Exhibit Space

Background/Goals: The overarching goal of the gift shop museum is to create a learning environment that enhances the audience experience in the retail area and is an extension of the interpretive exhibits in the Long Barrack. The west arcade of the building is reserved for the exhibit, The Story of the Republic of Texas (wkg. Title). Elements of the recently completed Long Barrack exhibit will be incorporated to provide an overall unified look and feel to the exhibits on the grounds (exhibit furniture, color palette, typography, and overall graphic style).

The elements of the museum area and the retail area will work in an aesthetic symmetry, each complimenting the other to create a cohesive look and experience. Aligning color palettes and lighting hardware and coordinating exhibit/retail furniture will accomplish this goal.

Recommendations:

Define interpretive exhibit area - west arcade

I. Walls
  (a) Place walls between arched openings of west arcade
  (b) East side of walls used for retail while west side used for museum interpretation
  (c) Middle arched opening left as entrance/exit of exhibit (audience enters and exits through retail area)
  (d) Walls stop vertically at the point from which the arch springs to leave area above open.
  (e) Each wall has narrow vertical opening on either side between wall and col umn to provide an enticing glimpse into the museum area from the retail area. The gap also helps to keep the west arcade visually connected to the interior of the main area of the building.

II. Northwest room
  (a) Room used for changing exhibits of either featured documents from the DRT Library or loaned artifacts or documents
  (b) Doorway opened up to provide better traffic flow

Paint interior

I. Painting interior walls as per architect - perhaps terra cotta

Lighting

I. Ambient lighting
  (a) Remove old and replace with new LSI feature lighting (museum quality)
  (b) Lower light levels than retail for conservation purposes (also serves as attractor)

II. Feature lighting
  (a) Case lighting = fiber optics for conservation and dramatic effect
  (b) Interpretive panels illuminated from above (suspended track?)

Exhibit furniture

I. Cases - glass and metal cases from Casewerks to match existing in Long Barrack
  (a) Document cases
  (b) Artifact cases

II. Mounts - provide mounts for documents and artifacts

III. Interpretive exhibit panels with text and graphics
  (a) Wood substrate with graphic panels attached to face
  (b) Mounted on powder-coat painted metal frame attached to floor

IV. Title - three-dimensional lettering suspending in arch of center opening

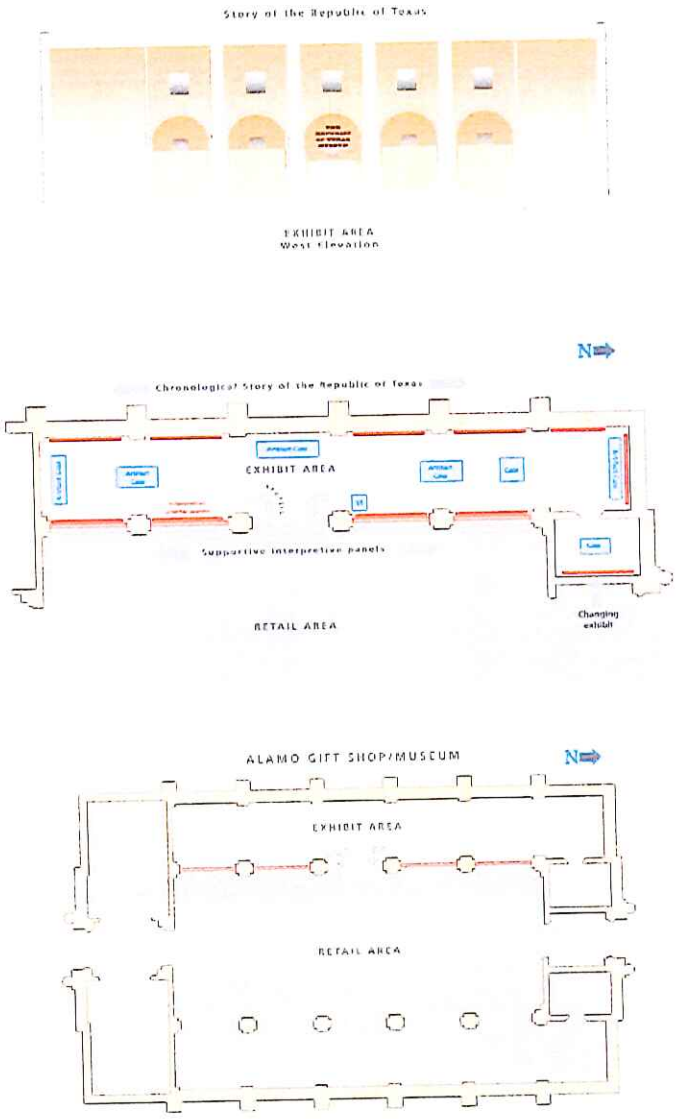
V. Possible multimedia or interactive elements such as touch screen or video

VI. Donation box at exit

Exhibit story flow

I. West wall for chronological storyline

II. East wall for supportive story elements



Proposed Retail and Exhibit areas for the Alamo Gift Museum. *Drew Patterson Studios*

Retail

Background: The Store is part of the Sales Museum built in 1936. The building is located just north of the exit from the Shrine. In addition to the retail presence the Sales Museum includes exhibits on Texas History, and offices and storage for the store.

The retail presence is unusually important to the Daughters of the Republic of Texas because, since no monetary help is received from local, state or federal government, the Daughters of the Republic of Texas depends solely on money from donations and proceeds from the store to preserve the complex and maintain exhibits.

Description/Existing Conditions: The retail sales area occupies approximately two-thirds of the first floor of the Sales Museum, mainly concentrated along the east and west perimeter walls and columns. The Texas History exhibits fill the remaining space down the center of the building.

Nearly all the freestanding fixtures and those on perimeter walls and around columns are old, broken, unattractive and inefficient, and collectively denigrate the experience and perception of quality. The inefficiency of the merchandising fixtures requires frequent restocking of products.

Merchandising is where product is placed for direct sale to the customer. Displays are like silent salespersons where diverse products are used to build vignettes that suggest related and add-on purchases. These vignettes increase the number of items in a purchase, resulting in increased average transactions and more revenue per visitor. The store has virtually no display areas.

There are insufficient fixtures, primarily glass cases, for the merchandising of products that need to be inaccessible to the visitor.

Lighting comes from a series of chandeliers that provide inadequate ambient and no effective direct lighting.

Analysis of Key Existing Conditions: The allocation of space between exhibits and retail requires continual back and forth foot-traffic between the two retail areas, resulting in constant interference with the visitor's enjoyment and study of the Texas exhibits. The net result is that neither the store customer nor the exhibit visitor has a wholly satisfying experience. Also, this divided retail area eliminates any possibility for a cohesive retailing environment that creates energy and generates incremental sales.

The lighting system provides limited ambient but virtually no directed or concentrated lighting. To many lighting is arguably the most important retail design element, but the current lighting is barely sufficient for the store and doesn't make any of the products 'pop'.

The lack of display space requires the customer to make multiple single-product decisions that often tires the customer before they can build a significant multi-product purchase. Especially in the absence of interaction with sales staff, displays provide the customer with multiple product ideas.

Recommendations: The mission of the institution is to honor the memory of those who fought and died defending liberty at The Alamo. However, the general ambience of the store does not enhance this mission. The recommended layout and design of the fixtures will support the mission, increase sales and enhance customer service and visitor satisfaction.

The most significant recommendation is to devote the west side of the Sales Museum to exhibits, and dedicate the center and east side of the building to retail. This will intensify the Texas History exhibit experience and create a more cohesive and energetic retail atmosphere. The division creates a line of walls between some of the columns on the west side for exhibits on one side and additional merchandising space on the other.

New freestanding fixtures and fixturing along walls and around columns will provide expanded sales floor storage, raise the products off the floor and provide maximum merchandising flexibility through a combination of a vertical merchandising system and adjustable shelves.

Some of the additional retail space will be devoted to an expanded book selection that will directly support the serious aspect of the mission statement. While maintaining the same number of point-of-sale positions, some will be clustered in the center of the store and integrated with the merchandising of higher-priced, more sophisticated products including jewelry and collectibles.

In addition to the existing ambient lighting (which can be retained to retain this aspect of the original design), a grid of adjustable lights will be installed to maximize lighting impact.

Electrical improvements will include a grid of floor receptacles to provide electricity throughout the space and high-speed internet connections to facilitate future buying through the web. A couple additional point-of-sale positions will be wired so temporary registers can be used when business demands. A music system will be installed to provide ambient music throughout the space.

All the above recommendations are designed to:

- Get the customer to linger
- Increase incremental sales
- Move people throughout the store
- Create sightlines that improve customer service and discourage shoplifting
- Enhance the overall image of The Alamo

ARCADE

Background: This arcade was constructed in 1937 as part of the Texas Centennial program. Designed by Harvey Phelps as part of the Alamo Gardens, it separates the Alamo site from the plaza to the west. As part of the Centennial, this structure was obviously not planned to clarify the relationship of the remaining original buildings with Alamo Plaza. The area where it is located was not part of the Mission Compound, and, by its design and location, is misleading to visitors trying to understand the site. In an effort to help this confusion, and to remove any pressures on the south wall of the Shrine that the Arcade might generate, about 4" of the arcade has been removed, leaving a gap between it and the Shrine wall.

Description: The Arcade consists of two parallel walls with nine matching limestone arches running north and south from the southwest corner of the Shrine to Crockett Street. There is no roof on the structure, but a series of vigas, supporting iron, octagional lanterns, span between the walls. Four large, square, iron hanging lanterns hang from viga ends on the east side of the arcade, facing the Library Garden. The walk is paved with polygonal flagstones. The arches on the west side of the wall are infilled with iron grilles, for security purposes. A shallow wooden cupboard has been added on the inside near the Shrine to encase electrical equipment.

Existing Conditions: The stone of the arcade is generally in good condition. It appears to be laid in a polygonal pattern, as a veneer, however, since the plans to this element are not available, one has to assume that the walls are load-bearing. Isolated stones, laid with their bedding planes vertical, show signs of deterioration. There is some evidence of deterioration of the stone surface, as bits of shell in the stone are visible above the surface, as if the surface is eroding faster than the shells.

Some of the mortar joints appear deteriorated.

As with all of the other buildings on the site, mold is in evidence on the walls.

The wooden vigas are in fair condition, see structural.

Recommendations: Treat walls with architectural biocide.

Selectively repoint deteriorated mortar joints.

Screen the walls appropriately to distinguish them from the original historic buildings.

Arcade at juncture with Shrine wall

STRUCTURAL

Background/Description: An arcade of limestone walls extends to the south of the Shrine along the west side of the Alamo grounds. Between the two walls are rough cedar trellis beams, also called vigas. Some of the vigas support large iron light fixtures. The walls have a series of arched openings in them, and iron grillwork is installed in the arches.

Existing Conditions: The walls appear to be in good condition. Some slight deterioration of the wood vigas was observed, but the level of deterioration is minimal at this time. Because some of the vigas support iron lamps, a safety issue could arise if they are allowed to deteriorate to the point of failure. There is no imminent danger, and we do not expect the cedar vigas to deteriorate rapidly.

Recommendations: Observation by maintenance personnel on an annual basis is all that is recommend at this time. When the vigas are replaced in the future, consider providing more durable means of supporting exterior lighting elements. These supports could be hidden within the vigas.

At the time of this Report revision, the vigas have been load tested and found to be structurally sound. We recommend periodic testig to assure structural integrity.

Slight deterioration of wood vigas in arcade

Perimeter Walls

Background: Constructed in 1937, and funded as part of the Texas Centennial Celebration, the limestone walls around the site outline the land acquired with this same funding to create an Alamo Garden, designed by Henry Phelps. As with the Arbor, and other monumentation added to the site, the interpretation of the original Alamo Compound in the Plaza was not the goal of this project. As a result, the limestone wall enclosing the grounds adds to the confusion of the visitors and makes it more difficult to understand the site.

The walls were modified in 1977, when a new section of north wall was constructed between the northeast corner of the Long Barrack and the gate to the Gift Museum. In addition to this work, a two foot section of stone was added to the top of the walls as a result of security concerns. At the time this addition was made, a section of conduit was installed in the top of the wall to facilitate future installation of wiring on the site.

Description: The wall is about 6 feet tall, constructed of limestone laid in a polygonal pattern. As with the Arbor, some of the stones are laid with their bedding planes oriented vertically, causing water to enter more easily and flake off the face of the stones. The mortar appears to be hard, and is deteriorating, allowing water into the wall.

Existing Conditions: Along the north end of the east section of wall, the stones at the base of the wall show a great deal of deterioration. Some of this may be caused by the softness of the stones as well as the fact that many were laid with their bedding planes oriented vertically. In the area of wall running behind the Support Buildings and parking area, the interior level of grade is higher than the sidewalk on the other side, allowing ground moisture to wick through the wall, no doubt, contributing to the problem.

The relatively hard mortar was applied in a rough, rustic manner, leaving voids where water can enter into the wall and the stones. In addition, some of the mortar has deteriorated.

The walls are gray with mold.

Perimeter Wall

Recommendations: Before any steps are taken to conceal the walls in order to make the story of the Alamo and the Mission Compound that became a Plaza more understandable, the walls should be repaired:

- Deteriorated stones should be repaired. If they are badly deteriorated, and are in the lower section of the wall, they should be removed and replaced. If not critical, they should be patched.
- The walls should be repointed to preserve the mortar joints.
- The walls should be treated with an architectural biocide.
- In areas where the interior grade is higher than on the outside, after the walls are repaired, damp-proofing material should be laid on the high side of the walls between the soil and the wall to minimize moisture penetration in the walls.

Ivy, or some other plant cover, should be trained over the walls to conceal the stonework and minimize the visual confusion caused by the limestone.

Structural

A visual survey was conducted of the perimeter wall and no structural issues were observed.

6.3 Alamo Hall & DRT LIbrary

Alamo Hall

The Roof

Background: The present roof is, in actuality, the second floor of the original building. Intended for demolition, this activity was halted after the top floor of what had been a fire station was removed. Plans developed by architect Henry Phelps to alter and reuse the first floor of the fire station included installation of a new exterior cladding of limestone and cast stone. The original fire station was constructed of brick on a concrete frame.

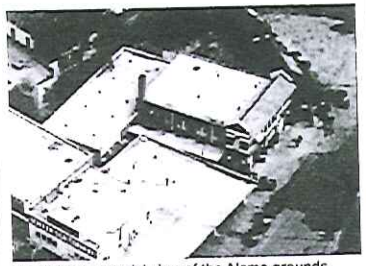
Description: The main roof is modified bitumen, flat, with parapets around all sides that extend about 2' above the roof.

Across the east façade of the building, there is a rustic porch, constructed of un-milled posts and beams. There is a wood shingle roof covering this porch and protecting the bank of French doors along this façade.

Existing Conditions: The existing modified bitumen roof, installed in 2000, is in good condition.

The shingle roof also appears to be in good condition. The trees in the area provide some protection from the sun, which dries out the oils in the wood.

Recommendations: Perform periodic inspections of the roof, at least at 3-year intervals and implement repairs as necessary.



Detail from an aerial view of the Alamo grounds showing the two-story fire station, c. 1930
Courtesy of The Daughters of the Republic of Texas Library

Inspect the shingle roof every 2 years, apply linseed oil, and repair at inspection time.

Exterior Walls

Background: The existing walls were constructed in 1938 when the building was converted from a fire station to a building housing the DRT Library. The exterior of the building was changed from brick to limestone and cast stone, designed to be consistent with the other commerative building on the site, the Gift Museum, in design. In the original design, the north, south, and west entrances of the building were similar, with central doorways surrounded by ornamental cast stone and stucco. Copies of the original drawings are available in the DRT Library collection.

The DRT Library, constructed in 1952, connected with Alamo Hall through the west doorway, covering it with the connection.

In the mid-1970's, in conjunction with the vertical extension of the site wall at the Library to cover the south addition of the Library, a new façade was placed in front of the existing south façade, keeping the 1938 wall in tact. The new wall is limestone with a simple form, no decoration, and a deep recess at the central door.

The original design of the east façade incorporated a rustic porch with a trellis across the length of the façade that was punctuated with pairs of French doors. At some point, either in the original construction or later, this design was changed to add a sloping wood shingle roof over the trellis, covering the porch.

South facade of Alamo Hall facing Crockett Street

East facade of Alamo Hall with sloping wood shingle roof

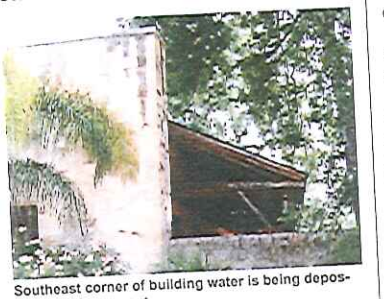
Description: The 1938 walls are limestone veneer on a concrete frame, with masonry infill, laid in a polygonal pattern. Many of the stones are toothed with tooled textures. The lintels over the windows are deep wood, with a curvilinear design across the bottom.

The walls are capped with cast stone, and the major entrances are marked by decorative cast stone surrounds.

Existing Conditions: Generally, the limestone walls are in good condition, however, in some locations, such as the north and east walls, the faces of some of the stones that are laid with their beds oriented vertically have flaked off from the original planes of the faces. Because the stone is supported by concrete, this is not the usual load-bearing masonry rising damp. The stones on the north may have absorbed water from the ground they are in contact with. There are also two scuppers at the top of the wall almost directly above the deterioration with a great deal of algae growing beneath them, indicating a fairly continuous presence of water, possibly from roof-top A/C units.

The stones showing deterioration on the east abut a flagstone floor, and are protected by the east porch. The upper portion of the wall under the porch has a few areas that indicate the presence of mold, though, otherwise, the section of stone in this area is very clean, except for a considerable amount of dirt on any flat ledges in the stone or near mortar joints. Though the porch is well flashed into the wall, in the past, water may have flowed down the face of the porch wall and puddled on the floor to be subsequently absorbed by the lower

Deteriorated column bases on Alamo Hall porch



Southeast corner of building water is being deposited by a downspout

stones in the wall, leading to their eventual deterioration.

There is a loose stone at the upper northeast corner of the building.

The rustic columns for the east porch are large cedar posts, stripped of bark and allowed to weather. The base of these columns is a raised masonry unit, however, at some time, possibly as the column bases began to deteriorate, cement was added around the base of the posts. There are cracks between the cement fill and the wood columns that allow water running down the columns to seep between concrete and wood, retaining the moisture and contributing to the added deterioration of the column bases.

There is surface mounted electrical conduit on the east wall.

The downspout at the southeast corner of the building deposits water between the south wall of the site and the south edge of the porch.

The outfall of this downspout is not visible, and the area appears to be damp. A stone at the base of the wall at the edge of the porch in this area is deteriorated, and cracks in the mortar joints run up the wall, indicating that this moisture may have caused movement in the wall. A gas line mounted to the east wall runs up to the air conditioning equipment on the roof.

Recommendations: The scuppers at the top of the north wall should be modified so that water doesn't run down the face of the stone.

Deteriorated mortar joints should be repointed. (10%)

Slopes on the parapet caps should be corrected to direct most water back on to the roof.

All sides of the building should be cleaned, and a fungicide applied to inhibit the future growth of mold. Fungicide should be applied about every 5 years, and the stones on the porch should be cleaned of dirt more often, taking care not to allow water to puddle against the wall.

The concrete fill should be removed from the bases of the cedar post columns, and the base condition of the columns as well as the method of anchoring the columns inspected, repaired, and re-anchored, if possible (Note: at the time of this revision, this has been completed and the posts were found to be structurally sound).

Faces of deteriorated stones should be cut back to sound stones and re-faced.

Moisture barriers should be installed against walls where planter beds are above the concrete foundation, touching the stone surfaces, or, beds should be lowered to below the base of the stones.

The southeast corner downspout should be corrected so that water is carried well away from the building.

Doors, Hardware and Trim

Background: The existing doors are part of the design implemented when the building was adapted from a fire station to its present use.

Repairs to the threshold at the north door have been made to correct a tripping condition. This work included the addition of riser height to the step at the exterior.

Description: The double wood doors on the north and west walls are made of wood with nine-lite windows on the top and carved panels on the bottom. The doors and transoms above are bordered by a cast concrete arch with a running vine and flower pattern. These doors and transoms have been duplicated in the north and west openings into the main room, however, the glass in the doors and transoms has been painted over.

The east façade of Alamo Hall has a sequence of four double french entry doors covered by a lean-to porch. The first four from the south are sets of ten-lite double doors with four-lite transom windows. The final door, on the north end of the porch, is a single ten-lite door with a single pane transom. There are metal grilles that also open in two panels on the exterior of the French doors

A carved wood double door serves as an additional entrance of the south façade, facing Crockett Street. This door is recessed away from the sidewalk.

Entrance doors on north facade of Alamo Hall

Existing Conditions: Though the threshold problem at the north entrance has been solved, this door is not handicapped accessible. Because of its height, a more extensive ramp than that presently used (temporary wood) will be required, extending from the doorway to a landing where the walkway turns, and extending beyond the turn.

The north door and transom is in good condition.

The doors and transoms are in need of maintenance, painting, repairs, etc.

The hardware on the French doors to the patio consists of one surface mounted floor bolt, one sliding bolt mounted horizontally across the meeting of the doors and one hasp with a keyed lock across the meeting stiles.

Recommendations: Provide a handicapped ramp to the north entrance.

Install improved hardware on the French doors, consisting of keyed deadbolts, removing the hasps and locks and surface deadbolts.

Repair and repaint the doors.

Establish an ongoing program of repairs and repainting.

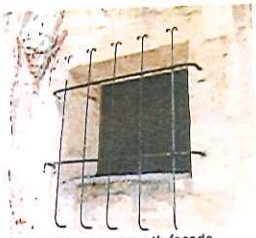
Windows, Hardware and Trim

Background: The windows in the exterior walls of Alamo Hall are original to the 1938 adaptation of the building frame to accommodate new uses.

The windows associated with the north entrance door were repaired and repainted in conjunction with the work on the threshold in 1938.

Description: Above the entrance doors on the north wall is a sixteen-lite arch transom window. The door is flanked on each side by two, six over six-lite, double-hung wood windows with concrete sills and carved wood lintels. Two similar windows are located on the west façade.

On the south façade that faces Crockett



Small window on south facade

Window type on north and west walls

Street, a small square window recessed into the wall flanks each side of the door covered by a wood door and an iron grille.

The windows on the north and west facades are 6/6 lite double hung wood.

Existing Conditions: Generally, the windows are in need of maintenance. Paint is peeling, and putty appears to be loose or missing.

The window sills on the west façade are heavily weathered, with the soft wood eroded away from the hard growth rings.

Recommendations: Repair windows, using the appropriate epoxy filler for eroded sills and missing areas. If the putty is firmly in place where it hasn't failed, install new putty. If it all can be removed without damaging the window frames or glass, remove and replace.

Repaint the windows and include in a regular maintenance schedule for all the windows on the site.

Interior Walls

Background: When converted from a fire station, the existing interior walls were removed. The fire station layout consisted of two bays for fire trucks and a central bay for stairs and equipment storage. The column spacing for the building was determined by this plan, resulting in two rows of columns more closely spaced down the center of the building. This column spacing has made the use of Alamo Hall for meetings difficult because of constricted sight lines.

The adapted configuration included addition of walls to enclose a stair to the basement, kitchen, toilets, and small spaces for office and parlor.

Description: The interior perimeter walls and columns are plastered. The walls for the added functional spaces are metal framing with plaster partitions.

Existing Conditions: The interior of the building is in good condition.

Interior Ceilings

Background: The original fire station plans indicate that the ceiling consisted of exposed concrete decking for the upper floor and concrete beams spanning between the columns. At some point in the history of the building, possibly after the 1938 remodeling, the ceiling has been lowered. The concrete beams are not visible, and air conditioning grilles are mounted in it, indicating that this change came after the war, possibly when the Library was added to the building.

Interior of Alamo Hall. The column spacing creates constricted sight lines.

Description: The ceiling is painted plaster, very smooth, and is suspended from the concrete framework of the building.

Existing Conditions: The ceiling is in excellent condition. Some structural reinforcing may be necessary when the upper floor is added.

Interior Floors

Background: The tile floor in the main space was made by the WPA, and several of the tiles are stamped with this logo. It was installed after the old fire house was reclaimed by the DRT in the late 1930's as the building was being demolished.

Description: Red hexagonal clay tile floors in the main space form a field of tiles and are surrounded by a wide section of square tiles set on the diagonal. The tiles were made in molds and have an unevenness of surface that contributes to their beauty.

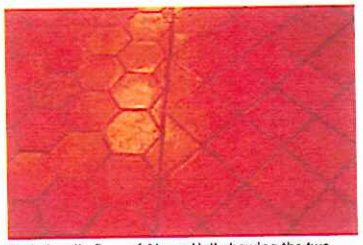
Existing Conditions: The hexagonal and square clay tiles have been maintained beautifully over the years, and the diligent waxing has caused the tiles to develop a warm, polished patina.

The WPA tiles were installed on a thick grout bed directly over the concrete floor of the existing fire station. In adjacent rooms, such as the kitchen and bathrooms, the sheet vinyl and carpet flooring is laid directly on the concrete and the difference in the surface elevations of these floors, which is about 2", is crudely taken up with sloped concrete thresholds.

Recommendations: Replace all sheet vinyl and carpet, correcting the level differential with the tile flooring.

Continue to maintain tiles.

Investigate possibility of installing a large carpet rug, not attached to the tile flooring, in the area of seating in order to minimize the hard surfaces which cause sound to bounce around the room.



Red clay tile floor of Alamo Hall showing the two patterns present

Structural

Background/Description: Alamo Hall is a converted fire station, formerly two stories high. According to the original drawings, the foundations for the building are spread footings, with pilasters to grade level. Concrete columns support the second floor, which consists of one-way concrete slabs on concrete beams. The former roof was framed in the same manner as the second floor. The original brick exterior of the firehouse was removed and replaced with the current limestone wall, and cast-stone elements were used at the new entry on the north side.

On the east side of Alamo Hall is a porch roof constructed of rough cedar logs. The logs are supported at the roof line by a wooden ledger which is nailed into the masonry wall of Alamo Hall.

Existing Conditions: The underside of the current roof (originally the second floor) was observed through an access panel in the ceiling. It appears that the original concrete structure is still in place. The framing consists of beams running east to west with a one-way slab spanning north to south. At one location the underside of the slab has been chipped away, exposing the reinforcing bars. The exposed reinforcing is smooth, round bars approximately ½" in diameter.

On the north side of Alamo Hall, roof scuppers are wetting the face of the exterior wall. This is not a structural issue, but will lead to deterioration of the exterior wall if allowed to continue.

The wooden ledger supporting the porch roof on the east side of the building is deteriorating at the open ends of the shed roof. In addition, the ledger has separated from the wall at the north end of the porch, and the nails are pulled out from the masonry. Both of these conditions are of concern. The deterioration and separation from the wall have both reduced the capacity of the ledger to support the cedar beams, and could lead to failure and collapse of the porch roof.

There are cracks in the limestone wall at the pockets for the cedar beams. The beams are placed in pockets in the limestone and have grout packed tightly around them. When wood is wetted it swells, and this swelling action can then burst the mortar and limestone blocks around it.

The bases of the cedar posts are also deteriorating. The posts sit on short limestone pilasters, and a mortar "skirt" surrounds them. Instead of shedding water away from the base of the posts, the mortar enclosing the bases is likely trapping moisture and preventing the post from drying quickly when wetted. This accelerates the rate of decay.

Recommendations: The structure appears to be in good condition and well maintained. The building has the capacity, structurally, to support the loads associated with its current use.

In order to prevent the possible collapse of the porch roof, serveral steps should be taken:

- The ledger should be repaired or replaced (Note: at the time of this revision, this has been completed).
- In order to preserve the limestone facade, the pockets for the beams should be retrofitted to allow for expansion of the wood, or the beams should be supported by another means, such as a ledger.
- The mortar around the post bases should be removed, and spacers should be installed between the wooden posts and the masonry bases to provide for drainage and drying of the wood.

