

B902 - EXCAVATION AND BACKFILL FOR STRUCTURES (OPSS 902)**902.1 GENERAL****902.1.1 Excavation for Structures****902.1.1.1 Excavation Within Backfill Zone**

Excavation for structures deals with excavation within backfill zone as defined in Section 6 of the Canadian Highway Bridge Design Code (CHBDC) and as recommended in the Foundation Investigation and Design Report (FIDR) in earth or rock for the placement of the following types of structures:

- a) Bridges
 - i) Working slabs/pads
 - ii) Footings for piers and abutments
 - iii) Wingwalls
- b) Concrete Culverts (Cast in Place; Precast)
 - i) Working slabs
 - ii) Bedding
 - iii) Footings
 - iv) Aprons
 - v) Headwalls
- c) Retaining Walls
 - i) Working slabs
 - ii) Footings

902.1.1.2 Excavation Beyond Backfill Zone

Excavation beyond the backfill zone is covered by OPSS 206 and includes additional excavations for the following items:

- a) Backfill- Frost Tapers
 - i) Bridges
 - ii) Concrete culverts
 - iii) Retaining walls

902.1.2 Backfill to Structures

This is not a separate tender item. Granular backfill is included as part of the general granular item.

Recommendations for backfill shall be provided in the FIDR.

Concrete structures may be backfilled with rock. In certain circumstances, when granular material is not readily available or in order to reduce high granular costs, rock available for fill may be used as backfill material. Before opting for rock backfill, a cost comparison must be completed to determine the more economical alternative.

902.2 REFERENCES

- Foundation Investigation and Design Report (FIDR)
- Pavement Design Report
- Canadian Highway Bridge Design Code (CHBDC)
- OPSS 206 Grading
- OPSS 510 Removal
- OPSS 1205 Clay Seal

902.3 TENDER ITEMS

0902-0010	Earth Excavation for Structure	(Normal, m3, PQP)
0902-0020	Rock Excavation for Structure	(Normal, m3, PQP)
0902-0030	Dewatering Structure Excavations	(Normal, lump sum)
0902-0040	Clay Seal	(Normal, lump sum)

902.3.1 Related Tender Items

Other tender items usually required with the excavation and backfilling of structures include granular material and protection system.

902.4 SPECIFICATIONS

The requirements for the excavation and backfilling of structures are contained in OPSS 902.

902.5 SPECIAL PROVISIONS

The designer should refer to Chapter “E” of this manual to review the special provisions applicable to these tender items.

902.6 STANDARD DRAWINGS

Applicable standard drawings are contained in the 800 and 3000 series of Ontario Provincial Standard Drawings (OPSDs).

902.7 DESIGN

The FIDR contains recommendations regarding the limits, geometry, and composition, properties of backfill, drainage requirements and compaction and placement of backfill.

The FIDR contains recommendations regarding the requirements for the geotextile specifically the class, the physical properties and the filtration opening size.

Frost tapers to establish the limits and geometry of the backfill zone are provided in

the FIDR and the Pavement Design Report.

Recommendations regarding dewatering are included in the FIDR. The requirements for a dewatering specialist to be retained by the Contractor and for a preconstruction survey related to dewatering are provided in the FIDR.

Recommendations for a clay seal at culvert inlets to prevent piping due to seepage gradients in the backfill and cover to the culvert are provided in the FIDR. OPSS 1205 includes the requirements for a natural clay and a geosynthetic clay liner.

Recommendations for a protection system are included in the FIDR.

902.8 COMPUTATION

Earth Excavation for Structure and Rock Excavation for Structure are Plan Quantity Payment items and are measured in cubic metres. Dewatering Structure Excavation and Clay Seal are lump sum items.

902.8.1 Source of Information

The main sources of information for guidance are the Pavements and Foundations Section in MERO, the Structural Office/Section and the Regional Geotechnical Section.

902.8.2 Method of Calculation

902.8.2.1 Earth and Rock Excavation

The total excavation for structure includes the excavations required to place the concrete structure, beddings and the backfill zone for drainage and frost tapers.

These tender items include the removal of overlying asphaltic or concrete pavements, curb and gutters and sidewalks.

Where there are separate tender items in the contract for the removal of pavements, curb and gutter or sidewalk, then payment for the removal of these surface features will be made under the appropriate tender items. In either case, the earth excavation for structure quantity shall include the pavement volume (including concrete base and asphalt treated base), curb and gutters and sidewalks.

