



**CONSTRUCTION SPECIFICATION FOR
STRUCTURE REHABILITATION-CONCRETE REMOVAL**

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928.01 SCOPE

This specification covers the requirements for the removal of concrete from existing structures, except by means of pressurized water, hydrodemolition, in order to facilitate structure rehabilitation.

928.01.01 Specification Significance and Use

This specification is written as a provincial-oriented specification. Provincial-oriented specifications are developed to reflect the administration, testing, and payment policies, procedures, and practices of the Ontario Ministry of Transportation.

Use of this specification or any other specification shall be according to the Contract Documents.

928.01.02 Appendices Significance and Use

Appendices are not for use in provincial contracts as they are developed for municipal use, and then, only when invoked by the Owner.

Appendices are developed for the Owner's use only.

Inclusion of an appendix as part of the Contract Documents is solely at the discretion of the Owner. Appendices are not a mandatory part of this specification and only become part of the Contract Documents as the Owner invokes them.

Invoking a particular appendix does not obligate an Owner to use all available appendices. Only invoked appendices form part of the Contract Documents.

The decision to use any appendix is determined by an Owner after considering their contract requirements and their administrative, payment, and testing procedures, policies, and practices. Depending on these considerations, an Owner may not wish to invoke some or any of the available appendices.

928.02 REFERENCES

When the Contract Documents indicate that provincial-oriented specifications are to be used and there is a provincial-oriented specification of the same number as those listed below, references within this specification to an OPSS shall be deemed to mean OPSS.PROV, unless use of a municipal-oriented specification is specified in the Contract Documents. When there is not a corresponding provincial-oriented specification, the references below shall be considered to be to the OPSS listed, unless use of a municipal-oriented specification is specified in the Contract Documents.

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

Ontario Provincial Standard Specifications, Construction

OPSS 905 Steel Reinforcement for Concrete

CSA Standards

CAN/CSA S6-06 Canadian Highway Bridge Design Code

928.03 DEFINITIONS

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

Certificate of Conformance means a document issued by the Quality Verification Engineer confirming that the specified components of the Work are in general conformance with the requirements of the Contract Documents.

Concrete Crusher means a piece of equipment fitted with a hydraulic attachment, such as a scissor type jaw, used for the removal of concrete.

Concrete Removal - Full Depth means concrete removals that typically apply to full or partial length removals of entire thickness of curbs, sidewalks, medians, wingwalls, concrete barrier walls and parapet walls, ballast walls, and approach slabs. This also applies to localized removals extending the full thickness of slab decks and culverts.

Concrete Removal - Partial Depth, Type A means concrete removals that typically apply to the top surface of decks, including removals over round voids in post tensioned structures; sidewalks; curbs; and culvert and tunnel floor slabs and the top and inside faces of concrete barrier and parapet walls.

Concrete Removal - Partial Depth, Type B means concrete removals that typically apply to deck soffit and fascia of bridge decks, soffit of the top slab of culverts and tunnels, girders, diaphragms, and outside face of concrete barrier walls and parapet walls.

Concrete Removal - Partial Depth, Type C means concrete removals other than the ones specified for Concrete Removal - Partial Depth, Type A and Type B, and typically apply to abutments, wingwalls, pier columns and caps, bearing seats, retaining walls, and vertical walls of culverts and tunnels.

Concrete Removal Sequence means a specified order of concrete removals within a stage to ensure structural adequacy, stability, and integrity throughout construction.

Concrete Removal - Structural Component means concrete removals that typically apply to full or partial length removals of entire thickness of decks, girders, diaphragms, pier columns, and pier caps that have an impact on the structural adequacy, stability, and integrity of a structure.

Engineer means a professional engineer licensed by the Professional Engineers Ontario to practice in the Province of Ontario.

Layer - Reinforcing Steel means two or more reinforcing bars placed in a plane parallel to a concrete face.

Mat - Reinforcing Steel means two layers of reinforcing steel, in different directions, tied together.

Quality Verification Engineer (QVE) means an Engineer retained by the Contractor qualified to provide the services specified in the Contract Documents.

Rehabilitation means any modification, alteration, or improvement to a structure or its components that is designed to correct defects or deficiencies.

