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A STRUCTURAL ENGINEERING EVALUATION REPORT

Date of Report: February 1, 2008

for

CARRIZO SPRINGS HIGH SCHOOL
CARRIZO SPRINGS CONSOLIDATED INDEPENDENT SCHOOL DISTRICT
CARRIZO SPRINGS, TEXAS

Prepared by:

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February 1, 2008

Board of Trustees & Dr. Cecelia May Moreno, Superintendent of Schools
Carrizo Springs Consolidated I.S.D.
Carrizo Springs, Texas

RE: A Structural Engineering Evaluation Report
Of The Foundations For The:
Existing High School Buildings at:
Carrizo Springs Consolidated I.S.D.
Carrizo Springs, Texas

Dear Board Members & Dr. Moreno:

In accordance with our agreement, we hereby submit our final Structural Engineering Evaluation Report for the foundations for the existing High School facility.

The evaluation report includes, but is not limited to the following items:

Item A: Floor elevations of the entire school facility at 1st floor only.

Item B: Visual Survey (review) of all exterior (perimeter) walls, as well as the interior walls.

Item C: Preparation of 13 sheets of drawings, plus 5 additional drawings of previous work.

Item D: Review & study of American Leak Detection report prepared in 2007.

Item E: Preparation of an exterior grade elevation survey of the entire building perimeter, except where asphalt or concrete cover occurs, prepared in December 2007.

Item F: Seek out and point to any problems that adversely affect the foundations of the buildings.

Item G: Review and comment on the Shilstone Engineering Testing Laboratory, Inc. report dated 12-08-82.

Consulting Structural Engineers
1135 W. Woodlawn Ave.
San Antonio, Texas 78201

Item H: Geotechnical soils report prepared by Burge-Martinez Consulting, Inc., taken December 27, 2007. Reports of underground water under the high school will be addressed.

We have studied and reviewed the conditions of the six buildings in conjunction with the items listed above. We have prepared this report, using the same sequence, item by item, for ease of presentation.

Item A: Floor elevations of the entire facility were taken at the 1st floor only in November 2007, and these were compared to the elevation readings taken by us in 1993.

The new readings show appreciable changes (increases) in floor elevations. The largest increase recorded occurred in the Cafeteria Building "D" @ 4-3/8", in front of the stage. The other floor elevation increases have occurred: Building "A"@ 1-3/8", Building "B" @ 2-3/8", Building "C" @ 2", Building "D" @ 4-3/8", Building "E" @ 2-7/16" and Building "F" @ 1-3/8".

In review of the above, we note the Kitchen area of Building "D" had the lowest elevation increase @ 5/8". The increase in floor elevations has resulted in wall damages in Building "A", "C", "E" and "F", and will be further discussed under Item B: Walls.

Item B: Visual Survey of all perimeter exterior and interior walls:

Exterior Walls: Our visual observation did not reveal any cracks. Movement was noted only at expansion joints between buildings. Horizontal damage at the masonry sills in Building "A" & "C" was noted, probably caused by differential movement.

Interior Walls: Buckling occurred in the paneling on the wall between corridor and classroom at the west end of Building "A", as well as west end of Building "C".

The heave in the slab has compressed the corridor walls between 1st and 2nd floor, resulting in the "buckling" of the wall panels.

A similar, but not as severe condition developed at the east end of Building "A".

Cracks in the walls have occurred at the Band Hall Office of Building "E" and at the Girls Dressing Room adjacent to the double doors at the west entry of Building "F".

Finally, we noted horizontal damage at the masonry course on the Interior side of the exterior walls of building "A" and Building "C", just below the window sill course.

Item C: We have prepared 13 sheets of drawings to record our findings and for use in conjunction with the evaluation report. We made comparisons of floor elevations we took in 1993 and those taken in 2007.

In addition, to the above drawings, we have included five drawings from our 1993 study to document some of those findings, as well as for future reference.

Item D: We have reviewed and studied the American Leak Detection Report and from it, we note plumbing leaks occur at the south elevation of Building "A" at the west elevation of Building "B". Also, severe leaks occur at the Girls and Boys Showers at Building "F". During our surveys, we noted moisture spots on the outside brick walls of Building "F", where the showers are located. The wet spots appear at the west and north elevations.