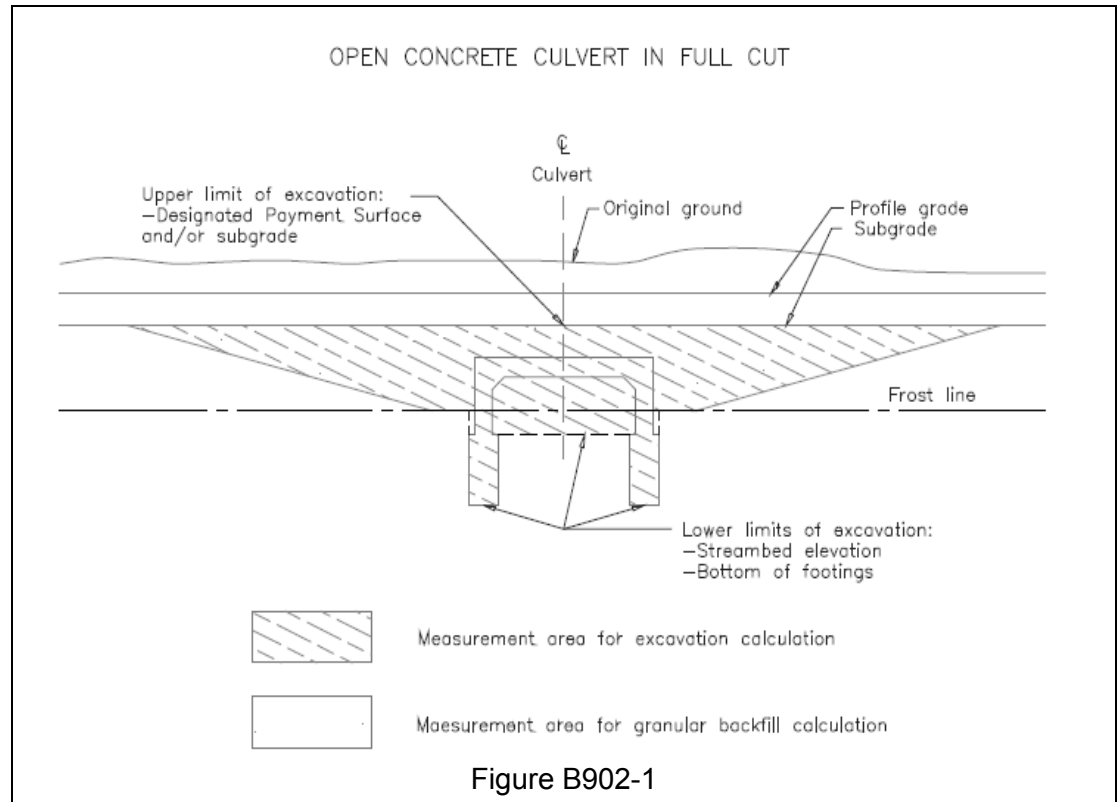
The excavation required to place a concrete structure is determined by calculating the volume in cubic metres normally based on:

1. An upper limit of:
 - a) Original ground, or
 - b) The designated payment surface (as per 902.9.1.3)
2. A lower limit of:
 - a) Bottom of footing
 - b) Bottom of bedding

- c) Bottom of working slab/pad
- d) Sub-excavation of weak/deleterious material
- e) Other special application

3. The plan area of the footings.

In excavating for standard and rigid frame open-footing concrete culverts, the material between the walls/footings and above the stream bed elevation shall be part of the structure excavation (see Figure 902-1).



For the removal of an existing concrete culvert only, the excavation required shall be paid under OPSS 510 Removal of Concrete item.

For the removal and replacement of an existing culvert, the volume of the excavation outside of those limits that is required to place the new concrete culvert is paid under the OPSS 902 item.

