

MESSAGE FROM THE PRESIDENT



Dear Friends,

Greetings!!

Hope you are doing well. You shall be happy to know that IAStructE is very actively engaged in routine technical lectures, webinars, publication of newsletters, CROSFALL & Structural Engineering Digest. All these activities have rich technical contents & are being appreciated by the fraternity. You may find details of such activities & publications in this newsletter and on our website. SED on Structural fire safety has also been published. Hope you must be finding it useful. Next issue is dedicated to the theme of "Structural Engineering for Sustainable Development" with Mr. Vijay R. Kulkarni as Guest editor. You may like to contribute your papers and case studies for the same. Confidential structural failure reports are also being invited for publication in the next issue of CROSFALL. You may contribute any structural failure for publication. As you know identity of the reporter and the project is not disclosed. It is purely for learning purposes.

As mentioned earlier a new program of accreditation of engineers as 'Chartered Structural Engineer IAStructE' has been launched on first January 2023. It is expected to raise the standards of structural engineering practice in the country. If interested, then apply as soon as possible and share this information with others. I am happy to report that a unique refresher course on "Strut & Tie models for structural concrete" is in progress in association with *fib*. It has received incredibly good response from fraternity.

IAStructE has started the process of elections for the new Governing Council for the term 2023-25. Notice from election officer has already been sent to all members. If eligible and interested then do participate in it actively. New Leadership is always good for innovative ideas and new initiatives and hence for the growth of any organisation.

I encourage you to send your feedback on our activities and suggestions for further improvements.

Best regards,



Manoj Kumar Mittal
President-IAStructE

FROM THE EDITOR'S DESK



Warm greetings to all the readers!!

Welcome to our January edition of the newsletter, we hope this newsletter finds you well and ready to take on the exciting challenges of the year ahead.

January is a time for fresh starts and new beginnings, and we're thrilled to kick off another year of providing you with informative and valuable content.

In this edition, we have a spotlight on our recent activities and upcoming programs. As always, we value your feedback and suggestions, so feel free to reach out to us with any thoughts or ideas.

Thanks & Regards,



Dr. Visalakshi Talakokula

CONTENTS

- 100 th GC Meeting	2
- Online Events	2-4
- Student Chapters Activities	4
- Call for papers for CROSFALL	5
- Call for Papers for the SED journal	5
- Advertisement Tariff	5-6
- IAStructE Publications	6-7
- Articles	7-19
- Message from Social Media Committee	19
- IAStructE Library	19
- New IAStructE members	20
- CSE-IAStructE accreditation program	21
- About IAStructE	22
- Membership Benefits	22
- How to become a member?	22
- Advertisement	23

IAStructE 100th Governing Council Meeting:

The 100th Governing Council meeting of IAStructE was held virtually on 07 January 2023 through Zoom platform, attended by 20 members. It was a very fruitful meeting in which various decisions were taken and the progress of the various committees were reviewed.

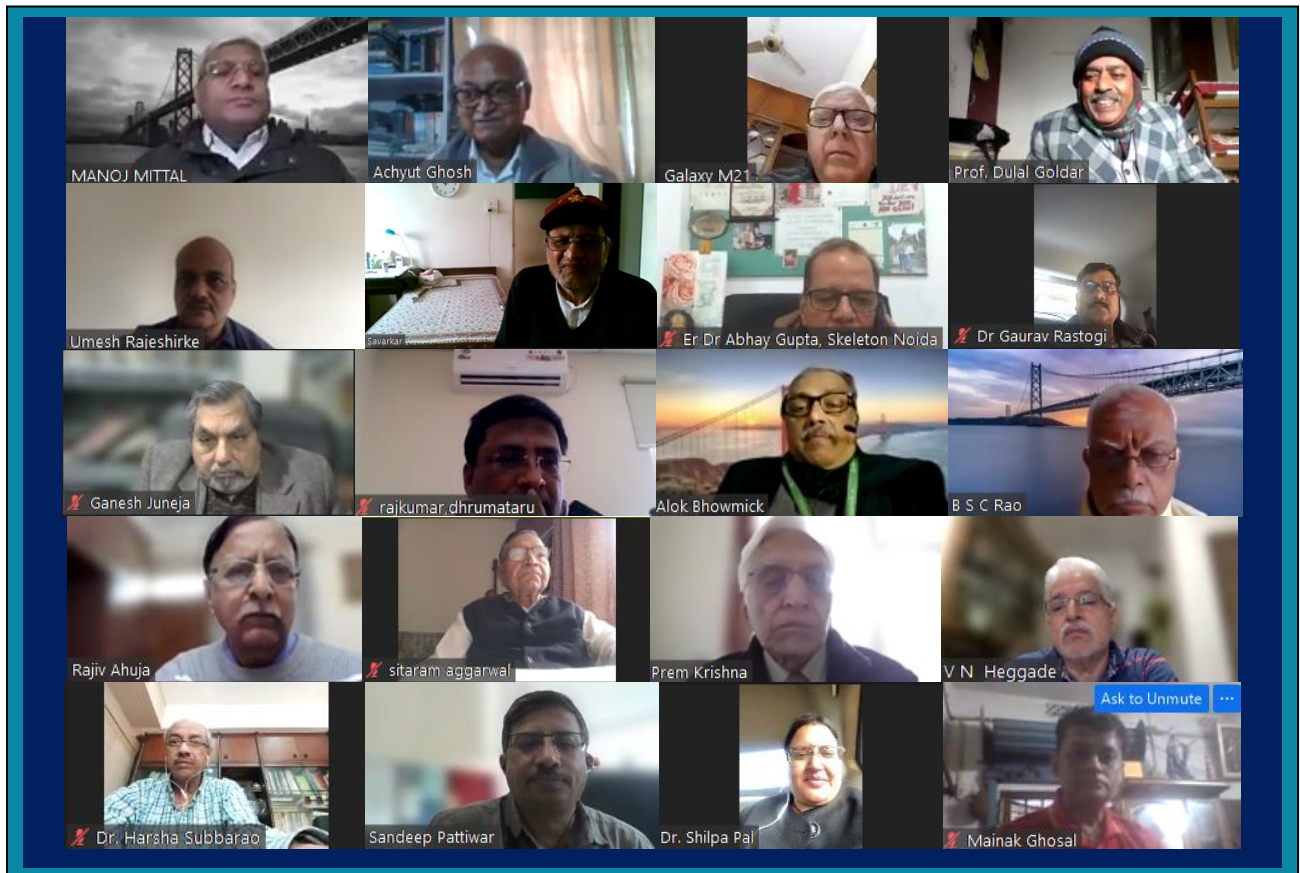


Fig. 1. Glimpses from 100th GC Meeting

Online Events:

1. Curtain Raiser Webinar on Strut and Tie Models in Structural Concrete:

A Curtain Raiser Webinar for the course on “**Strut & Tie Models in Structural Concrete**” by Mr. Umesh Rajeshirke, Vice President (West), IAStructE was organized on 14 January 2023. It was moderated by Mr. Alok Bhowmick, Chairman-PD&TE Committee & Immediate Past President, IAStructE.

