Composite Floor Diaphragm Testing

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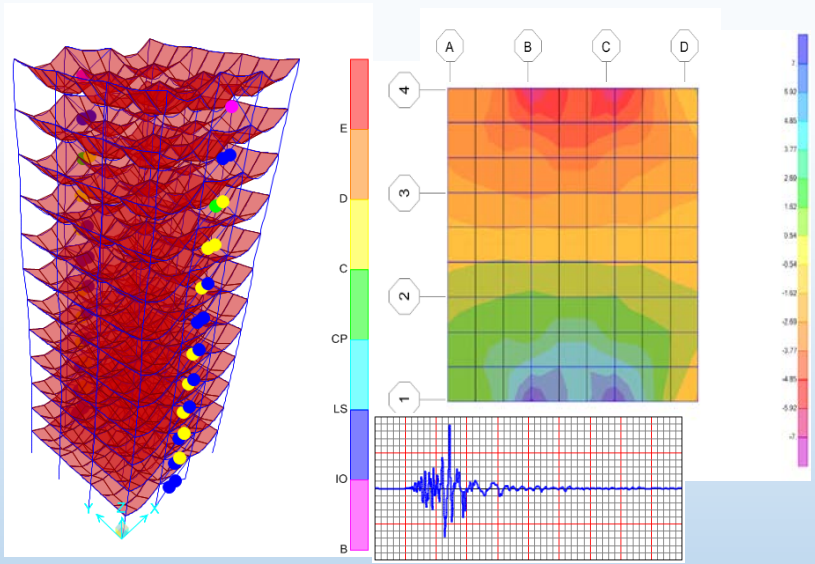
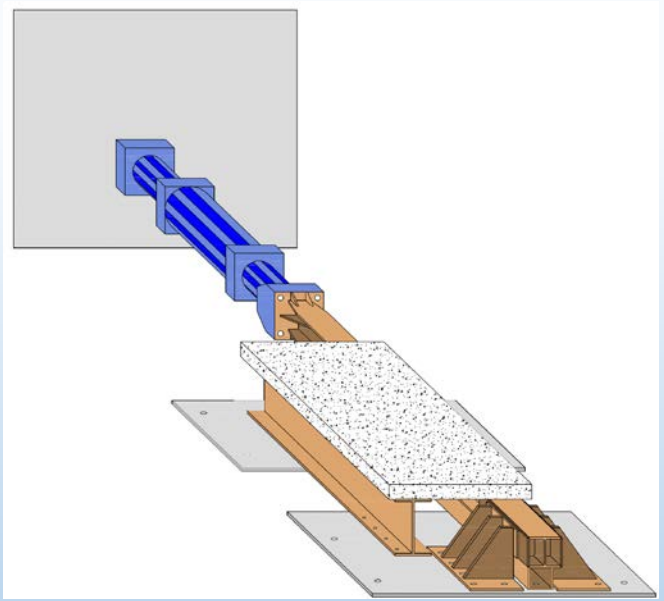
Outline

1. Nonlinear Time History Analysis



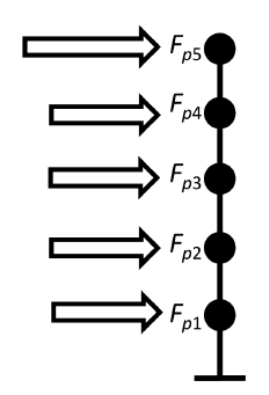
2. Experimental Test



1. **Inertia forces**
2. **Displacement compatibility forces**

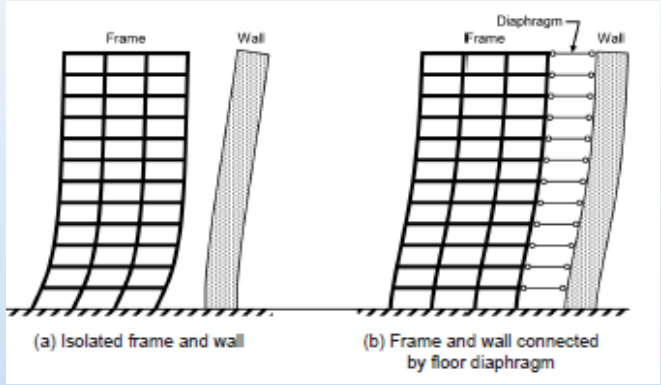
In-Plane Shear Forces

Two main types of diaphragm actions are:



1. **Inertia forces**

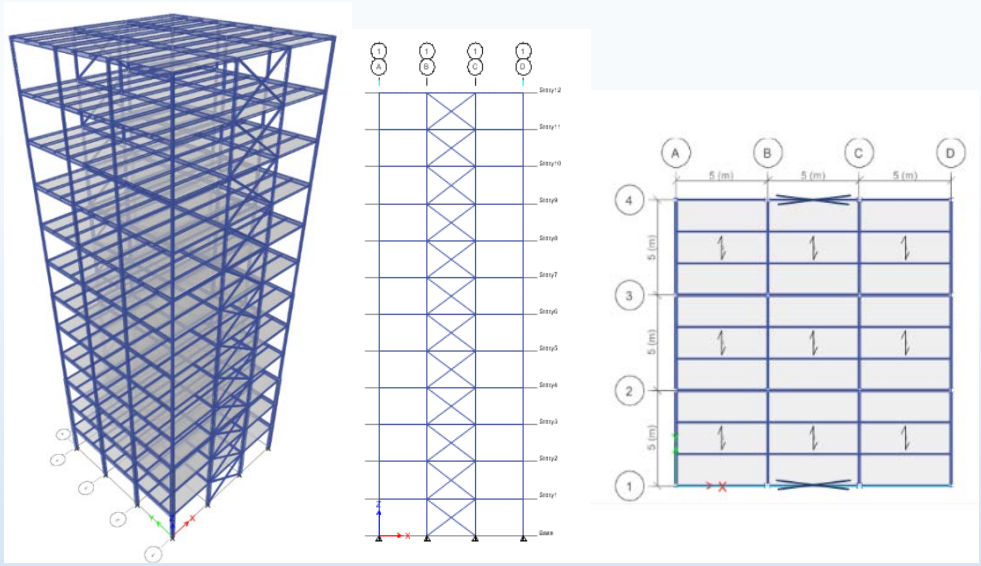
   It is equal to the floor mass multiplied by the floor acceleration caused by an earthquake.



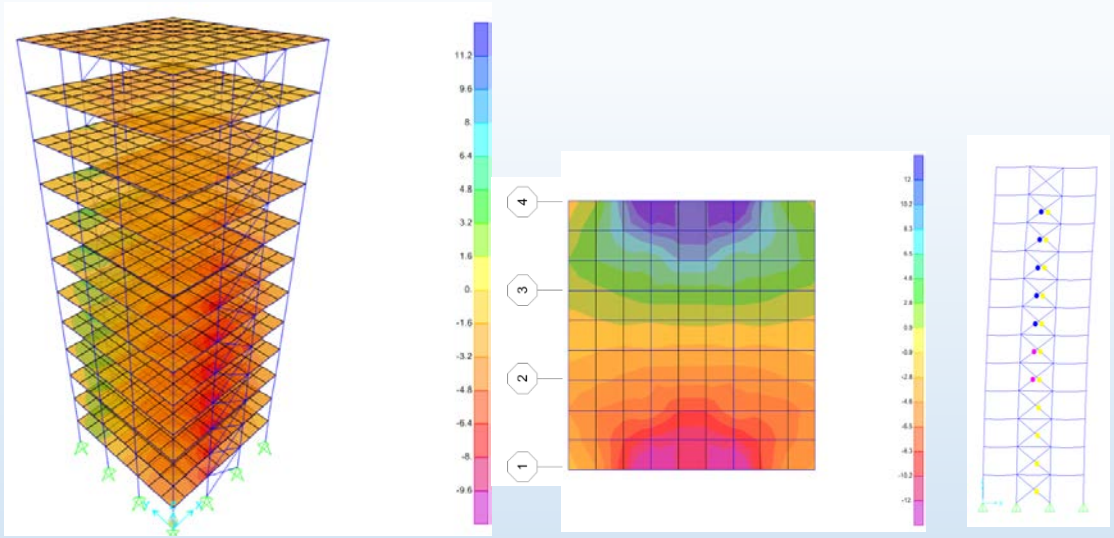
2. **Displacement compatibility forces**

