Central Baptist Church
Family Life Center

Case Study

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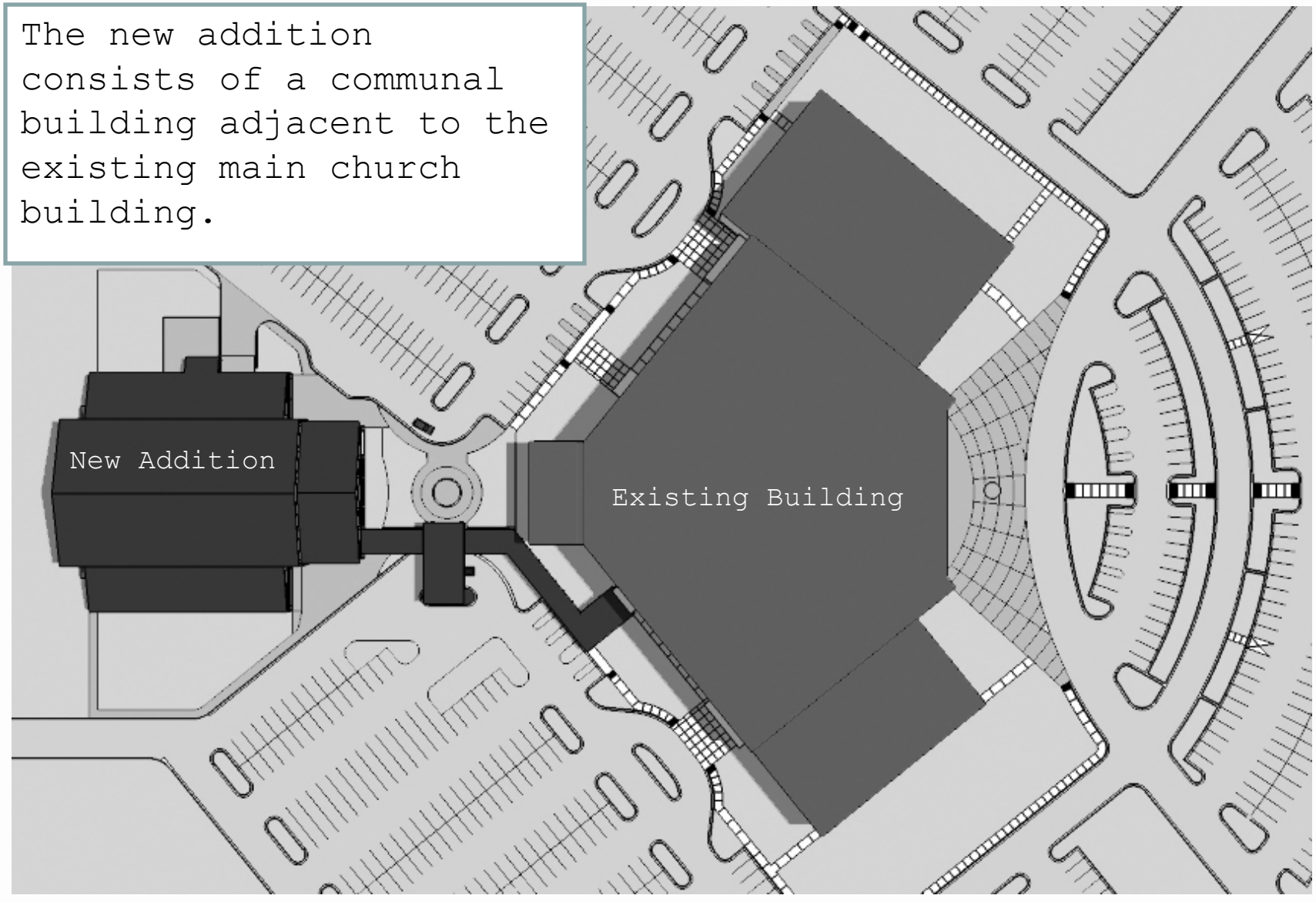
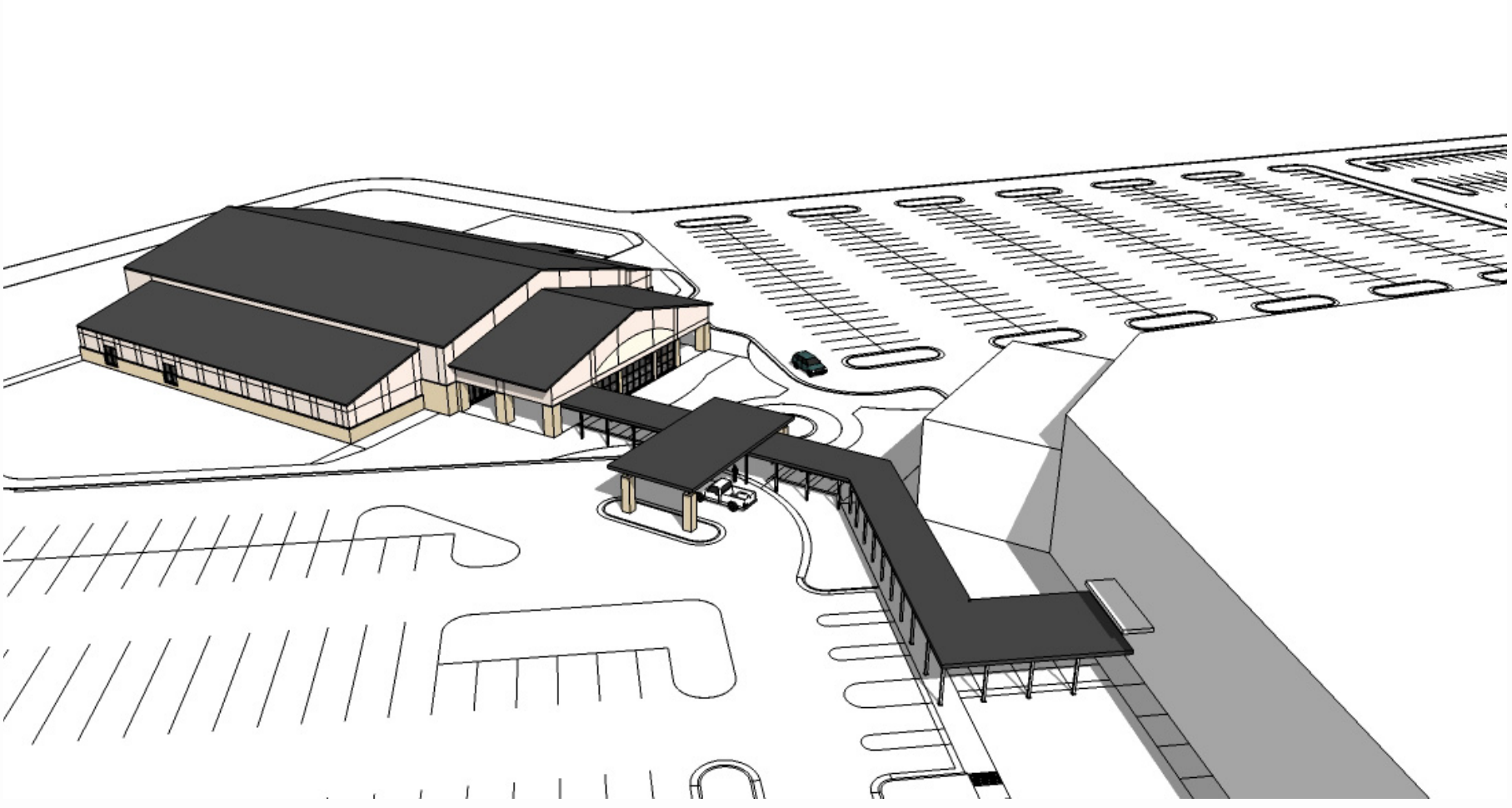
Introduction

The new addition consists of a communal building adjacent to the existing main church building.



First Look



First Look

New School

-Projected total project cost = $5,365,000

-Start date = June 5, 2008

-Projected completion date = Fall 2009

-Project architect = Arkitex

-Project engineers = Structural: Robertson Consulting Engineers
MEP: Swoboda Engineering
Civil: Goodwin Lasiter

New construction

This addition was proposed as a solution for the ever growing church membership. Over the past year the congregation has seen a 37% increase in members. This addition will provide a place for university ministries, youth education and activities.

