. Contractor will utilize one Tunnel Boring Machine (TBM), possibly refurbished.
e. TBM tunneling will be conducted in two (2) – 10 hour shifts, working 6 days per week.
f. TBM will be launched from a “launch pit”, created within the Mangrove Property, due to project constraints which require the TBM to be launched from that location, as well as TBM muck removal must occur from Mangrove Property.
g. TBM will under 1st/Alameda intersection, due to complexity of utility relocation and existing Gold Line tracks in the vicinity.
h. TBM will “walk across” an excavated 1st/Central Station.
i. TBM will mine thru 2nd/Broadway station, due to complexity of relocating a storm drain and the “tie-in” during low flow periods.
j. TBM will mine “walk across” an excavated 2nd/Hope Station.
k. TBM will mine into a “completed TBM reception pit”, as part of the Flower Street excavation.
l. TBM reception will be on west side, due to 84 inch storm sewer coming from 4th Street onto Flower Street.
m. Crossover cavern at 2nd/Broadway built using SEM methods, after the completion of the TBM run and in conjunction with 2nd/Broadway Station concrete operation.
n. Support of excavation using soldier pile and shotcrete/timber lagging, with walers and pipe struts or tiebacks.
o. Shoo-fly construction can take place as soon as possible, but is not required to launch the TBM; this allows extra time for approvals, co-ordination with decking

installation. There will be the requirement of a "bridge structure", to be installed on the north leg of the cut/cover as it turns north along Alameda to span the excavated area. There will be 2 bus bridge events, one to tie in the initial shoo-fly operation, the second, to operate during the construction of the work as it interferes north with the existing tracks by Temple and the inclined raised track structure (MSE Walls).

p. Decking installation to be on closed roadways, over a 55 hour weekend from Friday 10:00 pm to Monday 5:00 am. Some larger intersections, those wider than 56 ft wide, may need to be closed for a few days to a week (such as Flower / 5th St), since the work scope would be more than can be accomplished in a weekend, and cannot install a portion of deck and open to traffic.

q. Work Hours at Flower St
    1) soldier piles , day shift – 10 hrs
    2) contractor utilities, day shift 8 hrs
    3) 3rd party utility companies, may need to work 2 shifts / day to meet shovel in ground date
    4) raised decking, 55 around the clock weekend from 10 pm Friday to 5 am Monday
    5) excavation, concrete, day shift 8 hrs

r. Work Hours at 2nd Hope
    1) soldier piles, day shift – 10 hrs
    2) contractor utilities, day shift 8 hrs
    3) 3rd party utility companies, may need to work 2 shifts / day to meet shovel in ground date
    4) decking, day shift 8 hrs
    5) excavation , concrete, day shift 8 hrs

s. Work Hours 2nd Broadway
    1) soldier piles, day shift – 10 hrs
    2) contractor utilities, day shift 8 hrs
    3) storm drain, 2 shift per day, 16 hrs
    4) 3rd party utility companies, may need to work 2 shifts / day to meet shovel in ground date
    5) flush decking, day shift 8 hrs, close the road for 2 months to install
    6) excavation, concrete, 2 shift per day, 16 hrs

t. Work Hours SEM Cavern
    1) excavation and concrete, 6 days per week , 2 each 10 hr shifts, will need surface equipment cranes etc, to work this period at surface from 2nd Broadway Station

u. Work Hours 1st Central / 1st Alameda
    1) soldier piles, day shift – 10 hrs
    2) contractor utilities, day shift 8 hrs
    3) 3rd party utility companies, may need to work 2 shifts / day to meet shovel in ground date

4) raised decking, 55 around the clock weekend from 10 pm Friday to 5 am Monday, probably need to close 1st / Alameda intersection for 2 continuous weeks to install deck
5) excavation, concrete, day shift 8 hrs

v. Work Hours TBM Mining @ Mangrove
1) excavation 6 days per week, 2 each 10 hr shifts, will need surface equipment cranes etc, to work this period

w. Work Hours @ Temple St
1) 1 shift per day, close intersection 6 months, no decking

x. Contractor lay down / staging depicted in contract drawings

8.3 Narrative

The TBM operation consists of twin bored (assumed EPBM machine) beginning at STA 83+00 within the Mangrove Property and terminating at STA 19+00 within the north extent of the Flower St cut & cover operation. The use of a single TBM mandates the need to extract the machine from a reception pit and return it to the Mangrove property to "relaunch" from this location.

