

Treatment Facility Seismic Design Criteria

Water Infrastructure Seismic Design Considerations
PacNW AWWA Section Conference
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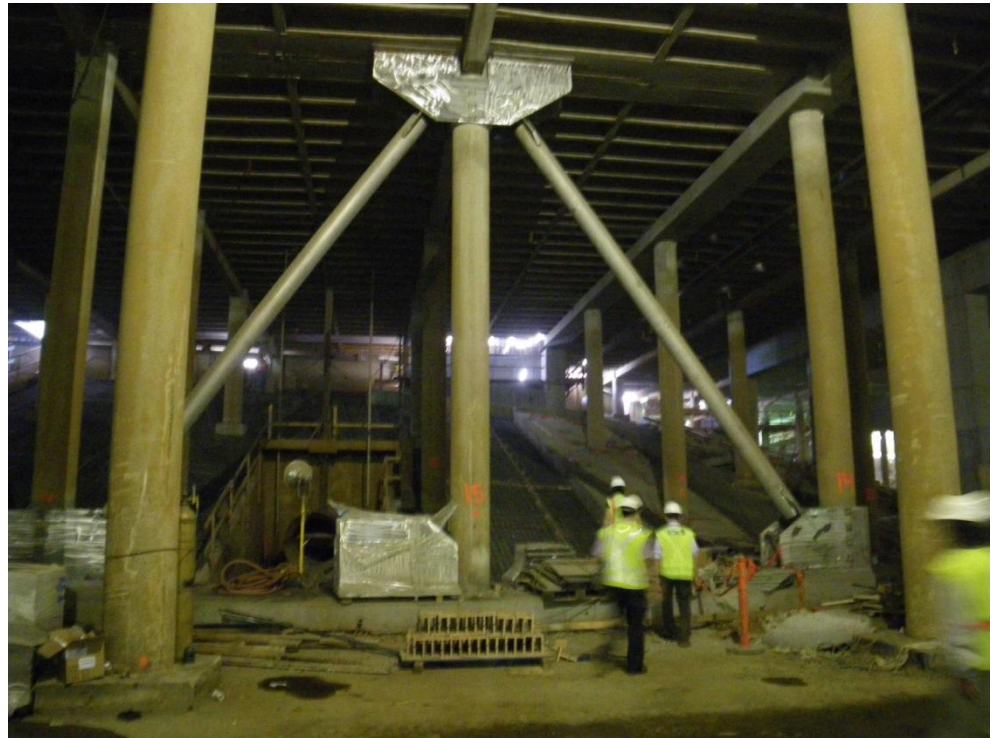


MWH

BUILDING A BETTER WORLD

Will the treatment facility perform at the desired level after a seismic event?

- New construction
- Existing Treatment facilities



New Construction

- How do IBC based Occupancy Categories (OC) effect reliability?
- Other things to consider.

How does the facility fit into the code?

OCCUPANCY CATEGORY	NATURE OF OCCUPANCY
III	Water treatment facilities for potable water.
IV	Designated earthquake, or other emergency shelter. Water storage facilities and pump structures required to maintain water pressure for fire suppression.

What is the benefit of designing facilities with OC IV?



- Structural elements are 20% more resistant to seismic loads.
- Equipment is tested for seismic loads (shake table (define)).

What is the cost of designing facilities with OC IV?





Is OC IV worth it for me?


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Watts Galvanized Steel Water Heater Strap Kit


