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SCHOOL SEISMIC EVALUATIONS

PHASE 3 REPORT

FOR

WYOMING DEPARTMENT OF EDUCATION

By

MGT Of America

And

J-U-B ENGINEERS, Inc.

November 2002

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INTRODUCTION

This report is a summary of findings concerning the evaluation of selected public school buildings located within the State of Wyoming for potential structural deficiencies pertaining to seismic events (earthquakes). The schools evaluated were selected based on a screening procedure intended to identify buildings likely to have significant structural deficiencies as regards seismic events. The screening procedure is one outlined by the Federal Emergency Management Agency (FEMA) and the results of this procedure were presented in a report titled "SCHOOL SEISMIC EVALUATIONS, Wyoming Seismic Zone 3 For the Wyoming Department Of Education" by MGT of America and J-U-B Engineers, Inc. and dated April 5, 2002.

The schools evaluated under this report are as follows (Refer Table #1):

1. Clark Elementary School; Uinta County School District No. 1.
2. Burgoon Elementary School; Lincoln County School District No. 1.
3. Kemmerer Elementary School; Lincoln County School District No. 1.
4. Kemmerer High School; Lincoln County School District No. 1.
5. Holdaway Elementary School; Lincoln County School District No. 2.
6. Metcalf Elementary School; Lincoln County School District No. 2.
7. Hot Springs High School; Hot Springs County School District No. 1.

All schools are located in Seismic Zone 3 or 2B, as defined by the 1997 Uniform Building Code, except for Hot Springs High School, which is located within Seismic Zone 1.

The Standard used to evaluate the school structures is the 1997 Uniform Building Code (UBC). The UBC provides methods to generate earthquake forces, specifies allowable stresses in materials, and defines fabrication and construction requirements for structural elements. Any noted violation of the Code's structural requirement will need to be corrected in order for an individual school building to be judged as meeting the structural requirements of the Code.

EVALUATION METHOD USED

Each school building was evaluated utilizing two basic steps. The first step was to do a building site evaluation coupled with an existing document search and review. Engineers contacted each school facility manager and located relevant existing building plans for each building. This included contacting Architectural and Engineering firms that worked on these facilities to obtain as much documentation as possible. The engineers visited each facility to do a visual inspection of the building and to take measurements of the building in order to determine or verify structural information that was contained on the documents obtained for each building. Where documents were available, these were reviewed for structural construction details pertinent to seismic performance of the buildings. Details were evaluated for conformance with the type of construction required by the UBC.

The second step used in the evaluation process was to do a numerical analysis of the primary elements of the building's structural elements. The type and characteristics of the buildings construction were examined and the total mass (weight) of the building components is estimated. Approximate seismic forces are then calculated based on the seismic design criteria in the UBC. These forces are then distributed to the appropriate supporting elements of the building starting with the roof and floor diaphragms and then to the bearing-shear walls and/or building support frames based on the relative strength and stiffness characteristics of these elements. Stresses acting within the individual building elements are then calculated using the distributed forces. These stresses can then be compared to allowable stresses given in the UBC. If the stresses in the particular element exceed the allowable stresses or if and element was not properly fabricated or constructed that element was noted for reconstruction or replacement as required.

SUMMARY OF DEFICIENCIES.

After each school building was evaluated a general summary of potential structural deficiencies pertaining to seismic effects was made for each building. Due to the limited scope of this report, the list of potential structural deficiencies is limited to seismic effects. Potential deficiencies for other type loads including dead, live, snow and wind were not typically included as part of the scope of this report unless specifically noted otherwise.

SUMMARY OF RECOMENDATIONS.

For each noted deficiency in each school building a recommendation was listed to strengthen, replace or supplement each deficient element to bring the overall facility into conformance to the UBC. The recommendations are based on common construction methods that have been used in the past for similar seismic structural renovations throughout the western United States. Renovation design teams may want to consider reasonable alternatives, including specialty or cutting-edge technologies not addressed in these recommendations. However such techniques require a level of design that simply is not possible in a study of this type, and without the detailed design required it is probable that such recommendations at this stage would lead to unrealistic expectations and inadequate fiscal planning. Therefore this list of recommendations should not be considered an exhaustive or exclusive list for upgrading each building. The recommendations should serve as a basis for aiding a design team in determining an appropriate final path to follow in the case that a determination is made to upgrade an individual building or portion of a building.

The exact nature and type of rehabilitation most appropriate to each individual building can only be determined by a design team of architects and engineers who are experienced in this type of work. There may be a number of different ways to bring each building into code compliance and each engineering team will likely come up with different methods depending on their individual experience and preference in engineering practices.

ESTIMATED COSTS.

Based on the list of recommendations developed for each individual building construction costs were estimated for implementing them. The construction costs given are for basic building structural work and do not include architectural, electrical, mechanical, site work or other aspects of the buildings that might be affected by the structural work unless specifically noted otherwise.

For most of the schools reviewed for this report, the structural deficiencies for either the entire school or for the older phases of the school were of such an extent that the recommended structural upgrades would require that these spaces be virtually gutted and reconstructed. As such it can be assumed that costs to repair/replace the affected architectural, electrical, and mechanical components of the buildings will be significant and likely will exceed the basic structural costs given in this report. This is consistent with our experience with other old buildings that have been investigated for re-use and/or upgrading. When the design team is weighing renovation alternatives one option that nearly always should be considered is to totally demolish the deficient structure and replace it with entirely new construction. This is often the most economical solution, especially if life cycle costs and the benefits of a modern facility are considered. Of course historic or civic significance and land availability must also be considered.

There are other cost issues that need to be considered when choosing among various seismic upgrade renovations or a new facility. While such issues may not have a direct cost in the construction budget, these costs are no less real and could be significant. These issues include but are not limited to loss of building use (and does temporary classroom space as in a nearby building even exist), relocation costs, damage to or loss of contents, and loss of teaching/learning time.

The estimated costs given in this report represent the Engineers opinion of the probable cost to complete the recommended type of work based on typical unit costs for similar type work completed on past projects. The exact cost to upgrade each individual building will depend on the final design method selected, as well a number of other issues that are beyond the scope of this report.

WYOMING PUBLIC SCHOOL PHASE 2 SEISMIC EVALUATIONS										
NO.	FACILITY NAME YEAR(S) BUILT	SEISMIC ZONE	SCHOOL DISTRICT LOCATION	TOTAL BUILDING FLOOR AREA		PERCENTAGE OF AREA DEFICIENT		ESTIMATED COST OF SEISMIC UPGRADE TOTAL COST	COST PER S.F.	
1	CLARK ELEMENTARY 1954, 1978	3	UINTA COUNTY S. D. #1 EVANSTON, WYOMING	40,120	SF	100	%	$1,354,000	$33.75	/ S.F.
2	BURGOON ELEMENTARY 1950, 1965, 1977, 1995	3	LINCOLN COUNTY S.D. #1 DIAMONDVILLE, WYOMING	25,140	SF	80	%	$632,500	$31.45	/ S.F.
3	KEMMERER ELEMENTARY 1972	2B	LINCOLN COUNTY S.D. #1 KEMMERER, WYOMING	39,185	SF	100	%	$1,132,000	$28.89	/ S.F.
4	KEMMERER HIGH SCHOOL 1958, 1966, 1977, 1995	2B	LINCOLN COUNTY S.D. #1 KEMMERER, WYOMING	167,560	SF	61	%	$2,412,000	$23.56	/ S.F.
5	HOLDAWAY ELEMENTARY 1956, 1983, 1989	3	LINCOLN COUNTY S.D. #2 THAYNE, WYOMING	39,550	SF	41	%	$540,000	$33.58	/ S.F.
6	METCALF ELEMENTARY 1956, 1988, 1992	3	LINCOLN COUNTY S.D. #2 ETNA, WYOMING	32,575	SF	49	%	$540,000	$33.58	/ S.F.
7	HOT SPRINGS HIGH SCHOOL 1958	1	HOT SPRINGS COUNTY S.D. #1 THERMOPOLIS, WYOMING	121,510	SF	100	%	$4,420,000	$36.38	/ S.F.

NOTE 1 COSTS PER S.F. ARE BASED ON TOTAL ESTIMATED UPGRADE COST DIVIDED BY TOTAL DEFICIENT FLOOR AREA, NOT TOTAL FLOOR AREA.
2 UPGRADE COSTS ARE FOR STRUCTURAL CONSTRUCTION REQUIREMENTS ONLY AND DO NOT INCLUDE ARCHITECTURAL, ELECTRICAL, MECHANICAL, CIVIL OR OTHER ASSOCIATED COSTS.

CLARK ELEMENTARY SCHOOL

UINTA SCHOOL DISTRICT NO. 1
Evanston, Wyoming

GENERAL BUILDING DESCRIPTION.

Clark Elementary school is a single story building which was constructed in two phases. The plans for the first phase of the school are dated March, 1954 and were prepared by Karl L. Krusmark A.I.A., Architect of Casper, Wyoming. The original phase contains the offices, classrooms, gymnasium, kitchen, cafeteria and assorted support spaces for a complete school. The original phase has approximately 33,600sf of floor space on the main level plus 3,750sf of floor space in the basement areas. The plans for the second phase are dated September, 1978 and were prepared by Richardson Associates of Salt Lake City, Utah. This second phase contains space for a media center of about 2,770sf. The building is a single level above ground with two separate basement areas located underneath parts of the original kitchen and the gymnasium. The school has a total floor area of approximately 40,120sf, of which 36,370sf is on the main floor and 3,750sf in the basement spaces.

STRUCTURAL SYSTEM DESCRIPTION.

The original construction consists of a combination of structural steel, masonry and wood. The structural framing for the roof consists of 2" timber tongue and groove decking supported on steel open web trusses. These trusses are supported on a steel frame consisting of wide-flange beams and channels bearing on steel columns. Interior corridor walls are a combination of tile and lava-block masonry that basically in-fills the space between steel columns. No structural support for the top of the interior walls exists other than that provided by the acoustical ceiling.

Exterior walls along the longitudinal sides of the building were originally consisted of a lower section of brick and masonry block which supported long bands of window glass and glass block that extended all the way to the structural framing supporting the roof structure. At some time in the past the glass block and old windows were removed and replaced with smaller windows and in-filled framed walls. Little is known concerning the construction of these in-filled walls. Exterior walls on the ends of the building consist of lava-block masonry with a brick veneer. Other than some joint reinforcement the masonry construction used for the walls in un-reinforced.

The roof framing at the gym is different in that 4 ½" metal acoustical roof/ceiling panels are supported by fabricated steel rigid frames. The roof framing at the end walls of the gymnasium is supported on the masonry walls.

Most of the main floor was constructed over a crawl space. These floors are framed with a cast-in-place concrete deck supported by steel open web trusses.

The steel trusses are supported on the concrete foundation walls at exterior wall lines and on cast-in-place concrete beams, columns and pad footings at interior wall line locations. The floor system over the basement areas is cast-in-place concrete slab supported by concrete beams and foundation walls. The floor for the remainder of the gymnasium is a concrete slab-on-grade. The foundations consist of a combination of reinforced concrete continuous wall and isolated column footings.

SUMMARY OF DEFICIENCIES.

Most of the structural deficiencies found in this building stem from the fact it was constructed at a time when building codes did not require buildings to be specifically designed to account for lateral loads. The following items were identified as potential structural deficiencies for seismic loads according to current building code structural criteria..

A combination of steel simple and moment frames are used to support the roof structure for this building. The simple frames have little or no capacity to resist lateral loads and the moment frames present in the gymnasium area were not designed to resist the high moments that would be associated with a seismic event. Because of this, the building must rely on the brick/lava-block walls along the interior corridors and exterior walls to resist all lateral loads from earthquakes. The primary concern is the number, location and construction of the brick/lava block shear walls. The exterior longitudinal faces of the building utilize large expanses of windows and in-filled framed wall, which are totally ineffective to resist lateral loads. The existing end walls are constructed using a combination of un-reinforced brick and lava blocks, which does not meet minimum code reinforcement requirements. The interior walls also are un-reinforced masonry and no structural connection exists to the roof structure to provide a complete load path for lateral forces from the roof structure to the foundations.

The existing roof decking which consists of 2" nominal wood decking nailed to the top of the roof trusses does not meet current criteria to allow it to serve as an adequate roof diaphragm. Also, the connection of the roof diaphragm to the shear walls is either inadequate or totally lacking.

The existing brick chimney adjacent to the Kitchen extends well above the supporting roof structure and constructed of un-reinforced masonry. This could present a falling hazard in an earthquake.

SUMMARY OF RECOMMENDATIONS.

Clark Elementary school will require extensive structural modifications to bring it up to current code requirements for seismic loads. All of the un-reinforced brick, lava block and glass block walls, both interior and exterior, will need to be removed and replaced or strengthened in such a manner as to resist in-plane and out-of-plane lateral forces.

Some of the perimeter walls are absent of shear walls, thus additional shear walls and/or braced frames will need to be added at selected locations. Foundations effected by new shear walls and/or braced frames will also need to be strengthened and/or added.

The existing roof diaphragms will have to be strengthened or supplemented. This will require the removal of all existing roofing materials. A new layer of structural wood sheathing (plywood) will need to be attached to the top of the existing wood decking. Perimeter connections will need to be strengthened and/or added to provide a complete load path for lateral forces from the roof to the foundation. The steel roof decking over the gymnasium may be adequate to serve as a structural diaphragm, though the connection to the supporting steel members will need to be supplemented with additional welds or screws.

The brick chimney needs to be either removed and/or rebuilt with structural steel or reinforced masonry to provide lateral stability.

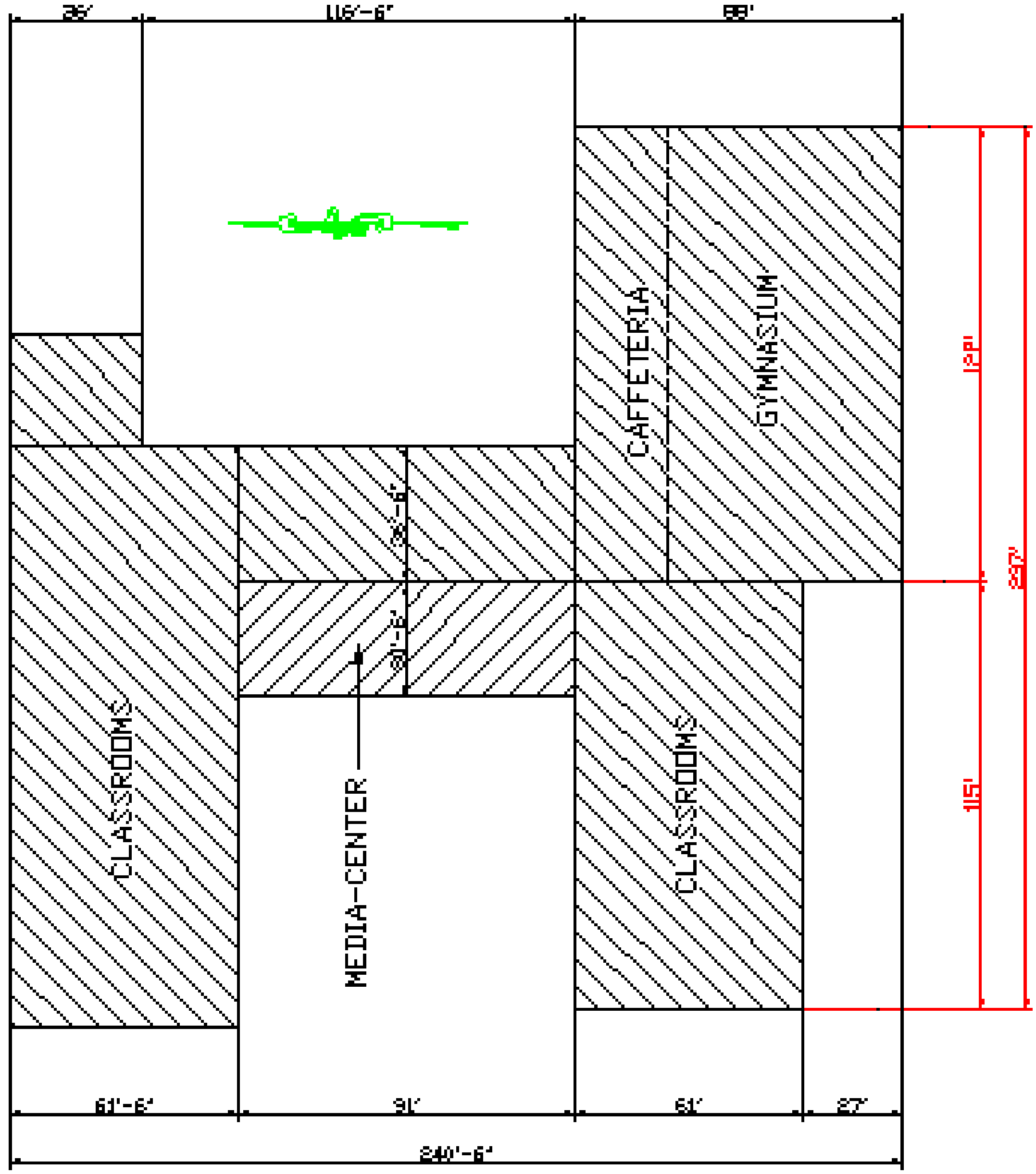
The exact extent, number and location of new/or strengthened structural elements can only be determined through a complete design performed by a qualified structural engineer familiar with this type of work.