Programming

14 classrooms = 2,987 sq. ft.

full kitchen = 905 sq.ft.

assembly area = 12,950 sq.ft.

stage = 831 sq.ft.

sound booth

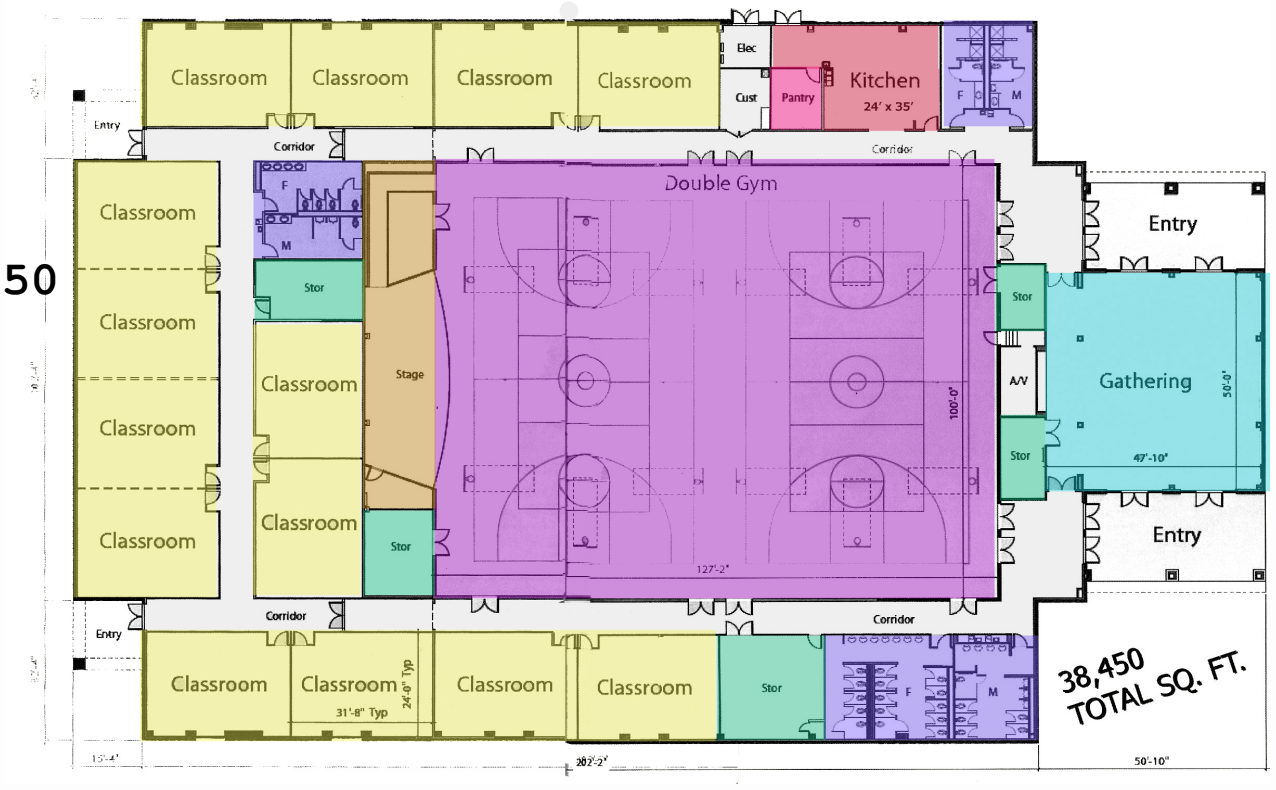
pantry

2 gyms

storage

6 restrooms

total sq. ft. = 38,450



Building Analysis

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Pre-Engineered

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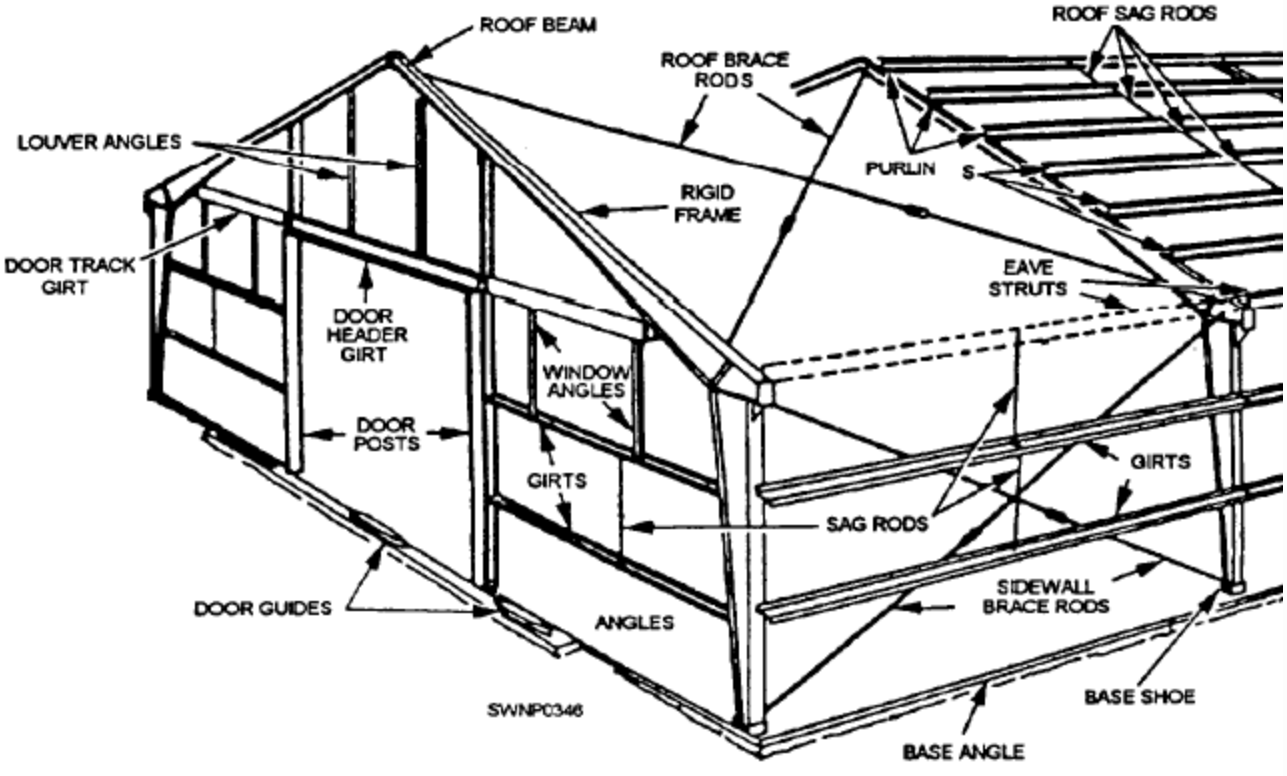
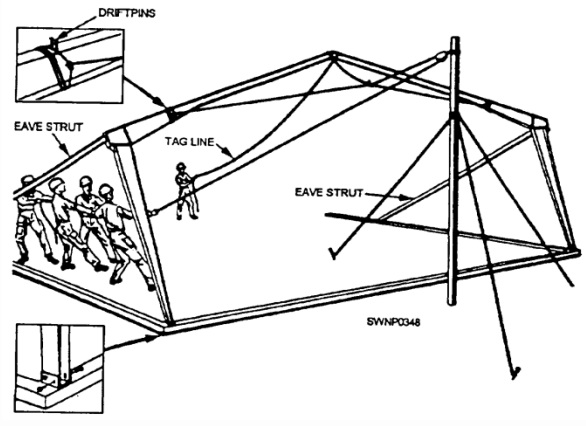
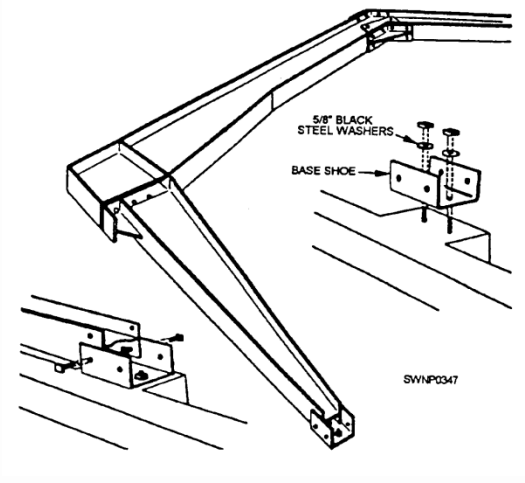






The main difference between the typical structural steel building and a pre-engineered building is, in theory, cost and timing.

