Confidential Reporting Of Structural Failures And Lessons Learnt

NEWSLETTER

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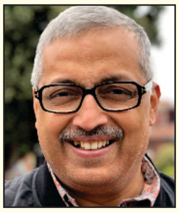
From the Desk of the President

I am extremely happy that editorial board of CROSFALL is coming out with third issue of this unique newsletter. As I mentioned earlier, it is first newsletter of its kind in India which focusses on the structural failures purely from learning point of view. Interesting feature is that identity of the project and the people involved is not revealed. The civil & structural engineering fraternity widely appreciated the earlier issues of this newsletter. Gradually people are coming forward to send the reports. Our editorial board members & domain experts are doing fantastic work in evaluating, editing & reviewing the reports before these are published. This issue contains reports which raises serious concerns on various aspects such as conceptual & detailed design, construction methodology & maintenance/ monitoring issues.

I am fully confident that this newsletter will serve the civil & structural engineering fraternity in more than one way. I urge civil & structural engineers to send reports freely without any fear and hesitation. Reports may be for any type of structural failures or structures which have visible gross structural deficiencies having substantial risk of failure. Do send your feedback & suggestions.

— Manoj Mittal

Message from Chief Editor



I have great pleasure in releasing this issue of CROSFALL. This newsletter provides reports of some very interesting case of failures, that will help readers to learn from the experience of other structural engineers and reduce the chance of such mistakes happening again. In this newsletter, we publish four reports that deal with different, but important topics:

- **Report CF-09 –** Deals with the failure of an under-construction arch bridge, which collapsed during backfilling. The arched superstructure was being constructed using pre-cast unreinforced concrete segmental blocks, which were erected in strips. The failure occurred while plum concrete filling over the arch strip was in progress. Reason for failure was incorrect sequence of back filling. The importance of sequence of construction can never be underestimated.
- **Report CF-10 –** Deals with an interesting case where the superstructure of a newly constructed bridge had to be raised by more than 4.5m due to unprecedented rise of high flood level in the stream, a year after bridge construction. The report teaches us the importance of proper hydrological and hydraulic assessment of stream for bridge design.
- **Report CF-11 –** Deals with the failure of an RCC canopy, which is commonly used to provide shelter on railway platforms. Failure was caused due to design deficiency.
- **Report CF-12 –** Deals with blatant robbery of solar panels, metallic crash Barriers, lacing and battens in electric poles, birds nest in electric pole and bollards etc. Notwithstanding the fact that in many cases there is CCTV surveillance. Such thievery can lead to endangering human safety of both pedestrians and vehicular traffic due to increased vulnerability and instability of the structures.

This is the third newsletter of CROSFALL and 1st issue in this calendar year. With the publication of this newsletter, we have published a total of 12 reports covering a wide range of issues, some dealing with particular issues and others of a more general nature. We would appeal to all those engineers, working in various sectors like buildings, industrial structures, dams, bridges, heritage structures, tunnelling etcetera to also come forward and contribute in the newsletter. Happy Reading.

— Alok Bhowmick

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REPORT No. CF - 09

Collapse of Precast Arch during construction

This failure report is regarding an arched overpass structure across an expressway. The under-construction structure which collapsed causing casualty, was a triple-arch bridge, with an overall length of around 57m and overall width of 33.6m. The arched superstructure was being constructed using pre-cast unreinforced concrete segmental blocks, which were erected in strips. At the time of the collapse, the casting of the sub- structure and erection of 96% of the arch strips were completed. The failure occurred while plum concrete filling over the arch strip was in progress.

Details of the Bridge and Erection Sequence

The superstructure of this bridge comprises two major arch spans of about 23m (with a rise of 5m), constructed using precast PCC segmental arch elements of 0.4m arch thickness. The haunch filling above the segmental arches is proposed with plum concrete. The arches comprised of 33 number of blocks of size 0.80m (top width) x 0.78m (bottom width) x 0.40 (thickness). Overall length of the bridge is 57m and the overall width is 36m. The animal overpass is designed over 3 lanes on each side. In total, 70 numbers of major arch strips were proposed in both spans. A central minor arch was proposed above the pier for added aesthetics to the structure. The span of the minor arch was about 4.5m (with a rise of about 1m).

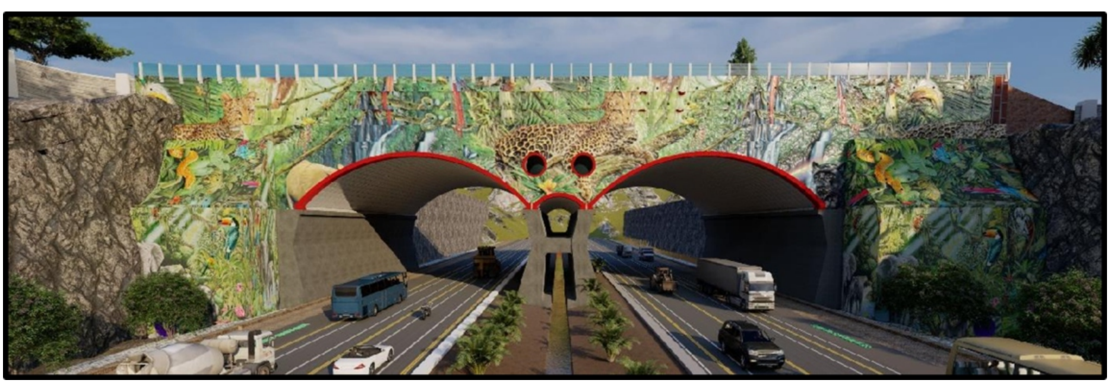


Fig. 1 : Representative image of the structure

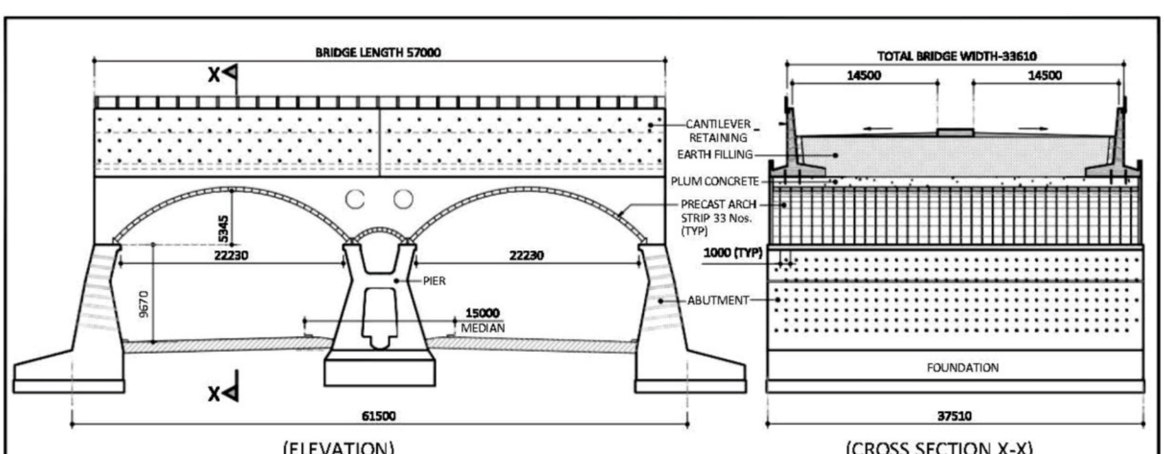


Fig. 2 : General Arrangement of the Bridge

Soil filling of 4.0m height was provided above the superstructure with a retaining wall on both sides to retain soil. The plum concrete in PCC M15 (60% concrete & 40% rubble) was provided as a haunch fill above the arches. With two circular openings of 2.0m diameter above the pier from aesthetic considerations.

The bridge is resting on an open foundation. Abutments of 13.5m in height are proposed. RCC H frame type central pier of 14m height is proposed with combined footing. H frame pier at the middle is designed to give aesthetic shape. The gravity- type retaining wall is proposed over filling of plum concrete behind the abutments. Fig. 1 shows the representative image of the structure and Fig.2 shows the general arrangement of the arch bridge.

