

Canadian Pacific Railway Technical Standards Engineering Services

Guidelines for excavations on CPR property

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1. Introduction

The purpose of this document is to assure the safety of rail operations and personnel, during the process of excavation on or near Canadian Pacific Railway (CPR) right of way and specifically adjacent to CPR tracks. It is intended to guide the proponent, their excavation contractor and CPR in screening, planning, designing and approving applications for geotechnical approval of proposed excavation near or on CPR property. The goal of the protocol is to:

- 1.1 Provide safe track conditions during and after excavation.
- 1.2 Set out specifications and procedures to reduce problems during excavation and the intended service life of the excavation.
- 1.3 Specify minimum engineering standards.
- 1.4 Assure adequate geotechnical investigation and engineering review has been completed to achieve the above objectives.
- 1.5 Allow timely processing of the excavation approvals.

The following protocol is independent of the requirements for assessing the structural components of the temporary shoring or track support. A separate approval from CPR's structural group is also required where applicable.

Geotechnical approval of a proposed excavation by CPR in no way warrants the applicability of the construction method to the expected ground conditions nor does it warrant the suitability of the ground conditions for the proposed method of excavation by the proponent. CPR requires that all designs, analysis be reviewed by a qualified geotechnical engineer. CPR does not take any responsibility for the suitability of the construction method or warrantee the ground conditions. CPR geotechnical approval of a specific design is based on available information the proposed excavation and design addresses the railway's needs. With all third party work on right of way, CPR will not attract any liability because of its approval of a specific design. As a result, CPR does not provide recommendations, direction or minimum standards to the proponent or their contractor. CPR insists that the proponent provides adequate documentation identifying the geotechnical engineer of record and the components of the project for which they are responsible.

2. Emergencies

In the event of any occurrence that does or could pose a hazard to rail traffic or the public, contact Canadian Pacific Railway at 1-800-716-9132.

3. General Terminology

- 3.1 The gauge of a track is the distance between the sides of the heads of opposite sides measured 5/8" below the top of the rails. The gauge of tangent and curved track up to 12° is 4' – 8½".
- 3.2 The center line of track is defined as an imaginary line dividing the gauge into two equal parts. The clearances for structures are measured parallel and at right angles to the plane of the center line of track. The minimum clearance envelope for structure is shown in Figure 1.

- 3.3** Base of Rail (BOR) is the bottom surface of the rail and is frequently used as a local datum from which vertical measurements are referenced. If an external datum is utilized the elevation of the BOR will be provided.
- 3.4** The “zone of potential train loading” (ZPTL) is defined as the area under the track and within a 1V : 1.5H zone extending down from a point at the level of the BOR and 2 m from the center line of the track as shown in Figure 1.

4. Process

To provide the appropriate level of engineering review of a specific proposal and allow timely processing of applications, the geotechnical review has been divided into two processes.

1. The crest of excavation line is more than 3 m from the nearest center line of track and more than 10 m measuring at right angles from the adjacent structures, turnout and signals and will not encroach onto the ZPTL.
2. The crest of excavation line is either within 3 m measuring from the nearest center line of track or within 10 m from the closest structures, turnout and signals and will encroach onto the ZPTL.

5. General Requirements

- 5.1** All proposed excavation proposal will be under the signature of a locally registered professional engineer. The objective here is to ensure a registered professional/firm or organization is given the responsibility to assess the site and take responsibility to ensure the proposal is appropriate for the site conditions. This may be in addition to the requirements for the proposal to be signed by a geotechnical and or structural engineer.
- 5.2** Applications to meet current regulatory and industry criteria for structural capacity, etc.
- 5.3** The application will include a construction plan that specifies the terms and conditions for execution of the work, including assignment of responsibility. The proponent of the excavation is responsible to the railway and must ensure the work is executed in accordance with the terms of the proposal.

An excavation proposal will be accompanied by at least the following three drawings showing the features indicated in true scale.