Reinforcing Steel means deformed steel bars used in the reinforcing of concrete and includes splice bars.

Scarifying means the removal of concrete from the top surface of a structure, to a specified depth achieved by the milling action of cutting teeth fitted to a rotating head.

Steel Reinforcement means a general term that includes reinforcing steel bars, splice bars, welded steel wire fabric, and prestressing tendons.

Structure means any bridge, culvert, tunnel, retaining wall, wharf, dock, guideway, or any part thereof or other reinforced concrete component designed to carry loads, including high mast pole footings and sign support footings.

928.04 DESIGN AND SUBMISSION REQUIREMENTS

928.04.01 General

The Contractor shall meet all design and submission requirements from other authorities, as specified in the Contract Documents. The requirements of these authorities and the Owner shall be satisfied before commencement of concrete removals.

928.04.02 Design Requirements

The structural design and evaluation shall be carried out according to CAN/CSA S6.

The design assumptions for structural design and evaluation shall accurately represent the condition of the structure during construction, including the effect of concrete removals on load distribution and member resistance, support location and restraints, construction loads and construction staging, and shall be based on the existing structure drawings.

The weights of construction equipment shall be based on the manufacturer's specifications. The minimum dynamic load allowance for rig-mounted breakers and concrete crushers shall be 0.4. The load factors for construction live loads shall be the same as for highway live loads.

928.04.03 Submission Requirements

928.04.03.01 Access to Work Areas, Platforms, and Scaffolding

When access to work areas, work platforms, and scaffolding are to be provided, the Contractor shall submit to the Contract Administrator detailed drawings, for information purposes, prior to the installation.

928.04.03.02 Working Drawings

The Contractor shall submit 3 sets of Working Drawings to the Contract Administrator at least 7 Days prior to the commencement of the concrete removals, for concrete removal, complete deck and concrete removal, structural component, for information purposes only. The Contractor shall have a copy of the Working Drawings on site at all times while the work is being carried out.

All Working Drawings shall contain the following:

- a) Layout and description of concrete removal sequences and temporary supports.
- b) Clearances at existing and proposed structures.
- c) The locations, loadings, and detailed descriptions of heavy equipment and vehicles to be supported on existing structures.
- d) Seal and signature of the design Engineer and design check Engineer employed or retained by the Contractor, and a statement certifying that based on the existing drawings of the structure that the serviceability limit state and ultimate limit state requirements of CAN/CSA S6 are satisfied when any one or more of the following are proposed by the Contractor:
 - i. Existing structures supporting rig-mounted breakers, concrete crushers, cranes, any other heavy equipment, and vehicles that would induce higher load effects than normal traffic on a structure.
 - ii. Removal sequence different from the one specified in the Contract Documents or when the Contract Documents do not specify a removal sequence.
- e) Identify stages of work that require interim inspection by the Quality Verification Engineer (QVE) for the safe execution of concrete removal, such as:
 - i. Installation of temporary support.
 - ii. Installation of temporary protection for traffic, pedestrians, and property.
 - iii. Structural strengthening or modification.
 - iv. Removal of existing dead load or earth pressure, or both.

928.04.03.03 Concrete Removal Equipment

The Contractor shall submit identification of equipment and the manufacturer's published specifications for all concrete removal equipment to be used to the Contract Administrator, at least 7 Days prior to the commencement of the concrete removal operation.

928.04.03.04 Saw Cutting Details

When it is intended to cut full thickness through a concrete component by the use of sawing equipment, the Contractor shall submit saw cutting details to the Contract Administrator, at least 7 Days prior to the intended commencement of the saw cutting operation. The details shall include the following:

- a) Depth and location of sawcuts.
- b) Method used to prevent any contact with components that are to remain in place.
- c) Method of collecting and managing the effluent from the saw cutting operation.

928.04.03.05 Traffic and Pedestrian Protection

Unless otherwise specified in the Contract Documents, the Contractor shall submit a description of the traffic and pedestrian protection plan to the Contract Administrator, at least 7 Days prior to the commencement of the concrete removal operations.

