

# USE OF PRE-STRESSED CONCRETE VOIDED SLAB IN INCOME TAX FLYOVER BRIDGE (ITFOB): A CASE STUDY

<sup>1</sup>Aneri Shah

<sup>1</sup>Final Year Student of Bachelor of Construction Technology

<sup>1</sup>CEPT University, Ahmedabad, Gujarat, India

**Abstract:** Change is an inevitable part of our lives in all aspects. Change in construction methodology is no exception. ITFOB has used void former technology-an unusual construction methodology in Ahmedabad. The given case study reflects its advantages, the reason for selection of this unique technology, procedure of installing void formers and its cost analysis.

**Index Terms –** Void Former, Construction Methodology, Pre-Stressed Concrete

## INTRODUCTION

The capital of Gujarat is Gandhinagar and yet, Ahmedabad is a more popular city for trade and commerce. Ashram Road is one of the most important and one of the longest roads in Ahmedabad. Be it Gandhi Ashram, or Sabarmati River front, or post office, or you want to cross the river and go to the old city of Ahmedabad, Ashram road is mandatory to be crossed.

Income tax circle is one of the main junctions on Ashram Road in Ahmedabad. Ashram road being one of the most important roads in Ahmedabad, it is always bustling with traffic. Hence, a flyover at Income Tax crossroads was a long-standing demand by the West Zone office of AMC.

The project was earlier delayed because of the finalization of the metro route. The Income Tax junction is the most important transit point in the city and could not handle the flow of vehicles. As per plan, the Income Tax flyover will be spread equally on both sides over Ashram Road.

With the ongoing construction of the flyover, the commuters on the stretch shift to parallel roads to avoid jams and construction chaos. This has resulted in increased flow of traffic on the roads along the Sabarmati Riverfront. The Income Tax Flyover Bridge has used PSC (Pre-Stressed Concrete) Voided Slab. Voided Slab is used for the first time in Ahmedabad, through this project.

## PSC VOIDED SLAB

Solid slab cross section can be divided into three zones Compression Zone, Tensile zone and Inactive zone. Inactive concrete zone adds extra weight to the slab. In addition, this extra weight puts a limitation on the length of the span, the energy consumption for the inactive concrete zone is a waste and the material used for this zone is also wasted as this zone has no function.

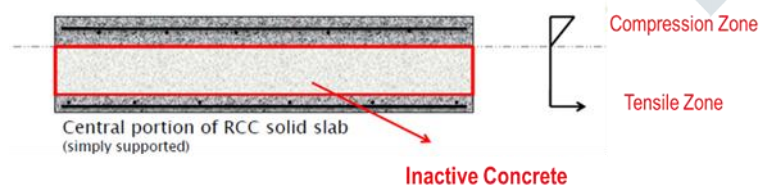


Figure 1 SOLID SLAB CONCRETE CHARACTERISTICS

The voided slab system is a simple system that eliminates non working dead load in concrete slab while retaining its strength fully. The void formers used in this particular bridge are cylindrical with closed cones at both the ends.

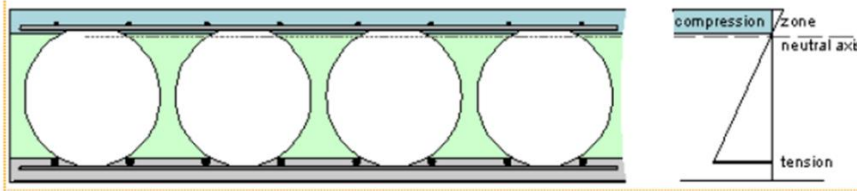


Figure 2 PSC VOIDED SLAB

Reason of selecting voided slab/bubble deck slab:

- There is no compromise of strength and serviceability.
- Flat slab technology can be implemented (no need of beams).
- Longer Spans can be constructed.
- There is reduction in dead weight of the slab.
- It is comparatively environmentally green and sustainable.

Structural Advantages:

- There is less weight of the structure.
- There is comparatively increased strength
- Only few columns are required and no beams are required.
- Larger Spans can be made.
- Choice of shape
- There is less foundation depth and as a result less excavation is required.

