University of Wisconsin-Extension

GEOLOGICAL AND NATURAL HISTORY SURVEY
3817 Mineral Point Road
Madison, Wisconsin 53705

M.E. Ostrom, State Geologist and Director

REPORT ON BALLAST QUARRY SITES ALONG CB &Q RAILWAY IN WISCONSIN

by

W.O. Hotchkiss

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Misc
Quarry Sites

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by

W. O. Hotchkiss, C.E.

INTRODUCTION.

In order to give a graphic picture of the geologic formations along the CB&Q Railway in Wisconsin I have prepared and included with this a rough sketch. The linear extent is based on the mileage figures in a CB&Q time table, and is on a scale of four miles to the inch.

The profile gives the river and the approximate height of the crest of the bluffs as seen from the track. This profile is based on the maps of the Mississippi River Commission, and its vertical scale is 400 feet to the inch. On this profile are put in the approximate elevations of the various rock formations. This information is from personal observations at the points checked on the profile line, and from the reports of the former Geological Survey of Wisconsin.

ROCK FORMATIONS.

Galena Limestone.

This formation is a dolomite and occupies the tops of the bluffs from the state line to near Bagley. It is very apt to be porous and soft from the effects of water action. It is the rock opened in the quarry at Cassville.

Platteville or Trenton Limestones.

This formation occupies the tops of the bluffs from Bagley to a short distance north of Prairie du Chien. It is usually a

rather pure limestone, and is inclined to be rather soft. It has a considerable amount of thin bedded shaly material in it that would be largely wasted in quarrying and crushing.

Saint Peter Sandstone.

This formation is a soft, clean sandstone and occupies the tops of the bluffs for a short distance north of Prairie du Chien.

Lower Magnesian Limestone.

This dolimite is by far the best rock for ballast available along the line examined. It is the hardest and most resistant formation to be found in that portion of the state. It forms the tops of all the bluffs from a short distance north of Prairie du Chien to Pullman Avenue with the exception of the hills between La Crosse and East Winona.

Its character is quite uniform throughout the whole distance. From DeSoto northward to Pullman Avenue it is composed of three fairly well defined parts. The lower part is 30 to 40 feet thick and is made up of a soft easily quarried rock that makes excellent building stone and flagging. This part is best shown in Mr. Kirchner quarry at Fountain City and at La Crosse. This soft rock is porous and generally not well suited for ballast. The La Crosse quarries are furnishing stone from this part of the formation. Above this quarry rock is a thick layer of what the men in Mr. Kirchner's quarry call "nigger heads", which is a very hard, dense resistant stone, and makes the tops of the hills from a short distance south of Lynxville nearly to Pullman.

The upper part is made up of a varying moderate thickness of somewhat softer thin bedded material. This top layer is only

shown a short distance north of Prairie du Chien and at Pullman Avenue.

At Perryville and southward the formation is somewhat thicker than toward the north and the two lower divisions above named are not well marked. The lower division is harder and less porous than that at La Crosse and Fountain City, and the middle division is not quite so hard and dense as in its exposures farther north.

All of the middle division of the Lower Magnesian is of far better quality than the crushed rock furnished by the La Crosse quarries.

Potsdam Sandstone.

This rock begins to be exposed at the bases of the bluffs a few miles north of Prairie du Chien and gradually rises as shown on the sketch until at La Crosse and Fountain City its top is nearly 500 feet above the river level. It is a soft sandstone and wholly unfit for ballast.

Factors considered in recommending Quarry Sites.

The three main factors considered in recommending sites for ballast quarries were,-

1. Quantity
2. Quality
3. Availability

Under Quantity it was considered that any quarry which would give less than 500,000 cubic yards of stone in the ledge or 800,000

cubic yards of crushed stone in the bin would not have a large enough amount. I was not instructed as to this quantity but assumed that enough would eventually be required to ballast about 300 miles of line at about 2800 cubic yards to the mile. Fortunately the matter of quantity entered into consideration with no locations which would be otherwise suitable.

