



IAStructE

news letter

April 2018 Issue

Newsletter of the Indian Association of Structural Engineers

In This Issue

- About IAStructE
- From the President's Desk
- Recent Activities
- Ongoing event
- Forthcoming event
- Member's Achievement
- Featured Article
- IAStructE membership benefits

IAStructE Secretariat

Indian Association of Structural Engineers

K-69A , Basement, Kalkaji,
New Delhi 110019

Tel: (011) 45794829 ;

Email: iastructe@gmail.com

Website: www.iastructe.co.in

Facebook:

<https://www.facebook.com/IAStructE-1702347580065625/>

Editorial Team:

Chief Editor : Ms. Anal Sheth

Members : Mr Alok Bhowmick

Mr Bhavin Shah

Mr Maulesh Shah

About IAStructE

Indian Association of Structural Engineers (IAStructE) is the national apex body of structural engineers in India established with the objective to cater to the overall professional needs of structural engineers. The association has become the source of expertise and information concerning all issues that involve structural engineering and public safety within the built environment. It has no commercial aim or objective. IAStructE is purely a professional learned society with the prime objective of supporting and protecting the profession of structural engineering by upholding professional standards and acting as a mouthpiece for structural engineers. IAStructE endeavors to ensure that it's members develop the necessary skill in structural engineering and work to the highest standards by maintaining a commitment to professional ethics and standards within structural engineering. IAStructE strives for continued technical excellence; advancing safety and innovation across the built environment. It also strives to make available to the Government, Public Sector and Private Sector - a credible source of well qualified and experienced Structural Engineers. A nationwide database of Structural Engineers has been compiled and is being constantly updated. IAStructE undertakes a broad range of technical activities which are aimed at information sharing and capacity building. The association provides opportunity for all the members to develop various skills in structural engineering and helps members to be at the forefront of structural engineering practice. Towards achievement of its aims and objectives, IAStructE is engaged in organizing the following: CPD Courses for Professionals at all levels Refresher Courses for Fresh Graduate Engineers, Student's orientation program, Seminars/Workshops, Technical Lectures by Experts, Technical Discussions on Contentious Issues. IAStructE is currently operating from four regional centers. These regional centres located in the Eastern, Western, Northern and Southern parts of the country effectively cater to the professional needs of members residing/practicing all over the country.

From the President's desk



Dear Friends,

You are well aware that a Refresher Course on "Design of Tall Buildings" organized by IAStructE has been launched on 28th April 2018, which will conclude on 23rd June. There will be an expert faculty for each lecture. Civil & Structural Engineers who have interest in joining this course may send their registration to the secretariat immediately. Sponsorship opportunities are also available for this course. We will announce the next refresher course very soon.

As informed in the last issue of Newsletter, the work for publishing the Structural Engineering Digest (SED) for July 2018 issue has been started. Your support by way of contributing quality technical articles, research report, case studies & advertisement etc. for publishing in SED shall be appreciated.

As per the bye-laws the annual membership subscription for the FY 2018-19 is payable in advance in the month of April'18. Therefore, the members are requested to remit their annual subscription at the earliest. You may also contact the secretariat to know more on it.

I would once again appeal to you to take more interest in our professional activities and to participate in larger numbers, wherever possible. This will motivate us to organize more programs of current professional interest to you all.

Do send your feedback & suggestions.

Best Regards

A handwritten signature in black ink that reads "Manoj Mittal". The signature is written in a cursive style and is positioned above a long horizontal line that extends to the right.

Manoj Mittal

Recent Activities

Technical Lecture

1. Technical Lecture by Prof. Kimiro Meguro Director, ICUS, University of Tokyo on "Recovering from 2011 Tohoku Earthquake & Tsunami" was organized by Indian Institute of Information & Technology Hyderabad in association with IAStructE Southern Region and NAC on 11th April 2018 at Hyderabad.
2. A Technical Lecture on the topic "Earthquake Resistant Design of Industrial Structures – Design Considerations" by Dr K G Bhatia, CEO, D-Cad Technologies was organized on 26th April 2018 at CDC, India Habitat Centre, Lodhi Road, New Delhi.