Deterioration at ends of ledger support on porch

Cracks visible in exterior masonry above socket for rough cedar beam

Seperation of ledger from wall at the north end of the porch. Nails are pulling out from the masonry

Deterioration at post bases on porch

Scuppers are wetting face of exterior wall

DRT Library

The DRT Library, connected to the west end of Alamo Hall, was constructed in three phases. The first building, designed in 1949 by Ayres & Ayres Architects, is the central volume of approximately 2,300 sq. feet connecting to Alamo Hall. The first addition to the Library in 1970 under the direction of architect Harvey P. Smith, Jr. added and additional 1,834 sq. feet to the building. Smith was also responsible for the second addition in 1974 of 660 sq. feet that filled in the space to the south of the first Library wing and the exterior wall of the compound. In 1977 the adjacent compound wall was raised nine feet to conceal mechanical equipment on the roof of the new addition.

The Roof

Background: Since this building was constructed in the 1950's, its flat roofs are all of modern materials. The most recent roof replacement was in 2000.

Description: Modified bitumen roof.

Existing Conditions:The roof is in good condition.

Recommendations: Inspect roof every 5 years, making appropriate repairs, if necessary.

Exterior Walls

Background: Constructed in 1953, with three subsequent additions, the building design appears to have been an attempt to pay homage to the Shrine by not eclipsing it, and to stay in the "Spanish" vocabulary of the commerative buildings. Set along the south wall of the complex, its expansions to the north have been obscured by shrub plantings. A large oak tree that spreads in front of the library also minimizes its presence on the site.

With three additions to the building over the years, one can expect visible differences in the scale and appearance of the limestone walls, and, indeed, this is true. The north addition, with the same random ashlar pattern of stone, is constructed of smaller stones, and has almost no cap to the top of the wall.

West exterior wall of Library

In about 2004, repairs were made to the concrete porch. The tile roof was leaking, deteriorating the concrete roof deck and allowing water to reach the cast concrete purlins, which were failing horizontally due to rusting of the reinforcing bars. The roof was removed, decking and purlins repaired, and new waterproofing installed under the tile roof.

The three additions fo the Library bear testament to its growth as an archive over the years. As families divest themselves of their collections, the need for accommodating these resources grows. A new program for the Library projects its spatial needs to be 15,000 square feet, three times the present area. See Appendix for this program.

By adding a second level to Alamo Hall, some of this need for expansion can be temporarily addressed. In addition, space for children's programs and the Distance Learning Center that were initially programmed for the Library have been located in the new support building planned for the northeast corner of the site. With more meeting spaces being created in the new support building, the possibility of future expansion of the Library into the first floor of Alamo Hall should also be considered.

Description: The DRT library building is a rectangular building connected to the Alamo Hall building at its rear. It is faced with random ashlar limestone, and has an entrance façade on the west wall that extends several feet out from the main west wall. The façade has a shallow cast concrete porch covered by a Spanish clay tile shed roof with exposed rafters and a horizontal lintel that rests on two large, square, white columns. The columns rest on a low L-shaped limestone walls. The façade base corners have slight limestone reveals. The façade is topped by a scrolled, stepped parapet that continues along the recessed wall on the south side of the façade. There is also a decorative recessed octagonal shaped cast concrete element in the center of the façade between the shed roof of the porch and the parapet.

The west wall to the south of the façade steps down about one foot from the height of the façade and steps back about one foot as well. The west wall to the north of the façade steps down from the height of the façade and steps back several feet. It is topped by a thin parapet and scuppers above the two windows.

The north exterior wall contains no windows and is topped by a thin parapet and four scuppers. At the corner of the east wall and northern-facing wall that connects the Library with Alamo Hall is a small shed-roof lean-to with a single window and a Spanish clay tile shed roof that hits the wall about two to three feet below the top of the main wall behind.

Existing Conditions: The walls are in good condition. The mortar and stone appear to be performing well.

There is mold on the stone, most likely encouraged in its growth by the overhanging oak tree limbs, which keep the humidity high under their spread.

Along the west, major façade of this building, there is a planter against the wall. The whole area around the southwest portion of this façade appears to be damp

Top of north wall showing a scupper. Note mold growth on stone surfaces

The flagstone floor of the entry porch is in poor condition. Stones are cracked, mortar is missing, and the floor is uneven.

Recommendations: Continue to clean the walls, using a biocide that is re-applied periodically, as needed.

Continue to monitor the condition of the repairs on the concrete porch.

Examine the walls periodically, about every 5 years, performing repairs as necessary.

Investigate the planter at the south side of the west façade to make sure it is not causing water to migrate to the exterior walls of the building. If this is the case, line the planter with waterproof material to prevent this condition.

Correct the flagstone porch floor by pulling up the flagstone and re-setting it to correct the broken stones and uneven surface, grinding some of the flagstones, if necessary to reduce the uneven surface.

Doors, Hardware and Trim

Background: The existing entrance doors appear to be the original ones. A second pair of doors has been added to the inside of the opening to create a vestibule.

Exterior wood entrance doors to Library

Double metal doors on the east side of the north addition access the fire suppression system in its mechanical room.

After the Library was constructed and connected to Alamo Hall, the exterior door of Alamo Hall bacme an interior entrance to the Library from this space.

Description: The main entrance door to the Library is located on the west façade behind a small lean-to porch. The double, solid wood doors are divided into 4 panels each, with curved elements at the corners of each pane.

A metal double service door is located on the east wall.

The door to Alamo Hall is described under the Alamo Hall section of the Report.

Existing Conditions: The wood doors appear to be in good condition. They have been stained the dark brown color, consistent with all sash on the site.

The metal doors are also in good condition.

The doors in the vestibule created at the entrance are too close together, making it difficult to pass through them, and almost impossible for the handicapped.

Recommendations: There are plans to expand the vestibule, moving the second pair of doors out away from the wooden entrance doors. This should be pursued.

Continue periodic maintenance.

Windows, Hardware and Trim

Background: The windows in the building are original to each building sequence. The later windows, though in more simple openings, are similar to the original ones.

Description: All windows are wood frame and sash with iron grilles. The two windows flanking the entrance porch are narrow three-lite windows with recessed cast-concrete scallop shells above. To the right of the façade there is one window, and to the left of the façade the wall contains two narrow six-lite windows.

Window flanking entrance porch. Note places were brown paint has flaked off.

The East wall along the rear of the library has one window and at the interior corner of the east wall and the connecting wall to Alamo Hall is a single window on the small lean-to structure.

All of the windows on the site have been painted the same color, a dark brown, which seems inappropriate for this building.

Existing Conditions: The wood in original three-lite windows flanking the entrance appears to be in good condition, however, the silicone caulk at the intersection of the sash and frame indicates problems with leaks.

In general, the windows are in good condition, however, the paint is beginning to flake off.

Recommendations: Address the infiltration problems at the front, original windows.

Repair all other windows as necessary

Repaint windows, checking to see original color and matching that.

Interior Walls

Background: The materials in the interior walls vary, because of the various additions made to the 1952 building.

Description:The walls of the original building are plaster on masonry substrate. The north addition walls are gypsum board, and the south addition walls are gypsum board and plywood.

Existing Conditions: The walls are in good condition. There are present plans to renovate the building, changing the layout of functions and modifying the walls in the central reading room. These plans include creation of a large glass foyer at the main entrance that allows easier access while retaining double doors as a climate buffer. This room will also serve as a reception area and will be flanked by recep tion desks.

Recommendations: Continue maintenance

Interior Floors

Background / Description: The original and added floors in the library are concrete covered in carpet, which is in good condition.

Existing Conditions: There is a mysterious source of water that has appeared in the main reading room in two locations. Maintenance staff have vacuumed the water and, by the next day, the area has been dry. This phenomenon happened recently, and previously in 1997 and 2001. It's timing does not seem to relate to the amount of rain at the time.

Recommendations: Remove carpet and inspect slab in areas where moisture has appeared to check for cracks or other sources of moisture.

It is assumed that all of the flooring will be replaced when the interior renovation is accomplished.

Interior Ceiling

Background: The ceilings in the Library are original to the various building phases to which they belong. There is a current plan to renovate the Library interior.

Description: The ceiling in the main reading room, the original part of the building, is plaster. The ceilings in subsequent phases are suspended acoustical, or gypsum board.

Existing Conditions: All the ceilings appear to be in good condition.

Part of the plan for the renovation includes adding a molding at the intersection of the wall and ceiling of the main reading room.

Recommendations: Since all of the details of the plan are not known, no recommendations will be included.

Structural

Background/Description: The library, located adjacent and connected to Alamo Hall, is a concrete frame structure. The foundation consists of belled piers which support reinforced concrete columns and spandrel beams at the roof. The roof is a thin concrete slab supported on steel bar joists. The ground floor is a 5" slab on grade over 6" of compacted gravel.

Two additions were built to the library, one to the north and the other to the south. Both additions are of similar construction: stiffened slab on grade, with steel columns and steel bar joist roof framing. The columns sit on the grade beams, and there are no drilled piers.

Existing Conditions: During our condition survey of the library, we noted a condensation drain line from a/c unit that is not securely mounted. Water was draining onto the roof rather than directly into the scupper. There were no other issues to report at the library.

Recommendations: Structurally, the library appears to be in good condition and well maintained. The structure appears to be performing well under the current occupancy loads.

Condensation drain line from A/C unit is not securely mounted. Water does not drain directly into scuppor, but onto the roof.

6.4 Support Area

Support Buildings

Background / Existing Conditions: The area at the northeast corner of the site, where the site corner comes together at less than a right angle has developed over the years into the location for many functions that support the operation of the buildings and site: security, maintenance, curatorial, accounting, Alamo committee meeting, site restrooms. Cars for staff and selected volunteers are also parked in this area.

Because the buildings have grown up in response to need, there is no comprehensive plan to the area, and some hazards exist, such as the Alamo Collection being stored over the maintenance area, where hazardous materials are used (Note: At the time of this revision, the Shop has been relocated).

In the course of interviewing the supervisory staff, it became painfully clear that the existing functions in this area need additional space and that area for additional activities are needed, in order to support and foster the mission and goals of the DRT. Some of the space requirements noted include:

Curatorial: office, workspace (450+sf), archive (1500+sf) and storage vaults (900+ sf).

Educational: office, storage for brochures/ education material, educational displays, TV studio and editing, auditorium (250+ seating).

Special Events: Catering kitchen on site.

Horticultural: office, storage, greenhouse.

Library: storage

Maintenance: office, workspace, woodworking shop, storage for tables/chairs, storage for linen/china/glasses, storage for maintenance equipment.

Public Areas: More restrooms, drinking fountains, gathering area for school children

Security: office, duty room, lockers, private break room, private restroom, first aid room, security equipment storage

Miscellaneous: staff break room, space for future/additional offices, employee lockers, Alamo Committee Chair office(s)

Recommendations: The above information makes the need for a new building compelling. The Master Plan addresses these needs in locating a new support building north of the site, however, some of the functions, such as Security, Maintenance and Horticulture will remain in the general location of the support area, against the north wall, behind the Ampitheater. The plan is to demolish the existing buildings and construct new structures to house these functions.

Currently, the Maintenance Shop is located directly below the storage space for the Alamo Collection. In addition to structural concerns regarding the density of storage in the Collection area, the volatile and flammable materials associated with maintenance work done in the Shop presents a serious threat to the Collection. Fortunately, the Shop is in a garage-like space, open to the air, so a build-up of fumes is highly unlikely. However, immediate steps should be taken to mitigate this situation: Fire alarms, fire extinguishers, a policy of using volatile materials, including paint, away from the structure, etc. Until the new spaces are constructed, the Alamo Collection should be kept as safe as possible (Note: at the time of this revision, the Shop has been relocated).

The buildings which currently house security and maintenance will be removed for new construction.

Security Summary

Background: At present, the Alamo Security Force provides 24 hour security for the site 7 days a week. This force has developed in response to the growing needs for this type of service, both for the urban location of the site, its fame, and the safety and security needs of our contemporary society.

In December of 2006, a report entitled "Security Assessment Survey of The Alamo" by the Risk Assessment Division, Guardsmark, LLC, was was completed and submitted to the Alamo Committee.

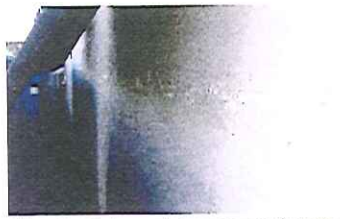
Because of the sensitive nature of the information in the report, it and its recommendations are not included in this document.

It is recommended that measures considered appropriate by the authors of the report and the Alamo Security force be implemented, and that care be taken that elements of security are integrated into the site and buildings in a way that is not distracting or detrimental to the historic nature of the site and buildings.

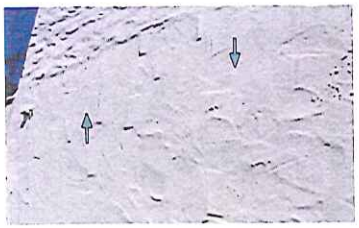
Structural

Background/Description: All of the buildings that make up the Support Area are constructed of load bearing CMU walls. The one story structures have cold formed steel "C" joists with roof decking. The two story structure utilizes steel channels with a slab on deck for the second floor, and steel framing at the roof.

Existing Conditions: Cracks were observed in a number of the cmu walls. There is an area of concern regarding the wall adjacent to the trash dumpsters. In the process of collecting the trash, the dumpsters are either being dropped or slid in such a way that they impact the cmu building wall. The wall has a horizontal crack at about eye-level on the inside surface of the wall (away from the dumpsters), which is consistent with flexural loads due to horizontal impact. The wall has most likely not been designed to sustain these repeated blows, and steps should be taken to protect the wall before further damage occurs.



Chipped paint along exterior north wall of maintenace storage room from impact from dumpsters.



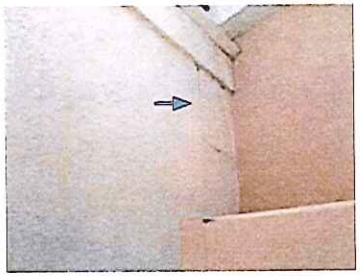
Cracks on west wall of two-story structure extending from grade level to elevation of second floor.

The office areas on the second floor of the service complex building appear to be functioning in practical terms as a storage area. The floors in this area are heavily loaded by shelving, cabinets and stored items. We feel that this is an undesirable condition, as the floor was designed for normal office loads.

Recommendations: To protect the wall adjacent to the trash dumpsters from future impact by the dumpsters a barrier, such as a high curb or pipe bollards, should be constructed.

A moratorium should be placed on putting additional items for storage in the offices on the upper floor, and as much of the material as possible should be moved out of those areas. Use of off-site storage should be considered if no storage space is available on the Alamo complex at this time.

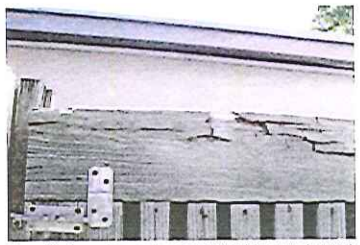
Diagonal crack in southwest corner of two-story building from floor level to level of second floor.



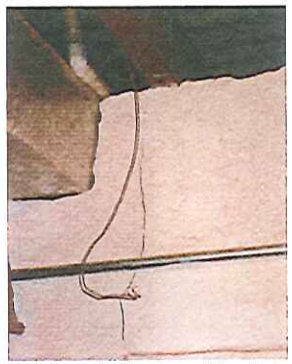
Crack in wall of kitchen adjacent to Alamo Committee room. Crack is visible on both interior and exterior wall and appears to follow masonry joint.

The location of the current support buildings is being considered for potential creation of two-story structures. The existing roof of the one story structure does not have the capacity to carry office occupancy loads. Because the existing framing bears on top of the cmu walls, it is not feasible to place additional load bearing walls on top of the existing walls and/or frame a new floor above the existing roof. One possible scheme for vertical expansion would be to remove the existing roof and replace the framing with heavier cold-formed steel members capable of carrying office loads, and a slab on metal deck. The second story could then be constructed by extending the cmu walls, or by framing the second story out of light gage steel or wood.

The previous scheme would require that load bearing partitions duplicate the layout of the floor below. The current layout has relatively short distances between load bearing partitions. If a more open plan is desired, or if the intended occupancy requires higher design loads than typical office space, demolition of the structure is indicated. The best structural system for a new building will depend in large part on the program (clear spans, intended use) for that building. Slab on deck over bar joists with either a steel frame or load bearing cmu walls is one good option, but other alternatives should be considered. Concerns such as life cycle costs also influence the selection of the most economical building system.



Top rail of wooden gate near A/C unit is deteriorated



Crack in non-load bearing partition attached to steel channel support for second floor in ground floor office

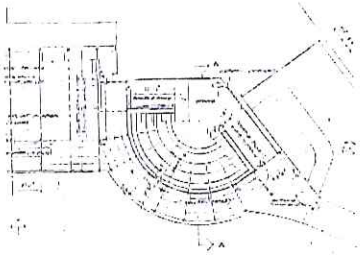
Exterior wall in courtyard is cracked at point of transition in height

Large crack in exterior limestone wall adjacent to south exit of Committee Room

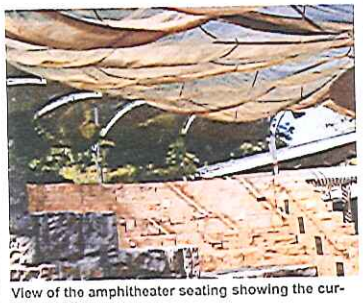
AMPHITHEATER

Background: This Amphitheater was designed by Ron Bechtol of the architectural firm of Lance, Larcade and Bechtol, and constructed in 2001, as a place to perform educational lectures for school children and other visitors.

Description: The small, semi-circular Amphitheater is constructed of limestone in a random ashlar pattern. There are five rows for seating that is covered by arcing shade screens that project from the rear wall. The seats are accessed by two flanking stone stairs. The backdrop for the "stage" consists of two limestone walls that come to a point behind center stage; these walls abut the wall of the support building. The "stage" area is covered by a circular shade screen. The floor is paved with random shaped flagstones. A walkway that follows the curve of the wall of the amphitheater seating is covered by a wooden pergola with climbing vines.



Plan of the amphitheater from 2001



View of the amphitheater seating showing the current shading systems.

Existing Conditions / Analysis: The Amphitheater has proven to be difficult to use:

- During warm and hot weather the space is too hot:
  - The stone heats up over time, exacerbating the ambient heat.
  - With the shade cloths not covering the whole area, sun also beats down directly on the limestone.
  - Though there is a small opening in the southeast wall, it is apparent that not enough breeze gets into and through the space to mitigate the heat.
- Even with a shade cloth over the speaker, the sun shines in the speaker's eyes at certain times of the day.

A green parachute has been draped over the space, as a temporary fix.

The staff of the Alamo has noted an additional problem, which is the tendency of school children to climb up to the top and up on the rear wall, posing a danger and a liability.

At the base of the problem is the idea of a limestone open air theatre in a hot, humid climate.....to retrofit, or to enclose and temper the air:

- Retrofitting would include opening up some of the southeast wall to allow more of the prevailing breeze through, the addition of misting devices for adiabatic cooling, and even, some forced air, designed in a way to minimize additional sound.
- Enclosing would include a roof, possibly translucent, with the addition of doors, and conditioned air. The problem with this approach is the inherent conflict with the installation of a solid roof and the existing shade devices and their structural supports, which are aesthetically pleasing

Recommendations: As discussed in the section of this Report on Visitation, this amphitheater has the potential to be part of the solution to managing the time and quality of a visit to the Alamo. It should be retrofitted with a solid roof, enclosed, heated and air conditioned, and equipped with audio/visual equipment, with back projection, so that it can perform as a location for live and filmed presentations. Every attempt should be made to retain as much of the original design as possible, and carry forward the aesthetics of the shade devices into the roof structure (Note: at the time of this revision, an awning has been installed).

6.5 Gallagher Building and Site

Background: A detailed history of the Gallagher Building has been included in the Appendix to this report.

In 2001, restoration and renovation of the building was accomplished under the direction of Lance, Larcade and Bechtol, Architects. The work included stabilization of the exterior and parapet, addition of space for an elevator and restrooms, HVAC, electrical and plumbing. The bottom of the wooden porch was built (the top existed), structure holding up the second floor was reinforced, and an interior stair to the second floor was added. The Houston Street façade was modified by changing a doorway into a window, to accommodate the internal stair, and a new storefront was installed on that façade.

A canopy across the Houston Street façade was constructed. On the interior, a fabric coated, curved section of wall with internal acoustic batting was designed to be placed in front of the entry, but was not constructed.

Description: This two-story building is constructed of stuccoed brick with wood windows and exterior porch. The standing seam roof over the main structure is hipped to the north and surrounded on all other sides by a parapet. It drains to the north and empties into two downspouts that take the water down to grade on each side of the north façade. On the west, windows have been inserted into the exterior wall, and louvers for fresh air intake have also been installed in the wall. Addition for restrooms, elevator, etc. is constructed of wood framing with a stucco exterior finish. The wood porch with historic detailing is painted, with a painted standing seam roof. To the east, a small courtyard is enclosed by fence with painted steel pickets suspended from brick piers.

Originally, the ground floor appears to have been wood framing over a crawl space, but it has been replaced with a concrete slab. The second story and roof are wood framed.

Structural Existing Conditions: Most of the structural framing of the building was covered by architectural finishes and inaccessible to observation. Signs of distress in the structure of the building were not noticed, and it seems to have adequate capacity for its current usage.

At several locations, signs of deteriorating wood due to water infiltration were noticed. They do not represent an area of structural concern, but leaks should always be addressed promptly. Left unattened, leaks will eventually lead to larger and potentially serious problems. Rotten trim was noticed at the north window and at the window along the stairs. There is also rotten wood in the floor below the window adjacent to the elevator.

The exterior masonry wall has been painted and appears to be in good condition. At the east end of the south wall, there is some pealing paint. It appears that moisture is wicking up into the wall from below grade at this locations. There are a few hairline cracks in the plaster on the west wall of the stairs that do not appear to be structurally significant.

The wood porch shows some signs of weathering but appears to be in good condition.

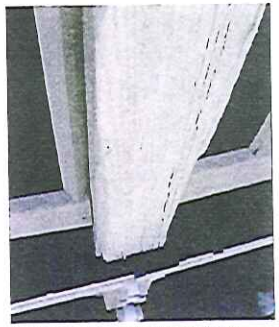
Recommendations (Note: at the time of this revision, these were completed):

Replace rotten wood trim in north window and window by stairs. If allowed to deteriorate, the glass could fall out of the window.

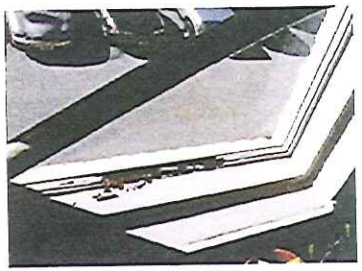
Replace rooten wood in floor adjacent to elevator. This condition should be repaired so that it does not deteriorate further and become a walking hazard.

Wood posts of the porch should be painted regularly to protect them from weathering and help prolong their service life.

Because the structure was originally a home, it is recommended that the use of the upper floor be restricted to relatively light loading. Placing heavy items upstairs or using the space for storage is not recommended.



Weathering of wood post at porch



Rotten trim at window by stairs

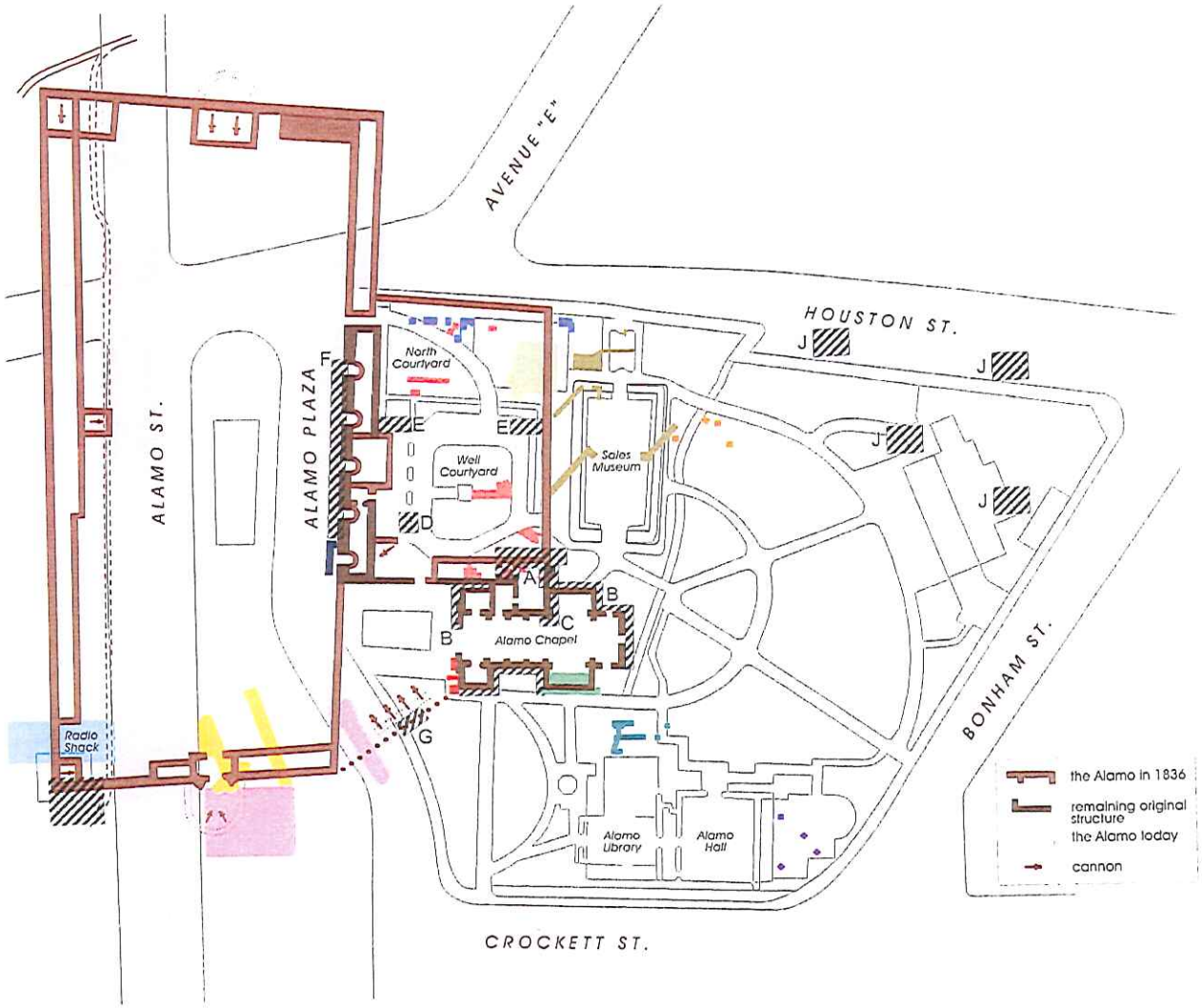
Paint peeling from south wall

6.6 Site Archaeology

As a State-Owned Property, the Alamo is subject to the Antiquities Code of Texas, which sets as a Public Policy the location, protection and preservation of all sites, objects, buildings, of historic, educational, or scientific interest. The General provisions of the Code go on to identify specifics about what comes under this Code, however, it is clear that this historic site qualifies. Also, as a property owned by a "Political Subdivision", the City of San Antonio, Alamo Plaza and the streets surrounding the Alamo Site also come under this jurisdiction.

The Alamo Compound has undergone recorded archaeological testing in search of information about its past since 1966. Some tests, such as Ivy and Fox 1979-80, Ivy 1979-80, Briggs 1991, and Meissner 1995, were in conjunction with construction or preservation projects.

In conjunction with the projected work associated with this Master Plan, additional areas needing investigation have been identified, and are noted on the accompanying plan.