Construction and Erection Sequence for Arch

The sequence of construction methodology involved the construction of cast-in-situ RCC sub-structure, followed by the erection of precast arch ribs and backfilling above the arches comprising of a layer of plum concrete, a layer of soil filling, and retaining walls on either end of the structure. Fig. 3 below indicates the sequence of construction pictorially, as envisaged in the design and as mentioned in the GFC drawings.

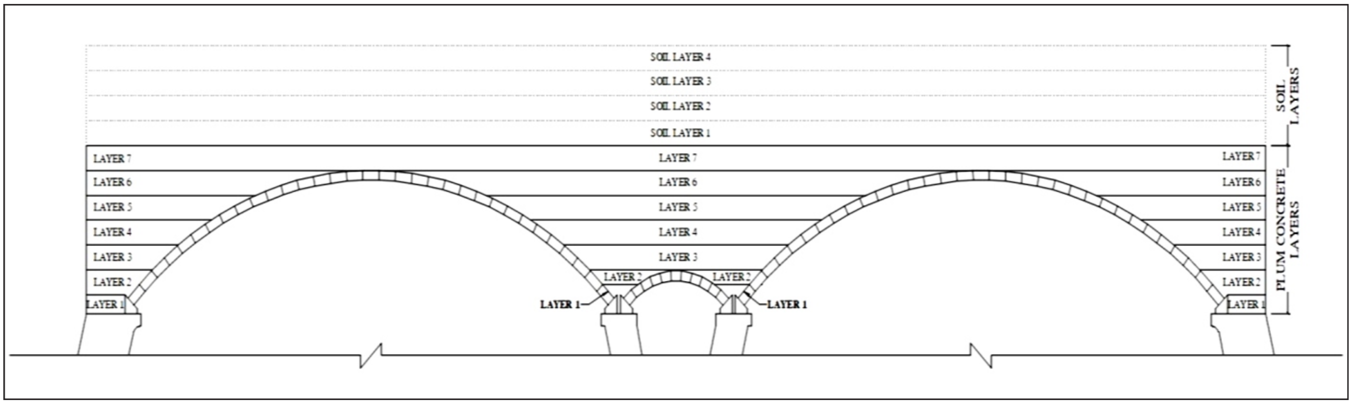


Fig. 3 : Construction Sequence of Arch Deck - Indicating Plum Concrete Backfilling in Layers.

a. The filling above the arches was proposed in layers of plum concrete of 1m height simultaneously to be carried out on both end of the arches and in between. Fig 3 shows the schematic arrangement of proposed layers of plum concrete.

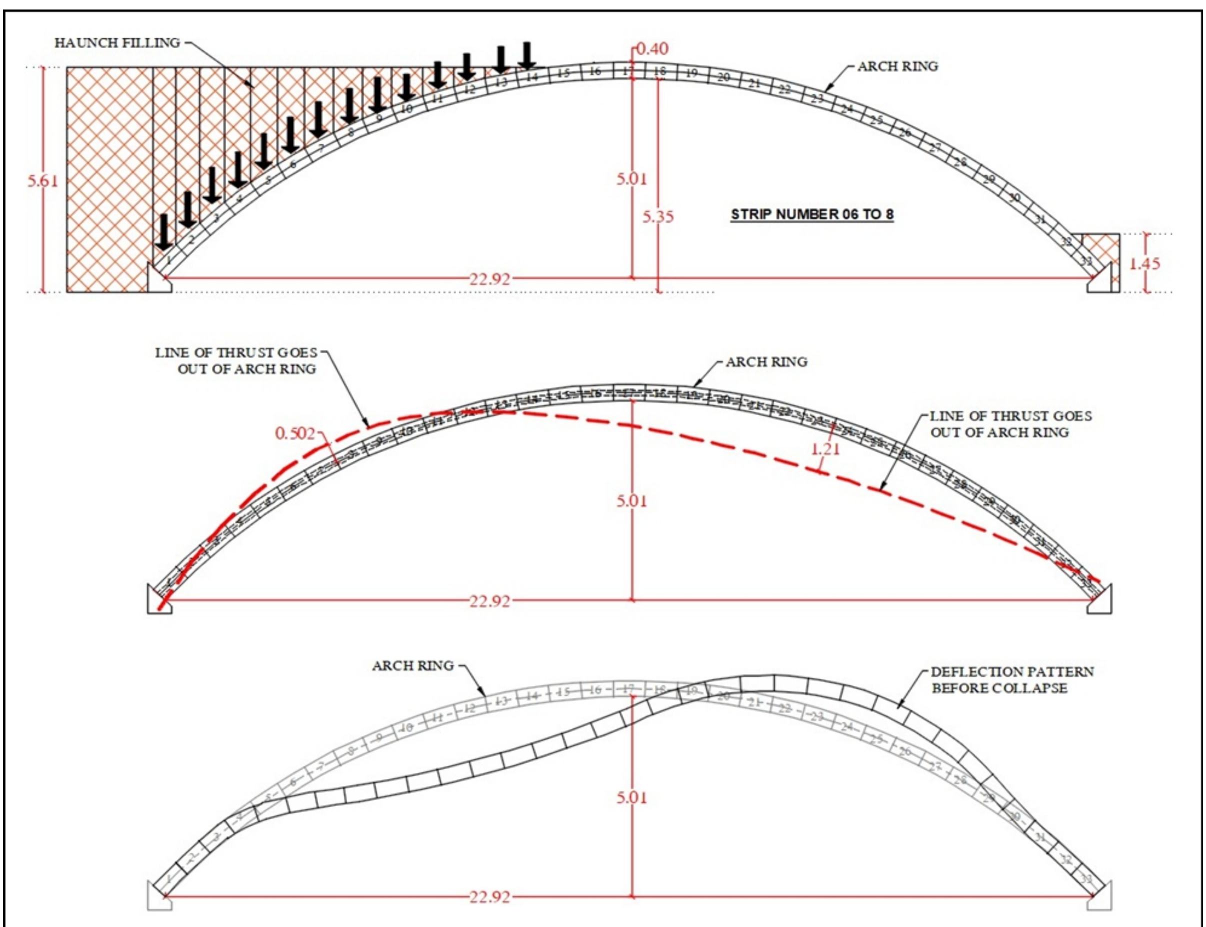
b. The philosophy behind the filling was to fill the plum concrete without causing any uneven loading on the arches. Therefore, it was proposed as a standard practice to restrict the difference between any two adjacent layers of plum concrete on both side of the arch to 1m.

About the collapse of under-construction Arch

A part of the bridge collapsed while the backfilling over the arch was in progress at the site. At the time of the collapse, the bridge was in an advanced stage of construction. Erection of 101 out of 105 arch strips were completed. The erection of balance 4 Major Arch Strips was scheduled to be started in the morning of the next day and to be completed by day end. The principal reason for the collapse is the unequal and unbalanced filling of plum concrete over the arch, causing uneven loading, which should have been avoided. Filling above the arches should have been carried out simultaneously at both ends of the arch. Post collapse data collected by the reporter revealed that the level difference between fillings on either side of the arch, in collapsed arches (15 out of 35 arches) was over 4m. This is expected to have created unequal loading above the arch strips, leading to failure.

Opening of the project was preponed by a months' time resulting in continuous concrete schedule. On the night the failure occurred, there was no expert supervisor present at the time of concreting at the site. The concrete boom placer was placed on the wrong side due to lack of information to the operator in the absence of the engineer. Failure took place at 02:30 AM. Fig. 4 shows the photograph before and after collapse, clearly indicating the difference in fill height.

Fig. 4 : Photo just before and after collapse



***Note :** All dimensions are in meters.*

Fig. 5 : Graphical analysis showing line of thrust and deflection of unstable arch just before collapse due to uneven loading of plum concrete on both ends of the arch ring.

