APPENDIX E

ITC Operating Systems

INGLEWOOD TRANSIT CONNECTOR

OPERATING SYSTEM CONCEPTUAL PLANNING

EIR PROJECT DEFINITION

AUGUST 2021

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ATTORNEY-CLIENT PRIVILEGE;
FOR REVIEW AND DISCUSSION PURPOSES ONLY

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1 Introduction

1.1 Project Background

The City of Inglewood is currently developing an Environmental Impact Report to evaluate the environmental effects of the proposed Inglewood Transit Connector (ITC) Project.

The ITC Project was developed to address the anticipated increase in mobility needs due to the City's projected population and employment growth and the new sports and entertainment venues. The City recognized that in order to provide quality and high level of service for residents, commuters, and event attendees, a transit system providing the "last mile" connection between the future Metro Crenshaw/LAX Station and the event venues is needed. The transit system would also improve economic activity along the alignment, providing opportunities for integration with transit-oriented development and other initiatives in the area.

In June 2018, the City of Inglewood released their Envision Inglewood report which established the City's locally preferred alternative for providing automated transit service to the City's growth centers. Named the Inglewood Transit Connector (ITC), this system would provide high-frequency service between the future Downtown Inglewood Metro Crenshaw/LAX Station and the Forum; the Los Angeles Stadium and Entertainment District at Hollywood Park (LASED), which is the home of the LA Rams and LA Chargers NFL teams; and the Inglewood Basketball and Entertainment Center (IBEC), which is the future home of the LA Clippers NBA team. The ITC system will provide service to residents and commuters on non-event days, and special event service on event days.

1.2 Report Purpose

The scope of this report is to present the results of the conceptual planning performed in support of the development of the EIR project definition.

The analysis includes:

- Description of the Automated People Mover (APM) configuration, including guideway geometry
- Overview of the APM demand
- Basis for the APM project
- Description of APM system operations and operating modes
- Normal and event-based operations
- Round trip times, fleet, and system capacity
- Maintenance and Storage Facility conceptual requirements
- Power Distribution System Substation conceptual requirements
- Conceptual cost estimates for the APM operating system

These Conceptual Plans identify the proposed Alignment for the APM, which will be in the public right of way, with some encroachments on property located adjacent to the public right of way as described further below. These Conceptual Plans will be refined as design of the facility progresses. However, in order to evaluate potential impacts of the project, the size of the APM guideway, columns and other components of the Project as identified in the Conceptual Plans illustrate the likely maximum potential size of these elements. The location, layout, and size of the proposed stations, power distribution system substations, and maintenance and storage facility as illustrated in the Conceptual Plans also represent the likely maximum potential size of these facilities for the purpose of analyzing the potential impacts of the Project. The description of the proposed changes to streets identified in the alignment plans are also illustrative and identify the likely maximum potential extent of changes to existing streets proposed as part of the Project. Engineering and design-level details of the Project will be refined as the Project moves through the environmental review, approval, procurement, and design processes.

1.3 Basic Assumptions

Initial planning for the ITC project was conducted under the Envision Inglewood effort, which included an alignment alternatives review, ridership development, operational analysis, and identification of the preferred alignment.

For this project, assumptions and parameters established under the Envision Inglewood effort were reviewed to determine their continued applicability for the ITC project. The following assumptions for the operations of the ITC system were identified as being relevant and are continued to be used as basic assumptions for the ITC Project.

- The ITC alignment would further refine Alignment A of Envision Inglewood: Market-Manchester Alignment, which was selected as the preferred alignment for further study. This alignment is also included in the City of Inglewood Notice of Preparation and Notice of Public Scoping Meeting for an Environmental Impact Report, July 16, 2018.
- The five-station alignment developed for the Envision Inglewood project was further refined for cost and operational efficiencies. The proposed dual lane system serves three (3) stations:
    - Market Street/Florence Avenue Station, located at the southeast corner of Market Street and Florence Avenue on property that requires acquisition, provides connection to the future Downtown Inglewood Metro Crenshaw/LAX Station;
    - Prairie Avenue/Manchester Boulevard Station, located at Prairie Avenue and Manchester Boulevard, which provides connection to The Forum; and
    - Prairie Avenue/Hardy Street Station located at the northwest corner of Prairie Avenue and Hardy Street on property that requires acquisition provides connections to LASED and the IBEC Project.
- The ridership developed for the Envision Inglewood Appendix B: Ridership Memo was refined by Raju Associates, Inc. based on new information as it became available throughout the project.
- Capacity per car is based on a passenger space allocation of 2.7 sq. ft per passenger identified in Envision Inglewood, Section 4.5 Operations Analysis, which this evaluation confirms is consistent with the Federal Transit Administration (FTA)-sponsored Transit Cooperative Research Program (TCRP) Report 57's definition of AW2 design load (seated plus 4 standing passengers per square meter) and is appropriate for peak period demands on an urban transit system. Sensitivity analyses performed also considered higher passenger densities, that have been considered in some locations across the world for limited frequency, high-demand, special event scenarios, to evaluate its impacts. These analyses considered criteria discussed in TCRP Report 165, Transit Capacity and Quality of Service Manual, Third Edition (2013), which considers passenger

densities to as much as 2.15 sq. ft per passenger (5 standing passengers per square meter) to be permissible during special events. Passenger densities as high as 1.8 sq. ft per passenger (6 standing passengers per square meter) were also evaluated to determine the effect on fleet size and train length; however, this density was considered not appropriate for a transit system in the United States.

- The Envision Inglewood report identified the technology to be an automated people mover (APM) and found the following three self-propelled technologies to be maintained for consideration: rubber-tire, large monorail, and steel wheel/steel rail. These three technologies as well as cable-propelled technologies were assessed as part of the ITC Project. See Section 3. The assessment found that while the application of steel wheel/steel rail and cable-propelled technologies are considered challenging due to the physical constraints and operational expectations, they are not precluded from proposing on the project to provide industry an opportunity to evaluate and determine their applicability to the project.
- The system operates daily from 6:00 a.m. to 11:59 p.m. and shuts down from 12:00 a.m. to 5:59 a.m. Extended hours may be operated for special event days.

2 System Layout

The ITC systems is a fully elevated, APM system, spanning a total length of approximately 8,100 ft (dual lane) and connecting a total of three, center platform stations, as shown in Figure 2-1.

On the north end of the alignment, the system begins with the Market Street/Florence Avenue Station located east of Market Street just south of Florence Avenue, serving the future Metro/LAX Crenshaw LRT Station located on the north side of Florence Avenue and the historic Market Street district. The ITC Project will operate as an extension of existing transit facilities by providing a station and passenger walkway connecting the ITC Project to Metro's Downtown Inglewood Station on the Crenshaw/LAX Line. The ITC Project is necessary to close the last-mile gap between the Crenshaw/LAX line and the City's new activity centers, allowing passengers to transfer to or from the Crenshaw/LAX Line and connect to the City's activity centers. From the Market Street/Florence Avenue Station the alignment runs south for approximately 0.35 miles, turning east at Manchester Boulevard for another 0.45 miles until turning south on Prairie Avenue.

The alignment continues south on Prairie Avenue for approximately .73 miles, ending just north of Hardy Street. The two event-serving stations, Prairie Avenue/Manchester Boulevard Station and Prairie Avenue/Hardy Street Station, are located along Prairie Avenue Further information on stations is provided in Section 6.

All stations and the immediate guideway connecting into these stations will be located adjacent to public rights of way on properties requiring acquisition. Where possible, the dual tracks are closely spaced and designed to allow for a single column to support both guideway lanes, thus minimizing the infrastructure needs.

Trains will be maintained and stored at an off-line Maintenance and Storage Facility (MSF), which is planned to be located on a site shared with the Vons Supermarket at 500 E Manchester Boulevard, Inglewood, CA 90301 at Manchester Boulevard. and S. Hillcrest Boulevard Further information on the MSF is provided in Section 8.

The system is planned to be powered by two power distribution system (PDS) substations. The final substation locations are yet to be confirmed with the local utility and City as of the time of the writing of this report. However, planned locations have been identified and are discussed in Section 9.

The alignment profile was developed assuming a minimum clearance of 16 ft – 6 in. is required above all roadways. The guideway elevations are dictated by the elevations at the stations. The guideway elevations between stations are adjusted to ensure the minimum roadway clearance is maintained.

The full alignment plan and profile is provided in Appendix A.

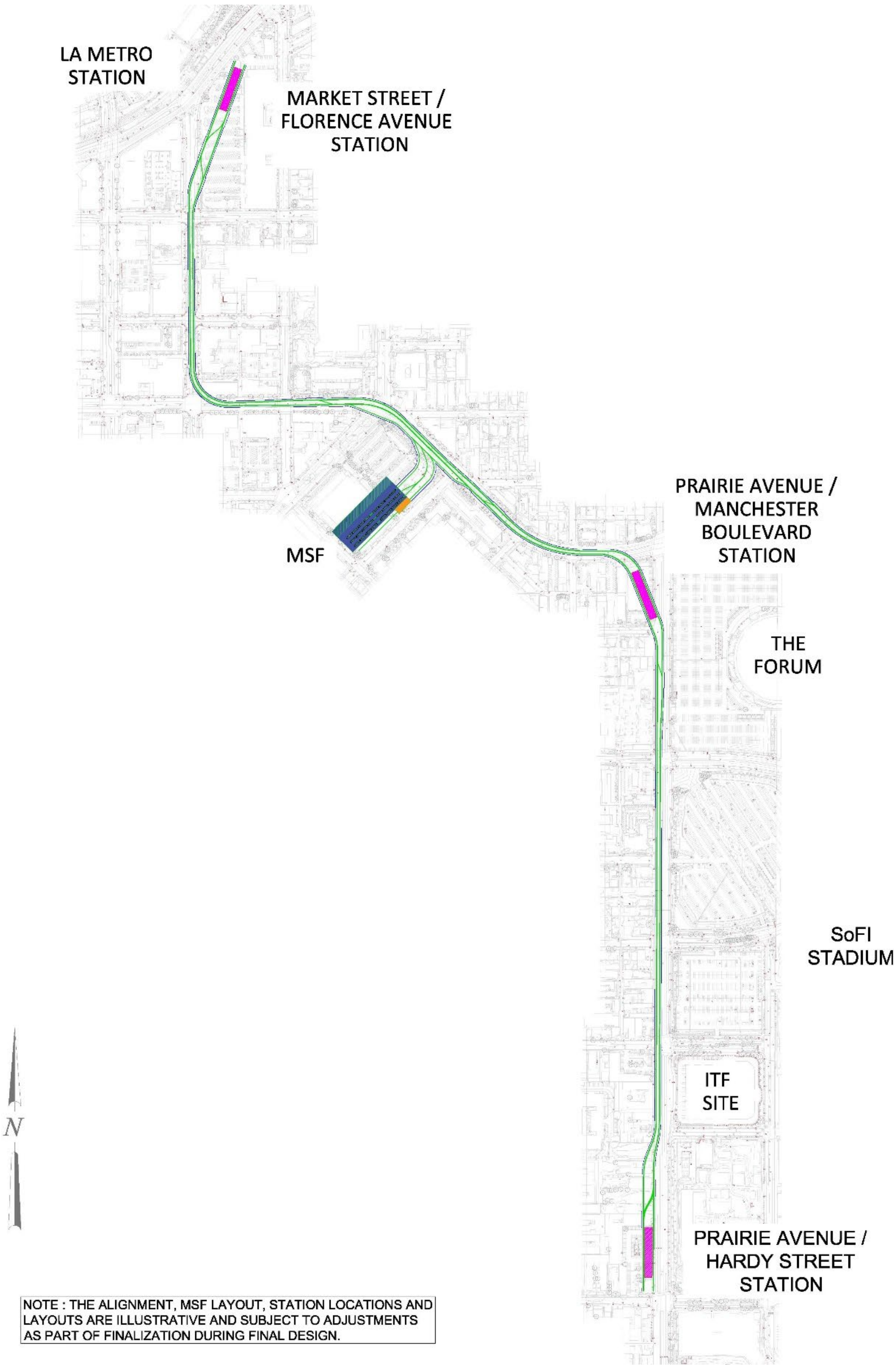

Figure 2-1: Map of Proposed System Alignment
(Preliminary conceptual draft: subject to change)

2.1 Utilities Review

During the development of the ITC alignment, the City of Inglewood advised that the large water and sewer pipes along Prairie Avenue are to be avoided. Relocation of these utilities would be a major effort.

Based on the review of the City-provided utility information, the large water and sewer utilities are concentrated either in the center or eastern edge of Prairie Avenue. An extensive utility mapping effort was performed by the EIR team's infrastructure consultant. The location of these utilities guided the development and refinement of the alignment along Prairie Avenue. The alignment is located on the western edge of Prairie Avenue, allowing for ITC Project foundations to avoid the large water and sewer utilities.

2.2 Alternatives

A five-station alignment alternative developed for the Envision Inglewood project was further refined as part of the ITC Project. This effort included the refinement of the alignment and station locations, including review of a station south of Century Blvd. As part of an optimization effort, which was informed by stakeholder coordination, station locations and their connectivity to the City's growth centers were assessed against various parameters, including passenger demand, operations, ability to integrate with their respective sites, and cost. Through this effort, the alignment was refined to three stations, optimizing the level of service for its passengers while providing cost benefits. The Market Street/Florence Avenue Station was refined to allow for a more seamless connection to the Metro station, minimize infrastructure over Market Street, and provide residential and commercial development opportunities to further enhance the Market Street commercial district. Manchester Station was removed as a non-event serving station. In preparation for the DEIR recirculation, the project was refined in coordination with stakeholders. The Prairie Avenue/Manchester Boulevard Station and Prairie Avenue/Hardy Street Station locations were refined to align the stations to the development and optimize service to the future growth centers, The Forum, the LASED development, and the IBEC development.

3 Technology

The ITC Project's transit technology is a form of light rail technology that can be steel-wheel/steel rail, rubber tired, magnetically levitated, or cable-propelled propulsion systems. The technology can also be supported on dual rails (that may be steel rail or concrete plinths), straddling or suspended from a single beam/rail such as in a monorail type technology, and operate within a dedicated trainway. Power distribution will be through a third rail instead of overhead catenary to avoid additional visual impacts due to the overhead catenary system wires and support structures. It will be fully automated (i.e. driverless) which is necessary to operate at the tight headways to meet the projected ridership needs. The vehicles are smaller than traditional heavy rail technology so as to successfully maneuver the tight-radius curves driven by the site-specific conditions. This type of technology is often times also referred to as automated guideway transit, automated people movers or simply monorails; regardless of the terminology used it is a form of a light rail technology.

3.1 Technology Assessment

As part of this ITC project, the Envision Inglewood technology conclusions were further assessed against the ITC project's alignment and station refinement efforts. These refinement efforts focused on ensuring that the physical requirements for the project (i.e., alignment including turn radii, guideway widths, station sizes, power distribution system substations and Maintenance and Storage Facility) were developed based on maximizing the number and types of automated transit system technologies that may be viable for the project – this encourages a robust competitive procurement environment. A key driver of potential technology viability was the ridership capacity, ability to fit within the physical project requirements, operational flexibility, and noise during operations.

The Envision Inglewood technology evaluation identified Large Monorail and Rubber-tire APMs as the technology to be maintained for consideration for the ITC project and identified large automated steel-wheel/steel rail technology as a "maybe" for further consideration.

As part of this ITC project, the technical requirements for large automated monorail, rubber-tire APMs, automated steel-wheel/steel-rail, also known as automated light rail transit (ALRT), and cable-propelled APMs were reviewed against the public right of way and property availability to determine the technologies best applicable for the project. The results of the review, also summarized in Table 3-1, are as follows:

- It was confirmed that large, automated monorail and rubber-tire APM technologies are still applicable and appropriate for the project. The requirements for rubber-tire and large monorail APM technologies were used in the project design.
- Through the Market Sounding efforts completed to date, cable-propelled technologies were identified as potentially viable for the project since they generally fit within the project right of way and have proven to be highly adaptable to project-specific requirements through innovative approaches and technological advancements. **Hence, cable-propelled technologies are not precluded from proposing on the project, providing industry the opportunity to offer the best possible solution for the ITC.**

- The review concluded that the typical ALRT requirements of technologies currently available should not continue to be used in alignment planning due to the resulting need for additional property acquisitions requirements and potential higher noise levels. **Although ALRT design requirements were not applied to the design of the project, they are not precluded to propose on the project if they can fit within the identified right of way and meet all other specified requirements.** This provides industry the opportunity to offer the best possible solution for application of ALRT to the project, within the constraints that are defined.

While rubber-tired APM systems, including monorail systems, can be readily applied to the project requirements as defined, cable-propelled and steel wheel/steel rail technologies may also be applied to the project provided they sufficiently demonstrate the ability to comply with the established project requirements including maximum limits on noise and fitting within the defined physical space of the project. Certain suppliers offer or are in the process of updating their technologies to meet these requirements, and it is therefore prudent to allow the market to determine the best solution in terms of the proposed technology as part of the procurement process.

TECHNOLOGY	MEETS CAPACITY	STAYS WITHIN ALIGNMENT SPECIFIC CONSTRAINTS/ GEOMETRY	AVOID MSF PROPERTY IMPACTS	LOW NOISE POLLUTION	SUMMARY OF VIABILITY
Rubber-tire APM	Yes	Yes	Yes	Yes	Yes
Monorail	Yes	Yes	Yes	Yes	Yes
ALRT*	Yes	No	No	No	Potentially viable
Cable-Propelled*	Maybe	Yes	Yes	Yes	Potentially viable

*ALRT and cable-propelled APMs are not precluded from proposing.

Table 3-1: Summary of Comparison Between Possible Transit Technologies

The following sections provide further information on the rubber-tire, large monorail, ALRT, and cable-propelled technologies and suppliers.

3.2 Self-Propelled Rubber-Tire APMs

Large rubber-tire APM systems are in widespread use at airports around the world, as well as in urban areas. These systems feature one-car to nine-car trains operating in a shuttle or pinched loop configuration. While vehicle characteristics vary significantly between the various suppliers, typical characteristics for the most commonly implemented technologies include:

- Train speeds of up to 50 mph;
- Urban system car capacity of approximately 90 to 100 passengers per car;
- Minimum turning radius of between about 75 ft and 180 ft;

- Vehicle dimensions of approximately 40 to 42 ft long by approximately 9 ft wide;
- Maximum recommended grade of 6%.

Currently available self-propelled rubber-tire APM technologies are:

- Alstom (formerly Bombardier) INNOVIA APM 300
- Mitsubishi Heavy Industries (MHI) Crystal Mover
- Siemens CityVAL and AirVAL: Currently implementing first AirVAL system at Bangkok Suvarnabhumi International Airport and CityVAL began service in Rennes, France in December 2020
- IHI/Niigata I-Max: IHI / Niigata has developed a new, larger vehicle, the "I-Max", and tested it extensively on a test track in Korea. This vehicle has yet to be implemented on a project.
- Woojin Industrial Systems Rubber-tire APM
- Schwager Davis APM

These are generally proprietary technologies that preclude interoperability as they each have different physical dimensions, power/signaling requirements, guidance mechanisms, and other features. MHI, Woojin, and IHI are potential exceptions to this rule, though interoperability requirements significantly limit the range of vehicle design, performance and other factors.

While rubber-tire APMs are most common at airports, they are also operated as urban transit systems. Urban systems where this technology is operating, and the suppliers of the systems include (the list does not include APMs that have been decommissioned or are no longer on service):

- Europe
    - France Rennes Metro: Siemens CityVAL
- United States
    - Miami, Florida Metromover: Alstom (formerly Bombardier)
    - Hilton Waikaloa Village and Maui International Airport, Hawaii: Schwager Davis
    - Orlando and Tampa SkyConnect, Florida: MHI Crystal Mover
- Asia
    - Shanghai Metro Line 8: Alstom (formerly Bombardier) INNOVIA APM 300
    - Guangzhou Zhujiang New Town: Alstom (formerly Bombardier) INNOVIA APM 100
    - Singapore Bukit Panjang LRT: Alstom (formerly Bombardier) INNOVIA APM 100
    - Singapore Sengkang and Punggol LRT: MHI Crystal Mover
    - Macau Taipa LRT: MHI Crystal Mover

Alstom (formerly Bombardier) INNOVIA APM 300

Bombardier has provided by far the most airport and urban APM systems. In addition to 20 worldwide airport projects, they have also implemented six urban systems in China, Singapore, and the United States. Their current vehicle is the INNOVIA APM 300, operated at Dubai International Airport and being implemented at Frankfurt International Airport. The INNOVIA APM 300 is a center-guided vehicle, with all guidance and power rails located between the vehicle tires.

Figure 3-1: Bombardier INNOVIA APM 300, Shanghai (Source: chinanews.com)

MHI Crystal Mover

MHI (Mitsubishi Heavy Industries) has several urban APMs in Japan and Singapore and is nearing the completion of the Macau Taipa line, which will operate 11 stations and 55 vehicles. It is also a strong player for airport APM systems, with 12 total urban and airport projects worldwide. The Crystal Mover is a side-guided vehicle, with all guidance and power rails and equipment located on the sides of the vehicle.

Figure 3-2: MHI Crystal Mover, MIA Mover, Miami International Airport (Source: Lea+Elliott)

Siemens AirVAL

Siemens Transportation's latest generation of their VAL system are the AirVAL and CityVAL transportation systems. The AirVAL and CityVAL systems differ in vehicle width only; all other systems (train control, guidance, etc.) are the same. In 2018, Siemens began operation of their first CityVAL system on the Rennes Metro in France and they are implementing their AirVAL system at Bangkok's Suvarnabhumi International Airport. The AirVAL and CityVAL are center-guided vehicles, with all guidance and power rails located between the vehicle tires.

Figure 3-3: Siemens CityVAL, Rennes, France (Source: Siemens)

IHI/Niigata I-MAX

IHI/Nigata has developed a new Japanese standard vehicle, the "I-Max", and tested it extensively on a test track in Korea as shown in the figure. However, this vehicle has yet to be implemented on a project, the I-Max is larger than the vehicles that IHI provided to Hong Kong International Airport. The I-MAX is a side-guided vehicle, with all guidance and power rails and equipment located on the sides of the vehicle.

Figure 3-4: IHI I-Max

Woojin Industrial Systems

Woojin is a newer APM supplier with only two airport APM systems in operation. The Seoul Incheon airside Terminal 2 shuttle APM system began operations in January 2018, and the Jakarta Soekarno-Hatta Airport landside systems began operations in 2018. In addition, Woojin implemented the Busan metro line No. 4 (South Korea) which operates their automated guideway transit (AGT) technology, a similar automated, rubber-tire technology. The Busan system started revenue service in 2011.

Figure 3-5: Woojin APM, Soekarno-Hatta Airport, Indonesia (Source: Gunawan Kartapranata)

Schwager Davis (SDI) APM

The existing SDI APM system is a smaller APM, with typically lower speeds and lower capacities than the other typical rubber-tire APMs listed in this section. However, SDI has proved to be an innovative company, tailoring their technologies to fit the needs of their projects, including developing new vehicle designs and switch mechanisms for unique applications.

Figure 3-15: IU Health (Decommissioned) (Source: Schwager Davis Inc.)

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3.2.1 Applicability to ITC Project

Rubber-tire APMs are feasible and applicable for the ITC project.

- Capacity: With a vehicle capacity of approximately 97 passengers per car, this technology can meet the demand requirements for the ITC project.
- Alignment Specific Constraints / Geometry: The minimum turning radii for operating and maintenance tracks are well suited for the urban environment and geometric constraints of the Manchester MSF location.
- MSF: The site slated for the ITC MSF can fit an MSF facility capable of performing all required maintenance and can store the full 6-train fleet anticipated for the project.
- Noise: Rubber-tire systems have much lower noise impacts compared to rail system.

3.3 Monorails

Monorails are in widespread use in urban environments around the world, as well as some systems at airports. The unique feature of monorails is that they are either supported by or suspended from a single beam, which generally provides a minimized visual impact. Monorails feature connected vehicles operating in a shuttle or pinched loop configuration. Typical characteristics include:

- Train speeds of up to 50 mph;
- Urban system car capacity of approximately 90 to 110 passengers per car;
- Minimum turning radius of 200 ft;
- Vehicle dimensions large monorails of approximately 55 to 65 ft long by approximately 9.5 ft to 10.3 ft wide; and
- Maximum recommended grade of 6%.

Example large monorail systems are:

- Alstom (formerly Bombardier) INNOVIA Monorail 300;
- BYD, SkyRail;
- Hitachi; and
- Scomi Rail.

These are generally proprietary technologies that preclude interoperability as they each have different physical dimensions, power/signaling requirements, guidance mechanisms, and other features.

Urban monorail systems and the suppliers of the systems include:

- <u>South America</u>
    - Sao Paulo Monorail, Brazil: Bombardier
- <u>United States</u>
    - Las Vegas Monorail: Alstom (formerly Bombardier)
- <u>Asia</u>
    - Daegu, South Korea: Hitachi
    - Chongqing, China: Hitachi

- Riyadh, Saudi Arabia: Alstom (formerly Bombardier)
- KL Line, Kuala Lumpur Malaysia: Scomi

Alstom (formerly Bombardier) Innovia 300 Monorail

Bombardier has implemented their Innovia monorail technology in multiple locations worldwide, including in China, Korea, Japan, and the United States. Their current vehicle is the Innovia 300, implemented most recently in Brazil and under construction in Saudi Arabia. The technology is a straddle-beam technology.

Figure 3-6: Las Vegas Monorail Four-Car Vehicle

Hitachi

Hitachi has a range of monorail vehicle sizes, ranging from small systems, such as the monorail on Sentosa island in Singapore, to large technologies implemented in Daegu, South Korea. The technology is a straddle-beam technology.

Figure 3-7 Hitachi Monorail, Daegu Metro Line 3 (Image source: IMKSv)

Scomi Rail

Scomi Rail is a rolling stock supplier in Malaysia, implementing multiple projects in Asia including in Kuala Lumpur and Mumbai. The technology is a straddle-beam technology.

Figure 3-8: Scomi Rail Monorail, Kuala Lumpur (Image Source: Howard Pulling)

BYD SkyRail

Build Your Dreams (BYD) is currently actively marketing their SkyRail monorail technology worldwide. SkyRail currently has projects in implementation; however, no projects are currently in operation. The technology is a straddle-beam technology.

Figure 3-9 BYD SkyRail Monorail, Shenzhen (Image source: BYD)

3.3.1 Applicability to the ITC Project

Large monorails are feasible and applicable for the ITC project.

- Capacity: With a vehicle capacity of approximately 100 passengers per car, this technology can meet the demand requirements for the ITC project.
- Alignment Specific Constraints / Geometry: The minimum turning radii for operating and maintenance tracks are well suited for the urban environment and geometric constraints of the Manchester MSF location. However, it does have larger property impacts at tight-radius turns at Market Street/Manchester and Prairie Avenue/Manchester Boulevard where tight-radius turns are needed.
- MSF: The site slated for the ITC MSF can fit an MSF facility capable of performing all required maintenance and can store the six-train fleet.
- Noise: Rubber-tire systems have the much lower noise impacts compared to rail system.

3.4 Automated Light Rail Transit (ALRT)

Large steel-wheel APM systems operate in numerous urban settings and two landside airport applications. These systems feature two-car to six-car trains operating in a shuttle or pinched loop configuration.

Typical characteristics include:

- Train speeds of up to 60 mph;
- Urban system car capacity of approximately 140 passengers per car;
- Minimum practical turning radius of about 300 ft;
- Vehicle dimensions of approximately 55 to 60 ft long by approximately 9 ft wide;
- Maximum recommended grade of 6%.

Currently available ALRT technologies are:

- Alstom (Previously Bombardier) Metro,
- KinkiSharyo, and
- Hitachi (formerly Breda).

The greater capacity and speed of this technology makes it more suitable for systems with relatively straight alignment on dedicated transportation right of way for the system.

ALRTs are most commonly operated as urban transit systems, and they are also applied at airports. Landside airport applications of this technology include New York Kennedy (JFK) and the Beijing Capital (PEK) International Airports.

Urban Systems where ALRT technology is operating, and the suppliers of the systems include:

- Europe
    - Copenhagen, Denmark; Breccia, Italy; Thessaloniki, Greece:

- North America
  - Vancouver SkyTrain: Bombardier
  - Toronto: Bombardier
  - New York: Bombardier
  - Honolulu (under construction): Hitachi
- Asia
  - Dubai Metro: KinkiSharyo/Mitsubishi system
  - Singapore: Bombardier
  - Kuala Lumpur: Bombardier
  - Taipei: Hitachi

Alstom (Previously Bombardier) MOVIA Metro

Alstom has implemented their ART technology worldwide, with multiple locations including the United States, Canada, and Singapore. Their current vehicle is the MOVIA Metro and is compatible with Alstom's CITYFLOW 650 automated train control technology.

Figure 3-10: Alstom MOVIA Metro ART, Singapore (Source: Bombardier)

KinkiSharyo

KinkiSharyo has implemented many manually-driven metro systems, but their fully automated systems are limited to the Dubai Metro system.

Figure 3-11: KinkiSharyo ART, Dubai (Source: KinkiSharyo)

Hitachi

Hitachi, which purchased AnsaldoBreda, has implemented multiple automated metro systems worldwide, including Asia, and Europe. Hitachi is currently implementing the Honolulu Rail Transit Project.

Figure 3-12: Hitachi, Honolulu (Source: Hitachi)

3.4.1 Applicability to the ITC Project

ALRT technology is not recommended for the ITC project. However, the technology is not precluded from proposing on the project if they can fit within the identified right of way and meet all other specified requirements.

- Capacity: With a vehicle capacity of approximately 140 passengers per car, this technology can meet the demand requirements for the ITC project.
- Alignment Specific Constraints / Geometry: The minimum turning radius (300 ft operating) is larger than what can be easily accommodated in Inglewood's urban environment and geometric constraints of the Manchester MSF location. It results in much larger property impacts at tight-radius turns at Market Street/Manchester and Manchester/Prairie where tight-radius turns are needed.
- MSF: It was found that the site slated for the ITC MSF resulted in space constraints for an ALRT MSF; further property acquisitions are likely to be required if an ALRT MSF is located at the ITC MSF site. However, an ALRT supplier is not precluded from proposing on the project if they can fit the ALRT technology into the identified MSF site without requiring additional property acquisitions.
- Noise: Generally, steel wheel/steel rail systems have higher noise levels than rubber-tire systems, and the tighter the turning radius, the higher the noise levels resulting from wheel squeal. As minimum turning radii will be required at Market Street/Manchester Boulevard and Manchester Boulevard/Prairie Avenue, higher noise levels may occur. However, there are certain suppliers and technologies that, if applied, can mitigate and limit the noise impacts.

3.5 Cable-Propelled

Cable-propelled APM systems operate in numerous urban settings and airport applications. The unique feature of cable-propelled system is that the vehicles do not have onboard propulsion motors. Instead, they are propelled by a cable. These systems feature two-car to eight-car trains operating in a shuttle or pinched loop configuration. Typical characteristics include:

- Train speeds of up to 31 mph;
- Urban system car capacity of approximately 10 to 56 passengers per car;
- Minimum turning radius of 130 ft;
- Vehicle dimensions of approximately 50 to 170 ft long by approximately 9.5 ft wide; and
- Maximum recommended grade of 6% to 10%.

Currently available cable-propelled technologies are:

- Doppelmayr Cable Liner; and
- Leitner Poma MiniMetro.

Cable-propelled APM systems are most commonly operated as urban transit systems, and they are also applied at airports. Landside airport applications of this technology include Toronto Airport LINK (YYZ), Mexico City (MEX), Birmingham (BHX), Detroit Metropolitan Airport (DTW), Minneapolis−Saint Paul International Airport (MSP), Doha International Airport (DOH), BART to Oakland International Airport (OAK) line, Miami International Airport (MIA), etc.

Urban cable-propelled systems and the suppliers of the systems include:

- Europe
  - Venice, Italy: Doppelmayr
  - Laon, France: Leitner Poma
- United States
  - Las Vegas Mandalay Bay Tram: Doppelmayr
  - BART to Oakland Airport Connector: Doppelmayr
  - MIA E Train, Miami, Florida: Leitner Poma
- Africa
  - Sun City, South Africa: Leitner Poma

Doppelmayr Cable Car

The Doppelmayr Cable Car (DCC) Cable Liner system typically operates their rubber tire vehicles on a steel truss system with cable drive and return rooms located along the system. Historically the system was implemented in shuttle operations. However, with the BART to OAC project, DCC introduced pinched loop operations. DCC has proved to be an innovative company, tailoring their technologies to fit the needs of their projects, including flexibility in configuring equipment located in cable drive and return rooms to meet project constraints and adjusting their vehicle size to better meet larger-demand systems.

Figure 3-12: BART to OAK APM (Source: Doppelmayr)

Leitner Poma MiniMetro

The MiniMetro technology is a rubber-tire suspension system running on concrete or steel beams attached to a concrete guideway deck. Structural steel side guidance mechanisms are used. The MiniMetro system also requires cable drive and return rooms located along the system. Variations of this technology have been implemented to tailor it to unique environments. At Minneapolis−Saint Paul International Airport (MSP), the system uses steel wheel on steel rails rather than rubber tires to help mitigate the effects of ice buildup on the running surfaces; at Detroit Metropolitan Airport the APM system (originally designed and implemented by Poma) rides on a thin cushion of air on a concrete "flying surface" to help mitigate exterior noise and structure-borne noise and vibrations inside the airport concourse.

Figure 3-13: MIA eTrain (Source: Leitner-Poma)

3.5.1 Applicability to the ITC Project

Based on past projects, the cable-propelled technologies will be challenged to satisfy the ITC project's passenger demands. However, cable-propelled technologies have shown flexibility to adapt car sizes and develop innovative solutions to challenges in various environments. These technologies are not precluded from proposing on the project if they can meet the capacity and all other requirements to be specified in procurement documents.

- Capacity: With maximum operating speeds of about 31 mph, and maximum vehicle capacity of about 56 passengers per car (at 2.7 standing passengers per sq. ft), existing technology designs will be challenged to meet the demand requirements for the ITC project.
- Alignment Specific Constraints / Geometry: The 130-ft minimum turning radius is well suited for the urban environment and geometric constraints of the Manchester MSF location.
- MSF: The site slated for the ITC MSF can fit an MSF facility capable of performing all required maintenance.

- Noise: Generally, cable propelled systems have low noise levels due to the lack of an onboard propulsion motor and gearbox. However, the cables generate a constant low noise as they move across guide sheaves when in operation, which is more pronounced at curves.

4 Projected Ridership

The basis for the normal weekday/weekend and event service projected ridership for the ITC project was first established in the Envision Inglewood report, detailed in the report's Appendix B: Ridership Memo. In the Envision Inglewood report, weekday and weekend demand was estimated on an hourly basis. For event ridership, pre-and post-event demand for small, medium, and large events at The Forum, IBEC, and LASED were estimated.

As part of this project, the basis and methodology for the development of the Envision Inglewood ridership was reviewed. It was determined that the ridership projected for the Envision Inglewood Alignment A was applicable for the project definition effort of the ITC project. The ridership projections were then re-calibrated against new information and inputs as the project alignment was refined.

In addition, further assumptions were established that were necessary to solidify the projected ridership. Those assumptions are:

- While it cannot be confirmed that there will be no conflicting events at The Forum, LASED, and the IBEC, it is confirmed by the City of Inglewood that it can be assumed that if there are overlapping events, they will not be NFL and NBA games.
- No surge factor is applied to the ridership presented in Envision Inglewood. As the riders travel from events to the ITC stations, they are metered and distributed at various points, including funneling through designated exits, walking the distance to the station, buying tickets at the ITC station, and passing through the fare gates. The riders can therefore be assumed to arrive in a fairly consistent rate throughout the hour.

Based on these assumptions, the following are the final projected ridership numbers developed by Raju Associates, Inc. for the ITC project:

PEAK PERIOD	PROJECTED RIDERSHIP	PROJECTED FREQUENCY
Normal Weekday/Weekend	414 peak hour passengers	Daily
Single Large Event: NFL Game	11,450 passengers departing SoFi Stadium within the one hour after the end of event	20 events per year

Table 4-1: Projected Ridership Numbers During Peak Periods

Based on the ridership analysis, there are rare scenarios where multiple events may occur on the same day. Based on the transportation analysis, those multiple-event scenarios, such as three events in the same day, may create demand exceeding the single large event NFL Game projected ridership of 11,450 pphpd. However, as those overlapping events would be rare, the passenger demand will be handled with crowd management methods and techniques to manage passengers before they reach the platform.

5 System Operations

5.1 Typical Operations

The ITC will be a "pinched loop" system, whereby trains operate back and forth from the Market Street/Florence Avenue Station to the Prairie Avenue/Hardy Street Station, stopping at the Prairie Avenue/Manchester Boulevard along the way. Trains will crossover between adjacent guideway lanes at Market Street/Florence Avenue and Prairie Avenue/Hardy Street Stations to reverse direction.

The system is planned to operate from 6:00 a.m. to 12:00 a.m. for normal weekday/weekend service, with the possibility to add trains and extend hours, as needed, to serve special events. Generally, additional service will be provided before the start of an event to bring passengers to the venue, and again at the end of the event to bring passengers back to the LA Metro system.

At the start of service, the Central Control Operator (CCO) will issue a command to initiate the required operations. The Automated Train Control (ATC) system will then automatically dispatch the necessary number of trains to the mainline from the MSF. The ATC system should be designed so that the station dwell times are adjusted until the trains are equally spaced at the required headway. To adjust the operating fleet for special event service, the CCO will issue commands to inject additional trains onto the mainline guideway. For removal of trains from the system, maintenance personnel will be staged at one or more stations to ensure that all passengers have deboarded the trains prior to the trains going out of service.

5.2 Simulation and Performance

The Lea+Elliott Train Performance Simulation Model (TPSim©) was run for the ITC alignment and the results were used to calculate the optimal number of trains and cars per train to provide the capacity required to meet the normal weekday/weekend and event ridership projections. An analysis of the minimum operating headway and other operating constraints were included in this analysis.