Pre-Engineering by Straightline

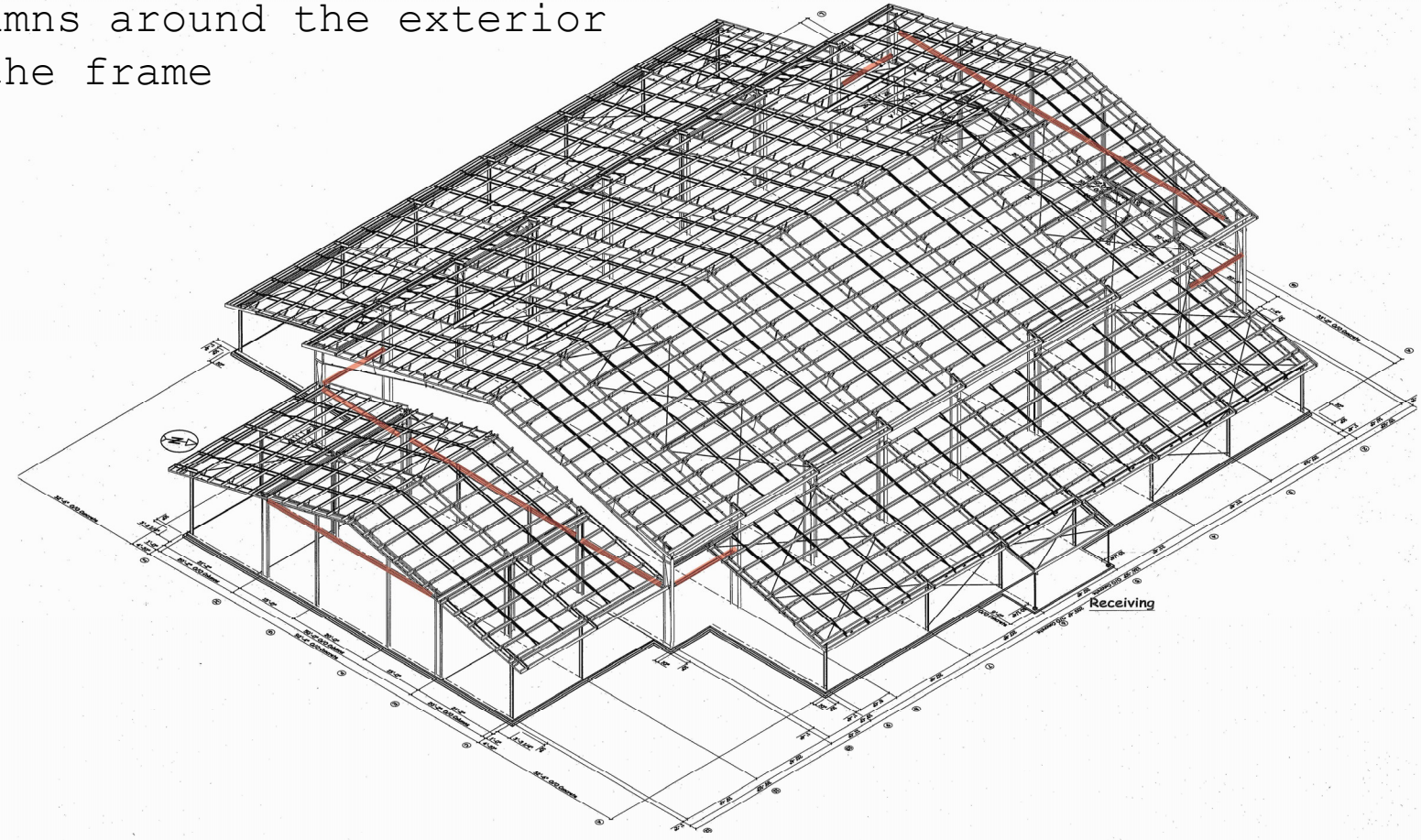
Lateral Loads

There are three connections in the pre-engineered structure that are unique to resist the lateral loads

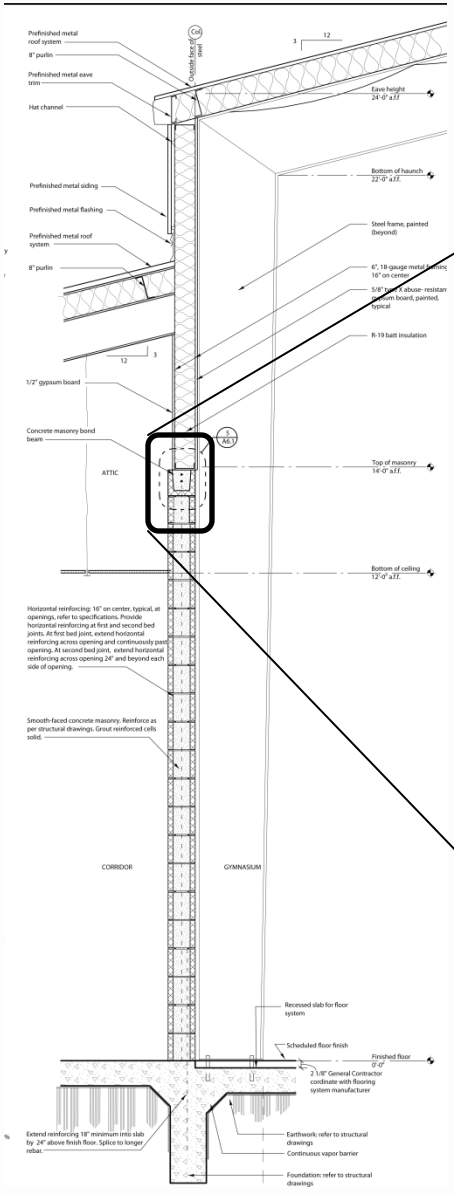
Spandrel beams
Masonry walls
Portal frames

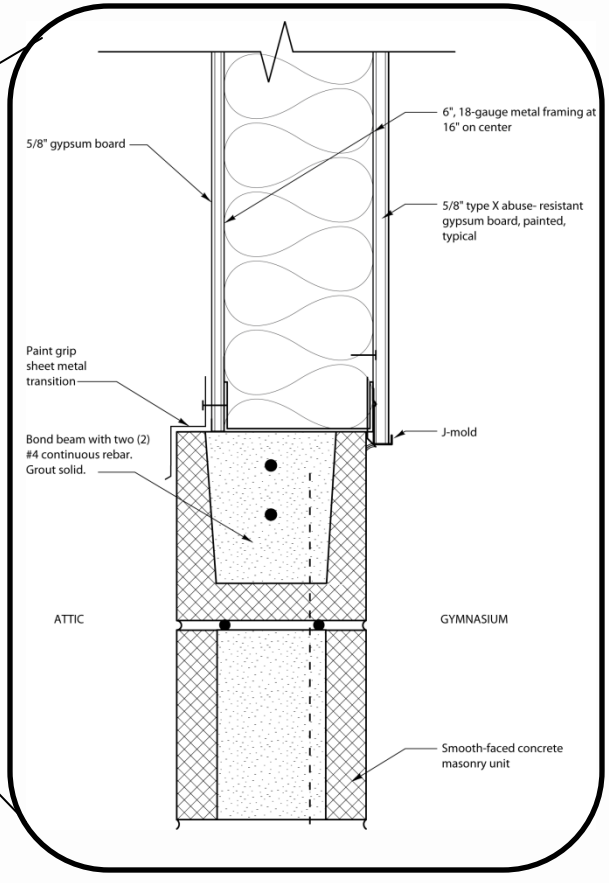
Spandrel Beam

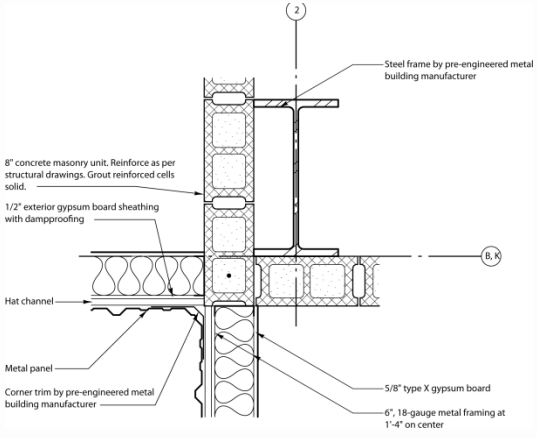
Prevents torsional effects of the bays by creating a horizontal connection to the columns around the exterior of the frame



