General Layout

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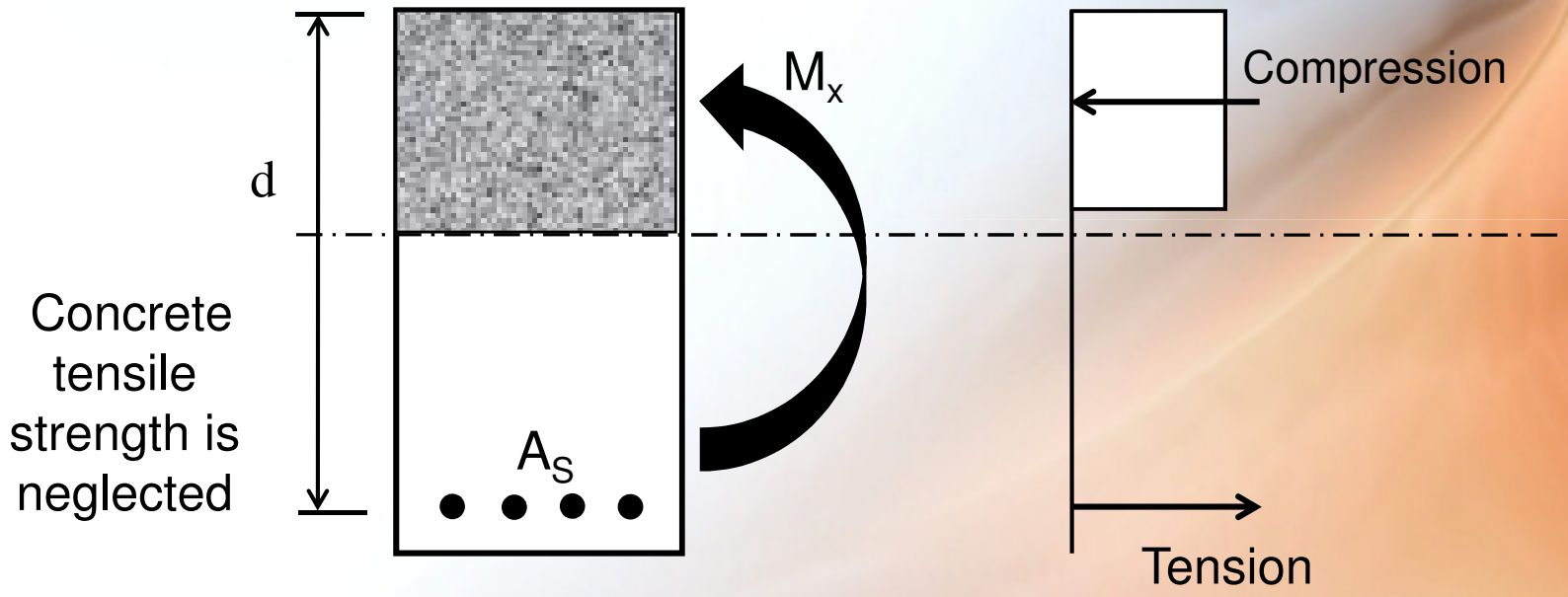
Introduction

Concrete Beam subjected to Bending Moment around Major Axis



If M_x increases ➔ increase d or A_s

Introduction

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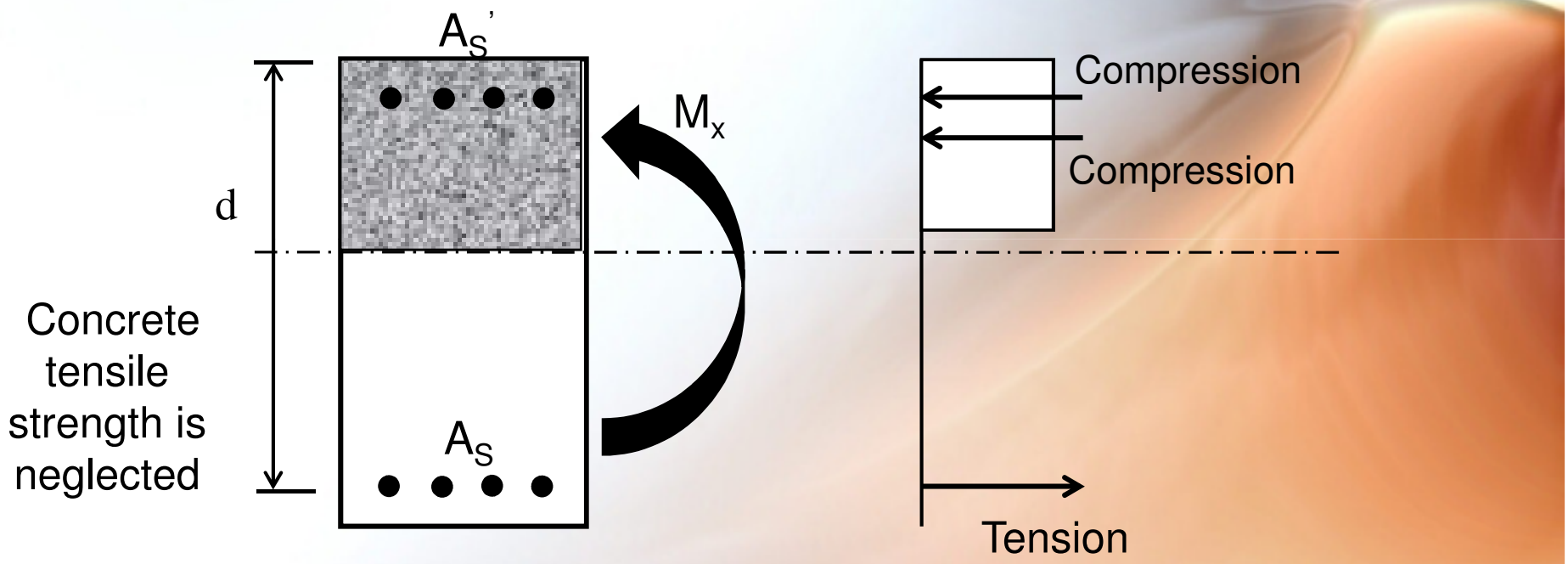

If d is limited & $A_s = A_{smax}$ ➔ Use Compression reinforcement

Introduction

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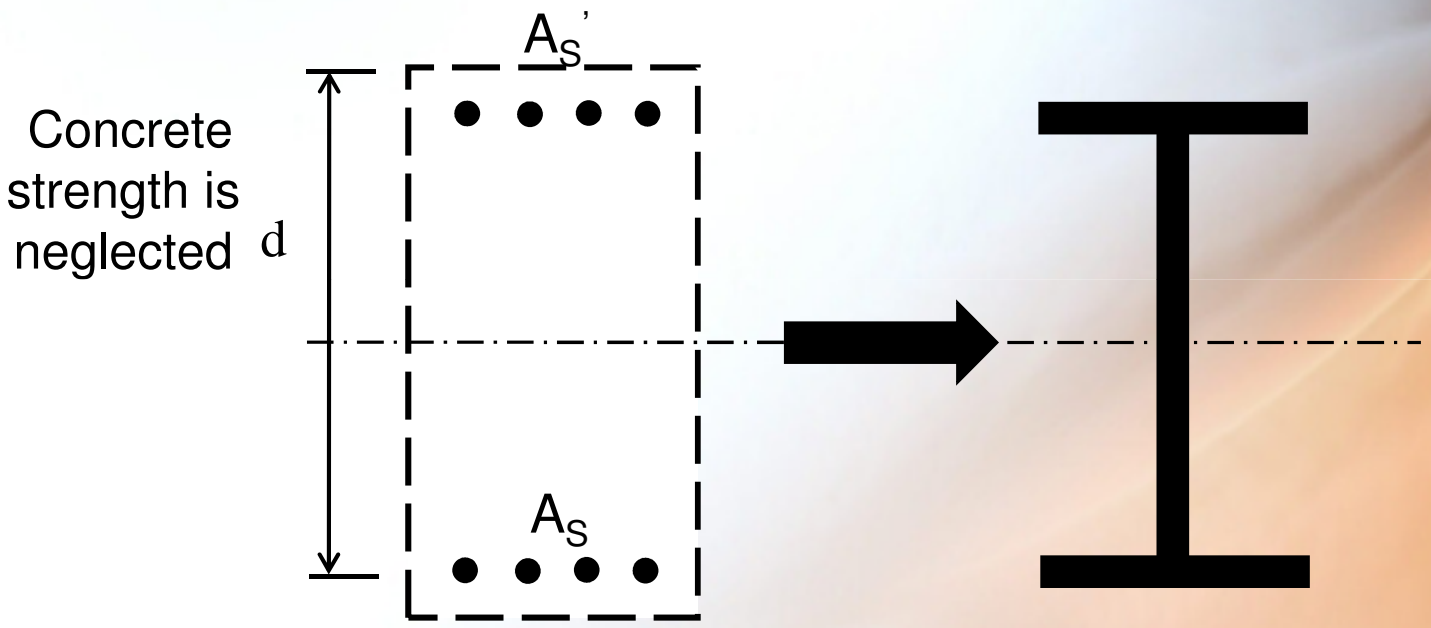


I-Beam Section ➔ usually used for beams and columns in steel structures

Introduction

Types of Buildings with respect to Construction Materials

Timber Building

Concrete Building

Introduction

Types of Buildings with respect to Construction Materials

Combined Steel-Concrete Building

Steel Building

Introduction

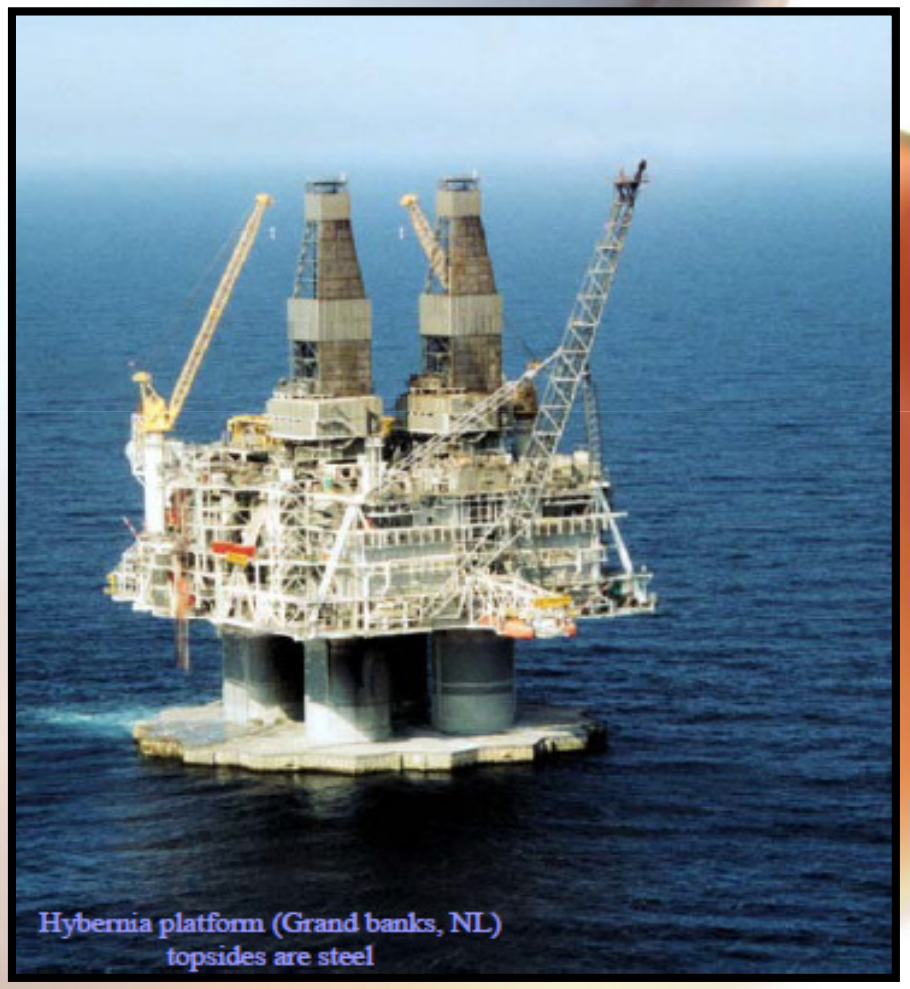
Typical Steel Structures

Industrial Buildings

Introduction

Typical Steel Structures

Multi-storey Bldgs.



Sea Platform

Introduction

Typical Steel Structures

Skyscrapers

Introduction

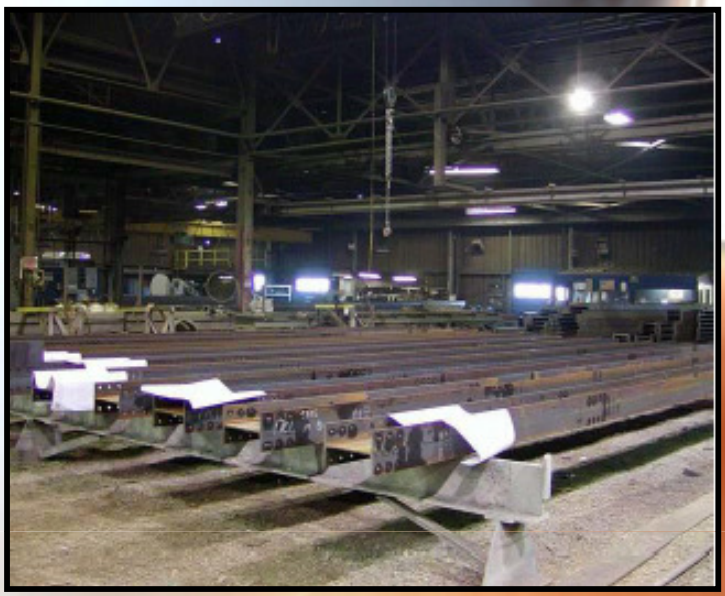
We will study Industrial Buildings this year

Steel Frame

Steel Truss

Introduction

- Advantages of Steel:
  - Economy
  - Durability
  - Design Flexibility
  - All Weather Construction
  - Easy Repair
  - 100% Recyclable

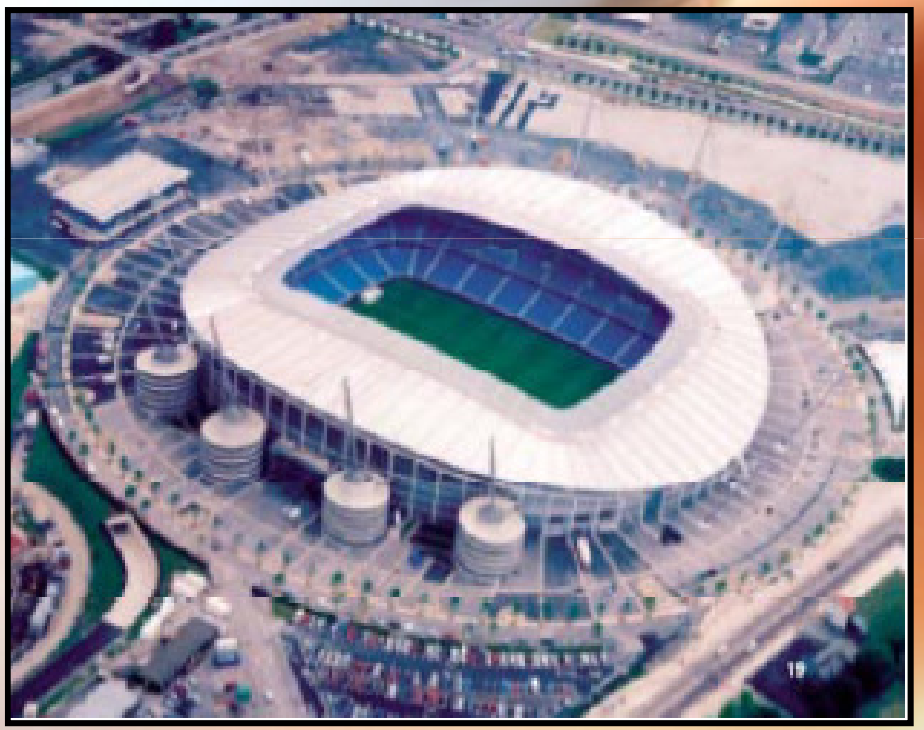


Course Outline

- Components of Structures and General Layout
- Bracing Systems
- Dead & Live Loads
- Crane & Wind Loads
- Tension Members
- Compression Members

Course Outline

- Bracing Members
- Axially Loaded Columns
- Beams:
  - Purlins & Side Girts
  - CTG & Monorail
  - Floor Beams
- Beams - Columns