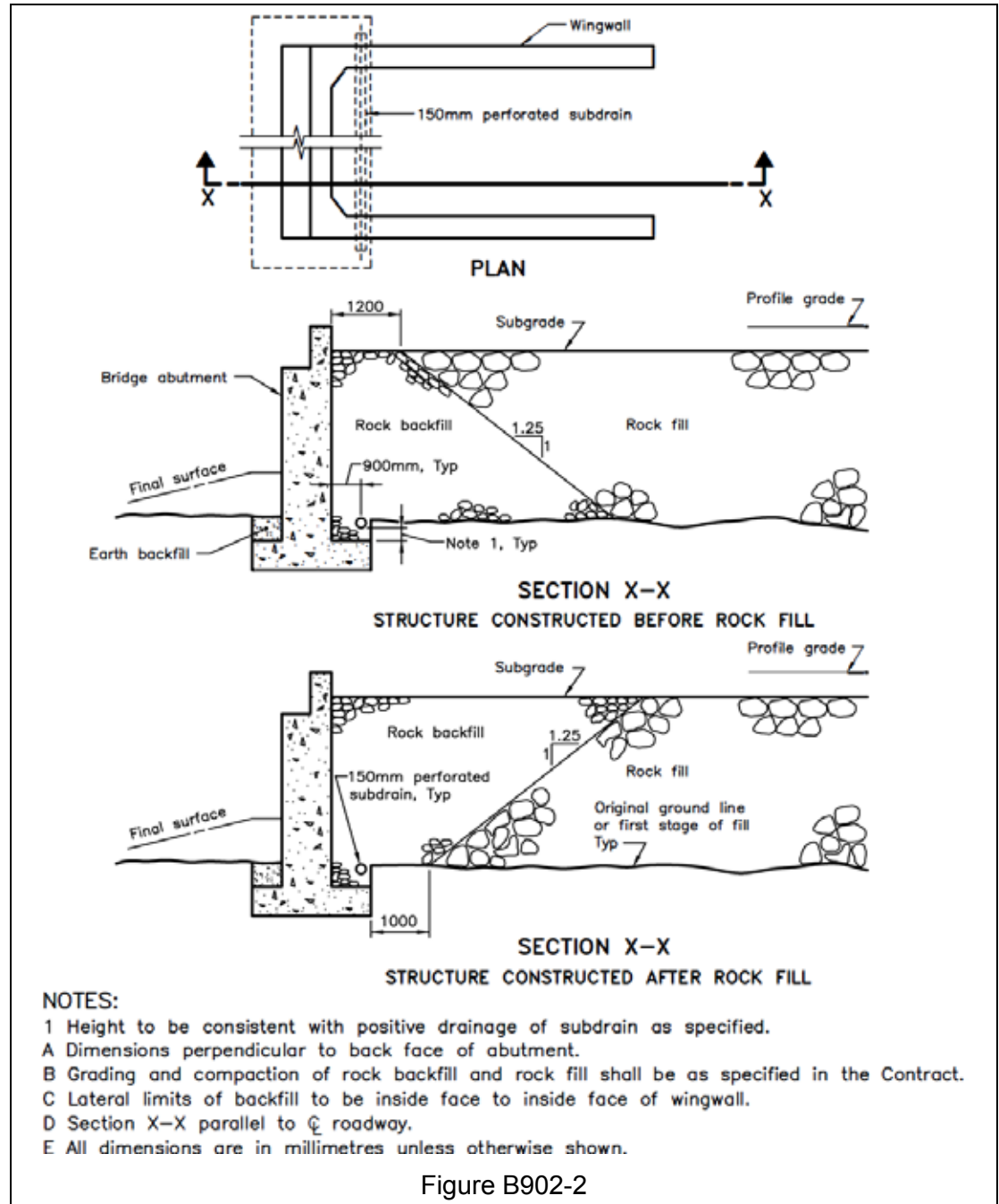
Excavation in rock is the same as that for earth, except that the upper limit is the rock line rather than the original ground line. Should a culvert occur in a rock cut location, the upper limit of rock is considered as the top of shatter.

902.8.2.2 Backfill - Granular/Rock

Granular backfill quantities are computed according to the dimensions shown on the OPSDs or the Structural Drawings. The upper limit is the bottom of granular sub-

base (except for retaining walls in cuts), and includes backfill for frost tapers, where required.

Rock backfill quantities for bridge abutments are computed according to Figure B902-2 depending on whether the structure or roadbed is constructed first. This will be determined in consultation with the regional Structural Section.



902.8.2.3 Clay Seal

For a natural clay liner, the volume of clay seal shall be computed by multiplying the surface area of the clay seal by the thickness of the clay seal.

For a geosynthetic clay liner (GCL), the surface area and thickness of the GCL shall be specified in the structural drawings. The surface area shall be calculated by multiplying the lateral and vertical extent.

902.8.2.4 Designated Payment Surface

If using the original ground elevation results in excessive overlap between earth excavation for structure and earth excavation for grading, the designer, in consultation with the Regional Structural Section, may choose a designated payment surface (DPS) at a lower elevation, with the purpose of reducing the overlap. When the original ground line is well above the subgrade line (and, in fact, above the top of proposed pavement), then a DPS could be struck at the subgrade elevation. This surface would be horizontal both longitudinally and transversely, (see Figures B902-3 and B902-4).

