709.00 Girder Shims

A. Definition

1. A girder shim is defined as the distance measured from top of girder to top of finished slab. There are three different types of bridges which we build that have girder shims. The first type is a steel girder bridge, either a rolled beam section or a plate girder section. The second type is a prestressed girder (NU Girder Section). The third type is a prestressed twin tee girder. When taking shim shots on a prestressed twin tee girder, they should be taken at the edges of the twin tee. Take shim shot on steel girders or NU girders along the girder centerline.

2. For each type, the definition of the girder shim is the same; girder shim is the distance measured from the top of girder to top of finished slab.

3. Stages of the Girder Shim Process The Bridge Division, upon completion of the design, will prepare the shim input forms. After the project has been let, we send these forms to the Project Manager. After the girders are erected and prior to forming the deck for the slab, shim shots are required to be taken. These shim shots should be taken at the bearings, field splices, and at 3 m intervals along the length of the girder. The shim shots can be recorded on the input forms.

4. The H.I. Elevation needs to be recorded by the inspector at the time the shim shots are taken.

5. The rod readings at each location are recorded on RDP Form 50a. This information is normally sent by computer to the Bridge Division. The Bridge Division will run a computer program which uses the grade of the roadway, crown of roadway, the dead load deflection of the girder, and your rod readings to determine the amount of shim at each location.

6. The Bridge Division will look at the shims to see if they are too large or too small. The final shim information will be sent to the Project Manager along with solutions to any problems which may have occurred.

7. The proper girder shims are critical to ensure that construction of the bridge is in accordance with the intended design.

8. Composite Girders

    a. There are two methods of designing girders. One method is a non-composite design and the other method is a composite design. The non-composite design is basically the slab sitting on top of the girders. By providing shear connectors on the top of the top flange, we can tie the slab to the girders into what we call a composite section. On prestressed girders, the stirrups extending out of the girder into the slab provide the composite action. The composite section produces a more economical design. The Bridge Division designs the girders as a composite section.

    b. AASHTO Specifications

(1) In order for this composite action to actually take place, it is critical that these shear connectors extend into the slab the proper amount. For steel girders, AASHTO specifications require that the shear connectors penetrate at least 2 inches (50 mm) above the bottom of the slab.

(2) The AASHTO specifications also state that the clear depth of concrete over the tops of the shear connectors for steel girders shall not be less than 2 inches (50 mm). So this gives the Bridge Division a range for the location for the top of the shear connectors.

(3) Proper vs. Improper Shims

(4) When you are inspecting a job, a visual inspection of the relationship of the shear connectors to the slab reinforcement will help you determine if something is wrong. Based on the slab thicknesses that we normally use [7.5 inches (190 mm) or 8 inches (205 mm)] thick, the length of stud that we normally use [5 inches (125 mm long)] and if the slab is reinforced, the end of the sheer connector should be located somewhere between the top and bottom transverse slab reinforcing steel.

(5) We specify 1 inch (25 mm) of clearance between the bottom of the slab and the bottom transverse reinforcing steel. A ¾ inch (20 mm) bar is the largest bar specified. Therefore, knowing that we need 2 inches (50 mm) of penetration for the shear connectors, the top of the shear connector should always be above the transverse bar in the bottom of the slab.

3. Problems and Solutions

a. When we have the problem of too large of a shim, there are a couple of things we can do to solve this problem. One solution is to provide some reinforcing bars at each shear connector location that properly extend into the slab. Another solution is to weld a plate onto the top of the shear connectors to gain the proper penetration length.

b. Where we have the problem of too small of a shim (top flange extending into the slab) there is only basically one thing you can do. That is to raise the grade of the roadway.

4. Critical Item - Proper Girder Seat Elevations

a. The most important thing that our inspectors can do to insure proper shims is to make sure that the girder seats are poured to the proper elevations. If the girder seat elevations are wrong, you can almost be sure that you will have problems with your shims. If your girder seats are correct, more than likely your shims will also be correct.

5. Critical Item - To Ensure Proper Shim

   a. Steel girders must be set on substructure by following the blocking diagram shown on the plans.

Example Computer Print

IDENT	PROB. NO.	GIRD. NO.	DIST. CL PROJ. TO CL ROADWAY	E FROM BASELINE	H.I. ELEV.
7018	1	1	O.C.	10.0000 LT.	1719.24

Girder No.	Station	Centerline Grade	Crown Correction	Girder Elevation	Dead Load Deflection	Rod Reading	X Distance	Shim
1	22+10.77	1715.662	-0.150	1714.920	0.0	4.32	0.0	0.592
1	22+20.77	1715.753	-0.150	1715.020	0.015	4.22	10.00	0.598
1	22+30.77	1715.840	-0.150	1715.100	0.023	4.14	20.00	0.613
1	22+40.77	1715.925	-0.150	1715.180	0.021	4.06	30.00	0.616
1	22+50.77	1716.006	-0.150	1715.260	0.011	3.98	40.00	0.607
1	22+60.77	1716.084	-0.150	1715.320	0.001	3.92	50.00	0.616
1	22+65.77	1716.122	-0.150	1715.350	0.0	3.89	55.00	0.622
1	22+70.77	1716.189	-0.150	1715.370	0.004	3.87	60.00	0.644
1	22+80.77	1716.281	-0.150	1715.470	0.019	3.77	70.00	0.630
1	22+90.77	1716.300	-0.150	1715.490	0.033	3.75	80.00	0.693
1	23+ 0.77	1716.365	-0.150	1715.550	0.040	8.69	90.00	0.705
1	23+10.77	1716.427	-0.150	1715.610	0.033	3.63	100.00	0.701
1	23+20.77	1716.486	-0.150	1715.700	0.019	3.54	110.00	0.655
1	23+30.77	1716.342	-0.150	1715.730	0.004	3.51	120.00	0.666
1	23+35.77	1716.588	-0.150	1715.770	0.0	3.47	125.00	0.648
1	23+40.77	1716.594	-0.150	1715.810	0.001	3.43	130.00	0.636
1	23+50.77	1716.644	-0.150	1715.860	0.011	3.38	140.00	0.645
1	23+60.77	1716.690	-0.150	1715.900	0.021	3.34	150.00	0.661
1	23+70.77	1716.733	-0.150	1715.950	0.023	3.29	160.00	0.656
1	23+80.77	1716.773	-0.150	1715.980	0.015	3.26	170.00	0.658
1	23+90.77	1716.809	-0.150	1716.010	0.0	3.23	180.00	0.649