A STUDY OF LIMESTONE DUST PRODUCTION

Thesis for the Degree of B. S.

MICHIGAN STATE COLLEGE

Donald Hodgkiss

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SUPPLEMENTARY
MATERIAL
IN BACK OF BOOK

A STUDY OF LIMESTONE DUST PRODUCTION

A Thesis Submitted to

The Faculty of

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of

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by

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THESIS

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THE PROPOSED STUDY

It is the purpose of this thesis to study the economic possibility of the production of limestone dust somewhere in the upper part of the lower peninsula of Michigan.

Limestone dust could be used for three separate uses, each use requiring different gradation and chemical purity.

1) Mineral Filler - used in asphaltic highway production. The usuage is 4.0 to 15% of the total weight. Michigan State Highway Dept. specification 4.11.02 reads, "Shall be limestone dust, dolomite dust, or Portland cement. Shall be dry, free from lumps, and objectionable materials and shall meet the following requirements:

Pass No. 40 sieve	100%
Pass No. 200 sieve	75%

2) Agricultural Limestone - is spread on the fields to neutralize or "sweeten" the soil. The dust must have neutralizing power, there is no required percentage of calcium carbonate or other chemicals. The required gradation of Agricultural Meal is:

Passing No. 10 sieve	100%
Passing No.100 sieve	30-40%

The Ag. Meal is favored by the Federal Government for the following reasons:

a. It is much cheaper - $3.25 to $4.50 per ton delivered and spread.

b. The coarser materal mixed with the fines gives greater lasting quality.

3) Feed Additive - limestone dust of the proper purity is used as a calcium additive to the diets of swine and poultry. Cattle of this state get enough calcium in the grass they eat. The poultry industry now uses only ground oyster shells. It is necessary for limestone used as a feed additive to meet the following specifications:

a. Must contain 90-95 (+) % calcium carbonate

b. Must contain less than 3.00% magnesium carbonate

c. Must contain less than 0.45% florine (swine)
0.65% " (poultry)

An economic study such as this includes three major considerations.

1) Transportation cost (determining area possible to serve).

2) Estimated demand per year for area possible to serve.

3) Production cost.

TRANSPORTATION COST

Since shipments of limestone dust (mineral filler and feed additive) would be mostly by rail the freight rates of the railroads are considered under transportation cost. The shipment of Ag. Meal is made by truck and is considered separately under Ag. Meal. The consideration of freight rates is in two categories:

1) Interstate Commerce Commission. The tariffs set by this group are only applicable when a State line is crossed by the shipment going from the point of origin to the point of destination.
2) Michigan Public Service Commission. The tariffs set by this group apply to shipments within the boarders of the state of Michigan.

The tariffs consulted are:

1) Detroit to Mackinac Railway Company
   G. F. D. No. 860-D effective September 1, 1942.
2) Pere Marquette (Chesapeake & Ohio) Railway Company.
   Tariff No. 6213-F effective July 17, 1940
3) Pennsylvania Railraod Company
   Tarriff No. 1885-B effective December 31, 1942
   Tariff No. 100-E effective August 1, 1944
4) Minneapolis, St. Paul & Sault Ste. Marie Railway Company

Tariff No. 187-F effective August 21, 1944.

There are two types of freight rates, class rates and commodity rates. A producer is granted commodity rates which are, usually, much less than class rates. If, for some reason, the class rate is less than the commodity rate, the class rate will apply.

Just as many other things, the rail rates have increased since 1940. The increases take the form of blanket percent increases with some exceptions. The exceptions are usually in the form of a maximum rate increases in cents per net ton of limestone.

The Interstate Commerce Commission rates now in effect are:

1) Tariff X-148 effective March 18, 1942- gave 3% increase to existing rate on limestone.
2) Tariff X-162 effective January 1, 1947 - gave to rate on limestone in:
   a. Open cars - 15¢ per net ton increase
   b. Closed cars - 20% increase but max. 30¢ /NT
3) Tariff X-166 effective May 6, 1948 - gave on limestone a 30% increase over October 12, 1947 but max. of 33¢ / NT.
4) Tariff X-168 effective January 1, 1949 - gave an emergency 6% increase. It must be noted that an emergency increase is not an increase in rate but is an increase in charges. Example - one

carload of dust, wt. 60,000 lbs. at $1.00 per ton (rate in effect including increases). Charges would be tonnage times rate per ton or 30 tons X $1.00 = $30.00 and to this charge would be added 6% of the charge for emergency charge, then, of course, 3% federal tax to that total. Or $30.00 X 1.06 = $31.80. With federal tax $31.80 X 1.03 = $32.80 for this carload. This 6% emergency increase cannot be applied to the rates in this thesis for the individual weight of the cars is not known.

