HELWAN UNIVERSITY - EGYPT

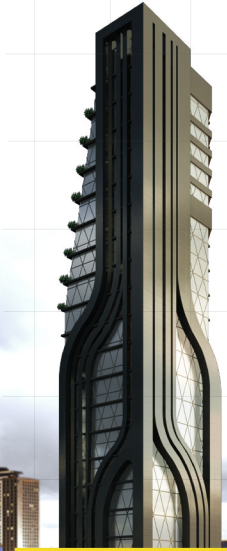
HUM EERI STUDENT CHAPTER

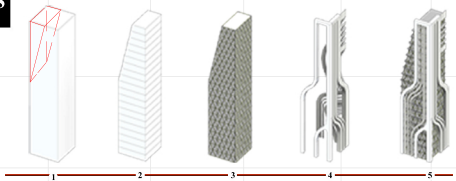
YEAR 2020-2021

CONTENT

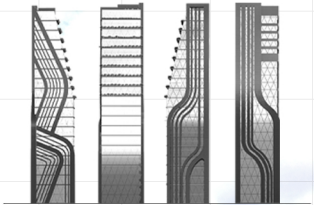
THE ARCHITECTURAL CHALLENGES

CONCEPT & FORM GENERATION





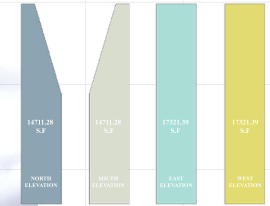
Form Generation Steps



ELEVATION

PLANS , CIRCULATIONS & ELEVATIONS COST

Elevations Cost



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Metal grids cost = 8.50$ *14711.28 = 125,045 $

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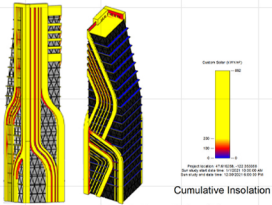
Curtain walls cost = 100$ To SF
Metal grids cost = 8.50$ To SF

THE ENVIRONMENTAL CHALLENGE

SITE & LEED STUDIES

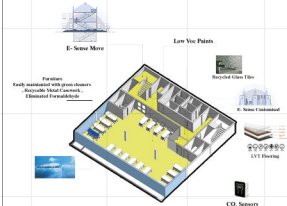
SOLAR STUDY:



Cumulative Insolation

After analysis we see all facades have a high radiation, thus the created rips on the North, South and East facade act like a diffusers for the wave, and for the Western facade; it has a greens barrier to absorb some of the radiation to cooperate well the the slopped facade.

MATERIALS & LEED EVALUATION:



Indoor Enviromental Quality:

- Daylighting sensors that reads available light and sends a signal to the control system.
- CO_2 Detector.
- Furniture used materials are eliminated formaldehyde , Cfc And VOC easily maintained with green cleansers, recyclable metal case work.
- HEPA filters.

Materials and resources:

- PVC excluded all interiors roofing, EPDM.
- Wall finishes for toilets recycable glass tiles.
- LVT for corridors, Nurses stations for heavy rolling loads.
- Wall : Low VOC paints, Zirell fabric.
- Terrazo floors for entrance.

Water Efficiency:

- Waterless urinals.
- Low flow faucets in patient in public spaces.
- Use irrigation system coupled with smart technology sprinkler have reduced lawn irrigation requirement.
- Sub-metering of various usage areas allows measurment and tracking of water consumption.
- The unit is metered separately from the rest of the hospital.
- Low flow of kitchen sinks, whick flow at a rate of 0.9 gallons of water per minute less than traditional sinks.

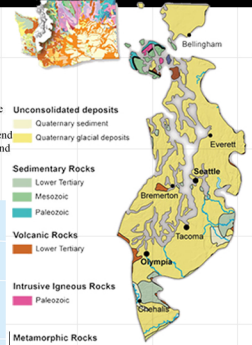
Energy and Atmoshpere:

- Energy star rated equipment was chosen for 90% of appliances.
- Multiple lighting level control.
- PVC curtain wall.

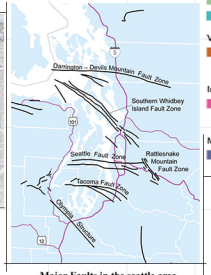
GEOTECHNICAL & SEISMIC ASPECT

ACCODRING TO Washington state Dep. of Natural Resources

The Puget Lowland region is a wide low-lying area between the Cascade Range to the east and the Olympic Mountains to the west.
The region extends from the San Juan Islands in the north to past the southern end of the Puget Sound. It is known for its scenic coastlines, bustling urban ports, and rich farmlands to the south.
The natural resources and the geologic history of the Puget Sound and surrounding areas have helped to shape the history of the Washington state



Extent of the Puget Lobe of the Cordilleran Ice Sheet during the latest ice advance



Major Faults in the seattle area

Glaciers are ice sheets that can be thousands of feet thick and are exceptionally talented at transforming landscapes. It was during the Vashon Stade (the latest ice advance and retreat about 15,000–12,000 years ago) that the Puget Lowland got the extreme make-over that we see today.

