4.18 Construction Impacts

The following subsection of Section 4.18 has been updated since publication of the Draft EIS/EIR to address comments received on the Draft EIS/EIR and based on refinements to the LPA to reduce or avoid previously identified impacts. Minor changes have also been made to this subsection in order to maintain consistency with other Metro projects. A vertical line in the margin is used to show where revisions have occurred to this subsection since publication of the Draft EIS/EIR. The construction impacts and mitigation sections (4.18.3 and 4.18.4 of the Draft EIS/EIR) are summaries of the impacts and mitigation measures from the other sections of Chapters 3 and 4. All significant new information in these chapters is contained in Sections 4.2, 4.7, and 4.12.1 herein above. As such, only the affected environment section (Section 4.18.2) is included herein below to show refinements to the proposed construction methods.

Refinements made since publication of the Draft EIS/EIR have reduced overall construction impacts by eliminating cut and cover construction on 2nd Street in Little Tokyo, eliminating cut and cover construction in the Financial District on Flower Street between 3rd and 4th Streets, moving tunnel boring machine (TBM) construction staging away from the center of Little Tokyo onto the Mangrove property, and reducing the acquisition of businesses and privately-owned property. The eliminated cut and cover segments would be constructed using TBM excavation.

4.18.2 Affected Environment

This section describes the affected environment as it relates to construction activities for the LPA. Construction activities for the other build alternatives, and the locations along each proposed alignment where different techniques would be used, are described in Section 2.4 of this Supplemental EA/Recirculated Draft EIR Sections and in Appendix K, Description of Construction, of the Draft EIS/EIR.

4.18.2.1 Locally Preferred Alternative Construction Scenario Overview

Typical construction activities for the LPA are described in Chapter 2 of this Supplemental EA/Recirculated Draft EIR Sections (Section 2.4). The construction duration for the LPA would be approximately four years. However, construction activities at any one location may be shorter. In the vicinity of cut and cover construction, surface streets would be impacted intermittently over a period of 24 to 48 months. Construction could begin simultaneously at several locations along the selected route to minimize the overall construction times. Facilities requiring the lengthiest construction work, such as tunnels and underground stations, could potentially be started first so that the entire alignment is completed at approximately the same time.

Construction of the LPA would involve conventional techniques and equipment typically used on similar projects in the Southern California region. Methods would include cut and cover and open cut excavation for certain segments of tunnels, crossovers, portals, stations, and ancillary facilities; and TBM excavation for most of the LPA alignment beneath 2nd Street. The portions of the 2nd/Hope Street station and 1st/Central Avenue station within the street right-of-way would be constructed using the cut and cover method, and off-street portions would be constructed using the open cut method. Part of the 2nd/Hope Street station and the crossover near 2nd/Broadway station may also be constructed using the Sequential Excavation Method (SEM). Also, the proposed portal on 1st Street would be constructed using either the open cut or cut and cover method. More information on these construction methods is provided in Section 2.4 of this Supplemental EA/Recirculated Draft EIR Sections and Appendix K, Description of Construction, of the Draft EIS/EIR. Figure 4.18-1 shows the approximate locations where these construction methods would be used.

The equipment that would be used during construction may include rail-mounted vehicles, earth moving vehicles, cranes, concrete mixers, flatbed trucks, sand and gravel delivery trucks, dump trucks, and TBMs. These construction vehicles may temporarily impede traffic mobility in areas of construction and, therefore, traffic detours, designated truck routes, and off-peak hauling schedules could be required during construction. Traffic management and traffic control measures would be coordinated with the City of Los Angeles Department of Transportation (LADOT).

Construction would follow all applicable local, state, and federal laws for building and safety. The Metro Fire Life Safety Committee, composed of members from the City and County of Los Angeles Fire Departments and Metro specialists, would approve all construction methods. Working hours could be varied to meet special circumstances. Standard construction methods and best management practices (BMPs) would be used for traffic, noise, vibration, and dust control, consistent with all applicable laws.

To provide an understanding of the likely steps involved, the anticipated construction activities are described below. This potential construction sequence does not represent the order in which construction activities would be performed. Actual construction would be a complex process with many activities taking place simultaneously. Some of the construction methods and sequences would be left to the discretion of the construction contractor.

