4. Project Description

The purpose of this chapter is to define the principal elements of the planned 6.2 kilometre extension of the Bloor-Danforth subway (Line 2) from Kennedy Station to Scarborough Centre, via Eglinton Avenue, Danforth Road and McCowan Road, and including a new station – Scarborough Centre Station – at the terminus. The Project description also includes an overview of the types of impacts that can be expected during construction. This chapter focuses on:

- **Subway Vehicle**;
- **Alignment** –the location and configuration for the running structure;
- **Scarborough Centre Station** – the subway station and bus terminal;
- **Ancillary Features** – the supporting elements required for the operation of the subway, such as special trackwork, emergency exits, and traction power substations (TPSSs) which provide power for operation of the subway trains, as well as the various electrical systems in the subway;
- **Construction Methods** – tunnelling versus cut-and-cover techniques; and,
- **Construction Sequencing** – the construction staging plan is currently under development.

The Scarborough Subway Extension (SSE) is designed in accordance with Toronto Transit Commission's (TTC) Design Standards. Design described here is preliminary, for the purpose of identifying likely impacts and mitigation strategies. All design is consistent with TTC Design Manual. Following the Transit Project Assessment Process (TPAP), Detailed Design will commence. It is the intent of the City and TTC to advance design to a point that will inform the creation of output specifications required to undertake a Design-Build-Finance approach to Project implementation.

4.1 Subway Vehicle

TTC's subway cars have a length of approximately 22.8 metres and a width of 3.1 metres. Trainsets of six cars result in a train length of approximately 135 metres. Maximum operating speed is 80 kilometres per hour. Trains are powered by electric motors, which utilize 600 volt direct current (DC). Wayside signalling regulates the movement of trains along the line. Since this Project is an extension of Line 2, the current technology and operation requirements on the existing line will govern its operation.

4.2 Alignment

4.2.1 Horizontal Alignment

The preferred alignment, shown in **Exhibit 4-1**, travels east along Eglinton Avenue East within the road right-of-way (ROW) from Kennedy Station to Danforth Road. The alignment then travels north along Danforth Road / McCowan Road in the centre of the road ROW until Lawrence Avenue East. North of Lawrence Avenue East, the alignment runs west of the road ROW to north of the Highland Creek and the Hydro Corridor, after which it returns to the centre of the McCowan Road ROW. Beginning a short distance south of Ellesmere Road, the alignment veers to the west, under several private residential properties, a gas station, and the Frank Faubert Woodlot, to allow the new Scarborough Centre Station to be located under the planned extension of Borough Drive. It then continues north underneath Borough Drive / Progress Avenue to the end of the tail tracks immediately south of Highway 401. For a more detailed overview of the horizontal alignment, see **Exhibits 4-17a-t**.

Exhibit 4-1: Preferred Alignment

As it relates to connecting to future higher-order rapid transit, it is important to note the McCowan alignment for the SSE would not preclude a future connection with the Sheppard subway via the technically feasible Sheppard-McCowan corridor, or through an interchange station in Scarborough Centre.

The subway station will be immediately north of the existing Scarborough Rapid Transit (SRT) structure. The tail track at the end of the line will extend north of the station to just south of the Ministry of Transportation ROW for Highway 401.

The key design criterion that affects the horizontal alignment is:

- Minimum horizontal curve radius – 300 metres

4.2.2 Vertical Alignment

The entire SSE will be underground. The depth of the subway tunnel is dependent on issues such as existing topography, maximum vertical grade / radius criteria, the tunnel diameter and utility locations. Except for a very short section east of Kennedy Station, there will typically be at least 10 metres of ground cover above the tunnel structure.

The key design criteria that affect the vertical alignment are as follows:

- Minimum length of vertical curve – 60 metres
- Maximum vertical grade – 3.50 %

The vertical and horizontal profile in the vicinity of McCowan Road and Lawrence Avenue East, will meet those required for the possible construction of a Lawrence East Station in the future.

4.2.2.1 Tunnel Diameter

A comprehensive assessment of tunnelling options resulted in the recommendation for use of a single, large diameter tunnel rather than twin tunnel construction – two separate 6-metre diameter tunnels - traditionally used by the TTC. This results in reduced cost and reduced construction impacts because the special trackwork – crossovers and tail track – can be constructed within the tunnel instead of by cut-and-cover methods that would be required with twin tunnel construction.

The tunnel will have a minimum depth of cover of approximately one tunnel diameter. The typical depth of the tunnel (from top of tunnel to surface) ranges from about 9 metres just before the tunnel boring machine extraction location east of Kennedy Station to 29 metres at Lawrence Avenue East.

Detailed plans and profiles of the entire SSE (showing the vertical and horizontal alignment) are provided in **Exhibits 4-17a** through **4-17t** at the end of this chapter.

4.3 Scarborough Centre Station

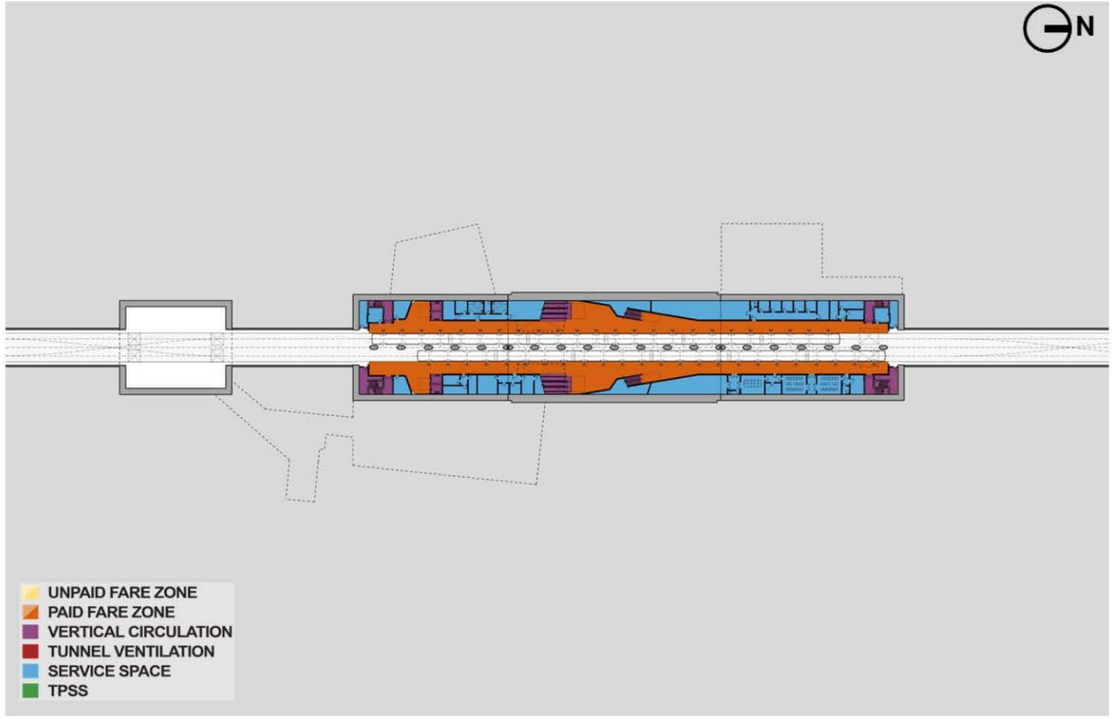
4.3.1 Subway Platform

As is indicated in the previous section, a comprehensive assessment of tunnelling options resulted in the recommendation for use of a single, large diameter tunnel rather than the twin tunnel construction that has been traditionally used by the TTC. The station itself still requires cut-and-cover construction. However, because the tunnel will extend to within a short distance on either side of the subway station box, it is not possible to divert the tracks to either side to facilitate for a large centre platform as is the case when both the station and special track work are constructed using a very long section of cut-and-cover construction. Hence, the tracks must remain at their minimum separation through the station and this requires the use of side platforms (**Exhibit 4-2**). Some added design criteria are:

- Length of platform – 152.4 metres
- Minimum width of side platforms – 3.2 metres
- Maximum grade of platform – 0.03 %

Some rooms, such as ancillary rooms, signal rooms and service rooms are provided at the platform level.

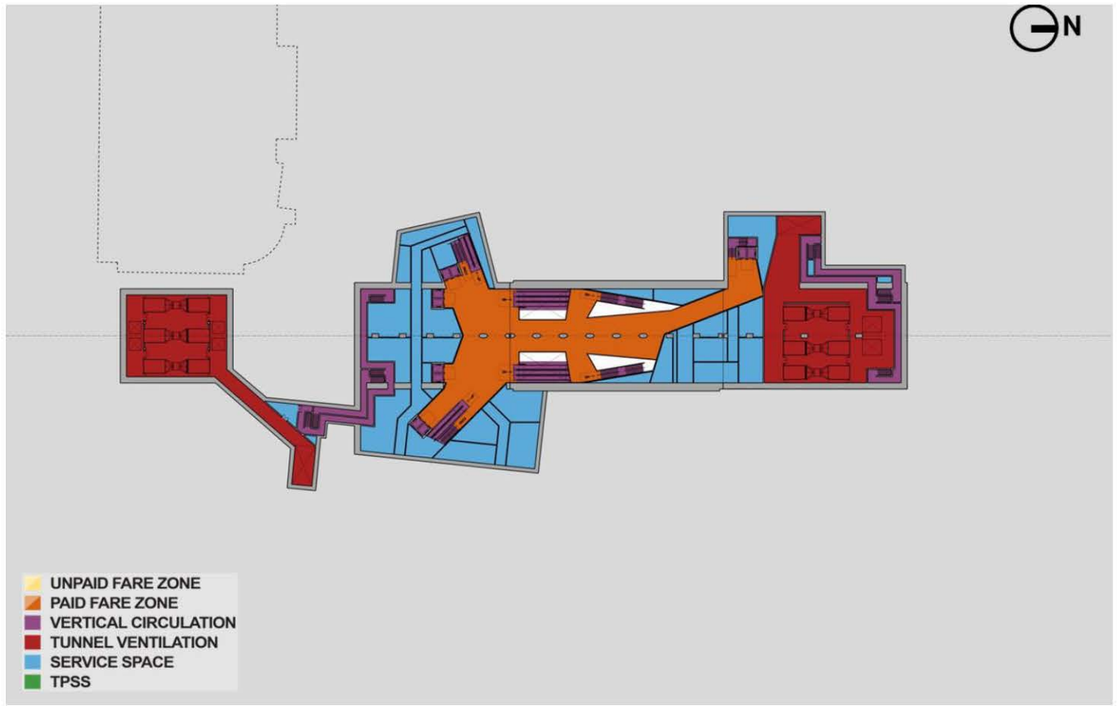
Exhibit 4-2: Subway Station – Platform Level



4.3.2 Concourse

The concourse level (**Exhibit 4-3**) is located directly above the platforms and permits transfers between the subway platforms and the surface level, and TTC bus platforms, via stairs, escalators and an elevator. Passengers entering directly into the station that have not paid a transit fare must do so at the various turnstiles provided in the concourse. Other rooms, such as staff rooms, electrical rooms, and service rooms are also housed at this level.

Exhibit 4-3: Subway Station – Concourse Level



4.3.3 Ventilation Shafts

Ventilation shafts are incorporated into the Scarborough Centre Station in order to balance air pressure within the tunnel and station and to provide for emergency exhaust and fresh air supply in case of an underground fire. Ventilation fans can also be used to alleviate high summer temperatures in the underground station.

The ventilation shafts will be equipped with high capacity emergency fan systems to remove smoke in the event of a fire in the station or on a subway train.

4.3.4 Bus Terminal

A key component of the SSE preferred alignment is the station design, including all the elements needed for the station to operate as a transit hub. One significant station element is the bus terminal. It provides a key transfer for many local and regional routes that will serve this new station. Ridership projections show approximately 80 % of boardings at Scarborough Centre Station will be transfers from the surface network. Consequently, a bus terminal that offers seamless transfers to local and regional services while supporting effective and efficient transit operations is essential to support existing and future ridership.

The major components of a bus terminal are:

- A central island or platform that provides both indoor waiting areas and an outdoor platform;
- A canopy to provide weather protection for passengers that are waiting as well as boarding / getting off buses;
- Bus bays, which are sized to accommodate either a regular or an articulated bus;
- Bus driveway circulation, which facilitates clockwise bus movements around the platform and bus bays; and,
- Bus driveway / access road, which connects the terminal to the local road network.

The current Scarborough Centre Station Bus Terminal comprises 13 TTC bus bays and six GO Transit / intercity bus bays for a total of 19 bus bays. Constructed in 1985, the terminal is currently operating over capacity during peak periods and limits the ability to introduce new services. Its current configuration envisioned a SRT (Line 3) extension to Sheppard Avenue and Malvern Avenue; therefore, it was not designed to accommodate the level of growth experienced over the past 30 years.

As indicated in the previous chapter, to meet existing needs and to accommodate future transit ridership growth, the future Scarborough Centre Station will require a new, expanded bus terminal comprising 34 bus bays, nine of which need to accommodate the longer, articulated buses.

- TTC – 24 bus bays with eight for articulated buses to meet existing TTC network requirements and to accommodate ridership growth, new services required with the closure of Line 3, and the expansion of TTC's express bus network; and,
- 10 bus bays to accommodate regional and intercity services provided by GO Transit (six bays), Durham Region Transit (DRT) who have advised of their plans to extend their Pulse bus service, as part of the Highway 2 Bus Rapid Transit (BRT) expansion from University of Toronto Scarborough Campus (UTSC) to Scarborough Centre Station (one articulated bay), and one bay each or on-street stopping areas for three private intercity carriers that currently use the Line 3 Bus Terminal.

The bus bay requirements were determined in consultation with TTC, GO Transit, and DRT.

As has been indicated in **Chapter 3**, the study of potential locations for this very large terminal concluded that the Triton Road corridor is the preferred location because it would best meet Project objectives related to future development and potential future improvements to the road network within Scarborough Centre. The recommended terminal concept is shown in **Exhibit 4-4**. The terminal concept has two levels. The majority of the bus bays (28 bays) are accommodated in the lower level in a widened Triton Road. An upper level would accommodate the remaining six bays, on a new extension of Borough Drive. This road extension is already part of the City's plans for road improvements in this area and is a necessary element of the Bus Terminal design.

Exhibit 4-4: Scarborough Centre Station and Bus Terminal at Borough Level

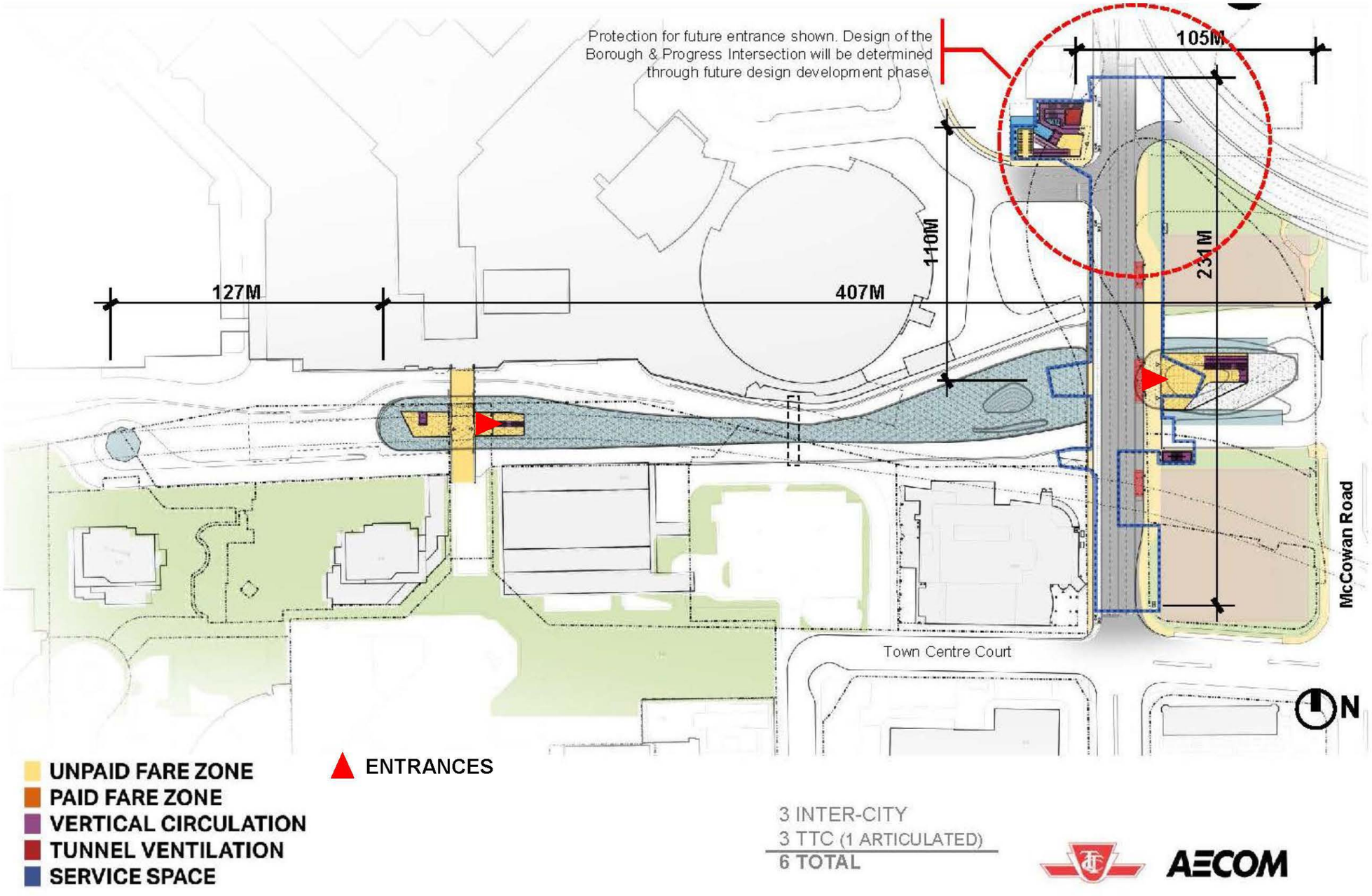
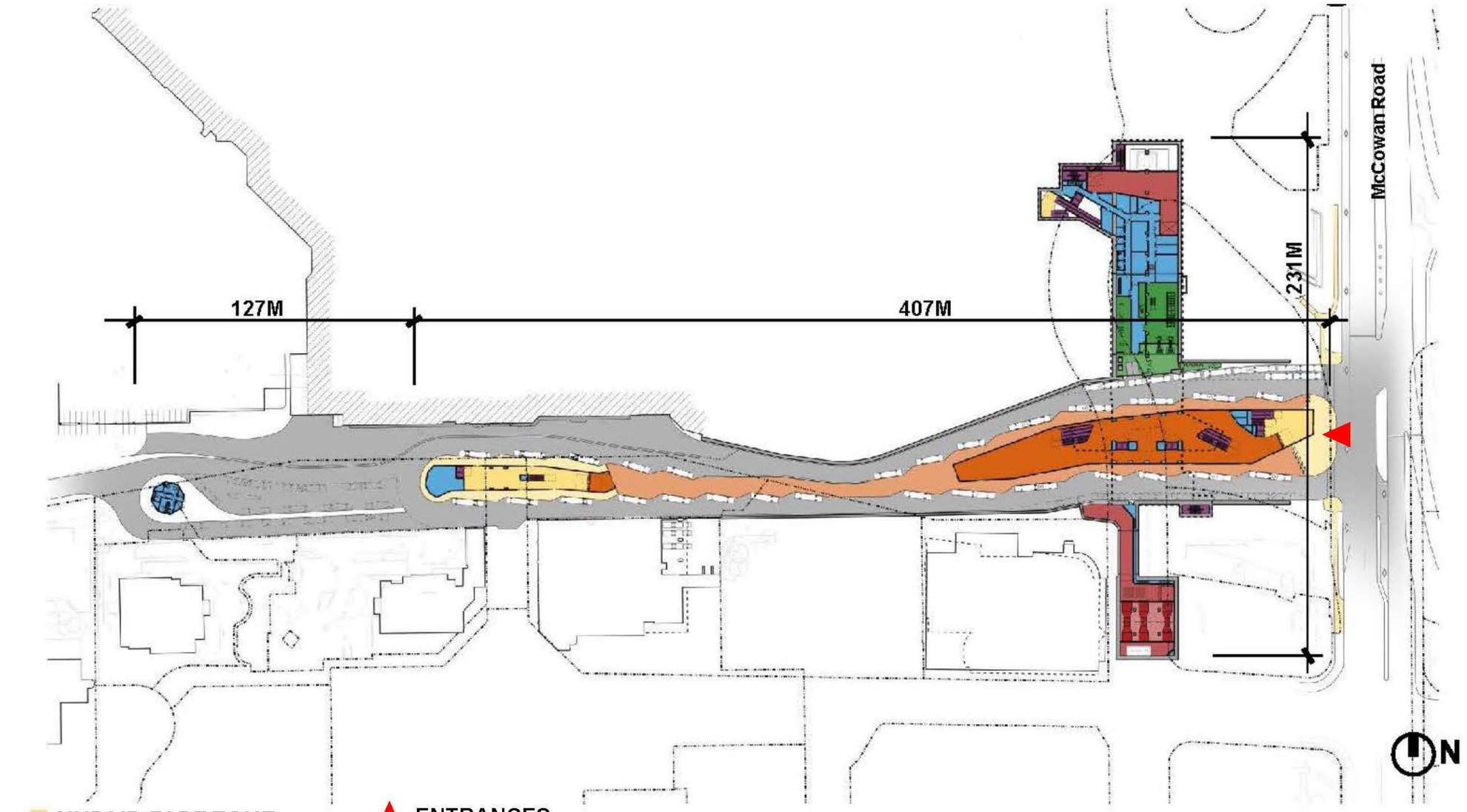


Exhibit 4-5: Scarborough Centre Station and Bus Terminal at Bus Terminal Level



The west end of the lower level of the terminal would be unpaid and accommodate the six GO Transit bays. There would be three entrances connecting to the bus platform area on the lower level of the terminal: one off the east side of Borough Drive, one at the west end of the terminal connecting the GO Transit terminal area to the pedestrian bridge between the Scarborough Town Centre mall and the development to the south, and a direct (same level) connection from McCowan Road at the east end.