YouTube link to watch the webinar: <https://youtu.be/nLqVedkzj0U>

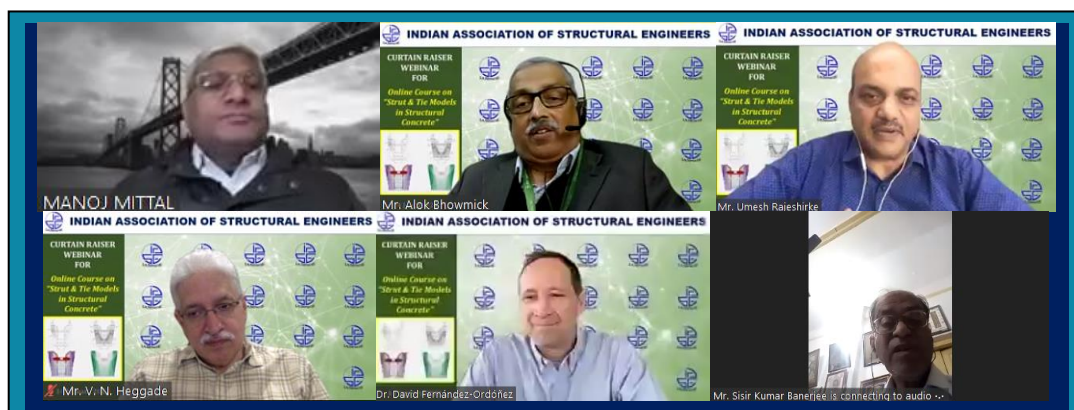


Fig. 2. Glimpses of the curtain raiser webinar

2. ONLINE COURSE (Ongoing)

Online Course on “Strut & Tie Models in Structural Concrete” is being jointly organized by IAStructE and The International Federation for Structural Concrete (*fib*). It was launched on 21 January 2023 and will continue till 11 February 2023. This course is based on series of 13 recorded lectures on the subject being organized every Saturday. 223 delegates have been registered for the course. Mr. Manoj Mittal, President IAStructE gave welcome address during the inaugural session and it was moderated by Dr. Harshavardhan Subbarao, GC member, IAStructE. All the authors of the *fib* bulletin 100 were attended the 2nd session of the course and answered the questions asked by the participants during the Panel discussion.

The following were the Panelists during the sessions organized so far:

- Mr. Alok Bhowmick, Immediate Past President, IAStructE
- Mr. V. N. Heggade Former CEO, GC Member IAStructE
- Dr. Miguel Filipe Passos Sérgio Lourenço, JSJ, Lda University, Portugal
- Dr. Jaime Mata Falcón, Professor at ETH, Zurich University
- Authors of *fib* bulletin 100

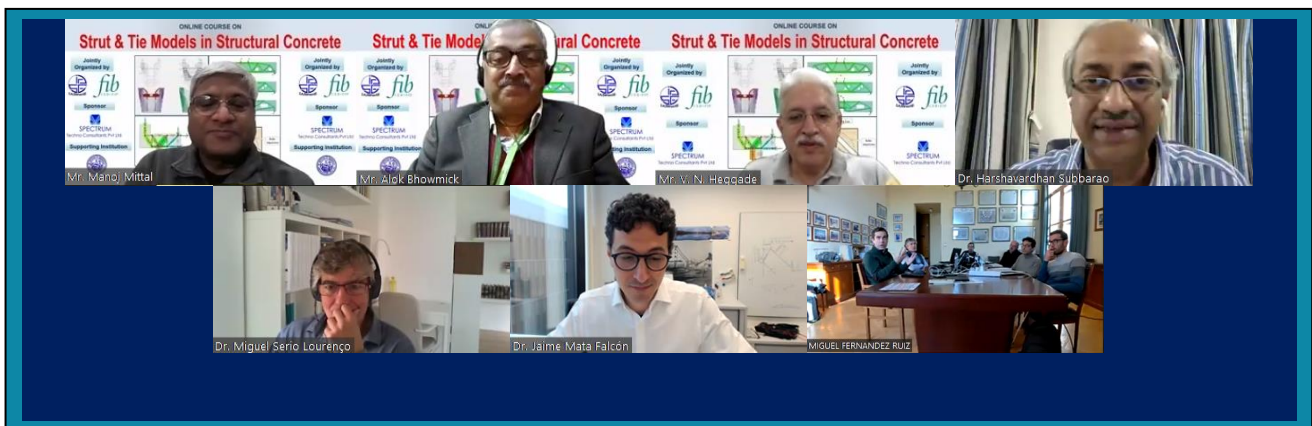


Fig. 3 Glimpses for the online course

3. Introductory Webinar on IAStructE-Chartered Structural Engineer Accreditation program:

An introductory Webinar on IAStructE-Chartered Structural Engineer Accreditation program was organized on 24th January 2023. The webinar was moderated by Prof. Prem Krishna, Professor (Retd.), IIT Roorkee & GC member IAStructE.

Following were the panelist:

- Mr. Manoj Mittal, President, IAStructE
- Mr. Alok Bhowmick, FNAE, Int. PE (India), Imm. Past President, IAStructE
- Mr. Umesh Rajeshirke, Vice President (West), IAStructE
- Mr. Abhijeet Kulkarni, Partner & Director-Structures Buro-Happold

YouTube link to watch the webinar: <https://youtu.be/PHExwXo7P8I>



Fig 3. Glimpses from the webinar

4. Webinar on “Effects of Climate Change on Performance of Bridges”

A Webinar on “Effects of Climate Change on Performance of Bridges” by Dr. Lakshmy Parameswaran, Chief Scientist (Retd.), CSIR-CRRI was organized on 25th January 2023. It was moderated by Mr. V. N. Heggade, FNAE, Design and Construction Consultant, DECon Complete Solutions & GC member IAStructE.

YouTube link to watch the webinar: https://youtu.be/-Zf9tuU1H_I



Fig 4. Glimpses from the webinar

IAStructE Southern Region Activity:

IAStructE and IIIT Hyderabad Monthly Lecture Series

Lecture 6 of the joint lecture series by IAStructE with IIIT, Hyderabad on “Building Construction using 3D Concrete Printing” by Dr. Ajay Chourasia, Chief Scientist & Head, Structural Engineering, CSIR CBRI, Roorkee was organized on 19 January 2023 through Zoom.

IAStructE Student Chapter Activity:

Title of the event: One day visit to “CSIR-NGRI”

Date & Venue: 18 January 2023, Hyderabad

Proceedings of the event: IAStructE student’s chapter of Earthquake Engineering Research Centre, IIIT Hyderabad organized a one-day visit to CSIR - National Geophysical Research Institute (NGRI), Hyderabad, Telangana on January 18, 2023. The main objective of the visit was to make M. Tech. students and Research scholars aware of the recent research activities in seismic monitoring, rock history and recording instruments. The visit started with the Seismological observatory with Dr. Vijaya Raghavan (Sr. Principal Scientist). The students have seen different types of seismometers and their functioning. The analysis of seismographs from numerous earthquakes and their recording has been explained. The excursion was then directed in the direction of the Rock Museum. Dr. Babu E.V.S.S.K (Chief Scientist) and Dr. Vijaya Kumar T (Principal Scientist) have given insights on the development and genesis of rocks during the discussion. The geophysical, 2D and 3D seismic survey devices were then demonstrated. Students were also exposed to the numerous investigational systems and instruments related to seismology and sub-structure testing. The programme was concluded with a visit to the instrumentation lab which facilitates the airborne survey services for the researchers. The interaction with the CSIR-NGRI scientists during the lab visit and demonstration sessions was enjoyable and a great learning experience for the students. The tour expanded the students' comprehension of the significance of seismic studies and geophysical investigations for the safer design of structures. The students curiously questioned the speakers throughout each conversation to comprehend what was being said. The visit helped the students to co-relate the theoretical concepts with the practical elements of structural earthquake engineering.



Figure 5: Educational Visit to CSIR-NGRI

Call for papers for CROSFALL:

CROSFALL Editorial Board invites reports for the forthcoming issues. Interested candidates can send the reports about structural safety issues related to all types of structures (i.e. buildings, bridges, tunnels, industrial structures etc.) in the built environment. The reporting can be related to:

- 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.

Reports do not have to be about current activities so long as they are relevant. Small scale events are equally important - they can be the precursors to more major failures. Report might relate to a specific experience or it could be based on a series of experiences indicating a trend. No concern is too small to be reported and conversely nothing is too large. Reports should aim to include information that will help others to learn from the safety issue identified.

To submit the report please go through the following link: www.iastructe.co.in/crosfall.php

Call for papers for the theme based issue of SED journal:

SED Editorial Board invites article contributions for the forthcoming issue of the Structural Engineering Digest on the following themes, which shall be published in e-book format. Details are as under:

- ★ **January – March 2023 issue:** Theme: Structural Engineering for Sustainable Development
Guest Editor: Er. Vijay R. Kulkarni
- ★ **April – June 2023 issue:** Theme: Liquid Retaining Structures
Guest Editor: Mr. L. K. Jain

Interested professionals may send their abstract on any of the above issues along with their photograph and brief resume latest by 15 February 2023 or at the earliest convenience. Articles are invited from i) Members of IAStructE; ii) Specialists in the field even though they are not members of IAStructE.