The launch pit was conceived to minimize risk to the tunneling operation, which could be greatly constrained (thus a project risk) if the utility companies were not able to relocated utilities within the 1st/Alameda intersection, allowing the contractor to perform raised decking and open cut construction to "walk the TBM thru this area". The contractors' precast segment loading operation, as well as crane operation and muck disposal take place within the Mangrove Property. A portion of the launch pit will be decked over, to maintain required parking spaces and vehicle access out of the site.

Building demolition on the 1st/Central Station location must be done in conjunction with support of excavation of this area, so that the contractor may "walk the TBM thru this area", thus beginning "pay TBM work" at approximately 1st/Central St.

Contractor will construct a Shoo-fly track within the Mangrove property, to divert Gold Line trains from its current track alignment, which interferes with RCTCP construction activities. Bus bridging will take place during the period of tying the shoo-fly.

Permeation and compaction grouting will be required on 2nd Street near the 1st /Central Station, as the cover of the storm drain and TBM works is minimal in this area.

2nd/Broadway Station requires the relocation of the existing large storm drain, to be supported and constructed new, to the north side of the station. This work is integral with the station construction and the TBM works. Due to the complexity of two new junction chamber manholes, the sequential excavation of the ground support and bracing system required, with the timely break in to the existing sewer during low flow, further complicates the construction sequence and timing of operations. Due to these complexities, it is assumed the contractor will not complete station excavation before the TBM arrives.

2nd/Broadway excavation completes to the invert of the new storm sewer at the time the TBM arrives, thus putting the focus on excavation and concrete of the Ancillary area during this time. The project continues, completing needed work, thus not delaying or complicating with other

similar work. After the TBM completes mining, the contractor completes station excavation and begins the SEM work in conjunction with Station concrete operations. The SEM work will follow the suggested sequence in the contract drawings, unless the Contractor gets acceptance of another method. The procedure is to excavate 2nd/Broadway station to invert level, install 1st row of canopy spilling, excavate the top heading (1), disassemble precast tunnel segments (2), shotcrete side wall (3), excavated bench (4) and shotcrete walls & invert (5). This process is very linear and will then be repeated on the other side, advancing the face incrementally to the east.

2nd/Hope Station requires road closure, and a bridge demolition to begin construction operations. Some minor road decking is required on Hope St, and the station and ancillary area excavation to be complete so the TBM can walk thru this area. During TBM operations, Ancillary concrete operations are taking place, leaving the station concrete for completion after the TBM drives.

Flower Street construction assumes a raised deck in conjunction with excavation support, and concrete operations. The north end of the Flower Street excavation is the reception pit for the TBM, thus creating an internal required milestone of completion, to extract the TBM.

Systems test plans and procedures for OCS, Traction Power, Train Control, Facilities and Communications Systems will be provided by DB contractor. It will outline the overall test and commissioning strategy as well as the test plan and procedure for every single subsystem in order to assure the best engineering practices to be achieved within budget, quality and time.

In general, on-site test and commissioning include systems installation check, local field acceptance test (LFAT) and systems integration test as the sequence of activities required from completion of Systems Factory Acceptance Test until the last stage of pre-revenue operational test. The details can be referred to the project schedule that reflects a parametric establishment of durations for every single subsystem and then integrated system.

Systems installation check is the in-process test conducted at the subsystem during the installation. The test is performed at the project site and pre-requisite to the local field acceptance test. Local field acceptance test shall be conducted in compliance with approved test plans and procedures at subsystem level. Systems integration test shall be conducted to confirm that the elements of the rail system will function properly as an integrated system at each rail station and then (Rail Operational Centre) ROC. The test is involved in end-to-end point test and verification when more than one subsystem is integrated.

