BAUTEX ENGINEERING REPORT

Structural Design Example 2-Story School Classroom

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

According the United States Census Bureau, more than $60 billion per year is spent constructing educational facilities across the country. The Houston Advanced Research Center (HARC) estimates that school districts in the United States spend over $12 billion per year on energy bills to operate their facilities. The United States Department of Energy also suggests that one-third of the energy is being wasted due to inefficient buildings and behaviors.

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

In this example Bautex Block is used to construct a two-story high school classroom building with a total wall height of 26'-8", a floor diaphragm located at 12'-0", roof diaphragm at 24'-0", and a 2'-8" tall parapet section. Building depth is 50'-0" with an interior load bearing wall at 25'-0" supporting the floor and roof joists.

The front of the building includes four 6'-0" square windows on each level stacked vertically over eachother. A 14'-0" wide center corridor runs front-to-back separating the building into two classroom sections on each floor.

PROJECT SPECIFICATIONS

Building Summary:

Type: High School Classroom

Stories: 2

Floor Heights: 12 feet

Total Wall Height: 26.67 feet

Building Depth: 50 feet

Loading:

Roof Live Load = 20PSF

Roof Dead Load = 10PSF

Wind Load:
Out of Plane = 25PSF

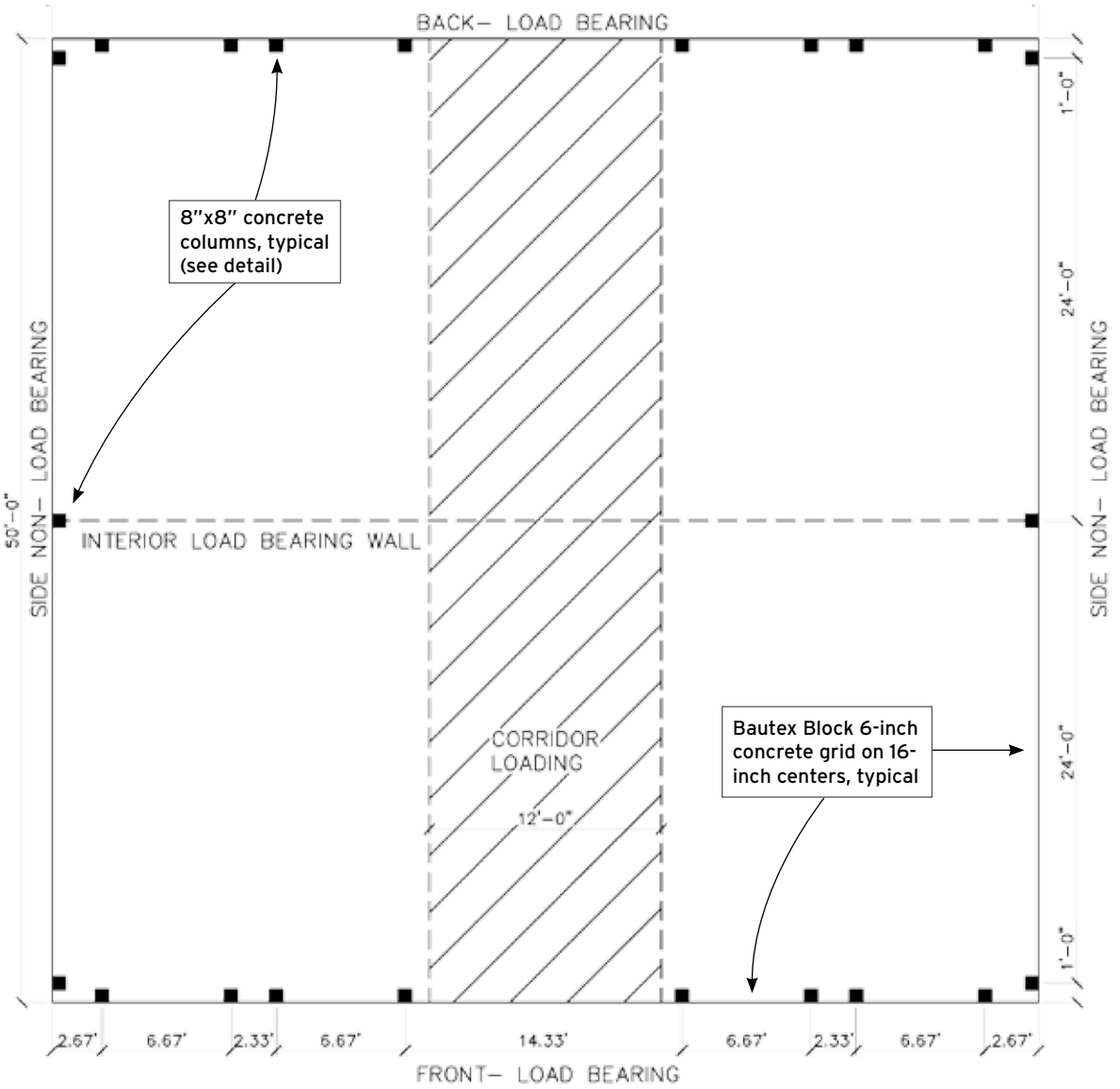
Floor Load:
Classroom = 40PSF
Corridor = 80PSF

References:

ACI 318-2011

2012 International Building Code (IBC)

PLAN VIEW



Lateral deflection controls the structural design of the classroom. This engineering example uses 8-inch concrete pilasters every 24'-0" maximum, as well as at corners and openings.

