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| **Activity 3.2.6 Beam Design**  |

Procedure

The PARTIAL SECOND FLOOR FRAMING PLAN for a new hotel is given below. The second floor will be used for conference space. Design the following floor framing members for the hotel structure.

* Interior beam
* Exterior beam
* Girder on Column Line 3
* Girder on Column Line 5

Criteria

The following data is to be used for design of the floor framing:

* Dead load = 50 psf
* Assume the weight of the floor beams and girders are included in the dead load.
* Floor live load = 100 psf (Hotels – Public Space per IBC 2009 Table 1607.1)
* Fy = 50,000 psi
* The floor will support a plaster ceiling.
* **http://www.structural-drafting-net-expert.com/steel-beam.html**
1. Complete the following the interior beam using the Allowable Strength Design method. You must show all work and include proper units for full credit.
	* + - Calculate the loading
			- Create a beam free body diagram
			- Calculate end reactions
			- Draw Shear and Moment Diagrams
			- Calculate the maximum moment
			- Calculate the required nominal moment
			- Calculate required plastic section modulus
			- Choose an efficient steel wide flange to safely carry the load
			- Check shear capacity
			- Calculate deflection limits
			- Check deflection using beam formula; if necessary, revise member choice and recalculate deflection
			- Choose final design; prove that the revised choice is sufficient to carry bending moment and shear

Conclusions

1. If the beam loading and beam span is different for every beam in a building, is it reasonable and practical to choose a different beam section for every installation? Why or why not?
2. Aside from simply pushing the wrong keys on your calculator, what is the most likely reason for an error in calculating a required section modulus or a deflection?
3. Which structural steel section would carry the largest bending moment, a W12 x 22 or a W14 x 22? Why? If subjected to the same magnitude of loading over the same span, which beam would display the largest deflection? Why?

Interior Beam

1. Calculate the beam loading.
2. Draw the beam free body diagram.
3. Calculate the end reactions
4. Draw Shear and Moment Diagrams

1. Calculate maximum moment.
2. Calculate the required nominal moment.
3. Determine the required plastic section modulus and select an efficient wide flange.
4. Check the shear strength.
5. Calculate deflection limits.
6. Calculate actual deflections.
7. Select a final design.