



FROM THE DESK OF THE PRESIDENT

This issue of CROSFALL marks the 3rd anniversary of the founding of CROSFALL, which is a remarkable milestone for IAStructE. The newsletter was created in line with CROSS-UK, with the objective to offer structural engineers and professionals a confidential space to report safety concerns without fear of blame, and also to learn important lessons from other's failures. Over the past three years, the newsletter has gained popularity in the industry and I am happy to note that professionals are coming forward and sharing their experience and knowledge on the subject, drive cultural change, and enhance public safety.

This time the publication got delayed from IAStructE due to certain unforeseen circumstances. My sincere apology to the readers for this delay. The next issue is also likely to be delayed. While we would try our best to bring out the next issue latest by end of January 2026, we will try and make sure that subsequent issue comes in a timely manner.

I take this opportunity to wish all readers Merry Christmas and a very happy and prosperous new year ahead.

Happy Reading!

— Alok Bhowmick



MESSAGE FROM CHIEF EDITOR

It gives me great pleasure to present the July-September 2025 issue of CROSFALL, IAStructE's flagship newsletter dedicated to the confidential reporting of structural failures and the dissemination of lessons learnt.

This issue brings together three important case studies that collectively underscore a recurring and critical theme in structural engineering practice—the vulnerability of structures during construction stages, the consequences of inadequate understanding of long-term structural behaviour, and the risks arising from deviations in design intent and site execution. The reported failures, ranging from a catastrophic collapse of a cable-stayed bridge during construction, to repeated distress of approach embankments due to hydraulic misjudgements, and the long-term serviceability issues of cantilever bridges with short suspended spans, provide sobering reminders of the price paid for compromised engineering decisions.

CROSFALL continues to serve as a neutral and confidential platform where such failures can be examined objectively, without attribution or blame, with the sole purpose of strengthening professional practice and enhancing public safety. The insights drawn from these reports reinforce the need for rigorous construction-stage analysis, sound appreciation of temporary works, adherence to approved sequences, and informed judgment in selecting structural systems and bridge locations.

I sincerely thank the contributors, reviewers, and expert panel members for their continued commitment to this initiative. I urge practicing engineers, designers, construction professionals, and asset owners to read these reports carefully, reflect on the lessons presented, and integrate them into their own projects and organisational processes.

Most importantly, I once again encourage members of the profession to come forward and share their experiences through CROSFALL. Only by learning openly from failures and near-misses can we collectively advance the culture of safety, responsibility, and engineering excellence.

Happy reading.

— Umesh K. Rajeshirke
Chief Editor, CROSFALL

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REPORT No. CF-40

Cable Stayed Bridge - Failure during Construction

1. Introduction

In this report, a case study is presented wherein a major cable stayed bridge collapsed during construction, which resulted in a number of casualties of construction workers. This four lane bridge with central main span of around 300m was under construction over a major river.