4.18.2.2 Utility Relocation and Street Closures

Prior to beginning construction, it would be necessary to relocate, modify, or protect in place all utilities and below-grade structures that would conflict with excavations for street level track work and underground structures (cut and cover sections, tunneling, and station structures). Shallow utilities that would interfere with guideway excavation work, such as maintenance holes or pull boxes, would require relocation. These utilities would be modified and moved away from the construction area.

Travel lanes would need to be temporarily occupied during utility relocation for approximately two to three blocks at a time. Closures could potentially occur in stages and alternate between opposite sides of the street. Depending on the extent of utility relocation work, construction could last up to four months on each two-block segment. Some of the major utilities (greater than 18 to 24 inches in diameter), such as the storm drains on 2nd and Flower Streets, may require more complex construction sequences and schedules for relocations and supports. Other pre-construction activities, such as soldier piling or installation of geotechnical instrumentation, may require temporary partial street closures and the use of drilling equipment and excavators.

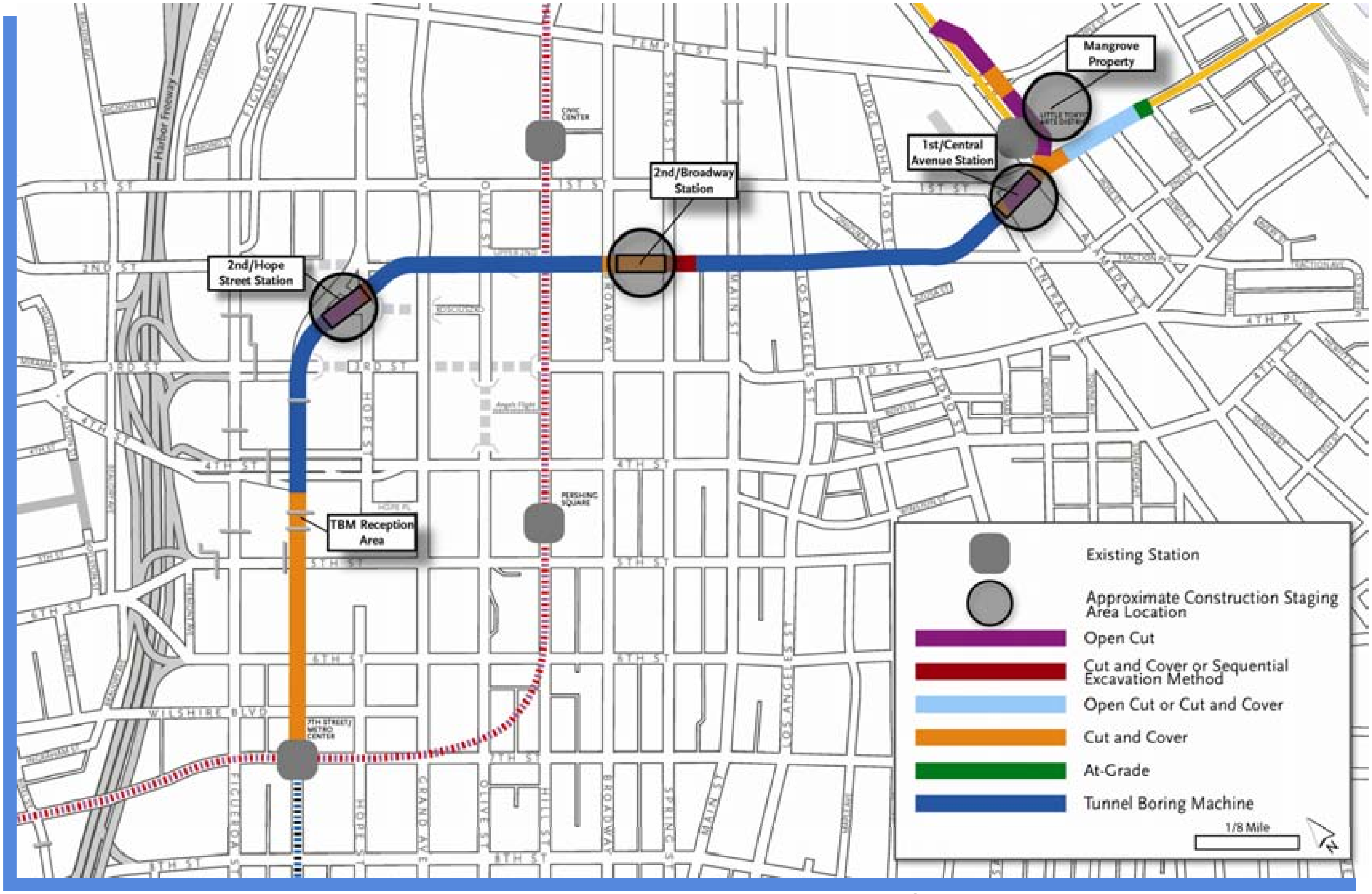


Figure 4.18-1. Locally Preferred Alternative Construction Methods

4.18.2.3 Staging Areas and Haul Routes

Various locations would be used for construction staging. Typically, a temporary easement would be acquired to reserve portions of the sidewalk and street, and sometimes private property for construction staging. Site clearance and demolition of existing structures at the construction staging areas would be necessary before major construction begins. Construction staging activities are described further in Section 2.4.1 of this Supplemental EA/Recirculated Draft EIR Sections and Appendix K, Description of Construction, of the Draft EIS/EIR.

Excavated soils and excess material would be transported off-site to approved disposal sites. To facilitate the removal of excavated materials, haul routes to disposal sites would be pre-determined by agreement with local authorities prior to construction. Testing of materials would be required prior to transportation. Depending on the test results of the soils, disposal options could include the following sites:

California Hazardous (metals) Class I facilities:

- Waste Management Inc., Kettleman City, CA
- Clean Harbors Environmental Services, Buttonwillow, CA
- Veolia Environmental Services, Azusa, CA
- US Ecology Nevada, Inc., Beatty, NV

Non-hazardous, Total Petroleum Hydrocarbon-containing wastes:

- Thermal Processing Systems Treatment, Adelanto, CA

Non-hazardous soil:

- Philadelphia Recycling, Mira Loma, CA
- Municipal landfills
- Other locations identified by the contractor

