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ALASKAN CEMENT MARKETS

AND

OPPORTUNITIES FOR REGIONAL PRODUCTION

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Research Monograph No. 4

The Institute of Business, Economic and Government Research

in cooperation with the

Mineral Industry Research Laboratory

of

The University of Alaska

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FOREWARD

This study, Alaska Cement Markets and Opportunities for Regional Production, is a part of the continuing research program of the Institute of Business, Economic and Government Research. The overall program of this Institute is designed to examine problems of economic development in Alaska. One important facet of this region's economic development is the growth in basic manufacturing industry and employment. This type of manufacturing is important for several reasons. Its successful growth would reduce and offset the import of this product from other regions in the United States, and from abroad. Its continued operation would result in the harvesting of natural resources that presently are of limited economic value. These manufacturing industries could employ a significant number of workers and add labor skills presently deficit in this region.

The attraction of manufacturing, therefore, is a realistic goal for Alaska. The current rate of unemployment and sharp seasonal fluctuations in employment in Alaska's major industries are very real problems. Some workable remedies to these problems should become apparent through economic base studies of this type.

This research project was conducted at the request of the Bureau of Indian Affairs, United States Department of Interior in accordance with provisions of federal contract No. 14-20-0300-1386. Mr. Robert L. Bennett, Juneau Area Director, was particularly helpful in guiding the project to its present published form. Mr. Wallace Craig, Area Field Representative in Anchorage, assisted the Institute at various times during the research.

Indirectly, the cement industry can provide technical training and stimulate employment for Alaska's native citizens. Directly, this industry may utilize Indian-owned lands and natural resources.

At the University of Alaska, the study was a joint undertaking of the Mineral Industry Research Laboratory and the Institute of Business, Economic and Government Research. The principal faculty investigators were Charles Beasley, Robert Haring and Graham Miller. At various stages of investigation, other faculty members contributed their special knowledge. In this respect, special thanks are due Dean Earl Beistline (mining), Richard Berg (transportation), David Clarke (labor), Michael Cruickshank (mineral engineering), Lado Kozely (economic development) and Harold Peyton (petroleum engineering). To Mrs. Helen Anderson we owe a special debt of gratitude for giving tirelessly of her time and effort in manuscript typing.

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I

INTRODUCTION

Background

Construction in Alaska is a major industry. Most of the raw materials, structural components and equipment of the construction industry are brought into this region from other states. The physical distances involved, coupled with a substantial time lag from order elsewhere to delivery in Alaska, have resulted in unusually high costs of construction in the region. The annual amount of construction activity, and consequently cement consumed, have varied considerably since World War II. As this region's cement market expanded and became more stable recently, the construction of a regionally based manufacturing facility has become a current question.

Purposes

The purposes of the investigation were to:

(1) Examine the market for cement in Alaska and the conditions influencing this market.

(2) Identify the current distribution channels through which cement is sold in Alaska and the Alaskan buyers that constitute basic determinants of demand.

(3) Examine the feasibility of manufacturing cement in Alaska utilizing available raw materials and labor.

(4) Demonstrate, through this study, the types of problems of attracting manufacturing industry which generally prevail in Alaska at this time.

(5) To identify employment opportunity, and economic benefits for Native people.

Methodology

The marketing segment of the report was accomplished through intensive field inquiry, analysis of consumption data, compilation of original consumption statistics, and identification of current and potential consuming sectors of the Alaskan economy. The manufacturing feasibility portion involved review of the pertinent technical literature, summary and evaluation of previous engineering proposals, and limited original design of quarrying and manufacturing operations based on preliminary field examinations and deposit sampling.

II

SUMMARY AND CONCLUSIONS

Summary

This report investigates the current and potential consumption of cement in Alaska. It has identified the complex pattern of physical distribution, and explored the marketing difficulties that would be encountered by a new manufacturing firm. The technical and economic feasibility of a proposed cement manufacturing plant were evaluated. Although hypothetical locations of plant and raw materials were analyzed, the general economic situation conforms closely to the specifications of cement plants now proposed for construction. While such operations are shown as technologically possible, they are not economically feasible for locations designated at this time. The major reasons for this overall evaluation follow:

(1) Utilization of the identified limestone deposits is less favorable than was believed in earlier reports. High quality limestone deposits, more favorably located with respect to cement marketing areas, are now owned by a national cement manufacturer. The manufacturer also possesses Anchorage distribution facilities, and obviously is in a relatively favorable manufacturing position.

(2) The proposed plant investment does not seem to reflect the high costs to be expected in the installation of dock facilities at the proposed locations.

(3) Plant operating costs have been understated with regard to labor costs.

(4) Alaska cement markets, while already at the annual "manufacturing feasibility" consumption level of 500-600 thousand barrels, cannot be acquired suddenly and completely by a new producer. Costly shipments to many ports, and price and sales competition with existing manufacturers would quickly reduce the profits reported on the *pro forma* financial statements.

(5) Because of the overall risks and uncertainties evident in both the manufacturing and marketing areas, the normal 20 year amortization period is too long.

Implications

Several implications logically follow from this examination of a proposed cement plant and its anticipated effects upon community economic development. First, cement manufacturing, though not "labor intensive" by manufacturing standards, would provide a significant number of job opportunities for native residents. Second, the attempt to locate plants based principally upon labor availability, without due regard to the location of either markets or raw materials, creates unnecessary problems. Third, certain select plant sites, power sources, raw materials and distribution facilities in Alaska could more easily be combined into a profitable cement operation. Because this optimum combination of resources is not owned by a single legal entity, cement manufacturing has not developed in this region. A solution among these interested parties could create profitable cement manufacturing in Alaska and include employment of Native labor.

III

MARKETING AND CONDITIONS AFFECTING DEMAND

Scope

The basic concern of Part III is analysis of cement consumption in Alaska. It examines the organization of factory outlets, the quantity, timing and geographic distribution of sales. The major determinants of cement sales as conditions of demand are segmented and their importance analyzed. Finally, the long and short-term outlook for regional cement consumption is presented.

Background

In the period examined, 1959-1964, all Portland cement shipped to Alaskan ports came from west coast manufacturing centers. All cement used in Alaska is manufactured in Bellingham and Seattle, Washington and Redwood City, California (Table 1). Cement must be transported to Alaska by barge shipment along the coast and inland waterways. In the past, small quantities have been imported from Japan and Hong Kong but such shipments are no longer significant.

Industrial Organization

Prior to World War II, domestic cement shipments to Alaska were relatively unimportant to the nation's manufacturers. Since that time, the effects of chronic domestic cement overcapacity[1] and an expanding

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[1] See S. M. Loescher, Imperfect Collusion in the Cement Industry, (Cambridge: Harvard University Press, 1959) Chapters 1-4.

TABLE 1
CEMENT SHIPMENTS FROM MAJOR NORTHWEST UNITED STATES PORTS*
TO DESTINATIONS IN THE UNITED STATES
1959-1963

In short tons (barrel equivalents)

	1963	1962	1961	1960	1959
Bellingham, Washington Shipments:					
Internal+	120,274	112,850	91,558	108,645	89,360
	(641,461)	(589,627)	(487,010)	(577,898)	(475,319)
Coastwise*+	59,119	10,655	14,262	49,217	28,170
	(315,301)	(56,675)	(75,861)	(261,792)	(149,840)
TOTAL	179,393	123,505	105,820	157,862	117,530
	(956,762)	(651,622)	(562,872)	(839,691)	(625,159)
Seattle, Washington Shipments:					
Internal+	45	376	1,316	1,153	2,560
	(186)	(2,000)	(7,000)	(6,132)	(13,617)
Coastwise*+	39,192	18,983	21,380	14,098	21,409
	(209,024)	(100,973)	(113,723)		(74,989)
TOTAL	39,237	19,359	22,696	15,251	23,969
	(298,210)	(102,973)	(140,723)	(6,132)	(88,606)
Aggregate Bellingham-Seattle Internal Shipments	120,209	113,226	92,874	109,798	91,920
	(641,647)	(602,265)	(494,010)	(583,984)	(488,936)

*Port of Portland is a substantial domestic importer and San Francisco-Oakland shipments are meager.

