INTRODUCTION

- Precast concrete is a construction product that is produced by casting concrete in a reusable mould.
- It is cured in a controlled environment, transported to site and lifted into place.
- Cast in-situ concrete is the traditional timber formwork method of pouring concrete and curing on site.
- Precast moves work offsite, greatly decreases waste, speeds up erection and reduces vulnerability to weather all while providing significantly reduced facility, supervision, equipment hire and wage costs. A full Precast project on average provides at least a 35% reduction in build time.

PROBLEM STATEMENT

- The smart and effective use of concrete is becoming increasingly important in the design of medium rise residential buildings to the tallest high-rise commercial building. When the use of precast concrete is available then the focus on the initial cost of precast concrete must be considered.
- The true cost of precast must not only consider the initial tender cost but also the general building and construction cost savings. Disregarding this in the total tender evaluation will often lead to poor project performance due to the overuse of concrete and the strong outcome of a second rate building being constructed.
- With rising raw material costs (such as steel and cement), the precast industry has been driving advancements in the way concrete is used to better utilise raw materials.
- Sustainable development challenges the design and construction industry to create buildings and structures that acknowledge the life cycle of the structure. The demand for durability and energy performance is growing. Greenhouse gas emissions in buildings are due to both embodied energy and operating energy.

COMPARITIVE STUDY

- Four case studies situated in NSW: two incorporating the Cast In-Situ flooring system and two incorporating the ULTRAFloor Precast flooring slab system were cost estimated.
- Estimations were on the Concrete, Formwork and Reinforcement costs – Using the 2013 Rawlinson’s Cost guide.
- Quantities and Costs were deduced on a per square metre basis (for comparisons) as shown in table 1 and 2 respectively.

Results

Table 1: The quantities of components per square metre of floor area for each case study

<table>
<thead>
<tr>
<th>Components Per square metre floor area</th>
<th>Cast In-situ</th>
<th>Precast</th>
<th>Cast in-situ</th>
<th>Precast</th>
</tr>
</thead>
<tbody>
<tr>
<td>Concrete Volume</td>
<td>0.24</td>
<td>0.07</td>
<td>0.20</td>
<td>0.11</td>
</tr>
<tr>
<td>Formwork Area</td>
<td>1.31</td>
<td>1.03</td>
<td>1.07</td>
<td>1.04</td>
</tr>
<tr>
<td>Reinforcement Mass</td>
<td>14.8</td>
<td>7.9</td>
<td>22.0</td>
<td>3.0</td>
</tr>
</tbody>
</table>

Table 2: The concrete flooring cost components per square meter for each case study

<table>
<thead>
<tr>
<th>Components Per square metre floor area</th>
<th>Cost Components per site</th>
</tr>
</thead>
<tbody>
<tr>
<td>Concrete</td>
<td>79</td>
</tr>
<tr>
<td>Formwork</td>
<td>61</td>
</tr>
<tr>
<td>Reinforcement</td>
<td>73</td>
</tr>
</tbody>
</table>

Discussion

- The concrete costs for the Precast sites are deduced to be approximately on average 40% lower than the Cast in-situ sites. This was observed to be due to the reduced thickness and volume of the floor slab and subsequently the cost savings of the Precast flooring alternative.
- Similarly, the reinforcement cost for the Precast sites are on average 35% lower than the Cast in-situ sites. This was a result of the reduced volume of steel. The ULTRAFloor precast beams provided additional strength to the floor slab due to its high strength concrete and prestressed steel within the beam.
- The formwork considered in Table 2.1 incorporated standard formwork for the traditional method but the precast beams were included as the formwork in the precast site analysis. The reason for this is that it acted as formwork on site.

CONCLUSIONS

- ULTRAFloor precast concrete flooring system produced significantly lower costs per square floor area in comparison to the traditional method.
- The reason for the lower cost rate were due to a set of critical factors that include; the use of minimal propping for formwork, need for less labour, speed of construction, lower need of steel reinforcement due to pre-stressing of the precast beams and the higher strength of precast members which resulted in less volume of concrete topping.