EXCEL DESIGN ASSOCIATES

321 North Mall Drive, Suite J-101, St. George, UT 84790
Phone: (435) 619-4586 ○ Fax: (435) 608-4586
Email: Charles@ExcelDesign.us

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Ms. Carol Timpson, Superintendent
Colorado City Unified School District
255 North Cottonwood Street
Colorado City, AZ 86021

Dear Ms. Timpson:

Subject: Property damage at Cottonwood Campus, Colorado City

On July 25th, the school informed us of a retaining wall failure which occurred shortly after heavy rains. We went onsite that same day to witness the event. Since that time, we have had time to investigate further and are writing to identify potential reasons for the collapse.

The existing retaining wall was constructed as a gravity wall, using only the weight of stacked masonry blocks to withstand the loads behind and above the wall. The wall ranges in height from a few feet to upwards of eight feet. Filter fabric separates the stacked block from the soil behind the wall.

There are different surface finishes along the top of the wall; including, a gravel parking lot, basketball court, gravel bedded play area, and an unfinished landscape planter. The area at the bottom of the wall is paved driveway.

Any retaining wall should be able to withstand the lateral pressure acting against the wall. Soil and hydrostatic pressure are two contributing factors of lateral pressure. Draining rainwater and/or groundwater is necessary to maintain the integrity of retaining walls. Additional structural reinforcements are required when retaining wall heights exceeds those conditions allowed in gravity wall applications, typically heights over four feet in most instances.

While it's difficult to identify all the reasons for failure using only visual inspections, it's apparent the wall failed due to water buildup behind the wall and lack of structural reinforcement (see Pictures 1-5, attached).

There are many ways to structurally reinforce a wall, however, it's typical to use anchoring or geosynthetic reinforcements in block retaining walls exceeding four feet. These methods stabilize the soils behind the wall and help prevent failure. The existing wall had no structural reinforcements.

Water behind a retaining wall greatly increases the pressures against it. Gravel packing and filter fabric behind the wall helps collect water, but drainage pipes, weep holes, and other methods are essential to allow water to drain through the wall. Without adequate drainage the wall will bulge, crack and ultimately fail.

It appears there is no gravel packing or drainage piping to convey the water through the face of the wall in a controlled manner. During the recent storm events, water built up behind the wall and created enough pressure to push it over.

The failure pointed out many issues with the wall that need to be addressed, even beyond the section that came down. It is our opinion that any stacked, block wall exceeding four feet lacks structural integrity. It's also apparent the existing wall is without adequate drainage.

These deficiencies are compromising the site improvements relying on the existing wall; namely the basketball court, concrete pad, portions of the gravel parking lot, playground and landscape area, and creates an unsafe school activity environment. The existing wall needs to be replaced with a structurally sound solution, and by doing so, all or part of the above wall improvements will need to be removed.

There are many possible solutions; potentially, replacing the wall with proper reinforcement and drainage, or a stepped wall solution to name a few. Either way, a detailed plan, including the necessary structural engineering, drainage design, soils and site testing is needed to identify solutions that meet the schools needs in a safe and reliable way.

If you have any further questions, please don't hesitate to contact us.

Thank you,

Charles Hammon
Professional Engineer

EXPIRES 12/31/17

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Picture 1 – Failed region of block wall.

Picture 2 – Failed region of wall.

Picture 3 – Failed region of wall.

Picture 4 – Area above failed region of wall.

Picture 5 – Water flowing from back of wall.