

# Research on construction technology of shaped steel reinforced concrete beam and column

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**Abstract.** The Shaped Steel Reinforced Concrete structures are increasingly used in large-span or irregularly shaped public buildings. In the actual construction, cross-operation of steel structures and concrete is more frequent. Traditional construction method causes a lot of quality problems easily like installation deviation of beam and column, improper treatment of steel at the joints of beams and columns, and unevenness of concrete surface. If you can not take timely measures to deal with or prevent, it will inevitably have a great impact on the reliability of the structure, and also delay the construction schedule. This paper makes related research about the quality issues, proposes corresponding solutions and provides a complete set of construction technology processes. At last, through engineering case, we analyze the economic and social benefits.

## 1. Introduction

With the development of economy, the number of new buildings which has different functions is increasing day by day. The Shaped Steel Reinforced Concrete structures are increasingly used in large-span or irregularly shaped public buildings. This structure has characteristics of a large stiffness, high strength, light weight and so on. Compared with the prestressed structure, this structure reduces the number of processes. Due to the external role of the concrete wrapped in steel, it overcomes the shortcomings of poor corrosion resistance, poor rust resistance, poor fire performance, and local or total instability.

However, in actual Shaped Steel Reinforced Concrete structures construction, steel and concrete cross jobs more frequently. Especially in the beam-column joints at steel complex cross. If not handled properly it will have a huge impact on the reliability of the structure, and also delay the construction schedule, affecting project quality. Due to the complicated beam and column joints of steel-reinforced concrete structures, steel banding, formwork support and concrete pouring process are different from ordinary reinforced concrete structure, there is still a series of problems in the construction process.

## 2. The key technologies and application principle

Space borrow measurement positioning technology: According to the shaped beam in 3D space to change the form of borrowed measurement method. According to the shape of the beam in the three-dimensional space changes, to develop borrowing measurement method.

Shaped beam cross-pillar node processing technology: In the design of the shaped beam, according to the position of the beam inside the beam column to draw the exact location of the cavities of the special beam wing, to ensure that the reserved hole does not affect the structural force of the special beam. In the factory production of shaped beams, according to the size of the drawings to control the location of the hole to ensure that the bottom of the steel bar in the hoisting accurately through the shaped beam.



Adjusting Perfusion and shaped twisted corbels concrete Pouring Technology: In ensuring the strength of concrete at the same time, adjust the ratio, try to use fine aggregate, timely adjustment of pouring method. First with a large rod diameter vibrating rods on both sides of the beam evenly drainage, and then a small rod diameter vibrating rods tightly vibrating, making the beam column force balance, to ensure the density of concrete pouring and concrete forming aesthetics. In the twist of the heel, control the distance from the beam. Pouring concrete with a small vibrating rod vibrating, to prevent the concrete pouring side of the pressure caused by the phenomenon of mold, to ensure that the concrete molding no hemp.

### 3. Construction process and operation points

#### 3.1. Construction Process

- (1) The processing and production of steel members
- (2) Space borrow measurement positioning
- (3) Steel Column in place installation
- (4) Steel Beam place installation
- (5) Outsourcing reinforced installation
- (6) Columns, beams template installation
- (7) Concrete pouring

#### 3.2. The Key Points of Space Borrow Measurement Positioning Technology

First of all, we use CAD to draw the drawings of the beams, columns of the plane line, the spatial line and steel layout.

Use the AutoCAD to establish the user's coordinate system. Through a complete control point database, we can get the coordinates of the points anytime for accurate measurement outside. Use CAD to accurately measure the horizontal distance between the points and the corresponding axis so that the steel structure, steel, template and other professional operations.

On the horizontal plane, use the Total Station to measure the coordinates of each control point to ensure that the coordinates on the screen is less than 3mm.

In the facade, since the fall line point error is greater, measured using a Laser Plumb Instrument.

#### 3.3. Installation points of shaped steel columns in place

This project is a rigid steel reinforced concrete structure, supported by the steel reinforced concrete column, the roof steel reinforced concrete beam irregular arrangement, resulting in the formation of irregular columns of steel reinforced concrete column cap. The steel cap is welded by a three-layer steel plate and a vertical stiffener.