+ Internal receipts and shipments -- These terms apply to traffic between ports or landings, wherein the entire movement takes place over inland waterways, except that those movements involving carriage on both inland waterways and waters of the Great Lakes system are also termed "internal" as are the inland movements that cross short stretches of open waters which link inland systems.

*+ Coastwise receipts and shipments -- These terms apply to domestic traffic receiving a carriage over the ocean, or the Gulf of Mexico, e.g., New Orleans to Baltimore, New York to Puerto Rico, San Francisco to Hawaii, Guam, or

[illegible] continued

[illegible], Puerto Rico to Hawaii. Traffic between Great Lakes ports and sea- [illegible] ports, when having a carriage over the ocean, is also termed "coastwise." [illegible] Chesapeake Bay and Puget Sound are considered internal bodies of water [illegible] than arms of the ocean and therefore traffic confined to these areas is [illegible]" rather than "coastwise."

[illegible]: U. S. Army Corps of Engineers, Waterborne Commerce of the United States

TABLE 2

FREIGHT TRAFFIC FOR FOUR ALASKAN PORTS
1950-1963
(Short Tons)

		Seward		Anchorage		Whittier		Valdez	
Year	Tons Total	Tons	Percent of Four Ports	Tons	Percent of Four Ports	Tons	Percent of Four Ports	Tons	Percent of Four Ports
1962	1,196,047	670,037	56	351,963	29	132,427	11	41,620	4
1961	1,072,995	631,209	59	267,679	25	119,212	11	54,895	5
1960	1,063,346	628,422	59	246,758	23	115,420	11	72,746	7
1959	938,812	556,124	59	221,387	24	118,831	13	42,470	4
1958	852,316	450,705	53	214,281	25	129,969	15	57,361	7
1957	863,055	529,834	61	170,006	20	100,588	12	62,627	7
1956	1,068,586	633,489	59	201,139	19	175,538	16	58,420	6
1955	929,045	524,796	57	170,195	18	139,439	15	94,615	10
1954	952,206	565,013	59	170,309	18	120,606	13	96,278	10
1953	927,069	587,201	63	137,192	15	131,758	14	70,918	8
1952	1,004,625	549,408	55	122,264	12	237,297	24	95,656	9
1951	1,106,230	572,470	52	110,756	10	297,421	27	125,583	11
1950	831,283	428,953	52	50,742	6	265,625	32	85,963	10

Source: U.S. Army Corps of Engineers, Waterborne Commerce of the United States

Alaskan economy based largely on military construction has increased the importance of Alaskan markets to west coast producers.

Dock facilities for, and the handling of cement destined for military consumption, were initially controlled by the military but later by contractors and the factory offices of the Permanente and Superior cement companies. During the early fifties, Permanente distributed cement from Anchorage; and Superior distributed cement from Seward. The Seward facilities of Superior were later acquired by the Lone Star Cement Company in 1957, but were abandoned in 1959. This left Permanente in Anchorage as the sole source of supply until 1961. In 1961, the Ideal Cement Company constructed storage and dock facilities adjacent to the Port of Anchorage and quickly became a major factory competitor throughout Alaska. The establishment and abandonment of factory sales offices would seem to be related to economic activity in the State as reflected in Table 2. During the 1959-1964 period blending and bagging facilities were added to permanent loading and storage facilities in Anchorage. A cement trucking fleet was also introduced in Anchorage.

The sales branches in Anchorage currently maintain port facilities and unloading equipment. When the peak construction season is approaching, the inventory in Anchorage approximates 175,000 barrels and requires utilization of barges and silos. During the building season port inventories decline because barge shipments, hindered by weather, arrive at irregular intervals. This may result in the factory outlets being out of cement for short intervals. At the end of the building season, and before barge delivery stops for the winter, Anchorage inventories are increased to approximately the total silo storage capacity of 100,000 barrels.

Many other Alaskan coastal cities receive waterborne shipments of cement. They are delivered from northwest ports to contractors and concrete companies which purchase directly from suppliers. One factory branch in Anchorage extends franchises to dealers in these ports and operates as a broker; accepting neither title to, or possession of, the cement.

Transportation

As noted in the previous section, barge transportation of cement from the Pacific Coast is currently the most efficient method of moving cement to Alaska. Barging accounts for over 88 percent of all cement deliveries. The remainder is carried as palletized cargo on Alaska Steamship runs from Puget Sound to the smaller ports along the route to Anchorage. Delivery of bulk cement to ports other than Anchorage occurs on a job-delivery basis associated with non-recurring government or civilian construction at various ports and off-shore islands. Normally small lot size deliveries are conducted by Alaska Steamship Line. Table 3 gives the shipments of building cement to Alaskan ports for the period 1959-1963.

Transportation costs vary according to order size and method of conveyance. Although barging is the most economical method of moving cement from the northwest to Anchorage, ice conditions in Cook Inlet prohibit deliveries from November to April. The shipper is responsible for unloading the

TABLE 3
BUILDING CEMENT SHIPMENTS TO ALASKAN PORTS
ACCORDING TO PORT AND GEOGRAPHIC DESTINATION
Fiscal Years 1959-1963
in short tons and (barrel equivalents)

	1963	1962	1961	1960	1959
Anchorage	40, 739	24, 711	42, 135	53, 379	41, 582
Seward	445	208	180	858	837
Whittier	-	-	-	-	-
Subtotal rail connecting ports	41, 184 (219, 648)	24, 919 (132, 547)	42, 315 (225, 079)	54, 236 (288, 489)	42, 419 (225, 632)
Juneau	3, 978	1, 408	3, 170	2, 360	1, 540
Ketchikan	126	1, 434	1, 508	353	885
Sitka	357	39	283	4, 891	9, 511
Kodiak	451	269	211	200	169
Nunivak-Point Barrow	108	457	827	201	262
Cordova	369	256	334	455	127
Yukon River	45	-	742	210	-
Nome	354	30	92	252	111
Subtotal significant non-rail connecting ports	5, 788 (30, 869)	3, 893 (20, 707)	167 (38, 122)	8, 922 (47, 457)	12, 605 (67, 047)
N. Side Alaska Penninsula	58	245	257	312	503
S. Side Alaska Penninsula	158	159	668	1, 056	158
Subtotal-Alaska Penninsula	216 (1, 152)	404 (2, 148)	925 (4, 921)	1, 368 (7, 276)	661 (3, 515)
All other*	2, 117 (11, 290)	4, 518 (24, 034)	4, 847 (25, 782)	4, 000 (22, 470)	882 (4, 694)
Total reported shipments to Alaska ports (barrel equivalents)	49, 305 (262, 960)	33, 734 (179, 436)	55, 254 (293, 904)	68, 752 (365, 702)	56, 567 (300, 888)
Shipment flow through Wrangell Narrows+	3, 729 (19, 880)	1, 893 (10, 069)	1, 813 (9, 643)	5, 936 (21, 574)	1, 658 (8, 819)
All Southeast Alaska imports*+	588 (3, 136)	5, 816 (30, 937)	4, 279 (22, 760)	9, 639 (51, 271)	12, 760 (67, 872)

*Metlakatla, Petersburg, Skagway, Wrangell Harbor, Valdez, Illulluk, Seldovia, Probilof, and other ports not clearly designated.
+ Gross flow north bound to other than the port of Wrangell Harbor.
*+ Juneau, Ketchikan, Metlakatla, Petersburg, Sitka, Skagway, Wrangell Harbor.
*excludes 17, 909 tons imported from foreign producers.

Source: U.S. Army Corps of Engineers, Waterborne Commerce of the United States.

cargo at the terminal point. Barges also carry palletized bags of cement. The loose cargo rates are shown in Table 4. Barge shipments utilize top-side loading to allow joint shipment of freight containers and industrial equipment. Combination loading does defray some of the overhead and operating costs of bulk shipping.

Trucks deliver cement in the Anchorage area. One factory branch does not deliver cement to customers, but has contracted for trucking from dockside storage to the buyer by an independent trucking firm. The expense of delivery may or may not be borne by the consumer. A number of retailers pick up orders at dockside. Another factory branch operates its own cement delivery trucks and absorbs the transportation costs in serving the Anchorage vicinity and other large-scale buyers. During the building season the Anchorage suppliers attempt to hold in inventory approximately 80,000 barrels of Type I cement and 20,000 barrels of Type III cement.[2] Due to the erratic and short term duration of construction activity, this large factory inventory is needed. The two week time lag between order and waterborne delivery occasionally has resulted in periods of depleted cement inventories for both major factory outlets.

