GESSNER
ENGINEERING

September 12, 2022
Paul Aschenbeck
Brenham Independent School District
P.O. Box 1147
Brenham, Texas 77834

Re: Structural Engineering - Structural Observation
Brenham Junior High
1200 Carlee Street
Brenham, Texas 77833
Gessner Engineering Job Number: 21-1197

Dear Mr. Aschenbeck :

An observation of the Brenham Junior High structure of the above referenced building was performed by Evan Roe, P.E. and Erick H. Roque, E.I.T of Gessner Engineering on July 28th & 29th of 2022 as a continuation of the investigation conducted Fall of 2021 by Gessner Engineering and documented in report dated for October 8, 2021. This observation was intended to collect additional data surrounding the areas of concern identified in the original report. This report contains a general discussion of the data collected along with recommendations for remediation beyond those originally suggested in the original report. A full engineering analysis of the structure was beyond the scope of this observation. The items listed are not meant to represent a total or exhaustive list of defects which may be present. Gessner Engineering neither extends nor implies any warranty as a result of this observation or any repair performed upon this building. The results of this observation are provided in the following report and are provided for the exclusive use of Mr, Paul Aschenbeck and Brenham Independent School District.

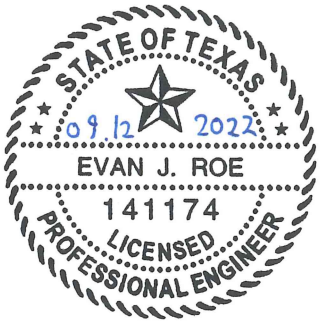
We trust that this report is responsive to your project needs. Please contact us if you have any questions or if we can be of further assistance.

Sincerely,

GESSNER ENGINEERING, LLC F-7451

Erick H. Roque, E.I.T.

Evan J. Roe, P.E.



OBSERVATIONS

Gessner Engineering conducted a Light Detecting and Ranging (LiDAR) scan of the gymnasium and auditorium spaces of the Brenham Junior High School. LiDAR scanning is a remote sensing technology that allows for the creation of digital 3D models of physical objects. Unlike x-ray scanning, LiDAR scanning only maps the physical surface of an object and does not provide any imaging of an object's underlying contents. With this data, Gessner Engineering can assess the performance of the building by identifying areas of potential distress or excessive deflection relative to building code standards.

In addition to the visual analysis and LIDAR scanning provided by Gessner Engineering, an observation of the building envelope was performed and documented by Apollo Better Building Consultants in a report dated September 8th, 2022. Observations from Apollo were focused on the roof and exterior wall conditions at locations where moisture infiltration was previously noted. Specific information regarding Apollo's observations, analysis and recommendations can be found in the report enclosed in Appendix A of this report. A discussion of key findings as they relate to previously discussed areas of concern are documented in the following paragraphs.

Auditorium

The roof of the auditorium space appears to be composed of pre-cast concrete double-tee beams spanning east to west across the space. The double-tee roof structure is supported by a reinforced concrete frame with concrete masonry unit (CMU) infill. Exterior wall infill extends from foundation level to an intermediate beam at ground level and then to the beam at roof level. The exterior wall towards the entrance to the auditorium is braced out of plane by the balcony level which extends approximately half the distance from the rear wall of the space to the stage area. Beyond the balcony, the exterior wall system is not braced out of plane.

Gessner Engineering was not able to conclusively determine the foundation construction; however, it is expected that the foundation is an elevated system supported by deep foundation elements. The foundation also appears to slope toward the stage area and level off directly in front of the stage.

The exterior walls are covered in a variety of brittle finish materials with the most common being a drywall assembly secured to the structural infill with metal hat channels. This system covers most of the wall surface, except for a small portion at the ceiling level. LiDAR scans of the finished surfaces within this space allow for the ability to measure deflection under the presumption that the finishes reflect the deflection of the structure behind. The observed deflections in finishes, do not necessarily indicate deflections exist in the structural system at locations where finishes are not directly applied to structural elements.

