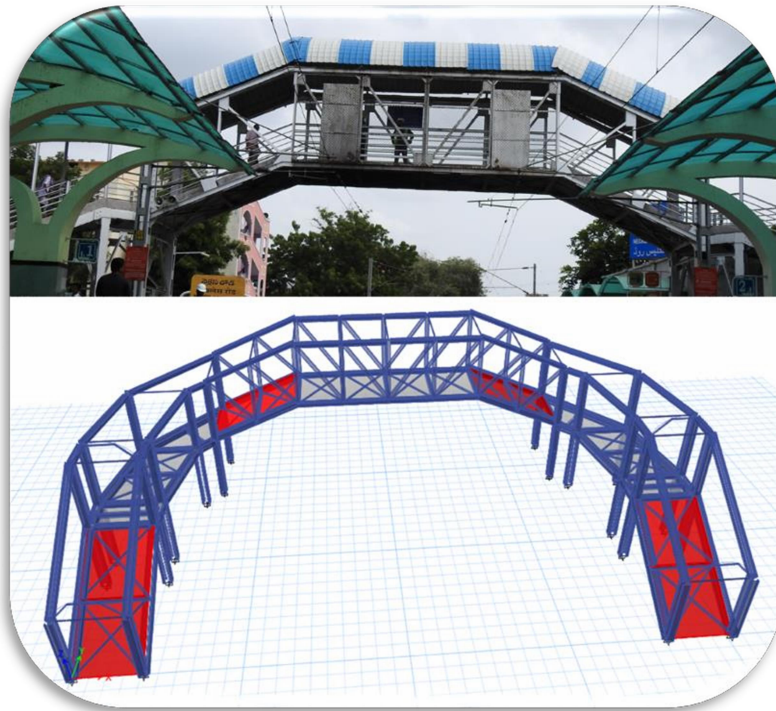


|                              |                                                                          |
|------------------------------|--------------------------------------------------------------------------|
| <b>Name of the Project</b>   | : VISUAL INSPECTION OF FOB/ PF-1 - PF-2 AT NECKLACE ROAD RAILWAY STATION |
| <b>Location</b>              | : NECKLACE ROAD RAILWAY STATION                                          |
| <b>Location Co-ordinates</b> | : 17°25'24.1"N 78°27'47.3"E                                              |
| <b>Date of Inspection</b>    | : 14 <sup>th</sup> and 25 <sup>th</sup> AUGUST, 2019                     |



#### **Summary:**

- a) From visual inspection, Slight rusting is observed at in the sacrificial plate of RCC slab.
- b) Internal corrosion is observed in staircase tie members.

#### **Tests to be conducted:**

- a) Ultrasonic Thickness gauge to measures local thickness of a solid element.
- b) Elcometer (Coating thickness Gauge) to measures dry film thickness on steel surfaces.
- c) Ultrasonic Flaw detector to detect hidden cracks, voids, porosity, and other internal discontinuities in metal.
- d) Fillet weld gauge to measures the size of the weld.
- e) Profometer Test for concrete cover and diameter of rebar.
- f) Rebound Hammer test surface strength of concrete (For RCC slab)

