Construction of Nhat Tan Bridge Superstructure
(Location - Hanoi, Vietnam)

IHI Corporation
IHI Infrastructure Systems Co., Ltd.
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Introduction and Location Map of Nhat Tan Bridge

Location:
Across Hong River in Northern Side of Hanoi City

Super Structure Works:
3,080 m consists of:
1. Main Bridge - Continuous Cable Stayed Bridge of 1,500 m length.
2. North Approach Bridge – Continuous Super T-Girder of 1,240 m length.
3. North Dyke Bridge – Continuous PC Box Girder of 340 m length.

Remarks:
Longest Cabled Stayed Bridge in Vietnam Eight (8) Traffic Lanes
General Profile of Nhat Tan Bridge Project

Main Bridge (L = 1,500 m)

Profile

North Approach Bridge (L = 1,240 m)

North Dyke Bridge (L = 340 m)
General Profile of Main Bridge

- Longest Cabled Stayed Bridge in Vietnam
- \( L = 1500 \) m
- 6 Continuous Spans
- Total Deck Width of 35.6 m
- Eight (8) Traffic Lanes
- A total of 220 numbers of Stay Cable
- Type of Stay cable is new PWS
- Maximum Typical Cross Section of Girder
Fabrication Shop of Steel Structure

- Fabrication works of steel girders and anchor boxes are distributed to 3 factories

Mitsui Thang Long
Steel Construction Co., Ltd.
Hanoi, VIETNAM
Fabricated quantity: 4,554 ton

IHI Infrastructure Asia Co., Ltd. (IIA)
Haiphong, VIETNAM
Fabricated quantity: 7,885 ton (Main structure), 4,000 ton (Accessories and...
Fabrication Works and Trial Assembly

Fabrication of Steel Girder

Trial Assembly

Fabrication of Steel Girder

Trial Assembly
Summary of Erection Method

i) P14 - P15 Closure

ii) P13 - P14 Closure

iii) P12 - P13 Closure

iv) P15 - P16 Closure
This Bridge is very sensitive for elevation because structure is highly flexible. Therefore, Geometric Control at each erection stage is required predicting deviation at bridge completion.

**Figure 1. Girder Elevation at P14 before Closure**

**Figure 2. Cable Tension on Outmost 3 Stay Cable at P14 before closure**
FEM Analysis for Concrete Slab

Decide the Sequence of Cantilever Erection depending on Crack Analysis

1. Install the 6 PDPs
2. Tensioning Stay Cable
3. Install the 24 PDPs
4. Cast in Place Joint Concrete

Analysis Model for 6th Stay Cable

Analysis Result after Installing the 24 PDPs

Allowable value = 7.5 MPa (0.2 mm crack occurrence)

Max. 4 MPa

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To torsion prevention system

Deformation of girder due to cable tensioning

FEM Analysis

Cable tensioning

Torsion prevention device as countermeasure

Pulling PC strand

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## General Erection Method

### Three Types of Erection Method

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<tr>
<th>5 Block Erection</th>
<th>Cantilever Erection</th>
<th>Closure Erection</th>
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<tbody>
<tr>
<td>5 Girder Segments for one side.</td>
<td>10 Girder Segments for one side (10 Cycles, Total 20 segments)</td>
<td>1 Girder Segment</td>
</tr>
<tr>
<td>1st Stay Cable</td>
<td>2nd to 11th (last) Stay Cable</td>
<td>30 numbers of PDP</td>
</tr>
<tr>
<td>120 numbers of PDP</td>
<td>600 numbers of PDP</td>
<td>30 numbers of PDP</td>
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Types of Erection Method

5 Block Erection (around Pylon)

Preparation Works
- Installation of Bearing
- Temporary Support System

Erection of Edge Girder and Floor Beam

Installation of Precast Deck Panel

CIP Concrete

Installation of 1st Stay Cable

Remove the Support Point of Temporary Support System

Geometry Control System

Installation of Inclined Bent

Erection of Edge Girder and Floor Beam

Installation of PDP and Rebar arrangement

Installation of 1st Stay Cable
Types of Erection Method

Cantilever Erection - 1 (Consists of 10 Cycles)

FLOW CHART
Cantilever Work Erection

South side
Pylon
North side
Cantilever Erection
5 Block Erection around pylon
Cantilever Erection

Installation of Edge Girder

Install floor beam and Strut

Installation of PC deck panel (6 pcs)

Install Stay Cable pylon side

Install Stay Cable girder side

Tensioning Stay Cable

Install PC deck panel (24 pcs)

Geometry Control System

Joint Concrete (40 m²)
Types of Erection Method

Can t i l e v e r E r e c t i o n - 2 (C o n s i s t s o f 1 0 C y c l e s )

- Installation of Edge Girder
- Install floor beam and Strut
- Installation of PC deck panel (6 pcs)
- Install Stay Cable pylon side
- Install Stay Cable girder side
- Tensioning Stay Cable
- Install PC deck panel (24 pcs)
- Geometry Control System
- Joint Concrete (40 m²)

Installation of Pre-Cast deck panel
Types of Erection Method

Cantilever Erection - 3 (Consists of 10 Cycles)

1. Installation of Edge Girder
2. Install floor beam and Strut
3. Installation of PC deck panel (6 pcs)
4. Install Stay Cable pylon side
5. Install Stay Cable girder side
6. Tensioning Stay Cable
7. Installation of PC deck panel (24 pcs)
8. Geometry Control System
9. Joint Concrete (40 m²)
10. Tensioning Stay Cable

Installation of Stay Cable girder side

Joint Concrete
Types of Erection Method

Bridge Closure - 1

Survey for Closing Blocks

Measurement

Measure the temperature for all points of each member

Measure the clearance of lower and upper flange at East and West side.

Case 1: Cantilever erection schedule is same time

Case 2: Cantilever erection schedule is different

Calculate the Average of each side

Analysis

Put the measured temperature in fisher bone model

due to measure temperature, calculate the ideal Edge Girder Length and Cross Section clearance in fisher bone

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Types of Erection Method

Bridge Closure - 2

Work Flow for Closure Block

1. Arrangement of Counter Weight & Alignment device for Preparation

2. Erection of Closure Block

3. Crane moves to Pylon

4. Crane moves back to P13 Northern end and Additional C/W is arranged

Analysis Result during Erection of Closure Block

Analysis Result after adjusting the elevation due to crane movement

Joint Lower Flange of Closure Block

After connection of web and U-Flange, Completion of Joint Closure Block
Types of Erection Method

Bridge Closure - 3

Adjustment of Girder elevation and alignment

For Adjusting Elevation, Counter weight (Concrete Block) is used.

For Adjusting Girder Alignment, install the alignment adjusting device on the lower Flange of Floor beam.

Floors beam

Edge Girder

Final closure portion

General Layout Plan for Adjusting Alignment

Adjusting Alignment Device

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Types of Erection Method
Bridge Closure - 4

Bolt Tightening

Final Casting between PDP

Installation of Closure Segments

Counter Weight

Final Casting between PDP (Upper view)