Ongoing event

Refresher Course

Refresher Course on "Design of Tall Buildings" has been launched on 28th April 2018 at PHD Chamber of Commerce & Industry, PHD House, 4/2 Siri Institutional Area, August Kranti Marg, New Delhi 110016. This course will be concluded on 23rd June 2018. The lectures are being held on every Saturday morning from 9.00 AM to 01.15 PM (with 15 mins. Tea break in between). Mr. S C Mehrotra Governing Council member is the Course Coordinator. Course participation fee is Rs. 7,500/- for IAStructE members and Rs.10,000/- for non-members. Group discount of 10% is available in case there are more than 3 number of participants from the same organization. Please visit www.iastructe.co.in or contact Secretariat for further details.

Forthcoming event

Governing Council Meeting

The 82nd Governing Council meeting of the Association shall be held on 08 May 2018 at IAStructE Secretariat, New Delhi.

Technical Lecture

Details of monthly Technical Lecture scheduled to be held on 24th May 2018 at Consultancy Development Centre, India Habitat Centre, Lodhi Road, New Delhi shall be announced shortly.

Conference

Two day Conference on Achieving EQ/Wind Resilience in Buildings & Bridges with Base Isolation & Vibration Control – Indian & International Approach scheduled to be held 14-15 September 2018. Details shall be announced shortly.

Member's Achievement



The Union Minister of Science & Technology Dr Harsh Vardhan conferred Homi J Bhabha Award to Fellow of IAStructE Dr Prakash Chand Jain Scientist DRDL Hyderabad at 105th Indian Science Congress held in March 2018.

Featured article

Salient Details Of A Recently Collapsed Partly-Constructed Pedestrian Bridge At Florida

Alok Bhowmick*

On March 15, 2018, at 1:47 pm, a 53 m span, partly-erected structure of the Florida International University (FIU) pedestrian bridge collapsed onto the major highway (U.S. Route 41). The main span over highway, of span length 53m was rolled into place and set on support columns on March 10, five days before the collapse. The canal span, access ramps, and faux cable-stay tower had not yet been built. Pedestrian use was to begin when the whole project was complete. The school was on spring break at the time of collapse. The section of the bridge that collapsed weighed 860 metric tons and fell onto several vehicles on the roadway below. The Bridge failed catastrophically crushing rows of cars stopped at a red light on a busy thoroughfare. Six people were killed and 10 injured. The bridge was under construction by the Miami firm "Munilla Construction Management (MCM)" and the design was carried out by FIGG Bridge Engineers Inc. of Tallahassee, Fla.

Structural Arrangement of the Pedestrian Bridge

This 2 span bridge was an iconic structure in the making with very unique open concrete trussed arrangement. Architecturally the structure was made to appear like a cable stayed bridge with a central pylon. The span arrangement for the bridge comprise of 2 spans of length 99'(30.18m) and 175'(53.34m). The overall width of the bridge was 30'(9.15m). The bridge was to cross a major six lane busy roadway and a parallel water canal with two separate spans connected at a faux (cosmetic) cable-stay tower. The overall bridge length was 320'(98 m).

The cross section of this single plane central, open truss, comprised of a narrower top chord that served as a canopy over the wider bottom chord, which was to serve as the walkway. Pipes that would have the appearance of cables were to have extended downward from a 109'(33.22m) high central pylon, adding stability. As per MCM-FIGG's proposal, the concrete deck was to have two-way post-tensioning tendons. The concrete truss members including the canopy were to have been compressed with high-strength steel cable and bars. The bridge was to be the first in the world composed entirely of "self-cleaning" concrete with titanium dioxide. Fig.1 shows the 3D rendering of bridge cross section from the pedestrian's perspective.

Fig.2 below shows the artistic view of the bridge. The bridge was designed and being constructed using the concept of "accelerated bridge construction," or ABC, a technique of fast-tracked prefabricated concept that has been promoted aggressively in USA, at both the state and federal levels. More than 1,000 bridges have been built with it, and it is ironical that FIU is one of the leading research centre for this kind of engineering.

