# IJCIET

## INTERNATIONAL JOURNAL OF CIVIL ENGINEERING AND TECHNOLOGY

Journal ID: 6971-8185



**IAEME Publication**

Chennai, India

editor@iaeme.com/ iaemedu@gmail.com

https://iaeme.com/Home/journal/IJCIET

**International Journal of Civil Engineering and Technology (IJCIET)**
Volume 16, Issue 5, September-October 2025, pp. 1-21, Article ID: IJCIET_16_05_001
Available online at https://iaeme.com/Home/issue/IJCIET?Volume=16&Issue=5
ISSN Print: 0976-6308 and ISSN Online: 0976-6316
Impact Factor (2025): 21.69 (Based on Google Scholar citation)
Journal ID: 6971-8185; DOI: https://doi.org/10.34218/IJCIET_16_05_001



# ANALYSIS OF LAUNCHING OF STEEL GIRDER USING CRANE FOR RAIL OVER BRIDGE

**Mr Jaiswar Ashok Kumar Ramchandra Suryamati[1,*], Prof Manisha Jamgade[2], Prof Raju Narwade[3]**

[1]Research scholar, Department of Civil Engineering, Pillai HOC College of Engineering and Technology, Rasayani
University of Mumbai, India. https://orcid.org/0009-0009-5860-8661

[2]Associate Professor, Department of Civil Engineering, Pillai HOC College of Engineering and Technology, Rasayani
University of Mumbai, India. https://orcid.org/0000-0002-9040-6789

[3]Associate Professor, Department of Civil Engineering, Pillai HOC College of Engineering and Technology, Rasayani
University of Mumbai, India. https://orcid.org/0000-0003-2349-0172

***Corresponding author: Jaiswar Ashok Kumar Ramchandra Suryamati**

## ABSTRACT

*The construction of Rail Over Bridges (ROBs) has emerged as a crucial solution to reduce traffic congestion and ensure smooth connectivity by eliminating level crossings. A vital phase in ROB construction is the launching of steel girders, which requires precise planning, technical expertise, and adherence to safety standards. Among the available techniques,* ***crane-assisted launching*** *has gained prominence due to its adaptability to constrained urban environments, flexibility in handling heavy components, and reduced dependency on permanent launching equipment.*

*This synopsis emphasizes the* ***methodology and practical aspects*** *of launching steel girders using cranes. It covers the major structural components involved, outlines the* *step-by-step erection procedure, and highlights the critical role of safety measures during operations. The discussion also addresses the challenges faced in real-world projects, such as restricted working spaces, live railway traffic, and night-block constraints, bridging the gap between theoretical structural design and field-level execution.*

*The study aims to improve understanding of crane-based girder launching by:*

- *Analyzing structural and procedural elements involved.*
- *Documenting step-by-step erection methodology.*
- *Identifying safety protocols before and during launching.*
- *Reviewing current limitations in practical implementation.*
- *Suggesting improvements for future construction practices*

*This work contributes toward better integration of* ***theoretical optimization*** *with* ***practical execution****, offering insights to improve construction methodologies. The findings aim to support engineers and project managers in achieving safer, more efficient, and cost-effective ROB construction through the effective use of cranes for steel girder launching.*

**Keywords:** ROB construction, Steel girder launching, Crane-assisted erection, Bridge methodology, Construction safety, Urban constraints, Night block operations, Live traffic management, Structural execution, Project optimization.

**Cite this Article:** Jaiswar Ashok Kumar Ramchandra Suryamati, Manisha Jamgade, Raju Narwade. (2025). Analysis of Launching of Steel Girder Using Crane for Rail Over Bridge. *International Journal of Civil Engineering and Technology (IJCIET)*, 16(5), 1-21. DOI: https://doi.org/10.34218/IJCIET_16_05_001

## I. INTRODUCTION

A **Rail Over Bridge (ROB)** is a critical transport infrastructure that allows road traffic to pass **over railway tracks**, eliminating level crossings where accidents, delays, and congestion are common. ROBs ensure uninterrupted road movement while maintaining safe and efficient railway operations.

**Need for ROBs:** With increasing vehicles and expanding railway networks, level crossings cause long delays, fuel wastage, accidents, and disruption to emergency services. ROBs address these issues by improving safety, reducing congestion, lowering pollution, and enhancing connectivity.

**Components:** A typical ROB consists of approach ramps, abutments, piers, girders or decks (steel/concrete), bearings, expansion joints, drainage systems, and safety features like parapets and crash barriers.

**Types of Girders:** Steel plate girders, box girders, and prestressed concrete girders are commonly used, selected based on span length, cost, and site feasibility.

**Construction Methods:** Techniques include cast-in-situ construction, segmental launching, and precast girder erection, with **crane-assisted girder launching** being a flexible method in urban and live-track conditions.

**Challenges:** Key challenges include land acquisition, limited working space, coordination with railways, safety during live-track work, and strict time schedules. Modern solutions rely on high-capacity cranes, advanced planning, and stringent safety protocols.

**Global Importance:** Worldwide, ROBs (or grade separations) play a vital role in reducing traffic congestion, enhancing logistics, and supporting economic growth. Countries like India, the U.S., China, Japan, and European nations integrate ROBs into urban transport and high-speed rail systems.

**Trends & Innovations:** Adoption of sustainable practices (green bridges, low-carbon concrete), smart monitoring systems, modular construction, and noise-reducing materials are shaping the future of ROB construction.

**Rail Over Bridge Mira Bhayandar**

Rail Over Bridges are essential for modern infrastructure, not only for convenience but also for safety and economic development. Their design and construction vary across countries depending on traffic volume, geography, technology, and budget, but their purpose remains universal to provide seamless and safe transportation

- Metro Line 9. The span Length of bridge will be 65.0m. The work consists of Construction of Bridge over Railway portion in between Mira Road Station & Bhayandar Station of Western Railway of Mumbai suburbs in connection with the busy Railway lines.
- Width of bridge is 9.575m. The work has to be carried out in stages without disrupting the railway services.
- The intermediate stretch of 65m is over the running tracks of Western Railway. Hence it is proposed to connect both ends of bridge using 06 no’s Steel Girders.
- **Steel Girder details: -**

- Grade of steel: - E350BO
- Overall length of Girder: - 65 m
- C/C of Bearing: - 63.0m
- Expansion Joint to Expansion Joint: - 65.0m
- Longitudinal slope: - 1.235%
- No. of Girders: - 06
- Overall width: - 9.575m
- Grade of Bolts: - 10.9
- Diameter of Bolts: - 24mm
- Height of girder: -3.250mm
- The torque value observed during the bolting process at site
- 1. Top Flange : 1250 N m
- 2. Bottom Flange : 1350 N m
- 3. Web : 1064 N m
- These values are taken on Suitability test done in third party laboratories and also considering Bolt Manufacturing torque value.
- **Acceptance criteria**

As per IS 4000-1992 High Strength Bolt in the steel structure- Code of Practice Annexure D, CL D-3,


Source: Rail over Bridge. Mumbai Metro Line 09. 2025

Fig No.1.Mira Bhayandar Railway crossing.