Standards set forth for establishing and evaluating the serviceability of structural elements are outlined in Table 1604.3 Deflection Limits of the International Building Code (IBC), 2021 Edition. Overall deflection and/or inflection from the original construction elevations shall be no greater than the length over which the deflection/inflection occurs divided by 360 (L/360) and by 240 (L/240) for roof (or floor) and exterior wall elements, respectively. Additional standards set forth by the Precast/Prestressed Concrete Institute (PCI) for variation from plumb state walls shall be no more than ¼"/ 10 feet of height or 1" total. Due to inherent changes in elevation in foundation floor of the auditorium, measurements of the foundation surface provide little insight of the foundation performance; however, individual elements such as floor slab and beam spans were evaluated. Results of measured deflections are presented in Table 1 below.

Structural Element	Measurement	Ratio	Magnitude (inches)	Location	Status
Roof Framing	Max Deflection (L/360 Allowable)	L/1900	½"	Midspan of Roof	Within Tolerance
Exterior Wall	Variation from Plumb (1" Allowable)	1/4" / 10 ft	3/4"	Eastern Wall Below Existing Grade Level	Within Tolerance
Balcony Floor Framing	Max Deflection (L/360 Allowable)	L/570	¾"	Balcony Spandrel Beam Connecting to Exterior Wall	Within Tolerance

Table 1: Maximum Deflection Results – Auditorium

To assess the current performance of the roof, floor and wall framing, Gessner Engineering utilized point cloud data collected from LiDAR scanning to measure the in-situ deflection and/or plumbness of the noted elements. Measurements were then compared with the appropriate standards to determine if each element complied to the noted standard to assess performance. In general, the roof, exterior wall, and balcony floor structure of the auditorium appear to be performing as expected. Based on visual inspection, connections from beams to columns appear to be in good condition where accessible; however, most of the connections along the exterior wall that exist at the basement level were not exposed for visual review at the time of the observation.

Gessner Engineering also conducted visual observations of the installed finishes to identify deterioration or damage that may be indicative of structural distress. Typical signs of distress in finishes include cracking, excessive deflection or bowing, and loose fasteners between finishes and underlying structure. While signs of damage from moisture intrusion were present in the wall finishes (water stains at both the roof and floor levels), no modes of deterioration that would be indicative of underlying structural issues were noted. Mild bowing of the brittle finishes was noted along the height of the wall when viewed in section; however due to the lack of cracking or loose fasteners and the presence of moisture damage, it can be reasonably inferred that the slightly bowed finishes are also a result of moisture intrusion.

Deterioration in the finishes where the balcony connects to the exterior wall such as flaking drywall finish and rusted metal at both the exposed deck edge angle and handrail were noted also during observation. Gessner Engineering was able to remove ceiling tiles directly below the and confirm that the concrete connection between the balcony framing and exterior wall appears to be in good condition. As the balcony floor framing was noted to be within tolerance in Table 1, It is the opinion of Gessner Engineering that the finish deterioration is not indicative of a larger structural issue and is likely also result of the moisture intrusion.

While Gessner Engineering did not collect relative elevations of the auditorium foundation due to the slope, a visual observation to identify signs of potential distress in the concrete. Much like concrete superstructure elements, signs of distress in foundations include cracking and excessive deflection at or between supports. Observation of the slab did not yield any appreciable cracking, beyond normal temperature and shrinkage cracking expected in all concrete slabs, meaning that the foundation appears to be in good condition as well.

Gymnasium

Like the auditorium, the roof appears to be composed of pre-cast concrete double-tee beams spanning east to west across the space. The double-tee roof structure is supported by a reinforced concrete frame with CMU infill. Exterior wall infill extends from foundation level to an intermediate beam at ground level and then to the beam at roof level. The foundation in this area is also expected to be an elevated foundation system, supported by deep foundation elements; however, Gessner Engineering was unable to verify the construction due to the presence of a raised, gymnasium floor assembly. This assembly was constructed of traditional stained wood flooring, elevated over the concrete slab by a series of risers that appeared to be mechanically fastened to the foundation system.

