

A photograph of a modern, single-story retail center building with large glass windows and brick accents. The building has a white awning over the entrance area.

Structural Design Example Single Story Retail Center

This Bautex Engineering Report provides an example of the structural engineering details and design considerations for constructing a representative project using Bautex Block as a load-bearing wall system. This example utilizes accepted engineering design models and calculations, but is not intended to be used as plans for the construction of an actual building, and does not take the place of actual engineering design.

PROJECT BACKGROUND

Historically, retail buildings have not been particularly well insulated structures, especially given the amount of storefront windows and doors commonly used at the front of the building. More demanding energy codes and higher energy prices, however, are causing designers and developers to rethink how best to achieve a higher level of energy efficiency in retail construction.

Bautex Block, a Composite Insulating Concrete Form (ICF) wall system, is very well suited for the construction of retail buildings based on their cost effectiveness, speed of construction, durability, and energy efficiency performance.

In this example Bautex Block is used to construct a single-story retail center building with a total wall height of 21'-4", a roof diaphragm at 18'-8", and a 2'-8" tall parapet. Building depth is 30'-0" with no interior load bearing walls.

The front of the building includes an 8'-0" tall by 8'-8" wide, an 8'-0" tall by 10'-0" wide, and an 8'-0" tall by 6'-0" wide opening for storefront window and door systems. There are no other major openings in the other three walls.

PROJECT SPECIFICATIONS

Building Summary:

Type: Retail Center
Stories: 1
Roof Height: 18.67 feet
Total Wall Height: 21.33 feet
Building Depth: 30 feet

Loading:

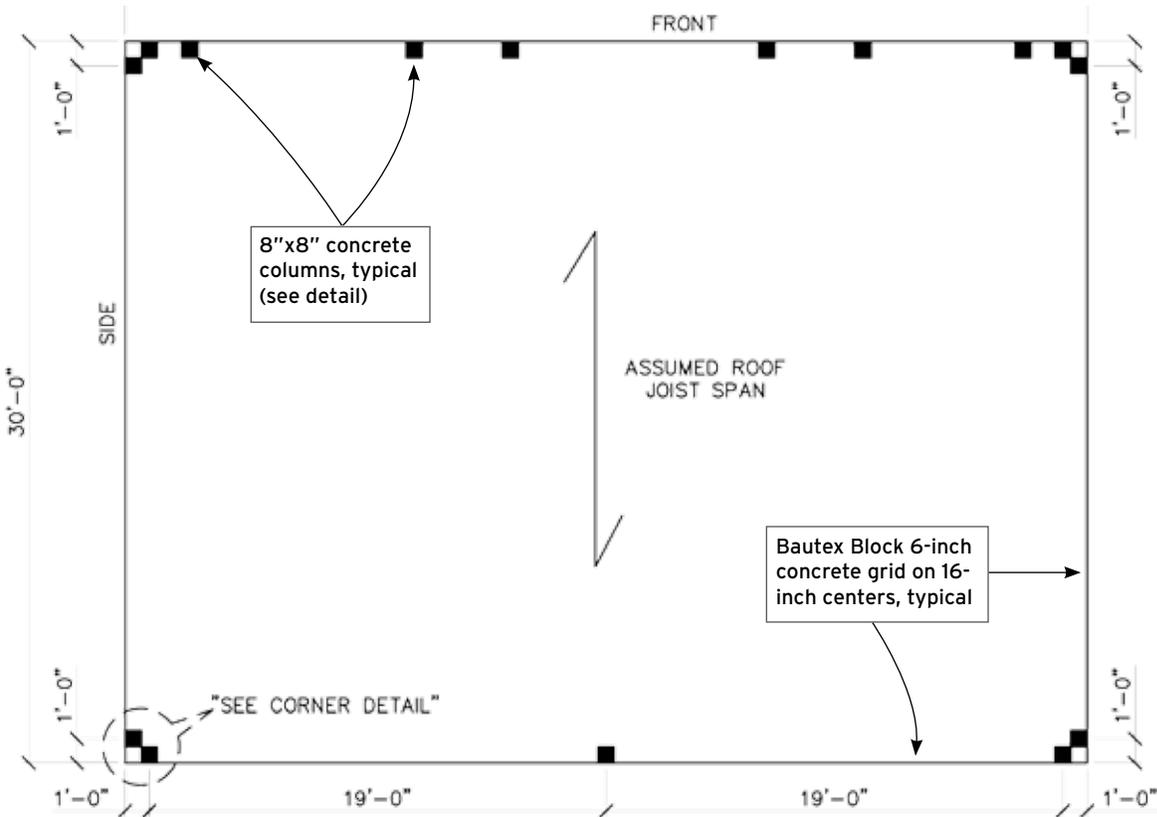
Roof Live Load = 20PSF
Roof Dead Load = 10PSF
Wind Load:
Out of Plane = 25PSF