Lessons Learnt from the failure

a. Every single activity on the site must be carried out after thorough understanding of the drawings issued and as per duly prepared and approved method statements.

b. Until the end of the project, communication channel must be kept open between designer, consultant, and execution site team.

c. Expert supervision is very important in the construction of specialized structures.

d. Minimum time required for the construction of the structure shall be given to the contractor without squeezing the timeline. Hectic working hours on construction site shall be avoided as far as possible, lengthy working hours increase the risk of making mistakes by engineers, supervisors and workers.

e. Construction procedure and sequence given in the drawing must be followed on site.

Comments of Expert Panel

The report highlights the case of what can go wrong when the laid down construction sequence and approved method statements are not strictly adhered to. The need for continuous and expert supervision during critical activities such as, in this particular case, the layer wise sequential filling of plum concrete over the arches, can not be overstated. Design in this case was highly sensitive to sequence of construction. Arch was designed for thrust line lying within the arch with minimum bending moment. Achieving this during construction would demand a strict control on sequence of construction.

From the sequence followed, it appears that concreting was taken up from one side for convenience of construction, proceeding with concreting from one end to the other end. It shows lack of supervision by competent staff and possibly no consultation with the designer during construction phase. The unbalanced loading of the arch caused shifting the thrust line outside the PCC blocks generating high bending moments for which arch was not designed. The case is analogous to stressing of prestress cables in the webs of a box girder in a symmetrical manner to avoid eccentric effects for which stressing sequence is normally specified in drawings.

For such structure typologies, it is extremely important to indicate the construction sequence clearly in the drawings, so that there is no ambiguity at site of works. The design intent of simultaneous pouring of concrete on either side arch, must be communicated to the executing agency in clear terms. The sequence should be specified in bold letters in the drawings by the designer. Also, a method statement for the construction sequence should be prepared by the executing agency and got approved from the designer before taking up the construction activities.

This report also serves to demonstrate the squeezing of time line followed by clients who put undue pressure on all concerned with the project, especially the contractor, increasing the Risk of errors at site and cutting of corners leading to very high risk in construction activities. At no time should a structure's safety during erection ever be compromised!

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REPORT No. CF - 10

Submergence of High-level Bridge Due to Unprecedented Floods Leading to Unique Rehabilitation Scheme

Background

This case study is of a newly constructed major bridge proposed over the tributary of a major river. Bridge is part of a national highway passing through rural central India. This major bridge has span arrangement of 4 x 20m and deck width of 2 x 12.5m. Superstructure is pre-cast RCC girder type resting on wall type abutment and pier with pile foundation. The structural design of the bridge was based on the limit state philosophy as per IRC 112: 2011. Construction workmanship was followed as per IRC 112 guidelines along with MoRTH specifications. Bridge construction was completed in year 2018 as per the contract schedule and bridge was subsequently opened to traffic. This bridge was performing well in terms of structural and functional requirements until the monsoon of 2019.

Fig. 1 : Major Bridge on NH passing through rural central India

Problem Statement

Major bridge was opened to traffic and as mentioned above, it was performing well on all parameters. However, in the year 2019, unprecedented rainfall was witnessed in this area. This rainfall intensity of 100-year return period rainfall intensity which is generally considered in the hydrology calculations was breached. Rise in Highest Flood Level (HFL) was so huge that it crossed Finished Road Level (FRL) and this high-level major bridge went underwater. The submergence of this crucial connecting link caused havoc, especially during the flood. Many villages and towns were immediately disconnected from the rest of the highway. Huge traffic congestion of trucks, buses, ambulances and all other vehicles were noticed on either side of this submerged bridge waiting for the flood water to recede.

After flood water receded, a joint site inspection by team of designers, Authority's representatives and contractor was conducted to study the condition of this bridge. The bridge was found structurally safe. Though HFL had crossed FRL of this bridge, there was no evidence of scour marks. Thus, scour depth as considered in the original design was found to be safe. Considering the importance of this major bridge to always remain accessible, no matter what, Authority asked structural and highway designers and contractor to re-work the design and construction of this major bridge. It was decided to further raise FRL by 4.61m of this major bridge immediately so that even in unforeseen circumstances bridge will always remain at high level. The deadline for completing the work of raising of FRL of this was bridge was decided to be completed before next monsoon season.