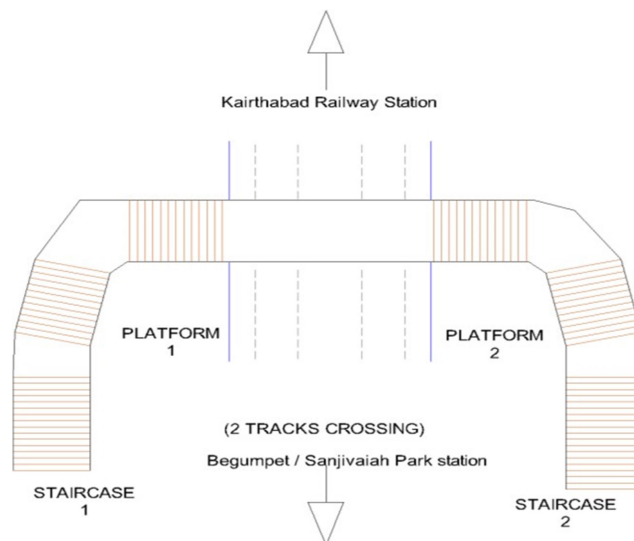
## VISUAL INSPECTION OF STEEL FOOT OVER BRIDGE

|                     |                                                                         |
|---------------------|-------------------------------------------------------------------------|
| Name of the Project | Visual inspection of FOB/ PF-1 to PF-2 at Necklace road railway station |
| Location            | Necklace Road Railway Station                                           |
| Date of Inspection  | 14-08-2019 & 25-08-2019                                                 |

### PART 1 GENERAL INFORMATION AND OBSERVATION

|      |                                                     |                                                           |
|------|-----------------------------------------------------|-----------------------------------------------------------|
| 1.1  | Name of the Bridge                                  | FOB/ PF-1 - PF-2                                          |
| 1.2  | Location of Bridge                                  | Necklace Road Railway Station                             |
| 1.3  | Type of truss Structure                             | N- type truss                                             |
| 1.4  | Year of Construction                                | Not available                                             |
| 1.5  | Description of the main use of the bridge           | Pedestrians Crossing                                      |
| 1.6  | Major Materials used in different parts of bridge   | Structural Steel (truss, frame),<br>RCC (Slab, Staircase) |
| 1.7  | Width of the pathway (m)                            | 3 m                                                       |
| 1.8  | Length of the pathway (m)                           | 15.96 m (3.9 + 8.16 + 3.9)                                |
| 1.9  | No of Railway Lines Crossings                       | 2 tracks                                                  |
| 1.10 | Span arrangement (no x Span in meters)              | 1x 15.96 m                                                |
| 1.11 | Vertical Clearance (from rail top to girder bottom) | 6.755 m                                                   |
| 1.12 | Head Room                                           | 2.75 m                                                    |
| 1.13 | Damages due to accidental hitting, Grazing Marks    | No Visible signs appear                                   |
| 1.14 | History of Repair/ maintenance                      | Not available                                             |
| 1.15 | Original structural drawings                        | Not available                                             |

#### 1.16 Key Plan



| PART 2 IDENTIFICATION OF LOADS ON BRIDGE |                                                  |                      |                                                                                                                                                                                                                                      |
|------------------------------------------|--------------------------------------------------|----------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                          |                                                  | Yes/No               | Photo ID                                                                                                                                                                                                                             |
|                                          | <b>Dead Loads at Roof level</b>                  |                      |                                                                                                                                                                                                                                      |
| 2.1                                      | a) Pipeline - Utilities                          | No                   | Not observed at site                                                                                                                                                                                                                 |
|                                          | b) Cables                                        | Yes                  | Cables are protected with 1-inch dia HDPE pipe<br>(Refer <b>fig :1</b> )<br>1-inch Hollow circular sections are used (truss member)<br>(Refer <b>fig :1</b> )<br>Steel Metal Sheet is used for Roof (Refer <b>fig :1</b> )           |
|                                          | c) Roof Truss                                    | Yes                  |                                                                                                                                                                                                                                      |
|                                          | d) Roof Sheet                                    | Yes                  |                                                                                                                                                                                                                                      |
|                                          | e) load of advertising hoarding                  | No                   | No Advertising boards are provided                                                                                                                                                                                                   |
|                                          | f) load of train/coach display boards            | No                   | No train coach display boards are provided                                                                                                                                                                                           |
|                                          | g) Electrical, OHE, signal equipment             | No                   | No electrical OHE and signal equipment are provided                                                                                                                                                                                  |
| 2.2                                      | <b>Dead Loads at Floor level</b>                 |                      |                                                                                                                                                                                                                                      |
|                                          | a) Additional wearing coat on Floor              | No                   | Chequered tiles used for Flooring                                                                                                                                                                                                    |
|                                          | b) Provision of protective screen for passengers | Yes                  | Chain link fence made of Galvanized wire of 2 mm gauge and 2 mm Galvanized sheet is used above OHE Line on both side of pathway is used for Protection. Mesh frame is supported with angular and MS flats.<br>(Refer <b>fig :2</b> ) |
|                                          | c) Type of Material used for mesh                | Galvanized wire mesh |                                                                                                                                                                                                                                      |