Future Excavations

- A Foundation of missing sacristy walls
- B Moisture barrier at base of walls
- C Interior floor interpretation
- D Location of arches
- E Location of courtyard wall and east compound wall
- F Verify location of arches
- G Verify location and profile of palisade
- H Location of southwest corner
- J Test pits in area of new construction

Excavations at the Alamo

- Greer 1966 [1967]
- Sorrow 1970 [1972]
- Schuetz 1973 [1973]
- Adams and Hester 1973 [1973]
- Fox et al. 1975 [1976]
- Fox 1977 [unpublished report at CAR]
- Eaton 1977 [1980]
- Ivey and Fox 1979-1980 [1997]
- Ivey 1979-1980, 1983 [notes on file at CAR]
- Nickels 1980 [1996]
- Fox 1988-1989 [1992]
- Briggs 1991-1992 [2006]
- Meissner 1995 [1996]

6.7 Cost Estimate Summary

Summary			2007		2012
New Buildings					
Visitors ctr. Learning, support	43840	300			13,152,000
Auditorium	8,530	400			3,412,000
Restoration, Maintenance of Exg. Bldgs					
Shrine					11,236,725
Palisade in front of Shrine					138,000
Long Barrack					1,248,000
Museum					1,620,000
Alamo Hall, add second floor for library					2,063,933
Library					160,000
Arcade					1,281,000
Walls					378,000
Site					1,450,000
Gallagher Building					313,000
Educational programs					
Electronic Communication					1,500,000
Special Programs					2,350,000
Sub Total					**40,302,658**
soft costs					**10,075,665**
Total					**50,378,323**

6.8 Condition Assessment Report

JAMES T. RODRIGUEZ CONSULTING ENGINEERS, INC.
412 WEST RHAPSODY DR.
SAN ANTONIO, TEXAS 78216-3110 (210) 496-0900 FAX (210) 496-0430

10 February 2007

Ms. Carolyn Peterson, FAIA
Ford Powell & Carson, Inc.
1138 East Commerce
San Antonio, Texas 78205

Subject: *THE ALAMO CONDITION ASSESSMENT REPORT*
San Antonio, Texas

Dear Carolyn:

We have completed a condition assessment of The Alamo grounds and facilities. This assessment considered the conditions of the following existing systems:

- Heating, ventilating, and air conditioning systems.
- Plumbing fixtures, piping and site utilities.
- Interior and exterior lighting systems.
- Electrical power distribution systems, including site utilities.
- Security and communications systems.
- Fire protection and alarm systems.

SUMMARY

Given the historic nature of The Alamo and its grounds, the overall condition is good. However, there is room for improvement, and specific recommendations are made in this report. While The Alamo cannot operate without the air conditioning, plumbing, lighting and electrical systems, the importance of keeping these support systems from being distractive to the overall appearance of the facilities cannot be overstated. It is important that the historic nature of The Alamo and its facilities are not compromised through the distractive appearance of equipment.

Overall Assessment.

Lighting. Much of the interior lighting within the public areas of the Shrine and other facilities uses incandescent lamps. Wherever possible, more efficient compact fluorescent fixtures should be considered, not only for their energy efficiency, but also for their relatively long life. Additionally, existing older fluorescent fixtures should be upgraded with more efficient T-8 fluorescent lamps with electronic ballasts.

Central Monitoring. A centralized system is warranted to assist in monitoring equipment status and environmental conditions. With advancing digital electronic technology, these types of monitoring systems are becoming more prevalent and easier to operate. Implement a centralized energy management system to monitor conditions of air conditioning equipment, space temperatures, operational status of pumps, etc.

Power/Gas Use. There are three areas of electrical racks, all exposed to the exterior, and on the inside face of The Alamo grounds exterior walls. These racks consist of electrical gutters, junction boxes, panels, disconnect switches, and electric meters. All of the electrical power serving The Alamo comes from the CPS Energy underground network, which provides power at 208 Volts, 3 Phase. Peak power consumption for the north electric service, which is a summertime condition, approximates 430 Amps (136 KW). Peak power consumption for the south electric service, also during the summer, approximates 300 Amps (94 KW). Under an ideal

condition, it would be better to have only a single electric service entrance for the grounds, with a switchboard for distribution to the individual buildings. However, it would be difficult to conceal such equipment and the additional underground electric feeds that would be required for such a system would be difficult because of the restrictions to underground excavations.

Gas use on site is limited to the Alamo Hall / Library and the Support Center Complex, and reflects primarily space heating. The gas piping and distribution system appears to be in relatively good condition.

Site Water & Sewer Piping. Much of the existing on site water and sewer piping is quite old. Where leaks have occurred, repairs have been made. Generally, there is not a preponderance of problems with this system, but because of the system age, consideration should be given to replacing main runs of piping when conditions warrant.

Plumbing. Except for the plumbing fixtures installed in the basement of the Gift Shop / Museum and the public restrooms in the Support Center Complex, most plumbing fixtures are residential in quality.

Air Conditioning Equipment. Beginning in 1999, much of the air conditioning equipment serving The Alamo complex has been replaced and upgraded. As a result, the overall facility air conditioning systems are in relatively good condition. A maintenance service contract has been entered into with Gillette Air Conditioning Co., Inc. (hereinafter referred to as "Gillette"). This maintenance service contractor performs quarterly checks on the equipment, repairs equipment when called, and performs other maintenance. Many of the prior air conditioning problems have been corrected through the institution of this regular maintenance program. Filter changing is accomplished by Alamo maintenance personnel.

- Gillette has completed a review of all the equipment and has judged the system to be operating well and with few problems. There have been some items identified that require attention for eventual correction. A copy of the February 12, 2006 report from Gillette is enclosed herein. Findings and recommendations made in this report have been incorporated within this document.

Fire Protection and Alarm Systems. Only the Gift Shop / Museum has a fire sprinkler system, which serves the basement. The Vault at the Library uses a "clean agent" extinguishing gas system, which is now being upgraded to replace an old Halon system. Both of these systems require monitoring, either onsite by the Security Office or by an off site licensed monitoring company.

Security and Communications Systems. Because of the presence of the Alamo Rangers, much of the need for elaborate security systems is diminished. However, there are still sensitive areas of artifact storage and other areas that are and should continue to be monitored. It is recommended that the fire alarm systems be incorporated into the security systems. Communications systems with the telephone systems and internet capability are good.

RECOMMENDATIONS

Site.

a. There are two (2) separate electrical service entries for The Alamo grounds; the "north service" at the north wall, just northeast of the Gift Shop/Museum, near the acequia and the "south service" on the south wall, near the southwest corner of the Library. The electrical services consist of gutters and disconnect switches that serve building electrical panels for distribution. The electrical equipment is exhibiting signs of rust, and action

should be taken to remove the rust and paint the gear as required as well as clean the interiors of panels, boxes, and switches from debris and dust. It would also be prudent to re-torque electrical connections of wiring at the switches and other electrical gear on an annual basis and perform an infrared scan of the electrical panels and switches to make sure that no "hot spots" are developing. Additions to the Support Center Complex will likely require upgrades to the north electrical service.

b. There is another assortment of electrical boxes located at the northwest corner of the grounds, adjacent to the north exit to the Long Barracks. An electrical service at this location, serves holiday decorations near The Cenotaph at Alamo Plaza. This electrical feed to Alamo Plaza consists of a vertical mast head that routes electrical cables overhead to an electric rack at Alamo Plaza by way of a lighting standard. It was reported that this routing was installed by the City of San Antonio as a "temporary measure" over 15 years ago and has never been made permanent. This overhead feed is an eyesore and is a violation of the City's own Electrical Code amendments prohibiting overhead electric within the downtown area. It is recommended that the Executive Director write a letter to the City of San Antonio Director of Public Works requesting that the "temporary" overhead electrical service feed be removed. Since this "temporary electric" was installed by the City and is for its use, any relocation should be at the expense of the City.

c. Site Lighting in Trees. Due to the height of existing site lighting installed in trees, it is difficult to replace burned out lamps. Most of these fixtures are beyond the reach of ladders. It is recommended that an Electrical firm, that has an articulating boom lift bucket (or extra tall ladder), be contracted with to replace lamps at periodic intervals (twice yearly). Additionally, the maintenance contract should include the regular inspection of the lighting fixtures, particularly tree mounted and in grade mounted light fixtures, to initiate repairs in a timely manner. Although a project to improve landscape lighting was completed for the southern half of the grounds, improvements to the northern half of the grounds remains to be done.

d. Alamo Plaza Side Lighting. There have been some lighting improvement projects implemented within the past several years to upgrade lighting at the Alamo Plaza Side of the grounds. However, there are improvements that could be made through upgrades and replacement to the City owned lighting standards to add better definition to the illumination of the exterior of the Shrine, Long Barracks, and outside walls. John Bos with Bos Lighting Design, in Houston, had made recommendations in this area that have yet to be implemented. It is my understanding that The Alamo was to finance the new lighting standards and light fixtures, but that the City would take over their operation and maintenance. Negotiations with the City and CPS Energy would be required to make this project a reality.

Shrine.

a. Shrine Air Handlers. Access doors to the control compartment of the air handlers are missing handles. As a result, the doors remain ajar and allow for the introduction of dust and debris into the control compartment. Provide new handles from the air conditioning unit manufacturer that are compatible with the type of door mechanism (shower door style) installed. Vacuum the control compartments of the air handlers.

Long Barracks.

a. Debris. The bottoms of condensing units located on grade are beginning to accumulate leaves and other organic debris. Over a period of time, this debris can contribute to

increased corrosion and reduced performance of the unit. It is recommended that this debris be cleaned out from within the unit casings on a regular (semi-annual) basis.

Gift Shop/Museum.

a. The existing Trane air handler and rooftop (northeast) condensing unit are almost 20 years old. Repairs have been increasing on these units over recent years and the units are rapidly approaching the end of their useful life. It is recommended that this system be replaced within the next five (5) years.

b. There is an existing abandoned wall mounted fan & coil unit on the wall of a first floor office, at the southeast corner of the building, that should be removed along with a corresponding Ruud condensing unit located on the southeast corner of the east roof. A window air conditioning unit (WAC) that has been provided to serve this office is an eyesore, as it is visible to visitors nearby. New split system air conditioning equipment, consisting of a console type fan & coil unit and exterior condensing unit, should be provided to eliminate the appearance problems caused by the window air conditioner.

c. There is an abandoned air handling unit, overhead above the ceiling of a first floor office on the southeast corner, that should also be removed. This unit was used to serve the Gift Shop proper and is no longer needed. There is also a smaller air handling unit overhead within the same office area that serves the office itself. This unit is approaching the end of its useful life and should be replaced within the next five (5) years.

d. Fire Sprinkler System. The fire sprinkler system alarm-check valve in the basement has been tagged as not being in compliance with the Fire Code because the tamper switch and flow switch not being properly supervised by the fire alarm control panel. This discrepancy has been noted for several years' worth of tags from annual inspections. The existing security system should be modified to include the monitoring of the fire sprinkler flow switch and tamper switches. The inspection tag also notes that the flammable items stored in the basement area are stacked too high. The Fire Code requires that stored items be kept a minimum of 18 inches below the ceiling and/or sprinkler head.

e. Rooftop Air Conditioning Units Corrosion. Components exposed to weather are exhibiting signs of rust. It is recommended that the exposed components be treated for rust, then painted with a rust preventative type paint.

Alamo Hall / Library.

a. Fire Protection System. A new 3M Brand, Novec 1230 Fire Protection System is being installed to serve the Vault. This system is a replacement for the old Halon system, which is now obsolete due to the problems with the fire extinguishing agent. Once the system is up and operational, there should be a more sophisticated fire alarm/security system to monitor this system.

b. Vault Environmental Control. The existing vault environmental control system consists of a Copeland condensing unit that is more than 20 years old coupled with a relay logic control system to monitor and control temperature and humidity. With advancements in technology, there are now more sophisticated refrigerant condensing unit systems with better refrigerant modulation as well as digital controls to more accurately monitor and control the environmental conditions within the Vault. New equipment and a monitoring and control system should be considered within the next five (5) years.

c. Plumbing Fixtures. The Alamo Hall is frequently used for educational seminars and other meetings where large numbers of the public are present. The existing restrooms that serve the Alamo Hall are not adequate in both quality and quantity; each restroom has only one (1) flush tank type water closet and one (1) lavatory. The existing water closets should be replaced with new flush valve water closets and existing lavatories should be replaced with newer commercial quality lavatories. For a gathering of 60 to 100 people, Plumbing Codes would calculate the occupant load at 30 to 50 males and 30 to 50 females. For such an occupancy, required plumbing facilities would include a Women's Restroom with 2 Water Closets and 1 Lavatory. For a Men's Restroom, the requirement would include 1 Water Closet, 1 Urinal, and 1 Lavatory. It would also be recommended that the restrooms be made ADA compliant.

Support Center Complex.

a. Rooftop Air Conditioning Units Corrosion and Preventive Maintenance. Miscellaneous grilles, fan guards, other components exposed to weather and exposed gas piping are exhibiting signs of rust. It is recommended that the exposed components be treated for rust, then painted with a rust preventative type paint. For all units on grade that are subject to receiving debris from falling leaves, the leaves and other debris that might accumulate within the unit should be removed.

b. PVC Piping. Paint or replace existing exterior PVC condensate drain piping. The PVC piping exposed to the weather will become brittle over a period of time, due to exposure to ultraviolet rays from the sun. This degradation can be minimized through painting the PVC pipe with latex paint. If the PVC piping is already brittle, then the piping should be replaced with copper or galvanized steel drain pipes.

c. Greenhouse Drain. The drain immediately in front of, and to the south of, the Greenhouse collects rainwater runoff from the surrounding paved areas, some drainage from overflows in the Greenhouse, and other similar discharge. The drain system does not adequately discharge to the existing storm water collection system resulting in frequent backups. It is recommended that an improved storm water collection system be provided with direct connection to existing storm sewers in the adjacent street.

d. Public Restrooms. Restroom plumbing fixtures were replaced approximately six (6) years ago, in 2000, along with supporting plumbing piping. This work eliminated many of the clogs, backups and other problems experienced at the time. While the plumbing fixtures appear to be in good condition, they receive a tremendous amount of use from the visiting public. Problems can still occur with the plumbing fixtures because of abuse by the public. Based on the current rate of use, it may be necessary to replace these fixtures within the next ten (10) years.

Gallagher Building.

a. Water Heater. There is evidence of possible leaking at the water line serving the water heater. Corrosion is building up and attention should be given to correcting this condition.

b. It was reported that one or two of the outdoor heat pump condensing units had compressors that required replacement within the past year. From all reports, the heat pump units appear to be running satisfactorily. However, it would be prudent to monitor these units more closely.

OPINION OF PROBABLE COSTS.

Enclosed is an itemized breakdown of recommendations. Each corrective action is identified as to whether the item should be corrected immediately (NOW), within the next 3-5 years, or within the next 5-10 years.

If there should be any questions, please do not hesitate to contact me.

Sincerely,

James T. Rodriguez, P.E.

Enclosures: Opinion of Probable Costs
Alamo Complex Air Conditioning Equipment
Drawings of Site & Buildings
Gillette Air Conditioning Co., Inc. Letter of February 12, 2007 w/ Attachments

6.9 Air Conditioning Equipment

ALAMO AIR CONDITIONING EQUIPMENT

BUILDING	MARK NO.	LOCATION OF EQUIPMENT	MANUFACTURER	MODEL NO.	SERIAL NO.	YEAR MANUF	REMARKS
Support Center	RTU SC-1	Parking, Outside Storage 102	YORK	D3CG090N13025G	NMFM135670	1998	
Support Center	RTU SC-2	Roof of Curator's Office	TRANE	TCC018F100BA	L2045UG2H	1994	
Support Center	HP SC-3	Roof of Curator's Office	CARRIER	38YDB036300	1101E28044	2002	
Support Center	AHU SC-4	Wood Shop	CARRIER	FB4ANF024	0801A78144	2002	
Support Center	AHU SC-5	Curator, 2nd Floor, Hall Closet	CARRIER	FV4ANF003000ABAA	0801A58077	2002	
Support Center	HP SC-6	Roof of Curator's Office	CARRIER	38YRA024320	4100E02000	2002	
Support Center	AHU C-1A	Committee Room, Closet	CARRIER	FV4ANF003	0802P64278	2002	
Support Center	HP C-1	Committee Room, Exterior	CARRIER	38YDB036-301	0502E03061	2002	
Gift Shop/Museum	AHU M-1	Basement	TRANE	SRUB-C106-F	T92C00830	1987	
Gift Shop/Museum	CU M-2	Roof, East, NE Corner	TRANE	CAUD-B102-A	T92103551 2B6-0	1987	
Gift Shop/Museum	RTU M-3	Roof, East, Center	CARRIER	48HJD008FS-531DA	0500G30352	2000	
Gift Shop/Museum	RTU M-4	Roof, East, SE	CARRIER	48HJD008FS-531DA	0500G30351	1999	
Gift Shop/Museum	CU M-5	Roof, East, SE Corner	RUUD	2 Ton	Unknown	1980?	Abandoned
Gift Shop/Museum	HP M-6	Roof, West, SW Corner	CARRIER	38YCC024300	0300E19572	2001	
Gift Shop/Museum	CU M-7	Roof, West, SW Corner	CARRIER	38CKC018330	1101E14938	2000	
Gift Shop/Museum	RTU M-8	Roof, West, NW	CARRIER	48HJD007GS-531DA	0500G20460	2000	
Gift Shop/Museum	RTU M-9	Roof, West, SW	CARRIER	48HJD007GS-531DA	0500G20465	2000	
Gift Shop/Museum	FCU M-10	Office, 1st Floor, S, By Stairs	LENNOX	C15-65-00-1	5187L6350	1987	Abandoned
Gift Shop/Museum	AHU M-11	Cash Room, 2nd Floor, S	CARRIER	40A0018700BU	P1A14029	1981	
Gift Shop/Museum	AHU M-12	OH, Business Office, 1st Floor	LENNOX	HS24-211-2P	5192D16205	1987	
Gift Shop/Museum	AHU M-13	OH, Reception, 1st Floor	LENNOX	GCS10-053-75-3Y	5487J00842	1987	Abandoned
Gift Shop/Museum	FCU M-14	Conference Room, 2nd Floor	FIRST CO	24DFCH2.5-246	Unknown	2000	
Gift Shop/Museum	CU M-15	Roof, West, NW Corner	CARRIER	38YCC024300	0900E242	2000	
Gift Shop/Museum	WAC M-16	Office, 1st Floor, SE	Unknown	Unknown	Unknown	2004	
Long Barracks	HP LB-1	Exterior, North of Sick Room	CARRIER	38YDB060-300	2401E07733	2001	
Long Barracks	HP LB-2	Exterior, North of Sick Room	CARRIER	38YDB060-300	2401E07733	2001	
Long Barracks	AHU LB-1A	Sick Room	CARRIER	FV4ANB006	1901A68398	2001	
Long Barracks	AHU LB-2A	Sick Room	CARRIER	FV4ANB006	1901A68413	2001	
Long Barracks	FCU LB-3	OH, Old T/R, North of Theater	CARRIER	42DE16	Unknown	2001	
Long Barracks	CU LB-T	Exterior, North of Sick Room	CARRIER	38EZA048-500	3900E02241	2001	
Library	AHU-27	Halon Room, Vertical	CARRIER	FB4ANF048	0901A76004	2001	
Library	CU-27	Exterior, East of Halon Room	CARRIER	38EZA048-501	3900E02224	2001	
Vault	FCU-28	Halon Room, Overhead	MAGIC-AIRE	36HBWLC	W060367696	2005	
		- Dehumidifier	MUNTERS	HC150	Unknown	1992	
		- Humidifier	RESEARCH PROD	350	Unknown	1992	
Vault	CU-28	Exterior, East of Halon Room	COPELAND	H3AH0200TAC001	Unknown	1980?	
Library	RTU-30	Roof, South	CARRIER	48HJD005GS-541	0402G20308	2002	
Alamo Hall	RTU-31	Roof, Alamo Hall	CARRIER	48HJD008GS-541	0302G50575	2002	
Alamo Hall	RTU-32	Roof, Alamo Hall	CARRIER	48HJD008GS-541	0302G50574	2002	
Library	RTU-33	Roof, Alamo Hall	CARRIER	48HJD008GS-5	0302G50573	2002	
Shrine	AHU SHR-1	Mezzanine, North	CARRIER	39LA08ABABP-AVP29	4199G00146	1999	
Shrine	AHU SHR-2	Mezzanine, South	CARRIER	39LA08ABABP-AVP29	3999G00187	1999	
Shrine	CU AS-2	Roof, North	CARRIER	38AK07-511	4199G00146	1999	
Shrine	CU AS-3	Roof, North	CARRIER	38AK07-511	3999G00187	1999	
Shrine	CU AS-4	Library, NW Corner	RUUD	UAMB-060JAZ	6299M0904	2004	
Shrine	AHU AS-4A	Closet, East End	RUUD	UBMK-25J185FA	150411061	2004	
Shrine	CU AS-5	Roof, North	CARRIER	38AK07-511	3999G00163	1999	
Shrine	CU AS-6	Roof, North	CARRIER	38AK07-511	3999G00177	1999	
Gallagher	AHU G-1	Mech Room, 2nd Floor	CARRIER	40RMQ012B6HC	0902F38851	2002	
Gallagher	AHU G-2	Mech Room, 2nd Floor	CARRIER	FV4ANB006	0902A09687	2002	
Gallagher	HP G-1A	Roof, North	CARRIER	38YCC'060540	0202E01115	2002	
Gallagher	HP G-1B	Roof, North	CARRIER	38YCC060540	0202E01117	2002	
Gallagher	HP G-2	Roof, North	CARRIER	38YDB60300	0902e04645	2002	

6.10 Work and Maintenance Schedules

Preservation Plan	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10	Year 11	Year 12	Year 13	Year 14	Year 15
Shrine															
Roof leaks	X									X					
Replace Roof															
Parapet Leaks	X														
Hatch at Sacristy	X														
Walls/Façade(Ext)												X			X
Monitor Moisture	X		X			X			X						X
Mortar Repair	X				X					X					X
Stone Repair	X				X					X					X
Poultice	X		X			X			X			X			
Damp Course	X	X	X	X	X	X							X		
Anti Fungal			X					X							
Clean Mold/walls			X							X					
Lower grade		X													
Soil Salt Monitor	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Interior Walls															
Clean	X														
Remove Cement	X														
Remove/Replace Mortar	X														
Remove Cement Slurry			X												
Repair Stones	X														
Poultice	X		X		X		X		X		X		X		X
Patch where core drilled	X														
Repair Door stone		X													
Replace Door Transom		X													
Floors															
Interpret orig.fl.level					X										
Lower grade at Façade			X												
Ceilings															
Repair leak damage			X												
Conserve Sacristy clf.			X												
Analysis of cracks	X														
See reconstruction															
See Archaeology															

Preservation Plan	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10	Year 11	Year 12	Year 13	Year 14	Year 15
Long Barrack															
Replace Roof			X												
Walls															
Repoint, Int and Ext.		X													
Clean exterior		X								X					
Anti-fungal		X					X					X			X
Monitor and repair		X					X					X			X
Remove paving at base			X												
Repair damamged stone	X														
Replace sills		X													
Damp Course					X										
Floors															
Smooth edges															
Doors															
Research locations															
Reinstall at hist. loc.															
See reconstruction															
See Archaeology															
Gift Museum															
Walls, Exterior															
Repoint, clean			X												
Repair damaged stone															
Monitor and Repair					X					X					X
Repair mortar at Belt Course			X												
Monitor Cast Stone			X					X				X			
Clean and repair Cornice			X												
Clean and repair Wall Caps			X												
Walls, Interior															
Repair Plaster	X														
Test and Paint Historic Color	X														
Floors															
Patch holes and divots	X														
Ceiling															
Paint Historic Colors	X														

Preservation Plan	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10	Year 11	Year 12	Year 13	Year 14	Year 15
Arcade															
Treat and repoint walls	X														
Repoint	X														
Cover with Ivy	X														
Inspect and replace vigas	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Perimeter Walls															
Repair Deteriorated Stones	X														
Repoint and Treat			X												
Damp Proof High Side	X														
Cover with Ivy			X												
Correct rough flagstone															
Alamo Hall															
Roof															
Inspect, oil, and repair		X			X			X			X			X	
Correct Downspout	x														
Exterior Walls															
Repoint				X											
Clean and Treat				X											
Repair bases of Columns				X											
Moisture Barriers	X														
Correct porch beams															
Windows															
Repair and Repaint Hist. Col.				X											
DRT Library															
Exterior Walls															
Clean, Treat			X					X					X		
Investigate Planter west wall	X														
Correct Flagstone	X														
Windows															
Correct Infiltration	X														
Floor															
Investigate slab for leaks	X														
Gallagher Building															
Exterior Walls															
Correct Leaks, NW Corner	X														
Windows															
Correct Leaks, West	X														

Maintenance Monitoring and Ongoing Repairs	Ongoing	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10	Year 11	Year 12	Year 13	Year 14	Year 15
Shrine- Exterior																
Soil Salt Monitoring		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Monitor and repair façade				X			X			X			X			X
Apply anit-fungal						X					X					X
Door and Window maintenance		X				X					X					X
Shrine- Interior																
Monitor salts on surface of walls		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Continuing poulticing		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Vacuum walls every 6 months		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Vacuum floors	X															
Long Barrack																
Mold and dirt cleaning						X					X					X
Door and Window maintenance		X				X					X					X
Gift Museum																
Clean and apply biocide to exterior walls						X					X					X
Continue inspection and repointing of Exterior Walls						X					X					X
Door and Window maintenance (paint with historic colors when necessary)	X															
Clean out light wells in basement, every 6 months		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Arcade																
Monitor vigas and replace when necessary		X		X		X		X		X		X		X		X
Alamo Hall																
Roof maintenance																
Clean and apply architectural fungicide						X					X					X
DRT Library																
Clean and apply biocide to walls, examine and repair as necessary						X					X					X
Door and Window Maintenance		X					X					X				X
Amphitheater																
Clean and treat walls						X										
Gallagher Building																
Door and Window Maintenance			X						X						X	
Paint exterior Stucco						X										x
All Roofs																
Inspect every Two Years																
Buy extended warrantees	X		X		X		X		X		X		X		X	

Roof Information

BUILDING	TYPE OF ROOF/DECK	CONTRACTOR/ DATE INSTALLED	WARRANTY PERIOD	WARRANTY EXPIRATION DATE	REPAIRS DATE(S)	EXPECTED LIFE	INSPECTION SCHEDULE	MISCELLANEOUS
Shrine Nave	Lead-coated copper, standing seam/Concrete	unknown/ 1936-1937	NA	NA	New Ridge cap		2 Yrs.	Leaks visible at NW and SE transept. Roof checked for leaks Original roof painted. Much of the paint has weathered away
Shrine North Rooms	Lead-coated copper, flat seam/Concrete	Samuel Dean Sheet Metal, 1997	Unknown				2 Years	leaks at west and north wall continued after roof installation. Extensive water testing, source couldn't be found.
Long Barracks	Soprema Modified Bitumen	Samuel Dean Sheet Metal	Unknown				2 yrs	Plan Replacement soon
Gift Museum Roof & Gutters	SBS Modified Bitumen/Poured Reinforced Concrete	Bentley Sheet Metal & Roofing Company, Inc. 4/26/2000	10 Yrs. material, 2 Yrs. workmanship	4/26/2002			2 yrs	Extend Warrantee
	SBS / Wood Workmanship ?	Bentley Sheet Metal & Roofing Company, Inc. 4/26/2000 ?	Unknown	3/3/2002			2 Yrs	Extend Warrantee
Library and Alamo Hall	SBS Modified Bitumen over poured concrete	Bently Sheet Metal & Roofing Company, Inc 5/2006	Unk nown				2 Yrs	Extend Warrantee
Support Building	SBS Modified Bitumen	Bently Sheet Metal & Roofing Company, Inc 5/2006	Unknow				2 Yrs	
Gallagher Building	Standing Seam Metal	Unknown	Unknown				2 years	
Roof at Arbor	Berridge Tee Standing Seam/1x4 wood, T&G	estimated installation in 2001	unknown				5 Years	

Renovation/New Construction	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10	Year 11	Year 12	Year 13	Year 14	Year 15
Shrine						X	X								
Research North Sacristy Wall								X							
Archaeology, North Sacristy								X	X						
Plan Reconstruction of NS Wall									X	X					
Construction															
Long Barracks						X	X								
Research Second Story								X	X						
Archaeology at west and south										X					
Structural Analysis											X				
Plan Addition												X			
Construction															
Gift Museum															
Planning for Retail	X														
Interior lighting, painting, etc.		X													
Construction/installationof Retail		X	X												
Planning/installation of Exhibit		X	X												
Amphitheater															
Planning for enclosure	X														
Construction of enclosure	X	X													
Arbor															
Installation of misting system	X														
Installation of interpertation		X													
Alamo Hall															
Plan column removal/improvements	X														
Construction		X													
Site Work				X											
Perimeter walls/planting			X												
Construction of pallasalde			X				X								
Historic wall marking					X					X					
Cavalry Courtyard Wall															
Paving changes															
Planting relocation		X					X								
New pathfinding system, Phase I					X										
New Pathfinding System, Phase II					X										
New acequia															
Additional fencing for new plan, east															
New Construction															
Negotiation for Street Closure	X														
Planning and moving street utilities	X	X													
Planning Building		X	X												
Construction			X	X											
Support Area				X											
Planning for new building					X										
Temporary relocation					X										
Demo of exisitng					X	X									
Construction															
Library					X										
Planning for new function					X	X									
Construction															

7.0

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8.0

Appendix A

8.1 1905 Legislation Giving Custodianship of the Alamo to the Daughters of the Republic of Texas

House of Representatives by a two-thirds vote, yeas 114, nays 0; and passed the Senate by a two-thirds vote, yeas 25, nays 0.]