Interested authors/contributors may kindly mail to iastructe@gmail.com regarding i) Broad guidelines on areas of coverage; ii) size of the article; iii) format of paper submission. As per the laid down procedures all the papers shall be sent to the referee for review and the comments will be informed to the authors for incorporating the same. Papers shall be published after peer review & approval of SED editorial board.

Advertisement Tariffs:

Structural Engineering Digest (being published in PDF format)

	Rates Per issue	Discounted rate at 20% for 4 consecutive issues	Advertisement Size
Full Page	Rs. 20,000/-+ 18% GST	Rs 64,000/- + 18% GST	9.5 inch x 7 inch

IAStructE Monthly Newsletter (being published in PDF format)

	Rates for advertisement	Advertisement Size
Full Page	Rs. 10,000 per issue, 10% rebate for quarterly, 20% rebate for half yearly and 30% rebate for yearly booking	9.5 inch x 7 inch
Half Page	Rs. 7,000/- + 18% GST per issue, 10% rebate for quarterly, 20% rebate for half yearly and 30% rebate for yearly booking.	4.75 inch x 7 inch
1/8th of a Page	Rs. 2,000/- + 18% GST per issue, 10% rebate for quarterly, 20% rebate for half-yearly, and 30% rebate for yearly bookings. (Only for IAStructE Members)	Standard size of Business Card

IAStructE Publications  :

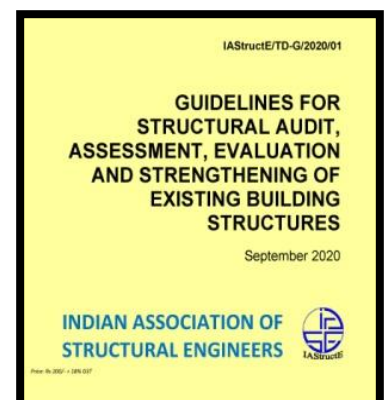
1. Commentary with Worked Examples for IRC: 6-2017: It is a document having commentary with worked example on IRC: 6-2017 (The code for Loads & Load Combinations for design of Highway Bridges). This commentary is in two separate volumes. Volume-1 pertains to the Commentary while Volume-2 pertains to Illustrative Worked Examples. It has 48 worked examples demonstrating application of various codal clauses

IAStructE/TD-CC/2020/02	IAStructE/TD-CC/2020/01
<p>COMMENTARY WITH WORKED EXAMPLES FOR IRC:6-2017</p> <p>STANDARD SPECIFICATIONS AND CODE OF PRACTICE FOR ROAD BRIDGES SECTION II : LOADS & LOAD COMBINATIONS (SEVENTH REVISION)</p> <p>NOVEMBER 2020</p> <p>VOLUME 2 OF 2 : ILLUSTRATIVE WORKED EXAMPLE</p>	<p>COMMENTARY WITH WORKED EXAMPLES FOR IRC:6-2017</p> <p>STANDARD SPECIFICATIONS AND CODE OF PRACTICE FOR ROAD BRIDGES SECTION II : LOADS & LOAD COMBINATIONS (SEVENTH REVISION)</p> <p>NOVEMBER 2020</p> <p>VOLUME 1 OF 2 : COMMENTARY</p>

It's a priced document and hence not freely downloadable. The documents are available for sale @ Rs 1200/- for Volume 1, and @ Rs 800/- for Volume II. Members of IAStructE and IRC will be entitled for a discount of 10% on this amount. Interested professionals who wish to purchase the commentary may kindly register with the following link or contact IAStructE Secretariat at iastructe@gmail.com

Registration link: <http://iastructe.co.in/new-iastructe-publication.php>.

2. Guidelines for Structural Audit, Assessment, Evaluation and Strengthening of Existing buildings Structures: This document will guide structural engineers in proper assessment of building structures before issuing structural stability certificate. These guidelines may be used by IAStructE members, all other structural engineers, house owners, housing society welfare associations, clients and corporation engineers for understanding structural audit of the private and public building structures. The Guideline focuses on the urgent need to strengthen risk resilience of buildings from any kind of risks due to earthquake and other hazards. It is hoped that this document will be useful to ensure that all structures across the country remain safe from any kind of disaster risk.



It's a priced document and hence not freely downloadable. The price of this e-document is Rs. 200/- .Interested professionals, who wish to obtain the soft version of the Guideline in pdf format, may register with the following link. Registration Link: <http://iastructe.co.in/guidelines-for-structural-audit.php>

3. Commentary on IS: 13920: The commentary is available on www.iastructe.co.in under IAStructE Professional Documents. IAStructE member can access this document after login.

4. Commentary on IS: 1893 Part 1: The commentary is available on www.iastructe.co.in under IAStructE Professional Documents. IAStructE member can access this document after login.

Articles:

Article 1: Structural Fire Protection: Compliance Pitfalls

1. Introduction

Traditionally in the world and in India, Structural Stability is sacrosanct. The regulatory frameworks may lag in other desirables of a building but it cannot fall down. Unfortunately, in India the understanding and implementation of Fire Safety is very incoherent across the states as well as various procurers. And structural fire safety is at the cusp of these two. And hence by default it becomes a weak-area for all those projects which are not super critical (Like Oil & Gas or similar). This note will help the readers understand the mechanics of technical compliance with a specific focus on how structural fire protection is evaluated and assured. To better equip jurisdictions, developers, specialist consultants, contractors and suppliers work towards implementing new measures to minimize potential future damages due to fires, we start with an overview of the tools available to do so.

2. What are Standards and Codes and what is Compliance

The aim of a Building Code is to provide guidance across various stages of conceptualization, planning, designing, constructing, maintaining and repairing the buildings. Keeping in mind substantial variations from region to region, codes endeavor to meet the requirements of different regions of a country, by taking into consideration factors such as building type, climatic and environmental conditions, geographical terrain, demographic readiness, etc. Some building codes can be very 'prescriptive' (where there is greater prescription of how exactly to do what all; often referencing published standards) whereas as some other codes can be 'performance based' (where the intent is described but the means are not detailed to limit the creativity to comply to the intent)

Whenever any 'standardization' is expected, it is done using a 'standard'. A standard often refers to a publication which would guide or define something with an intent to bring about uniformity. And in order to achieve any uniformity; repeatability and means of measuring repeatability are critical. Irrespective of the guidance being 'prescriptive' or 'performance based' the crux lies in measuring repeatability. The accuracy to which this measurement of repeatability can be done would create tiers of stringency. The higher the accuracy the more stringent is the method of checking compliance. Across the world, wherever the potential threat to life and property is high; the stringency or compliance requirements are high. Technical regulations in the world around electrical appliances, (baby) food, medicines and critical infrastructure will always be high. Fire safety continues to gain stringency across technical regulations and contracts.

3. Measuring Measurement

In the construction industry the assurance of these three is needed:

- A. Repeatable performance of Materials & Systems delivered to site;
- B. Repeatable workmanship for installation and
- C. Repeatable state of the materials & Systems after Maintenance.

Below published standards provide the methods to check the repeatability of these measurements or conformity assessment mechanisms.

- ISO/IEC 17025: General requirements for the competence of testing and calibration laboratories
- ISO/IEC 17065: Conformity assessment—Requirements for bodies certifying products, processes, and services
- ISO/IEC 17067: Conformity assessment — Fundamentals of product certification and guidelines for product certification schemes
- ISO/IEC 17020: Conformity assessment—Requirements for the operation of various types of bodies performing inspection
- ISO/IEC 17024: Conformity assessment — General requirements for bodies operating certification of persons.

See Figure 1 from the ‘toolbox’ published by ISO’s CASCO (International Organization for Standardization’s Committee on conformity assessment) for more on the family of these standards. These standards are used and referenced in technical regulations, specifications and contracts to define the means of measurement with certainty and establish specific stringent mechanisms.

