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GAMMON BULLETIN

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GAMMON

"We will make electricity so cheap that only the rich will burn candles."

Thomas A Edison

[Vision of a great prolific inventor – Thomas Alva Edison (1847-1931) holding over 1000 US patents to his credit]

IMS POLICY

Editorial

We are pleased to publish Jan- June, 2015 issue of Gammon Bulletin.

We take pleasure in presenting some of our recent significant achievements, successes, learning and events from across the country to our Gammon family, our esteemed customers and other beloved stake holders.

The lead article in the Bulletin is on Design and Construction aspects of Approach structures at Wazirabad which forms an important part of India's monumental bridge across Yamuna river – the Signature Bridge at Delhi. Keeping in view the beauty of Signature Bridge, approaches to this bridge were conceived and designed to create overall aesthetically pleasing structure. Authored by Mr. Arvind Singh, the article explains how challenges arising due to various conflicting requirements in congested locations were successfully met by creative construction-friendly design ideas and innovative construction methodologies while keeping an eye on cost-effectiveness and without compromising on aesthetically pleasing attributes. The success story of this prestigious mega project, highlights the fact that proactive involvement of Construction Engineers right from initial stages and close interaction with Design Engineers goes a long way in conceiving, designing and delivering desired product meeting all the pre-set objectives.

Second article in the Bulletin covers Fast Track construction of Residential towers at Runwal Project in Mumbai wherein available resources were effectively utilized to give optimum cycle times.

The third article briefly highlights Gammon's contribution in construction of Metro in Kolkata.

In our quest to continually improve the Bulletin, we will be glad to receive feedback and suggestions from our valued readers to make Gammon bulletin more and more interesting and informative for the readers.

Your feedback and suggestions may please be sent to
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Cover Photo: 5 x 660MW Power Plant, Tuticorin, Tamilnadu

DESIGN AND CONSTRUCTION ASPECTS OF WAZIRABAD APPROACH STRUCTURES

Arvind Singh
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Conceived by Delhi Tourism & Transport Development Corporation, the Signature Bridge Project across rziver Yamuna at Wazirabad in Delhi is indeed a Signature monument for Delhi and promises to become modern tourist destination for the capital of India. Apart from innovating design of cable stayed bridge with eccentric bow shaped steel pylon, innovations have also been made for the approach structures flanking either ends of the bridge.

Some of the innovative features in the approaches include:-

➤ Aesthetically pleasing viaduct structures by use of most modern construction techniques available in the country to construct a highly durable structure in minimum time.

➤ Precast- Post-tensioned-fully integral segmental-Concrete-Box Girder structure designed and constructed, for the first time in India and that too for such a mega project.

➤ Superstructure comprising of precast-segmental-single cell-box spine grider with a pair of precast curved ribs on each side of face, to enhance aesthetic beauty of superstructure as well as support the tip of cantilever of box deck slab.

➤ Shape of the pier following the flow of forces, integral connection between the piers and superstructure by cast-in-situ pier diaphragm thereby eliminating Bearings, which are the most brittle and fragile component in bridge system.

➤ Dedicated acceleration and de-acceleration lanes for merging and demerging loops in main flyover of western approaches.

➤ Merging and demerging loops, truncated precast segmental single cell girder having varying deck for viaduct portion.

➤Loop and main flyover segments stitching laterally at deck level by cast-in-situ RCC slab/diaphragm, thereby eliminating expansion joints to avoid jerk in traffic ride.

➤ Use of Self compacting concrete of M60 & M65 grade, (designed in house) for the first time in India for all piers and pier diaphragms of their work.

➤ Well (Cassion) foundation with jack down sinking technology.

1. Details of Project

Proposal to constructs a new 8-lane bridge across river Yamuna 600m downstream of the existing barrage cum bridge at Waziradab, Delhi was an outcome of decision of Delhi Government of making a land mark structure in Delhi and to develop the surrounding area into a tourist Destination. The proposed bridge will join marginal Bund Road at Khajuri Khas intersection on eastern side and will join Road No.45 (Outer Ring Road) on the western side.

Fig.1. Key Plan

Assignment also include development of Approaches on Western & Eastern sides of proposed Signature Bridge, Fig.1. The scheme developed was not only to provide the approach to Signature Bridge, but also to eliminate traffic congestion along the road no-45 (Outer Ring Road) in Western approach and at Khajuri Khas crossing in Eastern approach.

On Western side, grade separators comprises of flyovers, loops and ramps were constructed to ensure signal-free traffic movement at the proposed intersection of the bridge with Road No.45 and exiting intersection at Timarpur, Nehru Viahr and Wazirabad, Fig.2 &Fig. 3. Road widening, construction of footpath, storm water drains, cycle track and subways were also part of Western approach.

Fig.2. Model view of western approach to signature bridge

Eastern approach includes construction of embankment of about 2.0 Km length, river training work, river protection works, widening of existing roads, construction of roads, footpath, cycle track, storm water drain etc. In addition, 6 lane flyover was also constructed at Khajuri Khas intersection with rotary at ground level to ensure signal-free movement, Fig.3.

Fig.3. Model view of eastern approach

2. Geometric design

The alignment and position of proposed Signature Bridge was pre-fixed and challenge was to design a interchange on west side of the same within the available space which is surrounded by many boundaries as listed below.

(a) Existing Khyber pass bounding wall of DMRC was on west side.

(b) Tibetan colony on the south side.

(c) Grave yard is located on north side.

Various planned entries/exit have to be accommodated within the available space without any encroachment:-

- Entry to and exit from proposed

Signature Bridge to ISBT side.

- Entry to end exit from proposed Signature to Azadpur side.
- Entry to and exit from proposed Signature Bridge to existing Wazirabad barrage cum bridge.
- Entry to and exit from proposed Signature Bridge to Timarpiur.
- Wazirabad barrage cum bridge to ISBT and vice versa.
- Wazirabad barrage cum bridge to Azadpur and vice versa.
- Azadpur to ISBT and vice versa (along Road No.45-Outer Ring Road)

After evaluating many alternatives, geometry though complex was designed within available space which was best possible and meets all geometrical requirements of standard practice,Fig.2.

Apart from vehicular traffic cycle tracks were also planned for all such movement except to Signature Bridge. Combining eastern & Western approach nearly 50000 sqm of open portion of elevated flyover 25000 sqm of closed portion of viaduct & 90000 sqm of embankment was required to be constructed.

Flyover to be constructed was of different carriageway widths 9.7 m, 11 m &12.5 m. In addition, there are zones of acceleration and de-accleleration bays in western approach on the flyover along the Road No.45 (Outer Ring Road). Acceleration bay represent the zone wherein extra width of one lane is gradually provided over and above conventional main carriageway width so that traffic can be branched out the diverging road from main carriageway road.

Designing and constructing varying widths of superstructure and also maintaining the rhythm of structural system opted for other conventional zones i.e precast segmental portion was a challenging task. This has been achieved by planning and close co-ordination between structural designers, client and contractor from conception to completion.

3. Form of superstructure cross-section

Broadly, superstructure comprises of precast segmentally constructed, single cell box spine grider of constant depth having precast curved ribs on both of its side to support the wide cantilever slab at its tip.3.0m long precast segment accommodation two nos of curved ribs on each side of spine box segment was adopted. Outer profile of curved ribs and precast segment has been so shaped so as to maintain smooth curved bottom profile from one end to another end. These ribs were monolithically connected to spine box at web soffit junction at it bottom end and cantilever flange tip at its upper end.

Curved ribs has been shaped of varying width and varying thickness. Continuity of numbers of varying width of ribs in combination to spine box forms, arch shaped opening in between ribs in elevation to enhance the aesthetic appeal of superstructure, Fig.4 and Fig.5 Thickness of ribs was governed by structural strength requirement so as to sustain the design stresses.

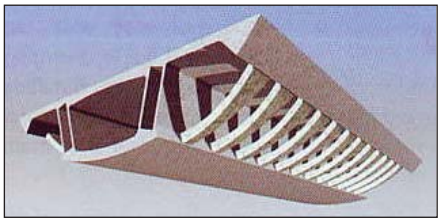


Fig. 4: Artistic impression of superstructure

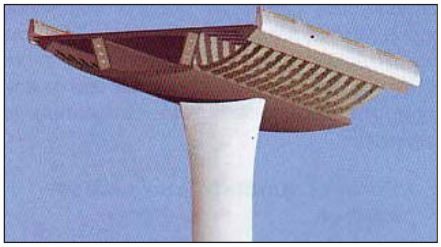


Fig. 5: Artistic impression of integral pier with superstructure

As in all jobs, heavily dependent on large scale precasting, standardization of formwork was key feature of planning. It was planned to have minimal component for casting of boxes of variable box width so that maximum repetition of resource of formwork can be done.

For three different width of boxes having different carriageway width of 9.7m (10.3 m wide box), 11m (12.0 m wide box) &12.5 m (13.2 m wide box), two nos of spine box and two types of curved ribs, Fig.8, 9, & 10 have been adopted as indicated in Table 6 below:-

Table 6: Spine & Rib Detail

	10.3 m Wide Box	12.0 m Wide Box	13.2 m Wide Box
Type of Spine Box	Spine Box Type-1	Spine Box Types-2	
Type of Rib	Rib Type-1		Rib Type-2

This was only possible by charging radius of spine box profile w.r.t radius of outer curved profile of rib but while doing so common tangent is maintained at the intersection of two Fig.8, Fig.9 and Fig.10. Such planning had resulted in requirement of only two type of moulds each for rib as well as precast segment for three different deck width.