| PART 3 STRUCTURAL SYSTEM OF THE BRIDGE |                                    |                                                 |                                                                                                                                 |
|----------------------------------------|------------------------------------|-------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------|
|                                        |                                    |                                                 | Photo ID                                                                                                                        |
| 3.1                                    | <b>Foundation Details</b>          |                                                 | Not visible at site                                                                                                             |
| 3.2                                    | <b>Pedestal/Base plate details</b> | Not visible                                     | Trapezoidal concrete encasement is observed at platform level for vertical supports (Refer <b>fig: 3</b> )                      |
|                                        | HD Bolts                           | Not visible                                     |                                                                                                                                 |
|                                        |                                    |                                                 |                                                                                                                                 |
|                                        |                                    |                                                 |                                                                                                                                 |
|                                        |                                    |                                                 |                                                                                                                                 |
| 3.3                                    | <b>Roof Truss</b>                  |                                                 |                                                                                                                                 |
|                                        | Element of roof truss section      | Semi-circular truss supported with hollow pipes | 1-inch Semi-circular truss are used for roof truss, supported on 1-inch Tie Members using welded joints. (Refer <b>fig :1</b> ) |
|                                        | Size of roof truss                 | 2.85 m wide                                     |                                                                                                                                 |
|                                        | Connection of Roof elements        | Bolted                                          |                                                                                                                                 |
|                                        |                                    |                                                 |                                                                                                                                 |
| 3.4                                    | <b>Steel Truss</b>                 |                                                 |                                                                                                                                 |
|                                        | Shape of Truss Section             | N- type truss, Double Channel sections          | a. Tie members ISMC 150 double channel section face to face                                                                     |

|     |                                                          |                                       |                                                                                                                                                                                                                             |
|-----|----------------------------------------------------------|---------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|     | Height of Truss (H)                                      | 2.75 m                                | b. Truss supported on ISMC 250 double channel section<br>c. Diagonal bracings of ISMC 150<br>d. Angular bracings of 75x 75 x 8 mm are supported for base slab. (Refer <b>fig :4 and 5</b> )                                 |
|     | Girder/Truss Support Condition                           | Ridged connection                     |                                                                                                                                                                                                                             |
|     | Type/Shape of Secondary Girder /Bracings                 | Double channel section                |                                                                                                                                                                                                                             |
|     | No of Secondary Girders/bracings for span                | 10 no's                               |                                                                                                                                                                                                                             |
|     | Arrangement of Bracings                                  | Diagonal                              |                                                                                                                                                                                                                             |
|     | Type of Beam-Column Joint (shape of gusset plate if any) | Cleat angles                          |                                                                                                                                                                                                                             |
| 3.5 | <b>COLUMN</b>                                            |                                       |                                                                                                                                                                                                                             |
|     | Type/Shape of Column section                             | Channel Section                       | a. Truss supported on ISMC 250 double channel section<br>b. Supported with angular bracings of 75x 75 x 8 mm<br>c. 10 mm thick gusset plate is used. (Refer <b>fig :3 and 6</b> )                                           |
|     | No of Columns/support                                    | 4                                     |                                                                                                                                                                                                                             |
|     | Dimensions of Column                                     | ISMC 250                              |                                                                                                                                                                                                                             |
|     | BEAM-Column joint (bolted, welded, riveted)              | Bolted connection                     |                                                                                                                                                                                                                             |
| 3.6 | <b>FLOOR SLAB OF THE PATHWAY</b>                         |                                       |                                                                                                                                                                                                                             |
|     | Material of Slab                                         | RCC                                   | a. RCC slab casted in-situ supported on sacrificial plate.<br>b. Chequered tiles flooring used<br>c. RCC slab is supported by angles and secondary girders of ISMC150 (Refer <b>fig :7</b> )                                |
|     | Thickness of Slab                                        | Not visible at site                   |                                                                                                                                                                                                                             |
|     | Condition of Slab from Bottom                            | Slabs hidden by sacrificial MS plate  |                                                                                                                                                                                                                             |
|     | Condition of Slab from Top                               | RCC slab covered with Chequered tiles |                                                                                                                                                                                                                             |
|     | Condition of sheeting – leaky roof                       | No leakage observed                   |                                                                                                                                                                                                                             |
| 3.7 | <b>Staircase Details</b>                                 |                                       |                                                                                                                                                                                                                             |
|     | Number of Staircase                                      | 2 no's                                | Staircase steps are RCC slab cast-in situ. Waist slab is supported on ISMC 250 Channel using cleat Angles. Staircase Landing 3 m wide is supported on Vertical and Horizontal Angular Members. (Refer <b>fig :7&amp;8</b> ) |
|     | Number of Steps from PF – 1                              | 42 no's                               |                                                                                                                                                                                                                             |
|     | Number of Steps from PF – 2                              | 45 no's                               |                                                                                                                                                                                                                             |
|     | Material used for steps                                  | RCC cast-in-situ slab                 |                                                                                                                                                                                                                             |
| 3.8 | <b>Staircase Railing</b>                                 |                                       |                                                                                                                                                                                                                             |
|     | Type of Parapet Railing                                  | Steel railing                         | Stair case is provided with Railing on both sides of one-meter height using Angular and Hollow Circular sections. (Refer <b>fig :9</b> )                                                                                    |
|     | Height of Railing                                        | 1 m                                   |                                                                                                                                                                                                                             |