The Michigan Public Service Commission rates now in effect are:

1) Tariff X - 162 effective January 23, 1947 - gave an increase of 25% to the base scale but with a maximum increase of 30¢/NT.
2) Tariff X-166A effective May 6, 1948 - gave a 30% increase over X-162, but a maximum of 33¢/NT. on limestone.
3) Tariff X-168 effective January 11, 1949 - gave an emergency 6% increase.

These two governing rulings will be used as a basis of determining the approximate increase of freight rates. It is next to impossible to compute the exact rates to each point due to the fact that this procedure requires two things:

1) A set of tables governing the increase of freight rates.
2) A great deal of time. So, estimating the freight rates by use of the blanket percentage increases, although not absolutely accurate, will be on the conservative side.

It is necessary to note that the means used by the railroads to increase their rates (that is a blanket percentage increase) is not at all satisfactory to the producer. First of all the percent increase disrupts the differentials established by the original tariff between shippers. This disruption shortens the distance possible to serve from the point of production and shipment to the consumer. An example is the best means to show this effect:

Let A = producer on rail line C.

B = producer producing the same commodity as A on rail line C.

To reach the same point on line C say A's rate is \$2.00/ton and B's rate is only \$1.50/ton. However, A is willing to absorb the 50¢/ton to obtain the business. Say, then, the railroad increases their rate by 20%; A's rate is then \$2.00 X 1.20 = \$2.40, while B's rate is \$1.50 X 1.20 = \$1.80/ton. This gives a new difference of 60¢ instead of 50¢/ton for the commodity. This works additional hardship

on producer A. The extra 10¢/ton probably could not be absorbed as readily as the 50¢/ton originally, so A would have to shorten his scope and no longer serve the point in question.

There is little doubt that competition in the dust field would bring lower rates from both Gibsonburg, Ohio and Waukesha, Wis. but these reductions would also bring reductions of rates on the northern Michigan road handling this production plant. The economy of this part of Michigan is such that the railroads could and would reduce their commodity rates so as to guarantee the travel of these thousands of tons of freight over their road each year. This is already evidenced by the existing rates from points in northern Michigan south are less per mile covered than the rates of the "out of Michigan" carriers shipping north.

The procedure used for estimating the increase of rates is as follows:

1) Using Michigan Public Service Commission ruling,
   tariff - Detroit to Mackinac RR GFD No. 860-D
   Commodity - Stone and limestone dust in carload lots - 90% marked capacity of car.
   Consider rate from Calcite (Rodgers City) to Alma, Michigan.

   Considering percentage increases:

   Increase #1 $1.17 X 1.25 = $1.46

   Increase #2 $1.463 X 1.30 = $1.90

Considering maximum increases.

Increase #1 $1.17 - $0.30 = $1.47

Increase #2 $1.46 - $0.33 = $1.79 = rate.

2) Using Interstate Commerce Commission ruling,

tariff - Pennsylvania RR No. 1885B

Commodity - Limestone dust in bags or bulk in box cars. Minimum weight is 60,000 lbs. Takes rate group #7.

Consider rate from Gibsonburg, Ohio to Ann Arbor, Michigan.

Considering percentage increases.

Increase #1 $1.38 X 1.03 = $1.42

Increase #2 $1.42 X 1.20 = $1.71

Increase #3 $1.71 X 1.30 = $2.22

Considering maximum increases.

Increase #2 $1.42 - $0.30 = $1.72

Increase #3 $1.71 - $0.33 = $2.04 = rate

All the rates shown on the included maps have been computed in this manner.

CONCLUSIONS - RAIL TRANSPORTATION

A study of the map comprising the rail rates from Calcite, Michigan discloses a lower rate to points on the New York Central (Michigan Central) RR than on the railroads under different ownership. This means that there will be an increase in area over the present estimated area possible to serve (see Map #3). The study shows also that although the distance from Calcite to Detroit is more than from Gibsonburg, Ohio to Detroit, the rail rate is less. Since the major market for limestone dust, for use as mineral filler, is in the Detroit area, a plant at Calcite could compete with the Gibsonburg, Ohio plant for that market. It should also be noted that when it is necessary for a railroad car to change lines during transit an additional increase in freight rate may be expected over that expected if distance of haul were the only factor in determining the rate.