Source: Mumbai Metro Line 09. 2025.

Fig No.2 Steel Assemble Area Mira Bhyandar.

## II- LITERATURE REVIEW

The reviewed studies highlight major advancements in bridge construction and girder launching techniques, with particular focus on cost optimization, innovative erection methods, structural performance, and safety considerations.

Key Contributions from Literature:

- Innovative Technologies:
  - Yaoyu Yang et al. (2024) introduced Gravity-Triggered Rotational Connectors (GTRC) for semi-automated crane-based erection, though not yet proven for large steel girders.
  - Patil & Kushwah (2023) proposed Open Web Girder (OWG) launching as a lightweight, safer alternative to cranes in congested urban projects, emphasizing RDSO norms and digital simulations (MIDAS, STAAD Pro).
- Structural Optimization & Safety:
  - Chaugule & John (2022) studied web openings and stiffeners in girders, validating their importance in preventing buckling and optimizing strength.
  - Itani et al. (2004) examined seismic behavior of steel girders, stressing the role of ductile detailing, cross-frame systems, and performance-based design.
- Cost & Method Comparisons:
  - Jadhav (2017) compared superstructure types, showing RCC T-beams most economical for short spans and PSC I-girders better for longer spans.

- Abhyankar (2016) outlined practical erection methods like tower cranes (for lighter elements), Moving Scaffolding Systems (slow but safe), and Ground Supported Staging (for curved or steep alignments).

- Foundational Studies on Launching:
  - Marco (2007) provided one of the most comprehensive references on bridge launching, covering ILM and crane erection.
  - Shao (2007) analyzed long-span composite box girders, integrating staging and load redistribution in erection planning.
  - Corres Peiretti (1993), Leonhardt & Menn (1978), and Zuk (1970s) developed early design frameworks for the Incremental Launching Method (ILM), addressing temporary stresses, launching noses, and curvature effects. These works remain central to modern practice.

Research Gaps Identified:

- Limited field-based studies on crane-assisted steel girder launching in ROB construction.
- Absence of standardized methodologies linking structural optimization with execution.
- Inadequate focus on safety risks, space constraints, and coordination in live railway environments.
- Underuse of simulation tools (e.g., MIDAS, STAAD Pro) for predictive analysis in erection planning.
- Few studies integrate environmental impacts with launching methodology.

Relevance to Present Study:

The current research aims to address these gaps by focusing specifically on crane-assisted steel girder launching in ROB projects. It seeks to:

- Develop a step-by-step, standardized methodology for crane launching.
- Enhance monitoring and safety protocols during live railway construction.
- Combine structural optimization with field execution for efficiency and reliability.
- Propose practical solutions tailored to Indian urban constraints, where space, time, and safety coordination are critical.

## III-MATERIAL USED

1. Steel Plate: IS2062-2011GrE350 quality BO
2. Plate 12mm and above thick, plates are fully killed/ normalized or controlled cooled.

3. Rolled section or any other structural steel member: IS 2062:2011 Grade E250 quality A/B.
4. Structural steel plates and structural section A&C no5 of IRS-B:2011, IS2062-2011
5. HSFG Bolting assemblies with DTI washer as per A&C No 11 of IRS B1-2001 and BS Reports Nos 111 (Rev.6) and relevant EN 14339 Series codes referend's bolts from approve vender from RDSO,
6. Paints approved by RDSO.IRS B1-2001, IS: 51, IS 104, IS:2339, IS:5666 and applicable codes

## IV. METHODOLOGY

### Introduction

The construction of **steel girder Rail Over Bridges (ROBs)** in congested railway corridors requires careful planning and execution, as it directly involves live railway operations, limited working windows (traffic blocks), safety concerns, and urban space constraints. One of the most widely adopted erection techniques for such projects is the **launching method**, where fabricated steel girders are assembled at a pre-defined location (casting/launching bed) and then progressively pushed, pulled, or lifted into their final position over the railway tracks.

This methodology minimizes interference with train operations, reduces on-site welding above tracks, and enhances safety by shifting most fabrication and assembly activities away from the live railway zone.

### 3.1 Methodology for Launching of Steel Girders

1. **Pre-Construction Planning**
   - Detailed survey of site conditions, railway alignment, and available working space.
   - Selection of launching method (crane launching, horizontal pushing, sliding/rolling, or incremental launching) depending on span length, girder weight, and urban constraints.
   - Preparation of staging area/assembly yard for girder fabrication and pre-assembly.
   - Approval of methodology and traffic block requirements from railway authorities.
2. **Fabrication and Assembly**
   - Steel girders are fabricated in workshops or site yards as per design.
   - Sub-girders or segments are assembled into full-length girders on ground using high-strength bolting/welding.
   - Temporary supports, rollers, or bearings are placed to facilitate smooth launching.

3. **Launching Operation**
    - **For Crane Method:** Heavy-duty cranes lift and place girders during block periods.
    - **For Pushing/Sliding Method:** Girders are launched longitudinally from one side using hydraulic jacks, winches, or strand jacks with rollers or sliding bearings.
    - **For Incremental Launching:** Girder segments are pushed in sequence, with a launching nose to reduce cantilever stresses, until the full span crosses the railway alignment.
4. **Positioning & Bearing Placement**
    - Once over the railway track, girders are carefully lowered and aligned onto permanent bearings at pier locations.
    - Cross girders, bracings, and deck slabs are installed after girder placement.
5. **Post-Launching Works**
    - Alignment checks, grouting of bearings, and removal of temporary supports.
    - Construction of deck slab, approaches, and finishing works.
    - Load testing and commissioning for railway and vehicular safety clearance.