() This article is prepared by Sh. Alok Bhowmick, Honorary Secretary, IAStructE by collecting available information in public domain (Source : Internet) and compiling the same sequentially. The information is shared in this newsletter with the objective of disseminating such useful technical information to the wider structural engineering profession so as to learn lessons from such failures and to prevent its reoccurrence. The source of these information is thankfully acknowledged and useful links are given at the end of this article for the benefit of readers, who would be interested to know more on the subject matter.*



The \$14.2 million project was funded with a \$19.4 million Transportation Investment Generating Economic Recovery (TIGER) grant from the United States Department of Transportation in 2013, along with state agencies. The bridge itself cost \$9.4 million to construct. When the bridge collapsed, the project was already running about \$2.6 million over its \$9.4 million initial budget. Originally scheduled to be completed in July, the finish date had been pushed back to January 2019.

In their winning 2015 proposal, designers said the bridge provided "spectacular views" for both pedestrians using the bridge and drivers passing beneath it.

Fig.1 3D rendering of bridge Cross Section



Fig.2 Elevation of the proposed Pedestrian Bridge at FIU

Proposed Construction Scheme

The step by step construction methodology proposed to be adopted for this bridge is as described hereunder with sketches:

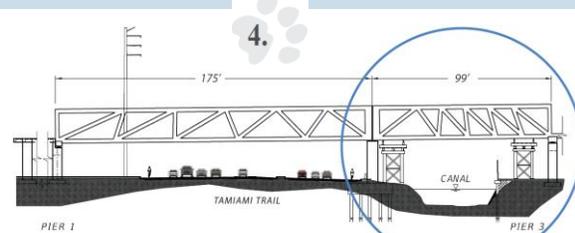
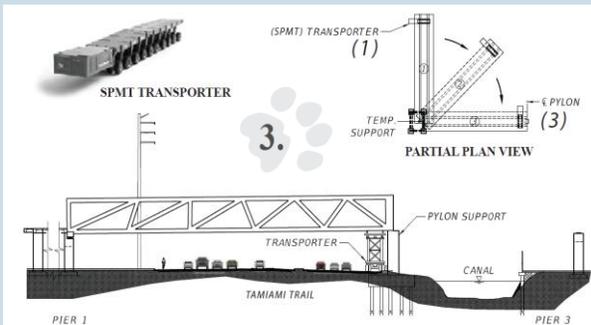
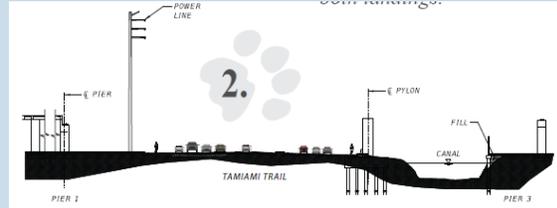
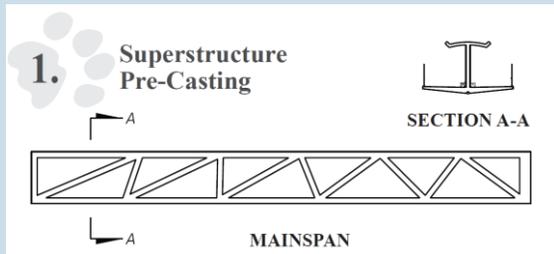
STEP 1: Superstructure Precasting: Cast main span superstructure including deck and canopy. Pre casting is carried out beside the actual site, but in a direction perpendicular to the axis of the bridge. Stress below slab longitudinal and transverse post tensioning cables.

STEP 2: Substructure casting in-situ: Build all footings and base of pylon. Build column frame for both landings.

STEP 3: Position Main Span: Rotate main span from casting position to final position. Build all footings and base of pylon. Install bearing pads in Pier 1 and remove temporary support. Secure truss at pylon support next.

STEP 4: Casting of Back Span: Erect temporary false work on banks of canal. Install bearing pads at pier 3. Cast deck, truss and canopy. Rotate main span from casting position to final

position. Build all footings and base of pylon. Install bearing pads in Pier 1 and remove temporary support. Secure truss at pylon support next.



Stage of Construction at the time of collapse

The schematic arrangement of the 2 span structure and the status of construction at the time of collapse is given in Fig. 3 below.