1) Example - Telegram from Waukesha Products Corp., Waukesha, Wis. "Quote on limestone dust for filler in bulk $3.35 and in bags $5.15 both prices net per ton at plant. Freight rate to Manistique $1.98 plus five per cent. Into Seney $2.93 plus five per cent."

The seeming excessively high difference in freight rates between these two points, where the milage differ-

ence is, at the most, 70 miles, is due to the number of railroad lines required to handle the shipment to Seney. The freight rates are always less on a one line haul than on a two line haul and greatly excessive on a three line haul or over.

Limestone dust from Waukesha, Wisconsin, can supply the entire upper peninsula except for the extreme eastern section. The division line would run north and south through Newberry. The demand for dust as mineral filler is small in the upper peninsula, therefore, no demand is figured in that area. It may well be, however, that certain asphalt pavement projects could be supplied over the span of years.

YEARLY DEMAND FOR MINERAL FILLER

Almost the entire usage of mineral filler is for state highway projects. Since it has been determined that for all practical purposes the entire state may be served, the entire estimated annual tonnage was determined in the following manner: There are four types of pavement which require the use of mineral filler.

1) Oil Aggregate Surface - 4.5% filler/ton of mix.
2) Bituminous Aggregate Surface Class F-1 -- 4.0% filler/ton of mix.
3) Bituminous Concrete Surface - 5.5% filler/ton of mix.
4) Sheet Asphalt Surface - 15.0% filler/ton of mix.

TYPE	TONNAGE 1948	TONNAGE OF FILLER
Oil Agg. Surface	36,844	1,660
Bit. Agg. Surface	52,180	2,086
Bit. Concr. Surface	307,000	16,850
Sheet Asphalt Surface	12,207	1,830
		22,426

An unofficial estimate by the State Highway Dept. is that the average yearly demand in the future will be 80% of the 1948 tonnage. Therefore, the yearly demand used for estimation purposes is 80% X 22,426 = 17,720 tons of mineral filler per year.

SELECTION OF A SITE

The selection of a site in Northern Michigan bases on two factors:

1) Quarrying expense

2) Mineral purity

Quarrying, even on a small scale requires large equipment. Quarrying limestone would require, at the minimum, the following equipment: one 1½ cu.yd. power shovel, two 1½ ton dump trucks, one pneumatic drill for dynamite holes, one compresser, rental on tractor and scraper for stripping overburden, and crushing equipment.

The quarry of the Michigan Limestone and Chemical Company at Calcite, Michigan (near Rodgers City) is used mainly for the production of stone for use in the steel industry. Their products require stone above ½" diameter and stone smaller than ½" has been simply stockpiled for years as waste. The gradation of this waste is:

Calcite Waste

Passing Mesh	3	99.19%
	4	97.57
	6	95.15
	8	91.57
	10	87.55
	14	82.01
	20	76.12
	28	70.07
	35	64.53
	48	59.20
	65	54.60
	150	48.02
	200	34.17

The price of these stone washings has been quoted at 25¢ per ton in the pile.

There is little question but what a section of their property could be leased and a railroad siding erected.

The distance from the roller mill to the pile is estimated at one mile. Electricity is available.

Mineral purity is not an important consideration for the production of mineral filler but is all important when considering the agricultural feed supplements for swine and chickens in Michigan. To locate a quarry in Michigan that will give an extremely pure calcite is difficult. Quarrys in Northern Michigan[1]:

Calcite Quarry, (Rodgers City)

Is exceptionally pure. An average of 235 analyses gave:

1) 97.85% calcium carbonate
2) 1.26% magnesium carbonate
3) 0.34 silica

Certain of the beds contain 3-10% mag. carbonate. The local average is 3-6% mag. carbonate. The yearly average in cargos of mag. carbonate is 1.81%.

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1. Mineral Resources of Michigan, Michigan Geological and Biological Survey. Publication 21, Geological Series 17.

Afton Quarry (Afton)

Is in the same Dundee limestone as Calcite. No railroad passes within ten miles. Quarrying would be necessary.