For casting of segment, two long line beds and one short line bed were used. Short line bed was exclusive used for 12.0m wide segment (for spans having plan curvature limited to 1000m curve) while long line beds were used for 10.3m wide, 12.0m wide & 13.2 wide segment. Total numbers of segments which were cast for the elevated part of eastern approach as well as western approach structure are indicated in Table.7 below:-

Table 7: Nos. of precast segments

Nos. of segments for Each Deck Width				
Deck Width	10.3m Wide Box	12.0m Wide Box	13.2m Wide Box	Total
Number of 3.0m Long Segment	201 nos	780 nos	150 nos	1131 nos

Same spine boxes and ribs were also used for varying width of decks in acceleration and de-acceleration zone.

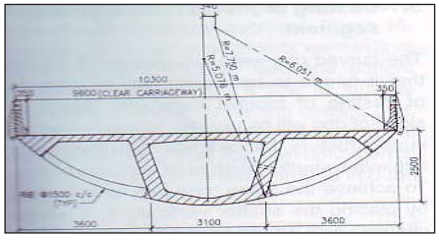


Fig. 8: Cross-section of 10.3 m wide box (Spine Box Type-1), (RIB TYPE-1)

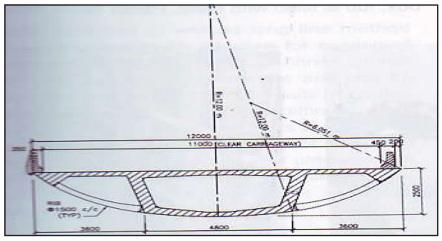


Fig. 9: Cross-section of 12.0 m wide box (Spine Box Type-2), (RIB TYPE-1)

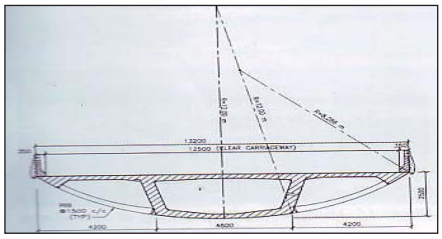


Fig. 10: Cross-section of 13.2 m wide box (Spine Box Type-2), (RIB TYPE-2)

4. Standardization of spans

Effort has been made to have minimal expansion joint and to have continuous unit of larger length as large as possible so as to have smooth rideable quality. Continuous unt of four spans, three spans & two spans were adopted.

In Western approach, number of span in a continuous unit and location of piers were guided by location of start and finish locations of diverging (acceleration bay) & merging zones (de-acceleration bay) where in expension joint between spans are necessary. Three spans units of length of 117m(35.25m+46.5m+35.25m) & 102 m (32.25 m+37.5m +32.25m), two spans units of length of 64.5 m (32.25m+32.25m) were adopted.

In Eastern approach, where there was no such limitation, two nos of four spans continuous unit of length of 163.5 m(35.25 m+ 46.5 m +46.5 m +35.25 m), Fig.11 & one unit of three spans continuous unit of length of 117 m (35.25 m +46.5 m +35.25 m) of dual carriageway of 11.0 m carriageway was adopted to form a flyover total length of 444 m over Khajuri Khas crossing.

As it can be seen that continuous module of varying spans or varying span length were being made either by eliminating a middle spans or reducing the span length by extracting one or more segments from the central zone of longest spans. A constant profile on the outer surface of the segment was adopted for a box of given carriageway. Variation of structural thickness affected only internal box. Segment in center of span which were planned to be extracted out to have a smaller span have similar prestressing duct as in adjacent segment. Such planning in design stage had resulted in standardization of span configuration and segment moulds.

After achieving minimum cube strength of nearly 25 mPa, shutters were removed and the ribs was transferred in the stacking yard for curing and stacking. Due to large numbers of ribs to be cast for the project and paucity of space available in the casting yard, multiple stacking of precast ribs was done, photo 14.

5. Casting of precast ribs & precast segment

The curved ribs were cast well in advance of casting of precast segment. Since all sides of ribs will be visually visible in erected superstructure, hence it has been planed to achieve a form finish to all surfaces of ribs. To achieve the same, ribs has been cast by placing the shutter vertically in a tub (in casting yard), Photo 11. Since reinforcement was required to be projected out from both of ribs end to form a monolithic connection with box, tub is filled with sand, photo 12. Such pre-precast curved ribs were placed in the mould of precast segment, Photo 14. Once all ribs (4 nos) of segment were in final position, outer shutter of web and bottom shutter of cantilever which was in multiple parts were assembled over the casting bed, Photo 15. Prefabricated reinforcement cage of segment was lowered into mould and then only internal mould of box segment was intruded into the same.

Photo 11: and Photo 12: Tub for casting of curved ribs-base of tub filled with sand to embed projected reinf at the end of curved rib

Provision in prefabricated Reinforcement cage of segment has been made so that projecting reinforcement from precast rib end can be taken inside it.

Both short line as well as long line method of casting has been adopted for casting of segment, Photo 17. Although inner shutter of spine box was in one piece and can be installed and extruded out on rails (mounted over soffit slab) without any difficulties but outer shutter of spine box was made up in many parts (due to presence of ribs) and requires careful assembly after placement of pre-precast ribs as well as extraction of the same in reverse sequence after casting of segment.

Photo 13 : Multiple level of stacking of curved ribs

Photo 14 : Placement of ribs of segments in long line bed

Photo 15 : Placement of external shutter of web & cantilever of segment

Photo 16 : Placement of pre-fabricated reinforcement cage in mould

Photo 17 : Lifting of segment from bed

6. Stacking of precast segment

After attainment of required strength of segment, it was lifted from casting bed, Photo 17 and transferred to stacking yard where they were cured. Due to paucity of space in casting yard, multiple level (two or three level) of stacking of segments was adopted, Photo 18. Structural adequacy of lower segment to take the weight of segments on the upper level has been checked before such system was adopted. Lower segment got it supported at web location by positioning the same on pedestal.

Photo 18 : Multiple tier stacking of precast segment

7. Provision of shear keys at joints of precast segments

Small sized shear keys were provided in the webs on the end faces of precast segments. The same has been continued till the inner face of the web so that the excess glue can be evacuated and not get entrapped during temporary prestressing. For aesthetic reasons, the shear keys were not exposed at the outer face of web, Photo 17. Due to presence of internal tendons, shear keys are positioned differently at every segment by eliminating the shear key where duct is placed at the face of segment. Shear keys were formed one one end face segment by casting against already cast segment and on the other end the face by placing a profiled steel bulkhead. The female part of the shear key was invariably formed at the fixed steel bulkhead. The shear keys were positioned such that duct was always located at the flat male part of the segment.

Apart from the web area of the box girder, shear keys were also provided in the deck slab and soffit slab to assist the alignment process during erection. The deck slab shear keys also ensures that it behaves contiguously for distributing local wheels load effects longitudinally.

8. Construction of superstructure

All three forms of erection techniques as given below which were used in the past for various projects were employed for construction of various stretches of flyover:-

- Using Launching girder (Overhead), Photo 19 and Photo 20.
- Using Ground Supported tresties/ Staging supporting trollies in conjunction with crane (of required capacity and boom length) for lifting of segments, Photo 21 and Photo 22.
- Using Ground Supported Trestles staging supporting trollies in conjunction with potable gantries for lifting of segment. In such case portal gantries were straddling nearly two carriageway width, Photo 23 and Photo 24.

Photo 19 and Photo 20: Precast segments are hung from lunching girder

Photo 21 and Photo 22: Ground supported trestles/ staging supporting segments lifted by crane

Photo 23 and Photo 24: Ground supported trestles/ staging supporting segments lifted by portal gantry straddling two carriageway width (30 m approx)

Span by span construction was envisaged for erection of superstructure. After dry matching of segments, epoxy application and temporary prestressing was done one by one. After stressing of first stage cables, end of each span was supported on trestles mounted at top of common foundation provided for permanent piers. As a additional precautions, such trestles were also connected to permanent pier to transfer any unforeseen horizontal forces during construction.

First stage cables stressed were sufficient to span the self-weight of erected span, temporary prestressing frames and construction load.

Once all such individual spans of a continuous unit were erected, in-situ diaphragm was being made which not only establish the continuity of superstructure but also forms a monolithic moment resisting connection with intermediate as well as end piers, Second stage cables which were in the form of cap cables (at top of deck) and long cables (at bottom of deck) were threaded and stressed. After completion of all second stage cables stressing, temporary supports provided at the end of each span were gradually lowered down so as to transfer the load to permanent piers.

Precast rib were placed in position in diaphragm external shutter to maintain the continuity of ribs pattern on outer facia of erected superstructure keeping same spacing with abjacent ribs as it

was kept for precast segment, Photo 25, Photo 26 &Photo 27.

For casting of intermediate / and diaphragms of all continuous units superstructure, self compacting concrete was pumped as it was not possible to vibrate such highly congested reinforced zone, Photo 27.

Photo 25 : Erected superstructure rested on end trestles with gap between two with pier reinforcement projected between two units

Photo 26 : Staging and precast rib put in position for in-situ connection of superstructure units with pier

Photo 27 : Self compacting concrete is poured with pumps

Photo 28 : Finished structure

9. Construction of acceleration and de-acceleration bay

Design & construction of super structure and substructure of Acceleration bay and De-Acceleration bay, was challenging considering the deck carriageway width has to be gradually and smoothly widened by maintaining the same form of structure and same type of construction.

It would be very uneconomical solution to have a precasting member of varying width to exactly match the required width of varying width deck. Hence a solution of multiply standard precast member in conjunction with variable width of cast-in-situ stitch between such multiply standard precast member was adopted to achieve desired result.

Twin precast member (spine box with ribs) were chosen from available form which has been used for standard superstructure and were transversely integrated by cross stitching in situ between the two.

