THE FALL OF A HISTORICAL STRUCTURE

1914 Nueces County Courthouse, Corpus Christi,

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BACKGROUND

The Historic 1914 Nueces County Courthouse, located at 1101 Mesquite Street, in Corpus Christi, was constructed around 1914 in the classical revival style and was a source of pride for the county. It received many architectural awards, including "The Most Beautiful Courthouse in Texas" from 1915 to 1920, and was placed on the National Register of Historic Places in 1976 (*McGloin & Sween, 2000*).

Image1. The 1914 Courthouse

Due to growth in the county, the original 1914 courthouse was becoming over-crowded, creating the need for an addition on the west side of the courthouse, which was approved in 1930 and constructed in 1931 (*McGloin & Sween, 2000*).

The courthouse experienced two major hurricanes, the 1919 hurricane and Hurricane Celia in 1970. Through the years, the county continued to grow, and even with the addition, the courthouse size proved to be inadequate. The lack of space, expanding maintenance requirements for the structure, concern for the structure's condition following Hurricane Celia in 1970 and falling pieces of the exterior façade, lead the county to begin the process of constructing a new county courthouse (*McGloin & Sween, 2000*). The new county courthouse, located at 901 Leopard Street, in Corpus Christi, was completed in 1977 and the historic 1914 courthouse was no longer used. Several studies have been performed through the years to check the structural condition of the building, as well as proposing new uses and providing recommendations for restoration. Unfortunately, there have been no successful or economically feasible solutions.

Limited rehabilitation of the 1914 courthouse and 1930 addition was begun in 2003, with drawings and details indicating repair methods for the distressed areas seen at the time. Only minimal structural concrete repairs are visible in comparison to the required repairs noted in the construction documents. Information obtained in the existing reports and other sources indicate that due to funding issues repairs were only made to the exterior brick facade and terra cotta elements on the south wing of the building, as well as sporadic concrete repairs to a few columns in the same area.

DESCRIPTION:

The building is a six-story structure, which includes a basement level that is at finished grade elevation. The structure is constructed of monolithically cast-in-place concrete beams, columns, and floor slab systems, with an approximate gross square footage of 68,400 for the 1914 courthouse and 18,000 for the 1930 addition, with a combined total gross square footage of 86,400.

Construction Materials

Reinforced concrete structures were commonly used during the time period of which the 1914 courthouse and 1930 addition were constructed. Based on the existing drawings, the 1914 courthouse is constructed using a proprietary system of "Kahn Trussed Bars" throughout the floor slabs and beams, while the columns remain conventionally reinforced with billet steel. The "Kahn Trussed Bar" consists of a main horizontal square steel bar with flanges on opposing sides that are sheared up at regular intervals forming diagonals, combining shear reinforcing and tension/compression reinforcing into a single composite section (*Trussed Concrete Steel Company, 1913*). The 1930 addition is constructed using conventional billet reinforcing steel for the columns, beams and floor slabs.

Foundation System

Both the original 1914 courthouse and 1930 addition are supported on conventional reinforced concrete spread footings. Based on the Raatz Report (*1957*), "the foundations are supported by medium firm plastic clay of reasonably good quality". The construction drawings reviewed provide a layout, footing sizes and reinforcement quantity, but are lacking the approximate depth of the footings. According to the Sparks Report (*2000*), the spread footings at the 1914 courthouse and the 1930 addition have the bottom of footings located 6'-0" and 7'-0" below existing grade, respectively.

Concrete Framing System

As mentioned previously, the main framing system is constructed of cast-in-place reinforced concrete columns and beams, as well as cast-in-place gabled roof trusses. Based on the method of concrete construction, the floor slab systems are also cast monolithically with the main frame of the structure.

The floor system at the basement level of both the 1914 courthouse and the 1930 addition is a floating concrete slab-on-grade.

The floor systems at the first, second, and third floors of the 1914 courthouse are a one-way slab type system consisting of a proprietary design known as "Floretyle" and utilize the "Kahn Trussed Bars" for reinforcing steel. The "Floretyle" system design uses permanent metal pan forms to create narrow concrete joists, seen in the photograph to the right, which carry loads to the main frame members. The metal pans serve as permanent forms, which provide no structural value to the system. Construction of this type is the precursor to the modern pan joist system.

Image 2. The "Floretyle system

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Based on the existing construction drawings, the depth of the "Floretyle" system varies from 4 inches to 12 inches throughout the 1914 courthouse with a 2-inch concrete topping. The fourth and fifth floors of the 1914 courthouse utilize solid one-way concrete slab systems of varying thickness based on span length.