Petoskey Portland Cement Co. Quarry (Petoskey)

The chemical analysis is:

1) 93.00% calcium carbonate

2) 5.00% magnesium carbonate

Quarrying would be necessary since washings are used in cement production.

Charleviox Quarry (Charlevoix)

Same limestone as Petoskey except that considerable layers of high calcite are encountered. Quarrying would be necessary.

Huron Portland Cement Co. Quarry (Alpena)

Is in same Detroit limestone as Petoskey and has same analysis. Quarrying would be necessary as washings are used in cement production.

It may be concluded, then, that Calcite Quarry is the most practical selection for a plant site.

If quarrying were necessary it would cost approximately $2.27½/ton.

COST OF QUARRYING OPERATION

Demand:

1) Tonnage per year = 17,720 tons
2) Yardage per year = 13,630 yards
3) Time required = 454.3 hours

Equipment:

1) Power Shovel (capacity 30 yds/hr.)

a. Original cost	$26,000.00
b. Fuel & oil 8 gal/hr. @ 15¢/gal)= $1.20/hr	544.00
c. One operator @ $1.75/hr.	794.00
d. Workman's Compensation-rate $4.74/$100	37.60
e. Depreciation is 20% capital investment	6,500.00
f. Overhaul, repairs, etc. are 15% cap. invest.	3,900.00
g. Interest, insurance are 11% cap. invest.	2,860.00
Estimated yearly operating cost.	$14,635.60

2) Two 1½ ton dump trucks.

a. Original cost	$3,200.00
b. Fuel & oil 3.8 gal/hr @ 25¢/gal = 95¢/hr.	432.00
c. Driver @ $1.10/hr.	500.00
d. Workman's Compensation-rate $4.74/$100	23.70
e. Repairs 50¢/hr.	227.15
f. Depreciation is 25% of capital investment	800.00
g. Interest, storage, insurance is 11% cap investment.	352.00
	$2,134.85

Estimated yearly operating cost for two trucks	$4,269.70
3) Pneumatic drill	
a. Original cost	$3,200.00
b. Two labors @ $1.00/hr.	908.60
c. Workman's Compensation-rate $4.74/$100	43.00
d. Depreciation is 33% of cap. invest.	1,000.00
e. Overhaul, repair, and drills	1,000.00
f. Interest, insurance	352.00
Estimated yearly operation cost.	$3,370.27
4) Compressor	
a. Original cost	$4,500.00
b. Fuel & oil 5 gal/hr @ 25¢/gal.= $1.25/hr	567.50
c. Depreciation is 25% of cap. invest.	1,125.00
d. Overhaul, repair	675.00
e. Interest, insurance	495.00
Estimated yearly operation cost	$2,862.50

5) Tractor & scraper for stipping overburden. It is estimated that 3500 cuyds. of overburden will have to be moved. This would be done in a continuous operation. Cost would be approximately 30¢/cu.yd. Estimated depth of cut is 3 feet.

Cost of stripping 30¢ X 3500 $1,050.00

6) Dynamite required

a. Use 2#/cu.yd. Wt/year = 27,260#

Cost	Prima-Cord	18½¢/#	
	Caps	11¢/cap	
	27,260 X 18½¢	$4,980	
	plus caps	800	
			$5,780.00

b. Labor required for setting the charge.

One labor @ $1.50	681.40
Workman's Compensation-rate $4.74/$100	32.80
Estimated yearly operating cost	$7,175.60

7) One large jawcrusher

a. Original cost	6,000.00
b. Depreciation is 17% cap. invest.	1,020.00
c. Repair is 15% cap. invest.	900.00
d. Power (80 HP Diesel)	
1. Original cost	6,000.00
2. Depreciation is 12% cap. investment	720.00
3. Repair is 12% cap. investment	720.00
4. Fuel & oil 8 gal/hr. @ 20¢/gal.= $1.60	727.00
Estimated yearly operation cost.	$4,087.00

8) One small hammermill

a. Original cost	4,500.00
b. Depreciation is 17% cap. investment	765.00
c. Repair is 25% cap. investment	1,138.00
d. Power (40 HP Diesel)	
1. Original cost	3,000.00
2. Depreciation is 12% cap. invest.	360.00
3. Repair is 12% cap. investment.	360.00
4. Fuel & oil 5 gal/hr. @ 20¢/gal.= $1.00	454.30

Estimated yearly operation cost. $3,077.30

The estimated cost of quarring this amount of stone per year is $40,311.72 which may be reduced to a unit cost of $2.96 per cubic yard or $2.27⅓ per ton. The initial investment required is $61,650.00.