Under Quality it was considered that the stone desired should be the hardest and most dense obtainable. Here too, it can be said that the quality of the stone entered into the consideration of comparatively few otherwise suitable locations. Practically all of the middle division of the Lower Magnesian Limestone will make excellent ballast.

With regard to quality I wish to say I do not believe that a small number of labratory tests are of any significance. This is very forcibly exemplified in the tests made preliminary to locating the crusher at Cassville. The best method of determining the quality of the stone will be discussed later.

Under Availability the first point considered was a suitable location for crusher and gravity head and tail tracks. Other items were cost of quarrying, and central location along the division to be ballasted.

It was rather hard to find suitable sites for crusher and tracks, and the stone in many cases was not examined because there was no cheap way of providing the desired trackage. There is a large amount of stone that could be easily quarried between Pepin and Bay City, but it was not available for this reason.

Under cost of quarrying the main factors considered were

stripping, and lowering the stone from the quarry floor to the crusher. In other respects the quarry sites would be on an even footing. In regard to the cost of lowering stone it was stated to me by Mr. Mead, the manager of the La Crosse Stone Company, that, according to very carefully kept cost records, the expense to them of lowering stone was eight cents per cubic yard of crushed stone. This included, as I understood Mr. Mead, interest on cost on tram and cars, repairs, and wages of the hoist man. This is apparently a high cost, and it forces the consideration of this item as a charge of eight cents, or any larger part of that sum, against each yard of stone is a very considerable expense.

BEST LOCATION FOR BALLAST QUARRIES.

Considered under the various heads given above there are three locations between which it is hard to choose. These are the large hill about two and one-half or three miles south of Lynxville, the Fountain City site, and just north of Cochrane. I am inclined to think that the Lynxville site has a little the advantage of the other two. The Fountain City and Cochrane sites are about the same distance north of the center of the division that Lynxville is south. The stone in all three sites is about the same, but the quarry floor at the Lynxville site would be only about 140 feet above the track, while at the northern sites it would be about 380 feet above the track. While it is possible that the stone in the Lynxville site may be a shade lower in quality, (it would take a good sized opening to prove this), the weathered stone seems to be better at Lynxville), it has the advantage of a workable thick-

ness of about 160 feet as against 80 to 100 feet at the northern sites. There is also a considerable amount of calcite in large lenses and irregular bunches that would be waste in the northern sites, which is lacking in the Lynxville stone.

In order of desirability I would put Lynxville first, Cochrane second, and Fountain City third.

After these three sites there are three good localities which are put in a second class because of their location near the northern end of the division. These are Eager, Diamond Bluff, and about two miles west of Point Douglas. The quality of stone at these sites is good. Good locations for tracks exist, and the quarry floor would be low, that near Point Douglas being level with or below the main track as desired.

These sites are all described in detail in the following paragraphs.

Lynxville.

This quarry site is about two and three-quarters miles south of Lynxville.

The tracks could be run in from the south on a rather sharp curve with a short fill and could then practically follow the contour of the hill as shown on the map. There is a wagon road to cross but is almost never used. Most of the travel goes up the valley and over the better ridge roads.

The crusher could be located back about a quarter of a mile from the tracks in a position where it would not be likely to suffer from blasting in the quarry face. It would be about 100 to 125 feet from the quarry floor to the crusher deck.

The quality of stone is excellent and quite uniform from the top of the hill down nearly to the bottom. Samples 5, 6, and 7 sent to Mr. Wickhorst were from this hill, and are probably poorer than the average of the stone. Sample 7 is from a 2 foot layer.

The thickness of the Lower Magnesian limestone is about 210 feet, and the quarry could be worked in four benches at a time, with 45 or 50 foot knock faces on each bench. This would cut down to a minimum the cost of getting the stone from the working face to the inclined tramway. The working faces could be made 1000 feet or longer if desired.

The stripping would probably average four or five feet on top and practically nothing on the sides. When the great thickness which this would uncover is considered its cost would be negligible.