Accommodation will be made for a future entrance from Borough Drive, on the north and west end of the station area, which would connect directly to the concourse level of the station. Other potential opportunities where provision could be made for additional entrances from future developments will be explored with landowners during the Detailed Design Phase of the Project.

This Bus Terminal concept is the result of an extensive review of alternatives in order to identify the solution that provides the best balance between providing good service to transit customers while, at the same time, avoiding impacts upon developable lands to the extent practical, and not precluding potential future improvements to the road network in this area.

The further development of the Bus Terminal will include provision of cycling facilities and consideration of potential opportunities for a taxi stand in the vicinity of a station entrance. However, neither a commuter parking facility nor a Passenger Pick-Up and Drop-Off (PPUDO) facility is included in the Project, given that, in keeping with the study objectives, the highest and best use of lands in the vicinity of the new Scarborough Centre Station is transit-supportive development.

Elements of the design will be further refined through Detailed Design Phase of the Project including but not limited to the following:

- Borough Drive Cross-section;
- The design of a dedicated linear stopping, loading and short-term layover area for buses along the east side of Borough Drive, to accommodate three TTC bus stops;
- Allowance for potential additional / future station entrances;
- Design of Bus Terminal access / egress onto McCowan Road; and,
- Public realm.

4.3.4.1 Station Entrances

- **Main Entrance:**
  There will be at least one main entrance at Borough Drive, equipped with stairs, escalators and an elevator in order to accommodate both higher pedestrian volumes, as well as barrier free access. The station entrance will be enclosed.
- **Automatic Entrance:**
  An automatic entrance is planned to be provided at the east end of the lower level of the station to allow customers direct access to the station from McCowan Road.
- **Potential Future Secondary Entrance:**
  Allowances will be made in the concourse design to provide for a potential added entrance as part of a future development plan.

The Scarborough Centre Station Bus Terminal will be located in the vicinity of Triton Road and is proposed to be divided into two levels to reduce its overall footprint and protect future development potential near the subway station (**Exhibit 4-4**).

This conceptual design meets operational needs while supporting the development of Scarborough Centre into a dense downtown with an urban street network that allows for high density development and improved pedestrian connections.

4.3.4.2 Barrier Free Access

Compliance with the *Accessibility for Ontarians with Disabilities Act* (*AODA*) is a priority of the TTC and City of Toronto. To this end, the Scarborough Centre Station will be designed to achieve accessibility for both passengers and TTC employees. In accordance with TTC's Design Standards, if a person is capable of arriving at the subway station entrances by bus, private car, Wheel-Trans or as a pedestrian, the design of the station will ensure the rider access to and from the subway trains. TTC's key design principles to achieve barrier-free access are as follows:

- Stations shall be designed for use by all passengers, and contain certain enhancements to address the needs of persons with disabilities;
- A wheelchair accessible route shall be provided to an accessible entrance from the Wheel-Trans bay, the passenger pick-up and drop-off zone, the designated spaces at commuter parking lots and any new entrances from a development;
- Where practical, barrier free entrances should be combined or minimized; and,
- Potential obstacles (e.g., garbage cans, fare vending machines, landscaping, etc.) shall be located such that they do not obstruct passage through the accessible route.

In order to achieve barrier-free access, elevators will be provided. In accordance with the Design Standards, specific requirements for landscaping, entrances, fare control, vertical and horizontal circulation, signage, washrooms and commuter facilities will be incorporated into the station during design.

4.3.4.3 Bicycle Facilities

Facilities for cyclists (i.e., bicycle lock-ups) are to be provided in the vicinity of the station. The final location and configuration will be determined in consultation with City staff during the Detailed Design Phase of the Project.

4.3.4.4 Associated Road Improvements

This Project will include the extension of Borough Drive between Town Centre Court and Progress Avenue. The design of the modified Borough Drive / Progress Avenue intersection is not yet known – however, it will be reconfigured into a functional intersection.

The only other road modification planned as part of this Project is a lengthening of the existing southbound bus-only right turn lane on McCowan Road at the entrance to Triton Road. This improvement would allow southbound buses earlier access to this lane, which serves as a 'queue jump' opportunity to by-pass lengthy queues of southbound traffic on McCowan Road and, thereby, reduces delays to transit customers.

4.4 Ancillary Features – Supporting Components of Subway Operation

4.4.1 Special Trackwork

'Special trackwork' refers to track, other than standard parallel running tracks that support the operation of the subway. There are three locations where this is necessary:

- Crossover connections will be provided roughly midway along the length of the SSE – in the vicinity of Lawrence Avenue East – to allow trains to switch tracks, that is to 'cross over' to the other direction when needed to address service reliability issues on the line or in emergency situations where there is a problem at or near the terminal station).
- Crossover tracks are included in front of (i.e., just south of) the subway platform at the Scarborough Centre Station to enable eastbound trains to terminate and turn back westbound. To allow for potential future conditions where the time between trains is scheduled to be much shorter, crossover tracks will also be provided to the north of the station (refer to **Exhibit 4-2**).
- Tail tracks are to be provided north of the Scarborough Centre Station. These are added parallel tracks, together with the north crossover, provide the added length that is required, from a safety perspective, to allow for high operating speed into the station. They also provide for temporary storage of subway trains (Refer to **Exhibit 4-2**).

4.4.2 Station Tunnel Ventilation

The Project contains a comprehensive fire life safety plan which includes mechanical fire ventilation using fans. Ventilation shafts are required in Scarborough Centre Station in order to balance air pressure within the tunnels and station and to provide for emergency exhaust and fresh air supply in the event of an underground fire. Ventilation fans can also be used to alleviate high summer temperatures in the underground station.

Initial studies conducted for the SSE identified a requirement for a mid-tunnel ventilation structure in the vicinity of Lawrence Avenue East. It will be combined with the construction required for an Emergency Exit Building (EEB) at that location. Based on these initial studies, the at-grade footprint of the combined tunnel ventilation and emergency exit is approximately 100 square metres. The at-grade footprint will be refined during the Detailed Design Phase of the Project.

Kennedy Station is slated for fire ventilation upgrades as part of the Fire Ventilation Upgrade (FVU) capital program. It has been proposed to include some or all of this work in SSE project. Fan units will be required at the east end of Kennedy Station in order to provide tunnel ventilation between Kennedy and the fire ventilation to be provided near Lawrence Avenue. The FVU for Kennedy Station and the SSE fire ventilation will need to act together in the future and, as a minimum, should be designed as such.

4.4.3 Emergency Exit Buildings

EEBs extend from the underground tunnel to grade and are designed to provide an emergency exit for passengers and an emergency access for firefighting crews. They can also provide emergency ventilation and secondary power sources.

Exhibit 4-6: Typical TTC Emergency Exit Building

Each EEB requires direct road access to the building by a fire pumper truck. Also, one parking space is provided at each EEB for TTC maintenance purposes unless specific circumstances (for example, conflict with by-law provisions) preclude such a parking space.

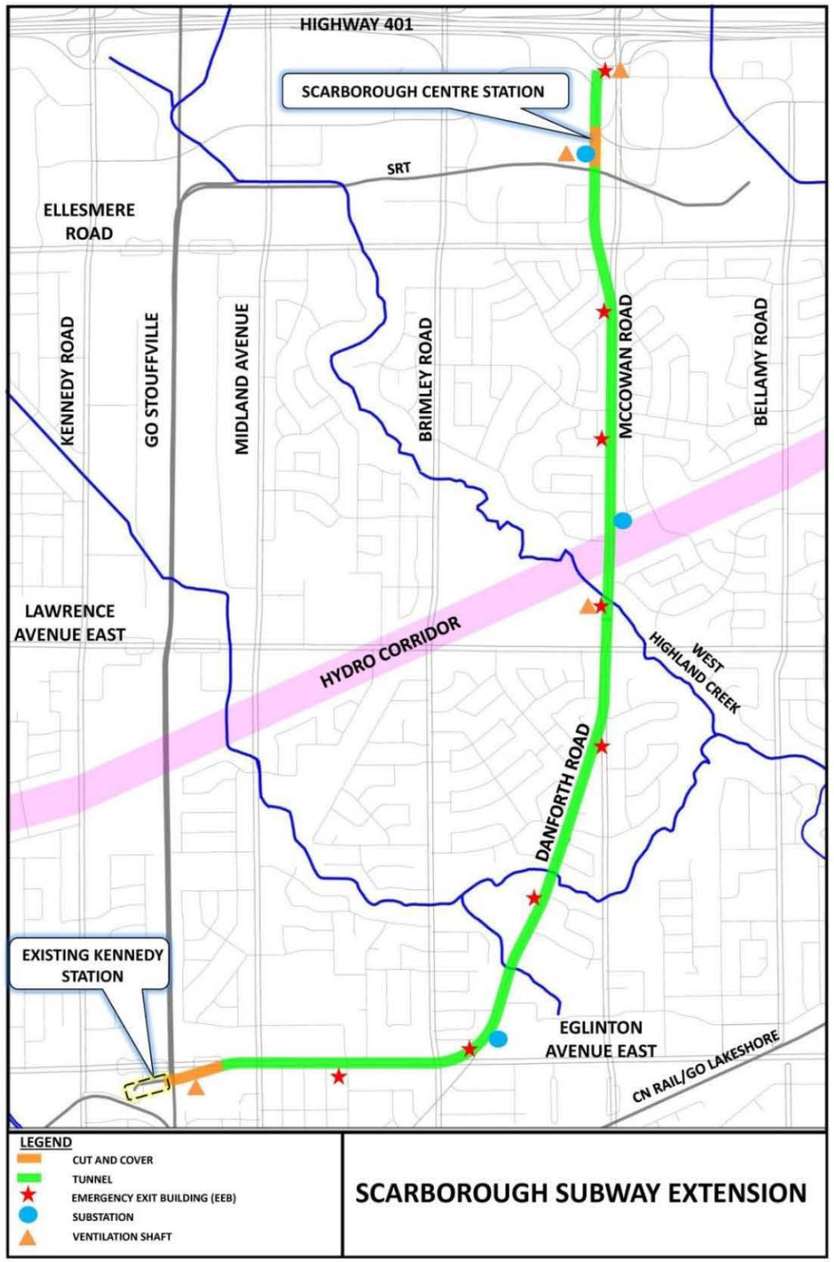
The at-grade footprint of each EEB is approximately 30 square metres (see **Exhibit 4-6** for typical EEB size).

In accordance with National Fire Protection Agency 130 *(NFPA) and TTC Standards (DM-0102-03/4.2.1)*, emergency egress from the tunnel shall be provided throughout the underground system so that the distance to an exit shall not be greater than 381 metres. Therefore the maximum distance from emergency exit to emergency exit or emergency exit to station shall be 762 metres.

Eight EEBs are required for the SSE as follows and as shown in **Exhibit 4-7**:

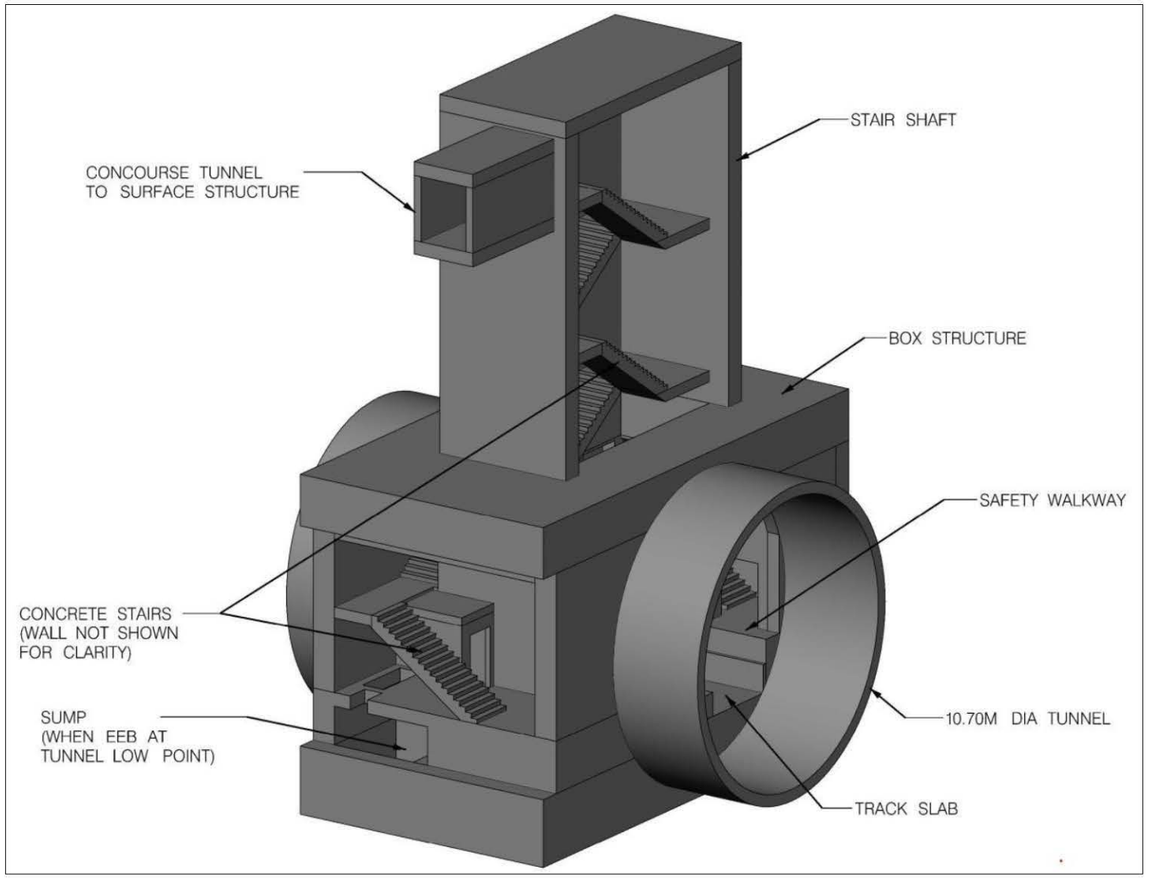
Emergency Exit 1: ..... Eglinton Avenue East at Winter Avenue
Emergency Exit 2: ..... Danforth Road at Eglinton Avenue East
Emergency Exit 3: ..... Danforth Road at Savarin Street
Emergency Exit 4: ..... Danforth Road at Barrymore Road
Emergency Exit 5: ..... McCowan Road at Lawrence Avenue East
Emergency Exit 6: ..... McCowan Road at Meldazy Drive
Emergency Exit 7: ..... McCowan Road at Hurley Crescent
Emergency Exit 8: ..... Corporate Drive at Progress Avenue

Exhibit 4-7: EEBs and Other Cut-and-Cover Sections



The mid-tunnel ventilation structure will be co-located with EEB 5. See **Exhibit 4-8** for typical EEB structure below grade, as required the ventilation structure will incorporated into the footprint.

Exhibit 4-8: Emergency Exit Structure – Below Grade



4.4.4 Traction Power Substations

Electrical power is required to power the trains (referred to as traction power) as well as to operate lights, equipment and safety systems associated with the SSE. The connections between TTC's subway and Toronto Hydro's power distribution grid occur in a facility that is referred to as an electrical substation. These substations contain transformers, switches and circuit panels to support the electrical requirements. Substations are typically constructed at-grade, depending on the available footprint are one or two storeys. To meet the traction power requirements for TTC's subway system, substations are typically 2.0 to 2.5 kilometres apart. Since subway stations require power for lights and equipment, TTC usually locates the electrical

substations near subway stations. As the SSE is 6.2 kilometres long, this extension will require three traction power substations (TPSSs) at the following locations:

- Traction Power Substation 1 – Danforth Road at Eglinton Avenue
- Traction Power Substation 2 – 1 and 3 Bellechasse Street
- Traction Power Substation 3 – located at Scarborough Centre Station.

In addition to traction power equipment, the mid-tunnel traction power substations will also house communications and subway signaling equipment rooms.

The approximate surface footprint of TPSSs 1 and 2 are approximately 800 to 1,000 square metres (see **Exhibit 4-9a and 4-9b** for an example of a TPSS in Toronto).

Exhibit 4-9A: Traction Power Substation

Source: Google Earth

Exhibit 4-9B: Traction Power Substation – Aerial View

Source: Google Earth

4.4.5 Connection with Existing Subway at Kennedy Station

The SSE will tie into the existing tail tracks at Kennedy Station via a box structure and will be typical cut-and-cover construction.

The vertical alignment at the existing Kennedy Station is such that there is insufficient cover for tunnelling so a cut-and-cover box structure will be needed to allow the alignment to descend to sufficient depth before tunnelling. The work includes the following:

- Cut-and-cover box structure plus box segments in the area of the extraction shaft, resulting in a total length of about 200 metres;
- Demolition of existing tail tracks, beginning just east of the GO Transit tracks;
- Mechanical, electrical and plumbing as required for the box structure;
- Changes to operations and train storage during construction; and,
- Traffic Management Plan:
  - Maintaining access to Don Montgomery Community Centre
  - Provision of temporary parking
  - Eglinton Avenue East service road access.

4.4.5.1 System Integration

Signals and Communications

The existing Kennedy Station signaling relay room and signaling power supply room are both at capacity and there will need to be modifications to renovate the existing space, or the construction of new rooms will be needed to accommodate this. Similarly, added space will be necessary to accommodate the SSE communications equipment.

4.5 Construction Methods

The SSE will be constructed via tunnelling and cut-and-cover construction. Most of the alignment will be constructed via tunnelling – from Eglinton Avenue, east of Kennedy Station to Town Centre Court and from the north end of the subway box to the north limit of the alignment, located immediately south of Highway 401. The key elements which will be constructed via cut-and-cover construction include:

- Construction of the tunnel boring machine launch and extraction shafts;
- Demolition and reconstruction of the existing Kennedy tail track structure (located below the Don Montgomery Community Centre parking lot); and,
- Construction of Scarborough Centre Station, the mid-tunnel ventilation structure, EEBs and traction power substations.

4.5.1 Tunneled Sections

Tunnelling uses a large machine – a tunnel boring machine (TBM), usually built for the specific project - to excavate a tunnel, handle the excavated material and place the initial tunnel lining in a continuous and highly automated process. The front end of the machine consists of a circular cutting face that excavates the soil and

pulls it into its round shell. Traditionally, TTC tunnelling techniques have utilized two separate tunnels – one for each direction, otherwise known as twin bores (6 metre diameter per TBM). However, the recommended tunnelling method for this Project will utilize a large single bore machine, 10.7 metre diameter, which can accommodate both sets of tracks within a single tunnel. This approach allows the special trackwork to be constructed within the tunnel rather than the requirement for long sections of cut-and-cover as is required with twin bore tunnelling – this will result in a significant reduction in construction impact. The single tunnel will also result in a lower construction cost for the project.

The amount of material excavated using a TBM is less than half that required for cut-and-cover construction. Tunnelling also minimizes disruption to traffic and buildings. Earth Pressure Balance (EPB) tunnelling methodology maintains a constant pressure along the cutting face through the use of a continuous injection of a slurry mixture. Excavated soil and slurry mixture are removed and the soil and slurry are separated to allow the reuse of the slurry. EPB reduces construction related settlement above the tunnel and minimizes the amount of groundwater that enters into the construction area. See **Exhibit 4-10** for a picture of the front of a typical TBM as well as the finished tunnel structure prior to the running infrastructure installation.

4.5.1.1 Tunnel Boring Machine Operations and Maintenance

The TBM is typically operated on two shifts per day advancing at a rate of 10 to 12 metres a day. Regular maintenance of the TBM will be required. Depending on the type of soil encountered, maintenance may vary across different depths and stages of construction. Stations and EEBs can serve as maintenance shafts, however the final operations and maintenance sequence will be determined during design and construction planning.

4.5.1.2 Installation of Tunnel Liners and Grouting

The TBM has equipment to assemble and place either a steel rib or lagging assembly or a precast concrete tunnel liner ring immediately behind its shell tailpiece as it advances. In soft ground, the machine advances by means of thrusting jacks reacting against the tunnel lining just placed. This structure is assembled immediately after the TBM shield advances and it is placed tightly against the excavated soil surface. Any resulting annular space between the soil surface and the tunnel liner is then backfilled with grout.

4.5.2 Single Large Diameter Tunnel

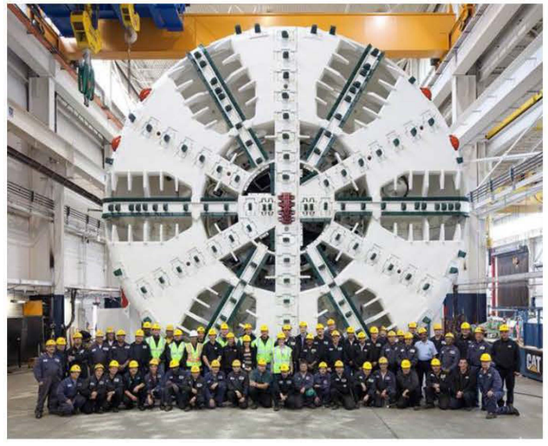
A comprehensive assessment was conducted to compare TTC's traditional approach – using two, 6 metre diameter tunnels with each direction of track in a separate tunnel – with the alternative of accommodating both sets of tracks in a single, large diameter tunnel.

With twin tunnels, there would be a significantly greater length of cut-and-cover construction required; the crossover track locations, the station box, and the tail track beyond the station. The assessment concluded that a 10.7 metre tunnel would be lower project cost, and would significantly reduce the extent of cut-and-cover construction as the crossovers and tail track could be constructed within the tunnel.

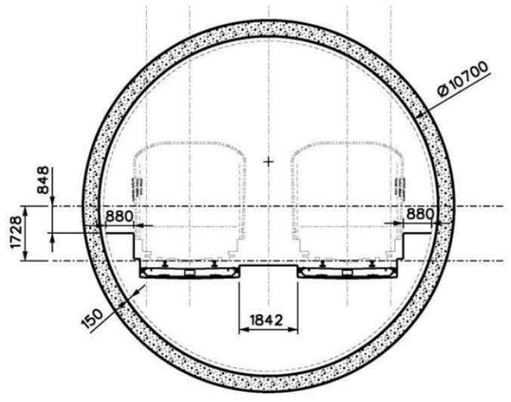
Given these benefits – reduction in cut-and-cover construction impacts and reduced capital costs – the 10.7 metre diameter tunnel is proposed for this Project. See **Exhibit 4-11** for the size and cross section of the proposed TBM and tunnel.