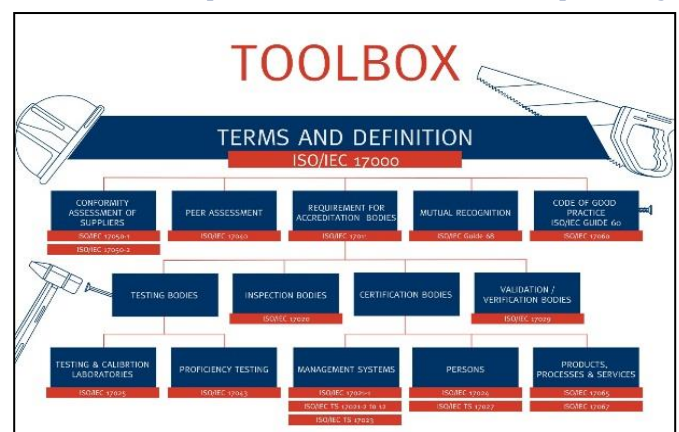


Fig. 1: ISO CASCO Toolbox

4. Structural Fire Protection

A “post-flashover fire” or a “fully developed fire” is one where the complete room or area under consideration is fully on fire. See Figure 2 from the research by the title “Assessment of Steel Structures Subjected to Fire Conditions” By Phillip Oosthuizen (UCT, Cape Town).

Everything that is undertaken to enable the structure of a building to resist a “post-flashover fire” in order to maintain its structural strength is grouped together to be called structural fire protection. Most frequently the enhancements are done using solutions that will increase the ability of the structural elements to resist a ‘fully developed fire’ for a duration long enough to enable evacuation of the type of building (occupancy type). As you can imagine the time required to evacuate and the intensity of the fire could vary between an Airport/ Mall and an Oil Refinery.

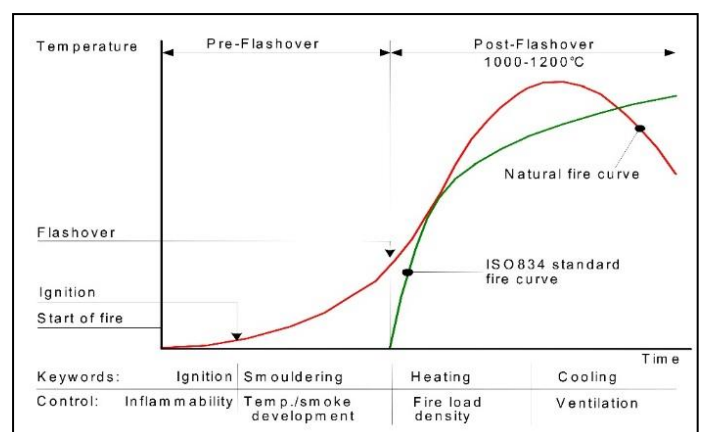


Fig. 2: Post Flashover Fire time temperature curve

The structure could be Steel, Timber, Concrete, Composite Structure, 3D printed or something else. There are also several methods to enhance the ability to maintain structural strength in a post-flashover fire. These are the methods which form the basis of material and solution development to bring about structural fire protection. Following are some popular examples:

- Intumescence: To increase in volume upon exposure to heat.
- Endothermic reaction: To absorb heat of the exposing fire and using that to decompose the material.
- Ablative reaction: To resist heat transfer by using the heat of the exposing fire to erode the material.
- Insulation: To resist heat transfer as the result of its low thermal conductivity.

5. Variables: Known & Unknown

The combinations of various types of structural elements and methodologies used to enhance the fire-resistance are already high. Often more than one method is used to develop and bring about a solution. Hence buyers need to be aware of several aspects to be aware of. Below are few of the lesser focused variables

6. Repeatability of Materials

Coatings, compounds, boards, paints and several types of materials often get manufactured in factories which are all gullible to changing supply-chain of raw materials, turnover of trained staff, breakdowns of equipment and measuring systems, as well as process changeovers. Not to forget the increasing amount of pressure to remain commercially viable and profitable with competitors who could have advantageous due to geography, policies or other means.

7. Compatibility

The effectiveness of most of these solutions is based on the compatibility between the solution and the substrate. Change in the substrate or its state or the ambient environment during application or installation will most likely change the response and end behavior; resulting in lack of assurance of the effectiveness of the solution.

8. Workmanship

Installations and applications to bring about Structural Fire Protection done in a control environment by trained experts (Say for conducting a fire test) is different from what may be happening on the site. Assurance of workmanship is most critical. Imagine a general car workshop claiming to assemble a car by buying all its parts from somewhere or the other. Would you drive such a car?

9. Maintenance

There are several planned and unplanned changes that happen about the Structural Fire Protection. Will the original fire protection remain after these changes? And who is keeping an eye out of it. Regular inspections during the lifetime of such critical installations are important.

10. Compliance Mechanism

10.1 Fire Testing

Conducting fire testing can get complex if several variables are factored in. For manufacturers, there is always a desire to cover maximum combinations with minimum tests. Below are some of the tests which are used to evaluate the materials and solutions used to bring about or enhance structural fire protection?

- EN 13381-1: Test methods for determining the contribution to the fire resistance of structural members - Part 1: Horizontal protective membranes
- EN 13381-2: Test methods for determining the contribution to the fire resistance of structural members - Part 2: Vertical protective membranes

- EN 13381-3: Test methods for determining the contribution to the fire resistance of structural members - Part 3: Applied protection to concrete members
- EN 13381-4: Test methods for determining the contribution to the fire resistance of structural members - Part 4: Applied passive protection to steel members
- EN 13381-5: Test methods for determining the contribution to the fire resistance of structural members - Part 5: Applied protection to concrete/profiled sheet steel composite member
- EN 13381-6: Test methods for determining the contribution to the fire resistance of structural members - Part 6: Applied protection to concrete filled hollow steel columns
- EN 13381-7: Test methods for determining the contribution to the fire resistance of structural members - Part 7: Applied protection to timber members
- EN 13381-8: Test methods for determining the contribution to the fire resistance of structural members - Part 8: Applied reactive protection to steel members
- EN 13381-9: Test methods for determining the contribution to the fire resistance of structural members - Part 9: Applied fire protection systems to steel beams with web openings
- EN 13381-10: Test methods for determining the contribution to the fire resistance of structural members - Part 10: Applied protection to solid steel bars in tension
- ISO 834-10*: Fire resistance tests — Elements of building construction — Part 10: Specific requirements to determine the contribution of applied fire protection materials to structural steel elements
- ISO 834-11*: Fire resistance tests — Elements of building construction — Part 11: Specific requirements for the assessment of fire protection to structural steel elements
- ISO 834-13*: Fire-resistance tests — Elements of building construction — Part 13: Requirements for the testing and assessment of applied fire protection to steel beams with web openings
- ISO 834-14*: Fire-resistance tests — Elements of building construction — Part 14: Requirements for the testing and assessment of applied fire protection to solid steel bar
- BS 476-23: Fire tests on building materials and structures. Methods for determination of the contribution of components to the fire resistance of a structure.

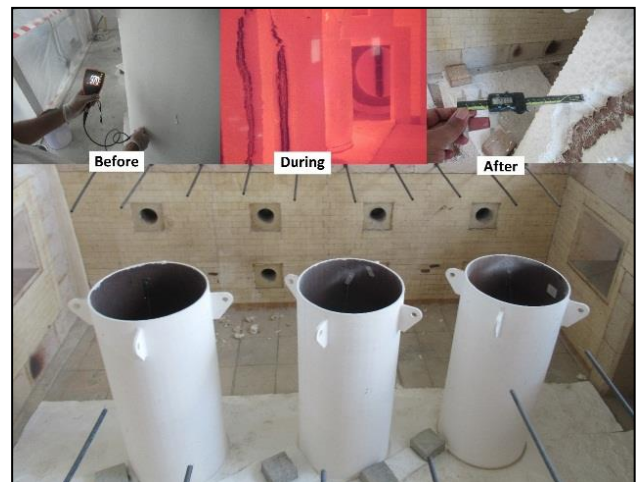


Fig. 3: Before, during & after a Fire Resistance Test

The Bureau of Indian Standards is a full member of ISO (International Organization for Standardization) and these standards can directly be adopted in Indian regulatory context. There are also other test methods which would have a system approach or an approach to test the specific evaluated system or solution. Below are some examples for such test methods