Masonry Walls

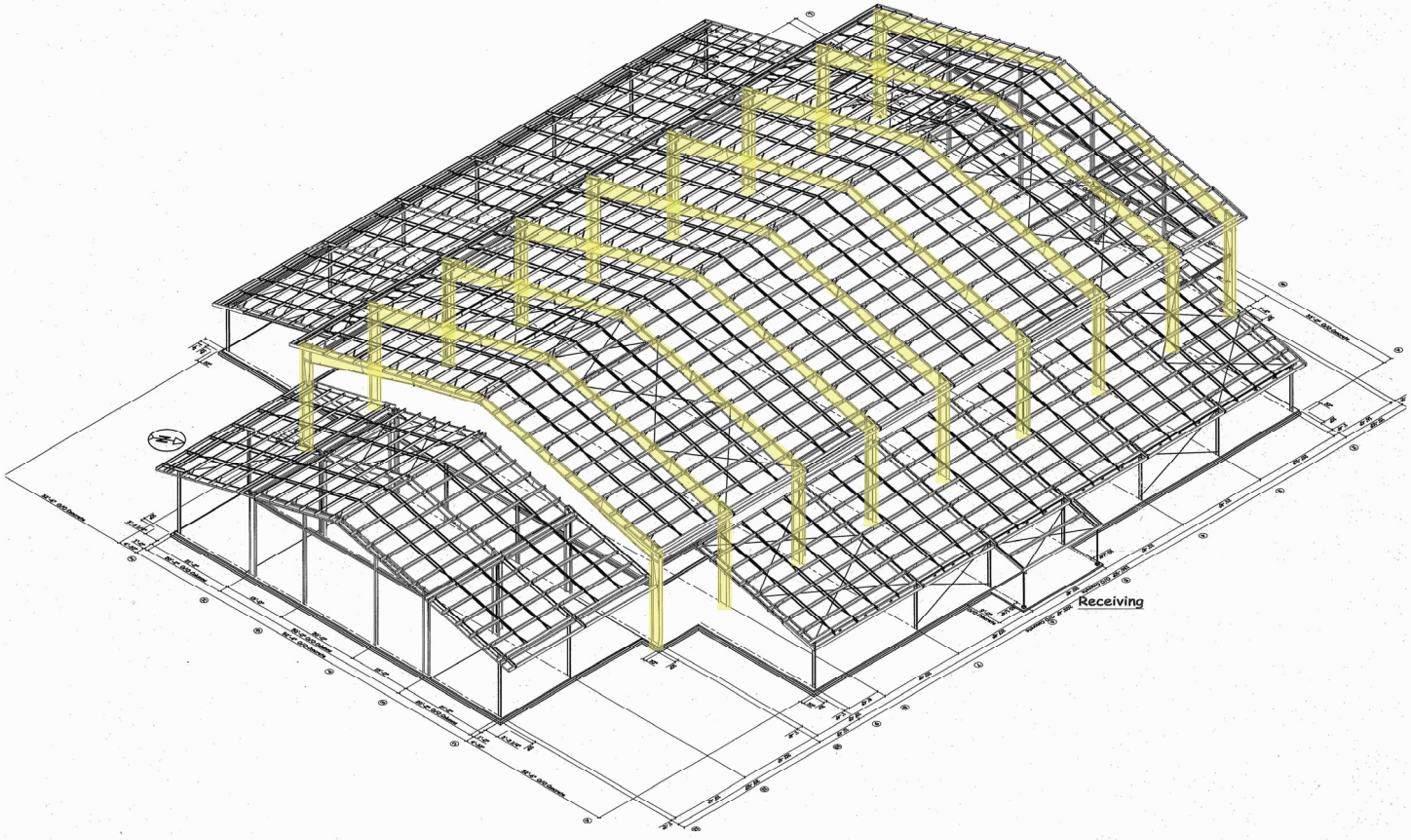






Portal Frame

Effective due to their good overhead clearance, relatively low cost, large span ability, and clean lines.



