CONSTRUCTION SPECIFICATION FOR STREETCAR TRACK PAVEMENT AND FOUNDATION SLAB

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TS 3.75.01 SCOPE

This specification covers the requirements for the construction of the streetcar track pavement and the foundation slab.

TS 3.75.02 REFERENCES

This specification refers to the following specifications and publications:

Ontario Provincial Standards

OPSS 180 – Management and Disposal of Excess Material
OPSS 919 – Formwork and Falsework

City of Toronto Standard Specifications

TS 2.10 – Construction Specification for General Excavation
TS 2.20 – Construction Specification for Excavation for Track Allowance
TS 4.50 – Construction Specification for Utility Adjustments
TS 405 – Amendments to OPSS 405 – Construction Specification for Pipe Subdrain
TS 501 – Amendments to OPSS 501 – Construction Specification for Compacting
TS 1010 – Amendments to OPSS 1010 – Material Specification for Aggregates – Granular A, B, M, and select Subgrade Material
TS 1350 – Amendments to OPSS 1350 – Material Specification for Concrete – Material and Production

City of Toronto Standard Drawings

T-216.02-10 – Streetcar Track Allowance Cross-Section

TS 3.75.03 DEFINITIONS

For the purposes of this specification the following definitions apply:

Track Allowance: means the area bounded by the outermost rails, plus the outer margins (460 ± mm) as shown in T-216.02-10.

Foundation: means the concrete slab (typically 225 mm thick) that supports the track pavement and associated rail system.

TTC: means the Toronto Transit Commission

TS 3.75.04 SUBMISSION AND DESIGN REQUIREMENTS

Any required submissions shall be in writing. All submissions shall be submitted to the City at least three weeks prior to the beginning of the work.

The submissions and design requirements shall be as stated in TS 1350 and the following:

1) A detailed mix design which outlines the mixing order and procedure to indicate that the ingredients will be mixed at appropriate times to ensure that no single ingredient will be adversely affected by being added in the wrong order or at the same time if it is required to be added by itself.

2) Documentation from the concrete supplier that during concrete production, a backup plant, that shall produce the same concrete mix, is available within 3 hours, should the principal plant break down.

3) Documentation from the concrete supplier, that concrete will be supplied at any time, day or night, as required and within 3 hours of ordering.

The City will review these submissions and has the right to modify the procedures, as required, and will also inspect the mixing at the plant. Any load that is not mixed in accordance with the approved mixing procedure or mixed in a way that is likely to adversely affect the properties of the additives will be rejected.

TS 3.75.05 MATERIALS

TS 3.75.05.01 Supply of Materials

Unless otherwise specified in the Contract, the Contractor shall supply all materials necessary for the execution and completion of the work.

TS 3.75.05.02 Concrete

The materials for and the production of regular concrete road base shall meet the requirements of TS 1350 and the following:

1)	Cement type	Normal Portland GU
2)	Minimum 28 day compressive strength	32 Mpa
3)	Class of exposure	C-2
4)	Maximum nominal size of coarse aggregate	19 mm
5)	Slump at plant	max. 50 mm
6)	Slump at point of discharge without plasticizer	max. 20 mm
7)	Slump at point of discharge with plasticizer	150 ± 25 mm
8)	Air content	6.5 ± 1.5 percent
9)	Maximum water/cementing materials ratio	0.45

The materials for and the production of special mix concrete road base shall meet the requirements of TS 1350.

TS 3.75.05.03 Admixtures and Additives

The water-reducing agent, non-chloride accelerator and super-plasticizer shall be preapproved by the Ontario Ministry of Transportation (MTO) and be listed on the latest version of their Designated Sources List. They shall be applied at a rate to maximize strength gain and to meet the specified requirements without any adverse affect to long term properties of the concrete.

All additives and admixtures shall be applied in strict accordance with the manufacturer's instructions. In addition, the Contractor may use an approved super-plasticizer to improve flow and handling during placement.

No extra payment will be made for any admixture or additive.

