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SEISMIC ANALYSIS OF PRECAST CONCRETE DIAPHRAGMS AND THEIR CONNECTIONS

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ABSTRACT
The precast solid structures are high predominance and rapid development with the confirmation of sturdiness. Additionally there would be a lessening in site work, formwork and possible mischief during arthquake. In all probability due to nonattendance of cognizance of the central 'thought of precast concrete during seismic tremor these couldn't get a spot in India till continuous past. Truth be told with accessible instruments and plan methods of reasoning fashioner of precast solid structures can make a structure which won't just endure a seismic tremor however will be exposed to a practically nothing, assuming any, harm. Appealing for this is the authority and limit of opposition being developed practice the introduction of precast strong structures depends upon the lead of affiliations. In low seismic district where gravity loads administer the plan of structures, precast development have been broadly utilized on the grounds that to make the recommendations to codal provision to improve the performance of these structural systems in future seismic events with the help of software.
Indian guidelines of development don't give critical significance to seismic plan of precast development. A part of the issues which need speedy thought in the Indian advancement models have been recognized as referenced at the present time. The precast strong structures are as of now by and large recognized as a money related, basically solid and compositionally flexible type of development. From writing it is presumed that precast development is constantly expanding and have gotten mainstream even in Seismic touchy nation.

INTRODUCTION

The precast solid structures are high caliber and expedient development with the confirmation of toughness. What's more there would be a decrease in site work, formwork and conceivable harm during earthquake. Probably due to lack of understanding of the basic 'nature of precast concrete during earthquake these couldn't get a spot in India till late past. Actually with accessible apparatuses and plan methods of reasoning originator of precast solid structures can make a structure which won't just endure
This innovation has numerous favorable circumstances over the customary cast in situ development. For instance: better quality control, sturdiness, lesser need of formwork, adaptability, control of creep and shrinkage, better completion, low upkeep, long ranges/substantial burdens, social and development might be structured and built to work as stomach, yet specific issues emerge in precast solid floors which contain singular units, such a shallow cored or twofold tee floors. Precast floor frameworks comprise of various units

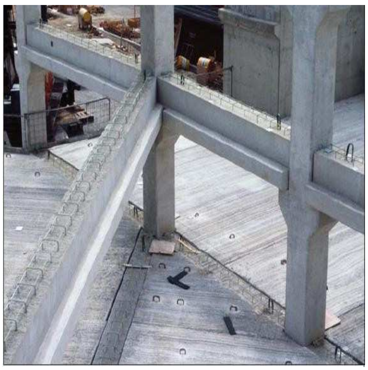

Figure 1 Construction of Typical Precast Building.

THEORY AND FORMULATION

The conduct of the floor/rooftop frameworks affected by gravity loads is entrenched when contrast with for the floor stomach when exposed to seismic burden. The capacity of a stomach is to get and oppose parallel loads by going about as a flat profound pillar and transmit the heaps to horizontal opposing components which convey the sidelong loads to the establishment. Along these lines, while the job of ond, and with regards to seismic structure, move the inertial powers that create in a seismic occasion purported stomach activity.

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CLASSIFICATIONS

Un topped Diaphragm- An un topped diaphragm refers to a floor system comprised only of precast units. In this case, diaphragm action must be provided by the precast units and the connections between the precast units.

Topped Non-composite Diaphragm- Associations between the precast units can exist with the end goal of erection steadiness, usefulness, or auxiliary respectability however are not part of the proper stomach plan. The bested non composite stomach is the regular development utilized as of now in high seismic zones.

Topped Composite Diaphragm- Topping slabs also experience tension due to restraint of differential shrinkage between the topping and the precast elements or metal deck (which has zero shrinkage) that should be considered in reinforcing the slab (ACI 318:2008).
The main benefits from composite action are in increased bending resistance and flexural stiffness. There are however a number of reasons why a structural topping may be specified, such as; to allow easier continuous ties in plans with irregular shapes or large openings, to, the additional topping weight increases the seismic design forces. It is suggested that a topping be considered in high seismic zones in buildings with plan irregularities or large diaphragm span to depth ratios.

Flexible or rigid diaphragms
Diaphragms are classified as "rigid", "flexible", and ". In the case of rigid diaphragms, the diaphragm deflection when compared to that of the to be rigid when compared to the lateral-resisting elements. For most low and mid-rise structures in low seismic risk areas, an assumption of a rigid diaphragm will be reasonable.