The only means possible to make this quarring operation economic would be to produce road gravel, aggregates, and road chips. This would not be practical due to the existing large capacity competition in Northern Michigan.

CONCLUSIONS - AGRICULTURAL LIMESTONE PRODUCTION

Ag. Meal is used on fields growing timothy, clover, and alfalfa. It is spread on the fields once in 5-8 years. (Use 5 years). It is not necessary to dry the meal. The usage is on the average of 250#/acre or 8 acres/ton[1]. The counties practical to serve were determined by truck transportation. The rate charged by truckers is at the minimum 3½¢/ton-mile. The maximum cost, delivered to the farmer, is $4.50. Even if the cost, at the plant, could be $1.50 the added area would do no good for existing competition is too great. There are producers of Ag. limestone at Charlevoix, Petoskey, Manistique, Essexville, Afton, and Bayport, Michigan. If their area was penitrated, it would be by rail, the rate being at least $1.50 per NT, then the meal would have to be transferred to trucks for distribution. With the trucking rate at 3½¢/ton then the radius of trucking would be 73 miles, and the maximum transportation cost would be $2.50 per ton.

Counties possible to serve:

County	Acres	Tons	Tons/year
Cheboygan	19,973	2,490	492
Presque Isle	20,695	2,588	518
Otsego	8,986	1,122	222
Montmorency	7,873	984	197
Alpena	24,983	3,122	622
Crawford	1,033	129	26
Kalkaska	7,188	892	178
Oscoda	5,516	689	138

1. Michigan State College, Extension Division, Folder #8

Alcona	16,213	2,030	406
Missaukee	24,509	3,062	612
Roscommon	1,210	151	30
Ogemaw	25,043	3,135	627
Iosco	14,505	1,815	363

Estimated yearly demand for Ag. Meal 4,431 tons.

If a small hammermill were added to the plant setup and its production divided between the roller mill and ag. meal, with an estimated rate of production at 30 tons per hour of ag. meal, the time required to produce the yearly demand would be 148 operating hours or 18½ - 8 hour days.

It may be concluded, therefore, that the production meal would be impractical because of the small demand and the competition already existing for that small demand.

DESCRIPTION OF EQUIPMENT NEEDED FOR PLANT

Transportation of screenings to plant:

1) Use a ½ yd. front loader with rubber tired tractor.
2) Use a 1½ ton dump truck.

Plant:

1) Dumping bin.
2) Single deck ½" vibrating screen.
3) Approximately 74' of 14" conveyor belt.
4) Raymond #5048 High Side Roller Mill, complete with feeder, pneumatic feed control, single wizzer separator with variable speed control and drives, main cyclone collector with double type discharge valve, main exhauster with flexible coupling and motor sub-base, vent fan, concentrator collector, and connecting piping, along with the necessary oil-burning furnace, including all of the hardware, the burner unit, and both fire brick and common brick in the required numbers for erection of the furnace at the plant.
5) 30' of 6" galvanized pipe to handle dust from bin to railway cars or trucks.
6) Bagger - use a St. Regis 301-FB with a capacity of 10 tons/hr.
7) Steel dust bin.

COST OF ENTIRE PLANT

Data:

1) Tonnage per year = 17,720 tons

2) Hours of operation = 2,963.3 hrs/year

Transportation of screenings

1) ½ cu.yd. front loader

a. Original cost	$3,300.00
b. Fuel & oil 2.0 gal/hr @ 25¢/gal = 50¢/hr.	1,481.65
c. Operator (also drives truck)@ $1.25/hr.	3,693.75
d. Workmans Compensation-rate $3.54/$100	130.77
e. Repair 25¢/hr.	740.83
f. Depreciation is 25% cap. invest.	825.00
g. Interest is 6% cap. investment	198.00
Estimated yearly operating cost	$7,070.00

2) One-1½ ton dump truck

a. Original cost	3,200.00
b. Fuel & oil 2.0 gal/hr. @ 25¢/gal = 50¢/hr.	1,481.65
c. Driver (above)	
d. Repair 25¢/hr.	740.83
e. Depreciation is 25% cap investment	800.00
f. Interest is 6% cap. investment	192.00
Estimated yearly operating cost	$3,214.48