The wooden finishes on the gymnasium floor appear to be in a similar state of distress as when previously observed. Portions of the floor appear to have sustained extensive damage as a result of the continued moisture intrusion into the space. The finished flooring exhibits changes in elevation as a result of sagging or buckling of the finished floor elements. For this reason, and the fact that the finished floor system is independent of the structural foundation, Gessner Engineering did not utilize a Zip Level system to collect relative floor elevations to comment on current foundation performance.

Similar standards as those presented for the auditorium were used in the evaluation of this space. Measurements of the floor surface have been omitted from this discussion due to the vast imperfections that can result in inaccurate results. Results of measured deflections are presented in Table 2 below.

Structural Element	Measurement	Ratio	Magnitude (inches)	Location	Status
Roof Framing	Max Deflection (L/360 Allowable)	L/1900	5/8"	Midspan of Roof (Camber)	Within Tolerance
Exterior Wall	Variation from Plumb (1" Allowable)	¼" / 10 Ft	3/4"	Eastern Wall Below Existing Grade Level	Within Tolerance
Floor Framing	Max Deflection (L/360 Allowable)	N/A	N/A	Refer to Discussion Below	N/A

Table 2: Maximum Deflection Results - Gym

Similar analysis methods to those applied to the auditorium structure were applied to the investigated elements in the gymnasium. Based on this analysis, the roof and exterior walls of the gymnasium appear to be performing as expected, with what appears to be some residual camber in the concrete roof framing. Camber is the intentional bowing of a beam element, normally used in long-spanning application, such as those seen in this space, to combat excess deflection. Typically, camber is introduced into beam elements so that the beam will take on a normal downward deflection by the time the building goes into service, however, without enough weight, some camber may remain. Though it is unusual to see residual camber in a beam system, it is not detrimental to the performance of the roof. Gessner Engineering believes that the residual camber in the roof framing is a designed element, likely done to encourage drainage off the roof to either side of the gymnasium structure.

Similar to the auditorium space, Gessner Engineering also conducted visual observations of the installed finishes to identify deterioration or damage that may be indicative of structural distress. Aside from the deterioration of the floor

finishes, Gessner Engineering noted no typical signs of structural distress in the finishes installed in the gymnasium aside from water stains and discoloration on finishes and paint.

Direct observation of some structural elements was possible in the gymnasium area and concrete spalling was noted on the northwest exterior corner of the gymnasium space. Said spalling was noted on the exterior of the building structure, directly above the concrete paving/sidewalk. Sealant between the structure and paving was also deteriorated at this location due to the spalling, and while no visible spalling was noted inside the gymnasium at the same location, signs of moisture intrusion were noted. Observed evidence included discoloration of finishes and deterioration of the wooden floor in the immediate area. It shall be noted that the sealant at the roof level in this corner was also mentioned in the envelope investigation as a location with deteriorated sealant, meaning that the spalling is likely due to unfavorable moisture conditions at the column as opposed to a larger structural issue.

Despite the noted concrete spalling, Gessner Engineering believes that the current performance of the superstructure in conjunction with the overall lack of further signs of structural distress in brittle finishes shows that the structure is performing in an acceptable manner, and that the continued moisture intrusion has not impacted the overall capacity or stability of the structure.

Ground Floor Corridor Wall

In addition to the previously discussed gymnasium and auditorium spaces, Gessner Engineering was asked, while on site, to review cracking in finishes noted along the corridor wall adjacent to the ground floor boy's restroom. The corridor finishes in question were observed during Gessner Engineering's previous observation of the structure in October of 2021 and were noted at that time to have cracked approximately 10 years prior to the date of observation. Gessner Engineering was notified that the crack had remained relatively unchanged in size or shape leading up to the 2021 observation. Based on review of site photographs and visual observation of the finishes in their current state, Gessner Engineering did not note an appreciable increase in size or change in shape of the cracking. No additional cracking or deterioration of adjacent finishes was noted in the immediate vicinity or on the opposite face of the wall.