DB contractor will take overall responsibility for all system and subsystem level testing including LFAT, systems integration test and trial-run test for OCS, Traction Power, Train Control, Facilities and Communications Systems. Interface management is absolutely essential to ensure that the system and its components will interoperate correctly with external systems to be provided by others like ROC, FCS and Vehicles. DB Contractor will prepare and submit an Interface Management Plan and Procedure for all direct and indirect interaction with systems and/or external interfaces. It shall identify the roles and responsibilities for interface definition and control, as well as the document to be produced and procedures to be followed for resolution of any interface issues between the respective parties.

Systems Integration Test (SIT) shall be performed on the installed system equipment and subsystems in accordance with the approved SIT plan and procedure. It shall be performed to

verify that the system has been properly installed and tested in order to satisfy all performance, safety, reliability and functional requirements under normal, degraded and/or emergency scenarios prior to pre-revenue operational test.

8.3.1 Phased Opening

Final tie-in to the Gold Line requires removal of the "shoo-fly tracks" and temporary interruption of rail operations. This requires the re-establishment of bus bridging on the East Side branch of the Gold Line and bus bridging of the Pasadena branch. The time to construct the remaining structures of each branch is substantially different. Therefore a phased open of RCTCP will be performed.

The initial phase will comprise of the RCTCP completed construction through SIT from 7th/Metro Center Station to the 1st /Central Station. Once revenue service has been established the "shoo-fly tracks" will be removed and bus bridging commenced. The next phase will be the completion of the RCTCP tie-in with the East Side branch. This branch has minimal structure to be constructed and tested. The final phase will be the completion of the RCTCP tie-in with the Pasadena branch. This branch has extensive demolition (LADWP, Little Tokyo/Arts District Station), excavation (across Temple St.) and existing ROW embankment reconstruction. As stated in Section 8.2 a detailed phase opening is in development.

8.3.2 Design

The contractor receives a Limited Notice to Proceed on Jan 7, 2013, with an anticipated shovel in the ground of Aug 19, 2013. During this period, the contractor is designing his temporary works (support of excavation/decking/utility support) as well as procuring the TBM, submitting baseline schedules and initial project required submittals. In addition, the contractor will be working on Final Design to concur with permanent structure construction in conjunction with his CPM schedule.

8.3.3 Enabling Work

Utility relocation, property acquisition, and lay down area/construction site work, are the main enabling project works. The assumption is made that all property acquisition, lay down areas, building/property takings and 3rd party utility relocation will be completed so as not to inhibit the contractor schedule. The inability to perform these works in a timely fashion can be the basis of contractor schedule claims and impact cost claims.

8.3.4 Tunnel Work

a. Schedule assumes 35 ft/work day, work day consists of two (2) – 10 hr shifts, mining 6 days per week.
b. Schedule includes a TBM procurement period not to exceed 12 months.
c. Schedule includes TBM power / switchgear being available ready for TBM operation.
d. Schedule includes the construction of a 250 ft long x 55 vertical foot high x (60 ft to 25 ft wide) reception pit, built within the Mangrove Property – to facilitate TBM operations.
e. Schedule includes walking the TBM thru 1st/Central, 2nd/Hope – each occasion approximately 8 days.

f. TBM Set up includes 42 shifts to initially install TBM, 15 shifts disassembly, 21 shifts reassembly and 21 shifts to remove from site
g. Precast segments will be installed during the mining operation as permanent lining (single pass)
h. The cross passages (4), will be constructed after the TBM completion, as the contractor must demolish the segments to excavate the work. Due to the geologic conditions, we have assumed pipe spilling be driven between the tunnels, as a means of ground support to construct these works.