Routes would follow streets and highways that form the safest, shortest route with the fewest adverse effects on traffic, residences, and businesses. Highways could include Interstate 5 (I-5), State Route 60 (SR 60), US 101, SR 110, I-110, I-10, I-710, and others as appropriate. In addition, the transportation of excavated materials would occur during off-peak hours. The potential staging areas under consideration for the LPA are presented in Chapter 2 and the construction staging drawings in Appendix R-1, Updated Locally Preferred Alternative Drawings, of this Supplemental EA/Recirculated Draft EIR Sections.

Haul routes would be along major arterial streets. These could include Aliso Street, Temple Street, Commercial Street, 1st Street, 2nd Street, 3rd Street, 4th Street, 5th Street, 6th Street, Wilshire Boulevard, 7th Street, Figueroa Street, Flower Street, Hope Street, Grand Avenue, Olive Street, Hill Street, Broadway, Spring Street, Main Street, Los Angeles Street, San Pedro Street, Central Avenue, and Alameda Street. Due to the large number of industrial and warehouse land uses in the project area, all of these streets currently carry large truck traffic. Precise routes would be confirmed prior to construction.

4.18.2.4 Surface LRT Track Construction Methods

Areas of the LPA where at-grade track work would occur, namely the portal areas near 1st and Alameda Streets and the underground junction, are outlined in Chapter 2 of this Supplemental EA/Recirculated Draft EIR Sections. Typical construction activities involved in surface track work are described in Section 2.4.2. Construction would be performed within the roadway median and existing trackway near 1st and Garey Streets, and alongside the roadway, potentially with some temporary staging in the travel lanes. Typical drilling of the shafts for catenary pole and track installation is relatively shallow.

Periodic lane closures, typically on just one side of the work zone, would be required for delivery of materials and other construction activities such as concrete pours.

During construction, cross street and alleyway lanes may be temporarily closed. Depending on allowable working hours, multiple lanes may require closure during excavation, preparation of subgrade, drilling for soldier pile installation, and track foundation placement. Closures would be staggered to facilitate traffic control. Where possible, two-way traffic could potentially be allowed on half of the street.

4.18.2.5 Below Ground LRT Construction Methods

4.18.2.5.1 Cut and Cover Construction

Cut and cover construction would be utilized in various portions of the LPA alignment, as outlined in Chapter 2 of this Supplemental EA/Recirculated Draft EIR Sections. These areas include underground cut and cover and trackway construction on Flower Street between Wilshire Boulevard and 4th Street, underground stations, crossovers, portals, and the TBM reception area.

