

7.1 Precast Concrete Girder Erection - General

Erection of precast concrete girders includes transporting the girders to the site, handling and temporary storage, installing anchor bolts, shear blocks and bearings, erecting the girders, placing and grouting connectors, post-tensioning, placing expansion assemblies, grouting the anchor bolts and placing grout pads.

- A major concern with girder erection is the security and stability of the superstructure during all phases of erection with respect to construction conditions, wind loads and construction loads.
- Delivery of precast concrete girders to the site cannot always be scheduled such that the units are lifted directly from the trucks and erected on the sub-structure.
- If girders are to be temporarily stored at site, the Bridge Inspector must check that the Contractor places the units on adequate timber blocking to keep them clean and adequately drained.
- Girders must be stored upright, braced to prevent tipping and supported at the bearing points only.
- Units must be lifted only at the lifting holes or hooks provided near the ends of the girders and must be kept vertical at all time, in order to prevent damage.
- Girder spans that are not over water can be erected with crawler or truck mounted cranes operating on the ground.
- Some long girders with thin webs require temporary compression flange support.

7.2 Environmental Constraints

Be aware of the environmental constraints as outlined in the Special Provisions, Specification Amendments, Plan and Permits sections of the Contract, and note the following:

- Before final acceptance, the Contractor is required to remove all temporary works.
- All earthwork, temporary pilings and falsework are to be removed and acceptably disposed.
- 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 his cleanup is satisfactory to the property owners.
- All disturbed riverbanks are to be acceptably restored, and borrow pits satisfactory reclaimed.

7.3 Safety

It is ESSENTIAL to have a pre-girder erection meeting with the Contractor to discuss all the safety issues.

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

- Part 3 Health and Safety Plan
- Part 4 Hazard Assessment, Elimination and Control
- Part 5 Specifications and Certifications
- Part 7 Cranes and Hoists
- Part 9 Entrances, Walkways, Stairways and Ladders
- Part 15 Personal Protective Equipment
- Issue "STOP WORK" order to the Contractor if necessary.

7.4 Bridge Inspector's Record

The following items must be included in the Bridge Inspector's record:

- Ensure agreements are in place between Contractor and private landowner pertaining to borrow and disposal areas.
- Record traffic disruptions or minor traffic mishaps.
- Record all "as-built" survey information and camber corrections.
- Record all shim elevations.
- Record temperature and bearing settings.

- Record final girder elevations.

7.5 Preliminary Work

The erection proposal is to be submitted for review and approval by the Bridge Project Engineer. The Bridge Inspector must not allow any erection work to begin until approval of the erection scheme has granted. This approval does not relieve the Contractor of his responsibility for safety and for ensuring that the work is done in accordance with the plans and specifications.

The erection procedure should address the following in full detail:

- Traffic accommodation plan as necessary.
- Survey of substructure.
- Access to work, earth berms, work bridges, and ice bridges.
- Sequence of operations.
- Size and position of cranes.
- Lifting devices and lifting points.
- Falsework details (Professional Engineer's stamp required).
- Method for securing the girders prior to grouting.
- Grouting procedures.
- Falsework release.
- Temporary access removal.

The Bridge Inspector must ensure that the following steps are diligently carried out to ensure all erection requirements are satisfactory achieved.

- Review and understand the erection procedure.
- Review falsework and traffic accommodation plan.
- Survey of the completed substructure prior to beginning of erection.
- The survey is to be done independently of the Contractor.

- Check that centrelines of bearings for piers and abutments, and bridge roadway centrelines are in the correct location.
- Check the locations of anchor bolts or pockets, elevations of pier and abutment seats and elevations of bearing pads.
- Where girders are erected onto bearings, ensure that the Contractor is required to take special precautions with the bearing areas on the piers and the abutments.
- The concrete surface to receive the bearings is to be finished to a smooth, true, uniform surface to ensure full contact.
- Minor grinding, chipping or filling may be required to ensure proper contact of the bearings.
- Bearings to be grouted are generally set on stacks of thin galvanized steel shim plates.
- Check the elevations of the bearings and review the shims requirements to ensure that they will be stable under load, and are distributed such that the bearings will not be damaged by high local stresses.
- Ensure that anchor bolts are fully grouted with an approved flowable grout.
- The grout must be kept sufficiently warm and wet to ensure proper curing.

7.5.1 Ice Bridge

It is advantageous to schedule girder erection over a river during the cold weather months, to take full advantage of the river ice to support all the equipment necessary to complete the erection.

