

# Risk Analysis

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Presented by Erica Spiritos and Graham Montgomery



*Disclaimer: This presentation was developed by a third party and is not funded by WoodWorks or the Softwood Lumber Board.*

# Learning Objectives

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## **Risk Analysis**

### Financial Risk

- Delivery Method (Design-Bid-Build vs. CM/GC or Design-Build)
- Tariffs and Trade Wars (or threat of the same)
- Commodity price fluctuation
- Unknown Product Type
- Inefficient Design

### Jurisdictional Approval

- Varying levels of acceptance across jurisdictions
- Limited tested assemblies
- Engineering judgements required
- AMMRs and Performance Based Design

### Schedule

- Supplier Capacity / Production Availability
- On-site productivity
- Delivery timeline (and design decision-making) for North American vs. European Supply
- Inefficient Details
- Lack of understanding of erection/assembly methods

### Product Quality/Failure

- Constructability issues arising from differences in manufacturing and construction tolerances
- Improper detailing
- Water-damage of material
- Rust staining of wood from steel connectors

# Types of Risk

# Types of Risk

## Financial Risk

- Delivery Method (Design-Bid-Build vs. CM/GC or Design-Build)
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# Types of Risk

## Schedule Risk

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# Types of Risk

## Product/Quality Control Risk

- Constructability issues arising from differences in manufacturing and construction tolerances
- Improper detailing
- Water-damage of material
- Rust staining of wood from steel connectors

# FINANCIAL RISK



# Delivery Method



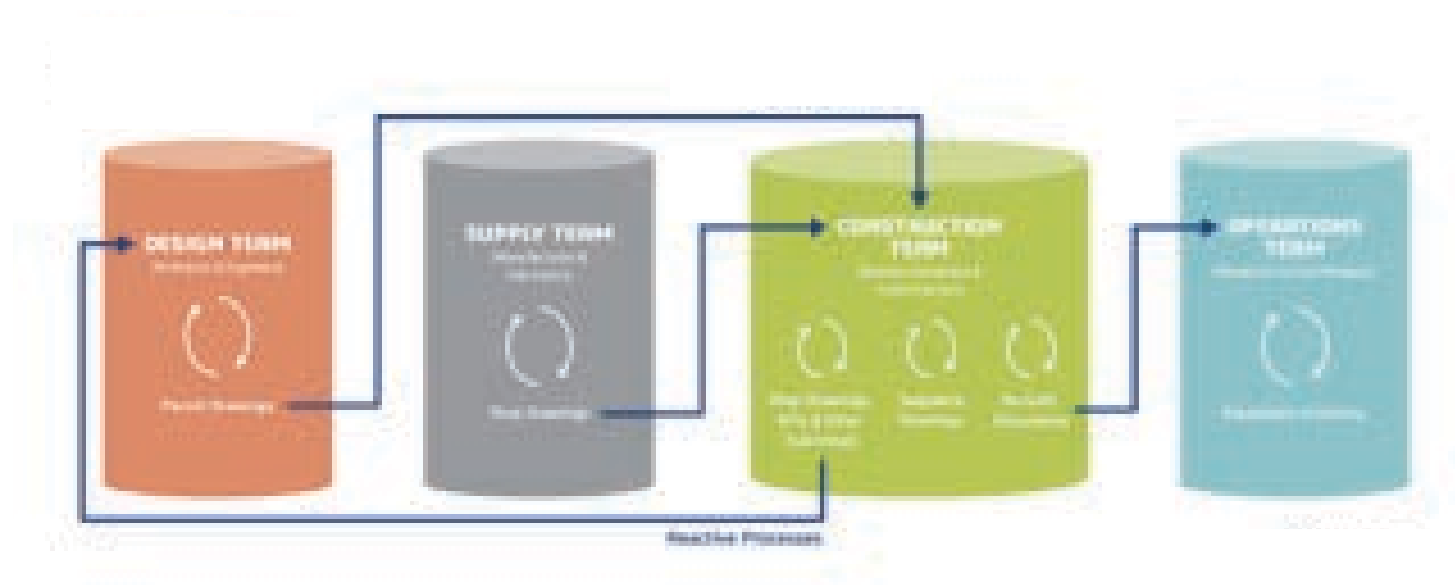
5% Savings

Neutrality



10% Premium

# Delivery Method







3

1

2



# Delivery Method









# Commodity Price Fluctuation

4

April 5, 2019

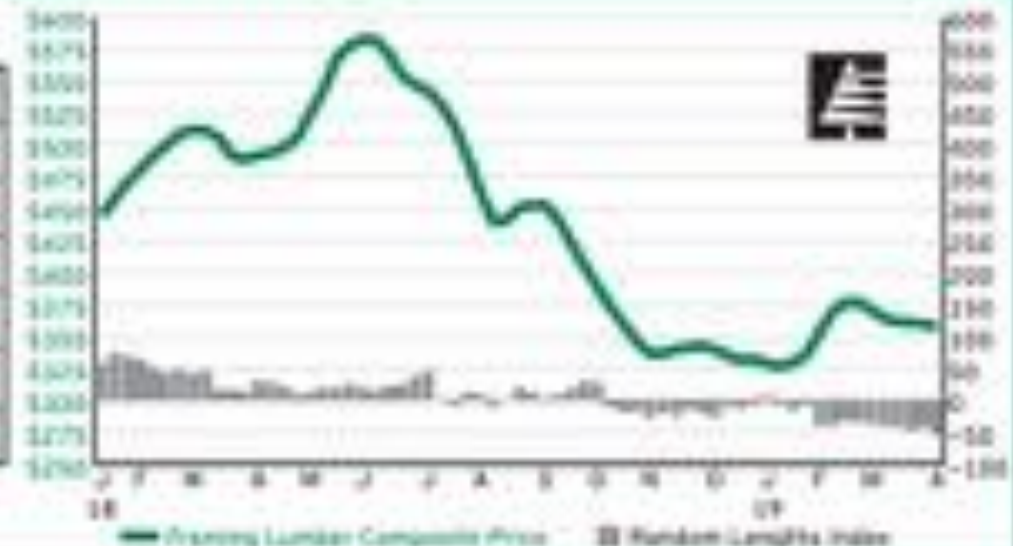
 **RANDOM LENGTHS**

## Lumber Market Report

### Lumber Market Indicators

|  | This Week   | Last Week   | Year Ago                 |     |     |     |
|--|---|---|--------------------------|-----|-----|-----|
| <b>Framing Lumber Composite Price</b>  | <b>\$358</b>  | <b>\$360</b>  | <b>\$492</b>             |     |     |     |
| 2x4 #2&lt;tr> <td>2x4 #1&amp;lt;tr&gt;<td>2x4 S&amp;lt;tr&gt;<td>2x4 #1 KD SYP (Westside)</td><td>405</td><td>405</td><td>564</td></td></td> | 2x4 #1&lt;tr> <td>2x4 S&amp;lt;tr&gt;<td>2x4 #1 KD SYP (Westside)</td><td>405</td><td>405</td><td>564</td></td> | 2x4 S&lt;tr> <td>2x4 #1 KD SYP (Westside)</td> <td>405</td> <td>405</td> <td>564</td> | 2x4 #1 KD SYP (Westside) | 405 | 405 | 564 |
| 2x4 #1 PCT KD Western S-P-F  | 270   | 270   | 378                      |     |     |     |
| 1x12 43 KD Ponderosa Pine  | 460   | 460   | 575                      |     |     |     |
| <b>Random Lengths Index*</b>   | <b>-53.6</b>  | <b>-41.6</b>  | <b>+29.9</b>             |     |     |     |

\* The index is a numerical representation of market activity based on a ratio of current season's order flow to inventories. In computing the index, the data are compared with similar data averaged over the past three years.