It is our opinion, that the plumbing leaks have contributed some moisture to the soils supporting the foundations. We also believe moisture in the soils comes from ponded (standing) water adjacent to the building, which has seeped into the soils supporting the foundation. The moisture in the soils, cause the soils to expand in volume.

During our inspection surveys, we have been told of the underground water (Carrizo Springs) that reportedly flows from just in front (south) of Building "A", down to an existing well just north of Building "F".

The underground water may also be a source of moisture penetration of the soils supporting the building foundations.

Item E: We have prepared a Grade Elevation Survey of the entire building facility perimeter except where concrete or asphalt cover exists.

The survey verifies our suspicions that poor surface drainage around some of the buildings has resulted in surface water ponding (standing) adjacent to buildings and eventually seeping into the soils supporting the foundations.

The above is particularly true at the interior corner between Building "A" and "B", and between Building "C" and "D", and somewhat on the southside of Building "A".

Item F: We have been studying the probable causes of the differential vertical slab displacements throughout our field observations and testing. It is our professional opinion the following items contribute and cause this movement. The terrain around most buildings drains poorly, if any at all. The south side of Building "A" has what appears to be a "soft berm" along the tree line for the 267' distance, when rains occur or irrigation takes place, water stands permanently, having no way to drain between Buildings "A", "B" and "C", and between Building "C" & "D", which also have poor drainage. The only appreciable drainage occurs at Building "F" and "E", as well as the east side of "B".

The southside of Building "A" has 13 - 4" x 4" downspouts one at each column – the west end has 2, and north end adjacent to Building "B" has 3 for a total of 18 downspouts all of them empty into a 6" or 8" main line that empties onto FM 1566.

The main 6" or 8" line is not big enough to carry the water. A 20", round pipe should have been used to carry this amount of water. During heavy rains or irrigation, when the pipes fill with water, some water will leak through the pipe joints, thereby adding moisture to the soils.

The swales that were indicated in the 1993 drawings are all missing with some exceptions.

The only appreciable swales occur at the west elevation of Building "F"and at the east elevation of Building "F" and north elevation of Building D & E.

The gutter boots at the west, north, and east elevations of Building "F" are all broken, some totally disconnected. Because of the swales that exist in this area, surface water still drains away.

The downspouts on the north elevation of Building "D" are usable, but at the northside of Building "E" the downspouts are emptying onto concrete splash blocks, which eventually empty on the adjacent ground.

The swales at both side of Building "F" empty into culverts that appear to be clogged up, or the drainage impeded by vegetation growth and debris.

Most of the downspouts empty into a 6" rubber boot and into a 6" PVC drain. The boot is clamped to the 4 x 4 downspout and this connection is not well sealed. When heavy rains occur, water shoots out from this source into the ground. The clamp at the 6" line is sealed. Additionally, the boots are cut to the edge of the clamps and with the slightest movement of the building these boots can be pulled from the drain.

Item G: We have reviewed and studied the Shilstone Engineering Testing Laboratory, Inc. soils report dated 12-08-82, we note various factors stated in the report and they are;

1. Plasticity indices (P.I.'s) range from 11 to 32 (the cutoff is about 15, TXDOT).

2. "The High School structure can be founded on a stiffened slab and beam foundation with thickened slabs at column and wall locations (slab on grade). Consideration must also be given to the uplift forces on the slab due to potentially expansive soils."

   The foundation type used on this facility was recommended by the soils report as noted previously, and that is what was used.

   This type of foundation generally is known as a slab on grade and consists of a floor slab directly on the soil (or fill) stiffened with exterior and interior beams, and where required, (such as in this case) thickened sections of the slab to form footings, particularly at columns to distribute the concentrated loads. In addition to thickened slabs, the engineers chose to add drilled concrete footings, some 14'-0" below finished floor.

   As noted on the Shilstone Report, the potentially expansive soils should be considered in order to prevent or minimize the uplift forces.