The simulation results are subject to change based upon refinements to the ridership demand forecasts and changes to the alignment, crossovers locations, station configuration, and other aspects of the system.

The following are the operational parameters assumed for the TPSim© simulation:

- Conventional self-propelled large APM technology
- Pinched loop operations, serving all three stations
- Maximum potential vehicle speed of up to 50 mph but operating at up to a maximum speed of 48 mph
- Station dwell of 40 seconds to accommodate larger numbers of passengers needing to board or deboard at once, as would occur for events. The dwell times for normal weekday/weekend service is anticipated to be shorter due to low demand. The longer dwell time for event service is therefore assumed for the operational analysis.
- Simulation inputs included:
    - Maximum longitudinal acceleration: 0.09 g

- Maximum lateral acceleration: 0.075 g
- Maximum jerk rate: 0.06 g/s
- Maximum brake rate: 0.08 g/s
- Superelevation through curves: 3%
- Speed limits were applied in specific sections of the route to prevent speed surges (spikes) that would impact passenger ride comfort.

Based on the simulation, the estimated round trip time for the pinched loop is 12.0 minutes (720 seconds). Trip times between stations, excluding dwell times, for the pinched loop are shown in Table 5-1. Graphs of train speed and time versus distance are provided in Figure 5-1.

FROM \ TO	MARKET STREET/ FLORENCE AVENUE	PRAIRIE AVENUE/ MANCHESTER BOULEVARD	PRAIRIE AVENUE/ HARDY STREET
MARKET STREET/ FLORENCE AVENUE	N/A	2.9	4.6
PRAIRIE AVENUE/ MANCHESTER BOULEVARD	2.7	N/A	1.7
PRAIRIE AVENUE/ HARDY STREET	4.7	2.1	N/A

Table 5-1: Forecasted Station-to-Station APM Travel Times (minutes)

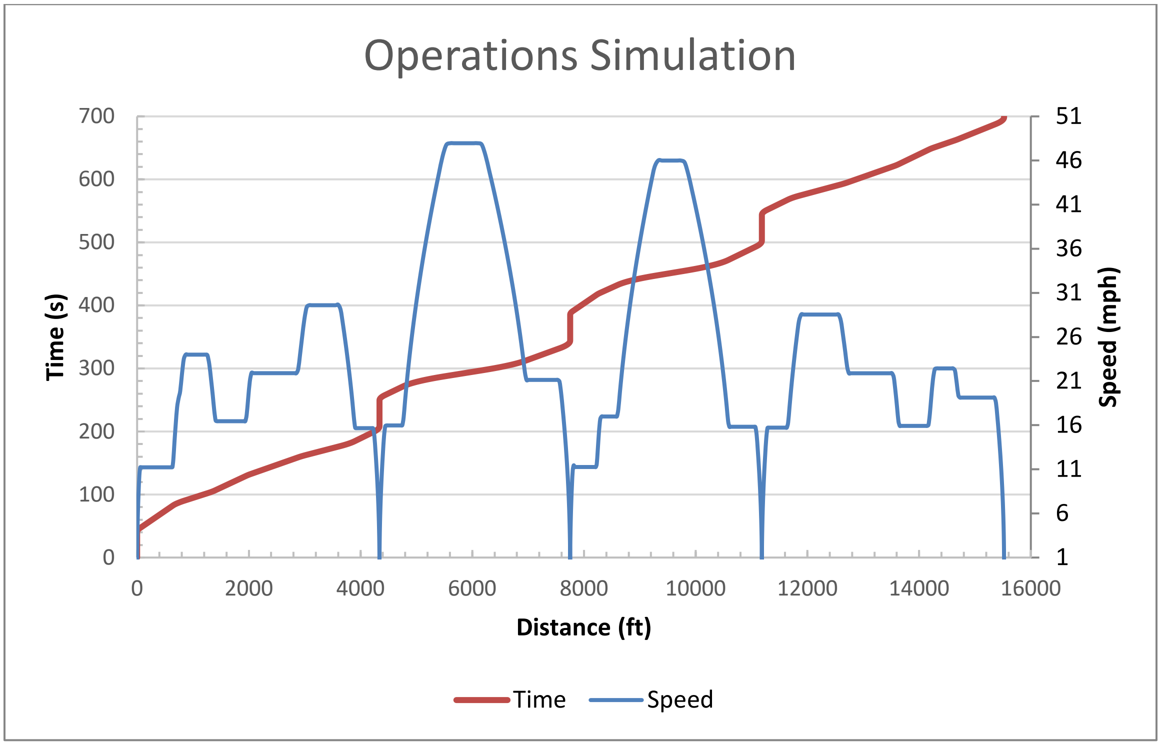


Figure 5-1: Train Speed (mph) and Time (s) versus Distance (ft)

5.3 Minimum Operating Headway

To minimize the overall footprint of the ITC system, and therefore its impact on the neighborhoods, the crossovers at the end stations, Market Street/Florence Avenue and Prairie Avenue/Hardy Street Stations, are locations in front of the stations. However, locating the crossovers in front of the stations limits trains from entering the end stations before the train ahead has departed. Thus, this time between trains being able to occupy the stations is the minimum operating headway.

In a pinched loop operation, the minimum operating headway is the time separation between two consecutive trains arriving at the same end-of-line platform. It also defines the frequency of the operation of the System. In practical terms, this is the time for a given train to approach and enter a switch, traverse the switch, enter the station, dwell, depart the station and clear the switch zone before another train can be permitted to enter the switch zone to enter the station vacated by the prior train.

The headway is affected by:

- Station geometry as related to guideway separation (station width), switch location (optimally switch must be located just outside the station), and the station length relative to the train berthing position.
- Station dwell time.

To minimize the operating headway, the crossovers in front of each of the end stations, Market Street/Florence Avenue and Prairie Avenue/Hardy Street Stations, are located as close to the platform as possible. In addition, the station dwell was analyzed as being the minimum dwell required to deboard a full train; as event ridership is directional, the additional time to board a train would be negligible.

5.4 Fleet Size and Line Capacity Analysis

Line capacity is defined as the number of passengers per hour per direction (pphpd) that the System can carry past any particular point. The estimated fleet size considers the operating fleet, which is the number of vehicles required to provide the necessary line capacity to meet the projected demand, as well as the spare fleet, comprised of the hot standby and maintenance trains to ensure that the number of trains required for operations is always available. The TPSim-developed round trip time is the foundation of the fleet size and APM system capacity. However, each APM system's performance is unique to the technology and maximum train speeds, round trip times and other factors that lead to fleet size determination are variable and will ultimately be determined by the selected APM supplier to satisfy performance requirements to be defined in the DBFOM procurement documents.

- <u>Operating Fleet:</u> The ITC system is sized to serve the most frequent, largest event, which is an NFL game at LASED. Given that NFL games only occur 20 days per year, and that the demand for those games will typically not reach full stadium capacity, the ITC system is being proposed to provide a capacity of 11,000 pphpd. The shortfall from the 11,450 pphpd NFL game ridership projection is less than 5%. To serve the 11,000 pphpd demand, a fleet of six, four-car trains operating at 2.0 min headways is required.

- Spare Fleet: For the ITC system it is assumed that one of the six-train fleet be used for hot standby or maintenance for the ITC system. For typical automated systems that operate the full fleet for normal daily operations, the spare vehicle fleet calculation considers a hot standby train in addition to a minimum of 10 to 15 percent of the operational fleet. This larger spare fleet is needed to ensure that at all times, including during maintenance rotations, the required number of operating trains is always available for normal service.

  However, the ITC system is not a typical automated system. As normal weekday/weekend projected demand is so much lower than event demand, there is added flexibility to perform maintenance during normal weekday/weekend service; maintenance is not limited to only non-operating or off-peak hours. In addition, the full six-train operating fleet is only projected for approximately 20 NFL events (or 3% of the time), concentrated into 18 weeks of the year.

For normal weekday and weekend service, the 4-car self-propelled APM trains may be de-coupled into smaller 1- or 2-car trains to provide service that is more optimized to the time-specific, low projected demands. Splitting one 4-car train into two 2-car trains and operating a headway of 6.0 min provides a reasonably good level of service for commuter and daily service and optimizes the utilization of the fleet with respect to the lower demand. Large monorails and cable-propelled technologies are more difficult to de-couple so would likely operate the full train length for normal weekday/weekend operations. The headways of the operating fleet to serve the projected number of passengers are shown in the following table.

PEAK PERIOD	PROJECTED RIDERSHIP (pphpd)	HEADWAY	FLEET	CAPACITY
Normal Weekday	408	6.0 min.	2 x 2-car trains or 1 x 4-car trains	1,900
All Other Events	Maximum 6,000	2.4 min	5 x 4-car trains	9,500 to 9,700
NFL Event	11,000	2.0 min	6 x 4-car trains	11,400 to 11,640

Table 5-2: Analysis of Project Ridership Numbers Against System Fleet and Capacity

In addition, the system is also capable of adding capacity through the addition of more trains. The ultimate capacity of the system is driven by the tightest headway achievable, considering the safe separation and operational requirements of the turnback. However, further detailed analysis is required to determine the exact final expandable capacity and associated system and infrastructure design considerations needed to support additional capacity expansions.

Operational and projected line capacity requirements for the duration of the anticipated service hours are provided below.

OPERATION AND LINE CAPACITY REQUIREMENTS SUMMARY					
PERIOD OR EVENT	**LINE CAPACITY RANGE (PPHPD)**	**DESIRED OPERATING HEADWAY (MINS)**	**SERVICE HOURS**	**% OF ANNUAL SERVICE HOUR**	**REQUIRED SYSTEM SERVICE AVAILABILITY (SEE SECTION 6)**
Off- Peak & Weekends	< 1,000	11 - 14	2,400 hrs.	37%	99.5%
Weekday Peak	Up to 1,000	5 to 7	1,800 hrs.	27%	99.5%
Small Events	1,000 to 3,000	5 to 7	1,600 hrs.	24%	99.5%
Medium Events	3,000 to 6,000	3 to 5	1,600 hrs.	9%	99.5%
Large Events	6,000 to 11,000	1.8 to 3	600 hrs.	3%	99.5%

Table 5-3: Operation and Line Capacity Requirements Summary

As discussed in Section 1.3, Basic Assumptions, sensitivity analyses were performed to evaluate impacts of assuming higher passenger densities on trains during the Large Events that occur during a limited number of days each year. It was determined that assuming a passenger density 1.8 sq. ft per standing passenger (6 standing passengers per sq. meter) could reduce the length of a generic large rubber tire APM from four cars to three and reduce the required fleet size from 24 cars to 18 cars. Assuming a passenger density of 2.15 sq. ft per standing passenger (5 standing passengers per sq. meter), the 6 x 4-car fleet is still required to meet the 11,000 pphpd demand.

Assuming passenger densities greater than the 2.7 sq. ft per standing passenger (4 standing passengers per sq. meter) value commonly assumed for peak periods on urban transit systems is sometimes assumed for relatively short period very high demand events as discussed in TCRP Report 165, Transit Capacity and Quality of Service Manual, Third Edition (2013). Doing so requires operational protocols be implemented that include deployment of staff to help manage large crowds, long queues, and ensure safety.

While higher passenger densities were evaluated as part of a sensitivity analysis, the standard 2.7 sq. ft per standing passenger density used for peak periods on urban transit systems has been used as the basis of design for EIR purposes.

5.5 Cable-Propelled APM Operational Considerations

As discussed in Section 3.1, Technology Assessment, cable propelled APM technologies were identified as potentially viable for the project through the ongoing Market Sounding process completed to date. These technologies have several operational differences from self-propelled APM systems. Because these systems have traditionally been limited to only one train at a time (per guideway lane) located between any pair of stations, their minimum operational headway is controlled by the longest trip time between stations. It was estimated that the minimum operational headway for cable propelled APM technology would be approximately 3.9 minutes, controlled by the trip time between Market Street/Florence Avenue and Prairie Avenue/Manchester Boulevard Stations. This makes it challenging for cable propelled APM technologies to satisfy the higher demand events that the ITC will serve; however larger vehicles, innovations and other technological advancements in cable-propelled APM technologies may allow these technologies to satisfy demands.

It is also more challenging for cable-propelled APM technologies to vary their train lengths, similar to monorail technologies. They are, however, capable of varying the number of trains in service to tailor service to demand or to adjust passenger wait times. Varying the number of trains in service can be a more complicated process than for self-propelled rubber tire APM systems, and it is not a fully automated process if the train to be added is not already berthed in an unused end-station berth.

Cable-propelled APM systems require trains be towed to and from an offline MSF for maintenance using a tow vehicle. For the ITC project, these train movements would be done between 12:00 a.m. to 6:00 a.m. when the ITC is not providing passenger service.

6 Stations

The primary function of the passenger station is to accommodate the boarding and alighting of passengers to and from the APM vehicles. This section discusses the conceptual planning performed for the APM stations, including vertical circulation, platform configurations, and overall station area requirements.

6.1 Basic Functions

Passenger station locations and designs must provide for the efficient and convenient movement of passengers. The functional spaces within APM stations typically include boarding/ deboarding platforms, access or vertical cores for circulation, and system equipment rooms. Features of each functional space are as follow:

- Station platforms provide for passenger deboarding/boarding, circulation and queuing at platform doors and are typically sized per the following criteria:
  - Projected peak passenger demands.
  - Space per passenger.
  - Accessibility and associated life safety requirements.
  - Dimensional requirements of candidate APM technologies.
  - Projected maximum trains length.
- Automatic station platform doors, integrated into a platform edge barrier walls separate passenger on the platform from the guideways. The barrier wall and station platform doors can be half-height or full-height.
- A refuge area under and along the entire station platform length is required for a person who is on the guideway to escape the path of an oncoming train. This refuge area is required for all platform edges that are adjacent to guideways. Per CPUC General Order 143-B, a minimum clear cross-sectional area of 2.5 ft by 2.5 ft is required. The refuge area may be interrupted by columns along the platform edge, as long as its functionality is preserved.
- Access and vertical circulation elements include stairs, escalators, elevators, and/or ramps. Requirements are typically determined based on:
  - Capacity to facilitate life-safety platform passenger clearing and exiting requirements.
  - Level of service provided to deboarding passengers in terms of wait time for escalators and elevators.
  - Areas that do not conflict with passenger horizontal circulation and queuing areas on the platforms.
- Station communication and surveillance equipment, including public announcement (PA) speakers, closed circuit television (CCTV) cameras, emergency telephones, and static and dynamic signage.
- Equipment rooms are required in each station to house ATC equipment, interface equipment for station doors, dynamic graphics, station CCTV, and public address systems and uninterruptible power supply (UPS) equipment. Station equipment rooms are approximately 1,000 sq. ft and are to be located within 200 ft of the station platform.

- In order to provide access to the Equipment Rooms for equipment delivery, replacement, and maintenance, a freight elevator with the following minimum requirements is recommended, if the room is not located on the ground level:
  - Min. door clear width: 6 ft – 4 in.
  - Min. door clear height: 8 ft
  - Min. interior dimensions: 6 ft by 8 ft
  - Min. weight capacity: 4,000 lb
- A janitor's closet of approximately 110 sq. ft is recommended.

Figure 6-1: Singapore Sengkang LRT Station with Half-height Barrier Wall/Platform Doors, MHI Crystal Mover APM (Image Credit: Peter Velthoen)

6.2 Station Configuration

Based on station size along with ridership and circulation parameters, the platform configuration can take three basic forms, visually presented in Figure 6-2.

- The first configuration is the center platform with cross flow movements, where there is a single center platform with boarding and alighting occurring through the same set of APM train doors. In this configuration, passengers are encouraged to allow the arriving passengers to alight before boarding begins, this option is the least costly and physical space demanding option.
- The second configuration is two side platforms with cross flow movements. Side platform stations allow closely spaced guideways through the length of the stations which can reduce the impacts of wide-spaced guideways adjacent to stations. However, side platforms can be more costly, require more physical space, and requires double the vertical circulation equipment than center platform configurations.
- The third configuration is flow through, where the station has a center platform for boarding passengers located between the two APM guideway lanes that are in turn flanked by two exterior or side platforms for alighting passengers. This configuration removes cross flow

movements by having the doors on the alighting (side) platform open first and then several seconds later having the doors on the boarding platform open. This separates conflicting passenger flows and allows the arriving passengers to begin to clear the vehicle before departing passengers begin to board the vehicle. However, it is the most costly and physical space demanding option.

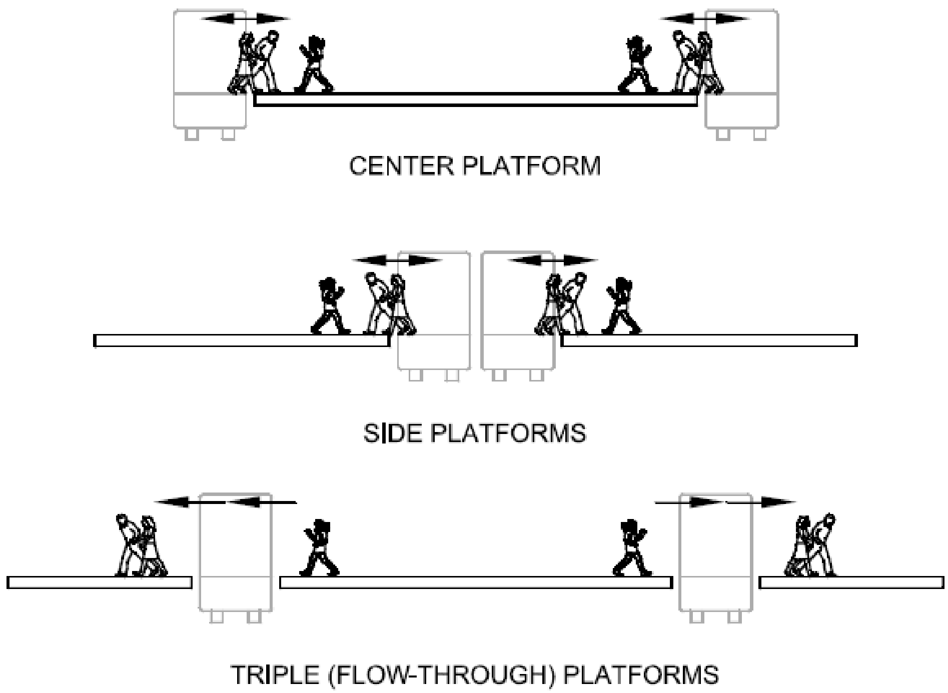


Figure 6-2: Platform Configurations

6.2.1 Applicability to the ITC Project

The center platform configuration is the preferred option for the ITC System. The single center platform allows for optimized use of the station while minimizing the total width required for the station.

- Spatial constraints: The ITC right of way is limited in physical space due to the existing developments. The center platform configuration requires the least total width.
- Optimized platform utilization: Due to the event-driven service, the instances of high ridership are typically boarding or alighting, and not both occurring simultaneously. Therefore, the need to provide improved cross-traffic flow in both directions is not critical for the ITC system.
- Optimized vertical circulation: Center platforms allow for a single set of vertical circulation that can serve either platform edge, even if one is rendered out of service. To provide full redundancy in case one platform is rendered out of service, side platform configurations require that the two platforms be designed to accommodate all levels of service, and therefore require duplicated vertical circulation.

6.3 Station Dimensions

The purpose of the APM station sizing analysis is to ensure that the conceptual station design provides the platform queue area/width and length needed to accommodate the forecasted passenger ridership.

Train simulations and operational analyses determined the system requirements such as train lengths, headways, and other parameters. These requirements, along with the forecasted ridership, were used as input for queuing, vertical circulation, and emergency evacuation analyses which define circulation and other spatial, fire and life safety considerations required to determine minimum platform sizes. The resulting conceptual platform sizes will be further analyzed by the project architects as inputs into their fire and life safety/code compliance assessment for the station design as a whole.

6.3.1 Station Length

Minimum platform length estimates are based solely on maximum train length and do not account for vertical circulation elements added to either platform end. An additional 10 to 15 ft beyond the end of the full length of a train is advised to be provided at the platform level for passenger circulation and vertical circulation queuing.

From the fleet size and line capacity analysis, it was determined that a four-car rubber-tire APM vehicle, approximately 170 ft long, or four-car large monorail, approximately 200 ft long is required to meet the projected demand assuming a passenger density of 2.7 sq ft per standing passenger on trains. Because it is expensive and potentially disruptive to APM operations to expand APM station platforms after completion and initiation of passenger service, stations should be planned to accommodate either technology's maximum length train. Thus, the four-car large monorail becomes the basis for determining the platform length. In addition, at this conceptual stage of the project, an additional 15 ft is included at each end of the platform, resulting in a minimum platform length of 230 ft. Longer train lengths may be possible depending on the unique requirements of the selected technology and if proposed will be evaluated during the procurement process.

6.3.2 Station Width

The purpose of the station sizing analysis is to ensure that the conceptual station designs provide the platform queue area/width needed to accommodate the forecasted passenger demands. The findings presented herein should be revisited accordingly should forecast data and/or APM operations be updated.

This analysis provides the methodology and results for passenger queuing analysis and the resulting minimum platform widths for passenger queuing and circulation. This analysis is not to replace the NFPA 130 platform evacuation analysis; the NFPA 130 analysis is anticipated in a future phase of the project.

6.3.2.1 Assumptions

The following are the assumptions for the platform queuing analysis:

- Passenger space allocations: An average of 8.5 sq. ft per passenger is assumed for this analysis. Based on the level of service descriptions for queuing in Pedestrian Planning and Design by John

J. Fruin, Ph.D., 7 to 10 sq. ft per passenger provides for a level of service C for passenger queuing.

- Circulation lane: To provide free flow of passengers, three feet per circulation lane is assumed. Due to the large number of passengers anticipated at Prairie Avenue/Hardy Street Station where the peak demand will occur, three circulation lanes are assumed.
- Buffer: As passengers do not queue or walk directly against walls, an additional 12 in. of space for each side of the platform is assumed.
- Queue depth in off-peak direction: The passenger flows for the ITC system are inherently single-directional; for event service, passengers will be travelling toward the venue before an event and away from the venue towards the Market Street Station after the event. However, as there may be passengers traveling on the ITC system who are not attending events, a width of three feet is allocated for queuing for those off-peak passengers.
- Train length: Four-car rubber-tire APM vehicle is used.
- Station width: A generic and common station platform width capable of supporting the maximum demand anticipated will be used as the basis for the station designs for all stations in the system for EIR purposes. The platform width is anticipated to be refined during a future phase of the project.
- Station demand:
    - Peak Direction: As the demand for each station differs due to their specific purposes, queuing analysis was performed for the highest boarding demand anticipated to be seen at any station.
    - Off-Peak Direction: The demand in the off-peak direction for event service is unknown. Off-peak demand is applicable for only the Forum Station. As Market Street/Florence Avenue and Prairie Avenue/Hardy Street Stations are end-of-line stations, there is no queuing in the off-peak direction.

Based on the assumptions above and a review of the ridership demand per station for the Large Event scenario the peak direction ridership demand value used for the queuing analysis is 11,450 passengers in an hour seen at Prairie Avenue/Hardy Street Station one hour after the end of a large NFL event plus 414 normal weekday passengers.

6.3.2.2 Platform Queuing Analysis

A vehicle boarding queue model was used to determine the queue depth associated with each side of the APM station platform. The maximum demand scenario of two trains, travelling in opposite directions, stopping at the same station and simultaneously boarding on opposite sides of the platform was modelled for this analysis. If the station platforms are too narrow and do not have sufficient circulation space, passenger freedom of movement will be compromised, passengers will not be able to disperse evenly among all the train doors, and a poor level of service and reduced capacity will result.

The vehicle boarding queues represent the number of passengers consolidated at each vehicle door. The vehicle queue model assumes that the passengers form a wedge-shaped queue in front of each vehicle door. The sum of the two opposite boarding queue depths and a circulation space in between comprise the minimum platform width requirement without accounting for columns and other obstructions that might be located on the platform.

It is important to note that the resulting minimum platform width requirement corresponds to a generic rubber-tire APM technology. Different technologies may produce different boarding queues depths due to variation in maximum speeds, headways, vehicle capacities, and door configurations. The final design of the stations should consider the potential for greater minimum platform width requirements depending on the selected automated technology.

The following table summarizes the queuing analysis results, as well as the minimum width required. Due to the large number of passengers, an additional circulation lane is assumed.

PEAK DEMAND (pphpd)	QUEUE DEPTH (FT)		CIRCULATION LANES (3 FT / LANE)	BUFFER (FT)	TOTAL MINIMUM WIDTH (FT)
	PEAK DIRECTION	OFF-PEAK DIRECTION			
11,450 Event	22.4	0	3	2	33.8

Table 6-1: Queuing Analysis Results Summary

Based on these queuing results, a generic 40 ft width was assumed for all stations. At this conceptual stage of the project, all stations are sized at the maximum platform requirement. This conservative approach a) allows for further tailoring of the station widths during future design efforts by reducing the widths to better meet the station-specific needs; and b) allows for the largest possible physical envelope for the project to be cleared as part of the EIR process.

As discussed in Section 1.3, Basic Assumptions, sensitivity analyses were performed to evaluate impacts of assuming higher passenger densities on trains during the Large Events that occur during a limited number of days each year. It was determined that the 40 ft platform width based on Table 6-1 results can accommodate the queuing for the reduced 3-car train operations for 1.8 sq. ft per standing passenger (6 passengers per sq. meter).

6.4 Vertical Circulation

Vertical circulation requirements are based primarily on the time required to clear station platforms of passengers that are deboarding trains. Deboarding passengers arrive in relatively large numbers over a relatively short time period and vertical circulation elements must clear this load from the platform before the next train arrives for passenger safety reasons. Level of service considerations, specifically the time required for deboarding passengers to access escalators and elevators, usually dictate that the platform be cleared well before the next train arrives at the station platform.

Where vertical circulation elements provide emergency egress from station platforms, escalators and stairs must satisfy code-prescribed emergency egress requirements. Among other requirements, codes will require adequate vertical circulation for passengers to clear the platform and reach a point of safety within specified time periods, and may require a secondary means of egress remote from the major egress route.

Lea+Elliott analyzed the vertical circulation requirements from an operational requirement perspective and established the minimum required vertical circulation to meet the normal boarding and deboarding needs for each station.

6.4.1 Operational Requirements Analysis

The purpose of the Operational Requirements analysis is to ensure that during normal operations, the station has the ability to:

- Bring the anticipated number of passengers onto the platform that are anticipated to be coming into the station based on post-event projected demand, and
- Clear the platform within one headway based on the projected event demand estimates, i.e., the number of passengers that will be on the trains.

To assess the vertical circulation, the maximum anticipated number of people to be at a station for boarding and deboarding was determined. The maximum boarding demand reflect the maximum number of passengers anticipated to be at a station, while the maximum deboarding demand is reflected as a full, four-car train deboarding at a station.

PEAK-DIRECTION DEMAND (pphpd)		NOTES
BOARDING	DEBOARDING	
11,450 Event*	11,640**	*Boarding: Maximum station peak boarding demand seen at Prairie Avenue/Hardy Street Station **Deboarding: Full 4-car train deboarding at Market Street/Florence Avenue or Prairie Avenue/Hardy Street Stations assuming 2.7 sf/pax

Table 6-2: Summary of Station Demand for Operational Requirements Analysis

Assumptions for the analyses were taken from industry-accepted planning resources and compared against the LA Metro Rail Design Criteria to determine the best fit for this unique special event-based system. Documents referenced for the station analysis are:

- Pedestrian Planning and Design, John J. Fruin, Ph.D
- TCRP Transit Capacity Quality of Service Manual
- LA Metro Rail Design Criteria, Section 6 Architectural
- Other APM application benchmarks

These reference documents resulted in the following key assumptions:

- Escalator nominal width: 48 in.
- Escalator tread width: 40 in.
- Escalator capacity: 70 people per minute (ppm) per 40 in. tread
- Stair capacity: 10 pedestrians per minute per foot of width (ppmpf)
- Minimum Stair Width: 5 ft – 6 in. to be consistent with the Metro Rail Design Criteria

In addition, the quantities of each type of vertical circulation must accommodate the number of people who likely want to or need to use each type of vertical circulation. Escalators are more popular than stairs. Due to a low number of passengers who may ride elevators, elevator use was not included in this analysis. For this project, the goal for the distribution of passengers on vertical circulation is as follows:

- Escalators: 80%
- Stairs: 20%
- Elevators: Not included for calculations; however, a minimum of two are assumed.

The vertical circulation analysis also assumed that due to the event-based nature of the project, the demand would be single-direction. The boarding maximum occurs pre-event, while the deboarding occurs post-event. Therefore, the direction of the escalators would change to reflect the demand.

Based on the above assumptions, the vertical circulation required to meet the operational requirements and projected demand are summarized for each station in the following tables.

VERTICAL CIRCULATION ELEMENT	BOARDING	DEBOARDING
Escalator Quantity: Peak Direction	3	3
Escalator Quantity: Redundant	1	1
Stairs (total width, ft)	5 ft – 6 in.	5 ft – 6 in.
Elevator	2	2

Table 6-3: Vertical Circulation Per Operational Requirements Analysis

The assumed 40 ft platform width identified in Section 6.3.2.2 is sufficient to accommodate all the vertical circulation elements.

As discussed in Section 1.3, Basic Assumptions, sensitivity analyses were performed to evaluate impacts of assuming higher passenger densities on trains during the Large Events that occur during a limited number of days each year. It was determined that the vertical circulation quantities identified in Table 6-3 can accommodate operations of 6 x 4-car trains at a passenger density of 2.15 sq. ft per standing passenger (5 standing passengers per sq. meter) and 6 x 3-car trains at a passenger density of 1.8 sq. ft per standing passenger (6 standing passengers per sq. meter).

7 Guideway

The term guideway structure refers to the structure providing support for running and guidance surfaces and other System equipment between and through passenger stations.

Guideway structures should be designed to provide a generally rectangular clearance envelope that accommodates:

- Clearance envelope for the vehicles, including additional width at curves for vehicle nosing and chording effects
- A continuous walkway along the entire guideway length to provide emergency egress for evacuating passengers and safe access to guideways and wayside equipment by operations and maintenance personnel
- Guidance and/or power equipment
- Cable trays, conduits, and/or wireways for power and communications needs

Guideway structure types and design requirements differ for each type of technology and between the various suppliers of each technology type. Therefore, for this project and for the EIR, the guideway structure requirements are based on a combination of requirements for the technologies identified as viable for the project in Section 3.

7.1 Guideways and Guideway Equipment

7.1.1 Clearances

Guideway structures should be designed to provide the necessary clearances to accommodate vehicles, power and guideway equipment, and emergency walkways. The clearance requirements vary as a function of alignment geometry to account for nosing and chording effects through horizontal curves. Required clearances, taking into account nosing and chording effects, are included in the figures below. As all technologies considered for the project have different vehicle designs, and therefore different dynamic envelope requirements, the dimensional data used for this project are based on worst-case dynamic parameters of the representative technologies.

Horizontal and vertical clearances between APM guideways and other existing and proposed infrastructure should be in accordance with the local, State, or Federal requirements specified by the governing authorities. For the EIR Project Definition, clearances between guideway structures and adjacent infrastructure were informed by code analysis, LA Metro guidelines, and best practices.

Clearance requirements for dual track and at stations are provided for APM and monorail technology in Figure 7-1 to Figure 7-10.

Other station-guideway interface requirements are discussed in the Stations Section 6.1.

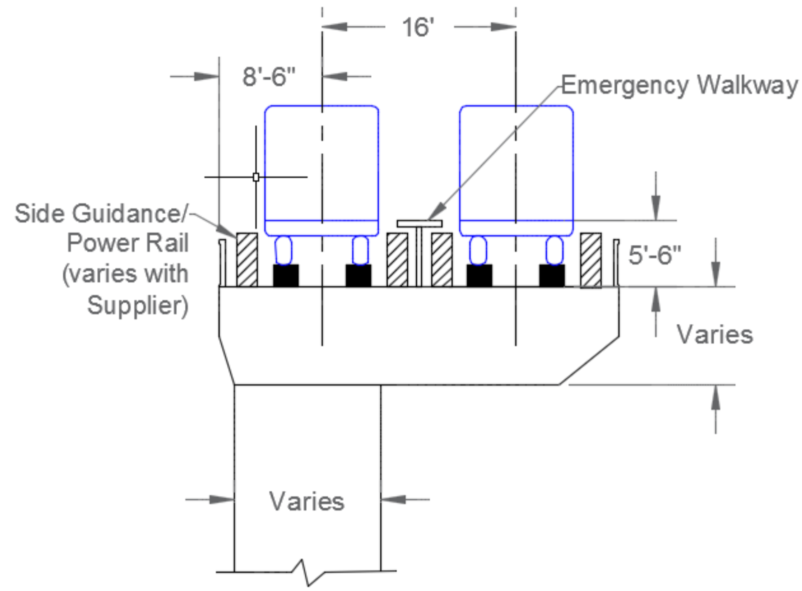


Figure 7-1: APM Guideway Clearances - Dual Track

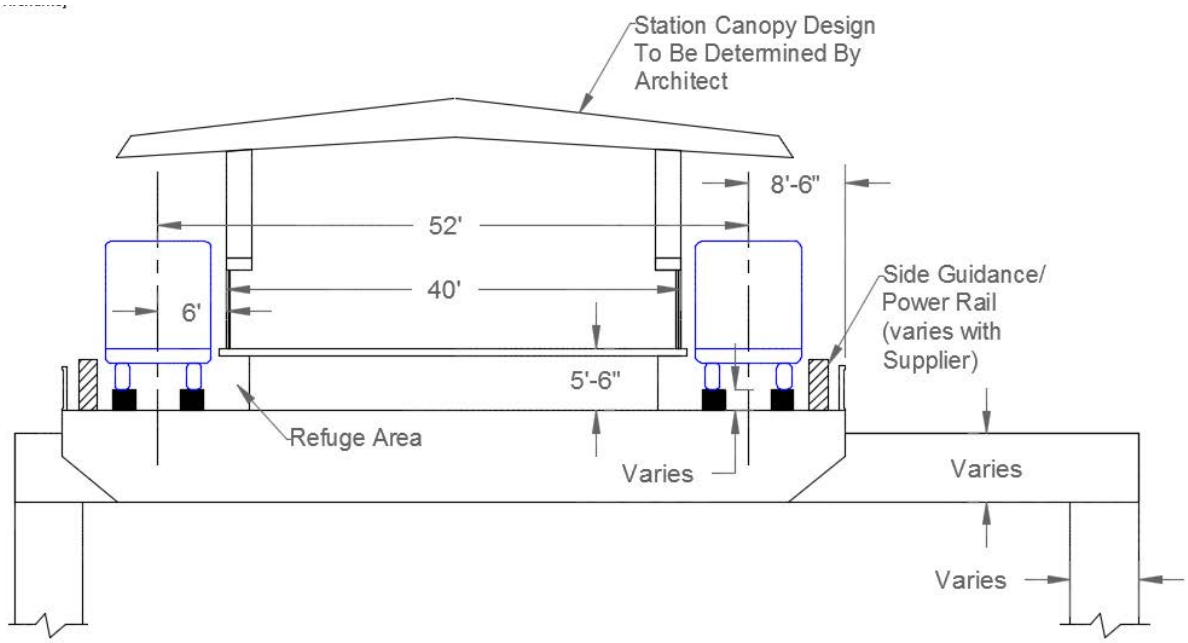


Figure 7-2: APM Guideway Clearances – In Stations

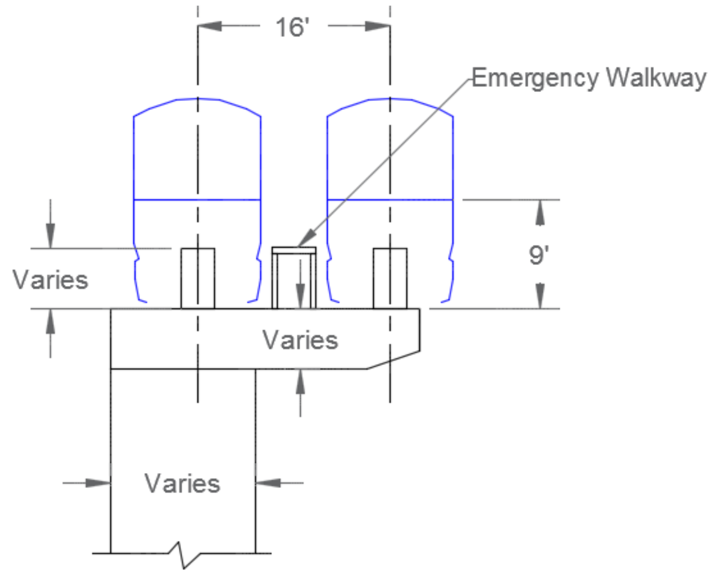


Figure 7-3: Monorail Guideway Clearances – Dual Track

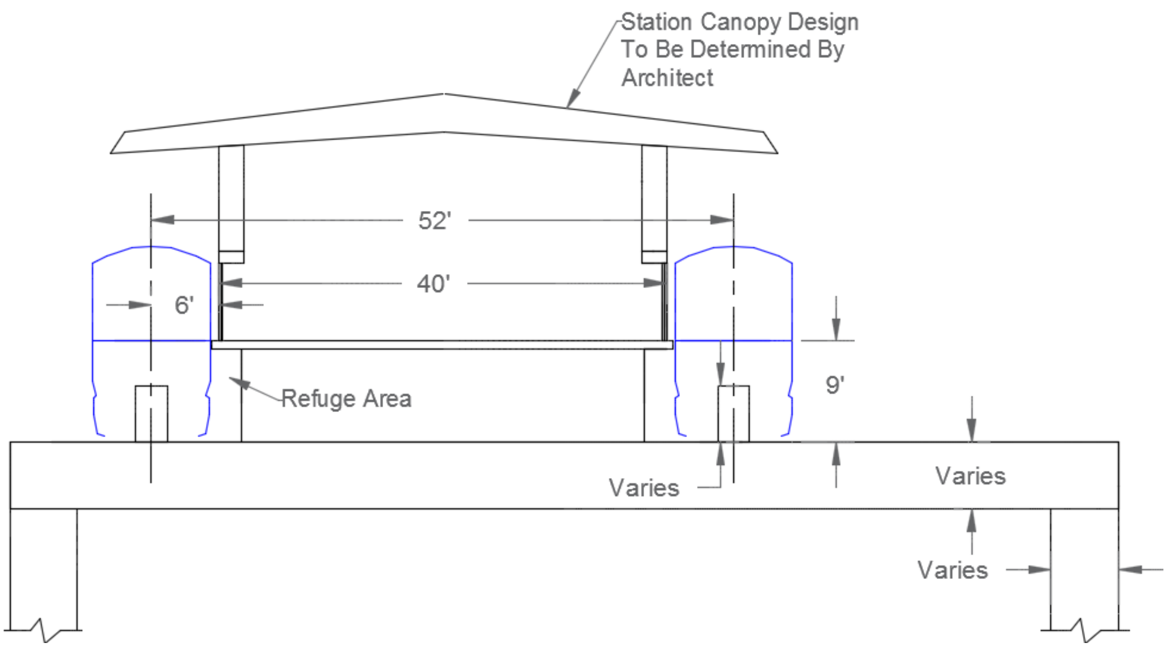


Figure 7-4: Monorail Guideway Clearances - At Stations

7.1.2 Maintenance/Emergency Walkway

A continuous walkway is required along the entire guideway length to provide emergency egress for evacuating passengers and safe access to guideways and wayside equipment by operations and maintenance personnel. For the ITC project, the walkway is assumed to be between the tracks, providing access into the center platform stations.