RECOMMENDATIONS & CONCLUSIONS

Gessner Engineering has found the performance of the structural roof and floor systems of this building to be in accordance with current building standards. The main superstructure elements do not appear to be exhibiting signs of distress and appear to be functioning as intended, despite isolated instances of noted structural repair. Typical signs of structural distress were also not noted in finishes attached to structural elements and infill framing such as, cracking, excess deformation, or loosening fasteners. For these reasons, it is the opinion of Gessner Engineering that none of the items discussed in the observations portion of this report represent a concern for structural performance nor present a concern for life safety at this time. It shall be noted that moisture intrusion, left unaddressed, cause deterioration of the structure, site and building finishes and could ultimately compromise the integrity of the supporting structure.

Investigation of the building envelope by Apollo Better Building Consultants, revealed areas of deteriorating sealant between roofing membrane and perimeter edge metal. Additionally, locations were noted over both the auditorium and gymnasium spaces where the roofing membrane was not fastened to the edge metal resulting in gaps. Gutters and

downspouts were also noted to be either corroded or full of dirt and debris at various locations along the exterior of the structure. Similar issues were noted at ground level to the items noted by Gessner Engineering in 2021 regarding site drainage, and stormwater management. Specific recommendations for remediation of the items discussed can be found in Apollo's full report, located in Appendix A.

It is the opinion of Gessner Engineering that the following remediations be completed as ordered to reduce moisture infiltration while minimizing impact to daily operations of the building.

1. Modification of roof system to install a metal gravel stop as recommended by Apollo. The contractor shall reference the attached report for specific installation instruction.
2. Repair of deteriorated roof membrane sealant. The contractor may reference the attached report for applicable locations.
3. Replace existing deteriorated gutter systems and install new systems along all roof edges.
4. Remediation recommendations as outlined in Gessner Engineering's 2021 report for addressing site grading issues and testing and maintenance to stormwater management systems. Should excavation adjacent to the building occur, this is an opportunity to apply a wet-application moisture barrier to the infill wall to further mitigate moisture infiltration.

Should the moisture infiltration continue, the client may choose to explore the following testing regimen to further investigate potential locations of moisture intrusion. Finishes should be removed in both the auditorium and gymnasium spaces to allow for moisture testing of the CMU per SSPC – Guide 23: Field Methods for Determination of Moisture in Concrete and Masonry Walls. Specifically, Gessner Engineering recommends the use of Methods 1 and 5.

- Method One consists of the use of plastic sheets, adhered to exposed CMU, as a means of moisture detection. The plastic and fastening shall be in accordance with, ASTM D4263 and Appendix X2.2 of ASTM F710. After a minimum of 16 hours, the plastic sheets shall be removed and inspected for the presence of moisture.
- Method 5 utilizes relative humidity probes to determine the presence of moisture in a cementitious material. Meters congruent with the requirements listed in ASTM F2170 Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs, shall be placed in holes drilled into the CMU infill and allowed to equilibrate for 72 hours. Following the equalization period, the presence of moisture inside the infill will be displayed as percent relative humidity.

Should the testing reveal significant moisture content in the infill material, the client may wish explore replacement of the waterproofing materials along the exterior of the structure, below grade.