## METHODOLOGY

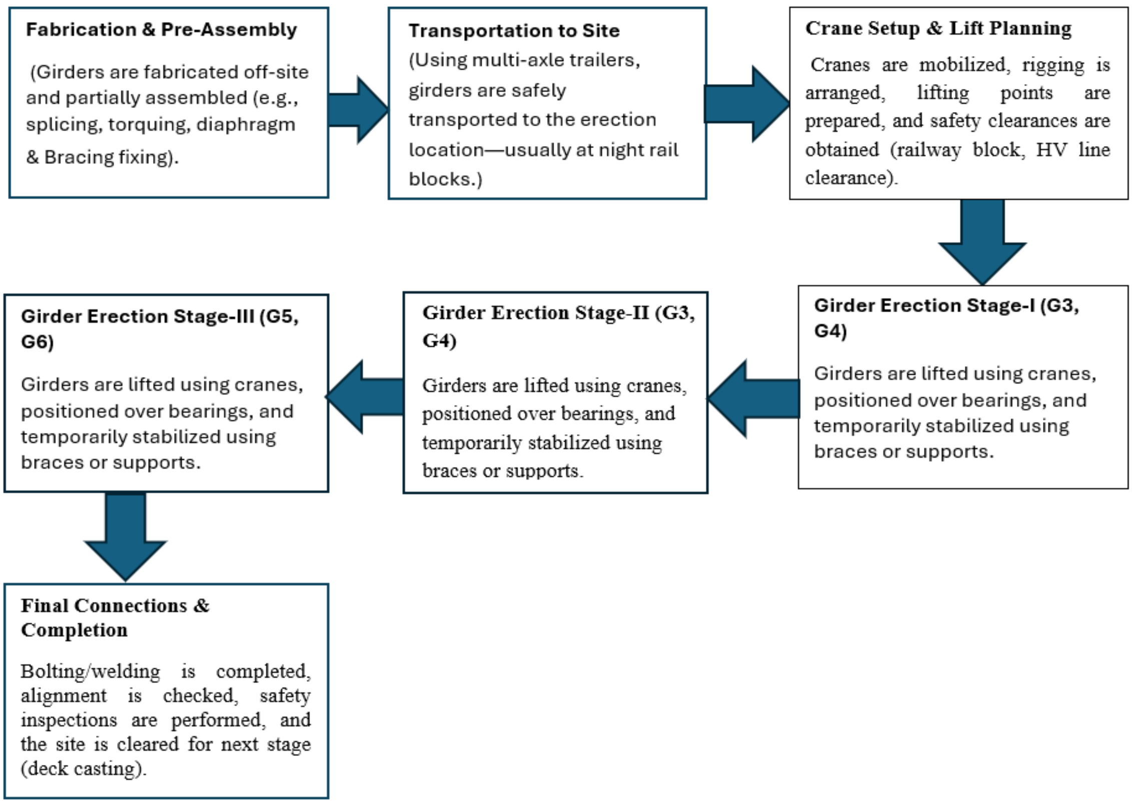



Fig.No.3. Flow Chart of Methodology

**3.3 Steel Girder Process:-**

I. **Fabrication & Pre-Assembly**

➤ Girders are fabricated off-site and partially assembled (e.g., splicing, diaphragm fixing).

II. **Transportation to Site**

➤ Using multi-axle trailers, girders are safely transported to the erection location—usually at night or during rail blocks.

III. **Crane Setup & Lift Planning**

➤ Cranes are mobilized, rigging is arranged, lifting points are prepared, and safety clearances are obtained (Railway block, HV line clearance).

IV. **Girder Erection (Lifting & Placement)**

➤ Girders are lifted using cranes, positioned over bearings, and temporarily stabilized using braces or supports.

V. **Final Connections & Completion**

➤ Bolting/welding is completed, alignment is checked, safety inspections are performed, and the site is cleared for next stage (deck casting).

Fig.No.4 Fabrication & Pre- Assembly

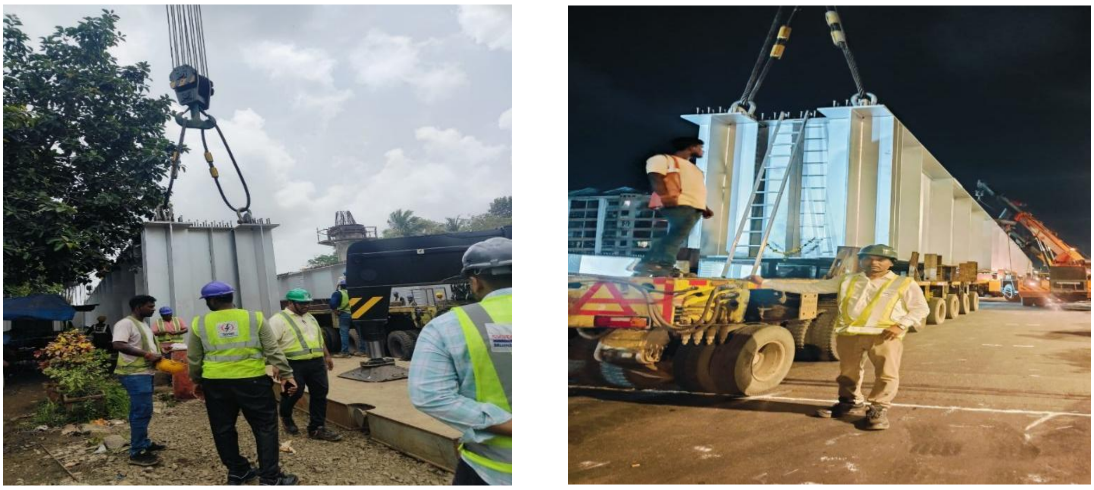


Fig.No.5 Fabrication & Pre- Assembly

**Transportation of Steel Girder and Erection**

Fig.No.6 Erection(lifting) of Steel Girder

### 3.9 Trestle Erection Method

The trestle erection method uses temporary support structures to aid girder placement, offering a crane-free alternative in constrained environments:

1. Support Platforms: Trestles are built adjacent to spans to form platforms for girder movement.
2. Mechanical Launching: Girders are shifted using winches, jacks, or trolley minimizing large crane usage.

3. Access Solution: Ideal for restricted sites like over tracks or in congested areas.
4. Continuous Launching: Enables progressive, sequential placement across multiple spans.
5. Improved Safety: Lower lifting risks through controlled movement on stable platforms

## 3.10 CRANE ERACTION METHOD:

Here on site proposed methodology for steel girder launching using crane method during railways traffic block period as follows:

- **FIRST DAY OPERATION (UNDER TRAFFIC BLOCK):** -In the above block period first and second steel girder G1 & G2 including cross bracing, end diaphragm & decking sheet will be placed at its respective position.