#### PART 4 SURVEY OF SIGNS OF DISTRESS, DEFORMATION IN BRIDGES

- 4.1 ✓ Corrosion is observed in double channel sections at staircase at PF 2 (Inside the joint)



Corrosion observed at Channel built-up section

- 4.2 ✓ Corrosion is observed at tie members (Double channel section) along the span of FOB



Corrosion observed at slab resting  
area & tie member

| PART 4 SURVEY OF SIGNS OF DISTRESS, DEFORMATION IN BRIDGES |                                          |                                     |                                                                                            |
|------------------------------------------------------------|------------------------------------------|-------------------------------------|--------------------------------------------------------------------------------------------|
|                                                            | Defects                                  | Location                            | Notes                                                                                      |
|                                                            | Cracking in Steel Members                |                                     | No cracks are observed in Steel during visual inspection                                   |
|                                                            | Cracking in RCC components               |                                     | No cracks are observed in RCC components                                                   |
|                                                            | Water seepage                            |                                     | No water seepage is observed                                                               |
|                                                            | Spalling                                 |                                     | No spalling is observed in RCC members                                                     |
|                                                            | Rust straining                           | Staircase supported channel section | Rusting is observed at joints of FOB at double channel section (Refer <b>Fig 8 and 9</b> ) |
|                                                            | Extent of Corrosion                      |                                     | Corrosion is observed along the span of FOB in slab resting area                           |
|                                                            | Corrosion in Gusset plate                |                                     | No Rusting is observed in Gusset plates                                                    |
|                                                            | Corrosion at steel-Concrete joint        | Tie members of clear span           | Corrosion is observed at steel concrete joint                                              |
|                                                            | Condition of Painting of steel structure |                                     | Painting is affected in corrosion prone areas                                              |



**Fig 1:** Electrical Cables, Roof truss and Roof sheet and bolted connection



**Fig 2:** Protective screening mesh for passengers

**Fig 3:** Trestles and their protection with concrete encasement





***Fig 4: Tie members and secondary girders with bracings***



***Fig 5: FOB Truss view***



***Fig 6: Cleat angle***



**Fig 7:** Rusting of sacrificial plate



**Fig 8:** Rusting of Channel section at staircase



**Fig 9:** Rusting of staircase supporting channels on both sides

## 5.0 Numerical Model

- Three-dimensional numerical model has been developed from the dimensions obtained by physical measurement and loads considered for foot over bridge taken as  $5\text{kN/m}^2$ . Obtained model and results are shown below.