Sections

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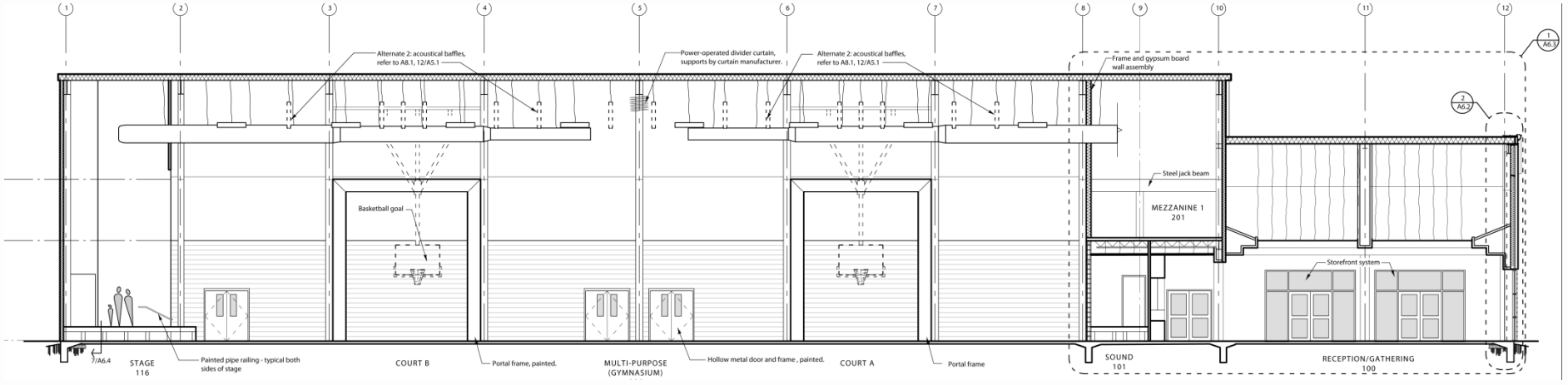
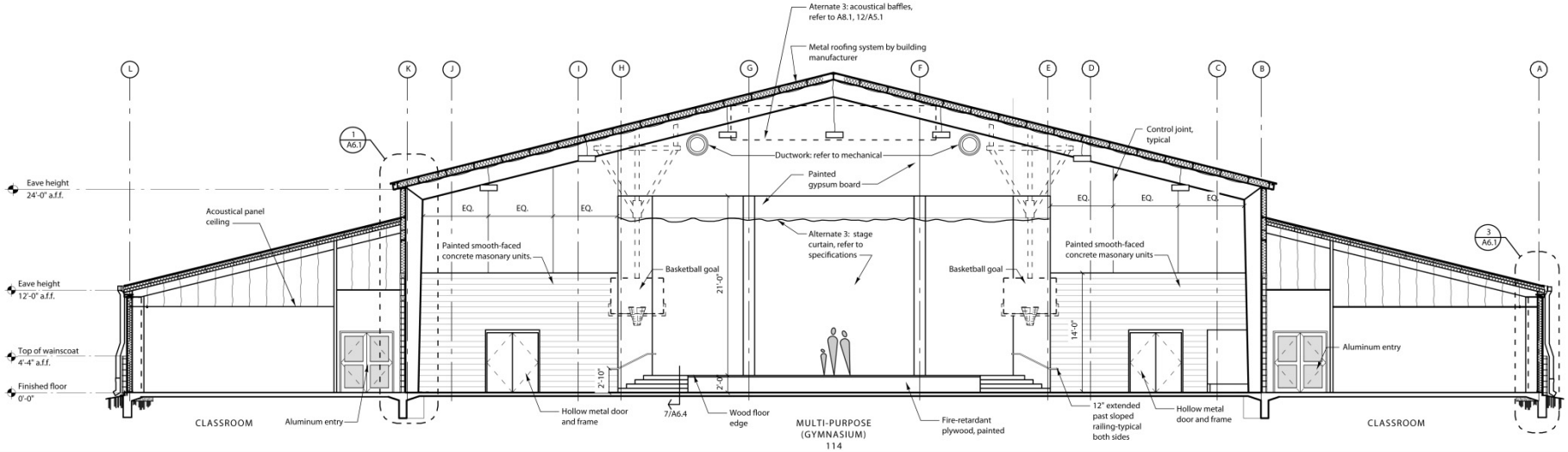
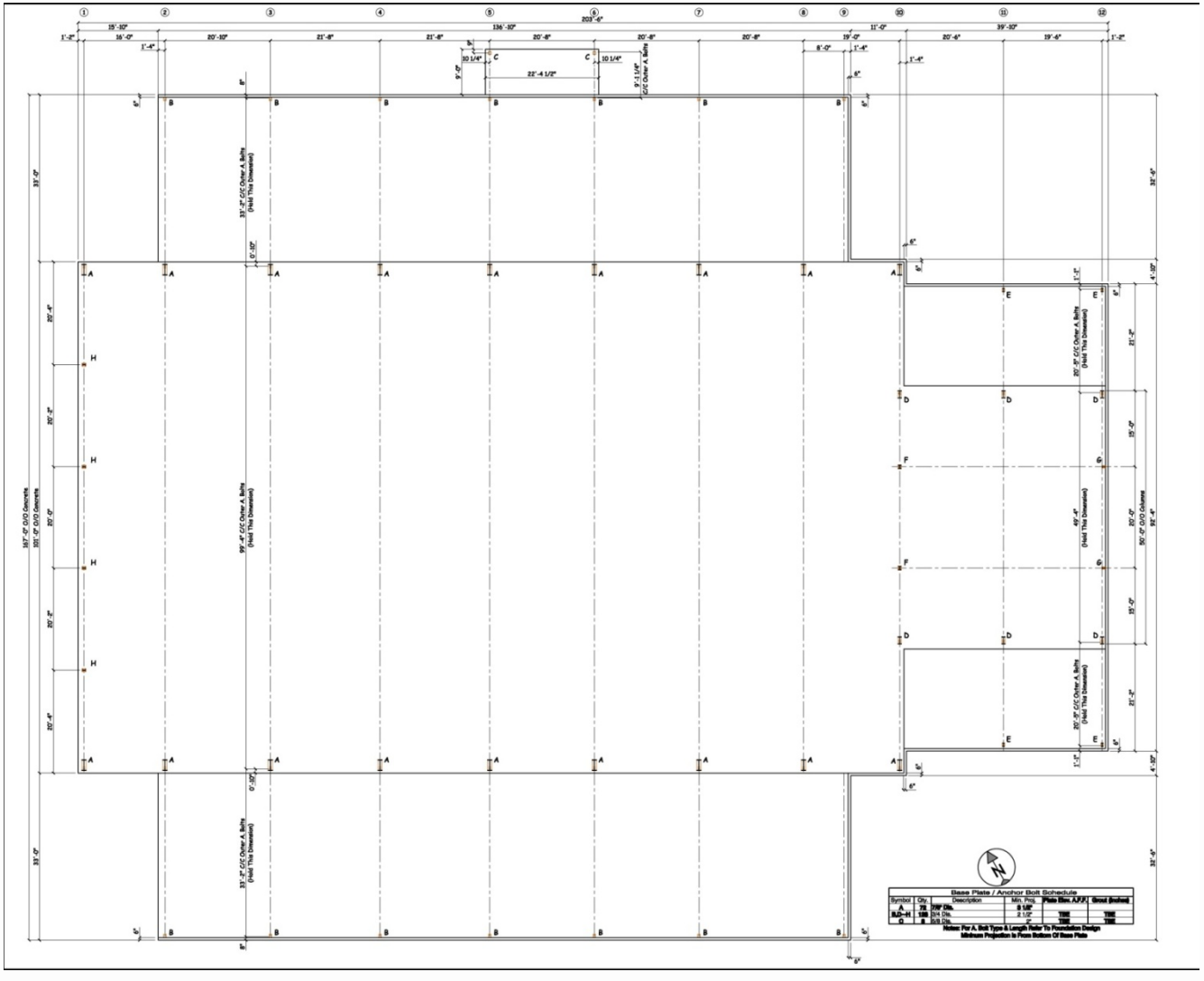


Longitudinal Section



Latitudinal Section

Structural Plan



Soils

The typical Bryan-College Station soil is clay.

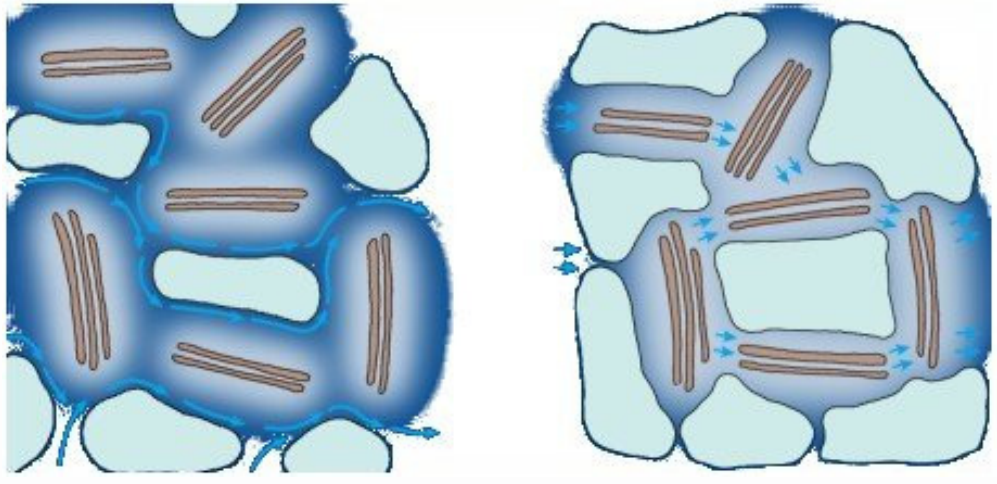
Generally, clay soils are referred to as cohesive soils.

This means they retain a measurable shear resistance in the absence of confining forces (the soil sticks together).

Unlike rock, gravel, sand, and many silts, clay soil tends to be unstable under changing subsurface moisture conditions.

Clay swells considerably as it absorbs water and shrinks as it dries.

The unpredictable volume changes make it difficult to rely on clay soils for stable support of structures.



Water movement in cohesive soils

Building Foundation

The foundation system for the building is a two-way slab with grade beams supported by piers. The foundation accepts the concentrated loads of the building and spreads them over a large area of soil. Several different parts of the foundation, i.e. the piers, footings, and grade beams, help transfer the loads.

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Piers are used in the foundation system to extend through poor soil beneath the structure into the acceptable bearing stratum.

The first step in constructing a pier is boring a hole into the earth to the bedrock or stable soil. Reinforcing steel is inserted and the hole is filled with concrete.

The load bearing capacities of the piles are calculated in advance based on soils test results and pier properties.

