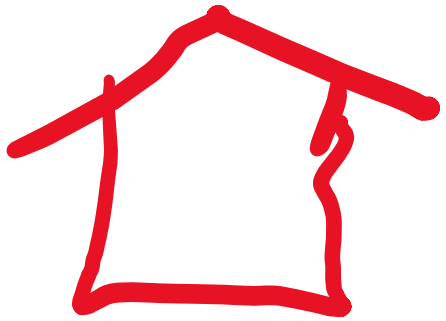
Beyond the Traditional use of Wood in Building Construction

Presentation to

Building Officials Association of BC

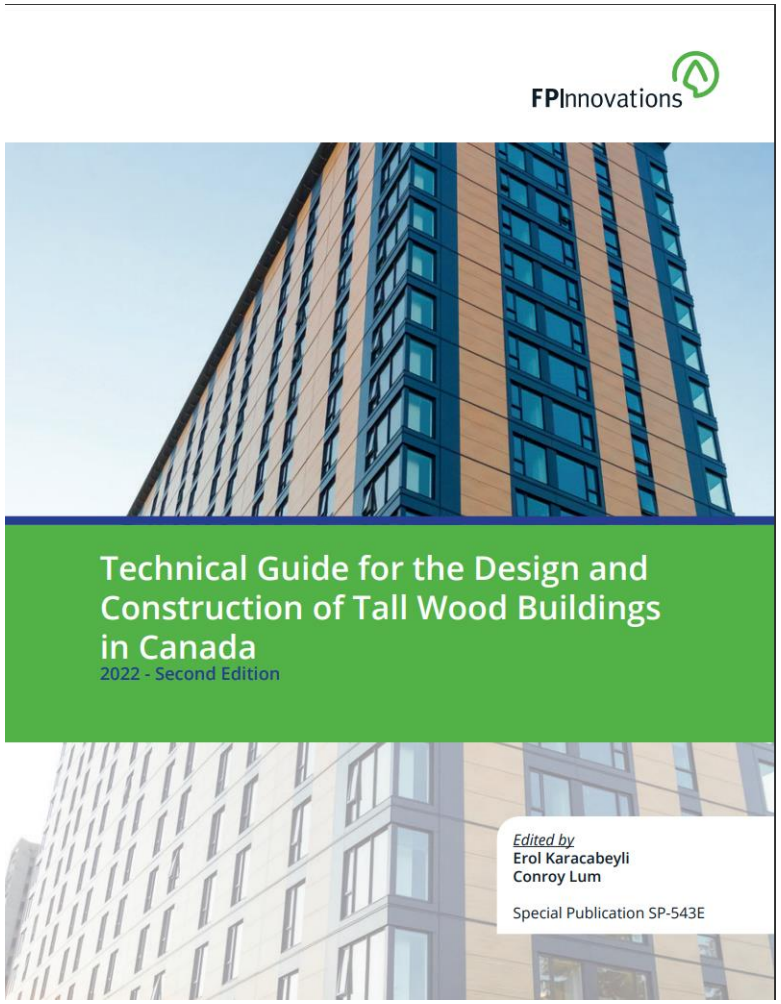
May 29, 2023



Conroy Lum

Overview

- Technical Guide for the Design and Construction of Tall Wood Buildings in Canada (TWBG)
  - Motivation and background
- Introducing New Products & Systems
  - Code options
- Innovations and Risk
  - Addressing Uncertainty
- Alternative Solutions
- Summary