- ASTM E119: Standard Test Methods for Fire Tests of Building Construction and Materials, were developed to simulate a building fire
- ANSI/UL 263: the Standard for Safety of Fire Tests of Building Construction Materials
- BS 476-21: Fire tests on building materials and structures. Methods for determination of the fire resistance of load bearing elements of construction
- EN 1364-1: Fire resistance tests for non-loadbearing elements - Part 1: Walls
- EN 1364-2: Fire resistance tests for non-loadbearing elements - Part 2: Ceilings
- EN 1365-1: Fire resistance tests for loadbearing elements - Part 1: Walls
- EN 1365-2: Fire resistance tests for loadbearing elements - Part 1: Floors and roofs

There is now an exhaustive list of methods available to evaluate the efficacy of a material or a solution or even an installation in Laboratory Environment. While everything can be evaluated under more than one test method; the test results achieved only lead to establishing the capability of producing such a material or solution one time in the laboratory. At this stage we are still inside an R&D center of a manufacturer

10.2 Certification & Listing

Any activity undertaken to determine if a product or service meets specific requirements (usually contained in a standard) is named as ‘Conformity Assessment’. See Figure 4 from ISO’s CASCO committee’s presentation describing the levels of assurance.

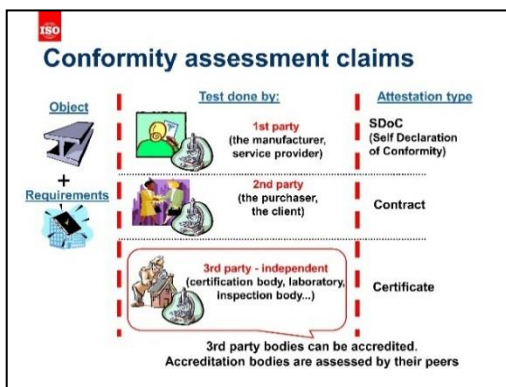


Fig. 4: Levels of Assurance

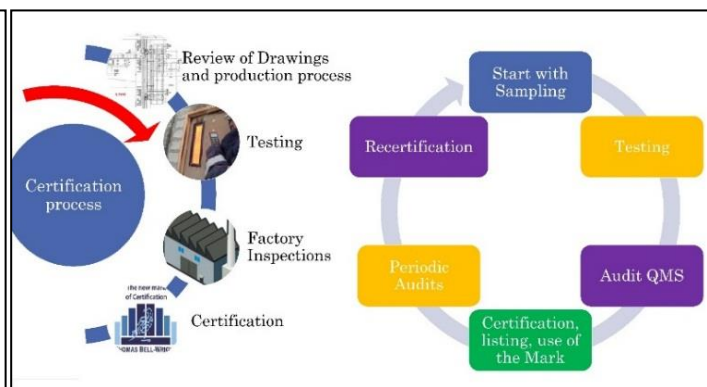


Fig. 5: General procedure for Certification & Listing

The general concept of certification & listing is described in Figure 5; but the exact methodology by which it can be conducted can vary between different certification bodies. Hence it is good to know and probably even define the type of certification program that could be acceptable considering the potential eventuality we are trying to avoid.

The ISO 17067(Fundamentals of product certification and guidelines for product certification schemes) guideline document defines how a Certification & Listing body needs to design and run their certification programs. The table in figure 6 was drawn from the standard which describes the fundamentals of product certification and provides guidelines for understanding, developing, operating or maintaining certification schemes for products, processes and services and was published as part of the code. As an example of how this is used: The UAE Fire & Life Safety Code of Practice mandates a Type 5 conformity program using Decree 213.

If the reader looks up the certification directories for some of the structural fire protection; the listings are detailed enough to assure repeatability and define compatibility. These listing reports also provide traceability information on what the product’s packaging and labelling should look like. There is also enough

Table 1 — Building a product certification scheme

Conformity assessment functions and activities ^a within product certification schemes		Types of product certification schemes ^b							
		1a	1b	2	3	4	5	6	N ^{c,d}
I	Selection , including planning and preparation activities, specification of requirements, e.g. normative documents, and sampling, as applicable	x	x	x	x	x	x	x	x
II	Determination of characteristics , as applicable, by: a) testing b) inspection c) design appraisal d) assessment of services or processes e) other determination activities, e.g. verification	x	x	x	x	x	x	x	x
III	Review Examining the evidence of conformity obtained during the determination stage to establish whether the specified requirements have been met	x	x	x	x	x	x	x	x
IV	Decision on certification Granting, maintaining, extending, reducing, suspending, withdrawing certification	x	x	x	x	x	x	x	x
V	Attestation, licensing a) issuing a certificate of conformity or other statement of conformity (attestation) b) granting the right to use certificates or other statements of conformity c) issuing a certificate of conformity for a batch of products d) granting the right to use marks of conformity (licensing) is based on surveillance (VI) or certification of a batch.	x	x	x	x	x	x	x	x
VI	Surveillance , as applicable (see 5.3.4 to 5.3.8), by: a) testing or inspection of samples from the open market b) testing or inspection of samples from the factory c) assessment of the production, the delivery of the service or the operation of the process d) management system audits combined with random tests or inspections			x		x	x		

^a Where applicable, the activities can be coupled with initial audit and surveillance audit of the applicant's management system (an example is given in ISO/IEC Guide 53) or initial assessment of the production process. The order in which the assessments are performed may vary and will be defined within the scheme.
^b An often used and well-tried model for a product certification scheme is described in ISO/IEC Guide 28; it is a product certification scheme corresponding to scheme type 5.
^c A product certification scheme includes at least the activities I, II, III, IV and V a).
^d The symbol N has been added to show an undefined number of possible other schemes, which can be based on different activities.

Fig. 6 Types of certification programs

information to inspect the installation or application to cross verify against what is assured and what is not.

These listings are the key guides which are available in public domain and provide all the means for verifying one of the most critical aspects of assuring fire safety: Structural Fire Safety.

This is where the rubber meets the road. All money spent for testing, certification & listing is wasted if they are incorrectly installed or applied or maintained. This is the most critical step of assurance. Unlike shopping done through online retailing where purchased goods can be sent back, it is always too late if incorrect installation is discovered after occupancy.

The standards ISO 17020 and ISO 17024 provide the constructs to evaluate organizations as well as individuals who could be claiming to have the capability to undertake installation or application inspections. Without measuring the measurer, there is risk of a gap in assurance. Hence it is critical to understand the availability of accredited inspection bodies and specify the same in Technical Regulations, Specification and Commercial Contracts. Figure 7 shows an application inspection in progress.



Fig. 7: Site Inspection

11. Conclusion

As a country aiming to join the 'developed countries' club by 2047 we need to understand compliance mechanisms to bring about assurance of "structural fire protection" to prevent accidents in the future of the buildings which are being designed now.

ABOUT THE AUTHOR:



Mr. Abhishek is an Engineer and a Post Graduate Diploma holder in Finance. He has been advocating the need for compliance to standards for improved safety and quality across industries for most of the last two decade. Presently he is Business Catalyst at Thomas Bell-Wright International Consultants, Dubai, UAE.

Article 2: Ground Sinking in Joshimath, Uttarakhand

Introduction:

On December 31, 2022, in news, Joshimath in Uttarakhand is sinking. With cracks appearing within a week in 46 more houses of Joshimath, the "sinking town", petrified locals have found themselves caught between the devil and the deep blue sea. On January 07, 2023, Friday, 9:32 am, scared locals say climate change and constant infrastructure development are to blame. Joshimath is the gateway to major Hindu and Sikh religious destinations like Badrinath, and Hemkund Sahib. Uttarakhand's "sinking town", Joshimath was on alert, Choppers were on standby for evacuation from danger zones. Uttarakhand Chief Minister Pushkar Singh Dhama visited the site on Saturday, to assess the situation following the collapse of a temple and several houses. He has ordered the immediate evacuation of around 600 families. On January 08, 2023, the Prime Minister, Chief Secretary of Uttarakhand and experts had a high-level meeting to discuss ground sinking aspects. More than 60 families were relocated and roads were cracked beyond their use. NDRF had deployed to take care of the safety of the citizens and experts are studying the situation for subsequent actions. The background of Uttarakhand and Joshimath may help to understand the problems and probable reasons for the sinking highlighted in this paper.