- 5.3.1. Plan of the proposed excavation under or above the track as shown in Figure 2 – This drawing will show the following features:
- 5.3.1.1 The location of the excavation referencing identifiable landmarks including the mileage and subdivision of the proposed crossing as per the CPR subdivision naming and mileage convention. The proponent can obtain the mileage and subdivision information from the CPR Real Estates Group.
 - 5.3.1.2 The excavation centerline, size and limits;
 - 5.3.1.3 Any adjacent structures, signals, switches;
 - 5.3.1.4 The location of the ditch line and any breaks in slope;
 - 5.3.1.5 The location of any boreholes or test pits; and
 - 5.3.1.6 The location of all tracks.
- 5.3.2 Profile of the track and the proposed excavation parallel to the center line of the track as shown in Figure 2. This drawing will show the following features:
- 5.3.2.1 The location of the excavation referencing identifiable landmarks including the mileage and subdivision of the proposed crossing;
 - 5.3.2.2 The excavation centerline, size and limits;
 - 5.3.2.3 Any adjacent structures, signals, switches or buried services including Fibre Optics Transmission Systems (FOTS);

- 5.3.2.4 The elevation of the surface water in ditches, the elevation of the ground water table at all bore holes locations and the date they were measured;
- 5.3.2.5 The test pit and borehole location and stratigraphic logs as determined by the geotechnical investigation;
- 5.3.2.6 The depth of the top and base of excavation to the base of rail; and
- 5.3.2.7 The profile of the track.
- 5.3.3 Section of the track along the center line of the proposed excavation as shown in Figure 3. This drawing will show the following features:
 - 5.3.3.1 The location of the excavation referencing identifiable landmarks including the mileage and subdivision of the proposed crossing;
 - 5.3.3.2 The excavation center line, size and limits in relation to the center line of track and the minimum clearance envelope;
 - 5.3.3.3 Any adjacent structures, signals, switches and buried services including FOTS;
 - 5.3.3.4 The elevation of the surface water in ditches, the elevation of the ground water table at all bore holes locations and the date they were measured;
 - 5.3.3.5 The test pit and borehole location and stratigraphic logs as determined by the geotechnical investigation;
 - 5.3.3.6 The location of the top and bottom of the excavation and the proposed cut slope angles;
 - 5.3.3.7 The location of the center line of all tracks;
 - 5.3.3.8 The depth of the top and bottom of excavation to the base of rail; and
 - 5.3.3.9 Any excavations that encroach on the ZPTL;
- 5.4 Proposals for excavation will only be considered at sites where conditions make other construction method impractical or where rail traffic is low.
- 5.5 Excavation proposal using water jet methods will not be considered.
- 5.6 The cost of remediating any settlement or heave induced by the excavation will be borne by the proponent.
- 5.7 Dewatering shall be provided to all excavation below the highest ground water level predicted during construction to prevent standing water in the excavation.
- 5.8 CPR head office is located in Calgary. As a result submissions received in English will generally be reviewed and processed more rapidly than those in French.

6. Process 1

6.1 Conditions

The general requirements included in Section 5 and the following must be met to obtain approval for excavation on railway property that qualifies Process 1 application.

- 6.1.1 Excavations shall be carried out in accordance with Canada Occupational Health and Safety Regulations (SOR/86-304).
- 6.1.2 The responsibility of all excavation and cut slopes resides with the proponent, who should take into consideration of site specific conditions regarding soil stratigraphy and ground water. All excavations shall be reviewed by a geotechnical engineer prior to personnel working within the base of the excavation.
- 6.1.3 There are no structures, signals or track switches within 10 m horizontal of the proposed limit of excavations.

- 6.1.4 The excavation limit shall not be within 10 m (30 ft) from the center line of track and not encroach on the zone of potential track loading.

6.2 Requirements

- 6.2.1 The proponent will provide drawings containing the information identified in Drawings 1, 2 and 3.

6.3 Process

- 6.3.1 Proponent submits engineering documents to CPR local Division office.
- 6.3.2 Local Division reviews documents to assure appropriate engineering documents have been provided.
- 6.3.3 Local Division is to provide approval.

7. Process 2

This process will be followed for the location of the proposed excavation limits that do not meet the criteria of Process "1". Expert engineering submissions are required, along with preliminary work such as dewatering as well as, monitoring by on site engineering consultants during construction. The applicant will be required to submit information for review and approval by CPR geotechnical engineers or their designated consultants at the applicant's expense.

CPR requires that all designs, analysis and notification protocol be reviewed by a qualified geotechnical engineer prior to submission. The applicant may be subjected to additional engineering, monitoring and construction requirements.