Cut and cover construction is one of various traditional construction methods for underground facilities. Open cut construction method is similar to cut and cover, but does not include temporary decking. Typical activities involved in cut and cover construction are described in Section 2.4.3 of this Supplemental EA/Recirculated Draft EIR Sections and Appendix K, Description of Construction, of the Draft EIS/EIR. Cut and cover entails a construction shoring system, excavating down from the ground surface, placing a temporary deck over the excavated area, constructing the underground facilities beneath the deck, and then backfilling and restoring the surface once the facilities are completed (Figure 4.18-2). Temporary concrete decking can be placed over the cut immediately following the first part of excavation (at about 12 to 15 feet below ground surface) to allow traffic to pass above. Once the deck is in place, excavation and internal bracing would continue beneath the deck to the required depth. Once the desired construction is completed inside the excavated area, the deck would be removed, the excavation would be backfilled, and the surface would be restored permanently.

Dewatering may be required at underground station locations and tunnel sites to temporarily lower the groundwater level below the excavation depth or to an impermeable layer. Dewatering facilitates installation of shoring systems, improves soil stability, and allows excavation in dry conditions. To dewater an area, groundwater would be pumped from wells installed around the perimeter of the excavation, limiting impacts to surrounding structures, ground, and utilities adjacent to the excavation. Any contaminated groundwater would be properly treated prior to being discharged. Uncontaminated groundwater may be treated and pumped back into the groundwater table, pumped to the sewer or storm drain system, or used on-site for dust control purposes.

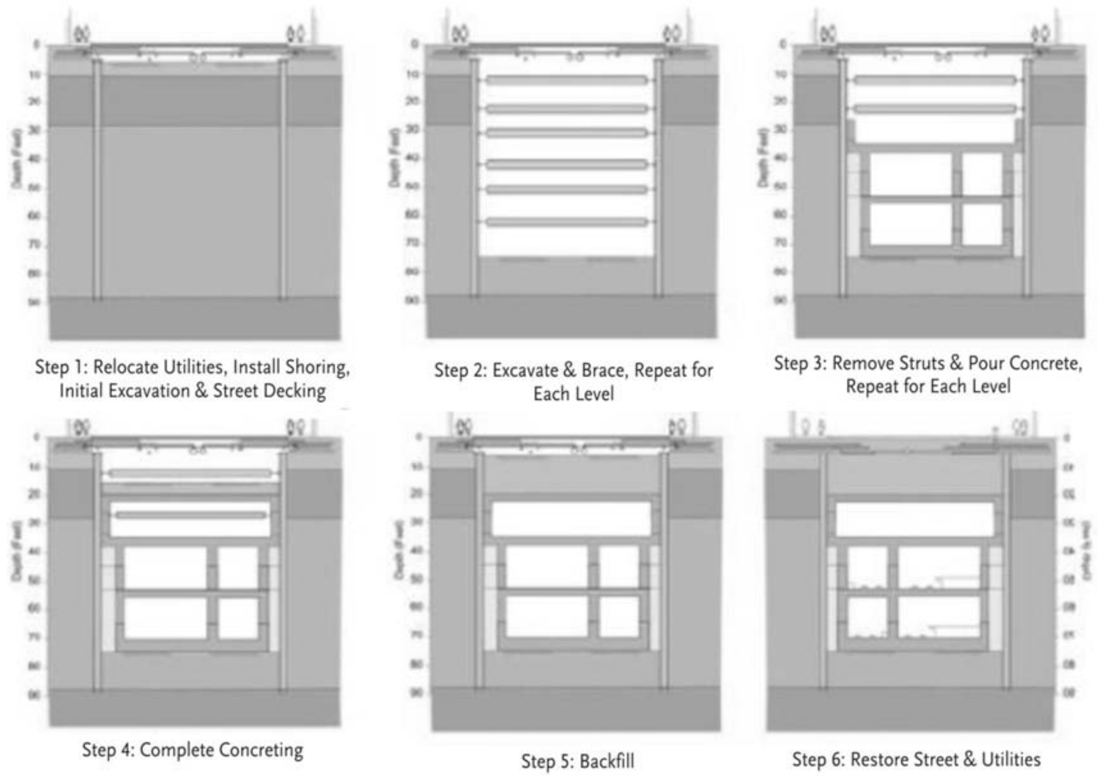


Figure 4.18-2. Cut and Cover Construction Method

Based on experience with the cut and cover construction of the two underground stations on the Metro Gold Line Eastside Extension, after the shoring system was in place, decking installation occurred in only several weekends with non-stop activity from Friday at 5:00 PM to Monday morning at 6:00 AM with community and local agency approval. Similar progressive staging could be performed for the Regional Connector project, and schedules would be developed in coordination with the affected communities. Portal construction would employ construction methods similar to those used for station excavations and retaining walls, but the portal would remain permanently open and no decking would be required during construction. However, decking may be used during construction of the portal on 1st Street for the LPA.