# Exchange Rate Effects

1 Canadian Dollar equals  
**0.76 United States Dollar**

Oct 18, 9:45 PM UTC - Disclaimer

|      |                      |
|------|----------------------|
| 1    | Canadian Dollar      |
| 0.76 | United States Dollar |

Data provided by Morningstar for Currency and Coinbase for Cryptocurrency



Convert currencies

1.00

Euro

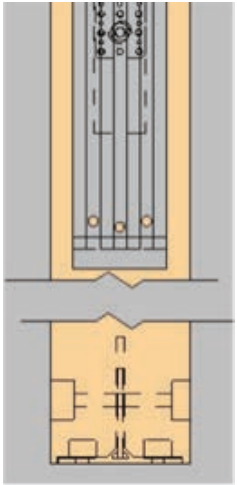
= 1.10

US Dollar



Last updated: October 18 9:45 PM - Data from Reuters

# Unknown Product Type



Detailing



Manufacture



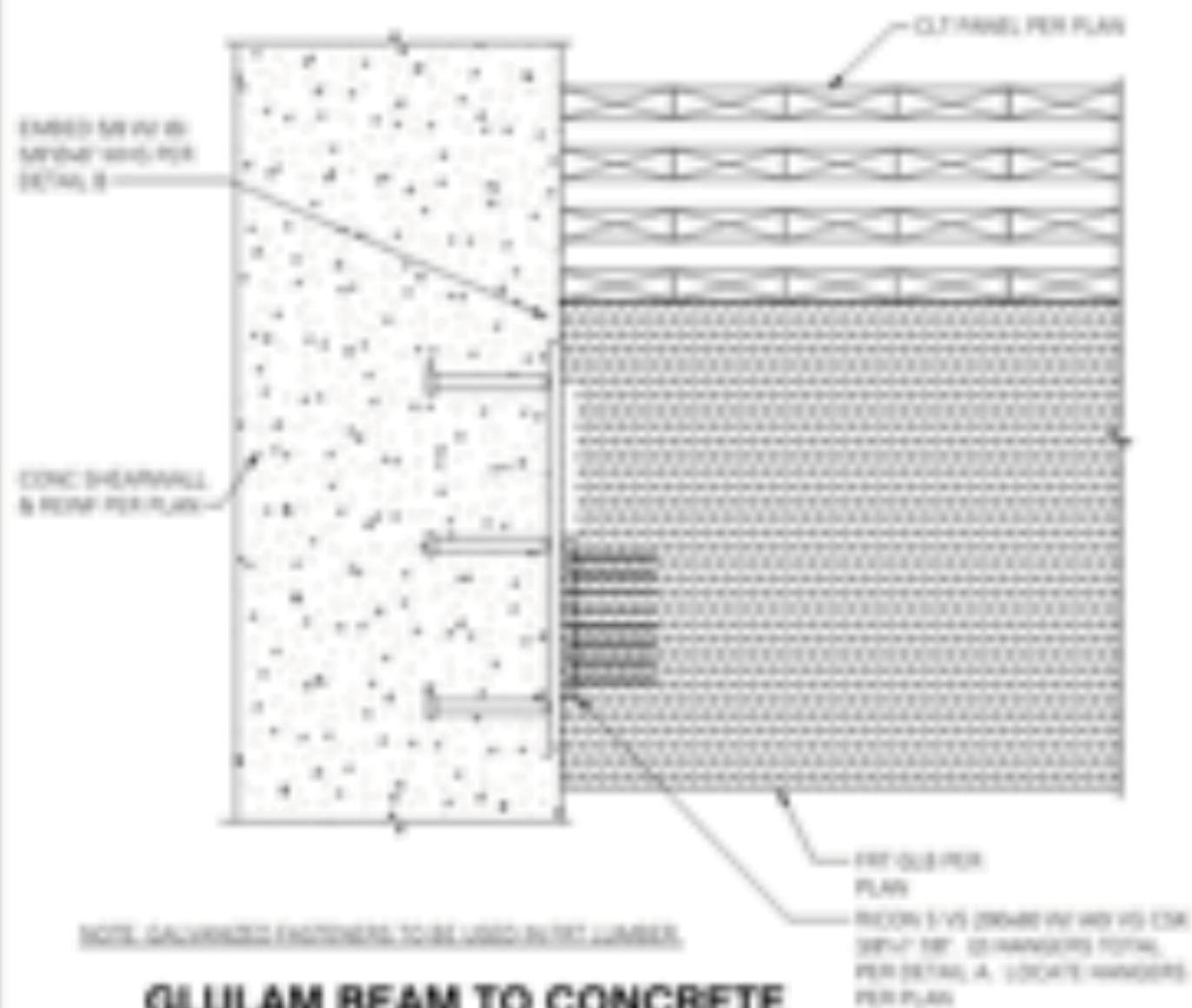
