Discussion on

Navigating NH Precast Concrete Policy from AE/IE's Perspective

FOR

ACCELERATED BRIDGE CONSTRUCTION

By

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MORTH's POLICY ON USE OF PRECAST CONCRETE

- An Official Circular "RW/NH-34049/01 /2020-S&R (B)" dated 8th April 2022 has been issued to encourage the use of the precast concrete elements for Accelerated Bridge Construction with Factory Made Products
- Policy covers MORTH's planning to ensure the use of factory manufactured precast concrete elements within 100 Km radius of the Factory with mandatory usage of 25% of total concrete volume of superstructure work. [Policy may further be extended to substructure (precast abutments & piers)]
- Upcoming Contract/Concession agreement documents shall be framed to include the provision of mandatory use of factory manufactured precast concrete elements in projects.
- This initiative will also help in promoting the Growth of MSME Sector and provide opportunity for new jobs.

Present Scenario in the Country

- In recent years, Precast and prefab construction for the bridge superstructure has become a first choice for the construction agencies working on number of National Highway Projects and other important bridge, elevated viaduct and flyover projects in terms of gain in quality, cost and time.
- Most popular forms of precast construction are full span precast planks (solid, voided & boxed) and girders for span range from 10m to 45m and precast segmental type for generally longer spans.
- At present, all such precast concrete elements are normally produced by the construction agencies by setting up a casting yard for the project.
- There is no obligation to the construction agencies to use precast or cast-in-situ type construction for longitudinal construction (i.e. superstructure) and vertical construction (i.e. Piers & Abutments) under present EPC or HAM Contract Agreements.

AE / IE's Perspective on Precast Concrete Policy

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- In view of this policy, It must be ensured the availability of Standard Technical Specifications for Design and Construction of Factory-made Precast Concrete Elements with use of different methods and equipment with complete Quality Assurance.
- AE/IE will be expected to explore various aspects that should be considered during constructability reviews and working in tandem with precast industry at various levels in terms of their products, capacity, quality and supply for effective delivery to the project.
- AE/IE's engineer will need to check potential erection methods as proposed by the Contractor with due consideration to different construction risks and hazards in order to ensure that a bridge can be built within a given construction time schedule.
- However, contractor will be fully responsible for the means and methods of building the bridge with precast concrete elements.

AE / IE's Perspective on Precast Concrete Policy

- AE/IE will review the Shipping Dimensions of the Precast Element to be transported to the expected construction site.
- Longer elements can be shipped with specialty hauling equipment, but problems may arise with turning radii on local roads
- Shipping length is normally not an issue in rural and open areas. However, it can be a significant problem in urban areas and hilly area having frequent bends. Hence, maximum length of precast elements will be decided in consideration with transportation facility and supply route. However on-site splicing/jointing of precast elements may be adopted to form complete span.
- Length of the precast element will also be restricted for its shipping weight if there are load restricted bridges in the area.
- AE/IE will also review the details of equipment required to execute the construction and their effectiveness

AE / IE's Perspective on Precast Concrete Policy

- List of certified fabrication plants for precast concrete products will be submitted by the Contractor for getting approval from AE/IE for procurement of the precast items.
- AE/IE may propose additional geotechnical investigations in order to determine the suitability of the ground to support the heavy cranes and other equipment.
- AE/IE will examine the designs and drawings as furnished by the Contractor's designer in conformity with proposed erection method statement.
- AE/IE will not allow lifting of precast units without use of proper spreader beams to avoid any inadvertent stresses and cracks.
- AE/IE will ensure the connection/jointing tolerances of precast units as per design standards.
- AE/IE will judiciously decide the implementation of the MORTH's Policy considering the project location, availability of manufacturing units and their connectivity and requirement of the precast product.