The following considerations affect the application of the DPS:

- a) Overlapping excavations are to be tolerated unless it is determined that the volume obtained is unrealistic, to the extent that contract balancing would be based on erroneous quantities;
- b) The DPS is to be used only in exceptional situations.

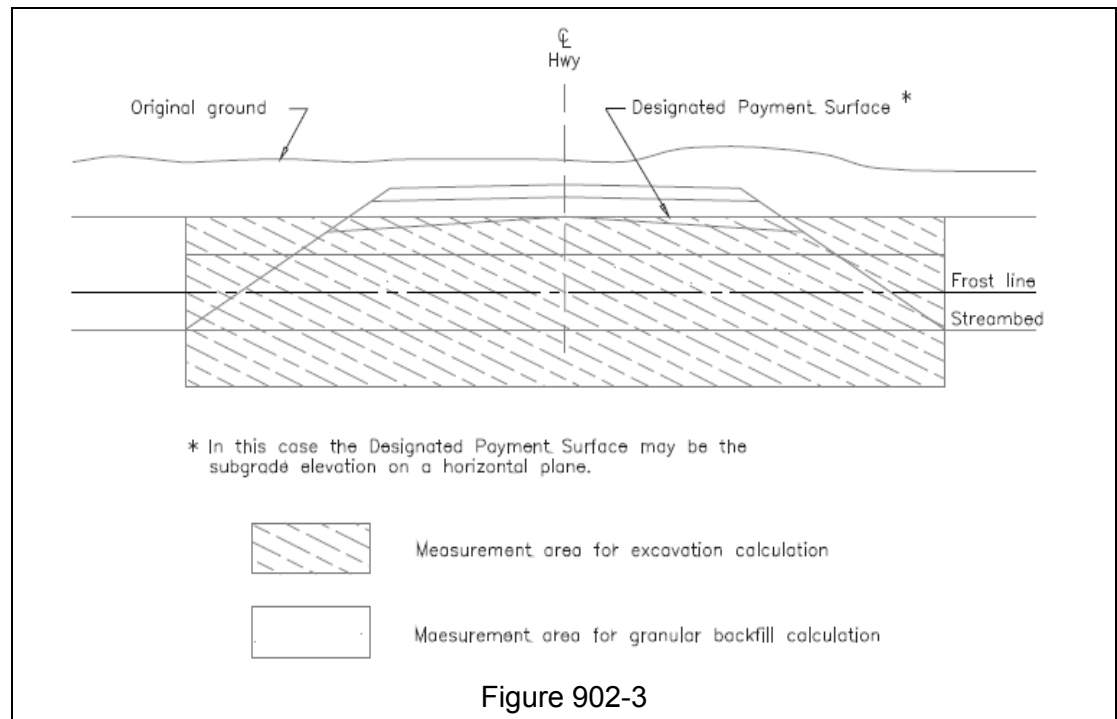
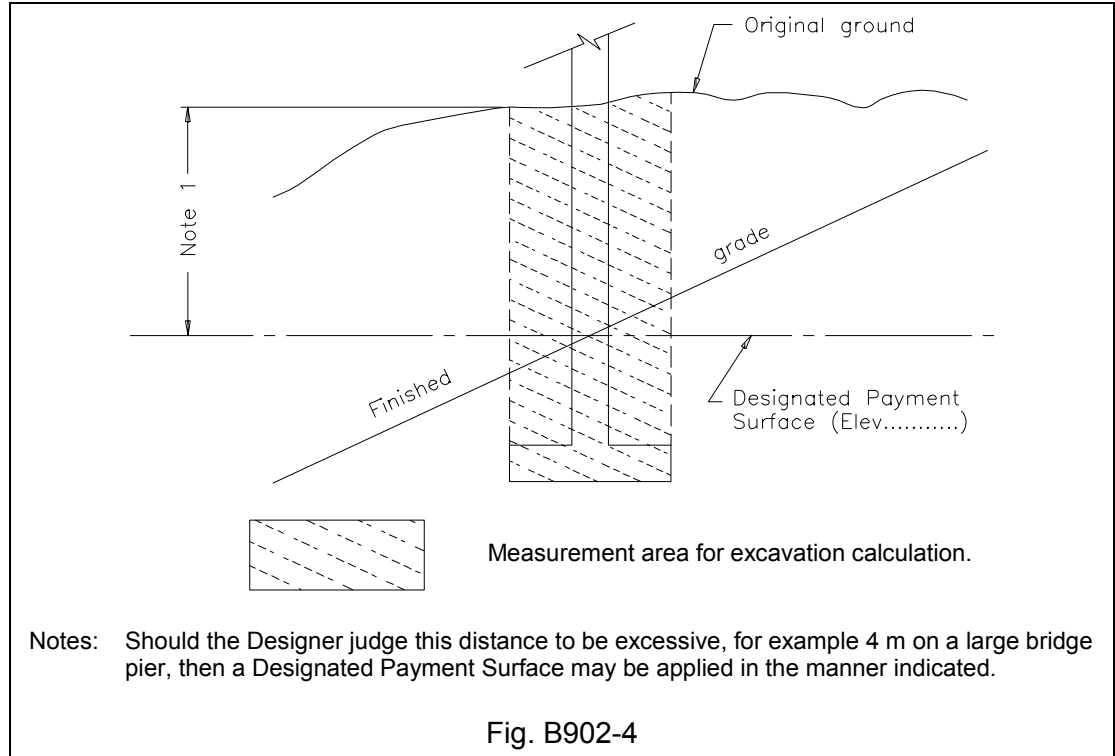