Potentially, expansive soils with PI's ranging from 11 to 32 can and will increase in volume when moistened and shrink in volume when dried.

Slab on grade foundation, such as the type used in the High School, have proven to be very successful, if moisture can be kept away from the soils supporting them, or at least minimized. This is due to the fact that the slab is supported by the soil, so water and/or moisture control is critical.

If suspended foundations are used, moisture or water penetration of the sols would not be important, because the suspended slab does not rely on the ground for support.

Item H: Due to the high floor elevations noted throughout the facility, we requested and obtained permission to investigate the soils at the facility from the School Board, as well as from the School Superintendent.

7 borings were drilled thus; the (3) exterior borings are as follows:

B1 - In front of Building "A"

B2 - Between Buildings "C" and "D"

B3 - East of Building "F" and north of Buildings "D" and "E".

The 4 interior borings were cut through the floor slab and they are labeled as follows:

B4 - West end of Building "A".

B5 - At the west end of Building "C".

B6 - In the Cafeteria in front of the stage.

B7 - In the Band Hall, Building "E".

The Burge-Martinez Soils Report notes various highlights we feel have affected the foundation of the facility, these include:

1. No ground water was encountered in any of the 7 borings.

2. Potential Vertical Rise (PVR's) of 1 to 3" were found to be common.

3. No select fill under the existing floor slabs was found in the interior borings. Usually, at least 8" of select fill are placed under floor slabs on grade.

4. The soil found immediately below the slabs is a mixture of tan and brown clay with gravel and PI's that range from 16 to 24. Based on the above indices, the fill has a moderate to high potential of change in volume if fluctuations in the fill's moisture content occur. This soil is labeled "fill" in the Burge-Martinez report together with the Stratum-I and extends to 2'-0" below grade.

5. Stratum II - extends from 1'-0" to 20'-0" below grade and consists of stiff to hard tan, to tan and light gray sandy lean clay (CL) to fat clay (CH) that grades to brown with depth. Liquid limits range from 32 to 63 and PI's range from 16 to 42, and 68% of this material passed the #200 sieve. Based on these measured indices, this clay stratum has a very high potential for large volume changes if moisture fluctuations in the material occur.

6. In boring B1, B2 and B3, as well as B5 and B6, the Stratum-II soils have high organic compound and have been listed in the Unified Soil Classification as CH, or high clay content soils.

7. Several samples were removed from Boring B6 at the 10'-0" depth and these were "swell-tested." The tests revealed PVRs of 5" on flat surface. If sloping or relief surfaces such as the one at the High School is the case, the 5" PVRs will increase.

8. The 5" (±) PVRs have resulted in spite of having 10'-0" of earth surcharge, (10 x 150 = 1500), and the schools floor and roof load of 150 x 2 = 300 for a total load to overcome of 1800 #/s.f. It is our opinion that the present foundation will continue to rise until it fails under this load.

Based on our studies and review of our findings, as well as the study of both the Shilstone and Burge-Martinez Geotechnical Reports, our opinion is as follows:

I. The present foundation supporting the six Buildings "A", "B", "C", "D", "E" and "F". Has risen some 3" to 6", in most of the buildings causing some damage to the interior walls. The rise in floor elevations is due to moisture entering the soils supporting the floor slabs, causing them to increase in volume, especially known now from the Burge-Martinez swell analysis.

II. The elevation increase may have occurred as follows:

a. 9/16" per year from 1983 to 1993 for a total of 5-5/8" (±).

b. 5/16" per year from 1993 to 2007 for a total increase of 4-3/8".

III. The floor slabs will continue to rise unless moisture entering the soil supporting the slabs can be eliminated, or at least reduced.

IV. The moisture sources affecting the soils supporting the slabs are due to:

a. Surface water (rain and irrigation).

b. Plumbing leaks.

c. Underground water.

Sources (1) & (2) can be controlled by using the maintenance method, which we include as Option I noted below.

