

# CE A438 Design of Civil Engineering Systems

Spring 2020

## Forest Park Condominiums

Client: Kimberly Riggs

Faculty Mentor: Scott Hamel, PE

Professional Mentor: Scott Gruhn, PE, SE

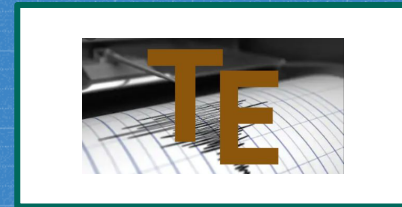
Prepared and Presented by

***Tectonic Engineering:***

Jordan Cooper

Obadiah Dawson, EIT

Bill Hand



# OVERVIEW



- Project Summary
- Basic Structure
- Existing Conditions
- Structural Analysis
- Alternatives
- Recommendations

# PROJECT SUMMARY

- 1 of 12 Units
- 2523 La Honda Drive
- Constructed in 1981



Photo: *Google Maps*

# PROJECT SUMMARY

- November 2018 Earthquake
  - Foundation wall
  - Inadequate bracing
  - Minimal Shear Strength
- Scope of Work
  - Review existing
  - Create model
  - Develop Alternatives



# BASIC STRUCTURE

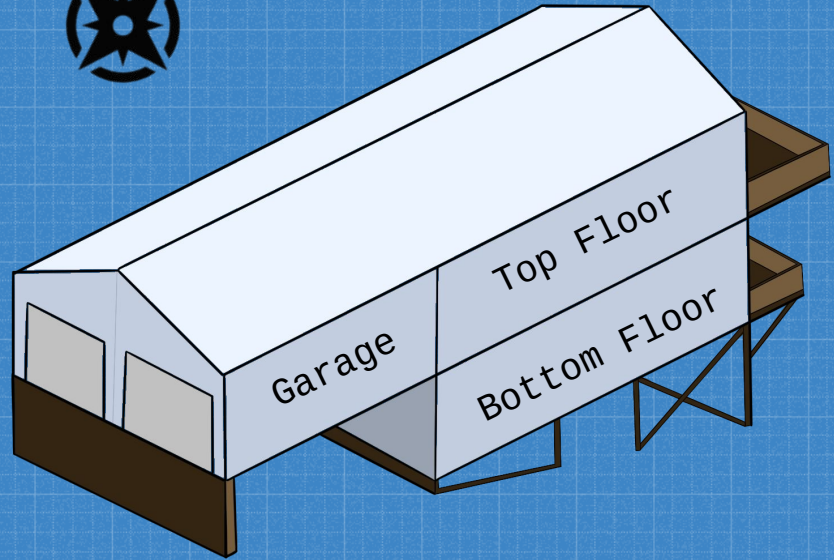
2 Stories & CrawlSpace

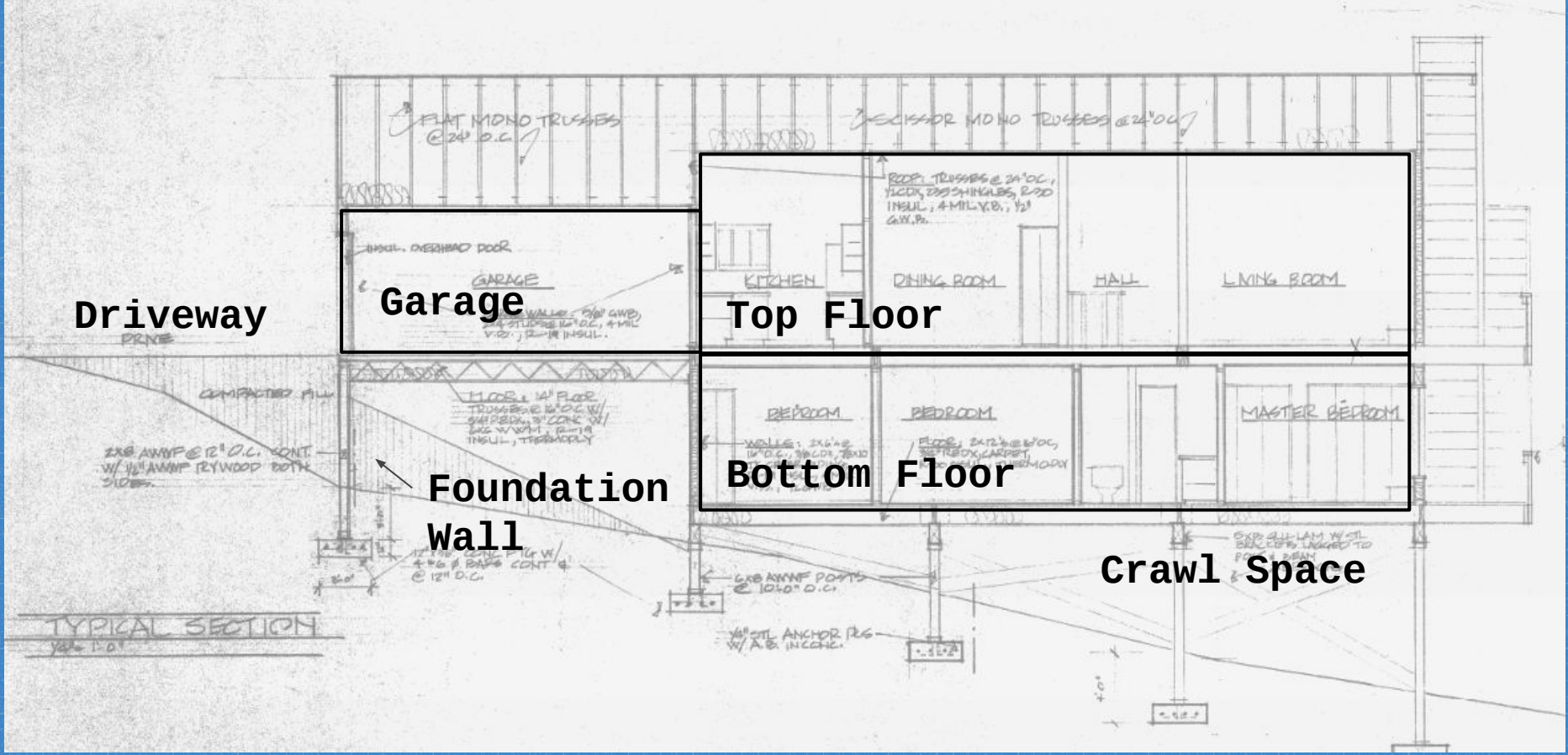
Lot Slope of Roughly 3:1

Driveway Uphill

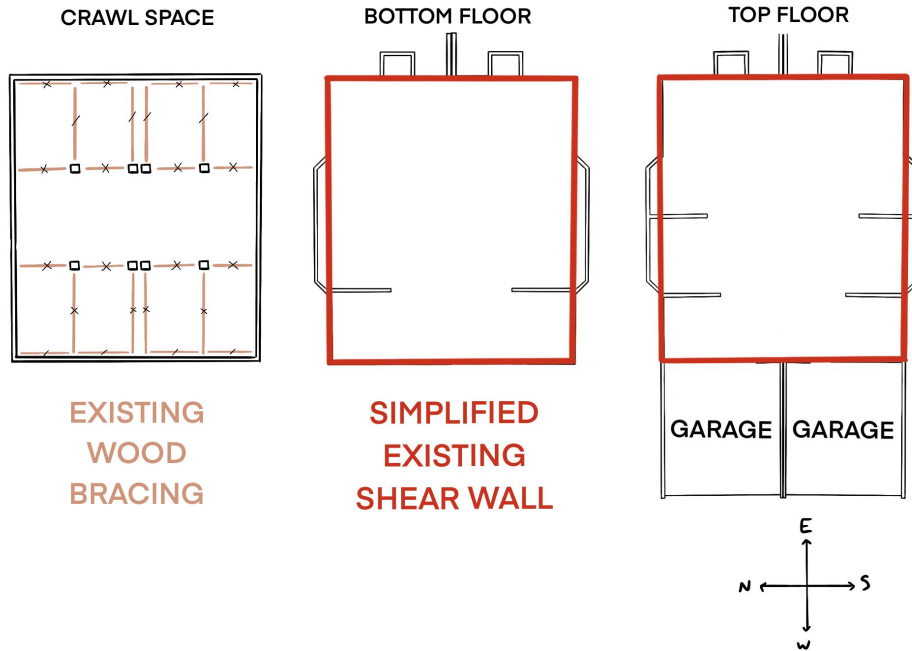
Scope Focus:

- Lateral System
- Garage Repair





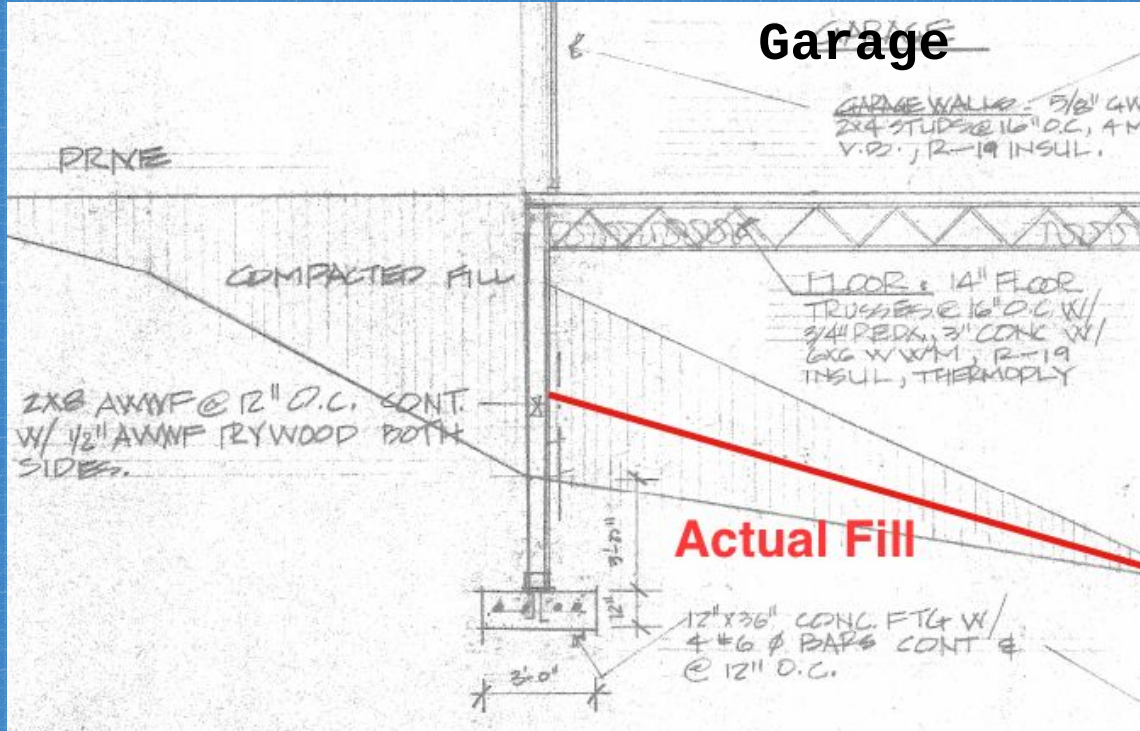
# BASIC STRUCTURE - LATERAL



## Existing Lateral System

- Attic trusses
- Minimal shear walls
- Wood bracing in crawl space
- Wood piles on concrete footers