Approved January 26, 1905.
Became a law January 25, 1905.

ALAMO—PROVIDING FOR THE PURCHASE, CARE AND PRESERVATION OF.

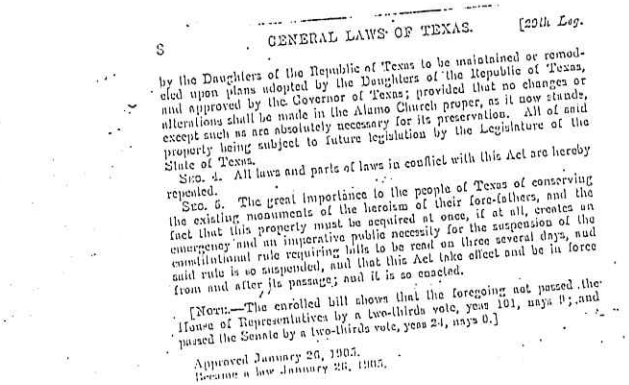
S. H. B. No. 1.] CHAPTER 7.

An Act to provide for the purchase and conveyance to the State of Texas of the land in the City of San Antonio known as the Hugo & Schmeltzer Company property, which was a part of the Alamo Mission; and for the care and preservation of said property, and of the Alamo church property now owned by the State; and appropriating the sum of Sixty-five Thousand Dollars ($65,000) to carry out the provisions of this Act.

SECTION 1. *Be it enacted by the Legislature of the State of Texas:* That the Governor of the State of Texas be and he is hereby authorized to purchase at a price not to exceed Sixty-five Thousand Dollars ($65,000), and to procure to be executed to the State of Texas by the owners of the property hereinafter mentioned a good and sufficient conveyance in fee of all the land in the City of San Antonio, Texas, known as the Hugo & Smeltzer Company property, formerly a part of the old Alamo Mission and adjoining the Alamo Church property now owned by the State; beginning at a stake set on the west bank of the Alamo Ditch, being the south-east corner of this tract, and the north-east corner of the tract heretofore sold to the State of Texas, and known as the Alamo; thence north, 79 1-2° west, 200 feet and 2 2-3 inches; thence north 11°, 33' east, 101.32 feet; thence south, 79.1° east, 222.22 feet; thence with the meanders of said Ditch to the place of beginning; and bounded on the north by Houston street, and on the east by the Alamo Ditch, and on the south by the Alamo and the Alamo Plaza, and on the west by the Alamo Plaza.

SEC. 2. The sum of Twenty-five Thousand Dollars ($25,000) is hereby appropriated, to be available during the fiscal year ending August 31st, 1905, out of any money in the State Treasury not otherwise appropriated, in part payment of the purchase price of said tract, to be expended during the fiscal year ending August 31st, 1905; and the further sum of Forty Thousand Dollars ($40,000), or so much thereof as may be necessary, is hereby appropriated out of any money in the State Treasury not otherwise appropriated, on the balance of the purchase price of said tract, to be expended during the fiscal year ending August 31st, 1906. But no part of said money shall be paid until a good title is shown in grantor, and a valid conveyance of said land has been made to the State, to the satisfaction of the Attorney General of the State.

SEC. 3. Upon the receipt of the title to said land, the Governor shall deliver the property thus acquired, together with the Alamo Church property already owned by the State, to the custody and care of the Daughters of the Republic of Texas, to be maintained by them in good order and repair, without charge to the State, as a sacred memorial to the heroes who immolated themselves upon that hallowed ground; and



S GENERAL LAWS OF TEXAS. [29th Leg.

by the Daughters of the Republic of Texas to be maintained or remodeled upon plans adopted by the Daughters of the Republic of Texas, and approved by the Governor of Texas; provided that no changes or alterations shall be made in the Alamo Church proper, as it now stands, except such as are absolutely necessary for its preservation. All of said property being subject to future legislation by the Legislature of the State of Texas.

SEC. 4. All laws and parts of laws in conflict with this Act are hereby repealed.

SEC. 5. The great importance to the people of Texas of conserving the existing monuments of the heroism of their fore-fathers, and the fact that this property must be acquired at once, if at all, creates an emergency and an imperative public necessity for the suspension of the constitutional rule requiring bills to be read on three several days, and said rule is so suspended, and that this Act take effect and be in force from and after its passage; and it is so enacted.

[NOTE:—The enrolled bill shows that the foregoing act passed the House of Representatives by a two-thirds vote, yeas 101, nays 0; and passed the Senate by a two-thirds vote, yeas 24, nays 0.]

Approved January 26, 1905.
Became a law January 26, 1905.

8.2 Summary of Interpretation at the Alamo by Bruce Winders, PhD

The 1905 enabling legislation which granted custodianship of the Alamo to the Daughters of the Republic of Texas specifically mandates that the site be preserved as a memorial to the men who sacrificed their lives in the epic 1836 battle.

For many years, the interpretation of the site was influenced as much from the outside as it was from any conscious effort on the part of the DRT. The 1936 Texas Centennial, the *Fiesta San Antonio* commissioned paintings, Fess Parker's TV portrayal of David Crockett, John Wayne's movie epic *The Alamo*, and books such as Lon Tinkle's *Thirteen Days to Glory* and Walter Lord's *A Time to Stand* all helped to create a widely accepted traditional interpretation of the Alamo and its defenders.

Traditional historical interpretations increasingly came under attack by the academic community, a trend which can be traced back to the social upheavals of the 1960s. The traditional notion of heroism was challenged as well as historical interpretations told predominately through the perspective of the "ruling class." Evidence of this change surfaced in the wake of Dan Kilgore's essay, *How Did Davy Die?*, which questioned what had become the accepted account of Crockett's death at the Alamo. The 1986 Sesquicentennial, although still widely celebrated, gave critics the opportunity to challenge the traditional Alamo story. These dissenting voices gained credence as society as a whole has become less willing to accept traditional explanations for historical events.

By the early 1990s, the DRT faced increased criticism from the outside for its interpretation of the Alamo's history. Instead of turning a deaf ear, the organization listened and responded with action. For example, the Fiesta San Antonio paintings which had long hung in the Shrine were removed. Additionally, the DRT installed a comprehensive outdoor exhibit entitled "The Wall of History." These were major concessions on the part of the DRT toward updating interpretation.

At the same time the DRT was responding to its critics, various outside agencies strongly urged the DRT to add a professionally trained historian to the Alamo's staff. In response, Dr. Richard B. Winders, a specialist in the history of the American Southwest was hired in July 1996. Dr. Winders has been given the task of developing and implementing a historical narrative for the Alamo that is based on the most current evidence available. The DRT also created an education department for the Alamo, which Dr. Winders oversees.

Upon assuming his position, Dr. Winders reviewed the existing interpretive plan for the Alamo and suggested changes. While commemoration is paramount to the Alamo's mission, he proposed that it be strongly supported by education. As he explained, "Can visitors be reverent if they don't understand what happened or why it was important?" With this question as a point of departure, interpretation at the Alamo took a new direction.

Dr. Winders decided that a comprehensive interpretation based on evidence needed to be put in place in order to counter the myths and legends that had passed for history. Rather than discard these myths and legends into the dust bin, he labeled them the "traditional story" and preserved them as they have a real societal value. However, the evidenced based interpretation and the traditional story were to be separated so as not to confuse the visitor with fact and fiction.

Context was key as it always is in interpreting history. Why was there even an event called the Battle of the Alamo? Moreover, why was there an event called the Texas Revolution? The thesis statement became "The Texas Revolution is an event which occurred in an ongoing Mexican civil war." This simple statement expands the battle from an isolated struggle into something tangible within the greater scope of human events.

In addition, Dr. Winders contended that although the 1905 enabling legislation focuses on the commemoration the Battle of the Alamo that the Alamo's interpretation had to offer visitors answers to frequently asked question: how the Alamo came into being in the first place, what happed to the Alamo after the battle, and why was not more of it preserved. These are valid questions for which the visitors need answers if they are to fully understand the Alamo's long and complicated history.

Dr. Winders also thought it was necessary to broaden the appeal of the Alamo in order to meet the needs of the site's complex visitorship. The interpretation incorporates three levels of interpretation: global, regional, and community. The

vehicle for doing this was again context—putting the Alamo in a historical perspective that was comprehensible and meaningful no matter what a visitor's place of origin is.

There are tangible results that demonstrate the Alamo's new direction in historical interpretation. The following is a brief list of interpretive and educational endeavors:

http://www.thealamo.org/
Updated Long Barrack Museum Exhibit (see review in SWHQ Jan. 2007)
Interpretive Waysides at 4 Entrances
Upgraded Training for Alamo Educational Staff
4th Grade Teacher Packet
7th Grade Teacher Packet
Mapping Texas: Texas History from Colonization through Statehood
Bi-National Conference on the Texas Revolution in the Rio Grande Valley
Fall at the Alamo (annual living history event)
1st Saturday at the Alamo (monthly event with speakers and living history)
The Alamo Messenger (teacher newsletter)
TEA Recognized Teacher In-Service
Student Internships
Rotating Exhibits in the Alamo Gift Shop
Adult Education Courses Offered through North East ISD
Community Outreach Program
New Orientation Film Produced by the *History Channel*
Resource Assistance to Educators and Students at all Levels

The goal of this effort by the DRT has been to enhance the Alamo's role as an educational and historical resource.

The Alamo plans to expand its interpretive and educational efforts in the future. Use is made of Alamo Hall, the Gallagher Building, the Arbor-Amphitheater, and grounds. However, these areas fall short when projecting the Alamo's future needs regarding space for offices, storage, and public meetings. Moreover, technology now enables the Alamo to engage in such activities as distance learning, meaning that resources developed by the Alamo can reach a potential global audience. Although dedicated to preserving the past, the DRT and Alamo's staff are preparing to meet that challenges the 21st Century brings.

8.3 History of The Edward Joseph Gallagher Building by Maria Watson-Pfeiffer

The Gallagher Building in the 19th Century

The building at 723 East Houston Street (also known at various times as 629 or 729 East Houston) was constructed between July 1885 and October 1888. A Sanborn's Fire Insurance map of the earlier date does not illustrate the building, while a map of the later date shows the two-story building with its distinctive porch on the east side.

Constructed by Edward Joseph Gallagher (1839-1919) and his wife Elizabeth Winder, the building was located on property purchased by Gallagher's uncle, Peter Gallagher, in 1840 (BCDR A2:319). Edward J. Gallagher was born in Dublin, came to New York in 1866, and to San Antonio about ten years later. In San Antonio, Gallagher became a successful building contractor (Davis and Grobe: 2372).

As early as 1879, Edward Gallagher resided on the Houston Street property that once extended west to the Acequia Madre and east to Nacogdoches Street. A plat map included in October 1887 real estate transactions references Gallagher's residence along the acequia and an office building to the east, both 1-story buildings (57:10).

In 1887, Gallagher sold his old residence to saloon owner Thomas Brady and traded land east of the office to Edward Steves Sr. in exchange for a strip of adjoining land to the north (BCDR 57:8-10, 453). These transactions might have preceded Gallagher's construction of the new 2-story building that in May 1890 he designated as his homestead. A complete discussion of these sales and Edward Steves' nearby lumber yard is found in the 1990 publication, Property Ownership and Monitoring for the Modification of Martin and Bowie Streets, San Antonio, Bexar County, Texas by I. Waynne Cox.

The Gallagher Building was constructed immediately east of an existing 2-story building at 625-627 East Houston Street designated on the Sanborn's map as a "dwelling." The two buildings were separated by a small passageway. A narrow vacant lot adjoined the Gallagher Building to the east, and the 1-story office stood at 631 East Houston Street. Subsequent Sanborn's maps in 1892, 1896, and 1904 continue to illustrate this same building pattern. By 1911, the small passageway between the two 2-story buildings was enclosed.

The Gallagher property on East Houston Street was sold in 1890 to Dennis O'Connor, and Edward Gallagher moved to a house he had built at 333 North Cherry Street (BCDR 70:437; San Antonio City Directory). A South Texas cattleman and partner in O'Connor and Sullivan Bankers, (established about 1883), Dennis O'Connor purchased the Gallagher property as an investment. O'Connor eventually sold his banking interest to his partner, Daniel Sullivan, and managed his San Antonio investments from his home in Refugio County (San Antonio Conservation Society files). Following his death in 1900, O'Connor's heirs sold the Gallagher property to Joseph Hill of Victoria in 1905. Hill also used it as rental property (BCDR243:260).

The Gallagher Building in the 20th Century

East Houston Street was re-numbered twice-- first about 1891-92 when the Gallagher Building was designated 729 East Houston Street, and a second time about 1919-20 when the building became 723 East Houston. Beginning in 1903, when the San Antonio City Directory first cross-referenced residents and businesses by street address, it is possible to study the use of the Gallagher Building in detail.

In 1903, the building was used as a boarding house, leased to M. Caldwell, and subsequently operated by Maggie Duffy (1910) and Mrs. Emma A. Hicks (1911). In 1911, the adjoining 2-story building at 725-727 East Houston was run as a rooming house by Mrs. Nell Franks and housed 15 people. To the east in the old Gallagher office (numbered 731), Sam Lee operated a laundry.

In 1913, Sam Lee evidently expanded his operation, moving both his laundry and residence to the first floor of the Gallagher Building. The second floor was operated by Mrs. Nora Mullinix as a rooming house. This arrangement continued for several years, though the rooming house changed hands and was run by Mrs. Ida Vollmer between 1916 and 1921. Vollmer's establishment was called the Lester Hotel (various San Antonio City Directories). Located on the ground floor

in addition to Lee's laundry (advertised as "first class hand laundry, your goods will come back all right) was the Register Barber Shop opened here in 1918 by African American I.B. Wells. Both Lee's laundry and Well's barber shop remained at this location until 1939.

East of the Gallagher Building

The area between the Gallagher Building and old office remained a vacant lot until at least 1919, but by 1921, the City Directory listed a building on the site (numbered 725-27). This is apparently the 1-story building that stood here until 1987. The building housed a fruit stand and the Texas Cafe. Formerly located west of the Gallagher Building (ca. 1913), the Texas Cafe was a Chinese restaurant operated by Wong Gow who advertised "we serve the best meals in the city for the money." After 1921 when Ida Vollmer closed the Lester Hotel, the upstairs of the Gallagher Building became the residence of Wong Gow and Huey Ten and Ng Yick who were also associated with Gow in the Texas Cafe (San Antonio City Directory, 1924).

West of the Gallagher Building

It is not clear when or why the 2-story building west of the Gallagher Building was demolished and replaced with a 1-story structure (or remodeled into a 1-story structure), though the change appears to have taken place between 1913 and 1921. Both the 1911 Sanborn's map and an undated photograph taken before construction of the Medical Arts Building (Emily Morgan Hotel) in 1926 shows the two-story building adjoining the Gallagher Building. The latter photograph shows the buildings unified by an "Alamo-inspired" parapet and suspended ground floor canopy.

The 1913 and 1921 City Directories both contain jumps in street numbering that might indicate building changes. In 1913 (prior to the ca. 1920 street renumbering), addresses skip from 719 to 727 and the Texas Cafe is listed at its first location west of the Gallagher Building. In 1921 after re-numbering, an address gap between 717 to 723 might also be explained by new construction. A photograph taken shortly after 1926 shows a one-story building where the two-story building once stood. At that time, as in the earlier photograph, the Gallagher Building is joined with buildings to both the east and west by a suspended ground floor canopy. (Sanborn's maps for 1911 and earlier illustrate the Gallagher Building without a canopy.) Using street addresses recorded in City Directories, it appears that the one-story building stood until about 1948 when a parking lot is listed adjacent to 723 East Houston. A Sanborn's map dated 1950 illustrates this parking lot.

Except for an occasional tenant- the Bradley School of Bartending (1972) and Eason's Institute of Technology (1983)- the Gallagher Building has been largely vacant for the last 25 years.

Conclusion

In summary, the Gallagher Building was constructed between 1885 and 1888. At the time of its construction, a 2-story building stood west of the Gallagher Building and a vacant lot was to the east. The 2-story building remained until ca. 1920 when it was replaced by a 1-story building that stood until about 1948. The vacant lot was in-filled ca. 1920 with a 1-story building that stood until 1987. Though Sanborn's maps indicate that the Gallagher Building was without a canopy in its early years, by ca. 1920 it shared a suspended ground floor canopy with adjoining buildings. The Gallagher Building and the 2-story building to the west were unified by an "Alamo-inspired" parapet prior to demolition (or remodeling) of the other building. The east side porch of the Gallagher Building is original (though details have likely been changed), appearing on the 1888 Sanborn's map.

8.4 The Alamo Collection Policy

THE ALAMO

Collection Policy

Alamo Mission Statement

The Daughters of the Republic of Texas are dedicated to the preservation of the Alamo as a sacred memorial to the Alamo Defenders. The DRT is committed to the conservation of the historic grounds and the research and study of Texas history.

Scope of Collection

The Alamo's collection reflects the site's 300 year long history. Nevertheless, emphasis is placed on the Alamo's garrison and other personnel as well as its role in the Texas Revolution. Of most interest are objects from the Battle of the Alamo, objects belonging the Alamo Defenders, objects from the Texas Revolution that provide context for the battle, objects not from the battle but representative of the period, and durable or expendable artifacts or historical reproductions for use in educational programming.

Collection Classifications

The Alamo has two classifications for objects in its collection: permanent and education.

The permanent collection is defined as those objects of a historical nature meeting the scope of the collection. Furthermore, objects in the permanent collection require conservation and are interpreted and exhibited to demonstrate aspect of the Alamo's 300 year history. These objects are subject to the Alamo's deaccessioning policy.

The education collection also is used to interpret the Alamo's 300 year history, however, but its objects do not have to be historical in nature and do not require a high degree of conservation based on museum standards. While the permanent collection includes objects used in traditional enclosed museum exhibits, objects in the education collection consist of artifacts, reproductions, replicas, facsimiles and other printed material that are intended to be touched and handled by the staff and public in educational programs. These objects are not subject to the Alamo's deaccessioning policy.

Accession Policy

All proposed donations will first be reviewed by the Curator, who will notify and consult with the Director. The Curator will prepare a written report for the Alamo Committee. No object will become part of the collection until formally accepted by the Alamo Committee and approved by the Board of Management.

The permanent and education collections are intended to support the Alamo's mission statement. Considerations affecting the decision to access an object into either collections can include:

- compatibility with the collection,
- overall condition,
- suitability for display,

- size,
- duplication of existing artifacts,
- security constraints,
- the need to construct new or adapt existing exhibit furniture,
- supports existing or future educational programming,

and other similar factors. No object will be accepted if it cannot be properly cared for and preserved. Additionally, no object will be accepted if it cannot be exhibited or used in some way to enhance the visitor experience in learning or appreciating the history of the site and the history associated with it. Objects with significant historical and/or monetary value will most likely be recommended for the permanent collection. Objects of a durable or replaceable nature that can withstand repeated handling by the staff or public and further educational programming will most likely be recommended of the education collection.

Deaccession Policy

In an effort to maintain the quality and focus of the permanent collection, it may become necessary to deaccess objects in the Alamo's permanent collection. Deaccessioning occurs when an object is deemed inappropriate for the collection, the object is a duplicate, ownership of the object is questionable, the condition of the object warrants it, or the objects is deemed inauthentic. After consulting with the Director, the curator will present the object(s) to be removed from the Alamo's permanent collection to the Alamo Committee for action. Each proposal for deaccessioning an object will provide the following information: its know history or provenance, its current estimated market value, and its legal status, reason for deaccessioning, and recommended disposition. No object will be removed from the collection unless the Curator's recommendation is formally accepted by the Alamo Committee and approved by the Board of Management. The State of Texas will be notified in order that the object can be removed from the state inventory.

The procedure for deaccessioning is as follows. If the object is a gift, the donor will first be contacted and notified of the Alamo's intention to deaccession the object, the reason for the action, and recommended disposition. If the donor cannot be located by a reasonable effort or in the event that he or she does not respond, the deaccessioning process will continue. The measures by with an object may be deaccessioned are as following measures: (1) locate a more suitable repository for the object; (2) offer the object for sale at public auction or other suitable venue; (3) place the object into the education collection; or (4) destroy the object. Alamo employees, members of the Alamo Committee, members of the Board of Management, and members of the Daughters of the Republic of Texas may not buy objects offered for sale.

All funds gained from the sale of deaccessioning will be dedicated to collection acquisition. In the event of sale of a deaccessioned object that has been donated or bequeathed to the museum, the donor's name will be associated with any object or objects purchased with funds from the sale.

Loan Policy

The Alamo can loan objects from its collection to other educational institutions upon request, with the understanding that they will be used in accordance with the museum's standard of preservation and presentation, and that the loan of objects will not impinge upon the museum's own exhibition and educational programs. All requests for loans must be reviewed by the Curator and Director, presented to the Alamo Committee and approved by the Board of Management. The borrowing institution shall pay all costs associated with the loan (DRT bylaws, Article 10, Section 1 (F).

The Alamo may accept loans from institutions and private individuals to augment its exhibits. All loans to the Alamo must reviewed by the Curator and Director, presented to the Alamo Committee and approved by the Board of Management.

Ethics in Receiving Gifts

The authorization for the acceptance of gifts to the collections is given only where there is genuine donative intent and where the gift is in the best interest of both parties. The museum must make full disclosure to the donor of any tax or other ramifications as required by the IRS and state and federal laws, and have encouraged the donor to seek his or her counsel on legal and financial matters. The museum does not authorize the acceptance of gifts that would jeopardize the financial, legal, or moral integrity or reputation of the institution, or where the gift would cause embarrassment to the donor or his or her family.

Valuing Gifts

In consonance with the tax laws, full responsibility rests on the donor in claiming any deductions including filing form 8283, and obtaining any appraisals or other documentation. Full responsibility also rests on the donor for the value given to tangible personal property or services, and each donor will be expected to give the Alamo a written statement for the value for these types of gifts.

Native American Graves Protection & Reparation Act

The Alamo recognizes the cultural and religious implications of human and religious icons. The Alamo, in accordance with both state and federal law, and in compliance with the Native American Graves Protection Act, does not collect human or religious icons of known Native American origin.

8.5 The DRT Library Collection Policy

DAUGHTERS OF THE REPUBLIC OF TEXAS LIBRARY
COLLECTION DEVELOPMENT POLICY

Purpose: To support the study of the history of the Republic of Texas, the history and development of San Antonio and Bexar County, and the early history of the state of Texas; to provide resource materials needed for independent scholarly research. The DRT Library collects as exhaustively as possible all library and archival materials relating to the Alamo.

The holdings in the DRT Library are complemented by materials in other San Antonio and area Texas libraries and archives. A selective list of special collections in the state is attached.

General Collection Guidelines

Language: English is the primary language of the collection, although Spanish and German are represented.

Chronological Guidelines: Primary emphasis is on material created (published or unpublished) during the years prior to and immediately after the period of the Republic of Texas (1836-1846); San Antonio and Bexar County history up to 1860; secondarily, the history of Texas as a Spanish colony and Texas to 1900; San Antonio and Bexar County to 1950. Contemporary material is collected if the subject matter falls within the Statement of Purpose.

Geographic Guidelines: Primarily Texas, Bexar County, and San Antonio. The library also supports material on the history of Mexico as it relates to the chronological guidelines.

Treatment of Subject: Primary emphasis is on material treating some aspect of the Republic of Texas as a subject. Juvenilia are acquired only if the subject falls within the guidelines stated above or if the material supports collections currently held by the library. Books published in Texas on non-Texas subjects are not normally acquired unless the subject supports collections currently held by the library.

Types of Material: Within the parameters of the above subjects, the Library acquires the following types of materials:

Texas State documents
Local government documents
Pamphlets
Musical scores and sheet music
Genealogies
County histories
San Antonio city directories
Broadsides, posters, advertisements and printed illustrations
Dissertations, reports and theses
Atlases
Ephemera
Publications in microform and video
Reference books, including dictionaries, encyclopedias, almanacs and biographical directories
Newspaper clippings

Cookbooks are acquired very selectively.

Date of Publication: Current and retrospective purchases are made, including original printings and editions when possible.

8.6 Staff Interview Meeting Notes

MEETING NOTES - Curatorial
Date: September 13, 2006
Location: Gallagher Building, Alamo
Attendees: David Stewart, Bruce Winders, Carolyn Peterson, Anna Nau

The purpose of this meeting was to discuss the goals of the master plan, including what types of spaces need to be improved or added to accommodate current needs and possible future needs of staff and visitors.

To accommodate current and future needs, the support area (behind the trellis and amphitheater) will need to be rebuilt.

- Storage Vault (for irreplaceable artifacts)
  - Protection against fire, theft and other hazards
  - Easy access by staff, preferably on ground floor
  - Should be 3 to 4 times larger than current space, 1500+ sq. feet, allowing safe storage of current items as well as room for future acquisitions
  - Current ground floor woodshop below existing vault is a hazard
- Storage area (for less sensitive items that still require protection, such as reproduction firearms, historical clothing, etc.)
  - Secure from public and unauthorized personnel
  - Easy access by staff
  - Should be 900+ sq. feet, allowing room for future acquisitions
- Preparation/work area (for preparing exhibits, etc.)
  - Secure from public and unauthorized personnel
  - Easy access by staff
  - Should be about 450sq. feet, with space for curating objects, assembling exhibits, workshop area
- Separate woodworking shop
  - Needs to be separate from curatorial space so as not to expose artifacts to hazards
- Outdoor classroom/lecture hall
  - This need could be achieved by covering the current outdoor amphitheater to keep heat out
  - This would also allow for the history talks for visitors to be held in the amphitheater, leaving the Cavalry courtyard for other functions
  - The Cavalry courtyard would also need to be covered or somehow made more usable in hot or rainy weather
- AV equipped lecture/conference hall
  - Possibly retrofit Alamo Hall and/or Gallagher Building; current space can accommodate about 150 seats in Alamo Hall and about 50 seats in the Gallagher Building
  - Columns in Alamo Hall obstruct views, and window/sun issues are a problem at certain times of day in Gallagher Building
  - Long distance learning capabilities
  - Possibly a control booth area for A/V equipment capable of producing education media about the Alamo and Texas History (TV studio?)
  - Issues about how to anticipate changes in technology and develop projections that allow the Alamo to respond to these developments in the next several years
- Preservation plan
  - Survey and document current condition of historic structures- base line study
  - Develop a long range preservation plan for historic structures- need to develop a clear preservation philosophy and approach to interpretation of the period of significance for each space
- Reconstruct acequia
  - The acequia is historical as well as horticultural
  - Need a better interpretation of the acequia- what did the irrigation ditches look like?
  - Widen bridges to eliminate traffic congestion points
  - Possible use of natural material (wood) to soften appearance
- Republic of Texas Gallery
  - Enhance museum exhibit component of gift shop
- Urge city of renovate Alamo Plaza
  - Offer ideas and assistance
  - For most visitors, this plaza is the center of the city
  - Interpretation philosophy for Alamo Plaza? A major element that needs to be developed and clearly articulated
  - The safety hazard of the curb/step needs to be addressed
- Develop long range archaeological plan
  - Coordinate with UTSA-CAR and THC
- Large Live Oak and Pecan Trees
  - These trees may fall or need to be removed within the next 20 years, and a plan of what to do with those spaces when

the trees are gone should exist
- Better Signage and possible PA system to communicate with visitors
- Modify South entrance gate to make it more noticeable/significant

Note: added 9/29/06
- Separate work/office area for interns and persons working on special projects

MEETING NOTES - Security
Date: September 19, 2006
Location: Gallagher Building, Alamo
Attendees: David Stewart,V. Philips, M. Merritt, Carolyn Peterson, Anna Nau

The goal of this meeting was to discuss the needs of the security staff and concerns for security of the Alamo Complex.