928.06 EQUIPMENT

928.06.01 Air Hammers

Air hammers shall be hand-held and meet the following requirements:

- a) Chipping hammers shall have a maximum weight of 9.0 kg prior to any handle modification and a maximum piston stroke of 102 mm.
- b) Jack hammers shall have a maximum weight of 14.0 kg.
- c) All hammers shall have the manufacturer's name and part or model number engraved on them by the manufacturer. All information must be clearly legible.

The manufacturer's published specifications shall be the sole basis for determining weight and piston stroke.

928.06.02 Rig-Mounted Breakers

Rig-mounted breakers using pneumatically driven equipment shall only be fitted with amoil point and produce a maximum energy of 1,000 Joules per blow as per manufacturer's specification.

928.06.03 Sawing Equipment

The sawing equipment shall be capable of sawing the concrete along the lines and to the depths specified in the Contract Documents.

928.06.04 Scarifiers

Equipment used for scarifying shall be capable of removing a minimum of 6 mm of concrete from the top surface of the structure in one pass.

The maximum weight of a scarifier used on bridge decks shall not exceed 26 tonnes.

928.06.05 Straight Edges

Two commercially made metal straight edges, 1.5 m and 3 m in length, shall be supplied.

928.07 CONSTRUCTION

928.07.01 General

Concrete shall be removed to the depth and demarcated boundaries as specified in the Contract Documents or as directed by the Contract Administrator.

Upon completion of the concrete removals in the demarcated areas, the Contractor shall notify the Contract Administrator for inspection of the removal areas. Additional areas of concrete removal identified by the Contract Administrator shall be removed as directed by the Contract Administrator.

928.07.02 Access to Work Area, Work Platform, and Scaffolding

Adequate access shall be provided to the work area, work platform, and scaffolding as required, for the following:

- a) Concrete surveys by the Contract Administrator.
- b) Inspection of work and measurement of the quantities by the Contract Administrator.
- c) Quality Assurance and acceptance inspections by the Owner.
- d) Performance of the Contractor's work, including concrete removals.

928.07.03 Concrete Surveys

928.07.03.01 General

The Contractor shall schedule operations so as to ensure there is no interference with the concrete surveys.

928.07.03.02 Covermeter Survey

The Contractor shall allow the Contract Administrator to carry out a bridge deck covermeter survey for all asphalt-covered decks when concrete removals from the top surface of the deck are specified in the Contract Documents.

The Contractor shall notify the Contract Administrator 24 hours prior to the commencement of the scarifying operation.

The covermeter survey shall be carried out as follows:

- a) When the deck is specified to be patched, complete the survey after the waterproofing is completely removed from the top surface of the deck.
- b) When an overlay is specified in the Contract Documents, complete the survey after the first pass of the scarifying equipment.

928.07.03.03 Concrete Removal Surveys

928.07.03.03.01 General

The Contractor shall submit a written notification to the Contract Administrator to carry out all applicable concrete removal surveys. The notification shall state that the Contractor has completed the work specified in the Work Requirements clause for the concrete removal surveys specified and has installed all accesses to the work area, including work platforms and scaffolding required by the Contract Administrator to carry out the surveys.

When the location and extent of removals are not completely defined in the Contract Documents, the Contract Administrator shall carry out one or both of the following concrete removal surveys as part of determining and demarcating the actual location and extent of removals:

a) Visual and Delamination Survey

A visual and delamination survey shall be carried out for all concrete removals.

When a structure has an existing overlay that is not to be completely removed, the Contract Administrator shall carry out the delamination survey twice. The first survey shall be carried out on the top surface of the entire overlay. The second survey shall be carried out on the top surface of the original deck within the removal area, after the existing overlay has been removed.

When a structure has an existing overlay that is to be completely removed, the Contract Administrator shall carry out the delamination survey after the overlay is completely removed.

b) Corrosion Potential Survey (Half-Cell)

A corrosion potential survey shall be carried out on all surfaces when concrete is to be removed based on corrosion potential criteria when specified in the Contract Documents.

When full depth removals are specified in the Contract Documents, the concrete removal surveys on the top of the deck and soffit shall be completed to determine and demarcate the full depth concrete removal areas.