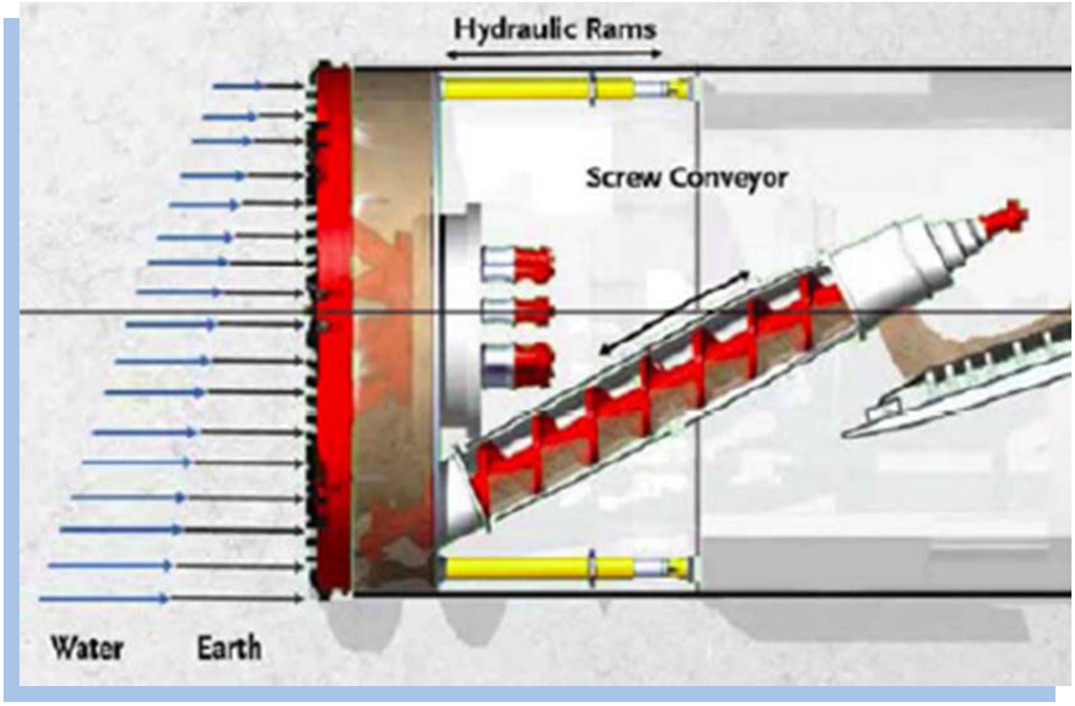
For the LPA, the trackway planned under Flower Street between Wilshire Boulevard and 4th Street, and all underground stations and crossovers would be built with the cut and cover technique. A potential exception is the 2nd/Hope Street station and the crossover near the 2nd/Broadway station, where open cut and SEM construction methods are being considered. Open cut construction would also be used for portions of the 1st/Central Avenue station for the LPA. Underground station construction could last up to 48 months at each underground station location.

Based on the anticipated volume of excavation for the cut and cover tunnel and stations, it is estimated that an average of 20 to 30 dump truck trips per day would be required to haul and dispose of the excavated soils.

4.18.2.5.2 Tunnel Construction and Tunnel Boring Machine (TBM)

Portions of the LPA along 2nd and Flower Streets are anticipated to be bored using a pressurized face TBM(s), as indicated in Chapter 2. Typical activities involved in cut and cover construction are described in Section 2.4.3 of this Supplemental EA/Recirculated Draft EIR Sections and Appendix K, Description of Construction, of the Draft EIS/EIR. TBMs are large-diameter horizontal drills that continuously excavate circular tunnel sections. Compared to the cut and cover method, tunnel boring is far less disruptive to surface traffic and adjacent land uses. The excavated materials would be removed through the tunnel using hopper type rail cars or a conveyor system. As the TBM advances, it would support both the ground in front of it and the hole it creates using a shield and pre-cast concrete tunnel liners (Figure 4.18-3). This method creates a tunnel with little disruption at the surface, and is especially suitable for creating a circular opening at depths that would not be practical for cut and cover construction. Concrete tunnel liner segments would have rubber gaskets between them where necessary to prevent water from entering the tunnel, allowing excavation to proceed below the groundwater level.