Introduction

Preliminary Grading
100%

Term Work
30%

Final Exam
70%

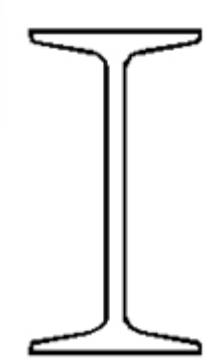
Midterm Exam
15%

Sheets
5%

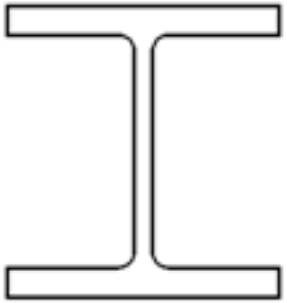
Quizes
10%

Introduction

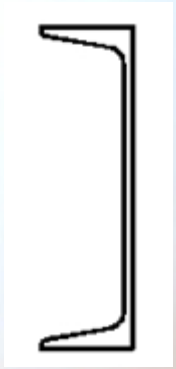
- Steel Sections



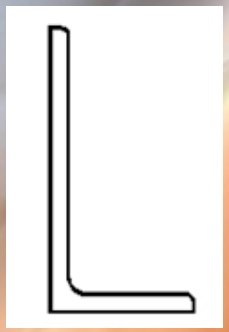
IPE Sections



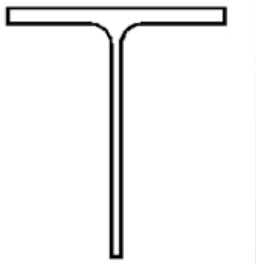
BFI Sections



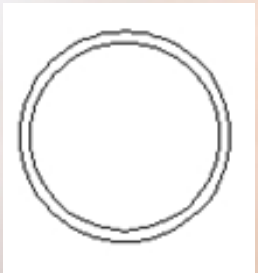
UPN Sections



L Sections



T Sections



PIPE Sections

BOX Sections

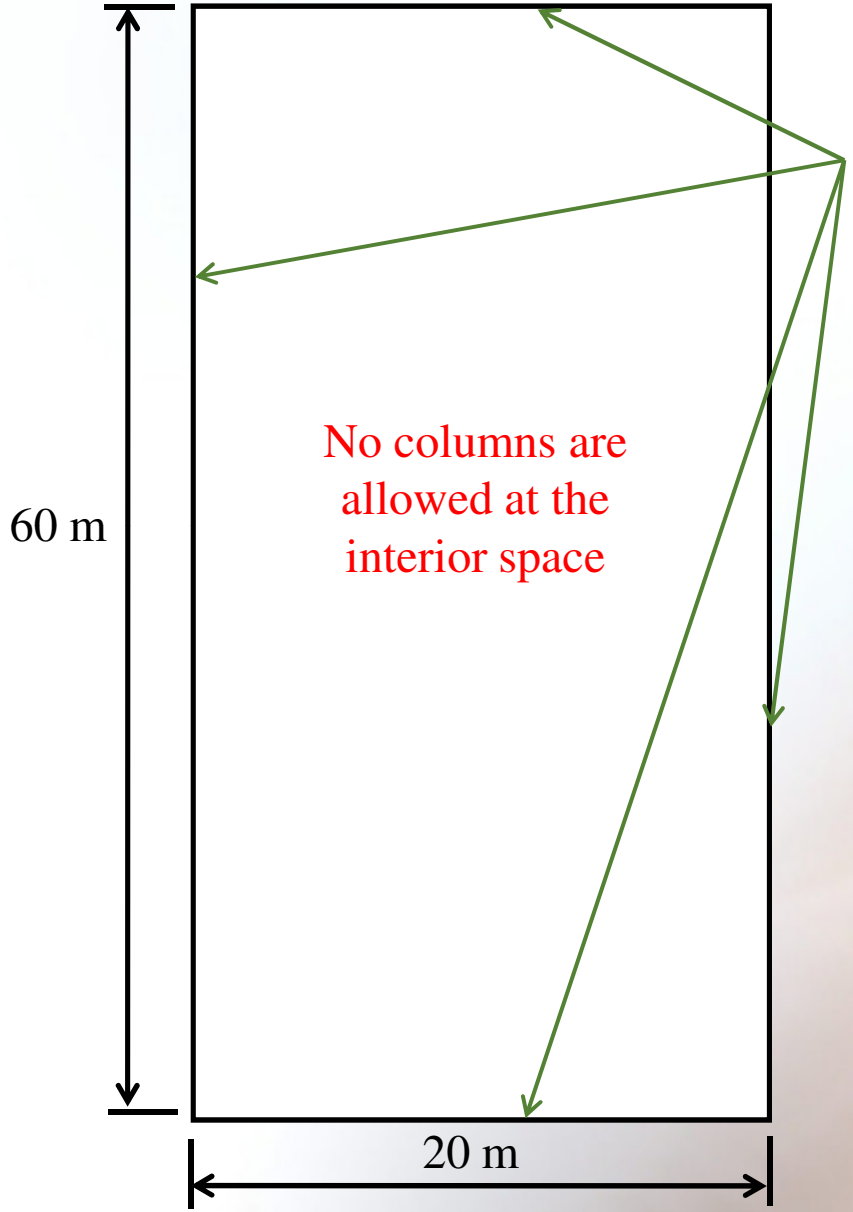
Introduction

- Steel Sections

General Layout

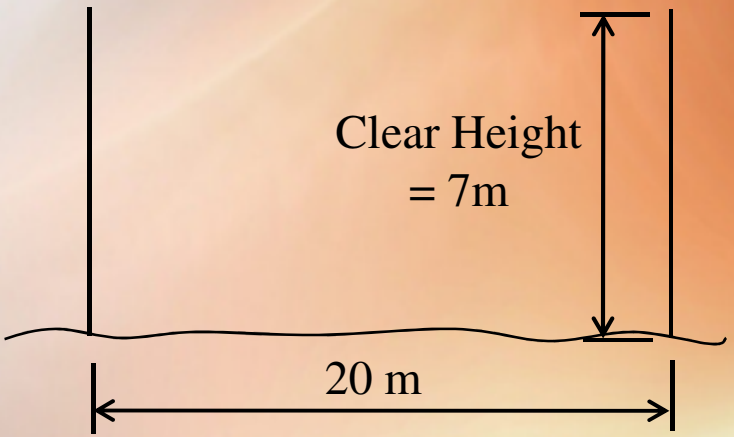
1. Types of Main Systems
2. Arrangement of Main Systems
3. Roof Slope
4. Roof Covering Materials
5. Side Cover
6. End Gables
7. Bracing System

1. Types of Main Systems



Columns are allowed on the Boundary of the Area

No columns are allowed at the interior space



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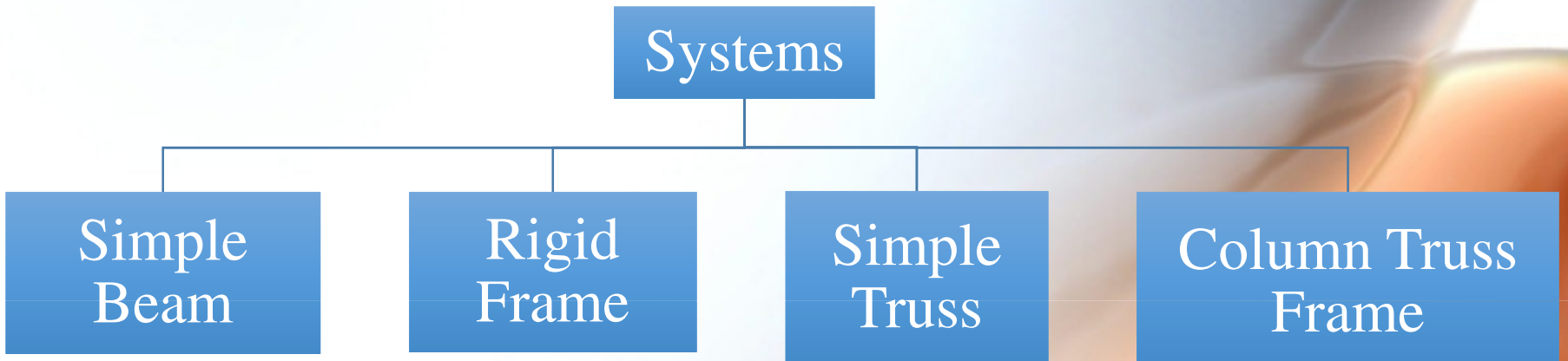

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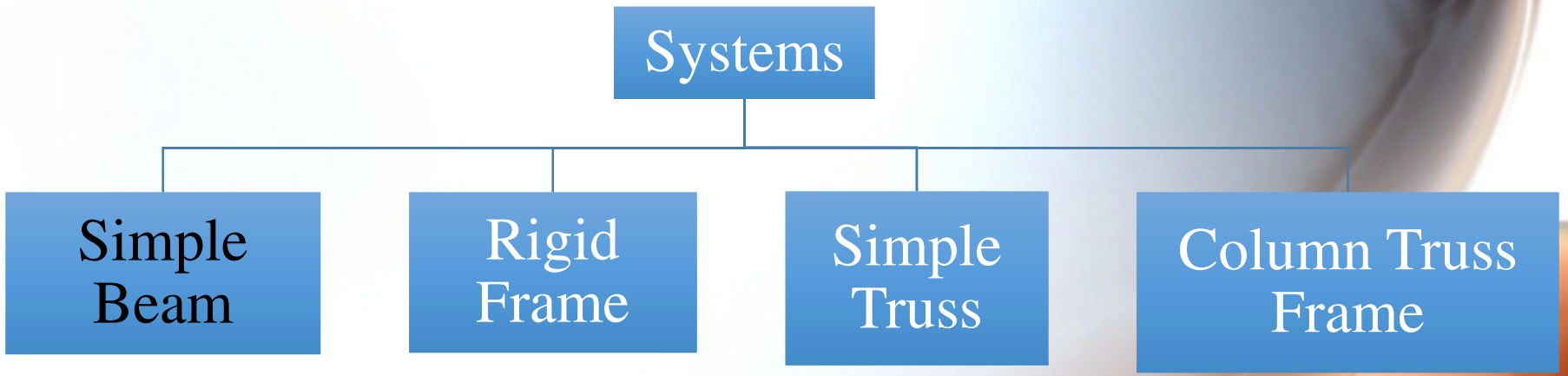

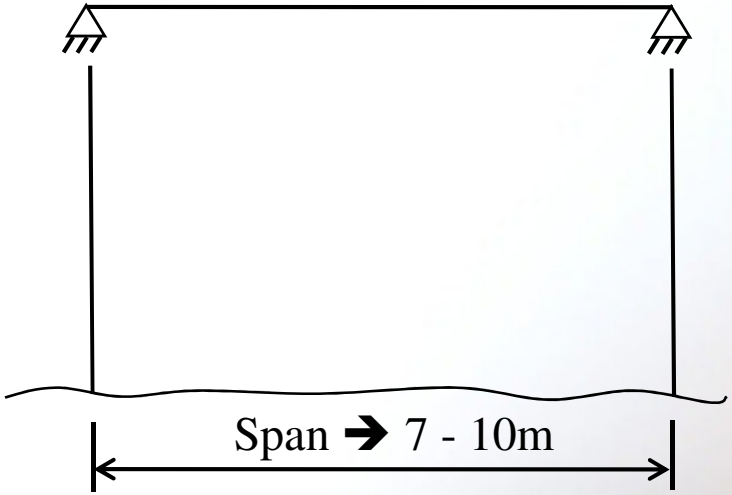

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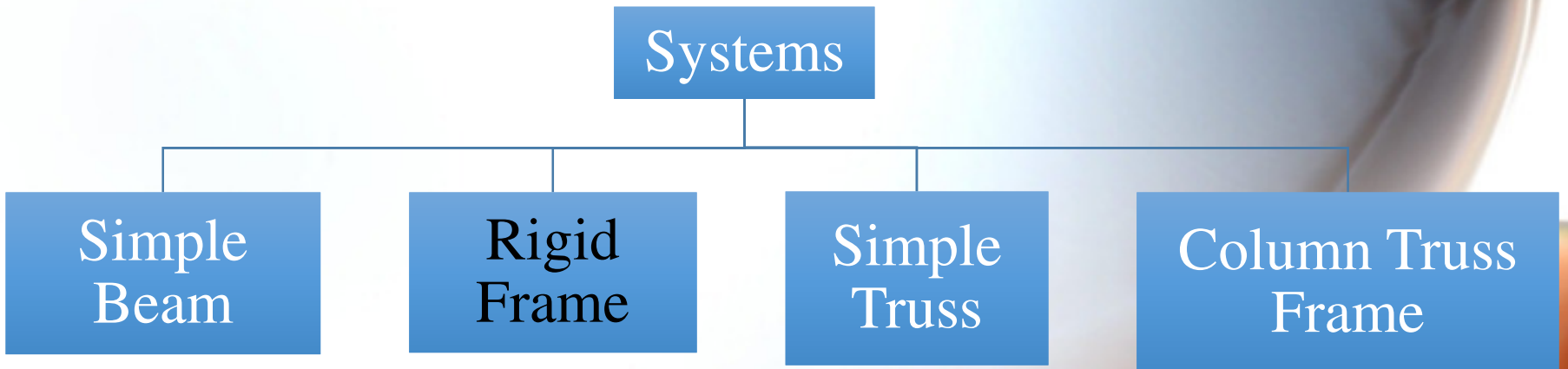
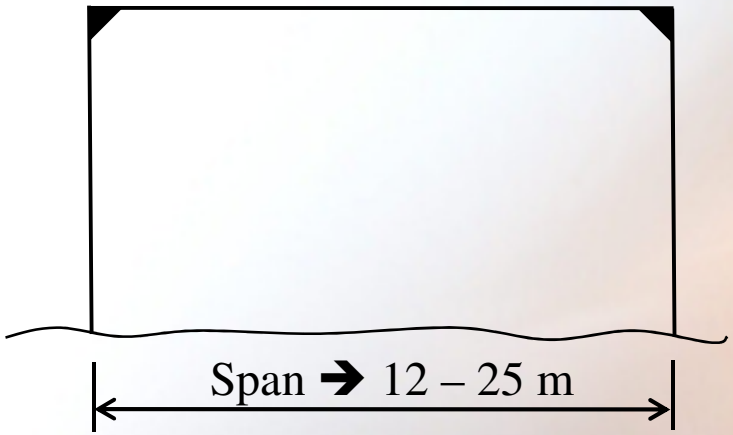
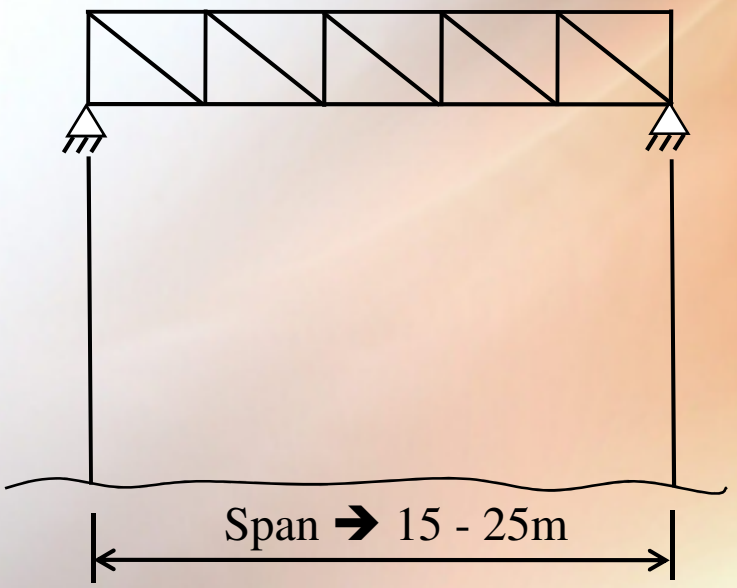




1. Types of Main Systems

- Systems
  - Simple Beam
  - Rigid Frame
  - Simple Truss
  - Column Truss Frame



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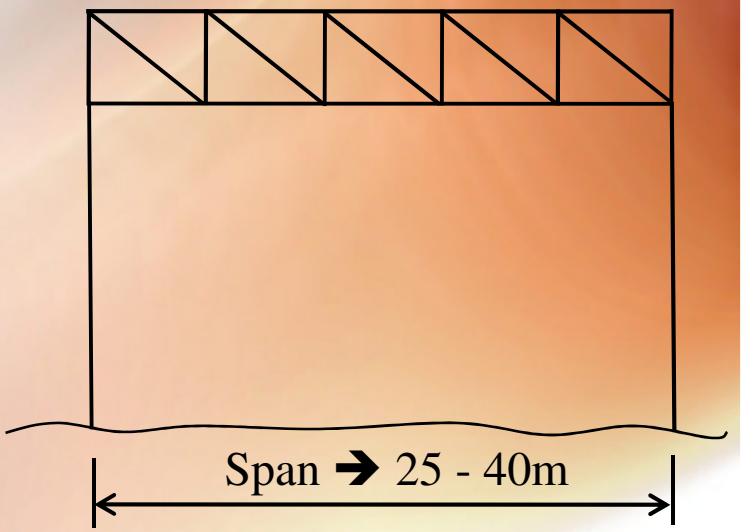

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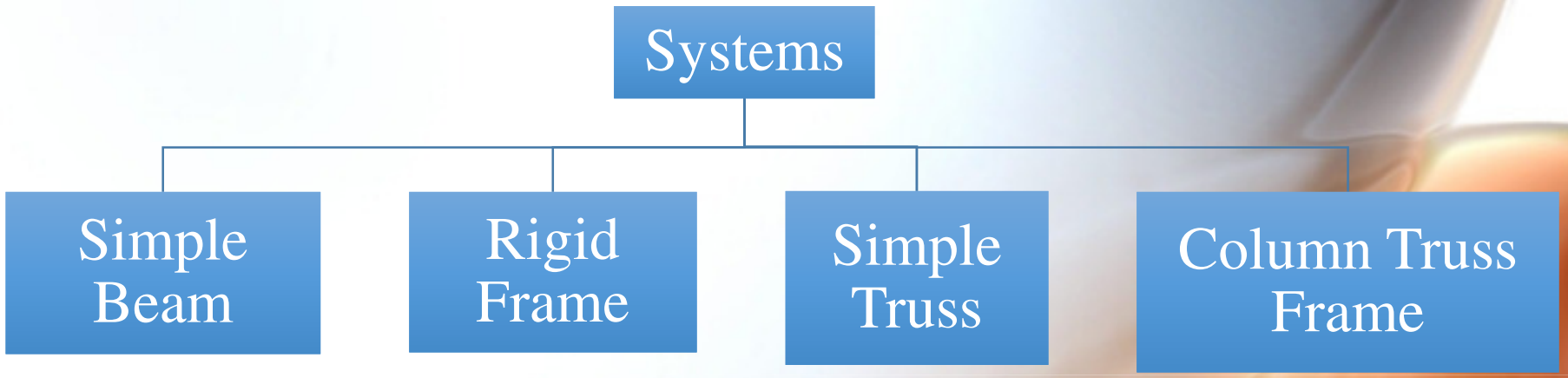