Model # TSE-25 Internet # 202266006 Store SKU # 437846

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Other things to consider



Existing Treatment Facilities

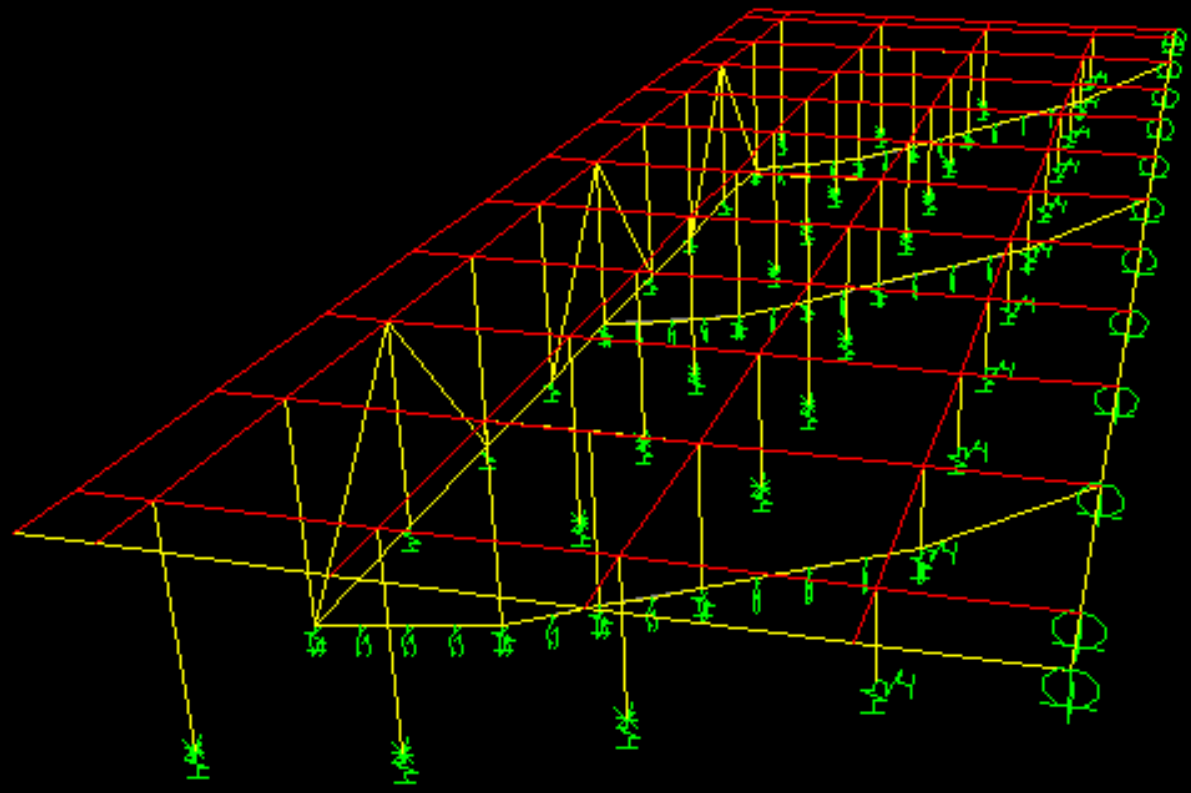
- When originally designed, what was the desired performance level after a seismic event?
- What is the desired performance level after a seismic event now?

Owner elected seismic upgrade

- Rate payers want a reliable source of water after a seismic event.
- Two examples:
 - University Mound – Reservoir in San Francisco
 - Filter Structure – Precast walls and roof

University Mound – San Francisco

- Added structural elements to resist earthquakes.
 - Steel Braces inside the reservoir
 - Fiber Reinforced Polymer (FRP) on top of the reservoir
- Increased expansion joint width from 1” to 15”



FRP on roof



Steel braces inside



Filter Structure – Precast walls and roof

- Central Utah Water Conservancy District
- 40 MGD Utah Valley Water Purification Plant
- Original WTP has Filters with sand bed filter gallery
- Built in 1971..
- Owner desires higher seismic performance.



Filter Structure – Precast walls and roof

- Chosen seismic performance level:
 - Prevent collapse of structure in the Maximum Considered Event (MCE)
 - Enable facility to be immediately occupied and allow for swift resumption of plant activity following a moderate earthquake

Filter Structure – Precast walls and roof

- Plant runs year round
- Existing structural system is precast double tee walls and roof.



Filter Structure – Precast walls and roof



Filter Structure – Retrofit option #1

- Retrofit option #1
 - Add a new concrete topping slab on top of the existing precast roof
 - Add new interior shear walls and braced frames



Filter Structure – Retrofit option #2

- Retrofit option #2:
 - Add FRP overlays on the existing precast roof
 - Strengthen exterior walls with FRP and tie into foundation with rebar.