Such transition zone has been divided in three sub zones as given below:-

Transition zone-1, This is intial zone of varying width of carriageway where one sided carriageway width remains to be of constant width but other carriageway width was required to be gradually increased. To achieve same, two boxes of standard width (12.0 wide box, spine box type-2) were independently erected with the same construction methodology as adopted for standard span followed by in-situ stitch in the varying between two.

Photo 29: Tansition zone-1 : - boxes (12.0 wide each) of dual carriage way were jain by cas-in-stitch (of varying width)

Transition zone-2, This the middle zone of varying width of carriageway. To achieve the same, two boxes (as used for 10.3m wide box, spine box type-1) with curtailed arm on one side were erected independently with the same construction methodology as adopted for standard span followed by in situ stich between two in varying gap. Such box section was geometrical un-symmetrical about vertical axes due to curtailed arm on one side of box resulting in plan eccentricity To counteract such effect of plan eccentricity, transverse slits, Fig.34 was provided in deck slab (on cantilever side) of precast segment so that prestressing force does not flow in the un-symmetric part and effect of prestress remains symmetric about spine box section. Such slits were provided at precast segment joints as well as in the middle of segment. After completiton of all prestressing in spine box, such as transverse slits were filled with grout. A cable was also stressed through hole left in cantilever tip to impart axial compression across such slited joints in slab after achievement of requide strength of grout.

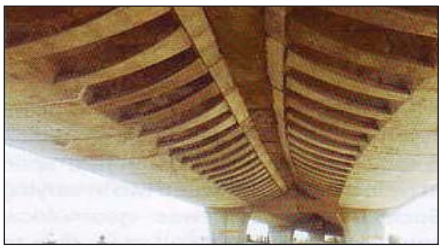


Photo 30: Transition zone-2 : - twin boxes (use 10.3 m wide deck) with curtailed arm on one were joined by cast-in-stitch (of varying ..) while other carriagway was made with regular

Transition zone-3, This is end zone of varying width of carriageway. To achieve the same, two boxes (as used for 12.0 m wide box, spine box type-2) with curtailed arm on one side were erected independently with the same construction methodology as adopted for standard span follow by in-situ stitch in the varying gap between two chosen box section was also geometrical un-symmetrical about vertical axis resulting in plan eccentricity, nos of strands in predefined cables location were varied on left side of the box and right of the box so that no net primary moment is generated about vertical axis of the box section. This was only possible as box spine used in this zone was quite wide and plan eccentricity was not too much. Of course such un-symmetric prestressing draped in webs had caused torsion and box structure has been designed for the same.

Photo 31: Transition zone-3 : - twin boxes (use 12.0 m wide deck) with curtailed arm on one were joined by cast-in-stitch (of varying ..) while other carriagway was made with regular

Due to variations in structural system of three transition zones, all such transition zones were separated by expansion joint.

In all three transition zones, pier diaphragms (end as well as intermediate diaphragm) of both joining boxes were extended and joined together to form a portal bent along transverse direction also. Firstly pier diaphragms were done for length equivalent to box width while independently erecting superstructure Photo 29, Photo 30 and Photo 31. Gap between two pier diaphragms along with in-situ slab was done in one go using shrinkage compensating compound.

Double-loop Joint was adopted at all cast- in-place connection of deck slab for joining of two independent precast box segment. In such arrangement of connection, side-loop bars was provided at the end of each precast segment while casting the segment. The center-Loop bars which is annular in shape with a welded lap is overlapped with side-loop bars projecting from both precast box segment.

10. Erection of precast segment of transition zones

Erection of un-symmetrical segments for transition zones is equally challenging. The lifting points were matched with geometrical plan CG of segment so that segment remains horizontal in all stages. Most of erection of such un-symmetrical segment was done by overhead launching girder. To enhance transverse stability of erected span (after stage-1) on temporary stool at both end of span, precast concrete block were planned at top of deck and kept it there till superstructure is integrated with piers (till end of stage-2 erection), Fig.32 and Fig.33.

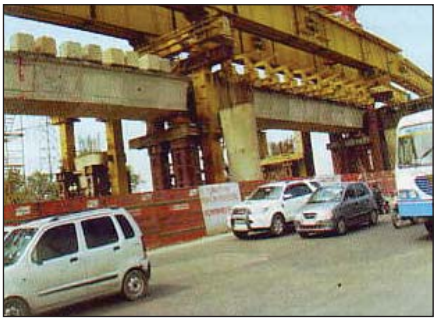


Photo 32 and Photo 33: Erection of unsymmetrical Segments by overhead launching girder

11. Construction of piers

The forms of the pier follow the flow of forces. Connection between the piers and superstructure has been made integral. Wall shaped pier of varying width and varying thickness at top with superstructure. Being a integral structure, each continuous unit was supported by set of pier. At expansion joint, twin piers were provided to support each continuous unit on either side of joint independently by separate piers, Photo 36. End piers were made slimmer than intermediates piers as end piers has to flax more than intermediates piers as end piers due to strain included effect such as shrinkage and cheep of concrete, global temperature changes and elastic shortening of concrete due to stressing of continuity cables. Being a integral pier with very high rigidity of superstructure and foundation, pier tend to deflect in double curvature inducing very high moments at top and bottom with contra flexure nearly at mid height. Hence thickness of all piers of continuous unit varies keeping minimum at mid from structural point of view. Thickness intermediate and end piers varying 1.2 m (at top and bottom) to 1.0 m (at height) & 0.75 m(at top at bottom) to 0.6 m (at mid height) respectively, Photo 36 and Photo 37 since access for vibration of thin wall shaped pier was not practical , it planned to use self-compacting concrete for casting of pier & pier diaphragm. About 50 cum self-compacting concrete of M60/M65 grade was used for casting of piers pier diaphragm in the project.

Full height of pier (7.5 m Approx.) was cast in one go. No tie bolt was allowed to pass through pier shaft to support the shuttering around. This would require a very strong arrangement of form work to with stand the fluid pressure of compacting concrete, Photo 46.

Photo 37 : Expansion jt piers (0.75 m thick at top & bottom & 0.6 m thick in center)

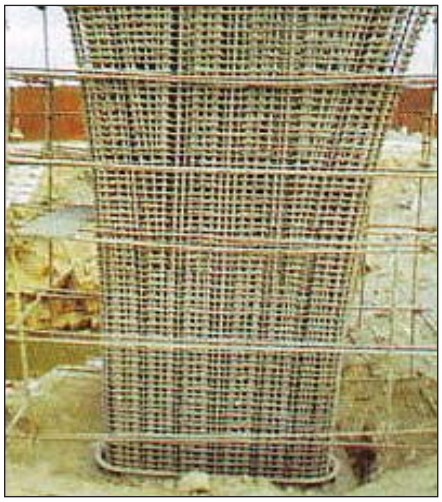


Photo 34 : Reinforcement detail of pier-compatible to requirements of high seismic zones

Photo 35 : Shuttering for pier (self compacting concrete is used)

Photo 36 : Intermediate pier of unit (1.2 m thick at top & bottom & 1.0 m thick in center

12. Project site stratigraphy

Stratigraphy along the project site consist overburden soil underlaid by quartzite. The depth of rock varies substantially across the bridge site. In general, rock is from west to east of project side.

Hence in western approach, open foundation were provided wherever rock is available at shallow depth and group of piles socketed in rock were provided as foundation where rock is available at medium depth.

Rock was severely weathered at shallow depth and moderately weathered at large depth. The rock core recovery ranges from 0 to 25% with 0 to 10% in the the zones 3 m - 4 m below the soil interface. The Rmr values range from at shallow depth.

In Eastern approach, rock was at very high depth, hence well (cassion) foundation adopted and rested in dense soil stricture.

13. Construction of open foundation

Isolated footings as well as combined footings were provided depending on space constraints, pier spacing etc. Some combined footings were constructed in stage with vertical construction joint based on traffic management at ground level along ring road. The same foundation were used to rest trestle supporting overhead launching girder as well as trestle supporting spans temporarily (after stressing of stage-1 cables). Design has been made for each foundation to transfer such construction loads during construction period as well as permanent loads during its service life.

14. Construction of well foundation

Detailed soil survey was conducted at every pier location and results gave more or less similar soil characteristics. Upper stratum comprises of fine send (upto 10.0 m) followed by silty clay with small pebbles (upto 19.5 m). Lower stratum (19.5m to 60.0 m) consists with predominantly of sandy silt low to medium plasticity. SPT value ranging from 25 to more than 100 reported exhibiting very stiff to hard consistency of strata.

A detailed study was carried out to identify the depth of potential of liquefaction in upper layer of soil and it has been concluded that upper 10-12 m soil are having liquefaction potential under seismic event. The formation level of flyover was nearly 16 m above the bed level. Proposal of pile was not practical as it was becoming too slender in seismic event.

Hence proposal of well (caisson) with staining thickness of 0.8 m was provided for a depth of 35-39 m for well foundation. A separate well foundation was providing for supporting each carriageway, "Jack down" method supplemented with air jetting/ water jetting was used for sinking of well, Photo 38.

Photo 38 : Jack down method employed for sinking of well

There are 24nos of similer type of walls which were sunk in Eastern approach using this innovating technique.

In Western approach, some part of approach structure was in river zone. In such, river zone, rock was available at shallow depth (nearly 10.0 m below river bed level). Open excavation was not possible in such zone. Hence well foundation was adopted for such purpose which are rather complex because they were required to be founded on sloping rock which is also the scour level. Moreover stringent guidelines of "Standard code of practice of Indian Roads Congress" for having a sump (shear key) of 600 mm at the base of well into soft rock of diameter of nearly 1.5 to 2 m less than inner dredge hole was required to be followed. In addition vertical anchoring of well foundation by reinforcing bars was also required to be followed.