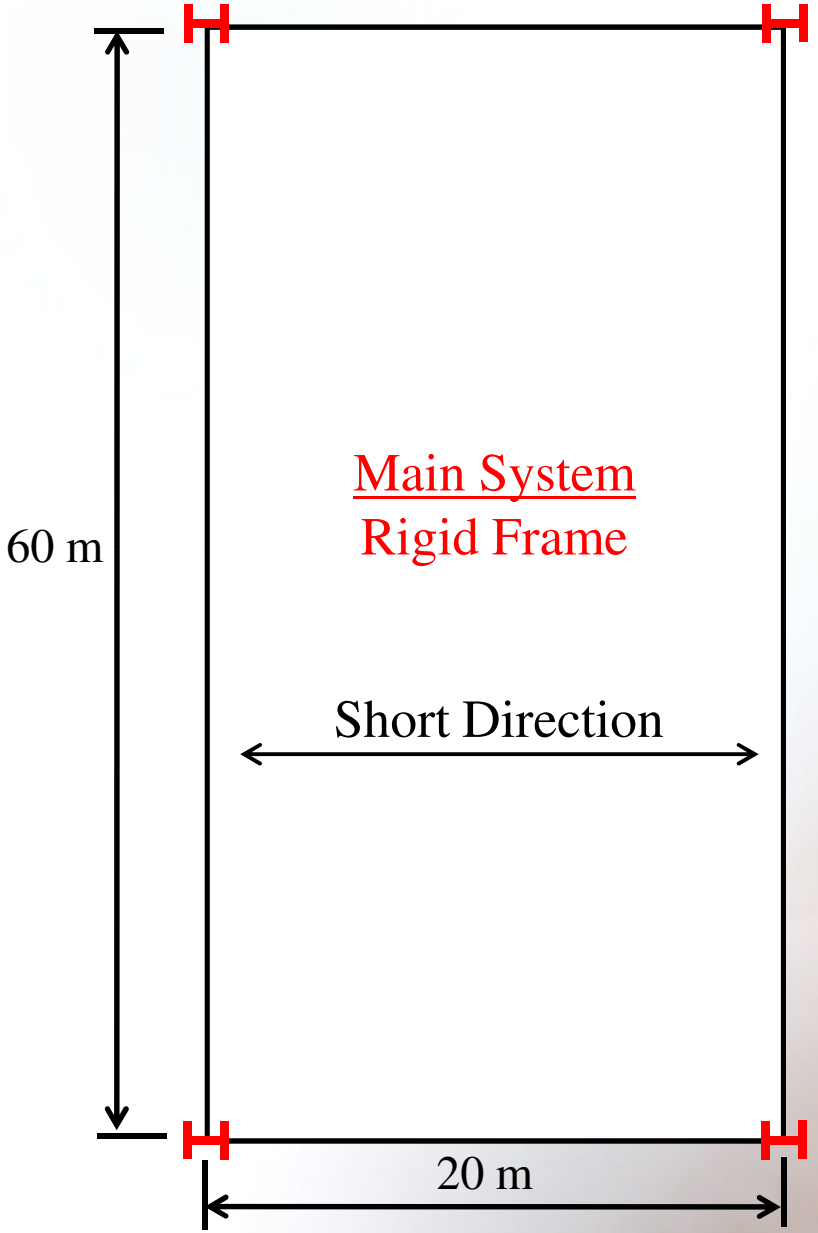
Span ➔ 7 - 10m

Span ➔ 12 – 25 m

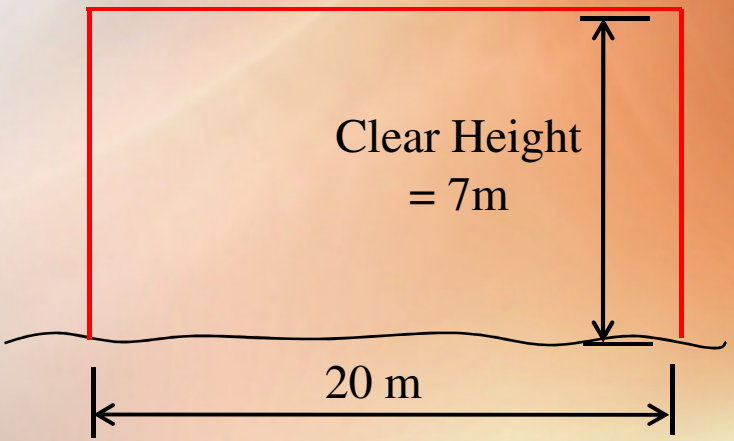
Span ➔ 15 - 25m

Span ➔ 25 - 40m

2. Arrangement of Main System



- Main System parallel to the **Short Direction**
- Spacing (S) = 4 ➔ 7 m



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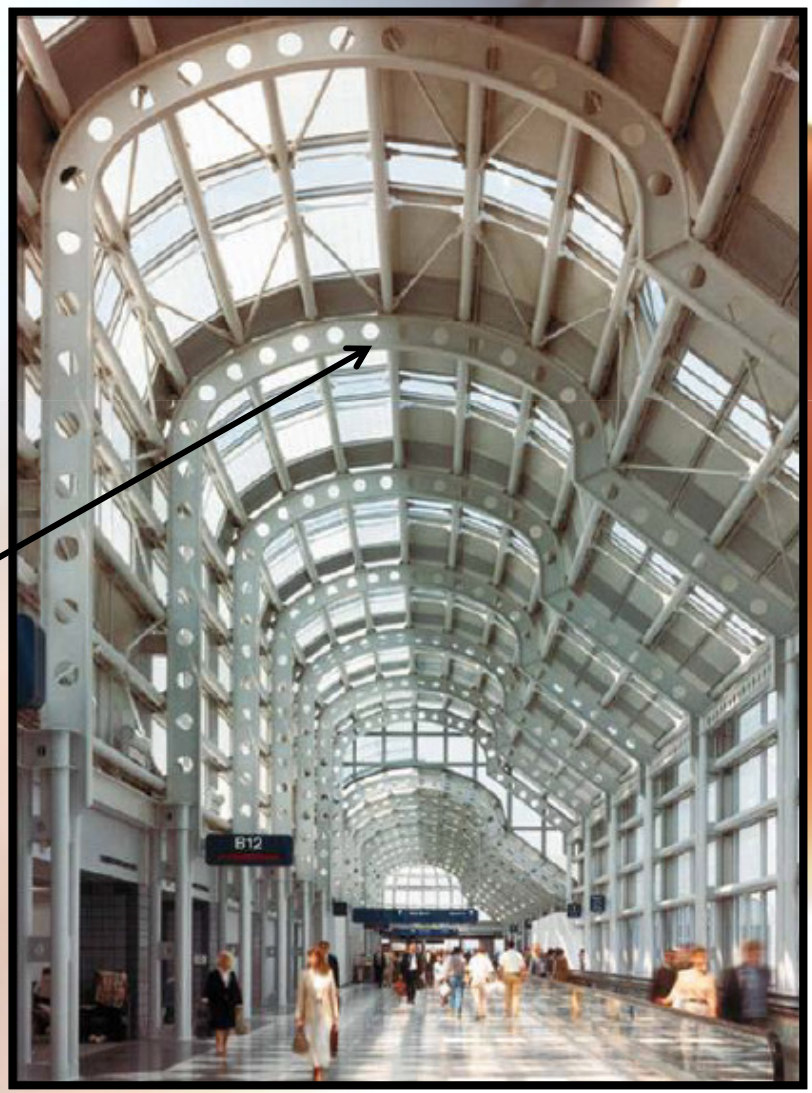

Main System

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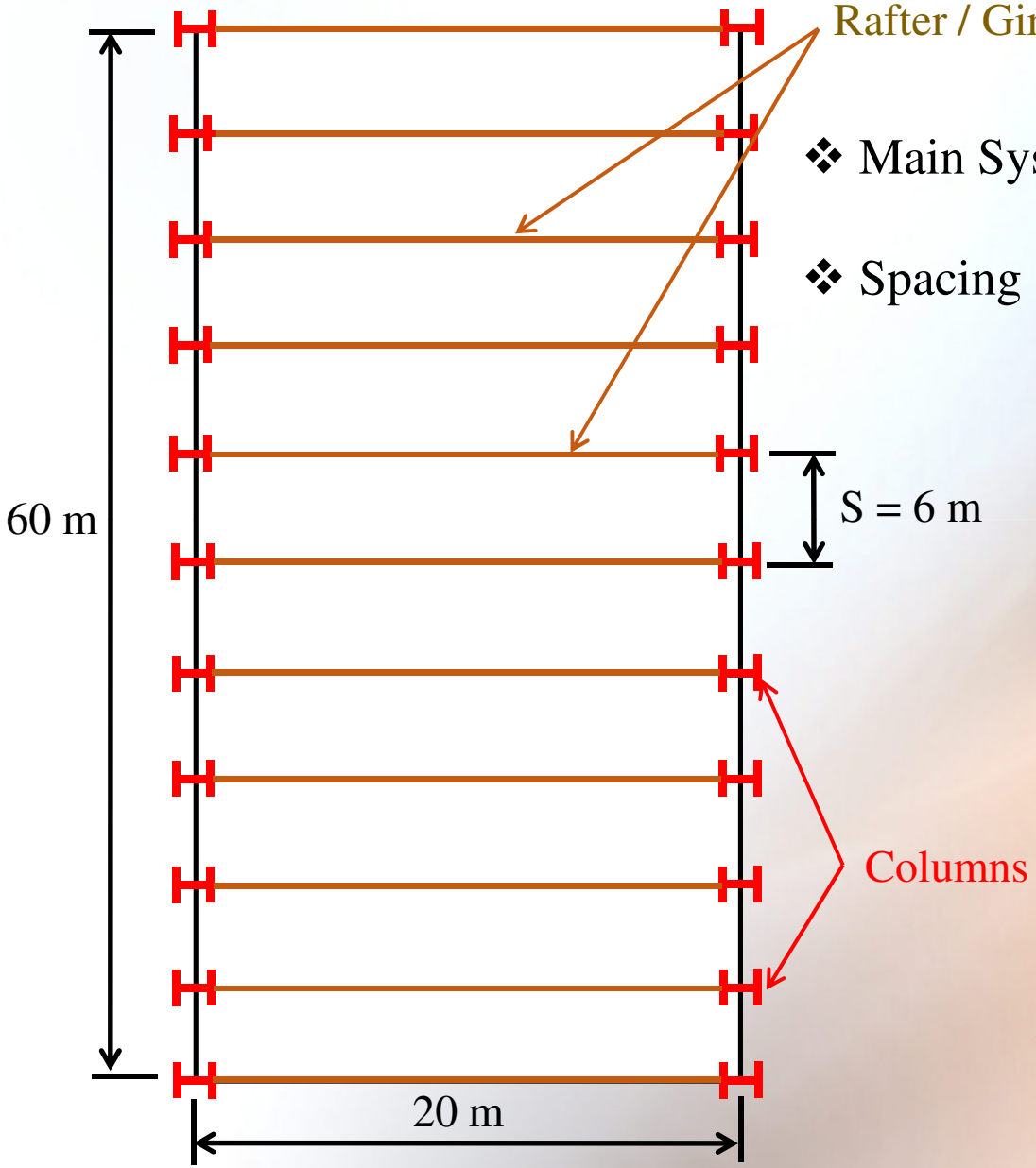

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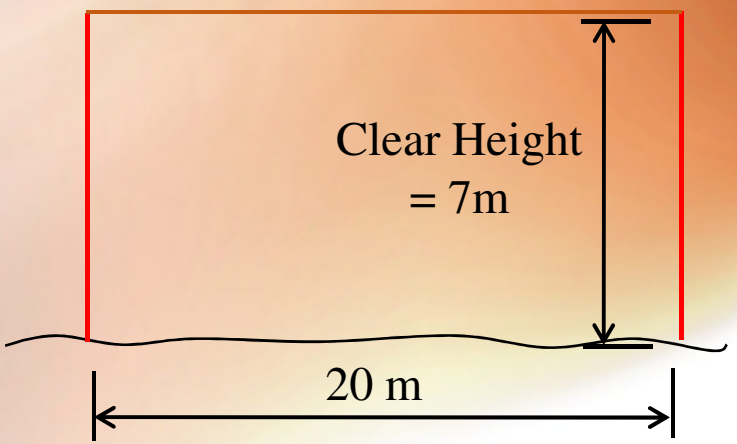
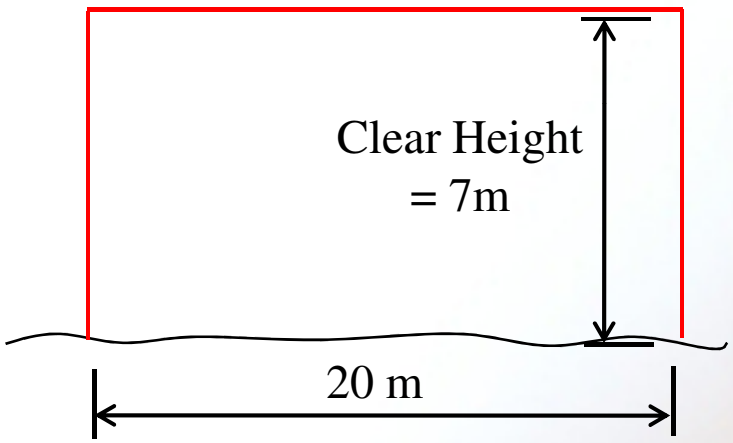
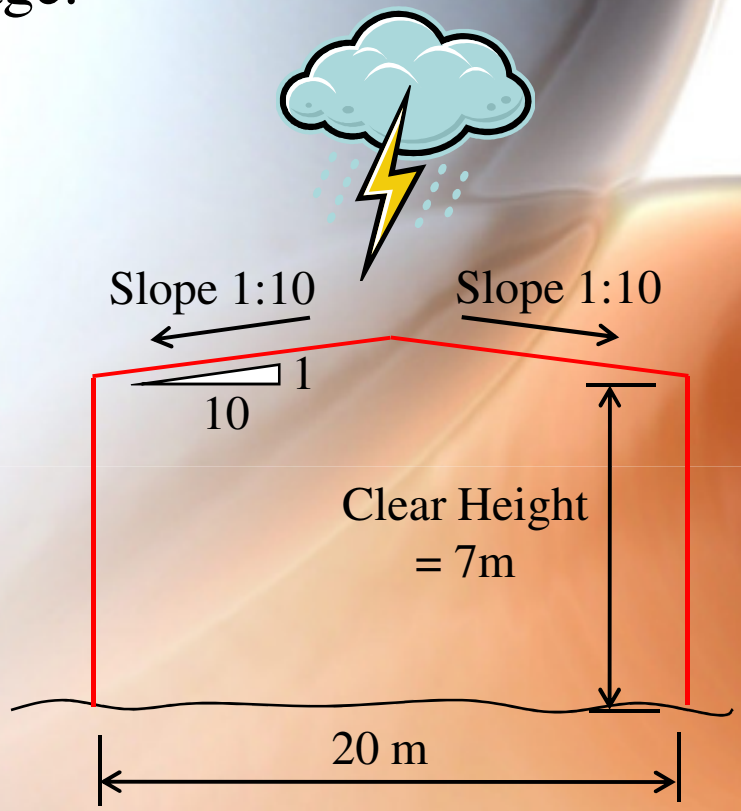


3. Roof Slope

- To accommodate rain water drainage.
- Slope 1: 5 ➔ 1: 15

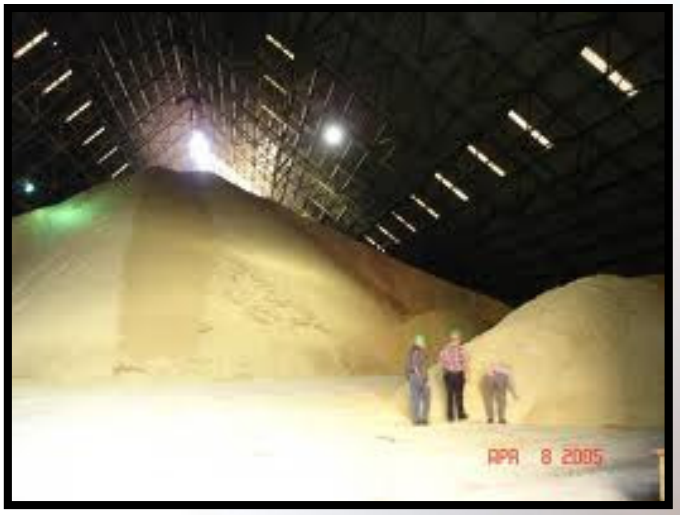


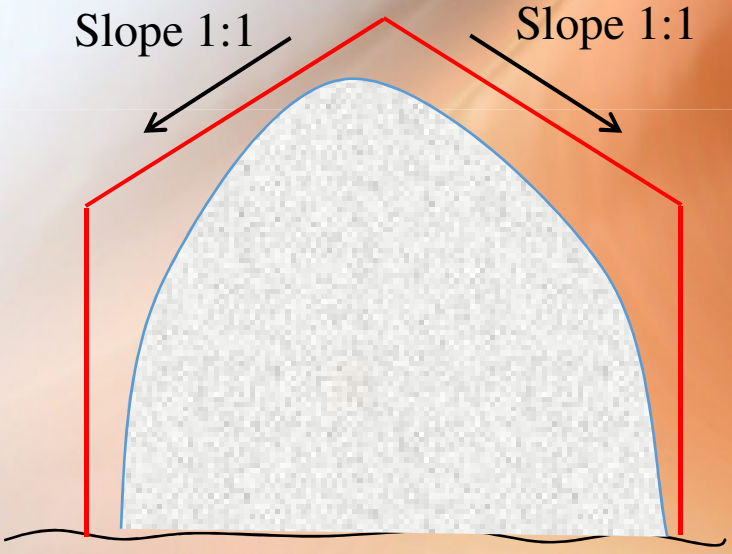
➔



3. Roof Slope

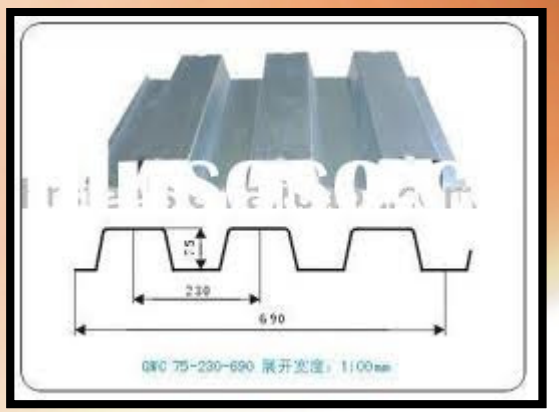
❖ Slope can reach values equal to: (1:1) in case of bulk material storage.