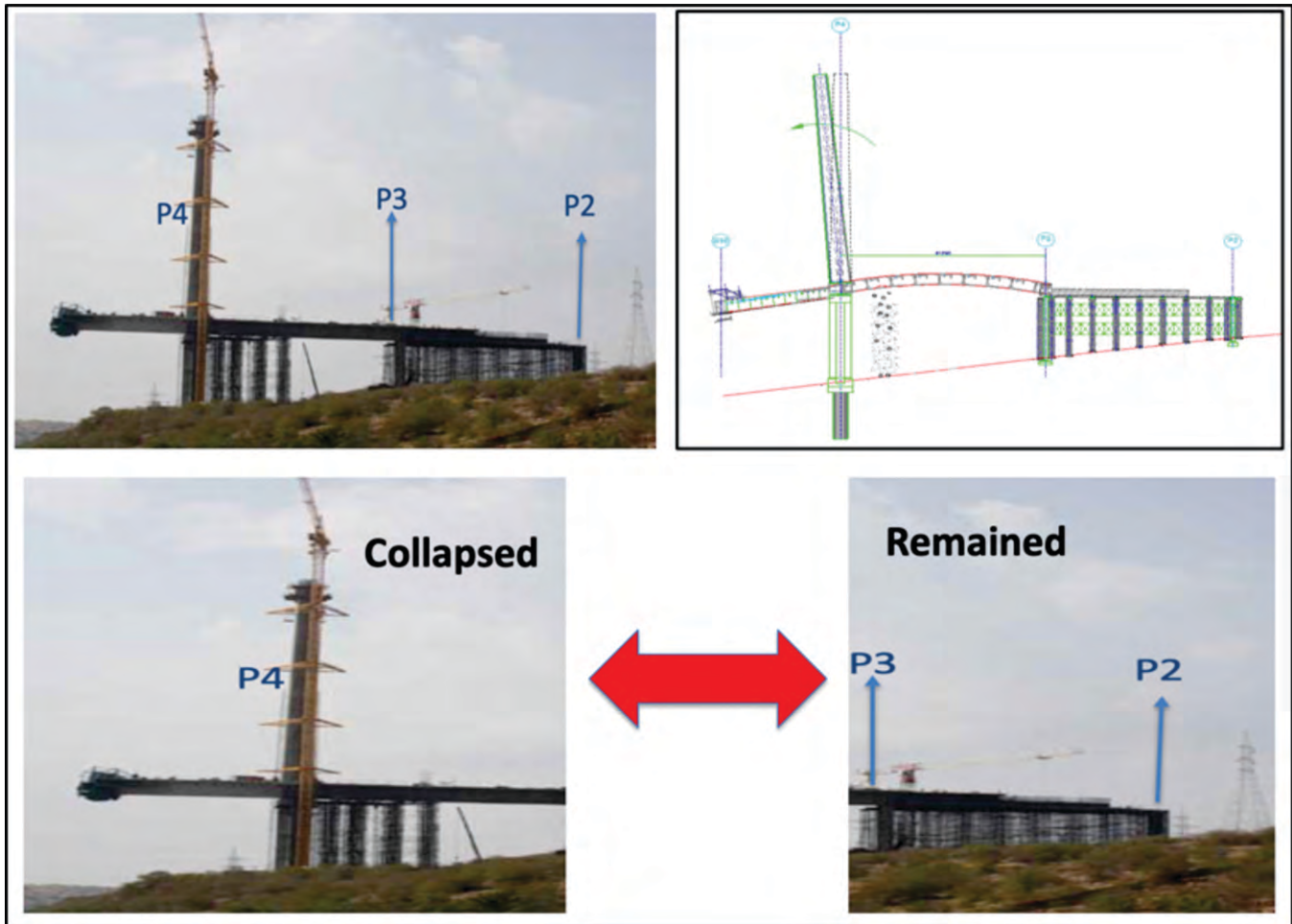


Fig.1 : Collapse mechanism of cable stayed bridge under construction

The superstructure consisted of a box girder with 30.20 m wide deck at the top supported by a single plane of cables at the centre line. The pylons are integrated with the deck and the deck is monolithic with pier at P5 (on the other side of the river, not in the photograph) and free longitudinally on all other piers. In the original design, when the back spans P2-P3-P4 were completed, the pylon height was 40m and the concreting of S10 segment was to be done in free cantilever construction method. However, at the time of collapse, the height of the pylon was more than 70m and the span P2-P3 was not completed.