Concrete removals shall not proceed until all the applicable concrete surveys have been completed, reviewed, and written permission to proceed has been given by the Contract Administrator.

928.07.03.03.02 Work Requirements

Prior to the concrete removal surveys, the Contractor shall carry out all applicable work as follows:

- a) Scarifying - Complete the scarifying operations.
- b) Refacing with Uniform Concrete Removal - Complete the uniform removal of concrete.
- c) Removal of Waterproofing, Asphalt, and Coatings - All existing waterproofing membrane, asphalt, and coatings shall be removed in such a way to prevent damage to the existing concrete surface.
- d) Concrete Removal by Corrosion Potential - The Contract Administrator shall select two widely separated locations for each portion of the structure when the reinforcing steel is continuous. The reinforcing steel within these locations shall be exposed for a length of 150 mm and a clearance of 25 mm all around the bar.

Immediately prior to the commencement of the concrete removal surveys, all equipment shall be removed and all debris and standing water cleared from the surfaces to be surveyed.

928.07.03.03.03 Time Requirements

The time required by the Contract Administrator to complete the concrete removal surveys, including review of the surveys by the Owner, shall be as specified in Table 1 and shall commence upon receipt of the Contractor's written notification to carry out the concrete removal surveys. When the area of a structure exceeds the maximum area surveyed for the time period shown, the time period specified in Table 1 shall be extended on the basis of prorating the area, rounded up to the nearest Business Day.

The maximum time period required to complete the concrete surveys does not include any days of inclement weather or days when the air temperature is below 5 °C.

928.07.04 Scarifying

928.07.04.01 General

The portion of the structure to be scarified and the depth of scarifying shall be according to the Contract Documents.

Prior to scarifying, all sand and debris shall be removed from the top surface of the structure to be scarified. The maximum depth of scarifying in any one pass of the scarifying equipment shall be 10 mm. After the scarifying operation, areas of the structure not scarified to the specified depth shall be re-scarified until the specified depth is achieved.

When the specified depth of scarifying is greater than 10 mm, the Contractor shall allow the Contract Administrator a 24-hour period to complete the covermeter survey prior to commencing the second pass of the scarifying.

The portion of the curb face, barrier or parapet wall, and all existing concrete surfaces that have not been scarified against which new concrete is to be placed shall be uniformly roughened by means of scabbling, chipping hammer, or bushhammering. A surface profile of 5 mm ± 2 mm shall be achieved by exposing the aggregates across the entire surface.

All material resulting from the scarifying operation shall be removed from the deck immediately after each pass of the scarifying equipment.

928.07.04.02 Protection of Reinforcing Steel

The Contractor shall immediately notify the Contract Administrator of any exposed reinforcing steel visible on the concrete surface prior to and at any time during the scarifying operation. Operations shall be adjusted to avoid contacting the reinforcing steel with the scarifying equipment.

The Contract Administrator shall demarcate an area around any exposed reinforcing steel. The concrete shall be removed from within the demarcated area to the depth specified for the adjacent scarifying area using chipping hammers or as directed by the Contract Administrator.

Exposed reinforcing steel shall not be cut, removed, or damaged.

928.07.05 Reinforcing Steel in Concrete Removal Areas

When the cutting, bending, and removal of reinforcing steel is specified in the Contract Documents, the work shall be done as part of concrete removals. The cutting and bending of reinforcing steel shall be according to OPSS 905.

When the area of concrete removal with exposed reinforcing steel exceeds 2 m², the reinforcing steel shall be retied at every second intersection point and shall be supported to maintain the steel mat in its original location. Supports shall be placed as required and tied securely to the reinforcing steel according to OPSS 905.

928.07.06 Equipment Restrictions

928.07.06.01 General

Only equipment specified shall be permitted for the removal of concrete.

Construction equipment shall be permitted on the structure provided that all of the following conditions are met:

- a) Contamination by oil or other deleterious substances shall be prevented. Contaminated concrete shall be removed according to the procedures specified in the Concrete Removal - Partial Depth Type A, B, and C clause.
- b) Vehicles, runways, and equipment other than hand held equipment shall not be supported by reinforcing steel.
- c) Heavy vehicles such as ready mix concrete trucks or dump trucks shall not be permitted on any portion of the deck, within a span, once concrete removals within the deck have commenced in that span.