In addition to the remediations regarding moisture infiltration, Gessner Engineering does recommend that the following concrete remediation of the column at the north-west corner of the gymnasium be performed as soon as reasonably able. All reinforcement exhibiting signs of corrosion shall be cleaned with a wire brush to meet SSPC, standard 3 or recommendations detailed by the manufacturer of the subsequent sealant. Loose concrete shall also be removed during cleaning and preparation of the reinforcement. The contractor shall take care to remove only loose material and to not chip or forcibly remove additional material. If appreciable section loss (1/4" or greater) is noted in the reinforcement or the extents of damage extend beyond areas immediately visible prior to remediation, Gessner Engineering shall be contacted for further evaluation. The column shall also be scanned, and care shall be taken to avoid concealed reinforcement or pre-stressing tendons. Otherwise, exposed reinforcement shall be properly prepared and coated with Sika Armatec 110 EpoCem. Removed concrete shall be replaced/ patched with SikaTop 121 Plus to provide appropriate

cover over the reinforcement. The EpoCem is used as a bonding agent to protect the exposed reinforcement, and the SikaTop is a hand applied grout that is applied over damaged areas. The selected products shall be installed in accordance with manufacturer's specifications and procedures as well as Precast/ Prestressed Concrete Institute (PCI) standards. Where the pre-cast elements exhibit fine cracking, these cracks shall be sealed with Simpson Strong-Tie CI-SLV, Sikadur– 55 SLV, or approved super-low viscosity epoxy to prevent potential moisture infiltration, subsequent oxidation of any reinforcement, and spalling of the concrete. For all specified products, reference the manufactures specifications for complete application instructions.

Repair of the cracking finishes in the first-floor corridor shall be completed per the recommendations outlined in Gessner Engineering's 2021 report. Since no structural issues have been identified as a cause or effect of the cracking, the repair is completely aesthetic in nature and can be completed at any time.

It has been a pleasure to provide you with this information. If you have any questions with this report or the recommendations provided herein, please contact us.

APPENDIX A

apollobbc
Better Building Consultants

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15710 John F Kennedy
N0. 260
Houston, Texas 77032
Main 713.869.0000

September 8, 2022

Hannah Loring
Structural Department Head
Gessner Engineering LLC
401 W 26th Street, Suite 3
Bryan, Texas 77803

Re: Building Enclosure Consulting
Brenham Junior High School – Brenham, Texas
Apollo BBC Project No. 22.01.1056

Dear Ms. Loring:

Apollo BBC is pleased to provide this report for our observations of the building enclosure and moisture-related issues occurring at the above referenced school building in Brenham, Texas. For this portion of the project, we observed the existing condition of the building exterior, including walls and roof systems, as well as portions of the interior spaces. In summary, we identified issues with the building drainage systems and roof installation that appear to have contributed to the reported moisture intrusion and exterior paving issues. This report documents our understanding of the reported issues, summarizes our observations, reports our findings, and provides schematic recommendations for further analysis to determine the underlying problem conditions.

Background

We understand that the building was originally constructed in 1963 and was later converted to its current use as a junior high school. The building is a 2-story structure with the first floor partially below grade. We understand that moisture intrusion has been reported at select areas of the first floor and at the roof to wall connection. Also, distress has been observed at areas of the exterior paving. We understand that the Owner wishes to better understand the causes of the observed issues as well as develop a course of action to repair the problem conditions.

Observations

Representatives of Apollo BBC visited the site on July 28, 2022 to review the existing conditions. We reviewed the conditions at the exterior and interior of the building to observe the reported damage conditions as well as the general construction and condition. Representative photographs of our observations are included in the appendix to this report.

Exterior Observations
We reviewed the condition of the exterior of the building. At the front of the building, we observed movements in the exterior paving. The roof drainage is directed from downspouts to a below-grade drainage system. We observed gaps in the piping systems that connect the downspouts to the below-grade piping systems. The drainage system appears to be directed a storm water piping system that runs perpendicular to the front of the building. The piping system appears to run near the root system for trees located at the front of the building. Staining and delaminated paint was observed at the top of wall conditions behind the perimeter gutter systems. Cracking and spalling were observed at the concrete wall frame systems at select areas of the building.