A flexible diaphragm distributes lateral loads to the VLLR elements as a series of simple beams spanning between these elements**.** Recent studies showed that diaphragm flexibility could result in greater participation of higher modes in the dynamic response of parking structures and that this could lead to substantially different seismic behavior than that from the commonly used first mode- dominated dynamic response in which diaphragms are assumed to be rigid. Higher accelerations and deformations can be induced in more flexible in-plane elements.

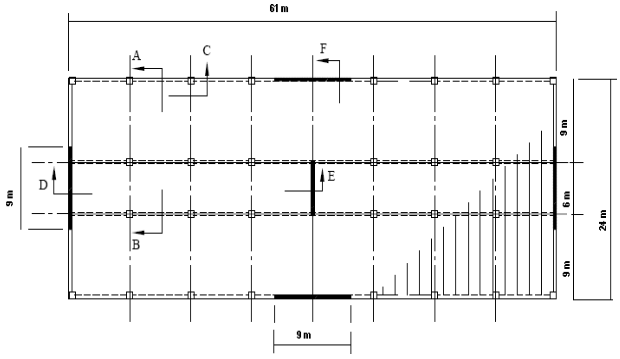

Figure. 2 Diaphragm bending moments.

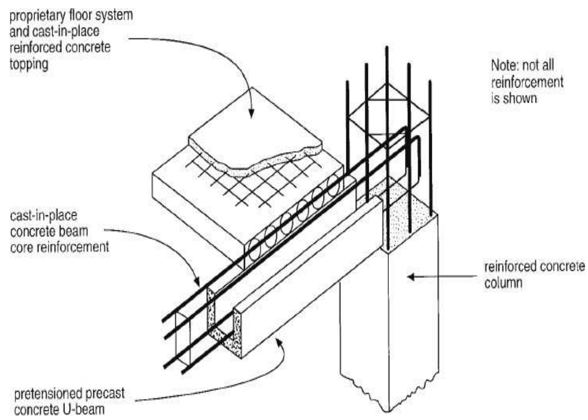

Figure 3 Typical Connections of Beam, Column, and Slab.

DESIGN OF A HOLLOW CORE

Design of 200 mm deep hollow core slab – Effective span – 4 m = 4000 mm

Therefore, the factor load =12.5 Kn/m^2 X 1.5 = 18.75 Kn/m^2 Moment for normal loading = $WL^2/8$

= 25 Knm/m = 25 X 1.2 = 30 Knm per mtr.
Moment for factored loading = $WL^2/8$
= 18.75 X $4^2/8$ = 37.5 KNm/m

Now, design in shear
V_u = WL/2

= 18.75 X 4 /2
= 37.5 Kn/m X 1.2 (for unit width)
= 45 KN per unit.

Referring to the design chat 5.1 Pg 239 (By using Kim .S. Elliott) Since the moment is M_s= 30 Knm , M_u= 45 Knm. Therefore, using type unit 15SS7322, therefore the % of steel provided
Will be .171% A_c (1200 x 200)i.e 4 bars of using (452.16 mm^2). (As shown in figure 10)

DESIGN IN BEARING

The active bearing length is taken as the least of-
1. The genuine bearing length of the levied affiliate i.e. 1200 mm. 2. One half of (i) + 100 mm i.e. 1200/2 +100 mm = 700 mm
3. 600 mm.

Net bearing width = 75 -15 = 60 mm

MODELING & DESIGN

In the present work a balanced 6-celebrated, fabricating exposed to live heap of 5 KN/m2. as: Design of Solid Pre-stressed units and RCC units are as per IS-1343:1983 and IS-456:2000. Designs of diaphragms are as per Uniform Building Code (UBC) 1994.

The grade of concrete used is M20 and steel for main and transverse reinforcement is Fe 415, for pre-stressed precast slab M30 grade of concrete is used, pre-stressing R/F strength is taken as 1800Mpa. Structure analysis (Linear structural analysis) and design are carried out as per PCI design manual: 1995.

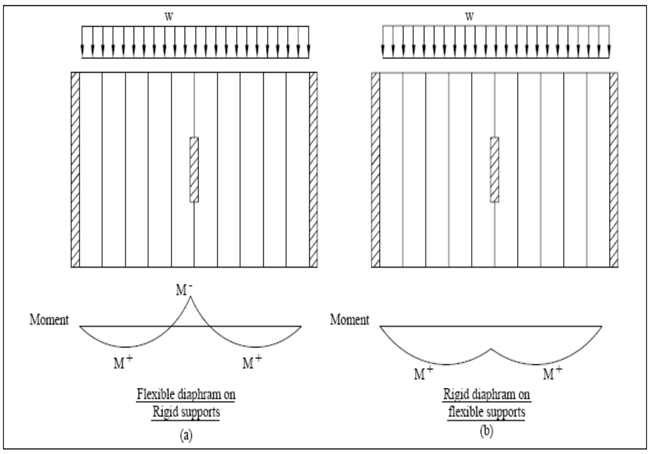

Figure 4 Typical Layouts.