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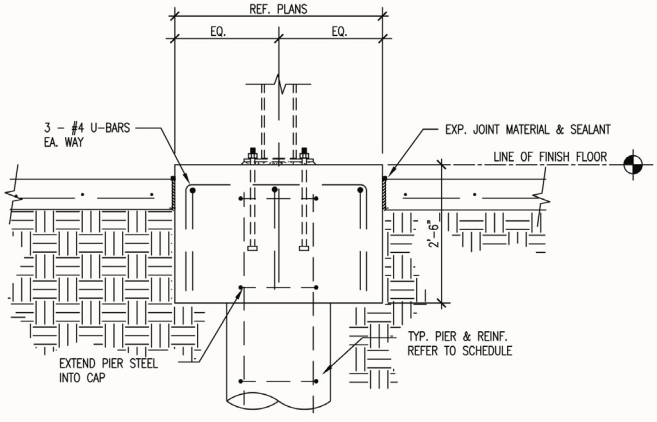
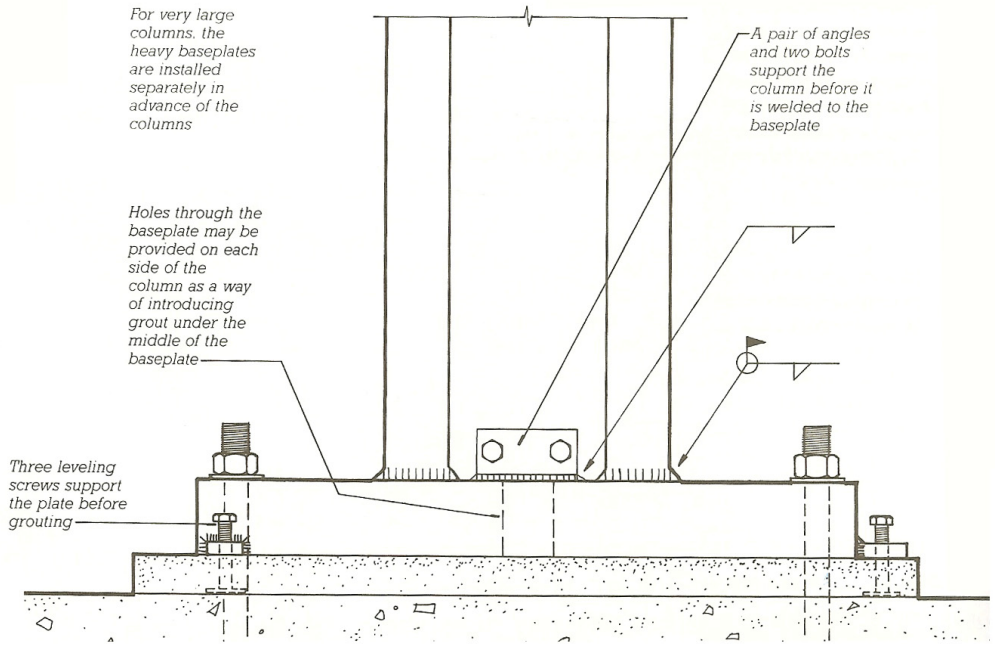
The grade beams transmit loads from bearing walls into spaced foundation, as the pier shown in this photo.

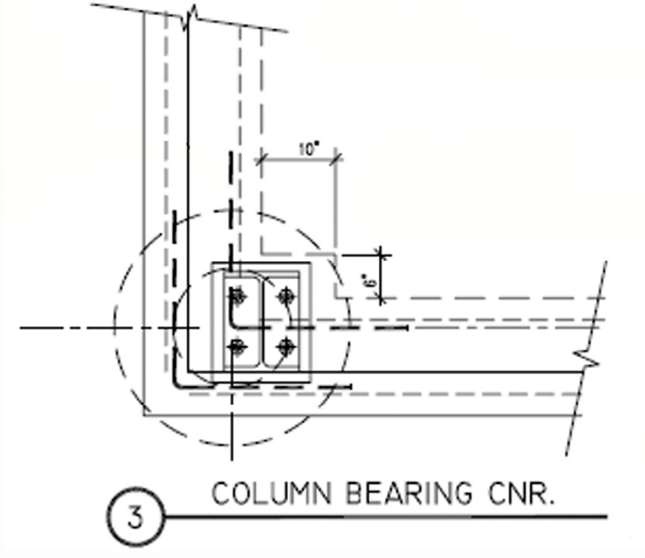


Connection Detail



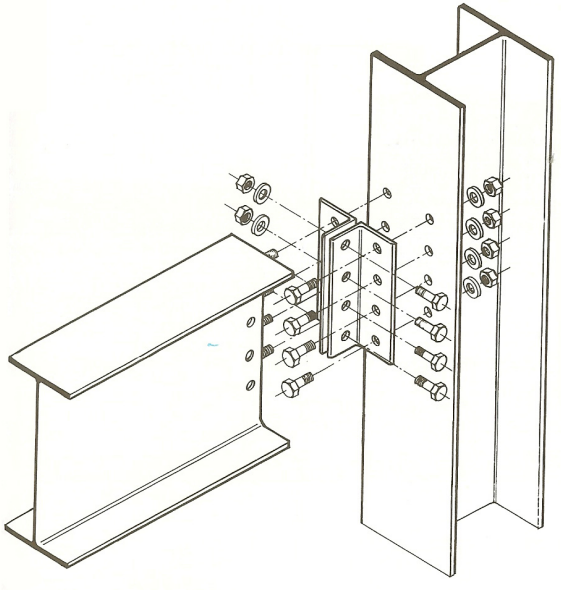
Baseplates distribute the concentrated loads of the column across a larger area of concrete foundation. Although not visible on site, leveling plates set in a bed of grout are assumed to be used under the baseplate. Anchor bolts, which are cast is the concrete slab, are used to join the members.

The photo shows a brick ledge around the column base connection for the covered drive.



Connection Detail

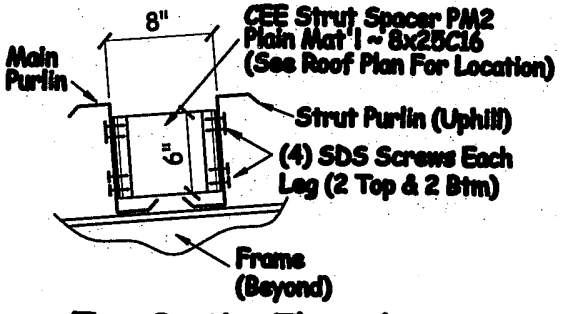
The beam to column flange connection uses a stiffener and 12 bolts to create a rigid frame connection transferring the vertical forces (shear) from the beam to the column.



The bolts hold the beam in place for welding and also provide shear resistance. Groove welds develop the full strength of the flanges of the beam.

Connection Detail

Steel purlins run horizontally between the steel rigid frames and support the roof deck as well as providing lateral support.



Typ. Section Through Strut Purlins & PM2

Load Tracing

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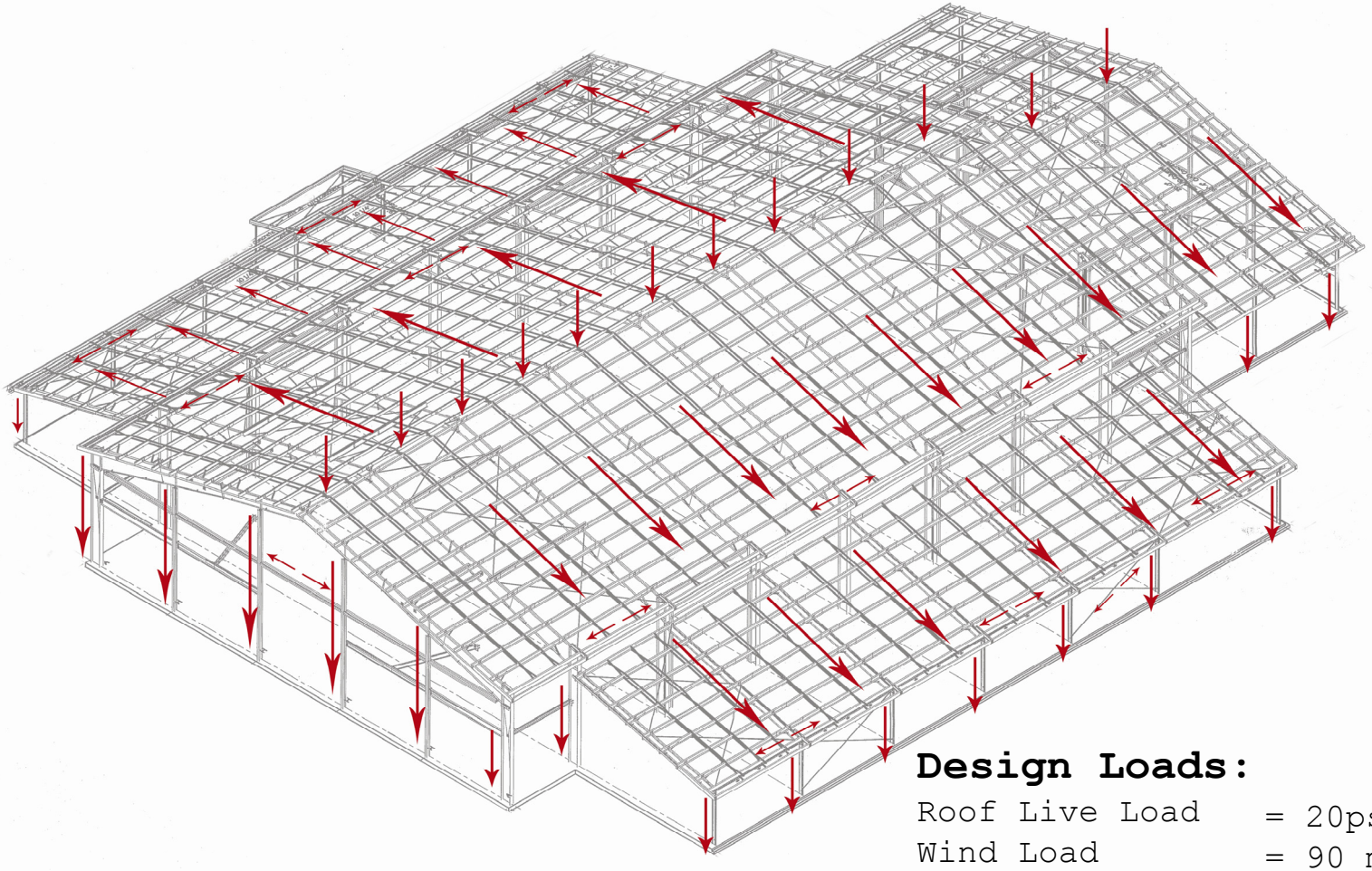

