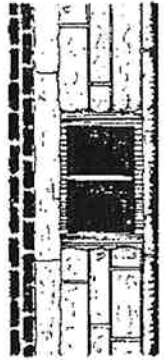
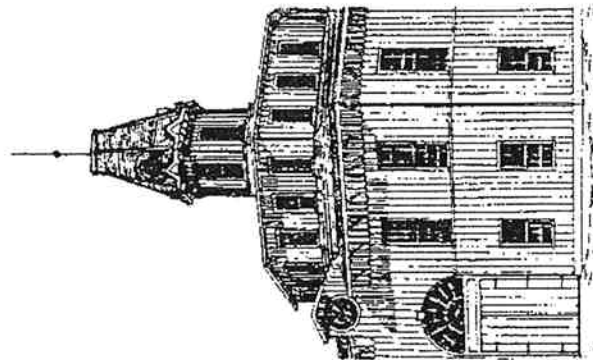
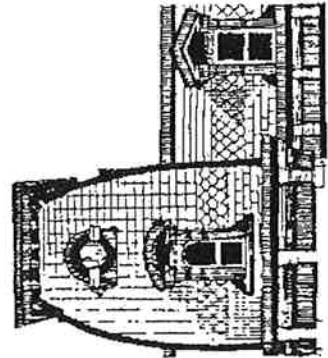
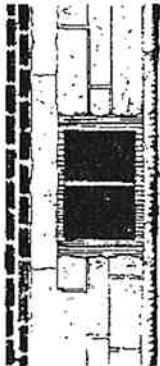


STRUCTURAL ELEMENTS



FOUNDATIONS



A foundation, as its name denotes, is the basis upon which anything is constructed. A house or similar structure rests on a masonry foundation since masonry is nearly impervious to deterioration and can sustain great weight. While a foundation is undoubtedly a structural element, it incorporates design features which correspond to the theme and style of the building.

Early construction utilized foundations made of field stone or rocks found at the site upon which the building was to be built. The stones were placed randomly to a height of about one foot. This height prevented frame building members from rotting.

By the mid-nineteenth century, local building trades had progressed sufficiently to rely on quarried limestone or soft baked bricks for foundation materials. Though brick was used, limestone was considerably more prevalent. Day-laid stone—a white, heavily veined or marbled limestone—was favored.

As basements replaced cellars and featured windows for ventilation, coursed or uniformly-sized pieces of limestone became the standard. This presented a more formal, finished appearance, and a foundation began to contribute more to the overall theme of the building.

The first quarter of the twentieth century witnessed a return to simple building designs. Poured concrete replaced lime-

stone as the common foundation material because it was easier to work with and did not require repointing.

The final detail a brick or stone foundation could afford was a styled mortar joint. Commonly finished joints were flush with the foundation surface. Other styles of joints include raked (which is recessed back from the surface) and grapevine (which is convex in shape and projects outward from the foundation surface).

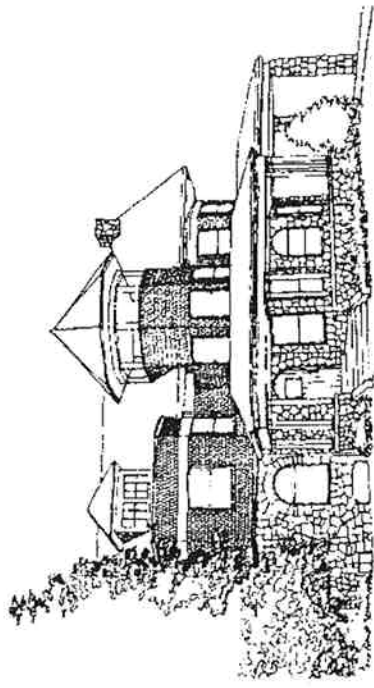
The most common form of deterioration in a foundation is the cracking between the stones or bricks and the subsequent crumbling of mortar in those joints. Replacing the mortar is done by repointing, a process which is described in *Exterior Walls Masonry* section.

