Brief Introduction

The AM Structure section consists of **five** sections, which weigh about 20% of the actual test. This section has only eight problems. The ratio between calculation problems to theoretical problems is a **5-to-3 ratio**. You shouldn't focus on these numbers much, that's just to give you an idea on what to expect. It is recommended to study the basics and expand your knowledge by solving as many problems as you can. It is emphasized here that Lindbergh manual is your best reference on the exam day.

Loads

Loads are forces that act on a structure. Loads can be categorized into two broad types: Dead Loads and Live Loads.

1.1 Dead Loads

Dead loads include the weight of the structure itself, which sometimes called the self-weight, and the non-movable components attached to the structure. Dead loads are permanent loads and they are the weight of all of the structural or nonstructural components that are **attached to a structure**, such as floor covering, partitions, light fixtures, mechanical equipment's etc.
Dead loads are important for engineers because without a correct assessment of the loads that a specific structure can withstand, the structure will fail.
Building codes are of little use in the determination of dead loads – they **must** be hand-calculated.

1.2 Live Loads

According to the International Building Code (IBC), a Live Load is defined as "*Those loads produced by the use and occupancy of the building or other structure and do not include construction or environmental loads such as wind load, snow load, rain load, earthquake load, flood load or dead load.*"

Examples of live loads include people, furniture, moveable equipment, and anything else that does not remain permanently stationary. Generally, the magnitude of a live load is not well defined as that of a dead load, and it normally must be calculated. For most of the cases, a structural element must be evaluated for possible locations of a live load in order not to overlook a critical load position that may produce the worst effect. Live loads are normally specified by the design codes.

The architect or engineer-of-record is free to **INCREASE** these loads as he/she feels necessary, however these loads **CANNOT BE DECREASED.**

1.3 Construction Loads

Construction loads are the loads imposed on the unfinished structure during phases of construction. Typical construction loads include material loads, workers loads, construction equipment loads, etc. Construction loads are temporary and vary throughout the phases of construction. For example, equipment and crane and/or trucks used during demolishing or widening a bridge represent construction loads.

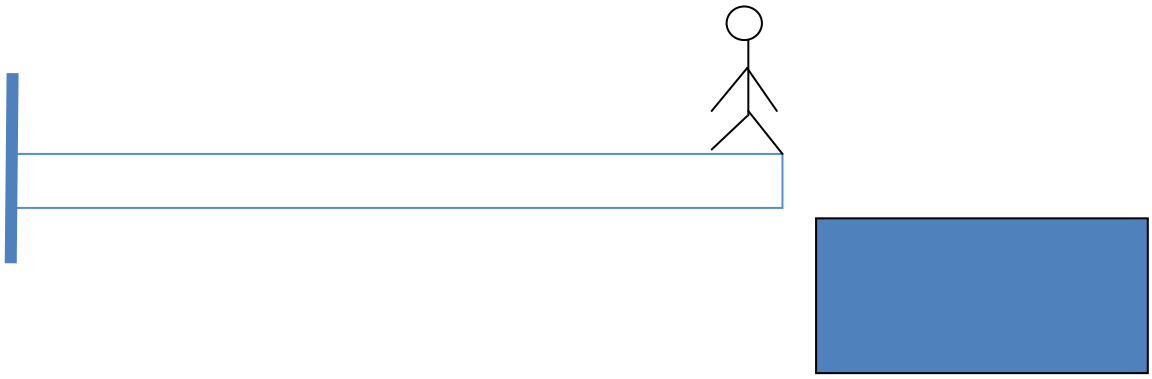
Classification of Loads

Loads can be classified according to their intensity to concentrated (point loads) and distributed loads