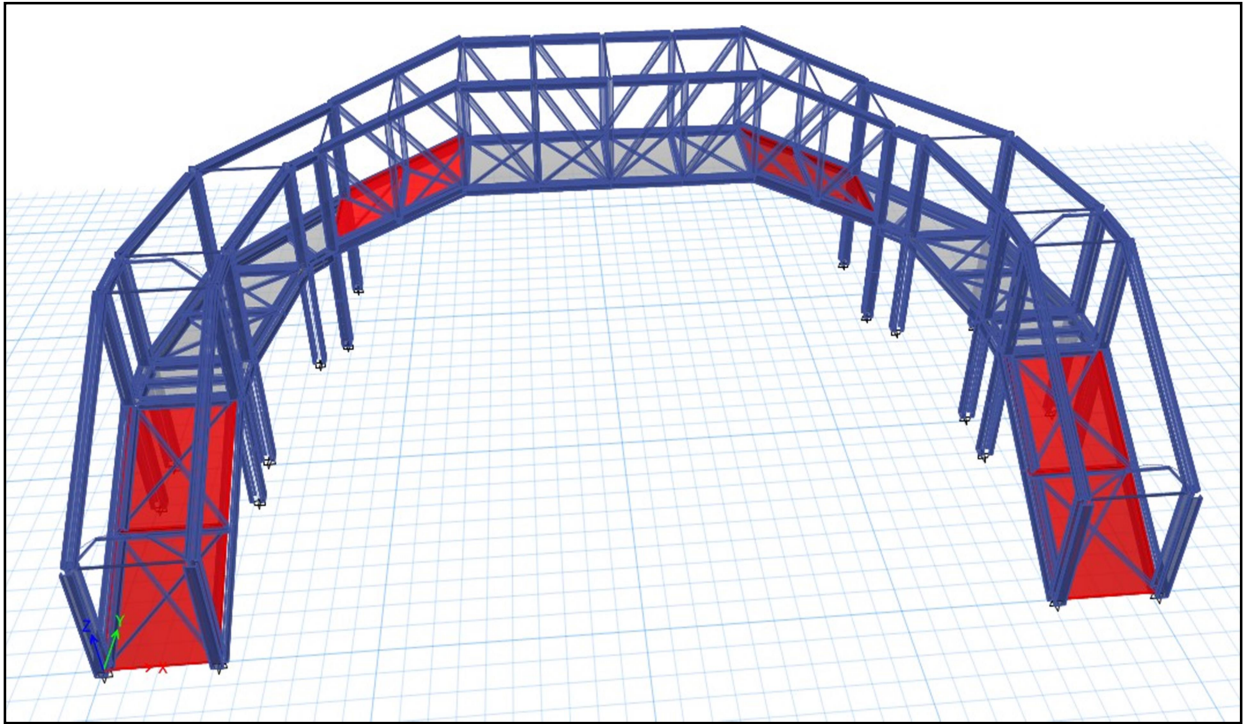


**Fig: 5.1** Numerical Modeling of Necklace road Railway station FOB  
(Developed from physical measurement)