It should be noted that the recommended structural work recommended for this building will virtually require this building to be completely gutted to the bare steel frames and then rebuilt from the foundations up. This will also require virtually all of the buildings architectural, electrical, mechanical and other aspects of the building to also require complete or nearly complete reconstruction.

ESTIMATED COSTS.

The total estimated cost for seismic upgrades for Clark Elementary School is $1,354,000 or a cost of about $33.70/sf.

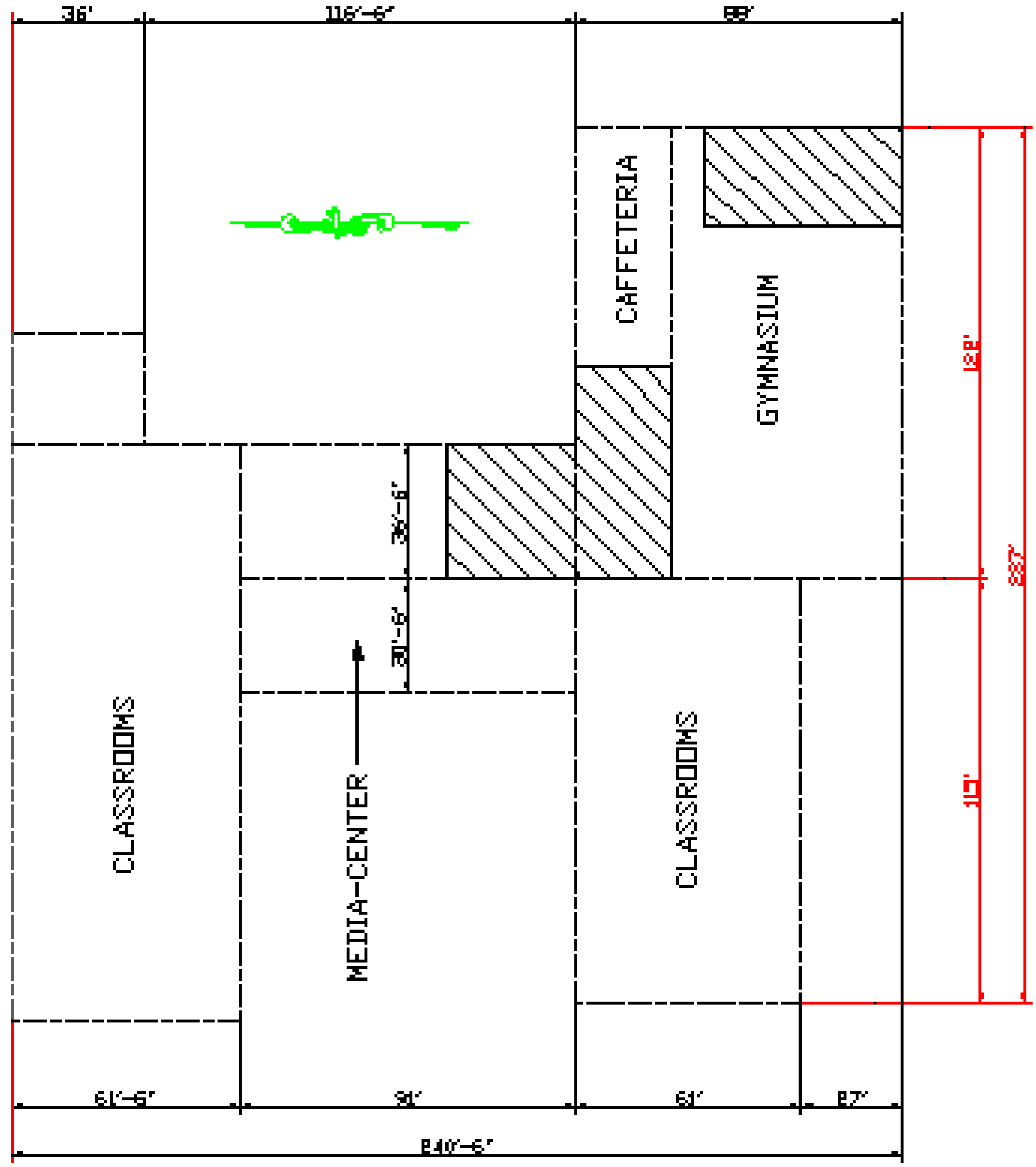
CLARK ELEMENTARY SCHOOL



MAIN LEVEL FLOOR PLAN

FILE: CLARK-PLAN.DWG

CLARK ELEMENTARY SCHOOL



BASEMENT LEVEL FLOOR PLAN

FILE CLARK-PLAN2.DWG

J-U-B ENGINEERS, INC.
ENGINEERS PLANNERS SURVEYORS
Boise, Idaho

ENGINEERS ESTIMATE OF PROBABLE CONSTRUCTION COSTS

PROJECT:	**WYOMING PHASE 2 SEISMIC EVALUATIONS**	JOB NO.	**20760-02**	PAGE:	
DESCRIPTION:	**CLARK ELEMENTARY SCHOOL**	CHK:	D.L.B.	DATE:	
FILE NAME:	CLARK-COST-EST.XLS	BY:	R.St M	DATE:	10-25-2002

ITEM NO.	ITEM OR ACTIVITY DESCRIPTION	QUANTITY	UNITS	UNIT COST	COST
1	NEW ROOF DIAPHRAGM	40,120	S.F.	$6.00	$240,720
2	EXISTING EXTERIOR WALL TO BE REMOVED	15,138	S.F.	$10.00	$151,380
3	EXISTING INTERIOR WALL TO BE REMOVED	15,672	S.F.	$10.00	$156,720
4	(New) EXTERIOR WALL REBUILT	15,138	S.F.	$25.00	$378,450
5	(New) INTERIOR WALL REBUILT	15,672	S.F.	$20.00	$313,440
6	NEW DIAPHRAGM CHORD MEMBER AND/OR DRAG STRUTS	402	L.F.	$50.00	$20,100
7	NEW EXTERIOR CMU SHEAR WALL	648	S.F.	$25.00	$16,200
8	UPGRADE EXIST. DRAG CONNECTIONS.	76	EA.	$100.00	$7,600
9	UPGRADE EXISTING CHIMNEY	1	EA.	$5,000	$5,000
10		0	EA.	$0.00	$0
11		0	EA.	$0.00	$0
12		0	EA.	$0.00	$0
13		0	EA.	$0.00	$0
14		0	EA.	$0.00	$0
15		0	EA.	$0.00	$0
16		0	EA.	$0.00	$0
		0	EA.	$0.00	$0
	SUMMATION OF ITEMIZED COSTS				$1,289,610
	PROFESSIONAL SERVICES	5	%		$64,481
	SUB-TOTAL ESTIMATED COST				$1,354,091

SUB-TOTAL ESTIMATED COST PER SF = $1,354,091 / 40,200 SF = $33.68 / SF

BURGOON ELEMENTARY SCHOOL

LINCOLN COUNTY SCHOOL DISTRICT NO.1
Diamondville, Wyoming

GENERAL BUILDING DESCRIPTION.

The facility currently known as the Burgoon Elementary School is a single story building of approximately 25,140 square feet built in four phases: 1st phase in 1950, the 2nd phase in about 1965, the 3rd phase in 1977 and the 4th phase in 1995. In addition to the four primary phases of construction the building has undergone several remodels, though these do not appear to have affected the basic building structure.

Phase 1 (1950). The original phase has approximately 7,995 sf of total floor area. The original building housed offices, classrooms, cafeteria, a gymnasium and support areas for a complete facility. It is a single story building. Plans for the original building were not available.

Phase 2 (1965). This phase has approximately 3,910 sf of total floor area. The 2nd phase was the addition of four large classrooms. It is a single story addition. Plans for the addition were not available and the exact date of construction is not known.

Phase 3 (1977). This phase has approximately 11,440 sf of total floor area. The 3rd phase included several classrooms, rest rooms, and support areas. It is a single story addition. Plans for this addition are dated 1977 and were prepared by Lawerance E. Matson Architect. These plans are titled Addition & Remodel At Burgoon School.

Phase 4 (1995). This phase has approximately 1,795 sf of total floor area. The fourth and final addition was a media-library-technology room and support areas. It is a single story addition. Plans for the addition are dated 1995 and were prepared by Quinn-Richardson Architects of Lander, Wyoming.

STRUCTURAL SYSTEM DESCRIPTION.

Phase 1. The original construction consists of a combination of wood, structural steel and masonry. The roof system consists of wood decking over Truss-joist type wood and steel roof trusses. The roof framing is supported on a system of steel beams and columns and masonry bearing walls. The masonry walls consist of a combination of concrete block and brick, and are generally un-reinforced. Floors are concrete slabs on grade and the building has a concrete foundation.

Phase 2. The second phase construction consists of a combination of wood, steel and masonry. The roof system has a wood deck supported on Truss-joist type wood and steel roof truss. The roof framing is supported by masonry bearing walls. The masonry walls consist of a combination of concrete block and brick, and are generally un-reinforced. Floors are concrete slabs on grade and the addition has a concrete foundation.

Phase 3 (1977). The third phase construction is similar to the 2nd phase. The roof system consists of wood decking supported on Truss-joist type wood and steel roof truss. All roof framing is supported by masonry bearing walls. The masonry walls consist of a combination of reinforced concrete block and brick. Floors are concrete slabs on grade and the building has a concrete foundation.

Phase 4 (1995). The fourth addition utilizes all non-combustible materials in the basic building structural system. The roof structure consists of steel decking supported on steel open-web joists and steel beams. Floors are constructed with a crawl space and consist of concrete fill over corrugated steel decking, which is then supported by open web steel joists, steel beams and either steel columns or reinforced concrete or masonry walls. Bearing walls consist of reinforced concrete masonry with a brick veneer. Foundations are constructed of reinforced concrete.

SUMMARY OF DEFICIENCIES.

Structural deficiencies in this building directly correlate to the age of the phase of construction. In general, the first two phases of the building have serious potential structural deficiencies, while the later two phases of construction have structures that are similar to that required by current building code.

Phase 1. The principal deficiencies found in this portion of the building are attributable to the fact that is was built without specific attention given to the effects of earthquake loads. There are no specific interior shear walls in this section of the building, which results in a very long and narrow roof diaphragm. The type of wood decking material used and method of attaching the decking to the supporting members does not conform to current code requirements. There are no continuous members at the top of the supporting walls to serve as a diaphragm chord, as required by current code provisions. All bearing/shear walls are constructed from un-reinforced masonry, which is not allowed under current building code structural requirements.

Phase 2. The principal deficiencies in this phase of the building are similar to those of the 1950 addition. The roof diaphragm is very long and narrow resulting in high shear stresses and there are no specific diaphragm chord members. All bearing/shear walls are constructed from un-reinforced masonry, which is not allowed under current building code structural requirements.

Phase 3 (1977). This phase of construction, with one notable exception, appears to be detailed in a manner consistent with current building code structural requirements. The one exception is the material used for the roof deck, which is a nominal 2-inch deep fiber-board material. This material does not have recognized diaphragm shear values and will need to be supplemented.

Phase 4 (1995). This phase of construction appears to be detailed in a manner consistent with current building code structural requirements. No specific structural deficiencies were noted.

SUMMARY OF RECOMENDATIONS.

Phase 1 and 2. These phases of the building will require extensive structural modifications to bring them up to compliance with current building code structural criteria. Virtually all un-reinforced brick and masonry walls, both interior and exterior of the building, will need to be removed and replaced or otherwise strengthened to resist lateral forces. Existing roof diaphragms will need to be strengthened or replaced and perimeter connections, and chords will need to be reconstructed in order to provide a complete load path for lateral forces from the roof to the foundation.

The recommended structural work will virtually require this building to be completely demolished and rebuilt from the ground up. This will also require virtually all of the buildings architectural, electrical, mechanical and other aspects of the building to also require nearly complete reconstruction.