Constructional Advantages:

- The structure is light in weight and less equipment are required.
- There is easy incorporation of duct and pipes into slab.
- There is comparatively less work at construction site.
- The biaxial flat slab system and columns are ideal for structures with high resistance against explosion.
- These slab and columns system acts as an elastic membrane which transfers the horizontal forces to stiff vertical structures which is used for earthquake resistance design.

Environmental Advantages:

- There is less material and energy consumption.
- This construction methodology helps in reducing CO<sub>2</sub> emission up to 40 kg/m<sup>2</sup>.
- There is saving in concrete materials and as a result there is cost reduction in that aspect.
- Transportation cost is reduced as well for these materials.
- There is faster construction time as compared to conventional methodologies.

Properties:

- Shear Strength – 80 % of solid deck slab
- Deflection – Same as solid deck
- Weight- 40% less than a solid slab
- Fire Resistance- 65% of solid slab

Calculations done before deciding the design of slab:

- Weight of slab without void former = **1030 MT**
- Weight of slab with void former ( including the weight of void former ) = **783 MT**
- Hence, straight away **25 %** decrease in weight, **25%** less material used, **25%** of time saved in our case.
- Which reduces the cost of slab by **25 %**.

**Void Formers**

- Before fixing void formers in slab, they are coated with cement slurry.
- Void formers 3 m long and with diameter 1.2 m are used. Their material is bright steel (corrugated)
- Cones are fixed on both the ends.
- Provision is given on both the ends of the void former cylinder and broader end of the cone to connect with other cylinders.
- Three rows of void formers are provided in each span of 2.5 lanes.
- These are placed using hydra and then dragged manually till the other end of the span and then fixed with each other using bolts.
- Cylindrical rings (couplers) of about 10 cm, bright steel (not corrugated, unlike the void former), are fixed on site on both sides of void former to facilitate joinery between two void formers.

**Table 1 COST DETAILS FOR VOID FORMER**

Sr. no	Particulars	Unit	Unit Rate	Quantity required in one slab	Amount
1	Void former dia 1200 mm*0.70mm thickness bright metal	R. mt.	1771	27.70 x 3 = 83.1	147170.10
2	End cone, std. size bright metal	No.	2024	6	12144
3	Couplers	No.	455.40	24	10929.60
<b>Total</b>					<b>170243.70</b>
<b>+ 18 % GST</b>					<b>200887.57</b>
<b>+ 10,000 Transportation cost</b>					<b>210887.57</b>

**PROCEDURE SEQUENCE FOR SLAB****CONCLUSION**

Compared to the conventional box girder slabs, pre cast girders or cast-in situ solid slab, voided slab is costlier. Agencies working at the ITFOB site (PMC and contractor) claim that construction methodology of voided slab saves 50% time than the other usual

methods. The reason for selecting this methodology for ITFOB is the time reduction. Ashram road, being a busy one, less time to spent build the bridge is an important factor. There are 15 spans (35m) and 1 span in steel girder (45m). Steel Girder is to be put at the income tax circle (45m span, longer than other spans of the bridge) as it will be difficult to cast spans at the income tax junction. PSC Voided slab and steel girder are the two unique features of ITFOB selected specially to reduce the construction time. The time period given for the construction of this bridge according to the contract was two years. At present, the project is delayed. By observation, the delay is due to various factors like land acquisition issues, removal of trees planted in the bridge span area and other legal matters.

#### ACKNOWLEDGEMENT

Author would like to show her gratitude to the Silver Oak college of Engineering & Technology, Ms Amita Shah and Ms Rewati Marathe (Faculty members of SOCET) for providing the wonderful exposure.

#### REFERENCES

1. PMC of ITFOB site : HCP Designs
2. Contractor of ITFOB : Ranjit Buildcon
3. Observations made on site.
4. [http://www.dynamicprestress.com/void%20former.htm?width=330&link=ducts\\_voidformer.php](http://www.dynamicprestress.com/void%20former.htm?width=330&link=ducts_voidformer.php)
5. <http://www.buau.com.au/bright-mild-steel.php>