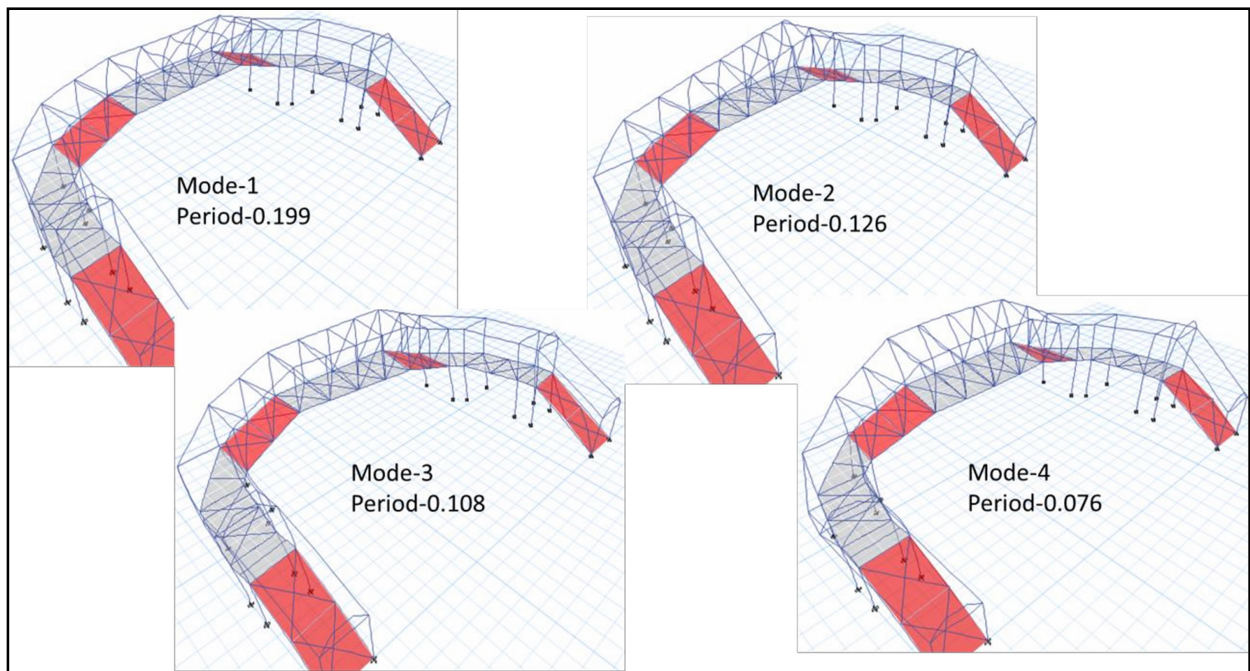


**Fig: 5.2** Modal analysis of FOB

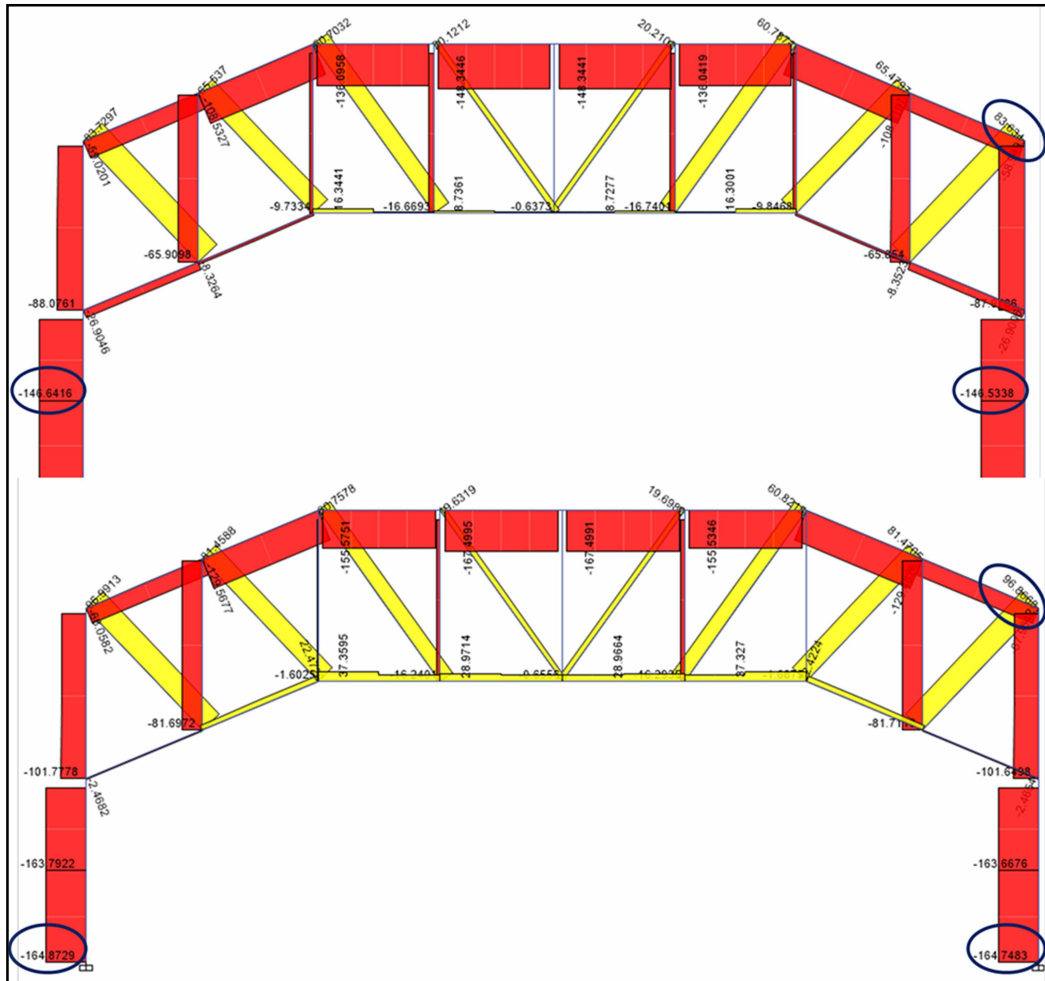