Bulk cement is transported from Anchorage to interior Alaska and to oil drilling sites. Resale and shipment by rail and truck accounted for more than 167 thousand barrels of cement in 1963; or approximately 35 - 40 percent

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[2] Type I is a general, all-purpose cement. Type III is a high early-strength cement.

TABLE 4

SUMMARY OF COMPARATIVE TRANSPORTATION COSTS
BY VARIOUS CARRIERS

FMC Steamship Rates
(Loose Cargo - Puget Sound to Anchorage)

Pounds	Rates
0 - 50,000	250¢/cwt
50,000 minimum	210¢/cwt
50 - 100,000	185¢/cwt*
100,000 - and above	160¢/cwt*

*Containers or pallets loaded by shippers

ICC Steamship Rates
Seattle/Anchorage

Pounds	Rates
L. C. L.	302¢/cwt
5,000 minimum	285¢/cwt
10,000 minimum	275¢/cwt
40,000 minimum	205¢/cwt

Source: Wagner Tugboat Company; and The Alaskan Railroad in connection with Alaska Steamship, Freight Tariff 5-0, February 3, 1964.

... cement consumed in Alaska. The Alaska Railroad (see Figure 1) services Fairbanks and the remainder of the railbelt area. The quantity cement shipped by rail during the period 1958-1964 is shown in Table 5. Current charges for rail transport are given in Table 6. There is no evidence of any cement being transported by truck over the Alcan Highway from Anchorage to Fairbanks.

Trucking is used to transport cement from the Fairbanks rail terminal the consumers and retail outlets. Two major cement buyers in Fairbanks are equipped with rail sidings for carload-lot delivery. Major consumers in Fairbanks purchase by carload-lots. Truck transportation is used to fill the gap between the rail terminal and the point of use. Intermediate trucking accounted for nearly 96 thousand barrels in 1963, or approximately 20 percent of total state consumption.

Transportation patterns for cement distribution have changed little during the period of investigation. The recent introduction of special bulk trucking has allowed more efficient delivery. It has not affected the selling price to primary outlets or consumers in Alaska.

Classification of Buyer Catagories

This section of the report presents an investigation into overall sales from factory outlets. The investigation is divided along the following lines.

(1) Sales in major urban areas.

(2) Sales to primary outlets.

(3) Sales to private and public buyers in the state.

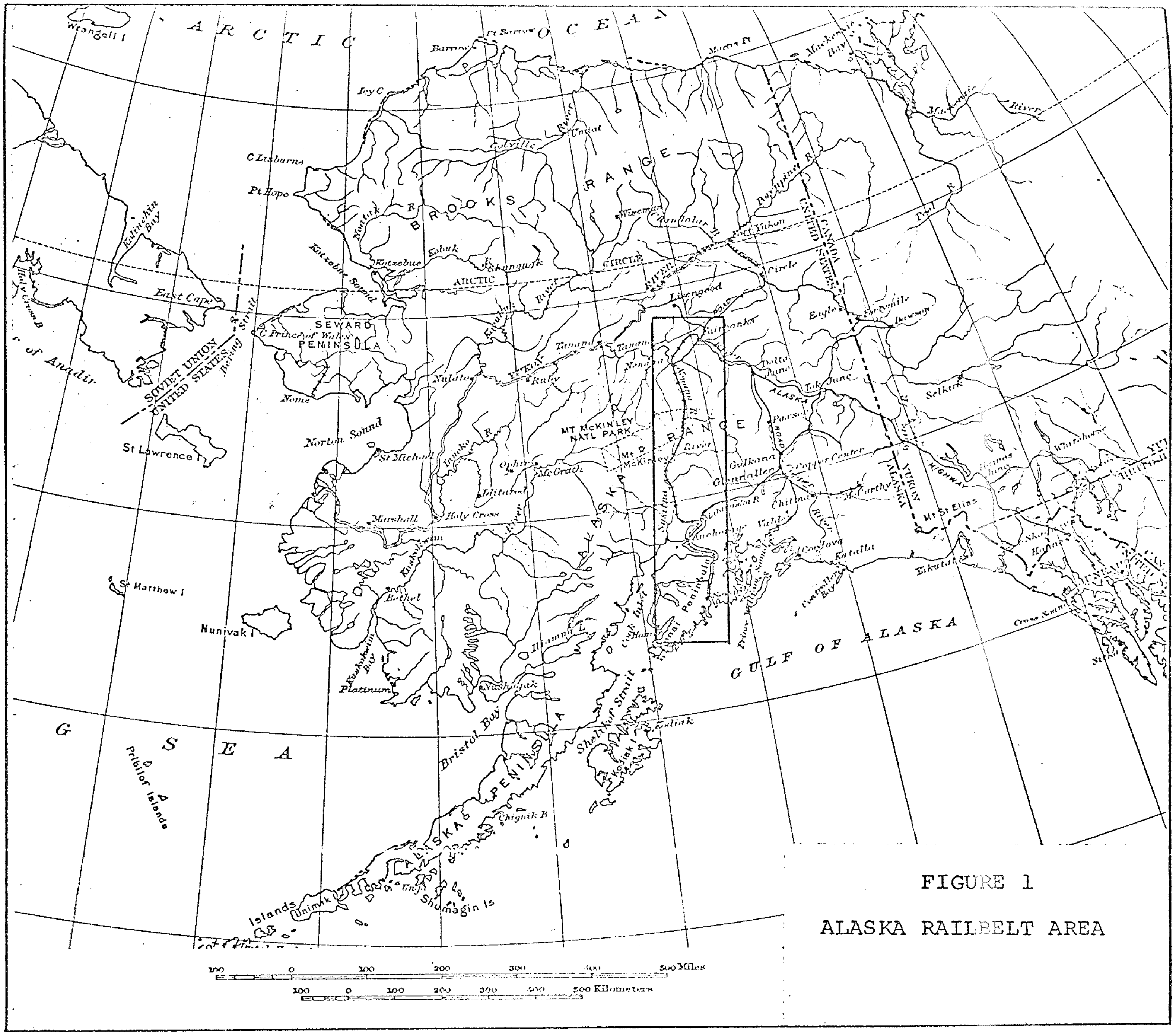

FIGURE 1

ALASKA RAILBELT AREA

Figure 1

TABLE 5

RAIL SHIPMENTS OF CEMENT IN ALASKA
1958-1963

	Fiscal Year					
	1963	1962	1961	1960	1959	1959
Number of Carloads	281	208	318	391	346	403
(Portland *	281	208	310	385	329	393
(Natural+	-	-	8	6	17	10
Number of long tons	12,052	8,735	13,184	16,972	14,617	18,028
(Barrel Equivalent)	(71,799)	(52,038)	(78,542)	(101.109)	(87,080)	(107,400)
(Portland	12,052	8,735	13,050	16,900	13,983	17,813
(Natural	-	-	134	72	634	215
Freight Revenues - Transportation Costs (in thousands of dollars)	177.4	128.5	186.3	249.6	211.0	245.3
(Portland	177.4	128.5	183.0	238.2	199.6	242.0
(Natural	-	-	3.3	11.4	11.4	3.3

*Portland Cement and related products as designated category 633 by the Alaska Railroad

+ Natural Cement as designated category 635 by the Alaska Railroad

Source: The Alaska Railroad, United States Department of the Interior, "Monthly Detail of Rail Line Revenue Freight Traffic."

TABLE 6

RAILROAD HAULING CHARGES FOR

NATURAL AND PORTLAND CEMENT
as of December 1964
Anchorage to Fairbanks

Pounds	Rate
0 to 24,000	232¢/cwt*
24,000 up	155¢/cwt*
80 - 140,000	70¢/cwt +
140,000 - beyond	65¢/cwt+

* Loose cargo

\+ In bulk

Source: Alaska Railroad Freight Tariff 16-F

The degree of overlap of the cement consuming sectors precludes construction of a detailed sales flow diagram. However, a general summary of cement sales is pictured in Figure 2.

The factory outlets in Anchorage sell cement by bulk and bag. The largest proportion of factory sales pass directly to intermediate users, such as redi-mix companies. Factory-to-retailer transactions are common and constitute an important trade channel.

