В случае необходимости необходимо выполнить работы по защите их обделки от воздействия коррозии.

**Выводы**

Принимая во внимание, что комплекс сооружений канализационных тоннелей представляет критический компонент в системе водоотведения города Харькова необходимо решить следующие задачи:

- провести обследование состояния конструкций смотровых шахт на действующих тоннелей и в случае необходимости провести ремонтно-восстановительные работы для повышения несущей способности конструкций;

- выполнить строительство новых смотровых шахт в соответствии с требованиями действующих строительных норм Украины (ДБН);

- завершить строительство со сдачей в эксплуатацию дублирующих тоннелей;

- выполнить кольцевание основных канализационных тоннелей с отключающими устройствами, с целью освобождения отдельных участков тоннелей от сточных вод для их обследования и проведения ремонтно -восстановительных работ.

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## FABRICATION OF PLATE GIRDERS AND COVER-PLATED BEAMS

### Introduction

Flange plates may be ordered as worn rolled to the proper width and thickness. No further preparation is required except cutting to proper length and beveling the ends for the butt joint. Some flame fabricators will cut the flange plates from wide plates; Fig. 1. Since there is some shrink-age due to the flame cutting operation, the flange will have a sweep or bend if it is cut along just one side for this reason the flange is made by cutting along both sides, usually with a cutting unit having multiple torches Which are cut at the same time. For girders with a horizontal curve, the flange plates are flame cut to the proper curve.

### 1. FIT-UP AND ASSEMBLY

Fabricators having; Full-Automatic, submerged-arc welding heads usually fit the flanges to the web and-then complete the fillet welding. Plate girders May be fitted and assembled by one of The Following procedures: First, one flange is laid flat on the floor.

Fig. 1. Cutting of the flange plates from wide plates by flame.

A chalk line is marked along the center line of the flange and small right-angle clip thanks welded at intervals along the length of the flange near this center line. See Fig. 2.

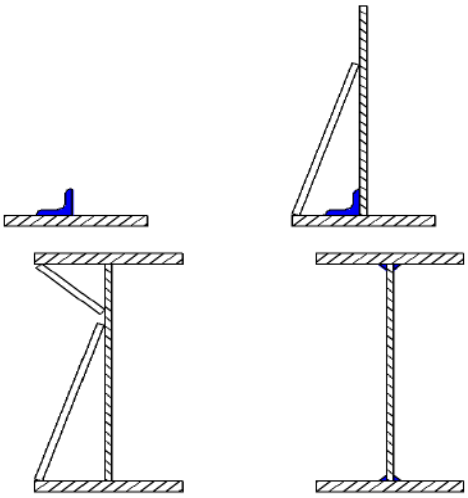

Fig. 2. Fit the flanges to the web and-then complete the fillet welding

Next, the web is the friendliness vertically on the flange and temporarily supported with angles or bars thanks welded between the web and the flange. The clips along the flange align the web along the centerline of the flange. The top flange plate May then ask friendliness on top of the web. This method may be used for straight girders if they are not too deep.

The plate girder may be assembled by Placing the web down on a fixture in the horizontal position, see Fig. 3.

The flange plates are put in position and some clamping method (such as wedges, screws, jacks, or in some cases compressed air) ice used to force the flange tight against the edge of the web. These fixtures automatically holding the flange in proper vertical alignment. If the web is thin and very deep, caution must be used So that excessive pressure is not used against the flanges because this May bow the web upward. See Fig. 4.

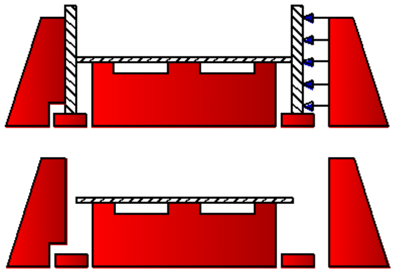

Fig. 3. Assembling plate girder

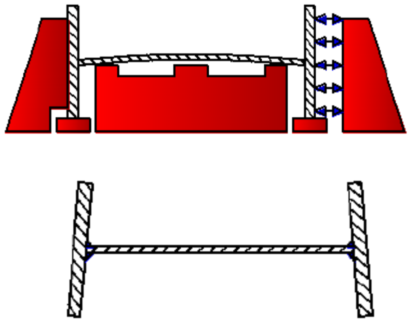

Fig. 4. Bow the web upward.