AE / IE's Perspective on Precast Concrete Policy

- From AE/IE's perspective, it is desirable that MORTH/IRC must publish a complete manual under its precast concrete policy comprising "Engineering Design, Fabrication and Erection of Prefabricated Bridge Elements and Systems".
- There must be a training/familiarization programme and certification course from MORTH/IRC for AE/IE engineers in view to enhance their knowledge and understanding to implement the work with established standards and quality.
- There must be an initiative from MORT/IRC to develop standard design and the drawing data for different precast concrete units (viz. beams, panels, walls, box section for culverts and closed drains) using either normal concrete or UHPC or UHPFRC with their direct reference in Contract. This will be followed by all expected bidders and will help AE/IE for an early review.

Precast & Prefabricated Bridge Elements and Systems

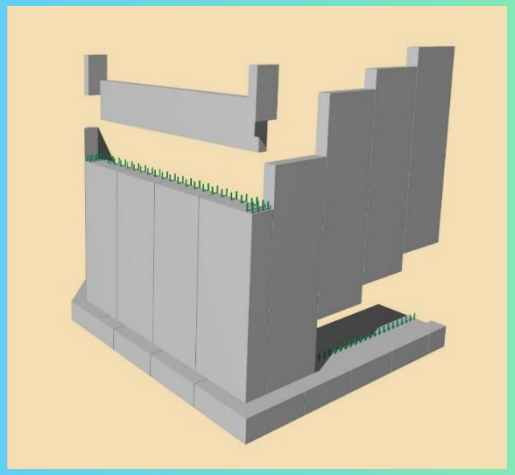
(For General References only)

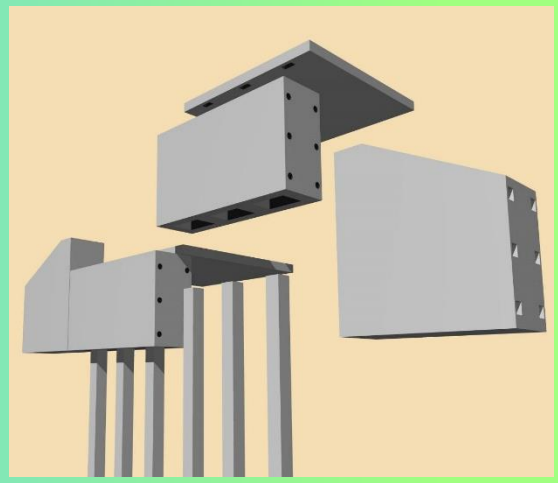
Accelerated Construction Methods for Bridge Structures

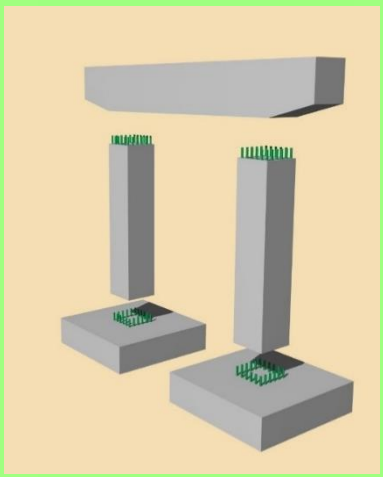
- Precast Concrete Pier
- Fully fabricated Composite Concrete Filled Steel Tube Pier/Column
- Precast Concrete Tee-Girders, U-Girders
- Precast Concrete Deck Slab (Solid / voided)