7.1 Conditions

- 7.1.1 The general requirements identified in Section 5 must be met.
- 7.1.2 The depth between the BOR and the bottom of proposed excavation is deeper than 1.4 m (4.6 ft).
- 7.1.3 The limits of excavation are within 10 m (32 ft) of the closest track center line or encroach on the ZPTL.

7.2 Requirements

- 7.2.1 Identification of the geotechnical engineer of records.
- 7.2.2 Description of the subsurface soil and ground water conditions within and adjacent to CPR embankment along the proposed excavation alignment and to a depth no less than 1.5 times the proposed excavated depth below the BOR. This will consider the impact of silt, fine sand or sand soil, and their relation to the water table and depth of excavation.
- 7.2.3 An estimate of the expected extent and magnitude of ground movement over time based on the proposed excavation method will be provided.
- 7.2.4 A program of ground surface and subsurface movement monitoring will be implemented. The program must be capable of detecting movement of no less than 50 percent of the movement that would result in a change of the track FRA or TC class as per the Transport Canada - Track Safety Rules accessible at <http://www.tc.gc.ca/eng/railsafety/rules-tce31-100.htm>
- 7.2.5 A procedure for notification of the appropriate CPR personnel in the event that excessive or unexpected settlement occurs. A complete CPR contact list, including local personnel and NMC will be compiled.
- 7.2.6 A recovery plan will be provided outlining the steps to be implemented in the event of failure (excessive ground loss or settlement / collapse, heaving etc).
- 7.2.7 Design of de-watering control measures where applicable for the proposed excavation method.
- 7.2.8 Temporary track support system will be required if any of the excavation is closer than 6 m (19.7 feet) from the centre of track and encroaches on the ZPTL. The length of the excavation and an estimated stand-up time of the proposed cut within these limits must be provided and demonstrated to be safe.

- 7.2.9 A complete description of the proposed method of excavation with confirmation that the proposed method is suitable for the site conditions and performance criteria.
- 7.2.10 An assessment of the influence of excavation on the track structure including estimated settlement/heave and assessment of risk associated with uncontrolled loss of ground or heaving.
- 7.2.11 In the event of complexities arise through the review of the conditions, CPR geotechnical group may elevate the review by referring to CP's designated consultants at the applicant's expense.
- 7.2.12 The proponent will provide resources for CPR to retain qualified geotechnical engineers or experts to analyses and advise CPR on the impact of the proponent's proposal to the right-of-way.
- 7.2.13 A qualified independent engineer is required to provide periodic or continuous (at the discretion of CPR) on-site supervision and document conditions during excavation.

7.3 Process

- 7.3.1 Proponent submits engineering documents to local Division office.
- 7.3.2 Local Division reviews documents to assure appropriate engineering documents have been provided.
- 7.3.3 CPR Geotechnical Group to review and provide geotechnical approval.
- 7.3.4 CPR Structural Engineering Group may have to provide structural approval.
- 7.3.5 Local Division office is to provide final approval.

8. Geotechnical Engineering check-list

The following is a check list of steps that will be completed to assure that the appropriate level of care has been taken for excavation application Process 1 and 2.

Table 2 – Check List

No.	Step	Group
8.1	Submission of excavation proposal by proponent including details of the excavation specification and potential construction method(s) to CPR Division office.	Proponent
8.2	Review of the proposal with respect to this protocol to determine what level of geotechnical engineering and review is required.	Division
8.3	Designation of review (CPR Division office, CPR Geotechnical Engineering or Independent geotechnical engineer) required.	Division
8.4	Identification of the geotechnical engineer of record.	Geotechnical Engineering
8.5	Assessment of the adequacy of the geotechnical investigation.	Geotechnical Engineering
8.6	Proponent's geotechnical engineer determines that the proposed excavation method will not cause settlement of the CPR track or structures.	Geotechnical Engineering
8.7	If there is a possibility of track settlement, a monitoring program will be developed by the proponent's geotechnical engineer, and reviewed and approved by CPR.	Geotechnical Engineering
8.8	Once a contractor has been selected, the geotechnical engineer of record will review the shop drawings submitted by the contractor or the sub-contractor(s) to determine if the proposed excavation and dewatering (if required) method proposed could cause track settlement.	Geotechnical Engineering
8.9	The proponent will provide CPR with written documentation of who will be completing the onsite review of the contractor's	Geotechnical Engineering