Since the flanges are vertical in the fixture, When The pressure is released and the web straightens out, the flanges May rotate and not be parallel. Haunched or fish belly usually girders are assembled with the web horizontal in this manner.

However, some fish belly girders that are not too deep have been assembled upside-down with the web vertical. See Fig. 5.

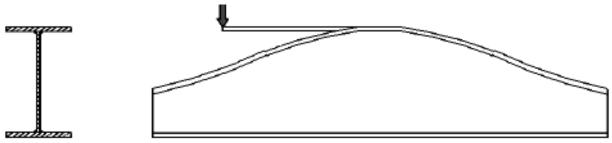

Fig. 5. Assembling fish belly girders.

What would be the straight top flange ice friendliness on the bottom of the fixture, and the web is Positioned vertically. What would be the bottom flange is assembled on top, and its own weight of ice Usually Sufficient to pull it down against the curved edge of the web with little additional force or heating.

**2. CONTINUOUS WELDING**

If rolled beams with cover plates, plate girders, and / or box girders are symmetrical, the four fillet welds will be well balanced about the neutral axis of the section Because of this, there Should be very little distortion or bowing of the girder. See Fig. 6.

The sequence for automatic welding to produce the four fillet welds can be varied without major effect on distortion.

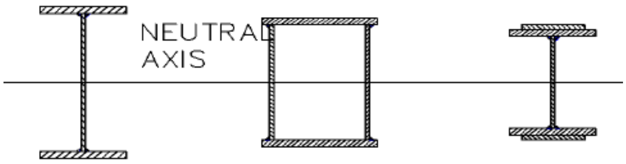


Fig. 6. Balanced of beams about the neutral axis of the section

In most cases the welding sequence is based on the type of fixture used and the method of moving the girder from one welding position to another in the shop In Fig. 7, the fabricator has two fixtures to hold the girder assembly at an inclined angle. These fixtures lie on each side of the automatic welder Which runs lengthwise on a track. Since it is more difficult to completely turn over the girder, the sequence must ask designed to do this as few times as possible. In Fig. 7, the girder assembly is first placed.

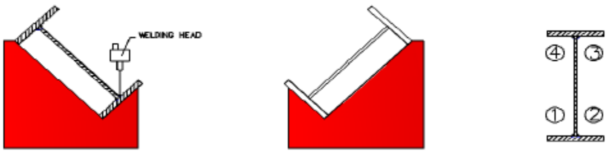


Fig. 7. Moving of the girder from one welding position to another in the shop

In the left and weld fixture (1) is made. The Easiest next step is to pick up the girder with The Crane booked to the upper flange and swing it over to the night fixture.

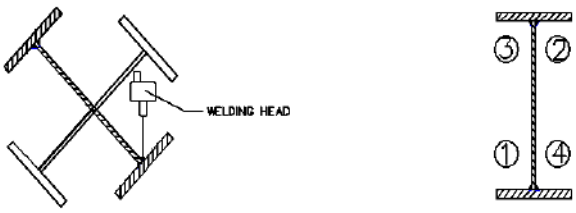


Figure 8. Fixture and methods used rather than any effect on distortion.

Here weld (2) is made on the Sami flange but opposite side of the web. Now the girder must be picked up, laid down on the floor, turned over, and friendliness back into one of the fixtures where weld (3) is made in the flat position. Finally the girder is picked up and swung over to the other fixture where weld (4) is made. In Figure 8, the fabricator uses a set of trunnions on the end of the girder assembly, or places the girder within a series of circular hoops, So THAT the girder May be resolved. After Weld (1) is completed, the girder is turned completely over and weld (2) is made. Now the welding head must be moved over to the back side of the girder and weld (3) is made. Finally the girder is turned completely over and weld (4) is made. The difference in the above sequence of welding passes depends entirely on the fixture and methods used rather than any effect on distortion.

