

BECHTEL CORPORATION
INTER-OFFICE MEMORANDUM

Date June 15, 1953

From V. R. Stirling

Dept. Construction

At Pt. LaBarbe Office, St. Ignace

Subject Mackinac Straits Crossing
Analysis of Dredging from shore to
depth - 65 feet

To Clark Rankin - Project Manager

Copies to E. F. Quiett

The following analysis is based on the following assumptions and considerations.

Its purpose is to determine the number and character of the dredges needed to provide the trenches for the pipelines so that both these lines will be in operation before the close of the present season.

CONSIDERATIONS:

- A. For digging below - 50 no dredge is available except derrickboats equipped with clamshell buckets.
- B. For digging above - 50 in material not unreasonably hard, the Hydraulic Dredge "Niagara" is on hand.
- C. For digging above - 32 in any material except hard ledge rock, a strong dipper dredge of the "Sullivan" class can work.
- D. For digging shallow cuts in ledge rock near shore a derrickboat equipped with clamshell bucket is probably the best solution.

ASSUMPTIONS:

- E. Clamshell Dredge will make bottom in the trench 10 feet wide. It can operate to advantage with this width.
- F. Hydraulic Dredge will make bottom in the trench about 140 feet wide. Great difference of opinion on this point exists among experienced hydraulic dredge owners. Having rather meager data on the nature of the material to be dredged and none at all on the amount of run back caused by unstable material and by wave action, the writer considers 140 feet bottom width as a very strong possibility before we get through with this job.
- G. Dipper Dredge will make bottom in the trench about 45 feet wide. Great difference of opinion on this point exists also, but the writer considers a width of 45 feet as advisable in forecasting probable yardages.

- H. A side slope of 1 vertical to $1\frac{1}{2}$ horizontal has been used in all calculations in an effort to arrive at a minimum estimate. There is no practical reason why we should get steeper side slopes and there are many serious reasons why we might get flatter side slopes when digging unstable material in the water.

It must be emphasized that if the material runs in badly as it is already doing in some localities, the yardage will be greatly increased beyond the amounts stated below.

- I. Overdepth dredging has been taken as 2 and 3 feet. Considerable difference of opinion also exists among experienced dredge operators, but the writer considers these to be a reasonable assumption in this case.

SUMMARY OF YARDAGE DISTRIBUTION 6-15-53

WEST LINE

	CASE I & IV Clam (stone)	CASE I & IV Clam (earth)	CASE II Hydraulic	CASE III Dipper
South Side	5,314 cu. yd.	12,480 cu. yd.	99,253 cu. yd.	0
North Side	3,295 cu. yd.	12,017 cu. yd.	287,415 cu. yd.	22,719 cu. yd.
Sub Total	8,609 cu. yd.	24,497 cu. yd.	386,668 cu. yd.	22,719 cu. yd.

EAST LINE

South Side	1,971 cu. yd.	23,814 cu. yd.	157,635 cu. yd.	8,830 cu. yd.
North Side	2,224 cu. yd.	20,248 cu. yd.	212,399 cu. yd.	14,321 cu. yd.
Sub Total	4,195 cu. yd.	44,062 cu. yd.	370,034 cu. yd.	23,151 cu. yd.

Grand Total 12,804 cu. yd. 68,559 cu. yd. 756,702 cu. yd. 45,870 cu. yd.

CONCLUSIONS AND RECOMMENDATIONS

1. No conclusions or recommendations are made at this writing in regard to clamshell dredging for the reason that additional clamshell dredging is expected in the deep portion of the crossing below Depth - 65. Analysis of this work is now under way and a separate report on it will follow.

2. Dipper Dredging (Case III)

The tabulation shows 46,000 cu. yds. which could be moved advantageously by a 6 cu. yd. Dipper Dredge.

This amount does not include bodies of hard material which are quite liable to be encountered in the volumes classified as hydraulic dredging. Owing to the miscellaneous formation of the material in the lake bottom hard material is found to occur alongside, over or under soft material. This condition slows down production by the hydraulic dredge "Niagara".

In view of these conditions the immediate transfer of a strong dipper dredge to this work is recommended.

3. Hydraulic Dredging (Case II)

The tabulation shows about 750,000 cu. yds. of material which could possibly be removed by the Hydraulic Dredge "Niagara" which is now on the job.

In considering this yardage it must be borne in mind that this work is not inside a harbor where work can be continuous insofar as weather is concerned, but, on the contrary is offshore from two capes projecting into Lake Michigan. Consequently, yardage production figures for the dredge must be materially reduced for two reasons:

- (a) The storm damage to the plant may cause serious delay. One storm damage delay has already caused a twelve day set-back in the construction of the pipelines. A few more of these and success will be impossible.
- (b) Plant breakdowns nearly always occur when the dredge is working in good weather and very seldom when the dredge is idle in refuge from storms. Consequently, plant breakdowns mean a loss of good weather rather than bad.

The writer considers it unsafe to assume that the "Niagara" will average more than 150,000 cu. yds. per month on this job. This means 5 months operation which is about twice too long.

Therefore, the writer recommends the immediate transfer of another large hydraulic dredge to this job on the basis that it is better to have the trenches in readiness for launching the pipe 10 days too early rather than 60 days too late.

Respectfully submitted,

/s/ V. R. Stirling
V. R. Stirling
Assistant Construction Manager

VRS:rb

Att. (11)
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CASE I

Clamshell Dredge



NOTE:

NOT TO SCALE