The quantity is extremely large. An area 1000 feet wide and 2000 feet long parallel to the tracks coule be quarried, and more if desired. With a thickness of 60 yards this would give nearly 15 million cubic yards of stone in the ledge or from 22 to 26 million yards of crushed stone.

The only disadvantage which this site may be said to possess is the possibility that there might be a thin layer of St. Peter Sandstone to strip from the higher parts. There was none seen, but it could not be positively stated that there is none until a few pits are dug to test it. These pits should be dug before any money is spent to open up a quarry.

Fountain City.

This quarry site is located about a mile north of the city, and is just north of Mr. Kirchner's quarry.

The tracks would be rather difficult to locate as there is a rather steep slope from the main line and a well travelled highway would have to be crossed.

The crusher could be located a fairly good distance from the quarry face so as to be quite free from rock falls, but the slope is so steep that there would be danger of injuring teams passing on the highway. The crusher deck would be 360 to 380 feet below the quarry floor.

The quality of stone is excellent and quite uniform at the top. The lower 20 feet is softer and makes an excellent quarry stone. Sample 24 sent to Mr. Wickhorst is of this lower soft material. Sample 25 is from the hard upper rock.

I would suggest that if there is any tendency on the part of the owners to hold their land at an exorbitant price there is just as good if not a better location south of town as shown on the map.

The stripping at Fountain City would be somewhat heavier than at the Lynnville site. It would be about 10 feet on the side hill and about 6 or 7 on top.

The quantity of stone would be all that could be desired.

The disadvantages of this location are the well travelled road lying just at the foot of the hill, the difficulty in finding place for the stripping, the danger to passing traffic from blasting, and the great elevation of the quarry floor.

Cochrane.

There are three possible locations here. The one marked is probably the best. Another site is the hill just opposite the station, and the third is about a mile south. This last would be the best if it did not seem probable that the stripping on the

back side might be rather heavy. The location for track here would be ideal and it might pay to sink a few pits to see if the stripping on the back of the ridge might not be light enough to make it practicable. Sample 25 was from this hill south of town. The sample is probably better than the average of the rock would be. The location opposite the station would be impracticable on account of danger to the town from blasting. The following statements relate to the hill about a mile and a half from town.

Tracks could be located fairly easily. The only obstacle would be a private road to a ramshackle house.

The crusher could be located aside from the main quarry face where it would be free from danger in blasting.

The thickness of stone here would be about the same as at Fountain City as far as could be judged.

The quality of stone would be about the same, or a shade lower, than at Fountain City so far as could be determined from the weathered outcrop. Sample 26 sent to Mr. Wickhorst is from this hill. This hill is full of calcite bunches the same as the Fountain City stone.

The stripping on top would be from 6 to 8 feet so far as could be judged unless there were a layer of St. Peter Sandstone to remove. No ledges of sandstone were exposed but there were numerous pieces of float which suggested the probability of some sandstone. Pits would have to be dug to determine this before opening a quarry. The stripping on the slope could not be determined as there was no opening.

The quantity obtainable could be expressed in millions of yards in the ledge.

The disadvantages of this site would be the possibility of having to strip off St. Peter Sandstone, and the great elevation of the quarry floor, which would be about the same as at Fountain City.

Hager.

The stone examined here was about one and one-half miles northwest of the station, and is just across the track from the gravel pit.

The tracks would have the best location seen. Any desired length of head and tail tracks could be laid with practically no grading.

The crusher could be located between two quarry faces, well out of danger from blasting. It would be about 160 to 180 feet from the quarry floor to the crusher deck.

The quality of stone would probably be somewhat below that of the Fountain City stone in general, but there is a long, even, high exposure that speaks well for the uniformity of the material. Sample 30 was sent to Mr. Kirkhorst from this ledge, but is of better stone than the average.

The thickness of workable stone would be about 100 to 120 feet.

The stripping would be about 4 to 8 feet on top, and there would be plenty of room to dispose of the refuse.

The quantity could be expressed in millions of yards in the ledge.

The only disadvantage in this location would be that the quality of stone would probably be not quite so good as at Fountain City, though nearly equal to it.