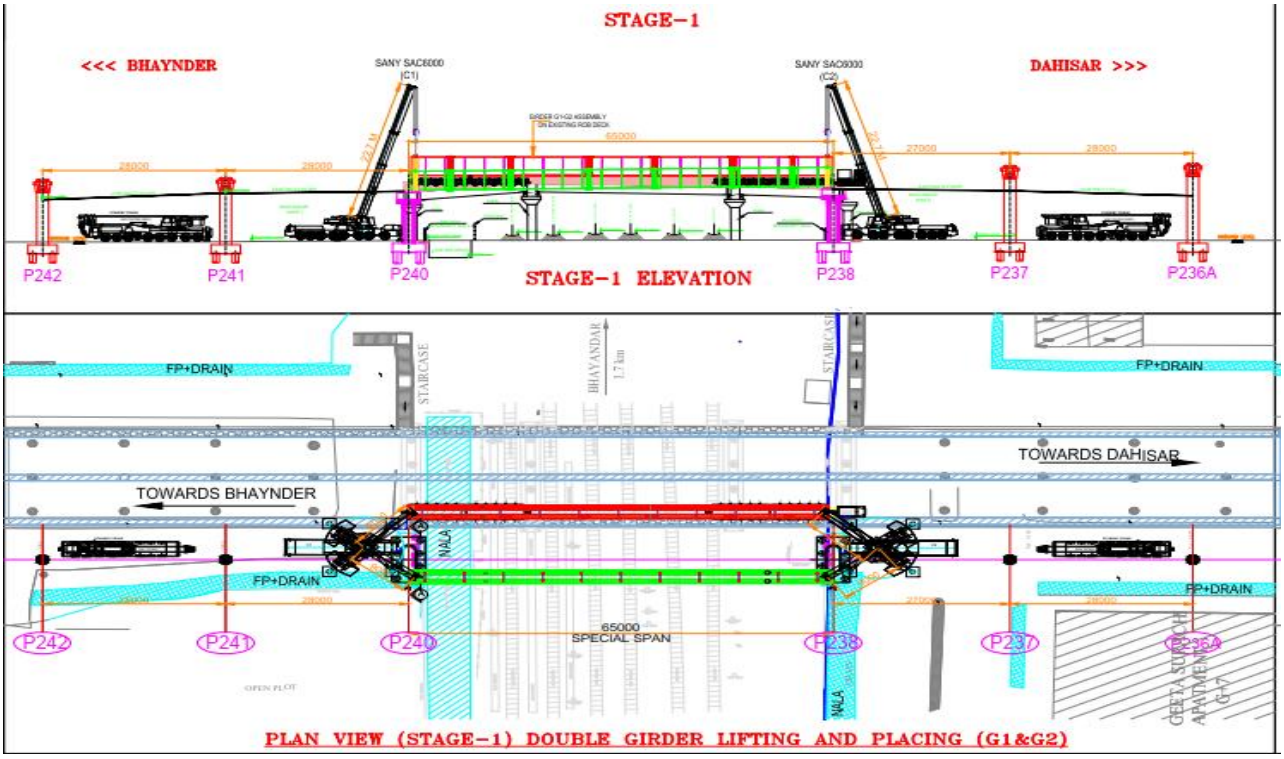



Fig. No. 7. lifting Plan for Stage-I Steel Gird

- **SECOND DAY OPERATION (UNDER TRAFFIC BLOCK):** -In the above given time period third and fourth steel girders G3 and G4 including cross bracing, end diaphragm & decking sheet will be placed at its respective position. Fixing of bolting work of cross bracing and end diaphragm between G2 and G3 girder will be completed along with decking sheet.

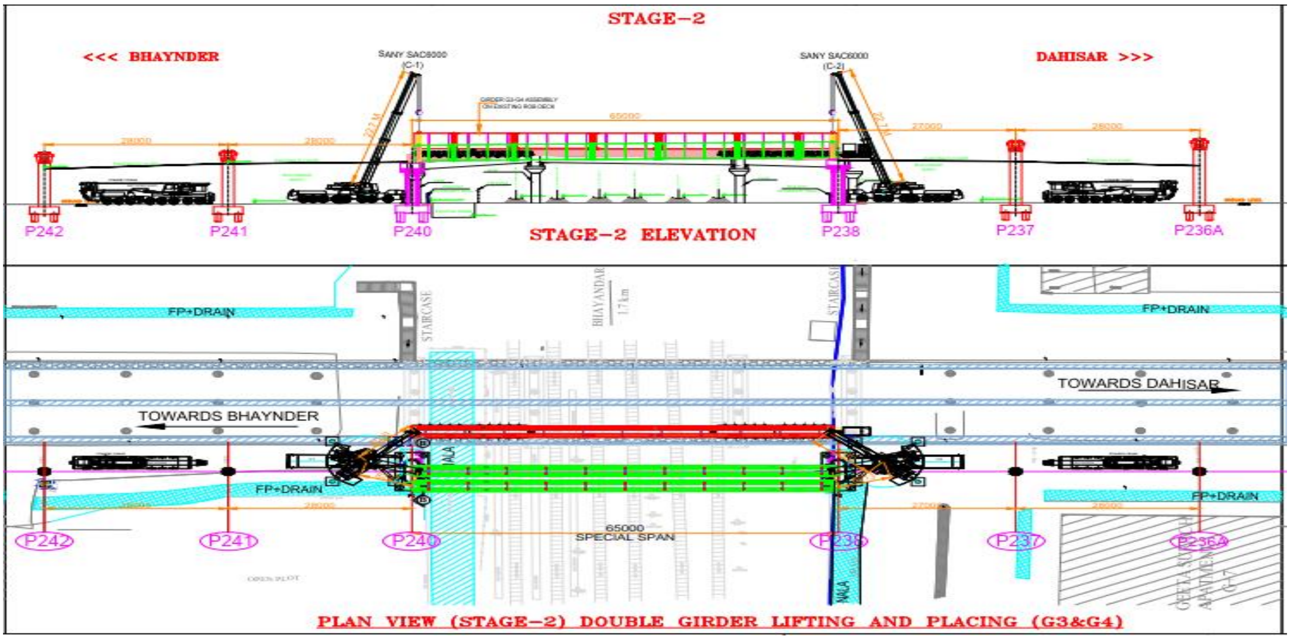



Fig. No. 8 lifting Plan for Stage-II Steel Girder

- **THIRD DAY OPERATION (UNDER TRAFFIC BLOCK):** -In the above given time period third and fourth steel girder G5 and G6 including cross bracing, end diaphragm & decking sheet will be placed at its respective position.