References:

ACI 318-2011
2012 International Building Code (IBC)

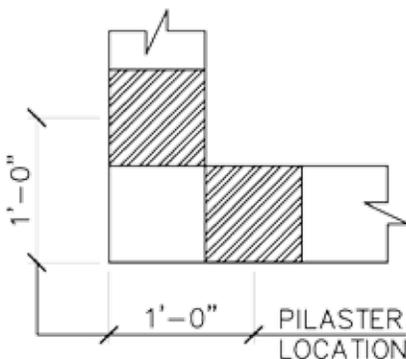


PLAN VIEW



Storefront openings and lateral deflection control the structural design of the retail building. This engineering example uses 8-inch concrete pilasters every 28'-0" maximum, as well as at corners and openings.

CORNER DETAIL



ENGINEERING DESIGN

The structural design for this single story retail example was done using a RISA 3D model and design calculations from ACI 318. The eccentricity at the top of the wall was assumed to be 5-1/2 inches.

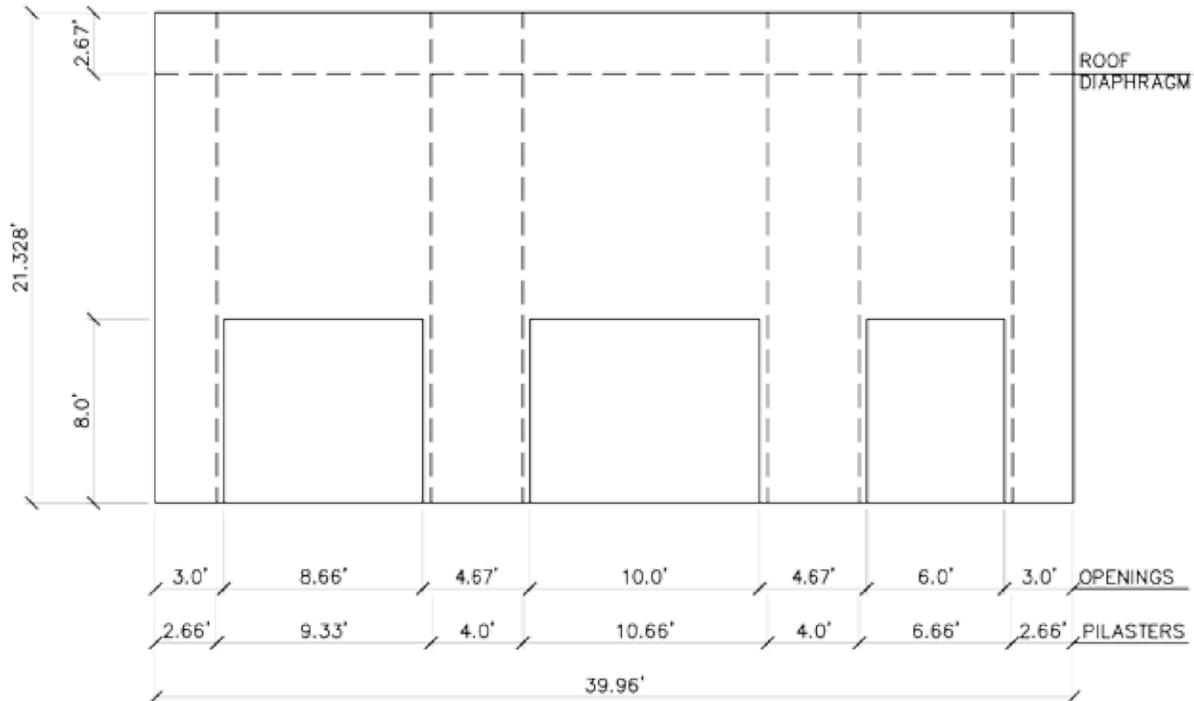
In this case, the model showed that lateral deflection ($L/360$) controls design of the structural members. The standard concrete grid in the Bautex Block carries much of the load on the walls, but the walls must be augmented with 8-inch concrete pilasters at specific locations and spacings.