# BASIC STRUCTURE - GARAGE



Longitudinal trusses

Foundation wall

Compacted fill

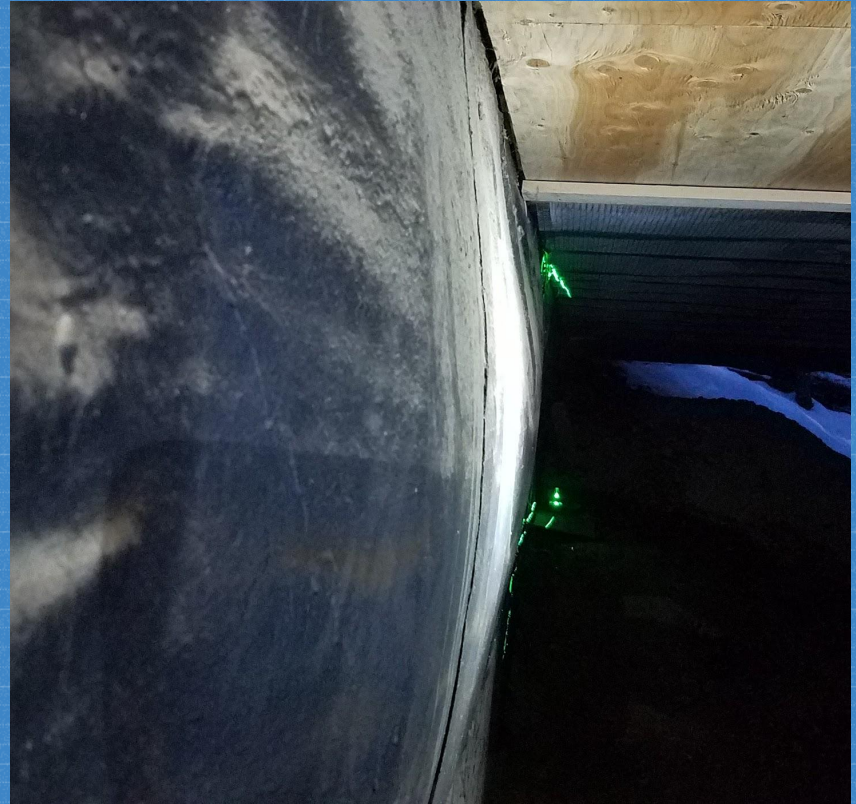
Wood piles on concrete footers

# EXISTING CONDITIONS

Blown out garage  
foundation wall

Deflection

Lack of soil  
backfill



# EXISTING CONDITIONS

Inspected crawl space

Lateral bracing  
deformation

Unsupported braces

Unconventional  
building techniques



# EXISTING CONDITIONS

Glulam beams  
supporting floor  
joists

Lack of finger  
jointing



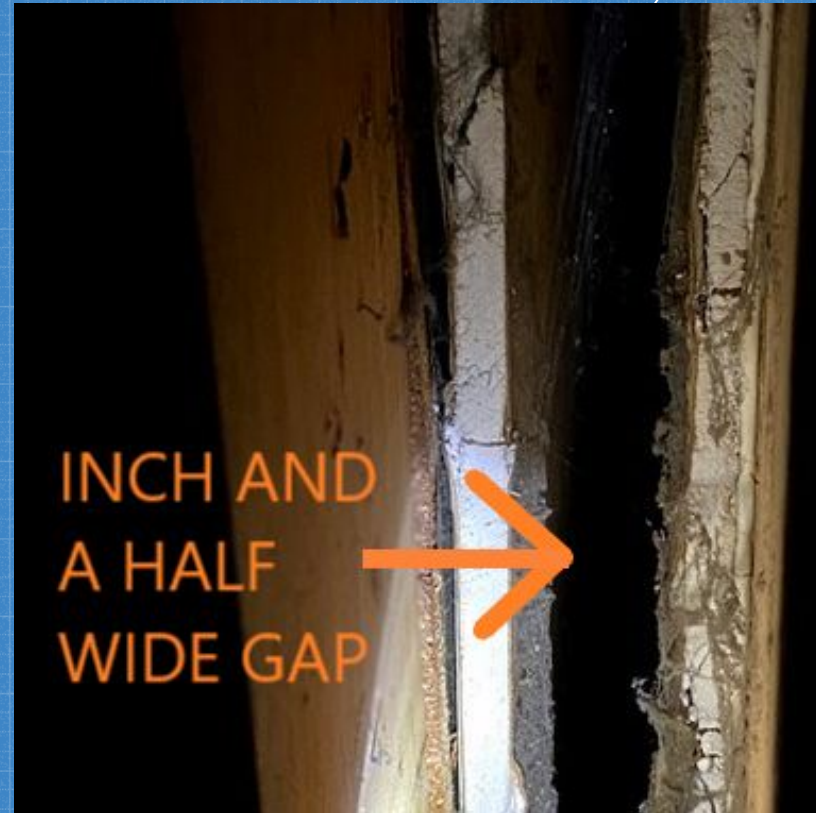
# EXISTING CONDITIONS

Lack of shear strength

Crawl space walls

Piling foundation