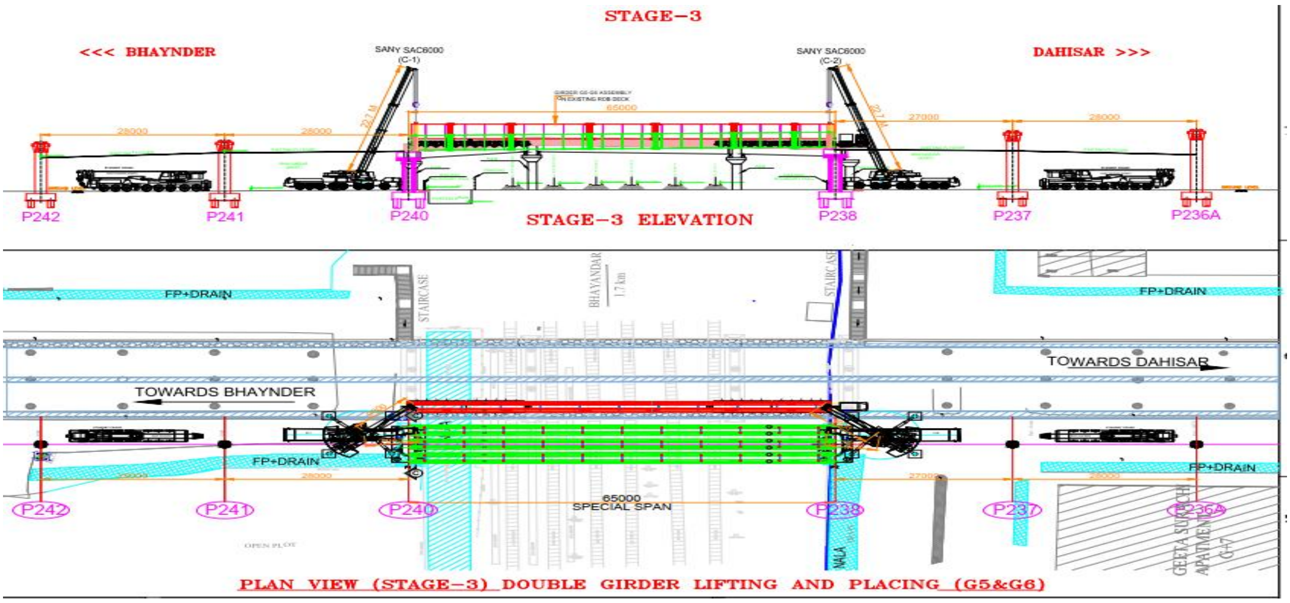



Fig. No. 9 lifting Plan for Stage-III Steel Girder

Fixing of bolting work of cross bracing and end diaphragm between G4 and G5 girder will be completed along with decking sheet. The crane erection method involves lifting and installing steel girders using heavy-duty cranes, designed for precision placement and operational efficiency.

Here is detail **Minute of Minute Detail Plan** for girder launching as per activities –

| **Sr.No.** | **Description of Activities.** | **Time Required** | **Remarks** |
|---|---|---|---|
| 01 | Lifting of Girder Assembly and placing over Bolester axle using cranes near assembly area P270-P274. | ------- | Activity to be done prior to launching |
| 02 | Locking arrangement of Girder Assembly over axles for transportation | ------ | Activity to be done prior to launching |
| 03 | Crane positioning at P238 and P240 | ------ | Activity to be done prior to launching |
| 04 | Transportation of Girder Assembly towards Launching area near P252 over Bolester axle. | 1 hour | Activity to be done prior to launching |
| 05 | Transportation from P252 to existing Road Over Bridge (ROB) and positioning over ROB i.e. besides P238-P240. | 45mins | By closing one lane of ROB (LHS) |
| 06 | Launching crane boom movement and fixing of sling with launching hook over Girder assembly in Traffic and Power block of UP Through line and Stabling Line 01. | 45mins | Ready for Launching Stage. In Traffic and Power block for 2 lines as mentioned. |
| 07 | Erection, Launching of Girder Assembly at required radius and height and placing over Bearings in Traffic and Power block for all lines and Survey check for Alignment over Bearings. | 1 hour 15 min | In Traffic and Power block for all 6 lines. |
| 08 | Locking of Girders for stability after block period and removal of slings etc. of cranes. | 30 min | In Traffic and Power block for all 6 lines. |
| 09 | Fixing of both end diaphragm & central bracing between girder assembly in traffic and power block of DN Through line and UP local line, DN local line and Stabling line 1 and 2 | 1 hour | In Traffic and Power block for 4 lines as mentioned |

### 3.11 COMPARISON OF DATA

Comparison data for Steel I-Girder by Crane and By Open Web Girder(Trestle) Method

- **CRANE CALCULATION**

| SR. NO. | DESCRIPTION | STEEL I - GIDER | | OPEN WEB GIRDER For Trestle Method | |
|---|---|---|---|---|---|
| | | NO. / SIZE | COST ( ₹ ) | NO. / SIZE | COST ( ₹ ) |
| 1 | No of Piles | 20 | 1,50,00,000.00 | 28 | 2,10,00,000.00 |
| 2 | Pile Cap | 11 X 5 X 1.5 M | 30,66,433.00 | 12.3 X 9.3 X 2.2 M | 82,21,443.00 |
| 3 | No of Pier | 2 | 1,17,74,592.00 | 4 | 1,29,77,770.00 |
| 4 | Pier | 5.5 X 2.2 X 8.5 M | | 2 X 3.14 X1.4^2 X8.5 | |
| 5 | Pier Cap | 10.5 X 2.2 X 2.5 M | 33,79,096.00 | 13.13 X 3.75 X 2.5 M | 45,31,946.00 |
| 6 | Raw Material | 660 MT | 4,01,62,909.09 | 456 MT | 2,77,48,919.01 |
| 7 | Fabrication Work of Material | 660 MT | 2,81,14,036.36 | 456 MT | 1,94,24,243.31 |
| 8 | Assembling Work of Material | 660 MT | 56,22,807.27 | 456 MT | 38,84,848.66 |
| 9 | Temporary Arrangement | 660 Mt | - | 56 Trestle Column Fixing and Dismantling | 5,32,00,000.00 |
| 10 | Erection And Transportation | Crane 2 Nos Bolester 1 Nos | 24,20,000.00 | Tower Crane Push Pull Jack Cost | 87,10,423.66 |
| 11 | Temporary Land Rent for Erection | 65 M | - | 65 M | 7,20,000.00 |
| 12 | Railway Blocks | 45 HR. | 2,25,00,000.00 | 15 HR. | 75,00,000.00 |
| 13 | Deck Slab (Including Parapet) | 65 M | 30,17,820.00 | 65 M | - |
| **TOTAL COST** | | | **13,50,57,693.73** | | **16,79,19,593.64** |
| **DIFFERENCE COST** | | | **3,28,61,899.91** | | |