The floor system throughout the first, second, and third floors of the 1930 addition are constructed of one-way slabs and rib-slab beams formed between clay tile forms with reinforcing steel in the rib, which is another type of pan joist system. These rib-slab beams then transfer all loads to the main frame members of the system. The clay tile forms of this system also act as permanent forms and do not provide structural value to the system. Based on the existing construction drawings, the depth of the clay tiles at all three levels of the 1930 addition is 6 inches with a 2-inch concrete topping.

Image 3. 1914 Roof Framing

The fourth and fifth floors of the 1930 addition use conventionally reinforced concrete beams with solid one-way concrete slab systems of varying thickness based on span length.

Roof Framing System

The roof system of the 1914 courthouse consists of cast-in-place concrete roof trusses with solid one-way slab systems spanning between these concrete trusses at both the third and fifth floor roofs, as seen in the photograph below. The only exception occurs at the flat portion of roof over the fifth floor, which is framed similarly to the fourth and fifth floors with solid one-way slab systems spanning between concrete beams.

Image 4. 1930 Roof Framing

Image 5. Hollow clay tile & brick infill

The roof system of the 1930 addition appears to have been constructed in two phases. In the first phase, the roof framing formed the flat ceiling followed by the second phase of the additional concrete beams with one-way slab systems which form the gable portion of roof, (see image 4).

Exterior Walls

The exterior walls consist of hollow structural clay tile with common clay brick material used as infill around openings and structural components, as well as brick veneer with architectural terra cotta cladding. These elements are classified as "Components and Cladding." The main framing system, or Main Wind Force Resisting System (MWFRS), for the courthouse consists of the cast-in-place concrete columns and beams. The "Components and Cladding" elements are designed to transfer lateral loads, such as wind loads, to the MWFRS of the structure and do not provide any structural support to the main framing system itself. Furthermore, "Components and Cladding" elements are secondary and can be taken away from the system without causing failure of the main framing system.

FIELD OBSERVATIONS:

Based on observations of the visible structural elements, severe deterioration is present throughout the structure, as well as significant evidence of differential movement of the foundation systems. The concrete main framing members are noted to be physically large in size, which has allowed some re-distribution of the structure's self-weight (gravity) loading as the deterioration process has progressed. It is important to note that deterioration does not progress in a linear fashion, but is instead more of an exponential progression. Due to the facility's proximity to Corpus Christi Bay and the abundance of salt in the air, the natural deterioration process is accelerated.

What may start as a small crack in a concrete member, will allow moisture to penetrate to the reinforcing steel, allowing corrosion to begin. As the steel reinforcing corrodes, it expands in volume, causing larger cracks to form in the concrete, which eventually result in portions of the concrete becoming displaced or breaking loose completely, also known as spalling. the corrosion of the reinforcing steel will continue down the length of the reinforcing causing more cracks and spalls, exposing more of the reinforcing to the elements, and further accelerating the corrosion and deterioration process.

Foundations and Differential Movement

The 1930 west wing addition appears to be settling at the west end causing a noticeable tilt in the addition portion towards the west. The Killis Almond report does mention differential foundation movement, and notes that the west end of the 1930 addition had settled approximately two inches at the time of their investigation (*Almond, 1998*). The Killis Almond report also mentions that during their investigation, they were informed that there had been indications of foundation movement in the past, but significant movement was not noticed until construction of the US Highway 181 overpass to the west of the courthouse began (*Almond, 1998*). It may be possible that the expansion of US Highway 181 changed the drainage pattern at the west end of the property or the surcharge may have contributed to the settlement that is seen today. During our assessment, it appears that the west end of the 1930 addition has settled a total of four inches, which is an additional two inches since the Killis Almond investigation.

There is also visually discernible evidence of differential settlement between the north and east entry stairs and the north and east wings, respectively, of the original 1914 courthouse. All the stairs appear to have remained relatively stationary, while the main structure appears to have settled, pulling away from the stairs. The differential settlement between the main building and both stairs is due to dissimilar loading conditions; the building having a greater weight than the stairs. This differential settlement has caused damage to the exterior finishes in the form of cracked and displaced brick veneer and has translated into the basement level causing damage to the masonry walls.

Main Frame Members

Deterioration of the concrete columns and beams is noted throughout the entire structure. The settlement of the west wing addition has created a void at the expansion joint that allows water to infiltrate into the building, exasperating the corrosion of the reinforcing steel in the vicinity of the building expansion joint which causes spalling of concrete beams, floor slabs and columns. Fortunately, the building expansion joint between the original 1914 construction and 1930 addition has prevented further structural damage due to reloading of the structure had the two portions been rigidly connected. Corrosion of the reinforcing steel is present throughout the entire structure due to exposure to the elements. Broken windows have allowed rain and humidity to infiltrate the building envelope. The reinforcing steel in the concrete members is susceptible to corrosion, which causes a volumetric increase of the steel with sufficient force that the surface concrete is cracked and displaced (spalled). Many of the concrete members have lost cross sectional area due to this process.