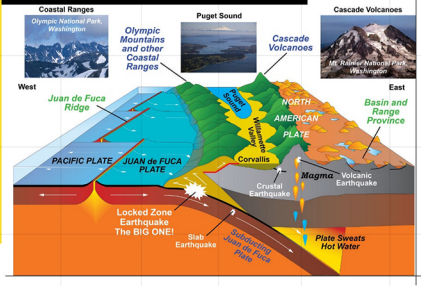
Several major fault zones traverse the province, including the Seattle Fault, the Tacoma fault, the southern Whidbey Island fault, and the Darrington–Devils Mountain fault zone. These faults are capable of producing earthquakes and lie within densely populated areas

Because of the hazards earthquakes along these fault zones pose to the public, they are still being studied to determine full extent and potential hazard

The Puget Lowland region

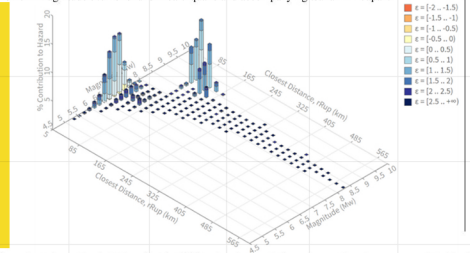
MAJOR FAULTS IN THE SEATTLE AREA

Cascadia Subduction Zone



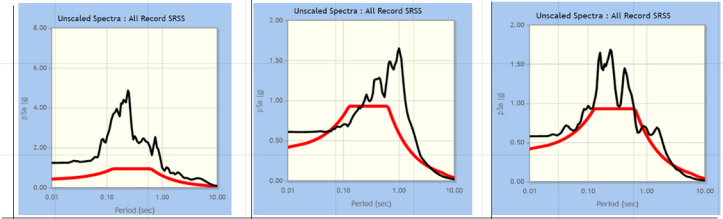
The Cascadia Subduction Zone plate interface slips every few hundred years in very large earthquakes with magnitudes approaching or even above 9.0. These earthquakes generate dangerous tsunamis similar to the 2011 magnitude-9.0 Tohoku-Oki earthquake and accompanying tsunami in Japan.

USGS DE aggregation plot



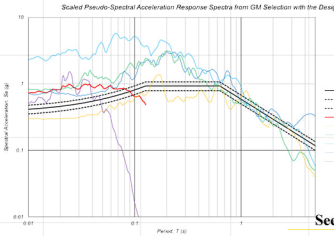
The seismic hazard calculations for the 1996 national seismic hazard maps have been geographically de aggregated to assist in the understanding of the relative contributions of sources. These de aggregations are exhibited as maps with vertical bars whose heights are proportional to the contribution that each geographical cell makes to the ground-motion exceedance hazard. Bar colors correspond to average source magnitudes.

Selecting appropriate ground motions to be scaled and applied on the model



Selecting motions to be scaled for later seismic analysis.
(The Selection process depends on several parameters, such as: Vs30 / M / R and the general shape of the GM in comparison to that of the design response spectrum)

Scaling of the selected ground motions

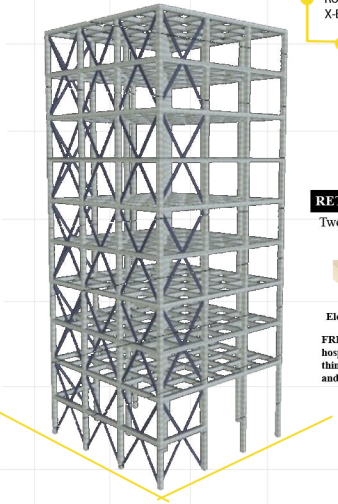


After the selection of several GMs,
they are scaled to be used for analysis purposes

Seed Motion Name	Scale Factor
Seed Motion #1 (Subduction Interface)	1.130743476
Seed Motion #2 (Subduction Interface)	3
Seed Motion #3 (Reverse Crustal)	1.841634484
Seed Motion #4 (Reverse Crustal)	0.824827795
Centerville Beach_ Naval Fac	1.066551025

CONCLUSION:

IRREGULARITY OF THE LATERAL SUPPORT SYSTEM RESULTS IN IMPERMISSIBLE PERFORMANCE, IN PARTICULAR WHEN SUBJECTED TO GM3



- Roof of the existing building is connected with the first floor of the addition with X-Bracings across all 4 sides of the building.
- Alternating between X-Braces and Global Bracings on the N/S sides of the building, with the mid-bay having only X-Braces and completely devoid of any global bracings.
- On the west side. Also alternating between X and global bracings, having the last 3 floors connected with X-Bracings.
- On the east side, another variation of bracings has been introduced, in which we use a combination of V & Inverted
- V-Bracings with global bracings

RETROFIT STRATEGIES

Two reliable and widely applicable retrofitting techniques have been adopted

1-Reinforcement with FRP wraps

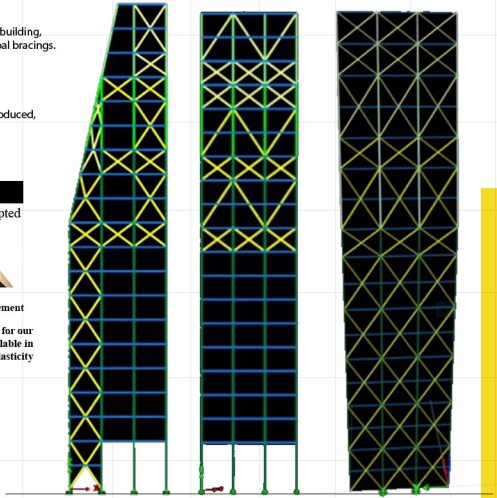
Element with unsafe D/C ratio — FRP reinforcement are wrapped around the element

FRP has proven to be a very effective retrofit technique and it made the perfect choice for our hospital situation because it kept operation interruption to a minimum. FRP are available in thin wraps, that when wrapped around a certain element increases its modulus of elasticity and, hence, its capacity.

2-Increasing beams and bracing dimensions

beam Jacketing was also used, it is done by enlarging the existing cross section with a new layer of concrete that is reinforced with both longitudinal and transverse reinforcement.

STRUCTURAL AND SEISMIC ASSESSMENT OF EXISTING STRUCTURE



NORTH AND SOUTH — EAST — WEST