Design Loads:

Roof Live Load	= 20psf
Wind Load	= 90 mph
Collateral Load	= 5psf
Dead Loads	= self weight load
Floor Live Loads	= none

Multiframe4D

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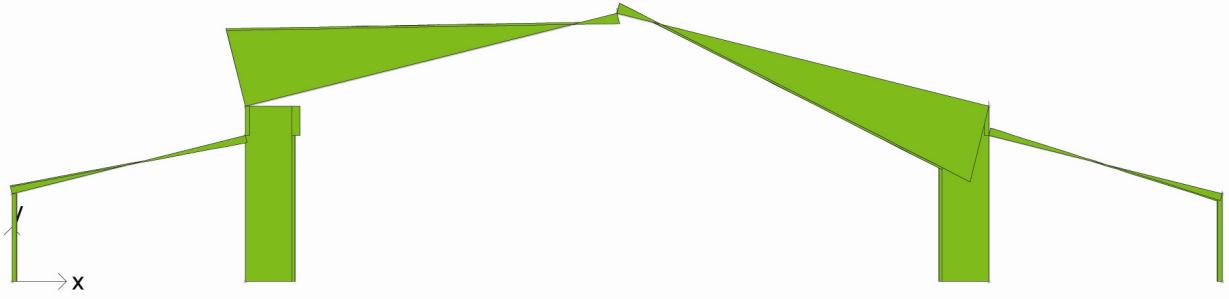
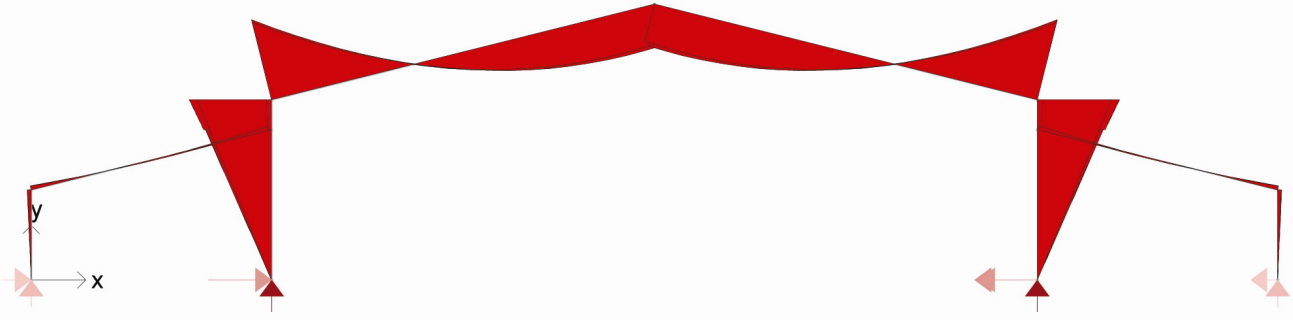
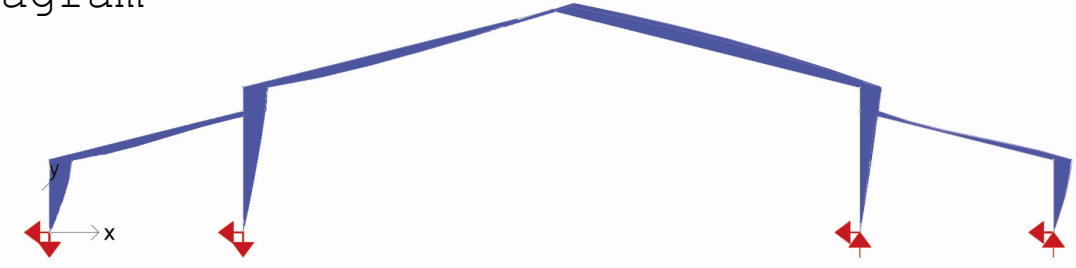


Shear Diagram



Moment Diagram



Deflection Diagram

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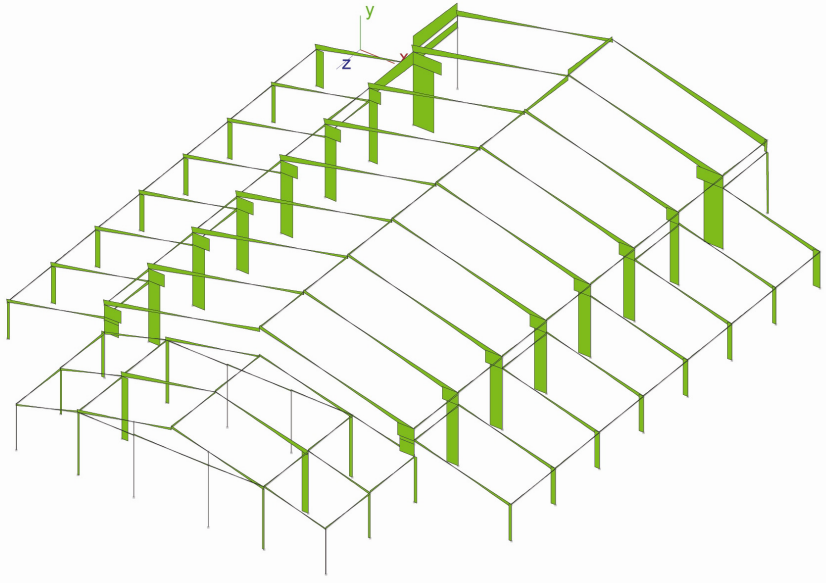
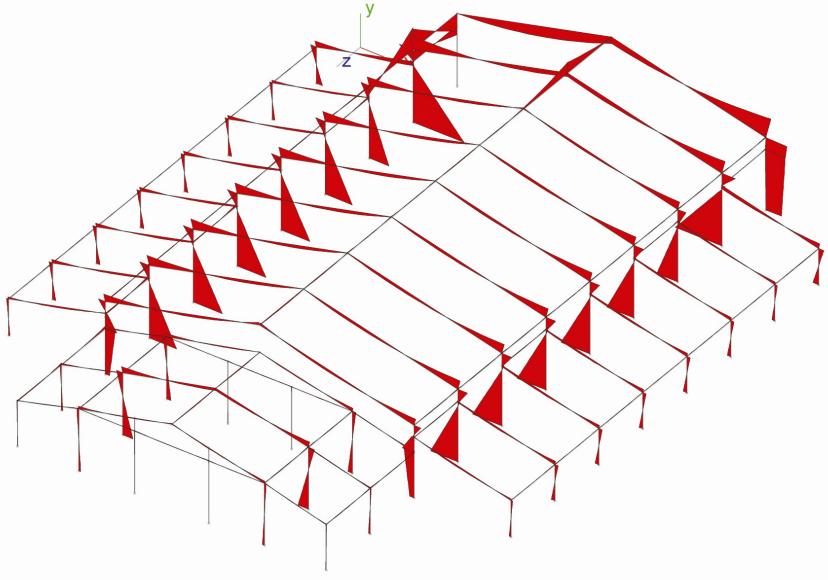