Urban Areas

The Anchorage and Fairbanks urban areas together with their neighboring military installations represent 90 percent (405,000 barrels) of the entire Alaskan cement market. The remaining 10 percent is delivered to smaller ports and to sparsely settled interior cities and military outposts. The Anchorage area (including Palmer) accounts for 190-250 thousand barrels annually and is approaching even higher levels of consumption. These increases are attributable to population growth, increases in residential, business and municipal utilities, and non-military Federal and State building programs. The March 27, 1964 earthquake stimulated construction of private and public buildings.[3] The business growth of Anchorage occurred more rapidly than elsewhere because it is the major industrial and distribution center for Alaska.

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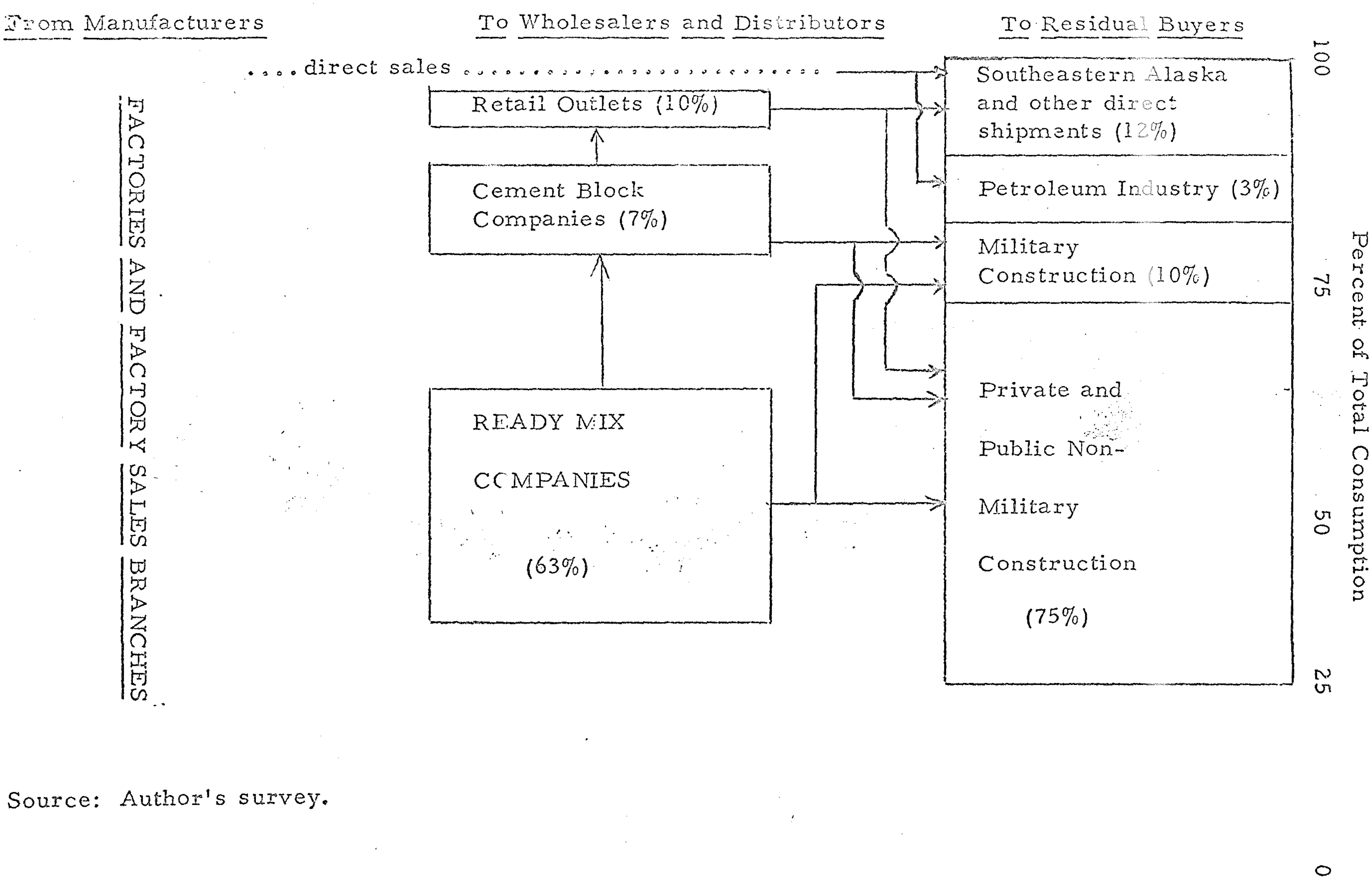
[3] See "Preliminary Evaluation of Markets for Cement - Post Earthquake Alaska," (Ivan Block and Associates, May 1, 1964).

Figure 2

DISTRIBUTION OF ALASKA CEMENT SALES BY CONSUMER SECTORS, 1965
(in percent of 450,000 barrels)



Source: Author's survey.

Surprisingly, the Fairbanks cement market has often been as large as the Anchorage market. It has reached 180 to 200 thousand barrels annually with its peak consumption occuring in 1962-63. A decline in military construction early in 1963 has been somewhat offset by increasing building construction and by federal and state road building programs.

Sales to Primary and Secondary Consumers

Anchorage has three redi-mix plants, four block-plants, and one cement pipe and septic tank company and numerous retailers of bagged cement. In direct contrast to its substantial sales importance, Fairbanks has only two redi-mix plants, one block plant and approximately 12 retailers of bagged cement. Redi-mix plants, block plants, and retailers represent separate types of non-competing cement consumers and outlets. Redi-mix plants in Alaska are capable of producing 500 thousand cubic yards of concrete. They constitute the largest segment of the cement market. In 1963 they consumed 63 percent (284 thousand barrels) of cement and produced 225,200 cubic yards of concrete.

Cement block plants purchased approximately 25,000 barrels in 1963 with block sales showing no appreciable gains over earlier years. Present block manufacturing facilities produce around 2 million concrete blocks annually. This cement product has not been as well received by Alaskan builders and homeowners as in other states. These firms will probably continue to constitute a relatively small percentage of the cement market in the future.

Bag cement is sold by factory branches to dealers such as lumber yards and hardware stores. These types of dealers do not maintain their inventory of cement during the winter. Their prices of bagged cement are higher than the prices of bagged cement sold by redi-mix and block companies. A typical dealer, such as a lumber yard or hardware store, sells between 600 and 800 sacks of cement during the building season. They sold 18 percent of the total amount of cement sold in Alaska in 1963. This sector of the market is expanding, expecially in Fairbanks.

Private and Government Sectors

The major contracting agencies who utilize cement are: the federal government (military and other federal agencies); the state government's capital improvement programs (see Table 7); and local government through municipal utilities. Business construction is not reported as a separate category of contract construction, but accounts for probably not more than five percent of total cement usage.

Accurate estimation of government cement usage is difficult.[4] However the relative importance of cement usage is reflected in Tables 8, 9, and 10. Military construction is contracted through the U.S. Army Corps of Engineers for the Army and Air Force, as are many other public works programs. (See Table 7). The Navy and Coast Guard procure cement and

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[4] The U.S. Army Corps of Engineers (Anchorage) publishes no consolidated contracts awarded series, and does not list cement usage in every contract.