928.07.06.02 Concrete Removal - Partial Depth Types A, B, and C

Only chipping hammers shall be used for all partial depth concrete removals.

928.07.06.03 Concrete Removal - Complete Deck, Deck Joint Assemblies, Full Depth, and Structural Component

928.07.06.03.01 Sawing Equipment

The use of sawing equipment, except for perimeter treatments of concrete removal areas shall not be permitted for the removal of concrete:

- a) Within the lap length of reinforcing steel to remain in place.
- b) Within 100 mm from the edges and faces of structural steel members and concrete components to remain in place.

Prior to making sawcuts in a concrete deck close to the areas of existing structural steel members and other components that are to remain, the concrete surface shall be delineated by a qualified surveyor to locate the underlying edges and the faces of structural steel members and other components so not to damage the structural steel members and other components while saw cutting the concrete as specified.

928.07.06.03.02 Chipping Hammers

The use of chipping hammers shall be permitted in all areas of concrete removal.

928.07.06.03.03 Jack Hammers

The use of jack hammers shall not be permitted for the removal of concrete:

- a) For partial depth removals.
- b) Within 100 mm from concrete to remain in place.
- c) Within 25 mm of any reinforcing steel to remain in place.
- d) Within 100 mm from the edges and faces of structural steel members to remain in place.

928.07.06.03.04 Rig-Mounted Breakers

The use of rig-mounted breakers shall not be permitted for the removal of concrete:

- a) In concrete barrier and parapet walls, and deck slabs supported by concrete girders, unless the girders are to be removed.
- b) In concrete barrier and parapet walls supported by steel beams, unless the deck slab is to be removed.
- c) Within the deck joint assembly.
- d) Located within a distance from concrete to remain in place equal to the sum of 600 mm and the specified lap length of reinforcing steel to remain in place.
- e) Within 600 mm from the edge and faces of structural steel members including shear studs to remain in place.

928.07.06.03.05 Concrete Crusher

The use of a concrete crusher shall not be permitted for the removal of concrete:

- a) Within 2 m of concrete to remain in place.
- b) Within 1 m of reinforcing steel to remain in place.
- c) Within 300 mm from the edge and faces of structural steel members, including shear studs to remain in place.

928.07.07 Concrete Removal

928.07.07.01 General

Concrete removal shall not be permitted within 1 m of newly placed concrete until the newly placed concrete has attained a compressive strength of 20 MPa.

Concrete shall be removed in such a manner to prevent damage to the concrete to remain in place and debonding of reinforcing steel beyond the demarcated removal area. Reinforcing steel, prestressing tendons, shear connectors, structural steel, Utilities, and all other components that are to remain in place shall not be damaged or loosened. Concrete debris shall be removed from the concrete removal area on an ongoing basis.

928.07.07.02 Concrete Removal - Partial Depth Types A, B, and C

928.07.07.02.01 Perimeter Treatment of Concrete Removal Areas

The perimeter treatment of a partial depth concrete removal area shall be prepared according to the rehabilitation method to be used as follows:

- a) Concrete Overlay or Refacing - The perimeter of the removal area shall have a 1H:1V sloped face for the full depth of the removal area. The perimeter shall not be sawcut.
- b) Shotcrete - Prior to carrying out concrete removal operations, the perimeter of the removal area shall be sawn to a depth of 10 mm or to the depth of the reinforcing steel, whichever is less. The perimeter of the removal area shall have a face perpendicular to the original concrete surface for the specified depth of the removal area.
- c) Concrete Patches - Prior to carrying out concrete removal operations, the perimeter of the removal area shall be sawn to a depth of 25 mm or to the depth of the reinforcing steel, whichever is less. The perimeter of the removal area shall have a face perpendicular to the original concrete surface for the specified depth of the removal area.

928.07.07.02.02 Depth of Concrete Removal Areas

For existing concrete overlays to be patched, concrete shall be removed to the top surface of the original deck in the demarcated areas to allow the Contract Administrator to conduct a second delamination survey.