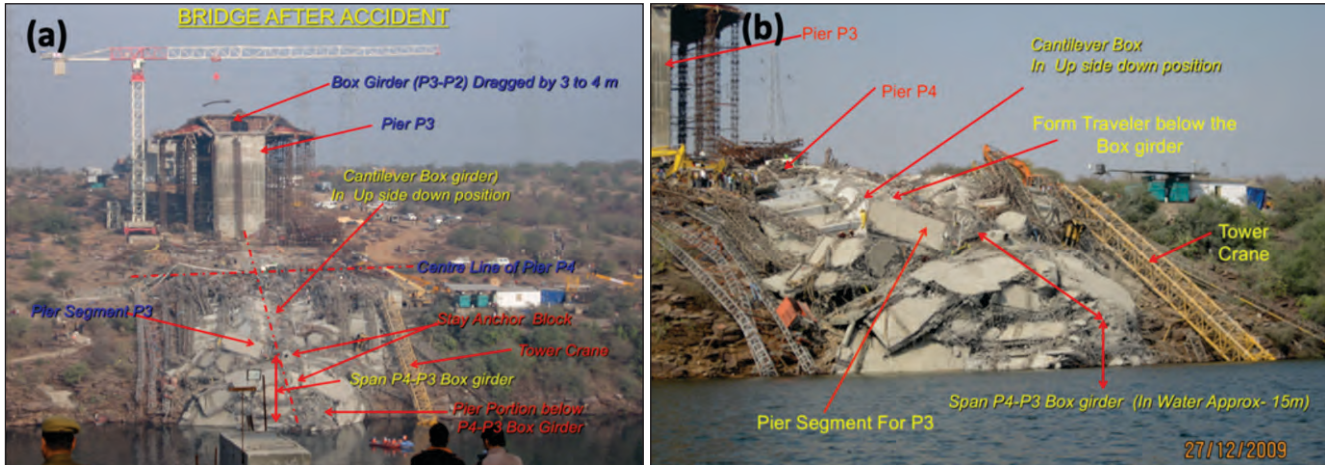


Fig.2 : (a) &(b) Mapping of the debris after the collapse of the bridge

2. Failure description

As per the eye witnesses report, the cantilever decking started drooping (Fig.1 right top) and simultaneously pylon on top of the pier P4 was tilting towards the river. The form traveller was sagging towards downstream (D/S) side in transverse direction, the pylon and cantilever together as a rigid body was rotating downwards till the cantilever along with form traveller hit the ground. The other eyewitness at the same time standing on the downstream side near the span P3-P4 observed that around 1/4th the span of P3-P4 towards the P4, the concrete dust and falling of pieces was observed following a breaking sound. The mapping of the debris (Fig.2 (a) &(b)) later revealed that the cantilever span was found upside down with its form traveller end near the P4 and the pylon with the span P4-P3 catapulted in to river by around 100 m. Half cast span P2-P3 was dragged on to the pier P3 by around 3 to 4m before being separated from the span P3-P4.

3. Investigations

Review of design & drawings, field investigation, mapping of debris, collection of concrete and steel specimen and laboratory tests, interrogation of all stake holders by expert committee, propositional approach was adopted. Finally, the conclusion was drawn on the basis of evidences collected and various interactions by the committee of experts. The independent structural analysis & modelling for structural failure stage was carried out and vetted by highly reputed an academic institution of repute.

4. Probable Causes of Failure

As per the report, change in the sequence of construction, poor quality of workmanship in counterweighing back span P3-P4, stabilising arrangement at the base of pylon P4 resting on guided spherical bearings and mechanical failure of the form traveller could be the probable causes of failure (Fig.1 & 2).

5. Lessons Learnt

The failure of the cable-stayed bridge during construction highlights the paramount importance of adhering strictly to the approved construction sequence, particularly in highly unbalanced structural

stages. Any unapproved modifications, such as excessive pylon height without completion of the counterweighted back spans, can induce severe instability. Proper counterweighting of the back spans and effective stabilisation of pylons on temporary bearings are indispensable to structural safety during staged construction. Equally critical is the rigorous quality assurance of temporary works, including form travellers, bearings, and stabilising systems, which must undergo regular inspection and maintenance. The incident underlines the necessity for coordinated communication between designers, contractors, and supervision teams, ensuring that any design or sequence changes are thoroughly reviewed and approved before implementation. Robust contingency planning and proactive risk assessments must be institutionalised to pre-empt such catastrophic failures in the future.

6. Opinion of Expert Panel

A critical review of the report indicates that the collapse was the result of an unstable construction stage, aggravated by a major deviation from the approved sequence. Increasing the pylon height without completing the counterweighting of the back spans created an unbalanced configuration that exceeded the stabilising capacity of the temporary system. The pylon's support on guided spherical bearings offered inadequate restraint under the altered loading, and the form traveller's mechanical failure further triggered the collapse. These factors point to systemic gaps in construction stage design validation, temporary works engineering, and site supervision. In complex cable stayed bridges, any change in geometry or sequence must undergo full structural re analysis, independent verification, and formal approval before execution. Temporary works must be treated with the same rigor as permanent structures, with comprehensive inspection and contingency planning. This failure illustrates that rigorous adherence to engineering discipline, proactive risk management, and coordinated oversight are indispensable to safeguard life and structural integrity.

REPORT No. CF-41

Failure of Approach Embankment of A Major Bridge on National Highway during Monsoon

Background

This case study is about Major Bridge constructed over a National Highway. Overall length of the bridge is 373.75m resting on well foundations. It is a Two-Lane bridge having footpath on either side. During heavy rainfall in the month of September 2024 part of embankment behind one of the Abutment (A1) has been washed out causing traffic disruption on this route. At that time traffic was diverted through another existing roads causing immense inconvenience to the road users. Considering the importance of this major bridge to remain always accessible, Authority decided to adopt proper restoration works, which calls for the inspection by the Structural Engineer. The purpose of the visit was to determine the condition of bridge and its protection works at site by assessing its existing site conditions, based on which the measures to be taken in selection of appropriate repair and/or rehabilitation works. Fig. 1 shows the photograph of the approach road behind Abutment A1 of the bridge.