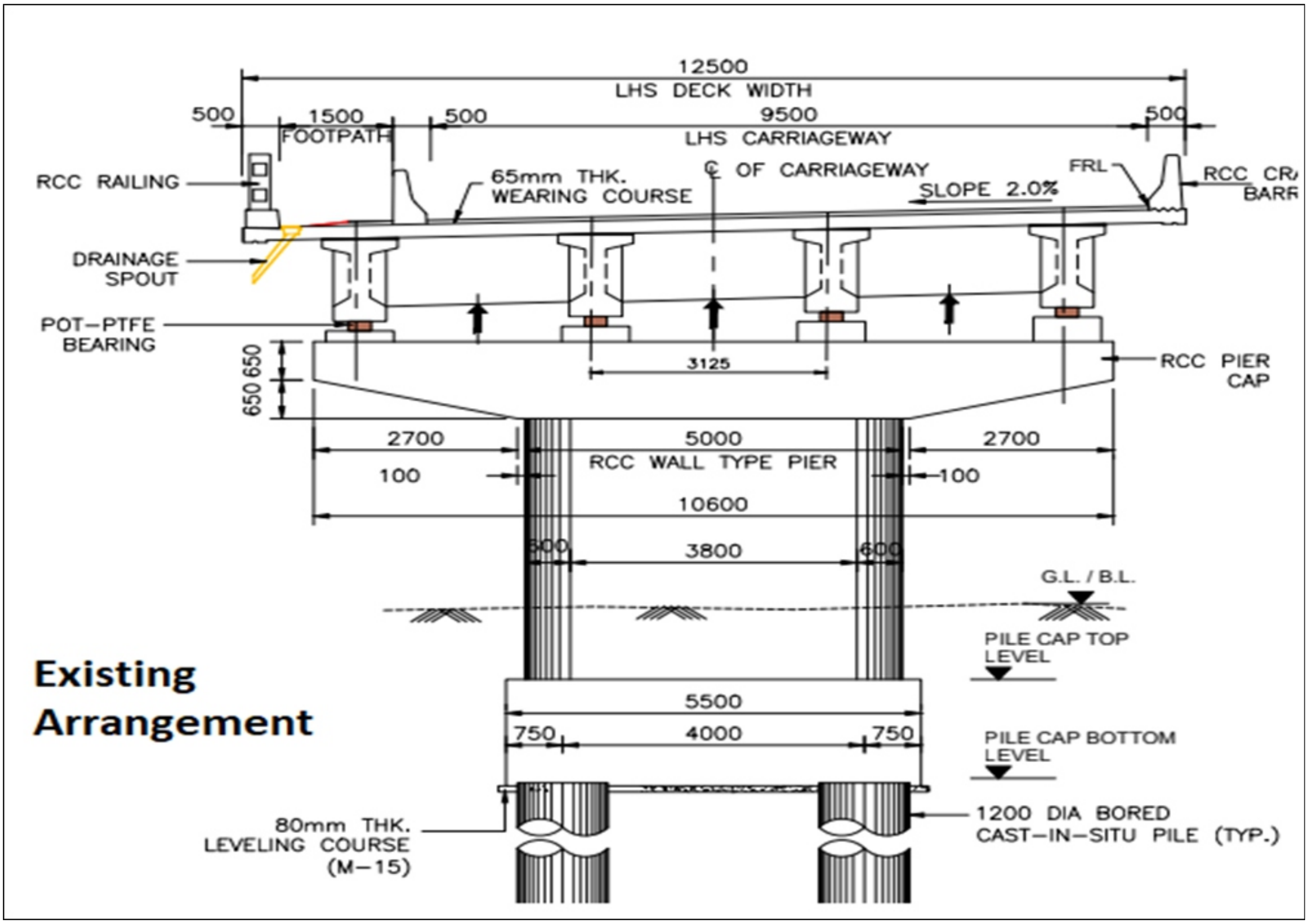

Fig. 2 : Existing Arrangement prior to flooding

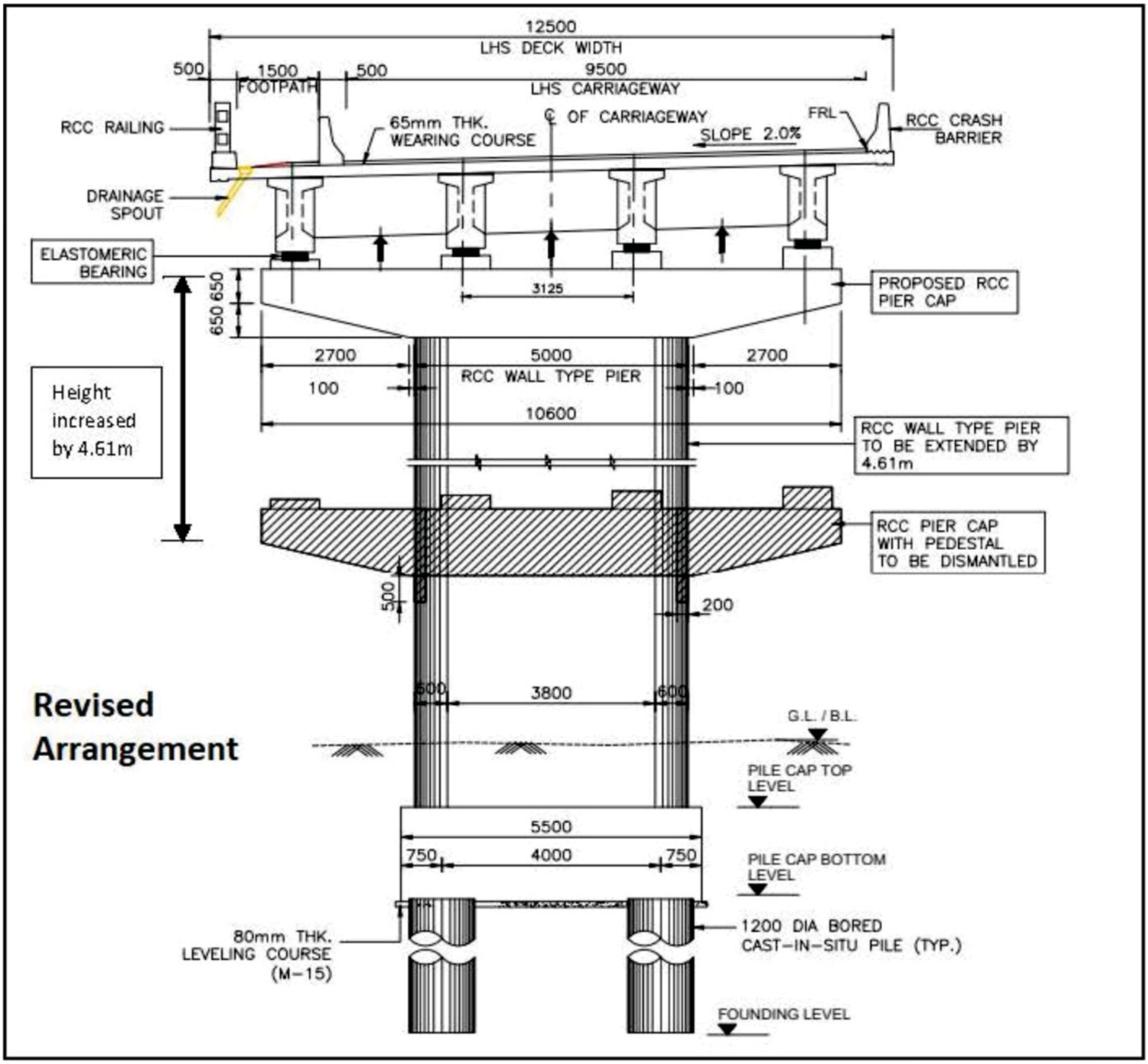

Fig. 3 : Revised Arrangement after rehabilitation

Solution Proposed

Structurally, all spans are simply supported. Superstructure type is pre-cast RCC girder supporting cast-in-situ deck slab and resting on POT-PTFE bearings. Detailed study of all design documents and drawings were done to understand loads and governing combination of design. As the FRL of this bridge is to be increased, same superstructure with existing reinforcement need to be used. But additional load due to rise in height of pier and due to greater earth pressure behind abutment have been checked against existing pile foundation and substructure bottom.

Construction Methodology

Construction methodology adopted for raising FRL of the bridge is as mentioned below:

1. Superstructure was dismantled as shown with sequence. (Refer figure 4)

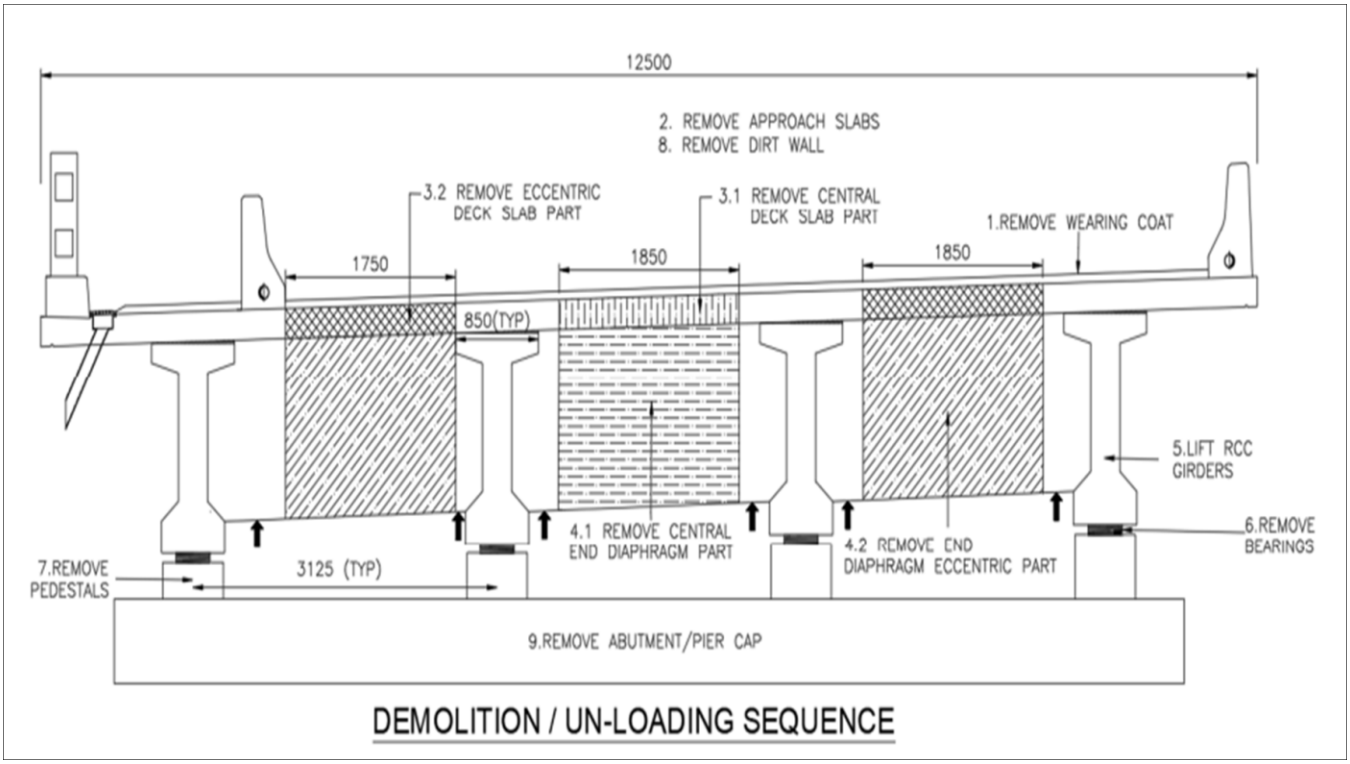

Fig. 4 : Demolition sequence of Superstructure

2. A horizontal cut in the pier was made and new vertical reinforcement was lapped with existing reinforcement to ensure structural connectivity. After the horizontal cut in the pier is done using mechanical cutting machine, old vertical bars are then connected to new reinforcement using repair grip couplers. (Refer figure 5 & 6)
3. Rise in FRL is 4.61m. This rise was achieved by raising the height of pier and dismantling cantilever pier-cap.
4. New reinforcement while increasing height of pier is exactly same as provided one.
5. Appropriate Lapping length was ensured between new vertical bars and existing vertical bars
6. Grades of concrete for new construction of pier-cap and pier are kept one grade higher than existing grades of pier and pier-cap.
7. Reference is being made to MoRTH guidelines on construction joint as per clause 1709.
8. Pier cap was constructed, and pedestal was casted on it.
9. New types of bearings, that is Elastomeric bearings are placed on top of pedestals to accommodate details of existing structure.
10. Pre-cast girders are then placed on top of elastomeric bearings.
11. Deck slab and end-diaphragms are casted.

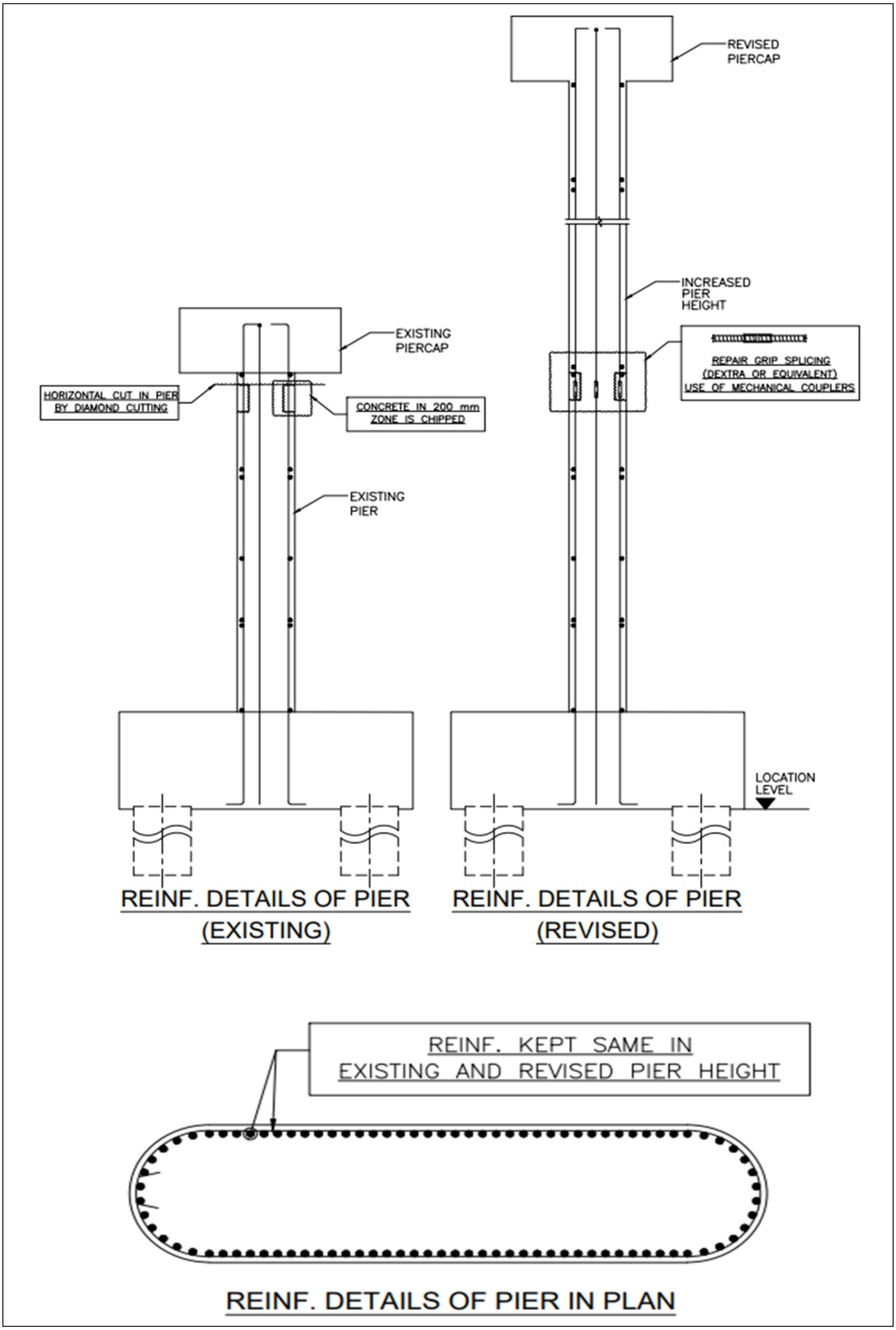

Fig. 5 : Schematic diagram for Revised reinforcement in Pier

Fig. 6 : Image showing pier being horizontally cut by diamond cutting.

After studying the existing bridge design and drawings, it was concluded that seismic case and not the wind case was governing the design. Value of response reduction factor, R=3 for POT-PTFE bearings was considered in the design and reinforcement in pile foundation and substructure bottom was governed by it. But, with the increase in height of pier and abutment, seismic demand of the structure increased, and existing pile and pile foundation and substructure bottom were structurally inadequate to take additional loads. It was noticed that no ductile detailing of substructure bottom was done so additional care was also required to be taken to avoid formation of hinge during seismic event. Thus, various options for capacity improvement were discussed which included additional piles, additional cross-section of pier by jacketing etc. It was decided that by changing the type of bearings from POT-PTFE to elastomeric bearings and by making use of their stiffness and with R=1, seismic demand can be reduced. As the height of structure is increased, structure has become more flexible. This phenomenon along with additional deflection provided by elastomeric bearings ensured that seismic demand at pier bottom and pile foundation remain within limit. Thus, all pier foundation and pier bottom reinforcement was found safe with elastomeric bearings.

However, additional load due to increased height of earth pressure behind the abutment was exceeding vertical load carrying capacity in piles. Fortunately, horizontal load carrying capacity of the pile was not exceeded even for increased height. To counter additional longitudinal moment due to active earth pressure, a counter-weight concrete block of size 3.6m x 3.55m x 12.5m was integrated with earthen side of the abutment. This counter-weight block replaced soil (with unit weight 2 ton/m^3) with concrete (with unit weight 2.5 ton/m^3). Back fill of both abutments was completely changed from cohesionless soil having ϕ = 30^o as per appendix VI of IRC 78:2014 to selected boulders with ϕ = 45^o. Both these structural changes reduced earth pressure on the abutment and provided reinforcement in pile foundation and abutment bottom was found safe.