Exhibit 4-10: Tunnel Boring Machine Tunnelling

Exhibit 4-11: Single Large Diameter Tunnel



Vancouver Evergreen Line, Tunnel Boring Machine "Alice" – 10 m diameter



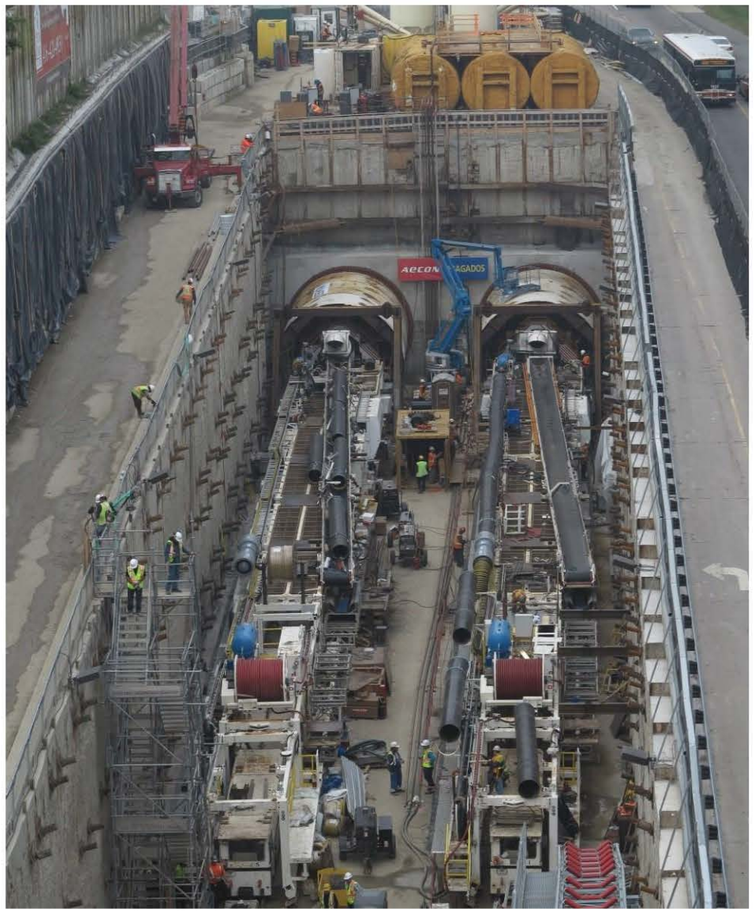
Proposed Scarborough Subway Extension Tunnel – 10.7 m diameter

4.5.3 Tunnel Boring Machine Launch / Extraction Shafts and Tunnel Construction Sites

The tunnel construction would begin at the north end of the alignment in order to complete the tunnel excavation to the south side of the station location as quickly as possible. This allows the construction of Scarborough Centre Station to occur at the same time as the majority of the tunnel construction.

The TBM requires both launch and extraction sites. The machine with its trailing gear for conveyor belts and line assembly may occupy a length of about 90 metres, and requires an initial open cut excavation for it to be mobilized. Once tunnelling commences, the contractor will occupy the launch site for soil removal and tunnel liner insertion until the tunnel section is complete. See **Exhibit 4-12** for an example of a tunnelling work site, here with two TBMs.

Exhibit 4-12: Tunnelling Work Site, Eglinton Crosstown LRT



The tunnel work site is a temporary construction site where many key functions of the subway construction takes place, including point of entry for the tunnel liners and tracks, and the excavation of discharged tunnel soil. Trucks bring the tunnel liners to this site and take excavated soil away. This work site requires an area of approximately 10,000 square metres (1 hectare) and will be in operation for the majority of the duration of SSE construction.

The TBM launch site must act as a temporary work site until the TBM reaches the primary work site, south of Scarborough Centre Station.

As a result, this area will be subject to the greatest level of impact during the construction phase.

The current plan is to extract the TBM via a shaft on the south side of Eglinton Avenue, in the vicinity of Town Haven Place. The TBM is dismantled in the tunnel and taken out in sections, thus requiring a significantly smaller shaft relative to the launch shaft. The staging plans for the cut-and-cover section immediately east of Kennedy Station will incorporate final plans for the extraction shaft.

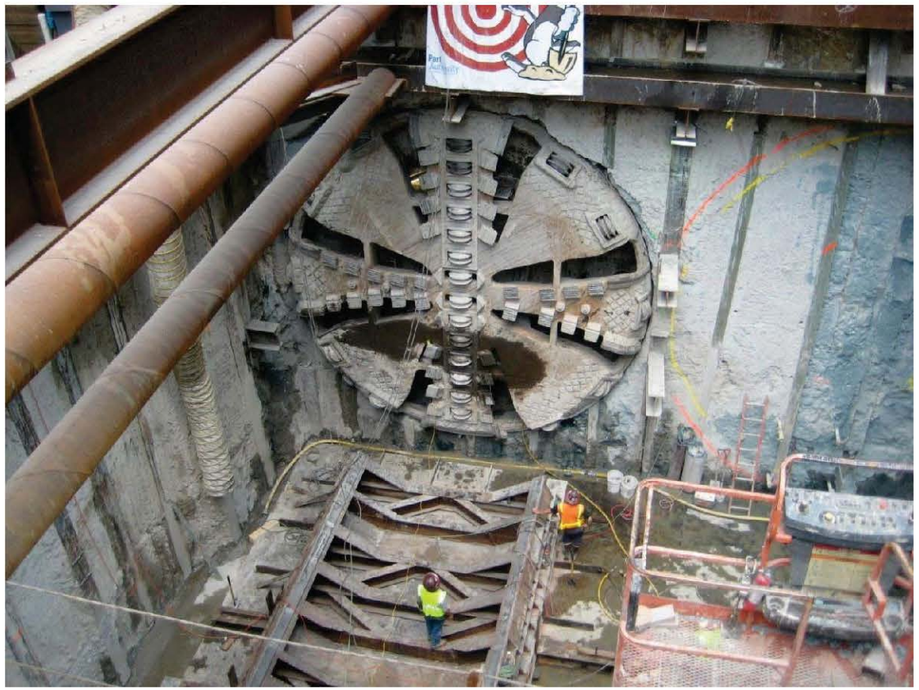
The typical area required for a tunnel launch site is 10,000 square metres and includes the following functions:

- Site trailers and facilities – accommodates site management offices, meeting room, bathroom facilities, etc.;
- Dry room trailers – workers lockers, change rooms, showers, bathroom facilities, etc.;
- Mechanics area – a garage type facility to accommodate the repair of heavy equipment under cover;
- Equipment / materials storage – storage of heavy equipment (e.g., loaders, forklifts, excavators) and materials (e.g., water pipe, vent duct, muck bins, tunnel chemicals, lubricants, fuel and bulk materials);
- Site electrical area – power supply transformers, substations and generators;
- Crane – 110 to 150 tonne crawler crane during tunnelling;
- Segment storage and loading area – storage, placing and slinging ring segments prior to their transport by crane into the shaft;
- Batch (grout) plant – tunnel grout batching facility;
- Water treatment plant;
- Muck handling area; and,
- Site parking.

The area required for the TBM extraction site is approximately 3,000 square metres and includes the following functions (refer to **Exhibit 4-13** for a TBM entering an extraction shaft):

- Site trailers and facilities – accommodates site management offices, meeting room, bathroom facilities, etc.;
- Dry room trailers – workers lockers, change rooms, showers, bathroom facilities, etc.;
- Equipment / materials storage – storage of heavy equipment (e.g., loaders, forklifts, excavators) and materials (e.g., water pipe, vent duct, muck bins, tunnel chemicals, lubricants, fuel and bulk materials);
- Site electrical area – power supply transformers, substations and generators;
- Crane – to lift TBM out of tunnel; and,
- Site parking.

Exhibit 4-13: Tunnel Boring Machine Entering Extraction Shaft



4.5.4 Cut-and-Cover Construction

Tunnelling is an effective means of creating an underground linear facility which has a uniform cross-section. For some portions of the subway line, excavation by a TBM is not practical or economical; for example, at stations where the total width required for the platforms is wider than the tunnel diameter and in sections of the Project where EEBs are required to be constructed – i.e., a passageway from the surface down to the tunnel.

In these instances cut-and-cover is the preferred method of construction. In addition, where the alignment can be close to the surface and access from the surface during construction results in negligible adverse environmental effects, cut-and-cover can be more economical than tunnelling. This is the situation in the shallow section immediately east of Kennedy Station; the work must be cut-and-cover until a suitable depth is reached to allow tunnelling.

This method has been used to construct subway systems for more than 100 years. The ground surface is opened (cut) to a sufficient depth to construct the subway tunnel structure and ancillary facilities. The sides of the excavation are usually supported by vertical temporary walls to minimize the volume of material excavated and to protect adjacent facilities and buildings. The walls require cross-bracing or tiebacks for support. Once the construction excavation is complete, the contractor builds the structure from the bottom to the top of the structure. Once the structure construction is complete, the remaining excavation is backfilled and the surface is reinstated.

At locations where cut-and-cover construction crosses a roadway, steel decking covering the open trench will be used to allow road traffic to cross while work is being completed below (see **Exhibit 4-14** and **Exhibit 4-15**).

The conditions where cut-and cover construction is necessary in this Project are:

- Scarborough Centre Station – The large spans (station platform widths), relatively short lengths and complicated spatial arrangements normally preclude economical tunnelling;
- EEBs and vent structures; and,
- The shallow section immediately east of Kennedy Station.

Exhibit 4-14: Cut-and-Cover Excavation

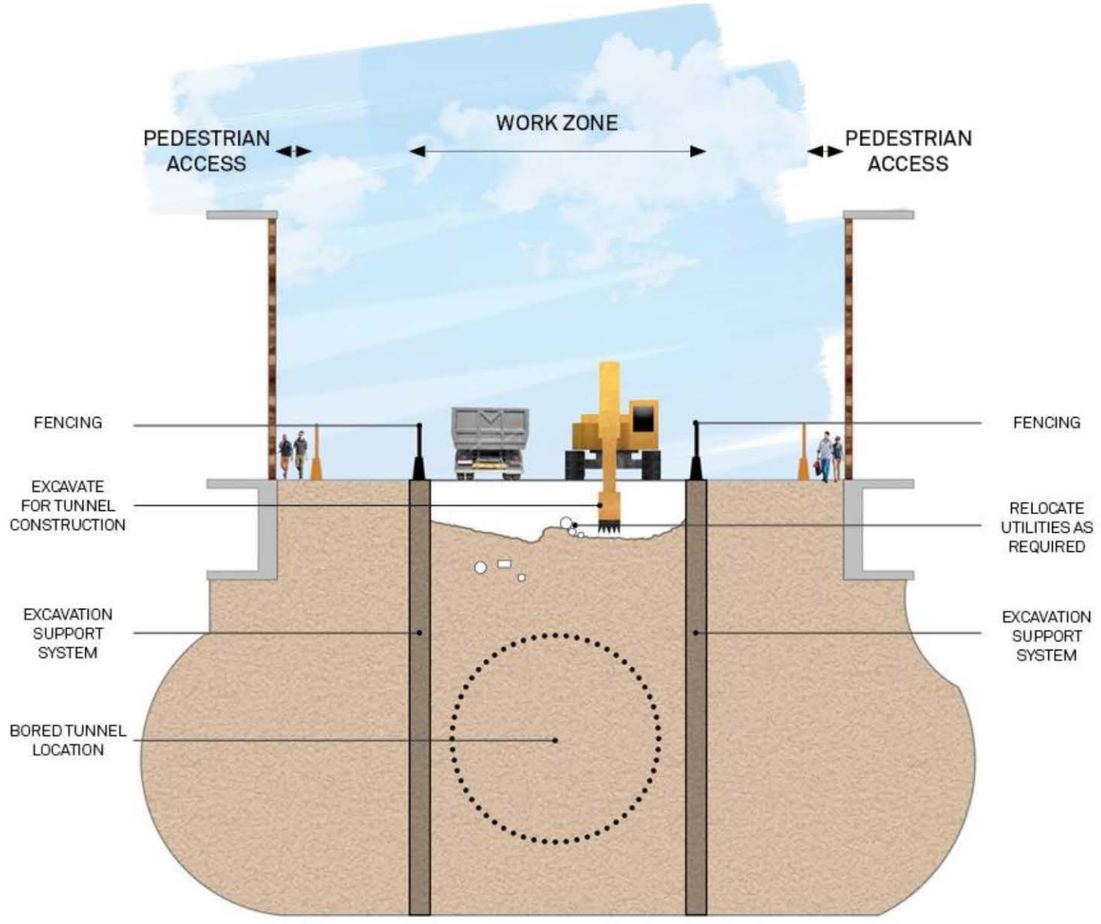


Exhibit 4-15: Cut-and-Cover Excavation at Roadways

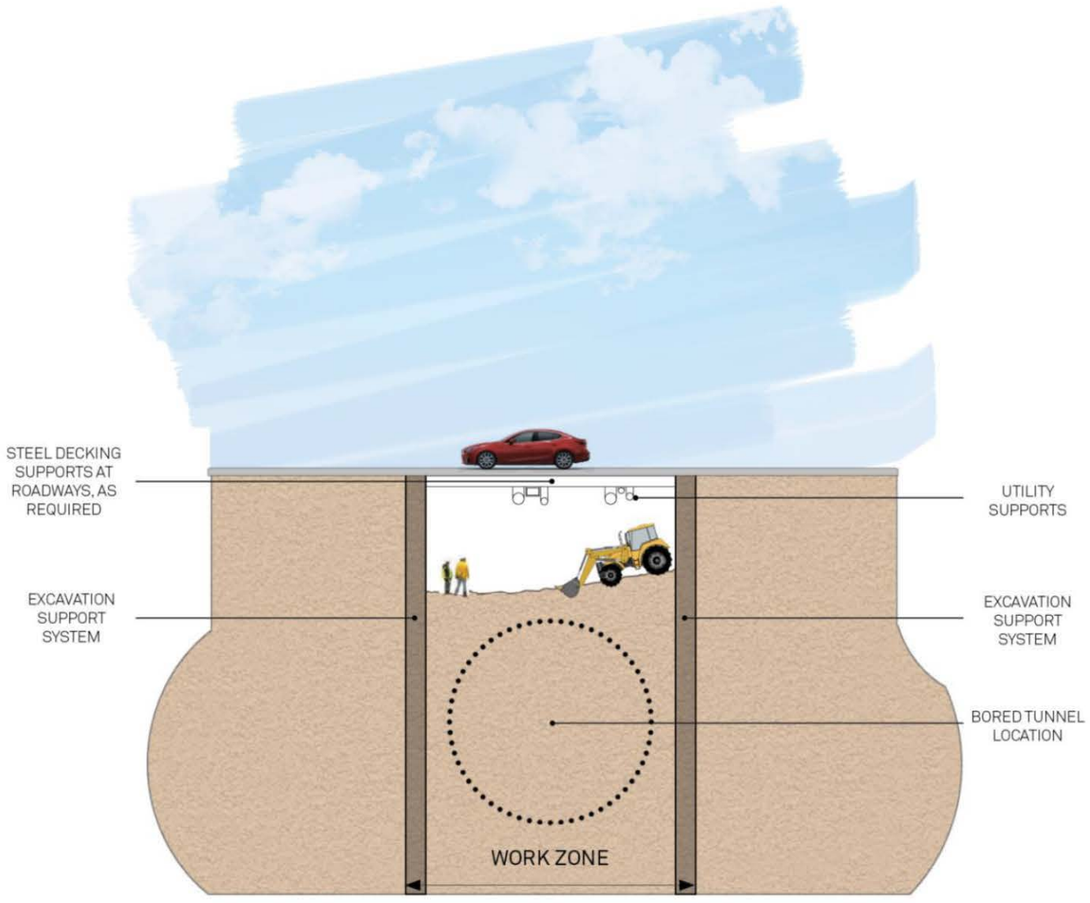
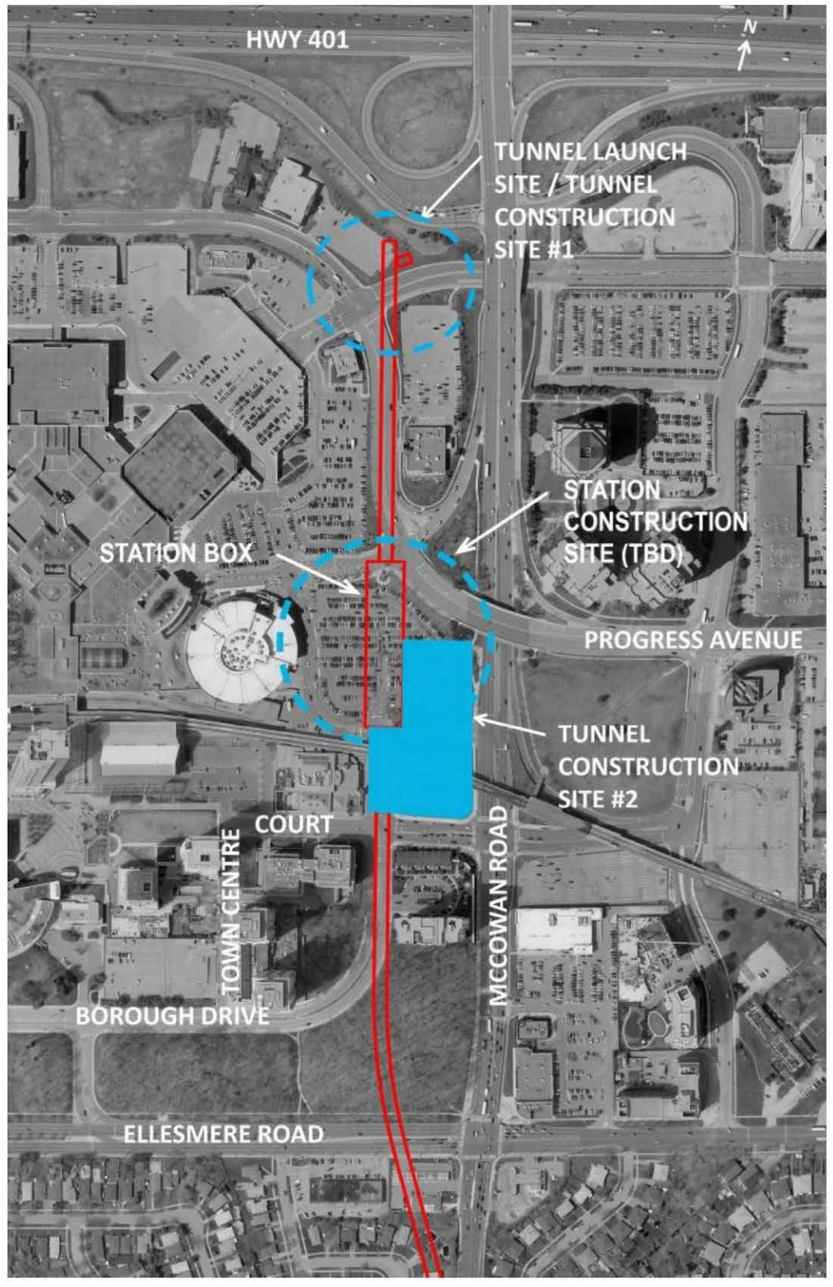


Exhibit 4-16: Proposed Construction Sites



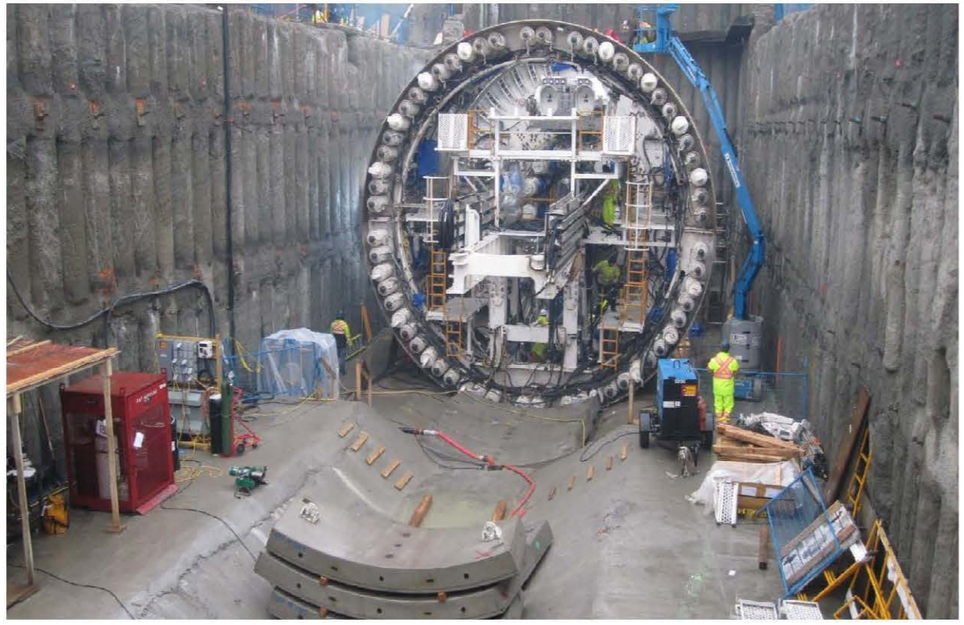
4.6 Preliminary Construction Plan

With reference to **Exhibit 4-16**, showing the associated tunnel construction sites, the initial tunnelling sequencing is as follows:

- Tunnelling would start from a launch site located immediately south of Highway 401 (Launch Shaft);
- Launch of the TBM requires an open cut, roughly 90 metres long by 20 metres wide which, if it crosses existing roadways, will require standard cut-and-cover traffic diversion, followed by decking;

- The area around the launch shaft would be used as Tunnel Construction Site #1 (refer to **Exhibit 4-17**)), and a portion of the shaft would be used for removing extracted soil and inserting tunnel liners for this first stage of tunnelling; the entire site would be roughly 10,000 square metres;
- Building TBM in launch shaft (**Exhibit 4-17**);
- This second work site would provide for soil extraction and tunnel liner insertion for the duration of the tunnelling (refer to **Exhibit 4-12**);
- It is estimated that each work site would accommodate approximately 240 trucks a day to both remove extracted soil and to deliver tunnel liner sections.
- The TBM would drive south to just north of Town Centre Court, where a second construction shaft and related tunnel construction site would be developed. This shaft would not be as large as the one required to launch the TBM but the size of the site would be similar – roughly 3,000 square metres;
- By providing this second tunnel drive from Town Centre Court south of the Scarborough Centre Station, construction on the subway station can proceed while tunnelling continues to the south, resulting in a more efficient (shorter) timeline to complete overall Project construction.
- Tunnelling would continue from Town Centre Court to Eglinton Avenue East just west of the Don Montgomery Community Centre driveway where a smaller shaft – to be incorporated within the area needed for the cut-and-cover construction plans – would be provided to allow for the extraction of the TBM. The location and design of this shaft would be established as part of the design of the cut-and-cover segment east of Kennedy Station.