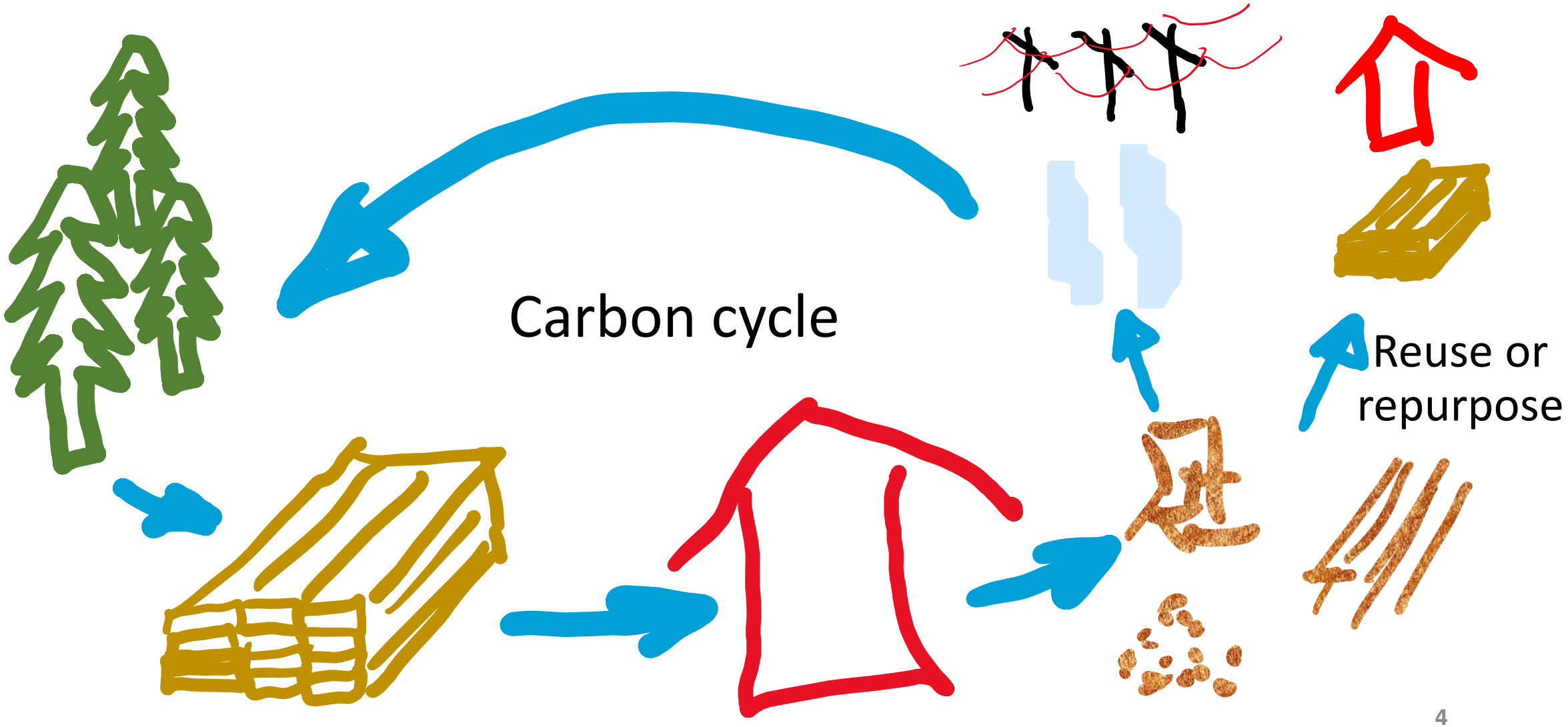


Download from web.fpinnovations.ca/tallwood/

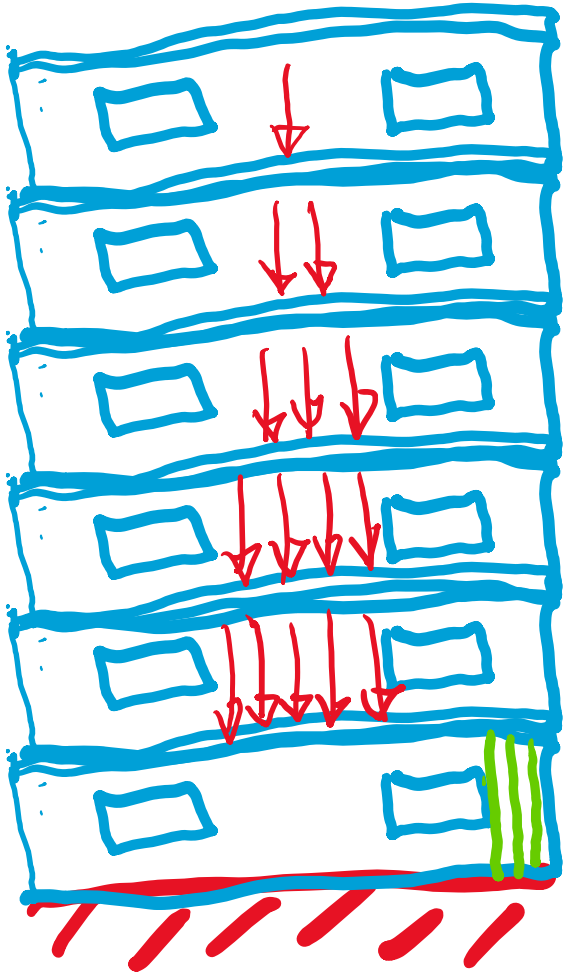
TWGB

- Technical Guide for the Design and Construction of Tall Wood Buildings in Canada (TWBG)
- Wood frame construction (WFC) is the traditional form
  - Dimension lumber
  - Structural wood panels
  - EWP such as I-joists, SCL, metal plate connected trusses
- First transformation mid-rise or 6-storey over the last decade
- How to move beyond WFC and why?