Fig: 5.3 Axial Forces of all Members

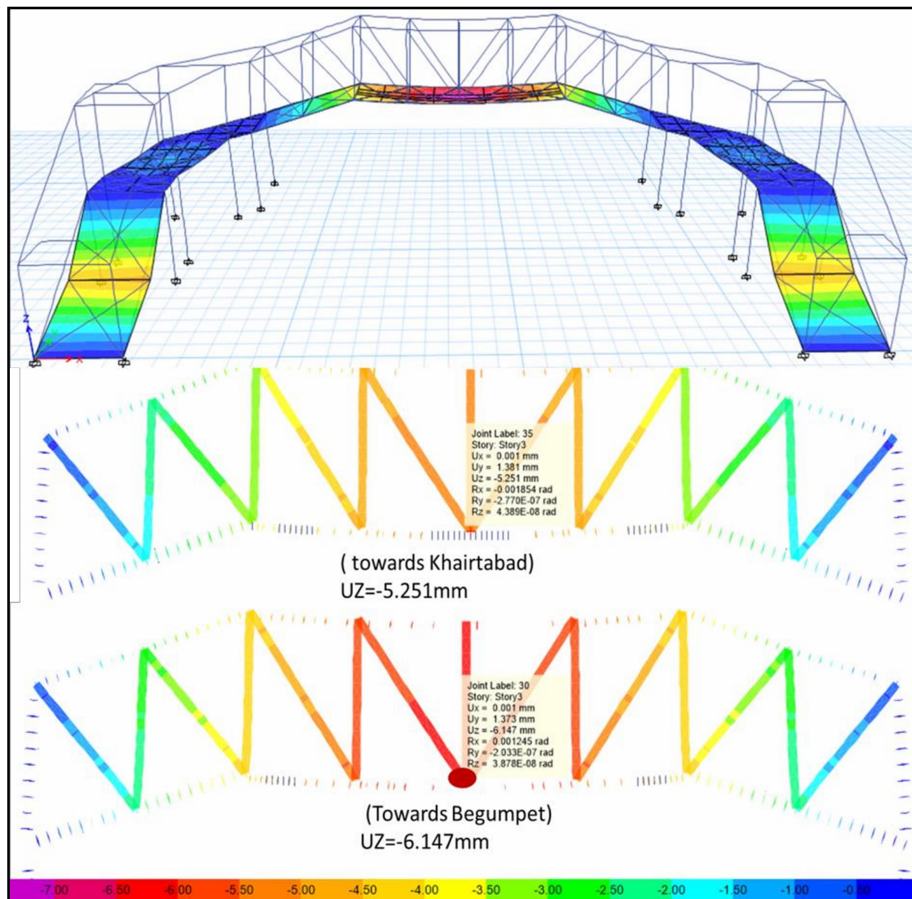


Fig: 5.4 Displacements in truss

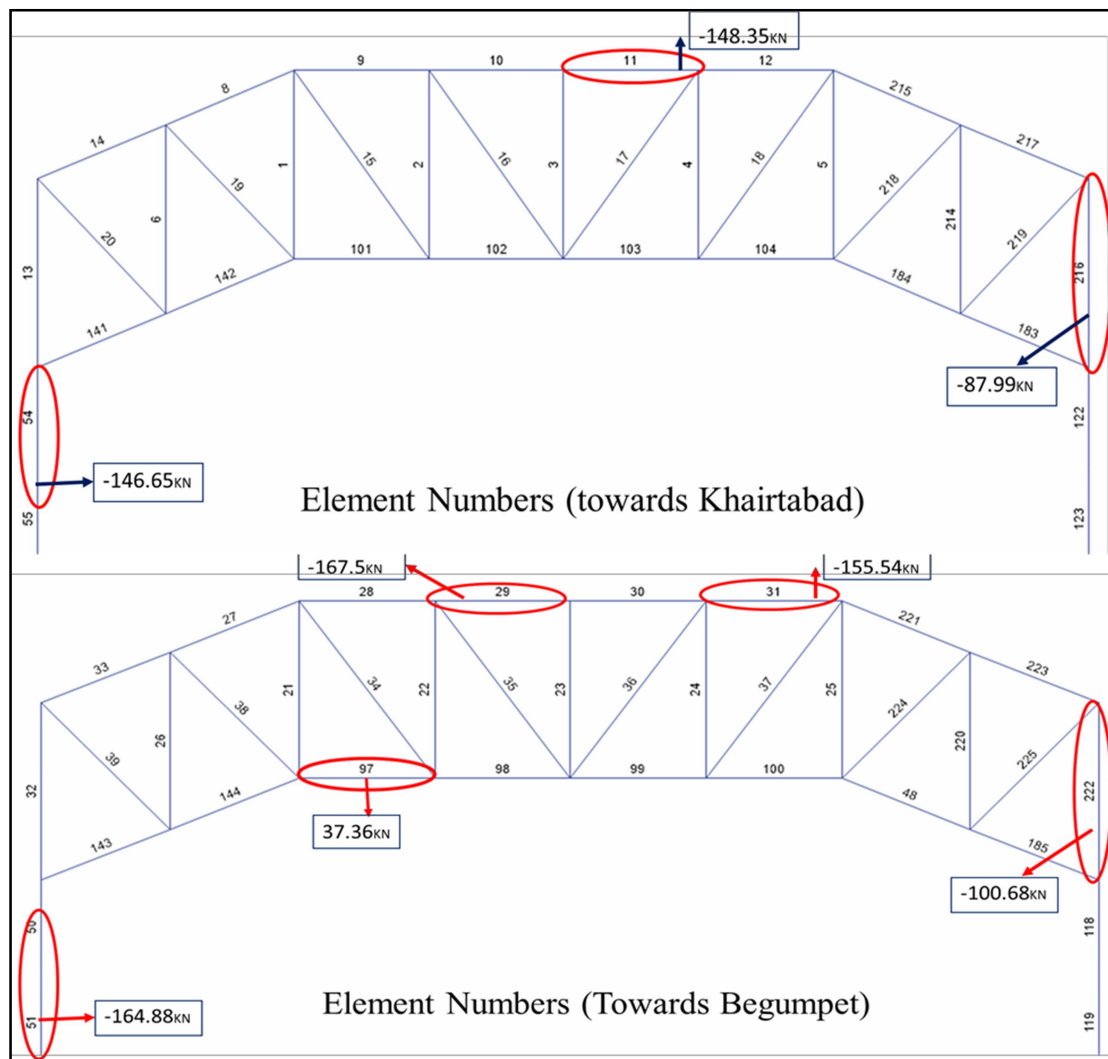


**Fig: 5.5** Highlighted members having maximum axial forces (Members shown with their respective element numbers)