The total yearly cost/ton of stone is $0.576/ton

Plant:

1) Steel dumping bin.

a. Original cost	$1,000.00
b. Freight	40.00
c. Depreciation is 20% cap. investment	260.00

2) Single deck ½" vibrating screen

a. Original cost	$1,100.00
b. Freight	30.00
c. Depreciation is 25% cap investment	280.00
d. Repair is 10% cap. investment	112.00
e. Electricity 0.27 KWH/ton @ 2½¢	124.04
Estimated yearly operating cost	$ 516.04

3) Two 14" conveyor belts are required.

a. Belt of 60' length for main feed from dumping bin to roller mill. Five HP motor and drives & gears are extra.

b. Belt of 14' length to take oversize stone from screen to waste pile. One HP motor and drives & gears are extra.

c. Cost:

1. Original cost		$2,175.00
2. 60' belt extras		
a) 5 HP motor	$130.00	
b) Drives and gears	100.00	230.00

3. 14' belt extras		
a) 1 HP motor	$25.00	
b) Drives & gears	30.00	55.00
4. 14" belt - length = 74' @ $25.00/ft.		1,850.00
5. Freight		40.00
6. Depreciation is 25% cap. invest.		543.75
7. Repair is 15% cap. investment		326.00
8. Electricity is 2.1¢/ton		372.12
Estimated yearly operating cost		$3,416.87

4) Raymond #5048 High Side Roller Mill. Basis for cost per ton breakdown:

a. Hours operated per day	8 hrs
b. 8-hr. days operated per year.	370.4 days
c. Output of pulverized stone/hr.	6 tons
8 hr. day	48 tons
/year	17,720 tons
d. Labor cost - mill operation	$1.00/hr.
e. Fuel cost (oil)	0.15/hr.
f. Power cost	0.02½/KWH
g. Original cost	$24,500.00
h. Freight Wt. 25 tons @ $20.00/ton	500.00
i. Approximate cost of motors (161 HP connected)	4,000.00
j. Approximate cost erected and ready to operate	45,000.00

Estimated cost per ton of stone.

Power (22KWH/ton @ 2½¢/KWH)	$ 0.55
Fuel for drying	.08
Labor	.17
Maintenance	.05
Fixed charges (20% of total installed cost/ year	.52
Miscellaneous	.05
Total cost, less bags and bagging labor	$ 1.42
Bagging:	
Cost of paper bags - 7¢ each	1.40
Bagging labor - 2 men @ $1.00/hr each	.34
Workman's Compensation	.03
Total cost, in bags in railway cars	$ 3.16

5) 6" Galvanized pipe - 30' long.

a. Cost = $1.00/ft.	30.00

6) Bagging machine

a. Original cost	$2,750.00
b. Freight	150.00
c. Labor (included in 4)	
d. Depreciation is 25% cap investment	725.00
e. Repair is 15% cap. investment	435.00
f. Electricity	50.00
Estimated yearly operating cost	$1,270.00

7) Steel dust bin (20 cu.yds.)

a. Original cost	$1,000.00
b. Freight	40.00
c. Depreciation is 20% cap. investment	260.00
Estimated yearly operating cost	$ 260.00

Cost of material is 25¢/ton in pile

The building to house the plant would be of general steel construction with beams, columns, trusses and purlins and including struts for attaching the galvanized sheets on the out side of the building.

1) Estimated cost	$15,000.00
2) Pay off in 8 years - yearly cost/ton	.106

The foundation for the roller mill will be of reinforced concrete and of dimensions of 10' X 11' X 6'

1) Cost of concrete for foundations

a. Cost of concrete/cu.yd.	$10	
b. Cost of lumber & labor	15	
c. Cost of steel	5	$30.00

2) Cost of foundation $\frac{10 \times 11 \times 6' \times}{27}$ $30 $ 733.00

3) Cost of incidental motor foundations 267.00

Total for foundations $1,000.00

Two steel frames are necessary to hold the collector and concentrator. The cost of fabricated steel is approximately 10¢/#. The estimated total poundage required is 9,612#.