TBMs require an insertion shaft to start the tunneling operation. For the LPA, the TBM would be inserted into the ground on the Mangrove property on the northeast corner of 1st and Alameda Streets and into Central Avenue through the 1st/Central Avenue station box. The TBM would then excavate toward the 4th and Flower Streets reception area. The TBM would then be dismantled and retrieved through a vertical shaft at the reception area. It would then be transported back to the insertion shaft, and reassembled to repeat its journey for the second twin tunnel. Inserting two TBMs simultaneously, therefore eliminating the need to dismantle and transport a TBM back to the Mangrove property, is an option as well.



Source: CDM 2009

Figure 4.18-3. Tunnel Boring Machine (TBM) Method

Based on comments received on the Draft EIS/EIR and input received during subsequent community meetings, the TBM insertion site options at 2nd Street and Central Avenue and at 2nd/Hope Street station are no longer being considered for the LPA. Instead, the property at the northeast corner of 1st and Alameda Streets, known as the Mangrove property, would be the insertion site for construction of the LPA. This site is bounded by the Metro Gold Line to the west, Temple Street to the north, 1st street to the south, and Hewitt Street to the east. The property to be used for staging is currently used as an undeveloped surface parking lot with one storage building on-site and is owned by the City of Los Angeles. The TBM would be inserted into the ground on the Mangrove property instead of at the originally proposed 2nd/Central Avenue insertion area, which would reduce the intensity of construction on the block bounded by 1st Street, Central Avenue, 2nd Street, and Alameda Street and result in fewer acquisitions. Spoils (excavated soil) would be removed within the Mangrove property, and trucks would be routed to the east and/or north to reach the freeway, and would not pass through Little Tokyo. Tunnel boring activities from this site would proceed farther down Flower Street to 4th Street, instead of ending at the proposed 2nd/Hope Street station. No cut and cover on 2nd Street in Little Tokyo would be required with use of this TBM insertion site, which would result in less cut and cover overall during construction.

The pre-cast concrete liners would be fabricated off-site and delivered by truck. Segment delivery would require six to ten truck trips per day for the duration of tunneling, assuming an average excavation rate of 35 feet per day for a single tunnel. Should simultaneous tunneling occur, 12 to 20 truck trips would be required for segment delivery. Table 4.18-1 shows the number of truck trips that would be needed to support TBM activities for the LPA. All delivery and hauling would be performed from Temple Street, Hewitt Street, Vignes Street, and Santa Fe Avenue. Tunneling operation would typically be continuous, occurring seven days a week, 20 hours per day.

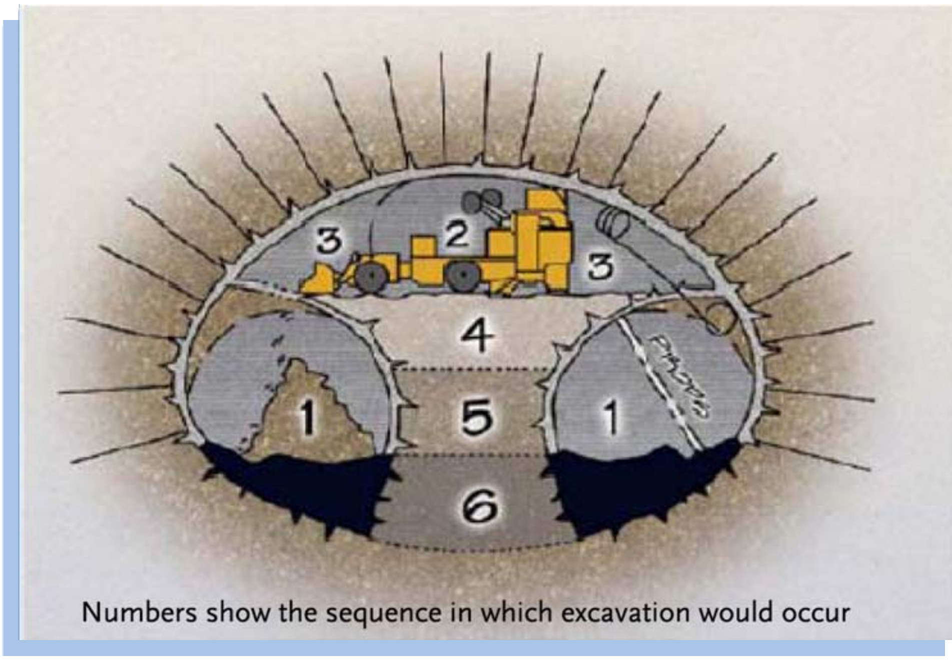
Table 4.18-1. Tunneling Activity Truck Trips for the Locally Preferred Alternative