Background of Uttarakhand: Uttarakhand is known for the natural environment of the Himalayas. On November 9, 2000, the state of Uttaranchal- the 27th state of India was carved out of Uttar Pradesh, and in January 2007 the new state changed its name to Uttarakhand, meaning “Northern Region,” which was the traditional name for the area. The native people of Uttarakhand are generally called Uttarakhandi and specifically either Garhwali or Kumaoni depending on their place of origin in either the Garhwal or Kumaon region. Uttarakhand has a total area of 53,566 km², of which 86% is mountainous and 65% is covered by forest. Most of the northern part of the state is covered by high Himalayan peaks and glaciers. In the first half of the 19th century, the expanding development of Indian roads, railways and other physical infrastructure was giving rise to concerns over indiscriminate logging, particularly in the Himalayas. Two of the most important rivers in Hinduism originate in the glaciers of Uttarakhand, the Ganges at Gangotri and the Yamuna at Yamunotri. They are fed by myriad lakes, glacial melts and streams. These two along with Badrinath and Kedarnath form the Chota Char Dham, a holy pilgrimage for the Hindus. Uttarakhand lies on the southern slope of the Himalayas range, and the climate and vegetation vary greatly with elevation, from glaciers at the highest elevations to subtropical forests at the lower elevations. The highest elevations are covered by ice and bare rock. Below them, between 3,000 and 5,000 metres are the western Himalayan alpine shrub and meadows.



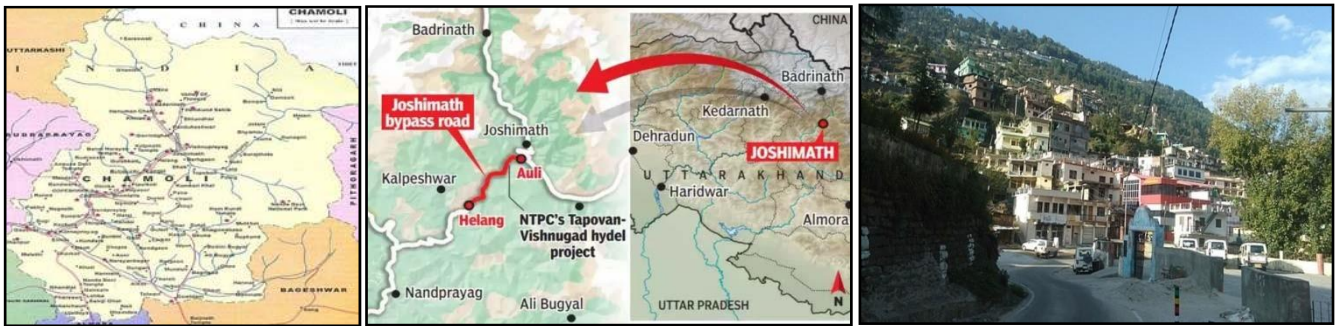
Uttarakhand Map



Garhwal and Kumaon Region

In June 2013 several days of extremely heavy rain in Uttarakhand caused devastating floods in the region, resulting in more than 5000 people missing and presumed dead. The flooding was referred to in the Indian media as a "Himalayan Tsunami". On 7 February 2021, floods emerged from the Nanda Devi mountain glaciers, devastating locations along the Rishi Ganga, Dhauliganga and Alaknanda Rivers, resulting in many people reported missing or killed, yet to be numbered. The damages include Rini village, several river dams and the Tapovan Vishnugad Hydropower Plant.

Background of Joshimath. It is described in the ancient scriptures as Kartikeyapura as it has been named after Kartikeya, the God of Katyuri kings. During winters, the town becomes home to Lord Badri, who is brought down from Badrinath to Vasudeva temple at Joshimath. It is also known as Jyotirmath, is a city and a municipal board in Chamoli District in Uttarakhand. Located at a height of 1875 m, it is a gateway to several Himalayan mountain climbing expeditions, trekking trails and pilgrim centres like Badrinath. It is located on the side of a hill in the Chamoli district of Uttarakhand. Joshimath is a hilly town located on the Rishikesh-Badrinath National Highway (NH-7) in the state of Uttarakhand. The city serves as a tourist town as it acts as an overnight rest stop for people visiting Badrinath, Auli, Valley of Flowers, and Hemkund Sahib, among other important religious and tourist locations in the state. Joshimath is also of great strategic importance to the Indian armed forces and is home to one of the Army's most important cantonments. It is home to one of the four cardinal pīthas established by Adi Shankara. Since 7 February 2021, the area was severely affected by the 2021 Uttarakhand flood and its aftermath. Tapovan has situated 10 km from Joshimath. It has natural hot water springs. The river Dhauliganga is visible from this spot



Chamoli District Map

Joshimath Location

Houses Sinking and Tilting

Importance of Joshimath:

- For decades on end, the town of Joshimath has been a centre of faith, and a spiritual getaway in the mighty Himalayas. Located on National Highway 7, at a height of 1875 m, it is the doorway to the holy shrines of Badrinath and Hemkund Saheb, the picturesque Valley of Flowers, and Auli.
- It is home to one of the four cardinal pīthas established by Adi Shankara, the great Hindu philosopher and guru, Adi Shankaracharya in the 8th century C.E. To promote Hinduism, Adi Shankara ensconced the four cardinal 'mathas' or monasteries in different parts of India, among which Joshimath or Joyotirmath was the first-ever northern monastery. Vasu Dev was of Buddhist origin, but later followed Brahminical practices and the brahminical practices of Katyuri kings, in general, are sometimes attributed to a vigorous campaign of Adi Shankara (788-820 CE). Katyuri kings were displaced by the Panwar dynasty in the 11th century CE.
- Between the 7th and 11th centuries C.E., Katyuri kings, ruled an area of varying extent from their capital at "Katyur" (modern day Baijnath) valley in Kumaon. The Katyuri dynasty was founded by Vasudev Katyuri. The ancient Basdeo temple at Joshimath is attributed to Vasu Dev.
- It has strategic significance too; home as it is to the Joshimath Cantonment, the permanent station of the Garwhal Scouts, close to the Indo-Tibetan Border.
- Chamoli district of Uttarakhand, which houses the township of Joshimath, falls in **Zone V of the seismic zonation** map of India and is particularly vulnerable to landslides.

Rivers and Temples. The various confluences of tributaries of the Ganges are another attraction around Joshimath, especially on route from Rishikesh. The closest such Prayag, meaning confluence is Vishnuprayag. A mesmerising sight, the two rivers meet at these important junctions and are a treat for any nature lover. The Alakananda River one of the two main source streams for the Ganga River originates near the Indo-Tibetan border near the village of Mana and flows through the town of Badrinath. As Joshimath arrives the river is joined by the Dhauli Ganga River at Vishnuprayag. This stretch of the river is popularly referred to as Vishnu Ganga. As the Alakananda cascades down the mountains it meets the Mandakini River in this quaint town of Nandaprayag. It was once the capital of the Yadu kingdom and is named after the Yadava king Nanda, the foster father of the god Krishna. Named after Karna, Karnaprayag is the confluence of the Pindar River, which originates in the Nanda Devi Mountain range with the Alakananda River. This place is mentioned in Kalidasa's epic Meghaduta and is also the site of Swami Vivekananda's 18-day meditation. There is also an ancient temple dedicated to the goddess Parvati, in the form of Uma Devi. Rudraprayag is the site of the merging of the Mandakini River with the Alakananda River. This site is dedicated to Lord Shiva's Rudra avatar. It is said that Shiva performed his Tandava dance here, the source of all creation and destruction. He also is said to have played his favourite musical instrument, the Rudra Veena here. Devprayag is considered the holiest of the confluences in Hinduism, on par with the Triveni Sangam in Allahabad. The river after this point is now referred to as Ganga after the confluence of both the headstreams: Bhagirathi, flowing

rapidly on a steep slope and Alakananda, flowing with a smooth, unruffled surface. This site is watched by millions as they descend here to pray at the site believed to be naval of the god Vishnu.