Exhibit 4-17: Tunnel Launch Shaft



4.6.1 Staged Construction of the Bus Terminal

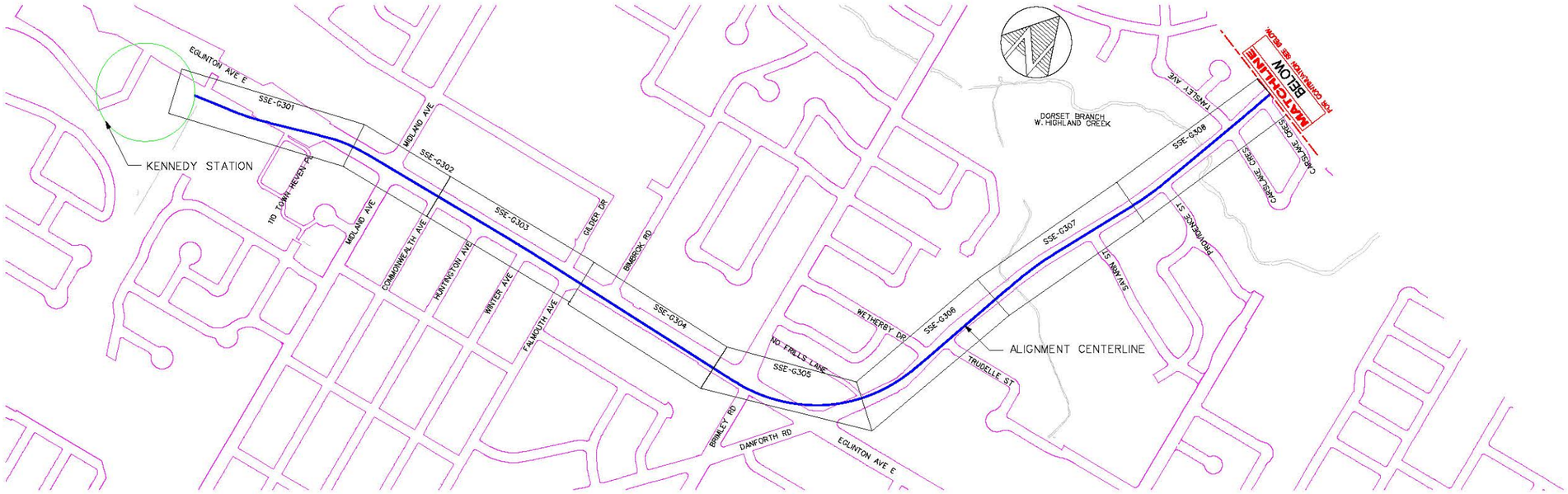
The existing Line 3 structure is an impediment to the completion of the new Bus Terminal. For this reason, the Scarborough Centre Station Bus Terminal must be constructed, and opened, in two separate phases:

Phase 1: ..... The portion of the Bus Terminal that can be constructed with the Line 3 structure in place will be completed prior to the opening of the subway. Buses will have use of the existing bus terminal during this time. However, as a result of the construction activities around the station area, Triton Road will be closed west of McCowan Road – potentially for lengthy periods of time – and the majority of buses now using the Line 3 Bus Terminal will have to be rerouted to the Triton Road access at the Brimley Road side of Scarborough Town Centre.

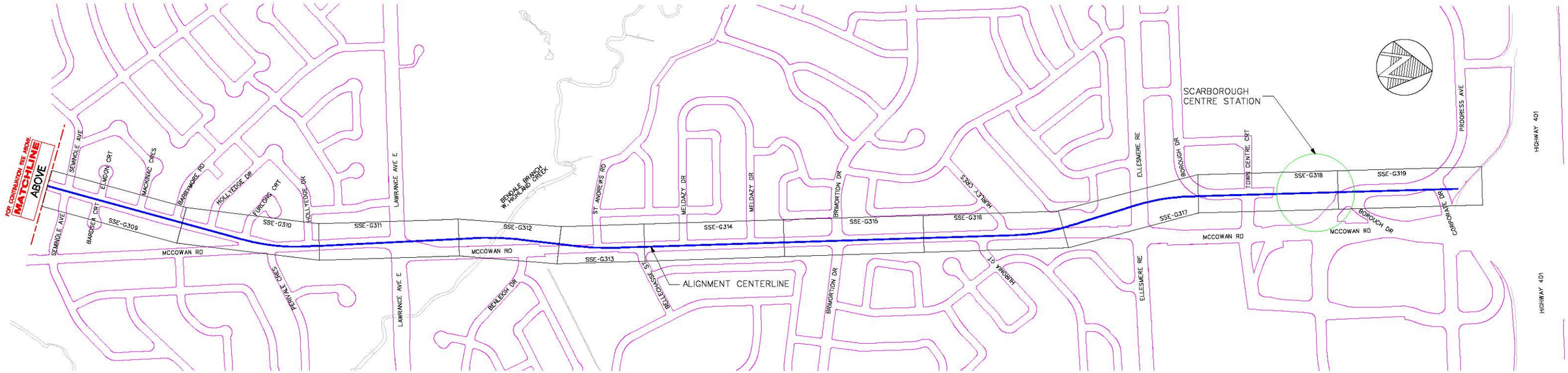
Phase 2: ..... Once the subway is open, Line 3 and the existing Line 3 Bus Terminal will be closed and buses will be able to use the portion of the new Scarborough Centre Station Bus Terminal that was constructed during Phase 1. An interim plan will be developed for bus service to serve the new Scarborough Centre Station. This will involve using the partially-completed Bus Terminal to the greatest extent possible, supplemented as necessary by temporary bus stops in the southbound bus-only right turn lane on McCowan Road at the station entrance and / or on the newly constructed Borough Drive. Once the second phase of the Bus Terminal is complete, all temporary stop locations will be eliminated in consultation with City staff.

Line 3, including the existing Line 3 station and bus terminal, will be demolished and the remainder of the Scarborough Centre Station Bus Terminal completed. The preliminary schedule for these activities suggests that the entire new Scarborough Centre Station Bus Terminal will be available 1.5-to-2 years after the subway is operational.

The following exhibits (**Exhibit 4-18a-t**) show the proposed vertical and horizontal alignment and surface structures relative to the alignment.



PLAN
STA. 10+000 TO STA. 12+920
1
G300



PLAN
STA. 12+920 TO STA. 16+229.081
2
G300

REVISIONS		AECOM	CONCEPTUAL DESIGN NOT FOR CONSTRUCTION	DRAWN L.Li YYYY/MM/DD 2017/02/28 CHECKED D.FANG 2017/02/28 CORRECT D.FANG 2017/02/28 SCALE SCALE: N.T.S	SCARBOROUGH SUBWAY EXTENSION EA PLAN AND PROFILE KEYPLAN

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Sheet No.

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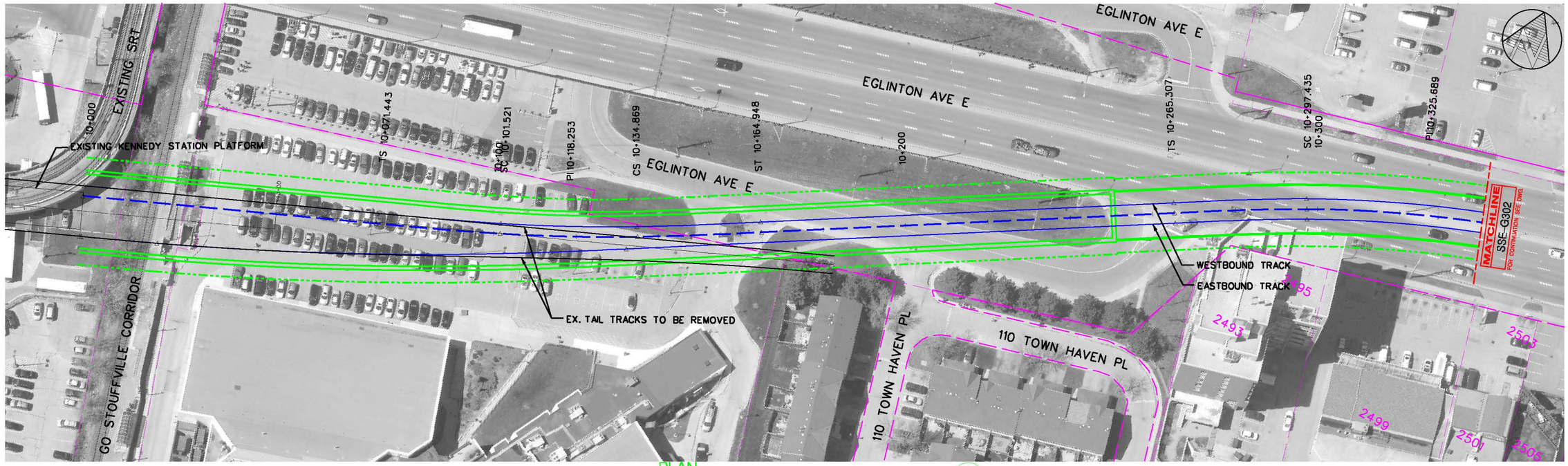

PLAN
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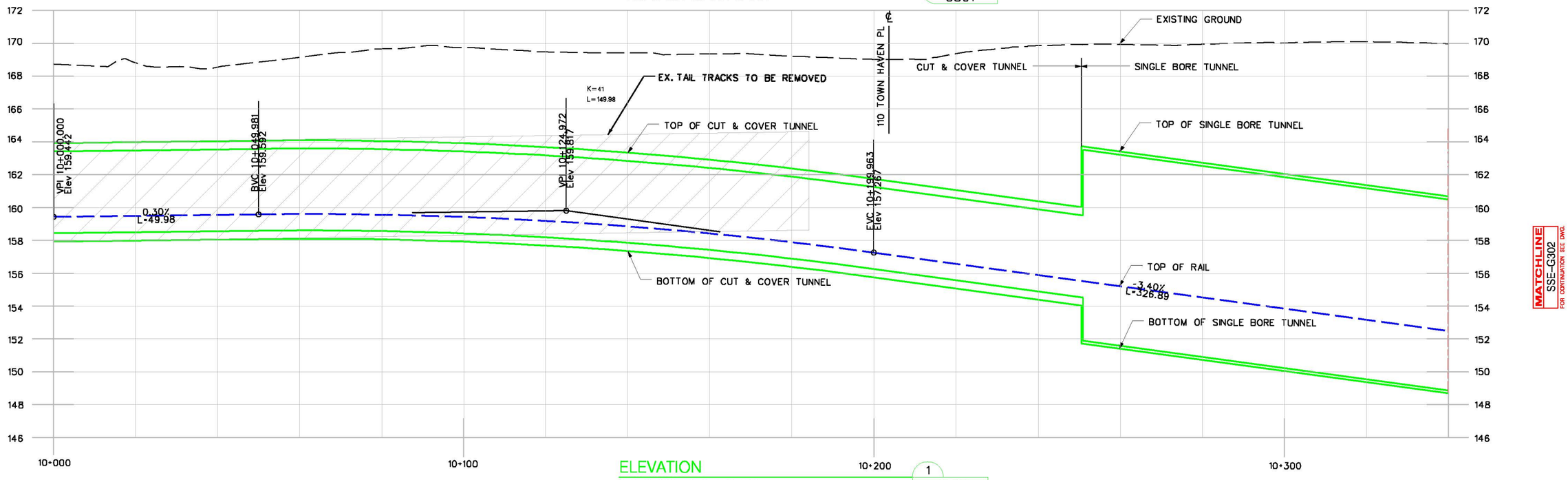

ELEVATION
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REVISIONS

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- ALIGNMENT ℄
- NEW TTC RIGHT-OF-WAY
- TRACK ℄
- EXISTING PROPERTY LINE
- EMERGENCY EXIT BUILDING (EEB)
- TRACTION POWER SUBSTATION

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SCARBOROUGH SUBWAY EXTENSION EA

PLAN AND PROFILE

STA 10+000 TO STA 10+340

Plot Date: 3/9/2017

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ENGINEERING DEPARTMENT

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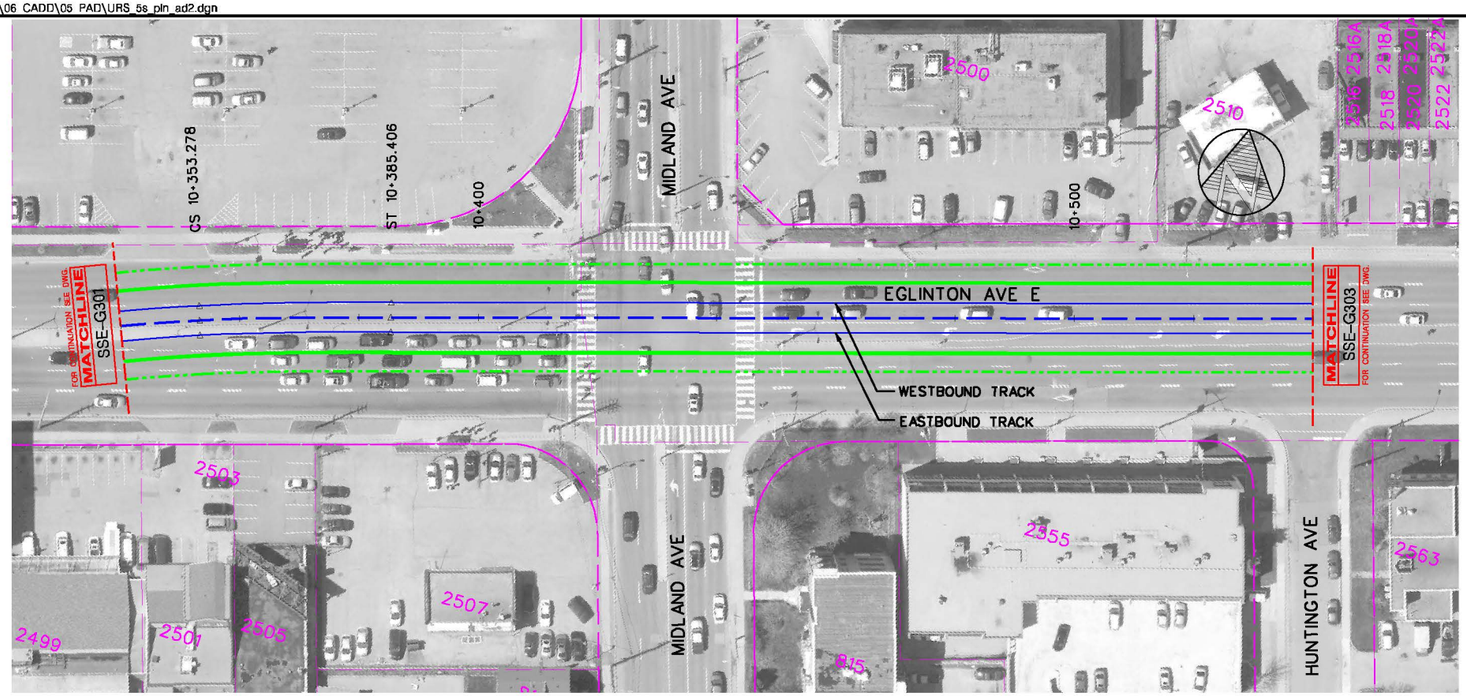
Sheet No.



PLAN

STA 10+340 TO STA 10+540

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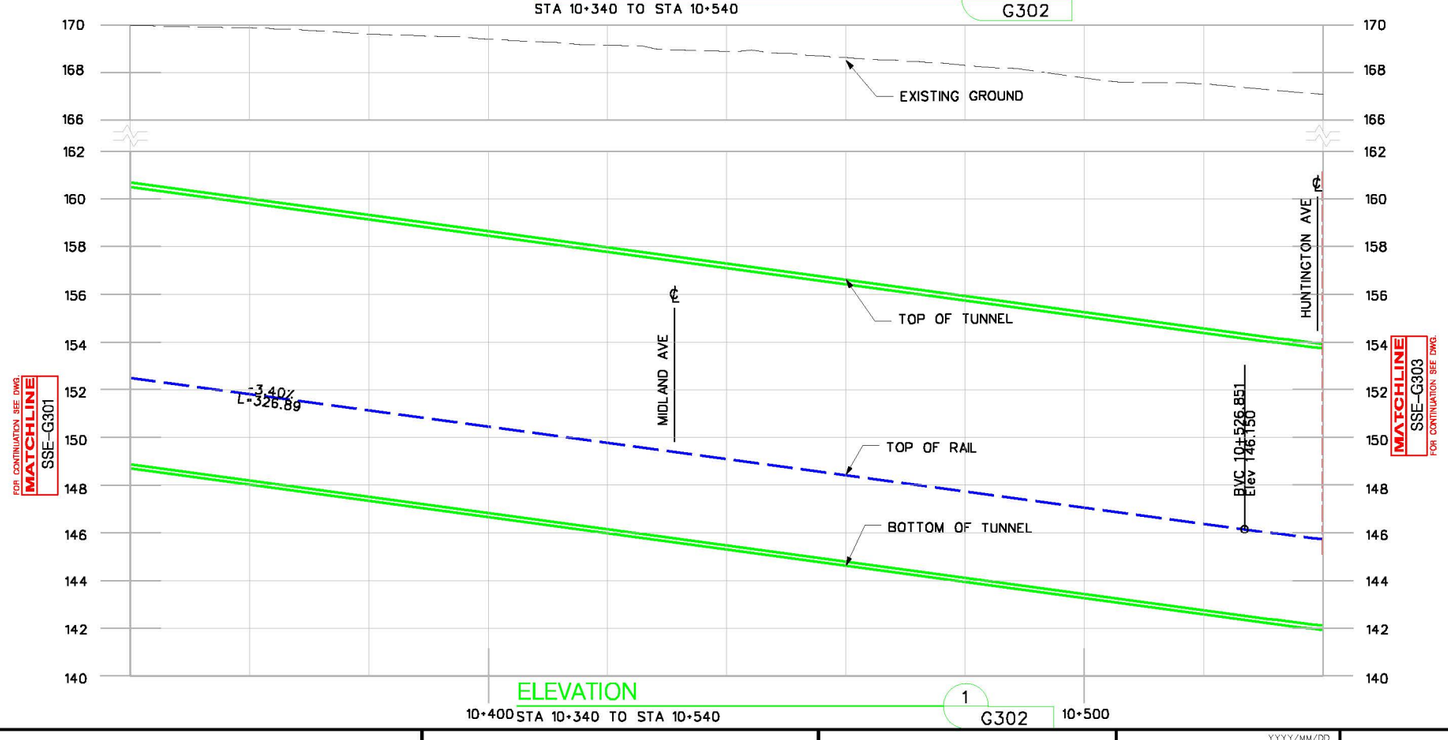

ELEVATION

10+400 STA 10+340 TO STA 10+540 1 G302 10+500

REVISIONS

LEGEND

- STRUCTURE
- ALIGNMENT ℄
- NEW TTC RIGHT-OF-WAY
- TRACK ℄
- EXISTING PROPERTY LINE
- EMERGENCY EXIT BUILDING (EEB)
- TRACTION POWER SUBSTATION

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SCARBOROUGH SUBWAY EXTENSION EA

PLAN AND PROFILE

STA 10+340 TO STA 10+540

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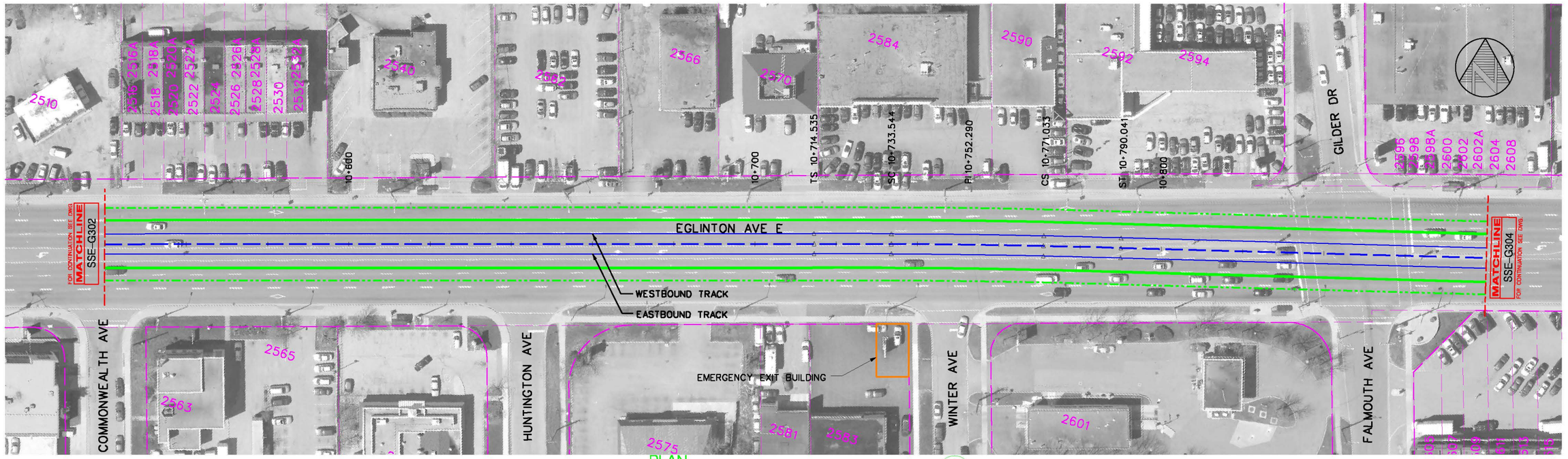