Activity	Duration (months)	Truck Trips per Day
Pre-Construction	4-6	5
Site Preparation	12-18	10-20
Flower Street Cut and Cover Tunnel	24-48	20-30
2nd/Hope Street Station (SEM)	24-48	10-15
2nd/Hope Street Station (Open Cut)	24-48	20-30
2nd Street TBM Tunnel	24-48	35-70
2nd/Broadway Cut and Cover Station	24-48	15-20
TBM Insertion Site (Mangrove Property)	2-4	5-10
Cut and Cover Tunnel near 1st/Central Avenue Station	12-24	15-20
1st/Central Avenue Open Cut Station	18-36	20-30
Open Cut/Cut and Cover from 1st/Central Avenue to East Portal	12-24	15-20
Open Cut/Cut and Cover from 1st/Central Avenue to North Portal	12-24	15-20
Improvements near 1st and Alameda Streets	12-24	15-20

4.18.2.5.3 Sequential Excavation Method (SEM)

SEM construction involves excavating incrementally in small areas and supporting with steel supports beyond the opening and sprayed concrete as shown in Figure 4.18-4 and described in Section 2.4.4 of this Supplemental EA/Recirculated Draft EIR Sections and Appendix K, Description of Construction, of the Draft EIS/EIR. While TBMs can only excavate a fixed circular shape, SEM can be used to construct a tunnel with a horseshoe or sub-rounded shape. This construction technique would be considered in special instances where the planned depth, shape, or length of the tunnel may render it not cost-effective using other methods.

Due to the depth of the 2nd/Hope Street station for the LPA, SEM construction is being considered as an alternative to the open cut and cut and cover methods. Application of SEM would have less surface disruption than these methods since the excavation would be performed mostly underground and accessed via a vertical shaft.



Source: CDM 2009.

Figure 4.18-4. Sequential Excavation Method (SEM)

4.18.2.6 Additional Construction Activities

4.18.2.6.1 Construction of Underground Station and Portal Structures

Underground stations would be constructed in the following steps: excavation of the station box, followed by the pouring of the foundation base slab, followed by the installation of exterior walls and any interior column elements. Portal structures would use similar construction methods involving placement of concrete inverts, walls, and walkways. Some temporary lane closures would be needed. Station entrance locations would likely be used as access points to underground stations during the construction process. Exterior entrances would be constructed after the station structure has been completed.

The Metro Gold Line tracks would need to be temporarily relocated in the vicinity of 1st and Alameda Streets in order to accommodate portal and underground junction construction. Temporary tracks would be installed. Some temporary closures of the Metro Gold Line around the existing Little Tokyo/Arts District Station may be needed. During these times, temporary bus service would be established to transport passengers around the closures.

4.18.2.6.2 Operating Systems Installation

Operating systems for the LPA would include traction power, an overhead catenary system (OCS), a communications system, and a signal system. An at-grade OCS consists of poles connected to drilled shaft foundations with overhead wires to supply power to the trains. Within the tunnel segments, the OCS would be connected to the top of the tunnels. The system would include Traction Power Substations (TPSS) to provide direct power to the trains. TPSS equipment would need to be installed within station boxes along underground segments of the alignment. Signaling and communications systems would be installed inside the stations and tunnels, and equipment would be housed in ancillary rooms. Communications antennas would be installed on poles or incorporated into existing or planned structures, as described in Section 2.3.3.7 herein above.

4.18.2.6.3 Ventilation Shafts and Emergency Exits

The underground segments would include a number of ventilation and emergency exit areas in the vicinity of the underground stations. The stations would house emergency ventilation fan shafts, as well as separate emergency exit shafts at both ends of the stations. Ventilation fans would be installed to extract smoke from tunnels and stairs for evacuation in the event of an emergency, such as a fire in the underground areas. The exact location of these facilities would be determined during the final design. These shafts would be built as extensions of the station excavations using cut and cover construction methods. In some cases, ventilation shafts can extend above ground level, but this is anticipated only at the LPA's 1st/Central Avenue station.