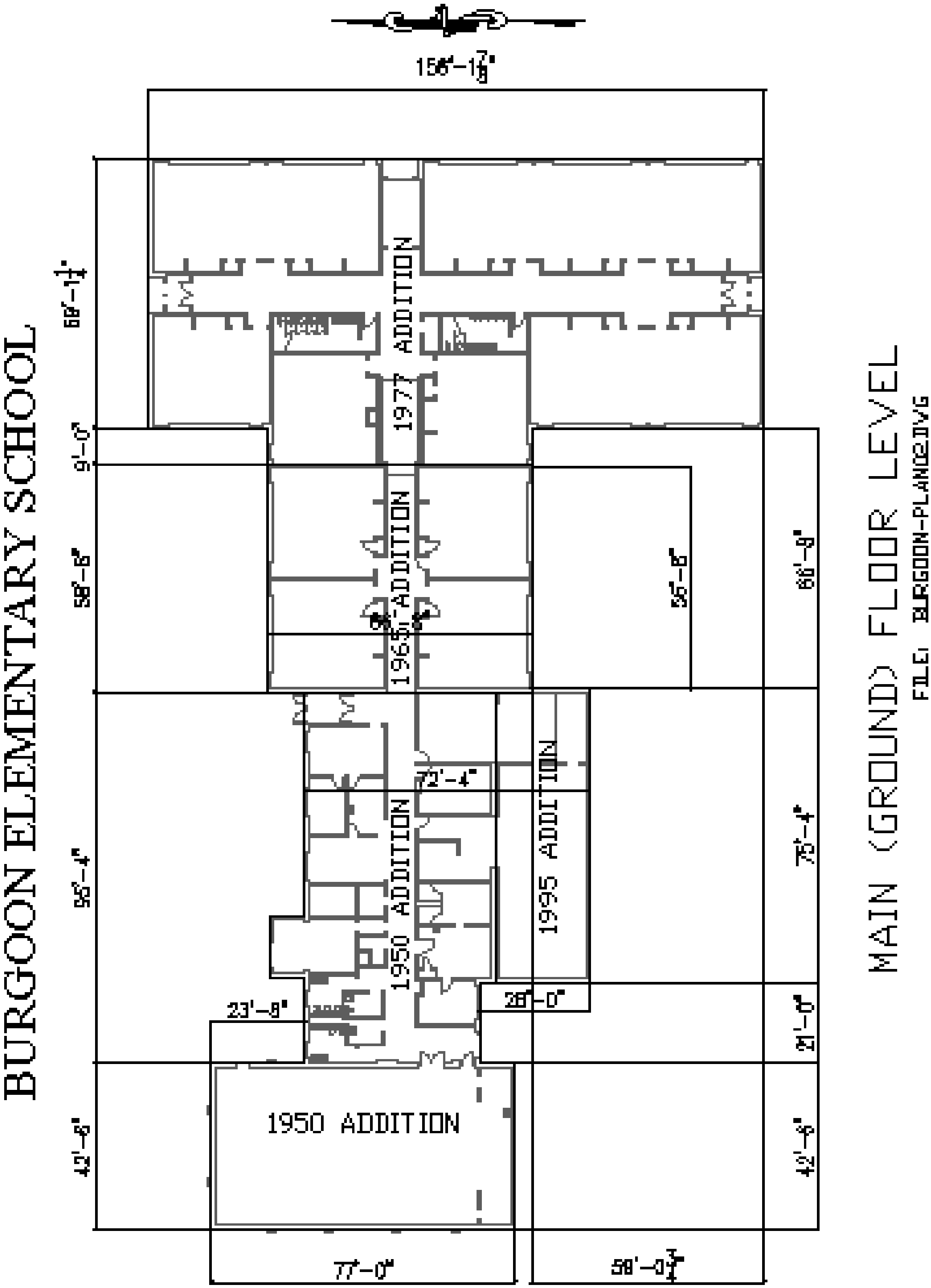
Phase 3 (1977). The existing roofing will need to be removed and replaced in order to allow the existing roof diaphragm to be supplemented. This will most likely be accomplished by nailing a new layer of structural wood sheathing (plywood) over the top of the existing wood decking material with a specific nailing pattern, determined by the final design requirements.

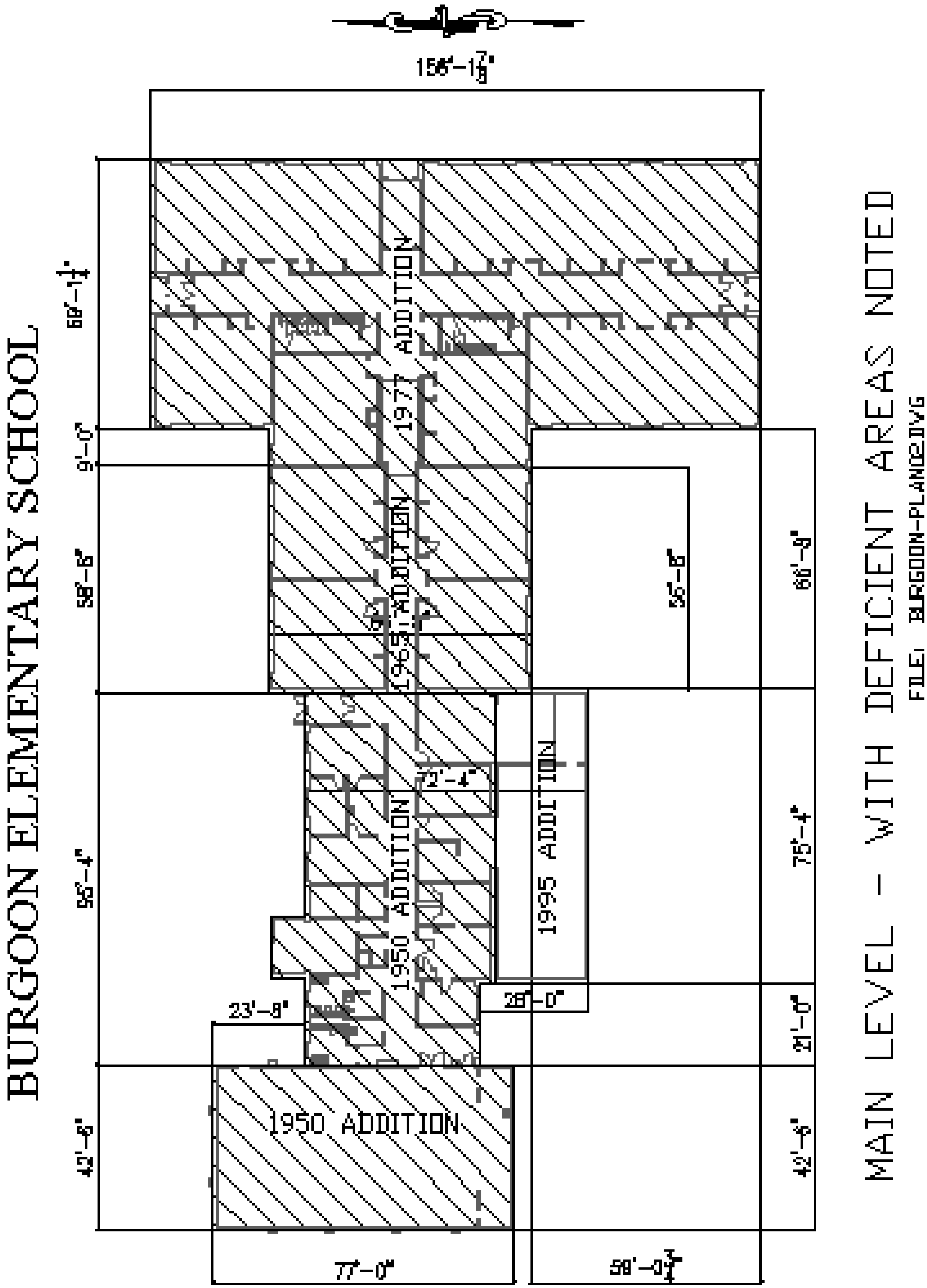
Phase 4 (1995). As this phase of the building appears to be constructed in a manner similar to that required by current building code criteria, no specific structural upgrade recommendations are proposed.

Any structural upgrade or modification to phases 1 and 2 will need to taken into account how this work might affect the 1977 and 1995 building structures.

ESTIMATED COSTS.

The total Estimated Cost for Seismic upgrades of this facility. $586,500 or $25.10/sf of space rehabilitated. This amount only includes the basic structural costs for upgrading this facility. As noted before, there will be significant architectural, electrical, mechanical, site and costs associated with this building if the decision is chosen to upgrade it. These other costs likely will exceed the basic structural costs noted in this report.


BURGOON ELEMENTARY SCHOOL
MAIN (GROUND) FLOOR LEVEL
1977 ADDITION
1965 ADDITION
1950 ADDITION
1995 ADDITION
1950 ADDITION
72'-4"
23'-8"
77'-0"


BURGOON ELEMENTARY SCHOOL
MAIN LEVEL - WITH DEFICIENT AREAS NOTED
FILE: BURGOON-PLAN2.DWG
1977 ADDITION
1953 ADDITION
1950 ADDITION
1995 ADDITION
1950 ADDITION
72'-4"
23'-8"
28'-0"
77'-0"
9'-0"
21'-0"

J-U-B ENGINEERS, INC.
ENGINEERS PLANNERS SURVEYORS
Coeur d'Alene, Idaho

ENGINEERS ESTIMATE OF PROBABLE CONSTRUCTION COSTS

PROJECT:	**WYOMING PHASE 2 SEISMIC EVALUATIONS**	JOB NO. **20760-02**	PAGE:	
DESCRIPTION:	**BURGOON ELEMENTARY SCHOOL**	CHK:	DATE:	
FILE NAME:	BUR-EL-COST-EST-01.XLS	BY: D.L.B.	DATE:	11-1-2002

PHASE 1, 2 & 3

ITEM NO.	ITEM OR ACTIVITY DESCRIPTION	QUANTITY	UNITS	UNIT COST	COST
1	DEMOLITION OF EXISTING PHASE 1BUILDING	7,995	S.F.	$7.50	$59,963
2	RECONSTRUCT NEW PH. 1 BUILDING ON EXIST. FOUNDATIONS	7,995	S.F.	$25.00	$199,875
3	DEMOLITION OF EXISTING PHASE 2 BUILDING	3,910	S.F.	$7.50	$29,325
4	RECONSTRUCT NEW PH. 2 BUILDING ON EXIST. FOUNDATIONS	3,910	S.F.	$25.00	$97,750
5	REMOVE-REPLACE PHASE 3 EXISTING ROOFING	11,440	S.F.	$10.00	$114,400
6	NEW WOOD DIAPHRAGM FOR PHASE 3 ROOF	11,440	S.F.	$5.00	$57,200
7		0	EA.	$0.00	$0
8		0	EA.	$0.00	$0
9		0	EA.	$0.00	$0
10		0	EA.	$0.00	$0
11		0	EA.	$0.00	$0
12		0	EA.	$0.00	$0
13		0	EA.	$0.00	$0
14		0	EA.	$0.00	$0
15		0	EA.	$0.00	$0
16		0	EA.	$0.00	$0
	SUMMATION OF ITEMIZED COSTS				$558,513
	PROFESSIONAL SERVICES	5	%		$27,926
	SUB-TOTAL ESTIMATED COST				$586,438

SUB-TOTAL ESTIMATED COST PER SF = $586,438 / 23,345 SF = $25.12 / SF

KEMMERER ELEMENTARY SCHOOL

LINCOLN COUNTY SCHOOL DISTRICT NO.1
Kemmerer, Wyoming

GENERAL BUILDING DESCRIPTION.

The facility currently known as the Kemmerer Elementary School is a primarily single story building of approximately 39,180 square feet built in a single phase in about 1971. There do not appear to have been any significant additions or remodels in the intervening years that would have affected the basic building structure.

Plans for the original building are dated 1971 and were prepared by Wheeler & Lewis Architects of Denver, Colorado. The facility houses offices, classrooms, cafeteria, a library, a multipurpose room, locker rooms, and support areas for a complete facility. It is a single story building with the exception of mechanical lofts over some of the hallway areas.

STRUCTURAL SYSTEM DESCRIPTION.

The basic construction consists of a combination of structural steel and masonry. The framing for all roofs consists of corrugated steel decking supported on either open-web steel joists or steel beams. The steel roof framing is then supported on a system of steel columns and masonry bearing walls. Exterior masonry walls are concrete block with a brick veneer and interior walls are concrete block. The masonry walls typically have a top course bond beam with continuous rebar and some longitudinal joint reinforcement, but otherwise are basically un-reinforced. Floors for the mechanical loft are reinforced concrete. Ground level floors are concrete slabs-on-grade and the foundations consist of reinforced concrete grade beams supported on concrete caissons.

SUMMARY OF DEFICIENCIES.

The basic structural deficiency this building is the lack of reinforcing steel in the masonry walls. This is because the building was constructed before minimum requirements for reinforcing steel in masonry walls in seismic area was required by the building codes.

The basic roof structure is sound and the combination of a steel deck supported on steel joists would provide an adequate roof diaphragm if the building had adequate shear walls. The exterior and interior bearing/shear walls are more than adequate as far as location and length are concerned but because they are constructed of un-reinforced masonry, their stability in a large earthquake event is questionable. Un-reinforced masonry construction is no longer allowed under current building code structural criteria.

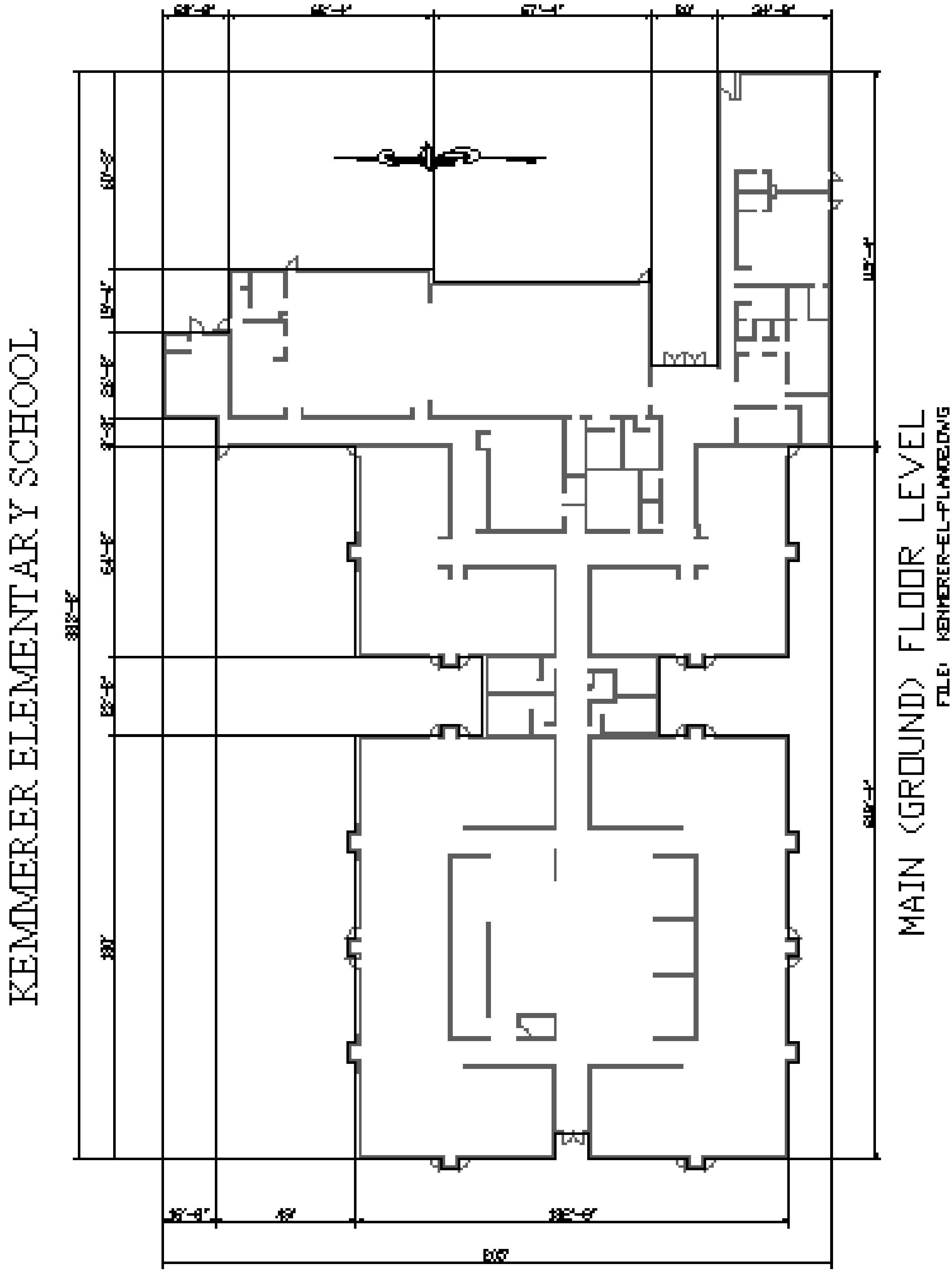
SUMMARY OF RECOMENDATIONS.

This building will require extensive structural modifications to bring it up to compliance with current building code structural criteria. Virtually all un-reinforced brick and masonry walls, both interior and exterior of the building, will need to be removed and replaced or otherwise strengthened to resist lateral forces. Existing roof diaphragm perimeter connections, and chords will need to be reconstructed in order to provide a complete load path for lateral forces from the roof to the foundation.