Characteristic of Soil in Joshimath. Soil is the thin uppermost layer of the earth's crust. It supports all forests, grasslands and crops from which all living creatures on earth derive their food. In the hilly mountainous Himalayan region, the soils found are mountain soils. These soils include peat, meadow, forest and hill soils. The soils found at the project site are entisols comprising mainly a combination of younger alluvial and old alluvial soil. The soil of the area is basically the product of a fluvial process of the river Alaknanda and its tributaries. The alluvial soil of the area is dry, porous, sandy, and faint yellow and consists of clay and organic matter. It is slightly acidic in reaction. The new alluvial is less acidic as compared to the old alluvial. Its pH value varies from 5.5 to 9.0 the old alluvial on the other hand occurs in the upper and middle parts of the valleys. These deposits contain alternating beds of pebbles, gravel or boulder with loose sand and clays.

2021 Glacial Outburst Flood. A part of the Nanda Devi glacier breaks off in Nanda Devi National Park in Uttarakhand's Chamoli district on 7 February 2021, causing a flash flood in Rishiganga and Dhauliganga River, devastating among others the village Rini, the Dhauliganga Dam, the Rishi Gangadam, Tapovan Vishnugad Hydropower Plant, killing and endangering people, according to media. At least 31 people are confirmed to have been killed and around 165 were reported missing after the flash flood. A PTI report put the number of workers missing at 150.

Reasons for Ground Sinking in Joshimath of this Himalayan Town:

News reports say that cracks have appeared in 560 houses in the town and roads and fields have also been similarly affected. Besides these, the poles of high-tension power lines are also becoming slanted. Residents say that malt and apple trees have begun collapsing into the ground. The Himalayan town of Joshimath is sinking and its residents have been sleeping outdoors in the freezing cold in fear of an imminent collapse of their houses – a number of which have developed huge ominous cracks. It is happening beneath the ground of this hilly town that is being slowly swallowed by the mountains. A Himalayan town is sinking and its residents are up in arms against fresh construction in the area as their houses, roads and agricultural fields develop huge cracks, ominously warning of a disaster waiting to happen. Many residents have been evacuated but they are still protesting as they demand permanent rehabilitation from the state government. They also want all kinds of construction work in the area to stop including the ongoing Char Dham project which aims for all-weather connectivity between the four major pilgrimage sites in the Indian Himalayas.

The Subsidence of Joshimath. Since the New Year 2023, Joshimath has had a dangerous new identity for its 20,000 residents, a town that they fear is sinking. The reasons for this subsidence, experts believe, are not new; they are: (a) Haphazard construction on fragile mountain terrains that have loose rock. (b) The seepage of water subsurface. (c) Erosion of topsoil, and (d) Local streams change their course because of man-made factors that block their natural flow. (e) The town is geologically sensitive, situated on an east-west running ridge to the southwest of Vishnuprayag, the confluence of the Dhauliganga and Alaknanda rivers. (f) The gneissic rocks in Joshimath are highly weathered with low cohesive value. (g) The subsidence itself is not new either, first flagged in the 1976 state government-appointed Mishra Commission report. (h) It is aggravation over the past two years, causing cracks in homes, rendering them unstable and prompting some to flee, calls for urgent action. (i) In August 2022, the state government set up a multi-institutional team to conduct a joint geological and geotechnical survey of Joshimath to ascertain the causes of ongoing subsidence and suggest remedial measures. In its findings, the committee found that unplanned developmental activities, periodic seismic activities, and the absence of the assessment of the carrying capacity of the ground have burdened the fragile mountain slopes on which the town rests.

Joshimath came upon an ancient landslide site, reports say. With rapid urbanization, greater stress piled on this fragile Himalayan town. The missing scoop of earth detected on Google Earth illustrates the 'slope problem' of Joshimath. Researchers say that historically these problems are exacerbated by

urbanization since it disrupts natural water drainage, undercuts slopes and also results in the uncontrolled discharge of water. People rushed out of their homes when water started seeping out of the 'Joshimath rock'. Twelve years ago a similar aquifer burst had led to water flowing into the town. Aquifers are underground water resources. In Joshimath, reckless construction has led to the water discharge from these places, leading to the ground above it subsiding.

The town is situated on a running ridge that is cut through by streams that descend steeply from Vishnuprayag, the point where the Dhauliganga and Alaknanda rivers converge. According to a report from 2022, there are numerous heavy layers of overburdened material covering the area near Joshimath. The town's geography is the main factor contributing to Joshimath's sinking. Experts have long warned that the landslide debris on which the city was built has a low bearing capacity and cannot support a high rate of construction. The slopes have become extremely unstable in the last few decades due to increased construction, hydroelectric projects, and the widening of the National Highway.

Researchers from the Wadia Institute of Himalayan Geology surveyed in 2022 and found that these gneissic rocks are highly weathered, have a low cohesive value, and have a propensity for high pore pressure when saturated with water, especially during monsoons. Other factors contributing to the fate of the city include erosion brought on by streams flowing from Vishnuprayag and sliding along natural streams. Old landslide debris including boulders, gneissic rocks, and loose soil has covered the area's strewn rocks.

The cracks are such that they can cause damage to life and property. Essentially, the land and the soil under Joshimath have a low capacity of holding together, especially when burdened with extra construction. "Seepage from streams uphill has been observed, which may have loosened the soil of Joshimath. The Nalas disappear underground and arise over the ground downhill, bringing totally muddy water, and then join the Dhauliganga or the Alaknanda (beyond Vishnuprayag). The drainage system of the town of Joshimath is not well maintained. Wastewater from the days' usage flows through improper drains," a 2006 report by Dr. Swapnamita Vaideswaran, Scientist, Wadia Institute of Himalayan Geology revealed. "The Nalas has been blocked by sludge that came from the 2013 Himalayan Tsunami, which also facilitated the toe erosion in the region. The Rishiganga flood disaster also worsened the situation, followed by incessant rainfall between August to October 2021.

The Nalas have been blocked by sludge that came from the 2013 Himalayan Tsunami, which also facilitated toe erosion in the region. The Rishiganga flood disaster also worsened the situation, followed by incessant rainfall between August to October 2021. One of the most important aspects that require investigation and development is drainage planning. As more and more waste seeps into the soil, loosening it from within, the city is suffering from poor drainage and sewer management. The state government has requested that the irrigation department look into the situation and develop a new plan for the drainage system. In order to preserve the soil capacity in the area, experts have also recommended replanting, particularly at vulnerable sites. To save Joshimath, there needs to be a coordinated effort between the government and civil organisations with the help of military organisations like the BRO.

Experts say warning bells started ringing in 1976. A recent survey by a team of experts confirmed what many locals had been fearing: the city is actually sinking at its base. According to Chief Minister Pushkar Singh Dhami, the circumstances in Joshimath are being closely watched. In essence, the soil and land beneath Joshimath have a low capacity to hold together Joshimath, a small town in Uttarakhand that was built on the site of an ancient landslide, is situated in the foothills of the Himalayas and has experienced rapid growth in both construction and population in recent years. The city, which serves as Lord Badrinath's winter residence, a staging area for troops stationed along the Sino-Indian border, and a sort of base camp for Himalayan expeditions, is in the news for the wrong reason right now: it is sinking. Residents are protesting and expressing worry about the collapse of the town's foundation. In order to prevent their homes from collapsing under their own weight, the

residents claim that their houses have developed cracks and that they are compelled to find support structures. There are cracks in more than 500 homes in the area.

Scientists and geologists working in the area have been sounding the alarm for decades. The first such report indicating the grave problem that could threaten life and property came in 1976. That report by the government-appointed Mishra Commission pointed to a crucial piece of information: Joshimath is located on the site of an ancient landslide. Times of India reported about a Mishra committee report of 1976 that the newspaper accessed and which predicted the future possibility of Joshimath sinking due to urbanization. Residents who had then rejected the report now rue that they did not heed the committee's findings. They also blame successive governments for not taking the threat seriously. The 1976 panel comprising members from the Army, ITBP, BRO, Shri Kedarnath-Badrinath Temple committee and local administration had warned that depleting natural forest cover and blasting stones near the area would disrupt the fragile balance of Joshimath which came upon an ancient landslide site. Old-timers say that heavy rain and floods from the Raini area of the Alaknanda River started eroding the bottom soil of Joshimath. The 70s panel was formed to find the cause of frequent landslides and short-term as well as long-term solutions for it.