Fig. 1: Approach Road behind Abutment A1

General Findings at Bridge Location

During site visit it was observed that the Bridge is located in meandering zone of the river (Refer Fig.2). These bends form due to unequal erosion and deposition along the riverbanks. Due to its meandering nature outer bank of the river is getting eroded enormously due to high velocity of water there, while inner bank accumulates sediments due to lower velocity. Due to its repeated embankment erosion almost in every monsoon, presently the Abutment A1 of the existing bridge is almost located into the main stream, obstructing the natural flow of water, leaving its approach embankment dangerously.

At the bridge location, the river is diverted into two distinct channels in the upstream side, diverting the water in two different directions. Major channel is diverting towards the outer bank (right bank with respect to the flow of water) which eventually is thrashing Abutment A1 at the bridge location. Obstructing the natural flow of river water by the existing Abutment A1 and its approach embankment is definitely disturbing the water velocity, resulting in deeper scour in and around bridge foundations.



Fig. 2: Meandering nature of River causing Embankment Erosion on Up Stream Side on Outer Embankment

The flow towards the right bank is eroding the outer embankment on both the upstream & downstream sides of the bridge for a substantial length. Moreover it was observed at site that towards the downstream side of the bridge, illegal mining activities are happening, which is not far away from the bridge site. The visiting Team also got the information that during monsoon in the Year of 2021 similar mishaps happened there. May be some temporary restoration measures were taken at that time, which was incapable of providing any long-term solutions. It seems the high velocity river water is eroding the outer embankment repeatedly in each monsoon leaving the embankment dangerously and posing a threat to the existing bridge. The embankment erosion caused by the high velocity river water has already reached an alarming situation (Refer Fig.3 & 4). Other than embankment erosion there are other issues of general erosion of river bed, scouring in and around bridge foundation etc. Moreover on the upstream side near to the bridge, existing railway track is there which is running very close to the eroded outer embankment of river.

Probable Restoration Works Proposed

The main problem, as stated earlier, is that the approach road behind the Abutment A1 has been washed away during heavy rains disrupting the traffic on bridge. Temporary works, which was adopted partially in the Year 2021, was also got washed away. Probably at that time some immediate temporary measures had been taken at site to restore the traffic on this route as soonest possible, which didn't address all the issues.

In the current situation proper permanent measures need to be taken to avoid any further recurrence of failure of Approaches at the Major Bridge location. This will not only disruption of traffic movement, this issue may invite fatal accidents at site for the unsuspecting road users, specially during monsoon seasons.



Fig. 3: Wash out Portion of Approach Road behind Abutment A1



Fig. 4: Embankment Erosion on Down-Stream Side

Recommendation, which is squarely based on visual observation, by the team on the damaged portions, shall be validated by the Authority by engaging competent Technical Agency.

The broad measures and steps which needs to be considered as follows:

- i. Looking into the flow pattern of River additional span is required behind Abutment A1 towards the Approach side. The number and length of span should be decided by the Technical Agency after thorough investigations considering the meandering nature of the river. Any short term solutions, like back-filling the embankment and open the road for traffic, will not serve long term solutions.

- ii. Technical Agency need to review the original design of the bridge as the behavior of the bridge is getting modified, specially the Abutment A1, which will eventually become the Pier due to addition of new span. Design of this Abutment alongwith its foundation needs to be checked.
- iii. Thorough engineering investigations like geotechnical investigations, hydrological investigations, material investigations etc. shall be conducted by the Agency before concluding the remedial measures.
- iv. The proposed embankment behind the proposed Abutment is to be protected from erosion; thus proper requirement of embankment protection is necessary.
- v. To push main current away from the outer bank of the river, Groyne to be constructed at upstream side by properly investigating the site as well as by conducting proper hydrology analysis. The Groynes are required to divert the flow from the point of attack; thus protecting the river embankment from onslaught of water current.
- vi. Guide Bund is to be constructed as Bank Protection measures on both upstream & downstream sides along the river for at least 100m length, taking advice from Technical Agency. Guide Bunds are required to confine and guide the river flow without causing any damage to the bridge and its embankments & approaches.
- vii. As stated earlier severe scouring has been observed in and around Pier Foundations. To arrest the further propagation of scouring proper protection works are required in and around the Pier Foundations (Refer Fig. 5).