4. Roof Covering Materials

- Covering Material
  - Flexible Cover
    - Corrugated Sheets
    - Sandwich Panels
  - Rigid Cover
    - R.C. slab
    - Precast Units



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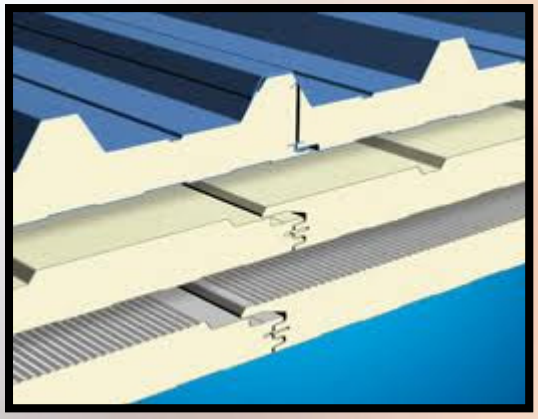

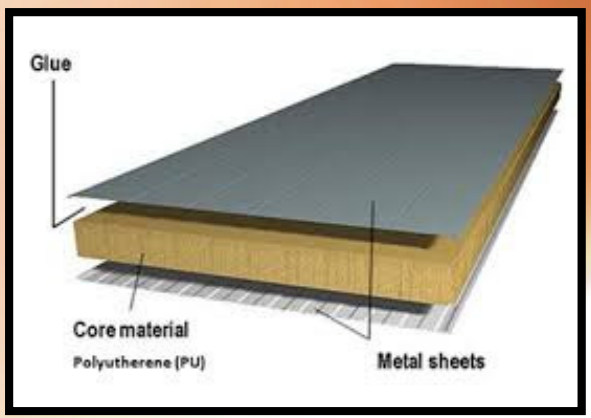

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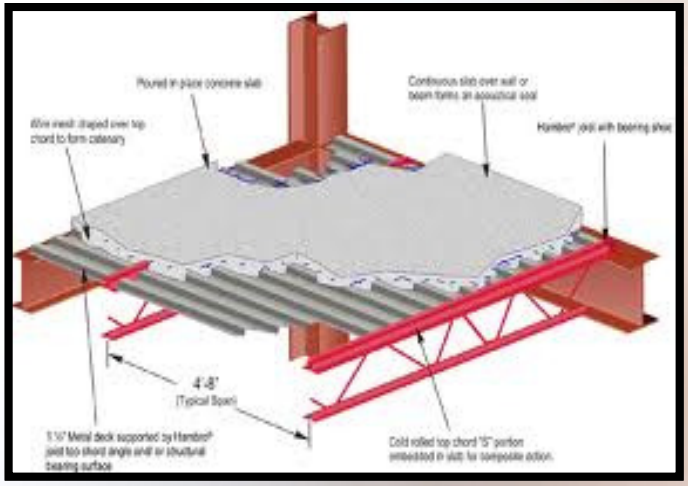

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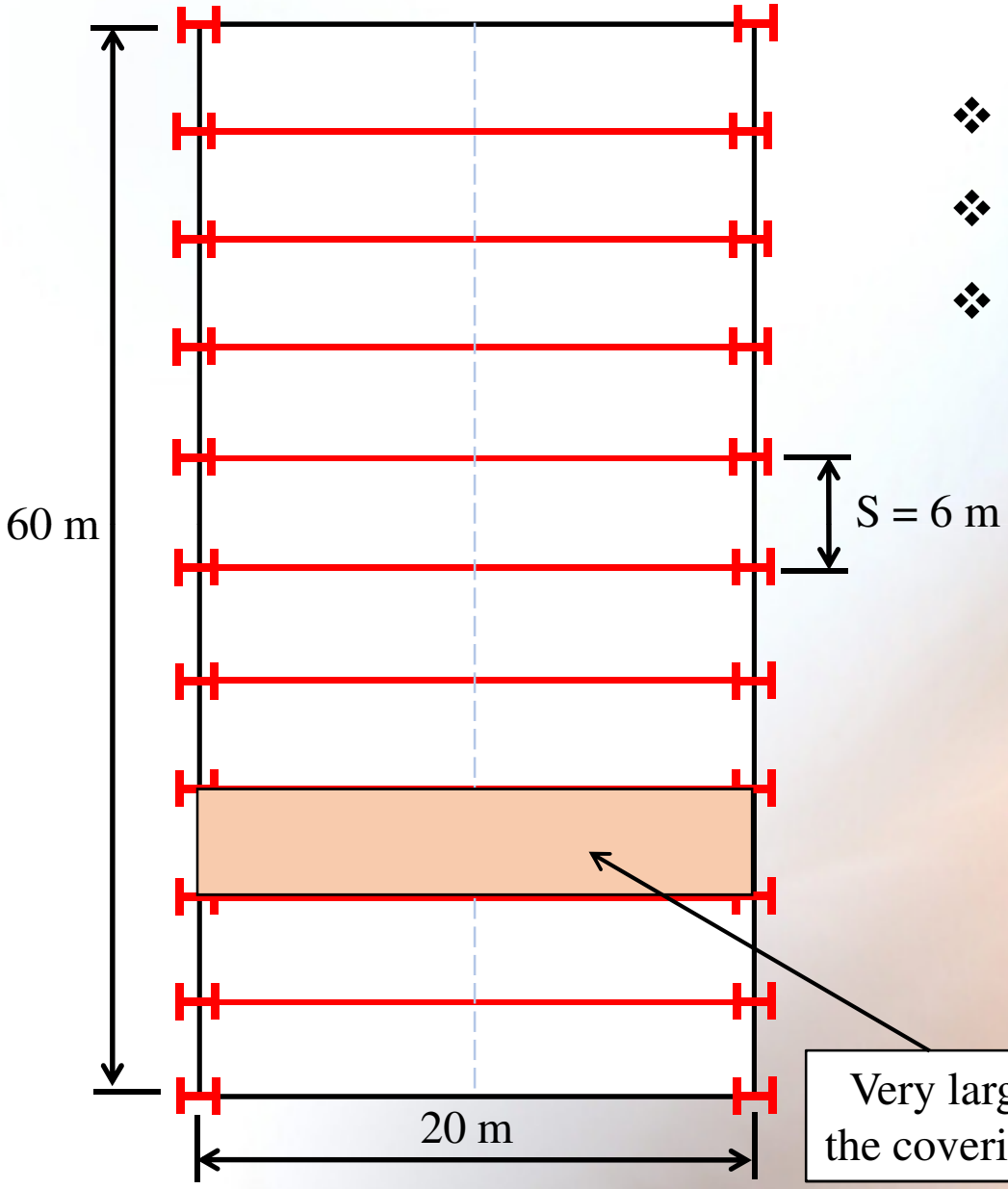
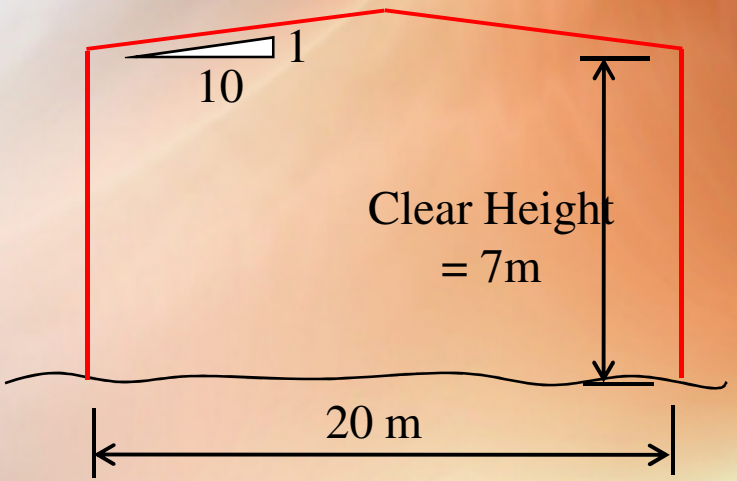
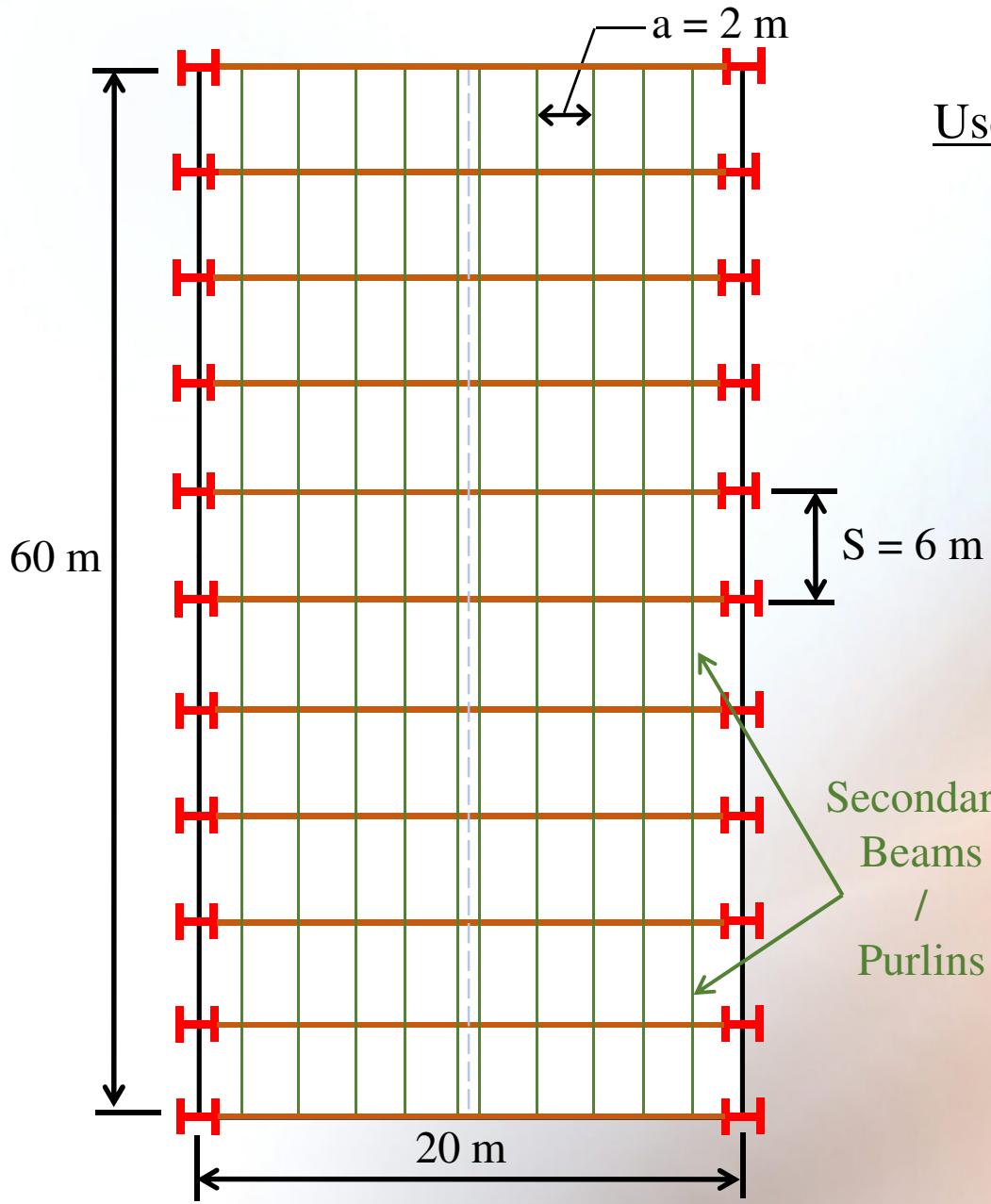


- Spacing bt. secondary beams ➔ a
- For Flexible Roof: $a \leq 2m$
- For Rigid Roof : $a \leq 3m$



Very large area for the covering material ➔ Use Secondary Beams

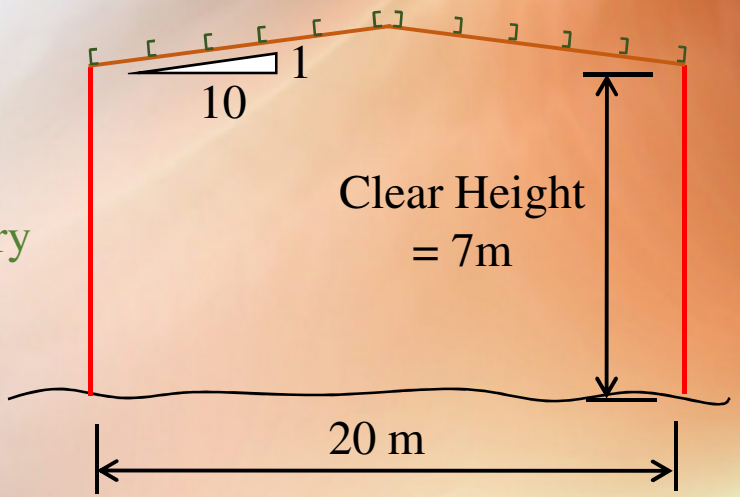
4. Roof Covering Materials



Used Sections for Purlins:

Channel Section

Z Section



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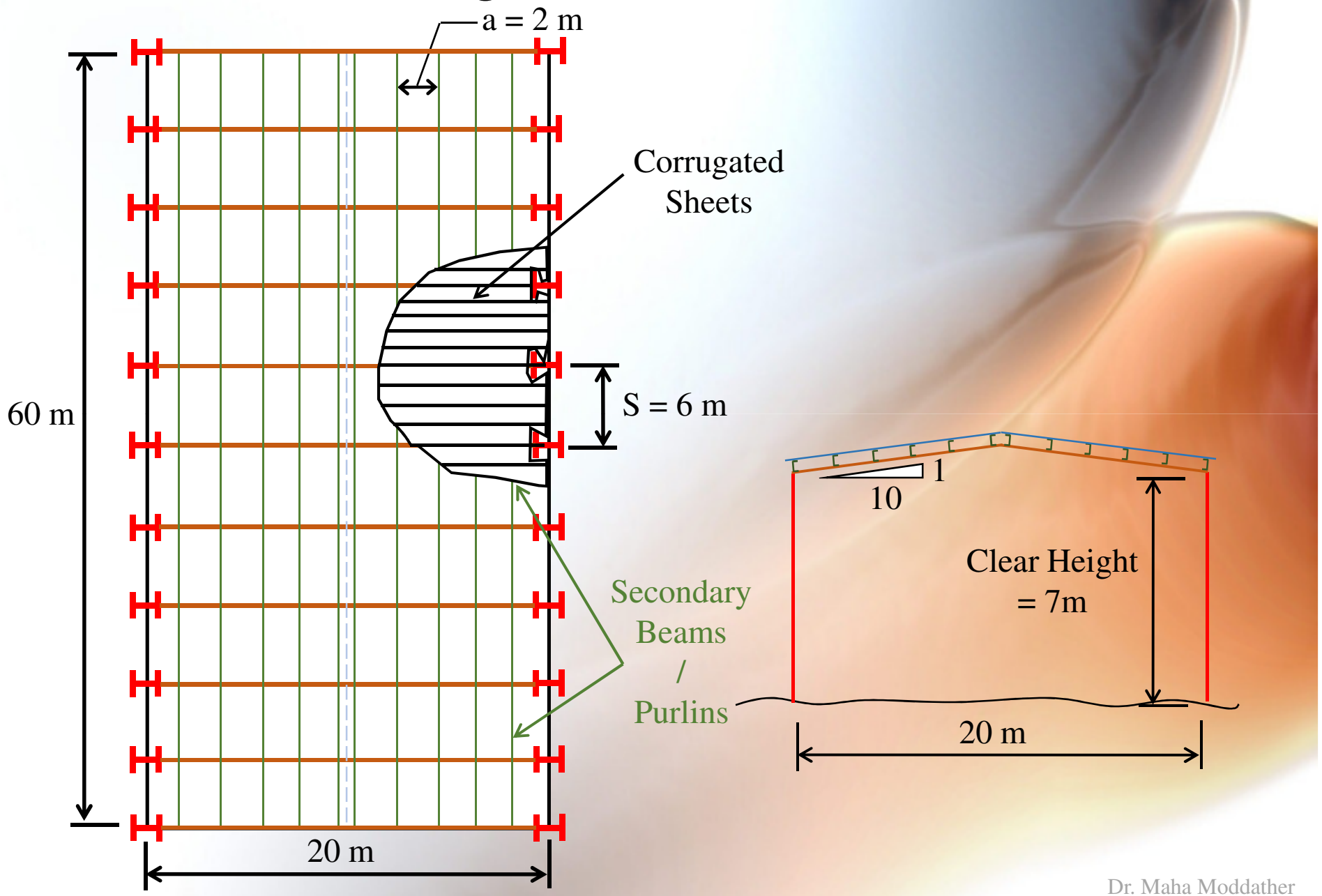