Serious foundation problems such as shifting or uneven settling situations which can affect the overall stability of the structure—require some treatment which can compensate for the movement of the foundation and prohibit any further damage. Frequently, this is accomplished by pouring concrete around the footer—the portion of the foundation below ground—since the footer is usually the first area to deteriorate. It reacts to movements in the earth around the structure, particularly those resulting from weather changes.

Because foundation damage can be difficult to correct, consulting an expert trained in structural building design is advised.

Brick and stone are still available for use as foundation materials. Poured concrete and concrete block (smooth or rough-faced) are readily obtainable and most common.

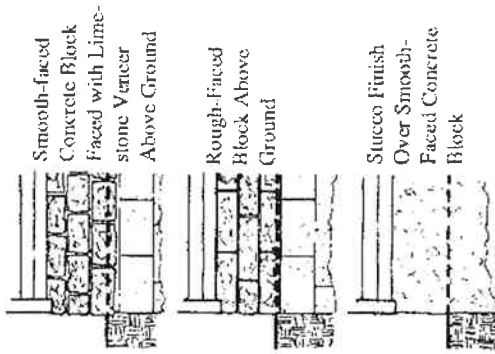
EXTERIOR WALLS



For building additions, the choice of foundation materials should be guided by the foundation material of the original structure. For example, an historic structure with a limestone foundation would be complemented by an addition with a limestone, rough-faced or stuccoed foundation rather than a brick foundation. Scale and color are deciding factors.

PROHIBITIONS

Smooth faced concrete block with an above ground exposure in excess of 8" —one course—is not permitted. If smooth-faced block is desired and the exposure is greater than 8", the foundation must be stuccoed.



available and, particularly in the latter section, wood was not in abundance.

Locally, both masonry and board materials were common. Combinations of the two were found in buildings as early as the beginning of the nineteenth century.

The *Exterior Walls* section covers historical and contemporary masonry and wood materials.

The most visible structural building element is the wall. It has the greatest amount of exposed surface and, as such, provides the initial visual impact for the building. Beyond the first desire for shelter, building walls have been a major consideration in architectural design.

Walls can be classified by materials into two primary categories. Masonry, the first category, includes brick, stone and concrete — non combustible materials derived from minerals and inorganic substances. The second category, Frame, includes wood products and wood derivatives — materials which are flammable and based upon organic substances.

Historically, geography played a major role in the selection of building materials. Wood was abundant in the eastern United States where rich forests supplied lumber for building frames, roofs, walls, windows, doors, and trim. In the southern and southwestern sections of the country, clay was readily

MASONRY



By far, the most common masonry wall material was and continues to be brick. Techniques, however, have changed greatly. Initially, brick walls were several courses thick with interior and exterior walls sharing the building load. Brick has now assumed a decorative role, being applied as a veneer.

Primitive bricks were made at or near the construction site in wood frames. The outside or skin was baked to form a hard shell; the inside remained soft and, over time, returned to a powder. Due to the amateur nature of the process, solidity and strength varied between bricks.

Early builders used multiple thicknesses to compensate for the fluctuation within the individual members. Another variation was to use headers—bricks turned endwise. This was done within rows of stretchers—lengthwise laid bricks—or as complete rows. With improvement in building techniques, fewer number of header rows were required.

During the last quarter of the nineteenth century, manufactured bricks were the standard. They were uniform in size and consistency. Improved technology also accounted for the development of pressed brick. This was an oil-finished brick with sharp edges and was used on

the street facade(s) of a building with the rest of the building constructed in less expensive brick.

Color experimentation began at this time, too. Brick was no longer limited to shades of red. Browns and blonds complimented the stylistic return to nature. Color was used in mortar with shades matching the brick color.

The 1910's witnessed the use of texture brick, featuring raised lines or patterns. This variation was used extensively on workmen's houses and neighborhood commercial buildings constructed prior to the Great Depression.

Limestone and sandstone were used historically as wall materials; however, limestone was more commonly found in a foundation or as trim. Both materials were favored in Romanesque style buildings which used large quarried pieces of stone.