Before lifting the steel plate with steel cap column symmetrical four-sided welding ear plate, with the tower crane hanging to the installed with the steel column alignment, with two 70\*400 connection plate and pre-welded to the steel column on the ear plate with bolts to do temporary fixed, in order to ensure the stability of the steel column, adjust the position and elevation, cut off the hanging ear. Steel pillar assembly node.

#### 3.4. Shaped beam cross-pillar within the node processing techniques

In the steel beam diagram of the second deepening design, according to the beam at the end of the column inside the steel bar to draw the upper and lower wing of the steel beam to set the exact location of the blank.

In the lifting process, with the tower crane to the first truncated to the steel cap next to the pre-erected installation platform, and steel cap (legs) to do temporary connection, and find the location, and then lifting the second cut steel beam.

In the installation of steel beams, we need to repeatedly observe and correct the axis, elevation, vertical deviation, until the requirements meet the requirements, before the butt welding. After the steel beam is welded, the vertical elevation of the steel beam is re-examined.

#### 4. Outsourcing reinforced installation

beam height  $< 700\text{mm}$ , the beam is not a retractor; beam height  $\geq 700\text{mm}$ , the hook will be welded at one end of the steel beam in the web, the other end with the beam barbed strong.

steel girder main reinforcement: beam in the beam at the junction of steel, the beam on both sides of the outermost main bar around the steel column, the outer second row of the main bar through the steel column web reserved hole, the middle of the main bar welded the steel beam is pre-welded on the connecting plate. At the intersection of primary and secondary beams, perforations are made on the web of the secondary girder, and the main girders are passed through the reserved holes.

steel beam with the first tie and then support the beam at the end of the way the template construction. Lashing steel bars before the steel beam in the bottom spot welding I-shaped positioning of steel, I-shaped positioning of steel spacing according to the beam span, generally a beam set three positioning ribs. Beam under the steel bar and steel reinforced with a solid band.

#### 5. Column and beam template installation

The beam side mold uses a 15mm thick multilayer board, and the beam bottom mold uses a 15mm thick multilayer board. Beam under the keel of  $50\text{mm} \times 100\text{mm}$  square wood, spacing 300mm; main keel for the  $100\text{mm} \times 100\text{mm}$  square wood, spacing 600mm. When the beam height  $< 700\text{mm}$ , the beam side mold with  $100\text{mm} \times 100\text{mm}$  square as a bracing, spacing 500mm; when the beam height  $\geq 700\text{mm}$ , the beam side mold with  $100\text{mm} \times 100\text{mm}$  square wood as a bracing, spacing 500mm, and set to pull Bolts, bolts and welded plates welded to steel webs, with a spacing of 500.

first install the beam at the end of the template, according to the design drawings, according to 2/1000 from the arch. Pad with self-made mortar pad, spacing 600, plum-shaped arrangement. And then install the beam side of the template, and  $100\text{mm} \times 100\text{mm}$  wooden square braided solid, tighten the pull bolts.

#### 6. Innovation in this paper

The space borrowing measurement and positioning technology solves the problem of the construction of profiled steel reinforced concrete beam. This technique ensures accurate transmission of structural forces.

Shaped beam cross-pillar within the node processing technology works on each connected node of the structure to draw steel through the steel flange or web perforation and reinforcement nodes. Factory custom components to ensure the accuracy and dimensional accuracy member opening position, to avoid the on-site repair work.

Adjusting Perfusion and shaped twisted corbels concrete Pouring Technology is reasonable to adjust the concrete ratio, to ensure the density of concrete pouring and forming aesthetics.

#### 7. Conclusion

By deepening the design, the amount of steel bars is reduced, and the amount of steel bars is reduced by about 10% before optimizing the design.

In this paper, through the use of steel components of the production and installation methods, welding methods, the installation of reinforced bars, template reinforcement methods and concrete pouring methods and other construction techniques, can improve efficiency and speed up the construction speed. This technology can save the construction machinery classes, steel and labor costs about 350,000 yuan, with a considerable economic benefit.

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