The recommended structural work will virtually require this building to be completely gutted and rebuilt from the foundations up. This will also require virtually all of the buildings architectural, electrical, mechanical and other aspects of the building to also require nearly complete reconstruction.

ESTIMATED COSTS.

The total Estimated Cost for Seismic upgrades of this facility. $1,131,000 or $28.88/sf of space rehabilitated. This amount only includes the basic structural costs for upgrading this facility. As noted before, there will be significant architectural, electrical, mechanical, site and costs associated with this building if the decision is chosen to upgrade it. These other costs likely will exceed the basic structural costs noted in this report.


KEMMERER ELEMENTARY SCHOOL
MAIN (GROUND) FLOOR LEVEL

J-U-B ENGINEERS, INC.
ENGINEERS PLANNERS SURVEYORS
Coeur d'Alene, Idaho

ENGINEERS ESTIMATE OF PROBABLE CONSTRUCTION COSTS

PROJECT:	**WYOMING PHASE 2 SEISMIC EVALUATIONS**	JOB NO.	**20760-02**	PAGE:	
DESCRIPTION:	**KEMMERER ELEMENTARY SCHOOL**	CHK:		DATE:	
FILE NAME:	KEM-EL-COST-EST-01.XLS	BY:	D.L.B.	DATE:	10-23-2002

PHASE 1 (1971)

ITEM NO.	ITEM OR ACTIVITY DESCRIPTION	QUANTITY	UNITS	UNIT COST	COST
1	DEMOLITION OF EXISTING BUILDING	39,185	S.F.	$5.00	$195,925
2	RECONSTRUCT NEW BUILDING ON EXIST. FOUNDATIONS	39,185	S.F.	$22.50	$881,663
3		0	EA.	$0.00	$0
4		0	EA.	$0.00	$0
5		0	EA.	$0.00	$0
6		0	EA.	$0.00	$0
7		0	EA.	$0.00	$0
8		0	EA.	$0.00	$0
9		0	EA.	$0.00	$0
10		0	EA.	$0.00	$0
11		0	EA.	$0.00	$0
12		0	EA.	$0.00	$0
13		0	EA.	$0.00	$0
14		0	EA.	$0.00	$0
15		0	EA.	$0.00	$0
16		0	EA.	$0.00	$0
	SUMMATION OF ITEMIZED COSTS				$1,077,588
	PROFESSIONAL SERVICES	5	%		$53,879
	SUB-TOTAL ESTIMATED COST				$1,131,467

SUB-TOTAL ESTIMATED COST PER SF = $1,131,467 / 39,185 SF = $28.88 / SF

KEMMERER HIGH SCHOOL

LINCOLN COUNTY SCHOOL DISTRICT NO.1
Kemmerer, Wyoming

GENERAL BUILDING DESCRIPTION.

The facility currently known as the Kemmerer High School is a primarily single story building of approximately 167,600 square feet built in four phases: 1958, 1966, 1977 and 1995. In addition to the four primary phases of construction the building has undergone several remodels, though these do not appear to have affected the basic building structure.

Phase 1. Plans for the original building are dated 1958 and were prepared by Scott and Beecher Architects and Engineers of Salt Lake City, Utah. The original phase housed offices, classrooms, cafeteria, a gymnasium and locker rooms, an auditorium and support areas for a complete facility. It is a single story building with the exception of second story spaces over the auditorium stage area.

Phase 2. The plans for the next addition are dated 1966 and were prepared by Wheeler & Lewis Architects of Denver, Colorado. This phase was known as the Junior High School Building at the time of construction and is mostly a single story structure. This phase of construction houses offices, classrooms, a library, shops, a music room, a multi-purpose room with locker rooms, a locker area and miscellaneous support spaces. There is a second story loft over part of the library and mechanical lofts over some of the hallway areas.

Phase 3. Plans for the third addition are dated 1977 and were prepared by Lawrence E. Matson Architect. These plans are titled the Vocational Shop Addition. It is a single story addition with the exception of a small loft in one of the shops. This addition houses woodworking, metal working and auto-mechanics shops, several classrooms and support areas.

Phase 4. Plans for the fourth and final addition are dated 1995 and were prepared by Quinn-Richardson Architects of Lander, Wyoming. This phase of construction consists of two separate additions to the existing facility, a single story Tech Center Addition and a partly two-story Gymnasium addition. The Tech Center Addition occupies a space between the 1958 and 1966 additions and houses technology education classrooms. The gymnasium addition removed and replaced the existing 1958 gym and also added on expanded locker and equipment areas on the main floor and new wresting and training areas in a second story space over the new locker rooms.

STRUCTURAL SYSTEM DESCRIPTION.

Phase 1 (1958). The original construction consists of a combination of structural steel and masonry. The framing for all roofs consists of corrugated steel decking supported on either open-web steel joists and steel beams or fabricated steel trusses. The steel roof framing is then supported on a system of steel columns and masonry bearing walls. The masonry walls consist of a combination of concrete block and brick, and is generally un-reinforced. Typically the masonry walls have a top course bond beam made out of cast-in-place concrete, which is reinforced with continuous steel bars. Floors over the wing areas of the auditorium, balcony seating for the old gymnasium, ground floors and foundations are of reinforced concrete.

Phase 2 (1966). The second phase addition utilizes several structural types. The multi-purpose room has a plywood roof supported by Truss-joist type wood and steel roof trusses. The roof structure is supported on masonry bearing walls made from a combination of concrete block and brick. The plans indicate that the masonry walls are basically un-reinforced.

The reminder of the facility utilizes several types of roof structure, though all are of primarily wood construction. The main classroom area has a folded-plate type roof configuration made from plywood and 2 by timber framing supported on steel posts and or brick masonry. The library has exposed glue-laminated beams with wood joists and the roof over music room and shop area utilizes wood and steel Truss-joist type roof trusses. The roof framing in these areas is supported on a combination of steel posts and un-reinforced double-wythe brick walls. Floors, foundation walls and footings are reinforced concrete.

Phase 3 (1977). The third addition utilizes all non-combustible materials in the basic building structural system. The roof structure consists of steel decking supported on steel open-web joists. All roof framing is supported on reinforced concrete masonry bearing walls with a brick veneer. Floors, foundation walls and footings are reinforced concrete.

Phase 4 (1995). The fourth addition also utilizes all non-combustible materials in the basic building structural system. The roof structure consists of steel decking supported on steel open-web joists and steel beams. New floor structure consists of concrete fill over corrugated steel decking, which is then supported by open web steel joists, steel beams and either steel columns or reinforced masonry walls. Exterior bearing walls consist of reinforced concrete masonry with a brick veneer.

Where the existing gymnasium structure was removed and replaced with a new gymnasium the old masonry walls forming the perimeter of the gym were left in place and new bearing walls were constructed along the interior face consisting of steel studs braced with steel strap X-bracing. The new gym roof structure consists of steel decking supported on steel open-web trusses. Floors, foundation walls and footings are of reinforced concrete.

SUMMARY OF DEFICIENCIES.

Structural deficiencies in this building directly correlate to the age of the phase of construction. In general, the first two phases of the building have serious potential structural deficiencies, while the later two phases of construction have structures that are consistent with that required by current building code

Phase 1 (1958). The principal deficiencies found in the 1958 portion of the building are attributable to the fact that is was built without specific attention given to the effects of lateral (earthquake) loads. Of primary concern is the number, size and construction of walls that must serve as shear walls. Other than the Auditorium, which is surrounded by solid masonry walls on all four sides and the kitchen area, most of the building utilizes large expanses of window wall with only short sections of masonry that might serve as shear walls. Where exterior masonry walls are present, they are too short in length, too few in number or spaced too far apart to resist the estimated shear forces. In addition the masonry is basically un-reinforced, which is not permitted by current code structural criteria.

Interior corridor and divider walls are not structurally connected to the roof framing and will not serve as shear walls. Steel roof diaphragms in several of the wings are very long and narrow resulting in high shear stresses in the steel decking. The method of attaching the steel decking to the supporting members is unknown and the steel decking utilized is not of a configuration recognized by current building codes and therefore these materials have no established design values for lateral forces.

Though the auditorium has adequate shear walls as far as location and size is concerned, these walls are basically un-reinforced, which is not allowed by current building code standards. The interior wing-sound walls around the auditorium seating space are constructed of un-reinforced masonry and the tops of these walls are not restrained to prevent lateral movement. It is possible that these walls may become unstable in an earthquake. Also, there is concern for the suspended ceiling over the auditorium space. No details are available concerning how this material is supported and braced to the supporting structure, and it is doubtful that this construction is adequate for seismic loads.

Phase 2 (1966). The plans for this phase of construction indicate a complete lack of independent detailing for lateral forces. The building was designed and detailed to support gravity loads only and has only limited inherent resistance to lateral loads due to the nature of the building materials used.

All shear, bearing and in-fill walls consist of either un-reinforced brick, or a combination of un-reinforced brick and concrete masonry. Many of the walls are simply in-filled brick walls between the steel posts that support the roof framing with no specific attachment to the roof framing, the steel columns or the foundations. Earthquake type lateral forces acting either in-plane or out-of plane to the walls will create high-tension stresses within the walls. Tension stresses can't be resisted effectively by un-reinforced masonry.

Plywood used for the roofs on this phase of construction is an acceptable material for diaphragm construction as long as it is blocked, nailed and attached in an appropriate manner. The plans do not indicate the specific nailing pattern and no blocking is indicated. More importantly, the roof diaphragms appear to have a complete lack of detailing required to form a continuous load path from the roof to the foundation. There are no continuous diaphragm chord members and there appears to be inadequate or no specific connection of the roof diaphragm to many of the masonry walls.

Phase 3 (1977). This phase of construction appears to be detailed in a manner consistent with current building code structural requirements. No specific structural deficiencies were noted.

Phase 4 (1995). This phase of construction appears to be detailed in a manner consistent with current building code structural requirements. No specific structural deficiencies were noted.

SUMMARY OF RECOMENDATIONS.

Phase 1 (1958). This phase of the building will require extensive structural modifications to bring it up to compliance with current building code structural criteria. Existing un-reinforced brick and masonry walls will need to be removed and replaced or otherwise strengthened to resist lateral forces. Essentially all exterior walls bearing walls have insufficient shear wall length and new shear walls or braced frames will be required at several interior locations. All roof diaphragms and chords will need to be strengthened and properly attached to new shear walls in order to provide a complete load path for lateral forces from the roof to the foundation. Foundations effected by new shear walls and/or braced frames will also need to be strengthened and/or added where required.

In the auditorium the existing perimeter masonry walls will need to be strengthened. The method assumed in our cost analysis is a gunite (or shotcrete) application of 4-inches of concrete over reinforcing steel anchored to the interior face of the existing walls. Un-braced interior wing-sound walls and the interior ceiling will need to be removed and replaced with new construction adequately braced for seismic loads. Roof to perimeter wall connections will need to be strengthened.

The exact extent, number and location of new/or strengthened structural elements can only be determined through a complete structural design performed by a structural engineer familiar with this type of work.

Phase 2 (1966). This phase of the building will require extensive structural modifications to bring it up to compliance with current building code structural criteria. Virtually all un-reinforced brick and masonry walls, both interior and exterior of the building, will need to be removed and replaced or strengthened to resist lateral forces. New shear walls or braced frames will need to be added at selected locations. All roof diaphragms, perimeter connections, and chords will need to be reviewed with the final shear wall plan and strengthened and or added to provide a complete load path for lateral forces from the roof to the foundation. Foundations effected by new shear walls and/or braced frames will also need to be strengthened and/or added. The exact extent, number and location of new/or strengthened structural elements can only be determined through a complete structural design performed by a structural engineer familiar with this type of work.

In the gymnasium the existing perimeter masonry walls will need to be strengthened. The method assumed in our cost analysis is a gunite application of 4-inches of concrete over reinforcing steel anchored to the interior face of the existing walls. A new continuous roof diaphragm will need to be added and roof to perimeter wall connections will need to be strengthened.

Phase 3 (1977). As this phase of the building appears to be constructed in a manner similar to that required by current building code criteria, no specific structural upgrade recommendations are proposed.

Phase 4 (1995). As this phase of the building appears to be constructed in a manner similar to that required by current building code criteria, no specific structural upgrade recommendations are proposed.

Any structural upgrade or modification to the 1958 and 1966 phases will need to take into account how this work might affect the 1977 and 1995 building structures.

It should be noted that the recommended structural work for phases 1 and 2 will virtually require these areas of the building to be completely gutted and rebuilt from the foundations up. This will also require virtually all of the buildings architectural, electrical, mechanical and other aspects of the building to also require nearly complete reconstruction.

ESTIMATED COSTS.

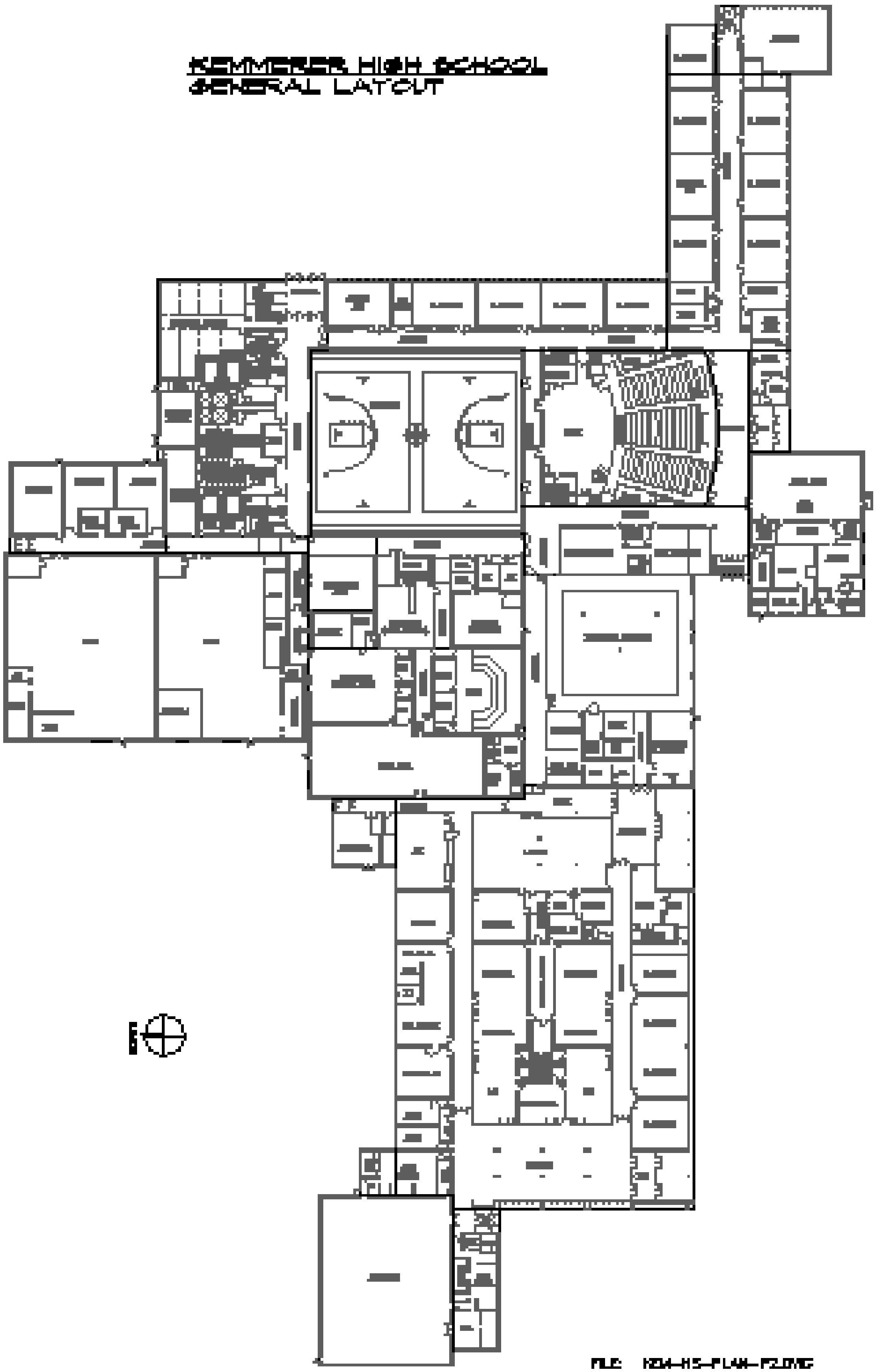
Phase 1 (1958). Estimated cost of structural upgrades for this phase of the building is $1,146,000 or a cost of about $25.20/sf.