No.	Step	Group
	construction practice and the specifics of the assignment.	
8.10	The proponent will enlist the services of a geotechnical engineer with the responsibility for inspection of the contractor's excavation. They will also assure that adequate measures are in place to minimize the potential for track settlement. The intention is not make the geotechnical engineer responsible for the settlement of the track but to empower an appropriate group with the task of assuring that actions undertaken by the contractor do not endanger the track structure as a result of ground loss during excavation.	Geotechnical Engineering
8.11	An emergency response will be developed and posted on site and will reside with key personnel.	Geotechnical Engineering
8.12	A contingency plan will be identified that can be completed within hours if settlement or heave is experienced.	Geotechnical Engineering

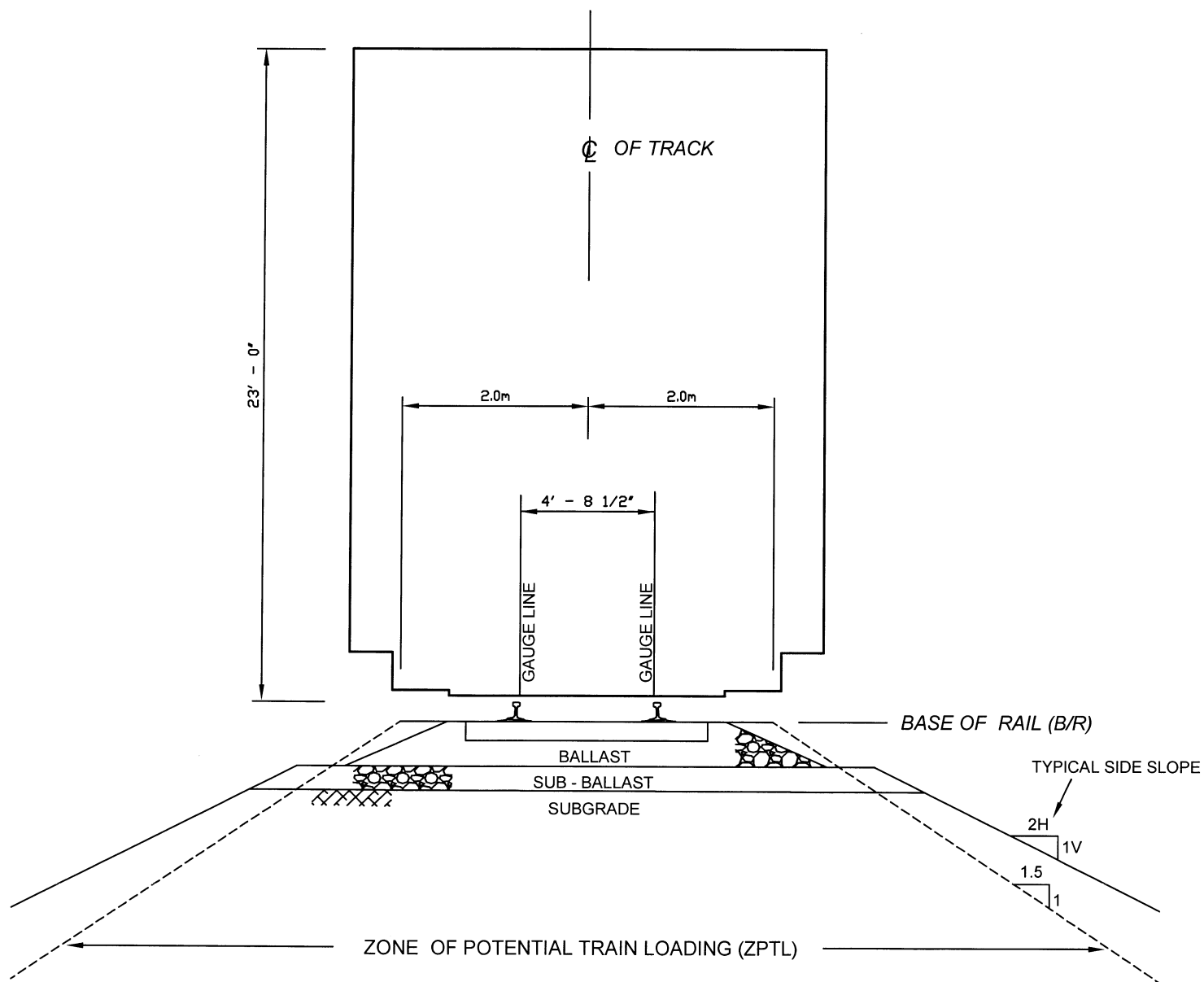


FIGURE 1 - CLEARANCES IN RELATION TO TRACK CENTER FOR STRUCTURE

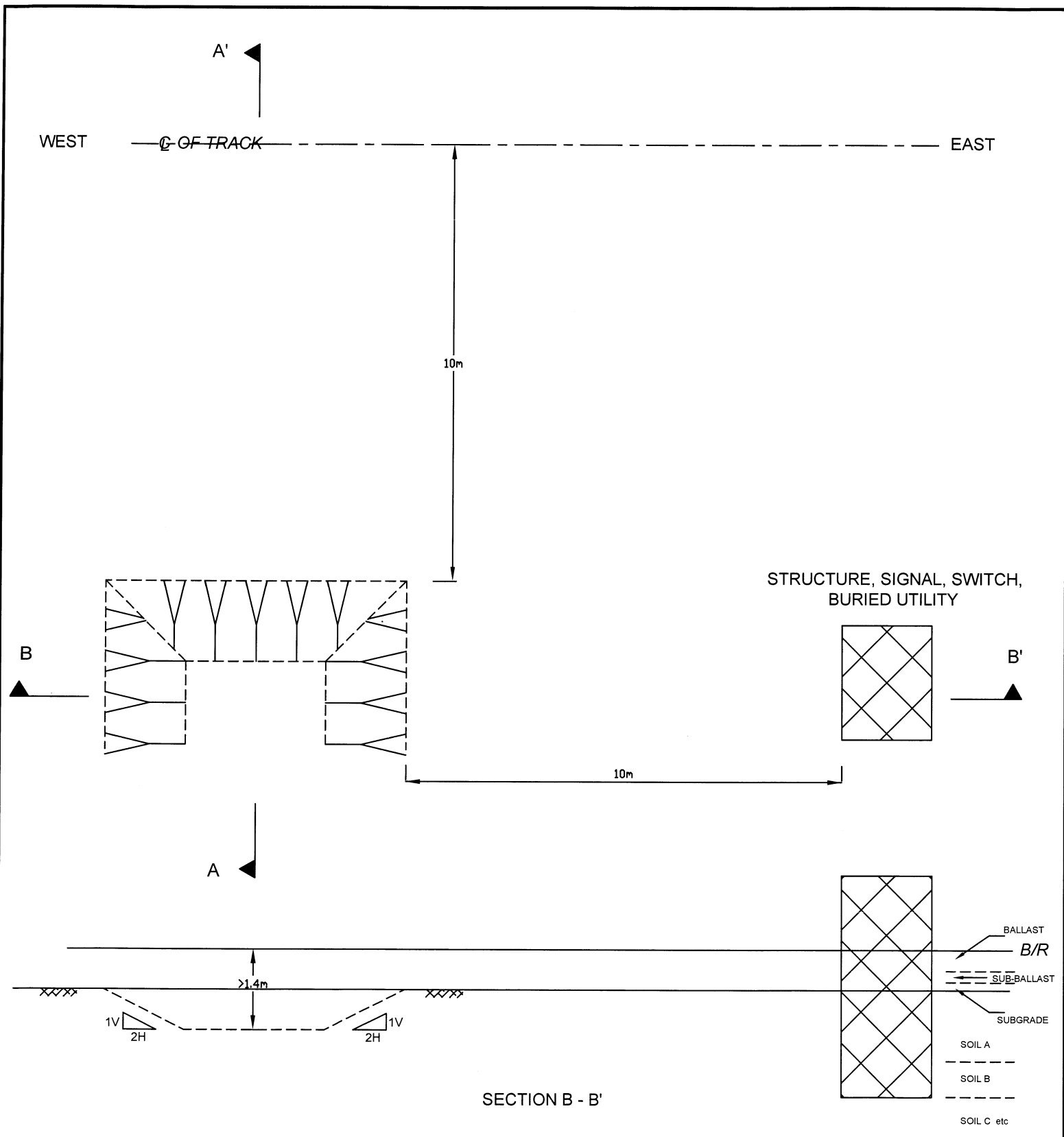


FIGURE 2 - PROFILE OF PROPOSED EXCAVATION PARALLEL TO THE CENTER LINE OF TRACK

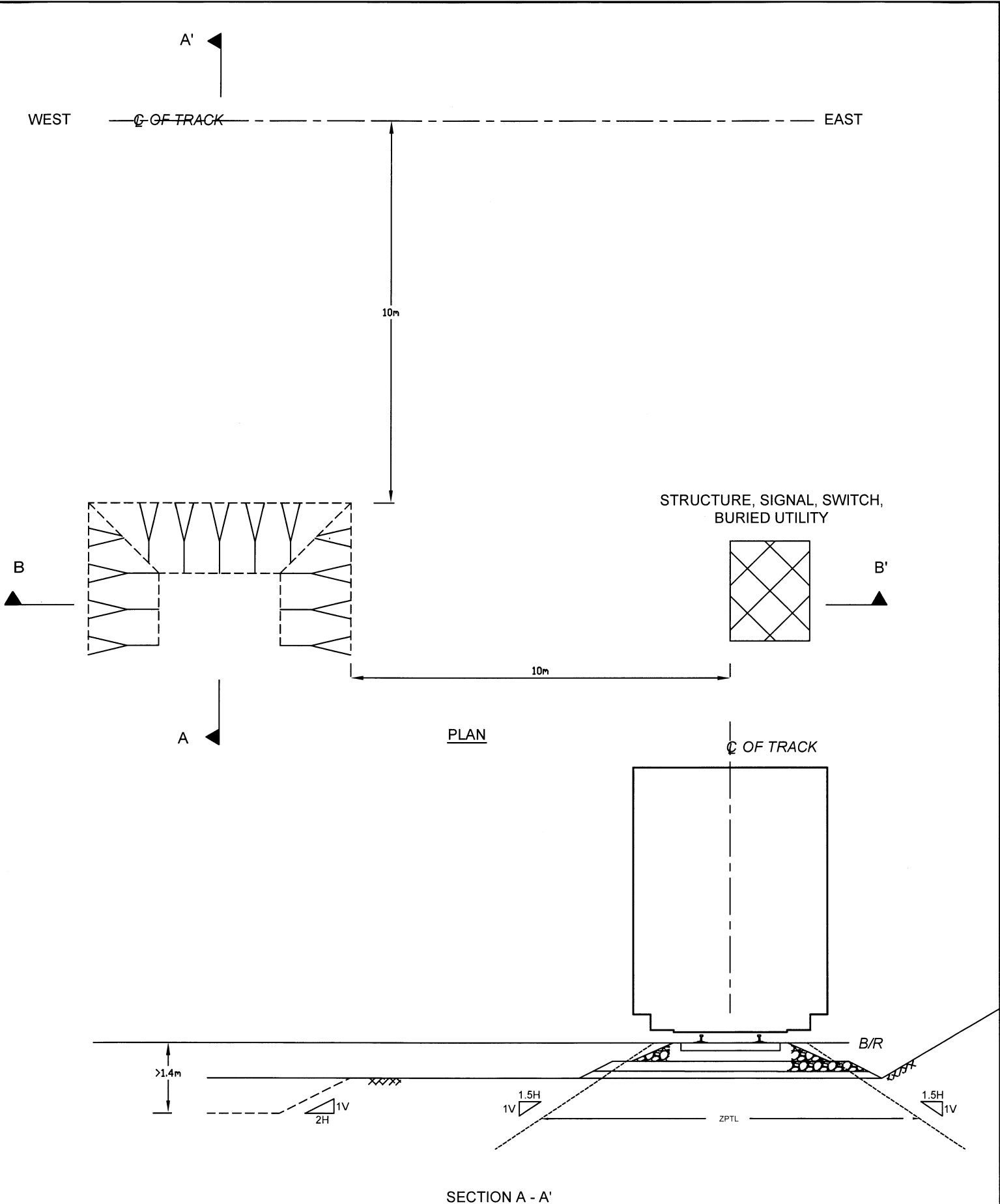


FIGURE 3 - SECTION OF TRACK PERPENDICULAR TO THE CENTER LINE OF PROPOSED EXCAVATION