   Displacement compatibility forces generated by deformation incompatibility of different lateral force resisting systems

1. Nonlinear Time History Analysis

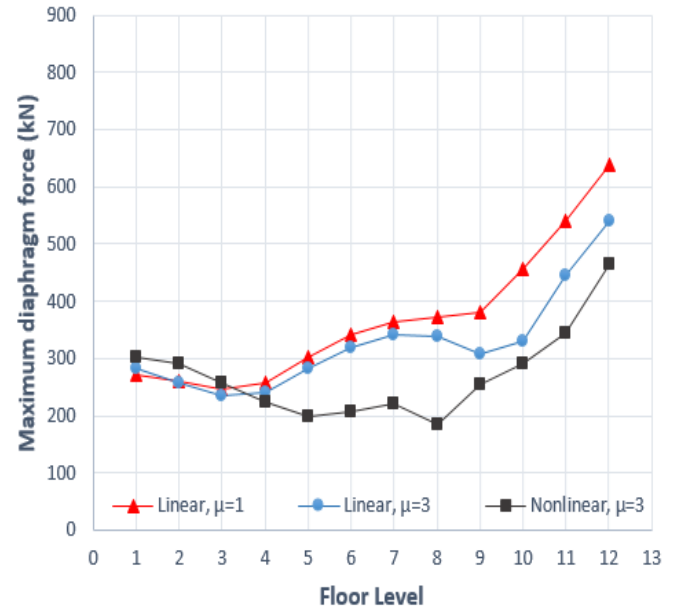


(a) 3D view (b) Elevation view (Axis 1) (c) Plan view

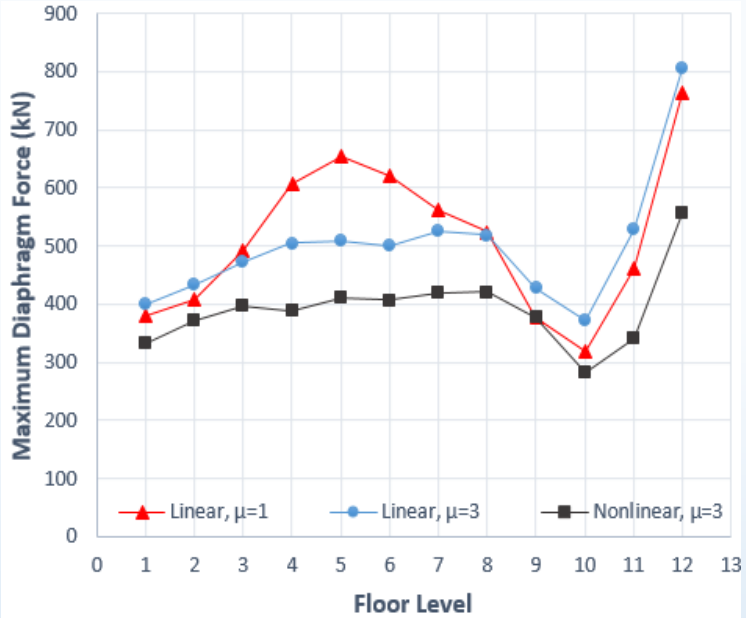


Shear force contour (kN/m)-Christchurch earthquake (2011)