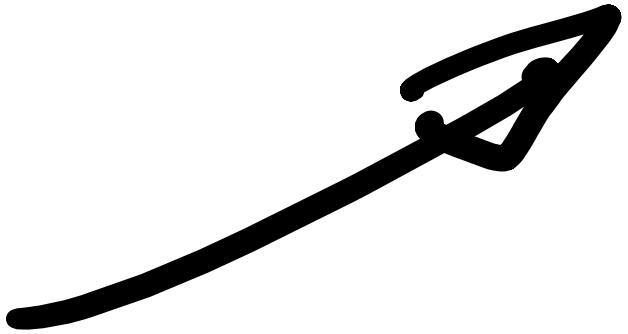
Motivation

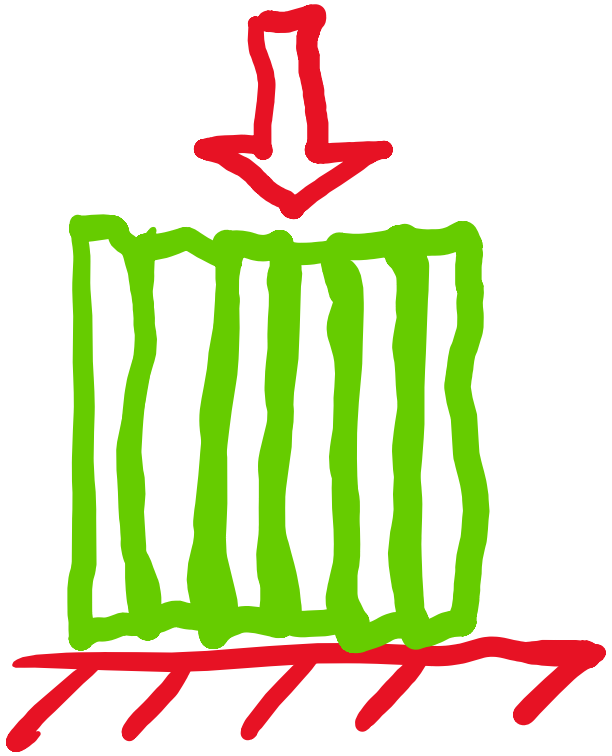

Combined heat and power from wood waste
Carbon cycle
Reuse or repurpose

Motivation



- Mid-rise wood frame construction up to 6-storey
  - Densification



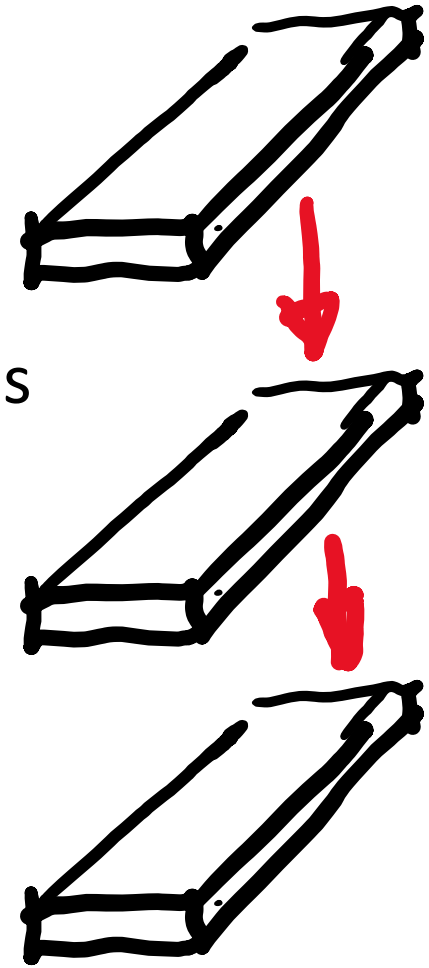


- Large stud packs needed to carry large loads at lower levels

Product Development - Existing

Input materials

- Lumber



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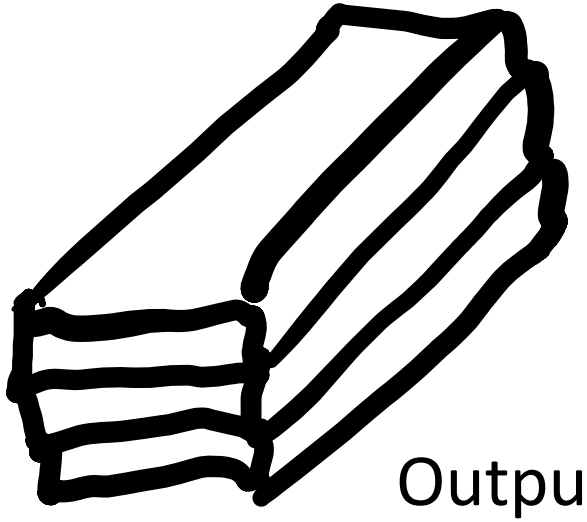
Structural adhesive