TABLE 7
PROJECTED COSTS OF STATE OF ALASKA CAPITAL CONSTRUCTION PROGRAM ACCORDING TO MAJOR FUNCTIONAL CATEGORIES, 1963-69
(in thousands of dollars)

	1968-69	Percent of Total	1967-68	Percent of Total
Economic Development (Highway construction, highway maintenance, harbors, airports, campgrounds, parks and tourist roads, fish protection and propagation)	47,614.8	93.4	47,092.6	71.8
Education (State operated elementary and secondary schools, vocational schools, University of Alaska	3,204.0	6.3	8,229.0	12.5
Public Safety (State Police outposts, district headquarters buildings)	106.2	.2	106.2	.2
Heath and Welfare (Mental Health, Juvenile institution, hospitals and health facilities, Pioneers' Home)	-	-	10,174.0	15.5
General Government (Office building additions, and alterations)	30.0	.1	30.0	-
Total Construction Value	50,955.0	100	65,631.8	100

Source: Department of Economic Development and Planning, A Capital Improvement Program for the State of Alaska, Juneau, February, 1963

1966-67	Percent of Total	1965-66	Percent of Total	1964-65	Percent of Total	1963-64	Percent of Total
47,348.8	78.6	47,573.8	69.8	51,458.9	68.4	54,139.6	80.4
9,336.0	15.5	18,244.0	26.8	16,427.0	21.8	7,590.0	11.3
70.0	.1	106.2	.2	123.0	.2	70.7	.1
3,349.9	5.6	2,199.5	3.2	7,222.0	9.6	4,991.5	7.4
100.0	.2	27.5	-	-	-	530.0	.8
60,204.7	100	68,151.0	100	75,230.9	100	67,321.8	100

TABLE 8

TOTAL CONTRACT EXPENDITURES AWARDED, HEAVY CONSTRUCTION AWARDS, AND DISTRIBUTION OF CONTRACTS AWARDED BY THE ALASKA DIVISION OF THE CORPS OF ENGINEERS ACCORDING TO CONSTRUCTION SITE, 1949-1950, 1954-1955, 1957-1958 AND FY 1964+
(in thousands of dollars)

	FY 1964+*	1957-58	1954-55	1949-50
Total Contract Awards	41,545	169,127	159,143	147,173
Heavy* Construction Contract Awards	35,660	147,839	136,937	92,276
Areas of Heavy Construction				
1. Anchorage	21,788	17,904	45,122	34,921
2. Fairbanks	3,503	31,161	35,858	25,104
3. Other	11,508**	91,841	53,140	31,694

+ beginning with award dates of January 1, 1949, ending December 31, 1950 with a similar division for the next two periods after which the basic data is available again only for fiscal year 1964.

* "Heavy" construction contracts are those which by inspection of the contract file involve significant use (5 percent) of cement products. Excluded specifically are the large number of contracts for design of facilities.

+* not directly comparable to the three preceeding periods even as approximately 50 percent of a two year value because of changing format of the original reports.

** largely construction @ offshore islands

Source: Alaska Division, U. S. Army Corps of Engineers

TABLE 9
U. S. COAST GUARD AND NAVY COMBINED**
CONSTRUCTION AND GENERAL USAGE
OF CEMENT
1959-1964
(In bags)

	1959	1960	1961	1962	1963	1964
General Repair* and Maintenance	1219	1053	1093	1132	3912	+
Construction Contracts in bags	8000	8000	8000	8000	8000	53264++

** Information gathered from individual personal interviews

* Branches were combined, because each as an individual consumer was insignificant

\+ Combined total largely due to Quake and Tidal Wave Repair in 1964

++ 1964 figure largely due to loss of historical data from tidal wave

Source: United States Coast Guard (Juneau); and United States Naval (Kodiak Island).

TABLE 10
PROJECTED ALASKA PRIMARY AND SECONDARY
HIGHWAY BUILDING ACTIVITY
Fiscal Year 1963-1967

	1967-68	1966-67	1965-66	1964-65	1963-64
Total Appropriation (in thousands)	39,769	39,769	39,769	39,769	36,363
No. of Bridges	6	11	13	31	21
Miles Paving	148.3	124.4	173.1	108.6	60.9
(Primary)	98.4	81.3	94.3	86.6	52.7
(Secondary Roads)	49.9	43.1	78.8	22.0	8.2

Source: Department of Economic Development and Planning, A Capital Improvement Program for the State of Alaska 1963-1969, Juneau, February, 1963 contract independently. Table 8 shows the Navy and Coast Guard consumption to be smaller and more stable than that of the Corps of Engineers.

Non-military federal and state capital improvement expenditures and the private construction sector represent a purchasing block that accounted for approximately 200,000 barrels of cement in 1963.[5] The private construction sector is much smaller than the public sector but has been steadily expanding. The recent increase in construction allied with petroleum exploration programs within the state are particularly significant. This exploration consumed 26 thousand barrels in 1963, but should reach 100 thousand barrels or nearly 20 percent of total consumption in 1965.[6]

Pricing and Price Policies

The price of cement is approximately $7.10 per barrel in Anchorage during any particular construction season. Once declared, the annual price is quite stable. Small yearly price fluctuations occur. A uniform price during the building season tends to stabilize building costs and this gives contractors a reasonably firm basis for contract bidding.[7] The above price is f.o.b. dockside. The discount is available to all customers. It is $0.20 per barrel, net 30 days. All but the financially weak contractors and dealers use the discount.

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5 Bulk cement in actual barrels. A price of $7.85 prevailed per barrel of sack cement, reflecting bagging and handling cost.

6 "The Petroleum Industry in Alaska," Alaska Monthly Review of Business and Economic Conditions, August, 1964.

7 All price estimates are derived from interviews with prime contractors and redi-mix companies, and examination of overall construction expenditures (Appendix A).

factory branches generally avoid selling to dealers previously supplied by their own larger customers. This enables the larger outlets to function as wholesalers to the smaller retail outlets.

Price competition between redi-mix companies is limited. This situation results in a policy of one selling price for business construction and household purchasers, and quantity discounts are nonexistent. It is interesting to note that the "retail" price per yard of concrete did not vary for a one yard order as opposed to a three-truckload order in the urban areas examined. Prices ranged from $30.00 to $32.50 per yard in Fairbanks and from $26.50 to $28.00 per yard in Anchorage. One price prevails for redi-mix concrete in all urban areas and is modified to f.o.b. plant for rural deliveries. Occasionally portable dry batch plants are established at rural construction sites.

Block producers and ready mix companies sell sack cement and extend credit to individual small builders, but normally have not delivered the product. Retailer sack prices varied substantially among types of stores in various localities and by season.

Nature of Competition

Although different types of cement are available for special purposes, Portland cement is basically a homogeneous product. This fact directly affects the nature of competition between major sources of supply. The pricing and credit policies of the major factory branches seem practically tical. Competition is most apparent in the area of services rendered chasers. This partially explains how a new factory branch, utilizing al bulk trucking facilities, was able to capture many large customers its entrance into the Anchorage market in 1961.

Redi-mix companies differ slightly in pricing policies but, similar the factory branches, competition is most obvious in the services rendered to the consumers. Services are particularly important to contractors re precision timing of deliveries is necessary, and scheduling errors costly.

The growing importanoe of a few large-order customers, such as il exploration and redi-mix companies, has certain competitive implications. Bulk delivery of cement will continue to be an important service to se large scale buyers. Cement used by oil exploration companies requires ependable blending of additives. Proper additives are a requirement of the technical specifications of drilling operations. As the need for this special type cement increases, suppliers must adjust to conform to these needs.

Outlook

The 450 thousand barrels of cement consumed in Alaska in 1963 is higher than any year since 1955. Military construction, while still important is decreasing whereas non-military government construction is increasing. A review of annual sales of cement in Alaska, 1950-1964 and 1959-1964, does not reveal a consistent pattern of increases. The influence of military construction activity on regional economic growth is gradually decreasing

...ularly in urban areas. Private residential and business construction ...n significantly dependent upon government employment. New industries ...not materially affected this situation until the recent Cook Inlet oil dis-...eries.

...Earthquake Reconstruction

During 1964, the largest proportion of the Corps of Engineers earth-...related contracts involved primarily demolition and design for new ...struction. Business re-construction has been prompt. Overall re-...struction will cause a temporary increase in cement sales and will help ... total annual cement consumption to the 550-600 thousand barrel level ...ring 1965-1966.

...jection of Cement Consumption

The present pace of employment, business, and industrial growth in ...aska should increase the annual consumption level from 450 thousand bar-...els in 1963 to 550-600 thousand barrels by the late 1960's. This projection ... based on the assumptions that federal and state construction expenditures ...ill continue and military construction expenditures likely will decline; and ...at private business and household consumption of cement will increase ...owly but consistently.

...mmary and Conclusions

Following World War II and the Korean War, curtailment of military ...xpenditures in Alaska led to readjustments in the economy. Total cement

...mption in Alaska declined through the mid-1950's. Other areas of ...nt consumption have emerged such as non-military public construc... ...nd petroleum exploration, which will support an annual consumption ...of approximately 600 thousand barrels within the next five years. Post ...quake reconstruction is increasing cement consumption faster than ...d have been normally anticipated. Oil exploration operations are in... ...sing in importance and are expected to become major consumers of ...ment. A series of major oil discoveries could greatly change the charac... ...of cement marketing in Alaska and easily raise total annual consumption ...the 750-800 thousand barrels level.