The foundations adopted were conventional wells sunk by the jack down method with thickened staining. Prior to the wells reaching the predetermined founding level, rock level was established by probing / boring all along the outer periphery of well.

Drilling of 193.5 mm O.D was first done in soil underneath well curb and continued up to nearly 500 mm into the rock. A partially perforated pipe was lowered down in each of these drilling of 150 mm dia is continued upto nearly 6.0 m into rock. Then the reinforcent bar of 32 mm dia along with other bunch of reinforcement is lowered down and micropile was grouted.

Once all micropiles in the well were installed one by one and gained adequate strength, then well was cleaned up to rock level below well curb by air lifting process.

By approximating the rock contour, in the dredge hole, steel ring of 10 mm thick plate with stiffeners of 150 mm size channel was fabricated and lowred down inside the periphery of the well. Gap between the ring and sloping cutting edge of the wall is filled with concrete had hardened, wells were dewatered and the rock portion inside the steel ring is excavated to a depth of 600 mm in the dry. The rock surface is cleaned and the bottom opening inside ring along with upper part of bottom plug is concreted. Thereafter a R.C.C slab was cast which was mainly as a safeguard to receive the upward pressure on the plug. The well is then completed in the normal manner. Inside opening of well was filled with sand and capped by a layer of concrete. The well cap and pier were thereafter executed in the conventional manner.

15. Construction of closed portion of Ramp

It was planned to have a reinforced earth wall structure for all the ramp adjoining to open portion of flyover. High performance concrete with Reskli from liner finish of M45 has been used in facia panels of RE wall to create bamboo finish in concrete, Fig.39, Fig. 40

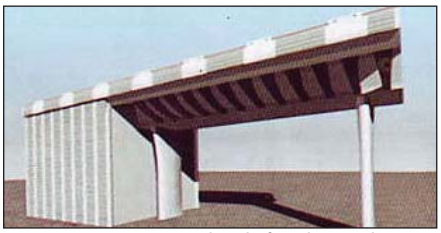


Fig 39 Junction detail of viaduct and ramp (RS wall structure)

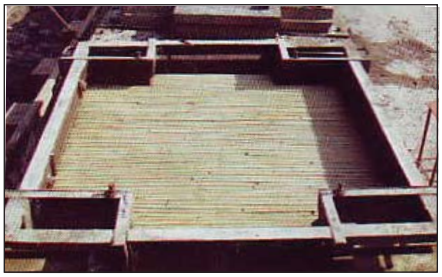


Photo 40: liner in Rs wall panel shutter

Being a integral structure, where end pier also flex longitudinally along with superstructure due to change in daily and seasonal temperature, it was planned to have separate structure (in the form of multiply columns) to support the dirt wall /approach slab at its top. Expansion joint was provided in between dirt wall & superstructure to accommodate the movement of superstructure. RS wall panel facia was also provided covering multiply columns were so spaced and positioned so that it that it does not interfere with steel strips holding RS wall panels.

16. Conclusion

The successful completion of such mega and challenging project has revealed that the difficult site condition can be dealt by innovative construction techniques and still structure can be made aesthetic-appealing and cost-effective. The design of the flyover has focused on adoption of local material and available equipment with innovative techniques uncommon in India.

It is expected that the various innovative techniques adopted in this project may form the basis for construction of numerous flyover /Bridge across India in the coming years.

A combined team effort and close co-ordination between Owner, Consultant and Contractor at every step i. e conception, design and implementation was a main contributing factor for this success story.

TEDE^X Gateway Women

A TEDE^X Gateway Women event was organized in NCPA, Mumbai on 29th May to highlight achievements of women who have attained great heights in their field. Over twelve dynamic women speakers from various walks of life shared their glorious journey to success through presentation and speech.

Leila Seth

Leila Seth was the first woman to top the Bar examinations in London in 1957. She was the first woman judge of the Delhi High Court and the first woman to become chief justice of a state in India. She was appointed as a judge in 1978 and retired as Chief Justice of Himachal Pradesh in 1992.

She was a member of the 15th Law Commission of India and co-authored the report suggesting amendments to the Hindu Succession Act giving equal rights to daughters in joint family property. She was also one of the three members of the 2012 committee (known as the Justice Verma Committee) which was constituted in the aftermath of the horrendous rape in Delhi of the young woman known as Nirbhaya. She is involved in pro bono work pertaining to health, human rights, women and children's rights, education, environment and ethics.

Upasana Makati

Upasana Makati is the Founder & Publisher of White Print – India's first English lifestyle magazine for the visually impaired in Braille. Launched in May, 2013, she started White Print to build a readership of enthusiastic individuals who would look beyond the realms of mere news as reading material. She plans to make available the luxury of reading well-researched and informative articles along with leisure reads to the visually impaired community. Upasana's journey so far has been bittersweet.

Sonam Kalra

SonamKalra has been trained in Indian Classical and Western music traditions and is equally adept at singing both genres. Sonam has learnt Indian Classical music from Smt. ShubhaMudgal and Pt. Sarathi Chatterjee and has also studied Gospel and Jazz with Ashley Clement in Singapore, as well as classical opera under the noted tenor, HurChul Young. Sonam is known for her powerful yet sensitive voice and ability to blend styles, yet stay true to the music. Sonam has also sung in venues around Asia,South Africa, Europe and North America.

Natalie Di Luccio, Artist | Playback Singer | Soprano

Natalie Di Luccio is a classically trained Soprano from Toronto, Canada. She has toured with the Grammy & Oscar Award Winning Composer. In India she sings in many languages including Hindi, Tamil, Telegu, Gujarati, Punjabi& Marathi. Natalie has done playback for Bollywood films like Ladies Vs Ricky Bahl, English Vinglish, Chennai Express & the Tamil film.Her aim is to constantly finding ways of bridging the gap between the east & west through music.

Dr Ananda Shankar Jayant Classical Dancer | Choreographer

Dr Ananda Shankar Jayant, is as one of India's leading classical dancers, choreographers and dance scholars. Ananda was diagnosed with breast cancer in July 2008.She underwent surgery, chemotherapy, radiation and Herceptin therapies for 2 years. Through it all she continued to dance, teach, choreograph, travel and perform on tour. She is in remission now, and continues to be under maintenance therapy and regular surveillance.

Ananda has been decorated with two national awards : "Padma Shri" in 2007 and the Sangeet Natak Akademi Puraskar for Bharatanatyam in 2009.She has also been honoured by the Govt. of Tamil Nadu with the "Kalaimamani", and with the "Kala Ratna" by the former Govt. of Andhra Pradesh.

Ananda holds a Masters degree in Ancient Indian History, M.Phil in Art History and a Ph.D in Tourism. She actively lectures on breast cancer support and advocacy issues, having successfully battled the illness over the last two years. A senior officer of the Indian Railway Traffic Service, Ananda is currently posted in Secunderabad.

Shwini Asokan, Co-founder, CEO at Mad Street Den & Mad Street Lab

Ashwini along with her husband Anand is bringing the power of Artificial Intelligence to every mobile user. An artist at heart, Ashwini, armed with a Masters in Design from Carnegie Mellon University was leading the mobile innovation team at Intel's Interaction and Experience Research Lab (IXR) in the USA. She spent 10 years in California working on how cutting edge technology can be useful to people. Ashwini quit her job at Intel only in May 2014 to work full time with Mad Street Den.

CONSTRUCTION OF HIGH RISE RESIDENTIAL TOWERS

R. Raghavan
Gen. Manager (Projects)

1. Introduction:

Population in India is growing at rapid rate which coupled with increased trend of migration to urban areas, has escalated demand of residential accommodation in urban areas. Urban land supply being limited, the need for high rise buildings is becoming more and more relevant now than ever before.

Mumbai, the commercial and financial capital of India, has most of the high-rise buildings in India - land being expensive.

The construction of residential skyscrapers in Mumbai started in the 1970s, when Usha Kiran and Matru Mandir were developed and stood at about 250 feet, or 25 floors each but this was followed by a two-decade long significant lull until the mid-1990s when construction boom began taking the skyline upwards, with a major acceleration in the pace of development kick-starting in 2000, when the textile mill land was released in Lower Parel area for residential construction.

More than 2500 high-rise buildings are already constructed in Mumbai Metropolitan Region in addition to more than a thousand mid-rises existing already.

Mumbai is the city with the 12th highest number of skyscrapers in the world. Most of skyscrapers in Mumbai are residential. Today, Mumbai is undergoing a massive construction boom, with more than 15 Supertalls, hundreds of skyscrapers and thousands of high-rises under construction. Currently Mumbai is perhaps the home to largest number of under construction supertalls and skyscrapers in the world.

2. Runwal Project - Scope of Work:

Due to the overcrowding of population and also the air pollution arising due to traffic, people want to live in a peaceful environment with proper facility. Citizens of Mumbai expect the best living standard and are accustomed to live in high rise structures. Runwal Homes Private Limited (RHPL) is one of the major developers in Mumbai and Pune having excellent customer satisfaction record for constructing residential towers and malls in the city. RHPL has planned to construct 8 high rise residential towers comprising of 1574 nos. flats in their 14 acre land located at premier location in Mulund-Goregaon Link Road @ Mulund (W), Mumbai. The proposed amenities in these towers for their valued customer include:

- Largest garden with wood landscaping.
- Club house with swimming pool
- High speed elevators
- Rain water harvesting
- Sewage Treatment Plant (STP)
- Shopping complexes
- Large podium with ample car parking.