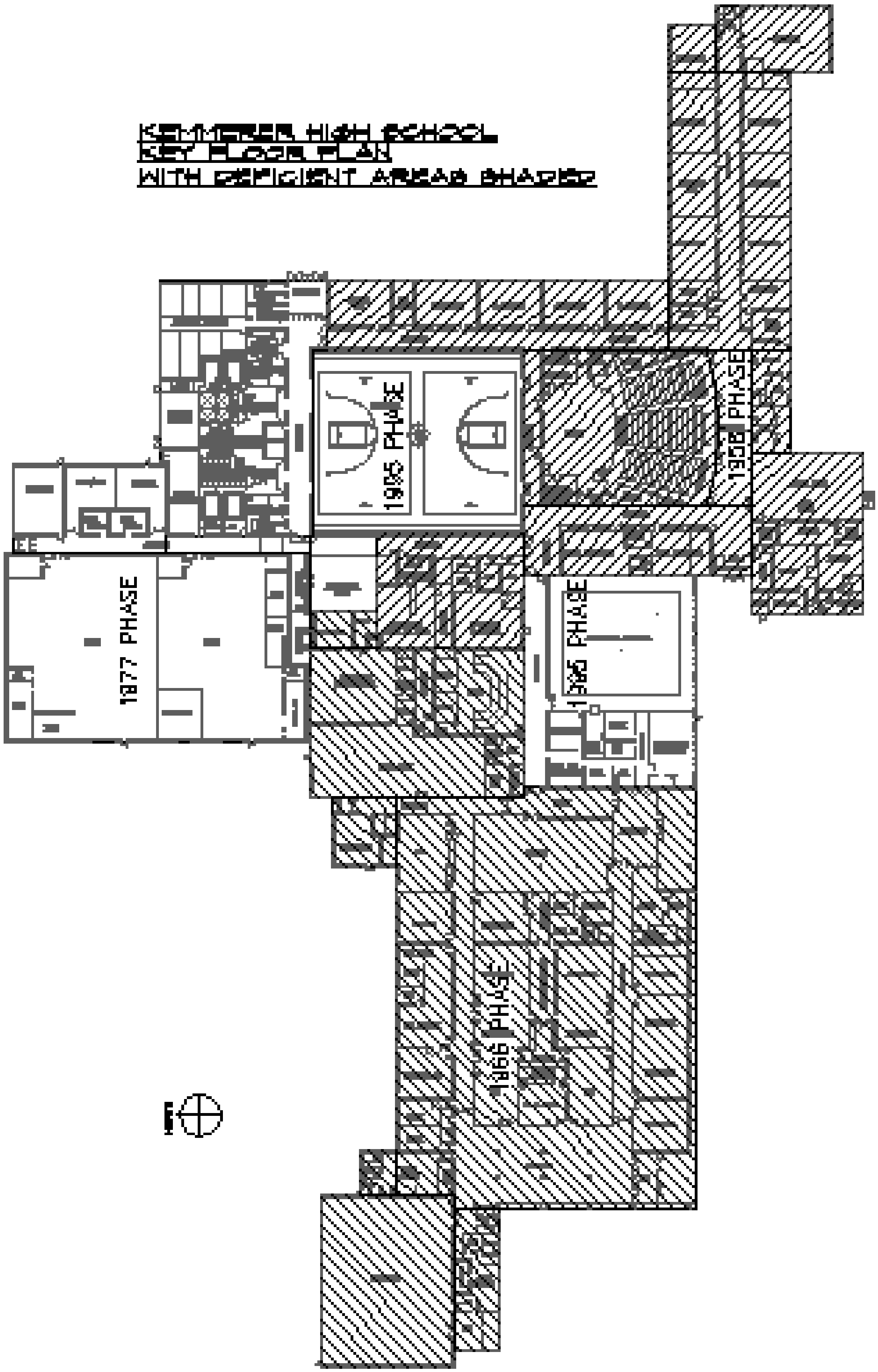
Phase 2 (1966). Estimated cost of structural upgrades for this phase of the building is $1,266,000 or a cost of about $22.30/sf.

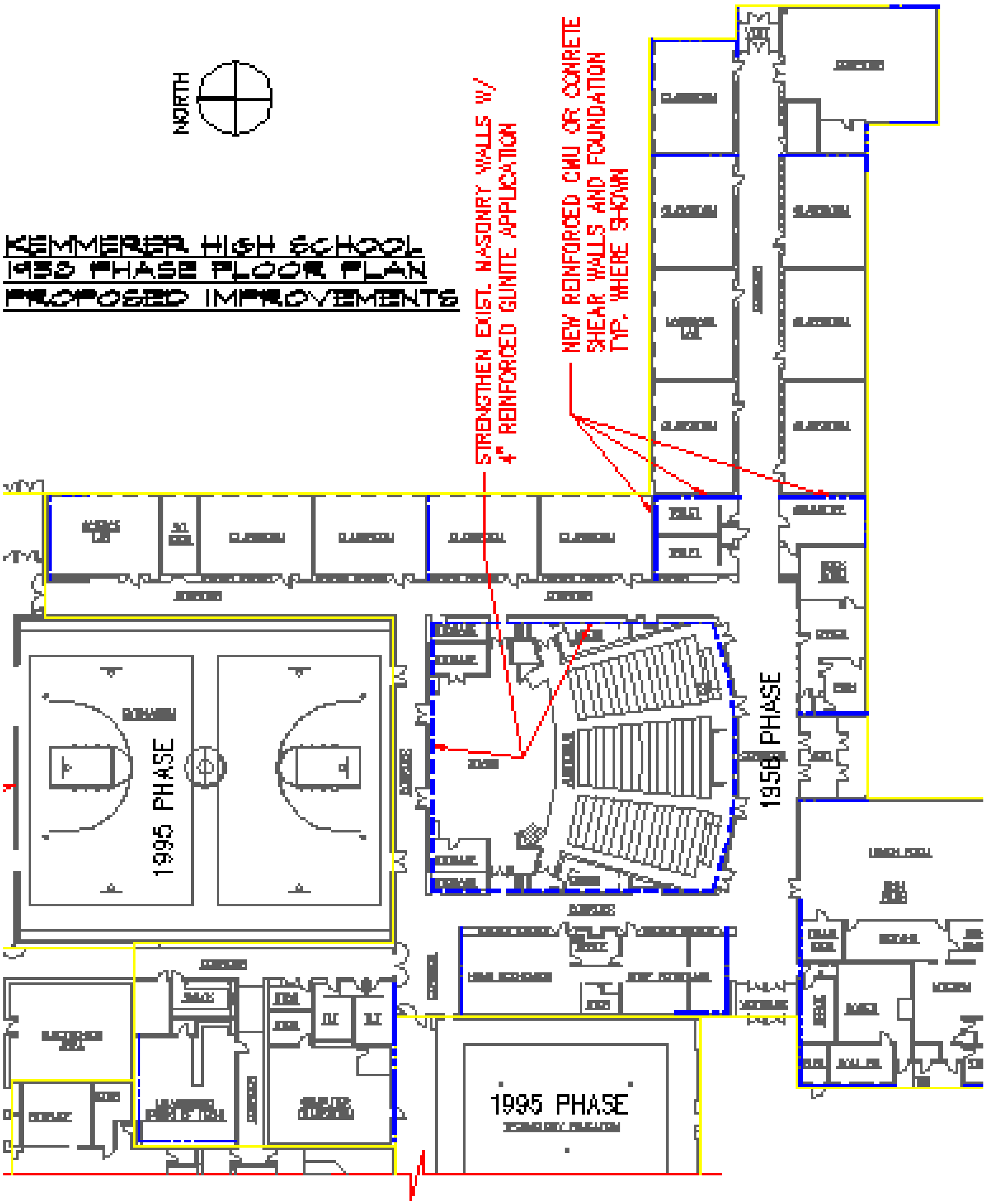
Phase 3 (1977). No structural upgrade recommended for this phase of construction.

Phase 4 (1995). No structural upgrade recommended for this phase of construction.

Total Estimated Cost for Seismic upgrades of this facility. $2,412,000 or $23.60/sf of space rehabilitated.


KEMMERER HIGH SCHOOL
GENERAL LAYOUT


1985 PHASE
1958 PHASE
1977 PHASE
1985 PHASE
1966 PHASE



FILE: KEM-HS-1958-REHAB.DWG

J-U-B ENGINEERS, INC.

ENGINEERS PLANNERS SURVEYORS

Coeur d'Alene, Idaho

ENGINEERS ESTIMATE OF PROBABLE CONSTRUCTION COSTS

PROJECT:	**WYOMING PHASE 2 SEISMIC EVALUATIONS**	JOB NO.	**20760-02**	PAGE:	
DESCRIPTION:	**KEMMERER HIGH SCHOOL - 1966 ADDITION**	CHK:		DATE:	
FILE NAME:	KEMHS-COST-EST-66ADD.XLS	BY:	D.L.B.	DATE:	10-18-2002

GYM AREA

ITEM NO.	ITEM OR ACTIVITY DESCRIPTION	QUANTITY	UNITS	UNIT COST	COST
1	GUNITE WALL STRENGTHENING	8,000	S.F.	$15.00	$120,000
2	NEW DIAPHRAGM CHORD MEMBER	330	L.F.	$50.00	$16,500
3	NEW CONC. TOP COURSE BOND BEAM	13	C.Y.	$500.00	$6,500
4		0	EA.	$0.00	$0
5		0	EA.	$0.00	$0
6		0	EA.	$0.00	$0
7		0	S.F.	$0.00	$0
8		0	S.F.	$0.00	$0
9		0	L.F.	$0.00	$0
	SUMMATION OF ITEMIZED COSTS				$143,000
	PROFESSIONAL SERVICES	5	%		$7,150
	SUB-TOTAL ESTIMATED COST				$150,150

SUB-TOTAL ESTIMATED COST PER SF = $150,150 / 6,625 SF = $22.66 / SF

CLASSROOM AREA

ITEM NO.	ITEM OR ACTIVITY DESCRIPTION	QUANTITY	UNITS	UNIT COST	COST
1	REMOVE EXIST. UNREIN. BRICK/CMU WALLS	25,000	S.F.	$10.00	$250,000
2	NEW 8" CMU W/ BRICK VENEER	25,000	S.F.	$25.00	$625,000
3	DIAPHRAGM CHORD CONNECTIONS	2,500	L.F.	$50.00	$125,000
4	MODIFY EXIST. FOOTINGS	1,250	EA.	$50.00	$62,500
5		0	EA.	$0.00	$0
6		0	EA.	$0.00	$0
7		0	EA.	$0.00	$0
8		0	EA.	$0.00	$0
9		0	EA.	$0.00	$0
	SUMMATION OF ITEMIZED COSTS				$1,062,500
	PROFESSIONAL SERVICES	5	%		$53,125
	SUB-TOTAL ESTIMATED COST				$1,115,625

SUB-TOTAL ESTIMATED COST PER SF = $1,115,625 / 50,235 SF = $22.21 / SF

GRAND TOTAL ESTIMATED COST	$1,265,775

GRAND-TOTAL ESTIMATED COST PER SF = $1,265,775 / 56,860 SF = $22.26 / SF

J-U-B ENGINEERS, INC.
ENGINEERS PLANNERS SURVEYORS
Coeur d'Alene, Idaho

ENGINEERS ESTIMATE OF PROBABLE CONSTRUCTION COSTS

PROJECT:	**WYOMING PHASE 2 SEISMIC EVALUATIONS**	JOB NO.	**20760-02**	PAGE:	
DESCRIPTION:	**KEMMERER HIGH SCHOOL - 1958DDITION**	CHK:		DATE:	
FILE NAME:	KEMHS-COST-EST-58ADD.XLS	BY:	D.L.B.	DATE:	10-23-2002

AUDITORIUM AREA

ITEM NO.	ITEM OR ACTIVITY DESCRIPTION	QUANTITY	UNITS	UNIT COST	COST
1	GUNITE WALL STRENGTHENING	12,000	S.F.	$15.00	$180,000
2	NEW DIAPHRAGM CHORD MEMBER & CONNECTION	375	L.F.	$75.00	$28,125
3	REMOVE-REPLACE WING SOUND-WALLS	3,000	S.F.	$35.00	$105,000
4	REMOVE-REPLACE HARD ACOUSTICAL CEILING	8,570	EA.	$15.00	$128,550
5		0	EA.	$0.00	$0
6		0	EA.	$0.00	$0
7		0	S.F.	$0.00	$0
8		0	S.F.	$0.00	$0
9		0	L.F.	$0.00	$0
	SUMMATION OF ITEMIZED COSTS				$441,675
	PROFESSIONAL SERVICES	5	%		$22,084
	SUB-TOTAL ESTIMATED COST				$463,759

SUB-TOTAL ESTIMATED COST PER SF = $463,759 / 8,570 SF = $54.11 / SF

CLASSROOM AREA

ITEM NO.	ITEM OR ACTIVITY DESCRIPTION	QUANTITY	UNITS	UNIT COST	COST
1	REMOVE EXIST. UNREIN. BRICK/CMU WALLS	11,000	S.F.	$10.00	$110,000
2	NEW 8" CMU SHEAR WALLS	11,000	S.F.	$25.00	$275,000
3	DIAPHRAGM CHORD CONNECTIONS	1,100	L.F.	$50.00	$55,000
4	MODIFY EXIST. FOOTINGS	1,100	L.F.	$100.00	$110,000
5	BRACE UNSUPPORTED INTERIOR WALLS	2,000	L.F.	$50.00	$100,000
6		0	EA.	$0.00	$0
7		0	EA.	$0.00	$0
8		0	EA.	$0.00	$0
9		0	EA.	$0.00	$0
	SUMMATION OF ITEMIZED COSTS				$650,000
	PROFESSIONAL SERVICES	5	%		$32,500
	SUB-TOTAL ESTIMATED COST				$682,500

SUB-TOTAL ESTIMATED COST PER SF = $682,500 / 36,970 SF = $18.46 / SF

GRAND TOTAL ESTIMATED COST $1,146,259

GRAND-TOTAL ESTIMATED COST PER SF = $1,146,259 / 45,540 SF = $25.17 / SF

METCALF & HOLDAWAY ELEMENTARY SCHOOLS

LINCOLN COUNTY SCHOOL DISTRICT NO. 2
Etna & Thayne, Wyoming

GENERAL BUILDING DESCRIPTION.