The entire cement production system in Alaska is characterized by ...rge capital requirements and an extensive distribution system. This ...kes entry by a new firm extremely difficult. Major suppliers are con... ...cted to major national cement companies. Any new cement distribution ...m in Alaska would be seriously handicapped. Acquisition of a large por... ...n of annual cement sales in the State would require substantial investment ...marketing facilities such as wharfs, silos, blending and transportation ...ipment, etc. and a sales organization. Sufficient working capital would ...ve to be available for the inventory and credit extension policies charac... ...eristic of the industry in Alaska. Consideration of the existing Seattle and ...edwood City f. o. b. mill prices of bulk cement and the current estimates ...of ocean freight costs suggests that the present factory sales branches could ...nd would meet any price established by an Alaskan producer.

IV

ANALYSIS OF MANUFACTURING

Purpose and Methodology

The purposes of Part IV are to:

(1) Determine approximate cement manufacturing costs for a hypothetical plant using assumed locations of plant and raw materials. These locations were selected to conform closely to the specifications of a cement plant recently proposed for construction.[7]

(2) Determine any factors not presently apparent which should be thoroughly investigated before serious consideration is given to the construction of a cement plant.

The analysis is presented in four sections:

(1) Raw material availability and supply

(2) Transportation requirements

(3) Manufacturing process

(4) Preliminary cost analysis

The raw materials section includes description of the assumed deposit characteristics, specification of the type of exploratory program required, preliminary design analysis of the requisite quarrying operation, and determination of mining costs.

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[7]All previous engineering reports and data referred to throughout this section are those of Moore Enterprises, Dallas, Texas. These were previously completed for private interests and made available for use in this study.

The transportation and manufacturing sections contain analysis summarization of previously recommended procedures, processes, designs. Critical factors are recognized which could adversely affect design, and which should be more thoroughly investigated before a final feasibility determination is made.

The cost section utilizes those costs deemed accurate and revised costs when necessary to arrive at a preliminary manufacturing cost and cash flow pattern.

Plant and Raw Material Locations

Plant location. The location of the manufacturing plant was assumed to be on the western side of Cook Inlet north of Tyonek, in the general vicinity of known gas and coal fields. Such fields could conceivably serve as fuel sources for the manufacturing process.

Raw materials. Multiple sources of supply have been assumed for the raw materials required in cement manufacturing. Sources of supply were established for limestone at Iliamna Bay (approximately 120 miles south of the plant site in Cook Inlet) and for sand in the immediate plant area. Both deposits would be company owned and operated. Gypsum and iron ore would be purchased from stateside suppliers.

Chemical analyses of the proposed raw materials are given in Table 2. The percentage raw mix composition for ASTM cement Types I, II, and III using these materials is given in Table 12, and the chemical analysis of the raw mix, cement clinker, and cement in Table 13.

TABLE 11

CHEMICAL ANALYSES OF RAW MATERIALS*

	Ursus Cove Limestone #2	Iliamna Bay Limestone #5A	Limestone Blend 3% Limestone #2 97% Limestone #5A	Tyonek Sand #9	West Coast U.S. Iron Ore
SiO_2	25.16	0.90	1.62	70.06	14.38
Al_2O_3	0.99	0.30	0.32	15.01	7.31
Fe_2O_3	0.63	0.32	0.33	3.93	65.83
CaO	40.91	55.15	54.73	1.77	4.00
MgO	0.70	0.67	0.67	1.43	0.37
K_2O	0.04	0.04	0.04	1.02	0.18
Na_2O	0.27	0.07	0.08	2.80	0.63
SO_3	0.27	0.06	0.07	0.08	0.08
Loss	31.42	42.40	42.07	3.74	7.36
TOTAL	100.39	99.91	99.93	99.84	100.14
Ratio	15.53	1.45	2.49	3.70	0.20
		Total Alkalies as $Na_2)$	0.11	3.47	0.75

*Analyses supplied by Moore Enterprises, Dallas, Texas

TABLE 12

PERCENTAGE RAW MIX COMPOSITION*

	ASTM Type I	ASTM Type I & II	ASTM Type III
Limestone Blend	78.74	78.29	79.06
Tyonek Sand #9	19.54	19.88	19.57
West Coast Iron Ore	1.72	1.83	1.37

*Supplied by Moore Enterprises, Dallas, Texas.

TABLE 13

CHEMICAL ANALYSIS OF RAW MIX,

CLINKER, AND CEMENT*

	Raw Mix		
	ASTM Type I	ASTM Type I & II	ASTM Type III
SiO_2	15.21	15.46	15.19
Al_2O_3	3.31	3.37	3.29
Fe_2O_3	2.16	2.24	1.93
CaO	43.51	43.28	43.67
MgO	0.81	0.82	0.81
K_2O	0.23	0.24	0.23
Na_2O	0.62	0.63	0.62
SO_3	0.07	0.07	0.07
Loss	33.98	33.82	34.09
Total	99.90	99.93	99.90
Total Alkali as Na_2O	0.77	0.79	0.70
Silica Ratio	2.78	2.76	2.91

	Clinker		
	ASTM Type I	ASTM Type I & II	ASTM Type III
SiO_2	23.23	23.54	23.23
Al_2O_3	5.05	5.13	5.03
Fe_2O_3	3.30	3.42	2.96
CaO	66.43	65.91	66.79
MgO	1.24	1.24	1.25
K_2O	0.12	0.12	0.12
Na_2O	0.63		
SO_3	0.00	0.00	0.00
Loss	0.00	0.00	0.00
Total	100.00	99.99	100.01

Table 13 (continued)

Total Alkali as Na_2O	0.71	0.71	0.71
Silica Ratio	2.78	2.75	2.91
Molecular Ratio	2.59	2.54	2.62
C_3S	55.2	50.0	57.3
C_2S	25.0	30.0	24.5
C_3A	7.8	7.8	8.3
C_4AF	10.0	10.4	9.0

	Cement		
	ASTM Type I	ASTM Type I & II	ASTM Type III
SiO_2	22.30	22.60	22.30
Al_2O_3	4.85	4.92	4.83
Fe_2O_3	3.17	3.28	2.84
CaO	65.08	64.58	65.42
MgO	1.19	1.19	1.20
K_2O	0.11	0.11	0.11
Na_2O	0.60	0.61	0.60
SO_3	1.86	1.86	1.86
Loss	0.84	0.84	0.84
Total	100.00	99.99	100.00
Total Alkali as Na_2O	0.67	0.68	0.67
Silica Ratio	2.78	2.76	2.91
Molecular Ratio	2.65	2.59	2.67
C_3S	53.0	48.0	55.0
C_2S	24.0	28.7	22.5
C_3A	7.5	7.5	8.0
C_4AF	9.6	10.0	8.6

*Supplied by Moore Enterprises, Dallas, Texas.

The cost of limestone at the plant site has been estimated to be $2.71 per ton and that of sand to be $1.00 per ton. Iron ore is priced at $15.00 per ton and gypsum at $20.00 per ton in accordance with previous estimates.

Limestone

Field Investigation. Samples of limestone for analytical purposes were taken at Iliamna Bay and Ursus Core (Figure 3). Cursory examinations were made of other deposits in the general region. Limestone float was identified at Tuxedni Bay (Figure 7 and Plate 3), but the source deposit was not located. Other nearby occurrences which could serve as alternative sources of supply are shown in Figure 4. Figures 5 and 6 illustrate the geology of the cliff sections at Ursus Cove and Iliamna Bay and show the sample locations. The general topography of these areas is shown in Plates 1 and 2. Chemical analyses of these samples are given in Table 14. Since only sample 1 form Ursus Cove and samples 5 and 6 from Iliamna Bay are suitable cement raw materials, Iliamna Bay was chosen as the hypothetical source for limestone. It is assumed that a limestone blend as given in Table 11 could be obtained from this deposit.

Reserves. Required reserves for a 25 year life would be 3.4 million tons. With a deposit thickness of 100 feet this would require only 2.86 acres. Indications are that this quantity is certainly available at Iliamna Bay.