Fig. 5 : Exposed Well & Well Cap due to Scouring

Lessons Learnt

1. Selection of Bridge location shall be finalized based on sound engineering practices. The basic fundamental thing shall be always remembered that the bridge should not be located across active meandering zones of rivers. Bank erosion mainly occurs in meandering rivers. In this aspect one should refer IRC:5 Clause 104.1.3.1 which states "A bridge should ideally be sited across the narrowest width of the river or channel where the course of the channel is straight in considerable length on both upstream and downstream sides of the site and the banks are stable having no history of being out-flanked."
2. Often hydraulic criteria don't get due attention during finalization of a bridge location. In most of the cases highway alignment prevails and supersedes the other major criteria such as hydraulics. These criteria need proper attention during finalization of bridge location, and if required, the highway alignment needs to be shifted/modified based on suitable bridge location as per hydraulic requirements.
3. In this regard one may refer IRC:5, where it is clearly stated good site should have the precedent for the bridge having span more than 300m and the alignment of approaches will have to conform to the selected bridge site.
4. Underestimation of waterway and scour may result in failure of a bridge, loss of properties and outflanking of bridge.
5. Bridge foundation is very important part which will provide stability and durability. Therefore, Bridge Engineers need to be very careful during finalization of bridge support location. In the present case Abutment A1 is placed almost over the active stream flow; which itself was a wrong decision during design & execution stage. This bridge alongwith with its associated approach is getting suffered due to their wrong position almost from the inception.
6. In such vulnerable bridge locations Bridge Protection works, River Training works etc. were almost neglected from the very beginning. These protection works are the integral part of any bridge. These items are costly and their maintenance cost is also very high. In case, their locations, configurations & sizes are not decided properly during implementation stage, these works can cause damaging effect on structures, which can have detrimental effect on it. It is always recommended to provide the protection works judiciously & appropriately.
7. Illegal mining in and around bridge locations are strictly to be prohibited by the respective Authority.
8. There are no short cuts for sound engineering. Otherwise, one would face such extreme case where the whole structure will become vulnerable.

Conclusions

This Report aims to highlight the root causes of approach failure of a Major Bridge and suggested some improvement proposal which is required to adopt at site. This improvement measures have been suggested squarely based on visual inspection without conducting any field investigations and material testing.



This river bridge location requires permanent solution such as river training works in the form of Guide Bunds both in upstream & downstream sides, Groynes, protection of well foundations other than adding suitable span behind one of its Abutment. This will require Authority to appoint well established Technical Agency, who will further study elaborately and will provide appropriate permanent solution to this problem.

REPORT No. CF-42

Cantilever Bridges with Short Suspended Spans – A failed experiment of the past : A Case Study

1. Background

1.1. This report pertains to case study of a long span prestressed concrete variable depth cantilever constructed bridge, with short suspended spans, constructed more than 50 years ago. The reporter in this case is a bridge expert who was engaged by the Owner Client to visit the bridge site when the bridge was reportedly in extreme distress and considered unsafe by the local authorities. It is an important bridge on National Highway in the north-eastern area, is a vital link connecting two states. The bridge was opened to traffic in the year 1974. It is one of the oldest bridges in the area and serves as a landmark. This 360m long bridge has been in distress within a couple of years after its birth in 1974. The cantilever tips at the center of spans drooped severely and also differentially, causing discomfort to passing traffic. Fig. 1 shows the General Arrangement of the Bridge.