PLAN
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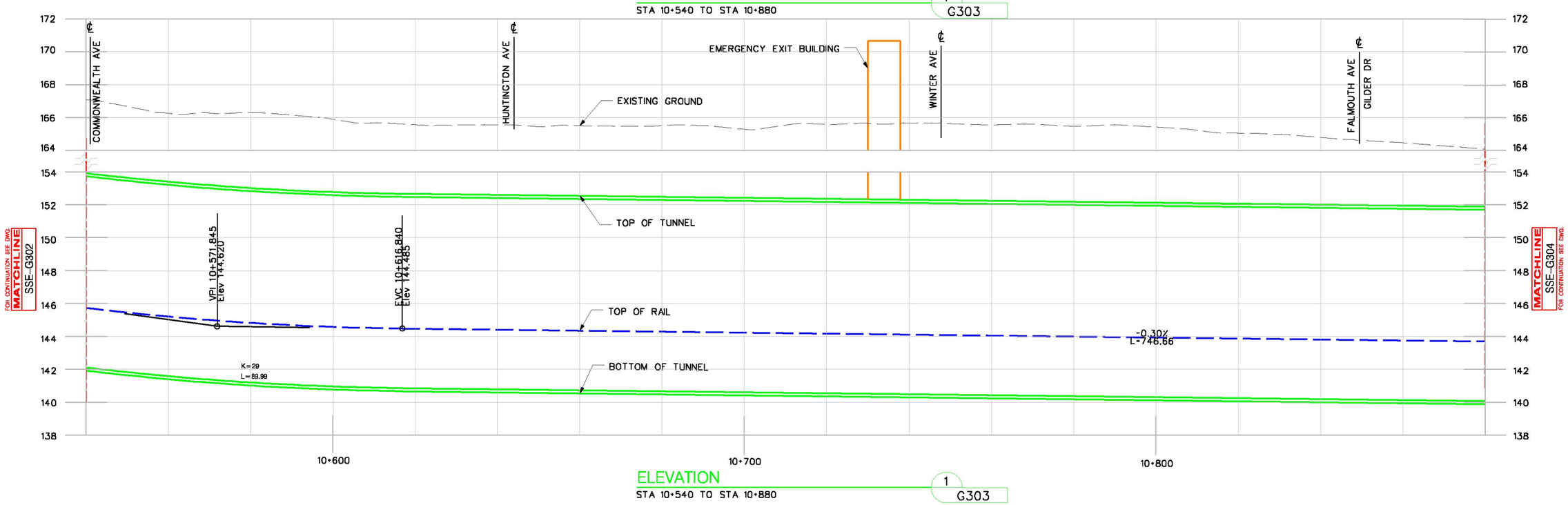

ELEVATION
STA 10+540 TO STA 10+880
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G303

REVISIONS

LEGEND
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- ALIGNMENT ℄
- NEW TTC RIGHT-OF-WAY
- TRACK ℄
- EXISTING PROPERTY LINE
- EMERGENCY EXIT BUILDING (EEB)
- TRACTION POWER SUBSTATION

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SCARBOROUGH SUBWAY EXTENSION EA

PLAN AND PROFILE

STA 10+540 TO STA 10+880

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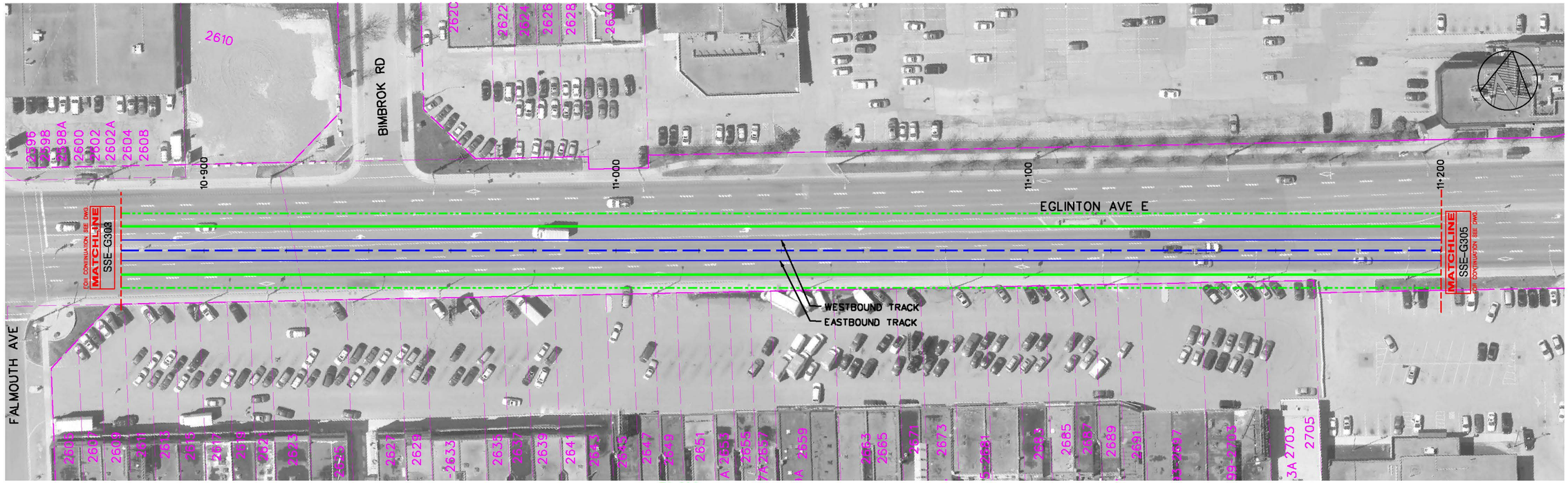

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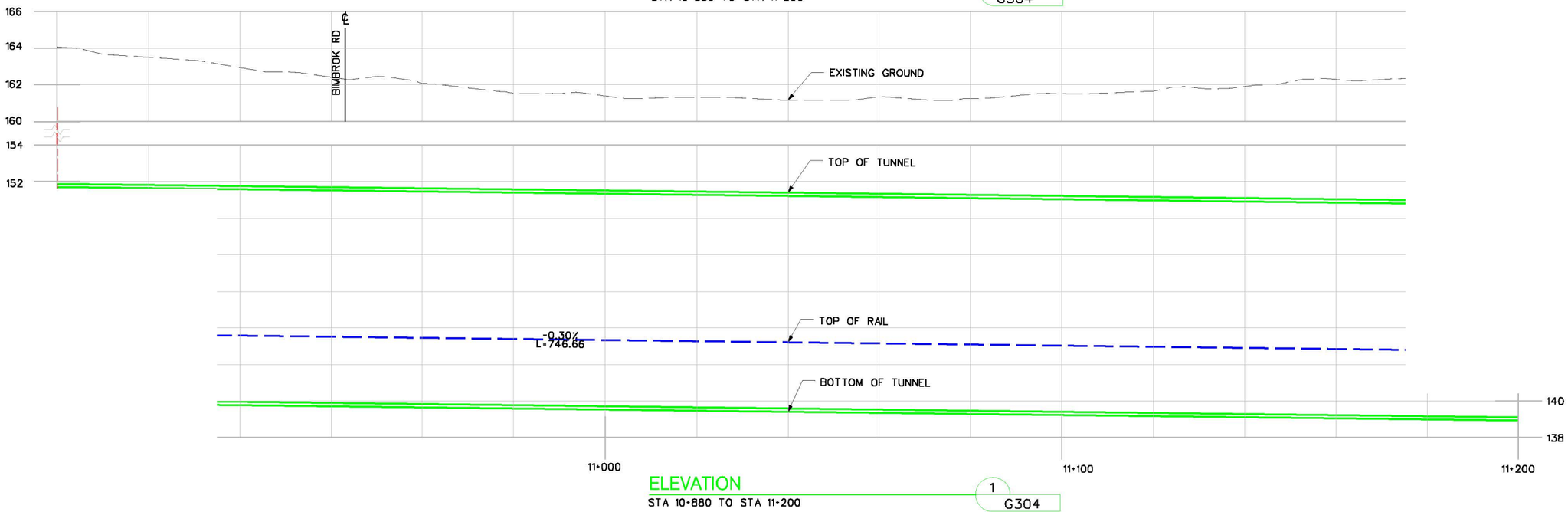

ELEVATION
STA 10+880 TO STA 11+200
1
G304

EMERGENCY EXIT BUILDING (EEB)

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SCARBOROUGH SUBWAY EXTENSION EA

PLAN AND PROFILE

STA 10+880 TO STA 11+200

Plot Date: 3/9/2017

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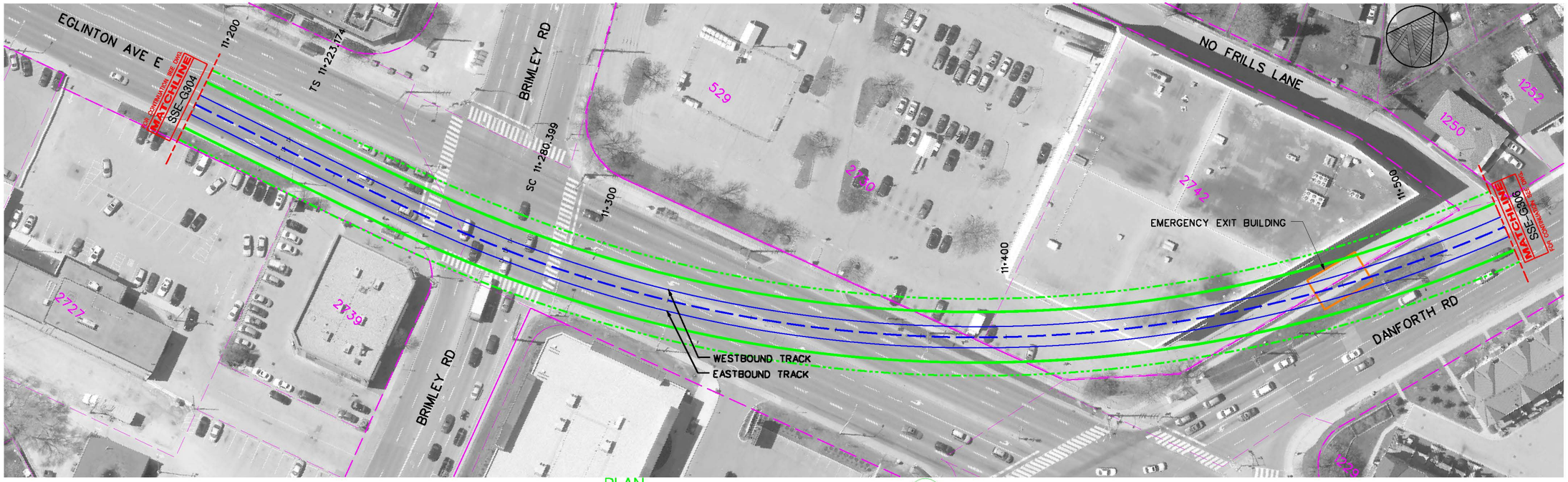

PLAN
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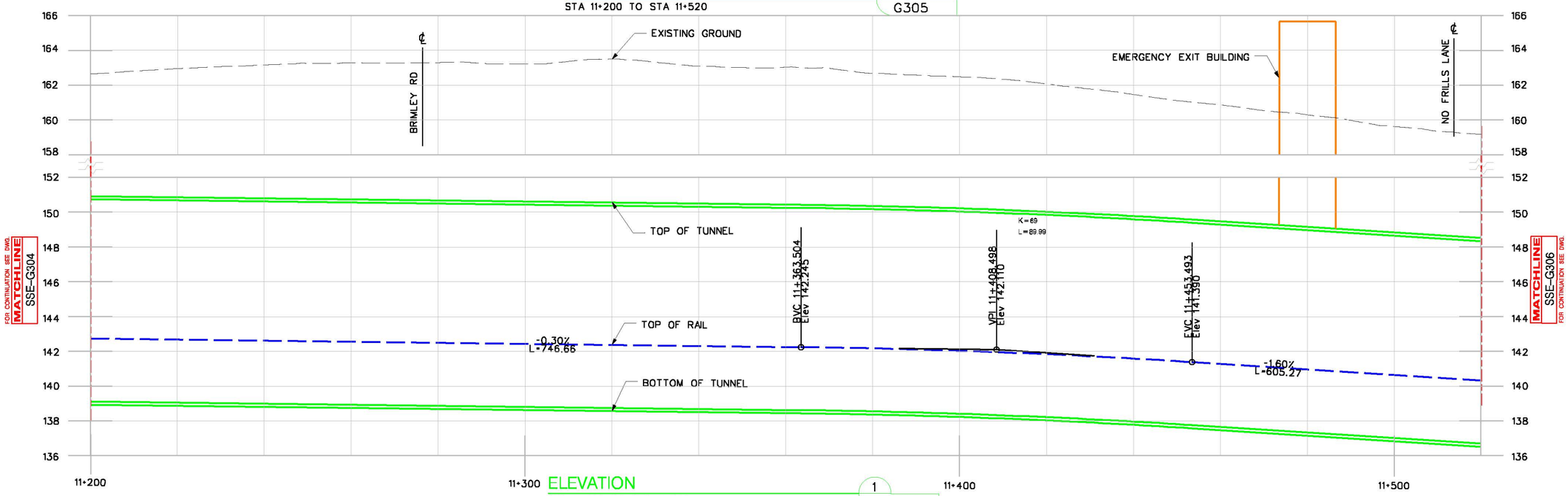

ELEVATION
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G305

REVISIONS

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- ALIGNMENT ℄
- NEW TTC RIGHT-OF-WAY
- TRACK ℄
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SCARBOROUGH SUBWAY EXTENSION EA

PLAN AND PROFILE

STA 11+200 TO STA 11+520

Plot Date: 3/9/2017

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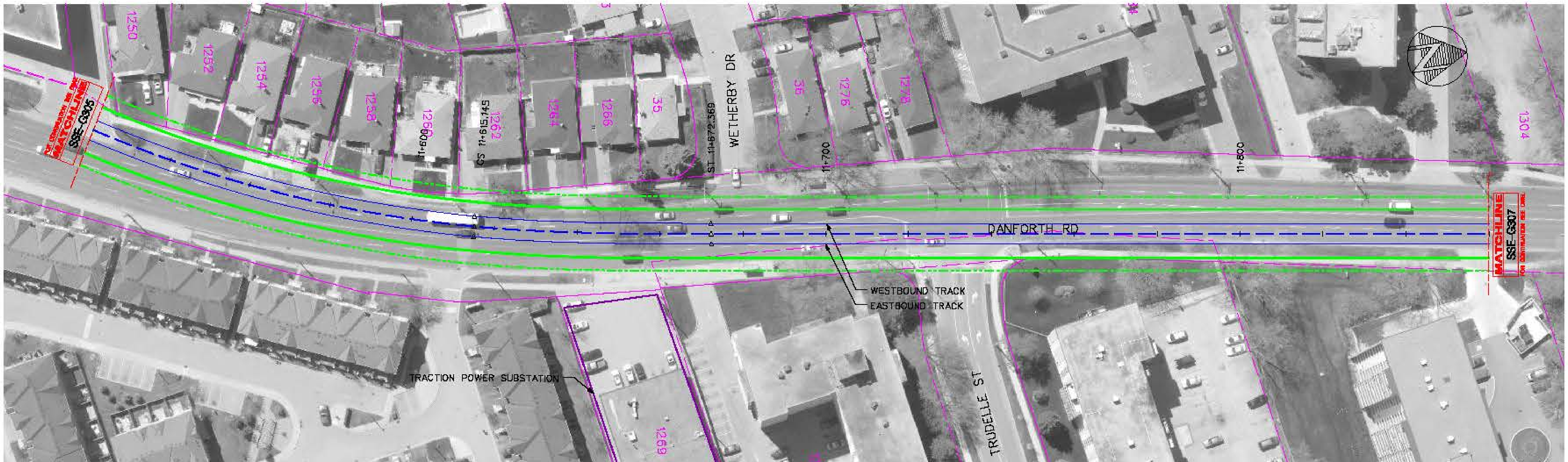

PLAN
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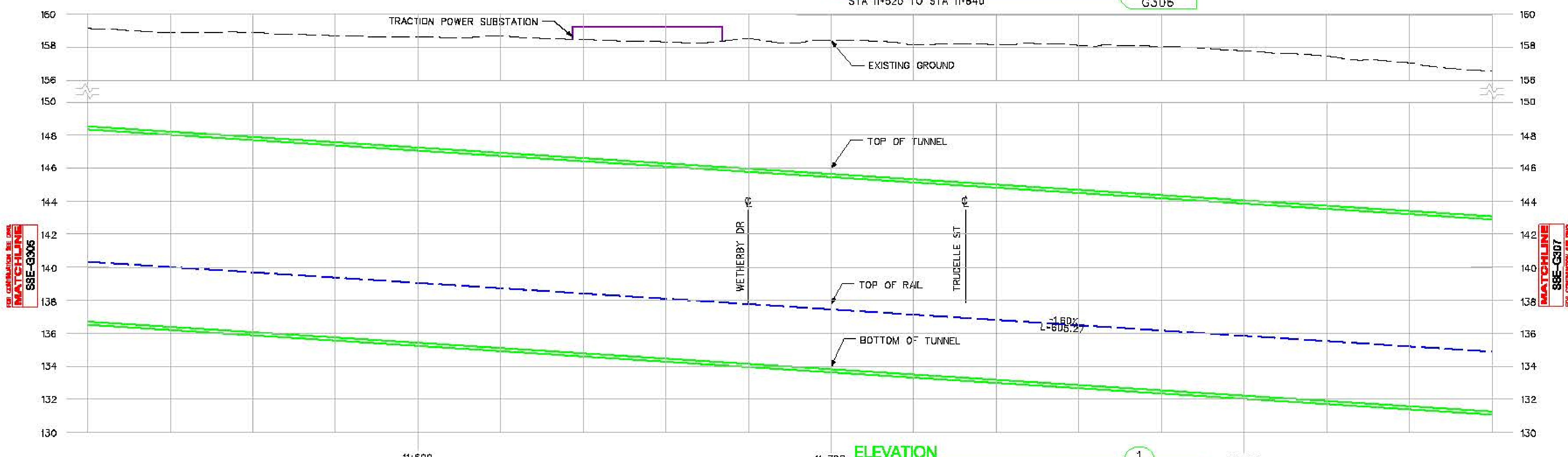

ELEVATION
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1 G306

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- TRACK ℄
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- TRACTION POWER SUBSTATION

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SCARBOROUGH SUBWAY EXTENSION EA

PLAN AND PROFILE

STA 11+520 TO STA 11+860

Plot Date: 7/20/2017

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PLAN
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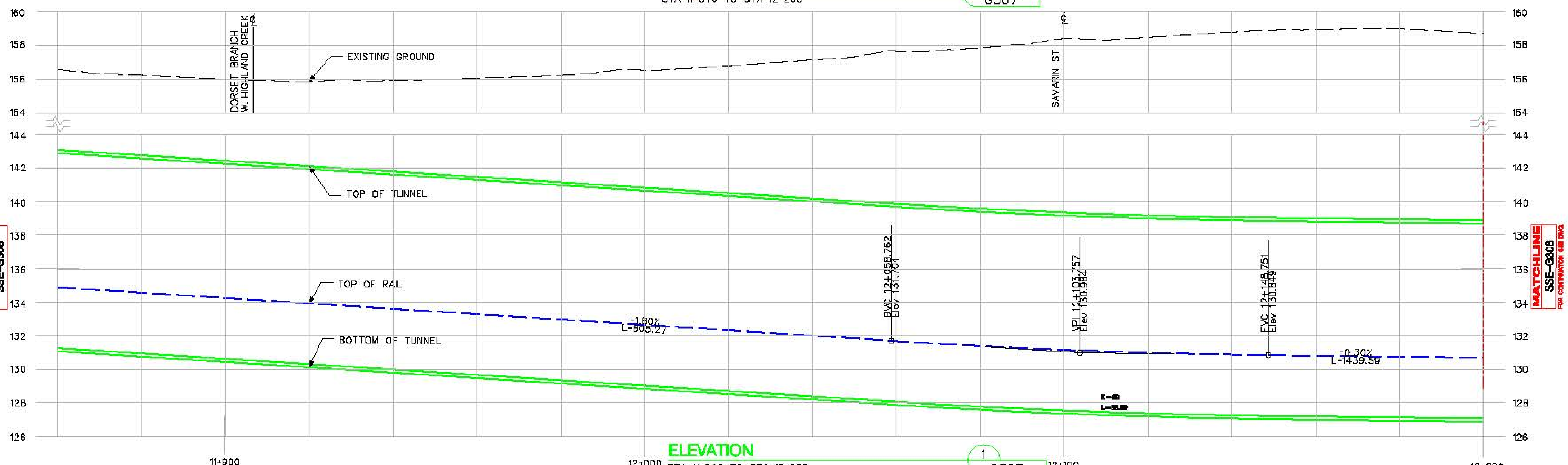

ELEVATION
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REVISIONS

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SCARBOROUGH SUBWAY EXTENSION EA

PLAN AND PROFILE

STA 11+860 TO STA 12+200

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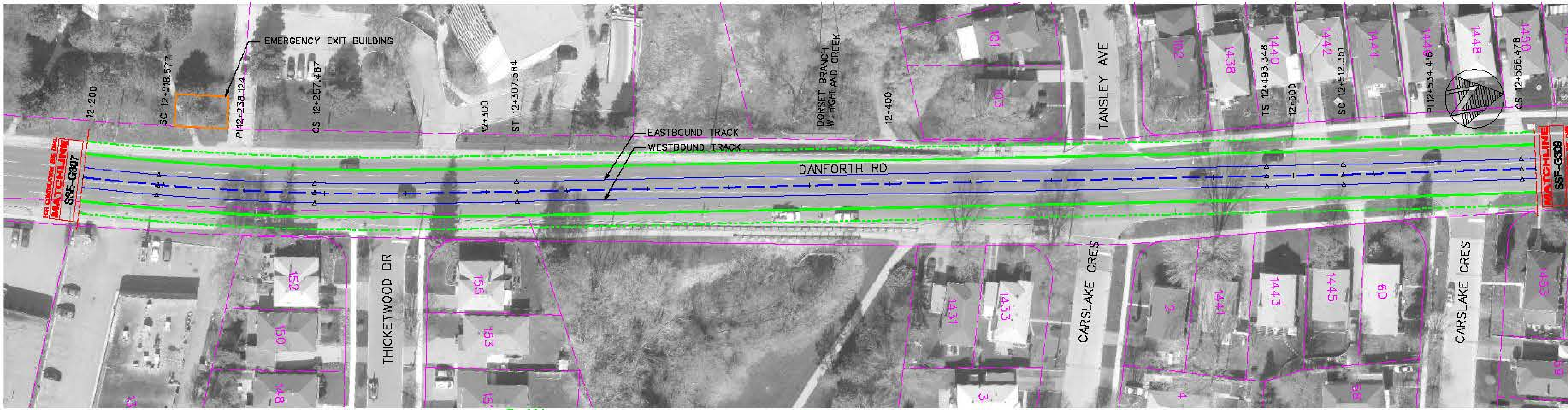