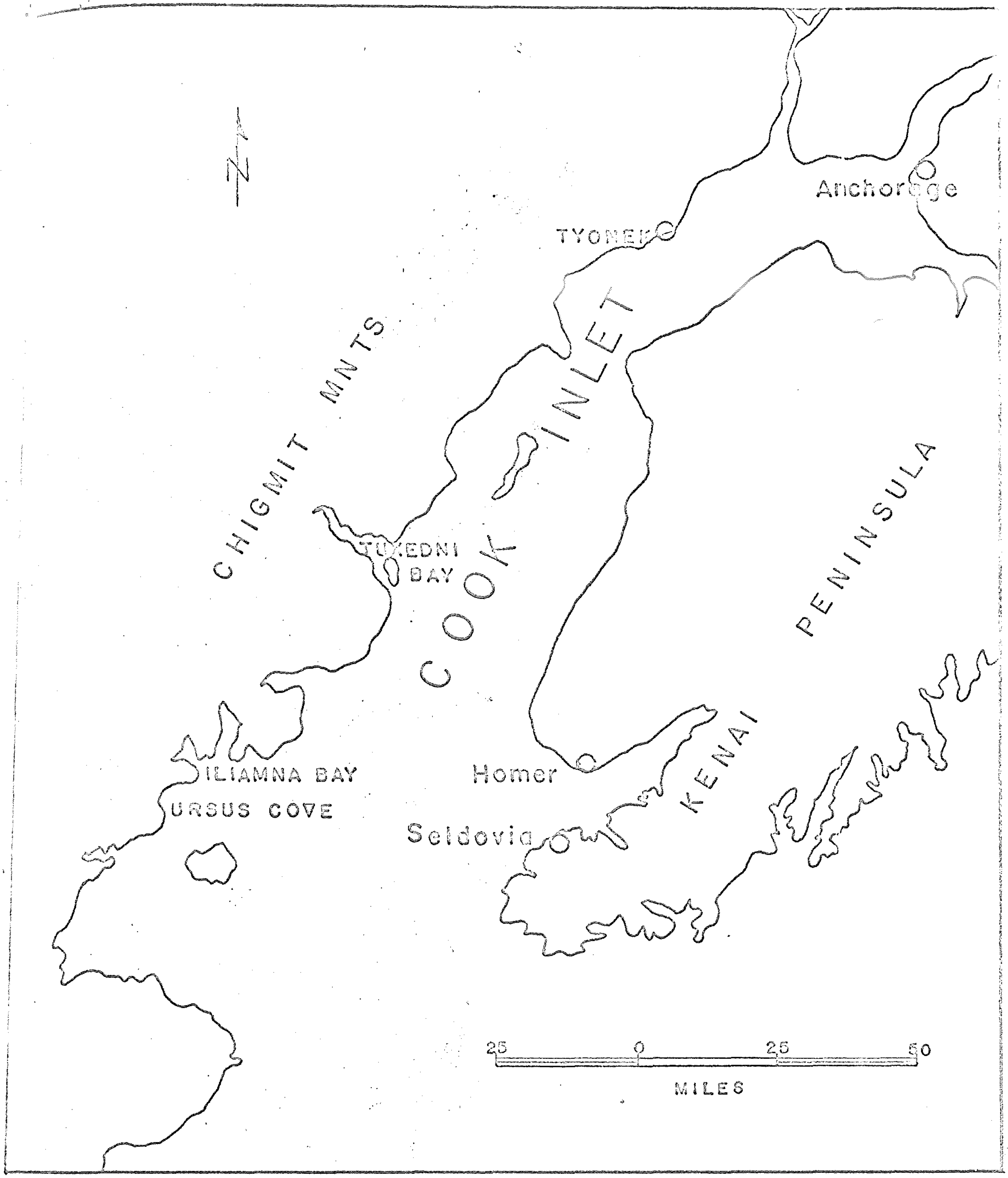

FIGURE 3
Index Map of Cook Inlet Showing Location of Raw Materials and Plant Sites.

Kamishak Formation

.. to dark-gray and black limestone, dark-gray to black cal-
..reous shale, and black, green, and white chert. Limestone
locally altered to white pyritiferous marble, and chert to
greenish-gray metachert near contact with pluton; some mineral-
ized rock present near contact with intrusive. Rocks locally
fossiliferous containing an Upper Triassic fauna; echinoid-
and coral-reef limestone present at Bruin Bay.
.. Cove; mainly dark-gray to black calcareous shale with
interbeds of black limestone and chert.
..in Bay; black, green, and white chert thin-bedded and highly
folded at entrance to bay; dark-gray limestone at southeast
end of bay, and black shale and limestone on north side.
..chonak Bay; highly folded green and white chert

Slate and limestone

..rk-gray to black calcareous rock with slaty cleav-
age parallel to original bedding; contains elon-
gated limestone concretions and a few beds of dark-
gray to white crystalline limestone. Rocks con-
fined to a small area between the heads of Cotton-
wood and Iliamna Bays

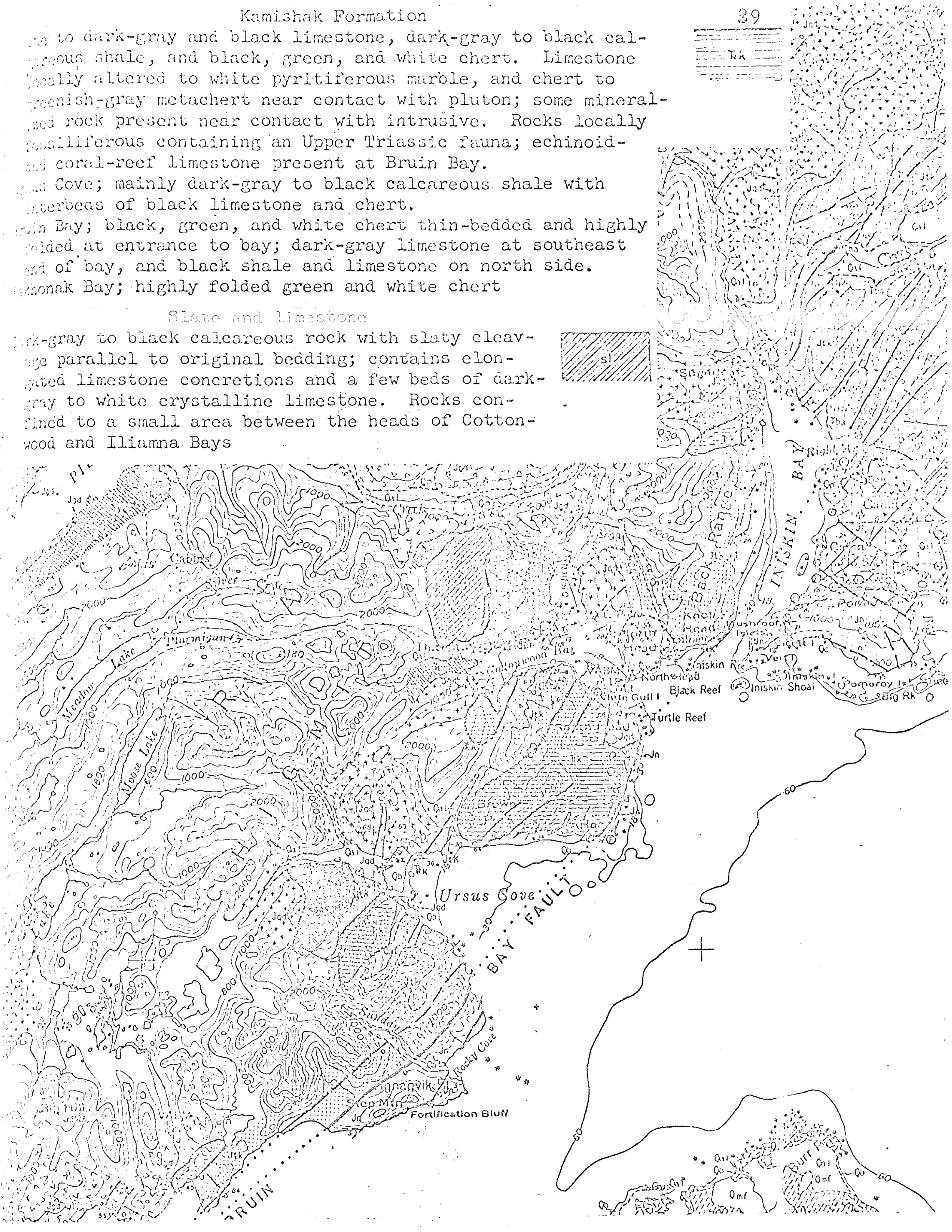

FIGURE 4

Geologic Map of Iliamna Bay Area Showing Known Limestone Bearing Formations (from U. S. Geological Survey 1964 Map 1-407).