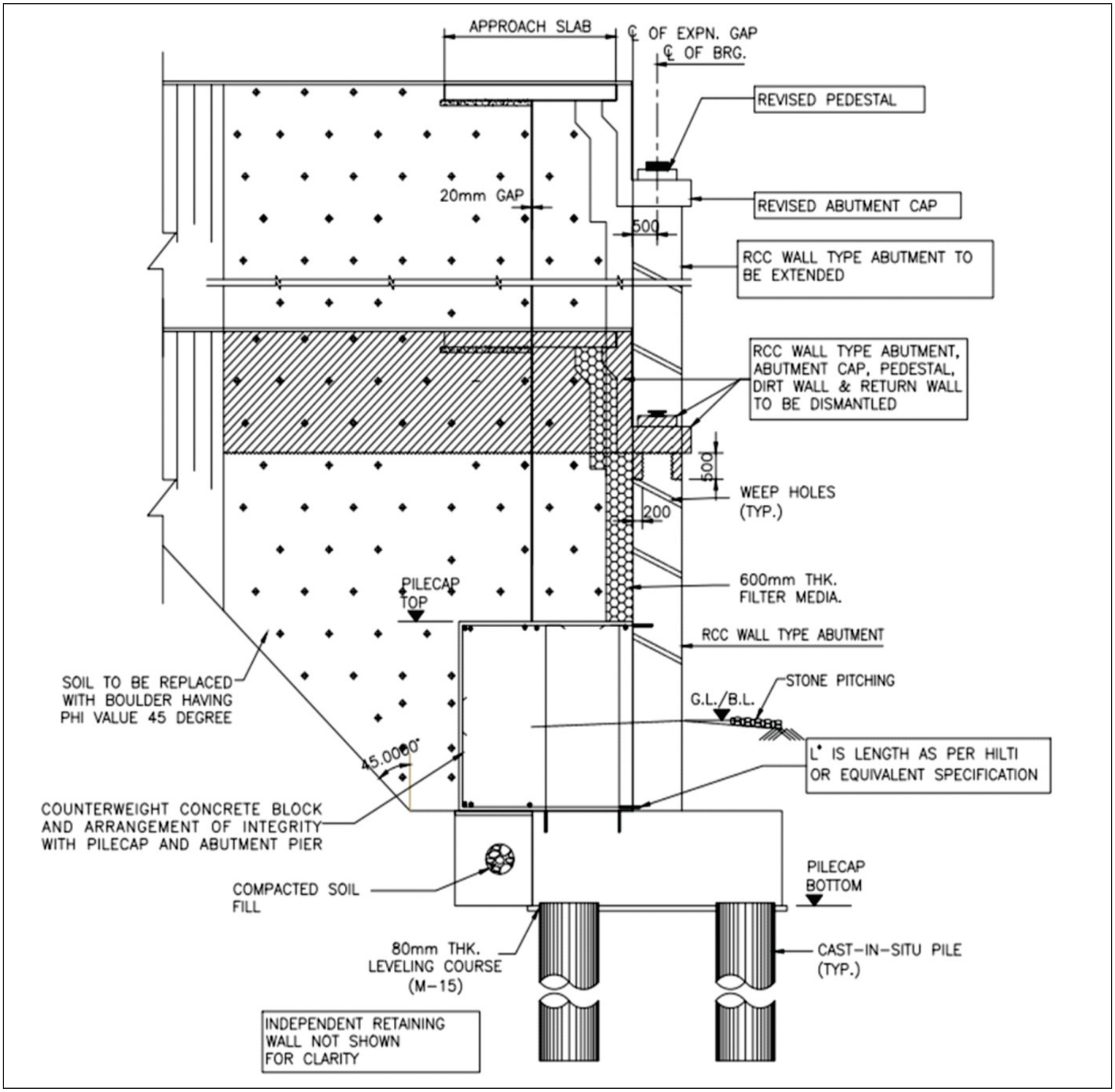

Fig. 7 : Structural changes behind abutment

With respect to lapping of new bars with existing bars of pier and abutment, mechanical couplers as recommended by IRC 112 clause 15.2 were used. These couplers from approved vendors ensured that required lap length between new and existing reinforcement is ensured. Also, a detailed demolition methodology of deck slab and diaphragm mentioning systematic step wise process along with their re-casting was prepared. It was ensured that under no construction stage, any unforeseen load path gets generated hampering sound working of the structure.

Future Learning

Generally, in the design of bridges over rivers and nallahs etc. hydrology is often given low priority. Crucial data required for valid hydrology results are absent and they are assumed based on previous records. Highest Flood Level (HFL) and scour depth govern FRL and foundation depth of the bridge. Thus, correct estimation of HFL, full flood discharge (all gates open) of any nearby dam or canal should be given serious thought before finalizing bridge location, its FRL and foundation depth. Only after validation of hydrology results approved after site inspection, further plan and profile of the bridge should be decided. Raising of FRL of newly constructed existing bridge having design life of 100 years is a challenging work and should have been avoided in the first instance by correct estimation of HFL.

Comments of Expert Panel

The report discuss the over toping of a newly built bridge due to an extreme and abnormal flood event and the remedial measures taken thereafter to avoid future overtopping and to keep the river crossing functional even after such extreme flood, which caused water levels well beyond the design HFL based on the design hydrological & hydraulic assessment.

As it was found that there was no evidence of scour after the flood receded it was concluded that the foundations were unaffected and that the substructures were undamaged. It was decided to raise the FRL by 4.61 m by dismantling the exiting pier cap and raising it by extending the RCC wall type piers. The step by step approach of dismantling super structure raising sub structures and reusing the girders by casting new diaphragms and deck slabs is elaborated. At the abutments, walls of which were raised, a counter weight of concrete was placed on the pile cap as well as soil replacement was done with $Ø=45°$, in order to reduce the impact of additional earth pressure behind the abutment on the vertical load carrying capacity of the piles. Diamond cutting of piers was done to remove existing pier caps and reinforcement were extended by using couplers. New pier caps were cast at the raised level. With the view to mitigating the impact of seismic force on the structure, the bearing were changed from POT-PTEE bearings (with R=3) to elastomeric bearings (with R=1) since no ductile detailing of the sub structure plastic hinge location, above pile caps, was done. The increased height helped in increasing the time period and reducing the seismic demand and ensuring that the existing and pier bottom and pile foundation required no intervention.

It is most important to perform a correct detailed hydrological & hydraulic calculations by collecting all the necessary data rather than assuming the same based on previous record to fix the FRL. The adverse impact of climate change on HFL, scour depth and FRL need to be taken into account by revising the necessary codes to accommodate this demand due to flooding which is being manifested worldwide.

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REPORT No. CF - 11

Structural Collapse of a Canopy of Platform (COP) during Construction

Incident

An RCC canopy of platform (COP) providing shelter to the passengers at a railway station collapsed during construction resulting in a casualty and injuries to persons. The (18m X 18 m) inverted pyramid shaped RCC canopy (Fig.1(a)) was conceived to be supported on 750mm diameter & nearly 4.50m tall RCC column which had a centrally placed pipe conduit of around 200mm for drainage of water which could potentially be collected inside the canopy during the monsoon. The canopy structure had an unusual combination of slabs and grid of beams in an inverted pyramid form (Fig.1 (b)). The drainage pipe in the column was exiting at around 375mm from the top of the pile cap (Fig.1(c)). At the section where drainage pipe is exiting, the resisting effective cross section area (Fig.1 (d)) is minimum making the section most vulnerable. The foundation was made up of 4 nos. 600 dia. bored cast in situ piles. The structural conceptualization was similar to that of existing adjacent COPs which were constructed 25 years back and still in service.