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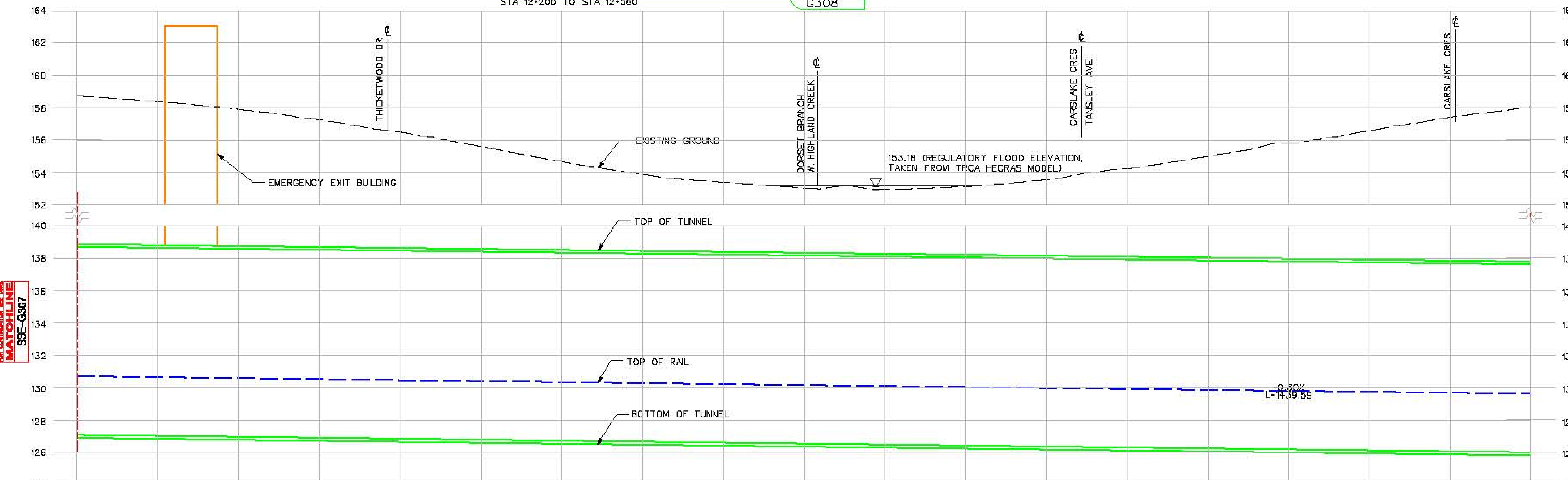

12+200 12+300 12+400 12+500

ELEVATION
STA 12+200 TO STA 12+560
1 G308

REVISIONS

LEGEND

- STRUCTURE
- ALIGNMENT ℄
- NEW TTC RIGHT-OF-WAY
- TRACK ℄
- EXISTING PROPERTY LINE
- EMERGENCY EXIT BUILDING (EEB)
- TRACTION POWER SUBSTATION

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SCARBOROUGH SUBWAY EXTENSION EA

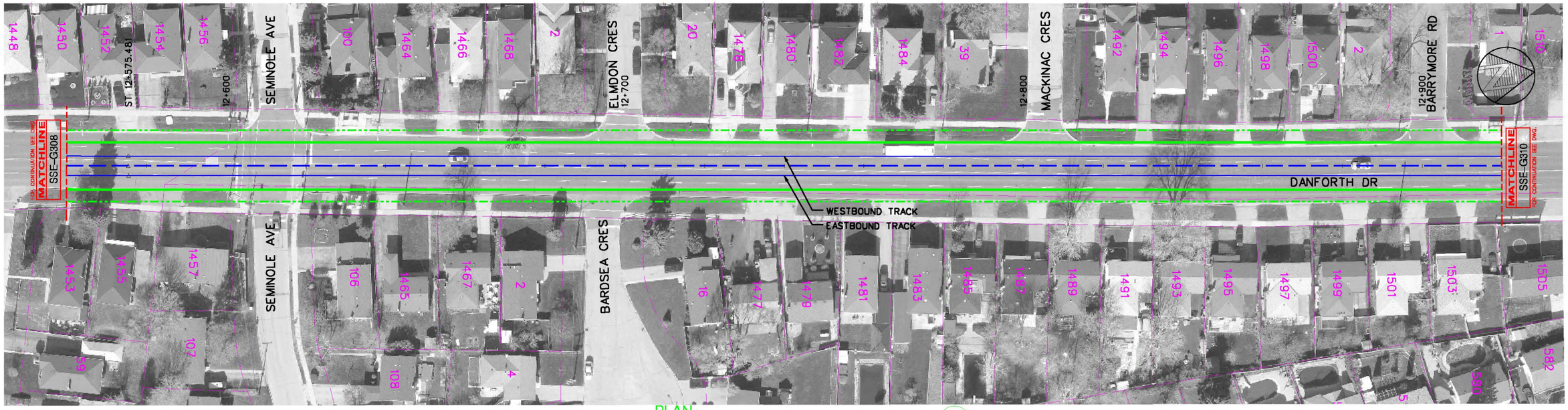
PLAN AND PROFILE

STA 12+200 TO STA 12+560

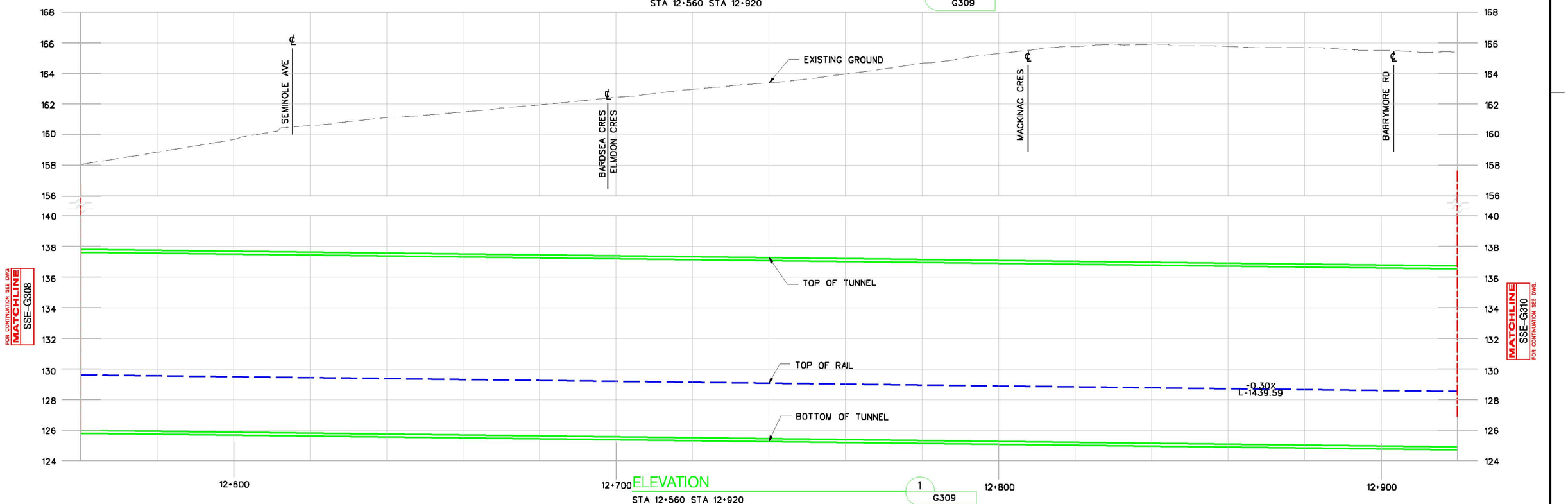
Plot Date: 7/28/2017

TORONTO TRANSIT COMMISSION
ENGINEERING DEPARTMENT

Dwg. No. SSE-G308



PLAN
STA 12+560 STA 12+920
1 G309



ELEVATION
STA 12+560 STA 12+920
1 G309

REVISIONS

LEGEND
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- TRACK ℄
- EXISTING PROPERTY LINE
- EMERGENCY EXIT BUILDING (EEB)
- TRACTION POWER SUBSTATION

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SCARBOROUGH SUBWAY EXTENSION EA

PLAN AND PROFILE

STA 12+560 STA 12+920

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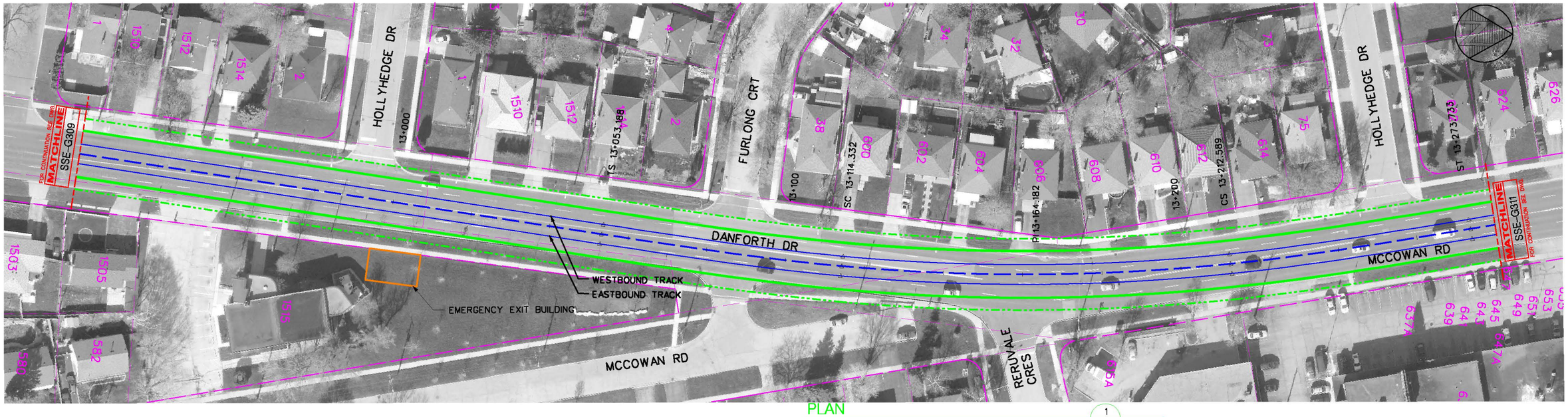

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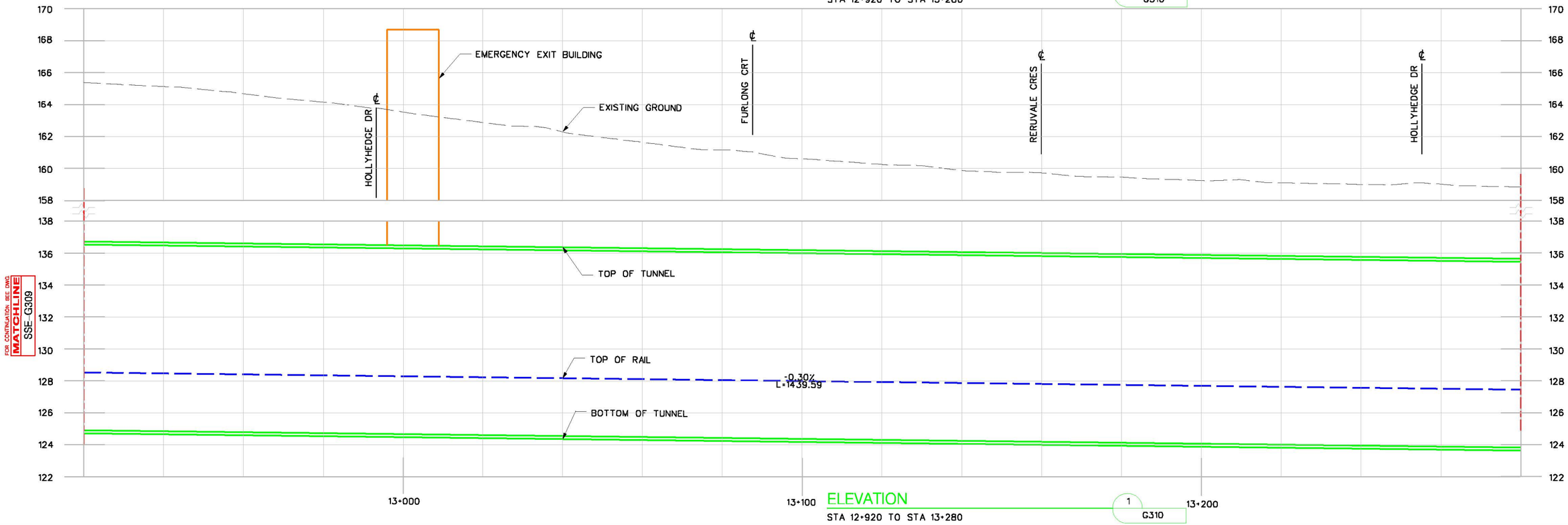
STA 12+920 TO STA 13+280
1 G310



ELEVATION
STA 12+920 TO STA 13+280
1 G310

REVISIONS

LEGEND
- STRUCTURE
- ALIGNMENT ℄
- NEW TTC RIGHT-OF-WAY
- TRACK ℄
- EXISTING PROPERTY LINE
- EMERGENCY EXIT BUILDING (EEB)
- TRACTION POWER SUBSTATION

AECOM

CONCEPTUAL DESIGN
NOT FOR CONSTRUCTION

		YYYY/MM/DD
DRAWN	L. LI	2017/02/28
CHECKED	D.FANG	2017/02/28
CORRECT	D.FANG	2017/02/28

SCALE HOR 0 10 20 30 40m - 1:1000
SCALE VER 0 5 10m - 1:250

SCARBOROUGH SUBWAY EXTENSION EA

PLAN AND PROFILE

STA 12+920 TO STA 13+280

Plot Date: 3/9/2017

TORONTO TRANSIT COMMISSION
ENGINEERING DEPARTMENT

Dwg. No. SSE-G310

Sheet No.

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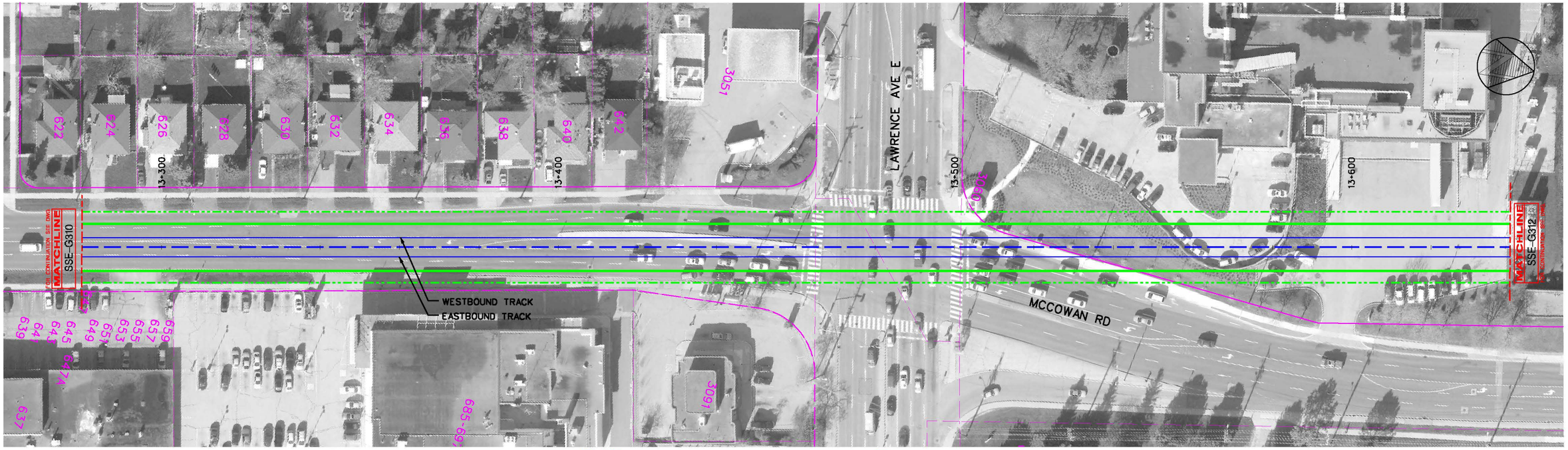
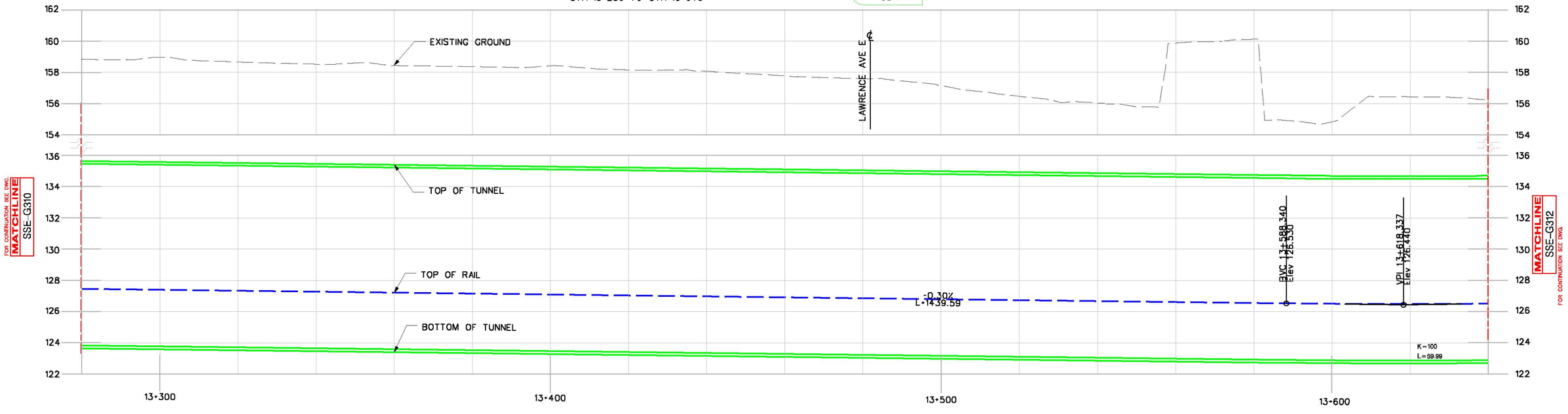
FILENAME:
SHEET No.
DRAWING No.



PLAN
STA 13+280 TO STA 13+640
1
G311



ELEVATION
STA 13+280 TO STA 13+640
1
G311

REVISIONS

LEGEND
- STRUCTURE
- ALIGNMENT ℄
- NEW TTC RIGHT-OF-WAY
- TRACK ℄
- EXISTING PROPERTY LINE
- EMERGENCY EXIT BUILDING (EEB)
- TRACTION POWER SUBSTATION

AECOM

CONCEPTUAL DESIGN
NOT FOR CONSTRUCTION

		YYYY/MM/DD
DRAWN	L. LI	2017/02/28
CHECKED	D.FANG	2017/02/28
CORRECT	D.FANG	2017/02/28

SCALE HOR 0 10 20 30 40m - 1:1000
SCALE VER 0 5 10m - 1:250

SCARBOROUGH SUBWAY EXTENSION EA

PLAN AND PROFILE

STA 13+280 TO STA 13+640

Plot Date: 3/9/2017

TORONTO TRANSIT COMMISSION
ENGINEERING DEPARTMENT

Dwg. No. SSE-G311

Sheet No.