Relief joint



# EXISTING CONDITIONS

Slender porch  
columns

Possibility of  
buckling

Foundation



# PLAN DISCREPANCIES

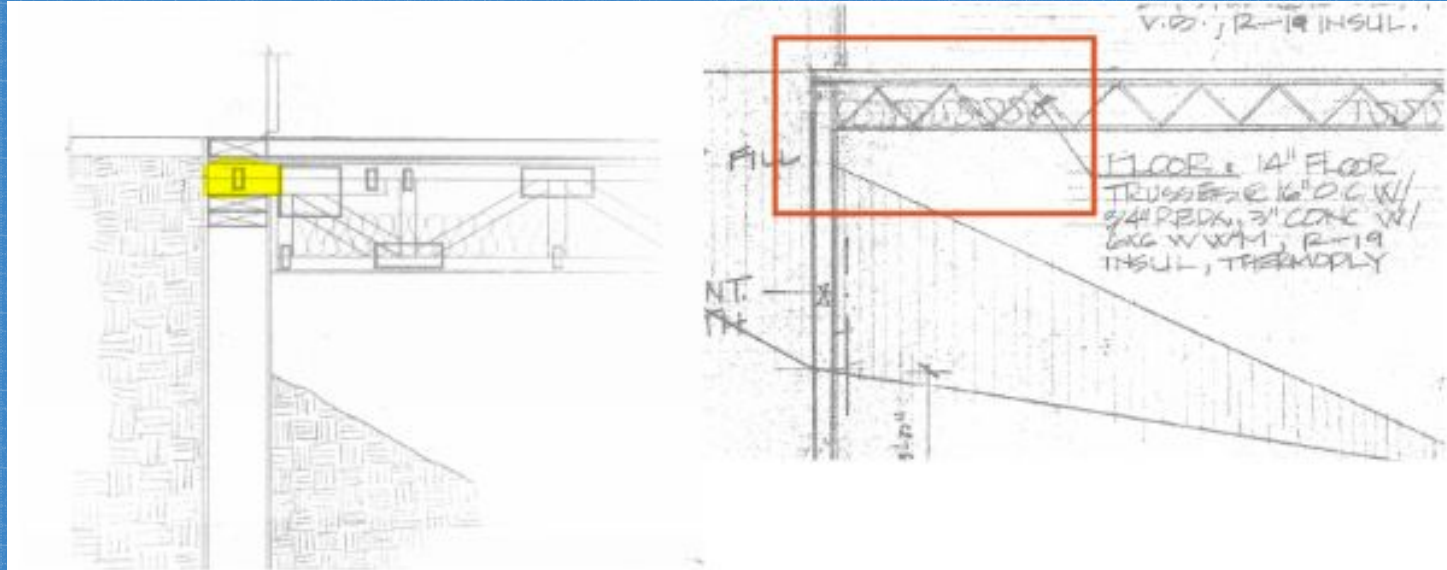


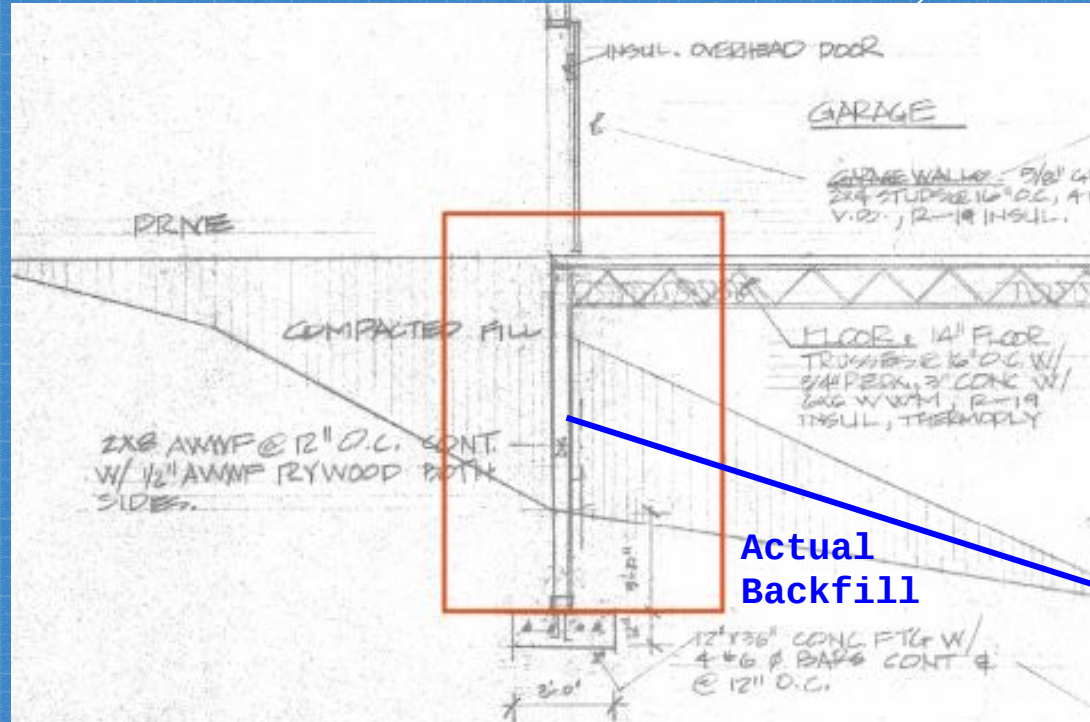
Image: NCP Design/Build LTD

Garage floor truss

# PLAN DISCREPANCIES

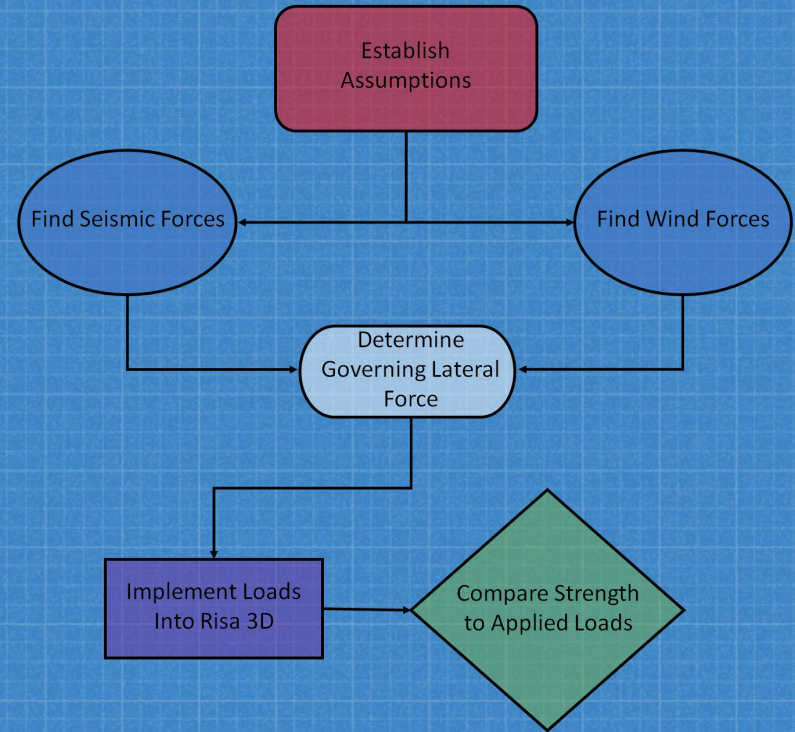
Lack of backfill  
in foundation  
wall

Potential cause  
of deformation



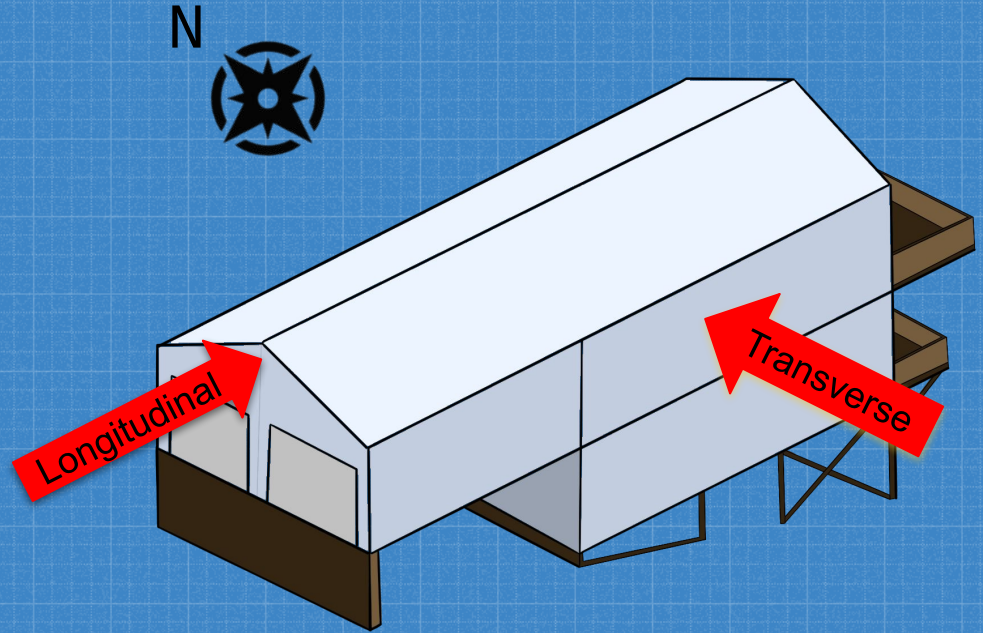
# METHODOLOGY

- Seismic based on Equivalent Lateral Force Procedure (ELF)
- Wind based on Envelope Procedure
- Member strengths based on National Design Specification (NDS)