3D Shear Diagram



3D Moment Diagram

Site Visit

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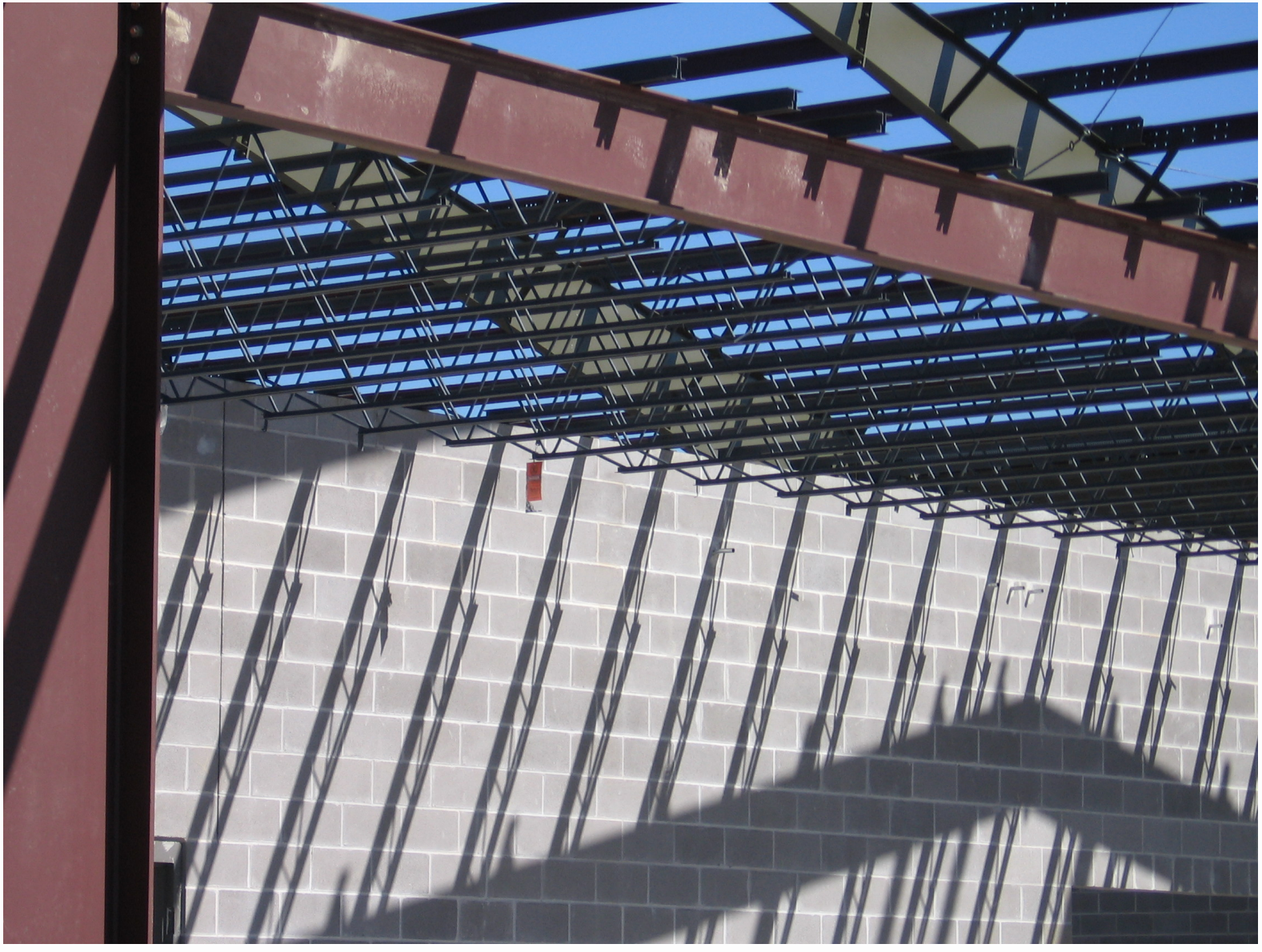

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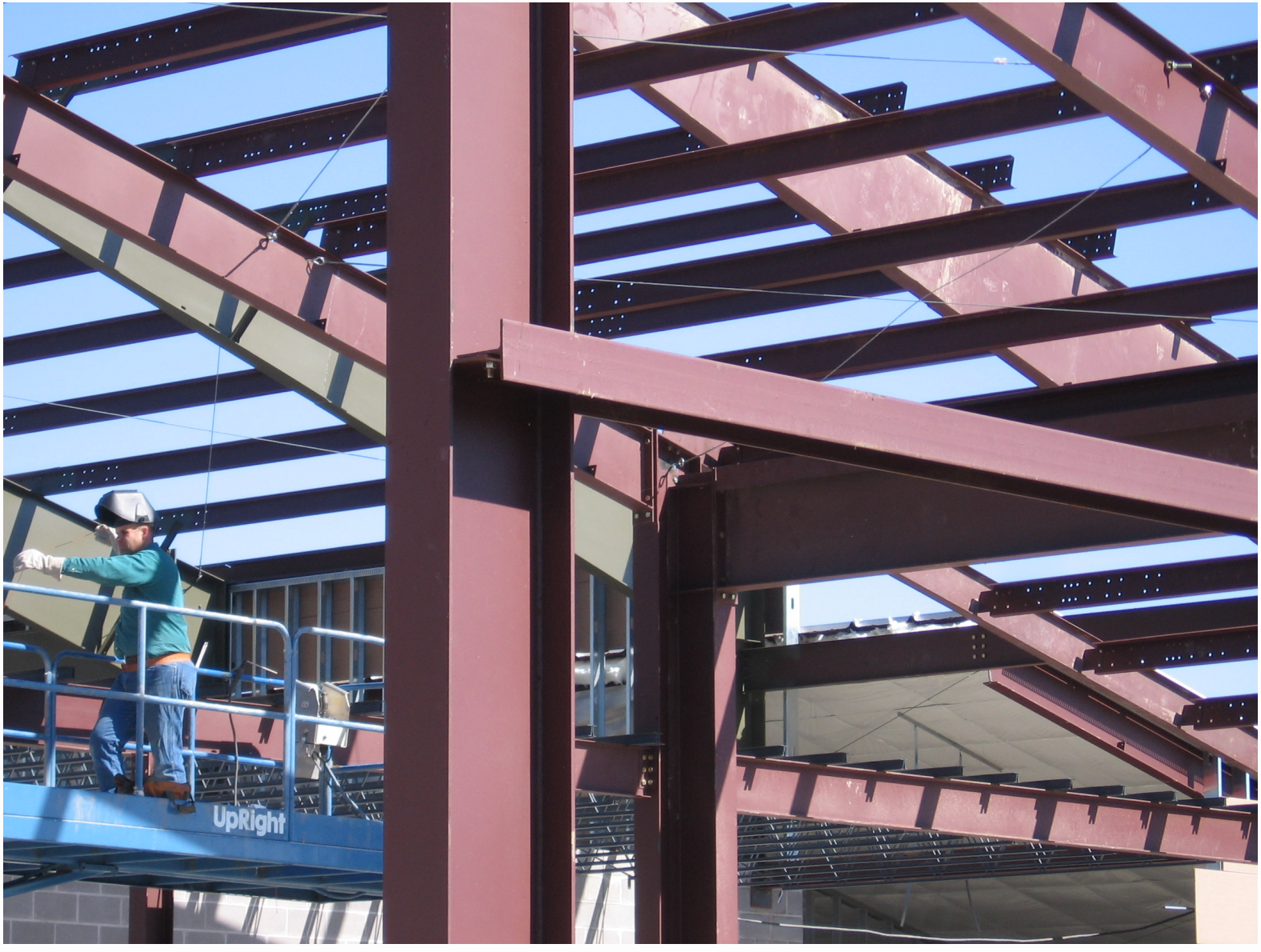

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