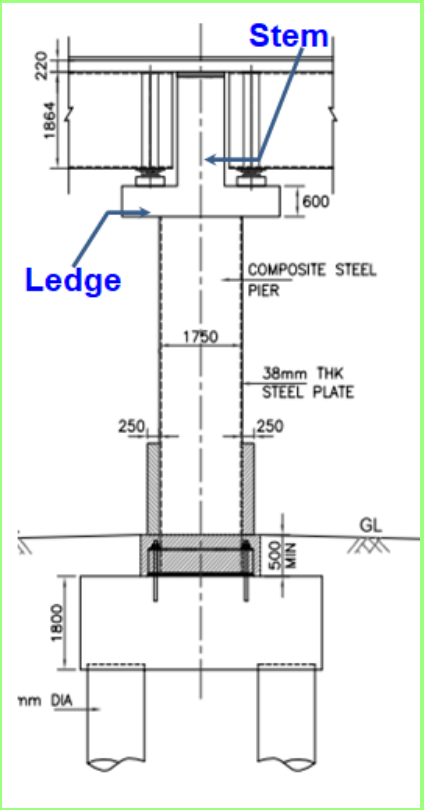
Vertical Precast Construction

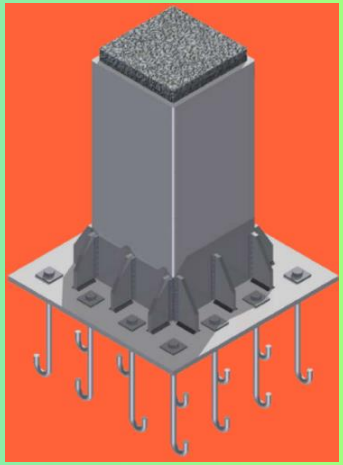
Precast Abutments & Piers

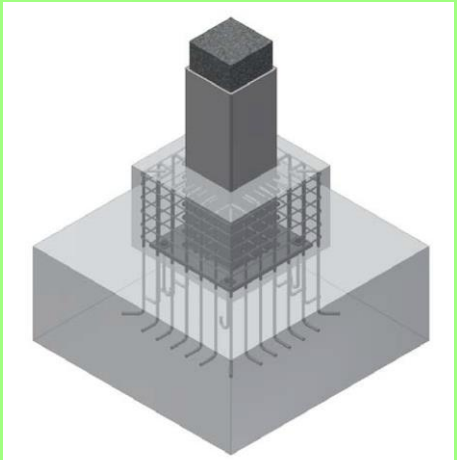








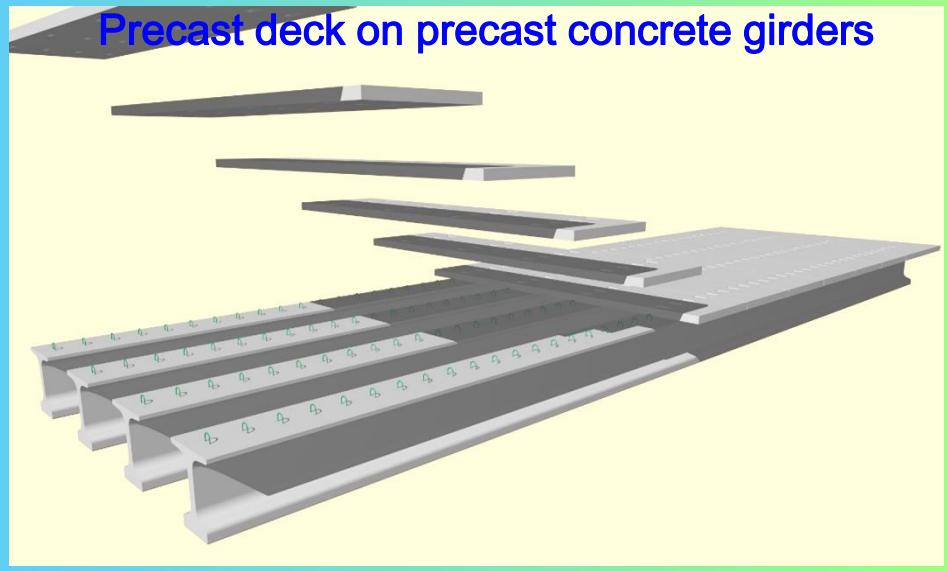




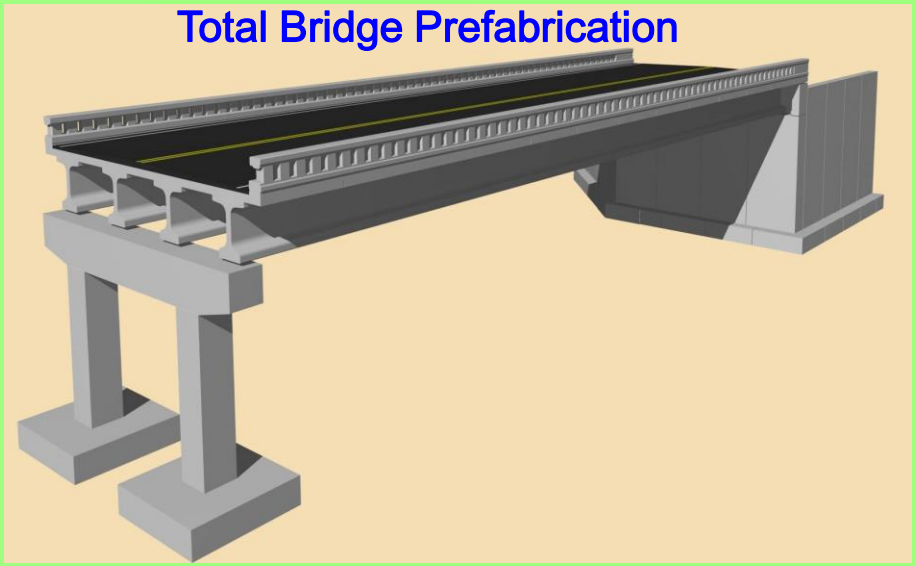
Concrete Filled Steel Tube Column/Pier

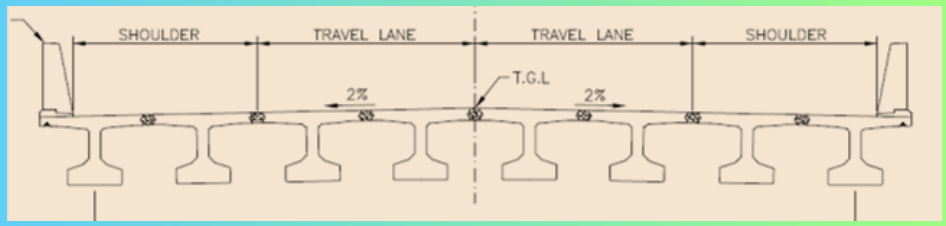
Longitudinal Precast Construction

Precast deck on precast concrete girders

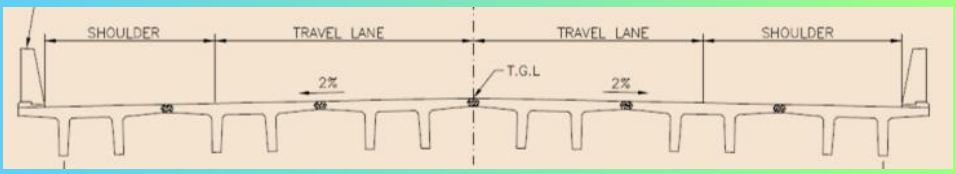


Total Bridge Prefabrication

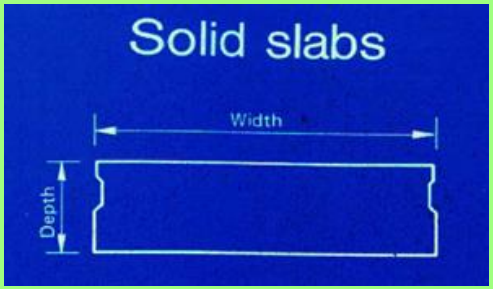


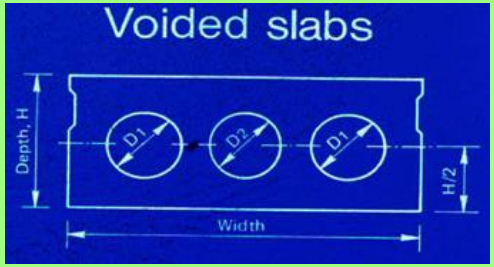


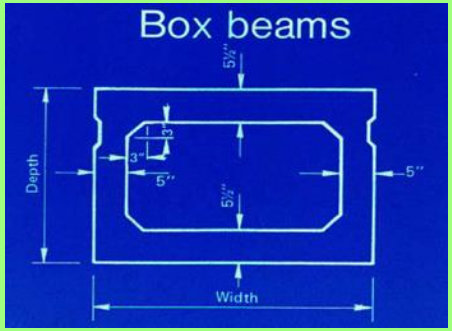
Adjacent Deck Bulb Tees



Adjacent Double Tees







RFP Document from AE / IE's Perspective

- Minimum dimensional and material requirement of the factory-made precast units to ensure their durability for 100 years life.
- Details of the empanelled vendors from MORTH/IRC having establishment in 100 Km radius of the project location.
- Relevant applicable Indian and other International design and construction standards to be referred in AE/IE's review and approval.
- Specific mention of the structure locations where use of factory made precast concrete components are desirable under the project.
- RFP must include potential cost of factory-made concrete products for any probable change with cast-in-situ to determine the case of COS and provision of the extra time (EOT)
