DESIGN OF A COAL STORAGE PLANT, M. A. C. POWER PLANT

Thesis for the Degree of B. S.

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T H E S I S

DESIGN OF A COAL STORAGE PLANT

M. A. C. POWER PLANT

MICHIGAN STATE COLLEGE

- BY -

R. S. RUSSELL and GUY H. SMITH

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Fig. 1.

Fig. 2.

Design of a Coal Storage Plant.

at

Michigan Agricultural College Power House.

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The present system of handling and storing coal at the college power house has been unsatisfactory from a number of different standpoints, in both method and cost. The recent coal strike also demonstrated that the storage capacity was wholly inadequate and the college came very near a coal famine because of its limited facilities.

It is the purpose of this thesis to recommend several important changes in the system of handling coal and to submit herewith a design of a suitable coal conveying and storage plant.

Under the present system the coal is brought in in ordinary railroad cars and must be shoveled into the storage house by hand requiring the services of two or three men. (See Fig. 1.) The building is of such a shape that it is also necessary for men to work inside the building in order to distribute the coal around the storage house. (See Fig. 2.) After the coal is stored only about one-half of one percent of it can be removed without re-shoveling; all the rest must be shoveled or scraped from the far ends of the building up to the spout in the elevator shaft.

The present building is estimated, by the Engineer in charge, to hold 2,000 tons when filled to the roof. From the dimensions of the building, however, this estimate seems

Fig. 3.

Fig. 4.

a little large as the cubic contents of the building only warrant a capacity of 1890 tons when completely filled. This capacity probably never could be reached because of the construction of the building and the labor necessary to fill it.

In order to have anywhere near a sufficient supply of coal on hand, it has been customary to pile coal along the side of the tracks opposite the storage house. The coal thus exposed to the action of the air and water deteriorates rapidly and must be rehandled in wagons to get it to the boiler room.

Fig. 3 shows a small part of one of the piles of coal along the railroad tracks. This pile formerly extended up to the end of the tracks as from the view shown in Fig. 1. The stains of the piles are also plainly discernible where the coal was piled up against the ends of the building (see Figs. 1 and 4), so that it would appear that as much, if not more, coal was piled outside than was stored inside of the building.

These methods necessitate entirely too much handling and it is estimated that the cost of rehandling is from 10 to 12 cents per ton, which is without taking into account the loss sustained through deterioration. The average coal consumption at the present time is about 20 tons per day, with a minimum of 7 tons and a maximum of 36 tons. This makes an annual consumption of 7,300 tons at an added expense of from $730.00 to $876.00 per year for rehandling!

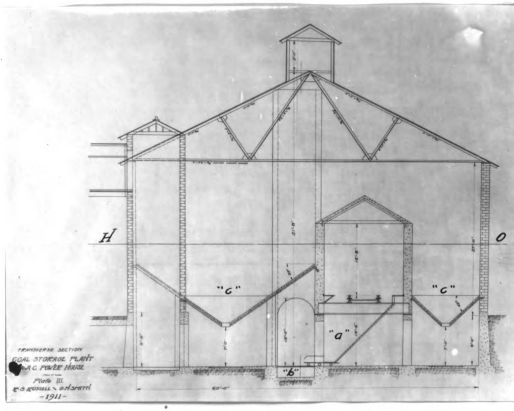

Fig. 5.

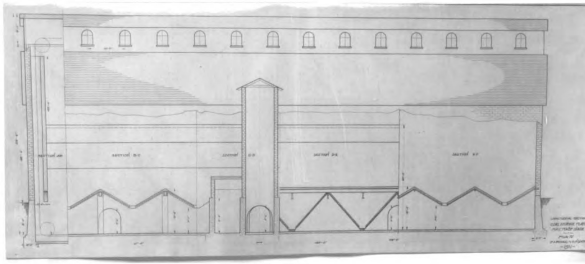

Fig. 6.

The system of loading the small industrial cars which carry and dump the coal into the bunkers in the power house is also very bad as the slope of the coal chute is not sufficient to load the coal into the cars except by shoveling.

Taking all these points into consideration we have designed our storage house so that no shoveling will be necessary, all of the coal being loaded and unloaded by gravity.

Fig. 5 shows a transverse section of the proposed plans. The coal is dumped from the rail road cars into the hoppers "a" and is fed onto the line of bucket conveyers "b" which travel in a trough in the floor to the end of the building where it is elevated and distributed into the hoppers "c - c" on either side of the train shed. Coal is then taken as needed from the storage bins thru gates which allow the coal to run into the small industrial cars directly below. These cars are then run onto the elevator and raised as at present.

In the proposed plans, the building is to be 140 ft. by 80 ft., inside measurement, with a height of 27 ft. from the ground. The floor is 9 ft. below the ground with a total inside height, to peak of roof, of 51 ft. 8 in. Fig. 6 shows a longitudinal section taken thru five different places. Section A-B shows the conveyer trough and concrete casing at the end of the building. This trough is to be deep enough to allow the conveyers to travel below the floor line so as not to interfere with the industrial car tracks from the

elevator. The section is taken thru the center of the casing which is arched below the storage hoppers to allow for accessibility in case of a break down.

Section B-C is taken thru the storage hoppers on the left of the train shed (Fig. 1). There are eight of these hoppers, the peak between each being supported by a steel box-beam resting on reinforced concrete columns.

C-D is a section thru the center of the elevator shaft and motor room, the bottom of the storage hopper forming the roof of the latter. The main parts of the elevator shaft and surrounding foundations will not be changed except to accomodate the new parts being put in.

D-E is a section taken thru the train shed just inside the north wall. It shows the I-beams supporting the railroad tracks over the hoppers into which the coal is first dumped. There are seven such hoppers the length of the building, each having an individual "feeder" which supplies the coal to the conveyers.