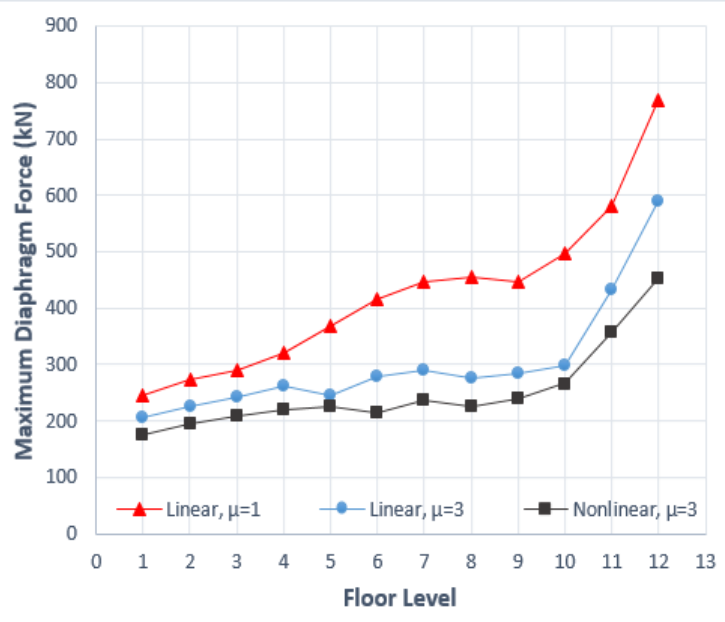
1. Nonlinear Time History Analysis



Christchurch earthquake (February 22, 2011 Resthaven)



El Centro 1940 earthquake (Imperial valley)