1) Cost of frames 9,612 @ 10¢/#	$ 961.20
2) Freight	50.00
Total cost of frames	$1,011.20

Starting-up stack for furnace, 14" Ø, length is 50'

1) Cost of stack 50' @ 15#/' @ 10¢/#	$ 75.00

Cost for a railroad siding would be approximately $5,000.00

COST OF MINERAL FILLER PRODUCTION

First year cost:

Transportation of screenings	$ .576
Raymond mill operating cost	1.420
Other Plant costs	.329
Material	.106
Building	.250
Frames & foundations	.115
Railroad siding	.282
Cost of mineral filler, bulk, f.o.b. plant	$3.08
Bagging	1.77
Cost of mineral filler bagged, f.o.b. plant	$4.85

Second year cost:

Transportation of screenings	$ .576
Raymond mill operating cost	1.420
Other plant costs	.313
Material	.250
Building	.106
Cost of mineral filler, bulk, f.o.b. plant	$2.67
Bagging	1.77
Cost of mineral filler, bagged, f.o.b. plant	$4.44

The present prices charged by existing competition:

1) Waukesha, Wis. - bulk $3.35 bagged $5.15

2) Gibsonburg, Ohio. - bulk $3.50 bagged $4.50

The initial investment required would be $81,641.20.

DUST STORAGE

Bulk dust -- Since the construction of storage silos is expensive and storage space is not absolutely necessary, there will be no provision for storage. A 20 cu.yd. steel bin is used to supply enough storage so that it would not be necessary to stop the operation of the roller mill while railway cars are being moved. This bin would give 22.14 tons or 3.69 hrs. of production. Limestone dust weighs 82#/cubic foot.

Bagged dust - No storage space is provided for bagged dust. The dust is bagged only when needed, and is chuted from the bagger into the railway car where a man with a buggy places it in either corner.

CONSIDERATION OF DUST AS CALCIUM ADDITIVE TO FEED

As indicated under mineral purity in Selection of a Site, Calcite Quarry would give the necessary purity. No doubt the material would have to be selected with care as to avoid high percentages of magnesium carbonate. This would naturally increase the cost of production slightly.

It would be necessary to investigate the feed additive business a little further, all indications are that it would supplement the mineral filler production and would add considerably to the profits. Since the poultry business alone uses approximately $500,000 of ground oyster shells per year in this State or, at a unit cost, bagged, of from $20-24 per ton, there is a definite possibility in this field.