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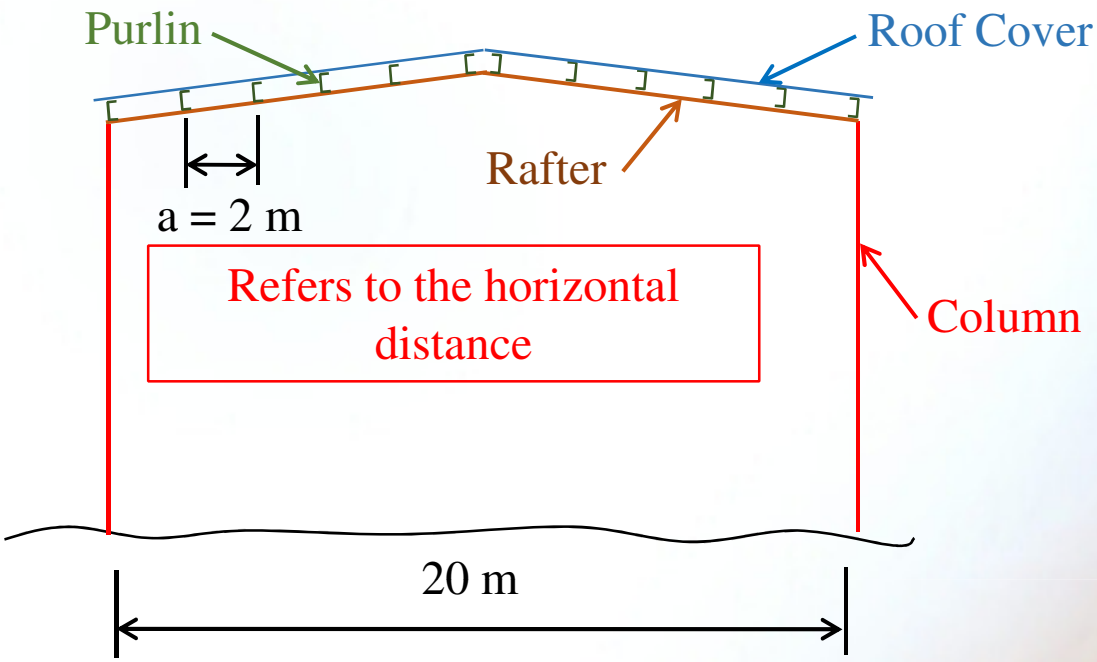

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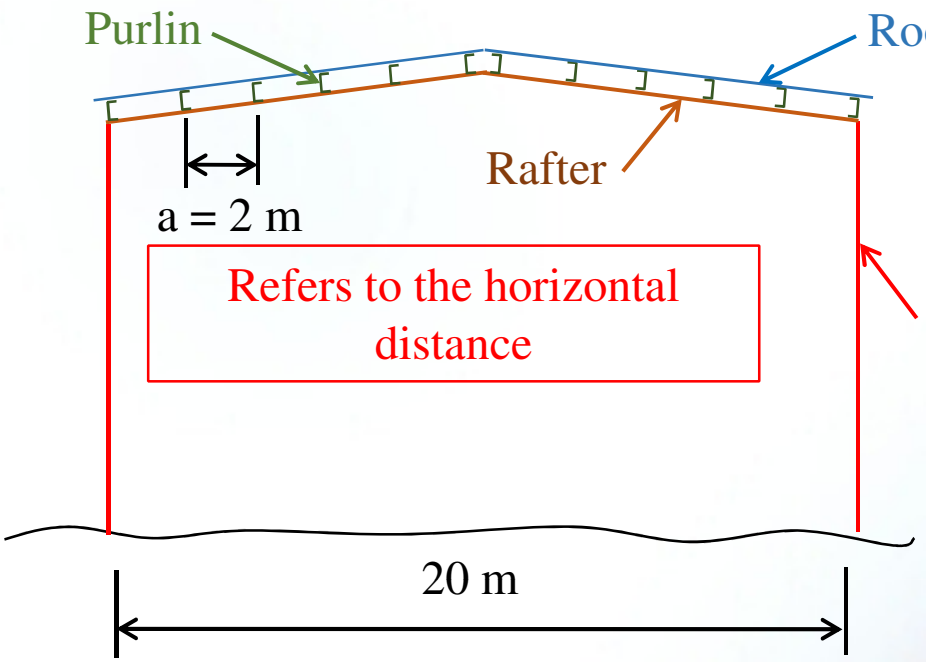
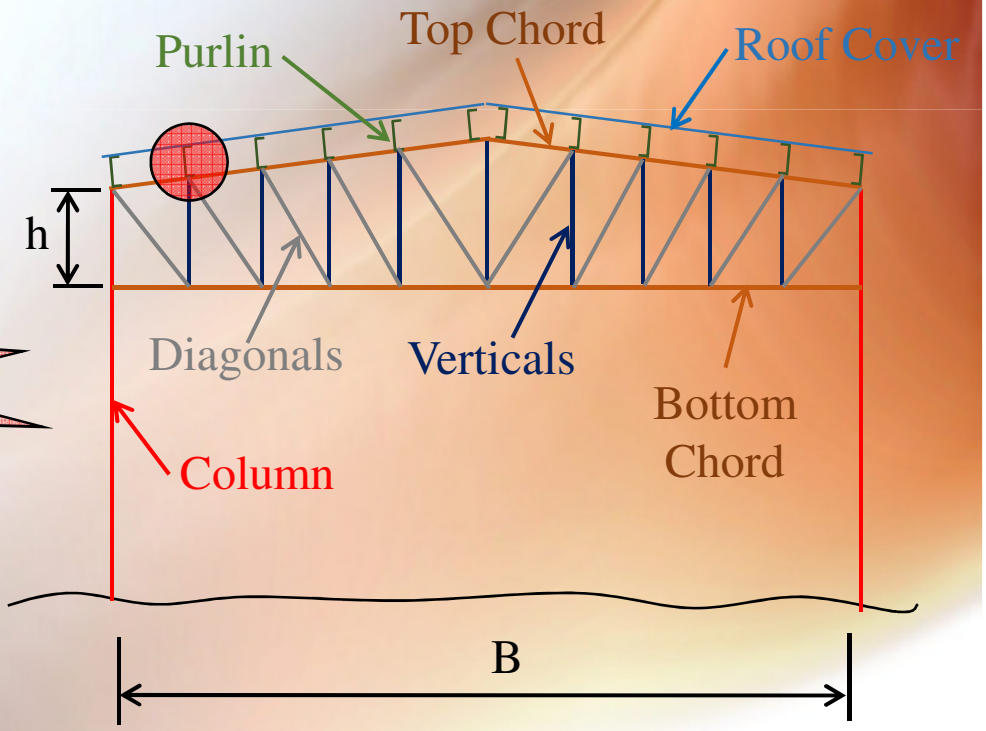


Purlins should be at Truss Joints



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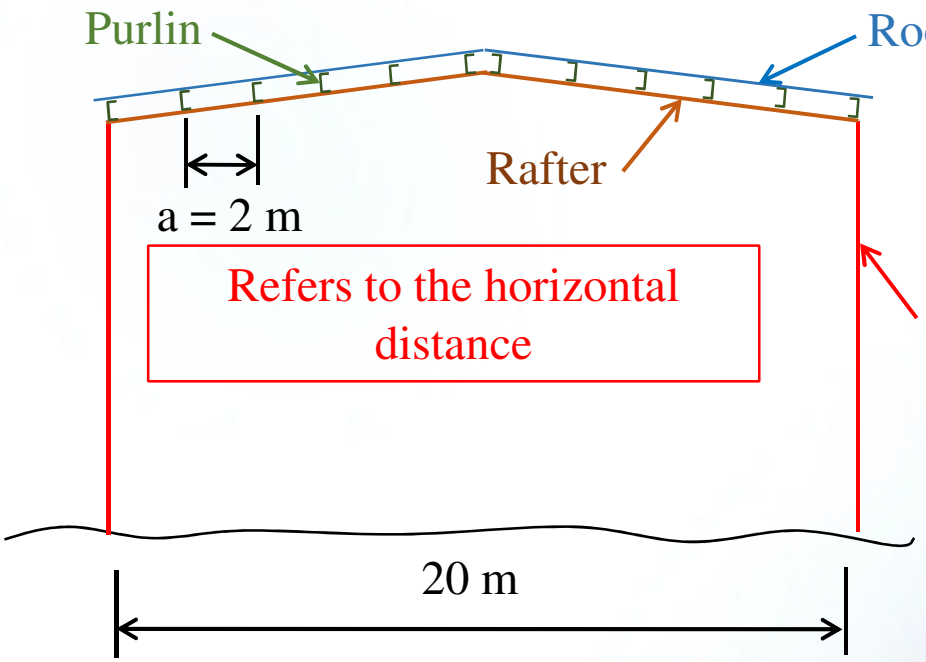

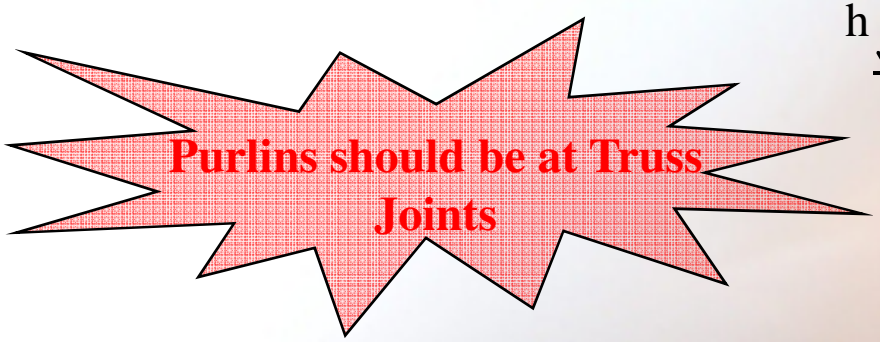

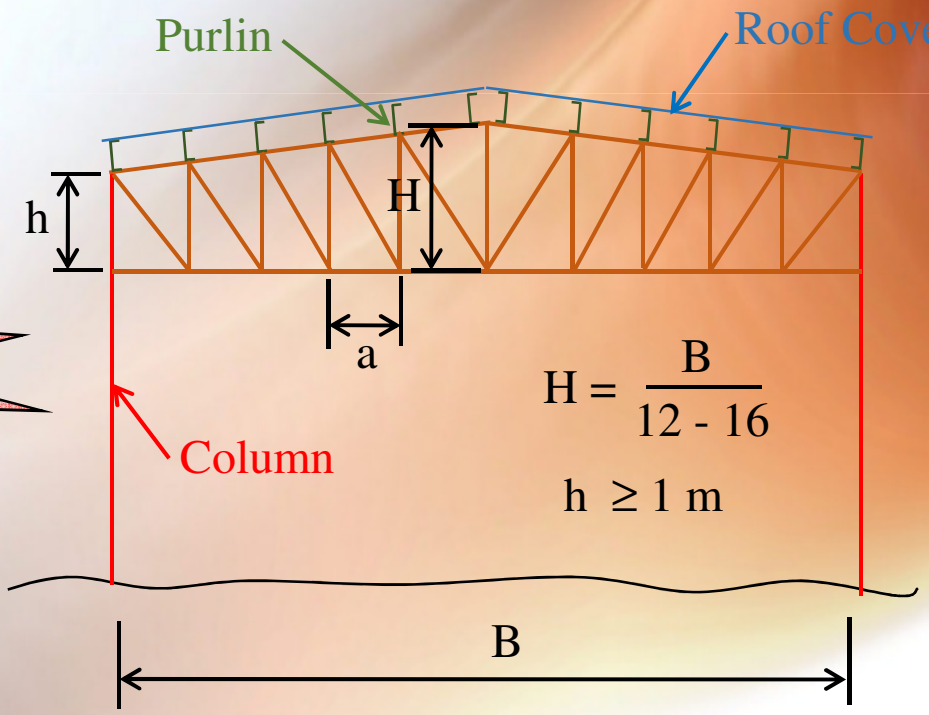

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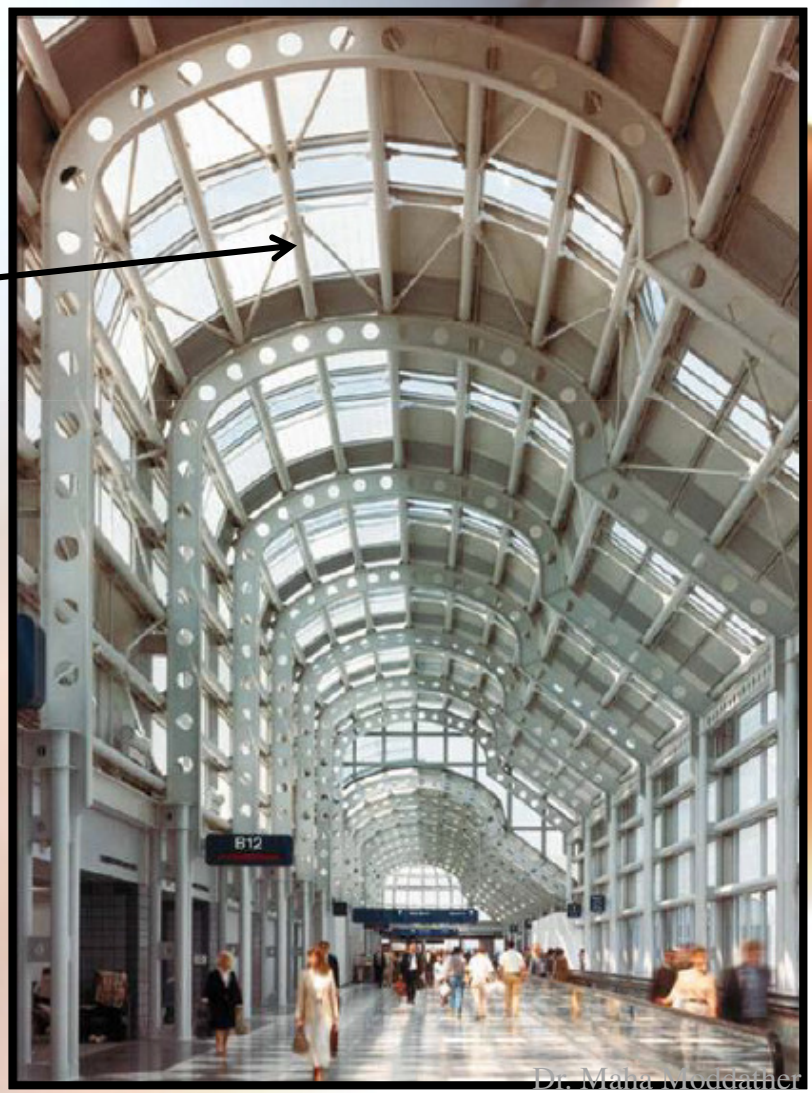
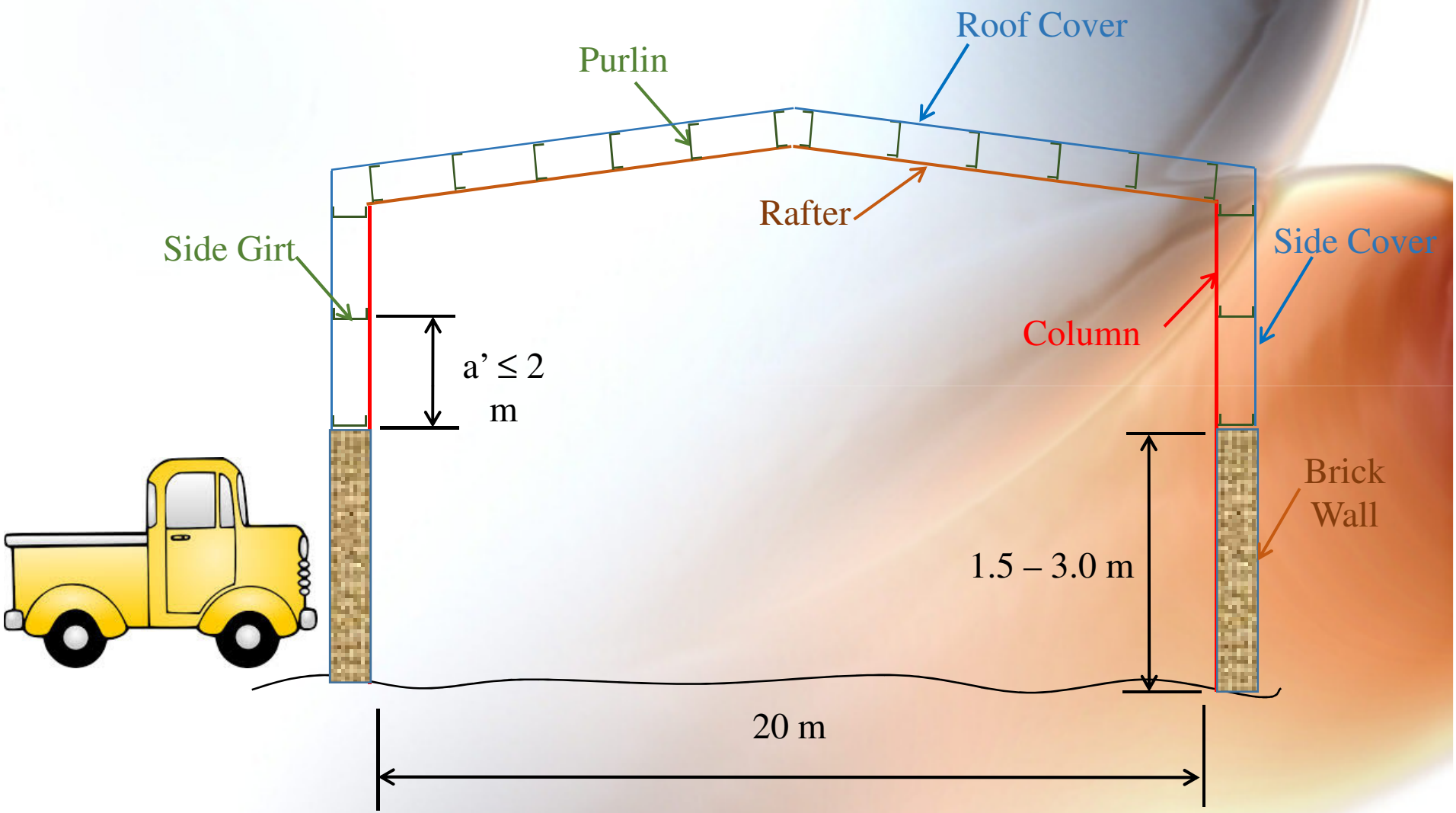