Office space:
- Larger office space is needed; serves a total of 19 rangers and first aid of visitors when needed.
- A separate first aid room/area- possibly would have more equipment, such as a defibrillator, emergency response equipment, etc. in the future. Most current incidents involve heat related problems or minor accidents.
- Separate restrooms for the rangers and first aid area. Security of rangers is compromised in public restrooms.
- Area for locker storage; approximately 20 lockers currently.
- Break room- prefer a separate one from other staff, especially for after public hours.
- Area to house security equipment; future alarms systems, camera/monitor system.

Grounds Security:
- Visible presence of rangers and bike patrol is best security tool.
- Will be getting new camera/monitor system in the future that will help.
- Always a need for more funding, especially for things like uniforms, radios, etc.
- Better communication with local authorities concerning notifications of activity in the area that might impact the Alamo.
- PA system for the entire complex is a priority- communications in emergencies, announcements to visitors, etc.
- Emergency power system/generator for power failures.
- Emergency lights in all parts of the complex.
- City not very helpful with security issues in Alamo Plaza. There is a potential for vehicles to get around bollards and drive towards the Shrine.
- Security concerns need to be kept in mind when considering possible re-interpretation of Alamo Plaza.
- Closing back gates into complex probably not a good option- it would impede pedestrian traffic flow and access for special events, especially at Alamo Hall. In addition, they serve as evacuation routes from the grounds in the case of an emergency.

MEETING NOTES - Maintenance
Date: September 20, 2006
Location: Gallagher Building, Alamo
Attendees: David Stewart,Virginia Garcia, Jerry Welch, Carolyn Peterson, Anna Nau

The goal of this meeting was to discuss the needs of the maintenance staff and current maintenance problems regarding the buildings.

Office/ Storage space:
- Need at least two times the size of current space, to store janitorial equipment, paper products, and other maintenance items.
- Storage must also accommodate approximately 250 folding chairs and 15 8ft-long tables used for events. More tables will be purchased in the future, so a need for additional space should be kept in mind.
- Storage for linens; a small laundry to wash and store the linens would be ideal.

Maintenance concerns:
- Biggest problem is lack of adequate public restrooms- lines become very long and the restroom area congested during peak tourist times (summer) and with large school groups.
- Separate A/C system for restrooms- doors of restrooms are constantly open with crowds, straining the A/C and affecting cooling in other parts of the building.
- Water fountain located just outside restrooms also adds to the congestion. The fountain water also becomes warm in summer, since there is no shade/covering over the fountain.
- A lot of time is spent on maintenance of the acequia- wall repair and a better cleaning/filtering system is needed.
- Recycled water running into the acequia appears to cause a greasy film and quickly dirties the water.
- Fountain in front of the DRT Library has a leak that has proven difficult to pinpoint- it losses about 6" of water a day.
- Better drainage is needed behind the greenhouse where equipment is washed off. Water ponds in the area and often causes a bad smell.
- Better drainage is also needed in the basement light-wells around the exterior of the Gift Museum- the drains/pumps often can not handle the water load, resulting in water seeping into the basement.
- There are several small leaks in the wall of the tunnel.
- The committee room roof has a leak near the skylight.
- The Gallagher building has several leaking areas in the roof and around the windows. Many of the window sills in this building appear to have dry rot.
- Water tends to pond severely in front of the DRT Library- the garden level has been built up, causing the water to drain towards the building. New drains have been installed, but not tested with a heavy rain yet. Additional drainage might need to be considered.
- Lights in trees are too high up for maintenance staff to change, requiring a tree company to work on them.
- The ground lights at the wall of history are also problematic- water accumulates around then and condensation forms inside the lens. They are also difficult and expensive to replace.
- Need to stabilize hanging lights on the Gallagher building porch- lights swing and move in the wind, causing the lights to burn out or break frequently.
- Would like additional lighting in gardens/walkways for evening tours and special events.

MEETING NOTES - Shrine
Date: September 22, 2006
Location: The Alamo
Attendees: David Stewart, Annie Burney, Carolyn Peterson, Anna Nau

The goal of this meeting was to discuss the needs and concerns for the Shrine.

- Additional foreign language brochures are needed, particularly Chinese, Korean, Hebrew and Arabic, and eventually Russian and Portuguese.
- There are congestion problems with the flow of visitors during busy days into the sacristy rooms off the main nave. Long lines form from the sacristy and out the entrance to the Shrine.
- Improve interpretation of the sacristy room with the frescoes to help visitors understand what the room may have looked like.
- Additional measures to keep visitors off the walls- the flags keep the visitors off the walls for the most part, but they still have a tendency to touch the walls, especially where there are holes.
- There are several areas where large pieces of stone are flaking off the interior walls.
- Significant amounts of mortar and plaster are flaking off the NE corner of the west sacristy room.
- Salts are also clearly visible on many surfaces- it was suggested that the cleaning staff brush off and dispose of the salts to prevent them from being absorbed back into the stone.
- Pulticing the walls should be considered- the work could be made into an educational opportunity for the visitors.
- Any cement on the walls should also be removed.
- South window (behind desk) has some holes, allowing moisture to get in.
- There are leaks at the parapet of the west (front) inside wall.

MEETING NOTES - DRT Library
Date: September 26, 2006
Location: DRT Library, Alamo
Attendees: David Stewart, Laura Beavers, Elaine Davis, Carolyn Peterson, Anna Nau

The goal of this meeting was to discuss the needs and concerns of the DRT Library.
See attached DRT Library Proposed Renovation Project list for detailed notes.

- Educating the public about Texas History should be a priority for the Alamo and DRT- facilities for educational videos, distance learning, lectures, etc.

- Auditorium to seat a minimum of 250 people is needed on the Alamo grounds- history forums, lectures, school groups. Auditorium could be multi-functional, for TV studio, distance learning as well.
- Adding a second floor to Alamo Hall- would be useful for extra storage space, a few offices (would need to be staff access only).
- Storage needs for future collections should be kept in mind.
- Storage for digital files, hard copies of electronic files- a need that will keep increasing.
- A reception area separate from library and reading rooms to keep non-researcher visitors from disturbing patrons.
- Restrooms on site for staff and patrons.
- Storage off site- Library has many duplicate copies of materials that could be stored elsewhere on the Alamo grounds, but would need fire suppression system and climate control.
- If possible, would like to
- About half of researchers are genealogical, but use same materials as historical researchers.
- One of the few research libraries that is accessible to school children- useful educational tool for students, especially 4th and 7th graders.
- Suggest linking all DRT and Alamo websites.

MEETING NOTES - Accounting
Date: September 27, 2006
Location: Alamo
Attendees: David Stewart, Margie Purell, Carolyn Peterson, Anna Nau

The goal of this meeting was to discuss the needs and concerns of the Accounting Supervisor and staff.

- Currently employ four persons in department, but may hire more in the future.
- Biggest concern/need is additional storage space- currently using north tower of sales museum, which is cramped and inadequate. The paper records grow each year, so storage for future documents must be kept in mind. These materials are accessed infrequently, but storage should still be accessible.
- More cabinets/files in the office are also needed.
- There is significant traffic through the office on a daily basis; therefore office should stay on ground floor.
- Open office space is preferred, but Human Resources/Benefits person would need more privacy.
- More general employee restrooms
- Locker space for employees to store personal items. Current lockers are in small employee restrooms, making space very crowded.
- Considering storage needs of each department for storing papers/documents, should consider building a large climate controlled storage area, that would protect documents and be comfortable for staff to look through files.
- Currently paying over $300/month for off-site storage.

MEETING NOTES - Education
Date: September 29, 2006
Location: Alamo
Attendees: Sally Kock, Bruce Winders, David Stewart, Carolyn Peterson, Anna Nau

The goal of this meeting was to discuss the needs and concerns for the education department.

Staff Issues
- Education department has the motivation and programming in place to do more education and events for the public- main problem is lack of resources (funding, marketing, staff, facilities).
- Need more part-time staff to be available for special events and living history events, on weekends in particular. Currently the number of staff does not allow the department to host as many events as they would like. Paid staff would be preferable to additional docents, since weekend commitments and scheduling has proved more difficult with docents.
- Improved salaries and work incentives are needed for education staff and guides- currently all additional activities that benefit the Alamo and the staff are dome for free and on own time (special talks, continuing education, outside research on Texas History, CPR certification, etc.).
- Need more bilingual guides- persons who can effectively lead tours in Spanish. Salary incentive might help in this area as well.
- Need help with docent program. Currently have about 18 docents, and takes a lot of time to organize and coordinate scheduling the docents.

Office/Layout Issues
- Current office (Sally's) is in Gift Museum basement. This space was not intended to be a permanent office, and is currently serving too many functions- education office, copy machine area, office for Shrine Hostess and for guides. It is also inadequate for education storage needs.
- Gift Museum could use this space for more inventory storage; therefore education office should be moved to the proposed new support building.
- More storage space for language brochures and other educational materials is needed, preferably all in one location- currently brochures are stored in three different buildings.
- Improve arbor and/or amphitheater area for history talks, etc. by adding permanent visual aids. Need to make the amphitheater more usable in general.
- Microphone systems in cavalry courtyard, arbor, etc. require constant attention/work to keep them functioning- need more funding to support current systems or replace them with a better system.
- Need to keep developing a better relationship between the Alamo and Alamo Plaza (city) to help gain support for a better interpretation of the Plaza.
- Improve lighting of grounds to allow for more evening events.

Educational Material
- Need material that can be sent to teachers and students who cannot physically visit the Alamo- special brochures, photos, virtual tour on website, etc. This issue ties into need for a TV/production studio of some kind on site.
- A brochure for school/large groups with information regarding hose to set up a tour and what to expect when visiting the Alamo would also be helpful.
- Consider using a professional printer to produce all educational material.

Miscellaneous
- Improve the website- would like more control to change/add information and graphics on site. Having the website run in house will require more server space/memory and training of a staff member, but it would provide more flexibility to update the site.
- Alamo needs a PR/Marketing staff person- would provide a relationship between the Alamo and local medial and allow for better publicity of special events, gift shop merchandise, etc.

MEETING NOTES - Gift Museum
Date: October 2, 2006
Location: Gift Museum, Alamo
Attendees: Barbara Bowie,David Stewart, Carolyn Peterson, Anna Nau

The goal of this meeting was to discuss the needs of the Gift Museum.

Layout and Storage
- Two biggest issues are poor traffic flow through the museum and the ability to restock items efficiently. During the busiest months, crowding in space deters potential customers and an inability to restock popular items quickly enough means a loss of potential sales.
- Need to better distinguish between the exhibit/museum space and the sales space- current layout devalues both.
- Have decided to pursue purchasing consultant services in "Layout and Design" to improve flow and function of existing space and create a better relationship between the exhibit space and the sales area.
- Museum exhibit should be placed in the west side aisle of the building. It was suggested that opening up the room on the northwest corner for additional display, possible for rotating exhibits.
- Exhibit space and sales space should be kept distinct, but still want to direct traffic flow from the exhibit space into the sales area to encourage visitors to purchase items.
- Shelves need to be deep enough to hold more than just a few items, especially items that sell quickly, like coffee mugs.
- Items should be grouped logically in sales area.
- Basement has too many overlapping functions- storage/inventory, office space, employee lockers and break room, and education department office. More storage space is needed for inventory, so non-Gift Museum functions should be moved in future to new support building. For inventory security, it would be preferable to move employee lockers and break room to support area as well.
- A more open plan in the basement would be preferable for merchandise storage.
- Air conditioning the building is a major expense, as doors are keep open all day to encourage visitors to go into the building.
- Better lighting is needed for sales display and the museum exhibit display.
- Need a better way to display posters for sale.

- Shoplifting is an issue on the floor and in the storage area- better monitoring and security measures are needed.
- Signage on the grounds to indicate to visitors that revenue for maintenance and upkeep of the Alamo depends on Gift Museum sales and not government funds might help increase sales.

Options for additional sales opportunities

- A new computer system is being put into place that will allow internet sales of merchandise. Possibly set up a sales website connected to the Alamo website that could be easily found through online search engines.
- If internet sales become successful, would need to have a separate area in basement for processing these sales and mailing items. Another option would be to hire an outside company to handle the internet sales and shipping.
- If new support building is built in the future, adding a smaller kiosk or store near the restrooms could benefit sales. This area could also house a book store. Area would need to be clearly visible to visitors to draw them in.
- Off-site: possibly open an airport store to help sales and marketing of the Alamo.

MEETING NOTES- Events
Date: October 10, 2006
Location: Gallagher Building, Alamo
Attendees: Laura Garcia,David Stewart, Carolyn Peterson, Anna Nau

The goal of this meeting was to discuss the needs and concerns for holding events on the Alamo grounds and to address any additional general issues not addressed in previous meetings.

Events Issues

- More restrooms in/near Alamo Hall for use during evening/special events.
- Lighting on grounds for evening events.
- A catering kitchen would allow for more functions.
- More electrical outlets on Alamo Hall patio- only one currently.
- Risers/small stage that can be assembled for performances.
- Storage for tables, chairs, linens, etc.
- To attract more outside groups to use facilities, need more professional equipment and flexibility of systems.
- Good outdoor sound system in front of Shrine that can be used during public events, with limited amount of wiring covering ground (tripping hazard).
- PA system for entire grounds.
- A/V equipment in Gallagher building; black-out shades in main space on first floor to allow for more daytime talks/lectures.
- Wiring in Gallagher is very poor- need more outlets to plug computers and other equipment into.
- Install gate in fence around Gallagher to allow events to be located on the porch/lawn without forcing traffic through building.
- More living history events to attract visitors.
- Make Cavalry Courtyard more functional in summers- provide additional shade.
- Additional seating in Cavalry Courtyard for history talks and special events.

Additional Issues

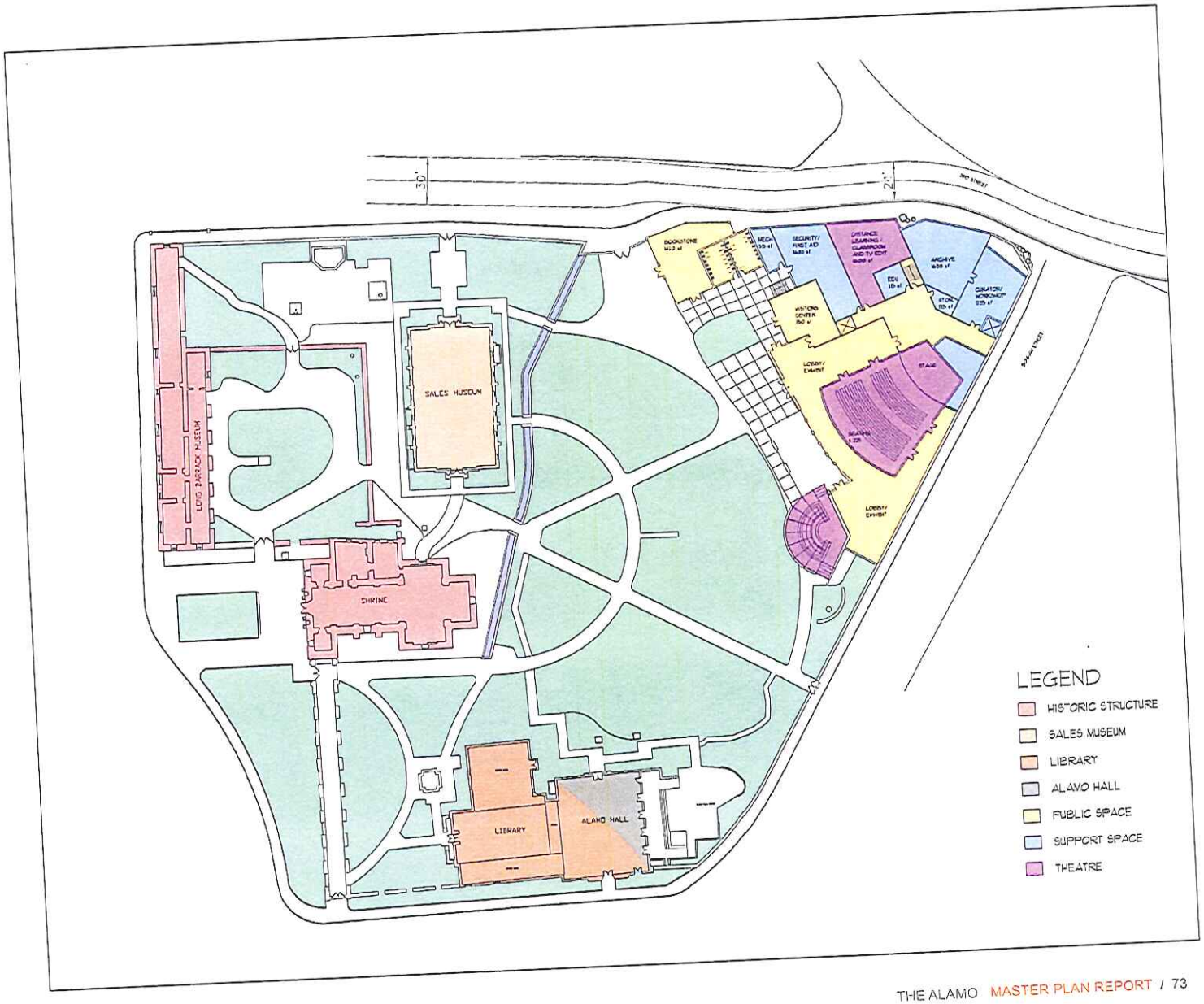
- Emergency power/ generator is a priority
- Security system with surveillance cameras on grounds- need cameras for gift shop, money room, doors to Gallagher building. Cameras would help not only with security, but would also allow staff to see who is visiting or entering the non-public buildings.
- In planning new support building, space for additional offices/future staffing should be kept mind- future marketing person, meeting rooms, etc.
- Committee Chair for both the Alamo and the Library should have own offices in addition to a conference room.
- Consider covering parking or making a parking garage next to the Gallagher building.
- Look into acquiring additional property to the west of the Gallagher building- could house additional staff/support functions or a Texas bookstore.
- Look into option of moving DRT Library facility to new support building- would allow for expansion of Library and its storage needs.
- If Library is moved, current building could be used for gallery/exhibit space and/or more retail (bookstore). Could house small traveling exhibits related to Texas History or display projects for school History fairs.
- Install fence around parking lot next to the Gallagher building to eliminate pedestrian traffic through the lot.
- Gallagher sewer system is problematic, requiring frequent attention.

9.0

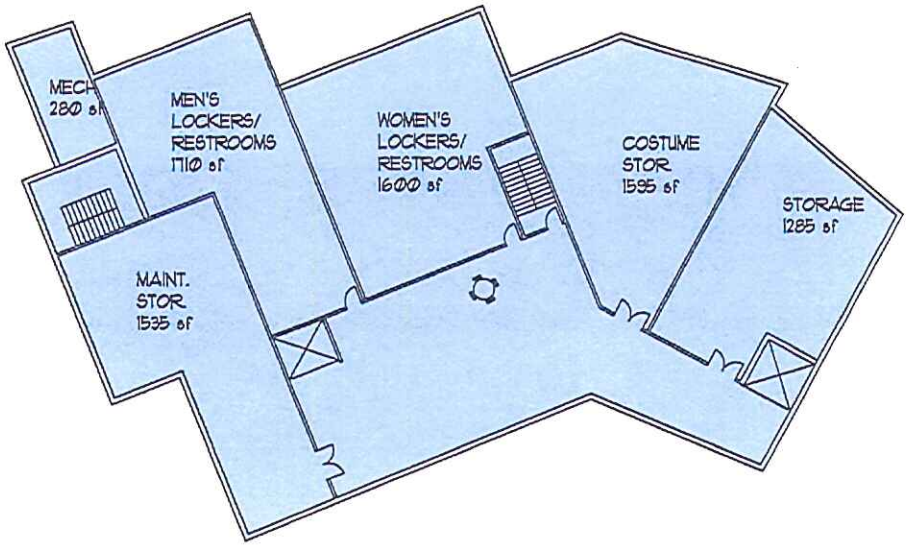
Appendix B

9.1 Site Plan with Proposed Support Facility
9.2 Proposed Exhibit/ Interpretive Areas
9.3 Viewshed Study

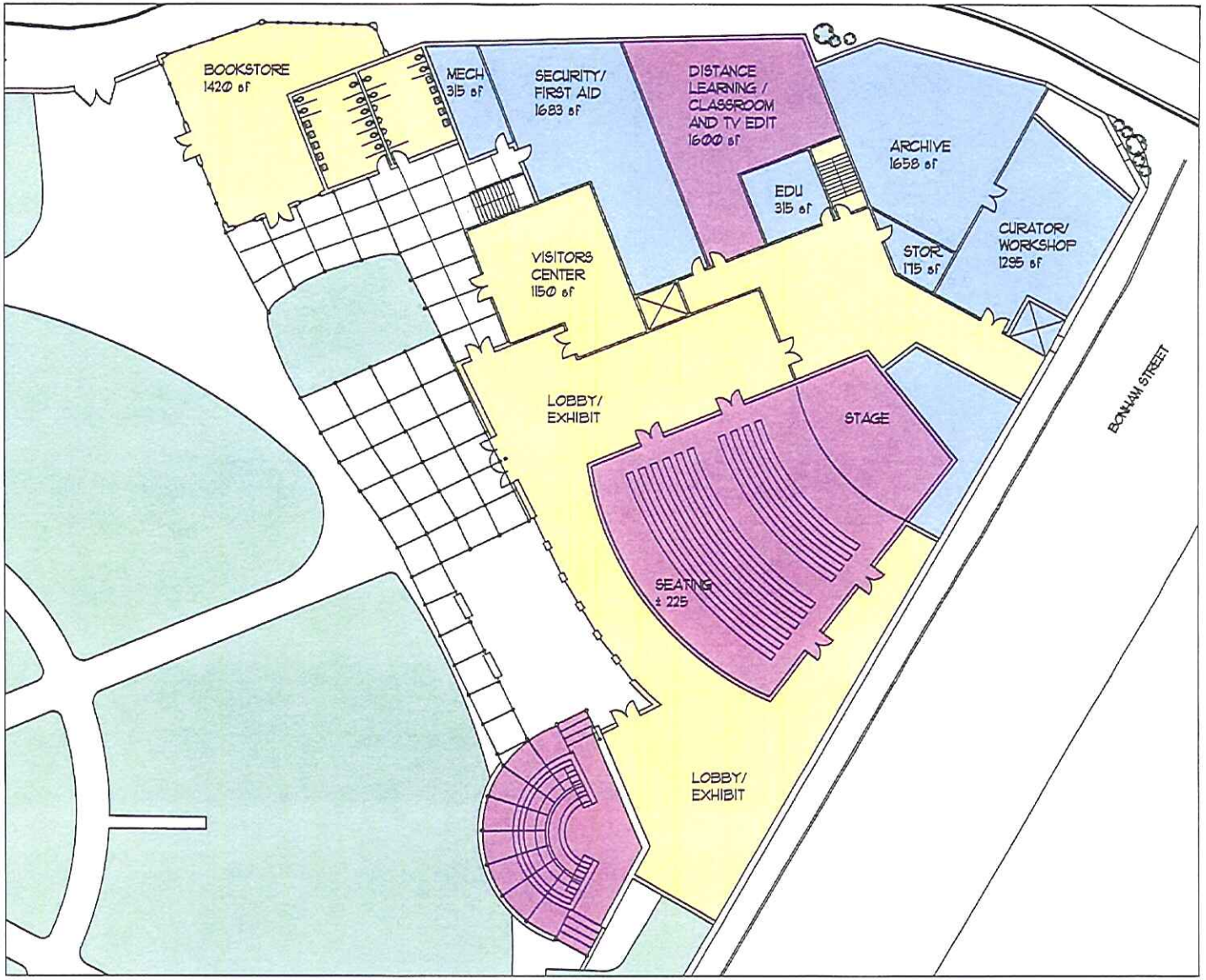
9.1 Site Plan with Proposed Support Facility