OPTION I - KEEP EXISTING FACILITY WITH PROPER MAINTENANCE:

PROBABLE COST:

1.	Regrade entire building perimeters --	$ 100,000
2.	Repair wall at Building A, E and F --	$ 20,000
3.	Repair downspouts boots & install -- new 20" drains & open culverts	$ 140,000
4.	Repair all plumbing leaks	$ 35,000
5.	Cosmetics; painting, etc.	$ 90,000
6.	Clean up & haul away debris	$ 10,000
	Subtotal:	$ 395,000
7.	15% Contractor's Overhead	59,250
	Subtotal:	$ 454,250
8.	10% Contractor's Profit	$ 45,475
	TOTAL FOR OPTION I:	**$ 499,675**

$$\frac{499{,}675}{140{,}310 \text{ sf.}} = 3.56 \text{ \$/s.f.}$$

Source (3) may require the services of a Hydrologist engaged in underground water work and these repairs are both difficult to execute and costly.

Please note that Option I has been reduced in cost almost to half from the original figure of 860,000 to 499,000.

Due to the swell tests performed by Burge-Martinez, we strongly suspect that a lot of the moisture entering the soil supporting the foundation is coming from underground water, so most of our top surface work we had proposed would not have reduced the moisture appreciably.

Please note how similar the swell tests compare to the high school floor elevations such as at Buildings "A", "C", "D", and "E". From this fact, we could conclude or infer that the swelling has reached an optimum condition and the swelling has ceased, however, this is really an unknown. _

Due to the logistics of relocating the student body to a new location, we will offer the following course of action:

a. Perform the reduced cost Option I – maintenance on the facility.

b. Perform a new floor elevation survey two to three years from now to determine if the soil movement has stopped, and re-evaluate the condition of the Buildings.

c. Opting for the above procedure (b), the school can continue to function until a new facility is provided or built.

d. Also, the maintenance of the facility will be executed and after the present High School Student Body is relocated, the facility may be used by others such as, Industrial and/or Vocational Classrooms. It can even become available for College classes.

Assuming the present high school is kept and maintained, the following issues must be considered:

1. Engineering study (floor-elevation survey) every 2-3 years @ 8%.

2. There will be no guarantee that the moisture content of the soils supporting the slabs will be reduced and slab upheavals will not continue.

3. If, floor upheavals continue and become excessive such as at the west end of Building "A", the existing foundation of this section will have to be removed and a new foundation on 12" carton forms on drilled piers will have to be installed.

4. Wherever slab upheavals occur and cause wall damage, the walls should be removed and new "expansive walls" installed in their place.

5. Hire a structural engineer to inspect the second floor and roof framing to assure stability and safety.

For your guidance and use we offer Option II, since it appears as a very strong possibility.

OPTION II - ABANDON HIGH SCHOOL BUILDINGS – ALLOW EXISTING HIGH SCHOOL TO REMAIN WITH MAINTENANCE - BUILD NEW FACILITY:

PROBABLE COST: (suspended foundation on piers)

1.	Abandon Building and leave in place --	$ -0-
2.	Maintenance --	$ 250,000
3.	New Site similar in size to exist. --	$ 500,000
4.	Rebuild new facility -- 140,310 @ 175	$ 24,554,250
5.	A.E. fees @ 6%of 24,554,250	$ 1,473,255
	Subtotal:	$ 26,777,505
6.	15% Contractor's O/H;15%x24,554,250	$ 3,683,137
	Subtotal:	$ 30,460,642
7.	10% Contractors Profit;10%x28,237,387	$ 2,823,738
	TOTAL FOR OPTION II:	**$ 33,284,380**

$$\frac{33,284,380}{140,310 \text{ sf.}} = 237.22 \text{ \$/sf.}$$

The above option includes a fully suspended foundation system on drilled piers, per Geotechnical Report.

We wish to add further, that any new facility being considered to be built by the District should be under the direction of a competent project manager, responsible and answerable only to the School District.

We will be available to assist the district in any of these efforts.

Again, we wish to thank the School Board, as well as Dr. Moreno for allowing us the opportunity to present this foundation evaluation report.

We will be available to explain any part of this report and to answer any questions, on this matter.

Sincerely yours,

Luis S. Faraklas, P.E.

LSF/clf