TS 3.75.05.04 Curing of Concrete Samples

The Contractor shall supply and maintain a CSA approved concrete curing box from the start of construction until the final cylinders have been removed for testing. The box shall be positioned, at a location, close to each concrete pour and acceptable to the City. The Contractor should note that the box may need to be relocated several times during the course of the construction.

TS 3.75.05.05 Expansion Joint Material

Expansion joint material shall be bituminous fibreboard that is 12 mm thick and 50 mm wide.

TS 3.75.06 EQUIPMENT

TS 3.75.06.01 Forms

Forms shall be steel, wood or metal plate forms and shall meet the requirements of OPSS 919.

They shall be of sufficient cross section and strength, and so secured as to resist the pressure of the concrete when placed, and the impact and vibration of any construction equipment they support without springing or settlement.

Forms shall be pinned or staked in place with not less than 3 pins for each 3 m length, and with a pin at each side of each form butt joint. The top surface of the formwork shall comply with the specified tolerances. The inside face of the form shall be vertical. The form shall not deviate from grade by more than 3 mm in 3 m, and shall not deviate in alignment by more than 6 mm in 3 m.

Forms shall be cleaned and coated with form oil, prior to each use.

TS 3.75.06.02 Finishing Tools

Finishing tools shall meet the requirements of CSA A23.1 and TS 1350.

TS 3.75.06.03 Testing Equipment

The Contractor shall supply an air meter, slump cone and all their associated equipment to the City, at all times, when concrete is being placed. The air meter is to have been calibrated, just prior to construction, by a technician with CSA certification.

TS 3.75.07 CONSTRUCTION

Prior to starting the work, the Contractor shall submit the verification that either the foreman/lead hand or the supervisor of the placing crew has ACI Flatwork Certification.

TS 3.75.07.01 Excavation

Where an existing track exists, the excavation shall meet the requirements of TS 2.20. Otherwise, the excavation shall meet the requirements of TS 2.10.

Excavation shall be to the lines and grades shown on the contract drawings or as specified by the City.

TS 3.75.07.02 Subgrade Preparation

The subgrade shall be compacted as per TS 501, except that the compaction shall be to a minimum of 100 % of the maximum dry density.

The subgrade shall be proof rolled, and any soft or yielding areas shall be subexcavated and replaced with material that is similar to the surrounding subgrade.

TS 3.75.07.03 Subdrain

The subdrain shall be supplied and installed as per TS 405.

TS 3.75.07.04 Granular Base Placement

The granular base shall be placed to the required thickness and compaction, and shall meet the requirements of OPSS 1010, for Granular 'A'. The moisture content and compaction of the granular base shall be uniform and shall meet the requirements of OPSS 501.

The granular base shall be moistened prior to the placement of concrete, but without any standing water. At the time of placing concrete, the base shall not be wet, soft or frozen.

TS 3.75.07.05 Utility Adjustment

Utility adjustments shall meet the requirements of TS 4.50, except that box-outs shall not be required.

TS 3.75.07.06 Placing Concrete

TS 3.75.07.06.01 General

Concrete shall be placed and consolidated in accordance with TS 1350.

The Contractor shall ensure the presence of sufficient workers to place, vibrate, finish and cover the concrete in good time, as the accelerator in the mix will speed the initial set.

The Contractor shall ensure that the supplies of concrete will arrive at the site, at the proper time, in order to achieve the earliest possible set and the maximum possible strength gain, prior to the resumption of the streetcar service. Also, the concrete supplier must be on constant standby over weekend periods, so that the concrete can be supplied at any time of the day or night.

Concrete trucks shall not wash out their chutes onto any part of the work area. The Contractor shall provide other means for chute washing.

TS 3.75.07.06.02 Foundation Slab

The foundation slab shall be placed in one 225 mm thick lift as shown on the contract drawings, or as directed by the City.

Extreme care must be taken to place this slab at the correct grade to prevent the compromising of the track elevations. Also the progress of the TTC track crews will be greatly affected by the speed with which the Contractor places the foundation slab and the speed at which the foundation concrete reaches sufficient strength to support a worker.

The outer edges of the foundation slab shall always be side formed for their full depth.