Output

- Glulam beams and columns

Product Development – New (to NA)

Input materials

- Lumber
- Strands

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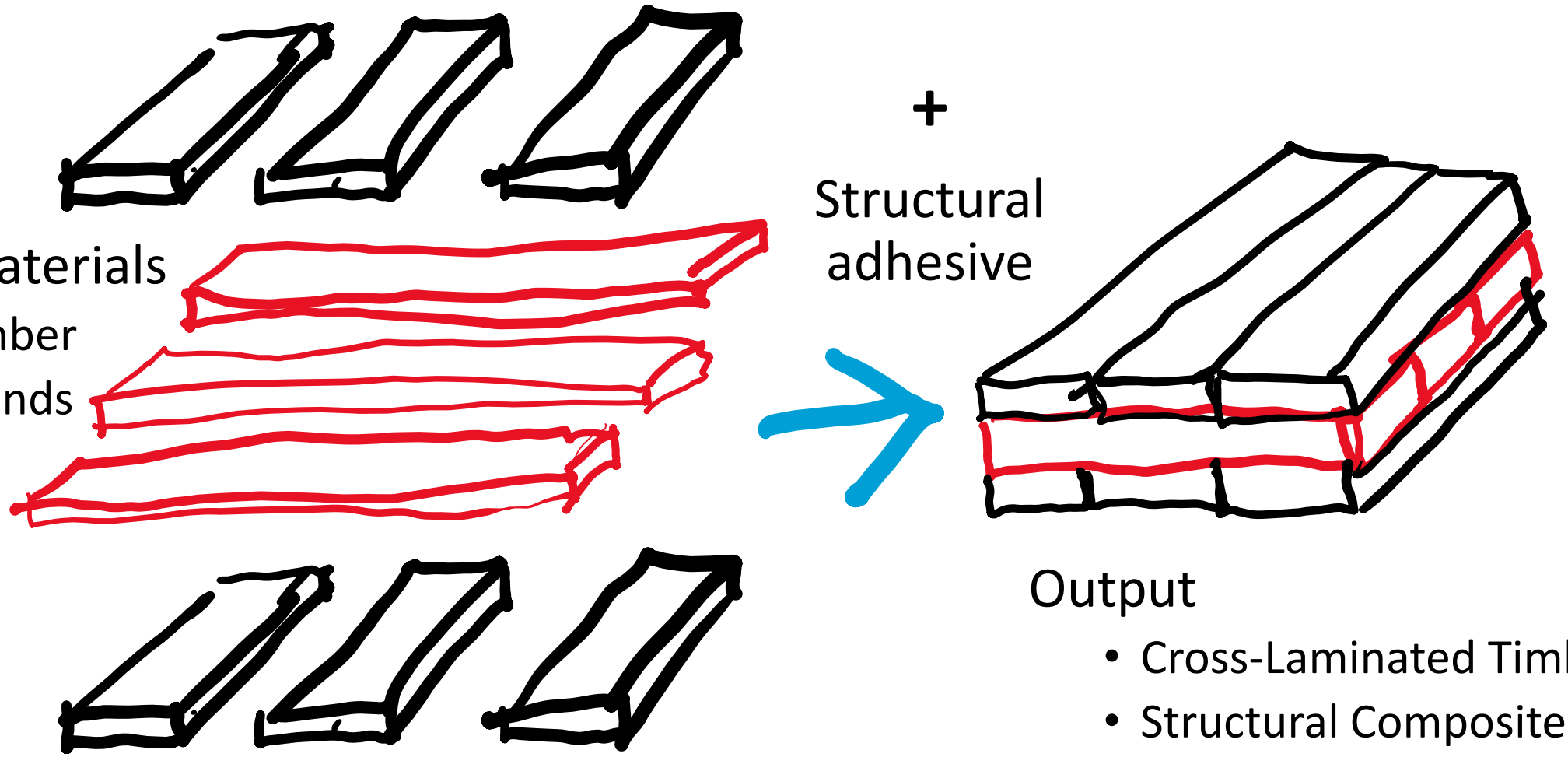
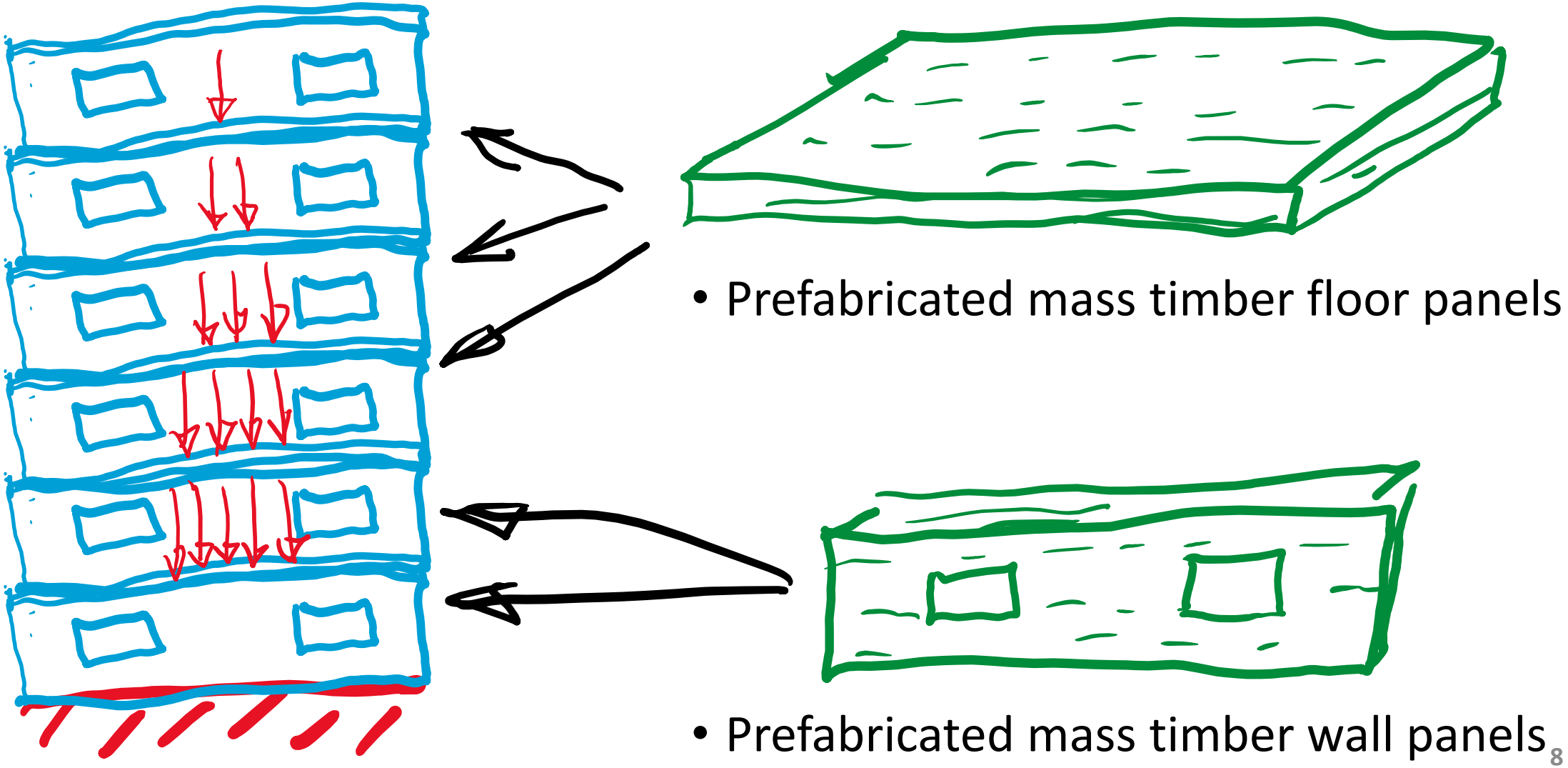
Structural adhesive



