



Public Schools of North Carolina
State Board of Education
Department of Public Instruction
Financial and Business Services
Division of School Support
School Planning Section

PRE-ENGINEERED BUILDINGS

Relating to the Construction and Maintenance of
Public Schools in North Carolina

March - 2008

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DEFINITION

Typically, a pre-engineered building is a metal building that consists of light gauge metal standing seam roof panels on steel purlins spanning between rigid frames with light gauge metal wall cladding. It is a relatively flexible structure vs. a conventional steel framed building. In other words, it has a much greater vertical and horizontal deflection. The intent for this publication is to recognize the nature and limitations of pre-engineered buildings for school projects.

GENERAL

A pre-engineered building may be purchased by local school boards as part of regular new school project, addition or renovation project, or stand-alone building project. It must be designed by a North Carolina licensed architect and/or engineer and submitted to School Planning for review per General Statute 115C-521.

The superstructure shall be designed by a certified engineer and fabricated by a pre-engineered manufacturer as a complete system. The foundation system shall be designed by an independent structural engineer who will be the engineer of record for the project. The engineer of record shall review and approve the pre-engineered manufacturer's shop drawings.

Project reviews are completed and certificates of review issued upon certification to School Planning that the pre-engineered structural systems have been reviewed and approved by a North Carolina registered structural engineer for the projects. General Statute 133-1 requires that project architects and engineers be in the employ of owners and prohibits project designers being employed by or having financial interest in manufacturers or suppliers of pre-engineered structures.

ADVANTAGES

1. Fast erection
2. Low cost if choosing manufacturer's standard package/inventory and no add-on
3. Open clear span
4. Can be easily expanded to grow with needs

DISADVANTAGES

1. Marginal design, material and construction
2. Not energy efficient
3. Higher lifetime maintenance
4. Not durable for long term use, generally last 10 to 15 years
5. May not include all construction/fit-up needed for the building to serve the intended purpose.
6. No secondary roof membrane
7. Usually no internal finished walls

Note: Because of the above disadvantages, pre-engineered buildings are generally **not** recommended for school buildings except for non-instructional purposes such as storage, maintenance facility and etc.

RECOMMENDATIONS

1. All manufacturer drawings and design calculation shall bear the professional seal and signature of licensed professional engineer registered in the state of North Carolina.
2. Roof system is very light (approx. 3 psf). Check the wind net uplift requirements for attachments of roof deck, roof structural members, anchorage of steel columns and column piers/footings in accordance with latest North Carolina State Building Code. Pay special attention to net uplift force at the columns that are part of vertical cross-bracing frames.
3. Roof deck has little diaphragm capacity. Horizontal cross-bracing shall be provided on the roof plane in both directions.
4. If using standing seam metal roof deck with clip anchors, place the continuous row of screw anchors at the ridge, under the ridge flashing.
5. Pay special care to the flashing at valley and intersections of roof.
6. Check roof structural members for surcharge load due to snow drifting.
7. Provide portal frames and/or cross-bracing at side walls to properly stabilize the building.
8. Use pre-engineered frame at end walls and add wind columns as necessary in between the columns of pre-engineered frame. It should easily accommodate future expansion.
9. Provide horizontal ties such as tie rods or hairpins to resist outward thrust at the base of rigid frame's column.
10. Foundation system including column piers/footings, tie rods/hairpins and anchor bolts must be checked against the forces calculated by pre-engineered manufacturer.
11. Provide and show the location of all collateral loads such as sprinklers, basketball goal, exhaust fan, underhung equipment, mechanical & electrical systems and ceilings.
12. Any field modifications of structural members shall be approved by pre-engineered building manufacturer and carried out under the supervision of engineer of record or a registered structural engineer.
13. Specify limitation of horizontal deflection/lateral drift of the pre-engineered frames if brick veneer and/or masonry wall are part of building enclosures and are supported laterally by girts.
14. To insure the quality of structural steel work, we recommend that pre-engineer manufacturer be AISC (American Institute of Steel Construction) certified steel fabricator.

MINIMUM DRAWINGS FOR DPI, SCHOOL PLANNING, REVIEW

- Site plan showing relationship to playfields, drives, walks, parking areas, utilities, other buildings and site improvements and property lines.
- Foundation plans showing slab on grade, slab control joints, tie rods/hairpins, wind columns, footings, locations of lateral bracing & portal frames and etc.
- Structural design of framing system including but not limited to anchor bolts, roof diaphragm, lintels, girts, wall openings and stability of the building must be reviewed and approved by the engineer of record, other than a registered engineer in the employment of the manufacturer.
- Pre-engineered shop drawings produced by the successful bidder shall be submitted to DPI, School Planning for review as a final step in securing a “Certificate of Review” and completion of the review process.
- Electrical system layout including electrical service equipment, lighting and power.
- Heating and/or cooling systems and ventilation.
- Plumbing Systems.
- Other architectural drawings as required to show subdivision of space, ceilings, finishes, doors, windows and etc.
- Building Code summary sheet and life safety plan.

ADDITIONAL RESOURCES

“Guide Specifications”

“Metal Building System Manual”

Metal Building Manufacturer Association

<http://www.mbma.com/>

“Technical FAQ”

“Fire rating/Insurance”

Metal Building Manufacturer Association

<http://www.mbma.com/>

“Metal Building system design Guidelines”

NC Department of Administration, Office of State Construction

<http://www.nc-sco.com/>

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