Figure 902-3



902.9 DOCUMENTATION

902.9.1 Contract Drawings

902.9.1.1 Excavation and Backfilling Drawings

Neat lines showing the area(s) of excavation shall be shown on the removal drawing(s). Neat lines showing the area(s) of backfilling shall be shown on the new construction drawing(s). The profile of the excavation and backfill shall be shown in the typical sections and details of the Contract Drawings.

When standard drawings apply to the work, a reference to the standard drawing(s) shall be included.

902.9.1.2 Protection System

Where the design shows a need for a protection system, a protection scheme system will be shown on the structural drawings. A separate tender item must be provided to cover the protection system work.

902.9.1.3 Designated Payment Surface

For each structure that utilizes a designated payment surface, a detailed sketch with supporting elevation(s) must be shown on the highway grading drawings, and not on structural drawings.

902.9.1.4 Use of Specific Materials

When the design depends on the use of a specific material, that material must be identified on the drawings even when it is to be provided under the Earth Excavation (Grading) or Earth Borrow item.

902.9.1.5 Clay Seal

A detailed dimensioned sketch for each location must be shown on the structural drawing. Note that clay seal information for pipe culvert locations are kept separately from those for Excavation for Structures.

902.9.1.6 Geotextile

The details of the geotextile including the type, class and filtration opening size shall be shown on the structural drawings.

902.9.2 Quantity Sheets

Each tender item is to be entered into a separate column in the quantity sheets. For multiple structures on the same contract, separate tender items are used for each applicable structure.

902.9.2.1 Excavation for Structures

Excavation quantities for each structure, computed in cubic metres to the nearest whole number, must be checked.

The quantity for each structure such as, bridge, concrete culvert and retaining wall will be shown separately on or "Quantities - Structural" sheet and the columns (Earth, Rock) totaled to form the tender quantities.

902.9.2.2 Dewatering Structure Excavation

Where dewatering operations are required, the appropriate column should show "100%" against the structure entry on the "Quantities – Structural" sheet.

902.9.2.3 Granular Backfill

The granular backfill quantity for each structure such as bridge, concrete culvert and retaining wall is included as part of the applicable item.

When using a designated payment surface, the granular material that exceeds the designated payment surface shall be included under the applicable granular tender item and is shown on the "Quantities - Hot Mix and Granular" sheet. The column subtotal is transferred to the main granular item to be totaled to form the tender quantities.

902.9.2.4 Clay Seal

Clay seal is documented on the “Quantities – Structural” sheet where concrete structures are documented. It is identified as a separate tender item without quantity entries. Note that clay seal information for pipe culvert locations are kept separately from those for concrete culverts, and generate a separate lump sum tender item under OPSS 421.

902.9.3 Documentation Accuracy

Volume (m3) quantities are documented to the nearest whole cubic metre.

902.9.4 Non-Standard Special Provisions

A NSSP is required when rock is to be used as structure backfill. The gradation, method and sequence of placement of the backfill material is to be provided. The rock backfill is paid for as part of the rock excavation from which it is obtained.

NSSP FOUN0003 is to be used when the Dewatering Structure Excavation item is required. The design storm return period and preconstruction survey distance are to be provided.