Maintenance/emergency walkway considerations and requirements include:

- The walkway must be continuous through crossovers/switches or other elements that may act as barriers.
- The walkway should be located at or below the vehicle floor level under both normal and worst-case vehicle suspension failure conditions. It is desirable to locate the emergency walkway not more than 12 inches below the vehicle floor level. The walkway must not be more than 40 inches below the vehicle floor level under any circumstances.
- Walkways without a railing should be at least 44-inches wide and walkways with a railing should be at least 30-inches wide.
- The walkway should provide a clear cross-sectional envelope at least 30 inches wide to a height of 6 feet-8 inches above the walkway surface.
- The APM System supplier may desire to locate cable trays, wireways, and other System elements below the walkway.
- Emergency walkway lighting is required along the entire walkway and egress route and will normally be turned on only when passengers are required to evacuate a train or during maintenance activities.

Images of emergency walkway examples for APM and monorail systems are provided in Figure 7-5 and Figure 7-6, respectively.

Figure 7-5: APM Emergency Walkway Example, TPA SkyConnect APM (Image source: L+E)

Figure 7-6: Monorail Emergency Walkway Example, Las Vegas Monorail (Image source: LAmag)

7.1.3 Crossovers and Switches

Crossovers provide the means for trains to move between guideway lanes and are required for pinched-loop operations and failure management purposes. A crossover is generally composed of two switches (one on each guideway lane) connected by a short length of special trackwork. Crossovers and switches must be located in constant-grade, tangent guideway sections. Approximately 50 feet of tangent, constant-grade alignment should be provided before and after switches. Expansion joints are not allowed in crossover zones.

Crossover requirements vary significantly among APM System and monorail suppliers and each supplier's switch and crossover requirements are "discrete" in that their geometric and other requirements are largely inflexible. Unique requirements exist for:

- Switch curve radius
- Turn (or throw) angle
- Need for spiral and/or tangent lengths before and/or after a switch
- Widened and/or depressed slab sections required for switch machine support
- Widened slab sections to accommodate movement of guidance devices
- Spacing between consecutive switches on a single guideway
- Transverse spacing between parallel guideways

The guideway length required to accommodate a crossover is dependent on the required switch/crossover geometry, crossover configuration, and the spacing between guideways. For the ITC system, crossovers are located adjacent to stations where the guideway spacing is dictated by the station platform widths or between close spaced guideways away from stations where the guideway spacing is controlled by the minimum track spacing required by each individual technology's crossover design.

The crossover configurations for the ITC project are assumed to be a “double crossover” where space permits for APM systems and an X-crossover for monorail systems. The total length required for these two types of configurations for the two technologies is similar.

- For APM systems, "double crossovers" include two consecutive, but symmetrically oriented, crossovers. The orientation of double crossovers is dictated by operational considerations. Crossovers configured to create an "X" between guideways should not be planned, as this configuration is not possible for most APM system suppliers. See Figure 7-7 for an example double crossover.
- For monorail systems, crossovers consist of a moveable guide beam that shifts positions depending on the required travel path and can be configured into X-configurations. See Figure 7-8 for an example monorail X-crossover.

Figure 7-7: APM Double Crossover Example at IAH (Image Source: L+E)

Figure 7-8: Monorail X-Crossover Example, Las Vegas Monorail System (Image Source: LRN Library)

For the ITC project, the guideway structure must allow for both the APM and monorail crossover clearance requirements. As switches require additional space for switch equipment and/or switch movement, as well as emergency walkway access from trains at all locations through crossover areas, the guideway structure at crossovers is wider than in areas with track only. Cross sections through the guideway structure for APMs and monorail at the crossover areas located adjacent to stations are provided in Figure 7-9 and Figure 7-10.

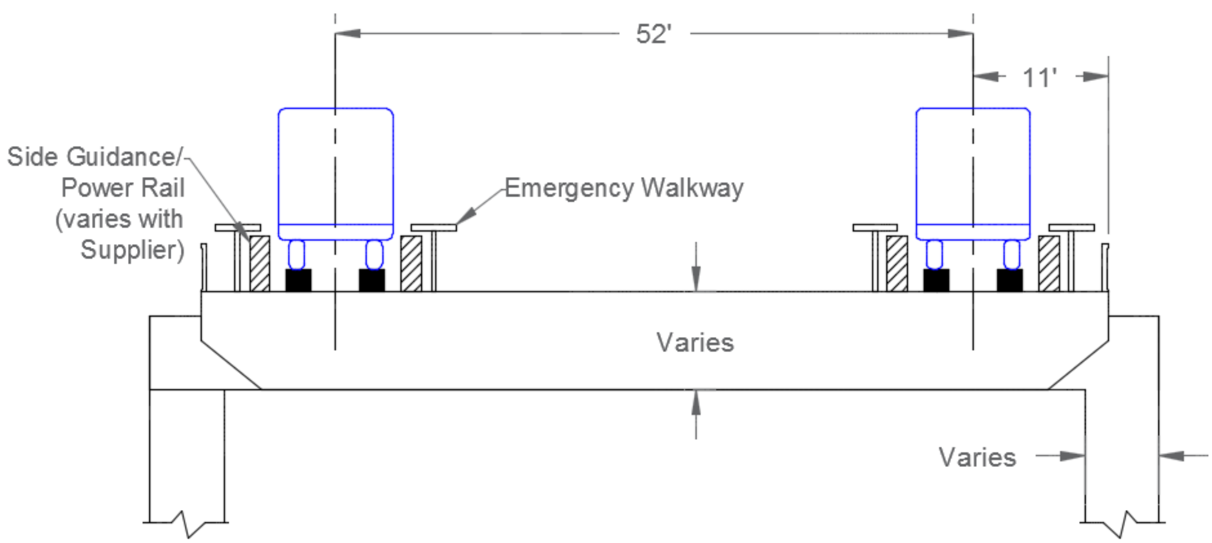


Figure 7-9: APM Guideway Clearances – At Crossovers

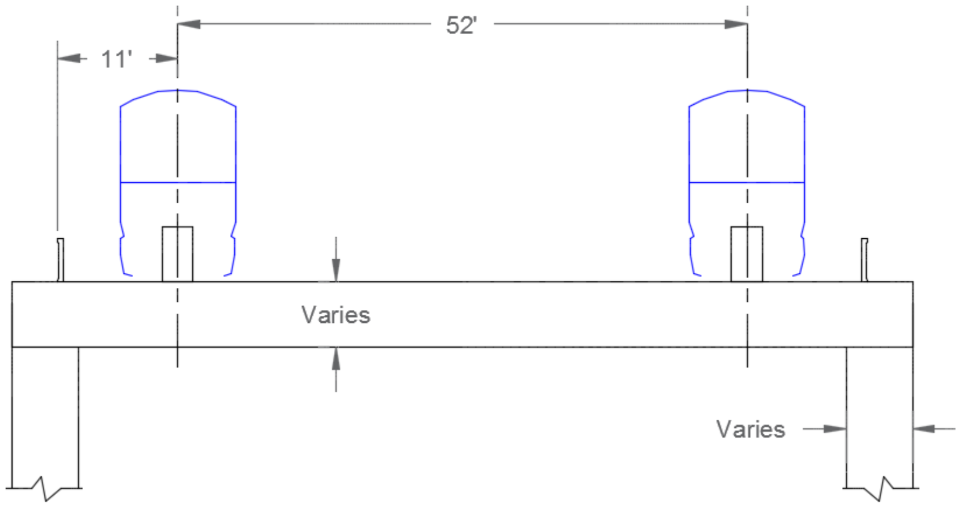


Figure 7-10: Monorail Guideway Clearances – At Crossovers

7.2 Alignment

The goal in defining the guideway alignment is to develop an alignment that allows APM and monorail systems suppliers to competitively bid on the project, and to optimize the alignment to their unique technology requirements. Optimizing the alignment also allows for optimized system performance and potentially reduced facility and structure sizes.

The alignment options developed for the ITC project assumed generic and reasonably conservative parameters given the early planning stage of the project. The following sections provide a summary of the parameters used for the horizontal and vertical alignment development. The preliminary plan and profile for the final ITC alignment, are provided in Appendix A.

7.2.1 Plan

The horizontal alignment consists of tangents joined to circular curves by spiral transition curves. Tangent alignment is required through and about 50 ft beyond the ends of station platforms.

Horizontal curves should use the largest practical radii. Large curve radii reduce required superelevation values and nosing and chording effects through horizontal curves; allow higher speeds to be maintained, which decreases trip times and potentially reduces the required fleet size and project costs; and improve ride comfort. Minimum radii should only be considered in extreme cases when the cost or other adverse effects of using larger radii are prohibitive. The following minimum radii for APM and monorail technology were used for the ITC alignment (these do not apply to switches and crossovers):

- Minimum radius for operating track:
  - APM: 180 ft
  - Monorail: 200 ft
- Minimum radius for maintenance yard track:

- APM: 100 ft
- Monorail: 180 ft

7.2.2 Profile

The vertical alignment should consist of tangents joined by parabolic curves having a constant rate of change of grade. Guideway profile grades should be kept as level as possible and the number of grade changes should be minimized.

A constant grade, at least 50 feet in length between two adjoining parabolic vertical curves should be provided. Grade must be zero percent through stations. On the mainline, desired maximum grade is 6%. Although some technologies allow for a maximum grade of up to 10%, grades higher than 6% are not assumed for the ITC project due to the very early planning nature of this project. Steeper grades restrict the design and should only be used when absolutely necessary. Grades through switch and crossover locations were located in profile grades of less than 1% and in 0% whenever possible.

7.3 Other Guideway Considerations

The following are further considerations for guideway and trackwork design as the project moves into more detailed design phases.

- Trackwork and the associated interface requirements vary significantly among APM system suppliers. Guideway structure designs must accommodate the variable trackwork load and connection and other interface requirements of the different APM system suppliers.
- Horizontal curves should be superelevated to limit sustained lateral accelerations parallel to the vehicle floor. Desirable maximum superelevation is 6%, but in some cases, the APM system supplier will be allowed to provide up to 10% superelevation.
- Access to the guideways is required at stations. Access and egress points must not permit unauthorized access to the guideway, and all guideway access and egress points must be monitored and alarmed at the CCF.
- Cable trays, conduits and/or wireways are required along the guideways to accommodate system cabling. These are typically located adjacent to longitudinal trackwork elements on the guideway structure, below emergency walkways, and are supported by elements such as walkways or parapet walls.
- Guideways must be designed and constructed to effectively drain water from their surfaces. Guideway drainage provisions should allow for reasonable and expected interaction with trackwork and other guideway equipment.
- Structure-borne, vehicle-induced vibrations and noise should be evaluated to mitigate passenger and facility occupant discomfort.

8 Maintenance and Storage Facility

The MSF houses functional spaces required for the operation and maintenance of the APM Systems, including the Central Control Room (CCR), administrative offices, spare parts and consumable storage, and space for regular maintenance, inspection, service, testing, repair, and replacement of parts for vehicles and other system equipment.

Maintenance facility functions include vehicle maintenance, cleaning, and washing; shipping, receiving, and storage of parts, tools, and spare equipment; fabrication of parts; and repair of vehicle spares. Supervisory offices, rest rooms, locker rooms, and break/training rooms are also provided for staff use.

Maintenance performed on System equipment includes:

- Service - Replacement of consumables and expendables, adjustment of parts
- Cleaning - Interior and exterior
- Inspection - Periodic inspection of parts, appurtenances and subsystems subject to deterioration and failure.
- Repair - The repair or replacement of a part that has been damaged, has failed, or is nearing the end of its service life.
- Departure Test - The MSF and adjacent non-passenger carrying guideway will contain departure test equipment and a dedicated section of track for the departure test.
- Maintenance Information Management and Scheduling - The processing of maintenance information, work reports, failure reports, and System performance data needed to manage the System maintenance program effectively and efficiently.

8.1 Layout

The primary functions of the MSF include support of APM System operations, vehicle storage, and APM System maintenance.

Area is be provided for service and inspection shops, major repairs, vehicle storage, inspection and service (including under-vehicle bays), equipment and materials storage, offices, lunch/break rooms, restrooms, locker areas, personnel wash facilities, loading platforms, and other areas based on design information to be provided by the APM System supplier. The design of the facility should also include roadway access, signage, and means of controlling access into and out of the MSF.

The MSF is currently sized for both, rubber-tire and monorail technology six-train fleet. This maintains the flexibility to define the exact needs in future phases of the project based on on-going coordination with the stakeholders. A reduction of the MSF size could occur in the next phases of the project as the design is refined and finalized. The final configuration of heavy maintenance, light maintenance, and storage tracks and the level of automated movements within the facility will be determined by the selected APM System supplier.

8.1.1 Vehicle Storage

The MSF needs to be sized to accommodate the maximum number of vehicles to be in maintenance or stored during off-peak periods. Vehicles are planned to be accommodated in dedicated storage tracks and in maintenance bays.

Dedicated storage tracks at the MSF will have traction power guide rails with automated train control into and out of storage. This fully automated vehicle storage area allows trains to be stored during off-service, off-peak, and non-event times while remaining ready for immediate dispatch. These automated areas are to be designed to control access in order to ensure the safety of maintenance personnel.

Locations of the vehicle storage tracks are identified in Figure 8-1.

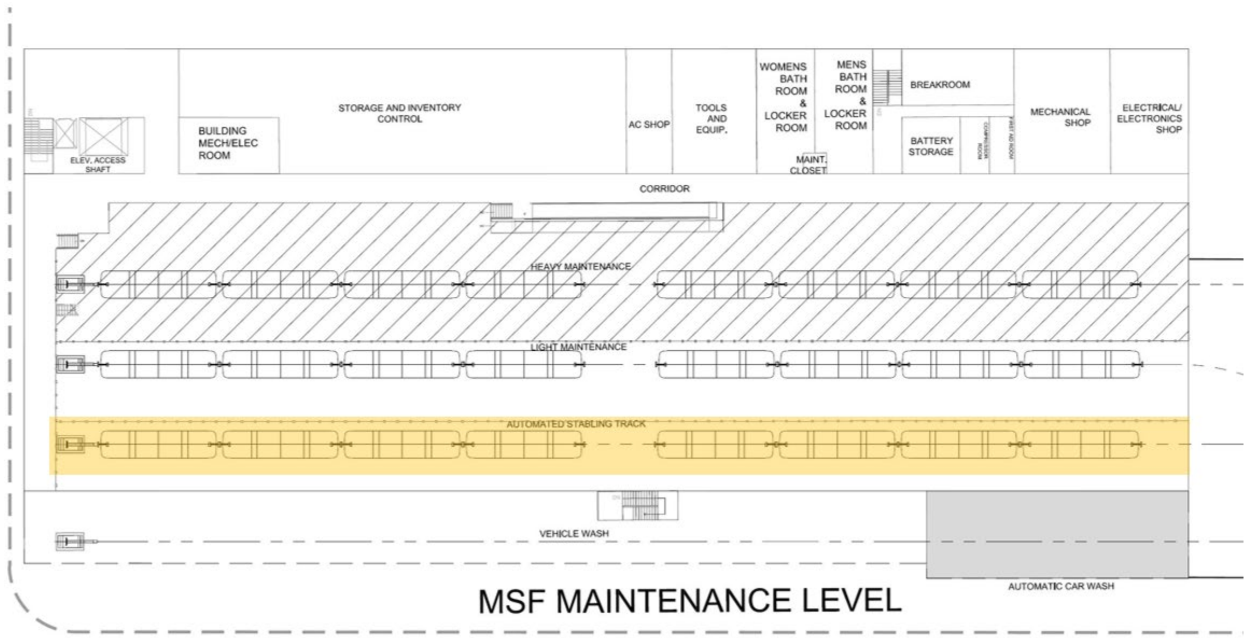


Figure 8-1: MSF Vehicle Storage

8.1.2 Maintenance Bays

Heavy and light maintenance bays are required to perform maintenance on trains at the MSF. The MSF design must include the space and related necessary infrastructure to inspect and maintain the APM vehicles. Shops, parts storage, and other maintenance-related functions should be situated at the same level as the maintenance floor. Trains are manually driven and moved to, from, and within the heavy and light maintenance bays. Power in the manual areas is provided to the vehicles via stingers, a festooning system with power plugs affixed to ceiling to allow for vehicle movements while connected to wayside power, or via third rail distribution depending on the technology.

There are two types of maintenance bays, each with their own specific uses and requirements. The locations of the light and heavy maintenance bays are identified in Figure 8-2.

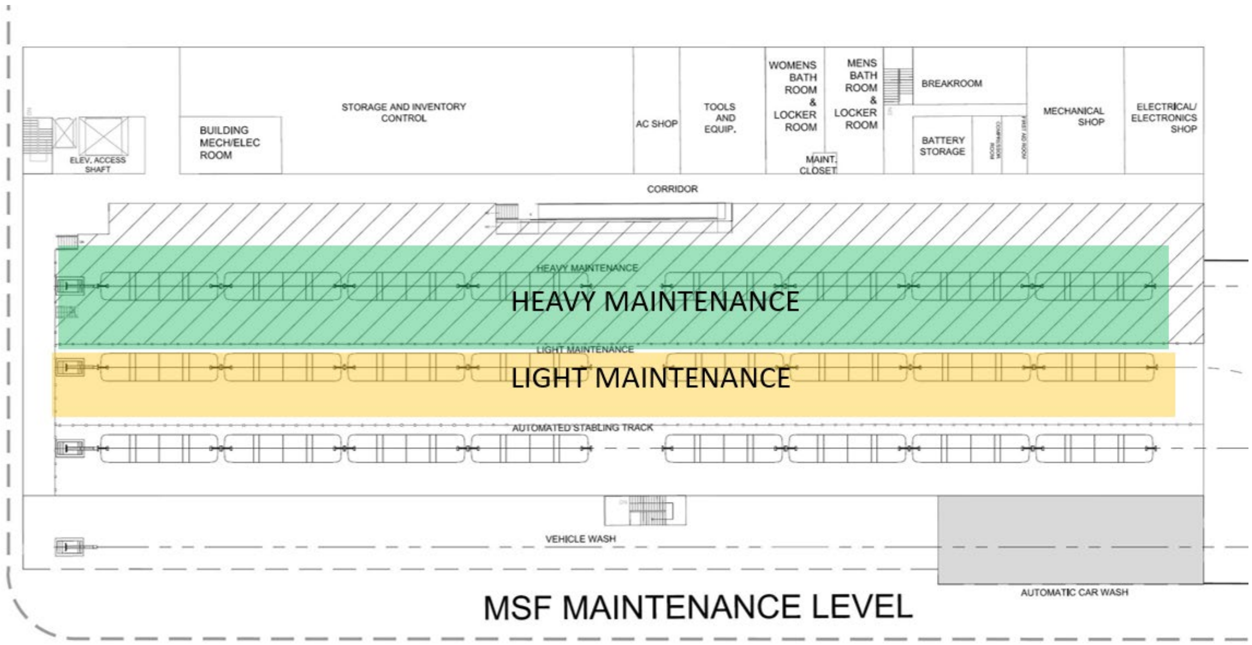


Figure 8-2: MSF Light and Heavy Maintenance

Light Maintenance Bays: Each train is required to undergo nightly light maintenance if it was in operation that day. Light maintenance is typically comprised of inspection and replacement of readily accessible parts and expendables and a general confirmation that the vehicle is available for the next day's service. Underbody access is required; light maintenance bays are over pits or on elevated structures such that staff can readily walk underneath them (some suppliers use lift jacks for under-vehicle access). Examples of access to the vehicle underbody are provided in Figure 8-3.

Typical light maintenance tasks include cleaning as needed, vehicle underbody inspection, checking and replacing brake pads, component inspection, dimensional verifications, contact/collector shoe replacements, inspection of running tires for wear/cuts, and other similar tasks that can be performed in relative short duration. Exact tasks and inspections performed are determined by the APM supplier per their maintenance practices.

Figure 8-3: Example Light Maintenance Access

Heavy Maintenance Bays: Heavy maintenance, required on periodic and scheduled frequencies, includes a more thorough inspection of the vehicle and replacement of parts showing excessive wear and/or approaching their scheduled replacement time. Heavy maintenance tasks generally include major repairs/refurbishments of vehicle subsystems such as bogies and air conditioning units, replacement of brake calipers, replacement of brake discs, draining and refilling of axle oil, flushing of hydraulic systems, replacement of shocks, replacement of air bags, dropping the bogie, hydraulic fluid decontamination, and other similar tasks that take a number of hours to perform. Exact tasks and schedules of the heavy maintenance rotation are determined by the APM supplier per their maintenance practices.

Heavy maintenance is generally performed on flat floors, with vehicles elevated on jacks, as needed. Four jacks per car are assumed, with the depot floor supporting loading up to 250 psf and a concentrated load of about 4 tons for the wheel load or load from lifting jacks. Guide rails in the heavy maintenance bays are removable to allow for unobstructed access below raised cars. An example of vehicles in heavy maintenance is provided in Figure 8-4.

Figure 8-4: Example Heavy Maintenance

8.1.3 Vehicle Wash:

Automatic washing of the vehicle exteriors should be accomplished at a Vehicle Wash Facility. The vehicle wash is typically a stationary system located in/near/adjacent to the MSF building where trains can be either manually or automatically moved through the wash facility. Various required provisions, including sanitary sewer, power, and other infrastructure provisions will be needed. The location of the vehicle wash facility is identified in Figure 8-5.

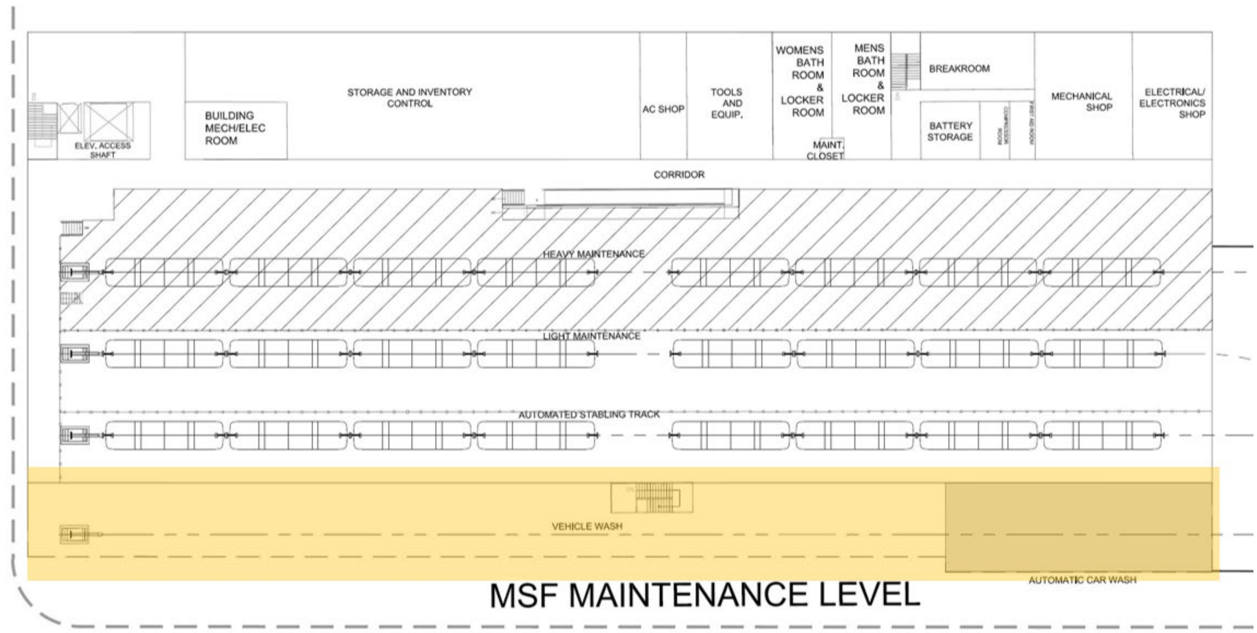


Figure 8-5: MSF Vehicle Wash

8.1.4 Maintenance Support Facilities

The following are the main support facilities needed for the APM MSF:

- Repair shops and inventory: For the maintenance of the APM equipment and storage of spare parts and inventory to support the maintenance needs, and located on the maintenance level
- Administrative: The APM operations and maintenance staff require space to support normal administrative functions. These are planned to be located on the mezzanine level.
- Command, Control, and Communications: The Command, Control, and Communications (CCC) facilities include the Central Control Room (CCR) and the CCC Equipment Room are planned to be located at the MSF on the mezzanine level.
- Roadway and Ground Floor Access: For personnel and visitor access, as well as deliveries and removal of inventory and equipment. These requirements are located on the ground floor.
- Power Distribution: The power distribution system substation is planned to be located at the MSF on the ground level. See Section 9 for further information on power distribution system substations.

These areas are identified in Figure 8-6, Figure 8-7, and Figure 8-8 and are further described in the following sections.

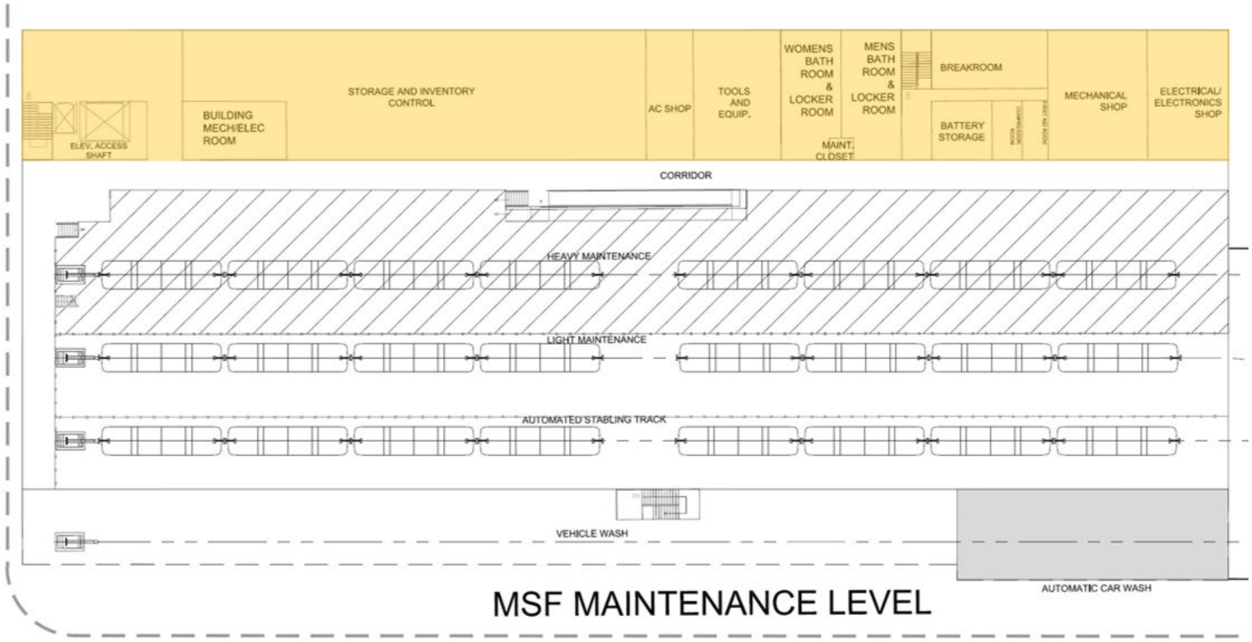


Figure 8-6: MSF Maintenance Level Support Facilities

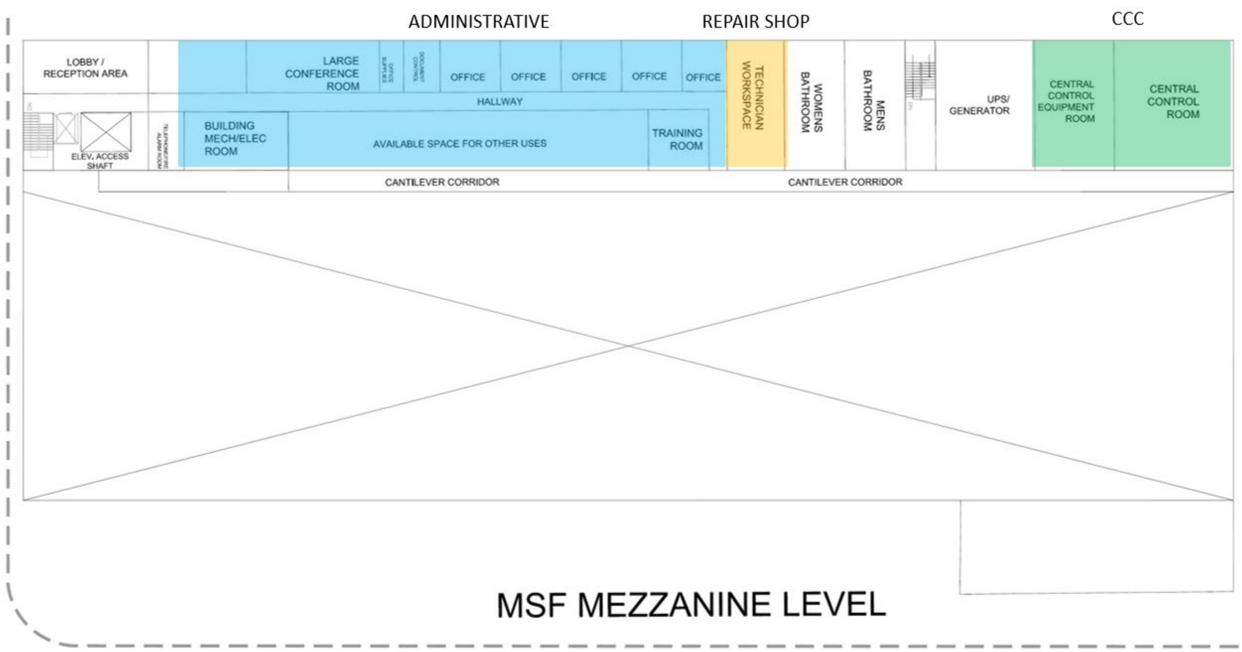


Figure 8-7: MSF Mezzanine Level Support Facilities

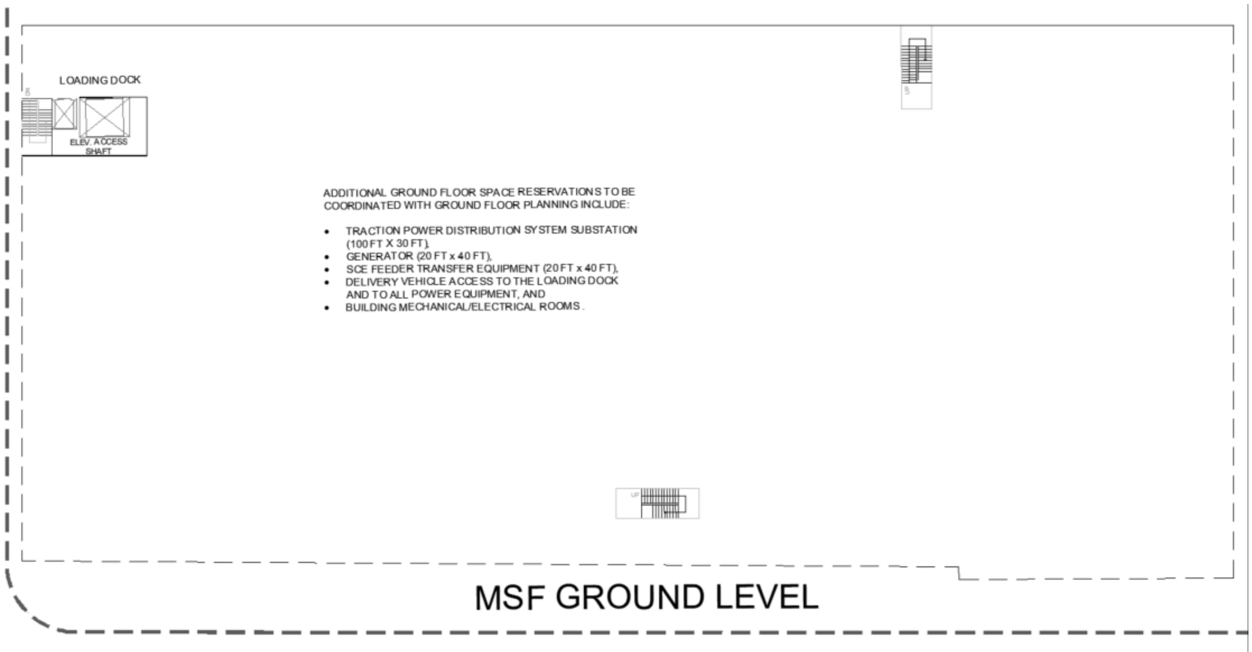


Figure 8-8: MSF Ground Level Support Facilities

In addition to the APM-specific functional areas, building HVAC, plumbing, electrical, and communications rooms will be required to serve the facility, and are anticipated to be located on the maintenance and mezzanine levels.

8.1.4.1 Repair Shops and Inventory

The maintenance support facilities provide for the maintenance of the APM system and vehicles. The shops and stores (i.e. inventory) allow for the maintenance of all but the most major repairs for all on-board and wayside systems. Major work includes the repair and replacement of bogies; traction motors; and heating, ventilation, and air conditioning (HVAC) units. All mechanical and electrical components are also repaired at the MSF. The shops include workbenches and storage areas, and specialty tools for each shop type. The electrical and electronics shops repair smaller components and units so access direct from the maintenance floor is less critical. Machine, HVAC, and mechanical shops are located with direct access to the shop floor maintenance areas.

The MSF must also house all inventory, including spares, tools, and consumables. A sizable inventory area is required in close proximity to the loading docks. To maintain inventory control, this area is to be secured with protocol for parts/consumables removal and use.

A layout of the maintenance support facilities is provided in Figure 8-6 and Figure 8-7.

8.1.4.2 Administrative

The requirements for administrative offices are typical of any professional office environment. Besides office space for administrators and support staff, functional spaces for reception, records keeping, meeting, training, document receipt and transmission, copying, etc. are representative of those required in the APM administrative offices. The administrative offices should comply with all relevant accessibility requirements.

Separation between administrative and maintenance staff uses is assumed, with the exception of shared conference and training rooms. Offices for maintenance managers are also assumed to be located with the administrative offices.

The location of the administrative offices is provided in Figure 8-7.

8.1.4.3 Command, Control, and Communications.

The command, control, and communications facilities, including the Central Control Room (CCR) and the CCC Equipment Room, are planned to be co-located at the MSF. Additional CCC equipment is located at stations and along the wayside. CCC equipment is required for train control and supervision, power control and supervision, station doors, dynamic graphics, closed-circuit television (CCTV), public address, radio, fire detection, and other System-related elements.

The CCR provides for the supervision of the overall APM operation. It houses all display, safety, and communications equipment required to monitor and control the APM system. Typical equipment includes large work consoles and monitor banks (for system overview, CCTV, etc.).

The CCC equipment room adjacent to the CCR houses all servers and equipment for the control of the APM system. The equipment room is also sized to house the uninterruptible power supplies (UPS) required for the operation of the System equipment. The UPS powers low voltage System equipment at the CCR and CCC equipment rooms.

The locations of the CCR and CCC Equipment Room are provided in Figure 8-7.

8.1.4.4 Roadway and Ground Floor Access

Road access to the MSF is required for employees, visitors, suppliers, and emergency vehicles. It is anticipated that all ground floor requirements can be accommodated below the building footprint.

- Employees and visitors require ample parking.
- Suppliers require a delivery entrance to load and unload equipment, materials and parts. A loading dock and adequate roadways and clearances must be provided for flat-bed trucks to deliver equipment and supplies into the MSF. The APM vehicles will be lifted onto the guideway, most likely at/near the MSF. Provisions must be made for these movements.
- Emergency Vehicles (fire trucks) require designated stopping positions for firefighting equipment adjacent to the MSF.

Appropriate space should be provided to allow adequate maneuvering by these ground vehicles. The number of employee parking spaces and assumed maneuvering for large delivery vehicles, as well as an area for APM vehicle delivery, have been identified in the conceptual MSF design. In addition to roadway access, vertical circulation (normal and emergency purposes) must also be provided, including a freight elevator for inventory/equipment delivery and removal.

An initial layout of the ground floor is provided in Figure 8-8.

8.1.5 Spatial Requirements

A summary of the estimated spatial requirements for all support facilities is provided in Table 8-1. These spatial requirements will be further refined during future phases of the project.