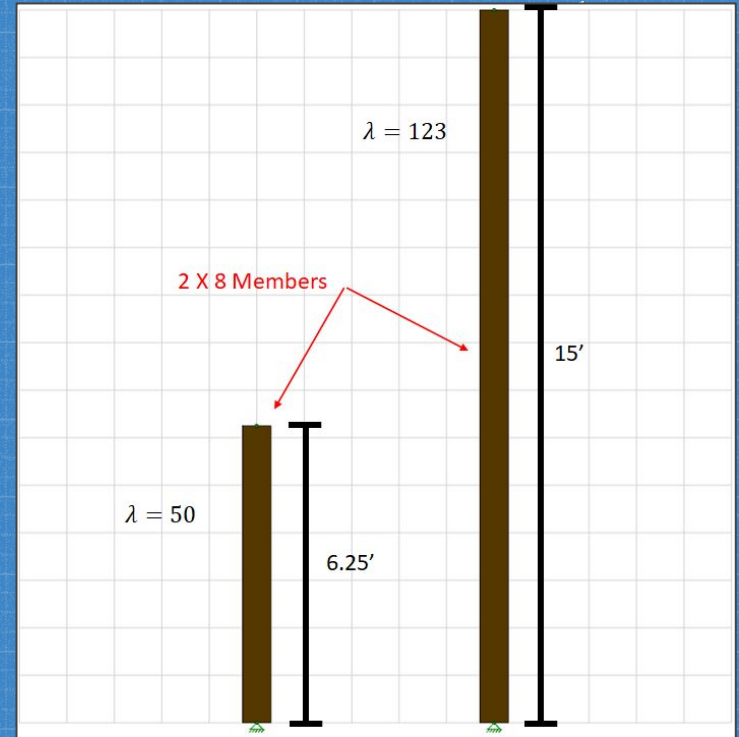
# SEISMIC AND WIND FORCES

- Static procedure
- Location based
- Includes both directions

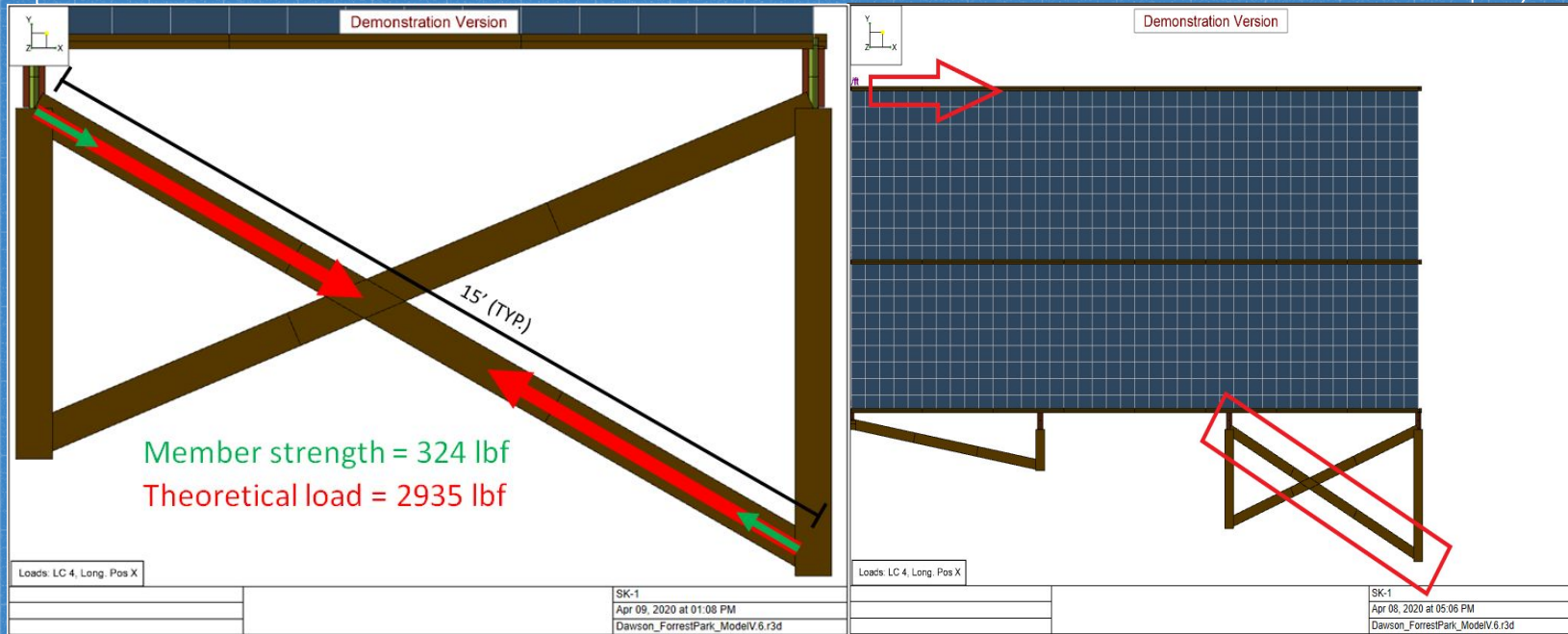


# LATERAL BRACING

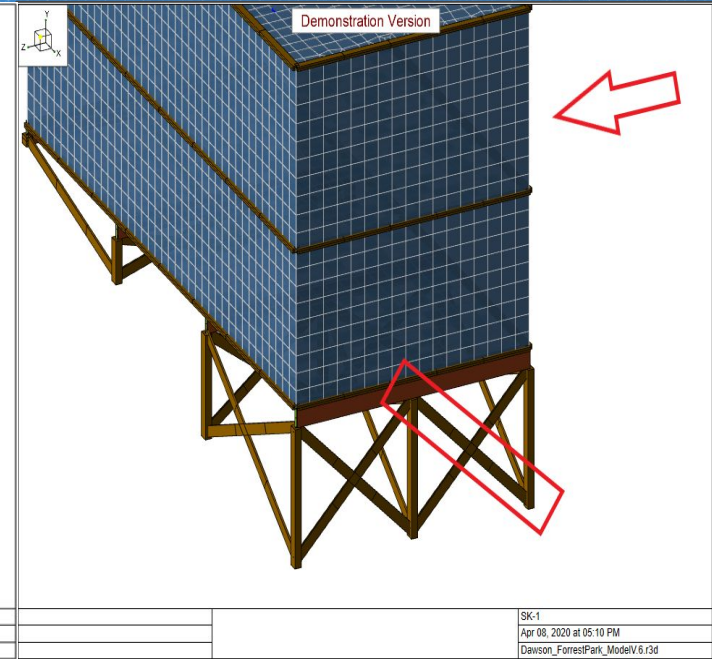
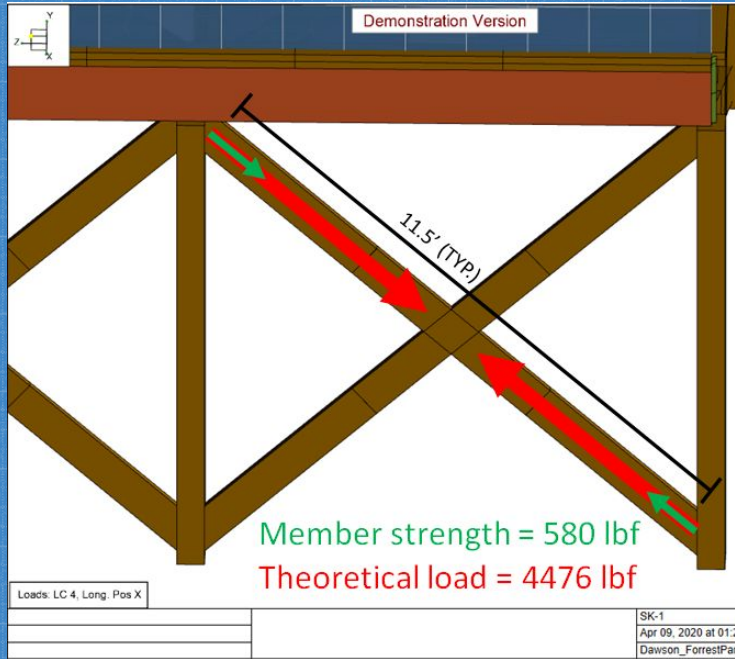
- Very slender
- Only braced at ends
