

# Baker Hughes Office/Warehouse Design



# Project Definition



A new structure needs to be designed for Baker Hughes in Donovan's industrial park in Mount Pearl. The structure consists of a pre-engineered warehouse as well as a two story office building. The steel frame needs to be designed for the office building and concrete footings need to be designed for the warehouse and the office building.



# Scope



- Provide design of structural steel for office area including columns, beams and joists
- Design the footings for the office building
- Design the footings for the warehouse
- Produce structural drawings for structural steel and footings
- Complete cost estimate of structure
- Provide alternative design methods for structure

# Office Building



## Design Loads

- The first step in designing the steel for the building is determining the loads acting on the building. The loads are determined by using the 1995 NBCC.
- The environmental data used to determine the loads were taken from the 2005 NBCC as they are more conservative.
- There are several loads that we are taking into account for the design of the steel and the footings:
  - Dead Loads
  - Live Loads
  - Snow/Wind/Seismic Loads (Environmental Loads)
- Critical load combinations must be determined to find the maximum reactions to design for.

# Office Building



## Steel Design

- The structural steel for the columns, beams and joists needs to be designed.
- The grid layout for the building has already been established so only the structural steel elements need to be designed.
- The lateral loads acting on the building (wind and seismic) need to be counteracted by the steel frame of the building through lateral bracing.
- The location for the bracing needs to be determined. This creates a problem at the west wall of the office building because there are no available bays without windows.

# Office Building



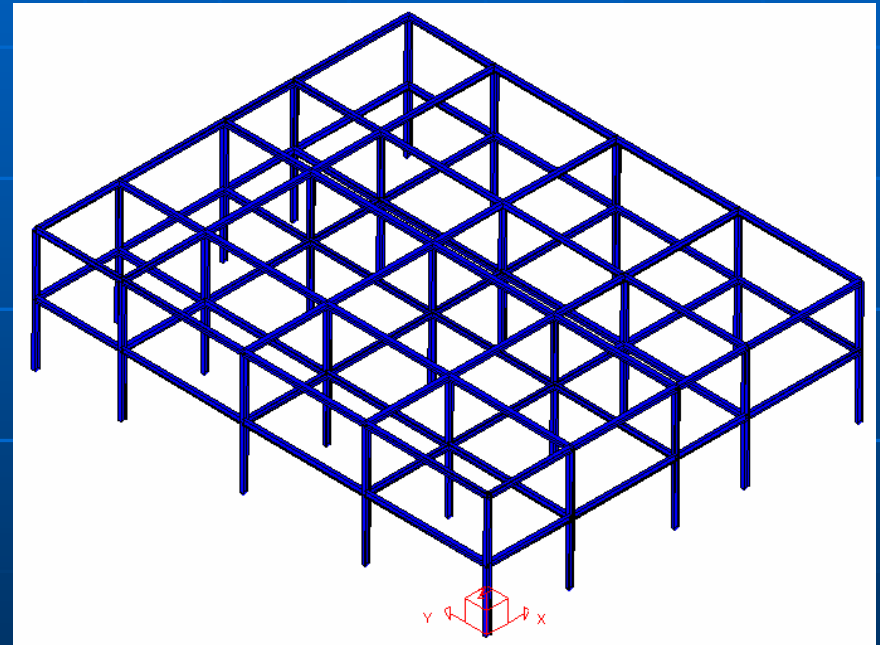
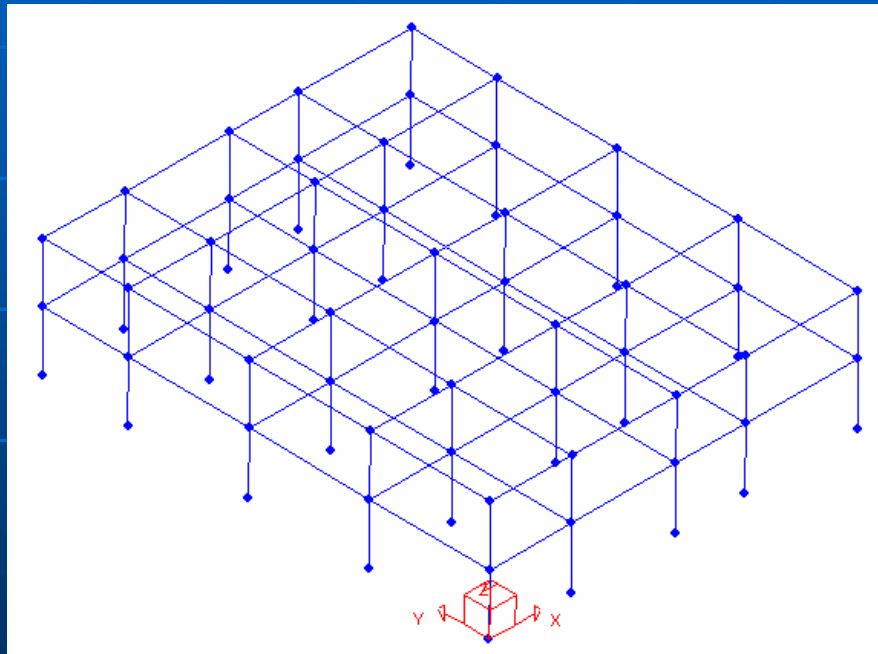
## Steel Design (3D Modeling)

- Once the loads have been determined, the structure can be modeled in S-Frame.
- A common steel size is selected for initial analysis based on the loads (eg. W310x60) and then the geometry of the structure can then be modeled.
- The loads are applied to the structure can be analyzed using the load combinations in accordance with the Canadian steel code.
- After analysis, the members are optimized to use the code to its maximum efficiency.