CONCEPTUAL MSF SPACE PLANNING REQUIREMENTS			
MAINTENANCE AND STORAGE FACILITY	**CITY OF INGLEWOOD APM**		
ROOM DESCRIPTION	**AREA (FT^2)**	**LEVEL**	**HVAC**
Central Control Room	1,500	mezzanine	Y
Central Control Equipment Room	1,000	mezzanine	Y
Telephone/Fire Alarm Room	200	mezzanine	Y
Management and Administrative Offices	1,350	mezzanine	Y
Lobby Reception	200	mezzanine	Y
Conference Room	500	mezzanine	Y
Restrooms (M/W)	350	mezzanine	Y
Training Room	350	mezzanine	Y
Technician Workspaces	950	maintenance	N
Break Room	500	maintenance	Y
Locker/Restrooms (M/W)	1,000	maintenance	Y
First Aid Room	100	maintenance	N
Storage/Inventory Control	6,150	maintenance	N
Electrical/Electronics Shop	1,250	maintenance	Y
Mechanical Shop	1,250	maintenance	N
AC Shop	600	maintenance	N
Welding Room	400	maintenance	N
Paint Shop	400	maintenance	N
UPS/Generator Room	1,000	maintenance	Y
Tools & Equipment	1,100	maintenance	N
Compressor	150	maintenance	N
Battery Storage and Charging	300	maintenance	Y
Vehicle Maintenance Area/Storage	43,600	maintenance	N
Car Wash & Equipment	13,800	maintenance	N
Elevators/Stairs/Hallways/Miscellaneous	2,200	mezzanine / maintenance	N
Loading Dock	400	ground	N
Power Substation	3,000	ground	Y
Generator	800	ground	Y
Total Maintenance Level (approx.)	**72,550**		
Total Mezzanine Level (approx.)	**5,450**		
Total Ground Level (approx.)	**4,200**		
Total Area	**84,400**		

Table 8-1: Conceptual MSF Space Planning Requirements

8.2 Elevations

The guideway elevation in the MSF is dictated by the elevation of the mainline guideways outside of the MSF. The top of building measured from existing grade is approximately 75'. A conceptual cross section of the MSF is provided in Figure 8-9; the actual configuration will be defined by the selected APM supplier.

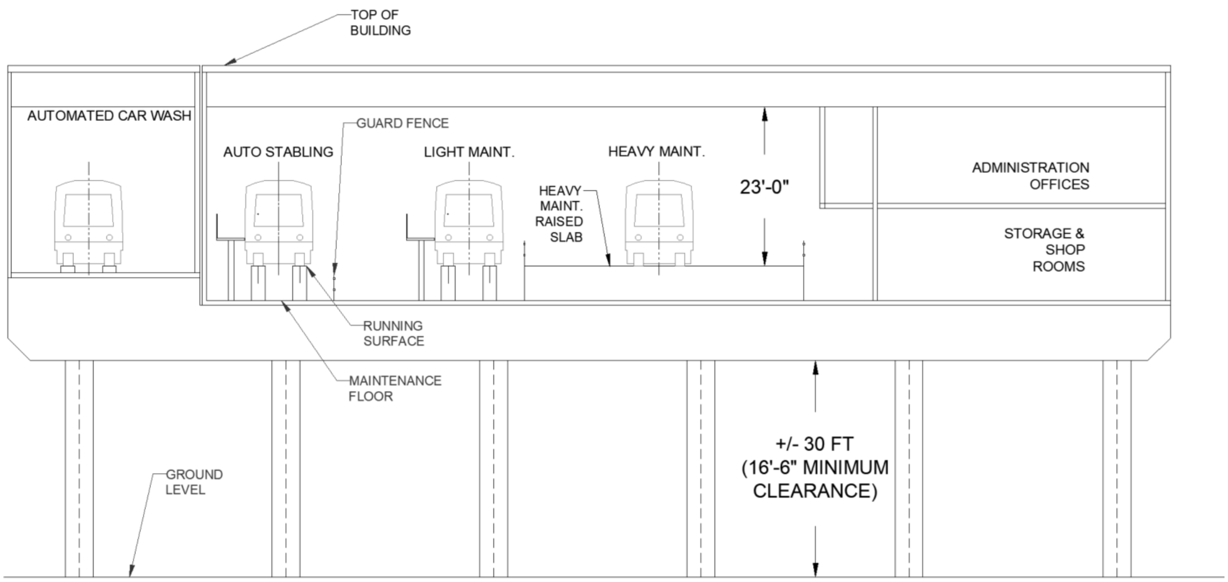


Figure 8-9: MSF Cross Section

9 Power Distribution System Substations

This section summarizes the preliminary power requirements analyses and results for the mainline operations and MSF operations for the ITC system. In order to obtain the power requirements for the ITC System, detailed load-flow analyses were performed for the rubber-tire APM technology. These load-flow analyses results were then combined with estimated power requirements for the MSF to determine the transformer ratings for each of the PDS substation locations.

This report identifies the key assumptions used as the basis for the analysis, provides some basic information about traction power systems and substations for informational purposes only, and summarizes the analysis results and considerations. The final locations of the PDS substations will be determined in a future phase of the project.

9.1 Introduction

The analysis for the propulsion power needs for the ITC system considered both normal and special event service operations.

Propulsion power (i.e. the power to run the train on a guideway) is provided via PDS substations located along the alignment. Each PDS substation includes equipment to transform the medium- to high-voltage power feed provided from the power companies to the required 750-volt direct current (VDC) needed to power the vehicles and other ancillary equipment.

A key element in a PDS substation is the transformer/rectifier unit, which needs to be sized to accommodate the power requirements for operating multiple trains simultaneously on the system. Load flow analyses were therefore performed to assess the potential locations for the PDS substation to determine the required locations for the substations and required transformer sizes to provide the necessary service for the ITC system.

The load flow analyses were performed using two Lea+Elliott simulation and calculation models, the Legends© Train Performance Simulator (TPSim) and the Power Demand Analysis Model. The train performance simulator calculates individual train performance and power demand characteristics on a per second and guideway location basis throughout a single round-trip. The power demand analysis model accumulates the total simultaneous (also on a per second basis) power demand for all trains operating at a defined headway using the output of the train performance simulator. The power demand analysis model then calculates the power demand for each substation as a function of the positional and time kilo-volt ampere (kVA) requirements of each train consist that is receiving power from that particular substation. The substation load calculation output provides both per second and root mean squared (RMS) kVA loads for each substation.

Predicted train performance from the Train Performance Simulator is obtained using a typical large capacity APM vehicle and train model, operating on the proposed ITC System alignment shown in Figure 2-1. To determine PDS substation requirements, simulations were conducted using 4-car trains loaded at the design load (AW1).

The operational train performance data were then applied to the Power Demand Analysis model to establish the peak and RMS capacity requirements for the minimum number of fully redundant substations. The configuration of substations was analyzed using the power analysis model and using this information, the Power Demand Analysis model generates the time and location distributed electrical load data.

9.2 Assumptions

The following are the key assumptions for the power load flow analyses:

1. The system must be able to operate at a minimum, 6 x 4-car trains at approximately 120-second headways.

2. The system operates for 18 hours per day and is closed with no trains operating for 6 hours per day.

3. The system alignment is as shown in Figure 2-1 above.

4. Various potential locations for the PDS substations were identified along the alignment, including locations near all stations. Based on discussions to date with the City on the possible use of various properties along the alignment, those locations were refined to the following three locations, as shown in Figure 9-1. Based on the assumed three potential locations for the PDS substations, two different PDS substation location combinations were analyzed. Further details on the parcels identified as possible locations for the PDS substation are provided in Appendix C. The final locations of the PDS substations will be determined in a future phase of the project.

    1. MSF site at 500 E Manchester Blvd, Inglewood, CA 90301 adjacent to E. Spruce Avenue;
    2. City of Inglewood Intermodal Transit/Park and Ride Facility (ITF) site on the east side of Prairie Avenue; and
    3. Prairie Avenue/Hardy Street Station located at the northwest corner of Prairie Avenue and Hardy Street.

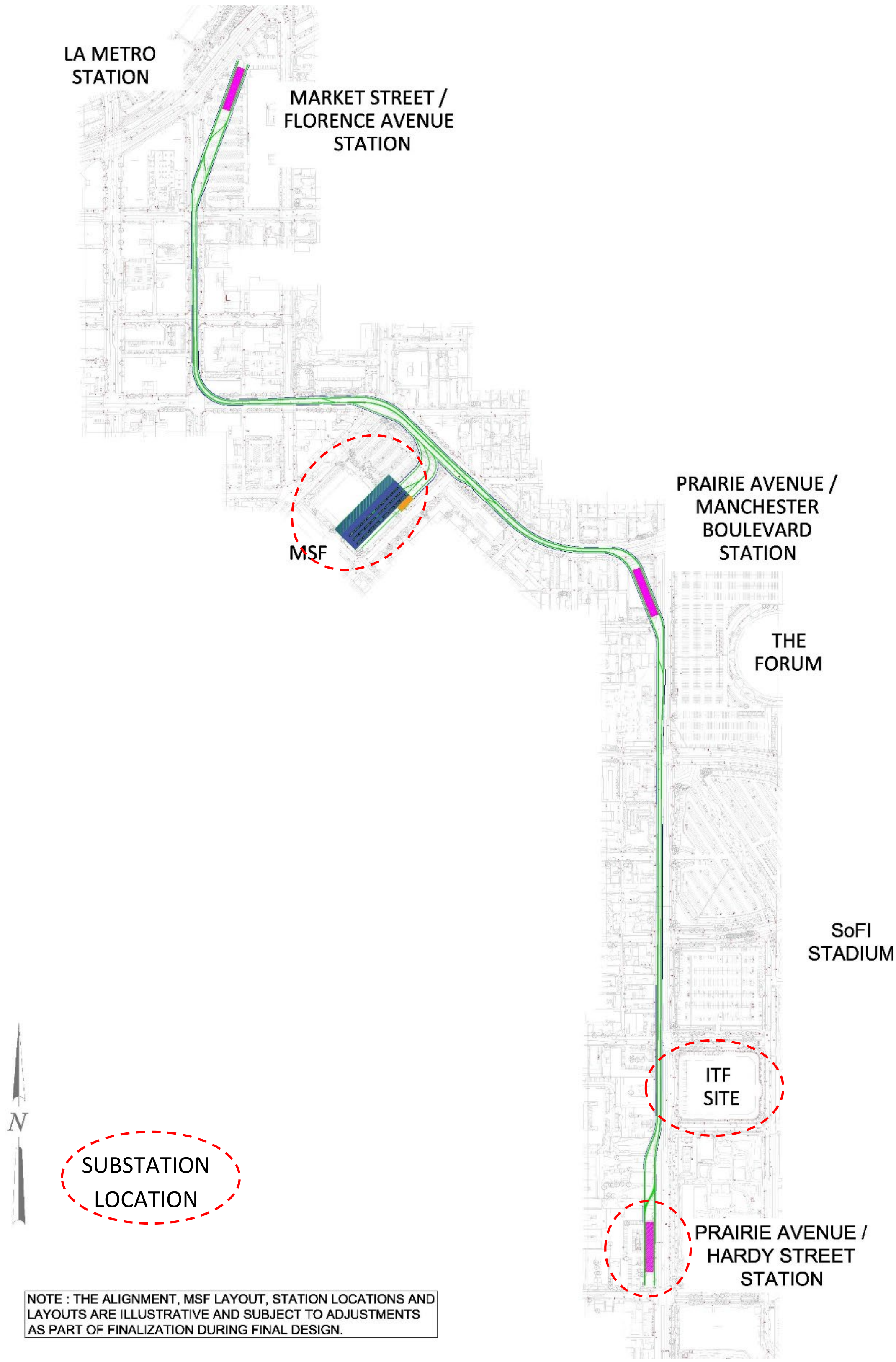


Figure 9-1: Potential ITC PDS Substation Locations

5. The PDS will be fully redundant, meaning that the PDS will continue to function after any single-point failure within the PDS, or the loss of either substation. Having a fully redundant PDS requires the following:

    a. Primary power is expected to be provided by primary power feeders such that the loss of the primary source is automatically backed up by a redundant source such that loss of the primary source would not affect train operations. While coordination with Southern California Edison is ongoing, the provision for redundant primary power will continue as a base requirement for the system.

    b. Each PDS substation will include two sets of equipment such that the loss of any single element within the PDS (e.g., feeder, transformer, breaker, etc.) would not affect train operations.

6. Other non-vehicle propulsion loads include the APM equipment located in the APM equipment rooms in each station, PDS substations, and the MSF.

7. 750 VDC distribution and rail resistance for a typical 750 VDC distribution APM system.

8. The MSF will be sized to store the full 6 train fleet and includes four train maintenance berths, one automated storage track that accommodates two trains, and one automated lane on which a train wash facility will be located.

9.3 Typical Substation Information

Prior experience indicates that when using DC power distribution, optimum performance of the PDS is obtained when the spacing between substations is kept under 5,000 feet due to power rail voltage drop and substations are located optimally less than 500 feet from the guideway.

Actual substation locations may be changed as the result of a design process by the final selected APM supplier who will utilize more complex dynamic load flow comparative analysis techniques that are based on their specific system technology and design criteria. Such a load flow examination is a design process beyond the scope of this programming level analysis effort since generic vehicle characteristics were assumed for the analysis. Nevertheless, the location selections made here are appropriate to provide efficient system performance and for prediction of power consumption and substation capacity requirements.

9.3.1 Substation Single Line Diagram

A typical single line diagram for a DC distribution system is provided in Figure 9-2 below. As mentioned previously, each substation will typically be designed to utilize two sets (redundant) of transformer/rectifiers such that either transformer/rectifier set is capable of supplying the entire substation load indefinitely.

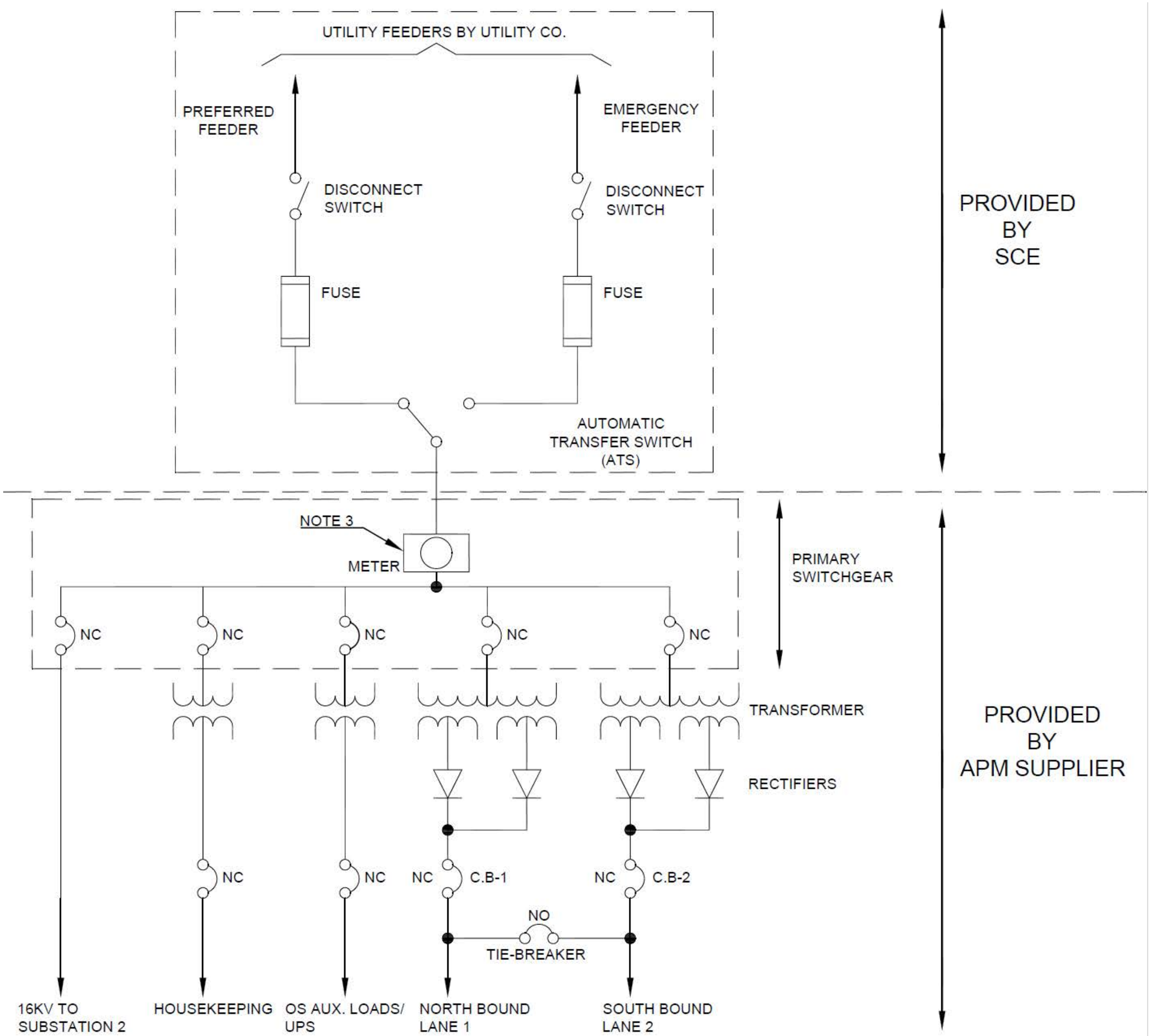


Figure 9-2: Typical Single Line Diagram

9.3.2 Estimated PDS Substation Space Allocations

The estimated minimum room space allocation for a fully redundant PDS substation is approximately 3,000 square feet and with 14 feet of clearance above the finished floor. Substations should be generally rectangular for power equipment placement. However, different aspect ratios can be considered provided that equipment spacing meets all applicable local codes and the National Electrical Code. The PDS substation houses transformers, DC rectifiers, primary and secondary switchgear, APM System auxiliary power transformer and switchgear and other propulsion related equipment required to provide power to the APM System for vehicle propulsion and other System equipment.

The PDS substation requires access for truck loading and adequate space for installation/replacement of PDS equipment. A typical DC propulsion power substation layout is illustrated in Figure 9-3 below.

Access to substations is also required for personnel to perform maintenance and testing activities. The PDS substation design should consider parking for approximately four APM ground maintenance vehicles and a loading/unloading zone to maneuver equipment, tools, and materials for maintenance activities. Ramps providing smooth transition over curbs, as applicable, should be provided to enable efficient movement of equipment using a forklift.

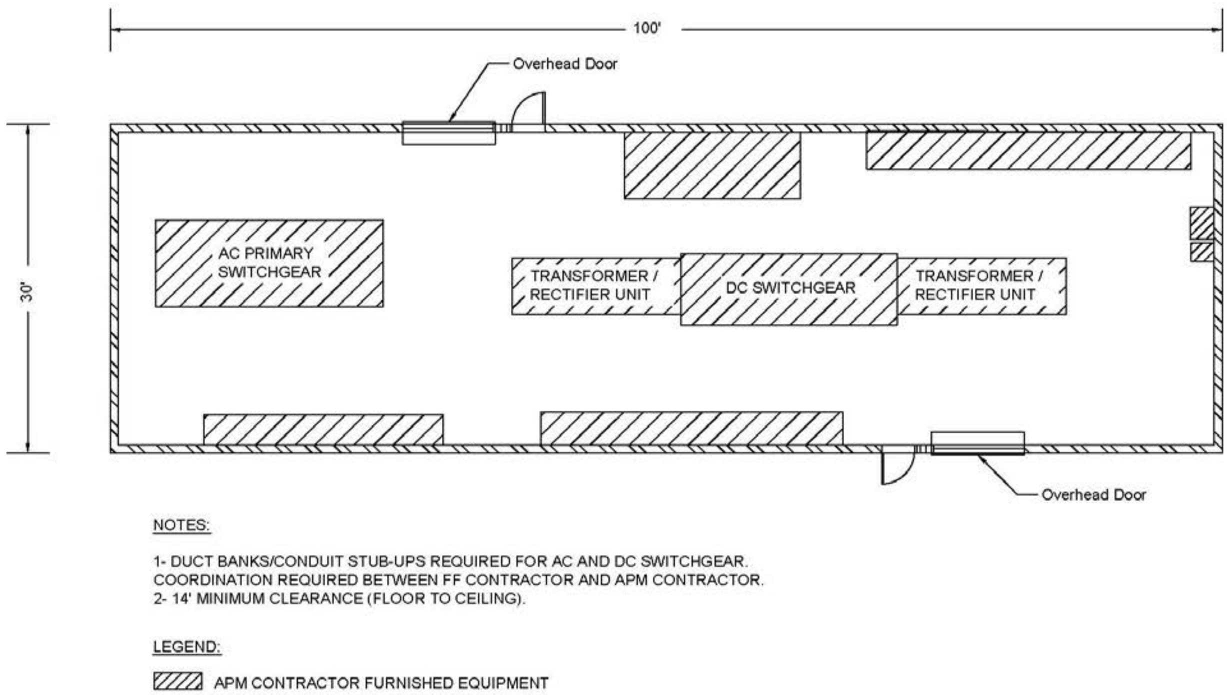


Figure 9-3: Typical Substation Layout

9.3.2.1 Underground PDS Substation

Typically, PDS substations are located at-grade due to local codes and regulations or at the direction of the local authorities having jurisdiction (AHJ). However, the possibility of an underground substation is also being preserved for as part of the ITC project. Further review of applicable codes and regulations and discussions with the AHJ are required for final determination on the acceptability of an underground substation.

For underground substations, the above requirements for an approximately 30 ft x 100 ft room is still applicable. Access for personnel and installation/replacement of smaller equipment can occur via freight elevators, and at a minimum, two staircases (one for normal access, and another for emergency egress). It is estimated that in addition to the 30 ft x 100 ft room, an additional space of approximately 30 ft x 30 ft should be adequate to fit the required vertical circulation. Access for large equipment installation/replacement, which is expected to occur infrequently, can occur via an access hatch located over the substation room in lieu of a ramp for truck access. The use of an access hatch minimizes the amount of underground excavation and construction. With the access hatch, equipment would be lowered down into or lifted up out of the substation via a temporary crane.

Note that, in addition to code/regulatory and local AHJ requirements, the following may also be considerations for underground PDS substations:

- Water table and flooding;
- Water proofing design requirements;
- Air circulation equipment to ensure the necessary environmental conditions are maintained within the substation; and
- Other safety and environmental mitigations.

9.4 Analysis Results

The following are the results of the load-flow analysis performed for mainline operations, as well as the estimated power load for the MSF.

9.4.1 Mainline Operations

The objective of the analysis was to determine the following:

A. Normal Operation: The service that could be operated with PDS substation located at the MSF and at the ITF site with both substations in operation;
B. Failure Operations: The service that could be operated with one full PDS substation out of service and the other in service; and
C. The resulting transformer size for each PDS substation location.

Based on the assumed three potential locations for the PDS substations, the following two different PDS location combinations were analyzed.

1. MSF Site + City of Inglewood Intermodal Transit/Park and Ride Facility (ITF) site
2. MSF Site + Prairie Avenue/Hardy Street Station

Results for both combinations are summarized in the following table. The full results are provided in the following sections.

- Combination 1 provides the best redundancy, providing the ability to operate full 6 x 4-train service even with one PDS substation fully out of service.
- Combination 2 provides the ability to operate full 6 x 4-train service under normal operation. Reduced service of 5 x 4-car trains may be required when the MSF substation is out of service.

COMBINATION		NORMAL OPERATION (ALL SUBSTATIONS IN OPERATION)	FAILURE OPERATIONS (ONE SUBSTATION OUT OF SERVICE)	PDS SUBSTATION SIZE (EACH LOCATION)
1	MSF Site, ITF Site	Full Service: 6 x 4-car trains	Full Service: 6 x 4-car trains	2 MW
2	MSF Site, Prairie Avenue/Hardy Street Station	Full Service: 6 x 4-car trains	Potentially Reduced Service: 5 x 4-car trains	2 MW

Table 9-1: Summary of Mainline Operations Load Flow Analysis

9.4.1.1 Combination 1: MSF + ITF

9.4.1.1.1 Normal Operation

The following tables present the results of the load flow analysis based on Normal Operation with both PDS substations in operation for the 6 x 4-car fleet. Normal Operations can be operated with the MSF and ITF site substation locations.

Normal	Peak Power (KW)	RMS Power (KW)	Average Power (KW)	RMS Current (A)
MSF Site PDS 1	2008	834	755	1067
ITF Site PDS 2	2119	777	639	996

Table 9-2: Combination 1, Normal Operations Load Flow Analysis

9.4.1.1.2 Failure Operations

The following presents the results of the load flow analysis used to determine the operations that are capable when one full PDS substation is out of service. The analysis determined that with one PDS substation out of service, the system can continue to operate the 6 x 4-car trains.

Based on the results provided in Table 9-3, the minimum transformer sizing is 2.0 MW.

Loss of PDS 1	Peak Power (KW)	RMS Power (KW)	Average Power (KW)	RMS Current (A)
MSF Site PDS 1	0	0	0	0
ITF Site PDS 2	4152	1671	1447	2200
Loss of PDS 2	**Peak Power (KW)**	**RMS Power (KW)**	**Average Power (KW)**	**RMS Current (A)**
MSF Site PDS 1	4353	1668	1436	2197
ITF Site PDS 2	0	0	0	0

Table 9-3: Combination 1, Failure Operations (6 x 4-car Train) Load Flow Analysis

The results indicated that the two PDS substations provide adequate redundancy with the ability to operate the 6 x 4-train fleet, even with either substation out of service.

9.4.1.2 Combination 2: MSF + Prairie Avenue/Hardy Street Station

9.4.1.2.1 Normal Operation

The following tables present the results of the load flow analysis based on Normal Operation with both PDS substations in operation for the 6 x 4-car fleet. Normal Operations can be operated with the MSF and Prairie Avenue/Hardy Street Station substation locations.

Normal	Peak Power (KW)	RMS Power (KW)	Average Power (KW)	RMS Current (A)
MSF Site PDS 1	2275	820	701	1051
Prairie Avenue/Hardy Street Station PDS 2	1460	657	531	838

Table 9-4: Combination 2, Normal Operations Load Flow Analysis

9.4.1.2.2 Failure Operations

The following presents the results of the load flow analysis used to determine the operations that are capable when one full PDS substation is out of service. Operating capabilities are technology dependent and ultimately, suppliers will need to design their operating system to meet requirements as specified in the procurement documents.

Based on the results provided in Table 9-5, the minimum transformer sizing is 2.0 MW.

Loss of PDS 1	Peak Power (KW)	RMS Power (KW)	Average Power (KW)	RMS Current (A)
MSF Site PDS 1	0	0	0	0
Prairie Avenue/Hardy Street Station PDS 2	4209	1557	1295	2044
Loss of PDS 2	**Peak Power (KW)**	**RMS Power (KW)**	**Average Power (KW)**	**RMS Current (A)**
MSF Site PDS 1	3455	1499	1260	1960
Prairie Avenue/Hardy Street Station PDS 2	0	0	0	0

Table 9-5: Combination 2, Failure Operations (6 x 4-car Train) Load Flow Analysis

As discussed in Section 1.3, Basic Assumptions, sensitivity analyses were performed to evaluate impacts of assuming higher passenger densities on trains during the Large Events that occur during a limited number of days each year. It was determined that assuming a passenger density 2.15 sq. ft per standing passenger (5 standing passengers per sq. meter) increases the risk of degraded service if the MSF PDS substation is out of service.

9.4.2 MSF Operations

The power requirements for the MSF were developed assuming a worst-case scenario where during operating hours, 1 x 4-car or 2 x 2-car trains are operating on the mainline and maintenance is simultaneously being performed on the remaining trains at the MSF. During non-operating hours, all maintenance berths are simultaneously performing maintenance. This worst-case scenario provides a conservative estimate for the MSF power requirements.

Based on the above assumptions and the operating hours noted in Section 9.2, Assumptions, it is estimated that the transformers at the MSF PDS substation location will need 0.5 MVA of additional capacity.

The power usage for the automated storage and train wash tracks can be accommodated by the power requirements for the mainline operations. There is no situation where trains are being moved into/out of the automated train wash area while the mainline is operating 6 x 4-car trains. Trains can only be moved into/out of automated train wash when the number of trains operating on the mainline is reduced. Therefore, it is not required to increase the size of the MSF or the mainline transformer sizes to power the automated stabling tracks.

9.5 Conclusions and Recommendations

The following table identifies the estimated transformer sizes for the analyzed MSF site and ITF site PDS substation locations, along with Lea+Elliott's recommendations and comments.

These sizes and recommendations are based on an assumed high reliability robust level of service that is reasonable for this early level of planning. As the project progresses, the transformer sizes can be further optimized. In addition, if the peak hour demand assumptions are updated in a future phase due to updates to the number of trains in the system, additional load flow analysis will be required to determine the resulting estimated transformer sizes and PDS substation facility size.

COMBINATION		TRANSFORMER SIZE	COMMENTS
1	MSF Site	2.5 MVA (2.0 MVA + 0.5 MVA)	• Strongly recommend providing two PDS substations. • Provides Normal Operations and Failure Operations of 6 x 4-car trains with one full PDS substation out of service. • Further optimizing of transformer sizes can occur in a future phase of the project.
	ITF Site	2.0 MVA	
2	MSF Site	2.5 MVA (2.0 MVA + 0.5 MVA)	• Two PDS substations likely required. • During a failure of the MSF Site substation, there is a risk of degraded service. • Further optimizing of transformer sizes and further analysis on failure operations can occur in a future phase of the project.
	Prairie Avenue/ Hardy Street Station Site	2..0 MVA	

Table 9-6: Summary of Estimated Transformer Sizes

Two PDS substations are strongly recommended. Although one PDS substation at either the MSF or ITF sites appears sufficient to support normal operations, there is a risk that full redundancy may not be able to be provided with one PDS substation at the Prairie Avenue/Hardy Street Station site. Although reduction from two to one PDS substation would result in a capital cost savings of upwards of $3 Million, this savings does not outweigh the potential risks of failure scenarios and reduced future operational flexibility. The likelihood of a full PDS substation failure is very low but is possible. And if it does occur, the repair process can at times take months to repair depending on the severity of the failure.

9.6 Coordination with Southern California Edison

In 2019, the EIR team reached out to Southern California Edison (SCE) to begin coordination related to the power demand requirements for the ITC system. The goal was to identify whether there were any major shortfalls or major issues at this time from a power capacity perspective.

The ITC Team provided the following requirements and assumptions to SCE regarding the ITC Project:

- The project would require approximately 10 MVA to power the System (trains, traction power, etc.) and infrastructure (station lighting and vertical circulation, guideway lighting, etc.).
- Fully redundant power feeds are requested.
- Feeds to be provided at single location. The ITC Project would distribute power as needed.

Using these assumptions, SCE's Distribution Engineering department completed a high-level Distribution Study to determine the amount of load that SCE could accommodate and required infrastructure upgrades in order to meet the ITC Project's recommended full redundancy design. SCE's analysis assumed the use of the existing single (non-redundant) 16kVA circuit currently available along Market Street as it may be the most likely used circuit for the ITC Project.

The results of SCE's Distribution Study found that:

- The maximum load that can be accommodated at the present time is 10 MVA.
- To accommodate the 10 MVA with full redundancy, the following upgrades would be required:
  - 1,500 ft of new civil work/duct banks
  - 1,860 ft of new 1000 JCN cable
  - 1,700 ft of upgrading/re-cabling existing SCE Primary cable to 1000 JCN
  - Two new Gas Switches

These values and upgrades are based on the current projected loads for 2026. SCE's also noted that their distribution system is dynamic and is subject to change as we approach the 2026 date. As the project details develop, SCE can effectively plan for this new load. The ITC project will need to be reevaluated by the SCE Distribution Engineering in a future phase of the project as the details are finalized.

In February 2021, the ITC Project had a follow-up meeting with SCE where the ITC Project provided an update on the project concept, status, timeline, and power consumption assumptions. The goal of the meeting was to further establish the next steps for coordination with SCE and SCE design requirements. Key discussion points include:

- SCE confirmed that a second primary feeder to the ITF PDS substation would be problematic.
- SCE noted that the ITC Project needs to submit an application for the project to be identified as viable and before power availability could be confirmed.

- SCE noted that the customer (i.e., the ITC Project) is required to provide the primary line extension from SCE infrastructure to the point of service (the ITC MSF site) and referred the project to SCE’s design standards and design review process.

Email correspondence from SCE from 2019 and 2021, as well as meeting minutes from February 2021 are provided in Appendix D for reference.

10 Conceptual Cost Estimates

The total cost for an APM project is comprised of the cost for the infrastructure and the Operating System. The following sections provide a summary of the conceptual capital and Operations and Maintenance (O&M) cost estimates for the APM Operating System only. The APM infrastructure capital and O&M cost estimates were prepared separately by the EIR team's infrastructure consultant.

An APM project, including this ITC project, can be separated into the following two distinct elements:

- APM Operating System: The APM operating system includes the rolling stock (vehicles) and associated equipment (such as automatic train control and communications equipment, power distribution system, guidance and power rails, running surface/trackwork, public address and CCTV systems, maintenance equipment etc.) required for the integrated safe and reliable operations of the APM operating system. The APM operating system equipment is installed within APM Fixed Facilities, for which requirements are driven by the APM operating system.
- APM Infrastructure (also called Fixed Facilities (FF)): APM Infrastructure is generally comprised of the passenger stations, guideway structures, maintenance and storage facility (MSF), central control facilities, power substations and equipment rooms, as well as establishing appropriate interfaces for life-safety systems such as lightning protection, grounding, NFPA 130, etc. The APM Infrastructure requirements are driven by the APM operating system.

APM Operating Systems are proprietary designs that must be procured as complete packages, whether in standalone contracts for Operating System or as part of a larger Design Build Operate Maintain contract with the design and construction of the infrastructure. In some cases, large infrastructure investments are also procured with the financing of the project integrated into the project delivery, such as Design Build Finance Operate Maintain (DBFOM). The procurement approach for the ITC project is planned to be DBFOM.

10.1 Systems Capital Cost Estimate

10.1.1 Overview

APM Operating Systems are proprietary designs that must be procured as complete packages. The major subsystems (e.g., vehicles, tracks, switches, control systems, station equipment, etc.) from different suppliers cannot be mixed to form a system. Therefore, the APM Operating System must be procured under a turnkey design, supply and installation contract. The APM Operating System equipment designs are proprietary and are different for each of the suppliers. Due to the highly specialized nature of this work, there are a limited number of qualified, responsible suppliers for the APM Operating System. As a result, the costs within the APM industry vary on a project-by-project basis often driven by market conditions (i.e., how many APM procurements are ongoing, economic conditions, as well as a potential supplier's strategic considerations in gaining market share, among other things), degree and level of competitive interest in the procurement, and the project specific requirements. Some of the key project specific requirements for an APM System include the fleet size, capacity requirements, operational modes and more significantly, the general terms and conditions of the contract, including but not limited to caps on damages.

The ITC project has been programmed for a “generic” class of large APM technology, including large monorails, to facilitate a competitive procurement environment.

The generic APM Operating System includes characteristics common to the available proprietary technologies such that these technologies could be “easily adapted” to site specific requirements. The aim of this approach is to ensure that the project is compatible with the various APM technologies and thus increase the competitive environment.

For cost estimating purposes, Lea+Elliott has developed a proprietary cost model using cost data from historical projects that can be programmed to create a theoretical composite APM Operating System most like the APM Operating System planned for the subject project. The cost model considers prices from an extensive database, including costs of APM systems with similar characteristics to the system being estimated.

10.1.2 Capital Cost Estimate Breakdown

Table 10-1 provides a breakdown of the estimated capital cost for the APM Operating System by subsystem and/or major activity. The following items are taken into consideration in the estimate:

- This estimate is provided in Q4 2020 dollars; additional escalation to mid-point of construction or bid dates is to be added should they be needed.
- Overhead and Bond costs are included in the contractor’s project management and administration, as they are typically assigned to this line item by the bidder/supplier.
- Variability factors ranging from 5% to 20% are applied to each cost estimate line item and an additional overall 5% contingency is applied; these contingency factors are applicable due to:
    - The proprietary nature of the technologies, as suppliers’ competitiveness, and therefore prices, vary depending on different economic factors;
    - Variability observed for line item-level costs between projects and between bidders on individual projects; and
    - Level of uncertainty at this early stage of this project;
- As noted above, this estimate does not include the APM infrastructure costs, including costs associated with extending SCE primary power to the MSF site, or the City’s costs for project management, technical assistance and administration of the contract, and any legal fees.
- Potential cost premiums associated with Buy America requirements discussed in the next section are not considered in the costs reported herein.

APM OS CAPITAL COST ESTIMATE (DOES NOT INCLUDE INFRASTRUCTURE)							
WBS NO.	ITEM DESCRIPTION	MAJOR QUANTITY AND UNIT		ESTIMATED COST (NO VARIABILITY FACTOR)	VARIABILITY AMONG SUPPLIERS		ESTIMATED COST INCLUDING VARIABILITY FACTOR
					%	AMOUNT	
2.1	GUIDEWAY EQUIPMENT	19,233	LINEAR FT. GUIDEWAY	$19,119,000	15%	$2,868,000	$21,987,000
2.2	STATION EQUIPMENT	3	STATIONS	$5,428,000	15%	$814,000	$6,242,000
2.2.5	FARE COLLECTION EQUIPMENT	3	STATIONS	$2,652,000	20%	$530,000	$3,182,000
2.3	MAINTENANCE AND STORAGE FACILITY EQUIPMENT	1	LUMP SUM	$12,679,000	5%	$634,000	$13,313,000
2.4	POWER DISTRIBUTION SYSTEM EQUIPMENT	1	LUMP SUM	$16,053,000	10%	$1,605,000	$17,658,000
2.5	AUTOMATIC TRAIN CONTROL EQUIPMENT	1	LUMP SUM	$15,564,000	15%	$2,335,000	$17,899,000
2.6	COMMUNICATIONS EQUIPMENT	1	LUMP SUM	$4,957,000	20%	$991,000	$5,948,000
2.7	CARS	24	EACH	$68,553,000	10%	$6,855,000	$75,408,000
2.8	OTHER OS EQUIPMENT OR FACILITIES	19,233	LINEAR FT. GUIDEWAY	$3,426,000	20%	$685,000	$4,111,000
2.9	OS VERIFICATION AND ACCEPTANCE	4.50%	% of subtotal	$6,679,000	15%	$1,002,000	$7,681,000
2.10	OS SUPPLIER'S PROJECT MANAGEMENT AND ADMINISTRATION	29.43%	% of subtotal	$45,679,000	5%	$2,284,000	$47,963,000
SYSTEM SUBTOTAL				$200,789,000		$20,603,000	$221,392,000
PROJECT CONTINGENCY			10%	$20,079,000			
RESIDUAL CONTINGENCY					5%	$11,070,000	$11,070,000
TOTAL (ESTIMATE YEAR 2020)				**$221,000,000**			**$232,000,000**

Table 10-1: Conceptual APM Operating System Capital Cost Estimate

10.2 Operations & Maintenance Cost Estimate

10.2.1 Overview

The Systems O&M is typically performed by the Contractor as part of their delivery of the initial system. The annual O&M cost estimate addresses labor, power and material (i.e., parts and consumables) costs for the system operations and estimated fleet size. O&M costs include vehicle and guideway maintenance, system controls, fare collection, roving staff that can respond to mechanical problems and emergencies, and management and administration support. As an automated system, APM O&M labor costs can be relatively low compared to regular transit and allow more frequent service to be operated.

