<u>**Proposal for announcing seat under the Institute Internship Program**</u>

1. Name of faculty member proposing: **Dr. Jagajyoti Panda**

2. Department/Centre: **National Centre for Disaster Mitigation & Management (NCDMM)**

3. Topic on which work is proposed:
   Seismic Performance Assessment of Precast Structural Systems: From Nonlinear Static to Incremental Dynamic Analysis

4. Preferred period of internship (after May 20th): **25 May, 2024 to 25 July, 2024**

5. Qualification of student (branch/semester of study):
   Branch: **Civil Engineering**,
          B.Tech. 6th Semester (completed) or M.Tech. 2nd Semester (completed).

6. Brief description of work (300-500 words):

   Introduction
   In recent decades, India has seen tremendous urban development, and the Central Government's programs on "Housing for All" and "Smart City Mission" have given additional impetus to the quest for alternative technologies. The severe housing shortages in the EWS and LIG categories forced India's building industry to innovate and embrace smart construction technologies to provide quality mass housing which is sustainable and inclusive. To assure speed, safety, strength, and sustainability, precast moment resisting frame technology for smart building has emerged as a favored and most viable alternative to traditional in-situ construction procedures. Prefab technology for smart building would be beneficial in achieving: (1) government's critical aims of "housing for all" and "smart cities" and (2) the commitment to inclusive and sustainable development.

   Problem Statement
   The precast moment resisting frame system utilizes self-compacting concrete (SCC) of appropriate grade to join various structural building components forming structural skeleton. <u>Protruding reinforcing bars of</u> <u>one structural element are anchored into the in-situ SCC of the adjoining elements to provide moment resistant connections,</u> which include: (i) sub-structure to super-structure connections, (ii) column beam connections, (iii) beam slab connections as presented in Figure 1. Numerous studies have been carried out to investigate the performance of such structures and their connections under dead, imposed, and wind loads, as well as other secondary effects, e.g., shrinkage, creep, temperature, handling, lifting, and erection etc. However, <u>investigation on progressive collapse performance of prefab systems and connections during earthquakes, both near-fault and far-fault, is rare</u>. Thus, for the implementation of this 3-S system on various high-rise building projects, it is imperative to study the <u>progressive collapse mechanism of 3-S element connections during strong ground shakings</u>.
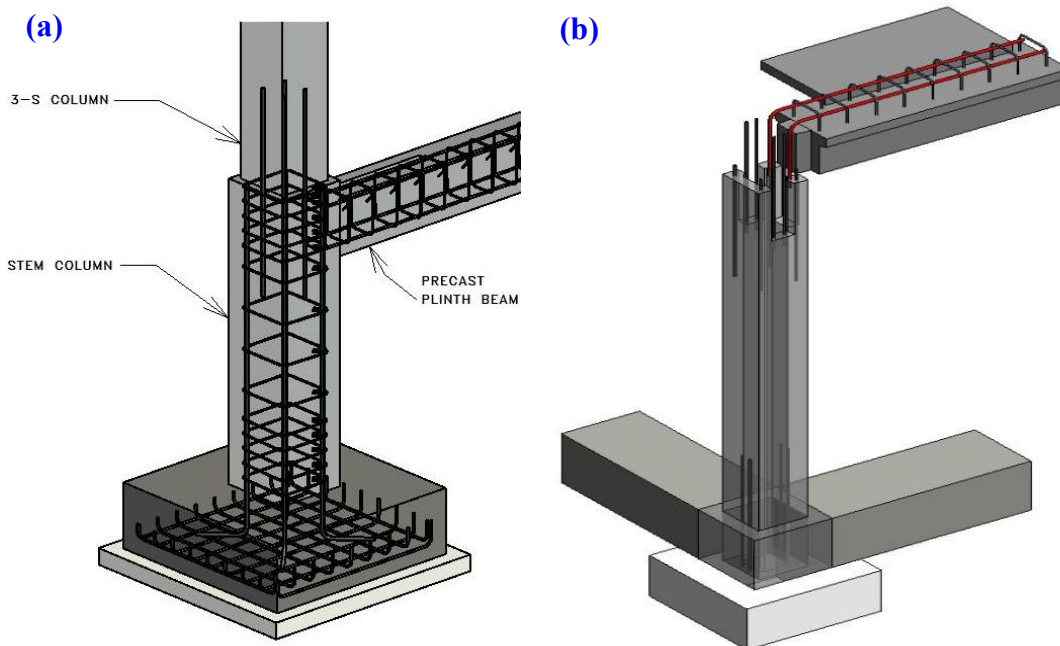
Figure 1 Connections details of (a) sub-structure to super-structure and (b) precast moment resisting frame column beam assembly

Objectives

The objective of this study is to comprehensively evaluate the seismic performance of a representative precast moment resisting frame multi-storied building model designed for Seismic Zone IV. The study will focus on:

A1: Design and detailing of a prefab reinforced concrete (RC) frame building as per the guidelines of IS1893:part 1 (2016) specified seismic zone IV.

A2: Perform nonlinear static pushover analysis (NSPA) to estimate the seismic behaviour of the building and the formation of plastic hinges in the structural members.

A3: Understand the progressive collapse mechanism of element connections through advanced incremental dynamic analysis (IDA).

Overall, the aforementioned objectives seek to contribute to the advancement of seismic engineering practices by providing a comprehensive evaluation of multi-storied building model in Seismic Zone IV, along with recommendations for enhancing their seismic performance through specific joint and connection detailing.

7. Expected learning of student (upto 100 words):

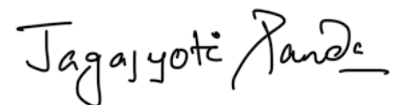Through the proposed work, the expected learning is threefold:

1. To understand the concepts of precast technology, in terms of construction methodology, imparting quality, and safety in construction, against the prevalent cast-in-situ construction practice.

2. To evaluate the behaviour of various joints of precast moment resisting frame system under all design loads including earthquake load. This involves evaluating factors such as structural integrity, stability, and overall behavior during seismic events.

3. To be familiar with the existing nonlinear seismic analyses and their applications in the context of Indian standard IS1893:part 1(2016).

8. Nature of work: (Experimental/simulation/mathematical modelling/data collection-analysis etc.): upto 50 words

The proposed work will involve conducting **numerical simulations** using a finite element (FE) program. Furthermore, the outcomes from these simulations will be analysed using computational tools such as **MATLAB and Python**.

9. If the seat is under project sponsored category: Yes/**No**
   a) If yes, number of seats announced:
   b) Name and ID no. of project from which stipend is chargeable

Date: 06.05.2024

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Assistant Professor

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