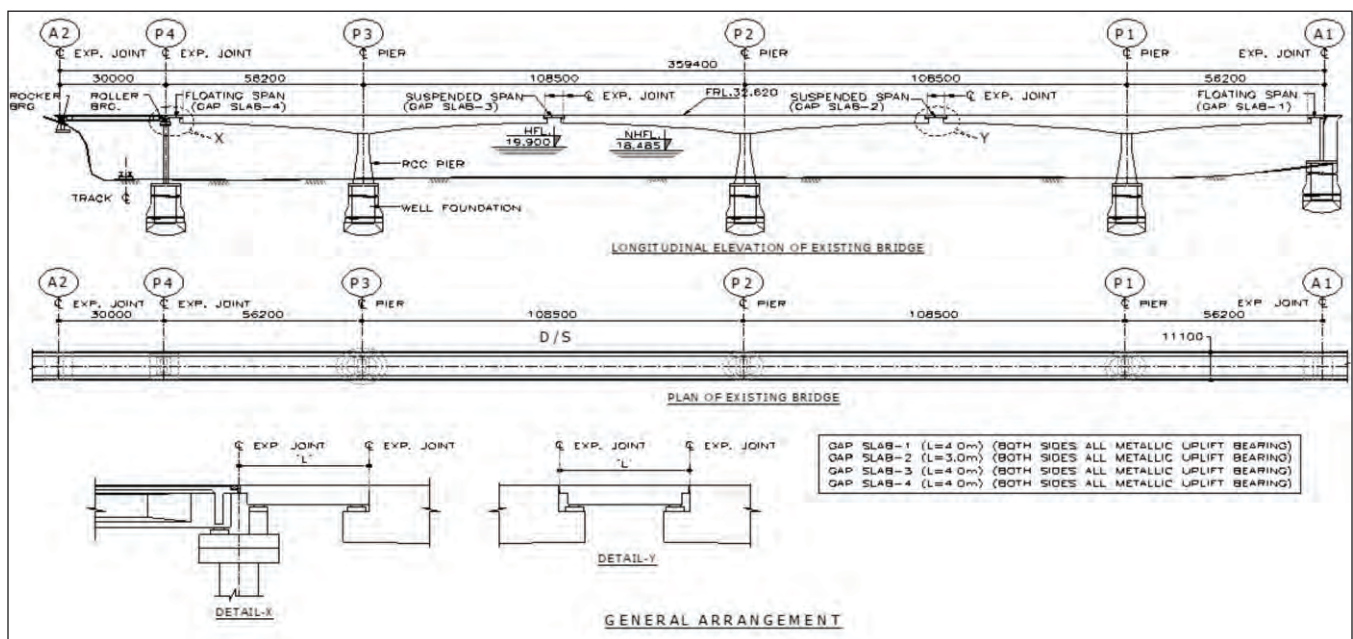


Fig. 1: Structural Scheme of the Bridge : (30m + 56.2m + 108.5m x 2 + 56.2m)

1.2. The bridge has undergone a major rehabilitation in the year 2002-2003 (within 28 years of its service). The extent of repairs undergone in 2002, as stated below :

- (i) External Stressing of Cantilever Arms
- (ii) Replacement of all gap Slab
- (iii) Replacement of all pairs of Bearings
- (iv) Replacement of Expansion Joints

1.3. In 2012, distresses were again observed. The details are as listed below :

- (i) Cantilever end between Pier-1 and Pier-2 :
 - Damage in pedestal due to punching of bearing at upstream side. It has also been observed that connection of pedestal plate totally damaged including bending of saddle plate.
 - Crack developed in steel girder at upstream side
 - Damage in pedestal due to punching of Bearing at Upstream side connecting pedestal plate totally damaged including bending of saddle plate (Bottom).
 - Cracked saddle plate at downstream side.
 - Displacement of bearing at upstream side.
 - Gap developed between saddle plate and bearing downstream side.
- (ii) Cantilever end between Pier-2 and Pier-3 :
 - Crack developed in pedestal at upstream side.
 - Cracked saddle plate (Top) at upstream side
- (iii) Pier-4
 - Roller Bearing completely corrugated
- (iv) Bearings at Abutment
 - The bottom plate of both the fixed end bearing at abutment on Katigorah side have cracked.
 - Both the bearings at free end in the gap slab at the Katigorah side displaced from its original position.

- 1.4. To pass traffic temporarily steel bridge was constructed over the gap slab between Pier No. 2 & 3.
- 1.5. In 2013, the bridge was investigated in detail by Japan international Cooperation Agency (JICA). JICA emphasized the need for detailed inspection of the bridge and also suggested for taking costly measures such as replacement of bridge, if needed.
- 1.6. In 2016, the bridge underwent another major set of repairs, where the suspended spans were reconstructed, bearings and expansion joints replaced. Uplift bearings introduced for suspended span. and many other works were carried out. The short steel bridge, which was added in 2003 was reportedly removed in 2016.

2. Recent Distress reported at the Bridge

- 2.1 In 2024, once again this bridge was reportedly in a severely distressed condition. All the expansion joints had failed. The bearings supporting the suspended spans failed and the bridge started vibrating dangerously at the suspended span locations. Bridge was inspected by a Bridge Expert appointed by the Owner Client. There was no arrangement made for MBIU. Therefore, visual inspection could be made only in accessible points. The cantilever box girder was inspected from top of deck. In 2 arms of the cantilever box, inspection was also carried out from inside box girder by entering into the box from opening provided at tip of the cantilever on the deck slab. The soffit

bottom and webs are difficult to inspect closely. Based on visual inspection, expert's observations are as follows:

2.1.1 Observation on Main PSC Box Cantilever Superstructure

- (a) It is noted that the wearing coat for the entire deck has failed. There has been overlay done number of times over the existing RCC wearing coat. Measurement carried out at site revealed that the increase in wearing coat thickness ranges from 40mm (minimum) to 100mm (Refer Photo 1 & 2). This increase in overlay has resulted in an increase in the dead load over the bridge, which is undesirable.