10.2.2 O&M Cost Estimate Breakdown

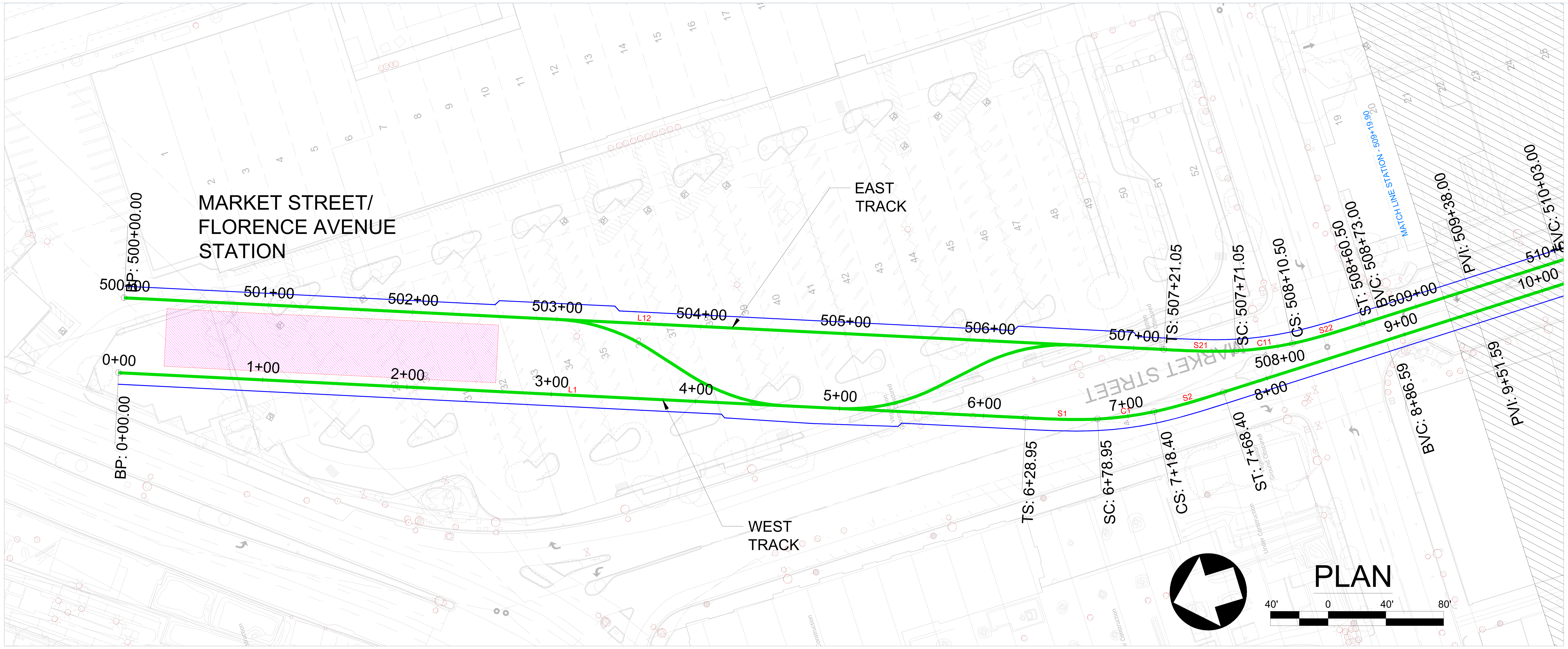
Table 10-2 provides a breakdown of the O&M estimate for the APM system equipment. The following items have also been taken into consideration in the estimate:

- Estimate is provided in Q4 2020 dollars.
- A 20% contingency is applied, which is applicable due to:
    - Increased level of unknowns at this very early planning level of this project
    - The proprietary nature of the technologies, as suppliers' competitiveness, and therefore prices, vary depending on different economic factors.
- A 10% profit is assumed for the Contractor.
- The estimate reflects the unique operating scenarios for the ITC; specifically that the range of service scenarios will be operated to reflect the different event sizes throughout the year.
- This estimate does not include the infrastructure O&M costs, capital asset replacement costs, or the Owner's costs for project management, technical assistance and administration of the contract, and any legal fees.

APM OPERATING SYSTEM O&M COST ESTIMATE (DOES NOT INCLUDE INFRASTRUCTURE)		
ITEM DESCRIPTION		**ESTIMATED COST**
LABOR - Operations		$1,040,000
LABOR – Maintenance and Other O&M Support		$4,290,000
MATERIALS		$1,460,000
SUBTOTAL		**$6,790,000**
PROFIT AND G&A (FEE)	10%	$678,000
ANNUAL O&M CONTRACT		**$7,468,000**
UTILITIES AND OTHER ANNUAL ENGINEERING SUPPORT		$880,000
SUBTOTAL		**$8,348,000**
CONTINGENCY	20%	$1,669,600
TOTAL ANNUAL O&M COST		**$10,020,000**

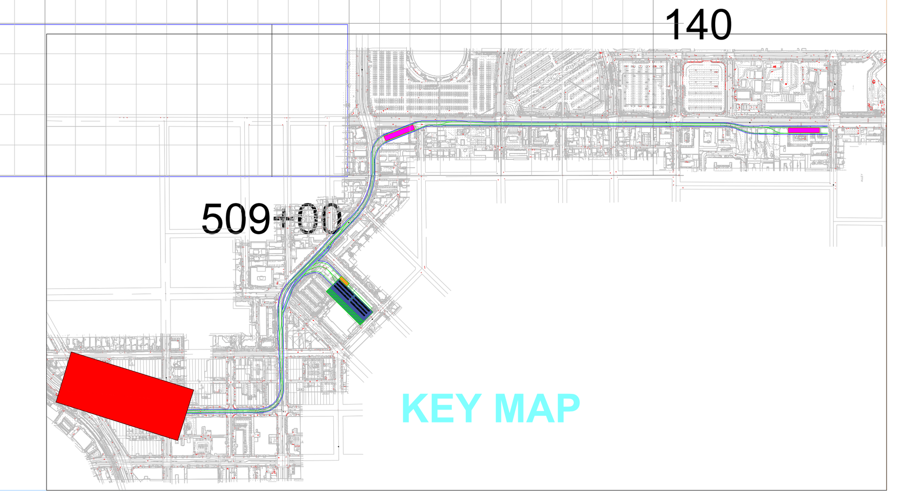
Table 10-2: Conceptual APM Operating System O&M Cost Estimate

Appendix A: ITC Alignment Plan and Profile



PROFILE
EAST GUIDEWAY LANE

NOTE:
THE CITY OF INGLEWOOD AND OTHER PUBLIC AGENCIES ARE STILL IN THE PLANNING STAGES OF THE PROPOSED PROJECT. THIS ILLUSTRATION DEPICTED HEREIN IS FOR PLANNING PURPOSES ONLY AND NOT FOR CONSTRUCTION OR THIRD PARTY USE. PROPOSED IMPROVEMENTS, STAGING, SCHEDULE AND LIMITS OF ACQUISITION (TO THE EXTENT APPLICABLE) DEPICTED HEREIN ARE SUBJECT TO CHANGE. EXISTING IMPROVEMENTS AND UTILITIES DEPICTED HEREIN ARE BASED UPON PLANNING LEVEL TOPOGRAPHIC SURVEY AND NOT INTENDED FOR DESIGN PURPOSES.



PROJECT TITLE & ADDRESS

INGLEWOOD TRANSIT CONNECTOR

ISSUANCE

DATE	ISSUE	BY	CHECK

ARCHITECT

CONSULTANT

LEA ELLIOTT

TITLE

ITC ALIGNMENT PLAN AND PROFILE

DWG NO.:

P673-AD-001

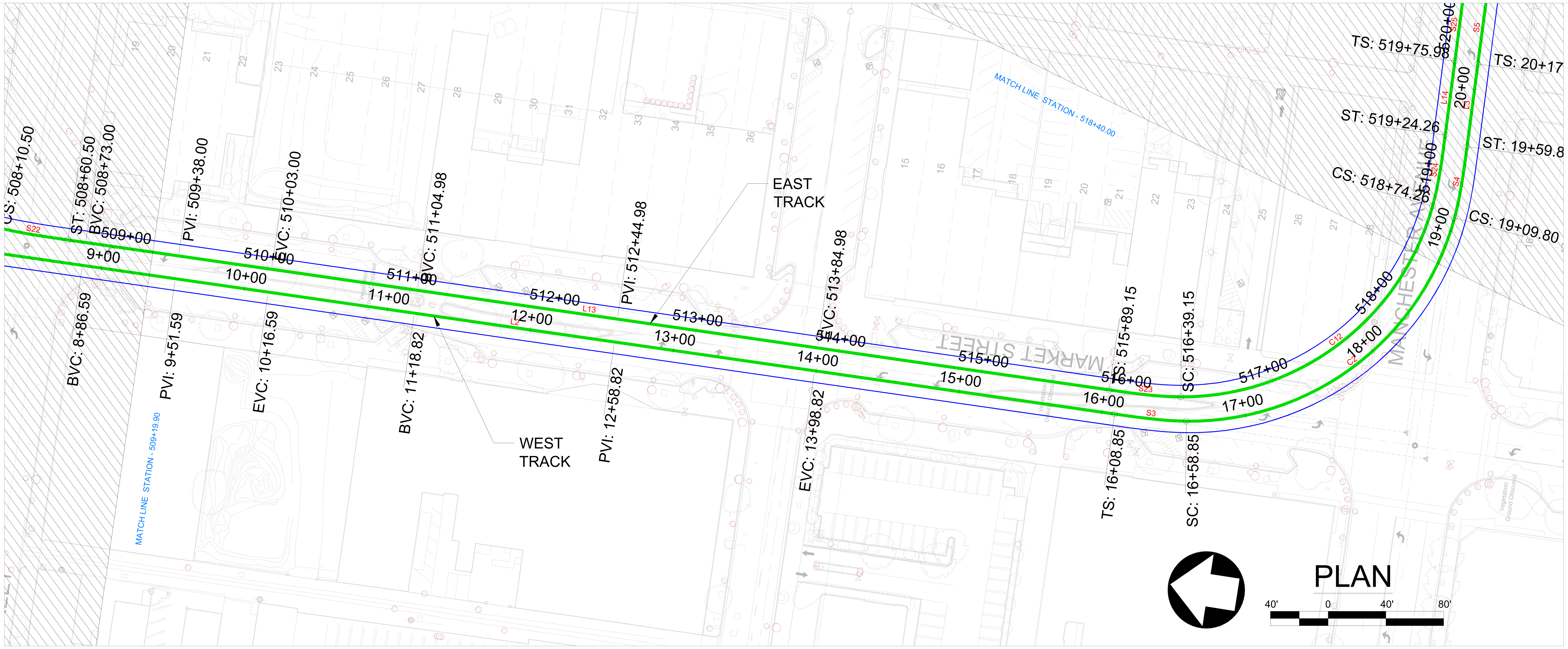
SEAL & SIGNATURE

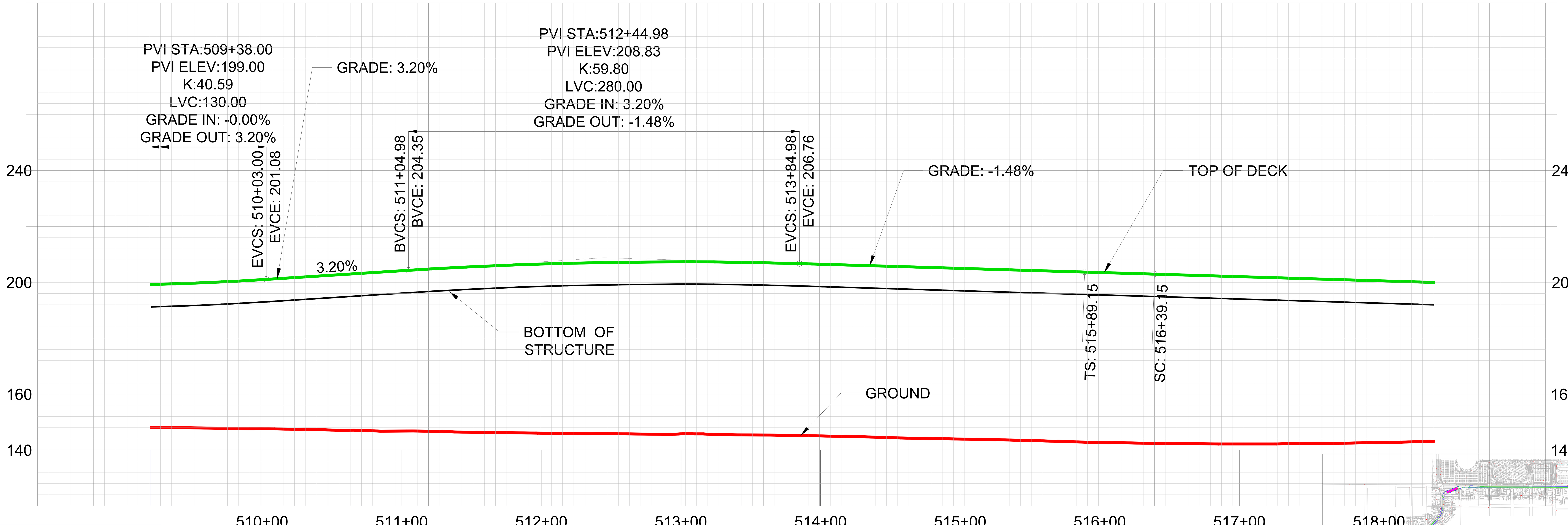
PRELIMINARY NOT FOR CONSTRUCTION

DATE: 08.03.2021
PROJECT NO.: P673
SCALE: 1" = 40'-0" H
1" = 20'-0" V

PROJECT NORTH
TRUE NORTH
W E S

GUIDEWAY ALIGNMENT PLAN AND PROFILE
STA. 500+00 TO STA. 509+19





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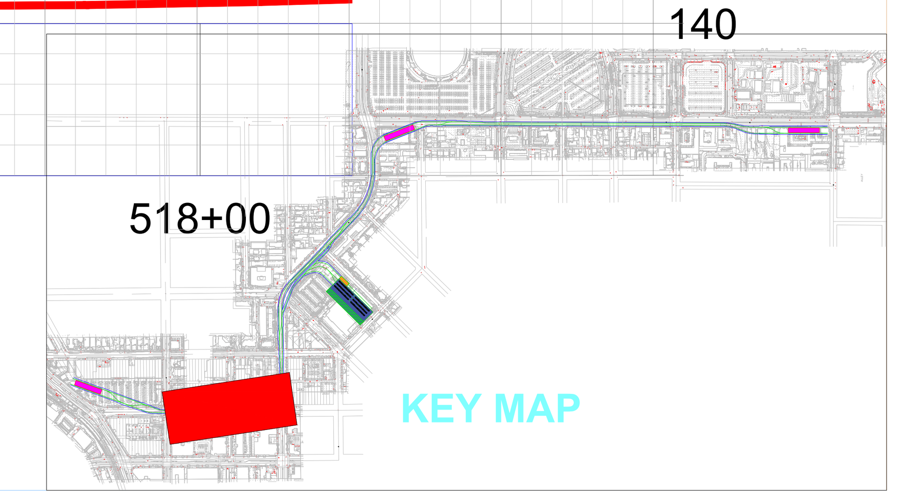


PROJECT TITLE & ADDRESS

INGLEWOOD TRANSIT CONNECTOR

ISSUANCE

DATE | ISSUE | BY | CHECK

ARCHITECT

CONSULTANT

LEA + ELLIOTT

TITLE

ITC ALIGNMENT PLAN AND PROFILE

DWG NO.:

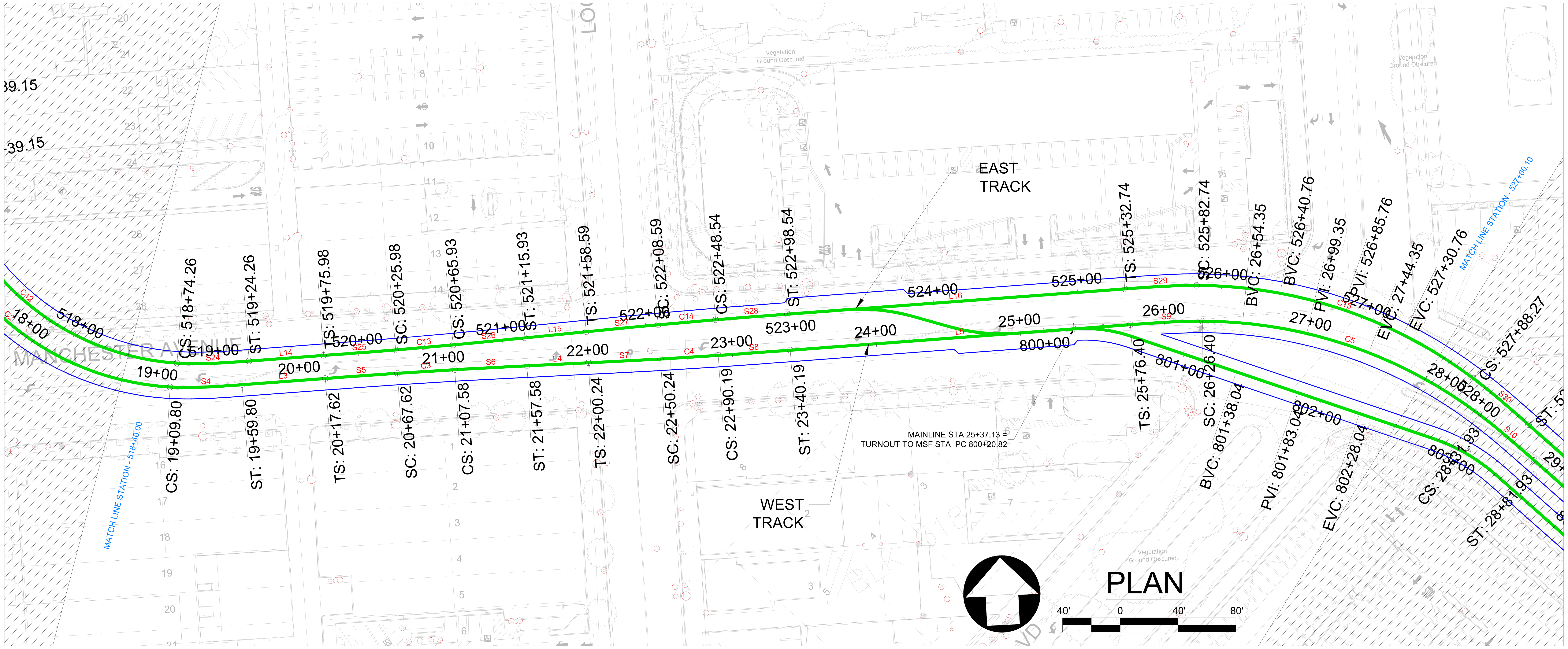
P673-AD-002

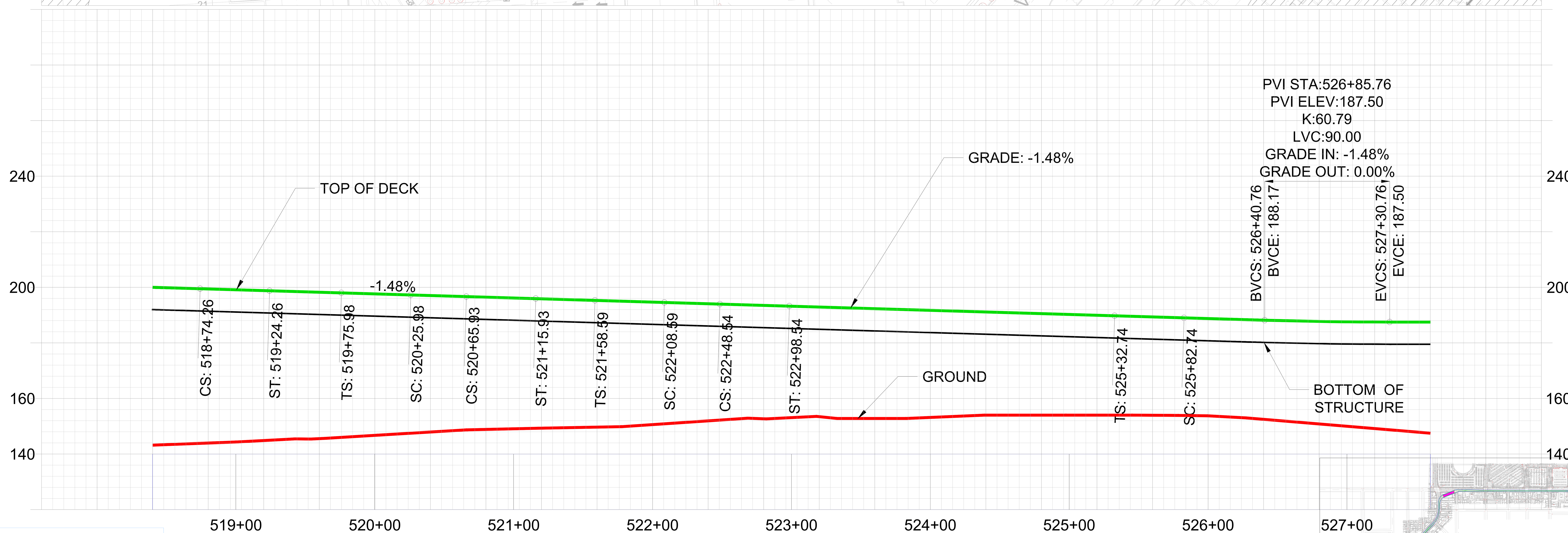
SEAL & SIGNATURE

PRELIMINARY NOT FOR CONSTRUCTION

DATE: 08.03.2021
PROJECT NO.: P673
SCALE: 1" = 40'-0" H, 1" = 20'-0" V

GUIDEWAY ALIGNMENT PLAN AND PROFILE
STA. 509+19 TO STA. 518+40





PROFILE
EAST GUIDEWAY LANE

NOTE:
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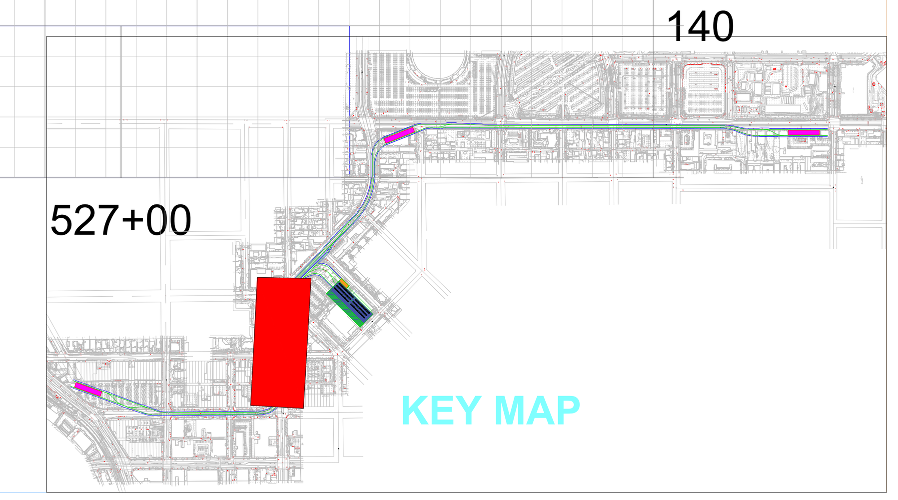


PROJECT TITLE & ADDRESS

INGLEWOOD TRANSIT CONNECTOR

ISSUANCE

DATE	ISSUE	BY	CHECK

ARCHITECT

CONSULTANT

LEA ELLIOTT

TITLE

ITC ALIGNMENT
PLAN AND PROFILE

DWG NO.:

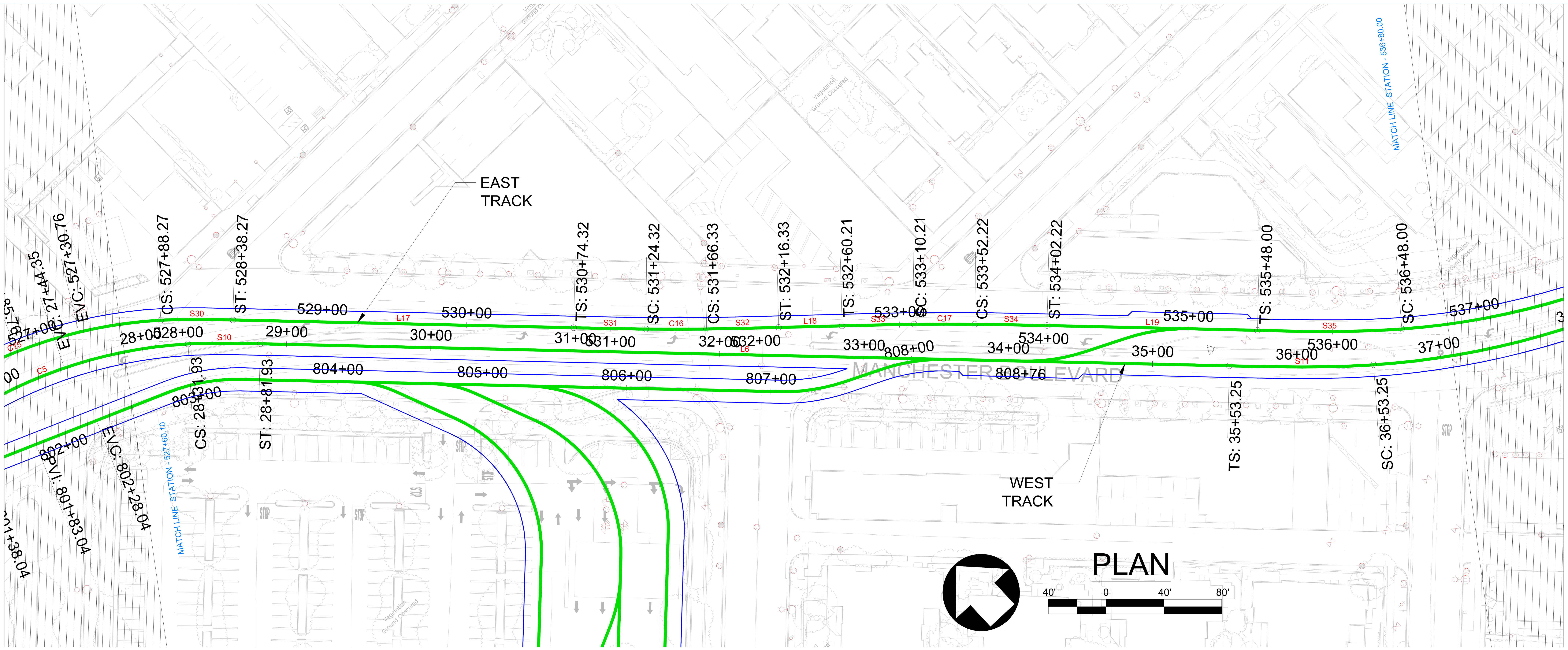
P673-AD-003

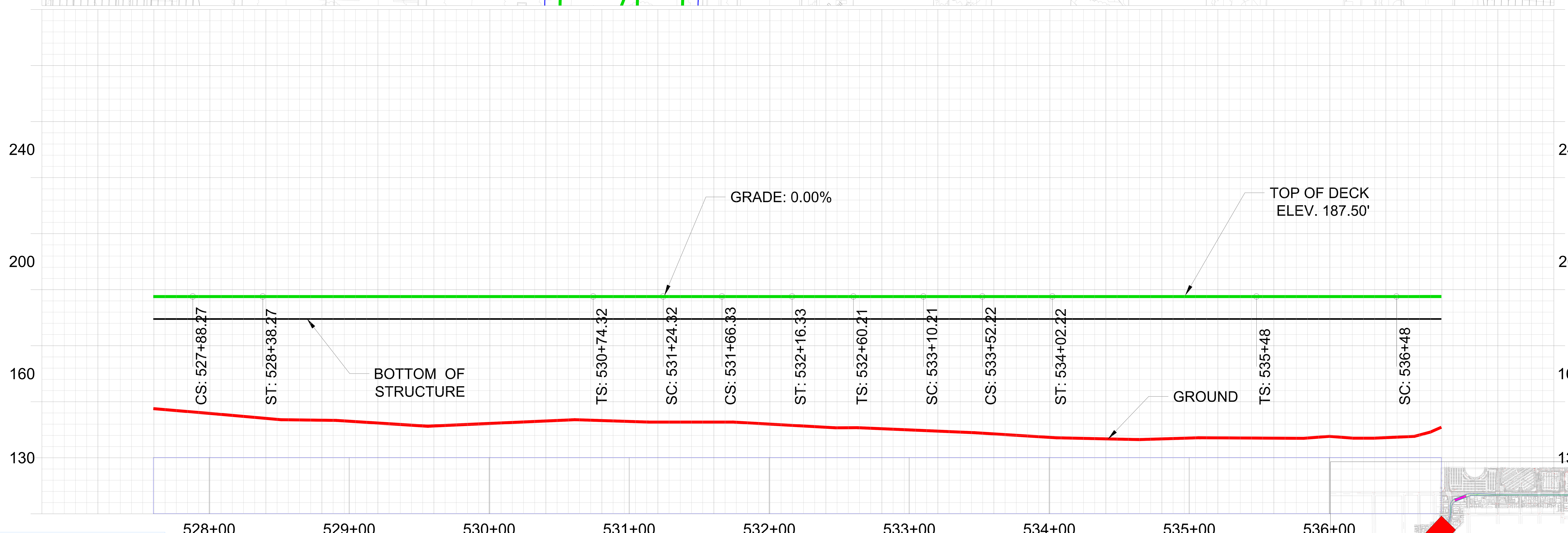
SEAL & SIGNATURE

PRELIMINARY
NOT
FOR
CONSTRUCTION

DATE:	08.03.2021
PROJECT NO.:	P673
SCALE:	1" = 40'-0" H 1" = 20'-0" V

GUIDEWAY ALIGNMENT
PLAN AND PROFILE
STA. 518+40 TO STA. 527+60





PROFILE
EAST GUIDEWAY LANE

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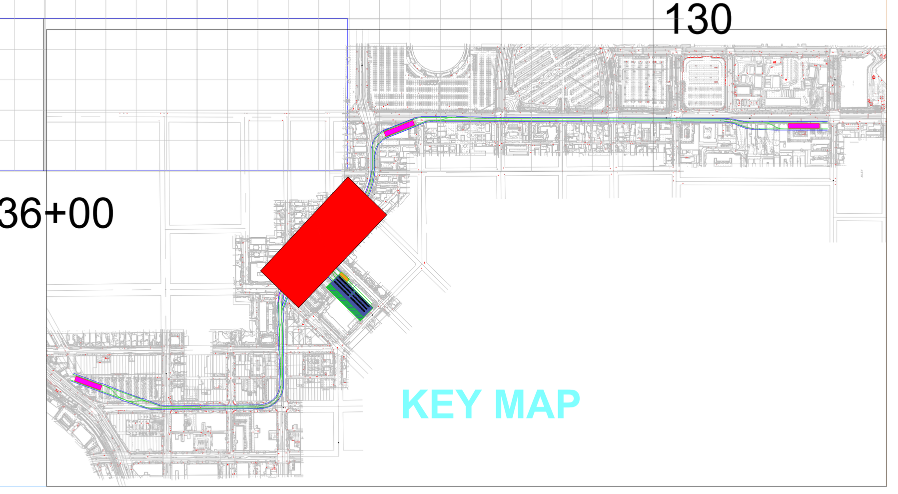

KEY MAP

PROJECT TITLE & ADDRESS

INGLEWOOD TRANSIT CONNECTOR

ISSUANCE

DATE ISSUE BY CHECK

ARCHITECT

CONSULTANT

LEA ELLIOTT

TITLE

ITC ALIGNMENT PLAN AND PROFILE

DWG NO.:

P673-AD-004

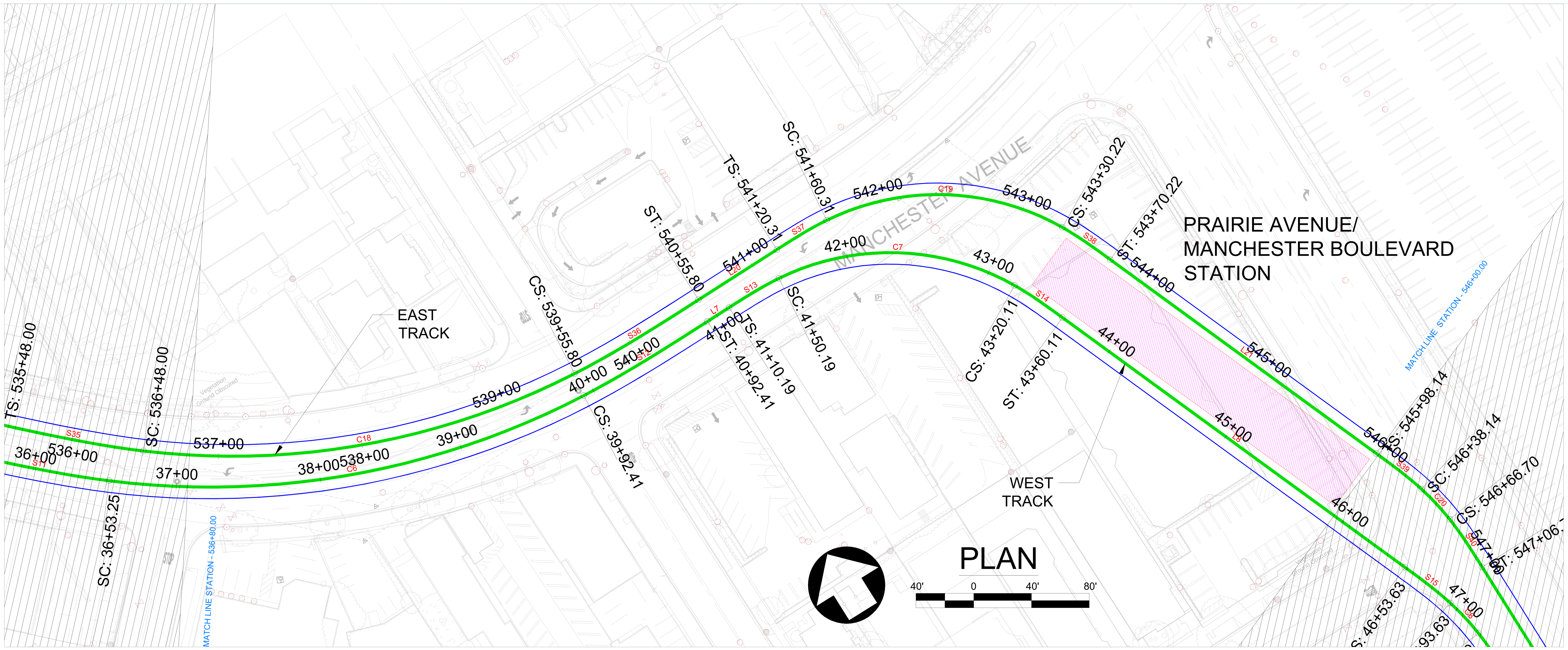
SEAL & SIGNATURE

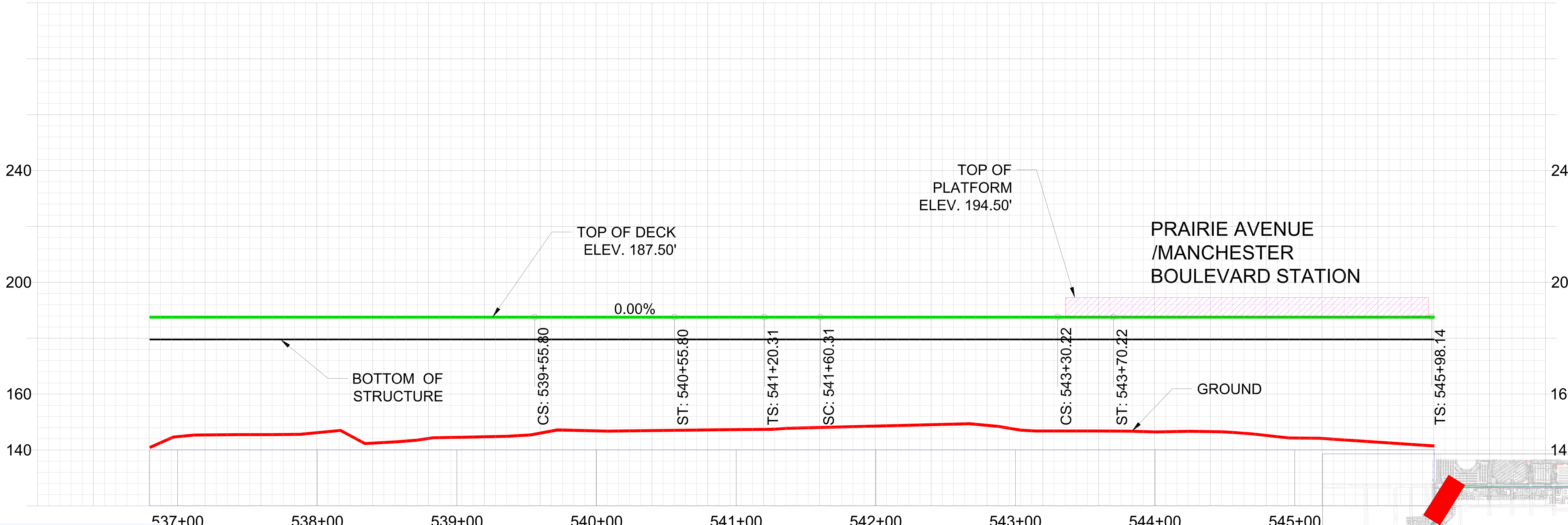
PRELIMINARY NOT FOR CONSTRUCTION

DATE: 08.03.2021
PROJECT NO.: P673
SCALE: 1" = 40'-0" H
1" = 20'-0" V

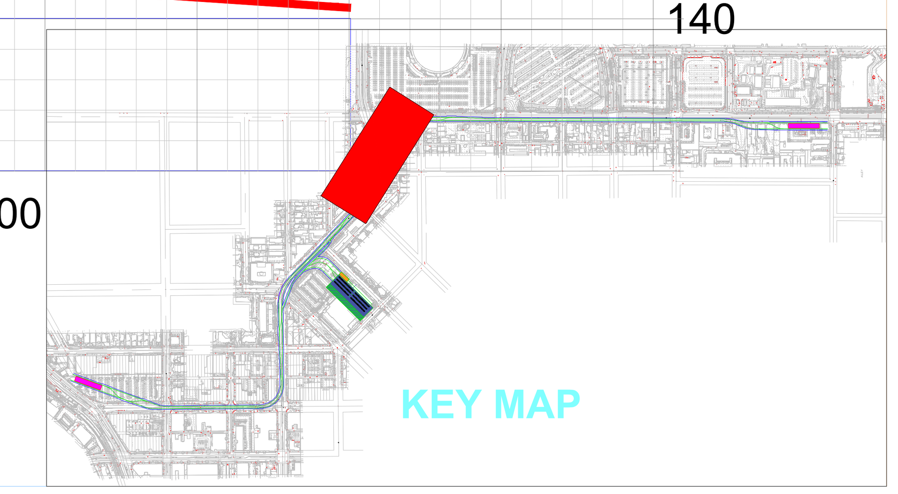
PROJECT NORTH
TRUE NORTH

GUIDEWAY ALIGNMENT PLAN AND PROFILE
STA. 527+60 TO STA. 536+80





PROFILE
EAST GUIDEWAY LANE



PROJECT TITLE & ADDRESS

INGLEWOOD TRANSIT CONNECTOR

ISSUANCE

DATE | ISSUE | BY | CHECK

ARCHITECT

CONSULTANT

LEA ELLIOTT

TITLE

ITC ALIGNMENT PLAN AND PROFILE

DWG NO.:

P673-AD-005

SEAL & SIGNATURE

PRELIMINARY NOT FOR CONSTRUCTION

DATE: 08.03.2021

PROJECT NO.: P673

SCALE: 1" = 40'-0" H
1" = 20'-0" V

GUIDEWAY ALIGNMENT PLAN AND PROFILE STA. 536+80 TO STA. 546+00

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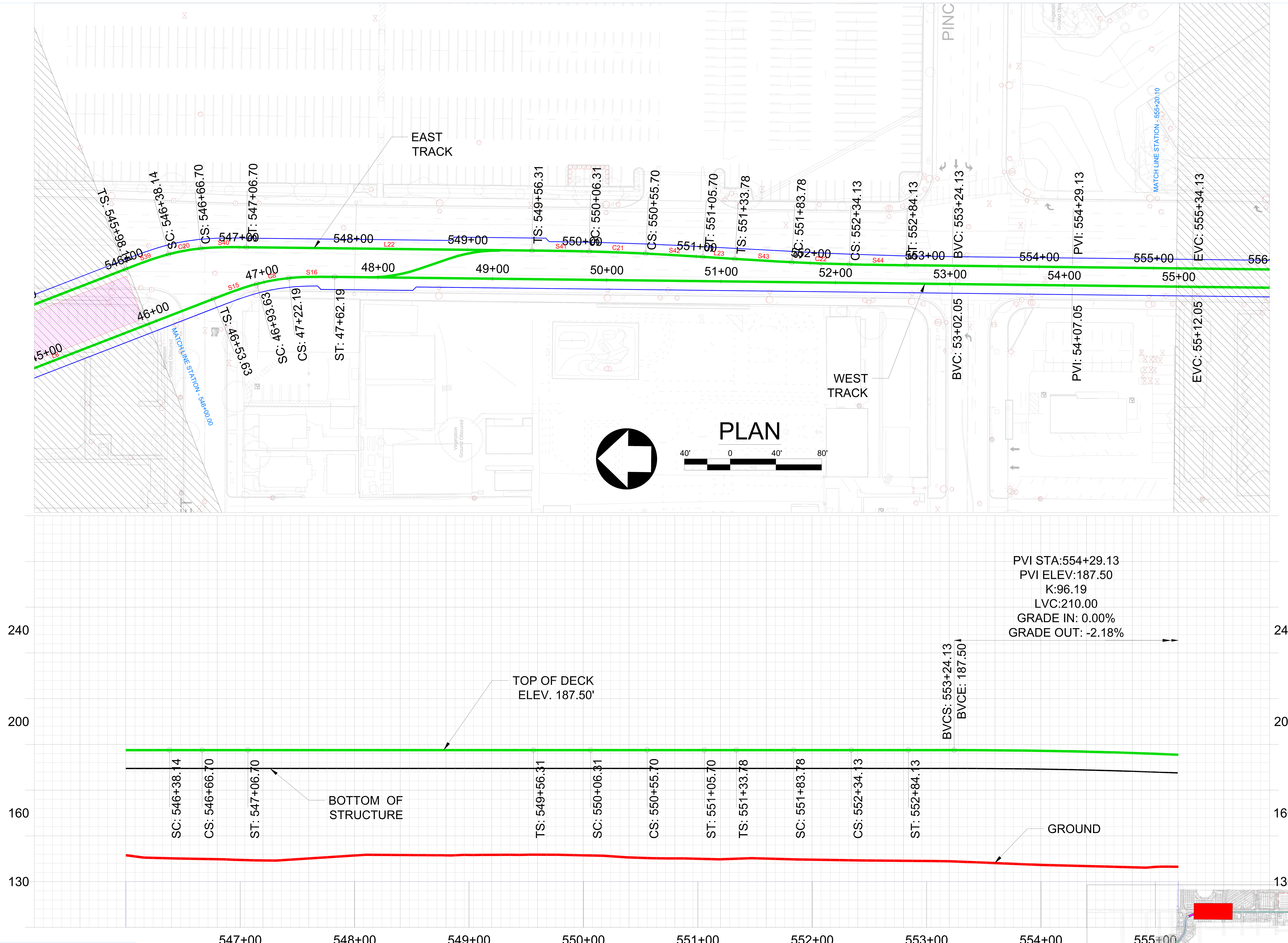

PROFILE
EAST GUIDEWAY LANE

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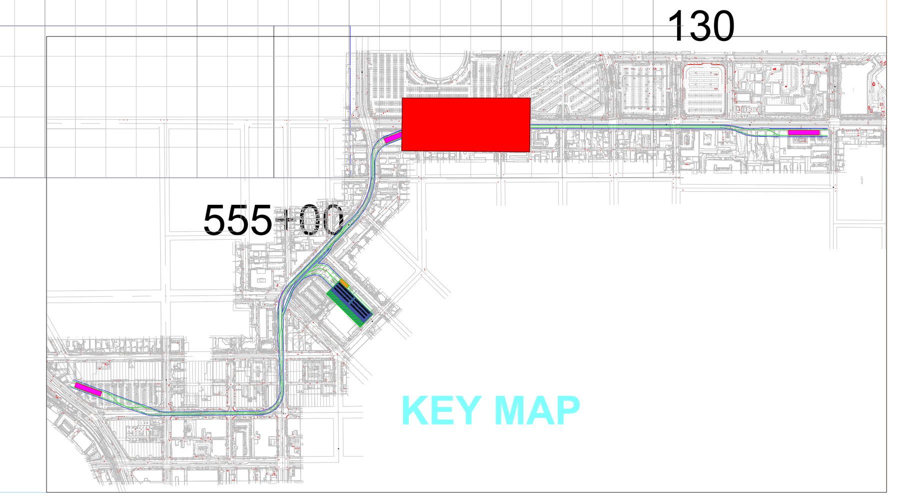


KEY MAP

PROJECT TITLE & ADDRESS

CITY OF INGLEWOOD INC. 1908 CALIFORNIA

INGLEWOOD TRANSIT CONNECTOR

ISSUANCE

DATE | ISSUE | BY | CHECK

ARCHITECT

CONSULTANT

LEA ELLIOTT

TITLE

ITC ALIGNMENT PLAN AND PROFILE

DWG NO.:

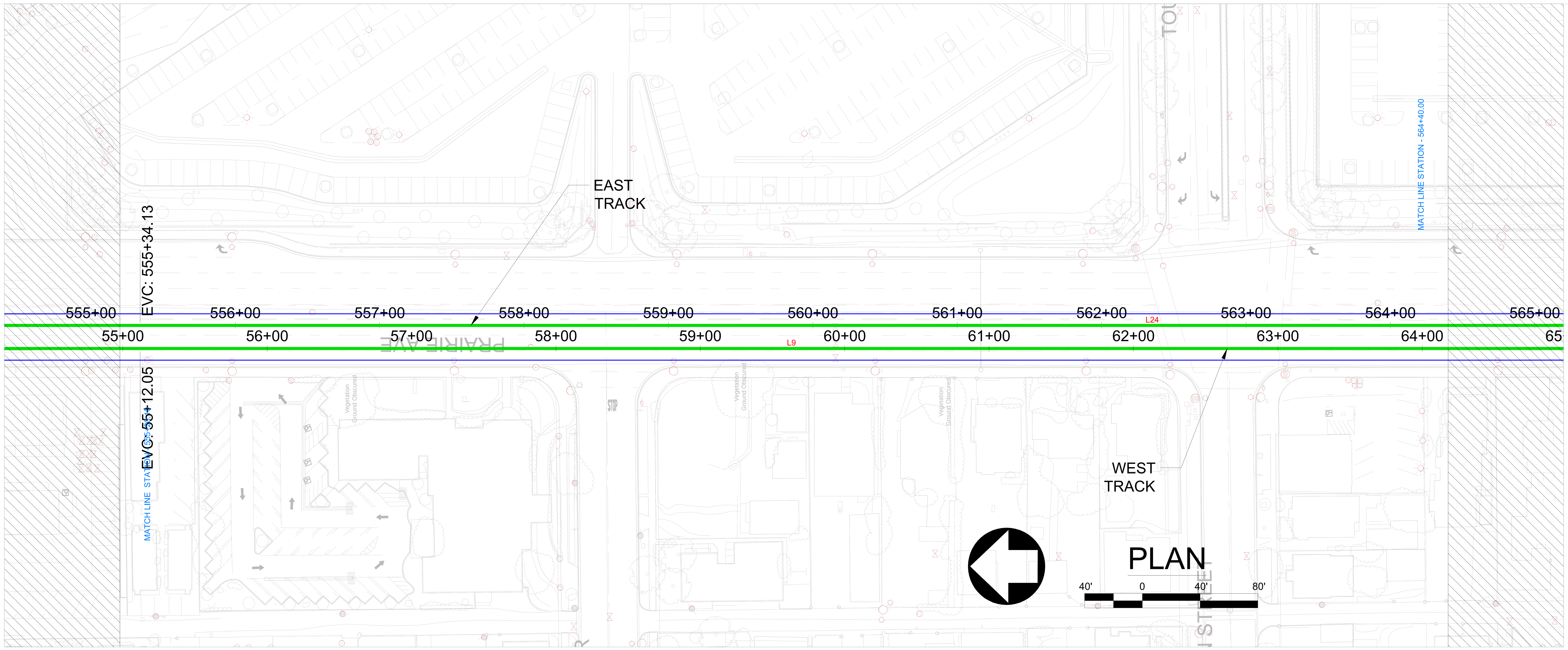
P673-AD-006

SEAL & SIGNATURE

PRELIMINARY NOT FOR CONSTRUCTION

DATE: 08.03.2021
PROJECT NO.: P673
SCALE: 1" = 40'-0" H, 1" = 20'-0" V

GUIDEWAY ALIGNMENT PLAN AND PROFILE
STA. 546+00 TO STA. 555+20



PLAN

PROFILE
EAST GUIDEWAY LANE

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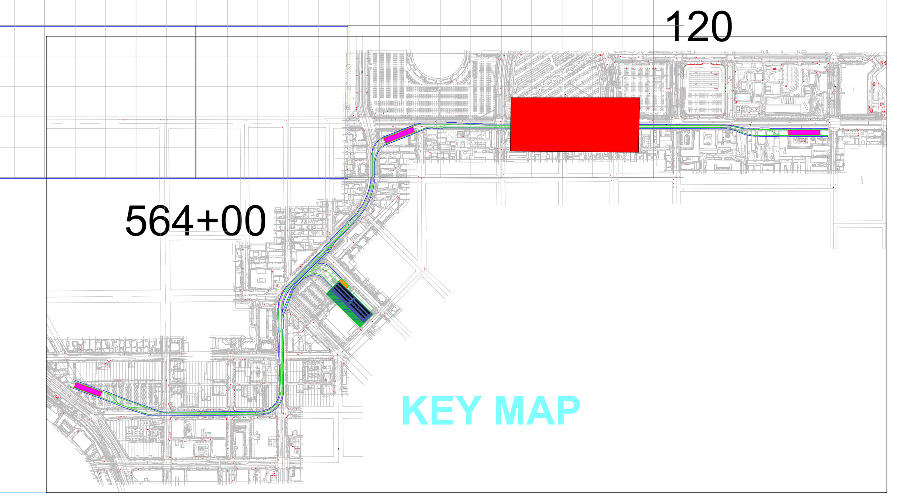


KEY MAP

PROJECT TITLE & ADDRESS

INGLEWOOD TRANSIT CONNECTOR

ISSUANCE

DATE	ISSUE	BY	CHECK

ARCHITECT

CONSULTANT

LEA ELLIOTT

TITLE

ITC ALIGNMENT PLAN AND PROFILE

DWG NO.:

P673-AD-007

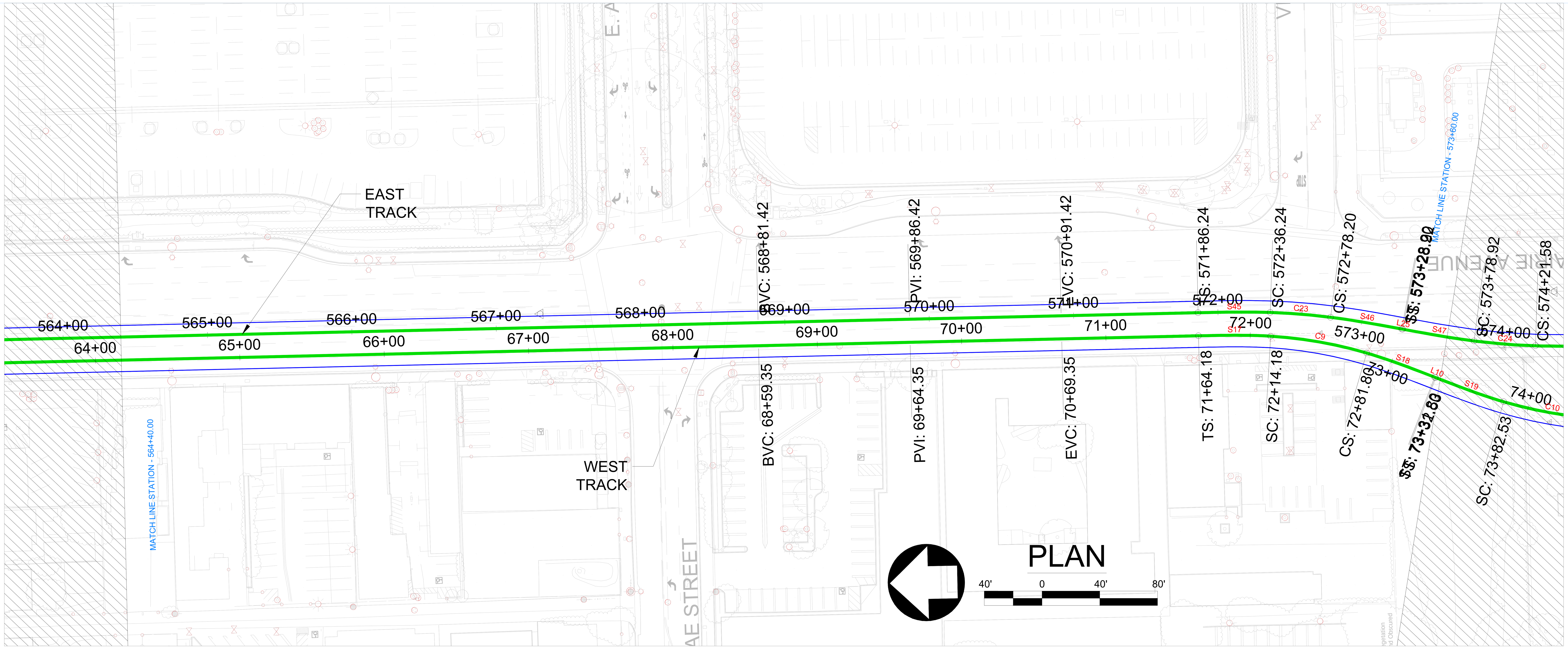
SEAL & SIGNATURE

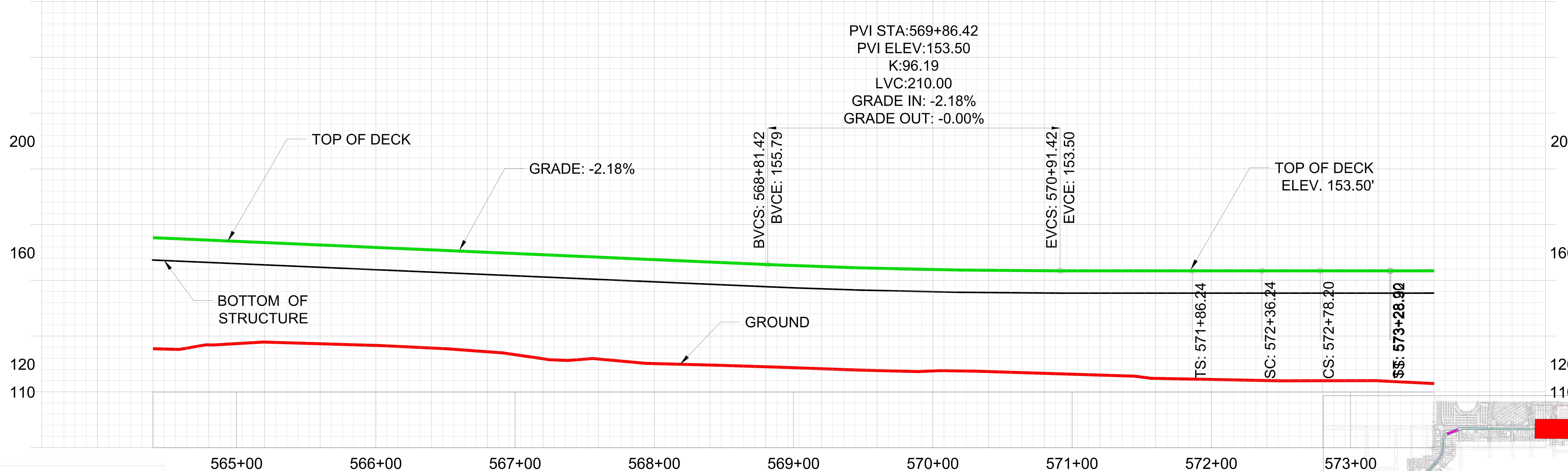
PRELIMINARY
NOT
FOR
CONSTRUCTION

DATE: 08.03.2021
PROJECT NO.: P673
SCALE: 1" = 40'-0" H
1" = 20'-0" V

PROJECT NORTH
TRUE NORTH
W E S

GUIDEWAY ALIGNMENT PLAN AND PROFILE
STA. 555+20 TO STA. 564+40





PROFILE
EAST GUIDEWAY LANE

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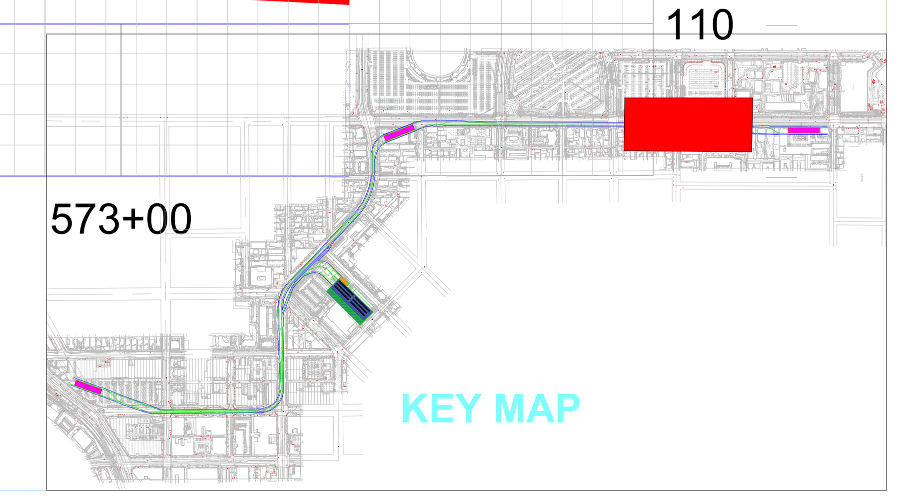


PROJECT TITLE & ADDRESS

INGLEWOOD TRANSIT CONNECTOR

ISSUANCE

DATE ISSUE BY CHECK

ARCHITECT

CONSULTANT

LEA ELLIOTT

TITLE

ITC ALIGNMENT PLAN AND PROFILE

DWG NO.:

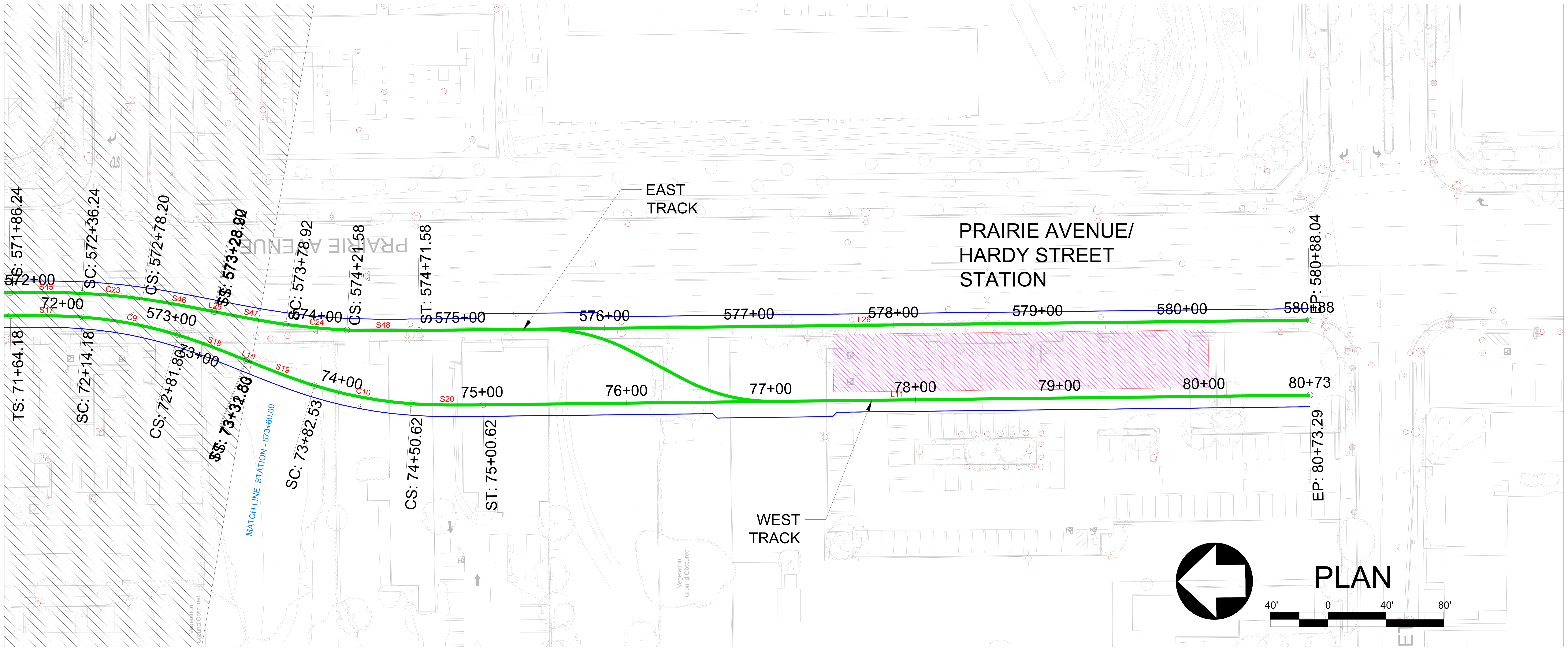
P673-AD-008

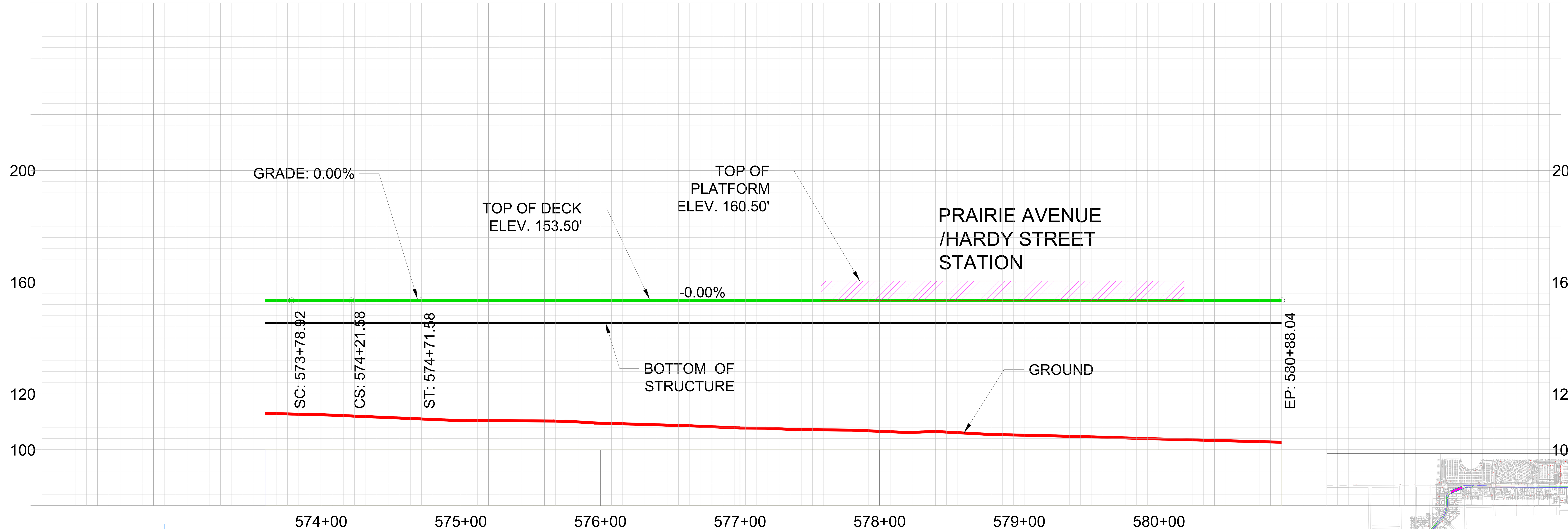
SEAL & SIGNATURE

PRELIMINARY NOT FOR CONSTRUCTION

DATE: 08.03.2021
PROJECT NO.: P673
SCALE: 1" = 40'-0" H, 1" = 20'-0" V

GUIDEWAY ALIGNMENT PLAN AND PROFILE STA. 564+40 TO STA. 573+60





PROFILE
EAST GUIDEWAY LANE

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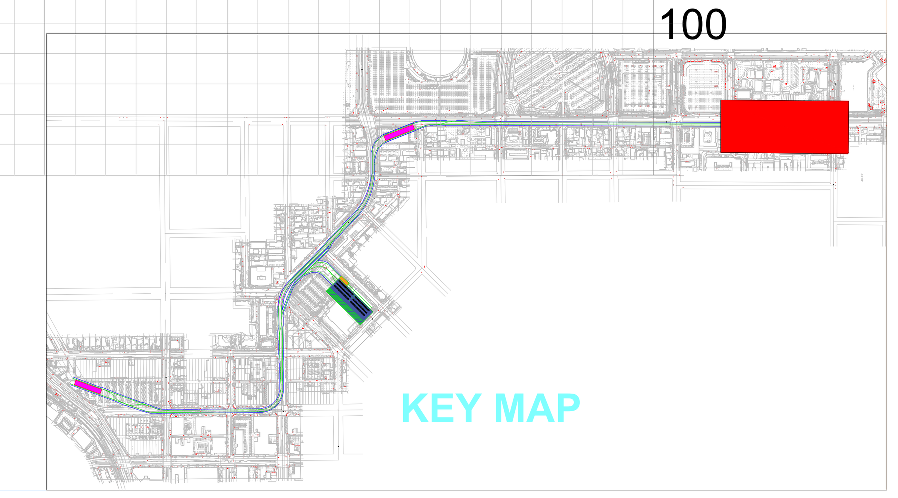


PROJECT TITLE & ADDRESS

INGLEWOOD TRANSIT CONNECTOR

ISSUANCE

DATE | ISSUE | BY CHECK

ARCHITECT

CONSULTANT

LEA+ELLIOTT

TITLE

ITC ALIGNMENT PLAN AND PROFILE

DWG NO.:

P673-AD-009

SEAL & SIGNATURE

PRELIMINARY NOT FOR CONSTRUCTION

DATE: 08.03.2021
PROJECT NO.: P673
SCALE: 1" = 40'-0" H
1" = 20'-0" V

PROJECT NORTH
TRUE NORTH
W E S

GUIDEWAY ALIGNMENT PLAN AND PROFILE STA. 573+60 TO STA. 580+88

West Track																		
Number	Radius	Length	Line/Chord Direction	A Value	Start Station	End Station	Delta Angle	Degree of Curvature by Arc	Long Tan	Mid-Ordinate	PI Station	External Tangent	Total X	P	K	Total Y	Short Tan	Chord Length
L1		628.95	S20° 01' 11.51"W		0+00.00	6+28.95												
S1	INFINITY	50.00		111.80	6+28.95	6+78.95	5.7296		33.35				49.95	0.42	24.99	1.67	16.68	
C1	250.00	39.45	S9° 46' 10.48"W		6+78.95	7+18.40	9.0414	22.9183		0.778	6+98.72	19.77						39.41
S2	250.00	50.00		111.80	7+18.40	7+68.40	5.7296		33.35				49.95	0.42	24.99	1.67	16.68	
L2		840.45	S0° 28' 50.54"E		7+68.40	16+08.85												
S3	INFINITY	50.00		97.47	16+08.85	16+58.85	7.5389		33.36				49.91	0.55	24.99	2.19	16.69	
C2	190.00	250.95	S45° 51' 25.17"E		16+58.85	19+09.80	75.6747	30.1557		39.947	18+06.43	147.58						233.10
S4	190.00	50.00		97.47	19+09.80	19+59.80	7.5389		33.36				49.91	0.55	24.99	2.19	16.69	
L3		57.82	N88° 46' 00.21"E		19+59.80	20+17.62												
S5	INFINITY	50.00		427.20	20+17.62	20+67.62	0.3924		33.33				50.00	0.03	25.00	0.11	16.67	
C3	3650.00	39.95	N89° 28' 21.83"E		20+67.62	21+07.58	0.6271	1.5697		0.055	20+87.60	19.98						39.95
S6	3650.00	50.00		427.20	21+07.58	21+57.58	0.3924		33.33				50.00	0.03	25.00	0.11	16.67	
L4		42.66	S89° 49' 16.55"E		21+57.58	22+00.24												
S7	INFINITY	50.00		427.20	22+00.24	22+50.24	0.3924		33.33				50.00	0.03	25.00	0.11	16.67	
C4	3650.00	39.95	N89° 28' 21.83"E		22+50.24	22+90.19	0.6271	1.5697		0.055	22+70.21	19.98						39.95
S8	3650.00	50.00		427.20	22+90.19	23+40.19	0.3924		33.33				50.00	0.03	25.00	0.11	16.67	
L5		236.22	N88° 46' 00.21"E		23+40.19	25+76.40												
S9	INFINITY	50.00		126.49	25+76.40	26+26.40	4.4762		33.34				49.97	0.33	24.99	1.30	16.68	
C5	320.00	205.53	S68° 21' 25.87"E		26+26.40	28+31.93	36.7997	17.9049		16.359	27+32.85	106.45						202.01
S10	320.00	50.00		126.49	28+31.93	28+81.93	4.4762		33.34				49.97	0.33	24.99	1.30	16.68	
L6		671.31	S45° 28' 51.94"E		28+81.93	35+53.25												
S11	INFINITY	100.00		236.64	35+53.25	36+53.25	5.1157		66.69				99.92	0.74	49.99	2.97	33.36	
C6	560.00	339.17	S67° 56' 51.36"E		36+53.25	39+92.41	34.7016	10.2314		25.482	38+28.21	174.97						334.01
S12	560.00	100.00		236.64	39+92.41	40+92.41	5.1157		66.69				99.92	0.74	49.99	2.97	33.36	
L7		17.78	N89° 35' 09.22"E		40+92.41	41+10.19												
S13	INFINITY	40.00		83.67	41+10.19	41+50.19	6.5481		26.68				39.95	0.38	19.99	1.52	13.35	
C7	175.00	169.92	S56° 03' 01.34"E		41+50.19	43+20.11	55.6313	32.7404		20.221	42+42.52	92.33						163.32
S14	175.00	40.00		83.67	43+20.11	43+60.11	6.5481		26.68				39.95	0.38	19.99	1.52	13.35	
L8		293.52	S21° 41' 11.90"E		43+60.11	46+53.63												
S15	INFINITY	40.00		84.85	46+53.63	46+93.63	6.3662		26.68				39.95	0.37	19.99	1.48	13.35	
C8	180.00	28.56	S10° 46' 29.08"E		46+93.63	47+22.19	9.0914	31.8310		0.566	47+07.94	14.31						28.53
S16	180.00	40.00		84.85	47+22.19	47+62.19	6.3662		26.68				39.95	0.37	19.99	1.48	13.35	
L9		2401.99	S0° 08' 13.75"W		47+62.19	71+64.18												
S17	INFINITY	50.00		122.47	71+64.18	72+14.18	4.7746		33.35				49.97	0.35	24.99	1.39	16.68	
C9	300.00	67.62	S11° 22' 09.90"W		72+14.18	72+81.80	12.9152	19.0986		1.903	72+48.13	33.96						67.48
S18	300.00	50.00		122.47	72+81.80	73+31.80	4.7746		33.35				49.97	0.35	24.99	1.39	16.68	
L10		0.73	S22° 36' 06.05"W		73+31.80	73+32.53												
S19	INFINITY	50.00		122.47	73+32.53	73+82.53	4.7746		33.35				49.97	0.35	24.99	1.39	16.68	
C10	300.00	68.09	S11° 19' 30.57"W		73+82.53	74+50.62	13.0037	19.0986		1.930	74+16.72	34.19						67.94
S20	300.00	50.00		122.47	74+50.62	75+00.62	4.7746		33.35				49.97	0.35	24.99	1.39	16.68	
L11		572.68	S0° 02' 55.09"W		75+00.62	80+73.29												

PROJECT TITLE & ADDRESS

INGLEWOOD TRANSIT CONNECTOR

ISSUANCE

DATE ISSUE BY CHECK

ARCHITECT

CONSULTANT

LEA ELLIOTT

TITLE

ITC ALIGNMENT GEOMETRIC DATA TABLE

DWG NO.:

P673-AD-010

SEAL & SIGNATURE

PRELIMINARY NOT FOR CONSTRUCTION

DATE: 08.03.2021

PROJECT NO.: P673

SCALE: NO SCALE

ALIGNMENT GEOMETRICS WEST TRACK

East Track

Number	Radius	Length	Line/Chord Direction	A Value	Start Station	End Station	Delta Angle	Degree of Curvature by Arc	Long Tan	Mid-Ordinate	PI Station	External Tangent	Total X	P	K	Total Y	Short Tan	Chord Length
L12		721.05	S20° 01' 11.51"W		500+00.00	507+21.05												
S21	INFINITY	50.00		111.80	507+21.05	507+71.05	5.7296		33.35				49.95	0.42	24.99	1.67	16.68	
C11	250.00	39.45	S9° 46' 10.48"W		507+71.05	508+10.50	9.0414	22.9183		0.778	507+90.81	19.77						39.41
S22	250.00	50.00		111.80	508+10.50	508+60.50	5.7296		33.35				49.95	0.42	24.99	1.67	16.68	
L13		728.66	S0° 28' 50.54"E		508+60.50	515+89.15												
S23	INFINITY	50.00		94.87	515+89.15	516+39.15	7.9577		33.37				49.90	0.58	24.98	2.31	16.70	
C12	180.00	235.11	S45° 51' 25.17"E		516+39.15	518+74.26	74.8371	31.8310		37.041	517+76.87	137.71						218.75
S24	180.00	50.00		94.87	518+74.26	519+24.26	7.9577		33.37				49.90	0.58	24.98	2.31	16.70	
L14		51.72	N88° 46' 00.21"E		519+24.26	519+75.98												
S25	INFINITY	50.00		427.20	519+75.98	520+25.98	0.3924		33.33				50.00	0.03	25.00	0.11	16.67	
C13	3650.00	39.95	N88° 03' 38.59"E		520+25.98	520+65.93	0.6271	1.5697		0.055	520+45.95	19.98						39.95
S26	3650.00	50.00		427.20	520+65.93	521+15.93	0.3924		33.33				50.00	0.03	25.00	0.11	16.67	
L15		42.66	N87° 21' 16.97"E		521+15.93	521+58.59												
S27	INFINITY	50.00		427.20	521+58.59	522+08.59	0.3924		33.33				50.00	0.03	25.00	0.11	16.67	
C14	3650.00	39.95	N88° 03' 38.59"E		522+08.59	522+48.54	0.6271	1.5697		0.055	522+28.57	19.98						39.95
S28	3650.00	50.00		427.20	522+48.54	522+98.54	0.3924		33.33				50.00	0.03	25.00	0.11	16.67	
L16		234.20	N88° 46' 00.21"E		522+98.54	525+32.74												
S29	INFINITY	50.00		126.49	525+32.74	525+82.74	4.4762		33.34				49.97	0.33	24.99	1.30	16.68	
C15	320.00	205.53	S68° 21' 25.87"E		525+82.74	527+88.27	36.7997	17.9049		16.359	526+89.19	106.45						202.01
S30	320.00	50.00		126.49	527+88.27	528+38.27	4.4762		33.34				49.97	0.33	24.99	1.30	16.68	
L17		236.05	S45° 28' 51.94"E		528+38.27	530+74.32												
S31	INFINITY	50.00		308.22	530+74.32	531+24.32	0.7539		33.33				50.00	0.05	25.00	0.22	16.67	
C16	1900.00	42.01	S46° 52' 06.51"E		531+24.32	531+66.33	1.2670	3.0156		0.116	531+45.32	21.01						42.01
S32	1900.00	50.00		308.22	531+66.33	532+16.33	0.7539		33.33				50.00	0.05	25.00	0.22	16.67	
L18		43.88	S48° 15' 21.08"E		532+16.33	532+60.21												
S33	INFINITY	50.00		308.22	532+60.21	533+10.21	0.7539		33.33				50.00	0.05	25.00	0.22	16.67	
C17	1900.00	42.01	S46° 52' 06.51"E		533+10.21	533+52.22	1.2670	3.0156		0.116	533+31.22	21.01						42.01
S34	1900.00	50.00		308.22	533+52.22	534+02.22	0.7539		33.33				50.00	0.05	25.00	0.22	16.67	
L19		145.78	S45° 28' 51.94"E		534+02.22	535+48.00												
S35	INFINITY	100.00		228.04	535+48.00	536+48.00	5.5092		66.70				99.91	0.80	49.98	3.20	33.36	
C18	520.00	307.80	S67° 56' 51.36"E		536+48.00	539+55.80	33.9146	11.0184		22.608	538+06.56	158.56						303.33
S36	520.00	100.00		228.04	539+55.80	540+55.80	5.5092		66.70				99.91	0.80	49.98	3.20	33.36	
L20		64.51	N89° 35' 09.22"E		540+55.80	541+20.31												
S37	INFINITY	40.00		83.67	541+20.31	541+60.31	6.5481		26.68				39.95	0.38	19.99	1.52	13.35	
C19	175.00	169.92	S56° 03' 01.34"E		541+60.31	543+30.22	55.6313	32.7404		20.221	542+52.64	92.33						163.32
S38	175.00	40.00		83.67	543+30.22	543+70.22	6.5481		26.68				39.95	0.38	19.99	1.52	13.35	
L21		227.91	S21° 41' 11.90"E		543+70.22	545+98.14												
S39	INFINITY	40.00		84.85	545+98.14	546+38.14	6.3662		26.68				39.95	0.37	19.99	1.48	13.35	
C20	180.00	28.56	S10° 46' 30.81"E		546+38.14	546+66.70	9.0904	31.8310		0.566	546+52.45	14.31						28.53
S40	180.00	40.00		84.85	546+66.70	547+06.70	6.3662		26.68				39.95	0.37	19.99	1.48	13.35	
L22		249.62	S0° 08' 10.29"W		547+06.70	549+56.31												
S41	INFINITY	50.00		313.05	549+56.31	550+06.31	0.7308		33.33				50.00	0.05	25.00	0.21	16.67	
C21	1960.00	49.39	S1° 35' 19.90"W		550+06.31	550+55.70	1.4437	2.9233		0.156	550+31.01	24.69						49.39
S42	1960.00	50.00		313.05	550+55.70	551+05.70	0.7308		33.33				50.00	0.05	25.00	0.21	16.67	
L23		28.08	S3° 02' 29.51"W		551+05.70	551+33.78												
S43	INFINITY	50.00		314.64	551+33.78	551+83.78	0.7234		33.33				50.00	0.05	25.00	0.21	16.67	
C22	1980.00	50.34	S1° 35' 22.83"W		551+83.78	552+34.13	1.4568	2.8937		0.160	552+08.96	25.17						50.34
S44	1980.00	50.00		314.64	552+34.13	552+84.13	0.7234		33.33				50.00	0.05	25.00	0.21	16.67	
L24		1902.12	S0° 08' 16.16"W		552+84.13	571+86.24												
S45	INFINITY	50.00		150.00	571+86.24	572+36.24	3.1831		33.34				49.98	0.23	25.00	0.93	16.67	
C23	450.00	41.96	S5° 59' 31.41"W		572+36.24	572+78.20	5.3423	12.7324		0.489	572+57.24	20.99						41.94
S46	450.00	50.00		150.00	572+78.20	573+28.20	3.1831		33.34				49.98	0.23	25.00	0.93	16.67	
L25		0.72	S11° 50' 46.66"W		573+28.20	573+28.92												
S47	INFINITY	50.00		150.00	573+28.92	573+78.92	3.1831		33.34				49.98	0.23	25.00	0.93	16.67	
C24	450.00	42.66	S5° 56' 50.87"W		573+78.92	574+21.58	5.4315	12.7324		0.505	574+00.27	21.35						42.64
S48	450.00	50.00		150.00	574+21.58	574+71.58	3.1831		33.34				49.98	0.23	25.00	0.93	16.67	
L26		616.46	S0° 02' 55.09"W		574+71.58	580+88.04												

PROJECT TITLE & ADDRESS

INGLEWOOD TRANSIT CONNECTOR

ISSUANCE

DATE | ISSUE | BY | CHECK

ARCHITECT

CONSULTANT

LEA ELLIOTT

TITLE

ITC ALIGNMENT GEOMETRIC DATA TABLE

DWG NO.:

P673-AD-011

SEAL & SIGNATURE

PRELIMINARY NOT FOR CONSTRUCTION

DATE: 08.03.2021

PROJECT NO.: P673

SCALE: NO SCALE

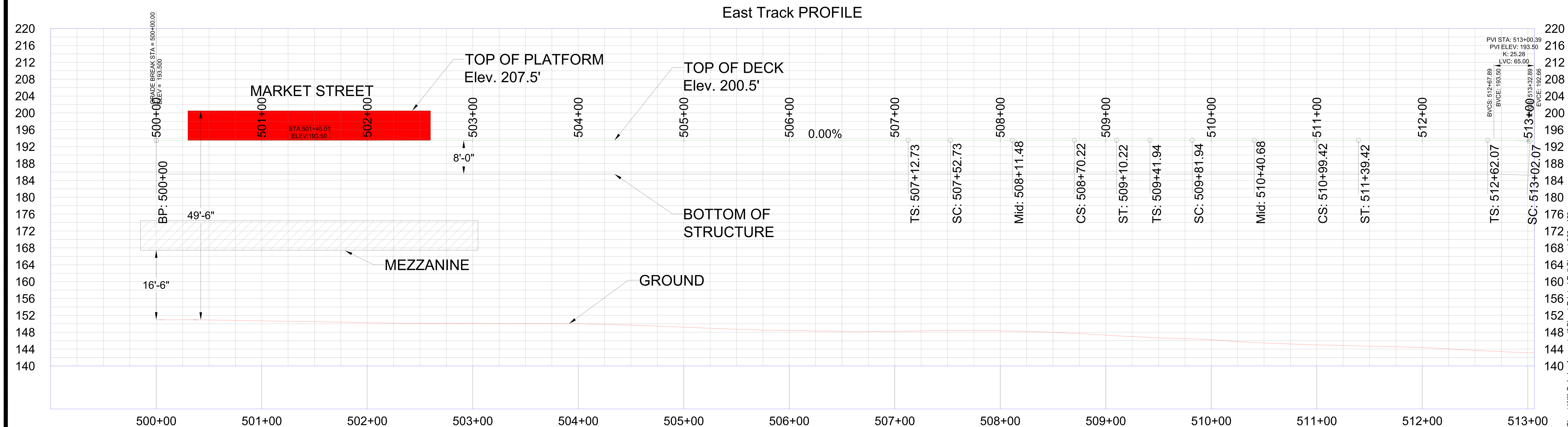
ALIGNMENT GEOMETRICS EAST TRACK

Appendix B: Five Station Alignment

ATTORNEY-CLIENT PRIVILEGE
FOR REVIEW AND DISCUSSION PURPOSES ONLY
DRAFT - MAY 23, 2019

Drawn By:
Checked By:
Approved By:

East Track PROFILE



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APM REFERENCE DRAWINGS

Revision		
No.	Date	Description

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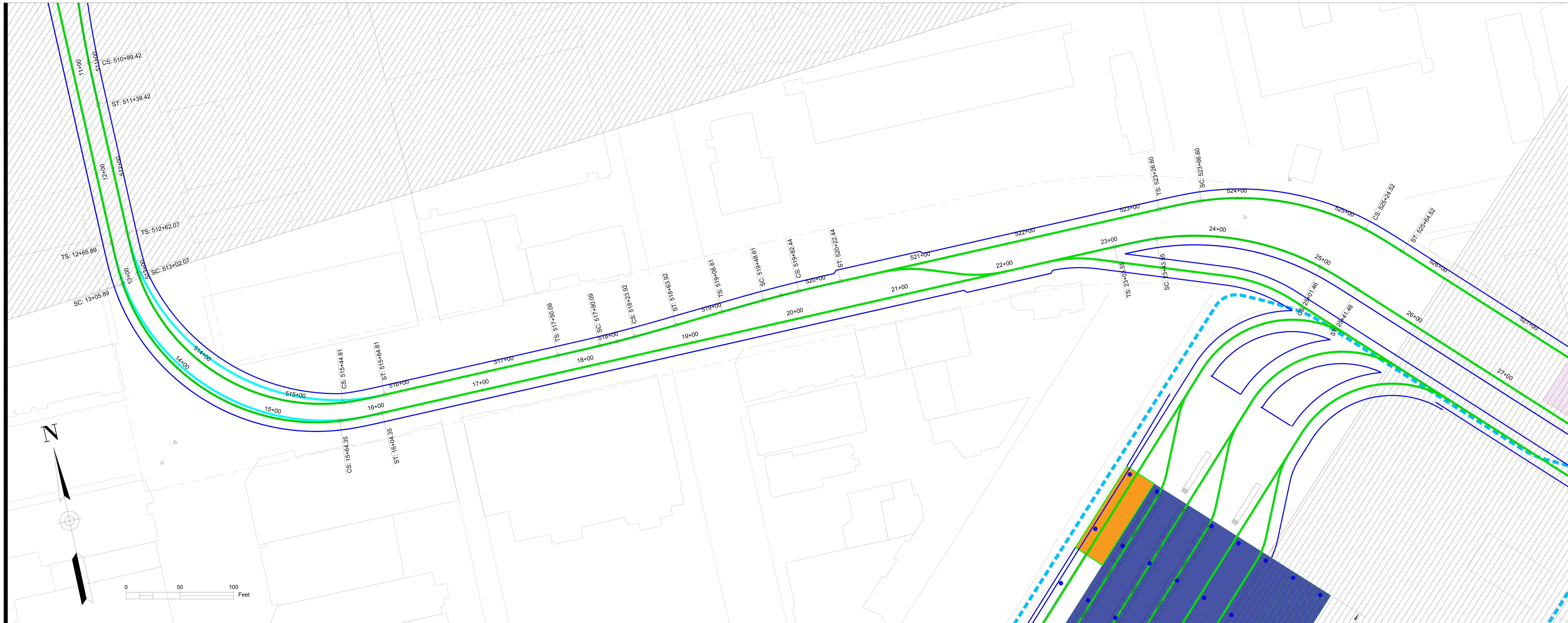
TR-01

PROJECT: 1920
DATE:

Drawn By: E.CUADRA
Checked By: S.BHATTA
Approved By: L.COLEMAN



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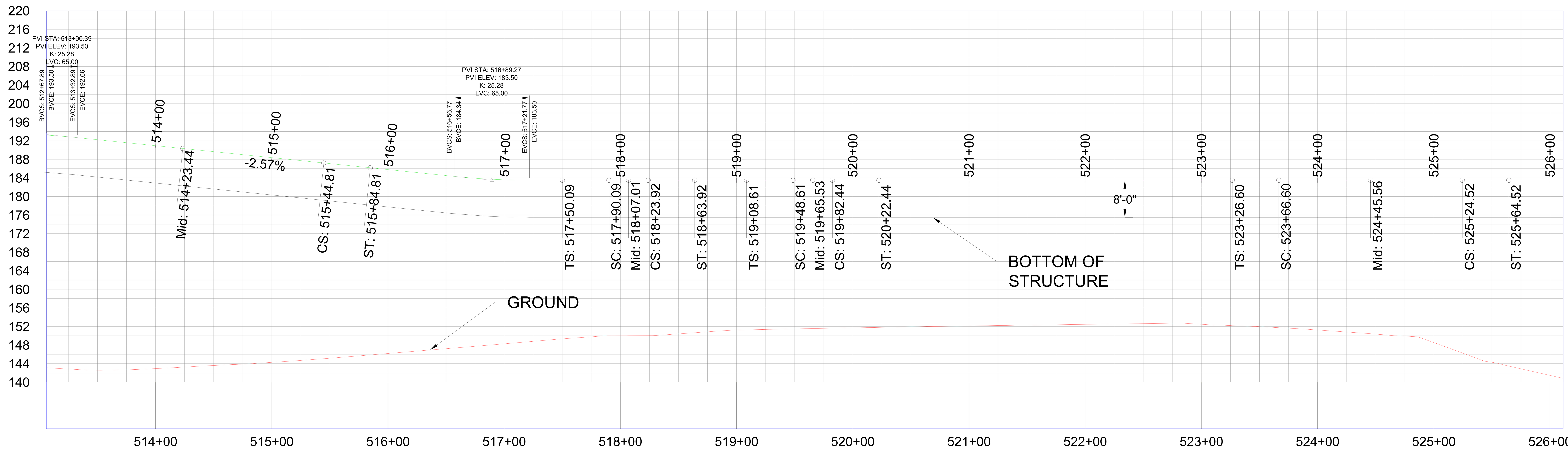

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APM REFERENCE DRAWINGS

Revision		
No.	Date	Description

TR-02

PROJECT: 1920
DATE:

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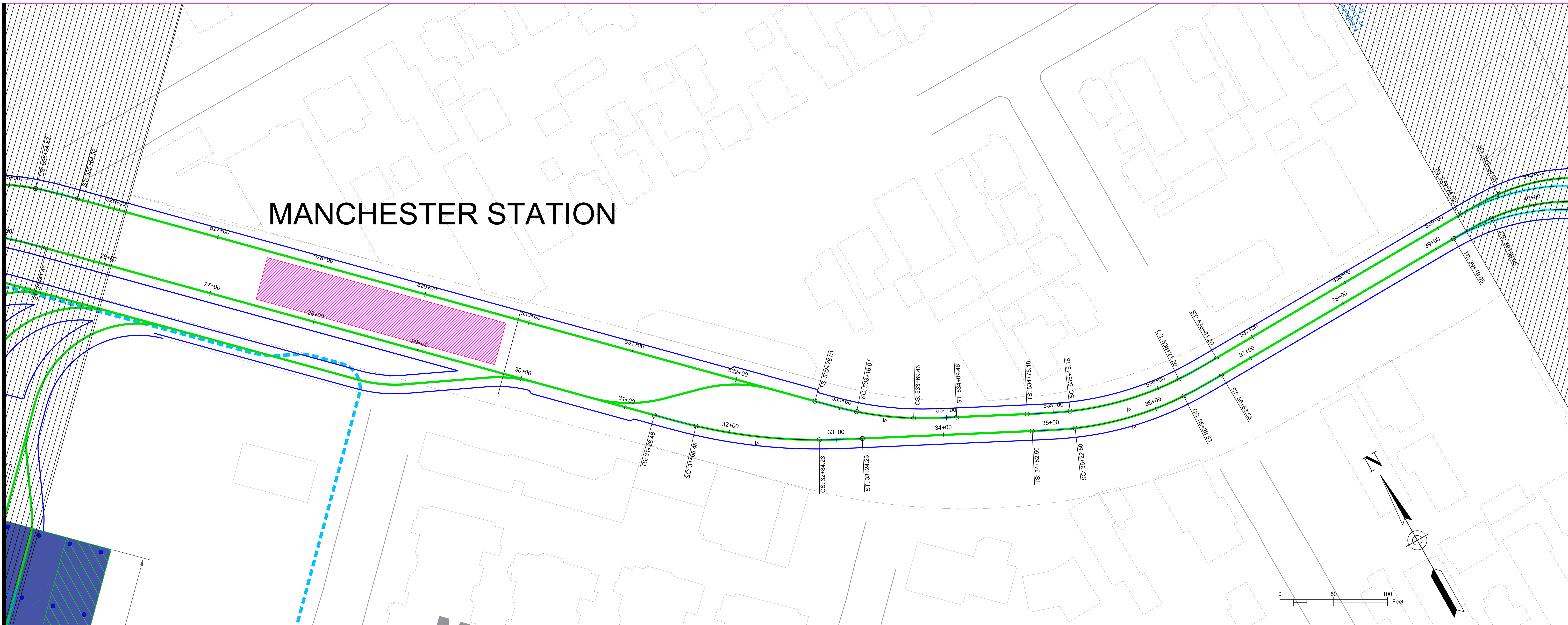
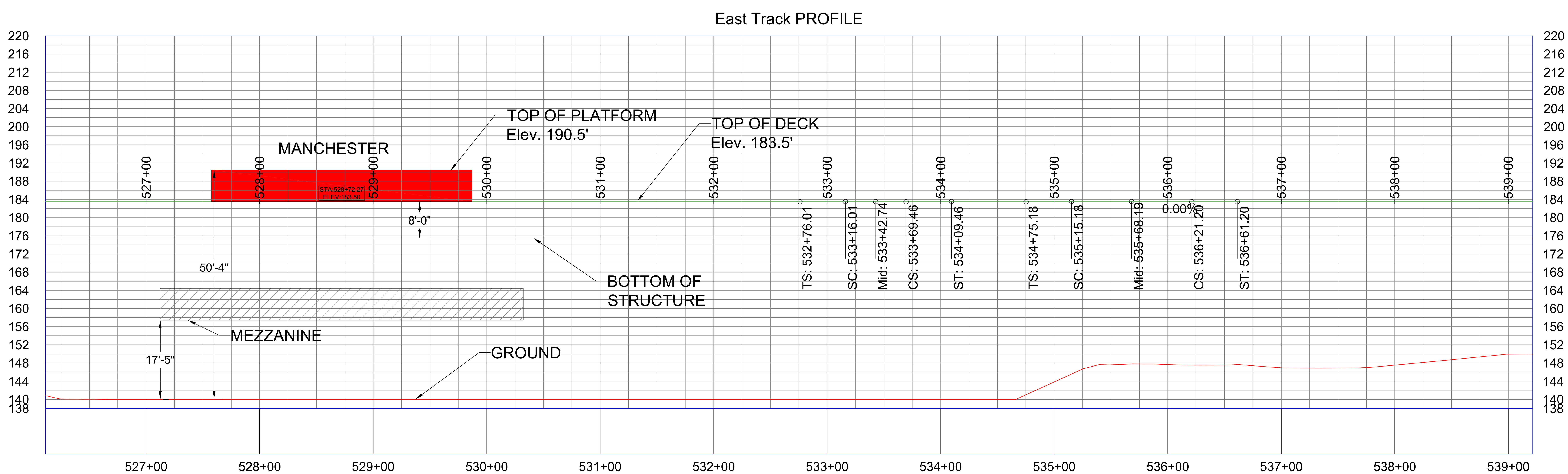
Drawn By: E.CUADRA
Checked By: S.BHATTA
Approved By: L.COLEMAN





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Revision		
No.	Date	Description

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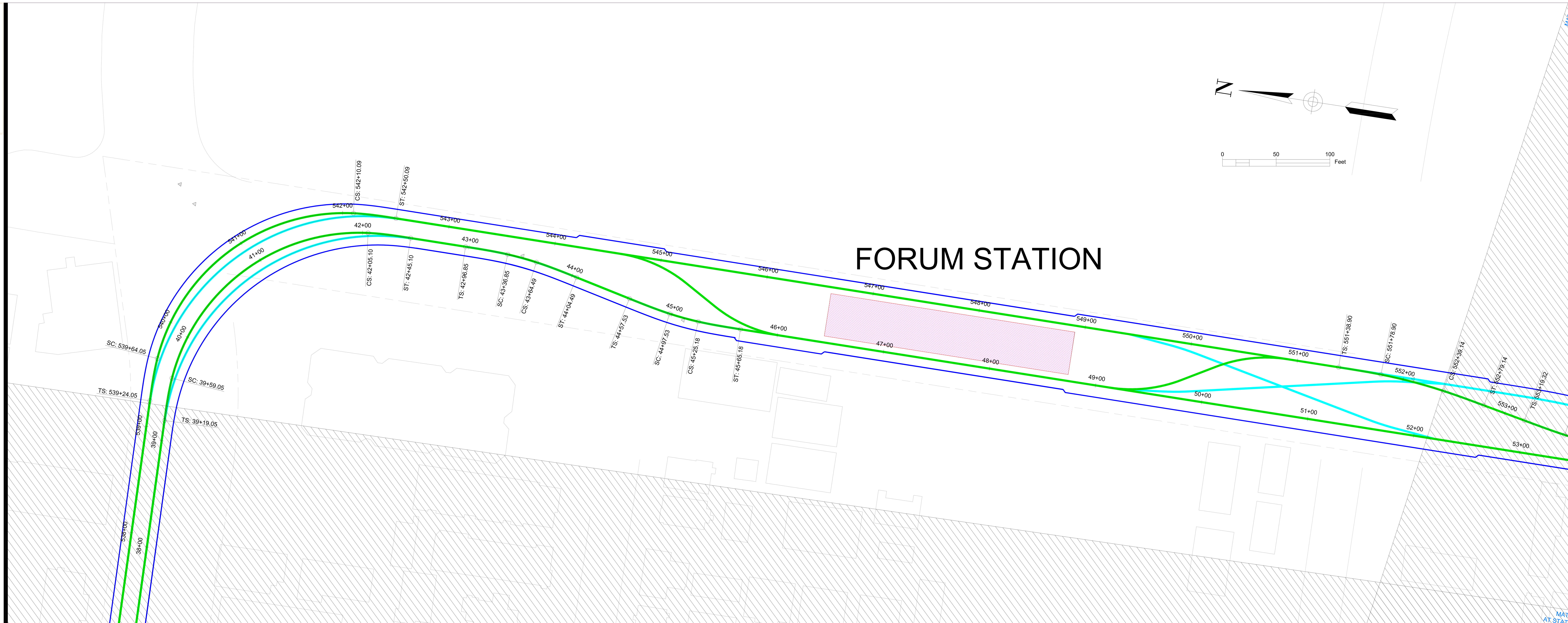
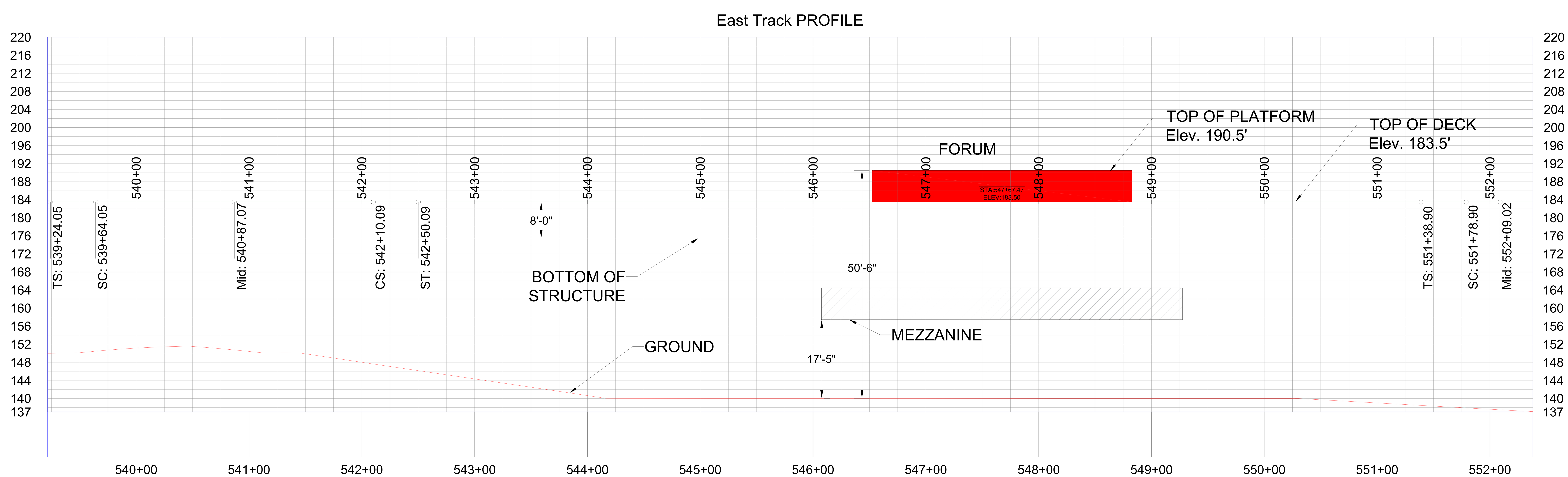
TR-03

PROJECT: 1920
DATE:





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APM REFERENCE DRAWINGS

Revision		
No.	Date	Description

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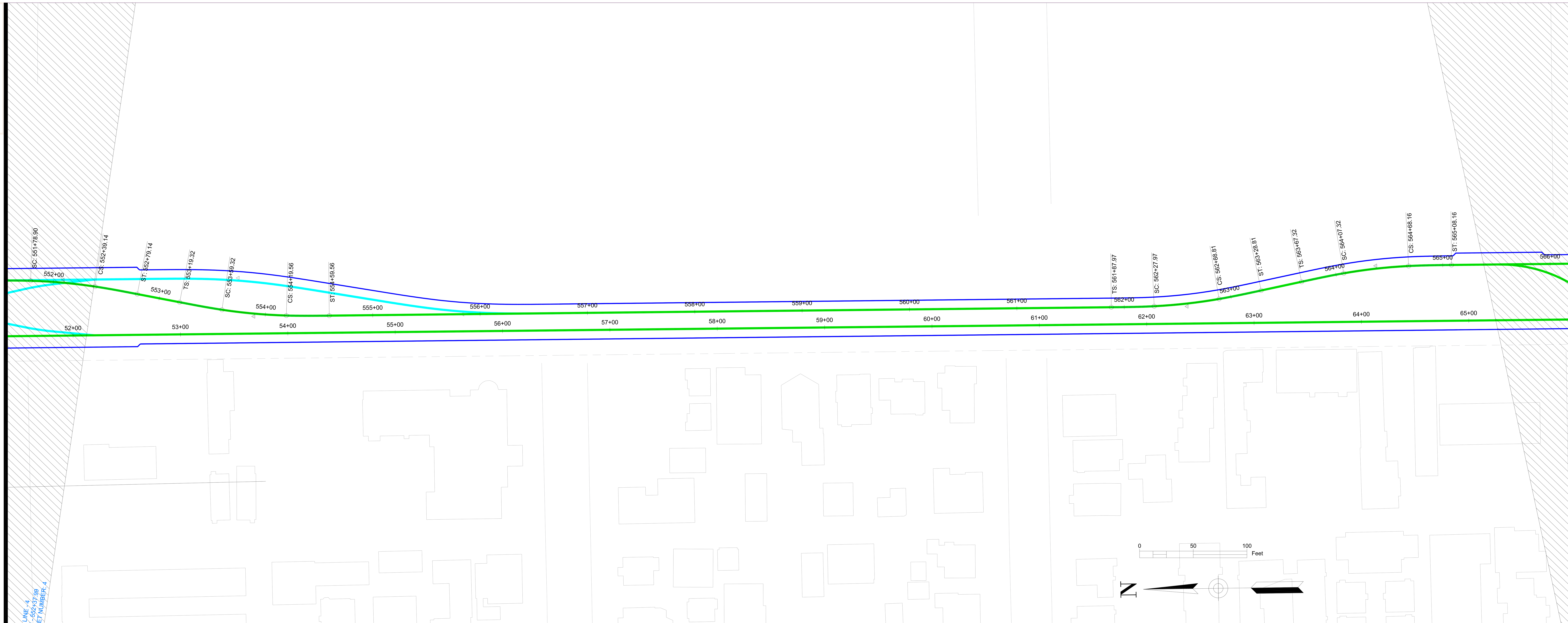
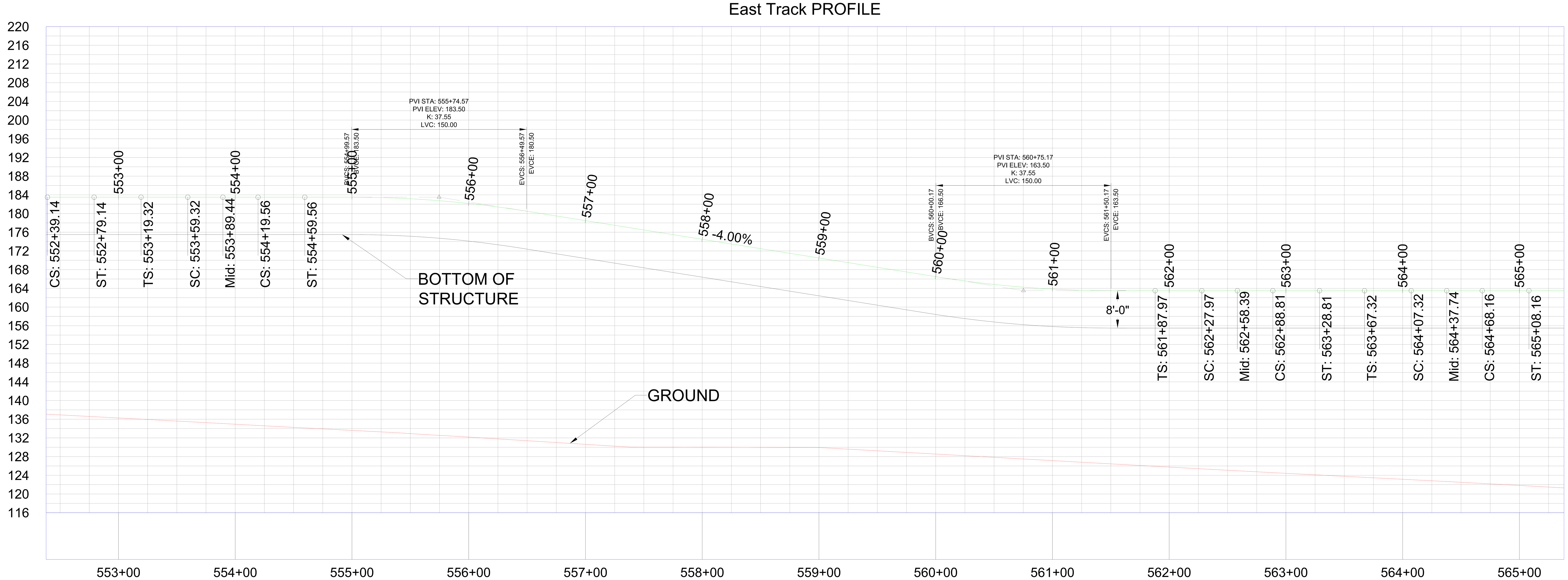
TR-04

PROJECT: 1920
DATE:

Drawn By: E.CUADRA
Checked By: S.BHATTA
Approved By: L.COLEMAN



East Track PROFILE



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Revision		
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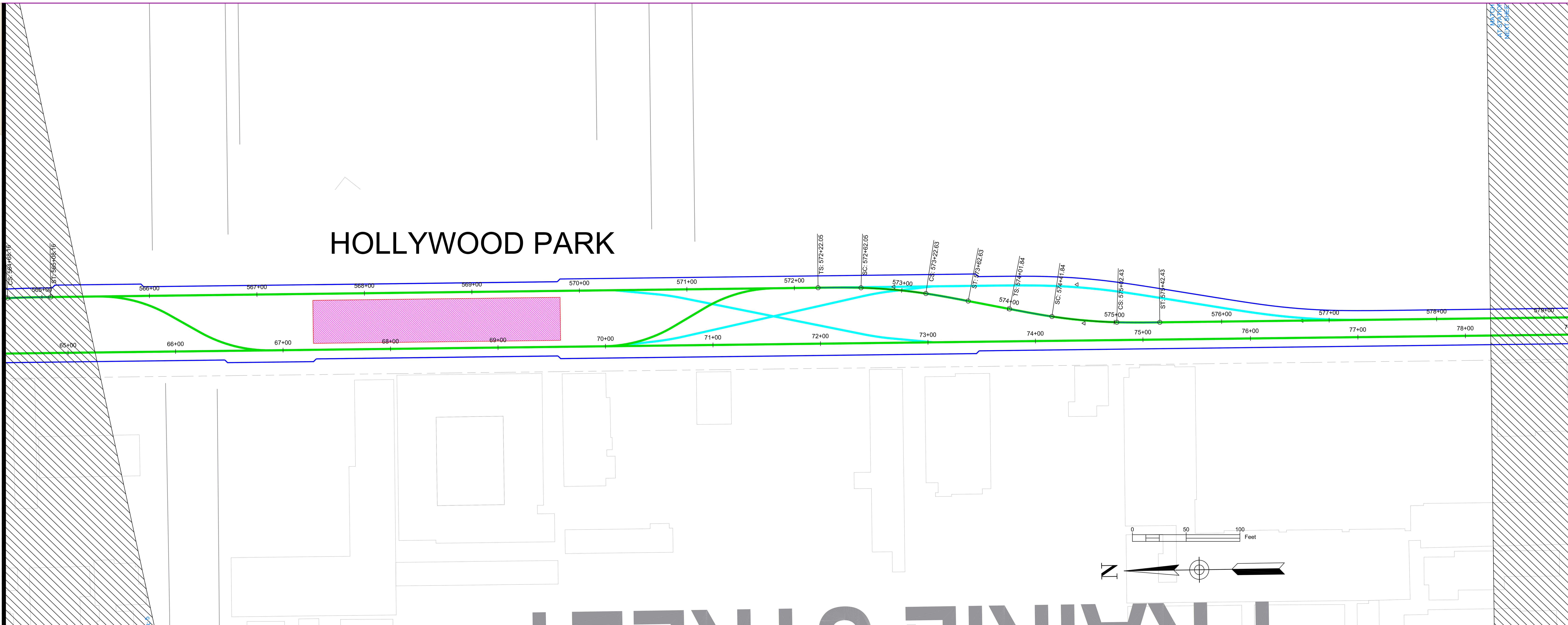
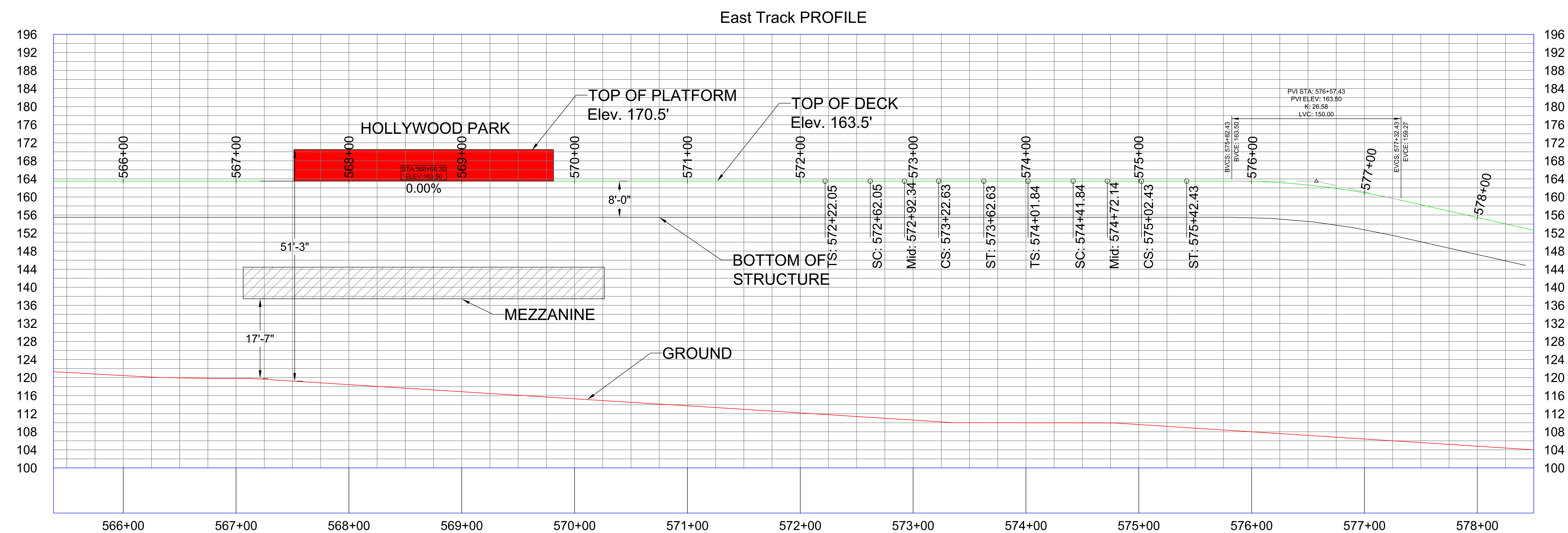
TR-05