Gammon has been entrusted to construct four towers out of eight towers. The scope of work includes construction of all civil works like foundations, basements, podium and 36 habitable floors of 11 ft. ceiling height including block work and plastering inside and outside of the structure.

For the construction of high rise building, there are some requirements that should be fulfilled. Safety and health aspects are the most important requirement of the high rise building.

3. Execution of High rise towers:

3.1 Site Mobilization:

Immediately on receipt of the Work Order in mid of 2010, inspite being monsoon, Gammon swung in to action and started mobilization of various resources including manpower, plant and equipment etc.

The excavation works of tower were taken up in advance by developer and Gammon put the resources directly for casting of PCC and raft foundation. Fully automatic 30m3 capacity batching plant was erected at site on fast track basis.

3.2 Shuttering Methodology:

Each floor consists of about 60 nos. (approx.) odd size columns, shear walls, double staircase, lift core walls, beams and slab.

Since the columns, shear walls, core lifts & beams were having different sizes and depths in each towers, Doka framing could not be effectively designed to suite such varying dimensions of all structural members and hence Gammon mobilized Doka panels only for columns and shear walls and decided to go for conventional shuttering for deck slab by using cup locks, acrow spans & plywood throughout the building.

3.3 Slab Cycle:

Each floor slab divided in four parts and concreting was done in four pours. While work was in full swing we achieved 2 slabs (8 pour) per month in each tower i.e. 15 day cycle. Later on due to stoppage of work and other hindrances due to variety of reasons, the speed was reduced to 1.5 slabs per month.

3.4 Reinforcement Work:

Mechanical couplers were used for higher diameter of reinforcement bars in columns instead of regular lapping method of reinforcement. Mechanical coupler reduces wastage of reinforcement by 25% in columns and can be used very effectively for higher diameter from 16 to 32mm bars.

3.5 Tower Crane & Concreting:

Telescopic tower crane was erected in one of the lift well and most of the columns & shear walls concreting was done by tower crane bucket and slab has been done by concrete pump.

Table 1: General Details Of Project

Sr.No	Description	Unit	Tower no.1	Tower no.2	Tower no.3	Tower no.4
1	Total Built up area	Sqft	297696	303933	367357	468442
2	No. of flats in each floor	Nos.	6	6	6	6
3	Flat configuration	Nos. Nos.	2 BHK - 4 nos 2.5 BHK - 2 nos	2 BHK - 4 nos 2.5 BHK - 2 nos	2.5 BHK - 4 nos 3 BHK - 2 nos	3 BHK - 4 nos 3.5 BHK - 2 nos
4	Total no of flats in each Tower	Nos.	216	216	216	228
5	Built up area per flat	Sqft Sqft	2 BHK - 1165 sqft 2.5 BHK - 1475 sqft	2 BHK - 1165 sqft 2.5 BHK - 1475 sqft	2.5BHK - 1475 sqft 3 BHK - 1740 sqft	3BHK - 1960 sqft 3.5 BHK - 2160 sqft
6	Basement + Podium + Stilt	Nos.	2 + 5 + 1	2 + 5 + 1	2 + 5 + 1	2 + 5 + 1
7	Residential floors	Nos.	36	36	36	38
8	Fire check floors	Nos.	1	1	1	2

Table 2: Tower wise Quantities

Sr. No	Description	Unit	Tower no.1	Tower no.2	Tower no.3	Tower no.4	Total
1	Total Built up area	Sqft	297696	303933	367357	468442	1437428
2	Concrete Qty	cum	16100	16100	18500	24865	75565
3	Reinforcement Steel Qty	MT	3175	3145	3540	4260	14120
4	Blockwork Qty	SQM	23517	24010	29020	37005	113551
5	Internal Cement Plastering & Gypsum	SQM	78781	80432	97216	123967	380397
6	External Plastering	SQM	42054	42935	51894	66174	203057

Table 3: Grade of Concrete

Sr. No.	Grade of Concrete	Levels
A	**Columns & Shear Walls**	
1	M40	Raft
2	M65	First level to Sixth level
3	M60	Seventh level to Tenth level
4	M50	Eleven level to Twenty level
5	M45	Twenty One level to Twenty Third level
6	M40	Twenty Fourth level to Twenty Ninth level
7	M35	Thirty level & above
B	**Slabs & Beams**	
1	M40	First slab to Nineteen slab
2	M35	Twenty slab to Twenty Fourth slab
3	M30	Twenty Fifth slab & above

Table 4: Plant & Equipment Deployed

(1)	Batching Plant	1 no.
(2)	Tower Crane	4 nos.
(3)	Builder Hoist	8 nos.
(4)	Diesel Generators	5 nos.
(5)	Passenger Elevator	4 nos.

3.6 Block work:

When the floor reached at Level 6 the block work was started for the habitable floors. 150mm thick solid blocks for partition and 200mm thick solid blocks for outer periphery walls of the tower were used.

3.7 Internal Plaster:

Plaster work of two types was used:

1. Cement face plaster in wet area like kitchen, toilet and common area for the thickness of 12mm to 15mm.

2. Gypsum vermiculate base in balance area like living, bed, master bed room and passage of thickness 12mm to 15mm.

3.8 External Plaster:

External plaster is carried out in three vertical stages considering height of the structure. Double coat of thickness 25mm was used for external plaster. For all dead walls plastering, suspended platform used and balance structure by using 'H' frame scaffolding.

1st Stage - Up to L15 floor
2nd Stage - L15 TO L27 floor
3rd Stage - L27 TO Terrace floor

3.9 Progress Monitoring:

Progress was monitored on daily basis. Also weekly meeting held with developers, clients, architect and structural consultants to monitor the progress and solution for any hindrance in drawings and execution.

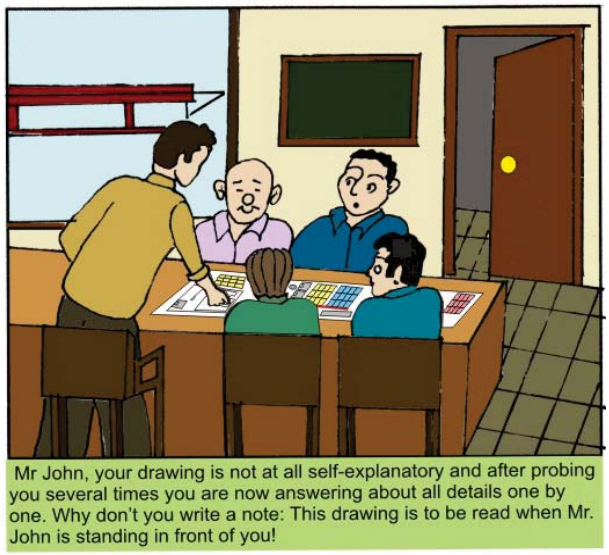
For Gammon this is the tallest residential structure constructed so far though tower under construction at Nathani Heights in Mumbai is far taller than these towers. Out of four towers at Runwal three towers terrace has been completed.

4. Credits:

We take this opportunity to thank our young and energetic team at site for execution with full support of dedicated team of client engineers.

We also thank Mr. Subodh Runwal, Director of Runwal Homes Pvt. Limited (RHPL) and Mr. Samir Dhar, Director Projects for their support for projects monitoring and execution for our success.

ENGINEER SAID IT... By M.U.SHAH



SUBSTITUTE FOR CIVIL ENGINEERS !!!

- M. U. Shah

A team of CIVIL ENGINEERs went to a small village for road survey. Three/ Four villagers, out of curiosity, went to the team and one of them asked,
"What are you doing here?"
One of the CIVIL ENGINEERs replied, "A new pucca road is coming up in your village so we have come here to do survey for this road."
Pointing to the instruments the villager asked further,
"What are all these instruments?"
The CIVIL ENGINEER replied,"This is an optical theodolite. That one is level. That one is Total Station. These instruments are required to give centerline of the road."
The villager said," We in villages do give center lines though we do not have any such instruments."
The CIVIL ENGINEER asked, "How do you do that?"
The villager replied, "Very Simple. We bring one DONKEY, put a gunny bag filled with chuna and cut small hole in the bag. Then we hit the DONKEY with a stick. The trained DONKEY runs in a straight line, chuna falls from the hole of the gunny bag and we get the center line of the road."
The leader of the team asked."Well, but what do you do, if a trained DONKEY is not available?"
The old veteran villager replied, "Then we call CIVIL ENGINEER!!!"

GAMMON'S CONTRIBUTION IN KOLKATA METRO

Amal Bhattacharya
Dy. Gen. Manager (Projects)

Kolkata is only city in India where all mode of transport from Metro Rail to hand pulled Rickshaw including Tram is available. Tram service started in 1873 with 200 Trams carrying about 1.8 Lacs passengers on average week days. First Metro Line i. e. **North – South** started in 1972 commission 1st stretch Esplanade to Bhowanipur in October 1984. There after it was extended up to New Garia (Kabi Subhash) to Dumdum of 2.77 km. At present 4.4 Lacs passenger travell on average week days.

Gammon journey in metro was started at Kolkata in Phase I (Dum Dum to Tollygunje) in early 80's where Gammon executed 1.2 km diaphragm wall 600 mm width for Section 14A, 14B i. e. Jagu Babur Bazar to Asutosh College for constructing underground Metro (Cut and Cover method). Thereafter Gammon's role extended in Metro construction in the city like Delhi, Bangalore& Chennai for viaduct construction, station building and underground Metro construction by Tunnel boring machine found remarkable.

A. Metro line details

In order to strengthen Metro service at Kolkata, Phase II Metro line has been planned& started under Kolkata Metro Rail Corporation Limited (major part through JICA loan & rest with domestic fund) & Rail Vikas Nigam Limited (domestic fund). Gammon has contributed a lot in Metro construction in Phase II since 2009.