8.3.5 Flower Street

a. Schedule allows for 2 access shaft locations, to facilitate excavation and concrete operations, setting up permanently on the east side of the street, maintaining 4 lanes of traffic thru this area.
b. Soldier pile installation allocates 2 rigs, working 10 hr shifts; production equals 4 piles per shift.
c. Deck installation includes 55 hour working shifts, from Friday 10 pm thru Monday 5 am, with full road closure to obtain 56 LF complete decks per weekend event. During the week following, contractor will hang / support utilities in place from prior 56 LF deck installation.
d. Excavation assumes average of 500 BCY production per 8 hour shift at each access shaft location, with a 150 LCY holding hopper on the surface. Lagging to be shotcrete or timber, struts and waler system assumed for support.
e. Concrete operation to be completed in 13 months.

8.3.6 2nd/Hope Station

a. Soldier pile installation, due to 95 ft depth to 110 ft depth average 2 per shift.
b. Excavation average rate = 600 BCY, average for a portion by ramping out and remainder by crane & muck box.
c. Decking is minimally required in this area, flush road deck is planned.
d. Tiebacks are the primary source of ground support with shotcrete or timber lagging. Top 2 layers are strut & waler, due to interference of chiller plant close to support of excavation layout.
e. Concrete in ancillary space takes 8 months.
f. Concrete in Station, done after TBM completion, takes 18 months.

8.3.7 2nd/Broadway Station

a. Soldier pile installation production is 3 each / shift.
b. Strut & walers assumed for the 1st 3 bracing levels, in conjunction with storm sewer installation. Pin piles are required within the ancillary area to carry the struts (80 to 90 ft) across to the far wall.
c. Excavation by 2 cranes, each producing an average of 500 BCY per shift, with a 150 LCY holding hopper on the surface. .

d. Flush deck system, assumed full road closure, takes 39 continuous work days, with crews hanging utilities as deck beams proceed.
e. Storm drain excavation proceeds to invert level, new junction chambers and new storm drain installed. Excavation in the station ceases, as the TBM enters the station box.
f. Ancillary area excavation and concrete continue during the period that station excavation ceases, with TBM operation going on.
g. Concrete operations take 16 months to complete, while the SEM excavation and concrete continue simultaneously.

8.3.8 1st/Central Station

a. Soldier pile installation production is 4 piles per shift.
b. Excavation is planned at 680 BCY per shift, with tiebacks as primary support in conjunction with shotcrete or timber lagging.
c. Assumed completion of this excavation in time to walk TBM thru the station area.

8.3.9 "Y" Intersection at 1st/Alameda

a. Soldier pile installation production is 3 piles per shift.
b. Excavation is planned at 390 BCY per shift, due to tight area under the deck, need to remove precast segments and install bracing.
c. Concrete of this area is completed in 5 months.

8.3.10 Alameda to Temple

a. Decking will not be required at Temple St. It has been assumed that Temple Street will be closed for 6 months. Need to keep Temple St open in one direction for use by the Los Angeles Fire Department is being evaluated.
b. Work can be performed in conjunction with TBM drive.
c. The bridge structure (trestle) that spans the excavation will need to be in place to operate the shoo-fly. This bridge / trestle is depicted on the contract drawings, spanning the north leg coming out of the Y-Structure going north along Alameda within the Mangrove Site

8.3.11 Temple to Project Limit

Work to be staged after TBM drive when bus bridging is required and existing Little Tokyo/Arts District station is demolished.

8.3.12 1st to Atlantic Construction

a. Requires shoo-fly construction to be completed, so work can be performed in existing Gold Line track area.
b. Stage excavation and concrete with TBM drive.

8.3.13 Architecture

Parametric schedule review indicates 12 months to 18 months for station finishes.

8.3.14 Systems

a. The design in the category of Systems is schematic and the schedule reflects a parametric establishment of durations accordingly to the following:
b. OCS cable installation – 500 lf/day.
c. Traction power cable installation – 200 lf/day.
d. Train control fiber optic backbone cable installation – 200 lf/day.
e. Train control copper control cable installation – 1000 lf/day.