(Photo 1)



(Photo 2)

Photo 1 : Checking excessive overlay thickness at deck, near man-hole

Photo 2 : Checking overlay thickness at deck, over pier location

- (b) Inspection was carried out from inside box girder, for two arms (namely A1 side arm over P1 and P3 side arm over pier P2). Inspection revealed following:
 - (i) The inside of box girder is not clean. It has layers of mud all over. There is also accumulation of water in some part of the box girder (Refer Photo 3 & 4)
 - (ii) External prestressing cables, introduced during the rehabilitation process which was carried out during 2012 appears to be functional. No cables were found broken in the two inspected arms. It is noted that the external prestressing cables are supported on steel framing at regular intervals. These steel framing structures would have increased the dead load on the structure, the account of which was not considered in the original design. Photos 5 show the external cables and the steel frames.
 - (iii) At a few locations, the cover portion of the deck slab has separated and has fallen. Highly corroded reinforcement is exposed in these areas. Photos 6 & 7 show the details.



(Photo 3)



(Photo 4)

Photo 3 : Accumulation of Water inside Box Girder; **Photo 4 :** Accumulation of Soil Layers inside Box Girder

(iv) Water is found to be trickling inside the box girder from deck top (as it was raining outside), particularly at locations where the steel frame is attached to deck (Refer Photo 8 & 9). The inside of box is fully wet and is impacting the durability of the structure.



(Photo 5)



(Photo 6)



(Photo 7)

Photo 5 : External Cables & Supporting Steel Frames

Photo 6 : Spalled Concrete from deck slab; **Photo 7 :** Spalled Concrete with exposed corroded reinforcement



(Photo 8)



(Photo 9)

Photo 8 : Excessively corroded steel frame inside Box Girder; **Photo 9 :** Leakage of Water from connections

2.1.2 Observation on Suspended Spans / Floating Spans

(a) Suspended span between Pier P1 and P2 was reportedly in extremely bad condition. Flange plate and web plate were broken at the bearing location. Before my visit, authorities, very rightly introduced a separate bridging span bypassing the suspended span. Though this solution helped to avoid a catastrophe, the solution adopted involved adding load over the distressed bridge. A rough estimate shows that additional load imparted at the middle of span is around 40 tonnes on this count. Proposed solution as adopted in shown in Photo-10.



Photo 10 : Bridging Span created at middle of P1-P2 to bypass Suspended Span

(b) Inspection of suspended spans and floating spans from deck top indicates that they have failed from serviceability considerations. It was not possible to inspect the suspended spans from below (where actually the problem lies), due to lack of adequate arrangement for underside inspection at site. However it was possible to inspect the floating span towards P4 (Badarpur side) from the land towards railway line. It is clear that the structural components of floating span is in failed state. Bearings transferring load of floating span to substructure has also failed apparently. Expansion joints have failed. These spans are hazardous for the running traffic and should be replaced at the earliest. Photo 11 & 12 shows the position of floating span at P4.



(Photo 11)



(Photo 12)

Photo 11 : View of longitudinal girders of floating span at P4 showing extent of corrosion in girders

Photo 12 : Longitudinal girder cracked at support – the girder is precariously positioned and can loose support any moment

2.1.3 Observations on Bearings and Expansion Joints

- (a) All bearings supporting suspended spans and floating spans have failed. Also all expansion joints have failed. Photo 13 & 14 shows a typical failed bearing and an expansion joint which has failed.



(Photo 13)



(Photo 14)

Photo 13 : Suspended Span Bearings displaced and rotated at P4 ; **Photo 14** : Failed Expansion Joint, Floating Span at P4

3. Recommendation of the Bridge Expert based on Inspection

On the basis of thorough visual inspection of the bridge, the Bridge Expert expressed the view that the bridge is extremely vulnerable at many critical locations. Prima facie, the bridge is not fit to carry heavy loads safely. Following actions are suggested by the expert

3.1. Immediate Actions:

The following emergency measures are proposed to be initiated immediately so that the safety of the structure can be ascertained and catastrophic failure of the bridge can be avoided :