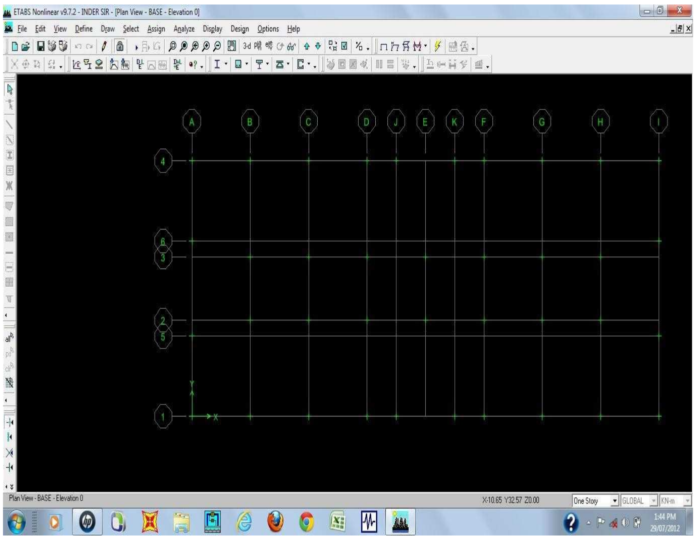

Figure 5 The typical plan is modeled in SAP 2000 for diaphragm freight examination all units in mts

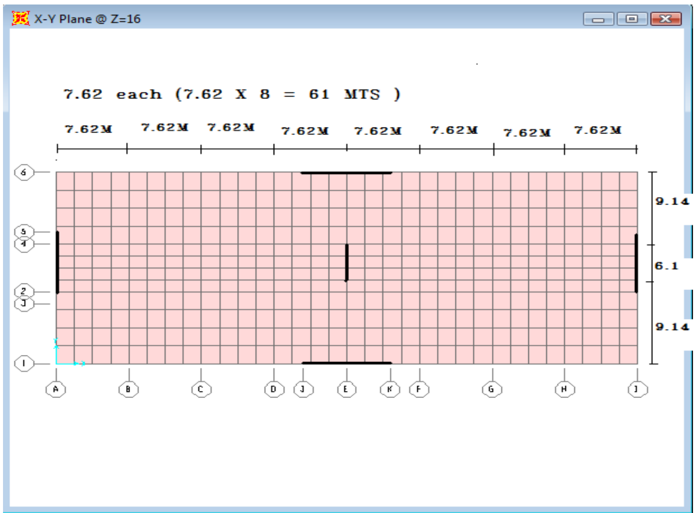

Figure 6 The typical plot is modeled in ETABS 9.2 for diaphragm freight examination.

DESIGN

Indian gauges are utilized for investigation and structure at every possible opportunity and correlation is given in the underneath table and structure of stomach is given for seismic zone 5.

Assuming a stiff soil of depth > 60 m Hence S = 1.2

Area of outer shear wall, $A_{e1} = 9 \times 0.1 = 0.9\ m^2$ Area of inner shear wall, $A_{e2} = 6 \times 0.1 = 0.6\ m^2$

$A_c = \sum A_e \times [0.2 + (D_e/h_n)^2] = 0.9$

$\times [0.2 + (2.14)^2] + 0.6 \times [0.2 + (1.42)^2] + 0.9 \times [0.2 + (2.14)^2] = 10.29\ m^2$

$C_t = 0.1 / (\sqrt{A_c}) \geq 0.02 = 0.1 / (\sqrt{10.29}) = 0.03 > 0.02$ Hence, $C_t = 0.03$

Period of structure $T = C_t \times (h_n)^{2/3}$ Period of structure T = 0.1162 sec $C = 1.25 \times S / T^{2/3} \leq 2.75$

$C = 1.25 \times 1.2 / 0.1162^{2/3} = 6.3 > 2.75$ Hence, C = 2.75

Base shear, $V = Z \times I \times C \times W / R_W = 0.15 \times (1.0) \times (2.75) \times (52362) / 8 = 2700kN$