5. Side Cover

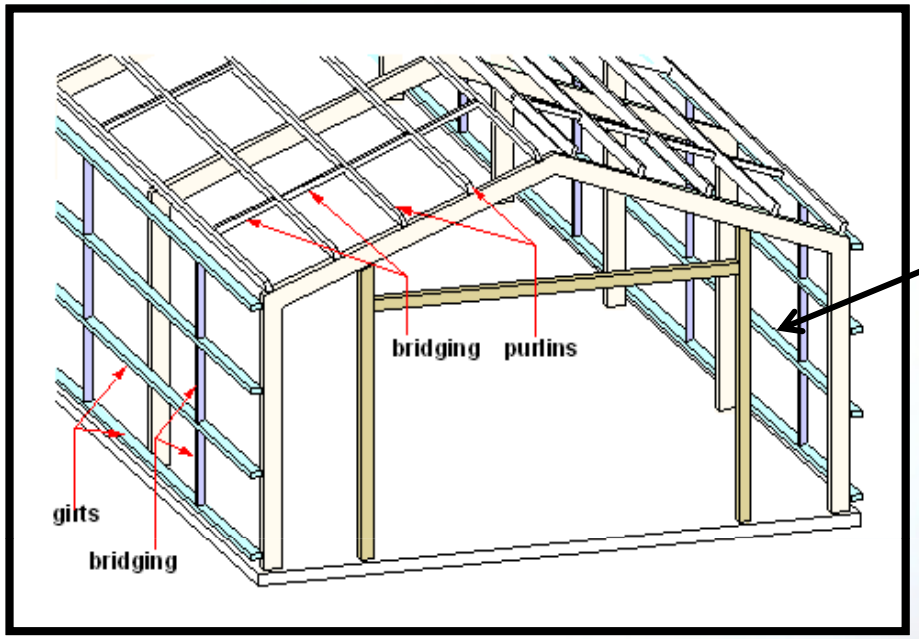
Corrugated Sheets

Brick Walls

5. Side Cover


Roof Cover
Purlin
Rafter
Side Girt
Side Cover
Column
a' ≤ 2 m
Brick Wall
1.5 – 3.0 m
20 m

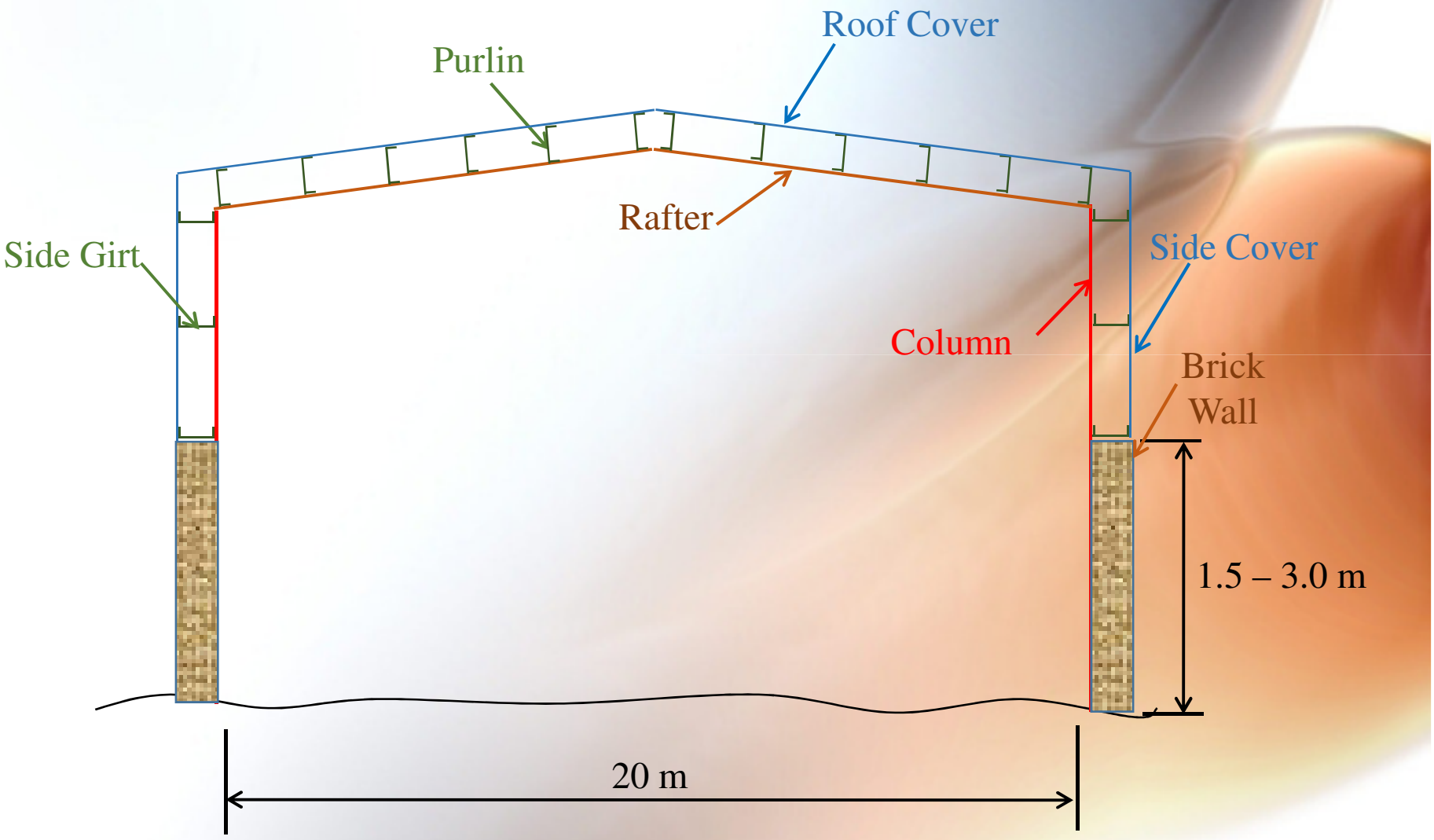
5. Side Cover



Side Girts

6. End Gables

- Add End Gable Columns with spacing 4 – 6 m



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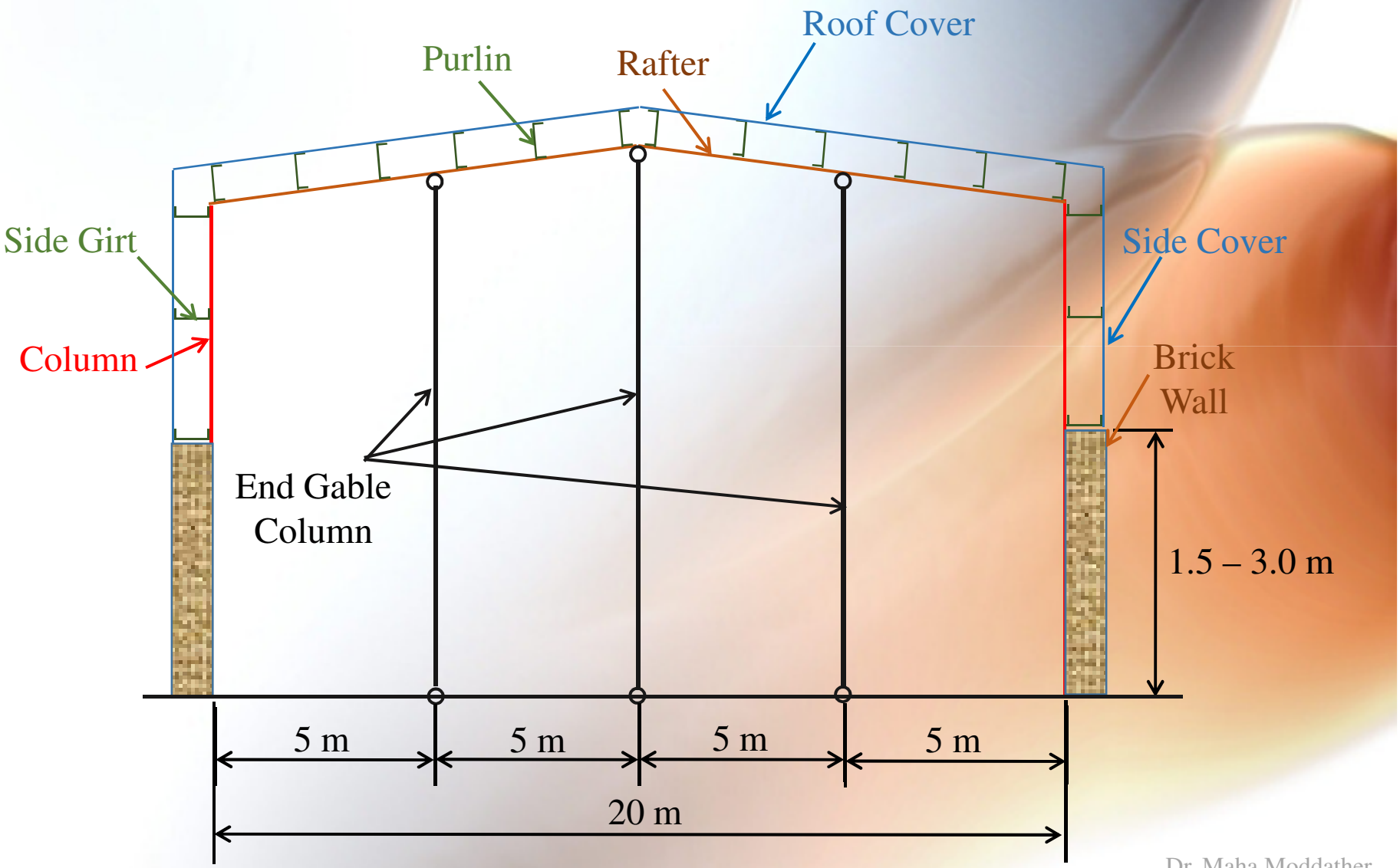
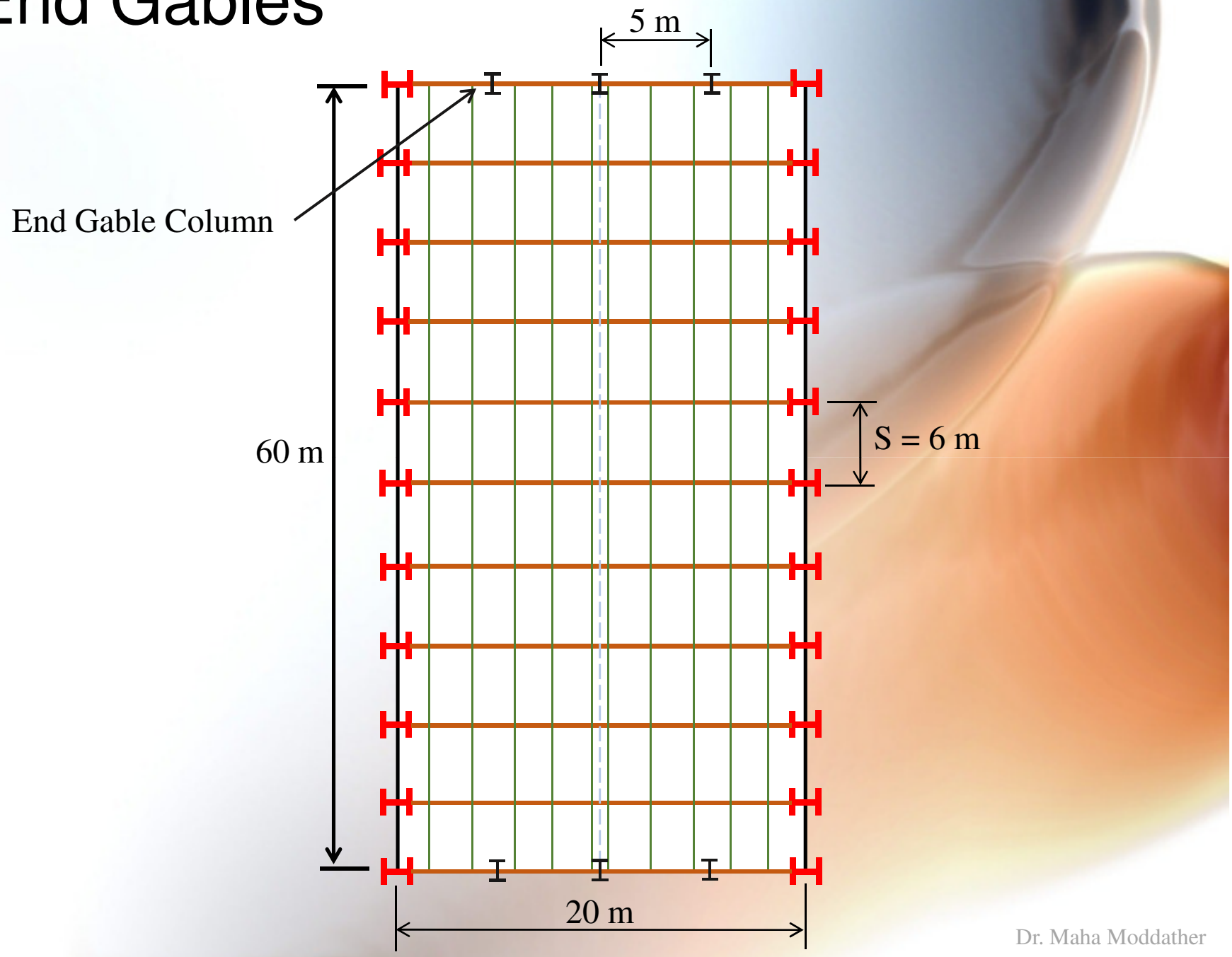
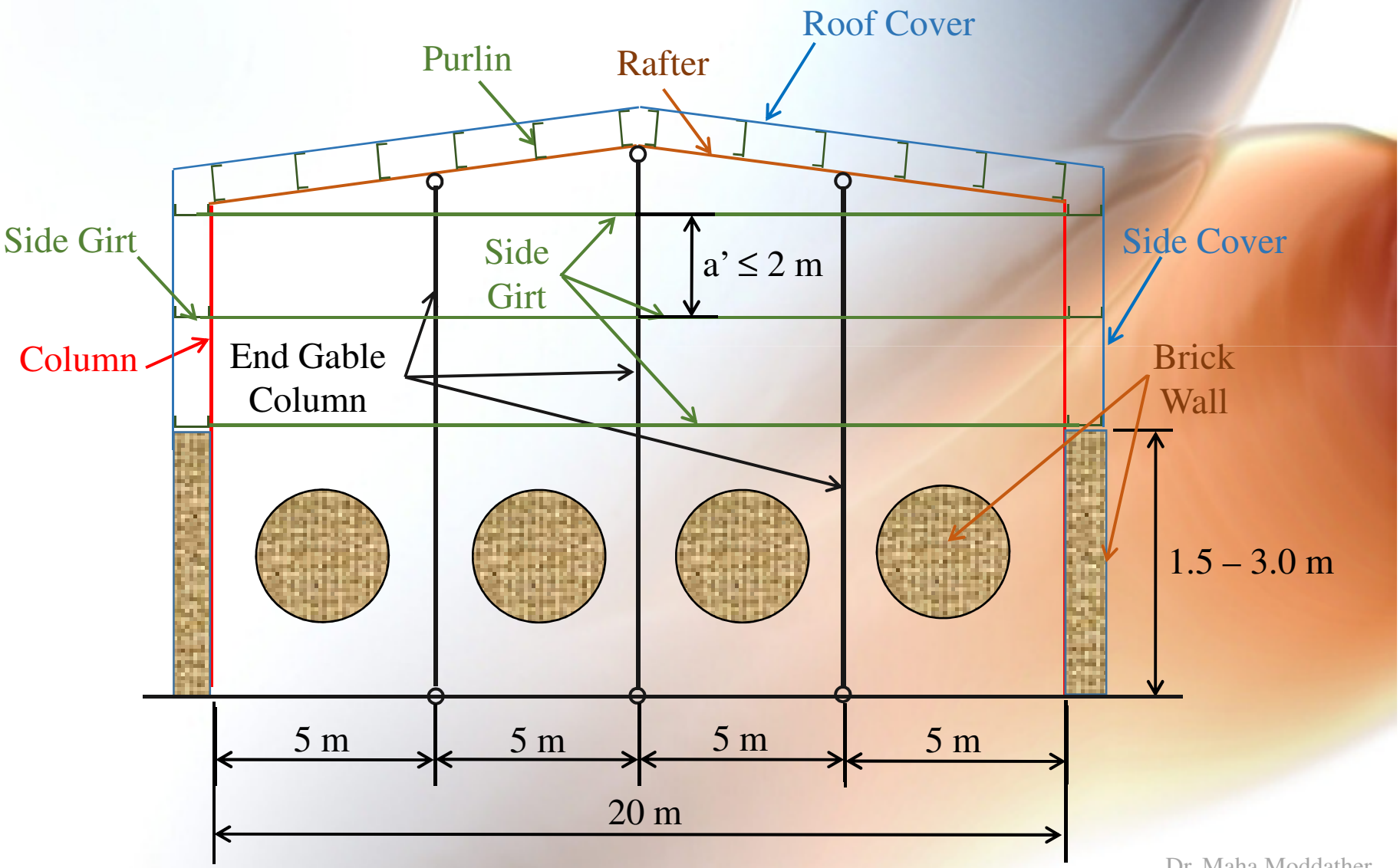