- a) Heavy commercial vehicles shall not be allowed over the bridge. Only light commercial vehicles, private cars, scooters and autos shall be allowed over the bridge. Strict compliance of this regulation is only possible through fixing of height gauge, restricting vehicles of height not more than 3.0m into the bridge.
- b) The bridge should be relieved of some unwanted dead loads, which is lying inside the PSC box girder. Close inspection of the box girder (at two arms) on 6th October 2024 revealed that the box girder has layers of soil and mud throughout the length. A portion of the box girder from inside is also found filled with water (i.e. over pier P2). All these added loads of soil/mud/water should be removed from inside the box girder.
- c) A short steel deck was added recently at the location of the suspended span between pier P1 and P2, since the suspended span was reportedly in failure condition. The steel deck is supported on the tip of the cantilever box girder and is about 250mm to 300mm above the deck

level. Ramps are created for a length of about 9m on either side of the steel deck to facilitate easy passage of traffic. However, in the process, an additional load of about 30t to 40t is added. It is suggested that this ramp length be reduced to about 5m on each side so that at least this added load can be reduced to a minimum.

- d) The bridge should be closely monitored daily. Any signs of excessive vibration, movement, cracks, or deflections shall be reported to the Engineer responsible for the safety and upkeep of the bridge.
- e) A detailed inspection of all components of the bridge shall be initiated, so as to enable scientific assessment of the bridge's capacity and extent of distress in various elements of the bridge. This task shall be assigned to a specialist agency having experience in carrying out detailed inspections of similar long-span bridges. The detailed inspection shall conform to provisions of IRC:SP:35 and IRC:SP 40. The Terms of Reference for the detailed inspection shall include following:
 - I. All Non-Destructive Testing in all visible components of the bridge (UPV, Rebound Hammer, Carbonation, Cover meter ...etc.)
 - II. Partially destructive tests (Core Test)
 - III. Crack Mapping for the entire structure
 - IV. Inspection of all Bearings and Expansion Joints
 - V. Inspection of all Suspended Spans and Floating Spans including all steel structural components and their connections

3.2. Short-Term Actions :

- a) It is proposed to eventually replace all the existing suspended spans and floating spans and expansion joints at the earliest.
- b) The present condition of these elements clearly indicates that they are short-lived and sooner rather than later, these components will give way. Therefore, it is proposed to replace the suspended spans and floating spans with prefabricated steel decks, which should be simply placed at the location after demolishing the existing suspended spans.
- c) Considering the fact that the closure of the bridge should be for a minimum period of time, to avoid inconvenience, the only feasible solution is to go for prefabricated all-steel deck. It is suggested that the design of these elements shall be initiated without any further delay.
- d) Specialist contractor should be tasked with fabrication and installation of such spans. The appointment of such contractors shall be on a nomination basis. The concept of L1 for awarding the work should not be done for this purpose.

3.3. Proposed Long Term Solution :

- a) Long term solution will depend upon the outcome of detailed inspection and NDT tests on the bridge.
- b) There are two possibilities :

- i. In case NDT test results show that the superstructure is in severe distress and it is not worth the repair / rehabilitation, the superstructure can be replaced with steel truss, keeping the substructure and foundation intact.
- ii. In case however, the NDT results are favourable and indicates that the bridge can be in service for at least another 25-30 years, after repair, repair and rehabilitation should be carried out.

Views of the Expert Panel

Construction of PSC variable depth cantilever bridges with short suspended span in between is an outdated structural scheme, which was prevalent in 70s and 80s in India when the problems associated with this structural concept was unknown. The primary problem faced in such bridges is excessive, long-term downward deflection (drooping) in the cantilever and suspended spans, often greater than initially predicted by design calculations. Presence of short suspended span also creates a steep gradient in the road profile at the cantilever tips due to unequal drooping of cantilevers, causing not only discomfort to the vehicular and pedestrian traffic, but also it causes fatigue related problems at the junction due to excessive vibration and reversal of stresses in the joints.

Those days the design used to be carried out manually and hence there was a tendency to provide a structural scheme without indeterminacy and hence suspended span concept was popular. In today's scenario, the design of such bridges should be a continuous bridge from abutment to abutment thus eliminating all intermediate expansion joints as well as bearings.

For the bridge described above, which is already 50 year old and in distress, the expert panel is of the view that the short term solution as suggested in the long run it is not worth the repair / rehabilitation, since even if the suspended span is replaced with a new one, the inherent problem of serviceability, discomfort to vehicular movement, vibration, reversal of stresses at joints and fatigue problems will remain. In the long run, one of the proposal given by the expert as mentioned in 3.3 (b) (i) is right choice according to this expert panel. The superstructure should be replaced with steel truss, keeping the substructure and foundation intact.

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 HSE). 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.
- Unethical practices in the profession.

To submit the report :

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

E-mail : crosfall.iastructe@gmail.com

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