Metcalf and Holdaway Elementary Schools are similar facilities that were originally built in 1956. The original buildings were approximately 16,075 square feet each with additions to both schools constructed in 1983 (14,615 sf) and 1992 (1,875 sf). An additional phase was added only to Holdaway Elementary in 1989 increasing that building size by about 6,970 square feet. At each location the original buildings, 1983 and 1992 additions were built from the same set of architectural plans. Therefore the evaluation for both schools is contained in this report.

Phase 1. Ashton, Evans and Brazier Architects and Engineers of Salt Lake City, Utah prepared building plans for the original buildings in 1956. These buildings consisted of a single story structure housing classrooms, restrooms, a library, and a combination cafeteria/gymnasium with an elevated ceiling.

Phase 2. Max L. Call and Associates, of Idaho Falls, Idaho, prepared the plans for the second phase to each building constructed in 1983. A new gymnasium, mechanical room, restrooms and classrooms were constructed at this time. The gymnasium consisted of a two-story high roof with the mechanical room located east of the gym on the second floor level. The remainder of the construction was single story. The original cafeteria/gymnasium room was converted into a library during this phase.

Phase 3. Call, Nielson and Bodily also of Idaho Falls, Idaho, prepared the plans for this phase that was only constructed at the Holdaway Elementary facility. The construction took place in 1989 and consisted of a six-classroom single story wing attached to the phase 2 construction.

Phase 4. Call, Nielson and Bodily, again prepared the plans for this phase which was added to each school in 1992. This phase filled in a single story area between the original buildings and phase 1, adding 2 classrooms.

STRUCTURAL SYSTEM DESCRIPTION.

Phase 1 (1956). The original buildings were constructed in 1956 and consist of single story masonry construction utilizing steel open-web roof joists and a 2-inch nominal tongue and groove wood roof decking. The exterior masonry walls are of double-wythe construction utilizing eight-inch and four-inch concrete masonry units. The walls are basically non-reinforced. All interior walls are eight-inch concrete masonry and are also un-reinforced. All structural masonry walls do have a reinforced cast-in-place concrete bond beam constructed along the top. Longitudinal exterior classroom walls were originally constructed with large expanses of window glass and metal infill panels. The structure sits on reinforced concrete foundation and continuous spread footings, with slab on grade floors.

Phase 2 (1983). This phase is constructed of all non-combustible materials consisting of reinforced CMU walls with steel open-web joists and a steel roof diaphragm. The second floor mechanical room consists of steel open-web joists with a composite steel and concrete floor deck. This phase of the buildings also bears on a reinforced concrete foundation and continuous spread footings. Walls joining the original buildings and phase 2 were removed and replaced with reinforced concrete masonry. Part of the long expanse of window glass and metal infill paneling on the longitudinal sides of the classrooms was replaced with 4-inch concrete masonry and wood framing with gypsum wall-board interior. No structural connection between the roof structures of the two phases is apparent from the plans, however both buildings are connected at the spread footing.

Phase 3 (1989, Holdaway only). Construction of this phase is identical to the phase 2 addition. Connection of phase 3 roof structure to the original building consisted of connecting the roof diaphragm to the bond beam of phase 2 with steel ledgers anchored with grouted bolts.

Phase 4 (1992). Construction of this phase is identical to the phase 2 and 3 additions. Again connection of the new roof structure to the existing structure occurred at the concrete bond beam with a continuous steel ledger and grouted anchor bolts.

SUMMARY OF DEFICIENCIES.

Only in the past 20 years has seismic loading been considered in design of structures. Before that time wind loadings were the only lateral force that might have been considered in design of the buildings. As might be expected, due to the age of construction, we found the original (1956) buildings to have potential serious deficiencies, while phases two through four appear to be constructed in a manner consistent with that required by current building code structural criteria.

Phase 1 (1956). As mentioned above, the majority of the concerns with this phase stem from the fact that it was not specifically designed with earthquake loading in mind. The principal potential deficiencies pertain to the type of construction material used for the roof diaphragm and the bearing/shear walls.

Currently building codes allow the use of tongue and groove timber decking to be used for roof diaphragms, but it must be installed diagonally to the framing members. The existing tongue and groove timber roof decking was installed perpendicular to the joists and therefore is not an acceptable diaphragm installation.

In general, in the North-South Direction and along the interior corridor walls there is sufficient length of shear walls to resist seismic loads, though the amount of reinforcing provided in the walls does not meet current minimum code requirements. In the East-West direction the exterior sides side-walls are of insufficient length to resist seismic loads and the in-fill walls that were constructed during later phases of construction were not designed and detailed to properly act as shear walls. Shear walls that have insufficient reinforcement may fail due to out of plane forces rather than in shear.

SUMMARY OF RECOMMENDATIONS.

Phase 1 (1956). Substantial work will need to be performed on this phase of the buildings to bring it up to current code criteria. Modifications to the existing roof structure and bearing/shear walls will be needed to do this.

The roof diaphragm should be strengthened to allow transfer of loads to adjacent shear walls. This can be accomplished by attaching a new layer of structural wood sheathing (plywood) over the existing tongue and groove timber decking and nailing the panels as required by a final design.

New shear walls designed and detailed to conform to current building code structural requirements will need to be added at certain locations in the building. Refer to the attached sketch showing the proposed location of new/replacement bearing/shear walls. At these locations the existing walls will need to be removed and replaced as required by a final design. The new walls will need to attached and tied to the foundations and roof structure as required to provide a complete load path for seismic forces from the roof diaphragm to the buildings foundations. Foundations may need to be modified to resist the imposed seismic loads. The exact number, location, length and type of shear wall can only be determined by a final structural design completed by a team of structural engineers, familiar with this type of design. Walls that were in-filled during the 2nd phase of construction should be removed and replaced with walls that are adequately braced and tied to the building structure.

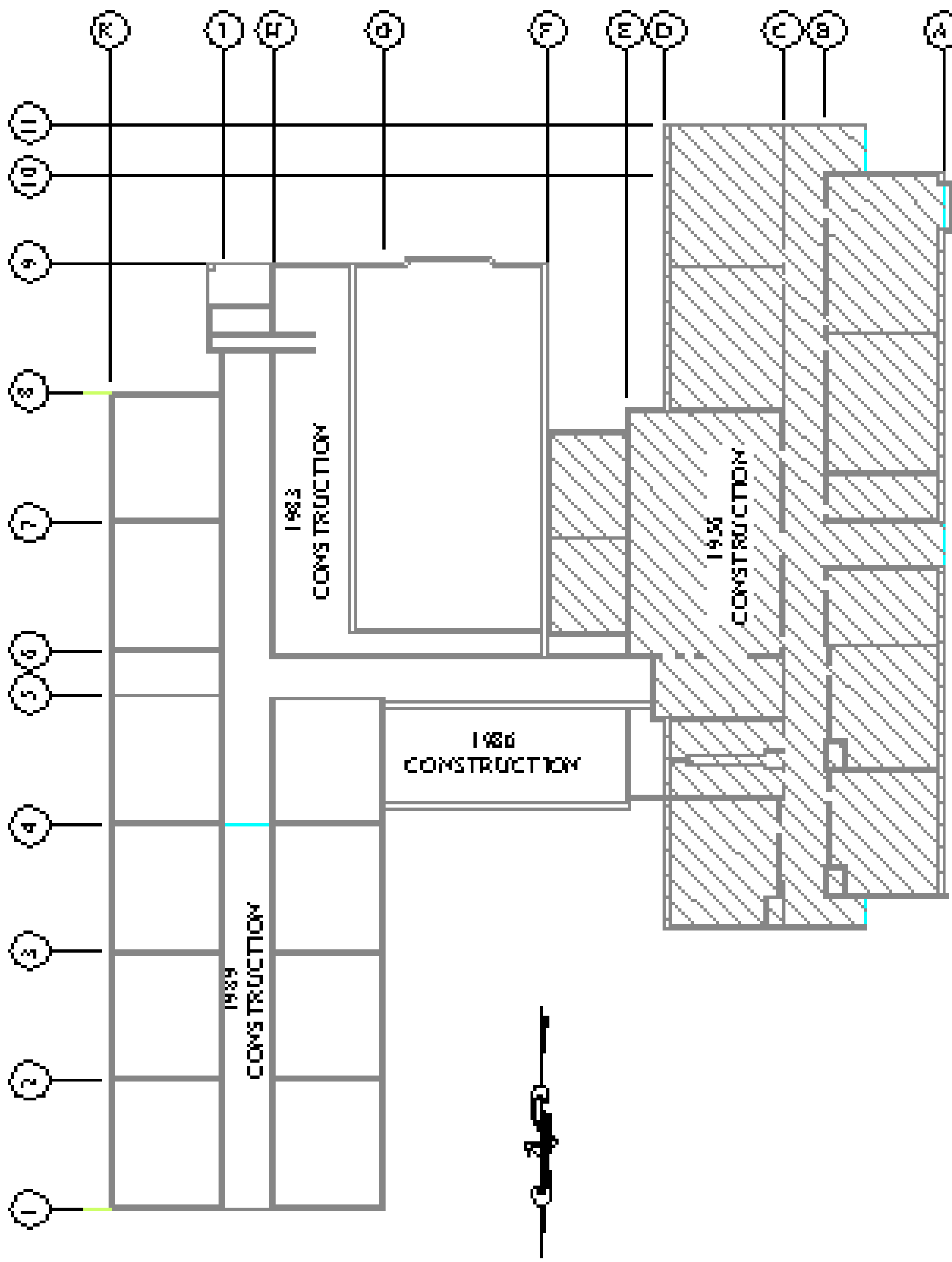
It should be noted that the type of reconstruction work recommended for this school to strengthen it for seismic requirements will cause serious disruption to the architectural, electrical and mechanical systems of the building. The costs associated with replacing and or rehabilitating these aspects of the building a re beyond the scope of this report, but they certainly will be substantial and very likely will exceed the cost of the recommended structural work.

ESTIMATED COSTS.

The estimated cost for structural upgrades for the each of these school facilities is about $540,000 or a cost of about $33.60/sf of area renovated. It is important to note that this estimate is for the basic structural construction only. Architectural, mechanical, electrical, site work or other associated costs have not been included.