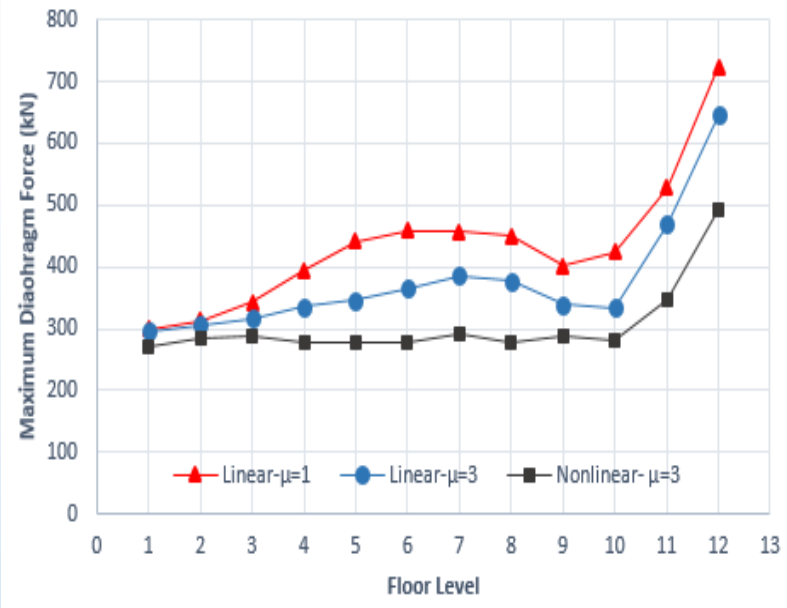


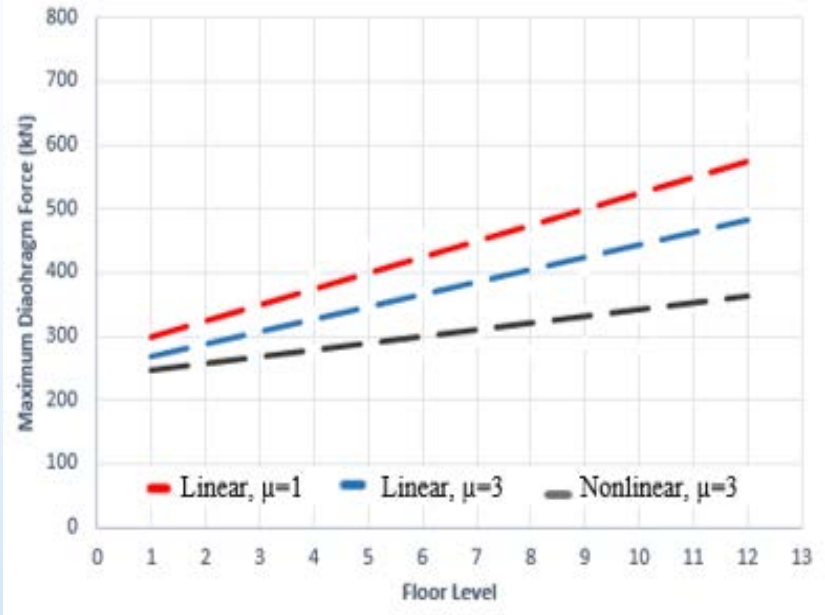
Hokkaido earthquake (HKD085-2003)

Inertial forces for each floor of a 12-story building due to different ground motions and ductility factors

1. Nonlinear Time History Analysis

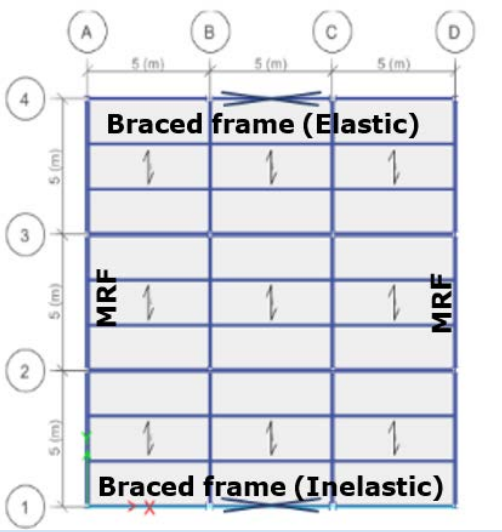
Inertial forces for each floor of a 12-story building due to different ductility factors