4.18.2.7 Protection of Existing Structures

The alignment of the Regional Connector project and stations have been planned to minimize construction near or beneath the existing structures. However, there are areas where this cannot be avoided. Existing structures along both sides of the LPA alignment on Flower and 2nd Streets would be close to the excavation sites or the tunnel alignment. Building assessments would be necessary as part of the pre-construction evaluation of existing structures along the alignment. During preliminary and final design of the project, subsurface (geotechnical) investigations would be undertaken to evaluate soil, groundwater, and environmental conditions along the alignment. The geologic conditions will influence design and construction methods specified for stations and tunnels and protection of existing facilities and foundations.

Before any construction, a survey of structures within the anticipated zone of construction influence would be conducted in order to establish baseline conditions. A geotechnical instrumentation and settlement monitoring plan and mitigation measures would be developed and adhered to during construction to ensure appropriate measures are taken to address any construction-induced movement.

If assessments indicate the necessity to proactively protect nearby structures, additional support for the structures by underpinning or other ground improvement techniques would be required prior to the underground construction.

For buildings adjacent to cut and cover construction, it is anticipated that the shoring system in conjunction with internal bracing could provide a temporary support for the proposed excavation that would result in deformation generally within the tolerable limits of the structures. Evaluations during future phases of design would help determine the appropriate levels of monitoring, protection, and mitigation measures required during construction.

To reduce surface settlement and the potential for ground loss and soil instability (sloughing, caving) at the tunnel face due to tunneling, closed pressure-face TBMs and pre-cast, bolted and gasketed segmental lining systems would be employed. In combination with the face pressure, grout would be injected immediately behind the TBM, in the annular space between the installed precast concrete liners (tunnel rings) and the excavated ground. The closed pressure-face TBM can tunnel below the groundwater table without requiring dewatering or lowering of the groundwater table.

Where conditions warrant, for example shallow tunnels directly below sensitive structures or utilities, additional methods to reduce settlement would be specified. The following is a brief summary of the various types of protective methods that could be employed along the alignment.

4.18.2.7.1 Permeation and/or Jet Grouting to Improve the Ground Prior to Tunneling

Chemical (sodium silicate) or cement-based grouts are injected into the ground to fill voids between soil particles and provide greater strength and stand-up time for the soil. This grout can be placed through pipes from the surface before the tunnel reaches the grouted area or from pits or shafts adjacent to the grouted area. The permeation methods have been used successfully for the Metro Red Line in instances where the tunnel passed under potentially sensitive or important structures such as the US 101 Freeway (downtown, Hollywood and at Universal City).

4.18.2.7.2 Compaction Grouting as the Tunnel is Excavated

This method involves injection of a stiff "grout," typically sand with small amounts of cement, above the tunnel crown as the tunnel advances. The grout increases soil density above the tunnel crown and replaces some of the lost ground, thereby preventing settlement from propagating to the surface. This method was used in several instances for the Metro Red Line project in the downtown Los Angeles area and along portions of Hollywood Boulevard.

4.18.2.7.3 Compensation Grouting

Compensation grouting involves carefully controlled injection of grout between underground excavations and structures requiring protection from settlement. For tunnel applications, the pipes for grouting are installed above the intended tunnel position, in advance of tunneling. A major key component in controlling compensation grouting is careful monitoring of both structure and ground movements to allow the timing and quantities of grout injected to be optimized. Grout injection can take place before, during, and after tunneling activity with grout pipes that are designed for multiple grout injections.

For grouting methods, surface preparation would likely be required (removal of landscaping etc.) to allow space for drilling equipment, installation of grout pipes, and injection of grout. In cases where large structures are directly over the tunnel, access into the building or basements, where basements exist, could be required for grouting operations, and use of the building could be limited during the grouting operations. After grouting is completed, the area would be restored to its existing condition.

4.18.2.7.4 Underpinning

Underpinning involves providing a direct support of the foundations of an existing building by carrying its load bearing element to deeper levels than its previous configuration. This method of protection provides positive protection of the building from settlement that may be caused by tunneling operations or open cut station excavations below the bottom of adjacent foundations. It permanently extends the foundations of a structure to an appropriate level beyond the range of influence of the construction activity. This can be accomplished by providing deeper piles adjacent to or directly under the existing foundation and transferring the building foundation loads onto the new system.