HOLDAWAY ELEMENTARY SCHOOL

THAYNE, WYOMING

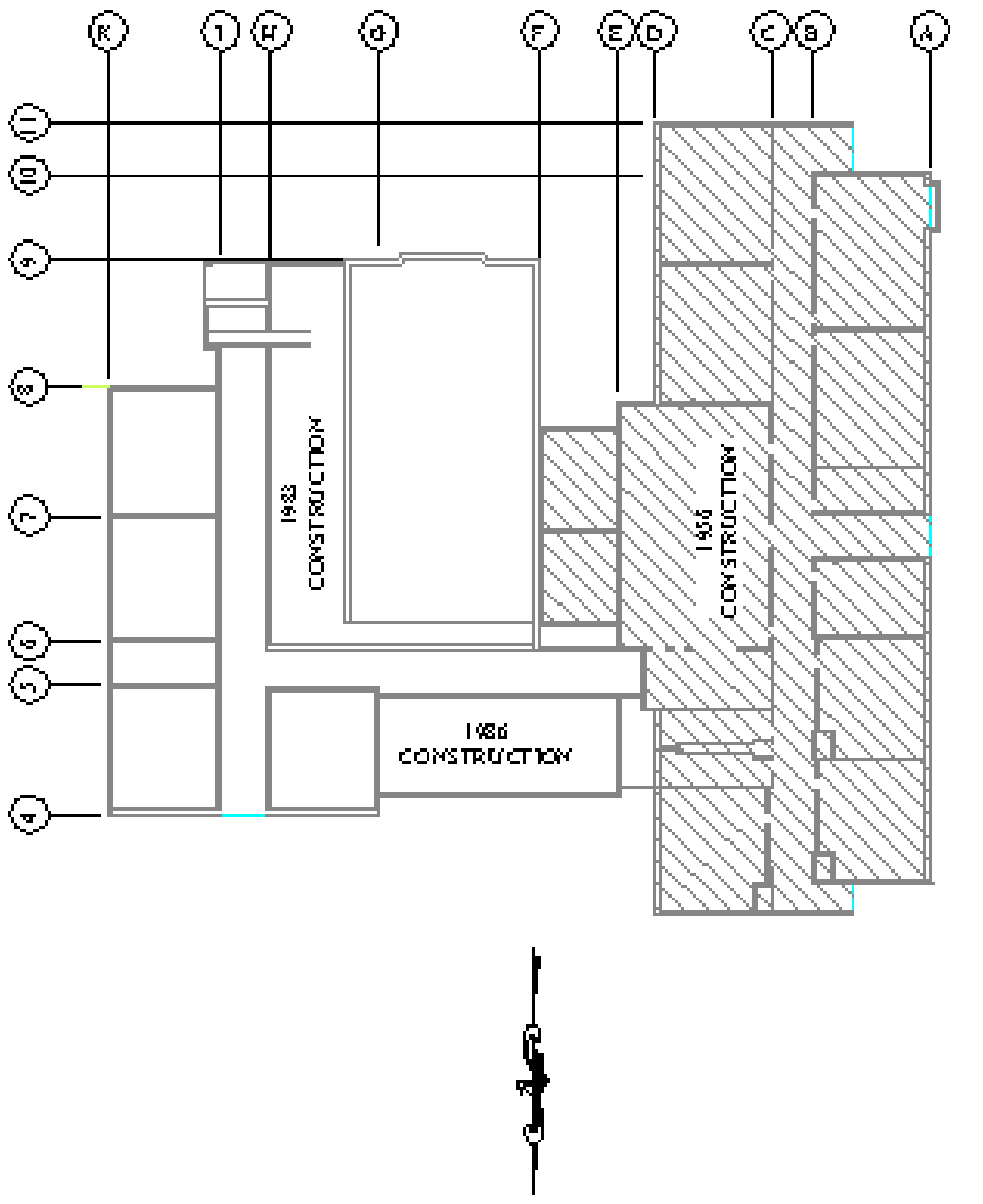


NOTE: SHADING INDICATES AREAS WITH STRUCTURAL DEFICIENCIES PERTAINING TO SEISMIC DESIGN CRITERIA

FILE: HOLD-EL-PLAN-01.DWG

METCALF ELEMENTARY SCHOOL

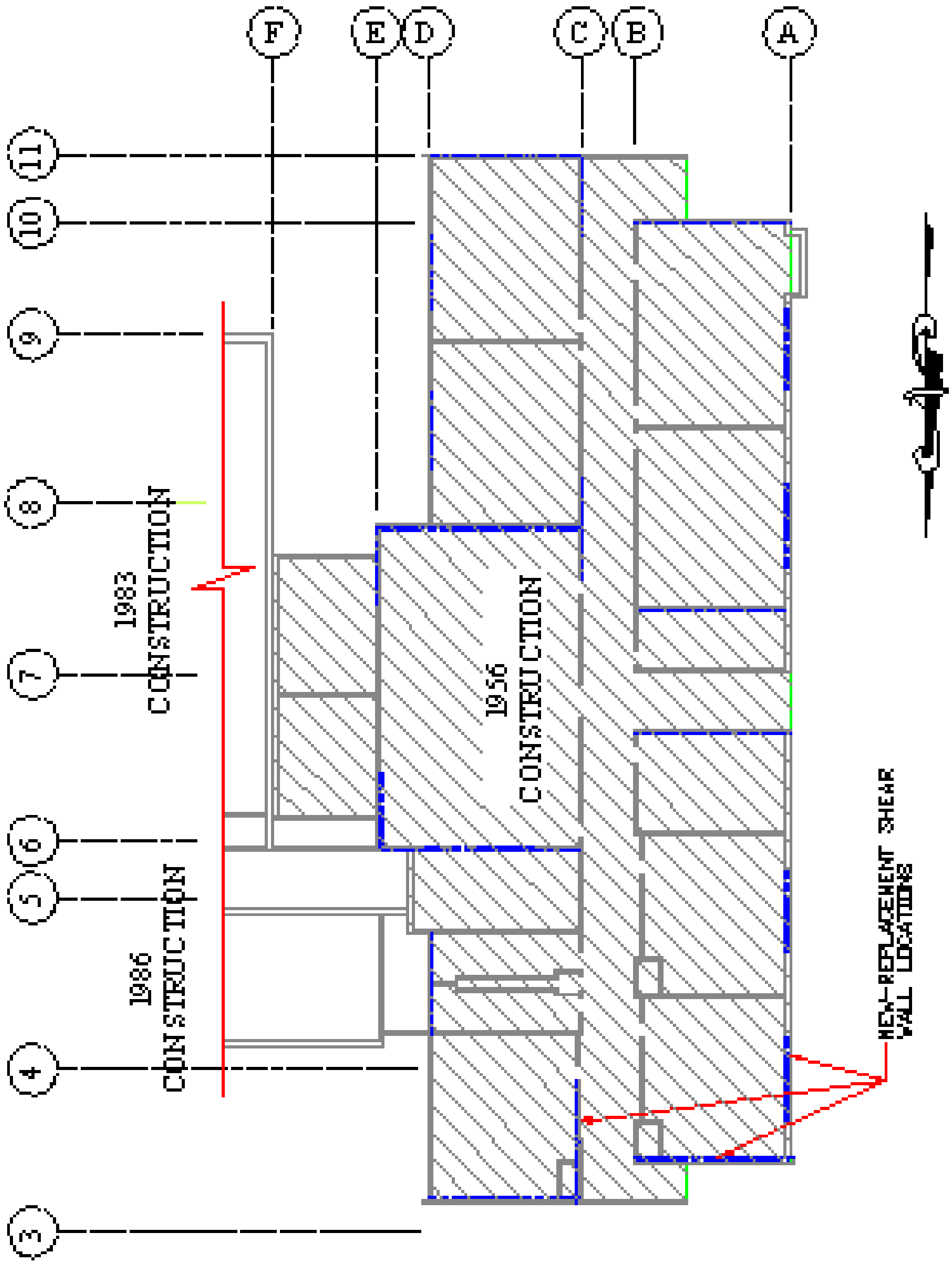
ETNA, WYOMING



NOTE: SHADING INDICATES AREAS WITH STRUCTURAL DEFICIENCIES PERTAINING TO SEISMIC DESIGN CRITERIA

FILE: HOLD-EL-PLAN-[illegible]

METCALF & HOLDAWAY ELEMENTARY SCHOOLS
ETNA & THAYNE, WYOMING



1956 ADDITION FLOOR PLAN WITH PROPOSED NEW-REPLACEMENT SHEAR WALL LOCATIONS NOTED

J-U-B ENGINEERS, INC.
ENGINEERS PLANNERS SURVEYORS
Coeur d'Alene, Idaho

ENGINEERS ESTIMATE OF PROBABLE CONSTRUCTION COSTS

PROJECT:	**WYOMING PHASE 2 SEISMIC EVALUATIONS**	JOB NO.	**20760-02**	PAGE:	
DESCRIPTION:	**METCALF & HOLDAWAY ELEMENTARY SCHOOLS**	CHK:		DATE:	
FILE NAME:	METCALF-COST-EST-01.XLS	BY:	D.L.B.	DATE:	10-23-2002

PHASE 1 (1956)

ITEM NO.	ITEM OR ACTIVITY DESCRIPTION	QUANTITY	UNITS	UNIT COST	COST
1	REMOVE/REPLACE EXISTING ROOFING	16,100	S.F.	$10.00	$161,000
2	ROOF DIAPHRAGM STRENGTHENING	16,100	S.F.	$5.00	$80,500
3	EXISTING BRG./SHEAR WALL TO BE REMOVED	5,040	S.F.	$10.00	$50,400
4	NEW REINFORCED CMU BRG./SHEAR WALL	5,040	S.F.	$25.00	$126,000
5	MODIFY EXISTING FONDATION WALL	420	L.F.	$100.00	$42,000
6	STRENGTHEN WALL TO ROOF CONNECTION	420	L.F.	$50.00	$21,000
7	REMOVE/REPLACE EXTERIOR WALL INFILLS	2,240	S.F.	$15.00	$33,600
8		0	EA.	$0.00	$0
9		0	EA.	$0.00	$0
10		0	EA.	$0.00	$0
11		0	EA.	$0.00	$0
12		0	EA.	$0.00	$0
13		0	EA.	$0.00	$0
14		0	EA.	$0.00	$0
15		0	EA.	$0.00	$0
16		0	EA.	$0.00	$0
	SUMMATION OF ITEMIZED COSTS				$514,500
	PROFESSIONAL SERVICES	5	%		$25,725
	SUB-TOTAL ESTIMATED COST				$540,225

SUB-TOTAL ESTIMATED COST PER SF = $540,225 / 16,075 SF = $33.61 / SF

HOT SPRINGS HIGH SCHOOL

HOT SPRINGS SCHOOL DISTRICT NO. 1
Thermopolis, Wyoming

GENERAL BUILDING DESCRIPTION.

Hot Springs high school was built in a single phase between 1956 and 1958. The plans for the school are dated June 1956 and were prepared by Tresler & McCall Architects of Cody, Wyoming. The school consists of two attached sections, a rectangular three-story classroom wing and a rectangular gymnasium building. Total building floor area is about 121,500 sf, with 79,650 sf in the classroom wing and 41,850 sf in the gymnasium. The Gymnasium has a basement and a mezzanine, each of which extend over a small portion of the Gymnasium footprint.

STRUCTURAL SYSTEM DESCRIPTION.

The basic structure for the classroom wing is comprised of a complete concrete building frame made from a combination of pre-cast and cast-in-place beams and columns. The concrete beams for all floor and roof areas support pre-cast concrete channel-shaped structural sections. The pre-cast channel floor sections have a cast-in-place concrete topping slab, while the roof members are un-topped. Interior corridor walls and some divider walls consist of in-filled concrete masonry block. The exterior walls consist of brick and concrete masonry in-fill walls with bands of in-filled metal wall panels and windows.

The basic structure for the gymnasium is similar in that it too is comprised of a complete concrete building frame made from a combination of pre-cast and cast-in-place beams and columns. The concrete beams for all floor areas and the flat portion of the gymnasium roof support pre-cast concrete channel-shaped structural sections. The pre-cast channel floor sections have a cast-in-place concrete topping slab, while the roof members over the flat portion of the roof are un-topped. The central vault portion of the gymnasium roof structure utilizes cast-in-place concrete arches with a concrete barrel-vault roof supported on cast-in-place cantilevered concrete frames. The exterior walls of the gymnasium on all sides consist of brick and concrete masonry in-filled between the concrete columns and interior divider walls consist of in-filled concrete masonry block.

The foundation for the gymnasium and the classroom wing consist of isolated reinforced concrete footings, which support the pre-cast columns throughout the building. The lobby, basements and gym floors are concrete slabs-on-grade.

SUMMARY OF DEFICIENCIES.

Most of the structural deficiencies found in this building stem from the fact it was constructed at a time when building codes did not require buildings to be specifically designed to account for lateral loads. The following items were identified as potential serious structural deficiencies for seismic loads according to the current building code structural criteria.

The concrete frame provided were not detailed as moment-resisting frames and will not serve to resist lateral loads, therefore this building must rely on the exterior, and in some cases, interior masonry walls to resist these forces. The primary concern for both the classroom wing and the gymnasium is the number, location and construction of these shear walls. Much of the classroom wing utilizes large expanses of metal infill panels with windows, which renders the shear walls at these locations ineffective to resist lateral loads. Existing shear walls are constructed using a combination of un-reinforced brick and concrete masonry, which does not meet current code standards for reinforcement requirements. In addition, these walls do not have adequate structural connection to the pre-cast columns, foundations, or the roof and floor systems. The gymnasium does have more shear walls in terms of number and location, but these shear walls are also un-reinforced and lack the necessary structural connections to provide a complete load path for lateral forces.

The interior divider and corridor walls of the classroom wing and gymnasium are also un-reinforced and therefore do not meet current code minimum reinforcing requirements. Also, there is no real structural connection between these walls and the roof, floors and/or foundation.

The existing roof structure over the classroom building, which consists of pre-cast structural members that are not structurally tied together. As such it will not serve as an effective diaphragm to resist seismic forces. The 2nd floor, 3rd floor and mezzanine floors do have a 1½" thick un-reinforced concrete topping slab that will aid in tying the members together. The topping slab may function as a diaphragm though the connections to shear walls and continuous diaphragm chord members are typically completely lacking.

The existing brick chimney located in the classroom wing is un-reinforced and could present a falling hazard in a seismic event.

<u>SUMMARY OF RECOMMENDATIONS.</u>

Hot Springs High School will require extensive structural modifications to bring it up to current code requirements for lateral loads. All of the un-reinforced brick and masonry walls for the entire building, both interior and exterior, will need to be removed and replaced or strengthened in such a manner as to resist in-plane and out-of-plane lateral forces.

The perimeter shear walls for the classroom wing are insufficient in terms of number and location. Additional shear walls and/or braced frames will be required at selected perimeter locations for each of the three stories of the classroom wing. Due to the classroom wing being very long and narrow, additional shear walls and/or braced frames will also be required at selected interior locations for each of the three stories. Walls on all four sides of the gymnasium will require removal and replacement with reinforced walls or braced frames designed to resist both in and out-of-plane lateral forces.

The existing roof diaphragm over the classroom building and the flat portions of the gymnasium roof will need to be strengthened in order to serve as an effective diaphragm. This roof diaphragm strengthening could consist of new metal deck secured to the pre-cast concrete sections or a new concrete topping slab if a final design confirms the capacity of the members to support the additional weight. Continuous perimeter diaphragm members and connection of the diaphragms to all shear walls will need to be added in order to provide a complete load path for lateral forces from the roof level to the foundation. Foundations effected by new shear walls and/or braced frames will also need to be strengthened and /or added.

The existing concrete frame members in both the gymnasium and the classroom wing need to act as continuous members to transfer seismic drag forces from the floor and roof systems to the supporting shear walls. Some of the existing connections are inadequate to transmit lateral forces and will need to be strengthened.

The brick chimney could become unstable in an earthquake and needs to be either removed and/or rebuilt with structural steel or reinforced masonry to provide lateral stability.

ADDITIONAL STRUCTURAL PROBLEMS.

We are aware of additional structural problems associated with Hot Springs High School that are not specifically related to this seismic study. First, the gymnasium is of the same design and construction as the Cody High School Gymnasium. In a previous study of the Cody High School Gymnasium, it was recognized that the cantilever frames were undergoing continuing creep and deflection, resulting in displacements and cracks in the supported floor members and the adjacent masonry walls. It is recommended that a structural tension tie member be constructed between the cantilever frames in order to alleviate this problem. Second, the corbels of the concrete beams are spalling where the pre-cast concrete channels bear on these beams. This condition was noticed below the gymnasium mezzanine, and is anticipated to occur throughout the entire building. It is recommended that a bearing seat be added to alleviate the problem. This work should be done at the same time that other connections are strengthened for seismic considerations,

It should be noted that the type of reconstruction work recommended for this school to strengthen it for seismic requirements will cause serious disruption to the architectural, electrical and mechanical systems of the building. The costs associated with replacing and or rehabilitating these aspects of the building are beyond the scope of this report, but they certainly will be substantial and very likely will exceed the cost of the recommended structural work.

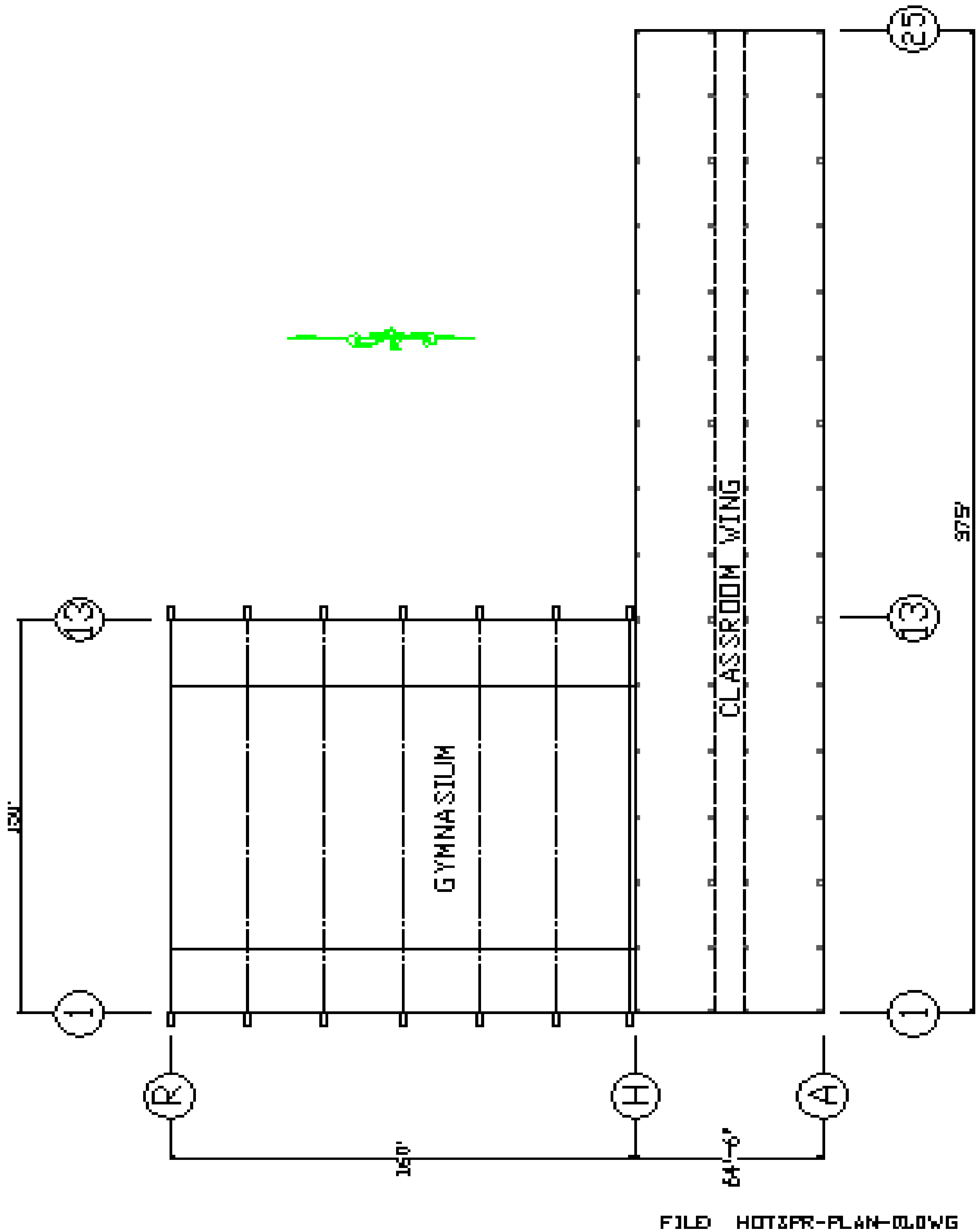
ESTIMATED COSTS.

The estimated cost for structural upgrades for the classroom wing of this building is $2,755,000 or a cost of about $34.60/sf.