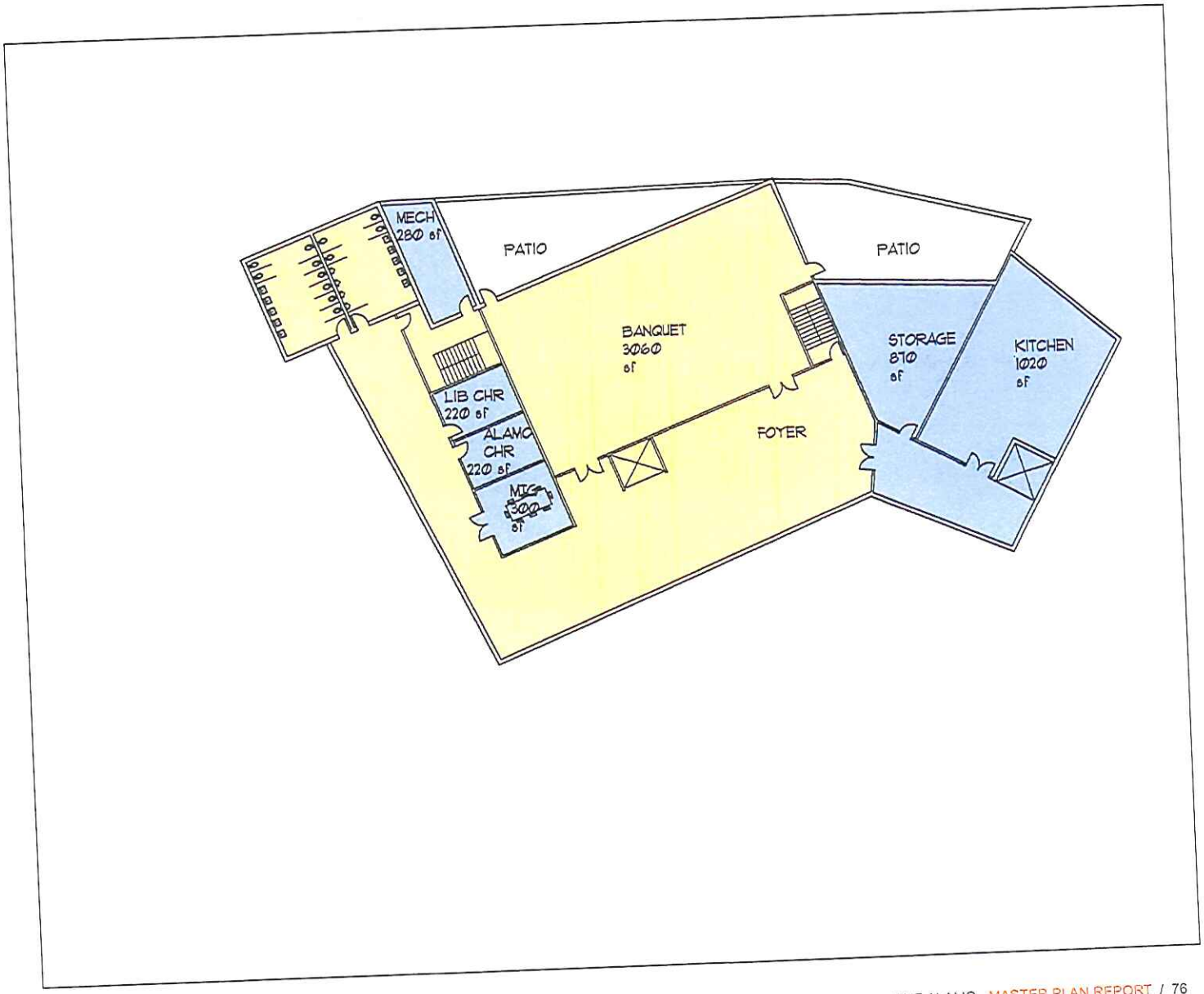
Proposed Support Facility
Basement



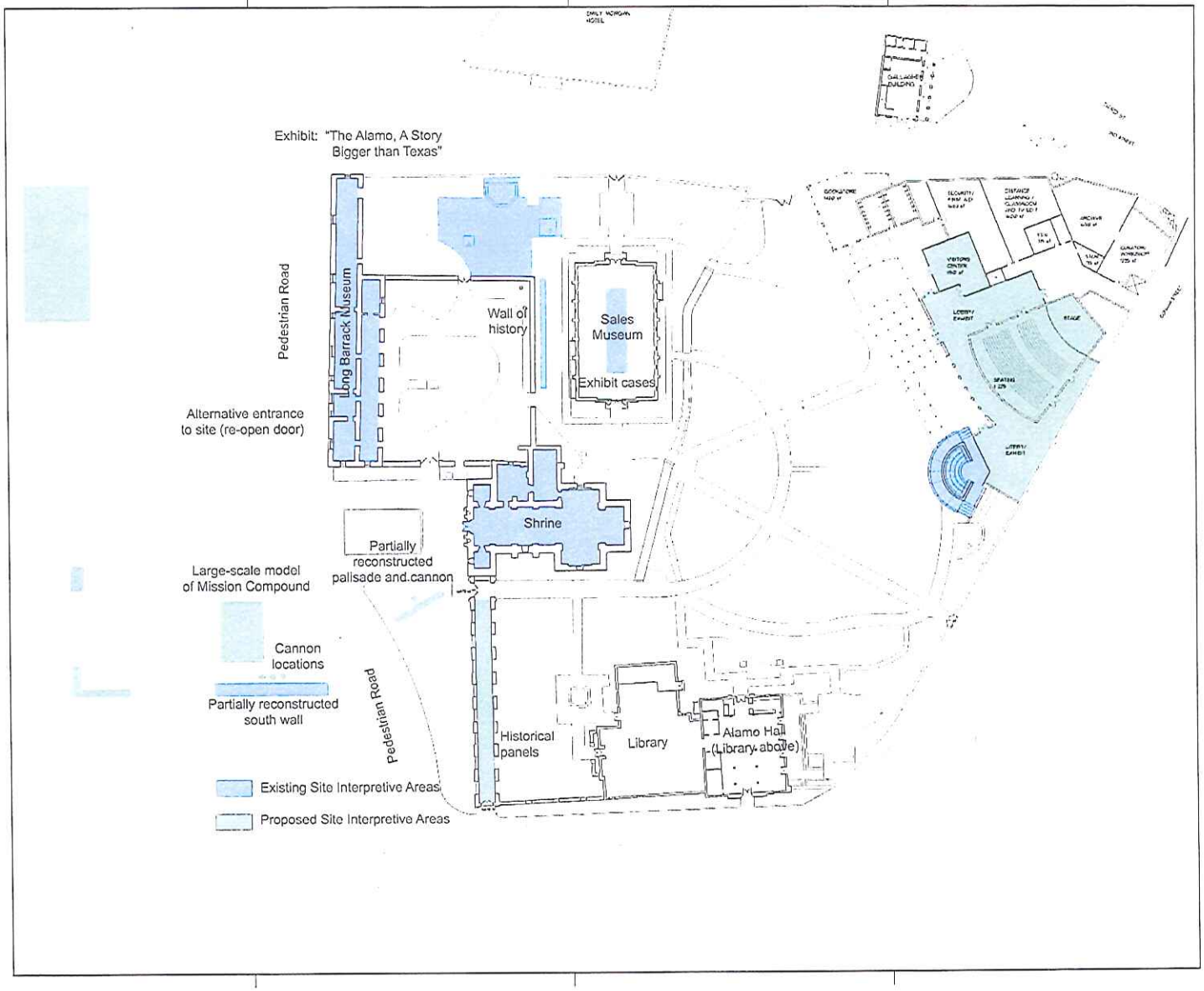
Proposed Support Facility
First Floor



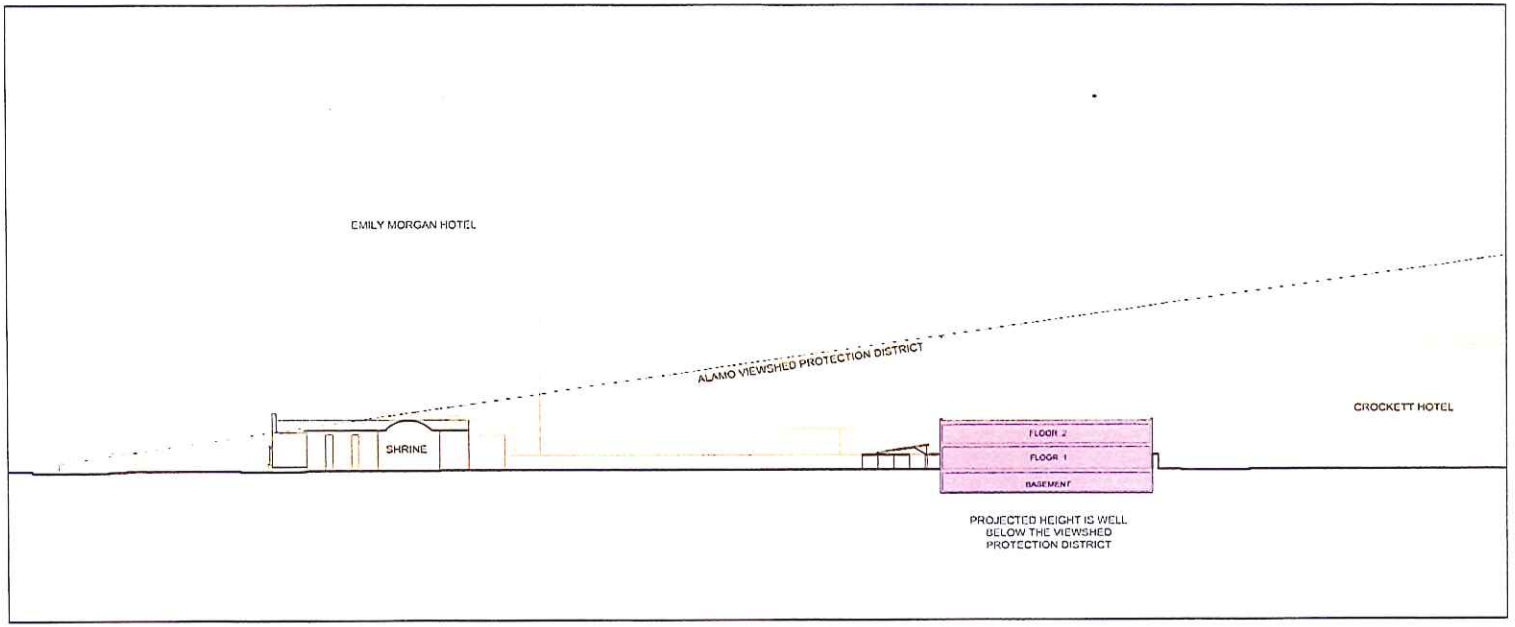
Proposed Support Facility
Second Floor



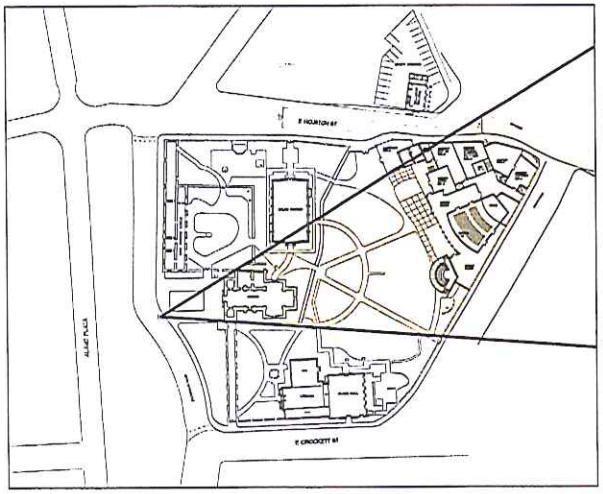
9.2 Proposed Exhibit/ Interpretive Areas



9.3 Viewshed Study



Viewshed Protection District for the Alamo, showing proposed building at northeast corner of the site falls well within historic viewshed



Plan of Alamo Site, showing Viewshed Protection District boundaries

10.0

Appendix C

10.1 Structural Finite Element Analysis

The Alamo

300 Alamo Plaza
San Antonio, Texas 78205

Structural Finite Element Analysis

Reinforced Concrete Vaulted Roof Structure

Prepared by:

Datum Engineers, Inc.

Texas Board of Professional Engineers
Certificate of Registration No. F-2819
5929 Balcones Drive, Suite 100
Austin, Texas 78731
(512) 469-9490
www.datumengineers.com

July 30, 2010

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EXECUTIVE SUMMARY

In response to a recommendation from the 2007 Master Plan study, Datum Engineers was retained by the Daughters of the Republic of Texas to conduct a structural analysis of the Alamo shrine's vaulted roof using a three-dimensional finite element model. The purpose of the analysis is to provide a better understanding of the structural behavior of the vaulted roof structure as well as establish a probable cause of existing cracks and determine what remedial work may be needed. Background for this study and for the Alamo structure is provided in Sections 1 and 2.

As construction drawings do not exist, a three-dimensional laser scan of the entire shrine interior was conducted. The data collected from the scan establishes an historical record of the interior of the shrine at the time of the scan and is available to the caretakers of the Alamo. In addition to the laser scan, a ground-penetrating radar (GPR) scan was employed at limited areas in order to establish the thickness of the existing roof and general location of steel reinforcement. Based on the results obtained from the GPR, most of the concrete roof deck was found to be approximately 6 inches thick, which is significantly thicker than the 4 inch value reported previously. The location and depth of the steel reinforcement was found to vary throughout the scanned area. An overview of the laser scan and GPR is provided in Section 3.

At the groined vault over the shrine, a continuous crack is visible along the crown of all four of the vaulted arches. The results of this study support the conclusion that the likely cause of the existing cracks is tensile stress induced by the curing shrinkage of concrete taken in combination with the absence of crack control reinforcement. All conventional concrete decreases in volume as it cures. Immediately after placement of the concrete roof over the Alamo shrine, the newly-placed concrete began to cure and reduce in volume. Unrestrained, this volume change would result in the movement of the edges of a concrete structure toward its volumetric center. In the case of the Alamo roof, however, this movement was restrained by its attachment to the relatively stiff limestone masonry walls that support it. The resulting internal forces caused by this restraint were large enough to cause the concrete roof to crack at the aforementioned locations. Because concrete always shrinks and typically cracks, reinforcing is usually provided in two orthogonal directions to distribute the cracking to multiple locations while limiting the width of individual cracks. The GPR scan has shown that the groined roof structure does not contain steel reinforcement perpendicular to the crack (i.e. in the curved direction of the vaulted slab). Without crack distribution reinforcing, all of the subsequent shrinkage caused the initial cracks to further widen at their original locations. The concrete roof structure was constructed around 1922. Since the bulk of concrete curing shrinkage occurs within the first few years after placement, we believe that the cracks over the vault were present shortly after construction, almost certainly by the mid 1920's. Photographic evidence of this cracking exists in photos that appear to date from the 1960's (Section 5).

It is important to note that concrete, as well as most other materials, also experience volume changes due to varying temperature. These temperature-induced volume changes generate the same type of strain as that caused by curing shrinkage except that it can move in either direction, depending on whether the concrete is getting warmer or colder. As a

result, even though the concrete roof no longer experiences shrinkage due to curing, it continues to expand and contract due to seasonal temperature variations. Thus, it is expected that plaster coatings applied across the concrete cracks in the vaulted roof would subsequently crack due to strain caused by varying temperatures.

Data from the finite element analysis of the concrete roof structure shows that the forces generated from curing shrinkage are sufficient to cause the roof to crack at the same location as existing cracks are located. In addition, a finite element analysis of the roof structure in its current cracked condition confirms that the roof's current structural capacity is adequate to resist the load combinations prescribed by the current Building Code. The results of the analysis are presented in detail in Section 4.

The finite element analysis has been used to confirm that the cracked vaulted roof structure has sufficient capacity to safely support the loads mandated by the Building Code. In addition, photographic evidence indicates that the cracks have existed in the crown of the groined vault for at least the last 50 years. Thus, from a structural standpoint, repairs of the vaulted roof are not required. We believe that filling the existing cracks at the crown of the groined vault may result in the creation of other stresses due to restraint. If the roof structure is restrained from the movement caused by temperature variations, it is likely that new cracks will form, either in the original locations or in new ones. The existing cracks serve to relieve that stress buildup and should be allowed to continue to provide that function. Given their likely age, they are nearly as historic as the roof, itself.

As for the damaged area of the vaulted roof located at the northwest corner of the groin, near the top of the stone walls, we propose that the concrete be repaired as part of the regular maintenance of the shrine. The structural loads on this region are relatively low and not considered critical given the massive size of the structure. Thus, repair of this area is not required from a load-carrying perspective, rather, it is recommended for the sake of appearance and to eliminate the opportunity for rainwater to collect within the structure.

Most importantly, we strongly recommended that the roofing over the entire Alamo shrine be repaired or replaced so that its integrity against water intrusion is restored. We firmly believe that the vaulted roof is stable and safe in its current condition, and that it will be an enduring structure, provided that it is adequately protected from water intrusion.

More detailed recommendations for remediation and/or repair are presented in Section 6.

1 INTRODUCTION

1.1 BACKGROUND

Datum Engineers performed a visual observation of the facilities of the Alamo complex in September, 2006, which was incorporated into the Master Plan Study Report of 2007. The purpose of the observation was to assess the structural condition of the facilities and make recommendations for their maintenance, repair, and future development. Findings of the structural assessment are outlined in a final report dated October, 2006 and were incorporated into the Master Plan Study Report of 2007. As described in this report, water-stained cracks and corroded steel reinforcement were observed in the reinforced concrete roof over the shrine (Figure 1-1). Due to the complex nature of the concrete roof structure, the report recommended that an analysis of the roof be conducted using a three-dimensional analytical computer model or *finite element analysis* (FEA).

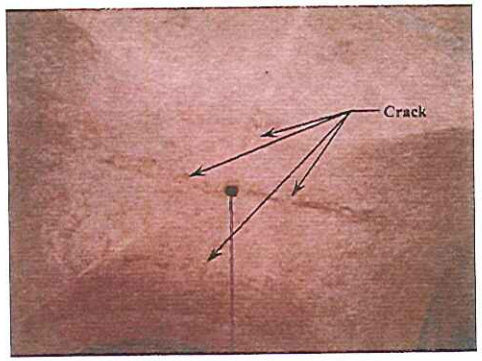


Figure 1-1. Existing Cracked Concrete Barrel Vault Roof over Alamo Shrine

Since the 2006 structural assessment, additional deterioration of the roof structure over the shrine has been observed. In the northwest corner of the groined vault, near the top of the masonry wall, a small piece of plaster coating separated, fell to the floor, and exposed some corroding steel reinforcement. As a result, Datum Engineers was retained to provide an additional structural review of the Alamo complex for the specific purpose of identifying any immediate threats to public safety. Findings of the public safety review are outlined in a final report dated June 1, 2010.

As a follow-up to the recommendation in the 2006 report, Datum Engineers has been retained to analyze a finite element model of the reinforced concrete roof structure over the shrine. The findings of the analysis are outlined in this document.

1.2 PURPOSE

The purpose of the following numerical analysis is to better understand the structural behavior of the complex reinforced concrete roof structure over the Alamo shrine; as well as establish the probable cause of existing cracks.

1.3 SCOPE OF INVESTIGATION

This report documents the finite element analysis that was used to assess the structural integrity of the arched roof structure over the Alamo shrine and determine the cause of cracking at the groined vault formed by the intersection of the nave and transept areas.

In order to establish the existing dimensions of the shrine, a three-dimensional laser scan of the entire interior was conducted in May, 2010. In order to establish the thickness of the existing concrete roof and general location of steel reinforcement, a ground-penetrating radar scan was conducted in June, 2010.

Based on the results of the numerical analyses, conclusions are made as to the probable cause of cracking and repair options are recommended.

2 DESCRIPTION OF STRUCTURE

2.1 GENERAL

Construction of the Alamo shrine began in 1724 and was built of limestone masonry. The original limestone masonry walls currently support the concrete roof structure. The current roof structure over the shrine was reportedly constructed around 1922 of reinforced concrete (Figure 2-1)

Figure 2-1. Reinforced Concrete Roof over Nave

The nave and the transept of the shrine are covered with a barrel vault roofs that intersects at a right angles and forms a double barrel or groined vault. Adjacent to the nave, there are additional rooms including the Baptistery, Confessional, Sacristy, and Monk's Burial Ground. These rooms are covered with a low-sloped reinforced concrete roof.

The Alamo structure is constructed of 42 inch thick limestone masonry bearing walls that partially support a reinforced concrete arch-shaped slab. The slab thickness is, generally, about 6 inches (Section 3.2). The slab is also supported every 14 feet by a 42 inch wide arched beam or *rib* that spans across the vault. Including the thickness of the slab topping, the depth of the ribs varies from approximately 12.5 inches deep at the crown of the arch to 42 inches at its supports. Each end of the ribs is supported on a 42 inch wide by 8 foot deep limestone masonry pilaster. A floor plan showing the layout of the shrine is presented in Figure 2-2. An interior elevation of the intersection of the nave and transept is presented in Figure 2-3.

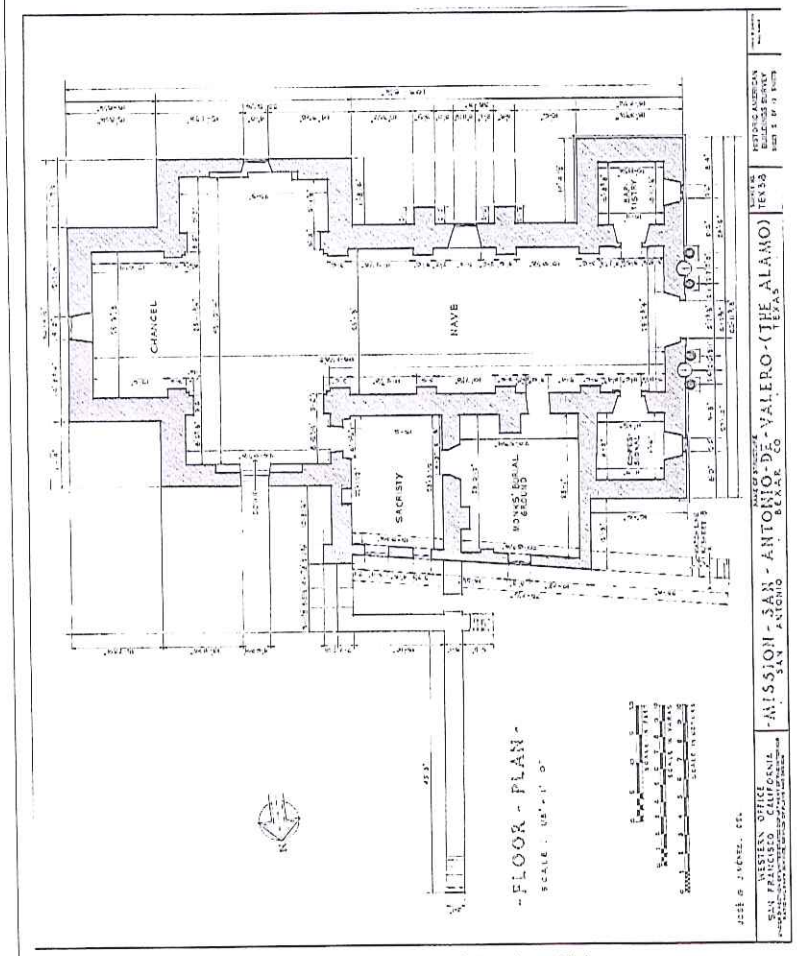


Figure 2-2. Floor Plan of the Alamo Shrine

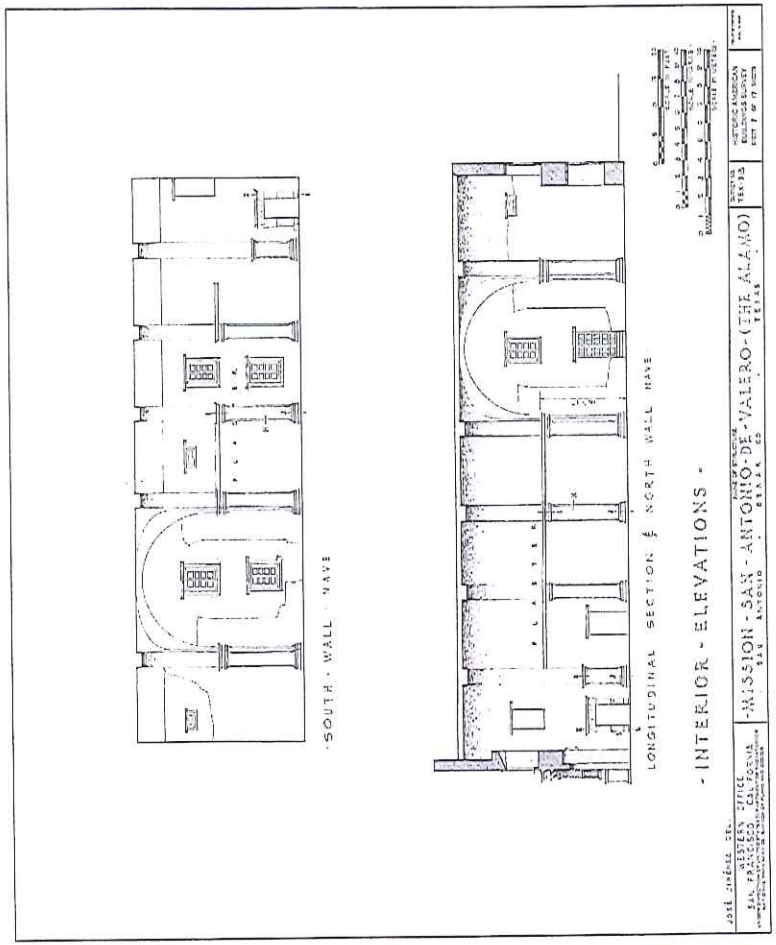


Figure 2-3. Interior Elevation of Nave

3 Discussion of Observations

3.1 Overview

There are no known construction documents of the reinforced concrete roof structure over the Alamo shrine. As a result, both a three-dimensional laser scan and ground-penetrating radar scan were employed in order to establish existing geometries and properties of the roof structure.

3.2 Survey

3.2.1 High Definition Three-Dimensional Laser Scanning

High definition three-dimensional laser scanning equipment was used to create a 3D spatial dataset or *point cloud* of the relative position of the physical interior surface. This dataset is electronically archived and can be used to create a three-dimensional model of the surface that has been scanned. A high definition survey of the shrine was conducted at the nave, transept, chancel, and monk's burial ground. For the purpose of this study, use of the data was limited because only basic information was needed to establish the geometry of the roof structure. Nonetheless, the entire dataset is available to the caretakers of the Alamo and can be used to establish a historical record of the interior dimensions of the shrine at the time of the scan.

3.2.2 Ground Penetrating Radar (GPR)

GPR is a non-destructive scanning technique that can be used for detecting subsurface embedments, voids, or delaminations. It can also be used for detecting concrete structural thickness. The method employs electromagnetic radiation and detects the reflected signals that result from a change in subsurface material. The roof structure was scanned using GPR in June, 2010.

Based on the GPR scan, the thickness of the barrel vaulted concrete slab was found to vary between 6 and 8 inches, except for one area in the northwest corner of the groined vault where the slab thickness was measured at 5 inches; and the thickness of the concrete slab over the monk's burial room was found to vary in thickness between 6 and 7 inches.

The GPR scan was also used to detect and approximately locate the steel reinforcement in the concrete slab. However, the method cannot be used to determine the size of the reinforcing bars. Based on the findings of the scan, the steel reinforcement was not found to be consistent in terms of location or depth. In the barrel vaulted portion of the shrine, reinforcement was found to be located approximately 1 to 2 inches above the bottom surface of the slab and spaced at 10 to 12 inches. At the groined vault portion of the roof, reinforcement was only found to be placed longitudinally along each of the four arches that frame the groin. There was no reinforcement found in the transverse (i.e curved) direction of the four arches. Reinforcement in the monk's burial room was found to be placed 2 inches above the interior surface and spaced between 5 and 20 inches. A report of the findings of the GPR scan is included in Appendix A.

4 Analytical Study

4.1 Analytical Model

4.1.1 Background of the Finite Element Method

The finite element method (FEM) can be used to solve structural problems involving complicated geometries, loadings, or material properties. The method is based on subdividing structural components into groups of interconnected smaller components, termed (finite) elements, whose vertices are typically referred to as the nodes. The collection of all elements is typically referred to as the finite element mesh. Based on principles of mechanics and mathematics, the displacements at the nodes of all elements in the model can be computed as the solution to a system of simultaneous algebraic equations. The boundary conditions, material behavior, and the loading are all taken into account when constructing this system of equations. Thus, the method can be used to numerically approximate the behavior of a structure. The resulting solution approaches the exact mathematical solution as the number of elements increases.

The types of finite elements that are typically employed in a structural model are *beam*, *shell*, or *solid* elements. It is important to understand the characteristics of each element in order to recognize their limitations, advantages, and disadvantages.

Beam Elements: Beam elements are one-dimensional elements, modeled at the centroid of the actual structural member, and usually comprise two end nodes. Each node of the element has six potential displacements or *degrees-of-freedom*. The six degrees-of-freedom are the translations and rotations in the local X, Y, and Z directions.

Shell Elements: Shell elements are two-dimensional elements, and are developed assuming that the thickness of a structural component is relatively small compared to its other dimensions. Shell elements are modeled at the mid-surface of the actual member, and are typically quadrilateral (or triangular) in shape. Each node has five degrees-of-freedom: the translations and rotations in the local X, Y, and Z directions (the rotation about the axis perpendicular to the surface of the shell element is not included). Shell elements allow for both membrane and bending action, and are usually preferred over solid elements for modeling two-dimensional structural components, since the use of solid elements for such components would typically result in either excessive computational cost or highly distorted meshes.

Solid Elements: Solid elements can be used to model thick or thin structural components. They are six-sided three-dimensional elements. Each of the element's nodes can transfer the three translational degrees-of-freedom. The advantage of solid elements is that they can be used for structural components that are too thick to be modeled with shell elements. Also, they can be used to more accurately model complex geometries, at an increased computational cost.

For this study, the finite element analyses are conducted using the commercial general-purpose finite element software package, RISA 3D Version 8.1.3. The 6 inch thick concrete roof deck is modeled using shell elements, and the 42 inch wide ribs are modeled

using beam elements. The centroid of the beam elements is connected to the centroid of the plate elements with a weightless rigid link element. The purpose of the rigid link is to allow for the model to consider the composite action between the beams and slab. The shell element used allows for modeling out-of-plane transverse shear. An isometric view and elevation of the model of the nave and of the groin are presented in Figure 4-1 through Figure 4-4. The first view of each model shows the two-dimensional elements used in the analysis. For the second view, the thickness of the elements has been rendered for clarity.