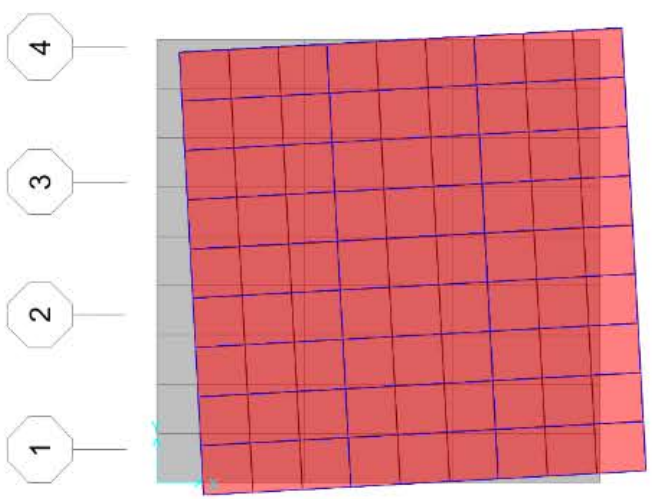


Mean of inertial forces for each floor for three earthquakes a) Actual b) Trend

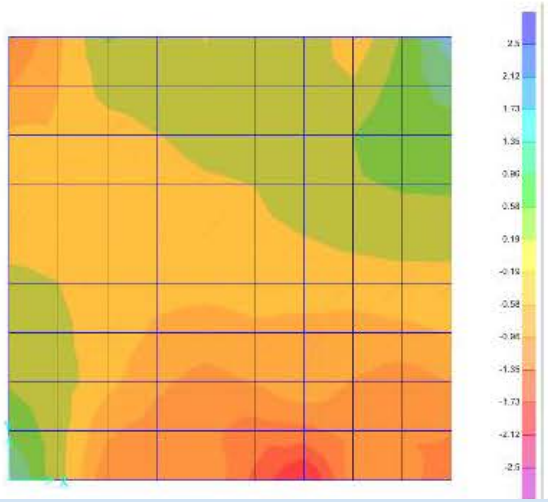
1. Nonlinear Time History Analysis



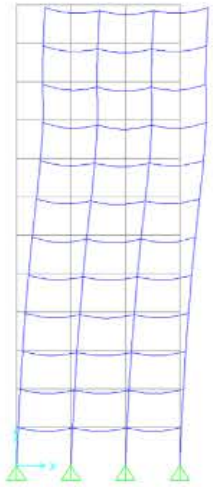
Plan view



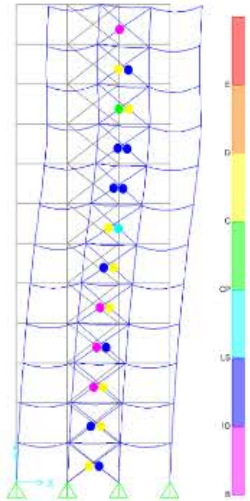
Displacement



Shear contour



Deformed elastic frame



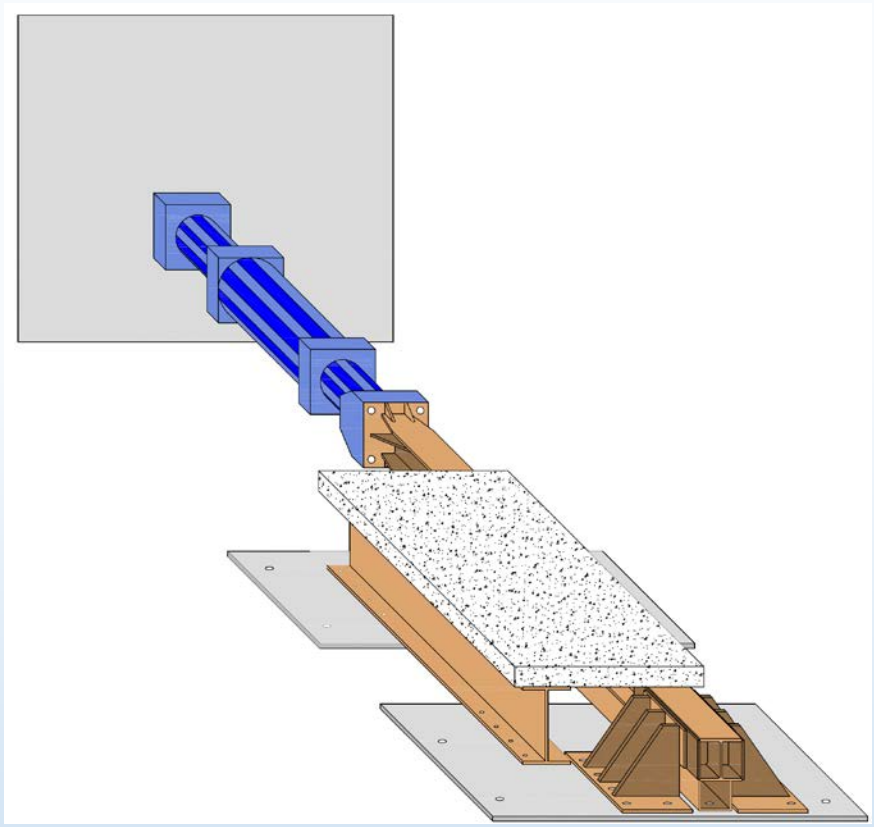
Deformed inelastic frame

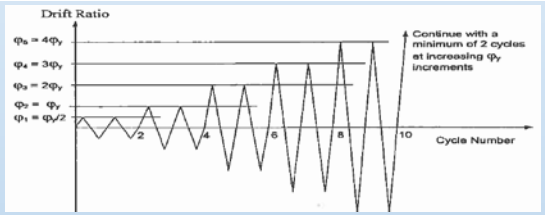
12th floor-Christchurch earthquake (2011)- Step 13.85s