Fabrication



Misc. Metals



Fasteners

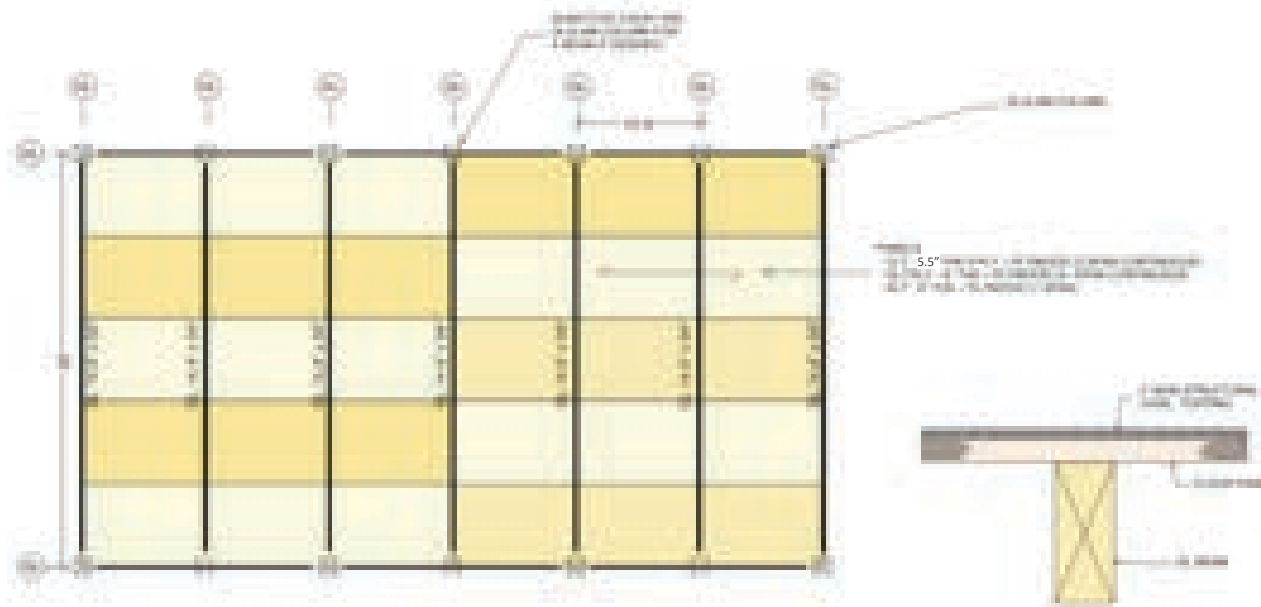


## GLULAM BEAM TO CONCRETE WALL CONNECTION

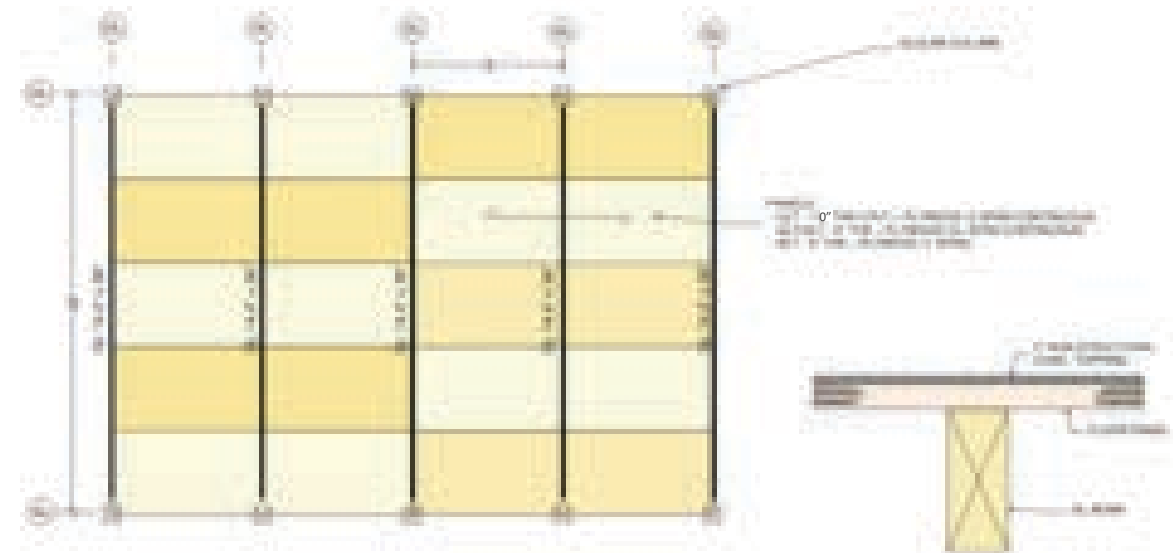
16

SCALE: 1/4" = 1'-0"

# Inefficient Design



Baseline

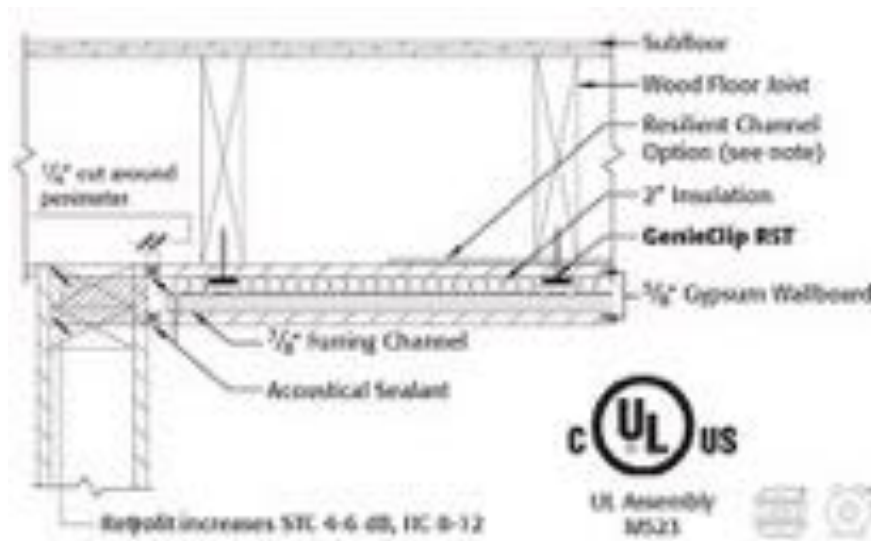


+5%

# JURISDICTIONAL RISK

# Limited Tested Assemblies

- Building Inspectors look for UL rated assemblies
- UL rated assemblies are like pre approved recipes with materials acting like ingredients
- Currently no UL rated assemblies with CLT in floors or walls



