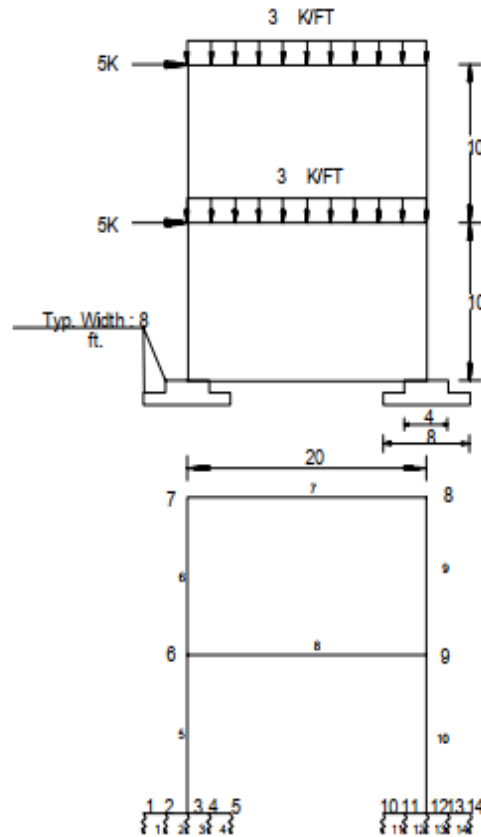# Example Problem No. 3

A portal frame type steel structure is sitting on concrete footing. The soil is to be considered as an elastic foundation. Value of soil subgrade reaction is known from which spring constants are calculated by multiplying the subgrade reaction by the tributary area of each modeled spring.

NOTE:
1) All dimensions are in feet.
2) Soil Subgrade Reaction - 250 Kips/cft

Spring constant calculation

Spring of joints 1, 5, 10 & 14 =	8 x 1 x 250
	= 2000Kips/ft
Spring of joints 2, 3, 4, 11, 12 & 13 =	8 x 2 x 250
	= 4000Kips/ft

Actual input is shown in bold lettering followed by explanation.

STAAD PLANE PORTAL ON FOOTING FOUNDATION

Every input has to start with the word STAAD. The word PLANE signifies that the structure is a plane frame structure and the geometry is defined through X and Y axes.

UNIT FT KIPS

Specifies the unit to be used for data to follow.

JOINT COORDINATES
1 0.0 0.0 0.0 5 8.0 0.0 0.0
6 4.0 10.0 0.0 ; 7 4.0 20.0 0.0
8 24.0 20.0 0.0 ; 9 24.0 10.0 0.0
10 20.0 0.0 0.0 14 28.0 0.0 0.0

Joint number followed by X, Y and Z coordinates are provided above. Since this is a plane structure, the Z coordinates are given as all zeros. Semicolon signs (;) are used as line separators to facilitate specification of multiple sets of data on one line.

MEMBER INCIDENCES
1 1 2 4
5 3 6 ; 6 6 7
7 7 8 ; 8 6 9
9 8 9 ;10 9 12
11 10 11 14

Defines the members by the joints they are connected to.

MEMBER PROPERTIES AMERICAN
1 4 11 14 PRIS YD 1.0 ZD 8.0
2 3 12 13 PRIS YD 2.0 ZD 8.0
5 6 9 10 TABLE ST W10X33
7 8 TA ST W12X26

The first two lines define member properties as PRIS (prismatic) followed by YD (depth) and ZD (width) values. The program will calculate the properties necessary to do the analysis. Additional information is available in sections 1 and 5 of the Technical

Reference Manual. Member properties for the remaining members are chosen from the American (AISC) steel table. The word ST stands for standard single section.

```
* E FOR STEEL IS 29,000 AND FOR CONCRETE 3000
UNIT INCHES
CONSTANTS
E 29000. MEMB 5 TO 10
E 3000. MEMB 1 TO 4 11 TO 14
DEN 0.283E-3 MEMB 5 TO 10
DEN 8.68E-5 MEMB 1 TO 4 11 TO 14
POISSON STEEL MEMB 5 TO 10
POISSON CONCRETE MEMB 1 TO 4 11 TO 14
```

The CONSTANT command initiates input for material constants like E (modulus of elasticity), Density and Poisson's ratio. Length unit is changed from FT to INCH to facilitate the input. Any line beginning with an * mark is treated as a comment line.

```
UNIT FT
SUPPORTS
2 TO 4 11 TO 13 FIXED BUT MZ KFY 4000.
1 5 10 14 FIXED BUT MZ KFY 2000.
```

The supports for the structure are specified above. The first set of joints are restrained in all directions except MZ (which is global moment-z). Also, a spring having a spring constant of 4000 kip/ft is provided in the global Y direction at these nodes. The second set is similar to the former except for a different value of the spring constant.

LOADING 1 DEAD AND WIND LOAD COMBINED

Load case 1 is initiated followed by a title.

SELF Y -1.0

The selfweight of the structure is specified as acting in the global Y direction with a -1.0 factor. Since global Y is vertically upwards, the -1.0 factor indicates that this load will act downwards.

JOINT LOAD
6 7 FX 5.0

Load 1 contains joint loads also. FX indicates that the load is a force in the global X direction. The load is applied at nodes 6 and 7.

MEMBER LOAD
7 8 UNI GY -3.0

Load 1 contains member loads also. GY indicates that the load acts in the global Y direction. The word UNI stands for uniformly distributed load, and is applied on members 7 and 8, acting downwards.

PERFORM ANALYSIS

This command instructs the program to proceed with the analysis.

PRINT ANALYSIS RESULTS

The above PRINT command instructs the program to print analysis results which include joint displacements, member forces and support reactions.

FINISH

This command terminates the STAAD run.