Concrete is a rigid masonry substance composed of cement, gravel, sand, and lime. Developed in the latter half of the nineteenth century, concrete was often faced with stucco, brick, or stone. Smooth concrete walls were favored for Art Deco and Art Moderne style buildings.

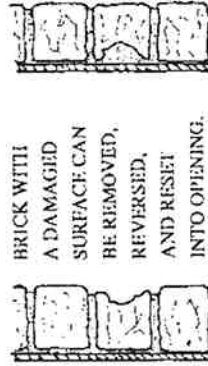
Concrete block, uniformly sized concrete pieces held together with cement mortar, is sometimes used as a replacement for poured concrete. However, exposed concrete block (as a wall surface) is not permitted; neither are artificial substances imitating stone or brick veneers although a layer of brick or stone as a facing is permitted in the construction of a new building or addition.

Stucco is a cementitious coating which can be applied over masonry, frame, or

wire mesh. It provides a continuous surface which can be flat or textured. Its use was functional—to cover deterioration—or decorative.

Soft brick is susceptible to major weather changes, expanding and contracting with seasonal heat-cold exchanges. Because of this reaction, cracking or chipping of the baked surface can occur.

This damage can be repaired by removing the mortar from around a damaged brick, removing the brick, reversing it, and replacing it in the opening. This treatment provides the closest match to the surface being repaired. If the brick is seriously deteriorated, a different brick is required. New brick is readily available commercially, and innumerable varieties exist. Old brick is handled by some salvagers, as is limestone. Many times, an unnecessary and nondecorative chimney can supply needed brick. In all cases, brick should be repaired with replacement brick which matches the original in size, color, texture, and consistency.



Limestone and sandstone repair is similar to that for brick. Limestone is an extremely dense substance and can withstand weather changes and impact without deteriorating. Its installation is comparable to that for brick and thus, an individual piece can be removed and replaced. Sandstone, however, is diffi-

cult to obtain due to its relative rarity as a building material.

Poured concrete's damage is due usually to cracking from uneven settling.

Repair requires chipping out a v-shaped area on the face of the building, filling this area with a concrete patch, and then smoothing the surface.

Stucco is repaired somewhat similarly to concrete. The loose stucco is removed, and the underlying surface is swept clean and repaired, if necessary. As an initial coat of stucco dries, it should be dampened to prevent its drying too quickly and shrinking. A second stucco coat should be applied after a few days, and it should be gently wire brushed to give the new surface the same texture as the original. Soft stucco consists of 1 part lime, 1 part portland cement, and 5 parts sand. The top coat should have 1 part pea gravel substituted for 1 part sand.

Mortar is the "glue" which bonds individual masonry units together into a homogeneous structure. Mortar, when mixed, is pliable allowing workability prior to curing to a hardened state.

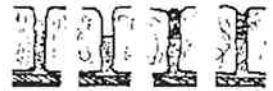
Until late in the nineteenth century, mortar was composed of lime, sand, and water. The type of sand could control the color—from white to gray-brown. This mortar was referred to as soft mortar because it expanded and contracted with major weather changes. Soft mortar which is used with soft brick can be mixed by combining 1 part of portland cement with 5 parts of lime and 12-20 parts of sand. Water is added to achieve a workable consistency. Hard mortar, which should be used with limestone or hard-baked bricks, follows a similar mixture of equal parts of portland cement and lime.

Cement was developed in the late nineteenth century and was used to guarantee solidity in masonry substances. When added to mortar, a virtually unchangeable substance—hard mortar—was achieved. This worked quite well with limestone and hard-baked brick, the latter of which was developed during the same period near the turn of the twentieth century.

Color could be incorporated into the mortar through the inclusion of clay or another substance in powder form. Colored mortar added a decorative twist to a functional building element. Replacement mortar must match the original in color, composition, texture, and application in order for the joints to be unnoticeable.