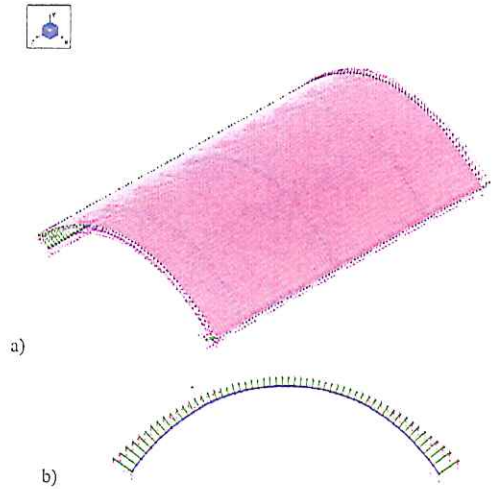
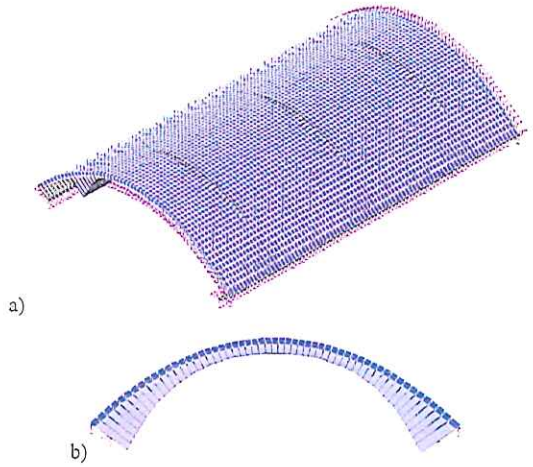


Figure 4-1. 2D Finite Element Model of Nave Roof: a) Isometric View b) XY Elevation View



ıre 4-2. Rendered Finite Element Model of Nave Roof: a) Isometric View b) XY Elevation View

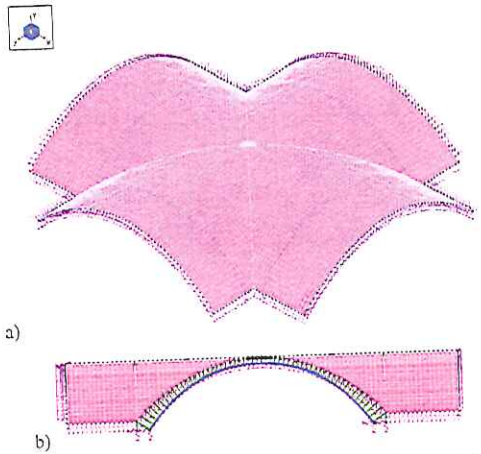


Figure 4-3. 2D Finite Element Model of Groined Vault: a) Isometric View b) XY Elevation View

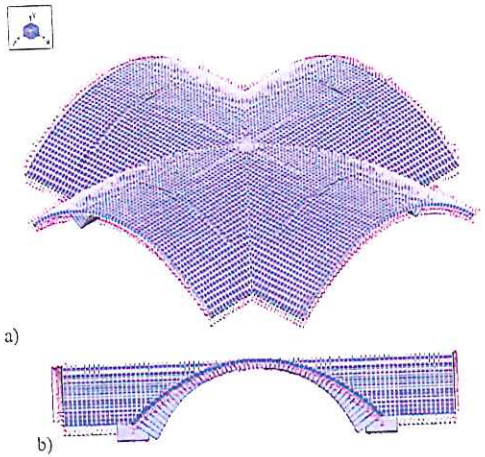


Figure 4-4. Rendered Finite Element Model of Groined Vault: a) Isometric View b) XY Elevation View

In addition to the uncracked model of the groin shown in Figure 4-2, an additional model was created and analyzed accounting for the existing cracks. For the cracked model, a strip of elements was removed at each crown of the slab over the groin, creating a crack opening approximately 1 inch wide. Thus, the crack completely extends through the slab and there is no transfer of shear or moment across its interface. In the model, the crack conservatively extends from the center of the groin to the centerline of the the support ribs. A view of the cracked model over the groin is presented in Figure 4-5.

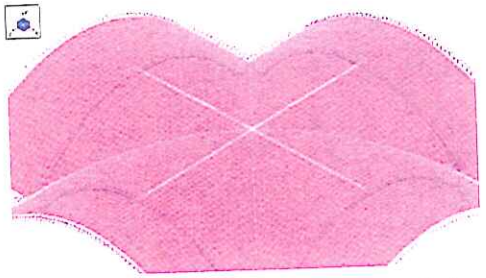


Figure 4-5. Modeled Crack at Crown of Groined Vault

4.1.2 Modeling Assumptions

The finite element model created in RISA 3D can be used to approximate the behavior of the structure under the application of multiple load combinations and with varying support conditions. The model is an idealization of the actual structure. There are many variables that are unknown. In order to account for some of the unknown variables, conservative assumptions are used based on standard practice and engineering judgment.

Linear-Elastic Concrete Material Properties. The analysis of the reinforced concrete model is based on the assumption that concrete is a linear-elastic material. In other words, the stiffness is constant and the loading is less than that which would cause permanent deformations. It is acceptable to assume that the concrete behaves linear-elastically provided that the compressive stress does not exceed 60% of the compressive strength, and the tensile stress does not exceed the cracking strength of concrete. If either the compressive or tensile stress exceed these limits, it may be necessary to adjust some of the modeling parameters.

Concrete Compressive Strength. The compressive strength of the concrete roof structure is not known. This information is difficult to accurately obtain using non-destructive means. For this study, it is conservatively assumed that the compressive strength of concrete, f_c', is equal to 2,000 psi. 2000 psi concrete was common in the 1920's according to evidence in the 1920 edition of the American Concrete Institute's (ACI) Standard Specifications No. 23, although 3000 psi concrete was also mentioned. ACI's predecessor organization, the National Association of Cement Users, issued a Standard No. 4 in 1910 that defined the mix ratios for structural concrete and established the design strength as

2000 psi. Even assuming that 2000 psi concrete was used in 1922, it will likely have gained significant strength since then, as the design strengths are defined for, and tested at, an age of 28 days, and concrete typically continues to gain strength for a significant period of time after that.

Concrete Cracking Strength. The tensile cracking strength of concrete in direct tension is assumed to be equal to $4\sqrt{f_c'}$ or 179 psi under the application of service loads. Under the application of ultimate loads, the tensile strength of concrete is calculated based on the plain concrete procedure outlined in the concrete standard, ACI 318-08 *Building Code Requirements for Structural Concrete*. ACI 318-08 specifies a tensile strength equal to $\phi \cdot 5\sqrt{f_c'} = 0.6 \cdot 5\sqrt{f_c'} = 3\sqrt{f_c'}$ or 134 psi.

Concrete Modulus of Elasticity. The concrete modulus of elasticity is assumed to be equal to $57{,}000\sqrt{f_c'}$ or 2,549 ksi for uncracked concrete. The modulus of elasticity for cracked concrete, containing reinforcement, was assumed to be equal to 70% of the cracked value or 1,784 psi. Poisson's ratio is assumed to be equal to 0.15.

Concrete Shrinkage Strain. The amount of strain caused by curing shrinkage for the concrete roof structure was assumed to be equal 0.00059 in/in. From an analytical standpoint, this magnitude of shrinkage was achieved by applying a uniform thermal load to the concrete roof and stiffener beams. Based on a coefficient of thermal expansion of 0.000006 inches per degree Fahrenheit, the thermal load applied to the components of the model was -98 °F.

Limestone Masonry Stiffness. Possibly, the most difficult variable to estimate for this study is the stiffness of the limestone masonry wall, which serves to both support the nave and the groin roofs. In general, the stiffness of limestone can vary between 400 and 4000 ksi. The stiffness of the lime mortar may be in a range between 200 to 300 ksi. Due to the large range of stiffnesses, it is necessary to create two separate models for every load case; one assuming that the limestone masonry is relatively stiff, and the other assuming that the masonry is relatively flexible. Analyzing these two models likely provides an upper and lower bound to the actual behavior of the structure. For this study, it is assumed that the stiffness of the limestone masonry is between 200 and 1500 ksi at the flexible and stiff limits, respectively.

Steel Reinforcement Yield Strength. The yield strength of the steel reinforcement is conservatively assumed to be 33,000 psi. In the 1920's, both 33,000 and 40,000 psi reinforcing steel was available.

4.1.3 Boundary Conditions

Boundary conditions are displacement constraints located at the perimeter of the finite element model. The stiffnesses of the boundary conditions are based on the size of the supports and restraining nature of the existing elements at the boundaries. Again, the models are bound between an upper and lower limit by considering both *stiff* and *flexible* boundary conditions. Joint reactions output from the analysis were validated for each load case to ensure compatibility with the boundary conditions. The boundary conditions were

calculated based on the one-dimensional linear elastic behavior of the supporting elements. A summary of the boundary conditions used is presented in Table 4-1.

Table 4-1. Summary of Boundary Conditions

			KX	KY	KZ	βX	βY	βZ
			(kip/in)			(kip-ft/rad)		
Barrel Vault	Stiff	Rib Support	831	14,175	8,232	0	0	0
		Slab Support	24.1/ft	3,150/ft	0	0	0	0
		Slab Edge	0	E: 2.7/ft W: 5.3/ft	E: 21.2/ft W: 23.8/ft	E: 1,154/ft W: 1,482/ft	0	0
	Flex.	Rib Support	111	1,890	1,094	0	0	0
		Slab Support	3.2/ft	420/ft	0	0	0	0
		Slab Edge	0	E: 2.7/ft W: 5.3/ft	E: 3.2/ft W: 3.2/ft	E: 1,154/ft W: 1,482/ft	0	0
Groined Vault	Stiff	Rib Support	E: 8,232 W: 51,940	18,225	N: 8,232 S: 8,232	0	0	0
		Slab Support	E:24.1/ft W: 24.1/ft	3,150/ft	N: 24.1/ft S: 24.1/ft	0	0	0
		Slab Edge	E: 23.8/ft W: 23.8/ft	N: 6.0/ft S: 4.5/ft E: 2.3/ft W: 2.8/ft	N: 23.8/ft S: 21.5/ft	N: 1,605/ft S: 1,443/ft	0	E: 1,155/ft W: 1,155/ft
	Flex.	Rib Support	E: 1,094 W: 6,886	2,430	N: 1,094 S: 1,094	0	0	0
		Slab Support	E: 3.2/ft W: 3.2/ft	420/ft	N: 3.2/ft S: 3.2/ft	0	0	0
		Slab Edge	E: 3.2/ft W: 3.2/ft	N: 6.0/ft S: 4.5/ft E: 2.3/ft W: 2.8/ft	N: 3.2/ft S: 3.2/ft	N: 1,605/ft S: 1,443/ft	0	E:1,155/ft W: 1,155/ft

Note: N, S, E, and W denote the North, South, East, and West side of the structure, respectively.
K_ and β_ denote the translational and rotation spring constants, respectively, about the global axis.

4.1.4 Load Combinations

The following load combinations were used to analyze the strength and serviceability behavior of the concrete roof structure over the Alamo shrine.

Serviceability:	**Strength:**
D + T	1.4D
D+L_r	1.2D+1.6L_r
D + 0.75T + 0.75L_r	1.2D + 1.6L_r + 0.8W
0.6D + W	1.2D + 1.6W + 0.5L_r
	0.9D + 1.6W

Where,

D =	dead load	=	[145 pcf concrete and 3 psf roofing]
T =	shrinkage strain force	=	[-0.00059 in/in]
L_r =	roof live load	=	[20 psf and 500 lb chandelier load]
W =	wind load	=	[varies between -14 to -20 psf]

The most significant service load that is evaluated is the strain caused by shrinkage of the concrete. Fresh concrete loses moisture and contracts as it cures. While this amount of contraction is relatively small, it can lead to very large tensile forces in the newly-placed concrete if it is prevented from contracting. As it turns out, the massive limestone masonry walls that support the concrete roof are very stiff and do not have the ability to accommodate the dimensional changes resulting from temperature and shrinkage strain.

Cracked concrete does not necessarily indicate a deficiency. In fact, the design of reinforced concrete is based on the assumption that it will crack. The presence of steel reinforcement in concrete is intended to distribute tensile stresses across the cracks. A properly reinforced concrete structure will contain evenly distributed and very small cracks. If a concrete structure is not reinforced for shrinkage, what results are infrequently spaced wide cracks. In the case of the groined vault, the roof slab does not contain reinforcement transverse to each of the four arches. In other words, reinforcement perpendicular to the existing cracks is not present. If stresses caused by shrinkage exceed the tensile strength of concrete at these locations, the structure does not have the ability to resist or evenly distribute the resulting cracking. In that condition, the initial crack is often the only crack, and it can become fairly wide.

4.1.5 Evaluation Matrix

The roof structure over the Alamo shrine has been analyzed using two sets of models. One set has been created to represent the barrel-vault over the nave, and another set has been created to represent the groined vault at the intersection of the nave and transept. The goal of this analytical study is to: i) determine the likelihood and location of cracking under service loads, and ii) verify the structural capacity of the structure in its cracked configuration. In order to account for the various model conditions, an evaluation matrix incorporating all of the critical variables is presented in Table 4-2.

Table 4-2. Evaluation Matrix

Concrete Condition	*Boundary Conditions*	*Structure Location*	*Objective*
UNCRACKED	STIFF Supports	Barrel Vault/Nave	Determine the potential for cracking under *Serviceability Load Combinations*
		Groined Vault	
	FLEXIBLE Supports	Barrel Vault/Nave	
		Groined Vault	
CRACKED	STIFF Supports	Barrel Vault/Nave	Verify the capacity of each structure under *Strength Load Combinations*
		Groined Vault	
	FLEXIBLE Supports	Barrel Vault/Nave	
		Groined Vault	

4.2 Analytical Results

Each model condition presented in Table 4-2 was analyzed under the load combinations presented in Section 4.1.4. A summary of the results is presented in Sections 4.2.1 through 4.2.3.

4.2.1 Serviceability Load Combinations

Groined Vault

The groined vault roof structure was modeled in an uncracked condition in order to assess the location and likelihood of cracking under service loads. Concrete is most likely to crack when the tensile stress obtained from the analysis exceeds its cracking strength (approximately 179 psi). The service load combination that causes the highest magnitude of tensile stress is the application of dead load and shrinkage strains (D+T). Principal tensile stress contours at the interior surface of the groined vault are presented in Figure 4-6 and Figure 4-7 for the models with stiff and flexible boundary conditions, respectively. The analysis identifies the distribution of stresses in the structure. Cracking is most likely to occur in those areas where the plotted tensile stresses exceed the cracking strength referenced above. Locations where tensile stresses are denoted with brown, pink, or red are high enough in magnitude to cause the concrete slab to crack.

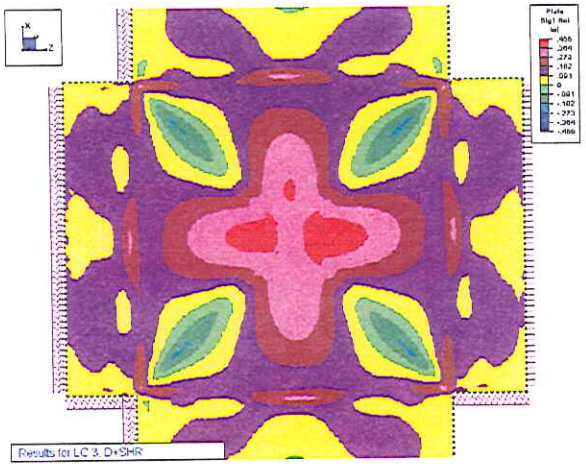


Figure 4-6. Top View of Principal Tensile Stress in the Groined Vault (STIFF Boundary Conditions)

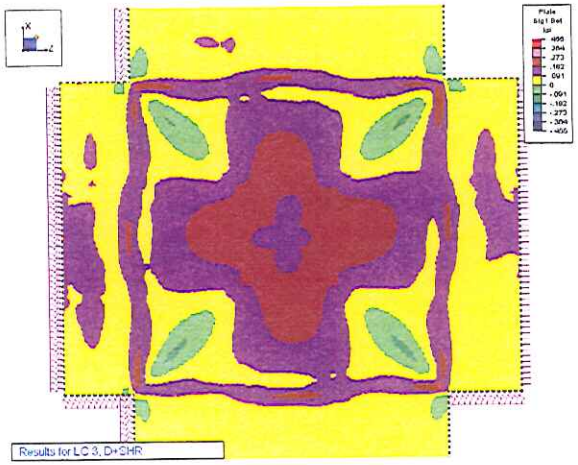


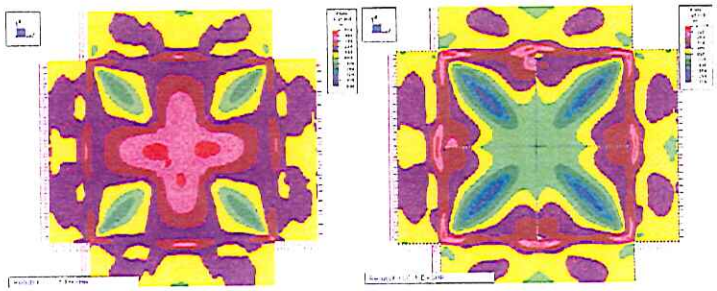
Figure 4-7. Top View of Principal Tensile Stress in the Groined Vault (FLEXIBLE Boundary Conditions)

As can be seen from both stress plots, tensile stresses due to dead load and shrinkage strains are highest at the crown of the four barrel vaults that form the groin. The RISA software program cannot display principal stress vectors; however a close examination of the output verifies that the direction of the maximum principal tensile stress at the crown is perpendicular to the existing cracks. Predictably, a crack has formed at this location. In addition, these areas of the roof do not contain reinforcement transverse to the direction of the tensile stresses. As a result, the resulting crack is a single wide crack rather than multiple distributed cracks. Given the results of the finite element analysis, it can be said that the likely cause of cracking over the groined vault is tensile stresses induced by shrinkage strains.

Tensile stresses in the slab also appear to be high enough to cause cracking over the arched ribs and their supports. This graphical outcome is likely a result of the model configuration. The high concentration of tensile stress over the ribs and at the supports is likely due to the one-dimensional modeling of the rib components. That is, the concrete slab in the model is attached to the ribs along a single line of nodes; effectively a *razor's edge*. In actuality, the slab is monolithic with the ribs across their 42 inch width, thereby reducing the span and stresses on the slab section. Also, the support of the ribs is distributed on a relatively massive pilaster. While it is true that the stiff restraint provided by the ribs would induce some tensile stress in the concrete slab, the one-dimensional simplified modeling of the ribs has exaggerated the magnitude of these stresses. It would be expected that these forces would be significantly lower had the 42 inch width of the rib elements been modeled three-dimensionally. However, as cracking is not evident in these locations, the high tensile stresses observed over the ribs in the model are not a concern.

Based on the results obtained from the *uncracked* model, it is also of interest to model the groined roof structure in its current cracked state. The purpose of modeling the structure in its crack state is to both understand the behavior and assess the structural capacity of the existing structure. A *crack* was added to the model of the groined vault by completely removing a 1.2 inch wide strip of elements at the crack location (Figure 4-5). This is a conservative way of representing the crack because the model does not have the ability to transfer any forces across the crack interface. In actuality, the existing crack likely has some ability to transfer force across the interface.

In order to understand the behavior of the cracked roof structure, the groined vault was analyzed under the same service load combination as the uncracked structure (i.e. dead load plus shrinkage strains). In other words, a crack was added to the structure presented in Figure 4-6 and the same analysis was completed. This loading condition represents the structure the moment after shrinkage cracking occurs. By comparing an analysis of the cracked and uncracked structures, it is possible to observe the effect that shrinkage cracking has at relieving the tensile stresses in the concrete slab. A comparison of the cracked and uncracked structure considering stiff boundary conditions is presented in Figure 4-8.



Uncracked *Cracked*

Figure 4-8. Analysis of Uncracked vs. Cracked Structure (STIFF Boundary Conditions).

The maximum vertical deflection in the groined vault roof was assessed under the application of all of the live load. According to the model, the application of live load causes the center of the cracked groined vault to deflect 0.03 inches (L/10,100); an insignificant amount. To put this in perspective, it is standard practice to limit the deflection of a structure due to live load to less than L/360. Thus, it can be said that the serviceability behavior of the groined vault in its cracked condition is considerably better than commonly accepted limits.

Barrel Vault/Nave

The barrel vault roof structure over the nave was also modeled in the uncracked condition in order to assess the location and likelihood of cracking under service loads. The results of this analysis are less significant than the results obtained at the groined vault because the barrel vault roof contains crack control reinforcement in both directions. If cracking were to occur, reinforcement exists to distribute the cracking. Nonetheless, the barrel vault/nave was analyzed in the interest of completeness. The service load combination that causes the highest magnitude of tensile stress is the application of dead load and shrinkage strains (D+T). Principal tensile stress contours at the interior surface of the barrel vault are presented in Figure 4-9 and Figure 4-10 for the models with stiff and flexible boundary conditions, respectively. Locations where tensile stresses denoted with brown, pink, or red are high enough in magnitude to cause the concrete slab to crack.

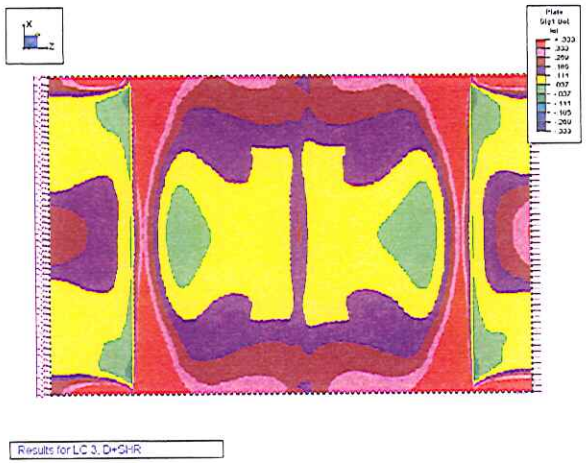


Figure 4-9. Top View of Principal Tensile Stress in the Barrel Vault/Nave (STIFF Boundary Conditions)

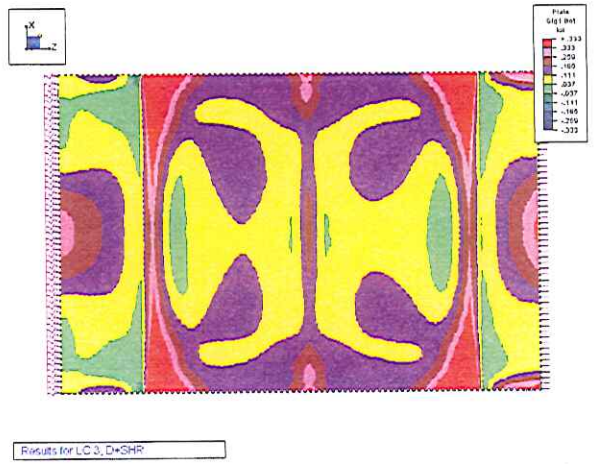


Figure 4-10. Top View of Principal Tensile Stress in the Barrel Vault/Nave (FLEXIBLE Boundary Conditions)

As can be seen from both stress plots, tensile stresses due to dead load and shrinkage are high enough to cause cracking parallel to the ribs and at the interface with the wall. However, the roof structure over the nave contains steel reinforcement to resist and distribute cracking. Thus, while it may be possible that shrinkage cracks exist in the roof structure over the nave, they are not evident.

4.2.2 Strength Load Combinations

Groined Vault

In addition to assessing the likelihood of cracking under service loads, it is of interest to examine the structural capacity of the cracked structure in its current state. The cracked finite element model illustrated in Figure 4-5 was analyzed for the factored load combinations presented in Section 4.1.4. The analyses assume that a minimum amount of reinforcement exists along the locations established with ground penetrating radar. Also, this assessment only considers the integrity of the slab located further than 18 inches from the centerline of the ribs. For reasons previously discussed, the portion of the slab that is integral with the beams is not considered in order to eliminate the discrepancies found at the discontinuities in the model. The results of these analyses are presented in Table 4-3.

Table 4-3. Results of Analyses of Cracked Groined Vault

Boundary Conditions	*Force*	*Load Case*	*Ultimate*	*6" Slab Capacity†*	
STIFF	Shear, V_{xu}	1.2D+1.6L_r	1.1 k	ϕV_n = 2.6 k	*OK*
	Shear, V_{yu}	1.2D+1.6L_r	1.2 k	ϕV_n = 2.6 k	*OK*
	Moment, M_{xu}	1.2D+1.6L_r	0.5 k-ft	ϕM_n = 0.8 k-ft	*OK*
	Moment, M_{yu}	1.2D+1.6L_r	1.0 k-ft	ϕM_n = 0.8 k-ft	LOW
	Tension, F_{xu}	1.2D+1.6L_r	3.8 k	ϕF_n = 9.7 k	*OK*
	Tension, F_{yu}	1.2D+1.6L_r	10.3 k	ϕF_n = 9.7 k	LOW
FLEXIBLE	Shear, Q_{xu}	1.2D+1.6L_r	1.3 k	ϕV_n = 2.6 k	*OK*
	Shear, Q_{yu}	1.2D+1.6L_r	1.5 k	ϕV_n = 2.6 k	*OK*
	Moment, M_{xu}	1.2D+1.6L_r	0.7 k-ft	ϕM_n = 0.8 k-ft	*OK*
	Moment, M_{yu}	1.2D+1.6L_r	1.1 k-ft	ϕM_n = 0.8 k-ft	LOW
	Tension, F_{xu}	1.2D+1.6L_r	4.0 k	ϕF_n = 9.7 k	*OK*
	Tension, F_{yu}	1.2D+1.6L_r	11.6 k	ϕF_n = 9.7 k	LOW

†Tensile, moment and shear capacity of the slab is calculated based on plain concrete provisions. Compression stresses were observed to be insignificant

ϕ = 0.6 for plain structural concrete

As can be observed from the summary of results listed in Table 4-3, the 6 inch thick slab that forms the groined vault over the Alamo shrine meets most of the requirements prescribed by the plain (i.e. unreinforced) concrete provisions. Based on the model output, it would appear as if the slab does not have adequate capacity to resist the maximum moment in the local y-direction. However, it is known that the slab contains reinforcement orientated in this direction. If it is assumed that the slab contains a minimum amount of reinforcement (0.25% of the concrete cross-section by current standards, approximately 1 #4 bar per foot), then the capacity (1.2 k-ft) is adequate to resist the factored moment. The output listed above also shows that the maximum factored tensile force in the slab exceeds

the prescribed capacity. The tensile capacity listed ignores the contributions available from the steel reinforcement. As such, taking into consideration the conservative assumptions built into the analysis and upon closer examination of the small localized area where this tensile force occurs, the roof structure has the adequate mechanisms necessary to redistribute and alleviate the stress.

The concrete rib elements were also evaluated under the application of the maximum factored axial, shear, and moment forces. Upon examination of the resulting stresses, it was immediately apparent that the capacity of the beam elements exceeded the applied loads to the extent that these forces may be considered trivial.

In summary, based on the finite element analysis of the reinforced concrete groined vault over the shrine, it can be stated that the structural capacity of the structure in its current cracked condition is adequate.

Barrel Vault/Nave

The barrel vault roof structure over the nave contains reinforcement in both directions. Thus, it has the ability to resist and distribute cracking. In order to evaluate the structural integrity of the roof and ribs, the combined effects of the applied loads were compared to the nominal capacity of each element. The finite element model presented in Figure 4-1 was analyzed with the load combinations presented in Section 4.1.4. In order to account for potential shrinkage cracks that may exist, the stiffness of the concrete slab was reduced by 30%. Also, similar to the groined vault analysis, stresses in the portion of the slab that is integral with the beams are not considered in order to eliminate discrepancies caused at discontinuities in the model. The results of this analysis are presented in Table 4-4.