TS 3.75.07.06.03 Track Pavement

Concrete shall be placed in two lifts, with a minimum of three (3) hours elapsing between the completion of the first and the start of the second lift.

The first lift shall extend from the foundation slab to the tops of the ties. The second lift shall extend from the first lift to the finished road surface.

Concrete shall be puddled under each tie and rail, from one side only, until it emerges from the other side, along the entire length. Concrete shall not be deposited on both sides of a tie or rail at the same time. This is to ensure that no voids are created under the track members.

Outer margins shall in all cases be side-formed for their full depth of new concrete.

Concrete in tracks through intersections shall not be formed with the normal crown, but shall be screeded flat between the rails. On approaches to intersections, the normal crown, as shown on the contract drawings, shall be formed.

TS 3.75.07.07 Finishing Concrete

The concrete surface shall be finished while it is still sufficiently plastic to achieve the desired grades, elevation and texture. The surface of the concrete shall not be finished when standing water is present on the surface. The surface shall be uniform, dense, and free from undulations and projections.

The top surface shall be screeded to true grade and cross section and finished with a magnesium or aluminum float. The finishing shall be performed in a matter that does not draw water to the surface. The surface of the road base shall have no irregularities exceeding 6 mm when tested with a 3 m straightedge in any direction.

TS 3.75.07.08 Joints

Transverse expansion joints shall be constructed 12 mm wide and 50 mm deep. They shall be placed across the track allowance over every tie-rod, at every joint between adjacent lengths of rail and at other locations, in areas of special track work, as the City may direct.

The expansion joint material shall not be placed until the concrete surface has been shaped, screeded and trowelled. The joint shall be flush with the concrete surface and at no point covered by concrete.

Expansion joint material shall extend in one unbroken piece across the concrete surface with no shortening near the rails.

TS 3.75.07.09 Concrete Curing

Due to the strict requirements of the curing temperature, the Contractor may be required to use extra material, such as thermal blankets, to maintain the concrete within the required temperature range. Concrete curing shall meet the requirements of TS 1350.

Immediately after each lift of concrete is placed and floated, an evaporation retardant shall be applied in accordance with the manufacturer's recommendations.

As soon as the concrete in the second lift has set, it shall be covered by two layers of water-soaked burlap and a layer of polyethylene sheet. No part of the concrete shall be left uncovered.

Joints in the burlap and polyethylene sheet, shall be overlapped a minimum of 200 mm and they shall extend a minimum of 300 mm beyond the limits of the concrete, in all directions. The covers shall be suitably weighted to prevent flapping and displacement.

The covers shall remain in place for seven (7) days or until within 30 minutes of the resumption of streetcar service. The Contractor shall ensure that all covers are removed, prior to the resumption of streetcar service.

TS 3.75.07.10 Concrete Protection

Concrete protection shall meet the requirements of TS 1350.

TS 3.75.08 QUALITY ASSURANCE

Quality assurance shall meet the requirements of TS 1350.

TS 3.75.09 MEASUREMENT FOR PAYMENT

TS 3.75.09.01 Regular Concrete in Foundation Slab and Streetcar Pavement
Special Mix Concrete in Foundation Slab and Streetcar Pavement

Measurement for the above item(s) shall be by the volume of concrete, acceptably placed within the neat lines of the structures, as shown on the contract drawings or as directed by the City, in m^3. The quantity shall be determined by the delivery tickets.

The quantity shall not exceed more than 105% of the theoretical volume.

TS 3.75.10 BASIS OF PAYMENT

TS 3.75.10.01 Regular Concrete in Foundation Slab and Streetcar Pavement - Item
Special Mix Concrete in Foundation Slab and Streetcar Pavement - Item

Payment at the contract price for the above item shall be full compensation for all labour, equipment, materials and incidentals to do the work. Payment shall include, but not be limited to, the supplying and placing of expansion joint materials and joint fillers, the supplying, placing, finishing and curing of regular or special mix concrete, including all admixtures and additives.

Payment for all concrete shall be as follows:

Supply and Place	80%
Curing and Final Finishing	20%