2.1.1 Concentrated Loads (Point Loads)

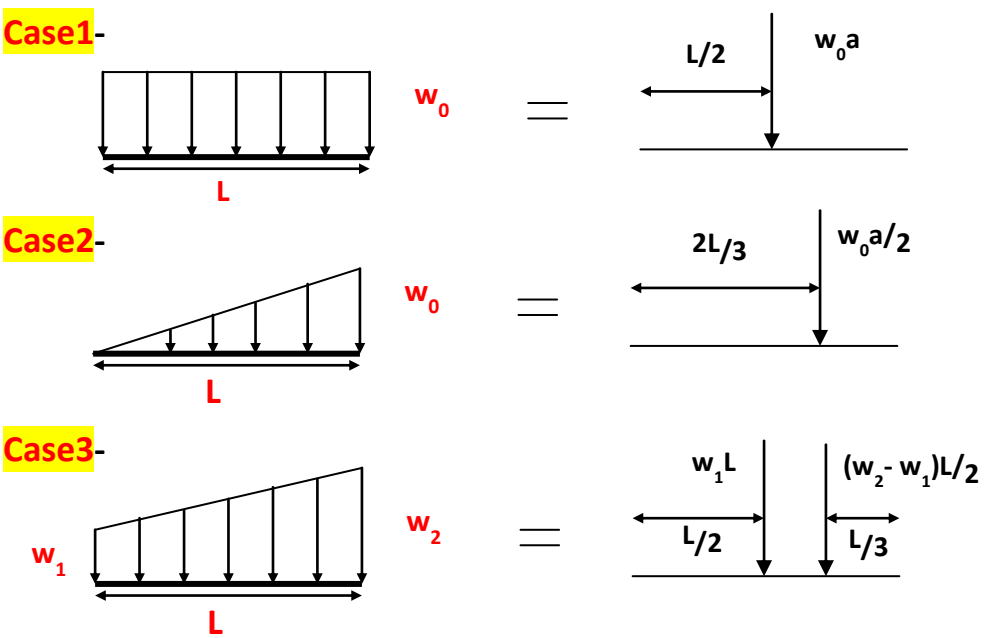
A concentrated load is a force applied at a single point of a member. For example as shown in **Figure 1**, the weight of a student standing at the tip of a diving board represents a concentrated load, even though the person's weight is only distributed over the area covered by his foot prints.

Figure 1



2.1.2 Distributed Loads (loading spread over a distance or area)

A distributed load is acting over a large area. It can be uniformly distributed, where the amount of force is the same throughout the area to which it is applied. It can also be non-uniform, meaning it varies throughout.
Uniform and variable loads are shown in **Figure 2** below:
Where w is the distributed load per unit length (lb/ft) and L, length of member in **FT.**



(Figure 2)

Example 1.

Q.1 Refer to Case 1, if w = 3 lb/ft and L = 6 ft. Find the total load applied.

A.1 3 x 6 = **18 lb**.

Example 2

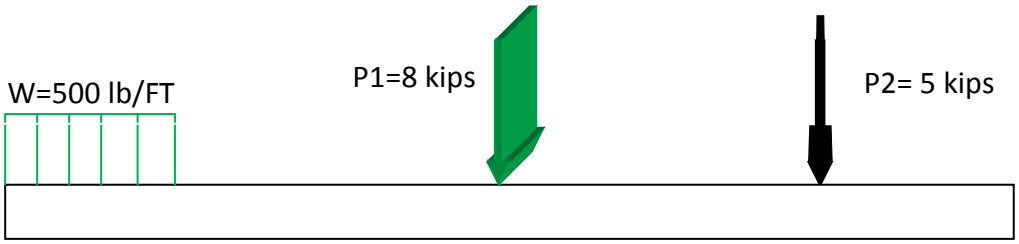
Q.2 Refer to Case 2 ,if w = 5 lb/ft and L = 6 ft. Find the value and location of total load applied.

A.2 5 x 6/2 = **15 lb** @ a distance = 2 x 6/3 = **4 ft** from the right end of the beam.

Practice Problem 1

Given: A beam segment in a bridge construction site with the following loads:

Distributed Dead Load, w = 500 lb/ft @ 10 ft
Concentrated Live Load, P1 = 8 kips.
Concentrated Live Load, P2 = 5 kips.



1- If the dead load factor is 1.2 and the live load factor is 1.6, the total factored and un-factored load acting on beam, respectively is?

A-19, 18

B-27, 18

C-26, 19

D-18, 27

Factored loads:

Dead loads = 1.2(500 x 10) =1.2(5000 lb) =1.2x 5 = **6 k**
(Don't Forget 1 kips = 1000lb)
Live loads = 1.6(8+5) = 20.8 = **21 k**

Total **= 27 k**

Un-factored Loads

Dead Loads = 5 k
Live Loads = 13 k
Total = **18 k**