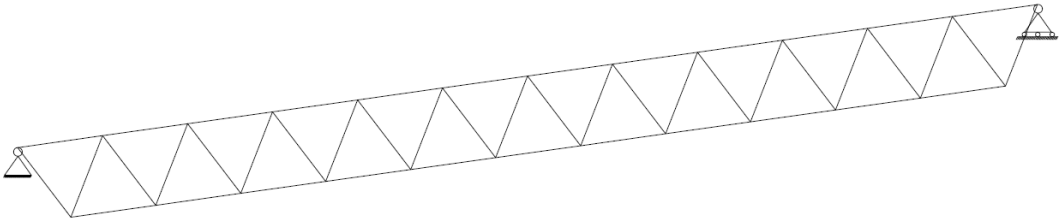
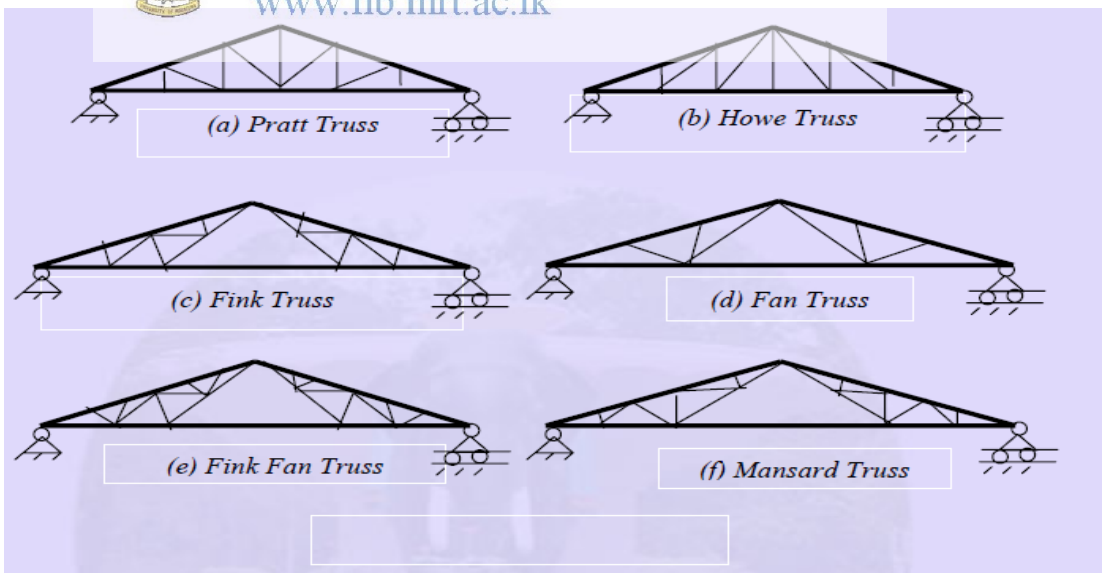
CHAPTER 03

3.0 TYPE OF TRUSSES AND STRUCTURAL IDEALIZATION

There are several types of trusses that have been using in roof structures in Sri Lanka. Figure 3.1 illustrate the most common truss types, identified after a survey of past-projects of which details are available in leading structural design offices in Sri Lanka.



a) Parallel Chord Truss



b) Pitched Roof Trusses

Figure 3-1 Type of Roof Trusses; a) Parallel Chord Truss b) Pitched Roof Trusses

Three buildings were selected for this study, which are situated in different part of Sri-Lanka, included a post disaster structure, Commercial Structure and normal structure. These structures are spread over the two different wind zones and comprise of parallel chord trusses and Pratt truss, having varied span from 4.0m to 12.0m.

The selected spans for this detail study were 4.0m, 8.0m, 10.0m, and 12.0m only. Bay spacing for above spans were 3.0m, 4.0m, 3.2m, and 6.0m respectively.

The Geometry of roof trusses for both steel families was kept exactly same for this study. That includes the bay spacing, purlin and tie rod spacing. Therefore, the design requirement such as direct stress and local buckling failure were addressed by selected design sections.

3.1. STRUCTURAL IDEALIZATION

Pratt truss system was use for 4.0m, 8.0m, and 10.0m span roof structure while parallel chord truss system was used for 12.0m span roof structure. The selected truss types for particular roof structures were analyzed for permanent and wind loads using finite element analysis software, SAP 2000-14. Full 3D analysis was carried out to study the exact structural response under static and wind loads & it's combinations, for both hot rolled and cold-formed steel sections.

3.1.1 COMPUTER MODELING

The finite Element software SAP2000-14 was used to model the roof structure. Eight basic trusses under four categories of span and two steel families were modeled. The bay spacing were defined according to the building geometry and column grid, as shown in Annex - A. Minimum head room requirement and roof pitch were maintained according to initial building requirement.

The top and bottom chord of each truss type were defined as continuous member, while bracing members are defined as individual section. The support conditions at one end, of each truss were defined as a pinned support while other end defined as roller support.

3.1.2 LOAD EVALUATION

The design loading for this study was selected to comply with BS6399-I; code of practice for dead and imposed loads, and other super imposed load requirement were defined to comply with building services and M & E requirements. The gravity loads evaluation according to roofing requirement is shown in Annex-B.2

The wind load was evaluated based on design wind speed in particular wind zone and building category as shown in Annex-B.1. The structures for this study were selected, such that it covers most common building category in Sri Lanka. Following building categories were covered, under this study.

- Normal structure
- Commercial structure
- Post disaster structure

The load combination used for 3D analysis is shown in Table 3.1

Table 3-1 : Combination Definitions

Combo Name	Combo Type	Auto Design	Case Type	Case Name	Scale Factor
SDL (Service Dead-Live Load)	Linear Add	No	Linear Static	DEAD	1.0
			Linear Static	LIVE	1.0
			Linear Static	SUPER DEAD	1.0
UDL Ultimate Dead-Live load)	Linear Add	No	Linear Static	DEAD	1.4
			Linear Static	SUPER DEAD	1.4
			Linear Static	LIVE	1.6
ULDW(max) (Ultimate Dead-Live-Wind [Inward] load)	Linear Add	No	Linear Static	DEAD	1.2
			Linear Static	LIVE	1.2
			Linear Static	SUPER DEAD	1.2
			Linear Static	Wind(max)	1.2
UDLW(min) (Ultimate Dead-Live-Wind [outward] load)	Linear Add	No	Linear Static	DEAD	1.2
			Linear Static	LIVE	1.2
			Linear Static	SUPER DEAD	1.2
			Linear Static	Wind(min)	1.2
ENV	Envelope	No	Linear Static	DEAD	1.0
			Linear Static	LIVE	1.0
			Response Combo	SDL	1.0
			Linear Static	SUPER DEAD	1.0
			Response Combo	UDL	1.0
			Response Combo	UDLW(min)	1.0
			Response Combo	ULDW(max)	1.0