Diamond Bluff.

Examined three ledges right near the station.

The tracks could be located here without great difficulty, but one or two small houses might have to be moved.

The crusher would have to be located a little too close to the town to be in the most desirable of situations, but could be put in a safe place so far as blasting is concerned. The quarry floor would be 150 or 160 feet above the crusher deck.

The quality of stone would be good. My notes say,- "If a quarry were to be limited to the upper 60 ro 80 feet of this rock a quality of rock not excelled anywhere could be gotten out. Sample 51 from this ledge to the north of town is possibly a little better than the average, and 52 from the ledge right opposite the station, is a little below the average. This last sample is less dense and more weather pitted than the rock back from the weathered face. Both samples were sent to Mr. Wickhorst.

The thickness of good rock would be from 60 to 80 feet.

The quantity would be great enough as over two million yards in the ledge could easily be obtained.

The disadvantages of this location would be its nearness to the town, and the church just below the center of the quarry face.

Point Douglas.

The ledges examined here extend from a point one mile west of the swing bridge to a point about two miles west of the bridge.

The tracks could be located fairly easily in the little valley west of the hill.

The crusher could be set where it would be in no danger from blasting, and the quarry floor could be made even with the crusher deck, or 80 feet below it as desired.

The quality of stone is excellent. The sample sent Mr. Wickhorst - 27 - is not quite so good as the general average of the stone would be.

The stripping would be light, not over 4 to 6 feet on top so far as could be judged, and almost nothing on the side.

The quantity would be all that could be wished. An area 5000 feet by 2000 feet could be quarried and with a thickness of 50 yards, which would have the quarry floor on a level with the crusher deck, there would be 60 million hards in the ledge.

The only disadvantage this location would have is its position at one end of the division and the consequent long hauls. Stone could probably be quarried and crushed here cheaper than at any other quarry site mentioned.

OTHER LOCALITIES VISITED.

Many other points were visited beside those above described, but for one reason or another they were not suitable. These locations are checked on the sketch included with this report and unless desired no detailed report will be made on them. Places under this category are Bagley, Wyalusing, Prairie du Chien, Picatee Creek, Ferryville, De Soto, ledge half way between Stoddary and La Crosse, La Crosse, Alma, Nelson and Pullman Avenue.

TESTING ROCK FOR BALLAST.

In regard to tests for the relative values of various rocks for ballast I wish to emphasize that I do not believe that laboratory tests as ordinarily carried on have any significance whatever. Only by opening up the fresh unweathered rock and taking samples from every foot of the ledge so exposed, and making a long series of tests can any valuable comparative estimate be made. I

found it impossible to satisfy myself with even a dozen samples from a ledge, that I had a fair representation of the stone. Taking all care possible, the personal equasion in selecting samples is so great that it vitiates all the care the tester in the laboratory may use. I was very soon forced to the conclusion in this study, that a careful estimate by the eye of the quarry or ledge as a whole, and comparing this with the estimate made of other ledges, was the only satisfactory means of arriving at the relative values of various locations. However, I endeavored to collect samples that were as representative as possible. I have mentioned whether they were above or below my estimate of the average quality of stone in the hill, but of course could not give any quantitative statement of how much they are above or below.

Consequently I believe that the most satisfactory results will be obtained by choosing the most desirable of the sites named and blasting out holes enough to get fresh rock from top to bottom of the ledge, and then either by field examination, or by a series of tests, deciding whether the stone is satisfactory or not. If the quality of the stone as a whole is not good enough than another quarry should be tested. Practically all of the middle division of the Lower Magnesian limestone, however, will make a good quality of ballast - better than that already supplied by the La Crosse Stone Company, and indescribably better than the Cassville stone.

GRAVEL.

A little time was spent in looking for gravel but after examining the Hagen pit it seemed inadvisable to look further. The gravels are mostly too sandy, and while they would be cheaper than rock even if the gravel were to be screened, yet the pebbles are so

well rounded and the percentage of limestone or other readily cementing rock in them is so small that they would probably be unstable under heavy traffic.