



Section 3:

CATEGORIES OF MITIGATION OPTIONS: WALLS & FOUNDATIONS

HISTORICAL SIGNIFICANCE

Walls provide support for the roof and upper floors. They also protect the interior of a structure from the elements. In many cases, such as the wood frame house, these functions are separated; structural support is provided by vertical wooden members while an exterior covering, or cladding, screens the interior. Many historic structures in Florida are built of balloon frame construction. This method incorporates closely spaced (16" to 24" on center) two inch thick studs and rafters with nailed connections. Studs extend from foundation to roof with the floor joists hung upon them. Historic cladding for wood frame construction can include horizontal or vertical boards, wood shingles, stucco, or brick or stone veneer. Early wooden walls were often supported by a series of posts or blocks made of rot resistant wood, or masonry piers. These foundations were designed to raise the walls from the underlying soil, thus providing protection from the damp earth and storm water. In Florida's sub-tropical climate, they also provided important air circulation to naturally cool and ventilate the structure. Wood walls were also supported by continuous masonry foundation walls.

Earlier historic structures sometimes incorporated masonry structural systems of fired brick, or cut and uncut stone. In structures built entirely of these materials, brick and stone serve both functions of support and exterior covering. Materials in the form of fired clay tiles or hollow concrete blocks which developed later, provided a lighter and cheaper alternative to earlier masonry structural systems. Poured concrete walls reinforced with iron or steel bars are common to 20th century commercial buildings. Masonry walls typically require a continuous underlying support, foundations which were generally wider and of heavier materials than the masonry of the overlying walls they supported. Monolithic foundation walls of poured concrete or concrete foundations with block stem walls (reinforced with cells filled) generally began to replace brick, stone and solid concrete block masonry foundation walls around WWII. Piers were eliminated with the use of concrete slab foundations, which were poured under the entire structure for support in mid 20th century Ranch style homes.

TREATMENT OF HISTORIC WALLS AND FOUNDATIONS

Foundation piers constructed of wood, brick or stone are subject to failure through rot, settlement, deterioration of mortar joints or connectors. Ideally the latter problem can be avoided through regular maintenance. If severe deterioration is present, repair of perimeter foundation features (i.e. visible piers) should match the historic construction with no visible change. Interior foundation improvements (i.e. those not visible) may be of contemporary construction engineered for the application. Infill between exterior piers should match the documented historic treatment. Typically,

this was with some form of wood lattice. Masonry infill between piers is not recommended. Historic wall cladding materials should be retained and preserved. The use of materials not found on a structure historically should be avoided. For instance, covering horizontal boards with aluminum or vinyl siding is inappropriate, as is replacing historic wood siding with fiber cement siding. Unique wall features such as decorative shingle patterns and stucco finishes should be retained and maintained. Wood elements should be firmly attached to the structure and painted for protection from the elements. Masonry veneers should be securely anchored to the underlying structure. If such a veneer is loose or delaminating, professional assistance should be sought to select the appropriate method of reattachment. Failure to address this type of deterioration allows water entry and can lead to more severe structural deterioration. A maintenance regimen of selective repointing of deteriorated mortar joints will assure long term integrity of load bearing masonry or veneers.

PROTECTION

Walls have to resist the uplift forces caused by high wind as they are the structural link between the roof and the foundation. Walls must maintain a continuous load path to resist these forces through the use of metal connectors for wood frame construction. Masonry construction should incorporate a bond beam at the top of the wall.

The lateral force of the wind will push the walls in and pull them out from the building. Walls must be secure enough to resist this push and pull effect. For wood frame construction, studs have to be sized and spaced to resist the lateral forces, and have to be securely supported at the top and bottom plates and through well-attached shear walls. Concrete block masonry resists the lateral forces by using reinforcement in grouted cells that extend from the bond beam to foundation.

In addition to wind forces, storm surge can weaken foundations and overturn walls. No matter the type of foundation construction, adequate connections between the wall and foundation are essential if the structure is to resist storm surge and the various types of wind loading. Install wall-to-foundation connections using brackets or straps between the wall framing and the foundation to strengthen connections. The sill, or bottom member of the wall frame, should be bolted to the foundation and studs should be strapped to the sill as well as the horizontal plate at the top of the wall. Again, connection designs must create a continuous vertical load path throughout the wall system. Pre-engineered straps, plates and other connectors are available for such improvements. They should be installed in accordance with manufacturer's recommendations and in such a manner to minimize loss or change in appearance of original materials and features.