PROJECT: 1920
DATE:

Drawn By: E.CUADRA
Checked By: S.BHATTA
Approved By: L.COLEMAN





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APM REFERENCE DRAWINGS

Revision		
No.	Date	Description

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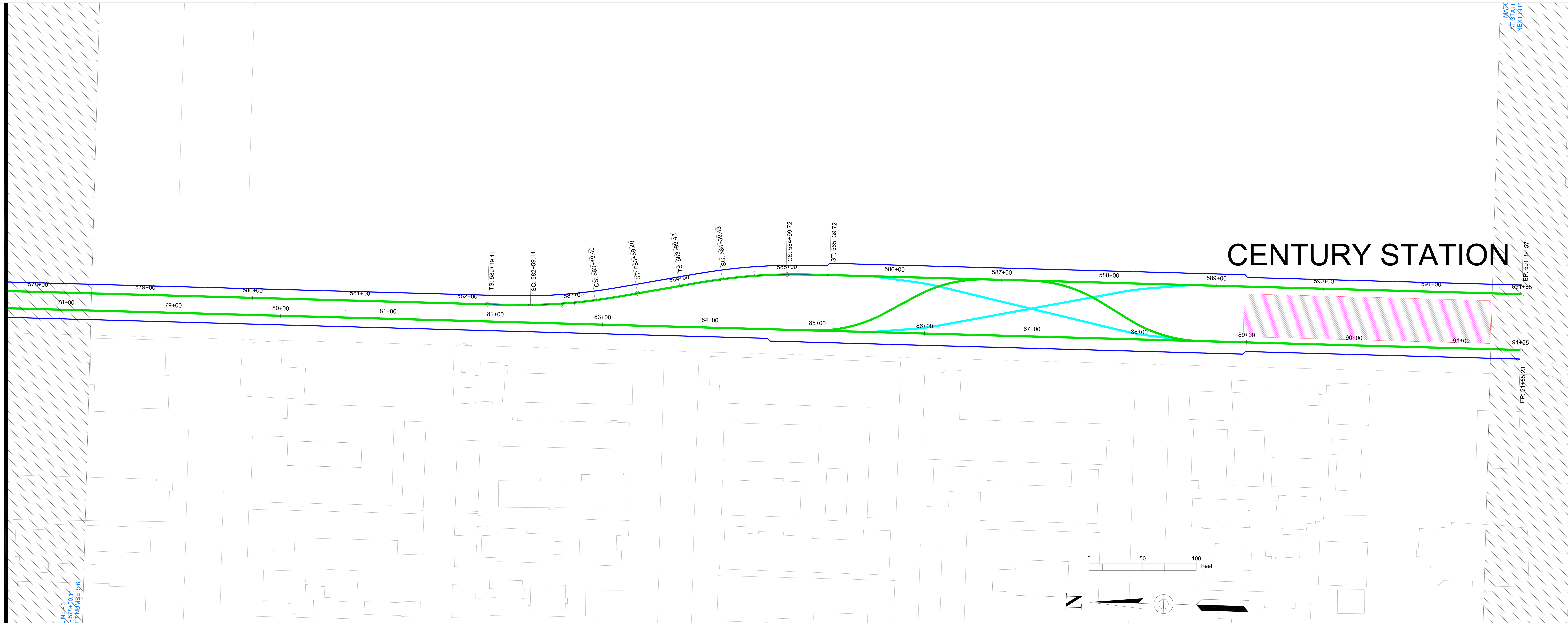
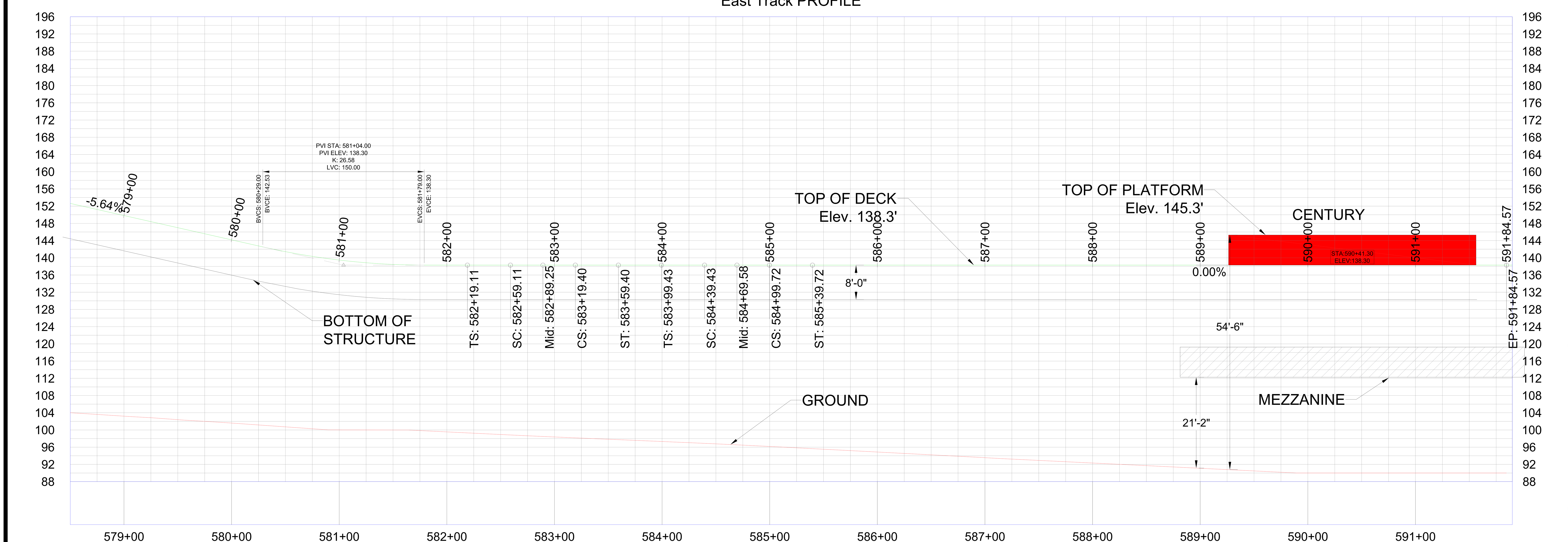
TR-06

PROJECT: 1920
DATE:

Drawn By: E.CUADRA
Checked By: S.BHATTA
Approved By: L.COLEMAN



East Track PROFILE



Scales Labeled on This Sheet Will Only be Accurate if Sheet Printed Full Size at 30" x 42"

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PROJECT PACKAGE:

APM REFERENCE DRAWINGS

Revision		
No.	Date	Description

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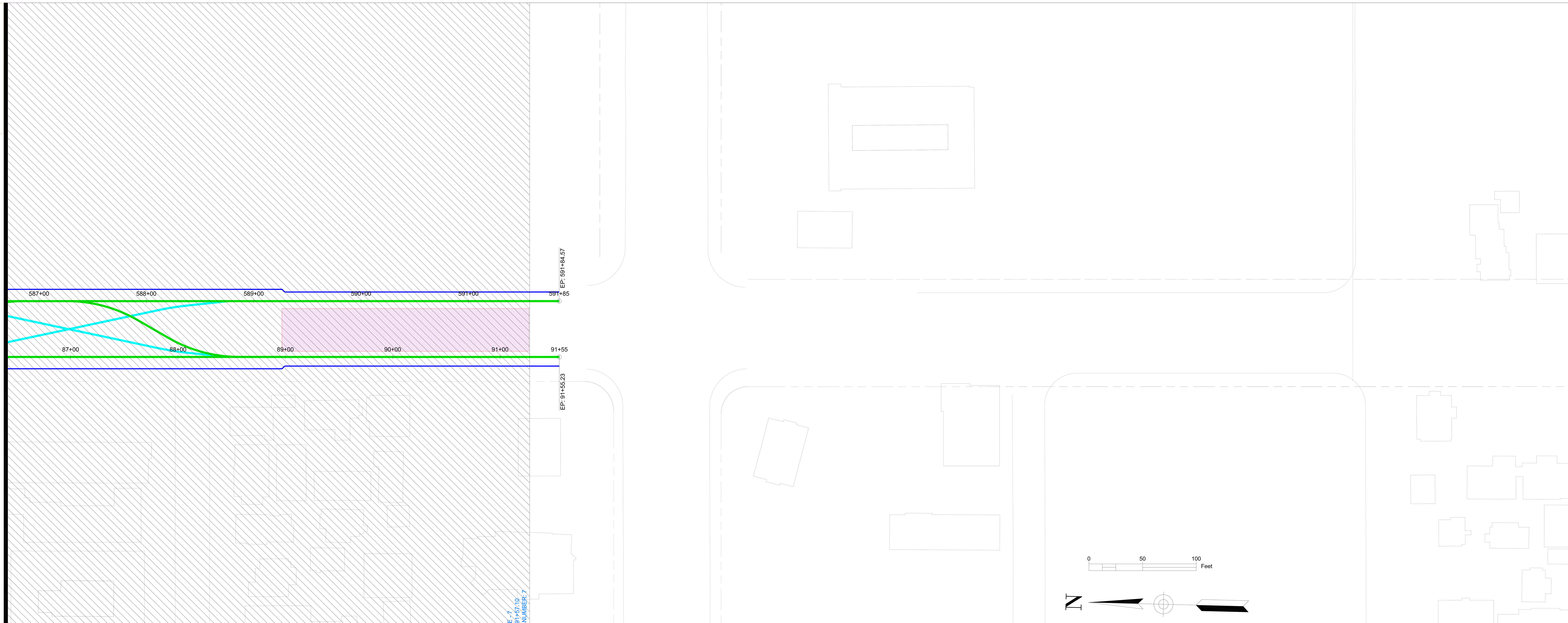
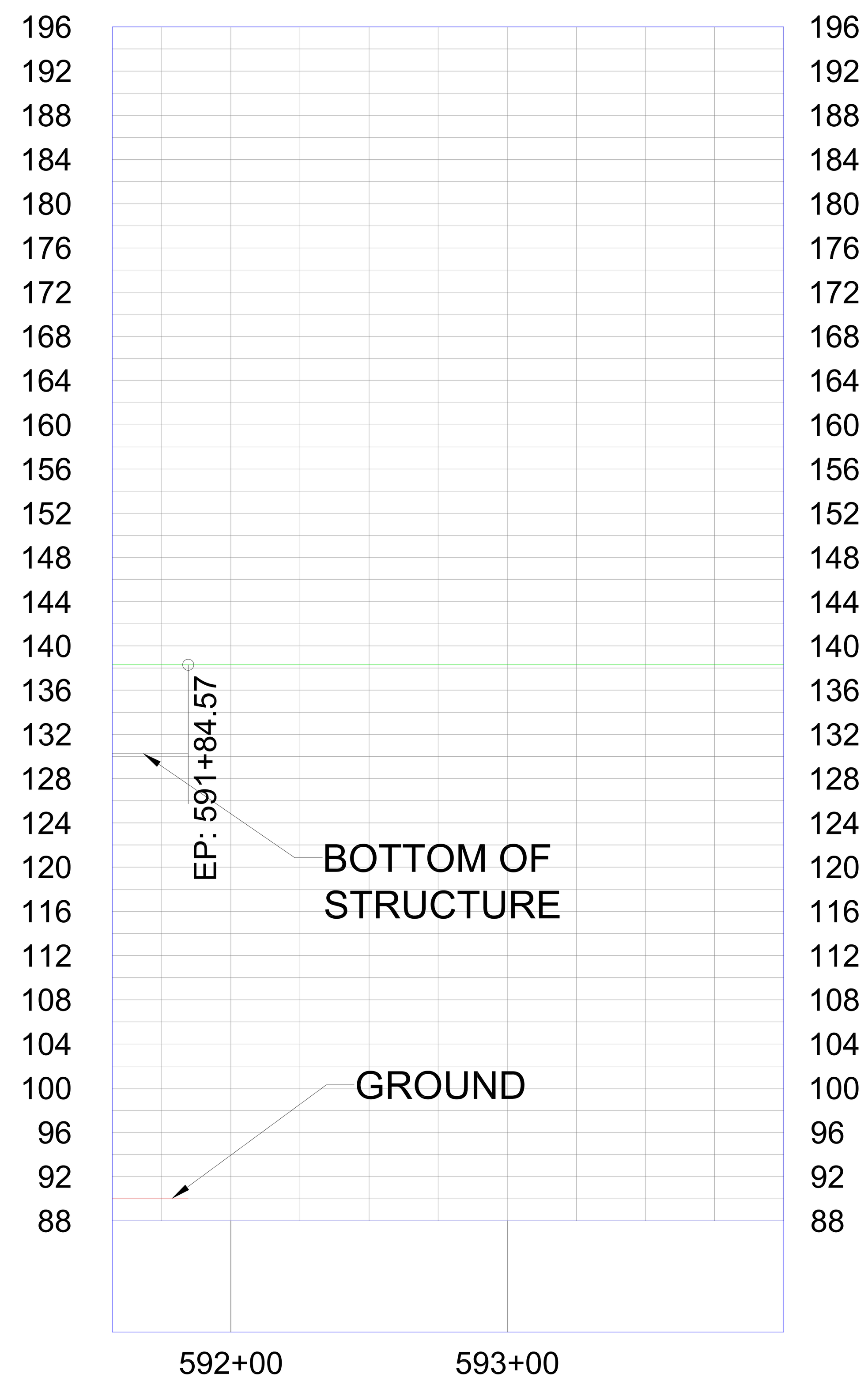
TR-07

PROJECT: 1920
DATE:

Drawn By: E.CUADRA
Checked By: S.BHATTA
Approved By: L.COLEMAN



East Track PROFILE



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DRAFT- FOR INTERNAL DISCUSSION PURPOSES ONLY

PRELIMINARY NOT FOR CONSTRUCTION

PROJECT PACKAGE:

APM REFERENCE DRAWINGS

Revision		
No.	Date	Description

Scales Labeled on This Sheet Will Only be Accurate if Sheet Printed Full Size at 30" x 42"

TR-08

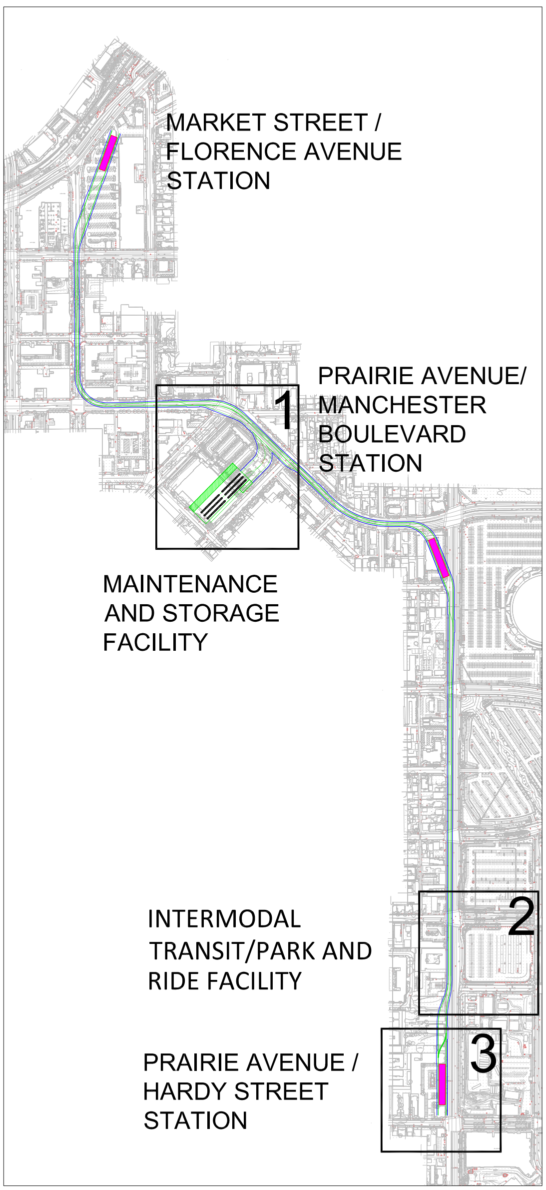
PROJECT: 1920
DATE:

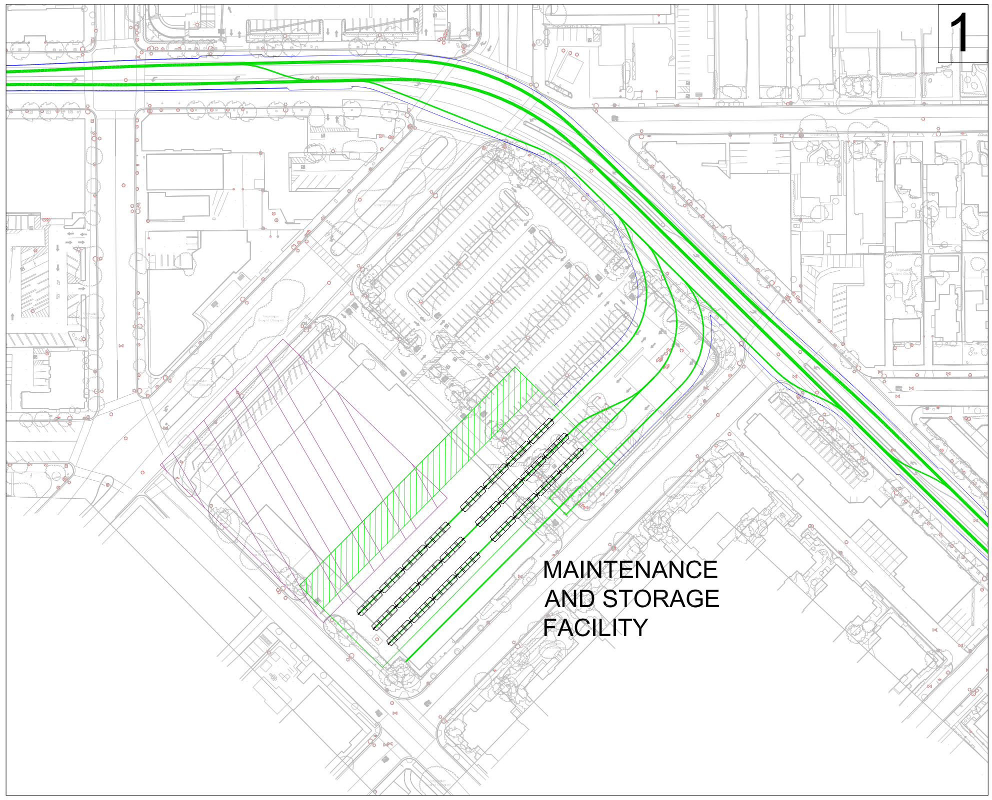
Appendix C: Potential Locations for Power Distribution System Substations

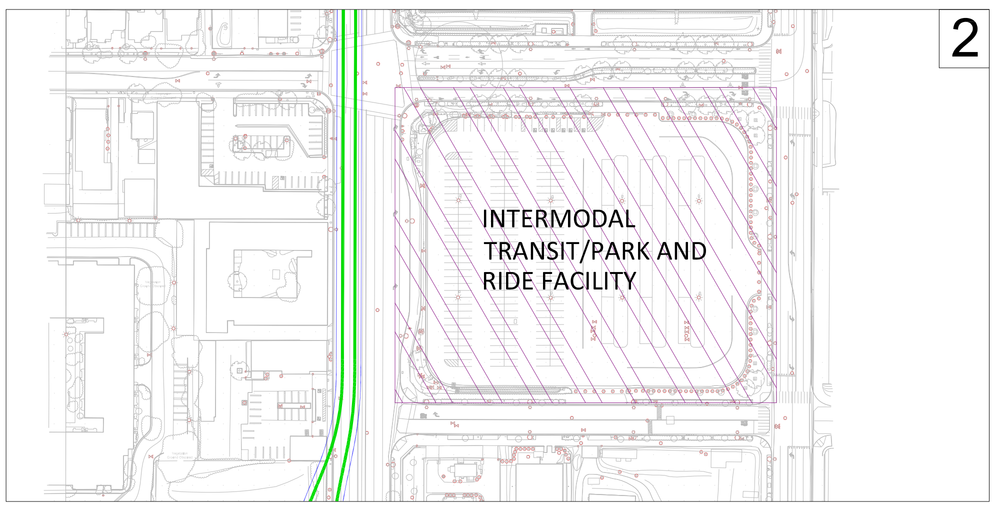
Inglewood Transit Connector
Operating System Conceptual Planning for EIR Project Definition
Appendix C: Potential Locations for Traction Power Substations

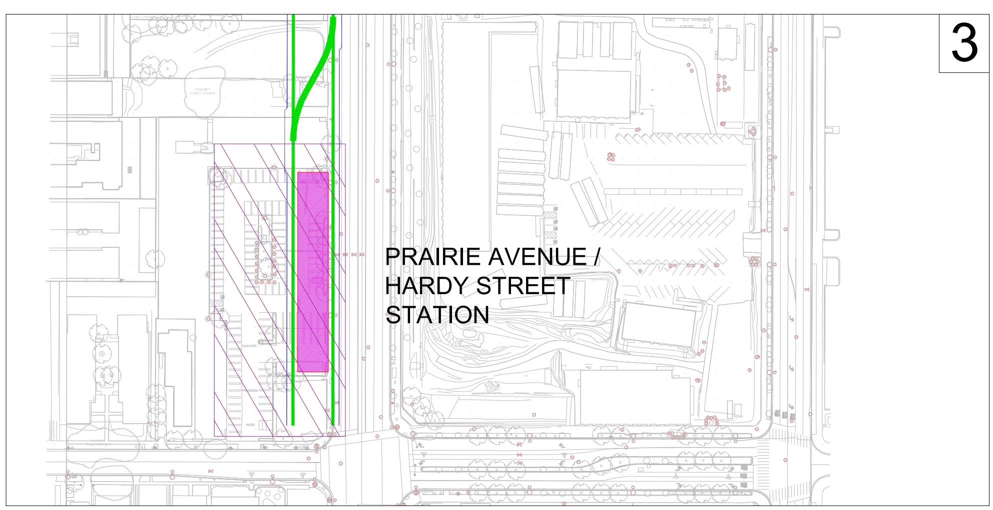
- Approximate locations for the traction power substations and generators are identified. The exact size of the available properties is to be determined.
- The location of the substation and generator within each of the identified areas is to be determined.
- Each substation and generator will require approximately a total of 3,800 sq. ft of space
- Parking and any additional area for fencing (if deemed necessary) is in addition to the 3,800 sq ft.
- Alignment is representative only. Further refinements may occur.

Drawing Scale: 1" = 250'   0'   100'   200'









Appendix D: Correspondence with Southern California Edison

Yuan, Iris

From: Danielle Chanes <DANIELLE.CHANES@sce.com>
Sent: Tuesday, August 6, 2019 1:45 PM
To: Oscar Marroquin; Omar Pulido
Cc: Jeffrey Kline; Perla Solis; Kennedy, G. John; Yuan, Iris; Michelle Marquez-Riley; Andrew J Peterson; Dylan Kasten; Gerald Frolich
Subject: RE: (External):RE: Inglewood Hollywood Park Rail

Hello Omar,

We have completed the requested study for the Inglewood Transit Connector project. There is only one existing 16kV circuit along Market Street. This circuit can accommodate the proposed 10MVA of load. For the requested redundancy, new infrastructure will be required. A further study is needed to determine the scope of work for the new infrastructure.

Moving forward, Dylan Kasten will be the Field Engineer for this project.

Please let us know if there are any questions or concerns.

Thanks.

Danielle Chanes
Field Engineer
Distribution Engineering | Metro West
T. (310)-608-5050 | (PAX: 35050)
M. (310)-710-4921

Dominguez Hills Service Center

Yuan, Iris

From:	Dylan Kasten <dylan.t.kasten@sce.com>
Sent:	Tuesday, September 17, 2019 8:55 AM
To:	Omar Pulido; Oscar Marroquin; Danielle Chanes
Cc:	Jeffrey Kline; Perla Solis; Kennedy, G. John; Yuan, Iris; Michelle Marquez-Riley; Andrew J Peterson; Gerald Frolich; Lisa Trifiletti; 'Joe Gibson (jgibson@meridianconsultantsllc.com)'
Subject:	RE: (External):RE: (External):RE: Inglewood Hollywood Park Rail

Hi Omar,

Distribution Engineering has completed a high level Distribution Study to determine the amount of load we can accommodate, as well as the required upgrades. With full redundancy proposed for the Inglewood Transit system, it is critical that the results are based on accurate projected loading values for the future service year of 2026. The project will need to be reevaluated by SCE Distribution Engineering once the project develops and as details are finalized. The results are as follows:

Maximum Allowable Load:
Distribution Engineering has determined that the maximum load (at the present time) that can be accommodated is 10 MVA.

Infrastructure Upgrades / Work Required:
To accommodate the requested 10 MVA of load with full redundancy, the following upgrades would be needed:

- 1500' of new civil work/duct banks
- 1860' of new 1000 JCN cable
- 1700' of upgrading/re-cabling existing SCE Primary cable to 1000 JCN
- Two new Gas Switches

These values and upgrades are based on the current projected loads for 2026. SCE's distribution system is dynamic and is subject to change as we approach the 2026 date. As the project details develop, SCE can effectively plan for this new load.

Thanks,

Dylan Kasten
Field Engineer 1 | Metro West
Dominguez Hills SC
Office: 310-608-5065 (35065)
Mobile: 310-613-0163

Inglewood Transit Connector Project

Coordination Meeting with Southern California Edison – Meeting Minutes

MEETING DATE/TIME:	February 5, 2021 01:00 PM	MEETING PLACE:	Virtual (Microsoft Teams)
MEETING PURPOSE:	ITC Project Coordination with SCE		
AUTHOR:	John Graddy/LE		

ATTENDEES

See Attached Attendance Roster.

A. Minutes of Meeting - Old Business

Mtg-Item No.	Item / Action	Status	Responsibility	Date
	Introductory Meeting; no old business at this time.			

B. Minutes of Meeting – New Business

Mtg-Item No.	Item / Action	Status	Responsibility	Due Date
14.1	TC provided and overview of the project as shown in the attached presentation and discussed the changes that have been made to the project since the previous coordination meeting with SCE. Significant changes included a reduction in number of passenger stations from five to three and in number of substations from three to two.	Info		
14.2	SSI discussed the ITC project delivery approach noting it will be DBFOM and the project team developing performance-based specifications for an RFQ/RFP process. SSI noted the team wanted to ensure that SCE's requirements were well understood and fully incorporated into the project's RFQ/RFP contract documents.	Info		
14.3	SSI provided an overview of the planned project schedule and highlighted key project milestone dates leading to a planned start of passenger service approximately Q3 2026.	Info		
14.4	LE provided an overview and discussed the ITC project's planned power distribution system. SCE confirmed that the planned configuration illustrated in the attached presentation was conceptually correct and consistent with previous discussions between the project team and SCE, assuming only one feeder for the entire system.	Info		

14.5	The possibility of SCE providing a second primary feeder to the project's Substation 2 at the ITF site was discussed. SCE noted that this was problematic due to the potential of cross feeding their substations and because SCE desires only one meter for each customer at the point of service. In response to an enquiry as to whether SCE could provide the primary service from the newly completed Prairie substation (as it could provide a connection to the ITC substation close by), SCE noted that this substation on Prairie Avenue was built by the customer (SoFi stadium) and as such SCE could not service another customer from that substation.	Info		
14.6	The ITC project's anticipated 10 MVA demand was discussed. SCE noted that customers cannot "stake claims" for their future demands until the projects and their demands are viable and the known demands are then included in their long-term forecasts. SCE further clarified that the ITC project is not yet at that state, but could be considered viable once an application was submitted, the exact amount of loads and point of service are defined. Once the project is viable the ITC project team should initiate actions with Obioma Osuji. Dylan Kasten will be responsible for evaluating Project against 10-year circuit plan and determine if there is enough circuit capacity available in the area.	Info		
14.7	SCE clarified that the 20 ft x 40 ft area for SCE equipment near the MSF substation is only an estimated area; actual required area could be larger or smaller than this.	Info		
14.8	SCE noted that the customer is required to provide the primary line extension to their point of service (the MSF substation), including all trenching, ducts, underground infrastructure, manholes, etc. built to SCE standards. SCE provides the cable to the connection point, transformation (if required), makes the connection to the customers switchgear, and installs the meter in the customer's switchgear.	Info		
14.9	SCE noted they have elaborate design standards, review processes and requirements that the ITC team should consider in the project schedule. SCE also has a design review and approval process specific to the customers switchgear. SCE requirements are public information and available on their website. Inrfastructure that supports the switchgear goes through the SCE Planning divisions review and approval process. The primary switchgear is review and approved by the SCE Engineering division. **SCE to provide links to TC for SCE design review, process, design standards and other SCE requirements documents. Jeffrey Kline (SCE) to provide requirements / design specs for the switch gear.**	A	SCE	2/12/2021
14.10	LE inquired about SCE's requirements related backfeeding regenerated power to SCE's power grid and clarified that when train bake to a stop their propulsion systems generate DC current that can be used by other trains in the ITC with excess either consumed by resistors or rectified and returned to the grid. SCE responded that Electric Rule 21 (available on SCE's website) covers generation facilities connected to the utility's distribution system and that Rule 21's review and approval processes would have to be considered. SCE noted that these review and approval processes also apply for any emergency generators that the ITC project may include. After discussion it was generally agreed that power generated by the ITC project should be absorbed by the project and not returned to the SCE distribution system.	Info		

14.11	SSI asked about the possibility of SCE providing power drops to ITC passenger stations for housekeeping power loads such as HVAC, lights, escalators, elevators and other non-operating system loads. GF noted the demand was estimated to be in the 500 kVA range at each station. SCE clarified that having multiple points of service for one customer was an issue and that they typically do not permit more than three to any one customer. They also acknowledged that because the project and its power demands are spread over a relatively large distance that it might be possible to receive three separate drops. SCE noted, however, that since the ITC project's expectation is that redundant feeders for housekeeping loads would be desired at each station, they would probably not provide the separate drops for station housekeeping power.	Info		
14.12	Electricity rates were briefly discussed and SCE noted that this is a subject that is handled through the SCE's project account manager and not a subject for discussion with their planning or engineering departments who were present at the meeting.	Info		
14.13	GF raised the subject of relocating SCE ductbanks due to potential conflicts with ITC structural foundations and temporary power needs. SCE stated that this is a very important subject and that in coordinating with SCE for temporary power needs in the future the ITC team should be very conservative with their demand estimates, number of connection points, and voltage levels. SCE forms are required to be filled out for these issues and that the ITC team should coordinate with Obioma Osuji for this.	Info		
14.14	SCE noted that Dylan Kasten should be closely involved in every aspect of the project's load forecasting.	Info		
14.15	SSI inquired about security considerations for SCE's new substation on Prairie due to the ITC project's relatively close proximity to this substation. SCE said there was nothing specific they could provide today and that feedback would be provided through the design review process, but noted the criticality of not cutting the feeders and other underground power infrastructure in the vicinity of this substation.	Info		
14.16	SCE shared that any questions and answers related to rates/costs of service should be discussed with the account manager for the City and not the Planning or Engineering division. **SCE to provide contact for City's account manager. TC to follow up with City to engage City's account manager.**	Action	SCE/TC	2/12/21
14.17	RE: 3rd party agreements, any relocation specific to the Project will require filling out a CPU form detailing the locations for SCE to assess and prepare a Work Order Map for the relocation.	Info		
14.18	RE: temporary power, if the Project requires it, discuss seperately with Obioma Osuji, and SCE requests that the applicant be conservative in their estimates	Info		
14.9	City to proceed with preparing applications for submittal to SCE to begin design review process and define estimated timelines for implementation	Action	TC	2/19/21

Attachments:
Presentation: Inglewood Transit Connector Project - Coordination with So Cal Edison February 5, 2020 DRAFT (2021.02.05_ITC Project_SCE Briefing_TRANSMITTAL)

Attendance Roster

Name	Organization	Phone	Email
Omar Pulido	Trifiletti Consulting (TC)	(909) 973-4794	omar@trifiletticonsulting.com
Sanjeev Shah	Sanjeev Shah, Inc. (SSI)	(786) 537-0990	sshah@ssiconsult.com
Mark Pilwallis	Gannett Fleming (GF)	(602) 684-3335	mpilwallis@gfnet.com
John Graddy	Lea+Elliott, Inc. (LE)	(817) 805-1028	jgraddy@leaelliott.com
John Kennedy	Lea+Elliott, Inc. (LE)	(703) 338-6850	jkennedy@leaelliott.com
Obioma Osuji	Southern California Edison (SCE)	(310) 720-7825	obioma.c.osuji@sce.com
Dylan Kasten	Southern California Edison (SCE)	(310) 613-0163	dylan.t.kasten@sce.com
Jeffrey Kline	Southern California Edison (SCE)	(310) 365-3186	Jeffrey.Kline@sce.com

End of Memorandum
This memorandum represents the interpretation of the proceedings of the meeting by the author. Comments, questions, or revisions should be addressed to jgraddy@leaelliott.com with copy to omar@trifiletticonsulting.com within two (2) business days of issuance of the minutes, after which these meetings minutes will become part of the Project Record.

Yuan, Iris

From:	Obioma Osuji <obioma.c.osuji@sce.com>
Sent:	Wednesday, February 24, 2021 2:08 PM
To:	Dylan Kasten; Omar Pulido; Sanjeev Shah; Pilwallis, Mark M.; Bhattacharjee, Sambit; Graddy, John; Jeffrey Kline; Kennedy, G. John; Yuan, Iris; Andrew Cortez
Subject:	RE: (External):RE: ITC Project - SCE Coordination Meeting
Attachments:	Primary Switchgear Review and Inspection Process.pdf

Thanks Dylan.

I am adding Andrew Cortez(Planner 3) to the conversation.

Obioma Osuji
Distribution Service Planner
South Bay Local Planning
T. 310-783-9309 | M. 310-720-7825

505 Maple Ave, Torrance CA

From: Dylan Kasten
Sent: Wednesday, February 24, 2021 11:57 AM
To: Omar Pulido <omar@trifiletticonsulting.com>; Obioma Osuji <obioma.c.osuji@sce.com>; Sanjeev Shah <sshah@ssiconsult.com>; Pilwallis, Mark M. <mpilwallis@gfnet.com>; sambitb@leaelliott.com; Graddy, John <jgraddy@leaelliott.com>; Jeffrey Kline <Jeffrey.Kline@sce.com>; Kennedy, G. John <jkennedy@leaelliott.com>; iyuan@leaelliott.com
Subject: RE: (External):RE: ITC Project - SCE Coordination Meeting

Hi Omar,

See attached Primary Switchgear Review and Inspection Process document. This goes through step by step the process SCE's review and inspection process for customer owned primary switchgears. This document does not include the Edison requirement for the actual switchgear design, but those specs are covered within the ESR that you mentioned Obi had already sent you.

All requests mentioned in the document should go through Obi since he is the assigned planner to this project and he will send them over to myself if Engineering analysis is required.

Thanks,

Dylan Kasten
Field Engineer
T&D | Distribution Engineering
T. 310-608-5065 | M. 310-613-0163
Dominguez Hills S/C

From: Omar Pulido <omar@trifiletticonsulting.com>
Sent: Wednesday, February 24, 2021 6:33 AM
To: Obioma Osuji <obioma.c.osuji@sce.com>; Dylan Kasten <dylan.t.kasten@sce.com>; Sanjeev Shah <sshah@ssiconsult.com>; Pilwallis, Mark M. <mpilwallis@gfnet.com>; sambitb@leaelliott.com; Graddy, John <jgraddy@leaelliott.com>; Jeffrey Kline <Jeffrey.Kline@sce.com>; Kennedy, G. John <jkennedy@leaelliott.com>; iyuan@leaelliott.com
Subject: (External):RE: ITC Project - SCE Coordination Meeting

***** EXTERNAL EMAIL - Use caution when opening links or attachments *****

SCE Team – thank you again for meeting with us earlier this month to coordinate further on the Inglewood Transit Connector Project. Please see attached a copy of the meeting minutes and the presentation for your records.

Regarding meeting minute item # 14.9, we discussed you and the team providing us a few links with more information on the design review process in general, and the design standards / specs for the switchgear. When you get a chance, can you still send those over to us?

Obioma – thank you again for sending us the ESR and UGS information for the primary meter cabinet and underground structures; those links were very helpful las well.

In the meantime, we are proceeding with completing the applications for formal submittal to you and the team, and will be following up shortly with the documents.

Thanks,

Omar Pulido
Senior Project Director
C: (909) 973-4794
TRIFILETTI CONSULTING

-----Original Appointment-----
From: Omar Pulido
Sent: Monday, February 1, 2021 5:15 PM
To: Omar Pulido; Obioma Osuji; Dylan Kasten; Danielle Chanes; Sanjeev Shah (sshah@ssiconsult.com); Mark M. Pilwallis; Sambit Bhattacharjee; John C. Graddy; Jeffrey Kline
Cc: Lisa Trifiletti; Derek O'Hara; Louis A. Atwell (latwell@cityofinglewood.org); Ellen Wright; Iris Yuan (iyuan@LeaElliott.com); Kennedy, G. John; Dixon, Matthew C.
Subject: ITC Project - SCE Coordination Meeting
When: Friday, February 5, 2021 1:00 PM-2:00 PM (UTC-08:00) Pacific Time (US & Canada).
Where: Teams Meeting

Hello Obioma and team – thank you again for your time this Friday at 1p to for us to share with you more details regarding the ITC Project's proposed scope of work and implementation efforts, and learn more from your team RE: SCE's design and construction process, and next steps for enabling actions.

We appreciate your time and look forward to continuing our coordination efforts.

Thanks!

Omar Pulido
Senior Project Director
C: (909) 973-4794
TRIFILETTI CONSULTING

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