- Cannot utilize member for compression
- Not ductile



# LONGITUDINAL BRACING



# TRANSVERSE BRACING

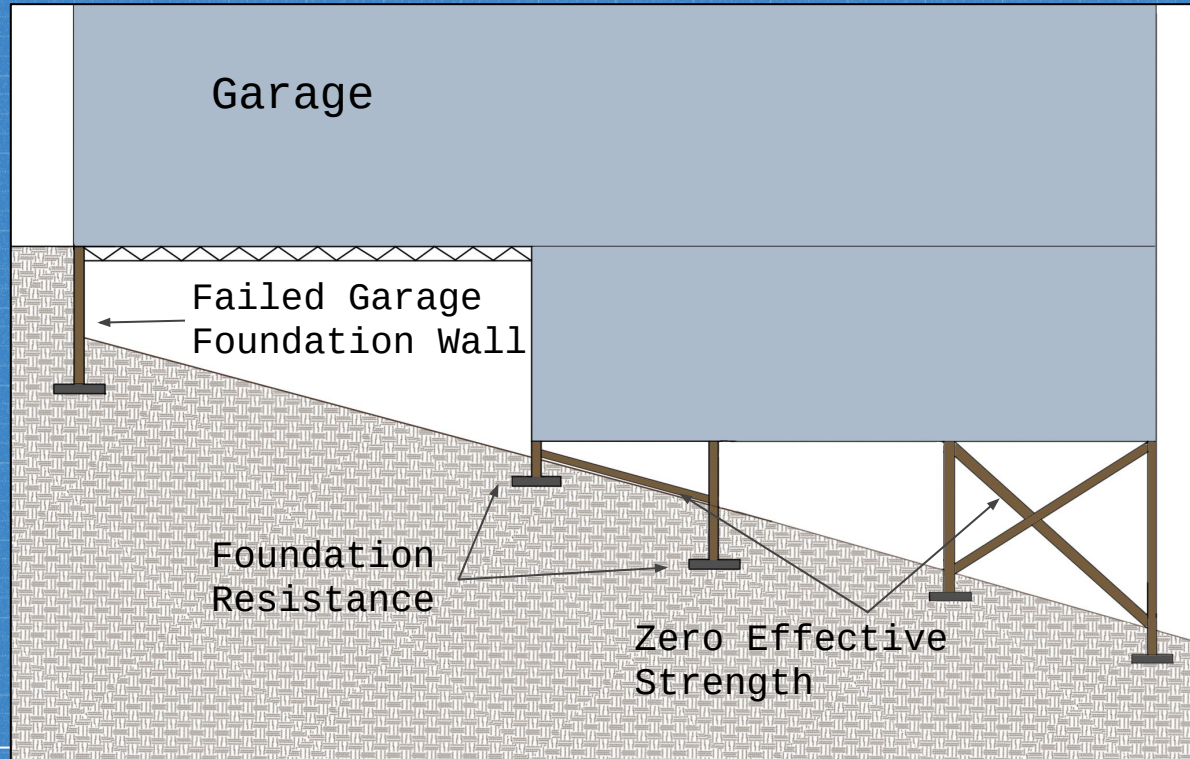


# AREAS OF CONCERN

Failed Garage  
Foundation Wall

Shear resistance for  
the crawl space

Shear resistance  
through the  
foundation



# CONSIDERATIONS



Recommended for all Alternatives:

- Add wall sheathing in garage
- Soil backfill

# ALTERNATIVES

## Alternative 1: Wood

Wood shear wall East end

Wood foundation wall  
repair

Steel beam under garage

## Alternative 2: Concrete

Enclosed concrete basement

Concrete foundation wall  
repair

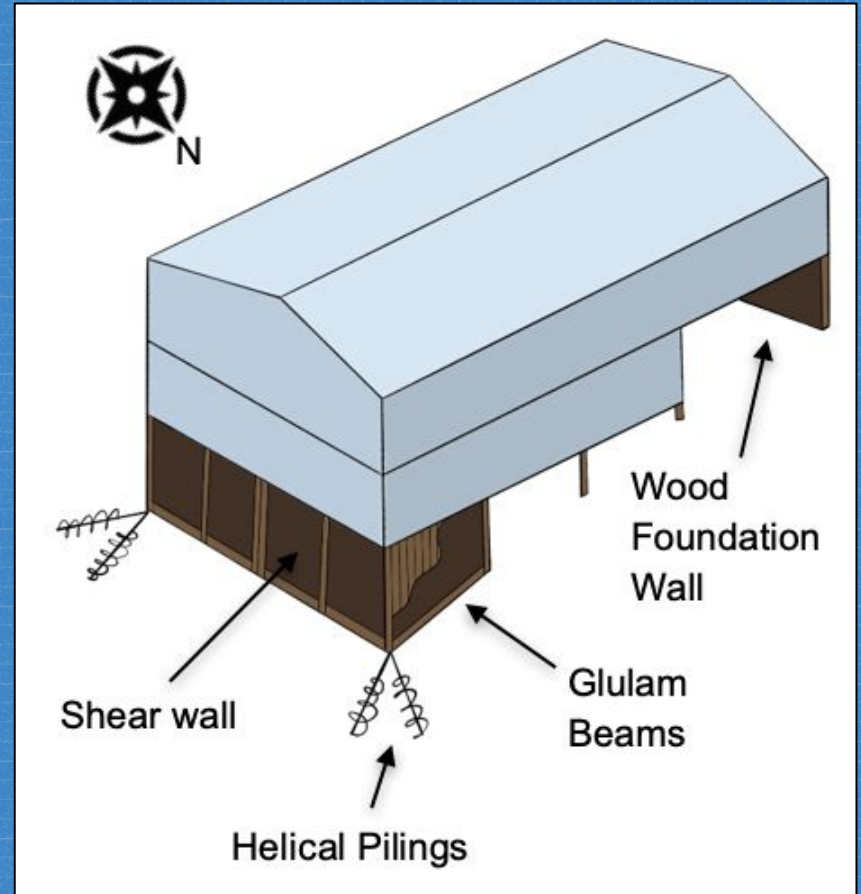
Steel beam under garage

# ALTERNATIVE 1: East End

Glulam beams

Helical Pilings

Wood sheathing

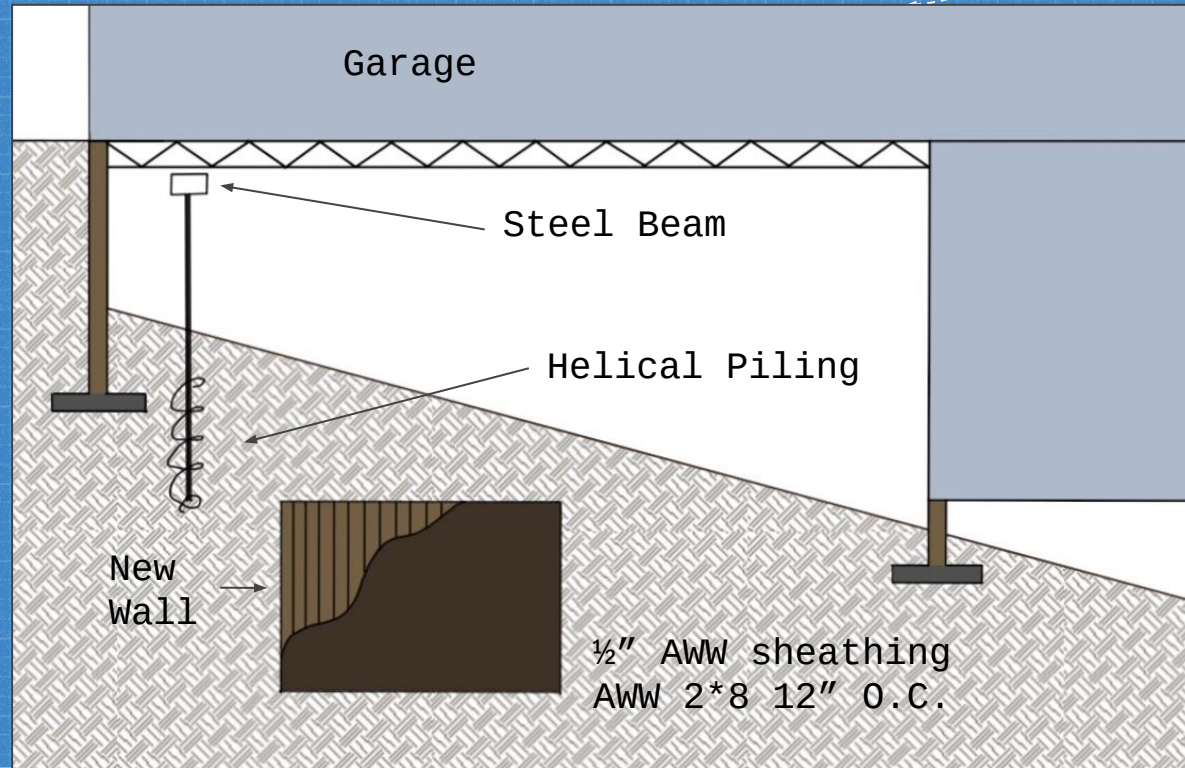


# ALT 1: Foundation Wall

Steel beam for temporary support

AWW foundation wall replacement

Leave beam  
Added support



# ALT. 1 CONSIDERATIONS



Construction time

Noise levels

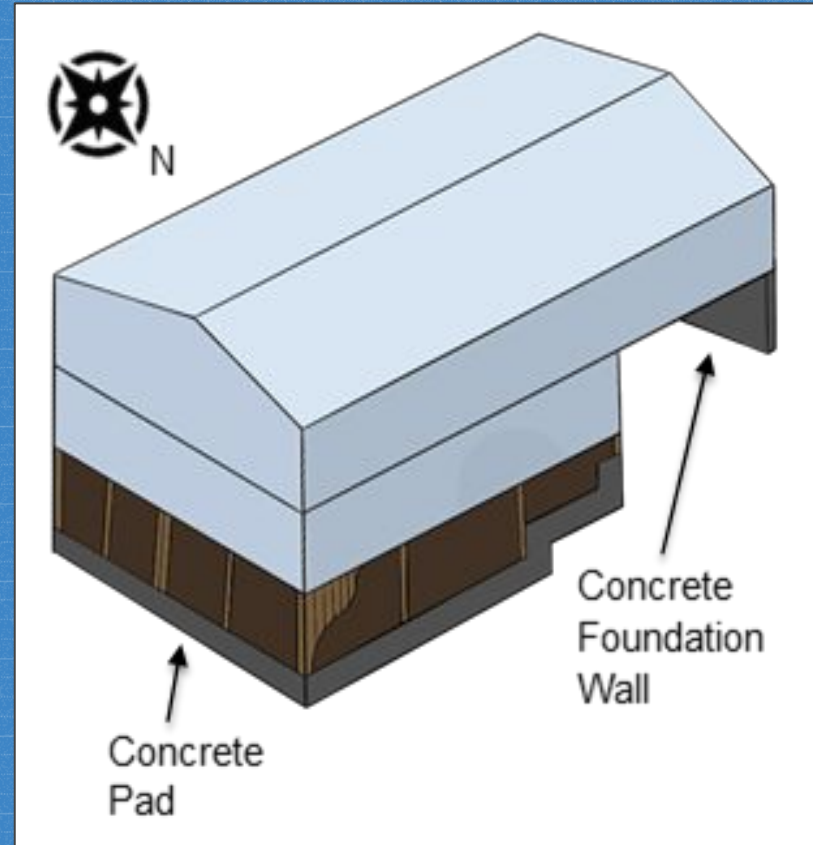
Total cost - \$24,000

# ALTERNATIVE 2: Basement

Monolithic concrete  
foundation

Basement adds 504  
sq. ft

Raises ground  
elevation  
approximately 2 ft

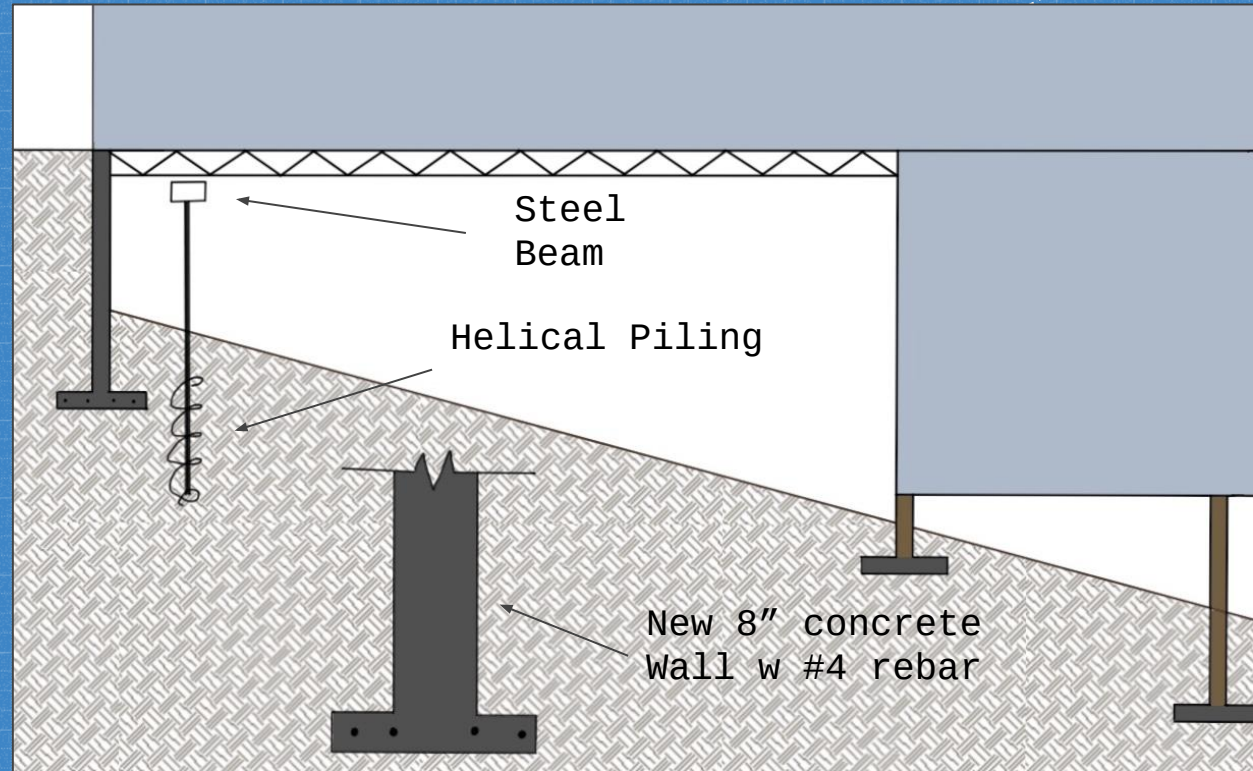


# ALT. 2: Foundation Wall

Steel Beam  
Brace

8" poured  
concrete wall

Waterproofing



# ALT. 2 CONSIDERATIONS



Construction time

Noise levels

Total cost - \$73,500