Section E-F shows the storage hoppers on the right hand side of the train shed (Fig. 5) of which there are eight, situated the same as those on the left hand side in section thru B-C.

The foundations of the building are to be of concrete as is also the floor. The walls above ground are to be of red brick to match the power house. The hoppers, both the track hoppers and the storage hoppers, are to be of reinforced concrete with the supporting columns of the same material.

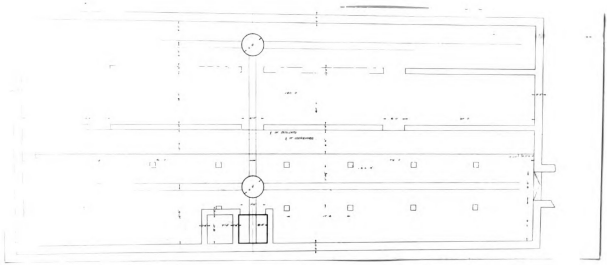

Fig. 7.

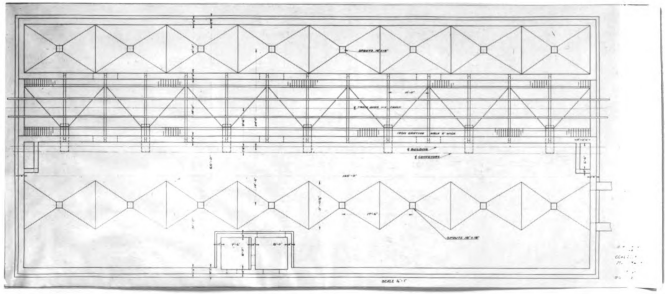

Fig. 8.

The roof trusses are to be of steel angle irons placed back to back and the roof covering to be of prepared cedar shingles The cupola is to be roofed with the same material as the storage house roof and sided with corrugated sheet iron, painted. The train shed is to be of concrete with a reinforced concrete roof, same as the construction for the hopper bottoms.

Fig. 7 shows a plan of the floor with foundations for the walls , columns and train shed. The industrial car tracks are connected by turn-tables and are shown directly under the hopper spouts from the storage bins. Two doors 3 ft. wide and 7 ft. high are cut thru the train shed foundation to connect the north and south storage hoppers. On the west end an 8 ft. door way is made to the outside of the building to allow for the entrance of machinery, etc.

Fig. 8 is a section taken thru H-O in Fig. 5 and shows the position of the storage spouts, railroad tracks, track hoppers, conveyor casings, etc.

ESTIMATED COSTS.

(Itemized)

CONCRETE.

Floors.	4" thick, 140'x60' 8300 sq. ft. at 7¢	$196.00	
Foundations.	Perimeter of the building 450'. No. sq. ft. in vertical section 10' high, 18.7 8515 cu. ft. @ 35¢ -	$3980.00	
Train shed.	25' high, 140' long 1.5' thick 10500 cu. ft. @ 35¢ -	3670.00	
Conveyer casings.	50' high, 1' thick, 10' perimeter. 1,000 cu. ft. @ 35¢ - -	350.00	$7,000.00

REINFORCED CONCRETE.

Columns.	Height 12', section 1.5'x1.5', no. 14. 378 cu. ft. @ 50¢ - -	$189.00	
Hopper bottoms.	6" thick. North side. 2430 cu. ft. @ 35¢ - -	850.50	
	South side. 1062 cu. ft. @ 35¢ - -	371.700	
	Track hoppers. 1488 cu. ft. @ 35¢ - - -	520.800	$1,932.00

BRICK WORK.

Walls, etc.	37' high, 1.5' thick, Perimeter 406', section 40.5 sq. ft. 16443 cu. ft. with 21 bricks per cu. ft. 345.3 M bricks @ $13 per M - - -	$4143.60

ROOFING.

The roof is to be 38' wide and 145' long, per side.
11020 sq. ft. @ $5.00 per C - $ 551.00 — 551000

STEEL WORK.

I-beams. 6" for R. R. track supports
24" for transverse supports.

6" - 140' long, 15# per ft.
24" - 16' " 90# " "
At 35¢ per lb. - $ 903.00

Box-beams. 17' long. 7 beams 20# per ft.
12' long. 7 beams 20# per ft.
Total of 4080# @ 35¢ per lb. 143.00

Angle irons, in roof trusses.
Lower chords 13.3# x 63'
2 upper " 12.4# x 36.5'
2 braces 6.8# x 8.5'
2 " 5.3# x 18'
Each truss to cost $137.00
15 trusses @ $137.00 - - - - - 2500.00

Siding for cupola. (corrugated sheet iron) 7' high, 143' long,
3002 sq. ft. @ #3.00 per C - - 60.00 $3305.00

GLASS.

28 windows, 3'x 5'
294 sq. ft. @ 7¢ per sq. ft. $ 20.58 — 20.58

FEEDERS.

6 Feeders @ $40.00 per — 240.00

TURN-TABLES.

3 Turn-tables @ $25.00 per — 50.00

INDUSTRIAL TRACK.

145' track, 12# per ft.
1740# @ $.015 — 26.00

CONVEYER SYSTEM [redacted]

The conveyer system is estimated at $5,000.00

ESTIMATE OF TOTAL COST.

Concrete	$7000.00	
" reinforced	1932.00	
Brick work	4143.00	
Roofing	550.00	
Steel (including cupola side)	3605.00	
Glass	31.00	
Feeders	240.00	
Turn-tables	50.00	
Industrial track	26.00	
Conveyers	5000.00	$22567.00
Engineering expenses 10%		2256.00
Grand total		$24823.00