8.3.15 Critical Path

a. Project duration is from NTP of September 15, 2013 through revenue date of Dec 15, 2019
b. Critical Path – due to the fact that all areas (2nd/Hope, 2nd/Broadway, 1st/Central, TBM launch pit, Flower St) all begin with shovel in the ground on the same day, produces a critical path which starts with the TBM, jumps to work in the 2nd Broadway Station after the TBM drive completes, then jumps to 1st Central Station after the 2nd TBM drive, and finally through Systems to revenue date. The detailed CPM submittal depicts the critical path; a run can be made identifying all items with 20 days float.

9.0 INTERFACES

The Regional Connector Transit Corridor will connect the existing light rail services of the Metro Gold Line, the Metro Expo Line, and the Metro Blue Line. In addition, the Systems shall interface with Rail Operations Center for remote supervision, control, and monitoring of the integrated system.

9.1 7TH/Metro Station Interface

The construction, installation, and testing of the systems shall be coordinated with METRO Operations to mitigate existing Blue and Expo rail operations disruption. The D/B contractor shall develop cutover and test plans. Special emphasis on the 7th/Metro Station interface to include:

- Train control work related to re-signaling between Pico Station and 7th/Metro Station
- Traction power work related to emergency trip station (ETS)
- Transfer trip to Pico Station TPSS and Communications work related to the cable transmission system (CTS), and
- Emergency Management System at 7th/Metro Station.

9.2 Metro Gold Line Interface

Similarly, the construction, installation and testing of the systems shall be coordinated with METRO Operations to mitigate existing Gold Line rail operations disruption. Approved and coordinated cutover plans and test plans shall be developed by the contractor in close coordination with all contractors involved. Emphasis to be placed on the phasing of systems work related to:

- Train Control
- Traction Power Emergency Trip Station (ETS)
- Transfer trip between existing Union TPSS, 2nd/Broadway TPSS, and Division 20 Yard TPSS,
- Communications work and the Overhead Contact System to meet the two-stage Rail Operation openings including Shoo-fly installation.

9.3 Rail Operations Center Interface

The re-configuration of the existing Service Control Area, CCTV Monitoring Area, Computer room and Communications room at the Rail Operations Center will be done by METRO. Interface with ROC will be done at the Union Station TC&C room. Due to the intended two-phase operations opening, integration testing with ROC will be done at the 7th/Metro Station TC&C room. The contractor will provide field support to METRO during ROC integration test.

9.4 Fare Collection and Gating Interface

The Fare Collection & Gating (FC&G) System encompasses Ticket Vending Machine (TVM), Standalone Fare Validator (SAV), and fare gates. The FC&G system will be procured under Metro's Universal Fare System (UFS) system-wide contract including TVMs, SAVs and fare gates at each station. These machines will be connected to a Network Server device. The Network Server will be interconnected to Virtual Local Area Network (VLAN) and leased telephone lines to the Central Fare Collection System through Cable Transmission System (CTS). Power and Communication conduits will be provided for the network server device, ticketing vending and fare validating machines.

10.0 CONTRACT PACKAGING

This section is adopted from a white paper was written to address the pro's and con's of a single contract package vs the multiple package option, with all the interfaces.

10.1 Constructability Review

A constructability review was performed during the month of Sept / Oct 2011, to identify "how a contractor might approach and build the project", in a most efficient manner, relative to cost and schedule. The work has been identified, much as a contractor schedule would have with the interfaces, interdependencies and taking advantage of beginning work in the timeliest fashion.

For example, an earlier schedule identified the TBM launch starting some 24 months after Contract NTP, mostly due to Utility Company relocation work and the complexity of the work in the 1st & Alameda Street intersection. A method was identified to launch the TBM now at month 14, thus eliminating the critical nature and interdependency of the TBM to the station construction, as well as mitigating the effects of dependency upon the utility companies to perform their work in a timely fashion.