Floor Systems

The floor systems in both the 1914 courthouse and 1930 addition are experiencing the same issues as the main frame members due to corrosion of the reinforcing steel and spalling of the concrete. This is seen in both the pan joist type systems of the first three floors of both structures as well as in the one-way slab systems present in the 4th and 5th floors of both structures. It was also visually noted that the floating slab-on-grade at the basement level was not level and soil movement beneath the slab has occurred over time.

The metal pans of the "Floretyle" system are severely corroded as is the reinforcing steel in the formed rib joists. Much of the concrete in the rib joists is spalled and/or missing. As deterioration of these rib joists progresses and their cross sectional area is reduced, the load carrying capacity of the floor system is significantly reduced since all that is left is a relatively thin concrete slab spanning between main frame members. The full extent of deterioration of these floor systems could not be observed due to suspended ceilings that are still in place, prohibiting our view. Repairs to the existing system will be extremely difficult due to the nature of construction for these types of systems, and complete replacement of the floor systems may be more feasible, should the building be restored.

Roof

The roofing material is in very poor condition and the concrete roof slab is completely exposed in several places. Exposure of the concrete roof deck allows moisture to penetrate through the concrete and cause corrosion in the reinforcing steel, which as mentioned above, causes spalling of the concrete. In several locations on both the 3rd and 5th floor roofs, corroded reinforcing steel is visible at concrete beams and roof slabs.

Separations between the concrete roof beams and stub columns above the 5th floor jail of the 1930 west wing addition are of high concern. These separations are consistent with the building settling underneath a relatively rigid roof system, but since these members are no longer considered monolithic and not performing as intended, a re-distribution of forces occurs resulting in an increase in stress seen by other members of the system.

As mentioned, the majority of the members have lost cross-sectional area and capacity due to deterioration and spalling of the concrete.

The introduction of additional stresses that were not originally intended to be applied to these members, in addition to a loss of member capacity, creates an unpredictable and potentially dangerous condition, including catastrophic failure.

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Exterior: Terra Cotta

Image 6. Current Roof Condition

On the exterior, the terra cotta facade is in poor condition. Steel brackets are used to support projecting and suspended terra cotta items, while terra cotta items that protrude less than 12 inches from the brick face appear to be held in place by mortar alone. Many elements are cracked, displaced, or missing due to corroded anchorage to the building. Some areas have been previously repaired with temporary bracing to prevent further detachment of terra cotta elements.

Exterior: Brick Veneer

Image 7. Temporary reinforcing previously added at displaced terra cotta

The majority of the exterior wall surfaces are clad with a masonry brick veneer system. The brick veneer is supported by steel lintels at all openings, but brick relief angles are not noted. Where they occur, the remainder of the brick veneer appears to only be supported by continuous bands of terra cotta. Metal corrugated ties appear to have been used to laterally secure the brick veneer to the hollow clay tile wall, however, almost all the ties have corroded away and no longer provide support to the brick. The specifications provided for the 1930 addition specify these ties to be galvanized with a tie placed at each brick of every fourth course (*Dielmann & Levy, 1930*).

Much of what appears to be the original mortar has severe erosion. The veneer also has separations and cracks in several areas as the result of the differential foundation movement previously mentioned. The steel lintels supporting the veneer over the windows appear to be corroded resulting in additional vertical displacement plus the movement already occurring in the structure. The additional vertical displacement of the lintel is a result of section reduction due to the corrosion.

Exterior: Structural Clay Tile

The infill walls consist of a hollow structural clay tile that has been stacked between the floor and ceiling and lightly mortared. The hollow structural clay tile material does not appear to be physically anchored to the main concrete frame at the 1914 courthouse or the 1930 addition, although the "General Specifications" by Dielmann and Levy for the addition state "*where tiles rest upon concrete, girders, walls, beams or adjoin concrete columns, they are to be anchored every 12" in height with suitable, approved, galv. iron anchors cast into concrete as that work progresses*" (*1930*). This type of material was commonly used during this time period based on best construction practices and because it is fire resistant. Because there is not readily available design information for hollow structural clay tile and the manner in which it was used during this time, qualitative design values for the wall system cannot be assigned for design purposes.