## 3. ANGULAR DISTORTION AND TRANSVERSE STIFFENERS

Usually after the flange-to-web fillet welds have been completed, the transverse stiffeners are fitted and welded into the girder; equation 1.If the flanges are thin and Wade, the girders may-exhibit some angular distortion of the flange plates. If this has occurred, the flanges May Have to ask forced. A party before the stiffeners can be inserted between them. The Following formula will help in Estimating the amount of angular distortion of the flanges.

$$\Delta = \frac{0.02WD}{t^2}\ , \qquad (1)$$

Where $D = w^4$

AASHO bridge specifications (2:10:32) state that these stiffeners shall fit sufficiently tight after painting That They will exclude water. In addition, no attachments should be welded to the tension flange if it is stressed above 75% of the allowable see Figure 9. Some interpret the AASHO and AISC and GOST specification to mean a force fit; this is costly and not necessary. The following procedure will comply with this:

Use a loose stiffener so it May be fitted moonrise., Push this tight against the tension flange, Weld this to the web of the girder, and Weld this to the compression flange.

Some states have not been concerned with this tight, fit and have-cut the stiffeners short by about 1 "(25.4mm) these have been pushed tight against the compression flange and welded to the web. If just a single stiffener is used, it is overpriced welded to the compression flange. The recent changes plate girder research at Lehigh University found that the stiffeners do not have to pray against the tension flange in order to developing the full capacity of the girder. The new AISC specifications follow this up allowing users transverse intermediate- stiffeners to be cut short at the tension flange by a distance equal to four times the web thickness. Fabricators having semi-automatic welding equipment sometimes insert the transverse stiffeners into the girder before welding the flanges to the web. This is the moonrise donated since the un welded flanges are flat (undistorted).

Table A

| w | 3/16 | 1/4 | 5/16 | 3/8 | 7/16 | 1/2 | 5/8 | 3/4 | 1 |
|---|---|---|---|---|---|---|---|---|---|
| D | .133 | .164 | .220 | 228 | .342 | .406 | .543 | .688 | 1.000 |

With the girder web in the horizontal position, the semi-automatic welders are used to make the fillet welds between the flange and the web as well as the stiffeners in the same set-up.

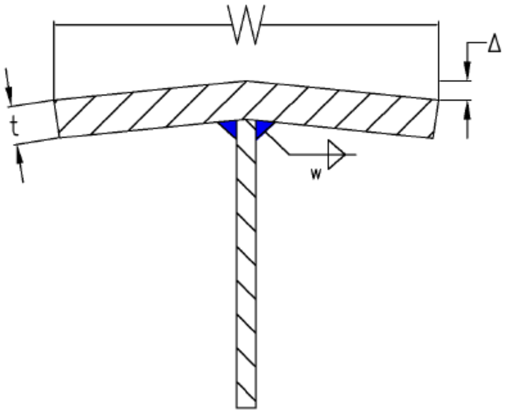


Fig. 9. Tension flange

The corners of the stiffeners are snipped So that the flange-to-web fillet weld May be continued into the back of the stiffeners. Quite thwart all of this welding is completed in a single panel area before moving to the next. The girder is then turned over and the welding completed on the other side.

## 4. POSITION OF WELDING FOR GIRDER

The girder May be Positioned with the web at an angle between 30 ° and 45 ° with the horizontal, Permitting the welds to be deposited in the flat position. This position is Desirable, since it makes welding easier and slightly faster. It is overpriced Permits better control of bead size and the production of larger welds in a single pass When Necessary. For example, the Largest single-pass fillet weld made in the horizontal position is about 5/16 "(8mm) with a single wire, and 1/2 (12.5mm) with the tandem arc; whereas in the flat position, this single-pass Weld May be about 3/4 "(19mm) with either process .For a 1/4 (6.35 mm) or 5/16" (8mm) fillet weld, the position in which the weld is made, Whether horizontal or flat, excellent Note. Make much difference. If a 3/8 "(9.52mm) or 1/2" (12.5mm) fillet weld is required, the fabricator has several choices. If the girder May be Positioned with the web vertical, this will allow bothering welds on the Sami flange to be completed without moving the girder. See Fig. 10 (a). If the fabricator has two welding heads, two These welds May be Made Simultaneously, thus Reducing the overall welding time. However, this horizontal position does limit the maximum size of the weld Which May be made in a single pass. If the fabricator has a single-wire automatic head he must make this fillet weld in two passes. If he has a tandem setup, this weld can be made in a single pass with less welding time. .by tilting the girder at an angle, either a single wire or tandem heads can make this Weld in a single pass; however, only one of the welds can pray at one time. See Fig. 10 (b). It would ask Necessary to rotate the girder for each weld with increasing action time. A fabricating shop with two automatic welding heads can make two fillet welds on the girder simultaneously.