<http://pliteq.com/products/genieclip/applications/retrofit.php>

## Limited Tested Assemblies

Building  
Permit

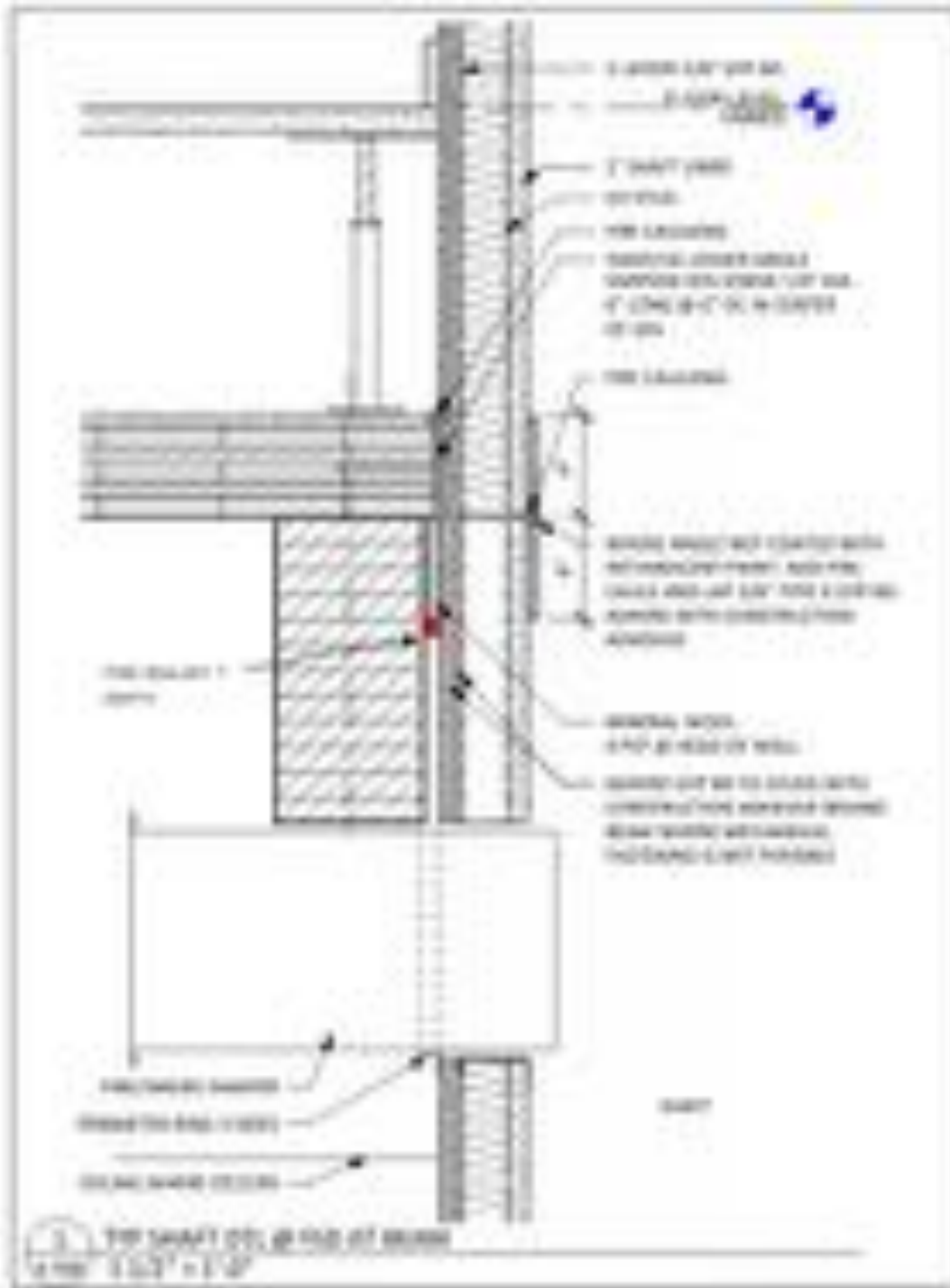
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Inspectable  
Condition

# Engineering Judgments

## 1hr Floor Panels in 2 Hour Rated Shafts:

- The shaft walls need to be continuous per code, but cannot feasibly be constructed as balloon frame. So to deal with this, First Tech used angle brackets at each floor to support the metal stud wall above.
- The angle bracket at each level needs to be coated with intumescent paint, which can be expensive. Best to coordinate this in advance.
- The shaft openings in the CLT need to be cut to the right size to accommodate whatever ductwork fits inside, and some degree of spacing (6") between the duct and the wall. Need to understand the wall thickness.





# AMMRs & Performance-Based Design

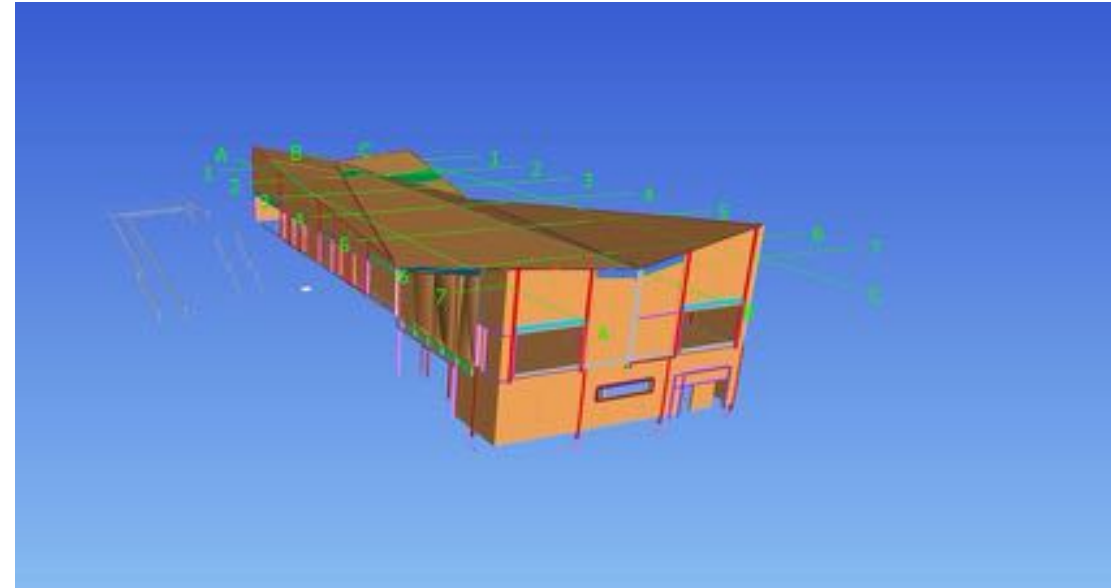
- Need to determine code acceptance path very early
- Engage strong design partners familiar with alternative approaches
- Pre-permit and pre-inspection communication with AHJ is key
- Fire engineering is often overlooked
- Read the general notes and code information!



# SCHEDULE RISK

# RFI & Shop Drawing Process

- Cloud collaboration is recommended to streamline process
- 3D coordination is a must, 2D documents are formality
- Front end heavy on CA – 3-6 months before project breaks ground
- Need to have all structural trades onboard early
- MEP trades onboard is strongly recommended



# Building Permit

- Creative permitting approach is usually needed to make timing work
- Understand how specialty / delegated engineering interacts with other permits



# Supplier Capacity | Production Availability

- Timing of Award
- Manufacturing availability is a huge constraint
- Workflow of information is different for every producer
- Allowances for OT and acceleration help
- Cash flow



[Downloaded At: 11:53 11 September 2009](#)