Table 4-4. Results of Analyses of Barrel Vault/Nave

Boundary Conditions	*Force*	*Load Case*	*Ultimate*	*6" Slab Capacity†*	
STIFF	Shear, Q_{xu}	1.2D+1.6L_r	0.3 k	ϕV_n = 2.6 k	OK
	Shear, Q_{yu}	1.2D+1.6L_r	0.2 k	ϕV_n = 2.6 k	OK
	Moment, M_{xu}	1.2D+1.6L_r	0.1 k-ft	ϕM_n = 0.8 k-ft	OK
	Moment, M_{yu}	1.2D+1.6L_r	0.6 k-ft	ϕM_n = 0.8 k-ft	OK
	Tension, F_{xu}	1.2D+1.6L_r	NA	ϕF_n = 9.7 k	OK
	Tension, F_{yu}	1.2D+1.6L_r	0.9	ϕF_n = 9.7 k	OK
FLEXIBLE	Shear, Q_{xu}	1.2D+1.6L_r	0.8 k	ϕV_n = 2.6 k	OK
	Shear, Q_{yu}	1.2D+1.6L_r	0.5 k	ϕV_n = 2.6 k	OK
	Moment, M_{xu}	1.2D+1.6L_r	0.3 k-ft	ϕM_n = 0.8 k-ft	OK
	Moment, M_{yu}	1.2D+1.6L_r	0.7 k-ft	ϕM_n = 0.8 k-ft	OK
	Tension, F_{xu}	1.2D+1.6L_r	NA	ϕF_n = 9.7 k	OK
	Tension, F_{yu}	1.2D+1.6L_r	0.5	ϕF_n = 9.7 k	

†Tensile, moment and shear capacity of the slab is calculated based on plain concrete provisions. Compression stresses were observed to be insignificant

ϕ = 0.6 for plain structural concrete

As can be observed from the summary of results listed in Table 4-4, the 6 inch thick slab that forms the barrel vault over the Alamo nave meets all of the requirements prescribed by the plain (i.e. unreinforced) concrete provisions.

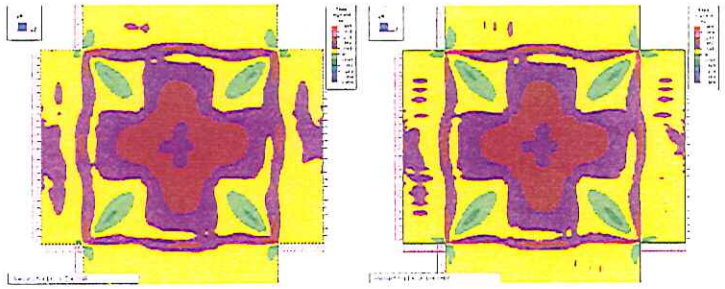
The concrete rib elements were also evaluated under the application of the maximum factored axial, shear, and moment forces. Upon examination of the resulting stresses, it was immediately apparent that the capacity of the beam elements exceeded the applied loads to the extent that these forces may be considered trivial.

In summary, based on the finite element analysis of the reinforced concrete arched slab, it can be stated that the structural capacity of the structure in its current condition is adequate.

4.2.3 Model Discretization

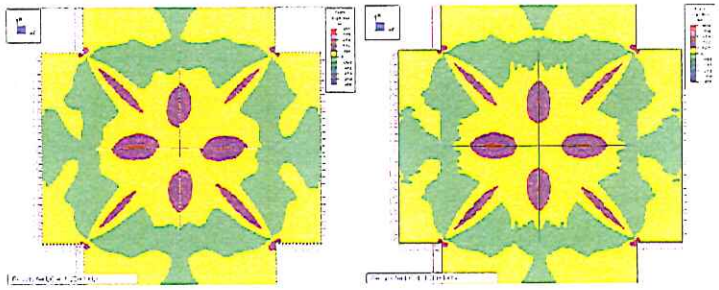
The numerical results obtained from a finite element analysis depend on the number of elements used to model a particular structure. In general, as the number of elements increases; the element mesh becomes finer; and the accuracy improves. A finer mesh is typically required at geometric, material, and loading discontinuities. Examples include concentrated loads, re-entrant corners, or the interface between different materials. There are various accepted metrics that are used to help assess the adequacy of a finite element mesh to produce accurate results. A relatively easy way to assess model discretization is to refine the mesh by subdividing the elements in the model, and by comparing the results of the two meshes. Both local and global measures of difference between the two sets of results are typically used, and, in general, small differences (e.g. 5%) indicate sufficient meshing, and results that are acceptable for engineering purposes.

In order to evaluate the model discretization for this project, the meshes used for both the uncracked and cracked models were refined by halving the element size of each shell element from 6 inches to 3 inches; this resulted in the quadrupling of the number of elements and an increase in the number of nodes from 6,561 to 25,193 for the uncracked model, and from 8,016 to 25,660 for the cracked model. A comparison of the principal (tensile) stresses for the two different meshes is shown in Figure 4-11 for the uncracked model of the groined vault, and in Figure 4-12 for the cracked model.



6,561 Joints *25,193 Joints*

Figure 4-11. Comparison between Uncracked Groined Vault Models with 6,561 vs. 25,193 Nodes



8,016 Joints *25,660 Joints*

Figure 4-12. Comparison between Cracked Groined Vault Models with: a) 8,016 vs. b) 25,660 Nodes

As can be seen from Figure 4-11 and Figure 4-12, refining the mesh did not have a significant impact on the results. As expected, stress contours are more defined at locations of geometric discontinuity such as corners and interfaces between components. However, the overall results and previous conclusions remain unchanged. Thus, it can be stated that the mesh chosen for the analysis of the roof structure is appropriate.

5 SUMMARY OF STUDY

The concrete roof structure over the Alamo shrine was structurally analyzed using a three-dimensional finite element model. The purpose of the analysis is to understand the structural behavior of this complex structure as well as to provide insight into the cause of existing cracks. An overview of the background of the finite element analysis including

modeling assumptions, boundary conditions, and loading combinations is presented in Section 4.1. The results of the analysis are presented for both the expected serviceability and strength loading conditions in Section 4.2.

Based on the results of the analysis and field observations, it is concluded that the likely cause of the existing cracks is the tensile stress induced by the shrinkage of concrete taken in combination with the absence of crack control reinforcement. The forces generated from shrinkage are adequate to cause the roof to crack at the same location as existing cracks are located. In addition, a finite element analysis of the roof structure in its current cracked condition confirms that the structural capacity of the roof as it currently exists is adequate to resist the load combinations prescribed by the current Building Code. While the finite element model indicates some localized areas where Code-mandated cracking stress thresholds are exceeded, those areas are small, and the structure provides alternative load paths to which those forces may be distributed without compromising the overall integrity of the structure.

Additionally, as the concrete roof structure was constructed around 1922, and as the bulk of concrete shrinkage occurs within the first few years after placement, we believe that the cracks over the vault were present shortly after construction, certainly by the mid 1920's. In fact, photographic evidence of the cracking exists from photos that appear to date from the 1960's (Figure 5-1).

Figure 5-1. View of Groined Vault dated from approximately 1960.

6 Conclusions and Recommendations

The results of the finite element analysis confirm that the existing vaulted roof structure has sufficient capacity to safely support the loads mandated by the Building Code. In addition, photographic evidence indicates that the cracks have existed in the crown of the groined vault for at least the last 50 years. From a structural standpoint, repairs of the vaulted roof are not required. The existing cracks at the crown of the vault were created by stresses that were caused by volumetric changes in the concrete roof. These cracks now provide a *relief zone* to accommodate the continued volumetric changes in the groined vault. Filling the cracks with a structural material would eliminate that relief zone. As a consequence, the structure would not have the ability to relieve thermal movements resulting in the accumulation of restraining forces. Without the ability to relieve those restraining forces, the roof or supporting structure could develop additional cracks at the same locations or elsewhere, depending on the temperature of the structure when the cracks are filled.

We propose that the damaged area of the vaulted roof in the northwest corner of the groin near the top of the stone walls be repaired for the sake of appearance and to eliminate that opportunity for rainwater to collect within the structure. The stresses in this region are relatively low and do not a play a significant role in transferring the structure's loads to the ground. This area includes a void in the cast concrete that has probably been there since the roof was constructed. Repair could be accomplished by chipping away the thin edges of concrete surrounding the void to expose the interior surface of the void. A polymer modified concrete patching grout could then be applied per manufacturer's instructions to fill the void and restore the profile such that it matches the other similar corners. Prior to placement of the patching grout, all corrosion products should be removed from exposed reinforcing by sand blasting, and all exposed surfaces of the void that will receive patching grout should be roughened to facilitate the adherence of the new patching grout to the existing concrete.

Most importantly, we strongly recommend that the roofing over the entire Alamo shrine be repaired or replaced so that its integrity against water intrusion is restored. The concerns regarding the observed structural issues in the Alamo appear to be largely attributable to the deterioration of their appearance, and this deterioration is a result of the effects of water infiltration. Fortunately, the vaulted roof structure is dependent on its steel reinforcing in only a limited way; the critical reinforcing does not appear to be compromised by water intrusion, at this time. Nevertheless, it is true that the single largest threat to the continued viability of the Alamo structure is water intrusion. Protected from water, the life expectancy of most concrete structures is practically indefinite.

We have carefully modeled and studied the vaulted roof structure of the Alamo shrine. In the process, we have developed a better understanding of how it behaves and more confidence in its durability. We firmly believe that the vaulted roof is stable and safe in its current condition, and that it will be an enduring structure, provided that it is adequately protected from water intrusion.

Robin Tuchscherer, P.E.

D. Martin Sloan, P.E.

Datum Engineers, Inc.

July 30, 2010

APPENDIX A – GROUND PENETRATING RADAR REPORT

GROUND PENETRATING RADAR SYSTEMS, INC.

June 9, 2010
Datum Engineers
Mr. Marty Sloan
5929 Balcones Dr.
Suite 100
Austin, TX 78731

Re: The Alamo
San Antonio, TX

Mr. Sloan:

On Tuesday June 1st 2010, we visited the property listed above to perform a geophysical survey with ground penetrating radar (GPR). The purpose of the survey was to identify the thickness of the concrete roof, and to determine the location and spacing of rebar within the roof, and to mark their location on the surface.

We used a ground penetrating radar device to survey the property. The radar equipment used consisted of a SIR-3000 operating system with a 1600 MHz antenna. This equipment is capable of scanning up to18 inches below the surface. As the radar equipment is in operation, real-time data is displayed on the monitor that is interpreted by a trained and experienced technician. The images portrayed by the system will reveal anomalies and changes in the concrete based on their conductive properties. For further equipment detail please visit www.geophysical.com.

The investigation consisted of performing "scans" over four areas on the roof of The Nave, and two areas on the roof of the Monk's Burial room. A "scan" is when the radar system is in operation and the technician moves the radar across the surface in an east-west or north-south direction, thus scanning, each area in a grid pattern. After each scan, data is obtained and shows the concrete thickness, and if any rebar is detected. If the reaction detected is consistent and substantial in size, then the anomaly may be interpreted a rebar.

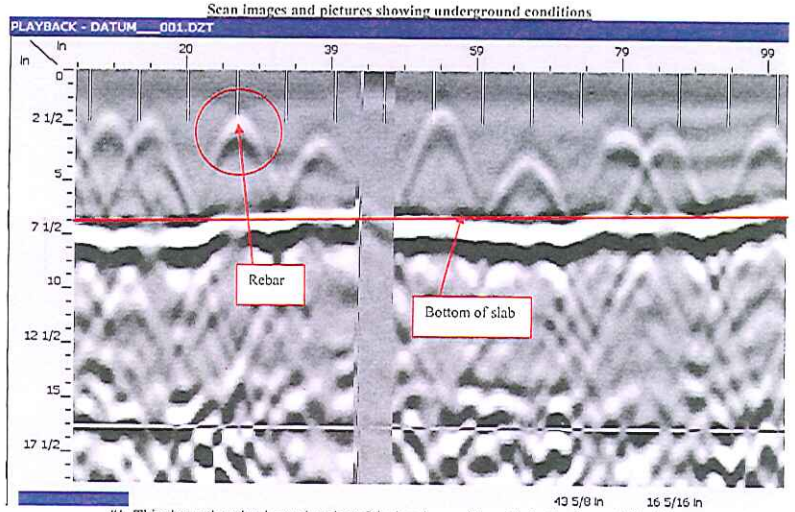
After scanning the property location, we found the slab in The Nave to be on average 6 inches thick, but was slightly thicker by the north wall. The rebar spacing was not consistent in terms of spacing or depth. In the very center of The Nave, there were no rebar located running east-west. The slab in the Monk's burial ground was around 6 inches thick, however it was around 6.5-7 inches by the north wall. This was the same as The Nave in terms of the rebar pattern being inconsistent.

The pictures and scans below show the areas where scans were performed, and have explanations below each of them. Please reference them for any questions you may have.

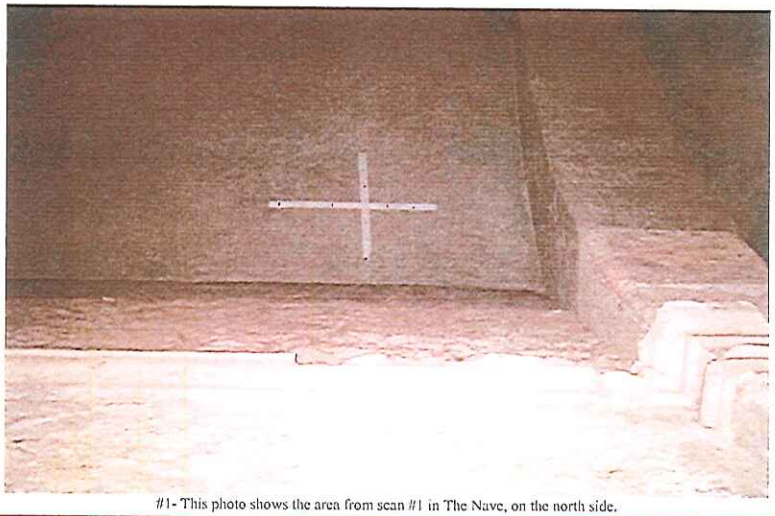
Sincerely,

Chad Fischer
Regional Manager – San Antonio & Houston Texas
Ground Penetrating Radar Systems, Inc.
"The New Way to X-Ray"
210.607.0361 – Phone
866.686.3412– Fax

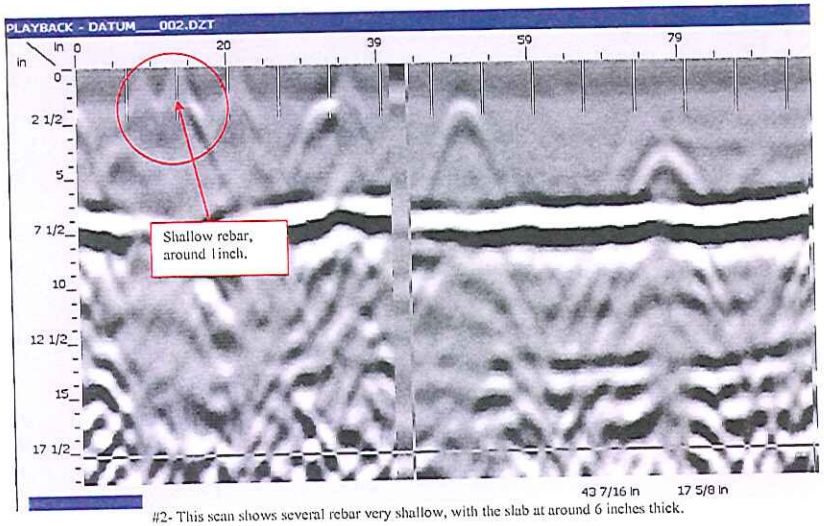
Scan images and pictures showing underground conditions



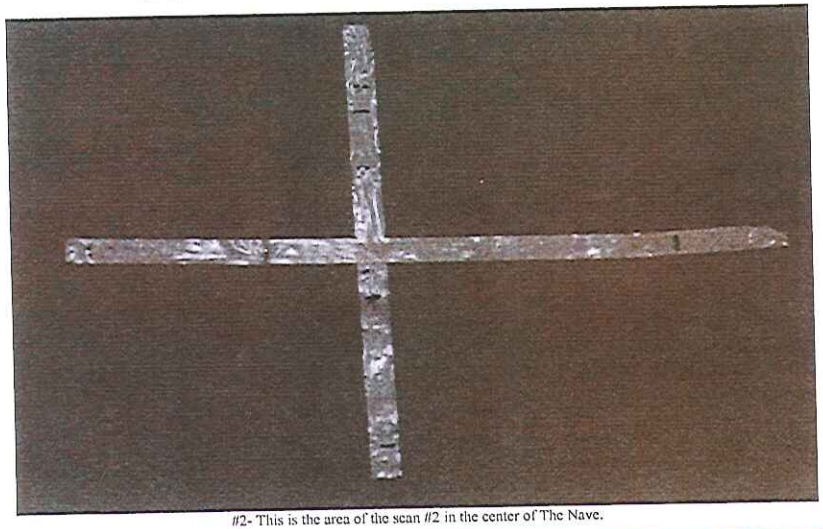
#1- This shows the rebar located at about 2 inches deep, with a slab depth of around 6 inches.



#1- This photo shows the area from scan #1 in The Nave, on the north side.

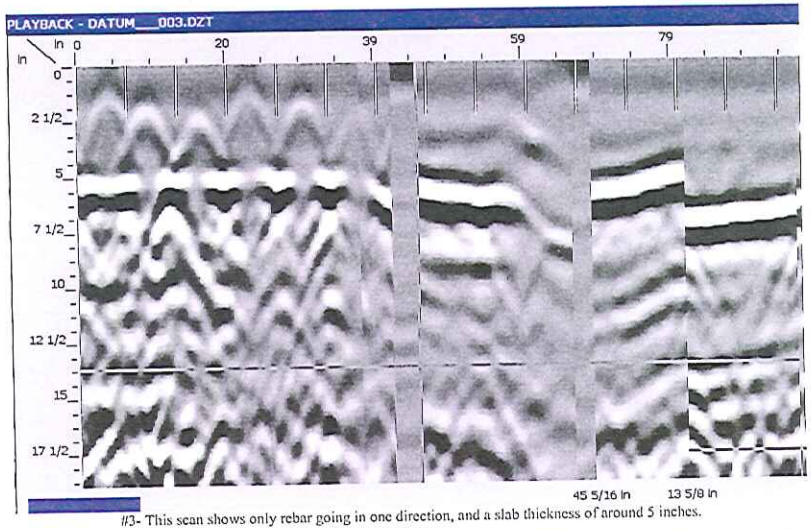


#2- This scan shows several rebar very shallow, with the slab at around 6 inches thick.

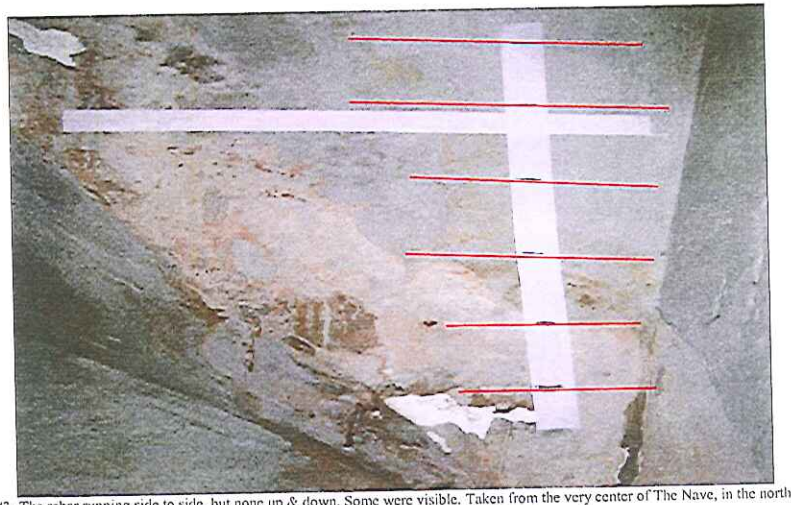


#2- This is the area of the scan #2 in the center of The Nave.

Ground Penetrating Radar Systems, Inc.
8534 W. Central Ave.
Sylvania, OH 43560
www.gp-radar.com



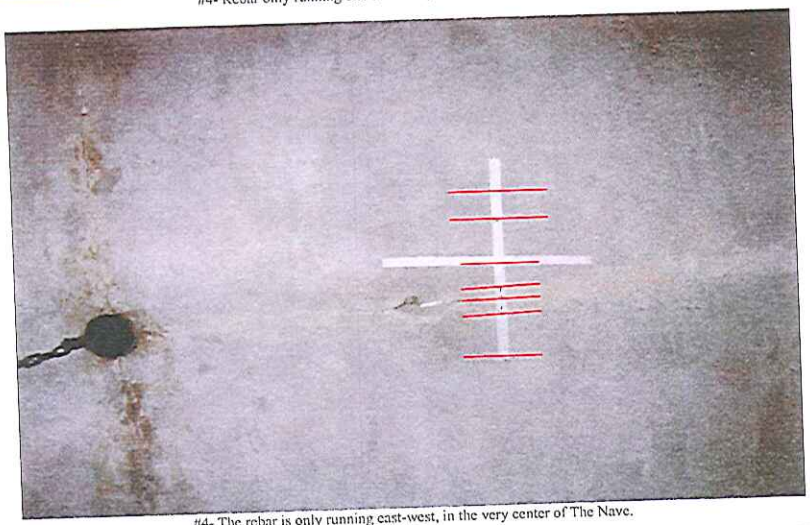
#3- This scan shows only rebar going in one direction, and a slab thickness of around 5 inches.



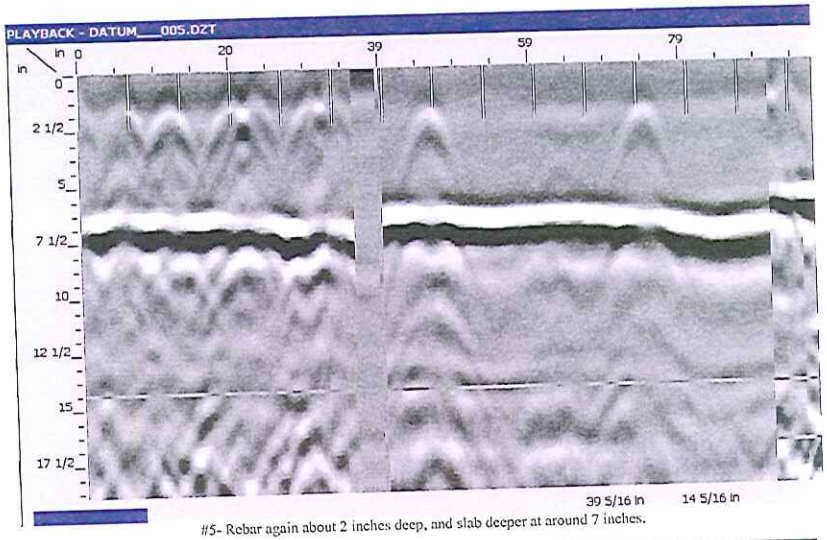
#3- The rebar running side to side, but none up & down. Some were visible. Taken from the very center of The Nave, in the north-west corner.

Ground Penetrating Radar Systems, Inc.
8534 W. Central Ave.
Sylvania, OH 43560
www.gp-radar.com

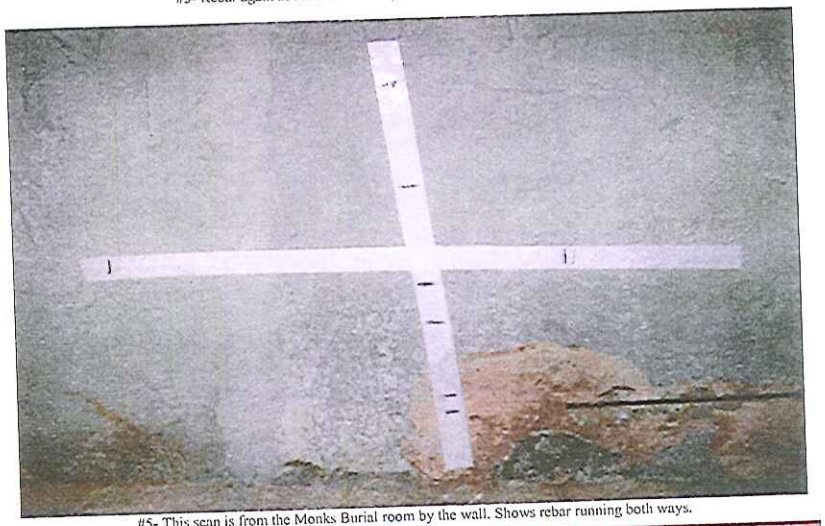
#4- Rebar only running one direction, and slab at 6 inches thick.



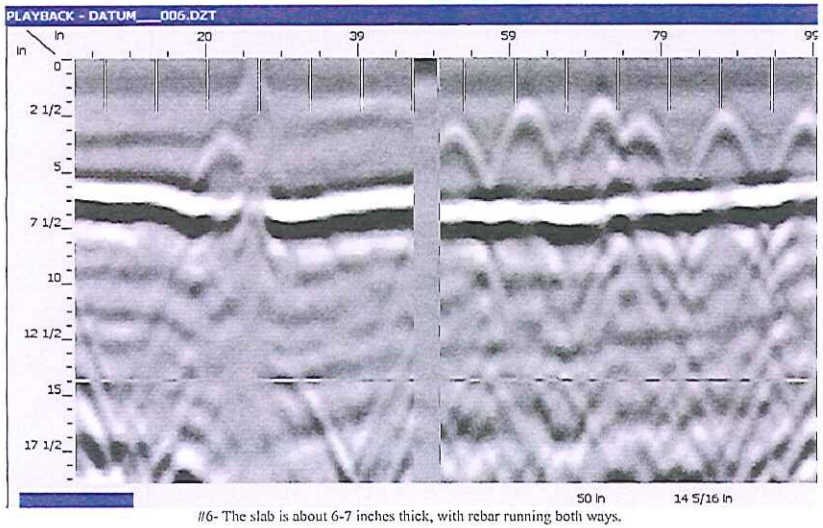
#4- The rebar is only running east-west, in the very center of The Nave.



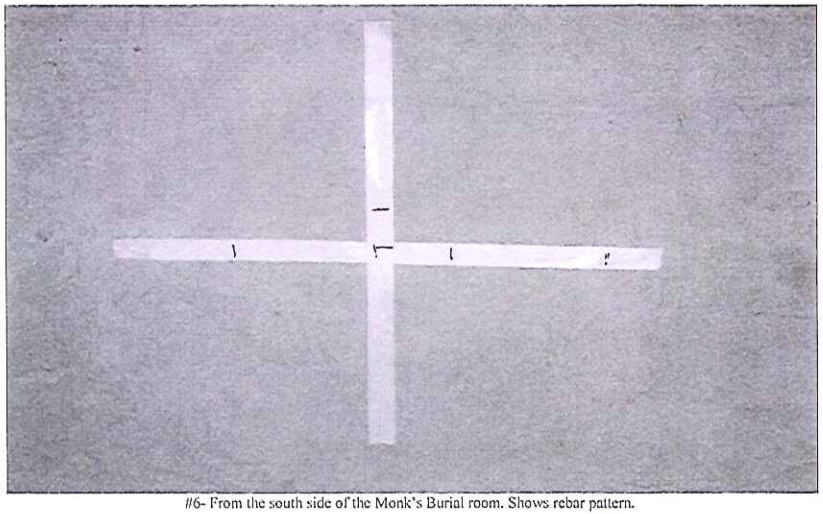
#5- Rebar again about 2 inches deep, and slab deeper at around 7 inches.



#5- This scan is from the Monks Burial room by the wall. Shows rebar running both ways.



#6- The slab is about 6-7 inches thick, with rebar running both ways.



#6- From the south side of the Monk's Burial room. Shows rebar pattern.