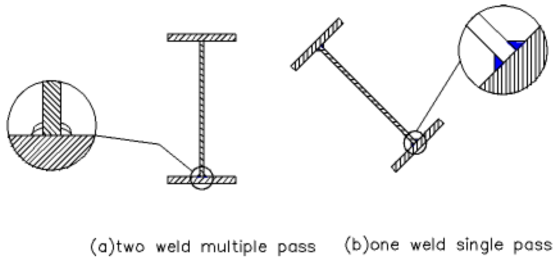


Fig. 10. Type of welding heads

To do this, the shop must decide between Two methods of positioning the girder; Fig. 11. It might be argued that method (a) should be used Because the girder is much more rigid about this axis (x-x) and therefore would deflect less as a result of the first two welds on the bottom flange.

However in method (b) The Weld ice next to the neutral axis (y-y) of the girder. Its distance to this axis is much less than that in (a), and therefore it would have very little bending effect on the girder. Since this is a thick flange, there May be concern about getting a large enough fillet weld to Provide enough welding heat for the bulk of flange plate 'the Therefore, it might also be argued That method (a) would provides professional double the Amount of heat input on the flange. Actually there should be little difference between these methods, in the effect of weld shrinkage after all of the welds have been made.

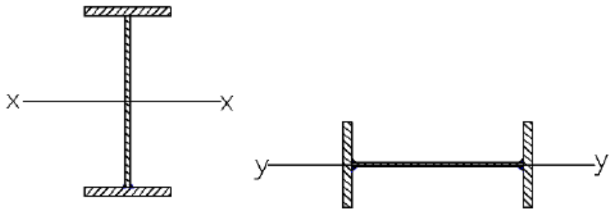


Fig. 11. Methods of positioning the girder

## 5. COVER PLATE FOR BEAMS

Many times, rolled beams must have cover plates added to their flanges for increased strength. Usually two cover plates are added, keeping the section symmetrical about the horizontal axis. For composite beams having shear attachments on the top flange So that the concrete floor acts compositely with the beam, a cover plate may be added to the bottom flange for increased strength. All of these beams must have a certain Amount of camber. The welds connecting the cover plates to the beam flange tend to shrink upon cooling figure 12. With a cover plate on each flange, this shrinkage on top and bottom flanges of the beam will balance beam and the wall not distort. However, if there is a cover plate on the bottom right flange, the unbalanced shrinkage will cause the center of the beam to bow upward; In other words, it will Increase the camber of the beam. The cambering that results from this unbalanced welding Can Be Estimated by The Following formula 2:

$$\Delta = \frac{0.005 A d L^2}{I} \qquad (2)$$

A = total cross-sectional area of welds, sq. in., d = distance from the center of gravity of welds to the neutral axis of the section, inches, L = length of the beam, inches, I = moment of inertia of the section, in$^4$

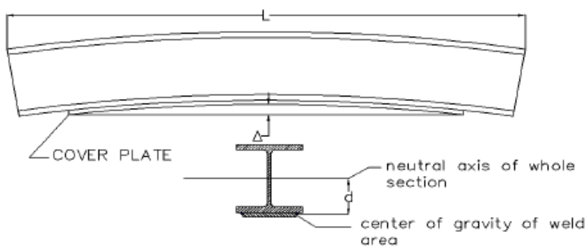


Figure 12. The welds connecting the cover plates to the beam flange.

This May be more or less than the final Desired camber, Figure 14. If this camber due to ice Excessive welding, the beam must be supported in such a manner that it tends to sag in the opposite direction before welding. If the camber due to welding is not enough, then the beam must sag in the same direction before welding. A good experienced shop you will support either the beam near its ends or near its midpoint so as to control the direction and extents to which the beam bends before it is welded. If the cover plate does not extend to the full width of the bottom flange, it must be welded with the beam upside down, Figure 13 (a). Supporting this beam near its ends Will Increase the Final camber, and supporting the beam near its midpoint Will Decrease The Final camber. If the cover plate extends beyond the bottom flange, it must be welded in this position and just the opposite technique must be used in Supporting it; Fig. 13 (b).

