

STRUCTURAL EVALUATION OF THE
SWEITZER GYMNASIUM
Cody, Wyoming

Prepared for MGT

By: J-U-B Engineers Inc.



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Introduction

In the early part of August, 2002 J-U-B ENGINEERS, Inc. was contacted by Dodds Cromwell of MGT to provide a second opinion on the structural integrity of the Sweitzer Gymnasium in Cody, Wyoming. Lower and Co., P.C. who prepared a previous assessment on the structural integrity of the gymnasium, suggested performing this additional evaluation.

In preparing this evaluation we have focused on the following 3 areas, as requested by Mr. Cromwell.

1. Validate the previous report prepared by Lower and Co.
2. Provide possible repair alternatives
3. Provide opinions of probable cost for the possible repair alternatives

We have inspected the building and prepared the following evaluation as a result of our observations, review of building plans and calculations.

Validation of Previous Report

Several of the items listed the previous report we feel are of valid concern and should be addressed as the building is repaired. These items include: removal of spalling and deteriorating concrete, poor site drainage, chimney repairs and removal of other possible falling hazards as noted in items S1 through S6 in the report prepared by Lower and Co. (See appendix A). Items S7-S9 will be discussed in more detail in the following pages.

The last three repair items (S7-S9) listed in the previous report all stem from deficiencies in the overall structural systems of the building. As we reviewed the building and plans, it was concluded that the following structural systems are incorporated into the gymnasium:

1. The gravity roof structure consists of cast-in-place concrete arches supported on cast-in-place concrete cantilever type piers. These cast-in-place arches and piers are designed to only resist gravity loads. Pre-cast concrete sections were used to frame the roof on the cantilever piers, and mezzanine floors above the locker rooms.
2. Lateral forces on the building are resisted by un-reinforced or under reinforced exterior CMU shear/bearing walls.

With these systems in mind, calculations were performed on the structure and the following conclusions were reached.

1. The cast-in-place concrete arch roof sections are adequate with the following exception noted: - In order for an arch to carry it's load as intended, the supporting structure must provide the necessary restraint at each end of the arch. The thrust restraint provided by the existing concrete piers is problematic.

2. The cast-in-place concrete cantilever type piers are inadequate to support the required gravity and dead loads.
3. The exterior masonry shear/bearing walls are inadequate to resist required lateral wind/seismic loads.

These calculated conclusions are consistent with the observations made in the field. As one looks at the overall structure of the building no deterioration of the concrete arch is apparent. However, the thrust from the arch has caused the cantilever piers to displace and caused cracking in the mezzanine beams and locker room CMU walls. From conversations with district personnel the condition of the locker room CMU walls and mezzanine beams are continually worsening.

Some repairs have been made to the north and south walls of the building to decrease the deflection of the walls due to wind or seismic loads. These repairs include placement of wide flange beams from floor to roof level, and lateral supports at the roof level between concrete beams and piers to prevent displacement between supporting members. Although these repairs have lessened the potential of movement in the wall, the infill walls are still severely under reinforced and may be unstable.

Possible Repair Alternatives

There are many possible repair alternatives. We suggest the following three as possibilities as they illustrate a range of costs and corresponding range of building impacts. But these alternatives are not presented as the only three possibilities. The three possible options are:

Option A- Leave the existing concrete roof structure in place and provide additional support as necessary.

Option B - Remove the existing cast-in-place and pre-cast concrete roof structure and replace it with a new all steel structural roof system.

Option C – Remove the arch portion of the existing concrete roof structure and replace it with a new all steel roof structural system.

Refer to the attached sketches labeled Figure A, B and C.

In detail, Option A would do the following:

1. Provide new columns and footings under each arch at the point where the arch bears onto the supporting concrete cantilever pier.
2. New footings would be placed under each new column at the required bearing level underneath existing floors.
3. New steel tension ties would be constructed under each arch connecting each bearing location at the existing concrete cantilever pier.
4. Existing exterior masonry side-walls between each concrete pier would be removed and replaced with new reinforced masonry construction.

5. Existing exterior masonry end-walls at either end of the building would be removed and replaced with new reinforced masonry construction.

Option A is economical, in that it takes advantage of the existing adequate components and utilizes them, but some disadvantages include some architectural aspects may be lost from installation of columns in viewing areas, hallways, and other rooms and extensive amount of work would be needed to place footings in the structure beneath the columns. This option needs to be further evaluated by an architect to determine if it is viable given the limitations it will impart upon the use of the building.

In detail, Option B would do the following:

1. Cut away and remove the existing cast-in-place and pre-cast concrete roof including the horizontal arms of the concrete cantilever piers.
2. Provide new steel trusses spanning the full 160 ft width of the building and bearing on top of the exiting concrete piers.
3. Provide new steel joists spanning between the new steel roof trusses and metal roof decking covering the entire roof area and side and end walls of the trusses.
4. Existing exterior masonry side-walls between each concrete pier would be removed and replaced with new reinforced masonry construction.
5. Existing exterior masonry end-walls at either end of the building would be removed and replaced with new reinforced masonry construction.

This option is the most expensive of the three. This option will allow an entire new roof structure to be placed on the building, and eliminate any changes to the functionality of the building. Little or no architectural layouts would be affected because no columns would be needed in to support the roof structure.