Output

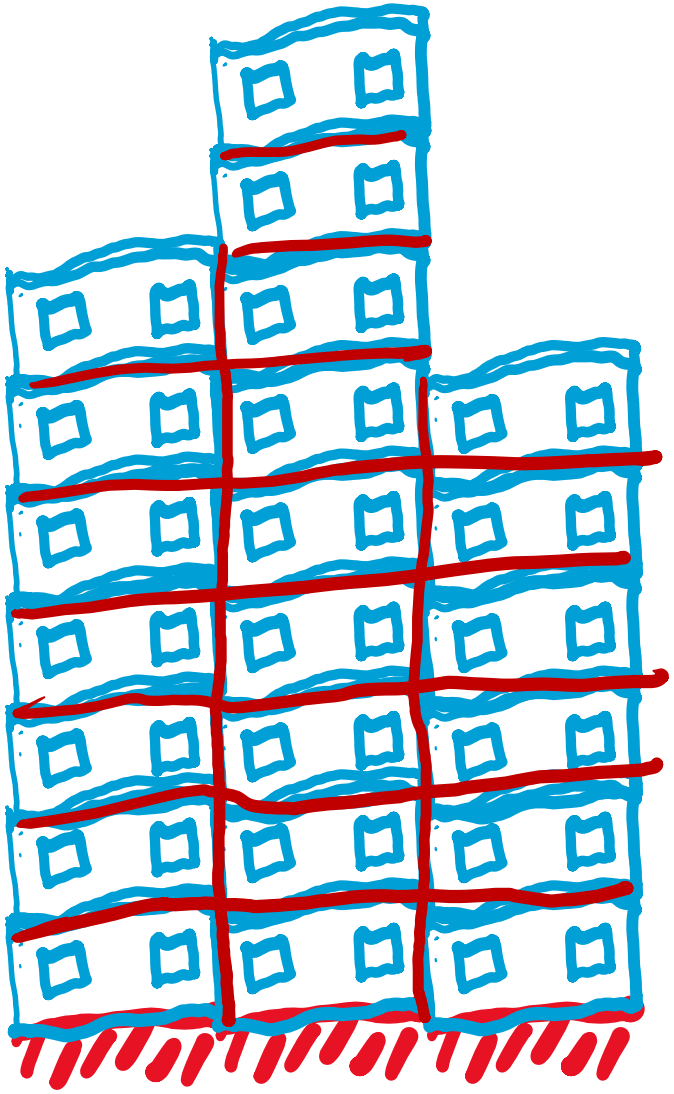
- Cross-Laminated Timber (CLT)
- Structural Composite Panels

System Development – Mass Timber



- Prefabricated mass timber floor panels
- Prefabricated mass timber wall panels

System Development – Mass Timber



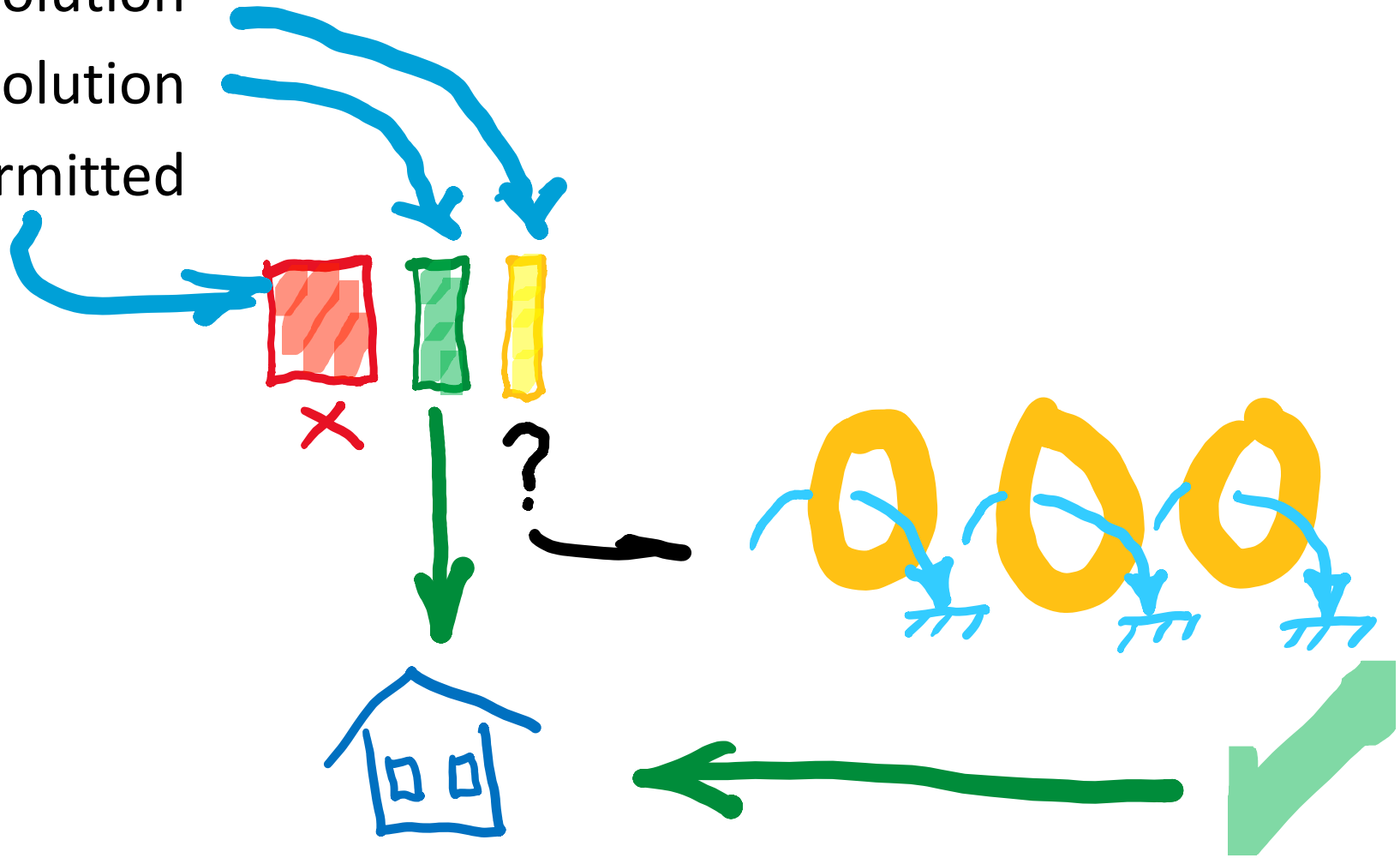
- Larger and taller structures possible
  - Needed for higher housing/building density
- Prefabricated fire separations
  - Mass timber panels can be design to function as horizontal and vertical fire separations

