

S-31 KEYHOLE EXCAVATION

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31.01. SCOPE OF WORK

This specification covers the requirements for coring, vacuum excavation, backfilling, and reinstatement of the core in pavements, sidewalks and other hard surfaces as a permanent repair within the City of Windsor road allowance.

31.02. REFERENCES

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

- S-6, S-9, S-10, S-24, S-29, OPSS 180
- AS-207A, AS-207B, AS-207C, AS-221, AS-222, AS-401

31.03. DEFENITIONS

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

Bonding Material: means a single component, cementious, rapid hardening, high strength concrete repair material, used to bond the undamaged keyhole core to the pavement from which it was originally removed.

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Boulevard: means that part of a public street that is not used or intended to be used for vehicle travel by the general public, and that is situated between the travelled portion of the road and the adjoining property line.

Composite Pavement: means a rigid pavement having an asphalt concrete surfacing over Portland cement concrete base (with or without granular base).

Flexible Pavement: means a roadway pavement consisting of a layer(s) of asphalt concrete placed over granular base/subbase.

Hard Surface: means a pavement, curb, sidewalk, paved driveway or any other structure constructed at or near the ground surface elevation.

Keyhole Excavation: means the operation of using a coring device to cut a circular hole through the roadway pavement, sidewalk, or other hard surface to allow the intact core of pavement to be extracted, and the removal of underlying material from the ground by water or air vacuum excavation method, and its disposal. The subsequent reinstatement of the cored pavement.

Rigid Pavement: means a pavement having a Portland cement concrete surface or composite structure over granular base/subbase.

Roadway: means the portion of the street designed, improved, and ordinarily used by vehicle traffic.

Sidewalk: means that part of the public street located within the boulevard that is improved for the exclusive use of pedestrians.

Unshrinkable Fill: means a self-compacting cement treated aggregate with flowable consistency and controlled low strength properties.

Mix designs shall meet the requirements of OPSS 335.

31.04. MATERIALS

31.04.01 Supply of Materials

Unless otherwise specified the contractor shall supply all materials necessary for the execution and completion of the work.

31.04.02 Bonding Material for Keyhole Cores

Bonding material when mixed shall flow easily and completely fill the annular space around the core to achieve a waterproof, mechanical joint between the keyhole pavement core and the original slab of pavement. The material shall be placed in accordance to the manufacturer's recommendations, including all mixing, handling, and curing practices. Test results meeting the requirements as outlined in specification 31.04.03 and 31.04.04 shall be submitted to the City for review and approval prior to it being used.

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31.04.03 Laboratory Testing of Bonding Material

Compression	ASTM C109 or C39
Freeze/Thaw	ASTM C666
Set Time	ASTM C266
Bond Strength (Slant shear)	ASTM C882
Thermal Expansion and Shrinkage	ASTM C531

31.04.04 Field Testing of Bonding Material

In testing, the bonding material shall, within 30 minutes at 21C reach an equivalent traffic loadable condition that is at a minimum two (2) times greater than the AASHTO H-25 standard on simulated loading slabs prepared to yield a standard mix with a 28-day compressive strength of 35MPa.

31.04.05 Unshrinkable Fill Backfill Material

The materials for and the production of unshrinkable fill shall meet the requirements of City of Windsor specification S-24, and prior to its use, the contractor shall provide documentation of compliance. The supplied material will be tested and material that does not meet City of Windsor requirements will be removed and replaced at the contractor's expense, including the cost of retesting.

31.04.06 Imported Granular Backfill Material

Granular material shall not be used for keyhole excavation backfill. However, with the written consent of City engineer, Granular 'A' meeting City of Windsor specifications for material and compaction may be used in boulevard areas to 300mm below surface grade of grassed or landscaped areas.

31.05. EQUIPMENT

Unless otherwise specified the contractor shall supply all labour and equipment required for execution and completion of the work.

31.06. CONSTRUCTION

31.06.01 General

All work performed using keyhole methods shall be carried out in such a manner that the pavement or sidewalk surfaces worked upon are restored and matched to the original condition of the surface.

31.06.02 Keyhole Pavement Coring

Cutting of existing pavements shall be performed with an appropriate keyhole-coring saw. The vertical alignment of the keyhole-coring saw shall be perpendicular with the horizon, and the cutting shall be extended to the full depth of the pavement structure. The coring operator shall place a temporary mark on the pavement core and the adjacent pavement prior to coring to ensure that the pavement core, when replaced, will have the same orientation as before it was removed.