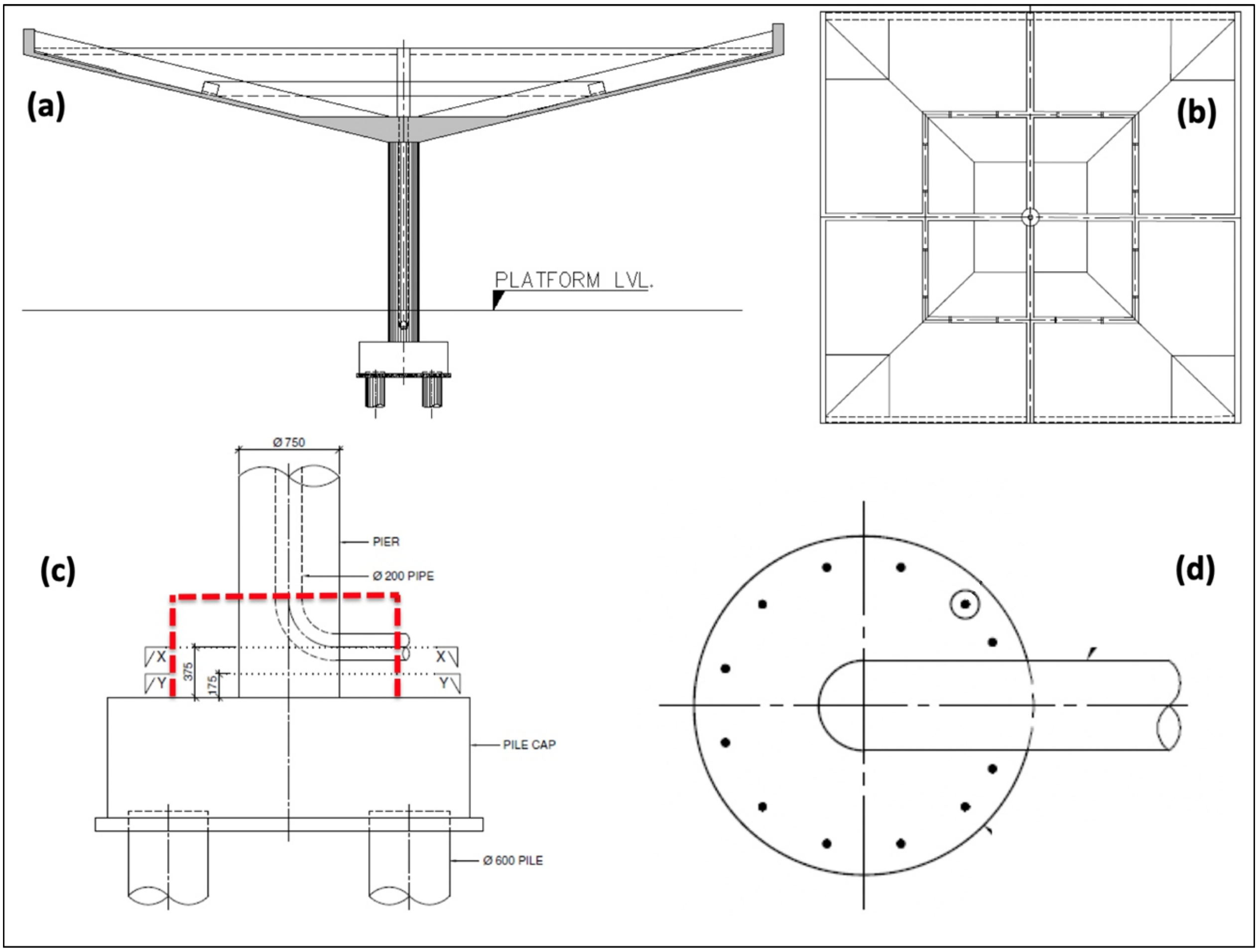

Fig.1 : (a) Elevation of RCC canopy of platform (b) Plan of the roof (c) Elevation at the bent drainage pipe (d) Effective cross section area at bent drainage pipe

The RCC platform roof structure under construction collapsed suddenly nearly after 5 months of casting of the roof slab and standing unsupported for three weeks after the removal of shuttering/formwork. The mapping of the debris after the collapse revealed that there was no failure of the slab and the same came down as a single body (Fig.2). The minor distresses that were visible in roof elements were due to the impact of the collapse and the roof frame remained intact. The roof was supported on a single column. It was obvious that the roof came down because of the collapse of the column. The column had fallen down at around 18.5° away from the bent drainage pipe (Fig.2). The column had broken at two locations, i.e. at around 175mm which is just below the bent drainage pipe and 900mm from the top of the pile cap.

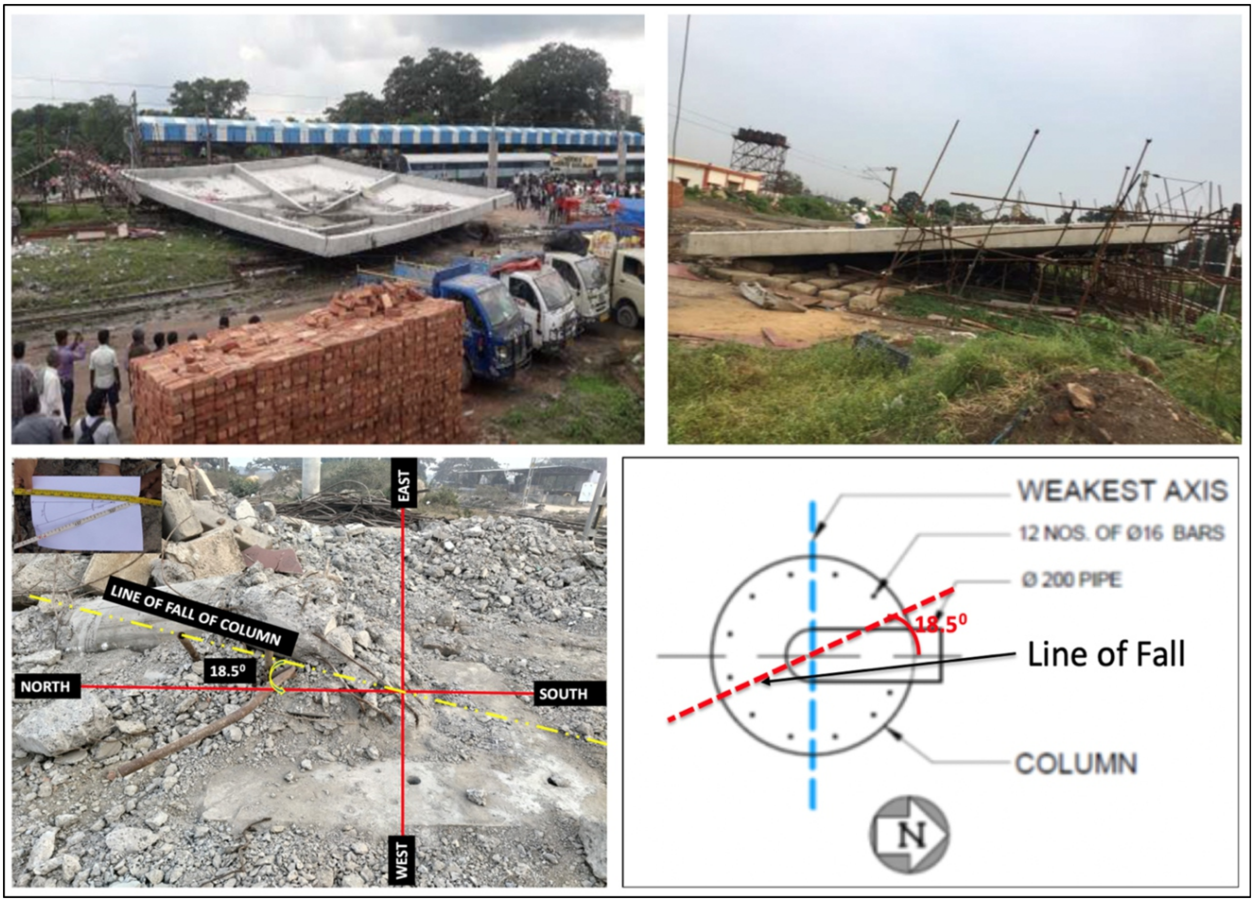

Fig.2 : Collapsed COP showing roof, column and Line of Fall

Probable causes of failure

a) The inverted pyramid of size (18m x 18m) is concentric about the CG and is supported by a small 750 mm dia. column. Any error in maintaining the verticality of the column and to construct the roof concentrically may create huge imbalanced eccentric moments in the column.

b) For any reason, if the drainage pipe is choked, the inverted pyramid may get filled up with water, the eccentricity because of the casting imperfections in roof clubbed with additional accumulated water load may magnify the moment effect in the column.

c) Where the drainage pipe is bent at the top of the pile cap, the effective cross section area is reduced to a large extent. The line of fall is in proximity of around 18.5° in the direction of the bent pipe.

The first crack seemed to have occurred at 175mm above pile cap which is just below the bent drainage pipe. The concrete quality underneath the pipe may not be good. The casted roof was supported on shuttering for nearly 5 months. The collapse took place after 3 weeks of decentering. If the decentering is not done in a prescribed sequence, there is a possibility of excessive moments due to eccentricities created during decentering causing distress in the column. If already distressed column is subjected to any trigger like the wind load, the collapse can take place.