ENGINEERING DESIGN

The structural design for the 2-story classroom 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.

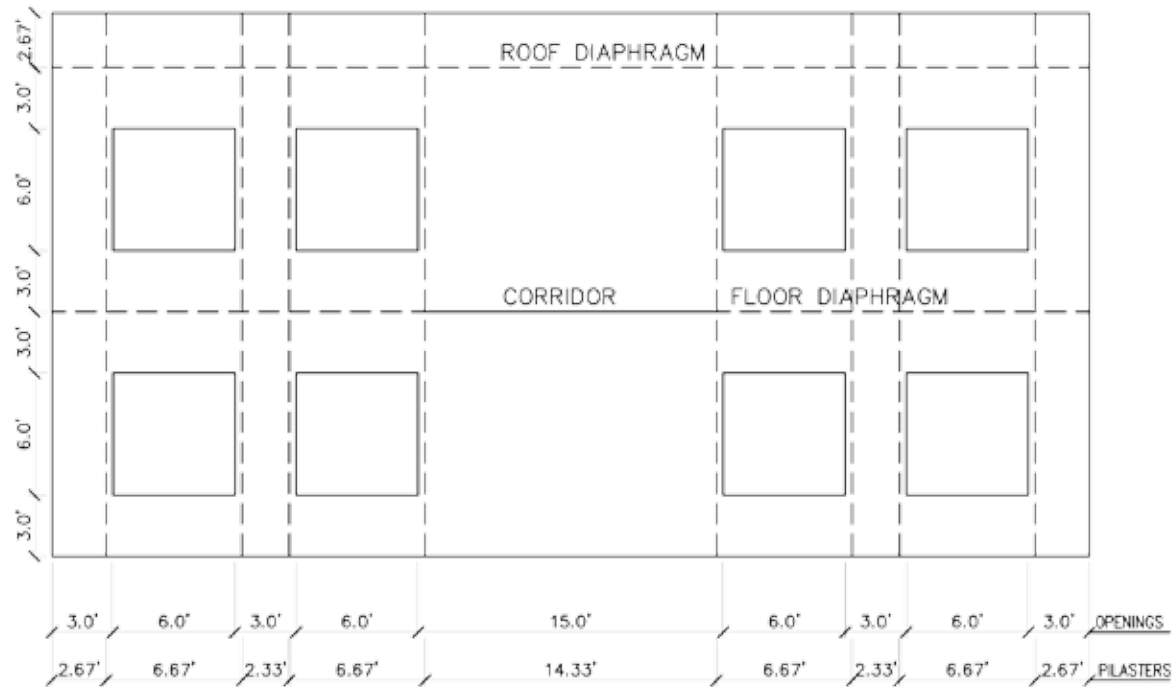
In this case, the model showed that lateral deflection (L/360) controls design of the structural members. The standard concrete grid in the Bautex Block carries much of the load on the walls, but the walls must be augmented with 8-inch concrete pilasters at specific locations and spacings.