Building Code Options

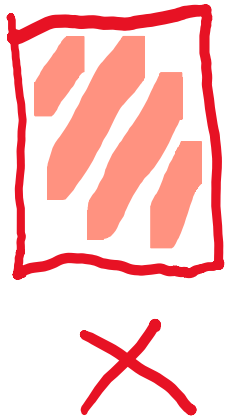
- Expectations
  - Minimum levels of performance (building code)
  - Acceptable Solutions
    - Structural and Energy codes
      - Prescriptive (Part 9)
      - Calculation-based (Part 4)
  - Alternative Solutions
    - Supported by Objective and Functional Requirements
    - What and Why … but how?

Building Code Considerations & Options

- Alternative solution
- Acceptable solution
    - Not permitted

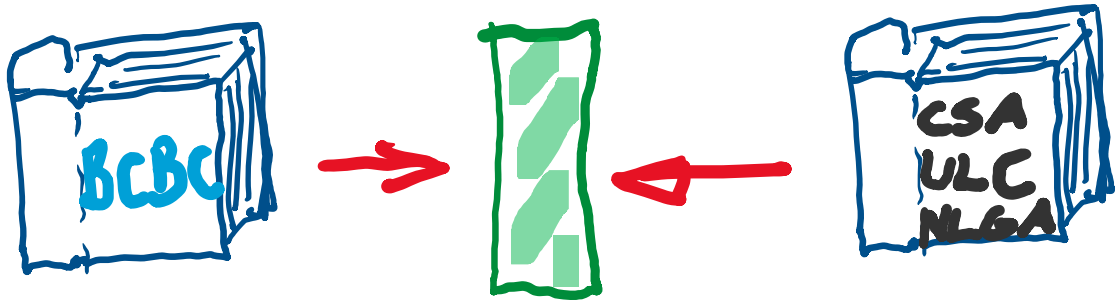


Not Permitted



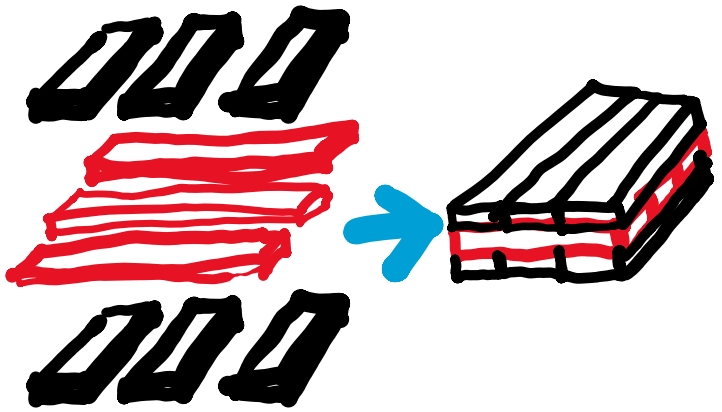
- Not supported by provisions provided (e.g., product standard or design code)
- Other means needed to justify solution