# On-Site Productivity



## Considerations:

- Number of trucks allowed on-site
- Lay-down staging area to sort materials
- Building Geometry
  - Consistency of panel sizes
  - Squareness of panels
- Extent of prefabrication for connections
- CLT Bearing members: glulam or steel?
  - Manufacturing Tolerances
  - Notching around columns

| STRUCTURELAM                |      |          |                         |                         |   |
|-----------------------------|------|----------|-------------------------|-------------------------|---|
| Item                        | Unit | Quantity | Unit Price              | Total Price             | Remarks                                       |
| 1. 200                      | mm   | 1.00     | 100.00                  | 100.00                  | 200mm thick concrete slab                     |
| 2. 150                      | mm   | 1.00     | 75.00                   | 75.00                   | 150mm thick concrete slab                     |
| 3. 100                      | mm   | 1.00     | 50.00                   | 50.00                   | 100mm thick concrete slab                     |
| 4. 50                       | mm   | 1.00     | 25.00                   | 25.00                   | 50mm thick concrete slab                      |
| 5. 25                       | mm   | 1.00     | 12.50                   | 12.50                   | 25mm thick concrete slab                      |
| 6. 12.5                     | mm   | 1.00     | 6.25                    | 6.25                    | 12.5mm thick concrete slab                    |
| 7. 6.25                     | mm   | 1.00     | 3.125                   | 3.125                   | 6.25mm thick concrete slab                    |
| 8. 3.125                    | mm   | 1.00     | 1.5625                  | 1.5625                  | 3.125mm thick concrete slab                   |
| 9. 1.5625                   | mm   | 1.00     | 0.78125                 | 0.78125                 | 1.5625mm thick concrete slab                  |
| 10. 0.78125                 | mm   | 1.00     | 0.390625                | 0.390625                | 0.78125mm thick concrete slab                 |
| 11. 0.390625                | mm   | 1.00     | 0.1953125               | 0.1953125               | 0.390625mm thick concrete slab                |
| 12. 0.1953125               | mm   | 1.00     | 0.09765625              | 0.09765625              | 0.1953125mm thick concrete slab               |
| 13. 0.09765625              | mm   | 1.00     | 0.048828125             | 0.048828125             | 0.09765625mm thick concrete slab              |
| 14. 0.048828125             | mm   | 1.00     | 0.0244140625            | 0.0244140625            | 0.048828125mm thick concrete slab             |
| 15. 0.0244140625            | mm   | 1.00     | 0.01220703125           | 0.01220703125           | 0.0244140625mm thick concrete slab            |
| 16. 0.01220703125           | mm   | 1.00     | 0.006103515625          | 0.006103515625          | 0.01220703125mm thick concrete slab           |
| 17. 0.006103515625          | mm   | 1.00     | 0.0030517578125         | 0.0030517578125         | 0.006103515625mm thick concrete slab          |
| 18. 0.0030517578125         | mm   | 1.00     | 0.00152587890625        | 0.00152587890625        | 0.0030517578125mm thick concrete slab         |
| 19. 0.00152587890625        | mm   | 1.00     | 0.000762939453125       | 0.000762939453125       | 0.00152587890625mm thick concrete slab        |
| 20. 0.000762939453125       | mm   | 1.00     | 0.0003814697265625      | 0.0003814697265625      | 0.000762939453125mm thick concrete slab       |
| 21. 0.0003814697265625      | mm   | 1.00     | 0.00019073486328125     | 0.00019073486328125     | 0.0003814697265625mm thick concrete slab      |
| 22. 0.00019073486328125     | mm   | 1.00     | 9.5367431640625e-05     | 9.5367431640625e-05     | 0.00019073486328125mm thick concrete slab     |
| 23. 9.5367431640625e-05     | mm   | 1.00     | 4.76837158203125e-05    | 4.76837158203125e-05    | 9.5367431640625e-05mm thick concrete slab     |
| 24. 4.76837158203125e-05    | mm   | 1.00     | 2.384185791015625e-05   | 2.384185791015625e-05   | 4.76837158203125e-05mm thick concrete slab    |
| 25. 2.384185791015625e-05   | mm   | 1.00     | 1.1920928955078125e-05  | 1.1920928955078125e-05  | 2.384185791015625e-05mm thick concrete slab   |
| 26. 1.1920928955078125e-05  | mm   | 1.00     | 5.9604644775390625e-06  | 5.9604644775390625e-06  | 1.1920928955078125e-05mm thick concrete slab  |
| 27. 5.9604644775390625e-06  | mm   | 1.00     | 2.98023223876953125e-06 | 2.98023223876953125e-06 | 5.9604644775390625e-06mm thick concrete slab  |
| 28. 2.98023223876953125e-06 | mm   | 1.00     | 1.4901161193847656e-06  | 1.4901161193847656e-06  | 2.98023223876953125e-06mm thick concrete slab |
| 29. 1.4901161193847656e-06  | mm   | 1.00     | 7.450580596923828e-07   | 7.450580596923828e-07   | 1.4901161193847656e-06mm thick concrete slab  |
| 30. 7.450580596923828e-07   | mm   | 1.00     | 3.725290298461914e-07   | 3.725290298461914e-07   | 7.450580596923828e-07mm thick concrete slab   |