Locals also blame a 12 km-long tunnel for National Thermal Power Corporation's (NTPC) Tapovan-Vishnugad 520 MW hydropower project for the damages in Joshimath. A flash flood hit this project in 2021, killing 200 people. NTPC officials had reportedly taken a group of journalists to view the tunnel and show that there were no leakages inside the structure. Residents had claimed that the punctured aquifer near Joshimath was causing seepage inside the tunnel as well. However, Joshimath has faced the brunt of several years of rampant construction on an unstable foundation where an aquifer burst had already made the land subsidence-prone. Experts advise that all construction and hydroelectric projects in the area be stopped immediately. The residents must first move to a safer area, and only then should the town's planning be revised to account for the new variables and shifting geographical conditions.

What can be done to save Joshimath?

Experts recommend a complete shutdown of development and hydroelectric projects in the region. But the urgent need is to relocate the residents to a safer place and then reimagine the town's planning to accommodate the new variables and the changing geographical factors. Drainage planning is one of the biggest factors that need to be studied and redeveloped. The city is suffering from poor drainage and sewer management as more and more waste is seeping into the soil, loosening it from within. The irrigation department has been asked by the state government to look into the issue and create a new plan for the drainage system. Experts have also suggested replantation in the region, especially at the vulnerable sites to retain soil capacity. There is a need for a coordinated effort between the government and civil bodies with the aid of military organizations like the BRO to save Joshimath.

The reasons for this subsidence, experts believe, are not new; they are: (a) Haphazard construction on fragile mountain terrains that have loose rock. (b) The seepage of water subsurface. (c) Erosion of topsoil and Local streams change their course because of man-made factors that block their natural flow. The town is geologically sensitive, situated on an east-west running ridge to the southwest of Vishnuprayag, the confluence of the Dhauliganga and Alaknanda rivers. The gneissic rocks in Joshimath are highly weathered with low cohesive value. The subsidence itself is not new either, first flagged in the 1976 state government-appointed Mishra Commission report. But its aggravation over the past two years, causing cracks in homes, rendering them unstable and prompting some to flee, calls for urgent action. In August 2022, the state government set up a multi-institutional team to conduct a joint geological and geotechnical survey of Joshimath to ascertain the causes of ongoing subsidence and suggest remedial measures. In its findings, the committee found that unplanned developmental activities, periodic seismic activities, and the absence of the assessment of the carrying capacity of the ground have burdened the fragile mountain slopes on which the town rests.

Guiding Points for the Safety of the Public. (a) The Centre has formed an expert panel to conduct a "rapid study" of land subsidence. A committee will study the effects of the sinking of land on human settlements, buildings, highways, infrastructure, and riverine systems, officials said. (b) "Saving lives is our first priority. Officials have been asked to shift around 600 families living in endangered houses in Joshimath to safe locations," Chief Minister Dhama said, adding that both immediate and long-term action plans should be prepared immediately. (c) Medical treatment facilities should be available on the ground and arrangements for airlifting people should also be made, the Chief Minister further said, while ordering expedited work on the treatment of danger zones, sewer, and drainage. (d) A temple collapsed here on Friday evening, and several houses have developed huge cracks, alarming residents living under constant fear of a major disaster. (e) Locals say climate change and constant infrastructure development are to blame. Experts argue that a variety of factors -- relating to both human activity and nature have led to the subsidence. The factors are not recent, they have built up over a long period of time, director of the Wadia Institute of Himalayan Geology Kalachand Sain has said. (f) Mr Dhama said a disaster control room should also be set up in the town, and there should be the adequate deployment of both the state and national disaster response forces. Helicopter services will also be made available to help affected people. (g) Joshimath is the gateway to major Hindu and Sikh religious destinations like Badrinath and Hemkund Sahib. It also houses one of the major military bases near India's border with China. (h) The Auli ropeway, which is Asia's biggest, has been stopped after a huge crack developed beneath it. (i) The Marwari area in the town, where an aquifer bursts, is said to be the worst hit as water is constantly flowing down with great force. (j) All construction activities related to mega projects like the Chardham all-weather road (Helang- Marwari bypass) and the NTPC's hydel project have been stopped till further orders on the demand of residents. The state government has said people whose houses are affected and have to vacate will get ₹ 4,000 a month as rent for the next six months from the Chief Minister's Relief Fund. (k) Surveys are already being carried out and Uttarakhand Chief Minister Pushkar Dhama assured that the disaster management team has been alerted and arrangements for the security of residents were being made.

Summary:

Astronaut reveals that Earth was formed by repeated bombardment from space elements. For the first half billion years of its existence, the surface of the Earth was repeatedly pulverized by asteroids and comets of all sizes. As Earth cooled, water vapour in the atmosphere condensed and rained out to form oceans. The surface of the earth during this period was extremely hot with numerous volcanoes. Hence, all the mountains are not the same. May be hard or soft depending on the way the mountain formed. We need to find the suitability of heavy construction, storage of water for hydro projects, blasting of rocks for roads and other construction activities.

Geologists, Rock specialists and soil consultants are needed to study the rock and surface soil to get information for construction activities. Subsoil investigation more than 40m deep at about 50m intervals, the study of the underground movement of soil and water, and soil liquefaction are necessary. Joshimath is in Earthquake Zone V, at this time any earthquake will result in unimaginable damage to humans and properties.

Deep high-pressure concrete grouting by injection, arresting landslides by the Gabion method and regulating the underground drainage system is the possible action to improve the stability of the sub-surface to protect the Joshimath area. These activities amount to be more costly, the adequacy and confidence are the questions.

Soil is available plenty, hence its importance is ignored. One cannot take the soil for granted. "Unfortunately, soils are made by nature and not by man and the products are always complex..." ~ Terzaghi, Father of Soil Mechanics. When mother earth is not supportive of construction activities, one has to offer more money to fulfil her requirements. People always perform Boomi Pooja before commencing the construction work to get the blessing of mother earth.

"Treat the earth well: it was not given to you by your parents, it was loaned to you by your children. We do not inherit the Earth from our Ancestors; we borrow it from our Children." - Ancient American Indian Proverb

About the Author:



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***Disclaimer:** The opinions expressed in this article are the author's own and do not reflect the view of the IAStructE.

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IAStructE has set up a library at K-69 A, Basement Kalkaji, New Delhi. It has a collection of good technical books and journals related to civil & structural engineering. Members staying in the vicinity are encouraged to utilize this facility, and if you want to contribute your books and journal to the library you are always welcomed.



Fig 6. IAStructE Library

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IAStructE has launched a new programme for accreditation of structural engineering practitioners. Upon successful completion of the process, the practicing structural engineer will be recognised as “Chartered Structural Engineer – IAStructE”. The program is suitable for practicing structural engineers who have experience in the structural design field and have a good understanding of applicable design codes/standards in India. This accreditation will help Structural Engineers in India to set a benchmark of proven professional & technical excellence and raise the levels of structural engineering practice in the Country.

The entire program would be on the basis of a two-stage process consisting of an interview for the assessment of Initial Professional Development (IPD) followed by a written examination based on actual problem-solving. Both stages are mandatory to clear the assessment process and thus to get the recognition. Applicants have to demonstrate their competence in the designated 13 core objectives on which they will be assessed during the interview. The applicant would then require to clear the examination by answering any single chosen question from the options given in the question paper with a minimum level of marks stipulated. This assessment process will be held bi-annually, being initiated in January & July respectively.

A Chartered Structural Engineer – IAStructE is someone who wishes to:

- Validate their comprehensive experience and understanding of all types of structural engineering work and managerial capabilities
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A booklet giving detailed information about the entire process along with the application form and Annexures, required to be submitted, are available on IAStructE website, which can be accessed from the following link: <https://www.iastructe.co.in/booklet-cse-iastructe-accreditation-program.pdf>



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 its 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.

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