Acceptable Solutions – How and What

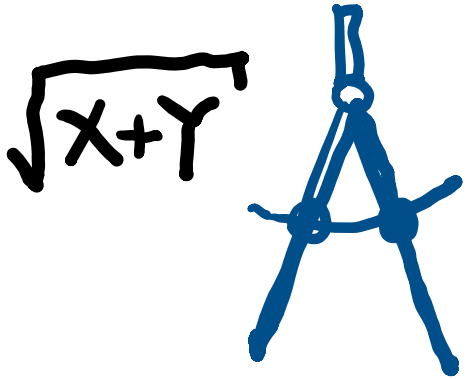


BCBC Part 9 **BCBC Part 4**

Prescribed Methods



Product Standards



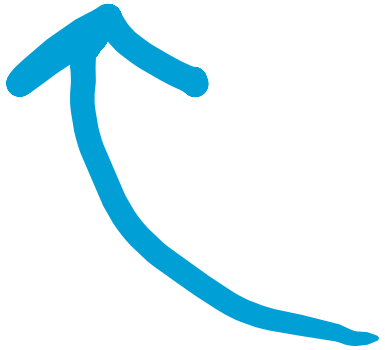
Calculation Methods

Alternative Solution

- An innovative approach
  - Benefits uncertain to support a code change
- Show equivalency to an Acceptable Solutions
  - Review checklist
  - Objective and Functional requirements

Innovation and Risk

- Uncertainty results in risk
  - Safety, performance, constructability or profitability
- How uncertainty is introduced
  - New elements: product, systems, construction method



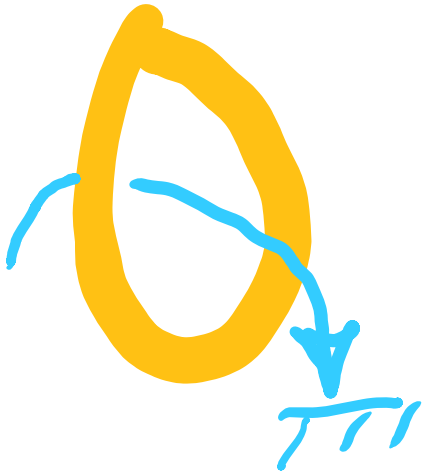
All considerations when pursuing the introduction of Mass Timber construction and products such as CLT

Addressing Uncertainty

- Two types of uncertainty
  - Epistemic uncertainty – can be studied (natural variability)
  - Aleatory uncertainty – cannot be studied (“black swan”, “tail event”)
- Safety factors (add more capacity)
  - Design to prevent progressive collapse
- Research and reviews; case studies; demonstration buildings

Addressing Uncertainty

- Theoretical studies
  - Costing
  - Computer modeling



- Trials
  - Laboratory testing
  - Small or full-scale mock-ups

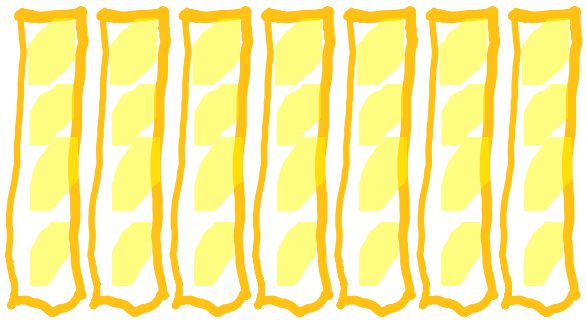
- Demonstration building
  - Cost
  - Constructability

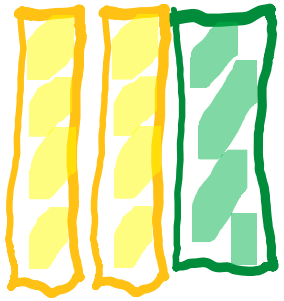
An iterative process to de-risk the project

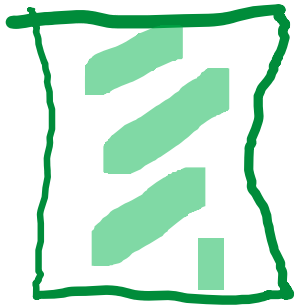
Addressing Uncertainty

- How much effort is enough?
  - Peer review**(s)** to get a different perspective**(s)**
  - Record of review, deliberations and how concerns, if any, were addressed
- Role of the TWBG, 1st and 2nd editions
  - Collect relevant information for design teams
  - Support modeling, trials and demonstration buildings

Long Term Objective







- Current Part 4 or Part 9 Acceptable Solutions
- Alternative Solutions reviewed for broad acceptance
- **Expanded list of Acceptable Solutions**

Summary

- Mass timber introduces a non-traditional method for building in wood
  - Solutions compatible with sustainability goals
- Need to address uncertainty that normally come with any innovative solutions
  - “Tall Wood” provides the resources to support research and learn from demonstration buildings
- Alternative Solutions create prototype building solutions that can be converted to expand the list of Acceptable Solutions

Thank-you … and questions?

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