Previous Repairs

Exterior repairs were made to the terra cotta façade, brick veneer, and roof of the south wing in 2003. These items are in much better condition than the same items at the remaining wings. Previous repairs to interior elements such as concrete columns and beams were noted in a few locations in the south wing, but do not appear to have been made to all elements requiring repair at the time, including the floor slab systems.

STRUCTURAL ANALYSIS:

A computational analysis of the structure was performed to determine the extent of the requirements to bring the structure to meet current adopted codes. Structural components were observed for evidence of damage and/or distress that would affect the ability of the component to transfer vertical and lateral forces to the foundation system. Observations were limited to readily visible elements. Removal of finishes or building components to inspect the condition of hidden elements was not performed for this level of investigation. Concrete materials testing, to include concrete core samples, Windsor Probe, and Ground Penetrating Radar (GPR), were performed on select components of the main frame system to more accurately perform the computational analysis.

Image 8. Severely corroded lintel

The results of the building analysis generally indicate that the main structural system does not appear to meet the design requirements of the current adopted design codes IBC 2003 / 2006 and ACI 318-2005.

The actual floor Live Loads applied to the system will vary based on the actual occupancy and use of the facility, though the 80 psf Live Load used throughout is a fairly accurate assumption.

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The same also applies to the actual occupancy and use of the flat roof area at the parapet level, where the 100 pounds per square foot used is based on the original use of the area (assembly area), and as such is a conservative value.

An average reduction of 15% is applied to the limit state, i.e. allowable moment, shear, and axial capacities, for the analysis of all members. In other words, the maximum moment, shear and axial load that a member can carry is reduced to 85% allowable by design based on field observations of the structure, and then compared to the actual moment, shear, and axial loads that are being applied to the member based on the design loads. This roughly equates to a reduction in gross cross-sectional area. Using this capacity reduction, approximately 60%-80% of the concrete framing members do not have adequate capacity to withstand the loads required by current adopted design codes. If all members are restored to original condition, the limit state reduction is still applicable to the members to account for uncertainties in the original materials, section properties, and detailing practices which differ from today's standards, and were verified with the concrete core samples and GPR results obtained. Strengthening of these members would be required in order to meet current adopted codes. A more detailed assessment and structural analysis will be required to determine the method of strengthening.

Based on the preliminary analysis of the foundation systems, the assumed allowable bearing capacity for both the 1914 courthouse and the 1930 addition is exceeded when the structure is loaded based on occupancy assumptions and current code requirements, which typically results in excessive settlement ast seen at the courthouse.

Restoration and/or rehabilitation of this structure would be a major undertaking both financially and construction wise. The sequence of construction and shoring plans will need to be well planned and closely monitored during construction in order to try to maintain a safe work environment. The vibrations induced by the required chipping of deteriorated concrete members in order to find sound concrete and make repairs will transfer through the structure and may cause destabilization of members and elements elsewhere in the structure. Preliminary estimates for complete structural repairs to the building and strengthening to bring it to current codes (not including Architectural, MEP, etc.), based on its current visible condition, are in the range of $24 million.

COMMUNITY IMPACT:

The historic 1914 Nueces County Courthouse has continually been a topic of discussion in the community, as evidenced by the large quantity of newspaper clippings that have been gathered throughout the years and stored in the county Commissioner's offices. Public opinion based on the latest news surveys seem to imply that though there is still much respect for the structure and its history, in its dilapidated state it has become an eyesore and a financial burden to the community that was once so proud of it. Many in the community feel that the architectural items that can be saved should be before they are allowed to further deteriorate. These saved elements can be incorporated into a new structure built in its place, or moved to the new county courthouse or a museum. Current deed restrictions placed on the Courthouse by the Texas Historical Commission when the county accepted funding in 2003 for the limited rehabilitation of the South Wing prohibit the removal of any item of the structure from the site, including facade elements which have been falling over the years. The unpredictability of these unstable elements, as well as instability of the structure, present safety hazards for county personnel and professionals required to monitor the facility and/or perform assessments of the structure. Currently, the fallen terra cotta and brick facade elements are stored in the basement of the courthouse. Lack of funding and community desire to restore the structure does not provide much hope that anything will be in a salvageable state once the deed restrictions expire sometime in 2027.

Though the Texas Historical Commission has been able to successfully restore many courthouses throughout Texas, to our knowledge none have been restored that are as large as the Historic 1914 Nueces County Courthouse with the deterioration level due to being abandoned for approximately 34 years. The majority of county courthouses that have been restored were still currently functioning as County Courthouses. The Nueces County Commissioners are currently talking with the Texas Historical Commission to determine the fate of the structure. The last thing the community wants is to continue to watch this once proud structure deteriorate and fall apart piece by piece.

REFERENCE LIST

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