Replacing deteriorated mortar is done by repointing. The process involves removing mortar to a depth of 3/4", dampening the joint, applying new mortar in the space, and smoothing the new joint with a small trowel. The new mortar joints should duplicate the original in appearance with the wet mortar being a shade darker since it will lighten as it dries. No mortar should remain on the surface of the bricks or stones between which it is applied.

TUCKPOINTING DETERIORATED MORTAR JOINT



REMOVE 3/4 INCH OF OLD MORTAR

CLEAN JOINT, THEN DAMPEN MORTAR AND BRICKS

ADD NEW MORTAR

TROWEL SHAPE TO MATCH ORIGINAL JOINT

Cleaning masonry is a process which can be an acceptable step in a repair program if the cleaning is done using non-abrasive techniques. Generally, the cleaning method should be geared to the individual surface; however, a few standards apply in the case of any historic masonry surface.

Sandblasting, featherblasting, or any similar technique which removes the outer surface of the masonry is not permitted. These abrasive methods will leave a rough, pock marked face which provides an excellent surface for new dirt to locate and which can cause water/moisture infiltration. For soft brick or sandstone, the baked exterior can be completely removed, exposing the soft powder interior and promoting the complete deterioration of the material.

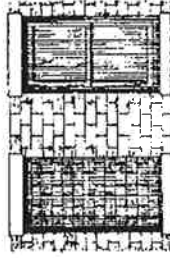
Similar problems can occur by using harsh chemicals. Hydrochloric (muriatic) acid leaves salt deposits on the building surface. These deposits can damage the surface long after the cleaning process has ended. Also, the acid most assuredly damages the soft mortar.

Some substances can be used effectively. A garden hose and bristle (never wire) brush will remove dirt. Lye and corn starch added to water is a gentle cleanser. Small percentages (four or less) of potassium chloride or hydrofluoric acid added to water and applied with a hose at no greater than 300 pounds of pressure at the nozzle (using a fan tip nozzle) is the strongest non-abrasive method permissible.

Analyze the surface prior to cleaning. Determine the type and condition of the

material and the substance(s) to be removed—dirt, stains, paint. Do test patches, small areas which can be observed through several weeks of weathering. Choose the cleaning method which removes the dirt but leaves the building surface unchanged.

Efflorescence, or salt residue, may appear. This is normal after water is sprayed on masonry. It can be removed easily by scrubbing with a bristle brush and rinsing with a garden hose.

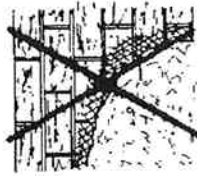


RECESSED BRICK MAINTAINS DIMENSIONS AND IMPRESSION WHILE A WINDOW HAS BEEN REMOVED

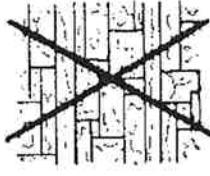
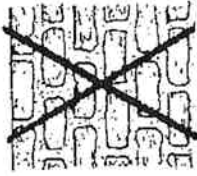
A masonry patch may be required where a building element has been altered, such as with the removal of a window. If the symmetry of the building would be interrupted by the complete elimination of the element, then the rhythm should remain intact. This can be done by recessing the patch to the location which the element occupied. Regardless of whether or not the impression is to be left in the masonry, the patch should feature materials duplicating those on the rest of the wall surface, and the rows should be aligned.

Tuck pointing or patching a masonry surface requires material of the same color, texture, composition, and application as the original.

STUCCO OVER BRICK OR STONE



SLOPPY TUCK POINTING



ARTIFICIAL STONE

CONCRETE BLOCK IN WINDOW OPENING

PROHIBITIONS

Because it changes the visual texture of the building, stucco or similar cement coatings are not permitted on historic masonry surfaces which have not had such materials applied previously nor are artificial substances imitating stone or brick veneers permitted. However, a layer of brick or stone as a facing is permitted in new construction if appropriate to the architecture. Exposed concrete block as a wall facing is not permitted.

Cleaning masonry by sand blasting, wire brushing, or using abrasive chemicals is prohibited.