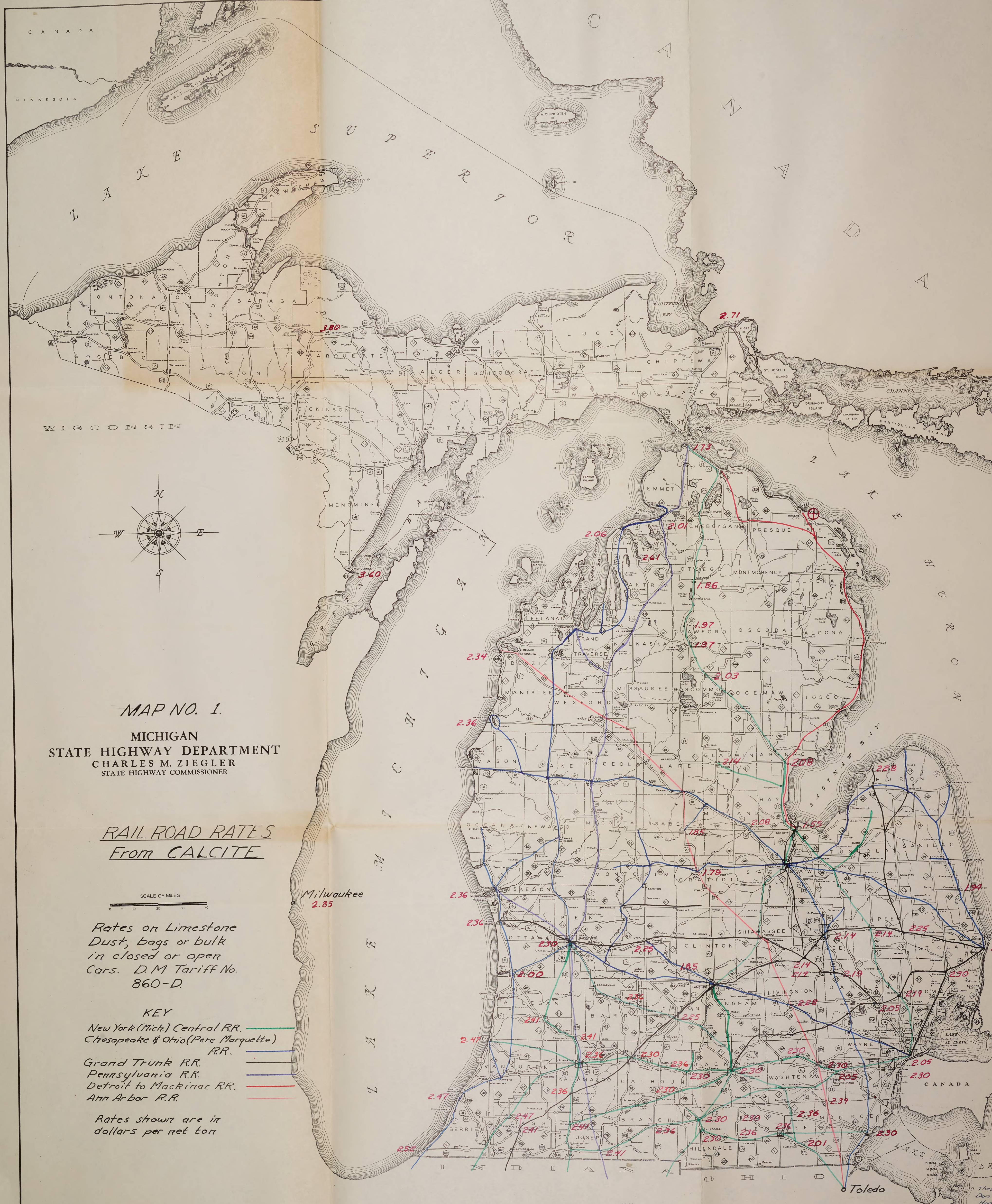
CONCLUSIONS

Producing mineral filler alone, the first year could show a profit of $5,670.40. The second year of production could show a profit of $14,707.60.

In the competitive business world this is not a comfortable profit for such a large capital investment, for, without a doubt, there would be price slashes by existing competition to drive the new producer out of business. Therefore, the entire conclusion would rest on either of two factors:

1) There would have to be enough of an opportunity in the production of feed additive to carry the firm over the initial attempt to drive the new producer from business. It is the opinion of the author that such a field of opportunity does exist and that such a production plant could be constructed and put into operation at Calcite, Quarry, Michigan.

2) It would require either a company or an individual with substantial financial backing to attempt such an enterprise, for, the first year or two of operation would, undoubtedly, display very little, if any, profit.



MAP NO. 1.
MICHIGAN
STATE HIGHWAY DEPARTMENT
CHARLES M. ZIEGLER
STATE HIGHWAY COMMISSIONER
RAILROAD RATES
From CALCITE
SCALE OF MILES
Rates on Limestone Dust, bags or bulk in closed or open Cars. D.M Tariff No. 860-D.
KEY
New York (Mich.) Central R.R.
Chesapeake & Ohio (Pere Marquette) R.R.
Grand Trunk R.R.
Pennsylvania R.R.
Detroit to Mackinac R.R.
Ann Arbor R.R.
Rates shown are in dollars per net ton
Milwaukee 2.85
Toledo
LAKE SUPERIOR
LAKE MICHIGAN
LAKE HURON
LAKE ERIE
CANADA
WISCONSIN
MINNESOTA
INDIANA
OHIO
1948

MAP NO. 2

MICHIGAN
STATE HIGHWAY DEPARTMENT
CHARLES M. ZIEGLER
STATE HIGHWAY COMMISSIONER

RAIL ROAD RATES
From Gibsonburg, Ohio

SCALE OF MILES
0 5 10 20 30 40

Rates on Limestone Dust, bags or bulk, in Boxcars. PRR Tariff No. 1885 B. – Rate Group No 7.

KEY

- New York (Mich.) Central RR.
- Chesapeake & Ohio (Pere Marquette) R.R
- Grand Trunk R.R.
- Pennsylvania R.R.
- Detroit to Mackinac R.R.
- Ann Arbor R.R.

Rates shown are in dollars per net ton.

1948

MAP NO. 3

MICHIGAN
STATE HIGHWAY DEPARTMENT
CHARLES M. ZIEGLER
STATE HIGHWAY COMMISSIONER

SCALE OF MILES
0 5 10 20 30 40

KEY

Line of equal freight rates as computed.

Line of equal freight rates as estimated with the New York (Mich.) Central R.R. as carrier.