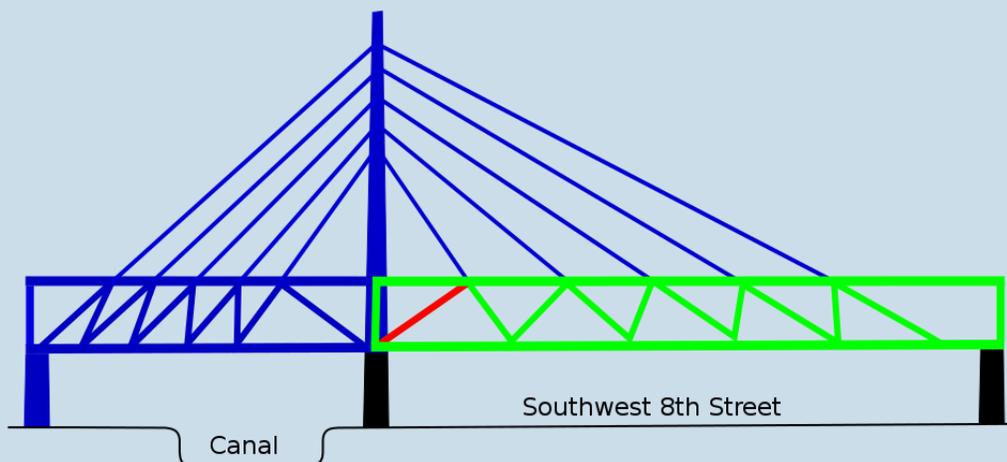


Fig. 3: Schematic General Arrangement of the bridge.

LEGEND :

Green: indicates collapsed parts

Blue: indicates not installed at the time of the collapse

Red: Indicates the diagonal beam that was undergoing post-tension cable/rod adjustment at the time of the collapse

The 862-tonne, 174' (53m) pedestrian bridge had been newly erected on 10th March 2018, in just six hours. The span was positioned by rotating the entire precast span using SPMT transporter (Fig.4). 2 days before the collapse, the engineering company, FIGG Bridge Engineers reported about some cracks in the bridge structure at the north end, near support. The matter was however deliberated and FIGG reportedly delivered a technical presentation on the crack to the Client, and concluded that there were no safety concerns and the crack did not compromise the structural integrity of the bridge. Dashcam videos of collapse show that the concrete, prefabricated segment of the bridge started crumbling on the same end of the span.



Fig.4 Photograph of the span being positioned over support.

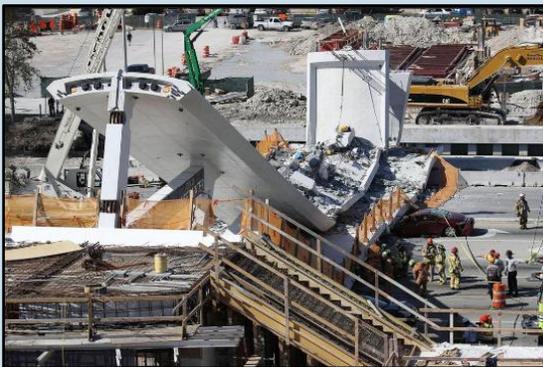
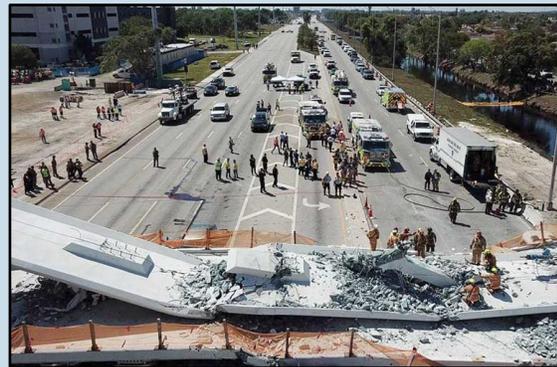


Fig. 5 Photographs of collapsed bridge

Post Disaster Investigation

Florida Bridge Collapse has moved into investigation phase. National Transportation Safety Board (NTSB) are entrusted with the task. They are collecting samples of materials from the bridge to test for their physical properties. They will be reviewing drawings and plans, and examining both industry standards and site engineers' calculations to understand what was supposed to be built – to compare with what was actually constructed. They'll look at photographs and videos of the collapse to identify the sequence of events and locations of key problems. Of course, they'll also talk to witnesses to find out what workers and passers-by saw and heard around the time of its collapse. Then they'll combine and analyse all that data and information to identify as clearly as possible what went wrong, in what order. Often there are many factors, each leading to or amplifying the next that ultimately caused the disaster. Putting that puzzle together is a key part of the forensic engineer's role.

