

8.1 Concrete Slope Protection - General

Concrete slope protection is normally provided on the head slopes of approach for a grade separation, or on slopes of river training works. The concrete slope protection resists erosion by wind and water and provides an esthetically pleasing surface with little maintenance required.

- Slopes to be protected required trimming to approximately the lines and grades shown on the drawings.
- The Contractor is required to do trimming to a surface 200 mm below the final concrete surface, and to place 100 mm of compacted granular fill and 100 mm of reinforced concrete.
- The Bridge Inspector must take elevations of the slope to determine if there are any discrepancies and should submit the results to the Bridge Project Engineer for review.
- The final grades of the slope protection may be adjusted to minimize or eliminate any Extra Work required, however the toe elevation is usually critical.
- The elevations for the top and bottom cut off walls are often specified and should not be altered unless approval is obtained from the Bridge Project Engineer.
- If the grade of the slope has discrepancies in its surface that final trimming requires excavation greater than 250 mm or more than 150 mm of fill, and the discrepancies were constructed by others, the excess quantities will be considered as Extra Work.
- If the discrepancies are the result of the contractor's activities, there will be no entitlement to extra compensation.

8.2 Environmental Constraints

Be aware of the environmental constraints governing the site as outlined under the environmental Code of Practice. Note the following requirements:

- Deposition of concrete or other debris in the stream channel is not permitted.
- Concrete truck or pump should be cleaned in a suitable area away from the worksite and the water channel
- Before final acceptance of the concrete slope protection, the Contractor is required to remove and dispose of all earthworks, such as berms and access roads.

- The Contractor is required to leave the bridge site, roads, stream channel and adjacent property in a neat and satisfactory condition.
- If adjacent property outside the right-of-way has been affected, the Contractor must provide written evidence that cleanup is satisfactory to the property owners.
- All disturbed riverbanks and/or borrow pits are to be satisfactory restored/reclaimed.

8.3 Safety

Refer to the Alberta's Occupational Health and Safety Regulation, General Safety Requirements for specific approved safety requirements:

- Part 3 Health and Safety Plan
- Part 4 Hazard Assessment, Elimination and Control
- Part 9 Entrance, Walkways, Stairways and Ladders
- Part 15 Personal Protective Equipment
- Part 27 Excavation, Tunnelling and Trenching
- Issue "STOP WORK" order to the Contractor if necessary.

8.4 Bridge Inspector's Record

The Bridge Inspector should keep an accurate record of the following information:

- Headslope survey information.
- Weather conditions on pour days.
- All quality control test results.
- Location of each tested batch.
- Maximum and minimum temperature inside the hoarding during winter concreting.
- Measured total area of concrete slope protection placed.

8.5 Material

Materials required in the construction of concrete slope protection include granular backfill, appropriate formwork, wire mesh reinforcement and concrete.

- The granular fill underneath the concrete and in the top or the toe of the cut-off walls is to conform to the applicable Specification requirements.
- The concrete shall meet the requirements of the Class B concrete as defined in the applicable specification
- Wire mesh reinforcing shall be 152 x 152 MW25.8 x MW25.8 flat welded wire mesh, and is to be supplied by the Contractor. The first set of two digits refer to the wire spacing in mm in each direction, and the second set of digits refer to the wire size (gauge) in each direction.
- Thickness of the granular fill and the concrete are to be measured perpendicular to the slope.

8.6 Placing

It is important that granular backfill, welded wire mesh and concrete are carefully placed for concrete slope protection.

8.6.1 Granular Backfill

Granular backfill serves as a base for the concrete slope protection.

- The granular fill is to be placed and compacted to a uniform thickness.

8.6.2 Welded Wire Mesh

The welded wire mesh serves as reinforcement for the concrete slope protection and must be properly installed to be effective.

- The welded wire mesh must be supported adequately in order to ensure that it remains at the mid-depth of the concrete.
- Formwork should be constructed in two pieces, one below and one above the mesh to provide support at the edges.

8.6.3 Concrete

Extra attention is required in placing concrete on a steep slope and precautions must be taken to ensure that the concrete does not freeze when placed during the cold weather months.

- The Contractor should do a layout of the slope protection prior to forming, so that horizontal or vertical strips of equal width will result.
- Slump control is vital to pouring concrete slope protection. Too low a slump will make finishing of the surface very difficult, whereas too high a slump will result in concrete tending to flow down the slope.
- Concrete may be placed in horizontal or vertical strips with one strip being allowed to cure before the adjacent strip is placed. Pouring alternate strips helps to reduce shrinkage and control thermal cracking.
- Horizontal or vertical joints between adjacent sections are to be cold joints with no filler. Joints are to be formed or grooved to provide regular locations for shrinkage and thermal contraction to occur. All joints are to be finished to a rounded edge with proper edging tools and must be at least half the depth of the concrete to the mesh. These joints must be carefully done to ensure that they are continuous and straight.
- The concrete must be consolidated as it is placed, but too much effort with the vibrator will result in concrete flowing down to the lower edge of the slope. A small amount of vibration, along with “spading” by the workers is essential to get the required consolidation.
- The surface is to be given a Class 5 Floated Surface Finish, Broomed Texture as specified in the Cast-In-Place Concrete section. The concrete is cast in a relatively thin section and it is very susceptible to rapid drying or cooling. Moisture may have to be added after initial set for curing before a sprayed membrane is applied.
- In cold weather, the Contractor may have to preheat the ground before placing concrete, and also provide hoarding and heating as required for curing.

8.7 Checklist**8.7.1 Bridge Inspector’s Responsibilities**

- Review the applicable Specification section and study the Drawings.
- Survey the slopes to determine whether they have been placed to within specified tolerance, particular the top and bottom elevations.

- If there are discrepancies in the required slope surface, provide the profile to the Bridge Project Engineer for consideration of modifications.
- If Extra Work by the Contractor is required in trimming the slope, record the quantities of material for which “Extra Work” will be paid.
- Check to ensure that the top, side and toe cut off walls are constructed as required.
- Check the granular fill material for gradation, thickness and compaction.
- Ensure that the forms are straight.
- Check that the size and type of reinforcement is as specified.
- Ensure that the mesh is flat and adequately supported at mid depth of slab, and remains at mid depth during placing operations.
- Ensure the Contractor checks the concrete for air, slump and strength.
- Ensure that the concrete is being properly and neatly edged in straight continuous line, which results in an esthetically pleasing appearance.
- Ensure that the Contractor takes proper measures to protect concrete during curing.
- Measure and calculate the quantities for payment.

8.7.2 Bridge Project Engineer’s Responsibilities

Discuss the following items with the Contractor and the Bridge Inspector:

- The pour procedure and schedule.
- The access road and berm locations.
- The hoarding and heating requirements if required.
- The final site cleanup, including restoration of riverbanks, access road, borrow pits and disposal areas, etc.

SECTION 8

CONCRETE SLOPE PROTECTION



8-1 Preparation of headslope



8-4 Concrete Slope Protection on headslope



8-2 Horizontal strip concrete placement



8-5 Vertical strip concrete placement



8-3 Pouring alternate strips to reduce shrinkage and control thermal cracking in addition to facilitating placing and finishing



8-6 Pouring alternate vertical strips

SECTION 8

CONCRETE SLOPE PROTECTION



8-7 Formwork for upper concrete slope protection



8-10 Forming key at the bottom of headslope



8-8 Alternate vertical strip concrete placement



8-11 Formwork for lower half of concrete slope protection



8-9 1st alternate vertical strip concrete placement complete



8-12 Concrete slope protection complete for lower portion