| 31. 3.725290298461914e-07   | mm   | 1.00     | 1.862645149230957e-07   | 1.862645149230957e-07   | 3.725290298461914e-07mm thick concrete slab   |
| 32. 1.862645149230957e-07   | mm   | 1.00     | 9.313225746154785e-08   | 9.313225746154785e-08   | 1.862645149230957e-07mm thick concrete slab   |
| 33. 9.313225746154785e-08   | mm   | 1.00     | 4.6566128730773925e-08  | 4.6566128730773925e-08  | 9.313225746154785e-08mm thick concrete slab   |
| 34. 4.6566128730773925e-08  | mm   | 1.00     | 2.3283064365386962e-08  | 2.3283064365386962e-08  | 4.6566128730773925e-08mm thick concrete slab  |
| 35. 2.3283064365386962e-08  | mm   | 1.00     | 1.1641532182693481e-08  | 1.1641532182693481e-08  | 2.3283064365386962e-08mm thick concrete slab  |
| 36. 1.1641532182693481e-08  | mm   | 1.00     | 5.8207660913467405e-09  | 5.8207660913467405e-09  | 1.1641532182693481e-08mm thick concrete slab  |
| 37. 5.8207660913467405e-09  | mm   | 1.00     | 2.9103830456733702e-09  | 2.9103830456733702e-09  | 5.8207660913467405e-09mm thick concrete slab  |
| 38. 2.9103830456733702e-09  | mm   | 1.00     | 1.4551915228366851e-09  | 1.4551915228366851e-09  | 2.9103830456733702e-09mm thick concrete slab  |
| 39. 1.4551915228366851e-09  | mm   | 1.00     | 7.2759576141834255e-10  | 7.2759576141834255e-10  | 1.4551915228366851e-09mm thick concrete slab  |
| 40. 7.2759576141834255e-10  | mm   | 1.00     | 3.6379788070917127e-10  | 3.6379788070917127e-10  | 7.2759576141834255e-10mm thick concrete slab  |
| 41. 3.6379788070917127e-10  | mm   | 1.00     | 1.8189894035458564e-10  | 1.8189894035458564e-10  | 3.6379788070917127e-10mm thick concrete slab  |
| 42. 1.8189894035458564e-10  | mm   | 1.00     | 9.094947017729282e-11   | 9.094947017729282e-11   | 1.8189894035458564e-10mm thick concrete slab  |
| 43. 9.094947017729282e-11   | mm   | 1.00     | 4.547473508864641e-11   | 4.547473508864641e-11   | 9.094947017729282e-11mm thick concrete slab   |
| 44. 4.547473508864641e-11   | mm   | 1.00     | 2.2737367544323205e-11  | 2.2737367544323205e-11  | 4.547473508864641e-11mm thick concrete slab   |
| 45. 2.2737367544323205e-11  | mm   | 1.00     | 1.1368683772161602e-11  | 1.1368683772161602e-11  | 2.2737367544323205e-11mm thick concrete slab  |
| 46. 1.1368683772161602e-11  | mm   | 1.00     | 5.684341886080801e-12   | 5.684341886080801e-12   | 1.1368683772161602e-11mm thick concrete slab  |
| 47. 5.684341886080801e-12   | mm   | 1.00     | 2.8421709430404005e-12  | 2.8421709430404005e-12  | 5.684341886080801e-12mm thick concrete slab   |
| 48. 2.8421709430404005e-12  | mm   | 1.00     | 1.4210854715202002e-12  | 1.4210854715202002e-12  | 2.8421709430404005e-12mm thick concrete slab  |
| 49. 1.4210854715202002e-12  | mm   | 1.00     | 7.105427357601001e-13   | 7.105427357601001e-13   | 1.4210854715202002e-12mm thick concrete slab  |
| 50. 7.105427357601001e-13   | mm   | 1.00     | 3.5527136788005005e-13  | 3.5527136788005005e-13  | 7.105427357601001e-13mm thick concrete slab   |
| 51. 3.5527136788005005e-13  | mm   | 1.00     | 1.7763568394002502e-13  | 1.7763568394002502e-13  | 3.5527136788005005e-13mm thick concrete slab  |
| 52. 1.7763568394002502e-13  | mm   | 1.00     | 8.881784197001251e-14   | 8.881784197001251e-14   | 1.7763568394002502e-13mm thick concrete slab  |
| 53. 8.881784197001251e-14   | mm   | 1.00     | 4.4408920985006255e-14  | 4.4408920985006255e-14  | 8.881784197001251e-14mm thick concrete slab   |
| 54. 4.4408920985006255e-14  | mm   | 1.00     | 2.2204460492503127e-14  | 2.2204460492503127e-14  | 4.4408920985006255e-14mm thick concrete slab  |
| 55. 2.2204460492503127e-14  | mm   | 1.00     | 1.1102230246251564e-14  | 1.1102230246251564e-14  | 2.2204460492503127e-14mm thick concrete slab  |
| 56. 1.1102230246251564e-14  | mm   | 1.00     | 5.551115123125782e-15   | 5.551115123125782e-15   | 1.1102230246251564e-14mm thick concrete slab  |
| 57. 5.551115123125782e-15   | mm   | 1.00     | 2.775557561562891e-15   | 2.775557561562891e-15   | 5.551115123125782e-15mm thick concrete slab   |
| 58. 2.775557561562891e-15   | mm   | 1.00     | 1.3877787807814455e-15  | 1.3877787807814455e-15  | 2.775557561562891e-15mm thick concrete slab   |
| 59. 1.3877787807814455e-15  | mm   | 1.00     | 6.9388939039072275e-16  | 6.9388939039072275e-16  | 1.3877787807814455e-15mm thick concrete slab  |
| 60. 6.9388939039072275e-16  | mm   | 1.00     | 3.4694469519536137e-16  | 3.4694469519536137e-16  | 6.9388939039072275e-16mm thick concrete slab  |
| 61. 3.4694469519536137e-16  | mm   | 1.00     | 1.7347234759768069e-16  | 1.7347234759768069e-16  | 3.4694469519536137e-16mm thick concrete slab  |
| 62. 1.7347234759768069e-16  | mm   | 1.00     | 8.673617379884034e-17   | 8.673617379884034e-17   | 1.7347234759768069e-16mm thick concrete slab  |
| 63. 8.673617379884034e-17   | mm   | 1.00     | 4.336808689942017e-17   | 4.336808689942017e-17   | 8.673617379884034e-17mm thick concrete slab   |
| 64. 4.336808689942017e-17   | mm   | 1.00     | 2.1684043449710085e-17  | 2.1684043449710085e-17  | 4.336808689942017e-17mm thick concrete slab   |