# Office Building



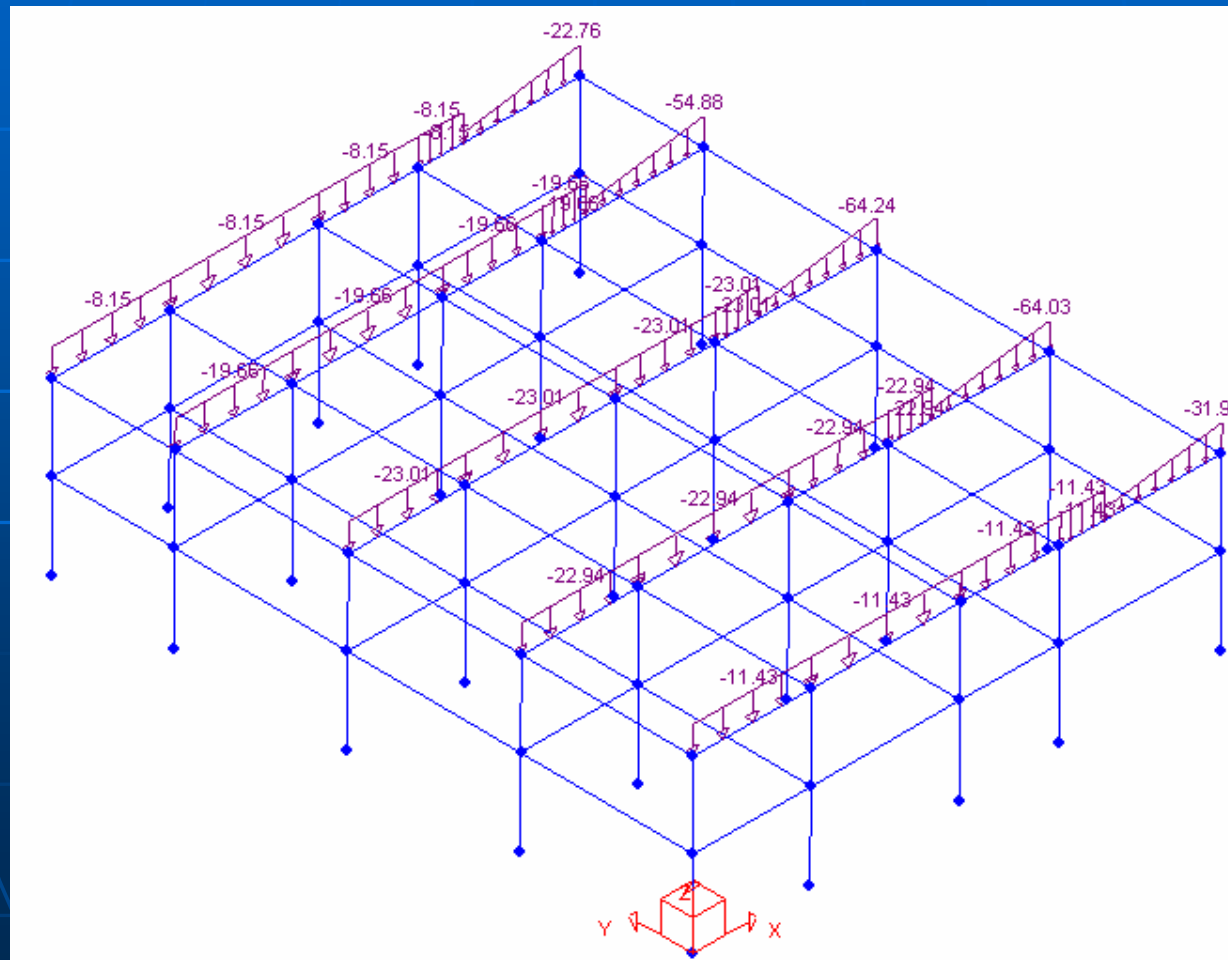
## Steel Design (3D Modeling)



# Office Building



## Steel Design (3D Modeling)





# Office Building



## Footing Design

- Once the design loads and the loading combinations have been determined, the footings can be designed from the column reactions.
- The columns for the office building are supported by spread footings and are connected with anchor bolts which acts as pin connections.
- The area of the footing is to be determined from the unfactored loading and the bearing capacity of the soil.
- The footings will then be designed for flexure and shear forces as well as the bearing capacity of the interface between the columns and footings.
- Footings of similar size will be grouped together and will be designed with the same dimensions.