Conclusions

- **Nonlinearity actions decrease inertial forces, and consequently nonlinear analysis results in smaller forces compared to linear analysis.**
- **Smaller ductility factor results in greater inertial forces.**
- **Inertial forces for all floor levels are close to each other except near the top floors.**
- **Inelastic actions on one side of the building resulted in torsion of building and induced compatibility forces in floor diaphragms and could increase the interface forces up to 30%.**

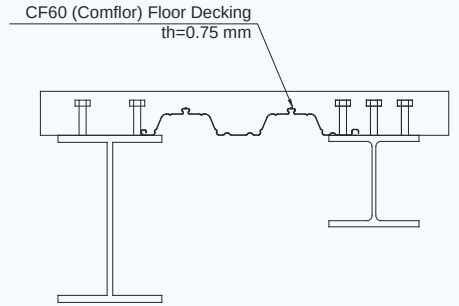
2. Experimental Tests





Test setup

1.



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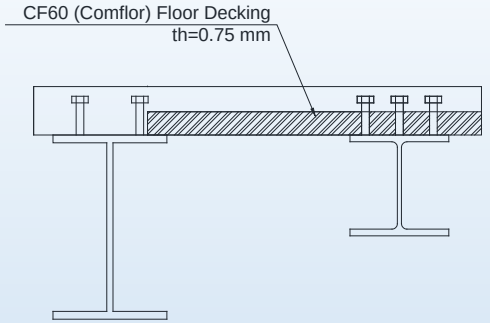

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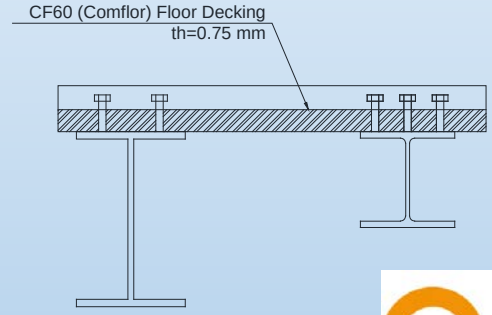
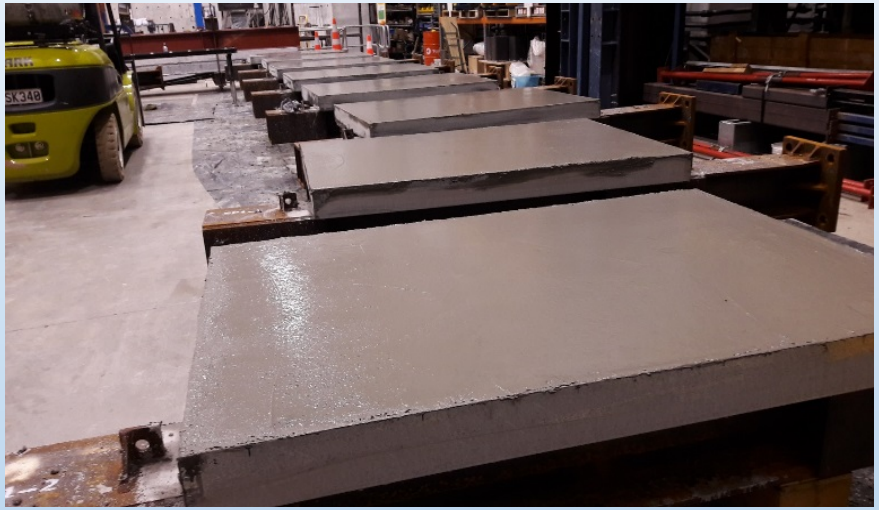


2. Experimental Tests

Deck laying

Rebar Placement

Concreting



Concreting and Curing

Acknowledgement

ComFlor

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NEW ZEALAND

EQC
EARTHQUAKE COMMISSION
Kōmihana Rūwhenua

QuakeCoRE
NZ Centre for Earthquake Resilience