OWNER	LINE	KM
Metro Rail (Broad Gauge)	North - South (Dum Dum - New Garia)	25
KMRCL (Standard Gauge)	East - West (Howrah Maidan - Sector V)	14
Metro Rail / RVNL (Broad Gauge)	Joka – BBD Bag	12
Metro Rail / RVNL (Broad Gauge)	New Garia - Kabi Subhash	21
	TOTAL	**72 KM**

B. Contract has been awarded under 4 packages for a value of Rs. 9380 Million

PACKAGE	WORK	VALUE	OWNER	ROUTE
EWE1	4.725 km Viaduct from Subhas Sarobar to Sector - V	2125.3 Millions	KMRCL	East – West
JMS2	3 elevated Stations (Behala Bazar, Taratala & Majerhat)	1626.6 Millions	RVNL	Joka – BBD Bag
ANV2	5.27 km Viaduct from VIP Bazar to Nicco Park	2245.7 Millions		New Garia – Airport
ANS2	7 elevated Stations (Barun Sengupta, Beliaghata, Gour Kishore Ghosh, Nicco Park, Sector V, Technopolis & Bidhan Nagar)	3389.6 Millions		
	TOTAL	**9387.2 Millions**		

C. Scope of work – Approximately 11 km viaduct with 10 station building construction under 4 packages.

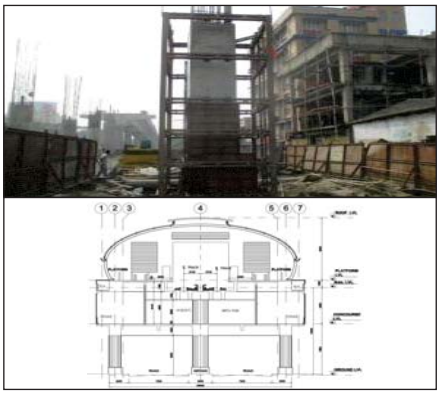
PACKAGE	ACTIVITY	PILE	CONCRETE QUANTITY	STEEL QUANTITY	EQUIPMENT
EWE1	4.725 km Viaduct from Subhas Sarobar to Sector – V	35,000 RM	1,06,000 m^3	11,300	Hydraulic Rotary Pilling Rig, Batching Plant Concrete Pump / Placer, Transit Mixers, 250Tcap Crane and Mobile Crane etc.
JMS2	3 elevated Stations (Behala Bazar, Taratala & Majerhat)	11,000 RM	42,000 m^3	8,000	
ANV2	5.27 km Viaduct from VIP Bazar to Nicco Park	60,000 RM	1,40,000 m^3	14,000	
ANS2	7 elevated Stations (Barun Sengupta, Beliaghata, Gour Kishore Ghosh, Nicco Park, Sector V, Technopolis & Bidhan Nagar)	44,000 RM	1,25,000 m^3	12,000	
	TOTAL	**1,50,000 RM**	**4,13,000 m^3**	**45,300**	

D.Present & Futuristic Photographs

EWE1

ANV2

JMS2



ANS2

SERIOUSLY, LAUGHTER IS THE BEST MEDICINE

Tenderness of Pre-tender Site Investigations !!!

- M. U. Shah

In good olden days, the most commonly used passenger vehicle at construction sites was Mahindra Jeep of model MM DP 540. While this model of Jeep was most popular in those days, at the same time it was also notoriously famous for sudden break-downs at odd times without any notice.

One Project Manager of a remotely located bridge job was asked by HO to carry out Pre-tender Site Investigations for a nearby prestigious Work-in –View (WIV) – a major bridge job.

Such pre-tender site investigations of major WIVs are usually carried out by deputing staff of different levels in organizational hierarchy from site and HO.

1) FRESH JUNIOR ENGINEER (CIVIL)

To start with PM sent one young fresh Junior Engineer (Civil) for preliminary site investigations. While returning at night his Jeep broke down. Since the location was very remote, there was no possibility of any Hotel being available in the vicinity for night stay. After extensive search for couple of hours, JE could locate one farmer's place who agreed to provide shelter for a night but said that they don't have extra room and asked him whether he would like to stay upstairs sharing the room with a baby or alternatively he can sleep in the shed of buffalo.

JE thought for a moment and opted for a buffalo shed thinking why to get wet with the baby.

Next day at 7 O'clock in the morning, one sweet voice woke him up. He saw one gorgeous looking cute young girl in her sweet seventeen with a cup of tea in her hand wishing him "Good morning".

After pinching himself repeatedly and confirming that he is not in his dreams, while continuing to rub his eyes, JE asked, " Who are you ?"

The girl replied, " I am the 'baby' of the family & further asked, "Who are you?"

JE replied, " I am stupid fellow who opted to sleep in the shed of buffalo. !!!!"

(Even several years after this incidence, if someone was to ask him which is the single most regretful choice he made in his life; with tears in his eyes, he would narrate this incidence.)

2) FRESH JUNIOR ENGINEER (MECHANICAL)

Then PM sent one fresh young Mechanical Engineer for site investigations. His Jeep also broke down while returning at night. He landed up at one widow's place who readily agreed to provide shelter for this young handsome Mech. Engineer.

Around midnight, the widow wakes him up to say that the door of her bedroom is open and that she could not lock the door as it's latch requires repair.

Unable to understand the hint, rubbing his eyes, Mech. Eng. gets up, goes to Jeep, brings tool box from Jeep, repairs the latch, goes to his room and started snoring !!!!

3) FRESH JUNIOR ENGINEER (ELECTRICAL)

Then PM sent one fresh young Electrical Engineer for site investigations. His Jeep also broke down while returning at night. He landed up at one lone lady's place who readily agreed to provide shelter for this young Electrical Engineer and accommodated him in Guest room.

Around midnight, the lady takes out fuse from the main switch. There was total darkness all around. She waited for an hour for something to happen but when nothing happened, she entered Guest room with a pillow and blanket in her hand and wakes up Electrical Engineer and said, " It appears there is power break-down. There is total darkness all around. I am afraid of darkness…."

Unable to understand her statement or her action, still clueless, Electrical Eng. ; rubbing his eyes, gets up, locates main switch board, replaces fuse, escorts the lady back to her room, switches on night lamp for her, comes to Guest room and went to deep sleep !!!!

4) SITE ACCOUNTANT

Then PM sent one young Site Accountant for site investigations. His Jeep also broke down while returning at night.

In search of a shelter for a night, he went to one place and requested for one night stay. The owner said, " I am sorry, I can't accommodate you. We have young daughters in our house."

He got similar answers at next two places.

Frustrated, he thought he should now search a house in this village where there are no daughters.

In order to cut short conversation, at next place he asked the owner, "Are there any young daughters in this house ?"

Owner asked, "Why ?"

The Accountant replied, " I want to sleep here for one night !!!!"

(For several months after this incidence, the Accountant could not walk nor he could sign vouchers with his hand!)

5) VETERAN STOREKEEPER

Then PM sent veteran Storekeeper for site investigations. His Jeep also broke down at night while returning. He located a "suitable" accommodation for himself. He liked this so much that he decided to extend his stay and to inform his wife he sent a cryptic telegram: " Busy buying. Will return home Friday " but packed off immediately and rushed back home when he received a return telegram from his wife reading : " I leave it to you when to return which you decide yourself but come before I start selling what you are buying !!!!"

(In good olden days there were no cadres of Purchasers and Storekeepers were used to buy materials also apart from storekeeping.)

6) VETARAN Sr. CIVIL FOREMAN

Then PM sent one veteran Sr. Civil Foreman for site investigations. His Jeep also broke down while returning at night. He located a Doctor's place who was on night duty. Doctor's wife readily agreed to provide shelter for him. The Forman introduced himself, made himself comfortable and explained the importance of profession of Foremen, habits of Foremen etc. etc. to the lady.

Unexpectedly Doctor arrived from night duty early. He saw an unknown person in his bedroom. Furious, he reached out to his drawer for pistol. Shocked by this his wife yelled, " Behave yourself ! Don't behave irrationally ! If everyone starts behaving irrationally like you, very soon country will lose many Foremen !!!! Do you know Foremen are real craftsmen and as it is their category is depleting very rapidly !!!!"

7) PROJECT MANAGER

Then PM himself went for site investigations. His Jeep also broke down at night while returning. He located a place where lady's husband happened to be a frequent traveler Civil Engineer and was on tour on that day.

Around midnight, unexpectedly lady's husband arrived from tour. He saw a strange person in his bedroom. Furious, he took out his pistol, loaded it and pointed at PM but when he was about to pull trigger, his wife fell on her knees and pleaded, " Please, please ..; dear, don't kill him before he writes a Method Statement ..... !!!!!"

8) VETERAN AREA MANAGER FROM REGIONAL OFFICE

Then veteran Area Manager from Regional Office thought he should also carry out site investigations - this being major WIV Job.

Being senior citizen, he was always travelling with his wife whom he married thirty years ago. He had met her at his first posting at job site and could marry her after a long courting period. Their Jeep also broke down at night while returning. In search of a shelter for a night they landed up in a place - the location of which resembled to their first site where they spent lot of time courting with each other.

After dinner, while sitting in verandah, his wife going down memory lane, started recollecting those golden moments they shared during those beautiful days of their courtship.

She asked, "Do you remember - we were used to sit in verandah like this and you were used to hold my hand ?"

Area Manager said, " Yes, I do remember " and he reached over to her and held her hand.

Then she said, " Do you remember - you were used to kiss me on my forehead?"

Area Manager, nodding affirmatively, leaned over and kissed her on her forehead.

Going further down memory lane she said, " Do you remember - you were used to bite me on my neck ?

