Shake Table Evaluation of Screen Grid Core Insulated Concrete Form Walls

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Tuesday, June 26 – Friday, June 29
What are Insulated Concrete Forms (ICF) Walls? & Why Studying Screen Grid ICF Walls?

Insulated Concrete Form (ICF) walls are building components that are primarily used in residential construction that strives for more sustainable buildings.

ICF Wall Advantages:
- Reduce greenhouse gases.
- Reuse of recycled materials.
- Energy efficiency.
- Prevent growth of mold and mildew.
- Minimize radon gas leakage.
- Decrease out loud noises.

Investigation Objectives:
- Dynamic properties of SGICF walls.
- Improve ICF walls lateral strength.
- Suggest new design of ICF walls.

Types of ICF walls

Previous Investigations on ICF walls

Abdel-Mooty et al

P. Dusicka and C. Werner

J. Garth

https://ascelibrary.org/doi/10.1061/(ASCE)29ST.1943-541X.0000354
https://pdxscholar.library.pdx.edu/open_access_etds/1857/
Screen Grid Insulated Concrete Walls Details

SGICF Wall

Proposed Improved Core Wall
Test Setup and Ground Motion

<table>
<thead>
<tr>
<th>Test</th>
<th>W-RC</th>
<th>W-FB</th>
<th>G-RC</th>
<th>G-FB</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Tn [sec]</td>
<td>ζ [%]</td>
<td>Tn [sec]</td>
<td>ζ [%]</td>
</tr>
<tr>
<td>Initial Values</td>
<td>0.28</td>
<td>0.92</td>
<td>0.3</td>
<td>1.0</td>
</tr>
<tr>
<td>At the End of Testing</td>
<td>0.51</td>
<td>3.1</td>
<td>0.57</td>
<td>3.0</td>
</tr>
</tbody>
</table>

Imperial Valley earthquake motion, M6.5
Failure Modes

**SGICF wall-Plain Concrete**

![Graph showing load-displacement behavior for Plain Concrete with a peak drift ratio of approximately 2.9%]

**SGICF wall-Fiber Reinforced Concrete**

![Graph showing load-displacement behavior for Fiber Reinforced Concrete with a peak drift ratio of approximately 2.9%]

- Drift Ratio (%)
- Lateral Force (kip)
- Lateral Displacement (in)

W-RC: ~2.9%
W-FB: ~2.9%
Failure Modes

New wall-Plain Concrete

New wall-Fiber Reinforced Concrete
Results Comparison
Results Comparison

Drift profile at 100% ground motion

[Graph showing drift ratios and height for different ground motion conditions: GM-1.0, W-RC, W-FB, G-RC, G-FB]
Conclusion

- SGICF wall with plain concrete showed higher lateral strength.
- Both SGICF walls reached similar levels of drift capacity.
- Rebar fracture at the base was the failure mode of the plain concrete SGICF wall.
- Strength degradation was the failure mode of SGICF wall that has steel fiber.
- Voids found in SGICF wall that has steel fiber caused the strength degradation.
- Workability decreased due to using of the steel fiber reinforced concrete.
- The new proposed walls showed lower lateral strength capacity when compared with SGICF walls.
- The new proposed walls showed higher lateral displacement capacity.
Thank you!

Questions?

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