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Comparison Between Precast And Cast-in-place Reinforced Concrete Structures In Mexico City

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By: Santiago Rodriguez Sanchez

Abstract

Both Precast and Cast-in-place reinforced concrete structures have its own advantages and disadvantages. However, Precast RC structures have more advantages than Cast-in-place RC structures. Furthermore, it has been found that, under seismic loads, Precast structures can behave similar to Cast-in-place ones. Therefore Precast structures are an optimal option in Mexico City.

Introduction

The first time I learned about Precast Reinforced Concrete (RC) I wondered, why Precast RC is not widely used if it has several advantages over Cast-in-place RC?

RC is a composite material which combines the benefits of concrete and steel to make a suitable material to build structures. Based on place of casting, RC can be classified as Precast and Cast-in-place. Although Cast-in-place RC structures are more common and are naturally well suited to earthquake resistance (Moehle, 2015), Precast RC structures have advantages in terms of quality, costs and resistance.

Cast-in-place RC

Advantages

- Cheaper in small structures.
- Suitable for unwieldy structures.
- Ideal for seismic zones.
- Heavy lift cranes are not necessary.
- Precast manufacturing plants are not necessary.

*Information can be found in Moehle (2015)

Precast RC

Quality

- Plant-fabrication
- Durability
- Highly attractive surfaces, shapes and finishes
- Optimal space distribution.

*Information can be found in PCI (2004)

Costs

- Construction speed.
- With prestressing: Less material.
- Less amount of labor.
- 22% cheaper (Oduro et al., 2016).

*Information can be found in PCI (2004)

Resistance

- With prestressing: Higher resistance, smaller sections and larger spans.
- Precast structures can behave similar to Cast-in-place structures (Rodriguez-Sanchez, 2021; Guerrero et al., 2019).

*Information can be found in PCI (2004)

Figure 1. Precast concrete arch being placed into position. (Bloodgood, 2015).

Comparison

- Conservative Precast design in building codes.

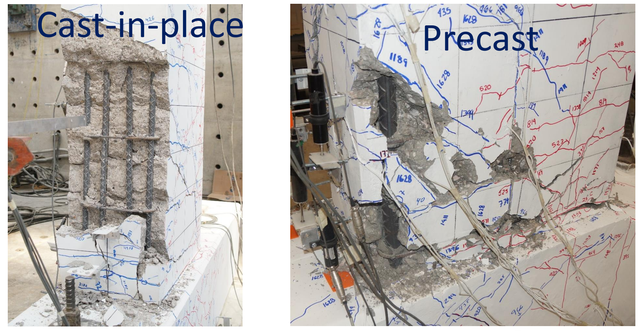

Figure 2. Damage comparison at 4% distortion in beam-column joints of Cast-in-place and Precast RC. Taken by: Felipe Bennets (2018-2020). in CENAPRED (National Center for Disaster Prevention)

Conclusion

Precast RC structures are not widely used in seismic zones due to conservativism in seismic design despite of having similar behavior under seismic loads to Cast-in-place ones. Based on the advantages of each type of structures, Cast-in-place is a better choice for small structures with no member repetition, while Precast is the best option for large structures, mainly in terms of quality and cost-effectiveness.

References

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