In detail, Option C would do the following:

1. Cut away and remove the existing cast-in-place and pre-cast concrete roof leaving the cantilever arms in place.
2. Provide new steel trusses spanning the full 98 ft width of the old arch span and bearing on top of the existing concrete cantilever arms.
3. Provide new steel joists spanning between the new steel roof trusses and metal roof decking covering the entire roof area and side and end walls of the trusses.
4. Existing exterior masonry side-walls between each concrete pier would be removed and replaced with new reinforced masonry construction.
5. Existing exterior masonry end-walls at either end of the building would be removed and replaced with new reinforced masonry construction.

Although more expensive than Option A, this option allows for a new roof over the gymnasium area without having to place columns to support the roof in inconvenient locations as mentioned in Option A.

As can be seen from this report and the previous report prepared by Lower and Co. there are many alternatives to repair the roof and gravity structure of the facility. It should be noted that all options include a replacement of the existing un-reinforced and under reinforced exterior CMU walls.

Opinions of Probable Cost

Along with the repair alternatives we have prepared opinions of probable cost for each repair options. The costs for the additional work for the three options listed in this report are as follows:

Option A- Leave the existing concrete roof structure in place and provide additional support as necessary. - \$580,000

Option B - Remove the existing cast-in-place and pre-cast concrete roof structure and replace it with a new all steel structural roof system. - \$1,080,000

Option C – Remove the arch portion of the existing concrete roof structure and replace it with a new all steel roof structural system. \$790,000

With this information we think that Option C may provide the best alternative for bringing the building up to current code structural requirements while minimizing the architectural impact on the building use.

Appendix A

Excerpts from
“Report of Structural Assessment
Park County School District #6
Cody, Wyoming
Sweitzer Gymnasium”

Prepared By Lower & Co., P.C., Casper, WY

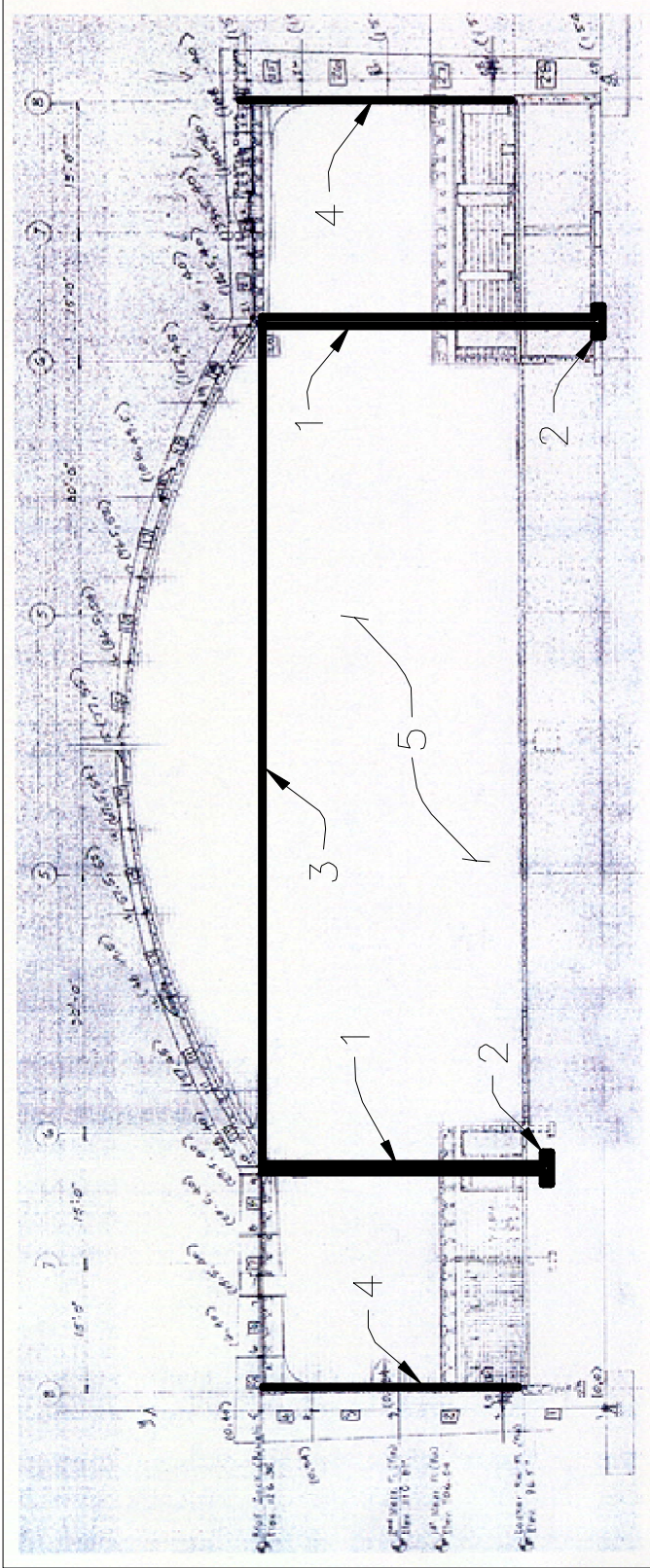


FIGURE - A
 Frame Elevation

- 1. NEW COLUMNS AT EACH CONCRETE ARCH
- 2. NEW FOOTINGS
- 3. NEW TENSION TIE AT EACH ARCH
- 4. NEW CMU WALLS BETWEEN ARCHES
- 5. NEW CMU WALL ENDS