Collapse theory's doing the rounds

While the actual investigation is in progress, there are several possibilities which are being discussed by forensic experts as cause of the failure. One such possibility as envisaged suggests that post-tensioning triggered the failure that brought down the structure. According to the theory, collapse occurred while a crew was post-tensioning bars in a diagonal member at the north end of the concrete truss that was the bridge's main element. The post tensioning compressed the diagonal so that it overstressed a joint in the top chord, triggering hinge failure at a connection in the lower chord and resulting in the catastrophic failure of the rest of the 53 m long structure. Fig. 6 shows one of the possible theories for collapse.

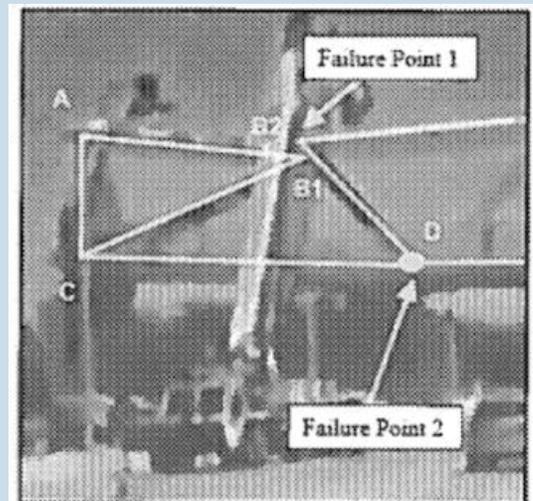


Fig.6 Possible cause of collapse

Acknowledgement

I acknowledge with thanks the information available in following links, which has formed the basis of this report on the bridge collapse.

1. Link for dashcam video of collapse : <http://www.nydailynews.com/news/national/dashcam-video-shows-deadly-florida-bridge-collapse-killed-6-article-1.3888934>
2. CBS News dated 20th March 2018 : <https://www.cbsnews.com/news/florida-bridge-collapse-fiu-florida-state-university-project-behind-schedule-over-budget-updates-2018-03-20/F>
3. WALL STREET JOURNAL NEWS : <https://www.wsj.com/articles/florida-bridge-collapse-moves-into-investigation-phase-1521406355>
4. MCM-FIGG PROPOSAL-WALKTHROUGH : https://www.youtube.com/watch?v=5Y_71L35Cv
5. SEFI FORUM

IAStructE Membership benefits

Membership of IAStructE is a sought after professional accreditation. Your membership of IAStructE can help you enhance your intellectual, academic, technical and professional status. It provides inter connectivity to the fellow professionals and the fraternity. Some of the benefits of membership is provided below:

Complimentary magazine subscription: All members (except Student Members) receive a complimentary subscription to the Institution's flagship publication 'STRUCTURAL ENGINEERING DIGEST' (SED). Published quarterly, each issue allows members to remain connected to the association through the provision of technical papers, Industry and Institution News, Featured articles, Professional Guidance on everyday matters affecting the practicing structural engineers. [To be relaunched soon]

- Access to all Technical Lectures, organized every month, at no charge
- Access to Technical Discussions held regularly
- Access to the association's library (Including e-library)
- Discounts in attending Seminars and Workshops organized by the association
- Full on-line access to the current volume and entire e-archive of journal "Structural Engineering Digest (SED)", Refresher Course Materials, Technical Lectures E-Newsletters and other Technical Resources of the Association.
- Opportunity to network with professional structural engineers of eminence and to meet potential employers in the association.
- Opportunities for professional development

For membership information contact Indian Association of Structural Engineers Secretariat.

Call for advertisements

Advertisement sponsorship for the IAStructE Newsletter is invited.

For advertisement opportunities, please contact the IAStructE Secretariat.

Call For Technical Article(s)

Selected technical article(s) will be published henceforth in the IAStructE Newsletter. High quality technical articles, project reports, research work and case studies are invited for the purpose of knowledge sharing among structural engineering fraternity.