Roofing Systems
The building has a low-slope EPDM/TPO membrane roof system that drains to primary perimeter gutters and downspouts. Select areas are drained to internal area drains. Some areas of ponding water were observed at the roof. The roofing membrane turned down at the perimeter of the wall and was obscured by the perimeter edge metal and gutter system. The roofing membrane was not integrated with the edge metal and gaps were observed. Remedial sealant appeared to have been installed at the gap between the roofing membrane and the edge metal at select locations. This sealant was deteriorated at numerous locations. Portions of the gutters were full of dirt and debris and corroding in several locations.

At the roofing transitions at the lower roof to wall conditions, the roofing membrane was wrapped and terminated to the exterior wall systems. Sealant was installed at the roofing terminations. At select areas, this sealant was separated and deteriorated.

Exterior Window Systems
The storefront type window assemblies at the Pride Den showed signs of moisture intrusion along with a history of ongoing repair strategies. We observed that gutters are not installed at the roof edge at this location and staining on the masonry shows that water is directed from the roof to the top of the windows. We also observed that there does not appear to be a drip head flashing installed to direct water from the masonry cavity away from the window assembly. At one window, it appears that the weeps in the masonry have been closed off with sealant. Over time, it appears that multiple rounds of wet glazing the window assemblies have been attempted due to the different types and colors of sealant observed on the window assemblies.

Interior Observations
We observed portions of the building interiors including spaces with below-grade exposure. We observed evidence of moisture intrusion at below-grade walls as well as at flooring system such as the wood floor in the gymnasium space. We also observed evidence of moisture intrusion at the ceiling framing systems at the gymnasium space. Additionally, we observed evidence of elevated humidity with bowed acoustical ceiling tiles at select areas.

Findings and Recommendations

The reported moisture intrusion appears to be related to the issues with the drainage at the perimeter of the building. Portions of the roof drainage are not connected to the below-grade storm water system and moisture may pool at the building perimeter. Additionally, the roofing system is terminated or connected into the perimeter gutter system. This can allow excess moisture at the exterior wall system, which if not adequately managed, may lead to moisture intrusion into the building. Water within the masonry cavity above the windows at the Pride Den does not have an adequate drainage path away from the window system, which can allow

excess moisture to affect the window system and infiltrated at glazing joints and perimeter sealants. As the underlying building enclosure components are not readily observable due to the cladding installation, we recommend the following steps to better understand the construction and potential problem conditions:

1. We recommend scoping the storm water drainage system at the front of the building as well as at the downspout connections to review the condition of the piping systems and determine if the flow is restricted or blocked.
2. We recommend that the detailing of the roof system be modified to include a metal gravel stop which is tied into the existing roof with a flashing membrane. This ensure roof drainage is directed into the gutters to reduce moisture at the exterior wall and building perimeter. If desired, we can assist with the development of a schematic repair detail for this condition.
3. We recommend that the gutters be replaced and installed at 100% of the roof edge.
4. We recommend installing a metal drip edge above the storefront window system at the Pride Den. During installation of the drip edge flashing the masonry above the window will need to be removed and additional deficiencies may be observed that will require new remedial action. Additionally, we recommend removing all existing sealant at the glazing to frame and frame to frame joints of the window system and replacing with silicone sealant.
5. We recommend that select areas of brick masonry veneer be removed at the base and top of wall sections to review the condition of the wall waterproofing and flashing systems. Additional remedial activities may be required depending on the condition of these systems.

This report documents our observations and review of the identified conditions. These opinions are based on our site observations and evidence available to us at the time of this report. Should other documents or information become available, we reserve the right to alter, amend, or revise our statements and opinions within this report.

Apollo BBC appreciates the opportunity to work with you on this project. We would be pleased to discuss our findings with you. Please contact me at 713.869.0000 should you require additional information regarding this project or if we can be of other service.

Sincerely yours,
Apollo BBC, INC.

Gordon A. Shepperd, PE, RRC
Principal

ENCLOSURES
Photographic Documentation