A) Front Elevation of Ringling Ca d'Zan Gatehouse; B) Rafter tie down straps/anchors in masonry wall;
C) Rafter tie down straps/anchors. 1926 Ringling Estate, Ca d'Zan, Sarasota

Photos Courtesy of Maroussa Lewis & Dodson Architects

MITIGATION TREATMENTS

Connections (straps, clips and other connectors) installed to improve anchorage of roof framing to walls and walls to foundation should be concealed. Existing exterior finishes should be carefully removed and reinstalled to accomplish installation. If these connections can be installed at

the same time as reroofing, a small area of the roof deck can be removed at the wall line to facilitate installation of the required straps – without affecting interior or exterior finishes.

Gable End Walls

Bracing of gable ends is encouraged. In most cases bracing of gable ends can be accomplished without affecting historic finishes and with only minor modification of the historic roof framing system. To the extent possible, supplemental framing required for this work should leave the historic framing intact. In interior spaces with exposed roof framing, supplemental framing should be designed to minimize its visual and physical impact, and should be compatible with but clearly distinguishable from the historic structural system.

Piers

Many historic structures are built on raised piers, which provide weight to resist overturning, sliding, and uplift loads. Check for proper anchors and reinforcements when evaluating adequacy. The piers should be well maintained and severe signs of weakening should not be present. If piers are in adequate condition but the floor framing is not connected to the piers, connectors must be installed. These should be concealed. If piers require repairs or replacement, they should match the dimensions of the historic piers if visible. New piers that are not visible may be of contemporary construction. In all cases, structural alterations and improvements should be designed by an architect or structural engineer to assure structural integrity and code compliance.

Masonry Foundations

The most common anchoring system for wood walls and wood floor systems to foundations is the use of metal straps or connectors. These straps and connectors are easily attached to masonry foundations with masonry screws or bolts. It is important to install these products following manufacturer's recommendations.

Slab On Grade

A slab on grade foundation is a single, continuous layer of concrete with turned-down edges that sits directly on the ground and acts as the floor and foundation system. A slab-on-grade foundation is typically reinforced with welded wire fabric and longitudinal steel reinforcement (rebar) in the perimeter footing or turndown and elsewhere where it supports load-bearing partitions. For wood-framed construction, the bottom plate of the wall should be anchored to the slab with anchor bolts and washers. In order to retrofit, drill through the wall's sill plate into the concrete slab to anchor the wood-framed walls. Install 5/8" retrofit anchors with minimum 3"x3"x1/8"; washers every 16 inches and within a foot of each corner. Again, it is important to install these products following manufacturer's recommendations. Threaded rods set in epoxy adhesive are



A



B

Photos Courtesy of Manouso Lewis & Dodson Architects

A) 1937 Maddox House in Port St. Joe; B) Sill Beam Tie Downs Trap to New Masonry Piers

also used for this type of retrofit.

For concrete block masonry construction, vertical reinforcement in a continuously grouted cell should extend from the wall above and be embedded in the concrete footing below with a standard hook. Historic concrete structures may lack this reinforcing. In the absence of such reinforcing, several proven engineering solutions are available; however, these must be designed on a case-by-case basis.

Don't forget...

Flood Mitigation

Standing water from heavy rains and storm surge may weaken the walls, ceilings, and floors of a structure. In flood-prone areas install "check valves" in sewer traps to prevent flood water from backing up into the drains. Construct barriers such as levees, berms, or floodwalls to stop floodwater from entering the building. Products designed to seal basement walls can adversely affect some historic masonry. Consider alternative means such as flood shields or flood walls to protect historic basements. These should be designed to be compatible with the historic construction and landscape development on the site.

In the absence of such permanent protective measures, sandbags should be installed around windows, doors, foundation vents, etc., below flood level. The likelihood of damage from a storm surge to a property can be determined by flood elevation maps, which are maintained at your local government planning office.

For additional information...

Division of Emergency Management:

http://www.floridadisaster.org/mitigation/rcmp/HRG/content/structural/gable_end_walls.asp

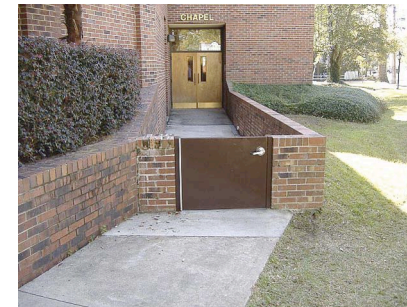
Blue Print for Safety:

<http://www.blueprintforsafety.org/windprotection/wproofwall.aspx>

<http://www.blueprintforsafety.org/windprotection/wpframing.aspx>

<http://www.blueprintforsafety.org/windretrofit/wrkeephouse.aspx>

Jim Sewell, Richard Wagner, Claudette Hanks Reichel; **Treatment of Flood-Damaged Older and Historic Buildings: 2005 National Trust for Historic Preservation**



Blessed Sacrament

Photo Courtesy of Scott Edwards