6. End Gables



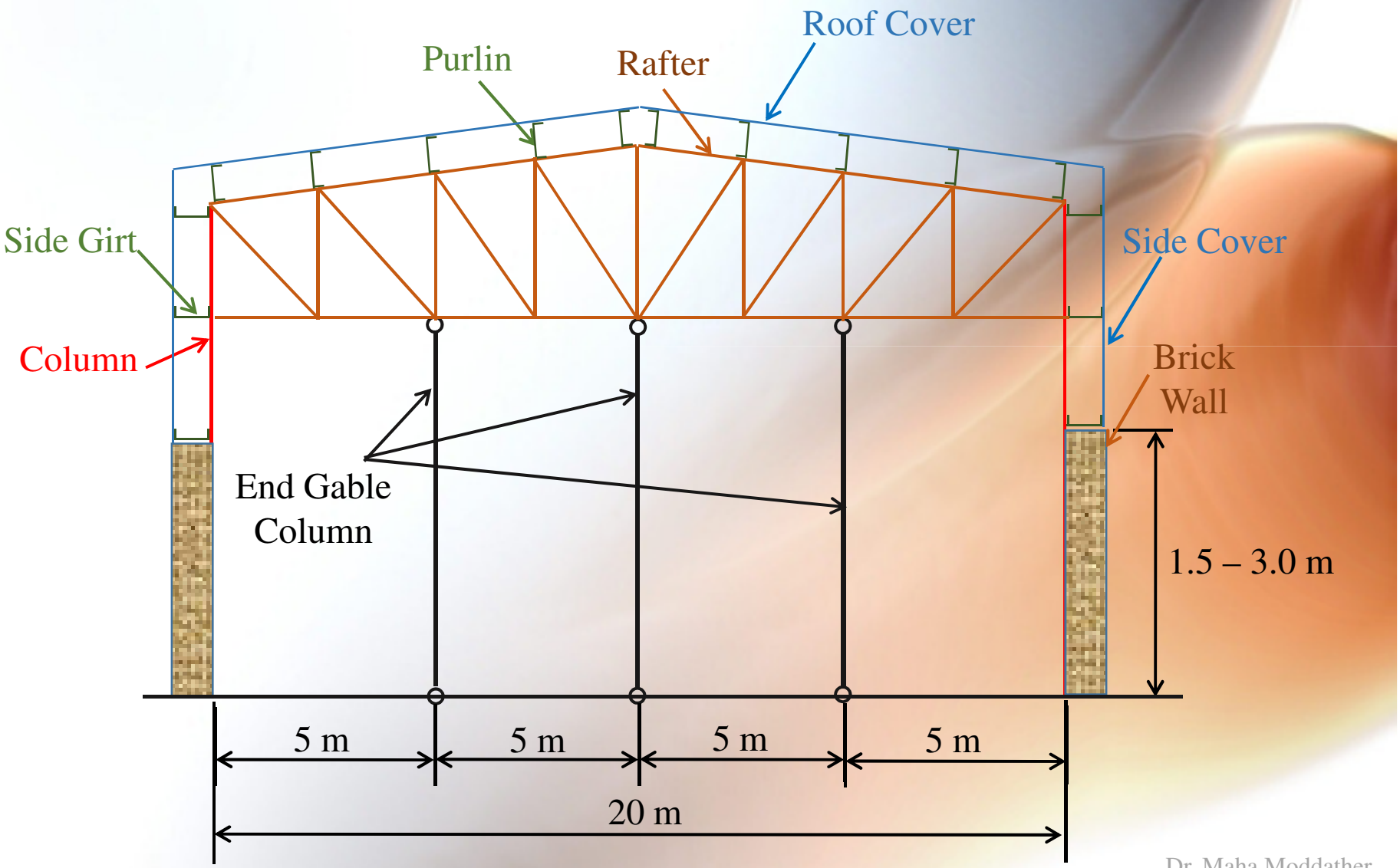
6. End Gables

- Use Side Girts at distance ≤ 2.0 m



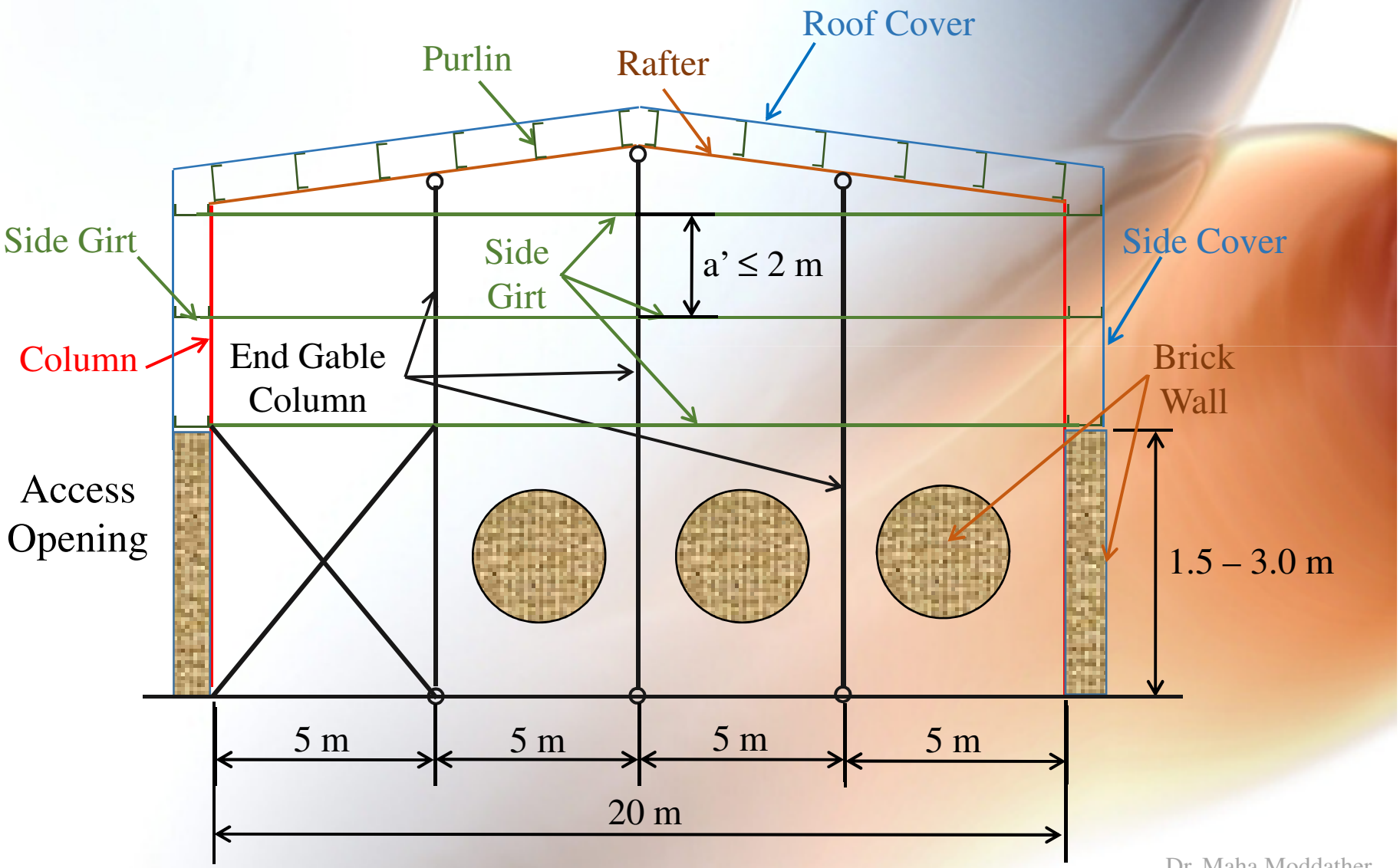
6. End Gables

- For trusses: End Gable Columns at truss Joints



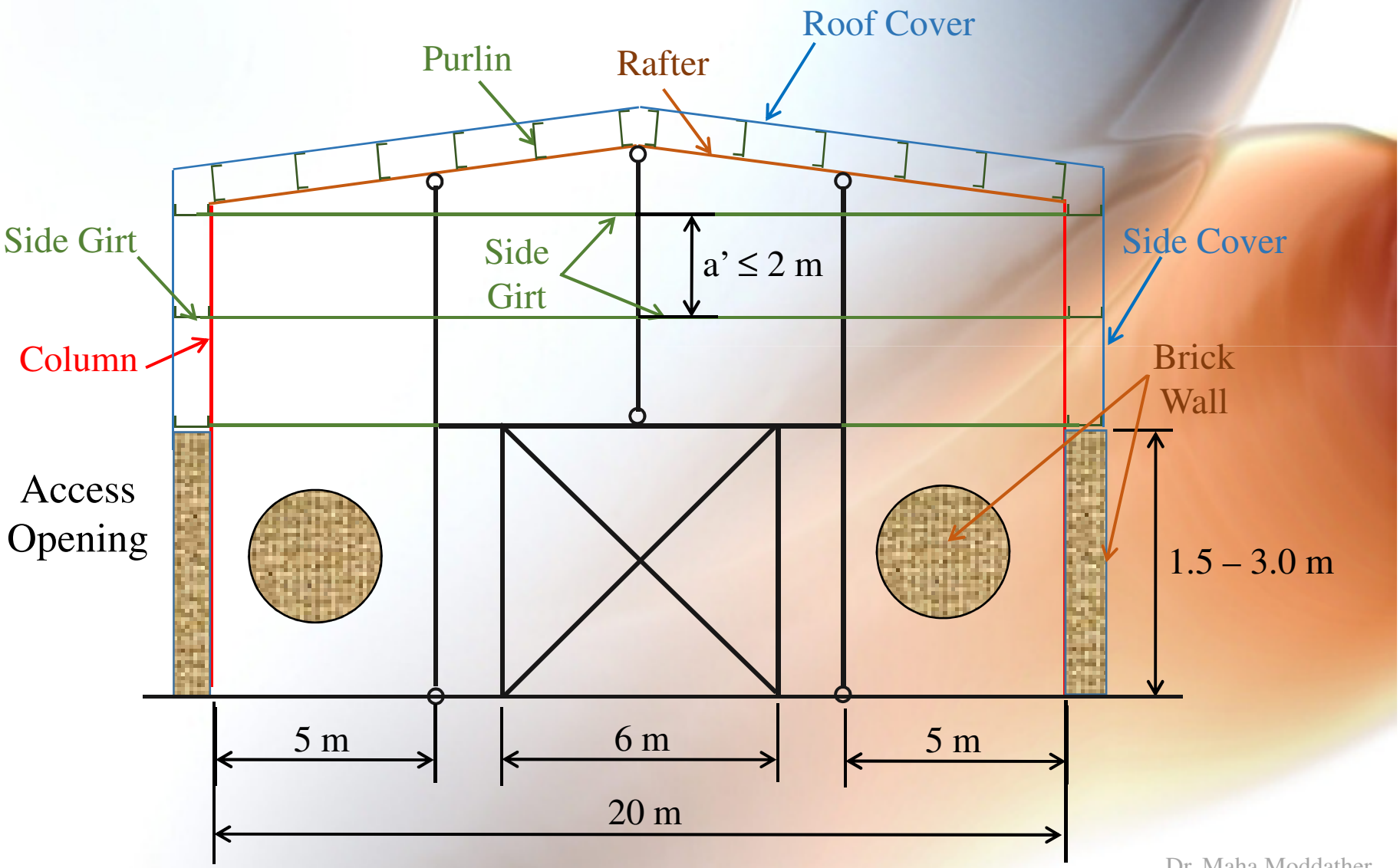
6. End Gables

❑ Access Doors



6. End Gables

❑ Access Doors



6. End Gables

- Types of Doors

Roller Shutter Door

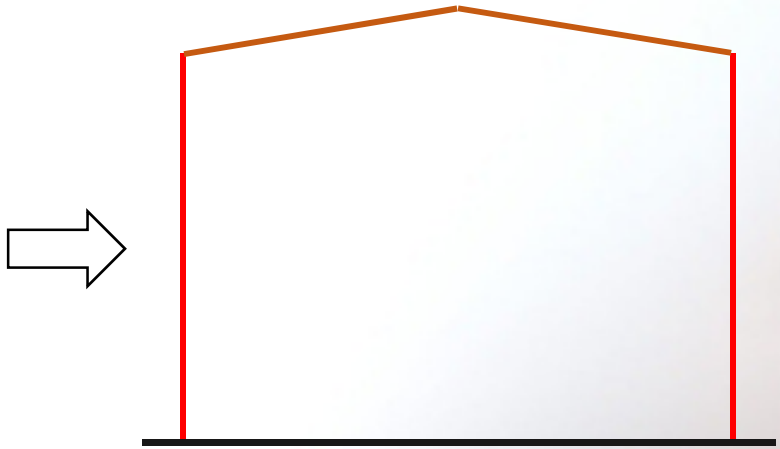
Sliding Door (One side)

Sliding Door (Two side)

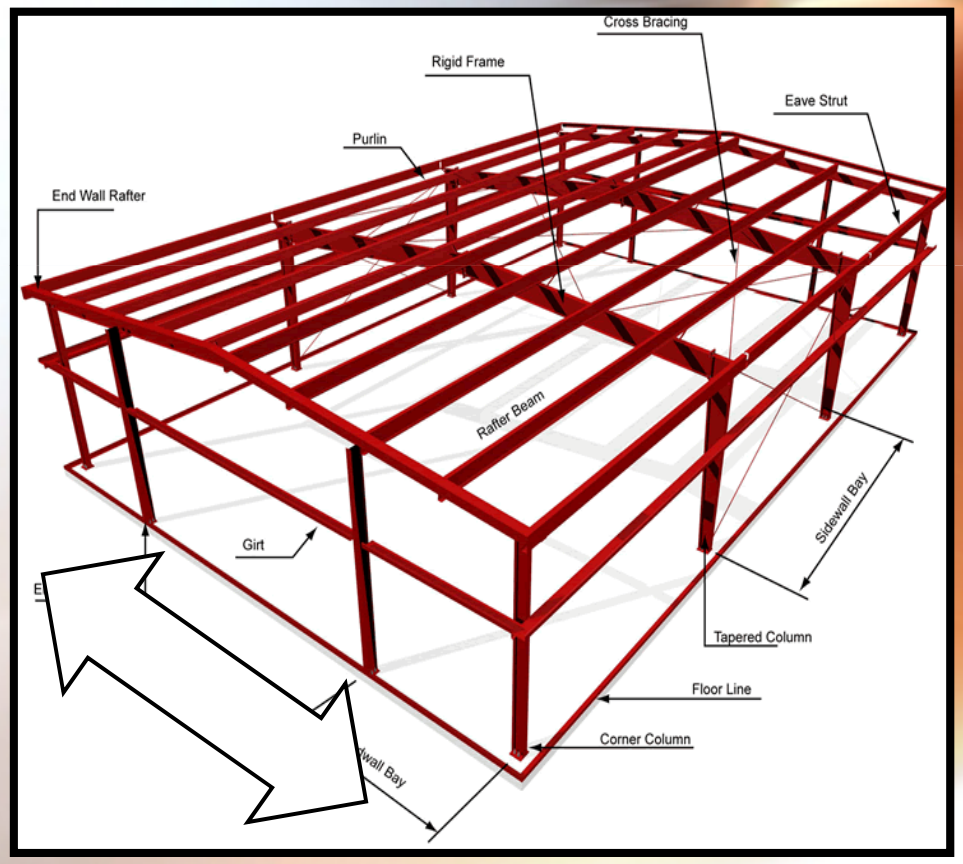
7. Bracing System

- Bracing system is provided to frames to provide stability under the lateral loads.