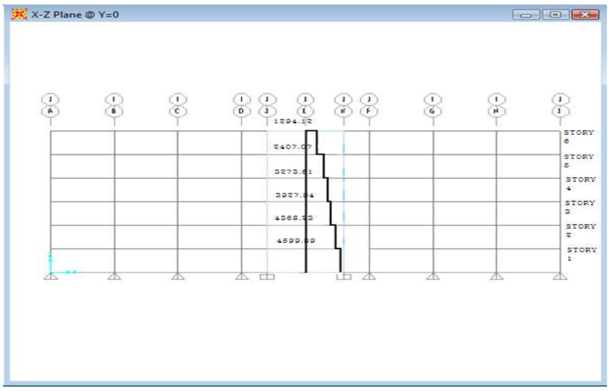

Figure 7 The trim force along Y – track.. (USING SAP 2000 V14).

MODELING

The productivity and exactness of the two option disentangled methodologies and analytical methods, one based on section analysis procedure and lumped plasticity models and the other one based on the use of multi-contact spring models. Recent developments in the research of precast/prestressed concrete structures for seismic are precast structural systems/connections (Pompano in et. al., 2004).

U.S.-PRESSS Program (PRE-cast Seismic Structural System), composed by the University of California, San Diego: unbounded post-pressure in ligaments/
to-column, wall-to-foundation) through opening and closing of an existing gap at the interface. A sort of "controlled rocking" motion of the beam or wall panel occurs.
Including self-focusing limit, just as giving sufficient measure of vitality scattering ability to the association, the seismic exhibition of cross breed frameworks has been there to beat least palatable as proportional solid arrangements regarding most extreme relocation/float request and a very better conduct if the lingering distortions are considered issues identified with the displaying of precast solid half and half associations, The analytical validation of the two different approaches, referred to beam-column subassemblies tested at NIST (National Institute of Standard and Technology) (Check et al, 1994) and the University of Canterbury (Rahman and Restrepo, 2000), and critical discussion and investigations will becarried out exclusively at global level.

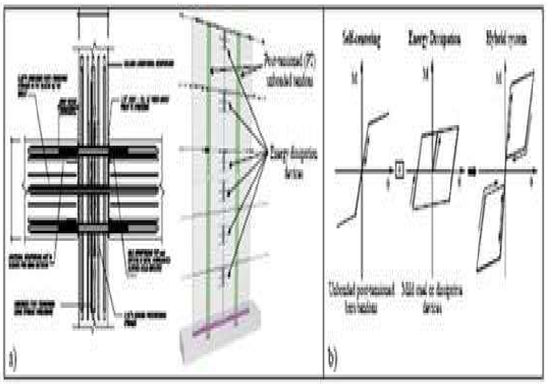

Figure 8 Hybrid solutions for precast concrete frame and wall system.

RESULTS AND DISCUSSIONS

- Indian norms give rules to plan and expansion of precast solid structures. No precise rules are accommodated protection and structure of precast cement floor slabs with adjacent loads i.e., seismic design of precast concrete diaphragms, especially for the hollow core slabs. Precast floor diaphragms are to be classified based on their construction and behavior requirements to provide an easy and suitable selection option to the designer.

- No specific guidelines are provided for connection of precast concrete diaphragm with lateral loads. i.e. seismic design of precast concrete diaphragms connection.

- Lateral stacks on floor frameworks because of seismic tremors. The guidelines to obtain diaphragm forces from the base shear distributions need to be included in the Indian standards for precast construction. The Uniform Building

Code provides

- In high seismic zones only solid slab concrete panels are recommended and their connection is permitted between ribs only. While the structural standards of practice across the world allow using composite or non-composite topping slab reinforced and detailed to provide for a complete transfer of forces to the lateral-force-resisting system Such flexibility must be brought in to the Indian standards to boost the use of precast concrete diaphragms in active seismic zones.

The nonappearance of updates on precast solid stomachs Indian guidelines is somewhat because of the relative low extent of such development being utilized in India. This likewise reflects by the moderately quicker updates in the significant development benchmarks in nations with high utilization of such development rehearses. Right now, is high time that Indian gauges investigate the seismic plan arrangements of precast solid floor framework.

CONCLUSIONS

- The nonappearance of updates on precast solid stomachs Indian benchmarks is mostly because of the relative low extent of such development being utilized in India. This likewise reflects by the moderately quicker updates in the significant development models in nations with high utilization of such development rehearses. In any case, with the framework developing more than ever and the requests for quicker, imaginative and more secure development alternative the ways to more quantities of such development rehearses.
- Study of manual deign is also presented in which the cause of failure of joints and suggested joints in G+3 story building is calculated and shown; design of floor diaphragm is also suggested.

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