31.06.03 Operational Constraints

Pavement and sidewalk cuts for vacuum excavation in keyhole coring shall not be greater than 460mm in diameter. Larger cores up to 610mm in diameter may be allowed only with written consent of City engineer.

In flexible, composite, or rigid pavements, keyhole cores shall not be within 1m of each other, edge of pavement, any construction joints, or a crack greater than 3mm in width.

Keyhole in sidewalks and other hard surfaces in boulevards shall not be within 100mm of a crack greater than 3mm in width, any joint, or edge of sidewalk or hard surface.

Keyhole coring shall not be permitted in flexible pavements where the asphaltic concrete is less than 100mm thick.

31.06.04 Backfilling

Material used for backfilling keyhole excavation shall meet City of Windsor 31.04.05 and 31.04.06 requirements.

Unshrinkable fill shall be used for backfilling of keyhole excavation within the pavement portion of the road allowance, alleys, sidewalks and other hard surfaces within the boulevard. With written permission from City engineer or his designate, Granular A meeting City of Windsor requirements, may be used as backfill material to within the top 300mm of landscaped or grassed areas of boulevards.

The use of up to a 50mm thick levelling course of crushed gravel (12mm) may be used to assist in levelling the core in place. The levelling course will be tamped once the unshrinkable fill has set.

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31.06.05 Surface Restoration

Pavement core holes removed shall either be removed from work site or stored in a safe and secure on- site location. The cores shall be made readily available for restoring the pavement once backfilling is complete.

The pavement surface shall be restored to its original condition by setting the reinstated pavement core flush and in its original orientation. Excess bonding material shall be removed from the restored pavement surface. The contractor shall reinstate the keyhole core, complete with the bonding agent within 24 hours of cutting the existing pavement.

31.06.05(a) Temporary Restoration

Until the core hole is reinstated or the site is left unattended, the opening shall be covered with an approved form of an appropriately sized, circular steel road plate fitted with a collar that when inserted into the keyhole, will prevent the cover from tipping, tilting, bouncing or spinning out of the hole in all types of traffic condition.

31.06.05(b) Permanent Restoration

Where the keyhole core is found to be fractured or defective upon removal, or becomes damaged after removal, or otherwise fails to meet requirements as outlined in 31.07.01 the core shall not be used to restore the pavement. If another equivalent core of sound condition and matching existing pavement of the same diameter, depth, and composition as the defective core is available, it may be reinstated in substitution of the defective core. The permanent pavement repair at the damaged core hole location shall be cut and a permanent repair performed as outlined in City of Windsor specification S-29 Utility Cut Restoration.

Permanent restoration of boulevard landscaped areas shall be to original site conditions or better. Imported topsoil and seed/sod to meet City requirements.

31.06.06 Management and Disposal of Excess Material

The contractor is required to remove and dispose of all materials from keyhole excavation off site at their expense.

Management and disposal of excess material shall conform to OPSS 180.

31.07. QUALITY ASSURANCE

31.07.01 Defective Keyhole Cores

A pavement core that is fractured in the vertical plane, or where two or more successive layers in the core become horizontally delaminated and cannot be re-bonded together with the bonding material shall be considered defective.

Any keyhole excavation, which fails to meet material specification or testing as outlined in S-31.04, shall also be deemed unacceptable. All repair work associated with failed or defective work originally performed shall be borne by the contractor.

31.07.02 Surface Tolerance

The reinstated core shall be flush and level with the adjacent pavement. No gap, attributable to the position of the core should be found between the bottom of a 1m straight edge and the surface of the pavement when placed in any direction of the keyhole pavement core, except across the crown or drainage gutters.

31.07.03 Records

The contractor shall maintain records containing the location and details of all keyhole core repairs. A sketch with horizontal control ties of core locations shall be included with records. The records shall be made available to the City within 7 days of completion of the work.

31.07.04 Warranty of Work

The contractor shall warranty all keyhole excavation work for 2 years. At the end of the warranty period, a quality control inspection report by a certified engineering firm, specifying the performance characteristics of the repair shall be submitted to the City.

31.08. MEASUREMENT FOR PAYMENT

Measurement will be made for each reinstated keyhole as specified.

31.09. BASIS OF PAYMENT

Payment at the contract price for the above item shall be full compensation for all labour, material, and equipment required to perform the work including traffic control, coring, vacuum excavation, backfill material and bonding material.