The constructability review has also identified those areas, where work in a station can continue, while the TBM operation operates thru and within the station. For example, during the construction of 2nd/Broadway Station, the station cannot be excavated to the bottom in time for the TBM arrival, although work in the station (excavation and concrete) continues in the ancillary areas while the TBM operates thru the station. Had the concrete portion of the project been identified as a later contract, it would delay starting this work for a year or even more. Also at 2nd & Broadway, the contractor can begin concreting the station, while the SEM work is ongoing. If the concrete of the station was delayed to another contract after station excavation is complete, this would delay station concrete by more than a year. These are just a few of the constructability examples, which identify "when work should be performed efficiently", without prejudice to contract packaging.

10.2 Possible Contract Packaging Options

There are many things that can go into deciding upon a contract packaging strategy, namely Project amount & bonding capacity, interface and potential claims due to multiple contractor issues, current economic times, timeliness of other mega projects procuring by same Owner, demobilization of one contractor and remobilization of another – lost time, and the geographic layout of the work – can limit areas of work stand alone.

10.3 Bonding

A recent project in NYC (namely No. 7 subway) issued a construction contract in the amount of $ 1.1 Billion for TBM and station cavern construction. During the bidding process, Surety Companies notified MTACC that the Contractor would only be insured to $ 500 million, thus putting the balance of the risk upon the Owner, should the Contractor default. This is noted as more a potential risk to the Owner, but a review of LA State requirements or contacting Surety Companies would be advisable.

10.4 Project Interface

This is probably the largest area of schedule and cost risk, the ability to mitigate potential interferences and co-ordination of work amongst contractors. It's been demonstrated that this project has a heavy interface between TBM production and station excavation. In addition to mere "anticipated production rates of work", there are outside sources such as timely completion of work by utility companies that can contribute to delays to successful completion of both TBM and station production.

10.5 Current Economic Times

Contractors in this economy are motivated to be more price competitive than ever before, taking on more cost risk and reducing profit margins. This can be best depicted in recent bids on the Indianapolis Deep Rock Tunnel, where many bidders were mostly within or below the Engineers Estimate. The economic climate may warrant that Metro bid this project as one bid to get the most cost efficient bid as can be achieved now, rather than to break the project up and bid other pieces years from now.

10.6 Competition amongst other LA Metro Projects

LA Metro needs to be mindful of the "procurement period or timeliness of bids" for other like projects, so that by bidding work too close together, contractors don't pick & choose, thus in a way eliminating competition. This happened on recent projects in NYC, where MTACC bid 2 projects within days of each other, East Side Access Contract CM09 for $ 700 million and No. 7 Subway for $ 1.1 Billion. What took place was one JV bid the East Side Access project and one JV bid the No. 7 subway project, eliminating competition, had the jobs been bid months apart, both JV's would have most likely bid both projects.

10.7 Demobilization of one Contract/Start next Contract

The very nature of one contracting completing his work at a location, demobilizing and performing punch list, then having another contractor mobilize the same site, make submittals, and procure materials could add 4 to 6 months of a " work gap " in the schedule, whereas one contractor would continue work efficiently without stoppage for this issue.

10.8 Geographic Location / Packaging

The geographic nature of the project can lend itself to "breaking up the project if needed", due to the geographic location. Namely the work at Flower St can stand alone from the other work, as it only serves as a reception pit for the TBM contract, which can be handled with a Milestone in the Contract. This contract could be broken up into either an excavation and decking contract, a concrete structure contract, or an excavation / decking / concrete structure contract.

10.9 Present Construction Schedule

The present construction schedule indicates a Contractor NTP of Sept 21, 2012, with major "shovel in the ground beginning 4 to 6 months thereafter".

10.9.1 TBM Work

The need has been identified to get the TBM "out of the gate early", assuming that a TBM can be delivered in 10 to 12 months, and assembled ready to go by month 14. This is predicated on the interdependency of a launch box in Mangrove being constructed, support of excavation of 1st & Central Station being completed to "walk the TBM across", mining thru the 1st & Alameda Intersection, and "walking the TBM across an excavated 2nd & Hope Station". If any one of these did not happen as planned, and were in the hands of more than one contractor, the "Contractors basis of assumption to build the work", would begin the claims process of pitting one contractor against the other, with the Owner in the middle to sort out the cost and impacts.