# Office Building

## Footing Design



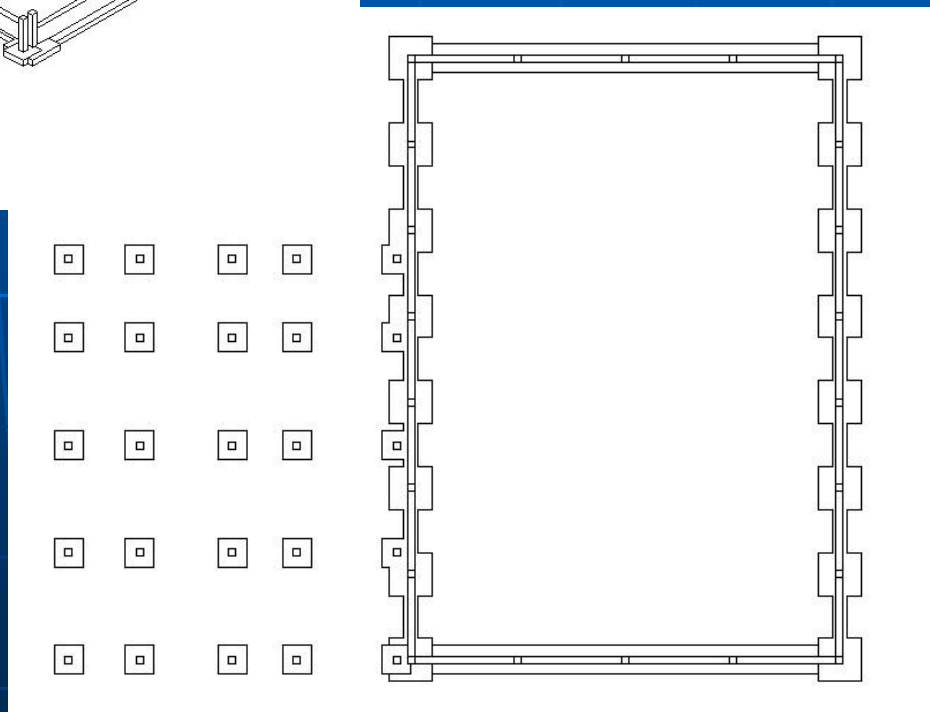
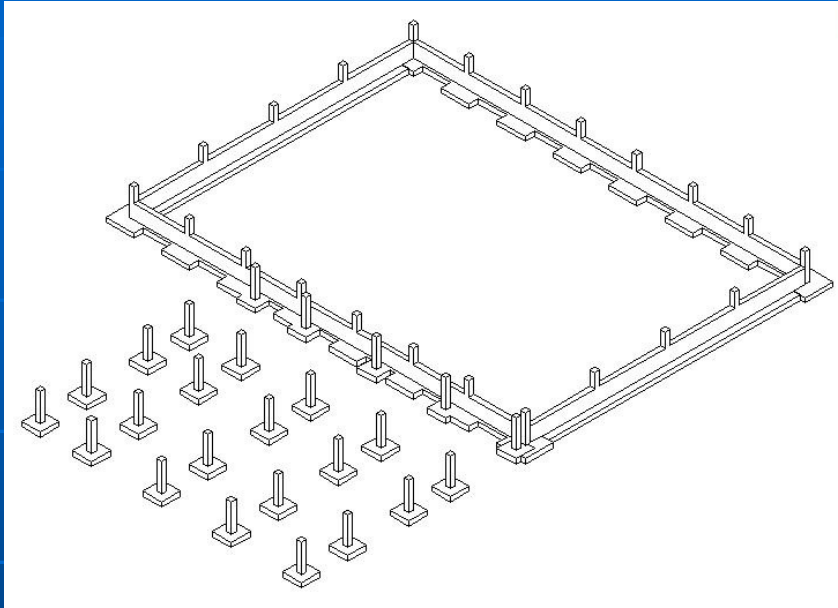
# Warehouse



## Footing Design

- Since this structure is pre-engineered only the footings for the warehouse need to be designed.
- Spread footings will be used to support the columns and strip footings will be used to support the wall.
- The unfactored loadings were provided and we were required to determine the critical loading combinations to determine the maximum point load reactions.
- The footings to be designed for the warehouse are also pinned connected with anchor bolts and will be designed for flexure and shear forces.

# Footings



# Alternative Designs



- Study of alternative designs with respect to layout and materials
- Generate cost estimations related to alternatives
- Assess feasibility of alternatives
- Select optimal option and redesign accordingly

# Progress to Date



## Office Building

- All loading cases have been determined
- Initial structural steel member sizes have been selected
- Structure has been modeled using S-Frame
- Structural analysis and optimization is in progress

## Warehouse

- Loading combinations have been determined
- Footing design is in progress



# Questions?