Concrete specified for this project was 4,000 psi structural concrete at 8-9" slump and 3/8" maximum aggregate for all the walls, including pilasters. Bautex Block grid and enhanced beams and columns are poured at the same time.

Screen Grid

Bautex Block provides standard 6-inch cylindrical concrete columns and beams on 16-inch centers throughout the wall section. In these areas, #5 reinforcement bar was specified in all the Bautex cores, both vertically and horizontally.

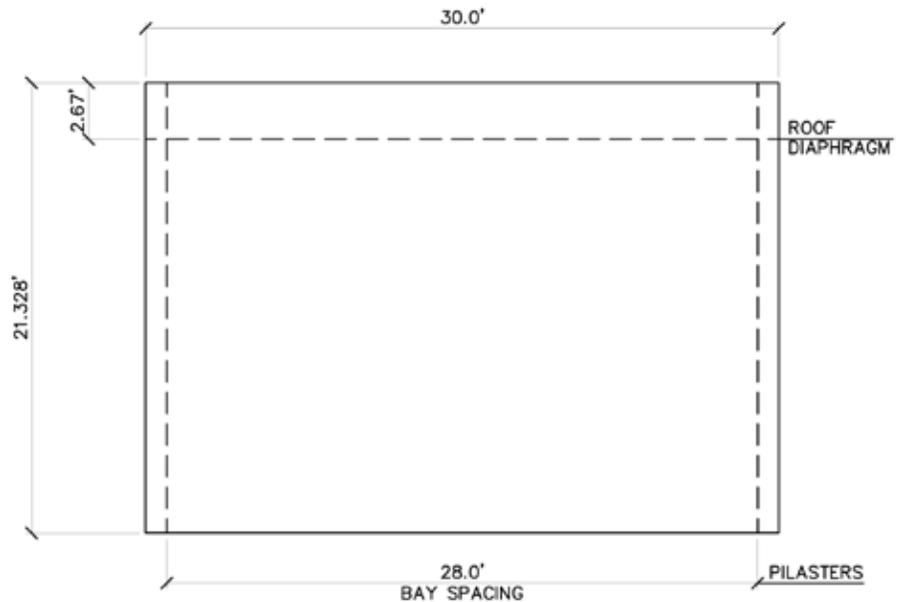
FRONT ELEVATION



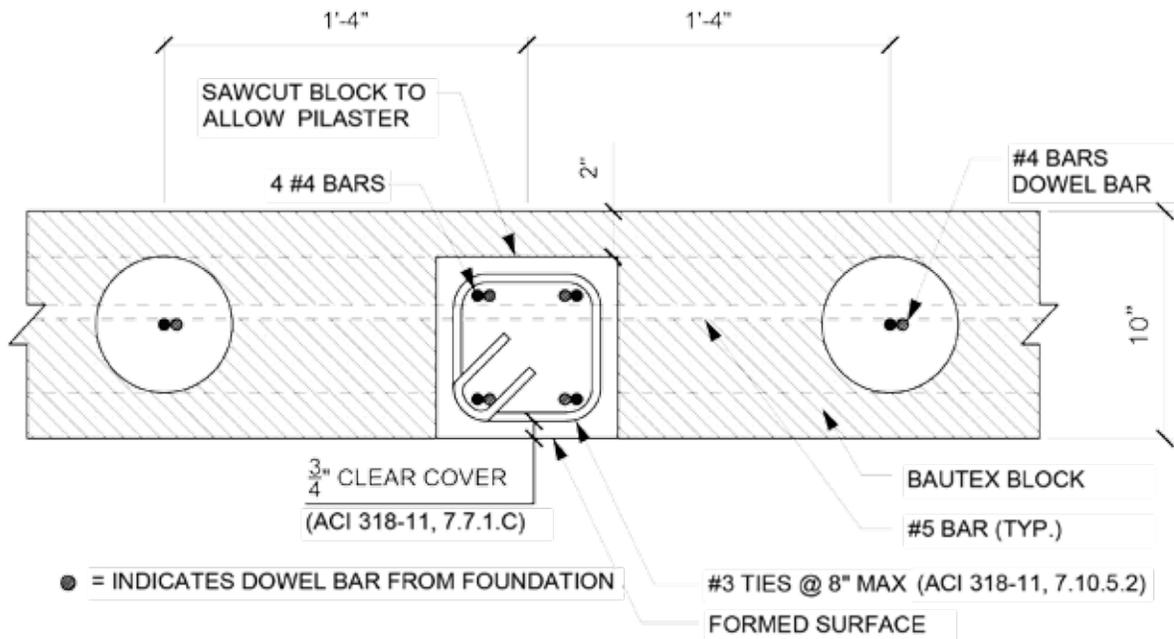
Total wall height is 21'-4" with the roof plate height at 18'-8". Design includes 8-inch concrete pilasters on either side of openings and at corners on the front and rear load bearing walls.

SIDE ELEVATION

The non load-bearing sides of the retail center require 8-inch pilasters on 28'-0" centers. With a building depth of 30'-0", two columns are required, one just off each corner of the building.



8" PILASTER DETAIL



Enhanced Concrete Elements

To provide enhanced structural capacity for the walls in certain areas where required, the design called for the construction of 8-inch concrete pilasters using #4 reinforcement bar as shown in the pilaster detail.

The pilasters are formed on three sides using the Bautex Block and standard concrete shoring on the fourth side. The pilasters are connected to the standard Bautex concrete grid by passing reinforcement bar horizontally through the pilaster, connecting the horizontal cores in the walls extending to either side of the pilaster (see Pilaster Detail).