Area Manager again nodded affirmatively but immediately got up.

She asked, " What happened? Where are you going?"

Area Manager replied, " Just a moment, please. Let me bring my teeth lying on dining table !!!!"

9) GENERAL MANAGER (TENDERING) FROM HO

Then GM (Tendering) from HO thought of getting first hand feel of site before preparing the Tender. His Jeep also broke down while returning at night. In search of a shelter for a night, he landed up in a place where a lady was staying alone. She readily agreed to give shelter. In absence of extra bed they had no option but to share the bed. He occupied right side of the bed.

After some time the lady started dropping hints after hints but in vain. So ultimately she said, " I am uncomfortable on left side as I am used to sleep on right side. You roll over me, I roll under you and we trade sides."

No response.

Impatient now, she reframed her proposal, " Ok, listen. I roll over you, you roll under me and we trade sides."

No response.

Loosing hopes, finally she said, " I don't think you understand what I really want."

Breaking his silence, GM said, " I know. I know….. Let me tell you, when I was small, my brother was used to play this with me to take possession of full bed. I know that you want me to get up so that you can occupy full bed but be informed that I am not going to allow this to happen at any cost !!! You know I am matured now and no longer a small child that I don't understand your hidden agenda and intentions !!!"

10) CONTRACTS MANAGER FROM HO

Then Contracts Manager from HO thought he should also conduct site investigations as he would not like this prestigious job to go in the hands of competitors. His Jeep also broke down while returning at night. In search of a shelter, he landed up in a place where a lady was staying alone. She agreed to give shelter but said she has no extra room. Since it was almost midnight and difficult to search other place, Contracts Manager reluctantly decided to stay there but he became really uncomfortable when he saw that her room was too small and neither there was second bed nor any place on floor to sleep.

But reconciling to this, he asked her , " Do you have some extra pillows ?"

The lady started wondering about his purpose of asking for extra pillows but she replied, " Yes, I do have " and gave him three extra pillows.

Contracts Manager placed these pillows on bed in a row and created a sort of partition on bed bifurcating space for him on one side and for the lady on the other side of row of pillows and slept in his portion of bed.

In the morning, on the breakfast table, the lady asked; " What exactly you do ?"

Contracts Manager replied, " I am Civil Engineer, specialized in Bridges. In your village new major bridge is coming up. We are going to submit tender for this bridge. I am here to do pre-tender reconnaissance survey and to decide strategy to complete this bridge in available contract period."

The lady said, " I don't think you can bridge this river in available time. "

Furious the Contracts Manager said, " What do you mean when you say I can't bridge this river? Do you know, I am internationally renowned Bridge expert with several Awards to my credit?"

The lady coolly replied, " May be."

The Contracts Manager said, " What may be? It is a fact. I am respected all over the country and also internationally in civil engineering fraternity for my expertise in bridge engineering."

She again said, " May be but I am pretty sure you can't even cross this river – what to talk of bridging it."

By now the Contracts Manager was boiling with anger. Red faced he asked her, " What makes you think so and that too with so much conviction?"

The lady replied, " Whole night was available to you but you could not cross even three pillows and you expect me to believe that you will built a bridge for crossing such mighty river? !!!"

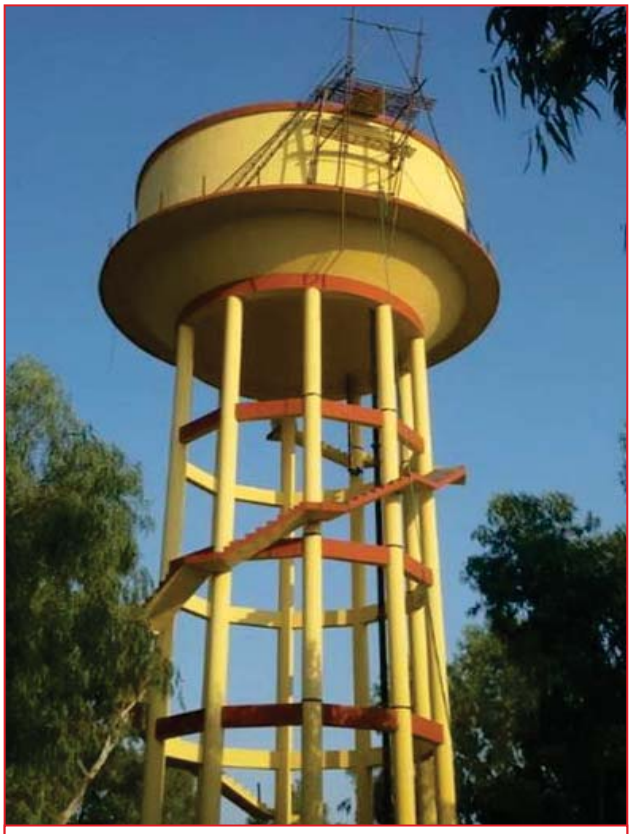
11) DIRECTOR

Then Director thought he should also investigate site – this being vital job for the Company. His Jeep also broke down in the night while returning. In search of a shelter for a night, he .....

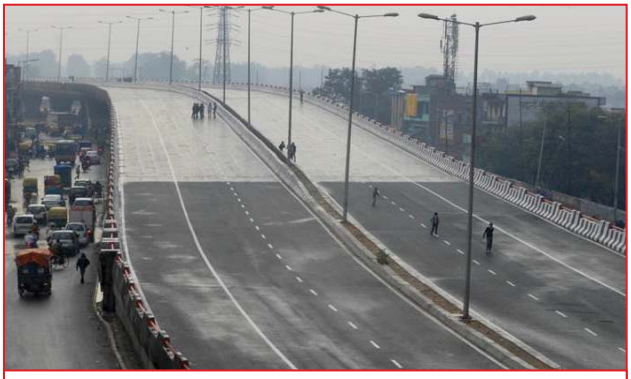
PS : All the generic characters portrayed in this Humour article are fictitious. Resemblance to any person- living or dead is purely coincidental nor frequent break-down of Jeep reflects in anyway on the manufacturer of the Jeep nor on performance of Plant Department who maintain it nor lack of "practical" knowledge among fresh graduates reflect on country's education system nor this is intended to label site staff or HO staff in any particular category.

WORKS IN PROGRESS

275m Chimney at Sagardighi, West Bengal



Elevated Water Tank, Rajasthan



Wazirabad Flyover, New Delhi

CLC at Bramhaputra Bridge, Assam

Sagarkatte Bridge, Karnataka

IDCT- Opal, Dahej, Gujarat

NEWS FLASH

1. Foundation Stone Laying

Hon'ble Minister for Road Transport and Highways Shri. Nitin Gadkariji laid Foundation Stone for 5km-long four-lane road from Varnapuri to Mormugao harbor including the 3.2km-long flyover. Also present were, Hon'ble Minister of Defence, Shri. Manohar Parrikar, Hon'ble Chief Minister of Goa Shri. Laxmikant Parsekar, Hon'ble Minister of PWD, Goa Shri. Sudin Dhavalikar, and other Cabinate Ministers of Goa.

While talking to media persons, Hon'ble PWD Minister Shri. Dhavlikar announced that, this Rs. 550 crore project has already been tendered.

2. Courtesy Visit

Mr. P. S. Raizada & Mr. Arvind Singh from Delhi office, made a courtesy visit to Hon'ble Minister for Law & Justice – Mr. Sadanand Gowda on his Birth Day.

3. Green Initiative at CMRL Project Site

Mr Veeraraghavan, working at our CMRL Package is a committed soldier for environment Protection. With an out of box thinking, he moved from pillar to post at CMRL Project site to collect 1200 KG of waste paper and deposited it with ITC (Paper and card Board Division) under the Gammon Banner. It was not an easy task but with positive and an enviable quality of patience in him, he sustained his efforts to accomplish his task.

By this initiative he has prevented cutting of 30 trees. A Green Initiative Certificate issued by the ITC will bear testimony of the Green approach of the CMRL Project as well as Gammon.

We place on record our appreciation to Veeraraghavan.

4. National Safety Day

Gammon Celebrated National Safety Day on March 4; 2015. The theme for 2015 was 'Build a Safety Culture for Sustainable Supply Chain'.

Various activities, games and events were organized across various sites and offices for the celebrations and spreading awareness across all the working partners.

5. Completion of Shell

Gammon's Raigarh NDCT team has successfully completed concreting of 4th - 155 m tall Natural Draught Cooling Tower Shell at Raigarh for Jindal Power Limited on 31st March 2015. The shell was completed in a record time of 5 Months 25 days from Ring Beam level to top level with remarkable Quality, Safety & accuracy in Shell Profile. Battery of 4 Nos. 155 m tall ND cooling towers has completely changed skyline of Raigarh.

6. RCD Rig at Signature Bridge

As an addition to the Gammon's Equipment Bank, a RCD Rig (Make: BUMA Korea, Model: R1820, Torque: 17.9 t-m) has been commissioned for specialized Piling activity at P23 Foundation of Signature Bridge, Delhi.

COMPANY NEWS

THANKS TO ESTEEMED CUSTOMERS

Channelization of Gomti river by Department of Irrigation & Water Resources, Uttar Pradesh
Rs. 516.73 crores

WELCOME TO GAMMON FAMILY

GENERAL MANAGER
Anand Vijayaraghavan

DEPUTY GENERAL MANAGER
J N Chandrasekhara
Devendra Verma
Somarao kulkarni
Tirumala Rao Tripuraneni

MANAGER
Chandra Bhushan Singh
C. P. Kumaravelu
Jayanta Saha
Mohammed ammarul Haque

DEPUTY MANAGER
Anil Kumar Annavarapu
Pankaj Kumar
Sunil Kumar Singh
Vivek Kumar Sharma
Srinivasulu Reddy
Parthapratim Tripath
Abhishek Jaiswal
Vishal Choubey
Korada Venkata Ramana
Anantha Kini
kinjal Chakraborty
Quamruddin
Prabhakaran Ramanathan

LECTURES DELIVERED

Dr. N. V. Nayak

January 23; 2015

"Redevelopment of Buildings", at two day Work shop cum Seminar at VJTI, Mumbai.