EXISTING FILTER – Roof retrofit



Roofing Removal for top FRP installation



JOINT CLEANING



CLEANED ROOF



ROOF FRP APPLICATION



EXISTING FILTER - Walls retrofit



SHEARWALL FRP



SHEARWALL FRP AND CONCRETE BASE



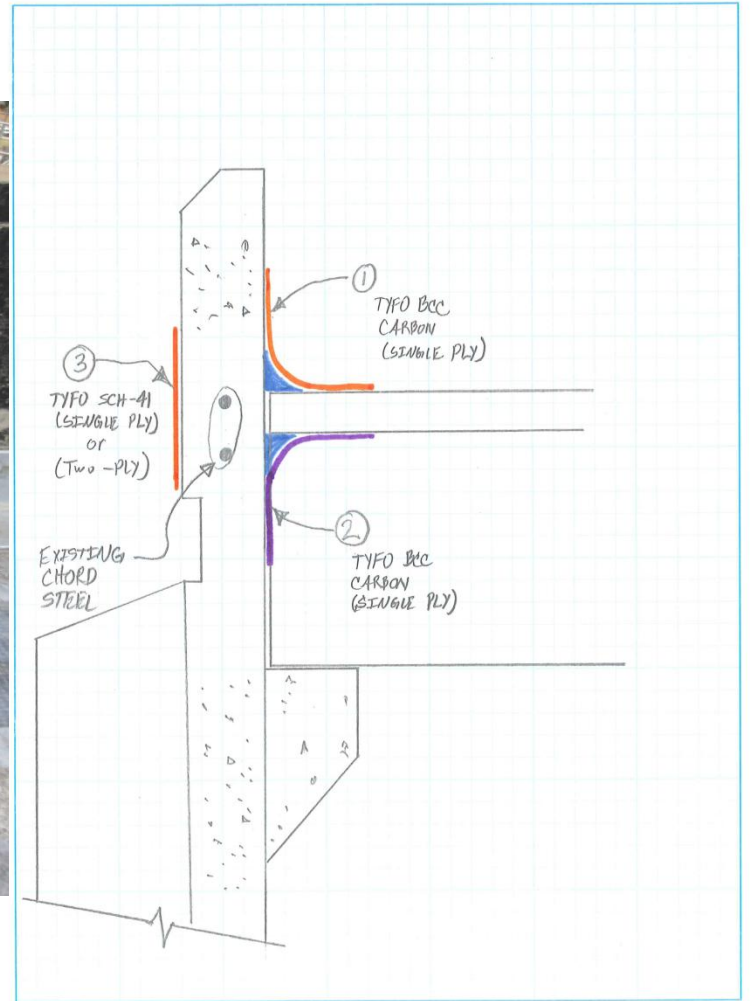
SHEARWALL FRP AND CONCRETE BASE



Wall to roof in plane shear alternative

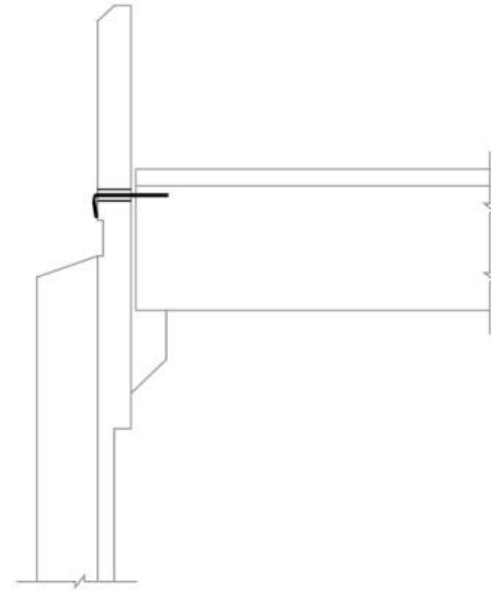


By _____ Date _____ Client _____ Sheet _____ of _____
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Anchoring walls to roof to prevent separation and collapse potential

- Conventional methods anchor walls to roof and base with steel angles and bolts
- Fiberglass approach uses composite anchors to anchor members



Conclusion

- Will the treatment facility perform at the desired level after a seismic event?
 - New construction
 - Existing Treatment facilities

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