| 65. 2.1684043449710085e-17  | mm   | 1.00     | 1.0842021724855042e-17  | 1.0842021724855042e-17  | 2.1684043449710085e-17mm thick concrete slab  |
| 66. 1.0842021724855042e-17  | mm   | 1.00     | 5.421010862427521e-18   | 5.421010862427521e-18   | 1.0842021724855042e-17mm thick concrete slab  |
| 67. 5.421010862427521e-18   | mm   | 1.00     | 2.7105054312137605e-18  | 2.7105054312137605e-18  | 5.421010862427521e-18mm thick concrete slab   |
| 68. 2.7105054312137605e-18  | mm   | 1.00     | 1.3552527156068802e-18  | 1.3552527156068802e-18  | 2.7105054312137605e-18mm thick concrete slab  |
| 69. 1.3552527156068802e-18  | mm   | 1.00     | 6.776263578034401e-19   | 6.776263578034401e-19   | 1.3552527156068802e-18mm thick concrete slab  |
| 70. 6.776263578034401e-19   | mm   | 1.00     | 3.3881317890172005e-19  | 3.3881317890172005e-19  | 6.776263578034401e-19mm thick concrete slab   |
| 71. 3.3881317890172005e-19  | mm   | 1.00     | 1.6940658945086002e-19  | 1.6940658945086002e-19  | 3.3881317890172005e-19mm thick concrete slab  |
| 72. 1.6940658945086002e-19  | mm   | 1.00     | 8.470329472543001e-20   | 8.470329472543001e-20   | 1.6940658945086002e-19mm thick concrete slab  |
| 73. 8.470329472543001e-20   | mm   | 1.00     | 4.2351647362715005e-20  | 4.2351647362715005e-20  | 8.470329472543001e-20mm thick concrete slab   |
| 74. 4.2351647362715005e-20  | mm   | 1.00     | 2.1175823681357502e-20  | 2.1175823681357502e-20  | 4.2351647362715005e-20mm thick concrete slab  |
| 75. 2.1175823681357502e-20  | mm   | 1.00     | 1.0587911840678751e-20  | 1.0587911840678751e-20  | 2.1175823681357502e-20mm thick concrete slab  |
| 76. 1.0587911840678751e-20  | mm   | 1.00     | 5.2939559203393755e-21  | 5.2939559203393755e-21  | 1.0587911840678751e-20mm thick concrete slab  |
| 77. 5.2939559203393755e-21  | mm   | 1.00     | 2.6469779601696877e-21  | 2.6469779601696877e-21  | 5.2939559203393755e-21mm thick concrete slab  |
| 78. 2.6469779601696877e-21  | mm   | 1.00     | 1.3234889800848439e-21  | 1.3234889800848439e-21  | 2.6469779601696877e-21mm thick concrete slab  |
| 79. 1.3234889800848439e-21  | mm   | 1.00     | 6.6174449004242195e-22  | 6.6174449004242195e-22  | 1.3234889800848439e-21mm thick concrete slab  |
| 80. 6.6174449004242195e-22  | mm   | 1.00     | 3.3087224502121097e-22  | 3.3087224502121097e-22  | 6.6174449004242195e-22mm thick concrete slab  |
| 81. 3.3087224502121097e-22  | mm   | 1.00     | 1.6543612251060549e-22  | 1.6543612251060549e-22  | 3.3087224502121097e-22mm thick concrete slab  |
| 82. 1.6543612251060549e-22  | mm   | 1.00     | 8.271806125530274e-23   | 8.271806125530274e-23   | 1.6543612251060549e-22mm thick concrete slab  |
| 83. 8.271806125530274e-23   | mm   | 1.00     | 4.135903062765137e-23   | 4.135903062765137e-23   | 8.271806125530274e-23mm thick concrete slab   |
| 84. 4.135903062765137e-23   | mm   | 1.00     | 2.0679515313825685e-23  | 2.0679515313825685e-23  | 4.135903062765137e-23mm thick concrete slab   |
| 85. 2.0679515313825685e-23  | mm   | 1.00     | 1.0339757656912842e-23  | 1.0339757656912842e-23  | 2.0679515313825685e-23mm thick concrete slab  |
| 86. 1.0339757656912842e-23  | mm   | 1.00     | 5.169878828456421e-24   | 5.169878828456421e-24   | 1.0339757656912842e-23mm thick concrete slab  |
| 87. 5.169878828456421e-24   | mm   | 1.00     | 2.5849394142282105e-24  | 2.5849394142282105e-24  | 5.169878828456421e-24mm thick concrete slab   |
| 88. 2.5849394142282105e-24  | mm   | 1.00     | 1.2924697071141052e-24  | 1.2924697071141052e-24  | 2.5849394142282105e-24mm thick concrete slab  |
| 89. 1.2924697071141052e-24  | mm   | 1.00     | 6.462348535570526e-25   | 6.462348535570526e-25   | 1.2924697071141052e-24mm thick concrete slab  |
| 90. 6.462348535570526e-25   | mm   | 1.00     | 3.231174267785263e-25   | 3.231174267785263e-25   | 6.462348535570526e-25mm thick concrete slab   |
| 91. 3.231174267785263e-25   | mm   | 1.00     | 1.6155871338926315e-25  | 1.6155871338926315e-25  | 3.231174267785263e-25mm thick concrete slab   |
| 92. 1.6155871338926315e-25  | mm   | 1.00     | 8.077935669463157e-26   | 8.077935669463157e-26   | 1.6155871338926315e-25mm thick concrete slab  |
| 93. 8.077935669463157e-26   | mm   | 1.00     | 4.0389678347315785e-26  | 4.0389678347315785e-26  | 8.077935669463157e-26mm thick concrete slab   |
| 94. 4.0389678347315785e-26  | mm   | 1.00     | 2.0194839173657892e-26  | 2.0194839173657892e-26  | 4.0389678347315785e-26mm thick concrete slab  |
| 95. 2.0194839173657892e-26  | mm   | 1.00     | 1.0097419586828946e-26  | 1.0097419586828946e-26  | 2.0194839173657892e-26mm thick concrete slab  |
| 96. 1.0097419586828946e-26  | mm   | 1.00     | 5.048709793414473e-27   | 5.048709793414473e-27   | 1.0097419586828946e-26mm thick concrete slab  |
| 97. 5.048709793414473e-27   | mm   | 1.00     | 2.5243548967072365e-27  | 2.5243548967072365e-27  | 5.048709793414473e-27mm thick concrete slab   |
| 98. 2.5243548967072365e-27  | mm   | 1.00     | 1.2621774483536182e-27  | 1.2621774483536182e-27  | 2.5243548967072365e-27mm thick concrete slab  |
| 99. 1.26                    |      |          |                         |                         |   |