Concrete removal shall extend below the reinforcing steel within the boundaries demarcated by the Contract Administrator in the following areas:

- a) The entire area of spalls and delaminations.
- b) The areas of concrete components when corrosion potential of the reinforcing steel is more negative than minus 0.35 volts, as determined by the corrosion potential survey.
- c) All areas of exposed reinforcing steel.

Concrete in these areas shall be removed to a uniform depth of 25 mm behind the first layer of reinforcing steel.

Concrete surrounding the second layer of reinforcing steel shall also be removed locally to provide a minimum clearance of 25 mm all around the reinforcing steel.

Concrete removal beyond the second layer of reinforcing steel shall be carried out only when directed by the Contract Administrator.

For all other concrete removals demarcated by the Contract Administrator, including scaling and honeycombing, concrete shall be removed as follows:

- a) To sound concrete, when an overlay or refacing is specified in the Contract Documents.
- b) To sound concrete for a uniform depth of at least 50 mm, when an overlay or refacing is not specified in the Contract Documents.

928.07.07.03 Concrete Removal - Complete Deck, Full Depth, and Structural Component

Prior to carrying out concrete removals, the perimeter of the demarcated removal area shall be sawn to a depth of 25 mm or to the depth of the reinforcing steel, whichever is less, except for localized full depth repairs in the deck.

Prior to carrying out the concrete removals for localized full depth repairs in the deck, the perimeter of the removal area on the top surface of the deck shall be sawn to a depth of 25 mm or to the depth of the reinforcing steel, whichever is less. After concrete removals from the top of the deck are completed, the perimeter of the removal area along the soffit shall be squared off by saw cutting to a depth of 25 mm or to the depth of the reinforcing steel, whichever is less. The concrete removals shall be completed from the soffit using chipping hammers.

928.07.07.04 Concrete Removal - Deck Joint Assemblies

The existing deck joint assemblies including joint filler materials and surrounding concrete shall be removed according to the requirements of this specification and the Contract Documents.

928.07.08 Remedial Work

The Contract Administrator shall be notified immediately in writing if any of the following work related defects are present along with an explanation of the cause and extent of the defect:

- a) Damage to concrete beyond demarcated removal areas.
- b) Damage to concrete not specified for removal and damage to reinforcing steel to remain in place.
- c) Damage to structural steel and other components that are to remain in place.
- d) Contaminated concrete.
- e) Work that does not conform to the requirements of the Contract Documents.

All work related defects shall be repaired. A proposal for the remedial work to correct defects shall be submitted to the Contract Administrator for review. The Contractor shall not proceed with repairs until approval of the proposal has been received.

Repairs shall be made to the approval of the Contract Administrator.

928.07.09 Certificate of Conformance

A Certificate of Conformance shall be submitted by the Contractor upon completion of the designated concrete removal for each structural component and complete deck. The certificate shall be sealed, signed, and dated by the Quality Verification Engineer. The certificate shall state that the Work has been carried out in general conformance with the Working Drawings and the Contract Documents.

928.07.10 Management of Excess Material

Management of excess material shall be according to the Contract Documents.

928.08 QUALITY ASSURANCE

928.08.01 General

After the concrete removals are completed in the areas designated for removal, the work shall be inspected by the Contract Administrator to:

- a) determine and demarcate any additional removals within and along the perimeter of the demarcated areas.
- b) verify that the concrete has been removed to the depth and dimensions specified in the Contract Documents or as approved by the Contract Administrator.
- c) identify any work related defects in the work.

All work related defects and deficiencies shall be corrected as outlined in the Remedial Work subsection.

928.08.02 Acceptance

The following work related defects are unacceptable and shall be subject to remedial work:

- a) Damage to concrete beyond demarcated removal areas.
- b) Damage to concrete not specified for removal and damage to reinforcing steel to remain in place.
- c) Damage to structural steel and other components.
- d) Contaminated concrete.
- e) Work that does not conform to the requirements of the Contract Documents.

928.09 MEASUREMENT FOR PAYMENT

928.09.01 Actual Measurement

928.09.01.01 Scarifying

Measurement of scarifying shall be by area in square metres of the structure surface area to be scarified.

Measurement shall not be made of the roughened portions of curb faces, concrete barrier and parapet walls or of areas that require a second scarifying due to the Contractor's method of operation.