March 14; 2015

"Sustainability of Concrete", during one day seminar organized by ASCE IS WR on theme **"VISION 2020- SMART CITIES & SUSTAINABLE INFRASTRUCTURE".**

Mr. Anupam Das

May9; 2015

"Well foundation Construction- Caisson foundation & Cutting edge construction - new initiatives adopted at Bogibeel Bridge" at two-day National Seminar-cum-Workshop at Tezpur University

GIL PARTICIPATION IN SEMINARS

Dr. N. V. Nayak

March 20; 2015

Participated in a Seminar at IIT, Mumbai.

M/s. V. S. Chako & Bibin Dhas

February 26, 2015,

Participated in workshop on Industrial Engineering & Recent Industry Based techniques for Civil Engineering students organized by Rajas Engineering College, Tamilnadu and delivered lectures on "Challenges & Opportunities for a Civil Engineer in Industrial Engineering" & "Construction and Process of a Thermal Power plant."

Mr. Bhavesh Thakkar

March 28-29, 2015

Participated in PMI- Asia Pacific Leadership Institute Meeting held at Bali, Indonesia.

AWARDS

1. Mr. Umakant Kulkarni was conferred with prestigious 'Achiever Award' by Hon'ble Chief Minister of Bihar on behalf of BSRDC for his contribution towards implementation of AIIMS – Digha Elevated Corridor.

2. Mr. Anupam Das was conferred with Prestigious 'Maharashtra PWD Medal for the Best Paper on Construction' by Indian Road Congress for his paper "Case Study on New Initiatives taken on Caisson Foundations and Cutting Edge Construction at Bogibeel Bridge". The paper was printed in IRC Journal Vol.74-3 (October-December, 2013).

3. On the occasion of "World Safety and Health Day" held on 7th April 2015, Ministry Of Labour and Human Resources, Royal Govt of Bhutan honored Gammon's Punatsangchhu HEP Project – I & II with **"Safety Recognition Certificate"** for adopting Good Occupational Health and Safety Practices at workplace.

The certificate of award was given by **Sri. Dasho Pema Wangda, Hon'ble Secretary of Ministry of Labour and Human Resources, Royal Govt. of Bhutan.**

4. Gammon's KOSI BRIDGE PROJECT was conferred with Prestigious 'CIDC Vishwakarma Award – 2015' under the category of Best Construction Project by Construction Industry Development Council (CIDC).

5. Corporate Safety Committee has immense pleasure in announcing the result of the CMD Safety Shield for 2013-14 as below:

1. Signature Bridge - Winner
2. Jindal Civil Works - 1st Runner up
3. Nathani Heights - 2nd Runner up

Congratulations to Winner & Runner ups!

STAFF RECOGNITIONS

Mr. Nandkumar Ghawalkar, Asst. Manager – HO (SMS), participated and completed Nagtibba snow trekking expedition at Garhwal – Uttarakhand organized by Society for Trekking & Environmental Preservation New Delhi. It was Six day trek of 35 participants from various parts of country. The first three days involved rocky mountain of Himachal Pradesh & last three days involved trekking through Snow at the temperature of - 60 C.

FAMILY RECOGNITIONS

Chi. Omkar Rajput, son of Mr. Meghraj Rajput (HO–Purchase) has secured a SILVER MEDAL with his outstanding performance in the National Jeet Kune Do championship tournament amidst competition from participants of the various states of India.

Jeet Kune Do is a very ancient game played and developed in USA inspired by world famous karate fighter Bruce Lee.

Chi. Omkar had won 8 gold, 5 silver and 1 bronze medal in his sporting career in this game till now.

COMMITTEE REPRESENTATIONS

Secretary General of Indian Road Congress has nominated following Gammonites in reconstituted Committee.

B-7 Committee

Mr. P. S. Raizada – Convenor
Mr. M. V. Jatkar – Member Secretary
Mr. Arvind Singh – Member
Mr. Arvind Tingloo – Member

BSS Committee

Mr V N Heggade

B3 Committee

Dr. N. V. Nayak
Mr. R. Prakash

BEREAVEMENT

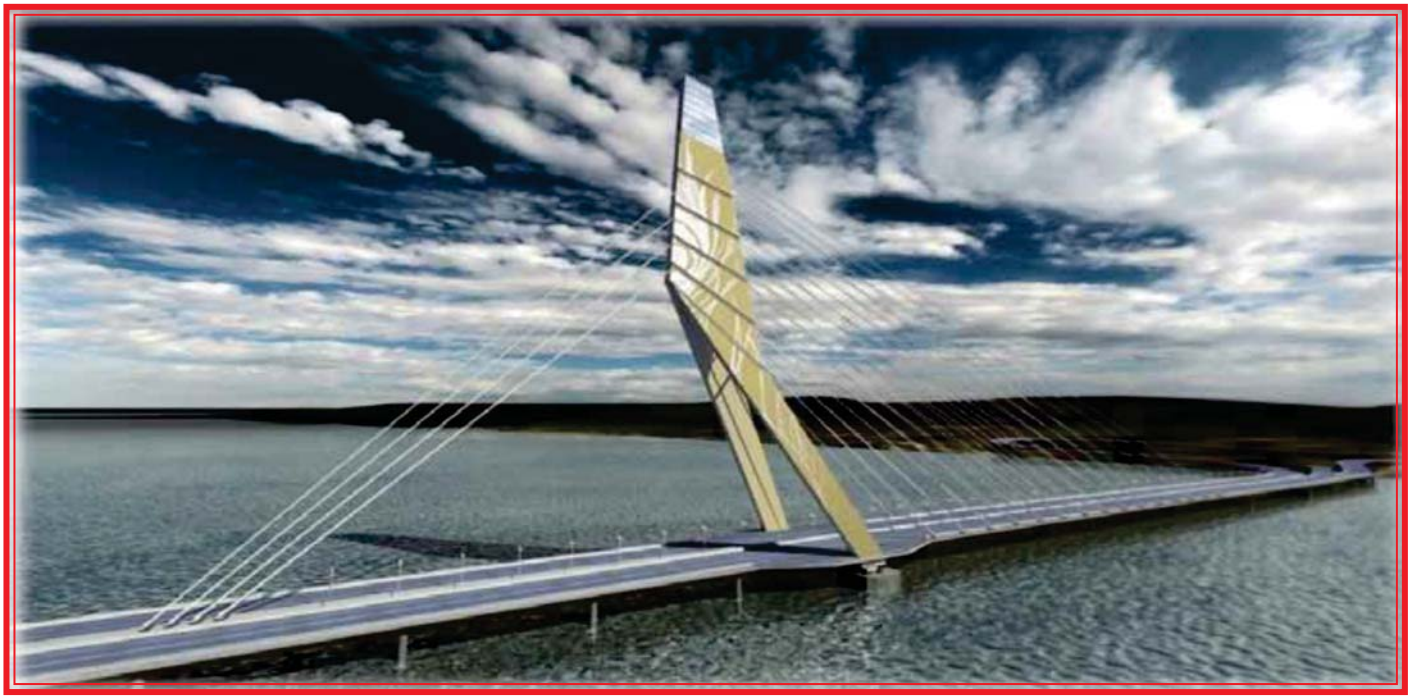
Madam Katy N Popat, Senior Stenographer expired on March 3; 2015 at the age of 71.

Madam Popat joined Gammon in January 1966 and recently completed her 48th year of continues service. During her long tenure at HO, she worked in various departments. She will always be fondly remembered in Gammon by one and all.

MAY HER SOUL REST IN PEACE.

A CAPITAL EXCELLENCE

- THE Signature Bridge ACROSS YAMUNA RIVER AT DELHI



India's First Cable Stay Bridge with an Inclined Steel Pylon

India's first *"Signature Bridge"* being constructed by Gammon across Yamuna river at Wazirabad, promises to be a great tourist attraction of Delhi, the Capital of India. This cable-stayed bridge will link NH-1 at Wazirabad on Western bank and at Khajuri Khas on eastern bank of the river Yamuna, connecting North Delhi with East Delhi.

With a length of about 575 m (main bridge) +100 m extension and a height of 154 m, with glass facade at top part, the proposed *Signature Bridge* would have a bow-shaped steel pylon in the middle. Two high towers will provide double cable support in the inner periphery of the carriageway. The deck will be composite (steel and concrete) while the pylon will be in steel.

Equipped with four lanes, this engineering masterpiece will have a 1.2 m wide central verge, space for anchoring cables, maintenance walkway and crash barrier on either side of the central verge. Once operational the *Signature Bridge* will dramatically improve access between North and West Delhi reducing present congestion and traffic jams and will become the identity of Capital City – the way Taj Mahal is to Agra

CLIENT: DELHI TOURISM & TRANSPORT DEVELOPMENT CORPORATION

CONTRACTOR: GAMMON INDIA LTD- C. CIDADE - TENSACCIAI JV

DESIGN CONSULTANTS: SCHLAICH BERGERMANN & Partners, Germany

PROOF CONSULTANTS: M/s SYSTRA SA, France

GAMMON INDIA LIMITED

GAMMON HOUSE, V. S. MARG, PRABHADEVI, MUMBAI 400025 INDIA

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