**COMPARISON FOR CALCULATION OF CRANE AND TRESLE**

**CRANE CALCULATION**

- Crane Ultimate capacity =600MT
- Counterweight =135Mt
- Weight of twin Girder = 229MT
- Weight of girder on Each crane = 114.5 x 1.5=171.75 MT
- Radius = 9m
- Boom Length = 22.7 m
- Safe Lifting Capacity of each crane as per chart = 185MT
- % capacity of each crane used = (114.5/185) x 100 =61.89%

**Crane Efficiency Chart: -**

| Sr. No | Parameter | Value |
|---|---|---|
| 1 | Span | P238 – P240 |
| 2 | Span Length | 65 m |
| 3 | Cranes | C1 & C2 (SANY SAC600) |
| 4 | Ultimate Capacity (each) | 600 MT |
| 5 | Counterweights (each crane) | 135 MT |
| 6 | Twin-Girder Weight (total) | 229 MT |
| 7 | Girder Weight (each crane) | 114.5 MT |
| 8 | Operating Radius (with 1.5× safety factor) | 9 m |
| 9 | Max Boom Length (each crane) | 22.7 m |
| 10 | Safe Lifting Capacity (each crane) | 185 T |
| 11 | % Capacity Used (each crane) | 61.89 % |

| Radius (m) | 17.1* | 22.7 | 28.3 | 33.9 | 39.5 | 45 | 50.6 | 56.2 | 61.8 | 67.4 | 73 | 78.6 | 84.2 | 90 (m) | Radius |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 3 | 600 | | | | | | | | | | | | | | 3 |
| 3.5 | 440 | 263 | | | | | | | | | | | | | 3.5 |
| 4 | 385 | 263 | 260.4 | | | | | | | | | | | | 4 |
| 4.5 | 292 | 262 | 250.95 | | | | | | | | | | | | 4.5 |
| 5 | 288 | 246 | 235 | 219.6 | | | | | | | | | | | 5 |
| 6 | 250 | 220 | 212 | 201.6 | 174 | | | | | | | | | | 6 |
| 7 | 225 | 196 | 194 | 187.2 | 159.6 | 139.2 | | | | | | | | | 7 |
| 8 | 205 | 176 | 174 | 169.8 | 147.6 | 128.4 | 112 | | | | | | | | 8 |
| 9 | 190 | 185 | 157 | 154 | 136.8 | 120 | 105 | 87.6 | | | | | | | 9 |
| 10 | 186 | 144 | 142 | 140.4 | 127.2 | 112.8 | 98 | 82.8 | 72 | | | | | | 10 |
| 12 | 140 | 120 | 118 | 118.5 | 110.4 | 99.6 | 87 | 75.6 | 64.5 | 55.8 | 49 | | | | 12 |
| 14 | 105 | 103 | 101 | 101.7 | 96 | 87.6 | 76 | 68.4 | 59 | 51.6 | 45.6 | 40 | | | 14 |
| 16 | | 88 | 86 | 88.2 | 85.2 | 75.6 | 68.4 | 62 | 54 | 46.8 | 42 | 37 | 32.5 | 25 | 16 |
| 18 | | 77 | 75 | 77.2 | 77.2 | 66 | 60 | 55 | 49.5 | 43 | 39 | 34.5 | 30.5 | 23 | 18 |
| 20 | | 66 | 65 | 66.2 | 66.2 | 59.4 | 54 | 49.5 | 45.2 | 39.2 | 36 | 32 | 29 | 21.5 | 20 |
| 22 | | | 57 | 55.5 | 55.5 | 54 | 48 | 45 | 41.5 | 36.2 | 33 | 29.5 | 27 | 20 | 22 |
| 24 | | | 51 | 48 | 47 | 47.9 | 43.8 | 40 | 38 | 33.5 | 31 | 27.5 | 25 | 18 | 24 |
| 26 | | | | 42 | 40 | 42 | 40.8 | 36 | 34.2 | 30.8 | 28.5 | 25.5 | 23.5 | 17 | 26 |
| 28 | | | | 37 | 36 | 36.8 | 37.8 | 33 | 31.8 | 28.2 | 27 | 24 | 22 | 16 | 28 |

| | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 30 | | | | 32 | 32 | 31.8 | 34.5 | 30.8 | 29.2 | 26 | 24.5 | 22 | 20.5 | 14.5 | 30 |
| 32 | | | | | 28 | 29 | 31.6 | 28 | 27.2 | 24.2 | 22.5 | 20.5 | 19.5 | 13.4 | 32 |
| 34 | | | | | 25 | 26 | 28.4 | 25.3 | 25 | 22.2 | 21 | 19 | 17.5 | 12 | 34 |
| 36 | | | | | | 24 | 26 | 22 | 23 | 20.2 | 19 | 17.5 | 16 | 11 | 36 |
| 38 | | | | | | 21 | 23 | 19.1 | 20.9 | 18.4 | 18 | 16.5 | 15 | 10 | 38 |
| 40 | | | | | | 19 | 20.6 | 17.4 | 18.4 | 16.6 | 16.5 | 15 | 14 | 9 | 40 |
| 42 | | | | | | | 18 | 15.9 | 16.1 | 15.2 | 15.2 | 14 | 13 | 8 | 42 |
| 44 | | | | | | | 15.8 | 14.5 | 14.3 | 14 | 14 | 13 | 12 | 7 | 44 |
| 46 | | | | | | | | 13.2 | 13.1 | 13 | 12.8 | 12 | 11 | 6 | 46 |
| 48 | | | | | | | | 11.8 | 11.9 | 11.5 | 11.5 | 11 | 10 | 5.5 | 48 |
| 50 | | | | | | | | 10 | 10.8 | 10 | 10.2 | 10 | 9 | 5 | 50 |
| 52 | | | | | | | | | 9.6 | 8.5 | 9.5 | 9.5 | 8.5 | 4.2 | 52 |
| 54 | | | | | | | | | 8.5 | 7.8 | 8.8 | 9 | 8 | 3.8 | 54 |
| 56 | | | | | | | | | 6 | 7.2 | 7.6 | 8 | 7.2 | 3.5 | 56 |
| 58 | | | | | | | | | | 6.6 | 6.5 | 7.5 | 6.8 | 3.2 | 58 |