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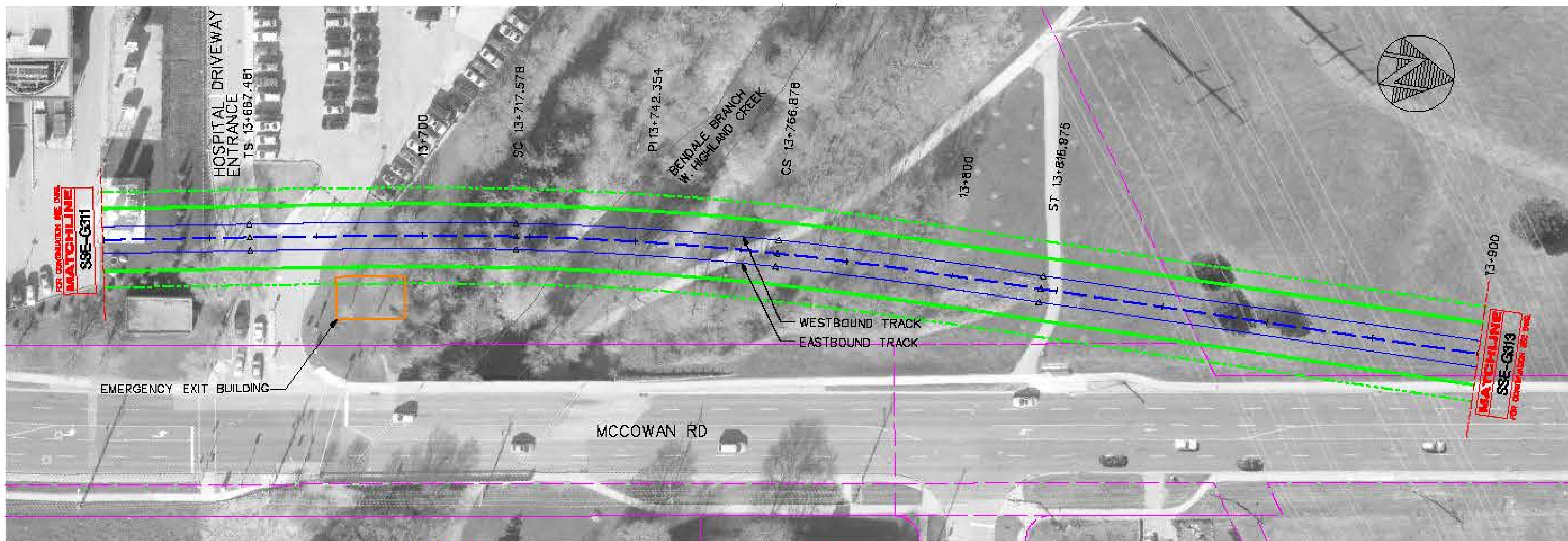
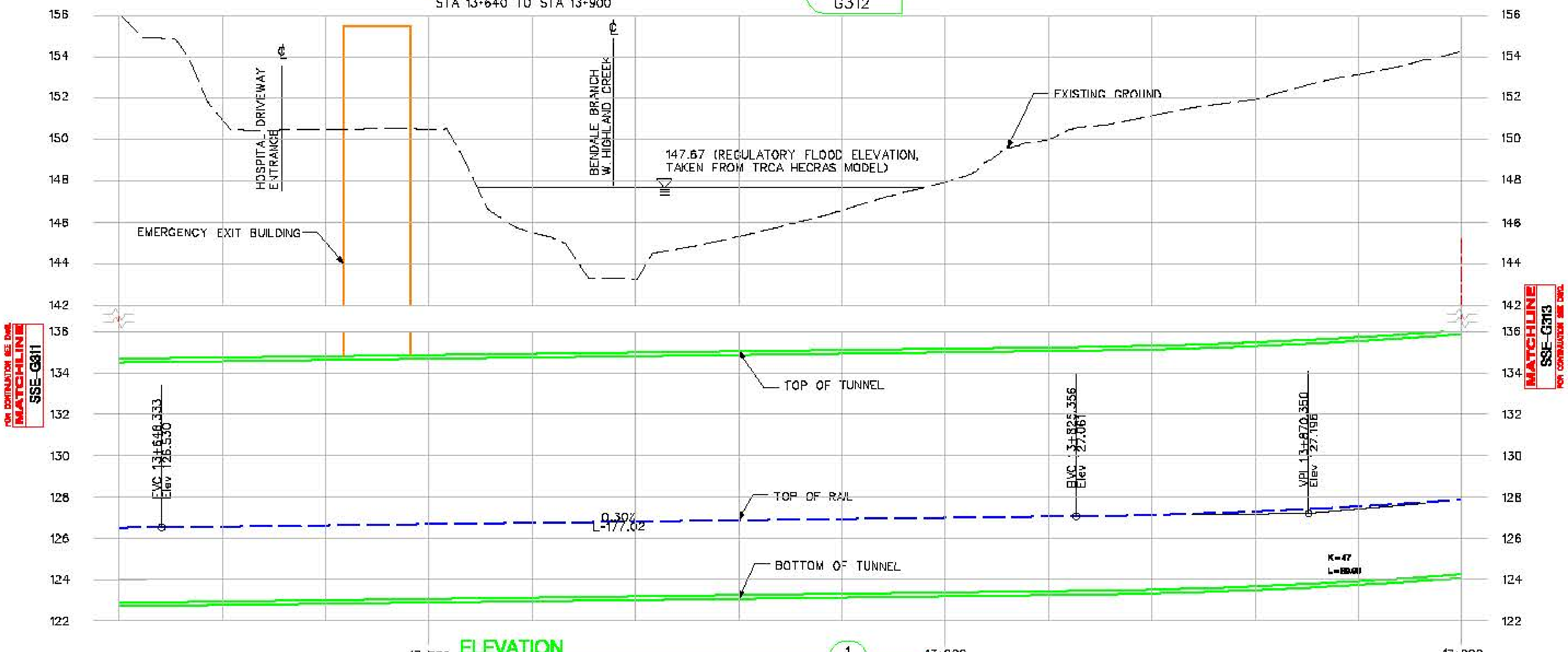


PLAN
STA 13+640 TO STA 13+900
1 G312



ELEVATION
STA 13+640 TO STA 13+900
1 G312

REVISIONS

LEGEND
- STRUCTURE
- ALIGNMENT ℄
- NEW TTC RIGHT-OF-WAY
- TRACK ℄
- EXISTING PROPERTY LINE
- EMERGENCY EXIT BUILDING (EEB)
- TRACTION POWER SUBSTATION

AECOM

CONCEPTUAL DESIGN
NOT FOR CONSTRUCTION

		YYYY/MM/DD
DRAWN	L.U.	2017/02/28
CHECKED	D.FANG	2017/02/28
CORRECT	D.FANG	2017/02/28

SCALE HOR - 1:1000
VER - 1:250

SCARBOROUGH SUBWAY EXTENSION EA

PLAN AND PROFILE

STA 13+640 TO STA 13+900

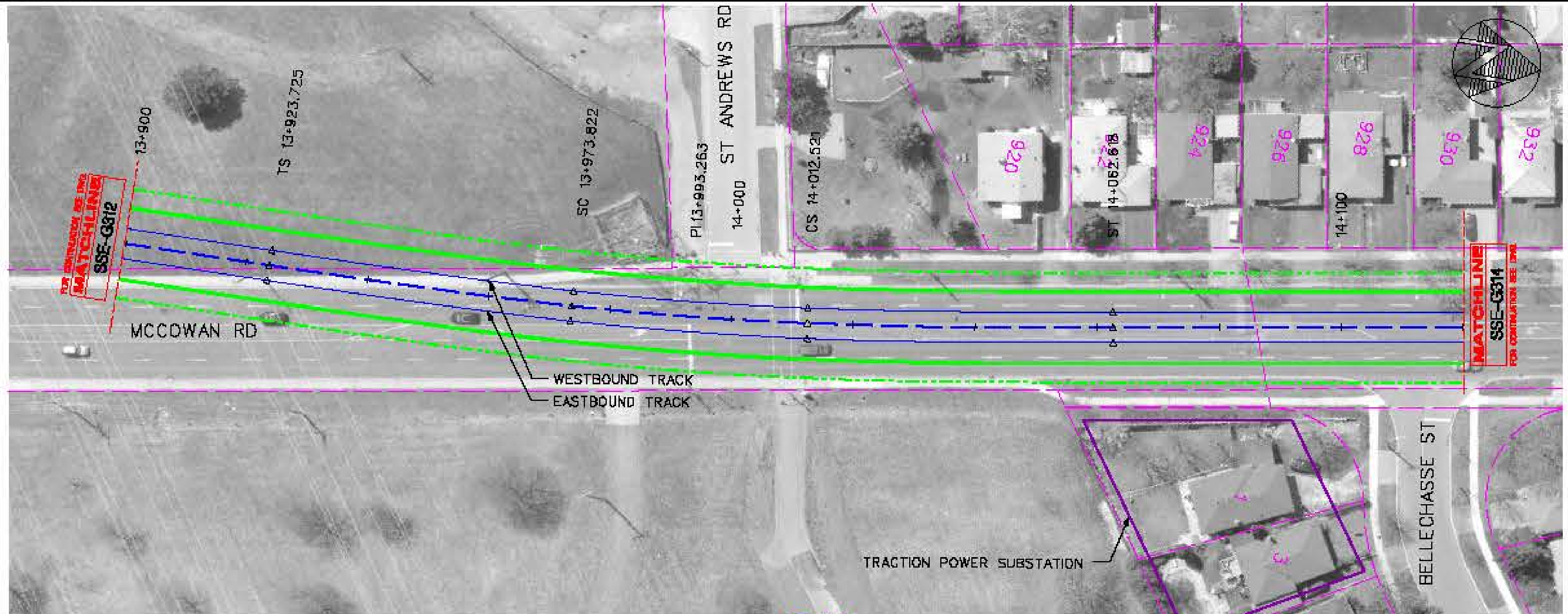
Plot Date: 7/29/2017

TORONTO TRANSIT COMMISSION
ENGINEERING DEPARTMENT

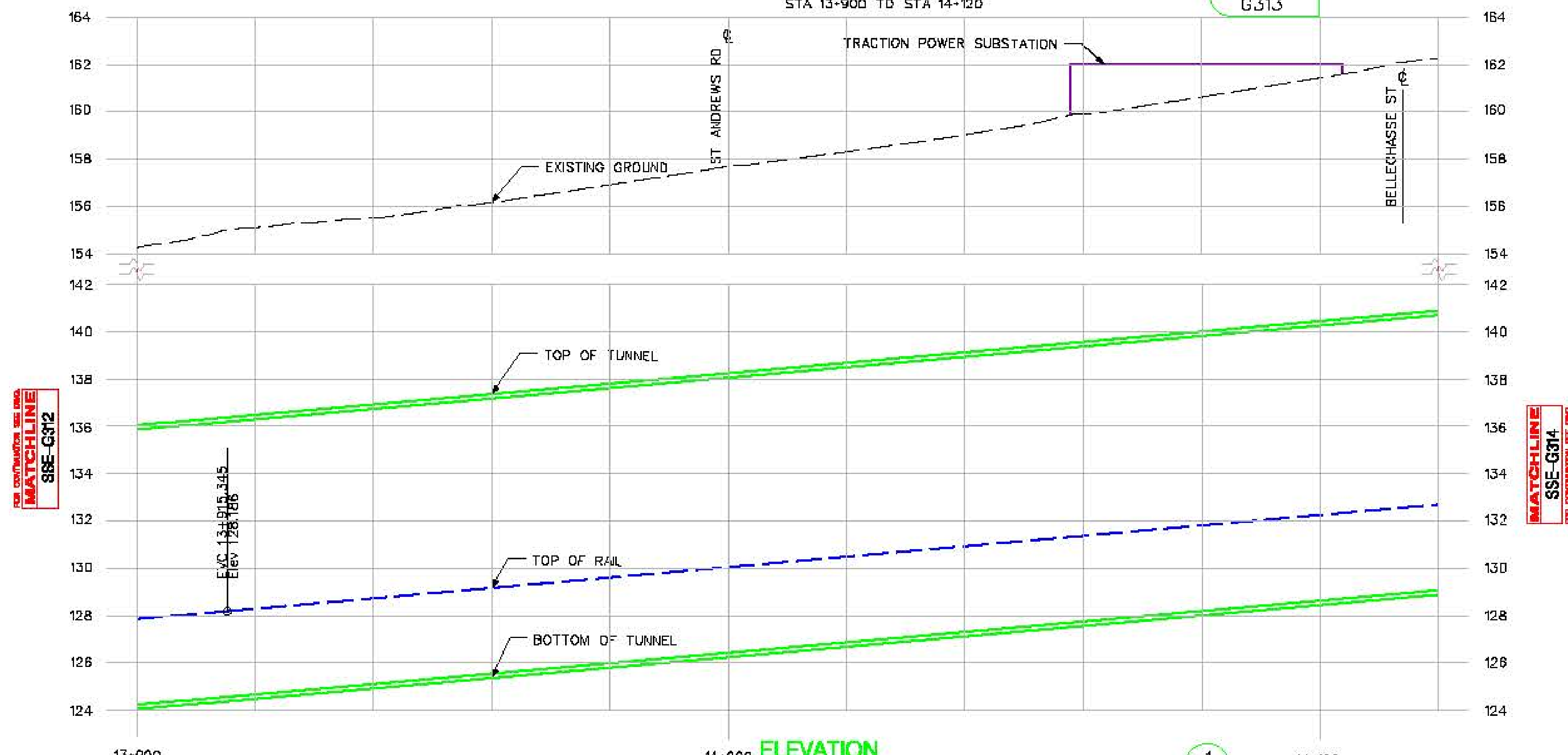
Dwg. No. SSE-G312
Sheet No.

BLDG. REF. No.
FILENAME:
SHEET No.
DRAWING No.

CADD FILE NAME: \\URSToronto.ca\ca.urs\Toronto\Projects\3-33017625-ScarbSubwayExt\05 CADD\05 PAD\URS 5a pln ad18.dgn

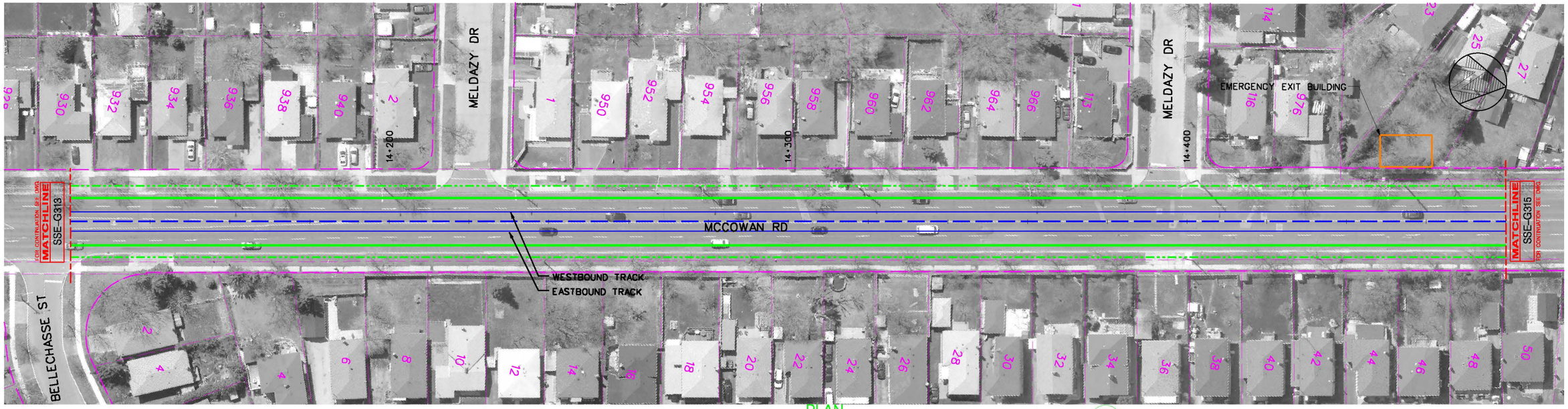


PLAN
STA 13+900 TO STA 14+120
1 G313

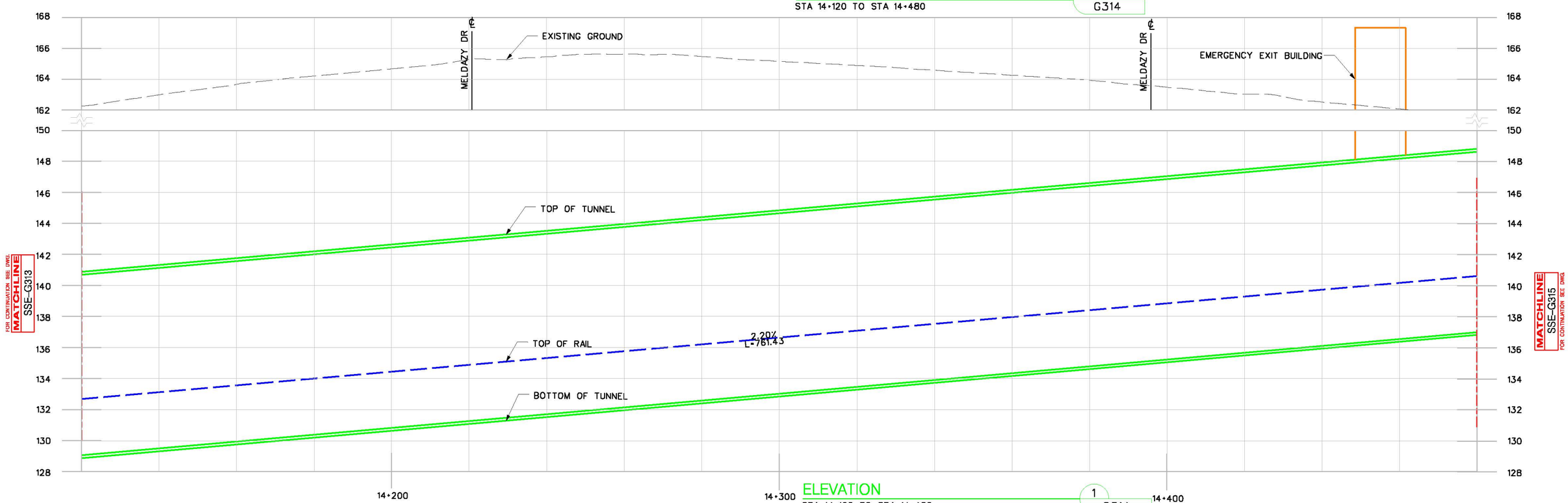


ELEVATION
STA 13+900 TO STA 14+120
1 G313

REVISIONS	LEGEND			CONCEPTUAL DESIGN NOT FOR CONSTRUCTION		SCARBOROUGH SUBWAY EXTENSION EA	Plot Date: 7/20/2017
	STRUCTURE	EMERGENCY EXIT BUILDING (EEB)	AECOM		DRAWN: L.U. 2017/02/28	PLAN AND PROFILE	TORONTO TRANSIT COMMISSION ENGINEERING DEPARTMENT
	ALIGNMENT ℄	TRACTION POWER SUBSTATION			CHECKED: D.FANG 2017/02/28	STA 13+900 TO STA 14+120	Dwg. No. SSE-G313
	NEW TTC RIGHT-OF-WAY				CORRECT: D.FANG 2017/02/28		
	TRACK ℄				SCALE HOR 1:1000 VER 1:250		
	EXISTING PROPERTY LINE						



PLAN
STA 14+120 TO STA 14+480
1
G314



ELEVATION
STA 14+120 TO STA 14+480
1
G314

REVISIONS

LEGEND

- STRUCTURE
- ALIGNMENT ℄
- NEW TTC RIGHT-OF-WAY
- TRACK ℄
- EXISTING PROPERTY LINE
- EMERGENCY EXIT BUILDING (EEB)
- TRACTION POWER SUBSTATION

AECOM

CONCEPTUAL DESIGN
NOT FOR CONSTRUCTION

		YYYY/MM/DD
DRAWN	L. LI	2017/02/28
CHECKED	D.F.ANG	2017/02/28
CORRECT	D.F.ANG	2017/02/28

SCALE HOR 0 10 20 30 40m - 1:1000
VER 0 5 10m - 1:250

SCARBOROUGH SUBWAY EXTENSION EA

PLAN AND PROFILE

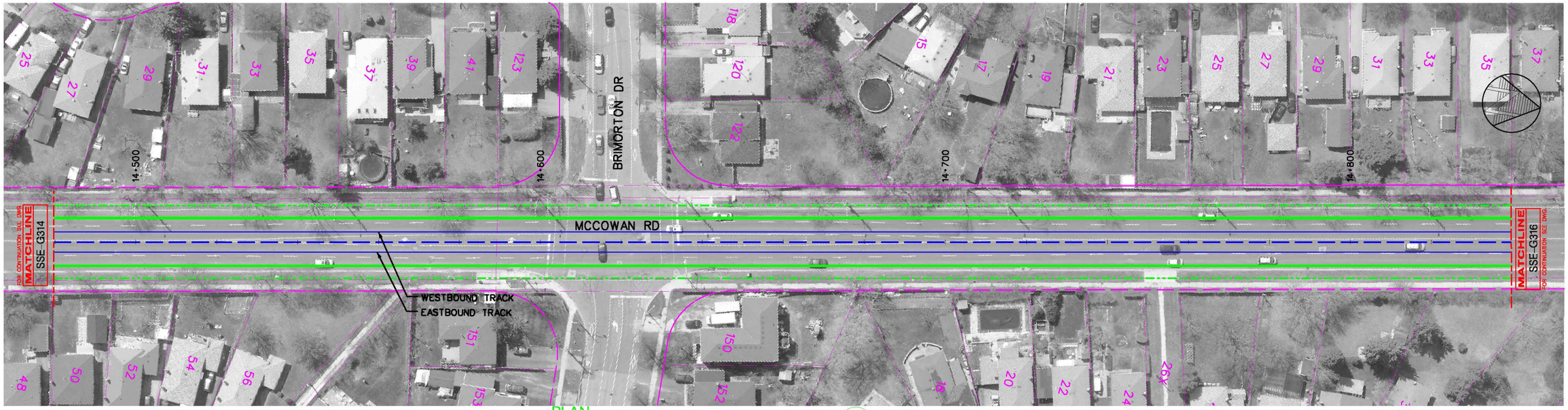
STA 14+120 TO STA 14+480

Plot Date: 3/10/2017

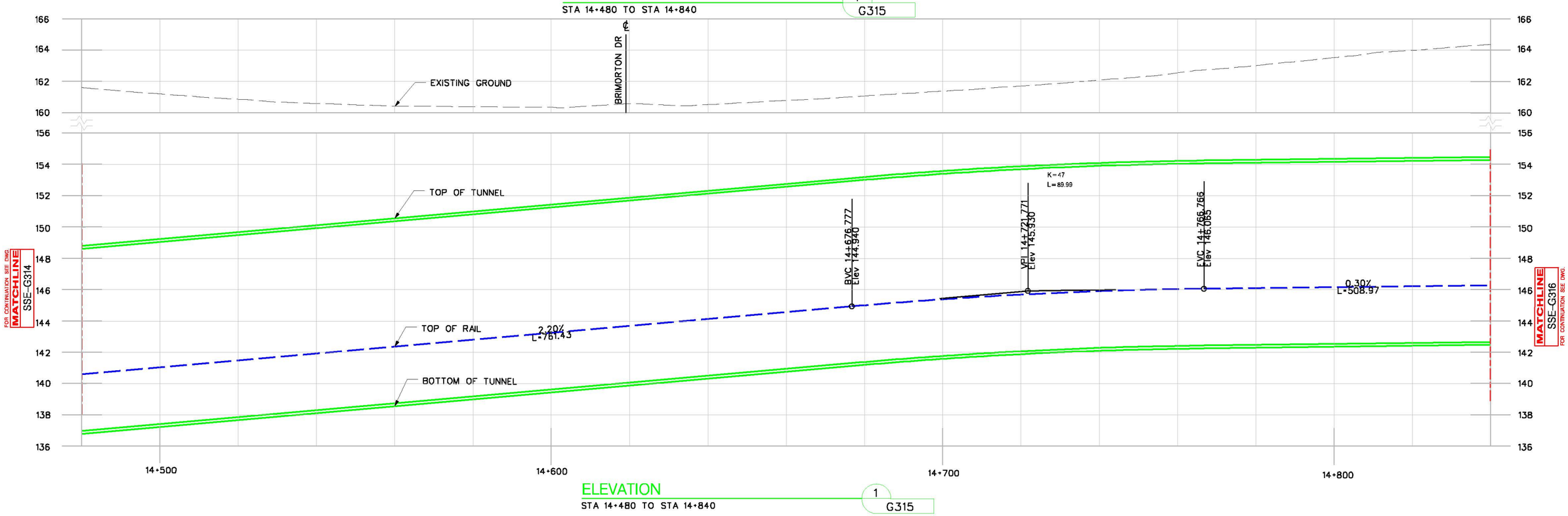
TORONTO TRANSIT COMMISSION
ENGINEERING DEPARTMENT

Dwg. No. SSE-G314

Sheet No.