The total area shall be calculated to the nearest 0.1 m².

928.09.01.02 Concrete Removal - Partial Depth Types A, B, and C

928.09.01.02.01 General

Measurement of partial depth concrete removal shall be by area or volume as specified in the Contract Documents.

928.09.01.02.02 By Area

Measurement shall be of the area of concrete removed in square metres.

The total area shall be calculated to the nearest 0.1 m².

928.09.01.02.03 By Volume

Measurement for payment shall be of the volume of concrete removed for the depth specified or to the depth approved by the Contract Administrator.

Material removed locally 25 mm around the second layer of reinforcing steel shall not be measured. However, if the Contract Documents specify a uniform removal below the second layer of reinforcing steel, measurement for payment shall be of the volume of concrete removed to the specified depth.

After concrete removal is completed, verification of concrete removal depths shall be completed by the Contract Administrator on a grid system that best describes the profile at the particular area.

Measurement shall be taken by placing a straight edge across the removal area and measuring the distance from the straight edge to the top of the remaining concrete surface, as follows:

- a) A minimum of three measurements for each removal area less than or equal to 1.0 m².
- b) A minimum of ten measurements for every square metre for each removal area greater than 1.0 m².

The depths for each removal area shall be measured and averaged to the nearest millimetre.

The total volume shall be calculated to the nearest 0.1 m³.

928.09.01.03 Concrete Removal - Full Depth

Measurement of the full depth concrete removal shall be by volume in cubic metres. Alternatively, full depth concrete removal may be a lump sum item.

The total volume shall be calculated to the nearest 0.1 m³.

928.10 BASIS OF PAYMENT

928.10.01 Scarifying - 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.

When exposed reinforcing steel necessitates concrete being removed from within the demarcated areas to the depth specified for the adjacent scarifying using chipping hammers, such work shall be paid as Extra Work.

- 928.10.02 Access to Work Area, Work Platform, and Scaffolding - Item**
- Concrete Removal - Complete Deck - Item**
- Concrete Removal - Deck Joint Assemblies - Item**
- Concrete Removal - Full Depth - Item**
- Concrete Removal - Partial Depth Type A - Item**
- Concrete Removal - Partial Depth Type B - Item**
- Concrete Removal - Partial Depth Type C - Item**
- Concrete Removal - Structural Component - Item**

Payment at the Contract price for the above tender items shall be full compensation for all labour, Equipment, and Material to do the work.

When the Contract does not contain a separate tender item for access to the work area, work platform and scaffolding, the Contract price for the concrete removal items shall include full compensation for all labour, Equipment, and Material to provide access to work area, work platform, and scaffolding.

Payment for the appropriate tender item Concrete Removal - Partial Depth Type A, Concrete Removal - Partial Depth Type B, or Concrete Removal - Partial Depth Type C or any combination of the three shall include full compensation for all labour, Equipment, and Material to remove concrete locally around the second layer of reinforcing steel to provide a minimum 25 mm clearance around the reinforcing steel.

When the replacement of corrosion damaged reinforcing steel is required, such work shall be paid as Extra Work.

Work related defects repaired as remedial work shall be completed at no extra cost to the Owner.

TABLE 1
Time Requirements for Concrete Removal Surveys

Concrete Component	Maximum Area Surveyed Per Time Period m ²	Time Period Business Days
Bridge deck surface, including sidewalks, concrete barrier, and parapet walls.	3,000	3
Bridge deck soffit, including fascias.	1,500	3
Abutments, wingwalls, and retaining walls.	1,000	2
Piers	500	2
Culverts	500	2

**Appendix 928-A, April 2012
FOR USE WHILE DESIGNING MUNICIPAL CONTRACTS**

Note: This is a non-mandatory Commentary Appendix intended to provide information to a designer, during the design stage of a contract, on the use of the OPS specification in a municipal contract. This appendix does not form part of the standard specification. Actions and considerations discussed in this appendix are for information purposes only and do not supersede an Owner's design decisions and methodology.

Designer Action/Considerations

No information provided here.

Related Ontario Provincial Standard Drawings

No information provided here.