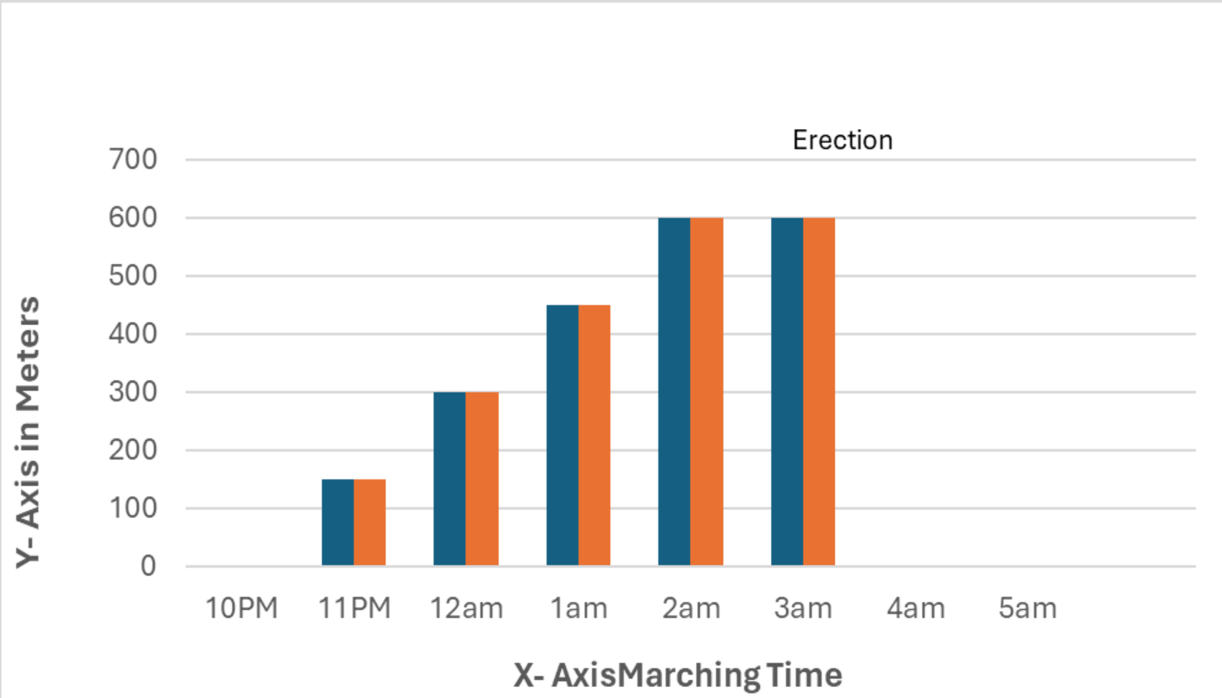
Fig No. 10. Load Capacity Chart

- **Cash Flow Chart**

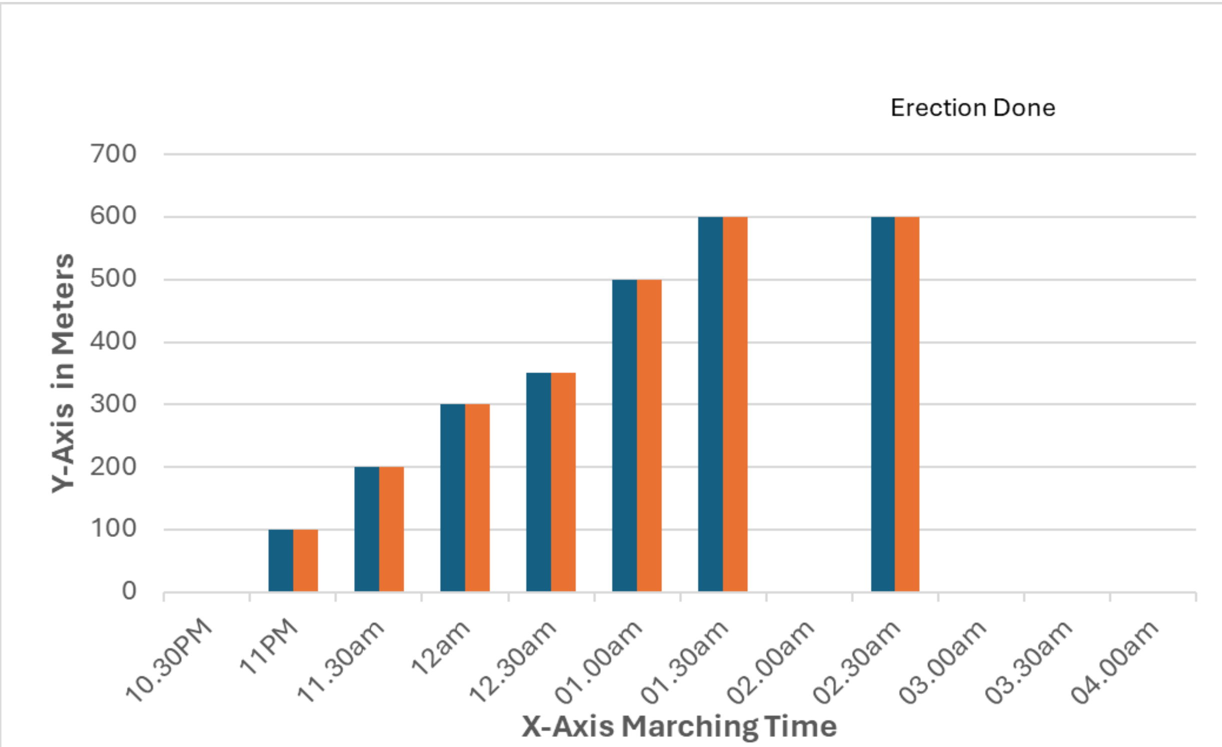

Fig No 11. Comparative Analysis Between Activity and Cost

## V-RESULT AND ANALYSIS

Comparison Between Steel Girder Marching and time Period for Stage-I (G1, G2)




Comparison Between Steel Girder Marching and time period for Stage-II (G2, G3)



## VI-CONCLUSION

From the comparative study of the Crane Method and the Launcher Method for steel girder erection, no single approach can be universally applied to all projects. Each method has unique strengths and limitations, and the selection must be carefully aligned with the specific project requirements and site conditions.

The Crane Method stands out as the preferred choice wherever adequate working space and crane accessibility are available. It offers significant advantages in terms of speed, cost savings, labour efficiency, and safety. By completing girder placement within shorter durations, it minimizes risks around live railway tracks and reduces overall disruption to traffic and public movement. This makes it highly suitable for Rail Over Bridges (ROBs), single-span structures, and open construction sites where mobilization of heavy-duty cranes is feasible.

In contrast, the Launcher Method becomes indispensable under challenging conditions. At sites with restricted access, narrow urban corridors, high-density surroundings, or long continuous viaduct stretches such as metro viaducts, cranes cannot be effectively deployed. Here, the Launcher Method provides a practical and safe alternative, despite being slower and more labour-intensive. It ensures that work progresses smoothly without disturbing the surrounding environment or requiring extensive land for crane operation.