- Permission of SPMTs and hauling permits for transportation. Insurance Cover. Acceptance criteria for precast units with cracks and other defects.

Precast Concrete vs. Cast In Situ Concrete

Construction Programme and Cost: Some international studies (FHWA) show the saving in time around 25% and in cost around 8-10% while using PC

Speed of Construction: No delay to gain strength at site	But CIS concrete needs generally minimum 28 days for gaining strength
No delay of precast production due to inclement weather condition of Site	CIS concreting can only be done during fair/normal weather condition.
precast concrete usually requires small amounts of skilled laborers to install.	CIS concrete requires more work done in preparing the ingredients, mixing, pouring, and curing the concrete
several other tasks are usually completed parallelly at site to ensure construction continues as expected	No such benefit of time in case of CIS concrete as all activities are carried out at site.
Very limited cost for formwork & shuttering material. Cost of erection & transportation of PC products.	CIS concrete needs formwork, shuttering material etc and it generally becomes scrap at the end the project
Concrete cover can be reduced. This helps in optimizing the PC design	Concrete cover is more for the case of CIS Concrete

Engineer's Opinion on use of Precast Concrete

Professionals opinions on using precast concrete product.

Number	Advantages	Rating 1	2	3	4	5	Total	∑W	Mean	RII	Rank
1	Low life cycle cost	0	0	2	42	34	78	344	4.4103	0.882	1
2	Reduction of on-site waste	0	0	2	50	26	78	336	4.3077	0.862	2
3	Speed of construction	0	2	6	46	24	78	326	4.1795	0.836	3
4	Quality	2	0	10	54	12	78	308	3.9487	0.79	4
5	Durability	0	2	16	48	12	78	304	3.8974	0.779	5
6	Dimensional accuracy	0	16	14	28	20	78	286	3.6667	0.733	6
7	Reduction of on-site labour	0	14	12	48	4	78	276	3.5385	0.708	7
8	Reduction of on-site activity, noise, and disturbance	0	14	20	34	10	78	274	3.5128	0.703	8
9	Sandwich panels available for insulation	6	16	12	26	18	78	268	3.4359	0.687	9
10	Minimal maintenance	6	16	4	46	6	78	264	3.3846	0.677	10
11	Thermal inertia reduces lifetime energy costs	0	14	22	42	0	78	262	3.359	0.672	11
12	Large spans available from prestressing	6	26	4	34	8	78	246	3.1538	0.631	12
13	Tight tolerances	4	34	6	28	6	78	232	2.9744	0.595	13
14	Acoustic insulation	12	36	10	14	6	78	200	2.5641	0.513	14

A survey from Opinions of Design Engineers, Construction Engineers and Quantity Surveyors using Relative Important Index (RII)

[1 : Poor, 2 : Unsatisfactory, 3 : Average, 4 : Good, 5 : Excellent]

thank you!