10.9.2 1st & Central Station

The entire station and ancillary area is assumed to be excavated and braced prior to the arrival of the TBM. The "ancillary area concrete" are scheduled to be performed during the TBM mining period, if this were in a separate package, it would be delayed until the end of the TBM mining process. From a public perspective as well, the site would be fenced, and no activity would be going on in the ancillary area until the TBM contractor finished. It would be good to continue the work in an efficient manner, and remove the construction fence in this area to eliminate the eye-sore to the community.

10.9.3 2nd & Broadway Station

By far this is the most complicated area of the project, due to the utility relocations needed to install the road deck, the construction of the storm drain and the interdependency with the "low flow cut over period". In getting the TBM out of the gate by month 14, the station would not be excavated to the invert in time, thus the station work would cease after the 1st TBM drive arrives. The ancillary excavation and concrete are scheduled to continue during the TBM interface period.

Once again, from a community perspective, the site does not seem disrupted and yet stays idle while the TBM progresses, here the work continues if one contract package is let. This location is a major point of "multiple contractor interface", if it were let as a separate package. The station contractor would be held up, further compounded by a 3rd contract if the concrete were let out after the excavation contract. The station concrete is also scheduled to proceed concurrent with the SEM work for the cross over. Once again, if the station concrete was let "after the SEM work was complete", a delay of station concrete completion is more than 1 year.

10.9.4 2nd & Hope Station

This portion of the project is less critical than 2nd Broadway, but assumes that excavation will be complete prior to the TBM arrival. If the concrete is in a single contract, the concrete could be scheduled in conjunction with the TBM drive, if let out as a separate package, the concrete would not begin until the TBM contract is complete.

10.9.5 Flower Street

This portion of the project can stand alone (It is recommended that this portion of the project to also be part of the one contract scheme.) from the other work, as it only serves as a reception pit for the TBM contract, which can be handled with a Milestone in the Contract. This contract could be broken up into either excavation and decking contract, a concrete structure contract, or an excavation / decking / concrete structure contract.

10.9.6 Track Concrete / Walkways / Rail

Having multiple contract packages would warrant “milestone turnover dates”, that the heavy civil contractor would need to meet to give a system contractor “guaranteed access to the project”. This is a major area of interface if milestones are not met, whereas in one contract, this work and interface becomes the responsibility of the General Contractor.

10.10 Conclusion for a Single Contract Package

This report recommends a single contract package for the Regional Connector for the reasons summarized as follows:

- Price Certainty – Owner knows his total Bid construction cost exposure in the beginning
- Economic Times – Contractors are more cost conscious, sharpen the pencil
- Construction Interface – Managed by the Contractor, minimizes any claims that would come from multiple contractors.
- Subcontracting Requirements - require Single Contractor to subcontract out portions / percentage of work to LBE / DBE / WBE for greater competition and involving local and smaller business.
- Schedule Certainty - Single Contract delivers project intended schedule. Breaking up the contracts introduces schedule mobilization/demobilization issues, procurement award timing of other contracts to continue seamless work continuity
- 3rd party Utility Coordination - Utility relocation and interface with one Contractor, better defines resources of utility companies and “priority of work” due to one contractor needs

A single contract package for the Regional Connector would result in a 15 month savings in schedule / escalation:

- 2nd Broadway – present schedule overlaps station concrete with the SEM construction, an overlap of 9 months. If multiple contracts were employed, present contractor would need 2 months punchlist / demobilization, while new contractor would need minimum 4 months mobilization and shop drawing approval & material delivery.
- 2nd Broadway – present assumption is that Ancillary excavation are performed during TBM mining. If concrete is deferred to another contract, this could add additional time and burden to coordinate ancillary concrete works and station concrete works at the same time.
- Cost savings at a minimum would be escalation associated with 15 months extra time.