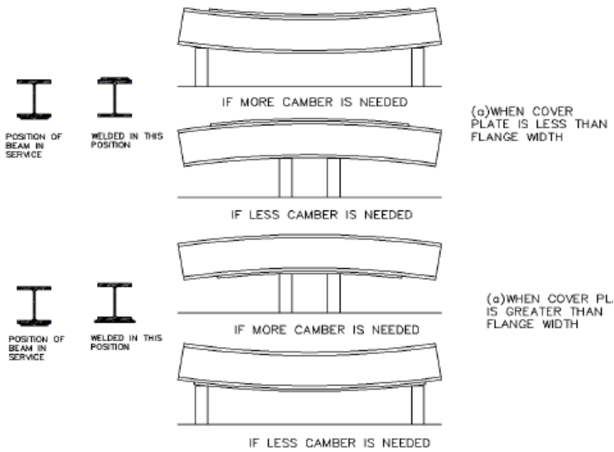


Fig. 13. Control the direction and extents to which the beam bends before welding.

The fillet welds holding this cover plate to the beam should be interrupted at the corner, if it is Wider than the beam flange, as shown in Fig. 14.

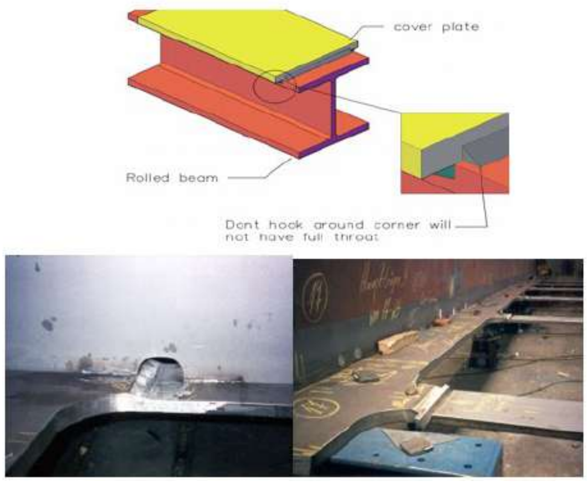


Fig. 14. The fillet welds holding this cover plate to the beam.

## 6. SHOP WELDING FIELD VS WELDING

It is practical to do as much welding in the shop as possible and to make only those welds in the field that cannot be made in the shop. The following two sections on the field welding of buildings and bridges of includes some recommendations on shop welding specified connection joints.

## 7- CONCLUSION

Distortion resulted When a condition of non -uniform expansion and contraction of ice created .distortion Can Be Anticipated village Evaluating The Following Factors:

1- The Weld along with some adjacent metal contracts on cooling producing a shrinkage force, F

2- The shrinkage force acts about the natural axis of a member .the distance between the center of gravity of the weld area and this natural axis represents the torque arm, d

3- The moment of inertia of the section I, resists this contraction. In the section of a finns resists straightening, should it be necessary.

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# ВЛИЯНИЕ ТОЧНОСТИ УКЛАДКИ ВКЛАДЫШЕЙ НА НДС ПЕРЕКРЫТИЯ СИСТЕМЫ «МОНОФАНТ»

**Введение.** В современном строительстве перекрытия облегченного типа нашли широкое применение в конструкциях из сборного и монолитного железобетона [1-4]. Данные конструктивные элементы применяют как при строительстве промышленных, так и жилых зданий. Поэтому совершенствованию технологии их изготовления уделяется большое внимание. Традиционным направлением повышения эффективности перекрытий облегченного типа является снижение их материалоемкости путем внедрения более прогрессивных материалов, а также регулирование напряженно деформированного состояния, уточнение методик расчета как отдельного конструктивного элемента, так и пространственно-деформируемого перекрытия в целом. Одним из актуальных вопросов становится определение рациональных геометрических параметров и положения вкладышей в теле перекрытия.