# Unfamiliar Erection & Assembly Methods

- All Engineered Pick Plans
- Specialty Rigging Hardware
- Spline Connection vs Butt Joints





# PRODUCT QUALITY RISK

# Manufacturing Tolerances



Timber to Concrete



Timber to Timber

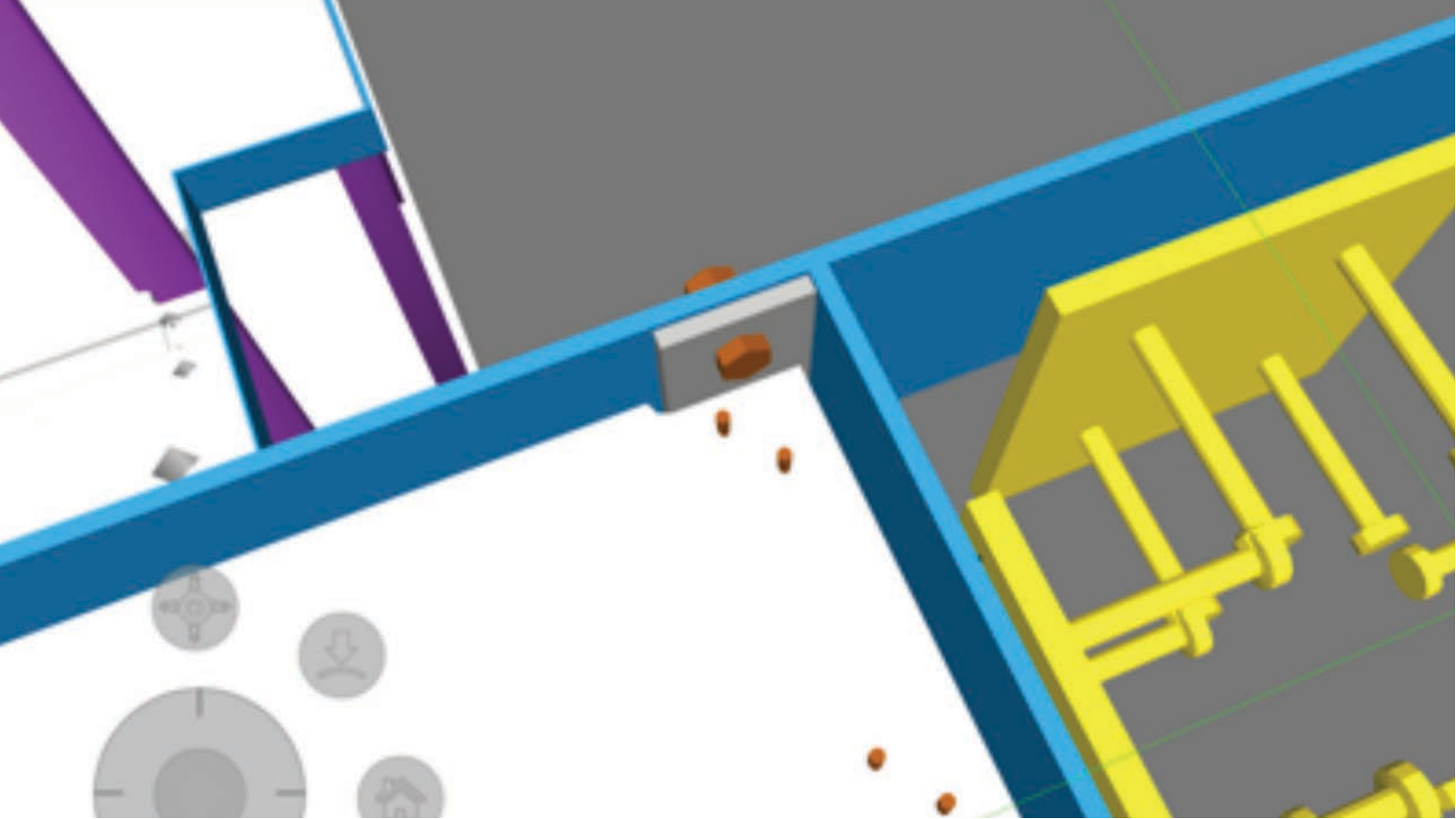


Timber to Steel

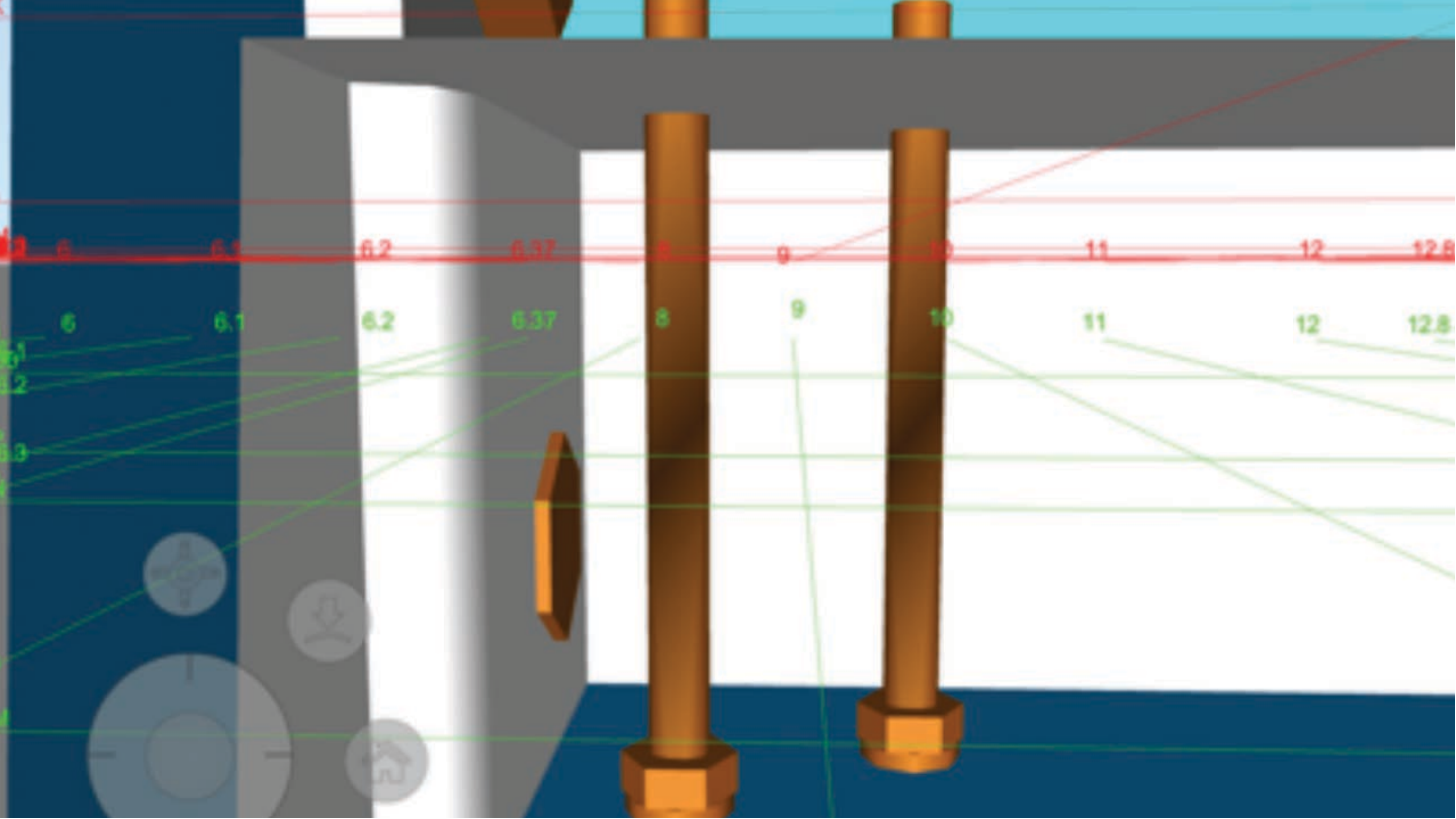
# Inefficient Detailing



- Field Cuts cause inefficient productivity
- Ripping down of panels
- Uncoordinated steel and concrete models
- RFI's post approved fabrication drawings







# Water Damage



- Engineered wood products are resilient when it comes to moisture
- Keep tarped as long as possible



# Rust & Iron Staining

- Importance of steel coating in high moisture areas
  - Galvanized



| Risk Category                    | Mitigation Phase |        |            |             |          |              |
|----------------------------------|------------------|--------|------------|-------------|----------|--------------|
|                                  | Project Start    | Design | Permitting | Procurement | Planning | Construction |
| <b>Financial</b>                 |                  |        |            |             |          |              |
| Delivery Method                  | X                |        |            |             |          |              |
| Tariffs and Trade Wars           |                  |        |            | X           |          |              |
| Commodity Price Fluctuation      |                  |        |            | X           |          |              |
| Unknown Product Type             |                  | X      |            |             |          |              |
| Inefficient Design               |                  | X      |            |             |          |              |
| <b>Architectural</b>             |                  |        |            |             |          |              |
| Varying levels of acceptance     |                  | X      | X          |             |          |              |
| Limited tested assemblies        |                  | X      | X          |             |          |              |
| Engineering judgments required   |                  | X      | X          |             |          |              |
| ABMMs & Performance-based Design |                  | X      | X          |             |          |              |
| <b>Schedule</b>                  |                  |        |            |             |          |              |
| Production Availability          |                  |        |            | X           |          |              |
| Building Permit                  |                  | X      | X          |             |          |              |
| Delivery Timeline                |                  |        |            | X           | X        |              |
| On-site productivity             |                  |        |            |             | X        |              |
| Inefficient Details              |                  | X      |            |             |          |              |
| Lack of assembly know-how        |                  |        |            | X           |          |              |
| <b>Quality</b>                   |                  |        |            |             |          |              |
| Manufacturing Tolerances         |                  | X      |            |             |          |              |
| Improper Detailing               |                  | X      |            |             |          |              |
| Water damage                     |                  |        |            |             | X        | X            |
| Rust staining                    |                  |        |            |             | X        | X            |



# > QUESTIONS?

This concludes The American Institute  
of Architects Continuing Education  
Systems Course

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