Therefore, the final decision between the two methods must be project-specific, guided by key factors such as:

- Site accessibility and space availability
- Safety requirements near live tracks and public areas
- Social impact considerations
- Project scale and type (isolated spans vs. long viaducts)
- Construction schedule and deadlines

the Crane Method should be prioritized whenever site conditions allow, due to its efficiency and economy. However, in situations where cranes cannot be mobilized, the Launcher Method remains the most reliable solution. A well-informed selection between the two not only ensures technical success but also enhances project safety, reduces risks, and optimizes overall construction outcomes

| Parameters | Crane Method | Trestle Method |
|---|---|---|
| Set up Time | 3-5 Days | 2-3 week |
| Girder Launch Time | 2- 4Hours | 1-2days |
| Labour Count | Labour count 10-20 | 15-30 |
| Productivity | High | Moderate |
| Risk Exposer Time | Short | Longer |

## REFERENCES


**2025**

[1] Huang, H., Xue, X., Ma, H., Zhou, Z., Dou, J., Yang, H., Guo, E., & Ma, J. (2025). Construction control technology and monitoring analysis of walking-type incremental launching construction of small-curvature steel box girder bridges across expressways. *Applied Sciences, 15*(2), 585. https://doi.org/10.3390/app15020585 MDPI

[2] Martins, H. M., Thrall, A. P., Byers, D. D., & Zoli, T. P. (2025). Behavior of incrementally launched modular steel truss bridges. *Engineering Structures, 326*, 119509. https://doi.org/10.1016/j.engstruct.2024.119509 ScienceDirectTRID

[3] *Structural health monitoring*. (2025). In *Wikipedia*. https://en.wikipedia.org/wiki/Structural_health_monitoring (accessed 2025).

**2024**

[4] Zhao, L., Xu, R., Wang, Y., Tian, C., & Qiu, K. (2024). Local deformation analysis and optimization of steel box girder during incremental launching. *Buildings, 14*(7), 2241. https://doi.org/10.3390/buildings14072241 MDPI

[5] Li, Z., Chen, Q., & Zhang, X. (2024). Mechanical analysis of steel box girder during incremental launching: Case of Fenshui River Bridge. *PLOS ONE, 19*(x), eXXXXXX. (Open-access record) PMC

[6] Reliability assessment of the whole process of incremental launching for a long-span continuous steel truss bridge. (2024). *Journal of Highway and Transportation Research and Development (English Edition)*. (English abstract page) Chengdu University

**2023**

[7] Jiang, Y., Wang, H., Chen, Y., & Li, J. (2023). Wireless sensor placement optimization for bridge health monitoring: A comprehensive review. *Sensors, 23*(x), xxxx. (Review article).

**2022**

[8] Liu, Y., Hu, Y., Chen, D., & Wang, L. (2022). Coordinate monitoring technology in the process of incremental launching construction of curved steel box girder bridge. *Civil Engineering Journal* (Wiley-hosted). (Preprint/research record). ResearchGate

[9] Desai, A. D., Biradar, V. D., & Desai, D. B. (2022). Slip formwork. *International Journal of Engineering Applied Sciences and Technology, 7*(2).

[10] Chaugule, T. G., & John, R. (2022). Optimization of steel plate girder bridge with web openings and stiffeners. *International Research Journal of Engineering and Technology, 9*(8).

**2021**

[11] Altınsoy, Z. (2021). *Investigation of initial construction stages of incrementally launched post-tensioned concrete box bridges* (master's thesis). Middle East Technical University. OpenMETU

**2020**

[12] Kotpalliwar, M., & Kushwaha, N. (2020). Incremental launching of steel girders for bridges. *International Journal of Trend in Scientific Research and Development, 4*(2).

[13] Zhang, Q., & Li, X. (2020). Damage detection in bridge structures: An edge computing approach. *arXiv preprint* arXiv:200x.xxxxx.

**2018–2017**

[14] Soman, R. K., Raphael, B., & Varghese, K. (2017). A system identification methodology to monitor construction activities using structural responses. *Automation in Construction, 75*, 79–90. ScienceDirectTU Delft Research Portal

**2015**

[15] Soman, R. K., Raphael, B., & Varghese, K. (2015). Sensor placement to monitor launching girder operations in segmental construction. In *Proceedings of the 32nd International Symposium on Automation and Robotics in Construction (ISARC)*. IAARC. IAARC+1TU Delft Research Portal

[16] Ranjith, K. S., Raphael, B., & Varghese, K. (2015). Automated monitoring of launching girder operations using wireless sensor network. *IIT Madras* (case study).

**2016–2012**

[17] Rizzi, E., & colleagues. (2016). Numerical validation of the incremental launching method of a steel bridge: Experimental–numerical study. *Innovative Infrastructure Solutions, 1*(3), 55. SpringerLink

[18] Li, C. X., Luo, Z. X., & Li, J. J. (2012). Incremental launching construction analysis of continuous skewed bridge with uniform cross section. *Advanced Materials Research, 368–373*, 293–298.

**2011**

[19] Zhang, Z., & Luo, Z. (2011). Patch loading and improved measures of incremental launching of steel box girder: Yandangshan Bridge case. *Journal of Constructional Steel Research, 68*(1), 11–19. ScienceDirectGlobal Author IDResearchGate

[20] Abhyankar, V. G. (2011, October). Bridge erection methods and their influence on permanent designs. In *National Workshop on Innovation in Bridge Engineering*, COEP, Pune.

**2007**

[21] Shao, C. Y. (2007). *Key technological study of long span continuous composite box girder bridges* (Doctoral dissertation). Tongji University.

[22] Svensson, H. (2007). *Bridge construction practices using incremental launching* (NCHRP 20-07, Task 229). Transportation Research Board. TRB Online PublicationsInstitute for Transportation

**2006–2002**

[23] Marco, R. (2002). *Bridge Launching*. London: Thomas Telford.

[24] Laviolette, M., Wipf, T., Lee, Y.-S., Bigelow, J., & Phares, B. (2011). *Bridge construction practices using incremental launching* (reprint/online edition). FHWA/ABC Manual cross-referenced. Federal Highway AdministrationPDF4PRO

**Citation:** Jaiswar Ashok Kumar Ramchandra Suryamati, Manisha Jamgade, Raju Narwade. (2025). Analysis of Launching of Steel Girder Using Crane for Rail Over Bridge. International Journal of Civil Engineering and Technology (IJCIET), 16(5), 1-21.

**Abstract Link:** https://iaeme.com/Home/article_id/IJCIET_16_05_001

**Article Link:**
https://iaeme.com/MasterAdmin/Journal_uploads/IJCIET/VOLUME_16_ISSUE_5/IJCIET_16_05_001.pdf



✉ **editor@iaeme.com**