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

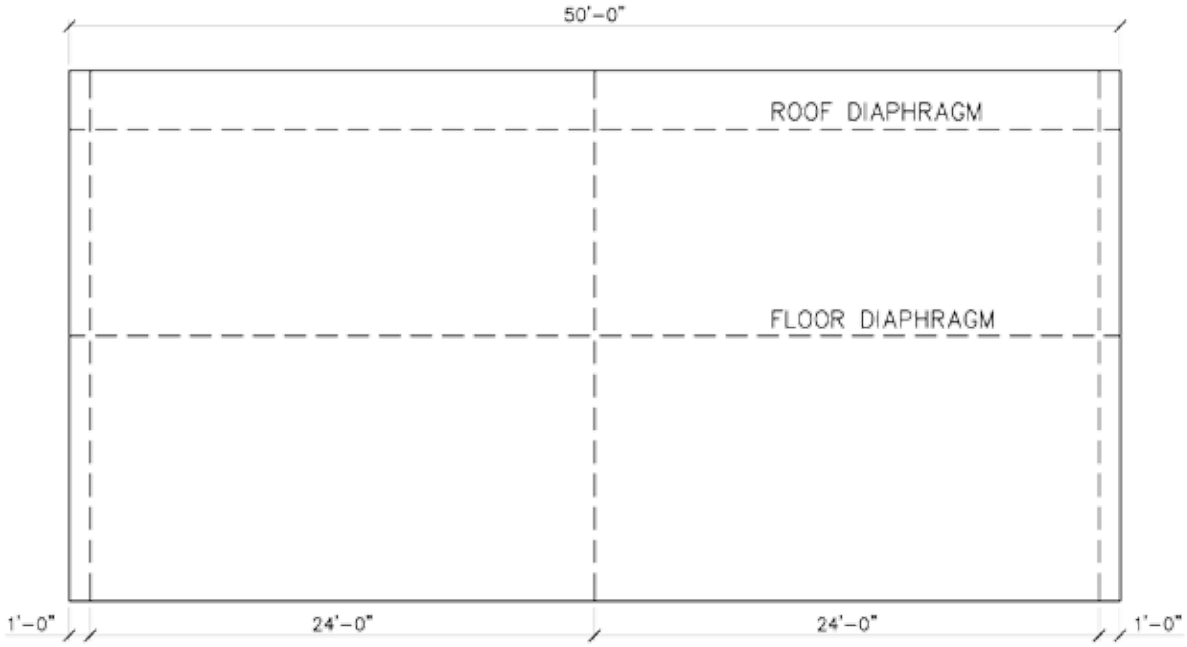
Bautex Block provides standard 6-inch cylindrical concrete columns and beams on 16-inch centers throughout the wall section. In these areas, #5 reinforcement bar was specified in all the Bautex cores, both vertically and horizontally.

FRONT ELEVATION



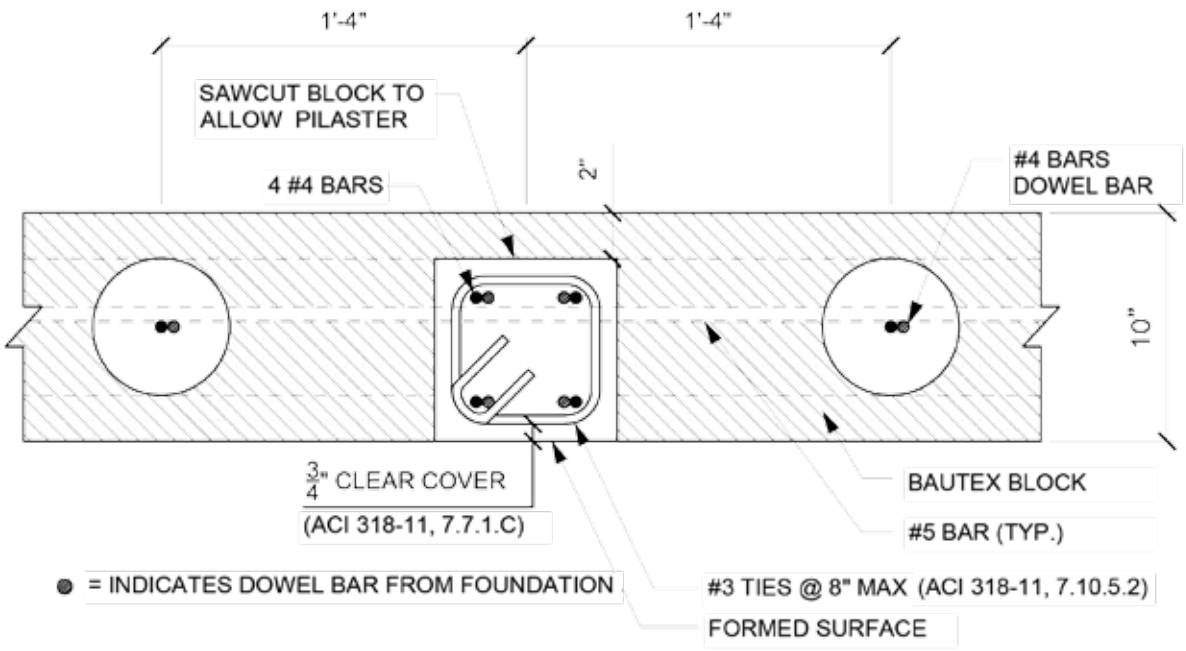
Total wall height is 26′-8″ with the second floor plate height at 12′-0″ and roof plate height at 24′-0″. Design includes 8-inch concrete pilasters on either side of openings and at corners on the load bearing walls.

SIDE ELEVATION



Non load-bearing sides of the classroom require 8-inch pilasters on 24′-0″ centers and just off the corners of the building.

8" PILASTER DETAIL



Enhanced Concrete Elements

To provide enhanced structural capacity for the walls in certain areas where required, the design calls 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 and rear load bearing walls is dictated by the openings. Pilasters are located on both sides of each window, and also serve as an enhanced window jamb. There are four windows and eight pilasters on both the front and back sides of the building.

There are three pilasters on each of the non-load bearing sides of the building on 24'-0" spacings just off both corners and mid span.

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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