- The river ice thickness must be adequate to support the erection equipment and may require flooding.
- Normally, 1.5 m of SOUND ice is required to support the erection equipment and concrete girders. However thicker ice may be required for extra heavy loads.
- In preparation for building ice, the snow should be piled around the perimeter to serve as a berm to contain the flooding water inside this area.
- On cold days, water can be pumped from holes drilled through the ice to flood the work area.

- It is sometimes advisable to do ice building during the night when air temperatures are more conducive.
- It is ESSENTIAL that the ice thickness be checked daily as the flowing water in the channel below the ice will have a continuous effect of eroding the ice thickness.
- When heavy loads are anticipated, it may be necessary to drive piles at crane outrigger locations for extra support.
- Falsework towers, if required to support the girders at the splice points, must be founded on piles not on ice.
- The Ice Bridge will tend to move, crack and heave as the temperature conditions change, and it is therefore important that the supporting piles be free of the ice at all times, to prevent the piles from being “pushed-up”.

7.6 Erection and Assembly

Erection of the precast concrete girders must be done accurately and carefully, as shown on the Drawings and in a manner that will prevent damaging the girders.

- Contractor must clean the bearing surfaces and the surfaces to be in permanent contact before the members are assembled.
- Check the elevations, camber, and girder alignment and ensure that the diaphragms are completely connected.
- Take profiles of the girder tops so that camber adjustments may be determined with particular emphasis on the differential camber between adjacent girders.
- When the girders are satisfactorily erected and approved, ensure that the lifting devices are cut off, all lifting pockets are filled with grout, and lifting holes on exterior girders are filled with grout.
- Inspect the girders for cracks, chips or other damage, which may have occurred during erection.
- Report any damaged girders noted to the Bridge Project Engineer.
- If post-tensioning of the girders is required, discuss the procedures and all aspects of the inspection required with the Bridge Project Engineer.

- When grouting post-tensioning tendons, ensure that there are a sufficient number of “breather holes” and ALWAYS commence grouting from the LOW end towards the HIGH end.
- Before final acceptance of the erected structure, the Contractor is required to remove all temporary works from the site.
- All earthworks, temporary pilings, falsework and the like are to be removed and disposed of to the satisfaction of the Bridge Inspector.
- The Contractor is to leave the bridge site, highway, stream channel and adjacent property neat and in an acceptable state.
- If adjacent property outside the right-of-way has been affected, the Contractor is required to provide to the Department written evidence that his cleanup is satisfactory to the property owner.

7.7 Checklist

7.7.1 Bridge Inspector’s Responsibilities

- Review the applicable Specification and study drawings.
- Survey substructure prior to erection to check centrelines, bearing locations, and elevations.
- Check that the erection scheme and falsework details are submitted by the Contractor and approved by the Bridge Project Engineer.
- Study and understand the erection scheme and the post-tensioning procedure.
- Check access roads and berms for stability, scour and drainage. Ensure conformity with Environmental Code of Practice.
- Check installation of anchor bolts, bearing elevations, shims below bearings, temperature offset of expansion bearings, and grouting of anchor bolts and base plates.
- Ensure that when girders are stored on site they are on blocking to keep them clean and securely braced.
- Check that all bearings and bearing surfaces of girders are clean before erection.
- Check security and stability of girders as erection progresses.

- Ensure all diaphragms are completely connected and properly fitted.
- Check that lifting hooks are cut off and all holes are grouted and metal parts painted.
- Inspect girders for cracks, chips or other damage.
- Survey top profile of each girder to record camber data.
- Ensure that cleanup has been satisfactory done and if private property is involved ensure that owner is satisfied.

7.7.2 Bridge Project Engineer's Responsibilities

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

- Discuss the "as-built" survey information and decide on corrections and elevations.
- Discuss the erection procedure.
- Discuss post-tensioning procedure if required.
- Discuss access road and berm locations.
- Discuss the final girder alignment.
- Discuss proposed methods employed for securing the girders.
- Discuss the final site cleanup, including restoration of riverbanks, access road; borrow pits and disposal areas.

SECTION 7

PRECAST CONCRETE GIRDER ERECTION



7-1 Precast concrete girder delivered to site



7-4 Girder on temporary bearing at abutment



7-2 Hoisting precast concrete girder into position with two crawler cranes



7-5 First girder erected, stabilized with temporary shoring



7-3 Girder on temporary bearing at pier



7-6 Subsequent girders erected, stabilized with permanent steel diaphragms

SECTION 7

PRECAST CONCRETE GIRDER ERECTION

Standard SC-510 Girders



7-7 Erecting girders on top of previously erected girders



7-10 Erecting first span girders from approach



7-8. Erecting girders from the ice



7-11 Erecting middle span girders on top of previously erected first span girders



7-9 Using a launching truss for girder erection



7-12 Erecting third span girders on top of previously erected middle span girders