PLAN
STA 14+480 TO STA 14+840
1
G315



ELEVATION
STA 14+480 TO STA 14+840
1
G315

REVISIONS

LEGEND
- STRUCTURE
- ALIGNMENT ℄
- NEW TTC RIGHT-OF-WAY
- TRACK ℄
- EXISTING PROPERTY LINE
- EMERGENCY EXIT BUILDING (EEB)
- TRACTION POWER SUBSTATION

AECOM

CONCEPTUAL DESIGN
NOT FOR CONSTRUCTION

		YYYY/MM/DD
DRAWN	L. LI	2017/02/28
CHECKED	D.FANG	2017/02/28
CORRECT	D.FANG	2017/02/28

SCALE HOR 0 10 20 30 40m - 1:1000
VER 0 5 10m - 1:250

SCARBOROUGH SUBWAY EXTENSION EA

PLAN AND PROFILE

STA 14+480 TO STA 14+840

Plot Date: 3/02/2017

TORONTO TRANSIT COMMISSION
ENGINEERING DEPARTMENT

Dwg. No. SSE-G315

Sheet No.

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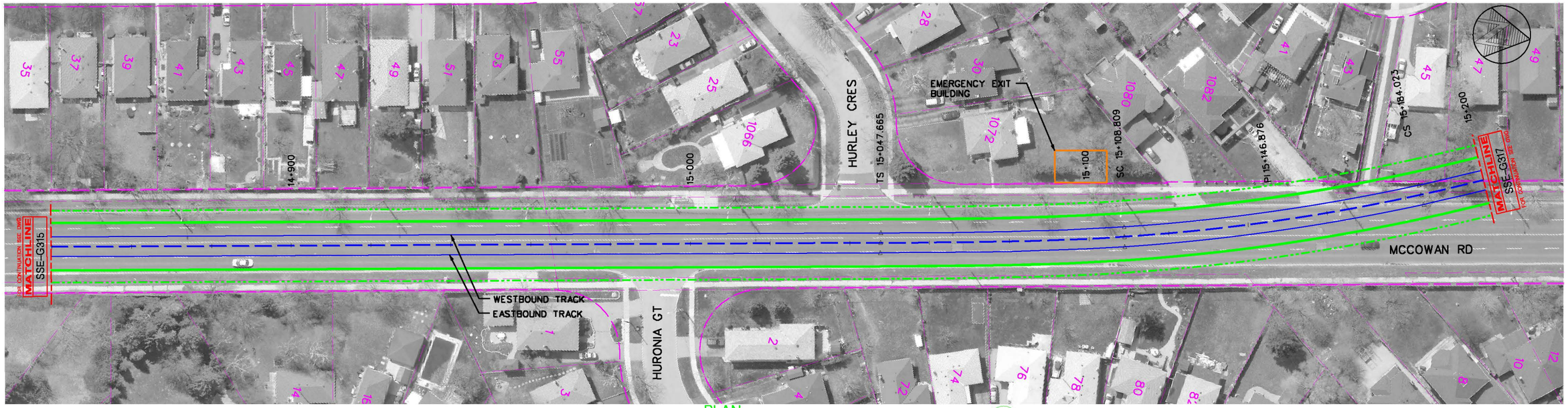
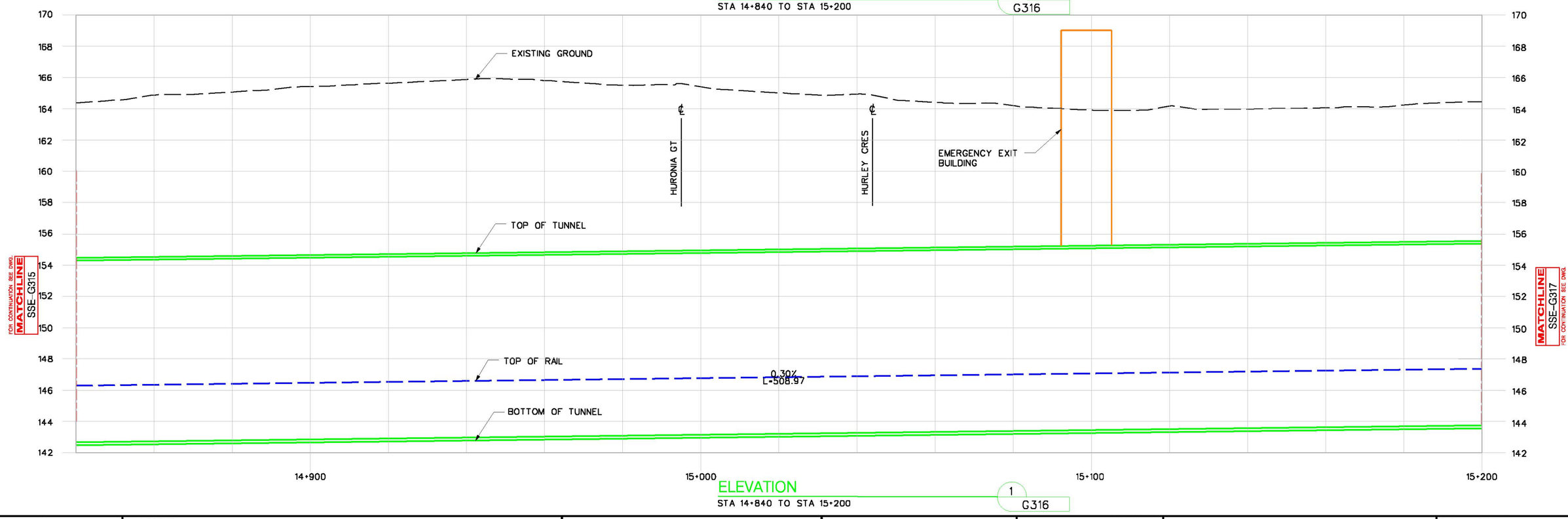


PLAN

STA 14+840 TO STA 15+200

1 / G316



ELEVATION

STA 14+840 TO STA 15+200

1 / G316

REVISIONS

DRAWING No.

SHEET No.

FILENAME:

LEGEND

- STRUCTURE
- ALIGNMENT ℄
- NEW TTC RIGHT-OF-WAY
- TRACK ℄
- EXISTING PROPERTY LINE
- EMERGENCY EXIT BUILDING (EEB)
- TRACTION POWER SUBSTATION

AECOM

CONCEPTUAL DESIGN

NOT FOR CONSTRUCTION

		YYYY/MM/DD
DRAWN	L. LI	2017/02/28
CHECKED	D. FANG	2017/02/28
CORRECT	D. FANG	2017/02/28

SCALE HOR 0 10 20 30 40m - 1:1000

VER 0 5 10m - 1:250

SCARBOROUGH SUBWAY EXTENSION EA

PLAN AND PROFILE

STA 14+840 TO STA 15+200

Plot Date: 3102017

TORONTO TRANSIT COMMISSION
ENGINEERING DEPARTMENT

Dwg. No. SSE-G316

Sheet No.

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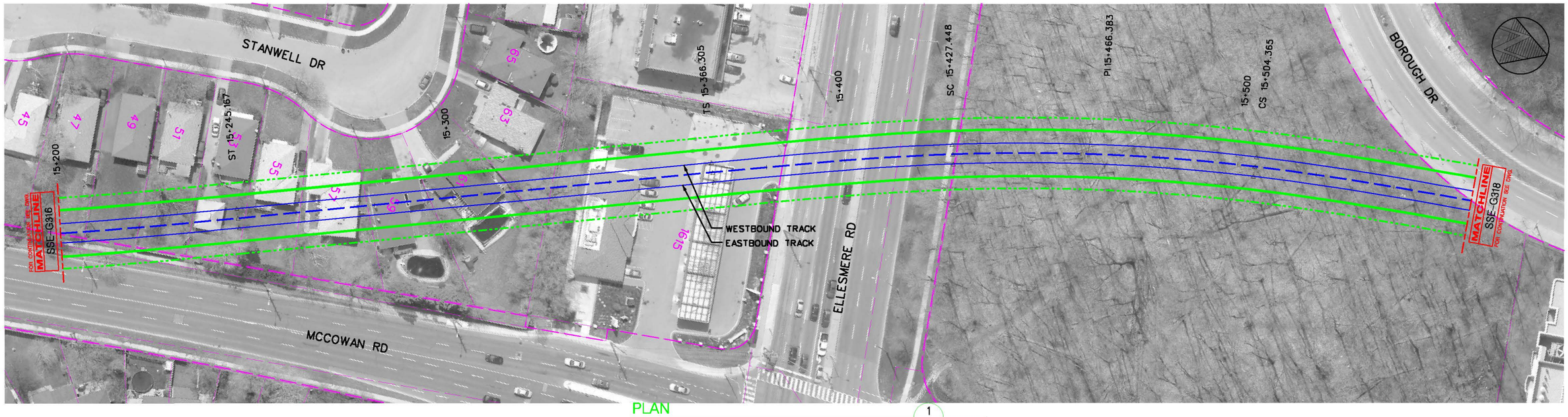
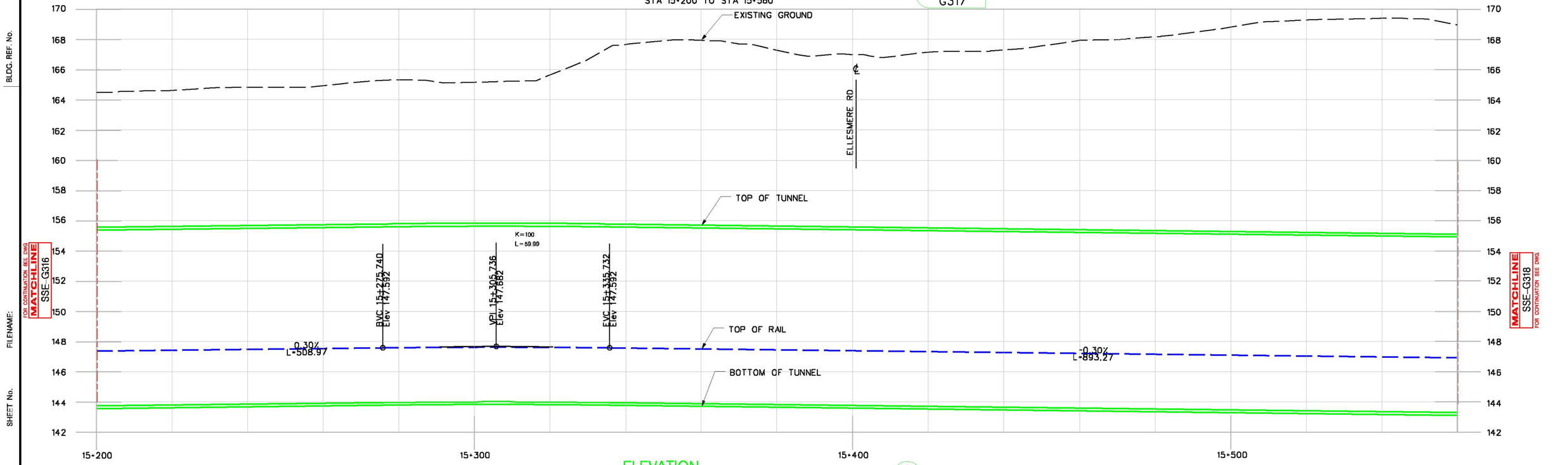


PLAN
STA 15+200 TO STA 15+560
1
G317



ELEVATION
STA 15+200 TO STA 15+560
1
G317

REVISIONS

LEGEND
- STRUCTURE
- ALIGNMENT
- NEW TTC RIGHT-OF-WAY
- TRACK
- EXISTING PROPERTY LINE
- EMERGENCY EXIT BUILDING (EEB)
- TRACTION POWER SUBSTATION

AECOM

CONCEPTUAL DESIGN
NOT FOR CONSTRUCTION

		YYYY/MM/DD
DRAWN	L. LI	2017/02/28
CHECKED	D. FANG	2017/02/28
CORRECT	D. FANG	2017/02/28

SCALE 0 10 20 30 40m HOR - 1:1000
0 5 10m VER - 1:250

SCARBOROUGH SUBWAY EXTENSION EA

PLAN AND PROFILE

STA 15+200 TO STA 15+560

Plot Date: 3/10/2017

TORONTO TRANSIT COMMISSION
ENGINEERING DEPARTMENT

Dwg. No. SSE-G317

Sheet No.

BLDG. REF. No.
FILENAME:
SHEET No.
DRAWING No.

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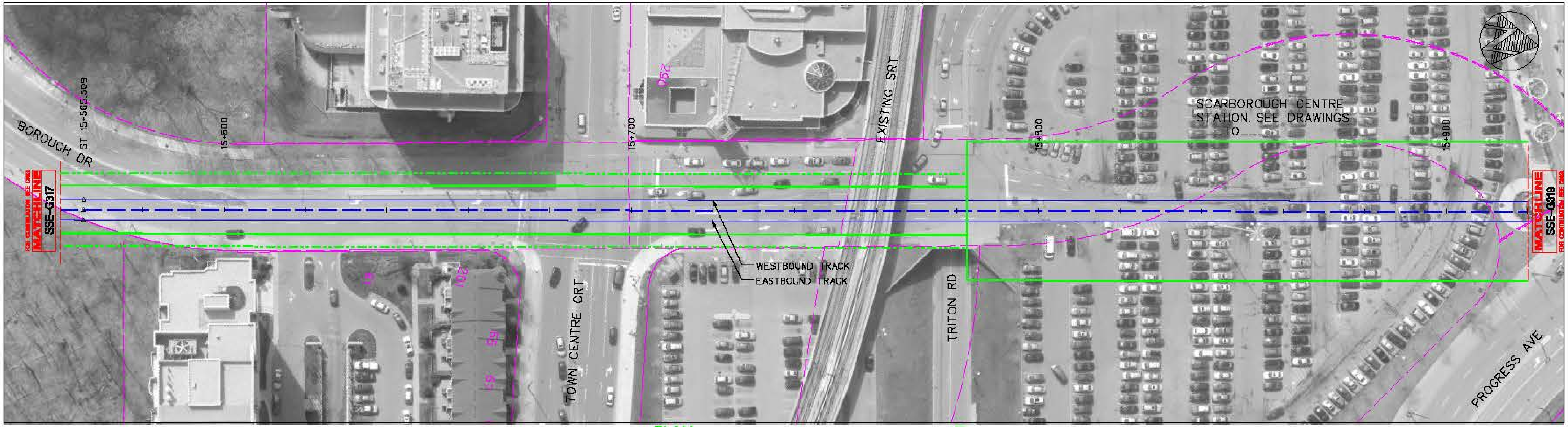
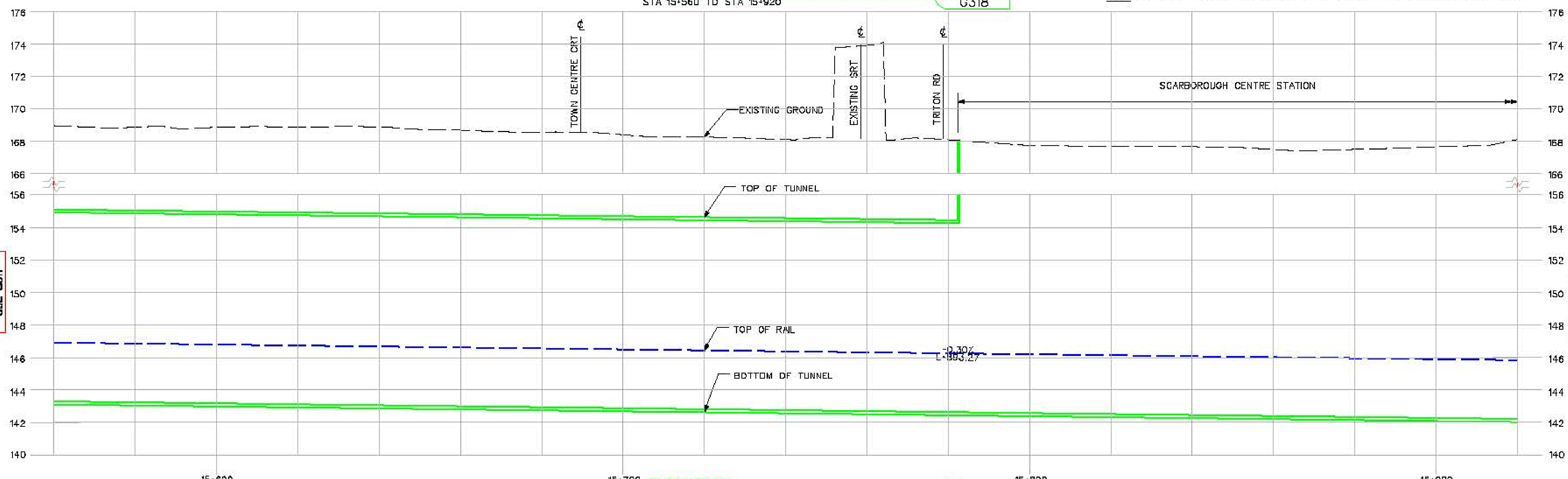


PLAN
STA 15+560 TO STA 15+920
1 G318

NOTE: TRACTION POWER SUBSTATION FACILITY IS LOCATED WITHIN STATION BUILDING.



ELEVATION
STA 15+560 TO STA 15+920
1 G318

REVISIONS

LEGEND
- STRUCTURE
- ALIGNMENT
- NEW TTC RIGHT-OF-WAY
- TRACK
- EXISTING PROPERTY LINE
- EMERGENCY EXIT BUILDING (EEB)
- TRACTION POWER SUBSTATION

AECOM

CONCEPTUAL DESIGN
NOT FOR CONSTRUCTION

		YYYY/MM/DD
DRAWN	C.LI	2017/02/28
CHECKED	D. EANG	2017/02/28
CORRECT	D. EANG	2017/02/28

SCALE HOR 1:1000
VER 1:250

SCARBOROUGH SUBWAY EXTENSION EA

PLAN AND PROFILE

STA 15+560 TO STA 15+920

Plot Date: 2/3/2017

TORONTO TRANSIT COMMISSION
ENGINEERING DEPARTMENT

Dwg. No. SSE-G318

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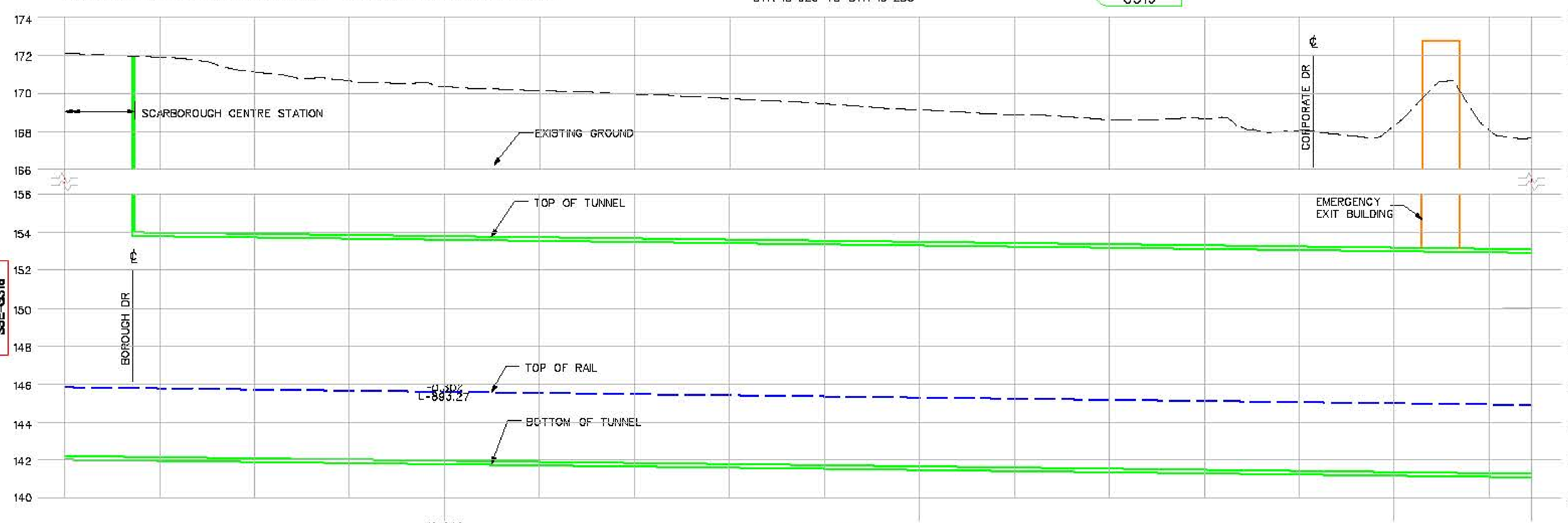
NOTE: TRACTION POWER SUBSTATION FACILITY IS LOCATED WITHIN STATION BUILDING.

PLAN

STA 15+920 TO STA 16+230

1 G319



ELEVATION

STA 15+920 TO STA 16+230

1 G319

REVISIONS

LEGEND

- STRUCTURE
- ALIGNMENT
- NEW TTC RIGHT-OF-WAY
- TRACK
- EXISTING PROPERTY LINE
- EMERGENCY EXIT BUILDING (EEB)
- TRACTION POWER SUBSTATION

AECOM

CONCEPTUAL DESIGN
NOT FOR CONSTRUCTION

		YYYY/MM/DD
DRAWN	L.LI	2017/02/28
CHECKED	D. EANG	2017/02/28
CORRECT	D. EANG	2017/02/28

SCALE HOR - 1:1000
VER - 1:250

SCARBOROUGH SUBWAY EXTENSION EA

PLAN AND PROFILE

STA 15+920 TO STA 16+229.081

Plot Date: 7/20/2017

TORONTO TRANSIT COMMISSION
ENGINEERING DEPARTMENT

Dwg. No. SSE-G319

Sheet No.