Frame can support loads in the lateral direction

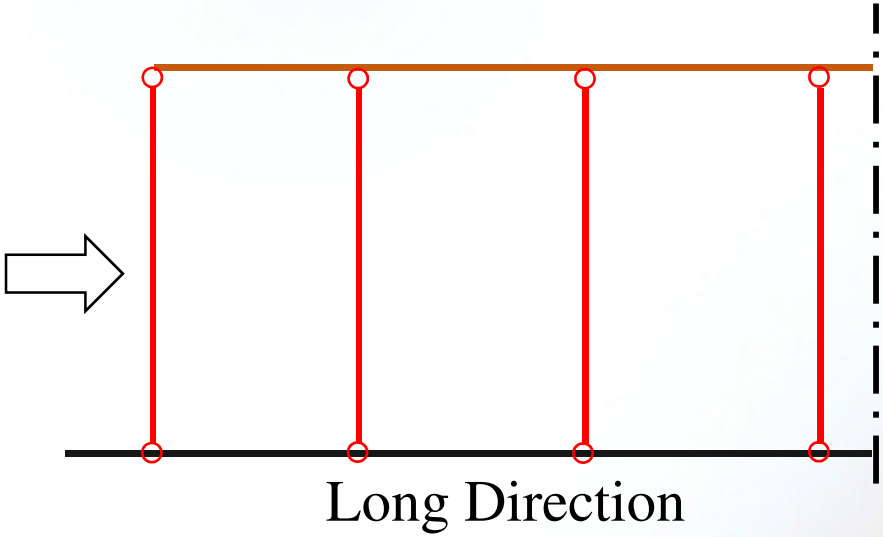


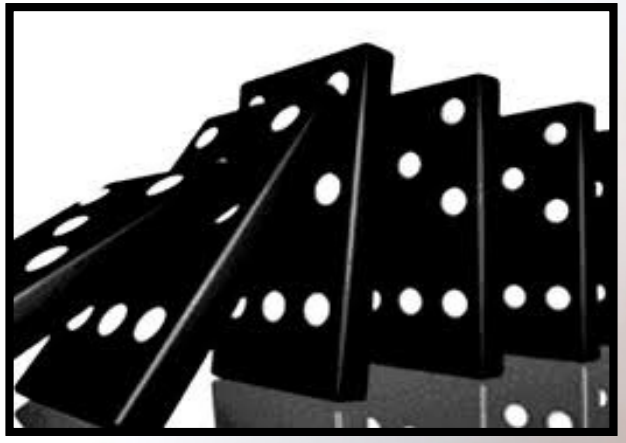
Short Direction

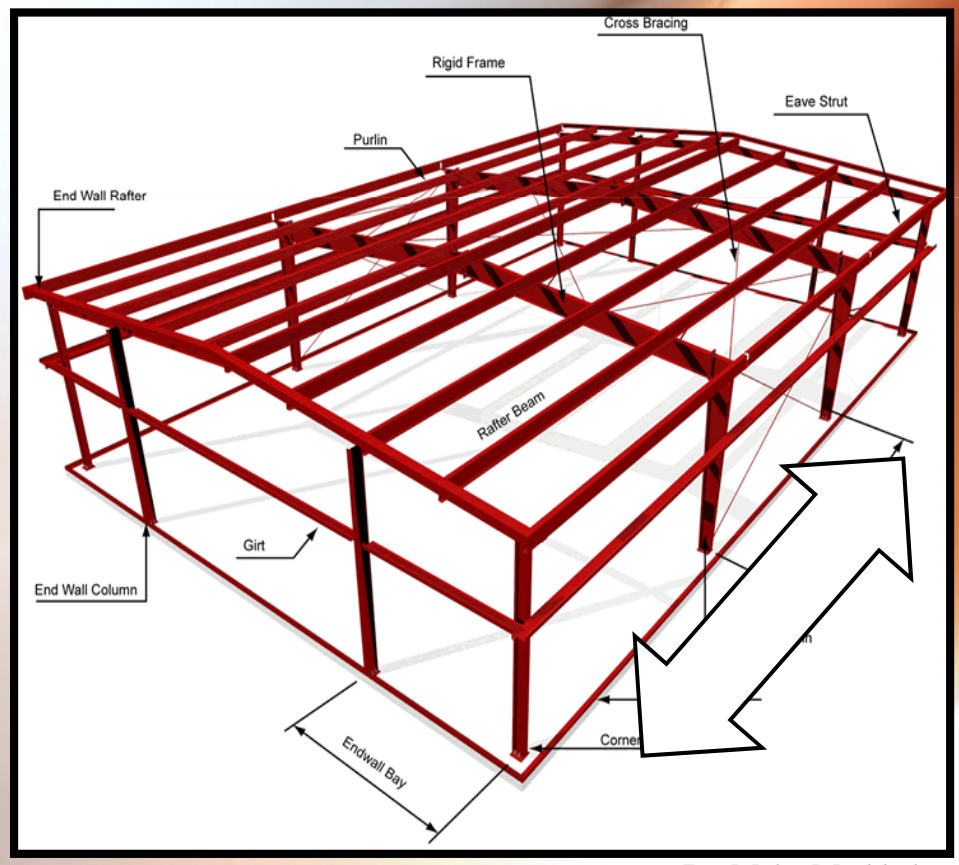


7. Bracing System

- Bracing system is provided to frames to provide stability under the lateral loads.







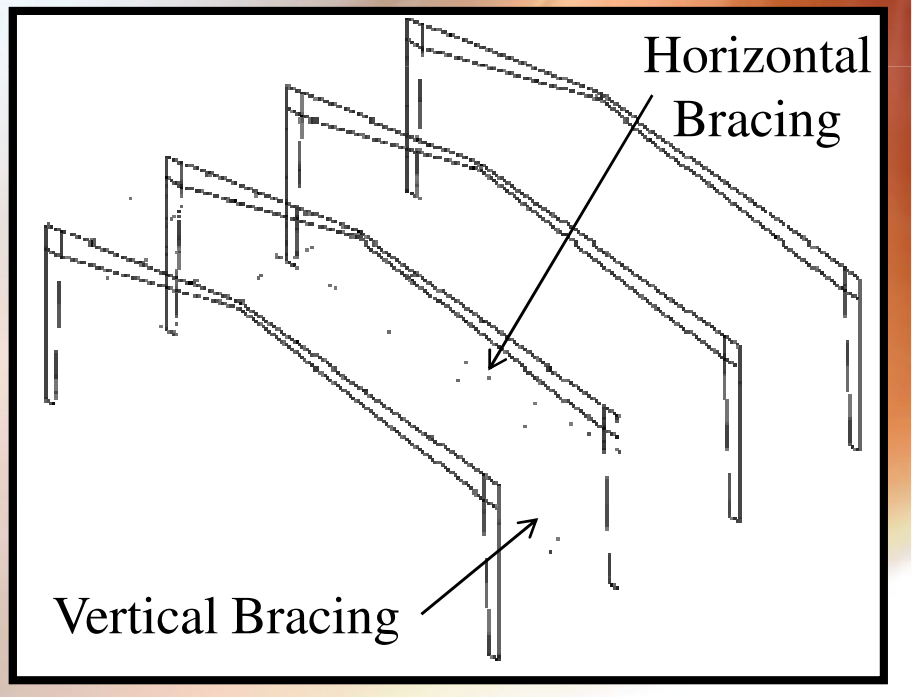
7. Bracing System

- Bracing System includes:
  - **Horizontal Bracing:**

Bracing in a horizontal plane provides a load path to transfer the horizontal forces (wind pressure on the cladding) to the planes of vertical bracing.

  - **Vertical Bracing**

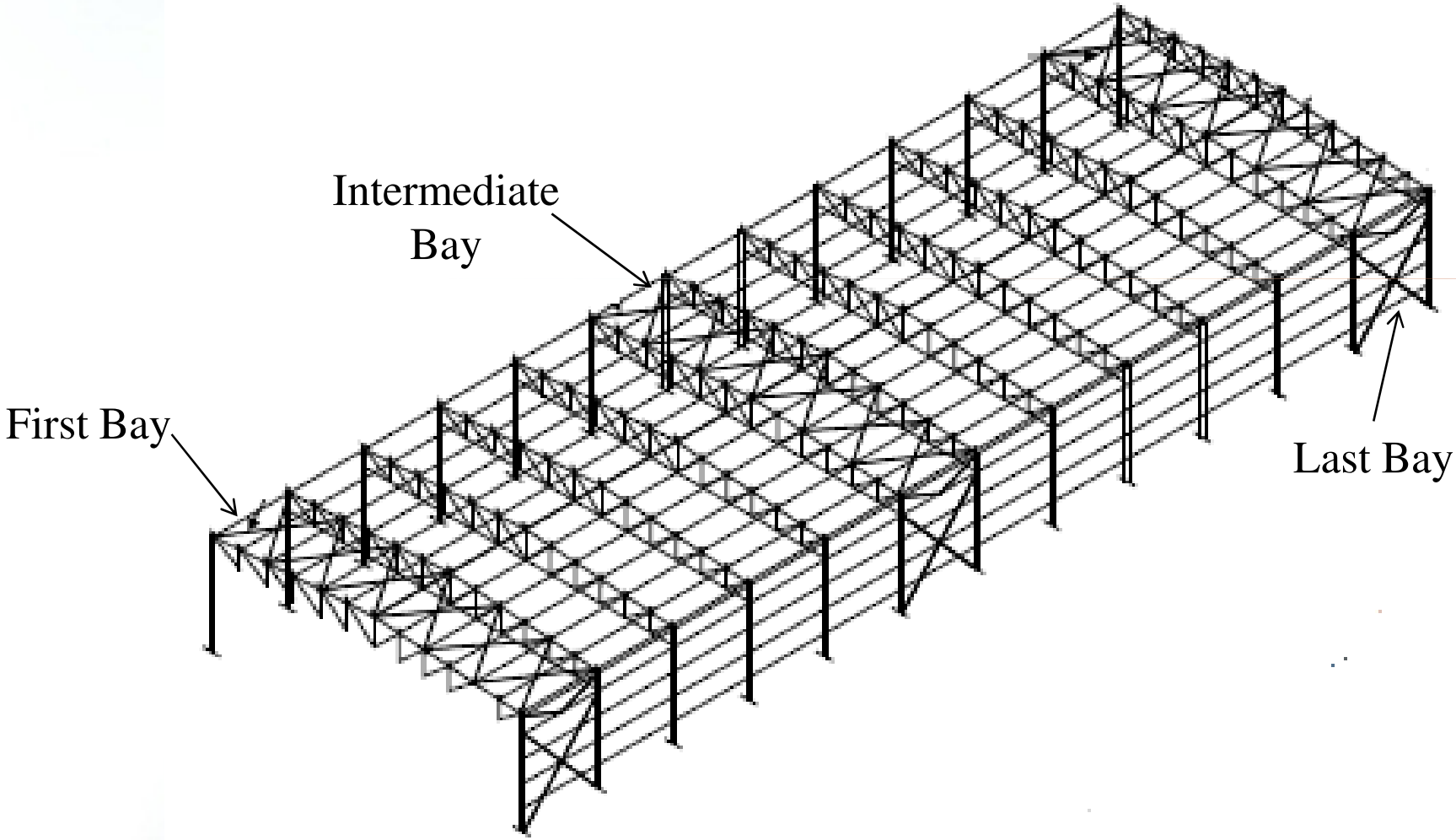
Bracing in vertical planes (between lines of columns) provides load paths to transfer horizontal forces to ground level.



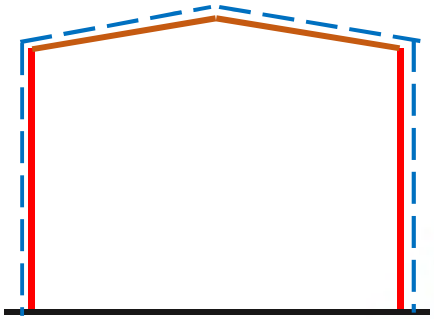
7. Bracing System

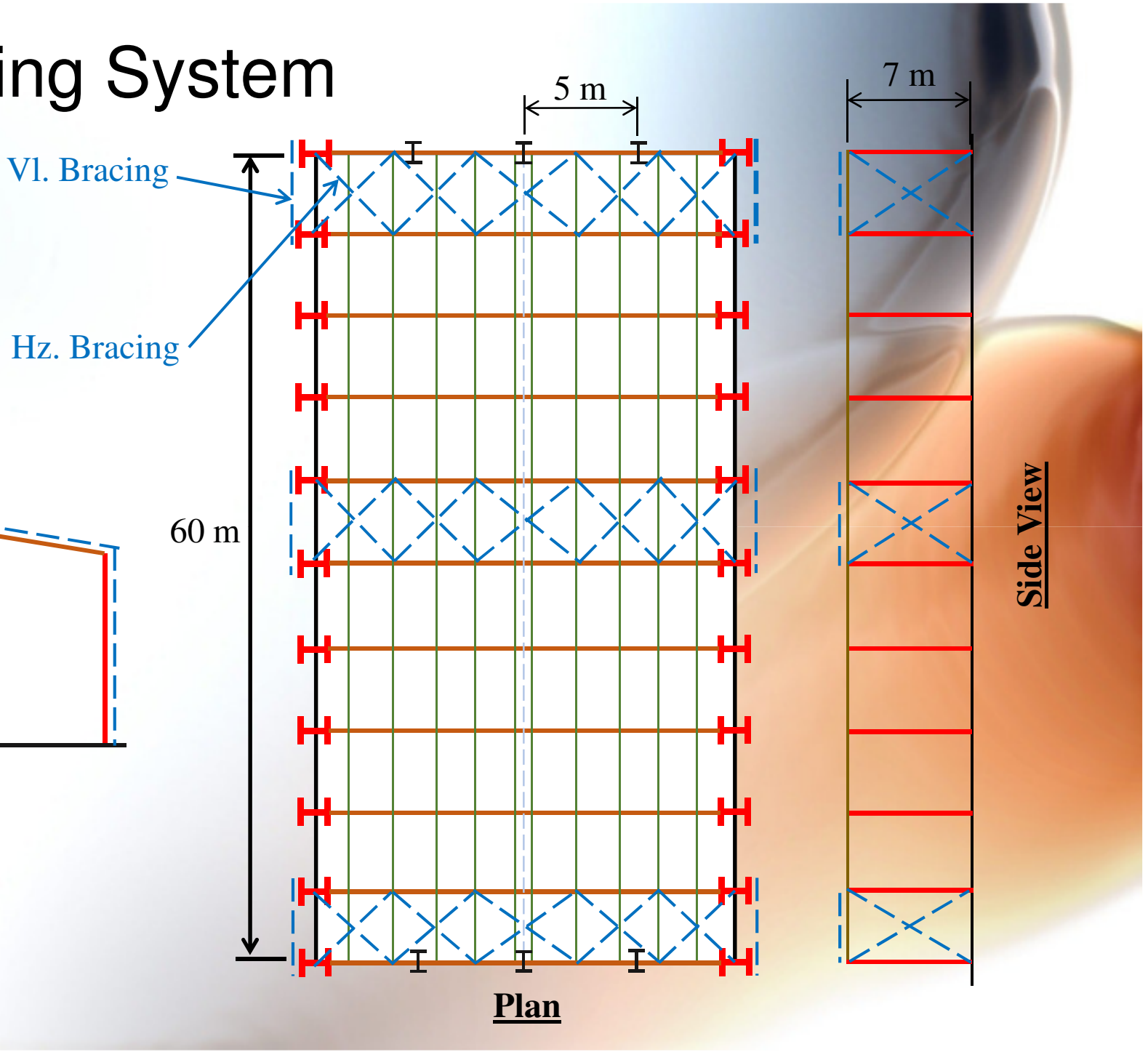
7. Bracing System

- Use Bracing at the First and last bays.
- Use bracing at intermediate bays, if length > 40 m.

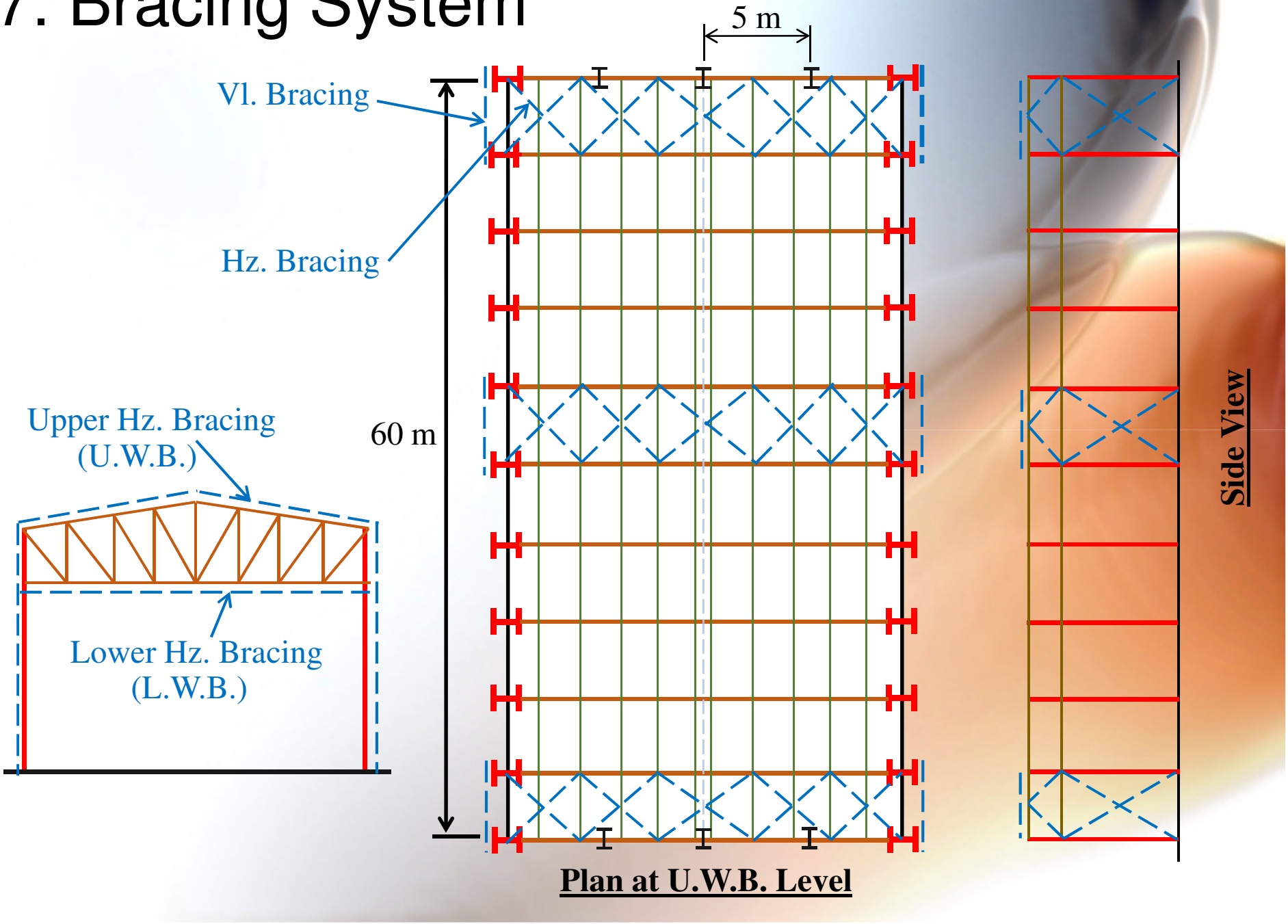


7. Bracing System





7. Bracing System



Assignment

- Prepare a General Layout Drawing (Using Ao sheet):
  - **Roof Plan:**
    - ✓ **Arrangement of Main System.**
    - ✓ **Arrangement of Purlins.**
    - ✓ **Horizontal Bracing.**
    - ✓ **End Gable Columns**
  - **Main System Elevation.**
  - **End Gable Elevation.**
  - **Side view for Vertical Bracing/ Side Girts.**