

**Construction Specification for
Unshrinkable Fill**

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TS 13.10.01 SCOPE

This specification covers the requirements for the placing of unshrinkable fill, in underground service and utility trenches, and around structures.

TS 13.10.02 REFERENCES

This specification refers to the following standards, specifications or publications:

City of Toronto Standard Specifications

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| TS 1010 | Amendment to OPSS 1010.MUNI – Material Specification for Aggregates – Base, Subbase, Select Subgrade and Backfill Material |
| TS 1350 | Amendment to OPSS.MUNI 1350 – Material Specification for Concrete – Materials and Production |

Canadian Standards Association

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| A23.2 | Test Methods and Standard Practices for Concrete |
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TS 13.10.03 DEFINITIONS

For the purpose of this specification, the following definitions apply:

Reclaimed Concrete Material (RCM) means removed or processed old hydraulic cement concrete.

Unshrinkable Fill means a mixture of aggregates, cementing material and water, with or without chemical admixtures, that hardens into a material with higher strength than soil that can be removed with hand tools.

TS 13.10.04 DESIGN AND SUBMISSION REQUIREMENTS

TS 13.10.04.01 General

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

The requirements for submissions and design requirements are given in TS 1350.

TS 13.10.04.02 Materials

Prior to starting the work, the Contractor shall supply the Contract Administrator with material safety data sheets (MSDS) for all the materials to be incorporated in the work.

TS 13.10.05 MATERIALS

TS 13.10.05.01 Use of Reclaimed Concrete Material

The producer shall ensure that the level of RCM used in the fill does not compromise the performance of the fill. Recycled aggregates shall satisfy environmental regulations and be in according to TS 1010.

The maximum passing the 75 µm shall be 5 per cent or less of the total aggregate weight.

TS 13.10.05.02 Unshrinkable Fill

The materials for and the production of unshrinkable fill shall be according to TS 1350 and the following:

1) Cement type	Normal Portland GU Portland limestone GUL
2) Maximum 28 day cylinder compressive strength	0.7 MPa
3) Class of exposure	N/A
4) Maximum nominal size of coarse aggregate	25 mm
5) Minimum slump at point of discharge	150 mm
6) Minimum cement content	25 kg/m ³

Supplementary cementing materials, for example fly ash, silica fume and/or slag cement may be used to meet the requirements of this specification.

TS 13.10.06 EQUIPMENT

TS 13.10.06.01 Mixing Equipment

A central mixing or dry batch plant capable of accurately proportioning aggregate, cement and water shall be used according to TS 1350.

TS 13.10.06.02 Transport and Discharge Equipment

Unshrinkable fill shall be transported to the site by means of ready mix trucks.

Unshrinkable fill shall be placed into the excavation using the chutes of the conveying equipment, by pumping, or with the use of buckets.

TS 13.10.06.03 Bracing and Shoring

Bracing, shoring or sheeting shall be placed to protect the services, utilities or surrounding excavation, and shall be removed as the backfilling proceeds.

TS 13.10.07 CONSTRUCTION

TS 13.10.07.01 Placing Unshrinkable Fill

The material shall flow into the excavation so that it fills the entire space without vibration and segregation. Care shall be taken that no air is trapped beneath horizontal projections or in other locations in the excavation.

Unshrinkable fill shall not be placed in direct contact with gas mains or plastic pipe. A layer of carefully compacted granular material shall be placed to ensure a separation of 300 mm between the unshrinkable fill and the gas or plastic pipes.

TS 13.10.07.02 Removal of Shoring and Bracing

When bracing, shoring or sheeting is used to support the sides of the excavation or to prevent movements that could damage other services or adjacent structures, this support system shall be removed as the backfilling progresses.

TS 13.10.07.03 Finishing Unshrinkable Fill

The unshrinkable fill surface shall be screeded while it is still sufficiently flowable to achieve the desired grades and elevation. The surface shall be uniform and free from undulations and projections.

TS 13.10.07.04 Unshrinkable Fill Protection

Where unshrinkable fill is placed, it shall be protected from vehicular traffic including construction equipment for at least 24 hours, by covering with a steel plate of sufficient strength to support the traffic during this period. The steel plates shall be countersunk to the asphalt surface with steel spikes to prevent any displacement of the plate. The steel spikes shall be hammered flush with the top of the plates and extend the full depth of the asphalt or a maximum of 150 mm. The edges of the plates shall then be ramped with Superpave 12.5 temporary asphalt.

Where vehicular traffic is not being accommodated, the backfilled excavation shall be covered with wooden planking or other protection for users of the road allowance until the unshrinkable fill can support the mass of an adult person.

TS 13.10.08 QUALITY ASSURANCE

TS 13.10.08.01 Acceptance Sampling and Testing

All acceptance sampling and testing necessary to determine conformance with the Contract Documents shall be performed by the Contract Administrator. Sampling and testing shall be according to CSA A23.2. The City will determine the lot sizes. The Contractor shall assist, as necessary, in obtaining samples of unshrinkable fill for testing.

The Contractor shall be responsible for the collection and disposal of the remains of all unshrinkable fill used for testing purposes. In order to simplify collection and handling, the Contractor should set aside a designated location for the temporary piling of this discarded material close to the point of discharge from the delivery truck and shall provide assistance to transport the material into the designated location.

TS 13.10.08.02 Acceptance Criteria

TS 13.10.08.02.01 *General*

The compressive strength shall be the criteria for the acceptance of unshrinkable fill.

TS 13.10.08.02.02 *Unshrinkable Fill Compressive Strength*

The unshrinkable fill shall be sampled and tested according to CSA A23.2.

Slump testing shall be completed each time the unshrinkable fill is sampled for compressive strength according to CSA A23.2. To conform to the specified nominal minimum 28 day strength requirements:

- 1) Compressive strength testing shall be the average of two 150 mm diameter by 300 mm long cylinder specimens (must be waxed cardboard moulds), tested at the same age.
- 2) The cylinders shall only be demoulded on the same day of testing for the compressive strength to minimize handling damage to the cylinder specimens.
- 3) The load indicating mechanism of the compression testing machine shall be capable of showing load changes of 100 N (Newton) or less. The loading rate shall be 0.11 MPa/s or lower.

The minimum frequency of testing requirement shall be one set of two test cylinders, per supplier, per day.

Unshrinkable fill represented by compressive strength samples or cores exceeding the requirements shall be removed and replaced at no extra cost to the City.

TS 13.10.09 MEASUREMENT FOR PAYMENT

TS 13.10.09.01 Unshrinkable Fill

Measurement of unshrinkable fill shall be by volume, in cubic metres (m³). Measurement shall be by the summation of delivery tickets, except that the total volume shall not exceed 10 per cent of the theoretical volume.

TS 13.10.10 BASIS OF PAYMENT

TS 13.10.10.01 Unshrinkable Fill – Item

Payment at the Contract Price for the above tender item shall be full compensation for all labour, Equipment and Material to do the work. Payment shall include the supplying, placing and finishing of the unshrinkable fill and the supplying, placing and removal of steel plates, including the steel spikes and the Superpave 12.5 asphalt ramping, wooden planking or any other protection required.

No payment will be made when the supply and placement of the above item is included in a separate contract item, other than unshrinkable fill.