

B950 – GLASS FIBRE REINFORCED POLYMER (GFRP) REINFORCEMENT FOR CONCRETE – (OPSS 950)

B950.1 GENERAL

The work under these items consists of the placing of glass fibre reinforced polymer (GFRP) internal reinforcement for concrete. The following design guidelines should be read in conjunction with CDED B904.

B950.2 REFERENCES

- Structural Manual;
- Canadian Highway Bridge Design Code (CHBDC), CSA-S6;
- Designated Sources for Materials (DSM) lists;
- OPSS.PROV 1640;

B950.3 TENDER ITEMS

0950-0010	Reinforcing GFRP Bar, Grade III	(Normal, Lump Sum)
9999-9205	Glass Fibre Reinforced Polymer Dowels Into Concrete	(Normal, Each, PQP)

B950.4 SPECIFICATIONS

The requirements for the work of placing GFRP reinforcing bars are contained in OPSS 950.

The requirements for the labour, equipment, and material to do the work of installing GFRP dowels into concrete are contained in a Structures Office non-standard special provision.

B950.5 SPECIAL PROVISIONS

The designer should refer to Chapter "E" of this manual to review applicable special provisions.

B950.6 STANDARD DRAWINGS

Drawings for GFRP reinforcing bar are contained in Ontario Provincial Standard Drawings (OPSD), Ministry of Transportation Ontario Drawings (MTOD), and Structural Standard Drawings (SSD).

B950.7 DESIGN

Refer to the Structural Manual and Structural Standard Drawings for standard details and exceptions to the Canadian Highway Bridge Design Code (CHBDC), CSA-S6.

Refer to the Designated Sources for Materials (DSM) list. Currently, only Grade III GFRP straight bars, bent bars and anchor headed bars meeting D1 (high) durability category are permitted in MTO structures.

GFRP bars are manufactured to shape and cannot be bent in the field, only shop bent shapes are permitted.

Design requirements for GFRP reinforced concrete are contained in the Structural Manual and the CHBDC.

Following the collapse of the suspended ceiling system of the I-90 connector tunnel in Boston on July 10, 2006, significant research was undertaken on the design, approval and installation of post-installed adhesive metallic anchor systems. Very limited research has been conducted in the use of FRPs as post-installed adhesive anchors and the evaluation methods used for metallic products have not been proven for use with FRPs. GFRP dowels shall not be permitted except in down-hole installation only.

B950.8 COMPUTATION

B950.8.1 Item Payment Basis

GFRP reinforcing bars is a Lump Sum item.

GFRP dowels are non-standard Plan Quantity Payment items and are measured in Each.

B950.8.2 Sources of Information

MTO uses approved suppliers of the Designated Sources for Material (DSM) for GFRP reinforcing bar.

Further information on the requirements for GFRP reinforcing bar can be found in OPSS 1640 Glass Fibre Reinforced Polymer (GFRP) Reinforcement for Concrete.

The main source of information for the tender items above is the Structures Office.

B950.8.3 Method of Calculation

The unit of measurement for the GFRP reinforcing bar item is LS/m³. The cubic metre quantity is calculated for cost estimating only. The volume is calculated using the nominal bar area (not the suppliers' listed/actual/measured area). The GFRP volume shall be provided by the Structural Office/Section for use by the Estimating Office. These quantities will not form part of the Tender Documents. In the tender, the item is Lump Sum (LS) with a quantity of 100%.

The unit of measure for dowels is Each. Dowels are Plan Quantity Payment items.

B950.9 DOCUMENTATION

B950.9.1 Contract Drawings

The designer includes the pertinent drawings provided by the Structure Office/Section into the contract.

The standard drawing notes for GFRP are found in the Structural Manual and are copied onto the relevant drawing.

B950.9.2 Quantity Sheets

GFRP reinforcing bars are recorded on Quantities Structure Q-Sheet. For multiple structures on the same contract, separate tender items are used for each applicable structure.

For GFRP reinforcing bars, the notations "100%" and "L.S." must also be shown in the "Totals" and "Unit" lines respectively for the appropriate rebar items against each component requiring GFRP reinforcement (i.e., concrete culvert, headwall, appurtenance, etc.).

For precast elements the GFRP reinforcing bar shall be included in the precast item.

The Structural Office/Section shall supply separate estimated quantities for GFRP reinforcing bar, for the Estimating Office, in the "Notes to Planning and Design." These notes are for information purposes only, and form part of the structural package sent to Planning and Design. Planning and Design will forward these quantities to the Estimating Office.