Lessons learnt

a) The success of this kind of single support column, depends on proper design and detailing taking all load combinations especially the wind load due to its large cantilevered roof area and the quality of the workmanship including maintaining verticality of the column and casting large roof without imperfections causing eccentricities.

b) For the drainage of water, there is a drain pipe of 200mm centrally placed in the column. For any reasons, during or after the construction if the drain hole is closed, the water may get collected in the roof and by virtue of eccentricity of imperfect casting of the roof may give rise to huge moments in addition to self-weight. Therefore the structure should be designed for the condition of canopy fully filled up with the water.

c) The drain pipe is bent at the top of pile cap, making the section weaker at that location. To compensate for the same, the area of concrete at that location may be increased by provision of pedestal as shown in the Fig.1(c) red dotted lines.

d) Such structures are sensitive to wind load suction, when the train is passing from one side and sometimes accounting for the same may not be accurate due to the shape of the roof. The overturning moment calculations caused due to suction of the wind has to be done on conservative side.

e) This type of RCC COP, large roof supported on single column does not have built in redundancy. In addition to strict quality control for precision during construction, structural deterioration due to aging may lead to catastrophic failure during the service. This can happen if the structure is not maintained and its health conditions are not properly monitored. The railway platforms being a public place is always crowded with people, this type of COP should be discontinued.

Comments of Expert Panel

The report highlights the conceptual design deficiency in RCC canopy commonly used to provide shelter on railway platforms. The probable causes of failure are clearly bought out as mentioned in the lessons learnt. By analyzing the debris of the collapse it is clear that the canopy structure came down as a whole but the column buckled about the base. Such type of inverted pyramid shaped RCC canopies on relatively slender column provided with 200mm diameter internal drainage pipe which comes out at the base of the column is prone to instability and due to the creation of reduced RCC section where it is most required i.e. at the base of the column. If this structure type is continued to be used by the railway authority, it is strongly recommended to encase the bottom portion of the column and pipe till just above the bent in the drain pipe. This will enhance the RCC cross section where failure has clearly occurred and prevent such a failure from occurring in this commonly used structure type. Further it would be better if column section at top supporting canopy can be flared up to support/accommodate the reinforcement of various beams coming and meeting at the supporting column. It is also not clear how water will cross through various grid beams.

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REPORT No. CF - 12

Stealing of Fencing wires, Solar Panels, Batteries, Metallic Crash Barriers and parts of Electric Poles from Highways and Expressways – A growing menace

The reporter in this case has reported a number of cases of theft of public assets from highways and expressways. This is regularly happening in various parts of the country, as reported. According to the reporter, over the last one year, more than 100 tonnes of steel and fencing wire from different locations of an expressway have been stolen in one of the state of northern India alone.

Solar panels, batteries, lights and so many other things have been stolen from the highway soon after the highway was opened to public. Fig. 1 shows a picture of missing solar panel from one of the expressway in northern India. Similar situation exists in other parts of the country as well.

Fig. 1 : Missing solar panels along the Expressway (pic via Twitter)

Metallic Crash Barriers from highways and expressways are easy prey for the thieves. In one of the expressway corridors in the southern part of India, reporter claims that the highway has become a favourite destination for wily thieves to steal metal crash barriers and metal water pipes, electric poles and any other metallic objects. The scale of thefts on the Expressway is baffling.

It is reported that the thieves are blatantly cutting off metallic crash barriers to sell them in scrap yards. Fig. 2 shows missing metallic crash barriers along the state highway.

Fig. 2 : Missing metallic crash barriers along a state highway

Thieves are also removing the battens and lacings from electric poles, from the bottom accessible part of the pole, without realising the consequences. Fig. 3 shows a typical such pole where the lacing and battens are stolen. As the lacings on the bottom half of the vertical poles have been removed, the poles are becoming structurally vulnerable, unsafe and there is a danger of them crashing down on commuters travelling on the road.

Fig. 3 : Missing lacings and battens in electric poles along the Expressway

In one case, the bird installed nests from the electric poles were found missing (Fig. 4). In another case, miscreants stole the traffic bollards from the traffic island in a metropolitan city. This happened despite the fact that CCTV surveillance was there near the traffic island (Fig. 5). Theft of government property is so rampant and blatant on the streets that its solution looks to be a challenging task. The reporter comments that it is an unfortunate development. Authorities carry out development works for public benefit and there are some anti-social elements who destroy public property without realising safety is endangered. The authorities need to beef-up highway patrolling and implement an Intelligent Highway Information and Traffic Management System (IHI-TMS) to control accidents and curb theft of metal barricades, electric poles and other items.

Fig. 4 : Missing Bird's nest in electric pole

Fig. 5 : Bollards stolen despite CCTVs near the traffic island

Comments of Expert Panel

The reporter brings out the blatant robbery of solar panels, metallic crash Barriers, lacing and battens in electric poles, birds nest in electric pole and bollards etc. Notwithstanding the fact that in many cases there is CCTV surveillance.

Such thievery can also lead to endangering human safety of both pedestrians and vehicular traffic due to increased vulnerability and instability of the structures. These hazard may lead to the risk of accidents.

It is recommended that authorities may increase patrolling and surveillance and implement Intelligent Highway Information and Traffic Management System (IHI-TMS) to control accidents and thefts of public assets especially metal parts along highways and expressways and metropolitan roads. Once theft is reported to or noticed by the authorities, it is important to take prompt action to restore the structures so as to avoid any accident due to lack of safety measure.

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About the CROSFALL Newsletter

CROSFALL is a newsletter created by Indian Association of Structural Engineers (IAStructE). Its purpose is to share lessons learnt from structural failures, near-misses and safety concerns. CROSFALL is greatly encouraged and inspired by CROSS (Confidential Reporting on Structural Safety), UK, which is a collaborative effort of three institutions (IStructE, ICE and IFE). There is however no connection between CROSFALL-IAStructE and CROSS-UK.

CROSFALL has a confidential reporting system, which allow safety issues and failures to be reported by professionals, without exposing their identity. Any identifiable details, such as a project, product, individual or organisation, remain completely confidential to CROSFALL editorial team. Reporters' personal information will be collected to only verify the contents of the report, and to communicate with the reporter as and when necessary. The newsletter will report only failures and safety related issues with the objective to learn lessons from such failures and to help prevent future structural failures, by providing insight into root causes of such failures and spurring the development of safety improvement measures. CROSFALL team will depend on professionals to submit reports, whenever they can share their concerns about what they witness around or what they experience on any real-life projects. Anyone involved in the construction industry is welcome to submit a report. The more reports submitted, the better CROSFALL can identify and quantify safety issues across the industry. This will help the entire industry to learn lesson from CROSFALL publications

What can be reported?

- Structural failures,
- Poor Design and Detailing, Lack of Seismic Safety in planning
- Safety concerns about high risk erection schemes at Site
- Safety concerns on Temporary Works
- Near misses or observations relating to procedures followed at site, which may lead to failures or collapses.

To submit the report :

Visit : www.iastructe.co.in/crosfall.php

E-mail : crosfall.iastructe@gmail.com

Disclaimer :

The objective of this newsletter is to help professionals to make structures safer. This is achieved by publishing information about failures, based on the confidential reports received by IAStructE and information available in the public domain. IAStructE can not be held liable for the veracity of the information given by the reporter. As this document is based on the Confidential reporting system, the reporter's name and identity as well as the project name, location and identity will not be divulged under any circumstances. Expert Panel opinions given in this document are those of the group of individual experts in the field and not that of the association. IAStructE cannot be held liable for the opinions expressed herein. This newsletter is intended for those who will evaluate the significance and limitations of its contents and take responsibility for its use and application. No liability (including negligence) for any loss resulting from opinions/informations given in this newsletter is accepted.