The spacing of pilasters on the front load bearing wall is dictated by the openings, and on the rear load bearing wall by the 28'-0" maximum span. Pilasters are located on both sides of each opening, and also serve as an enhanced jamb element. There are three openings and six pilasters plus two corner pilasters on the front of the building, and three pilasters along the back of the building.

There are two pilasters on each of the non-load bearing sides of the building on 28'-0" spacings just off both corners of the building.

RESULTS

In this example project, all of the exterior load bearing walls were constructed using concrete and Bautex Block. Supplemental structural systems were not required. The ability to use a single wall system to provide the structure, building envelope, and insulation significantly simplifies and speeds up construction, and can help to reduce overall project costs.

In addition to structural capacity and design flexibility, the patent-pending Bautex Block provides R-14 continuous insulation and thermal mass, 4-hour load bearing fire rating, very low noise transmission STC of 51, and is a FEMA 320/361 compliant safe room material. Bautex Block is manufactured in San Marcos, Texas.

BAUTEX ENGINEERING SERVICES

The structural design of the Bautex Wall System is based on widely understood specifications from the American Concrete Institute's Building Code Requirements for Structural Concrete - ACI 318. For more information, consult the Bautex Wall System Design & Engineering Guide.

To streamline and make your design process more efficient, Bautex does offer to have a completely engineered wall system with sealed structural engineering plans provided for your next project.

For more information on engineering design and solutions, visit the Bautex Systems website or contact our sales and construction support teams.



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