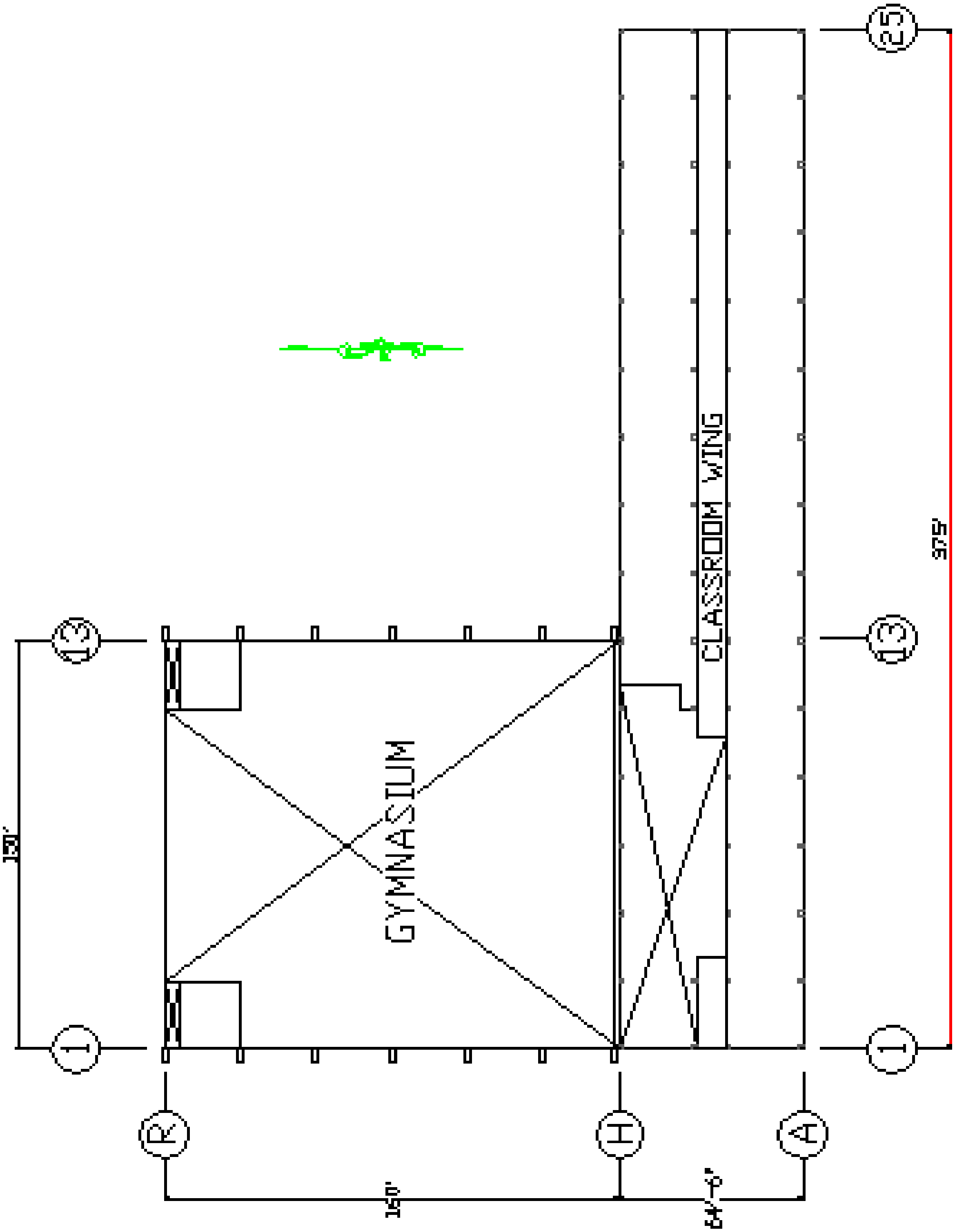
The estimated cost for the structural upgrades for the gymnasium is $1,787,000 or a cost of about $42.70/sf.

The total estimated cost for seismic upgrades for Hot Springs High School is $4,542,000 or a cost of about $37.40/sf.

HOT SPRINGS HIGH SCHOOL
ROOF LEVEL PLAN



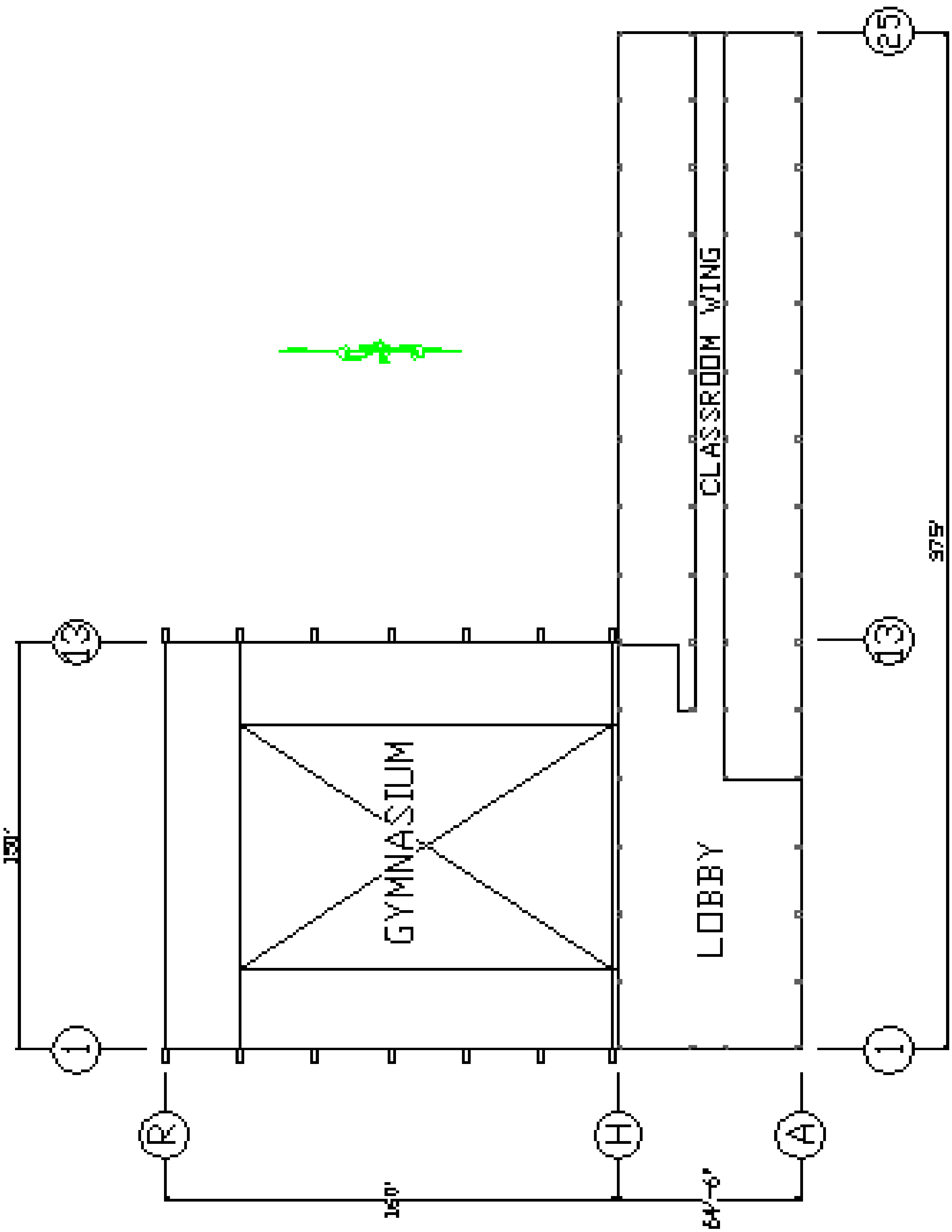
HOT SPRINGS HIGH SCHOOL
3RD LEVEL PLAN



FILE HOTSPR-PLAN-02.DWG

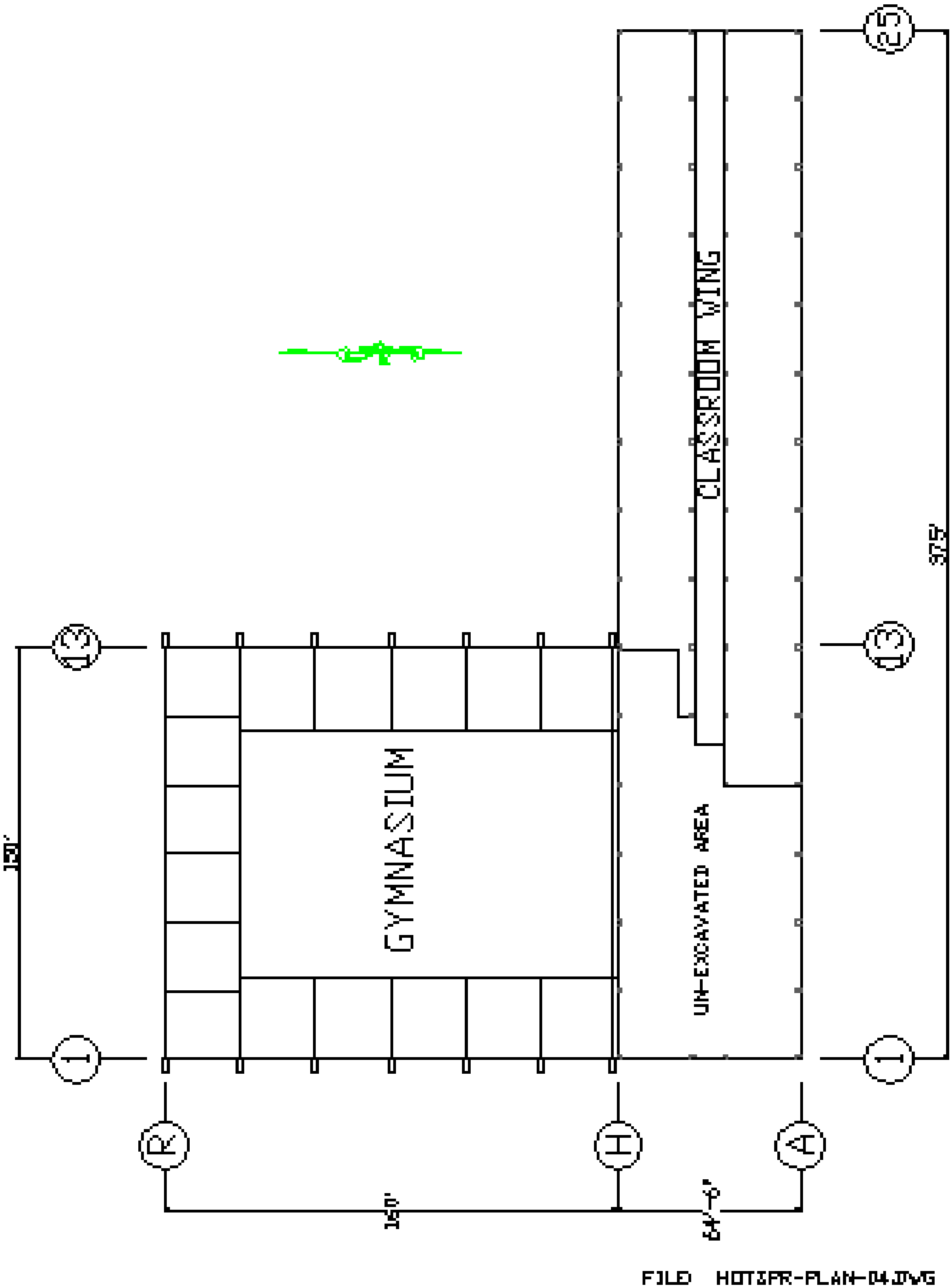
HOT SPRINGS HIGH SCHOOL

2ND LEVEL PLAN



FILE HOTSPR-PLAN-03.DWG

HOT SPRINGS HIGH SCHOOL
1ST LEVEL PLAN



J-U-B ENGINEERS, INC.

ENGINEERS PLANNERS SURVEYORS

Coeur d'Alene, Idaho

ENGINEERS ESTIMATE OF PROBABLE CONSTRUCTION COSTS

PROJECT:	**WYOMING PHASE 2 SEISMIC EVALUATIONS**	JOB NO.	**20760-02**	PAGE:	
DESCRIPTION:	**HOT SPRINGS HIGH SCHOOL**	CHK:		DATE:	
FILE NAME:	HOTSPHS-COST-EST-01.XLS	BY:	D.L.B.	DATE:	10-24-2002

GYMNASIUM

ITEM NO.	ITEM OR ACTIVITY DESCRIPTION	QUANTITY	UNITS	UNIT COST	COST
1	ROOF DIAPHRAGM STRENGTHENING	8,000	S.F.	$6.00	$48,000
2	EXISTING EXT. WALL TO BE REMOVED	21,000	S.F.	$10.00	$210,000
3	EXISTING INT. WALL TO BE REMOVED	18,600	S.F.	$10.00	$186,000
4	NEW DIAPHRAGM CHORD MEMBER	2,550	L.F.	$50.00	$127,500
5	NEW INTERIOR CMU SHEAR/IN-FILL WALL	22,200	S.F.	$20.00	$444,000
6	NEW EXTERIOR CMU SHEAR WALL	21,000	S.F.	$25.00	$525,000
7	NEW INTERIOR SHEAR WALL FOUNDATION	200	L.F.	$50.00	$10,000
8	UPGRADE EXIST. PRE-CAST CONNECTIONS	890	EA.	$75.00	$66,750
9	BARREL-VAULT ROOF TENSION TIES	7	EA.	$5,000	$35,000
10	UPGRADE EXIST. PRE-CAST BRG. SEATS	1,000	EA.	$50.00	$50,000
11		0	EA.	$0.00	$0
	SUMMATION OF ITEMIZED COSTS				$1,702,250
	PROFESSIONAL SERVICES	5	%		$85,113
	SUB-TOTAL ESTIMATED COST				$1,787,363

SUB-TOTAL ESTIMATED COST PER SF = $1,787,363 / 41,850 SF = $42.71 / SF

CLASSROOM WING

ITEM NO.	ITEM OR ACTIVITY DESCRIPTION	QUANTITY	UNITS	UNIT COST	COST
1	ROOF DIAPHRAGM STRENGTHENING	26,000	S.F.	$6.00	$156,000
2	EXISTING EXT. WALL TO BE REMOVED	21,100	S.F.	$10.00	$211,000
3	EXISTING INT. WALL TO BE REMOVED	31,200	S.F.	$10.00	$312,000
4	NEW DIAPHRAGM CHORD MEMBER	3,804	L.F.	$50.00	$190,200
5	NEW INTERIOR CMU SHEAR WALL	39,084	S.F.	$20.00	$781,680
6	NEW EXTERIOR CMU SHEAR/IN-FILL WALL	21,000	S.F.	$25.00	$525,000
7	NEW INTERIOR SHEAR WALL FOUNDATION	500	L.F.	$50.00	$25,000
8	UPGRADE EXIST. PRE-CAST CONNECTIONS	3,300	EA.	$75.00	$247,500
9	UPGRADE EXIST. PRE-CAST BRG. SEATS	3,500	EA.	$50.00	$175,000
10		0	EA.	$0.00	$0
11		0	EA.	$0.00	$0
	SUMMATION OF ITEMIZED COSTS				$2,623,380
	PROFESSIONAL SERVICES	5	%		$131,169
	SUB-TOTAL ESTIMATED COST				$2,754,549

SUB-TOTAL ESTIMATED COST PER SF = $2,754,549 / 79,660 SF = $34.58 / SF

GRAND TOTAL ESTIMATED COST $4,541,912

GRAND-TOTAL ESTIMATED COST PER SF = $4,541,912 / 121,510 SF = $37.38 / SF