Additional home value

# RECOMMENDATIONS

Garage wall sheathing  
Foundation wall backfill

Needs Further  
Inspection:

Porch Columns  
Garage Trusses  
Glulam Beam

Alternative 2: Concrete

Enclosed concrete basement

Steel beam brace

Concrete foundation wall

Total Cost - \$73,500

Additional value of \$50,000

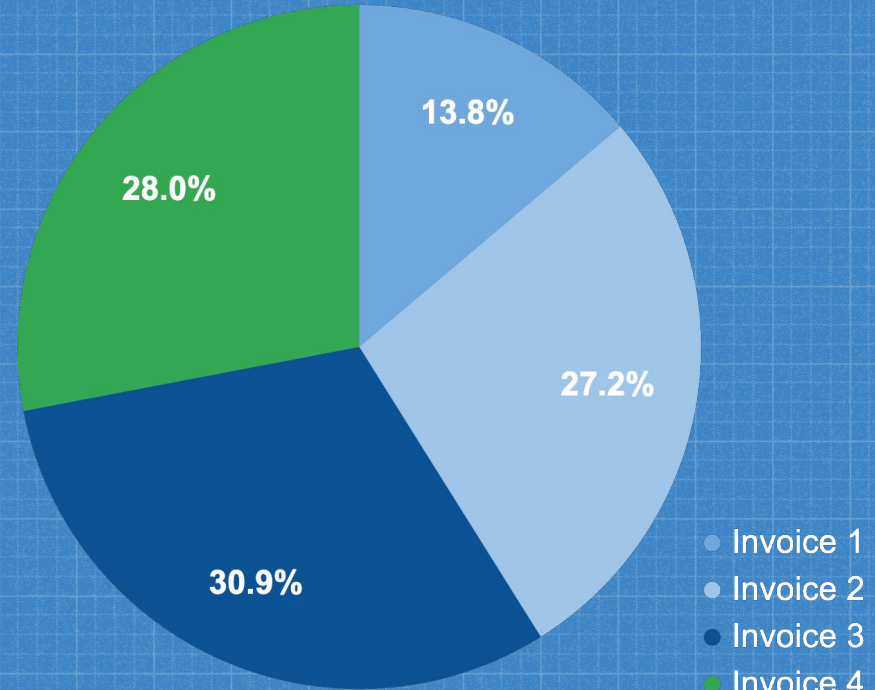
# FINAL BUDGET

Current Invoice Total	<b>\$13,390</b>
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Total Billed to Date	<b>\$47,820</b>
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Percent of Estimated Budget	<b>115%</b>
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Budget Remaining	<b>-\$2620</b>
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# Thank You!

ANY QUESTIONS?

# REFERENCES

1. <https://design.medeek.com/resources/wind.html>
2. <https://hazards.atcouncil.org>
3. <https://www.semanticscholar.org/paper/Friction-Joints-for-Seismic-Control-of-Large-Panel-Pall-Marsh/dd2388a7e46c01b4c736e7b78c2a20601f2ea1e7>
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