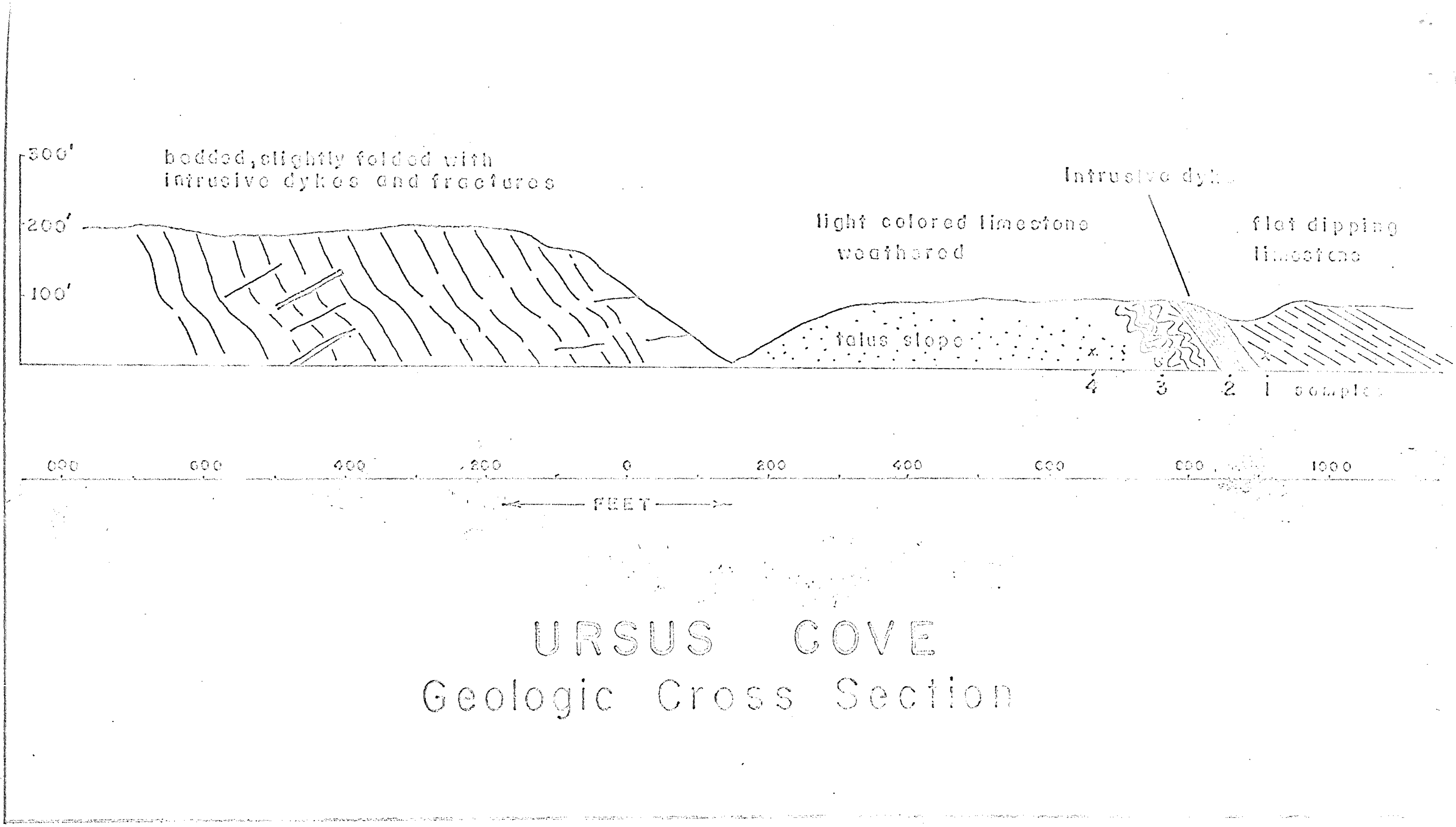

FIGURE 5
Geologic Cross Section of Cliffs at Ursus Cove.

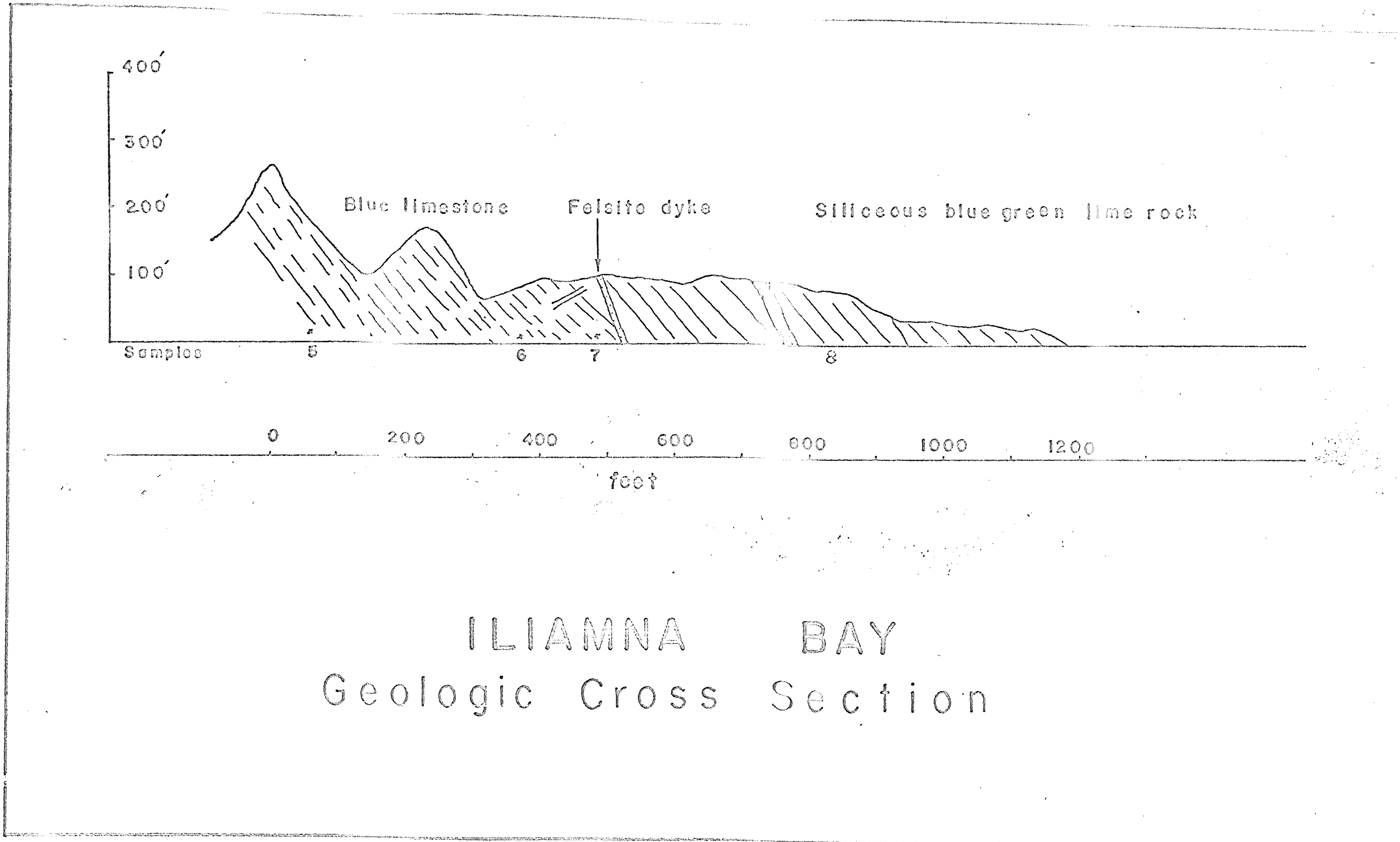

FIGURE 6
Geologic Cross Section of Cliffs at Iliamna Bay.

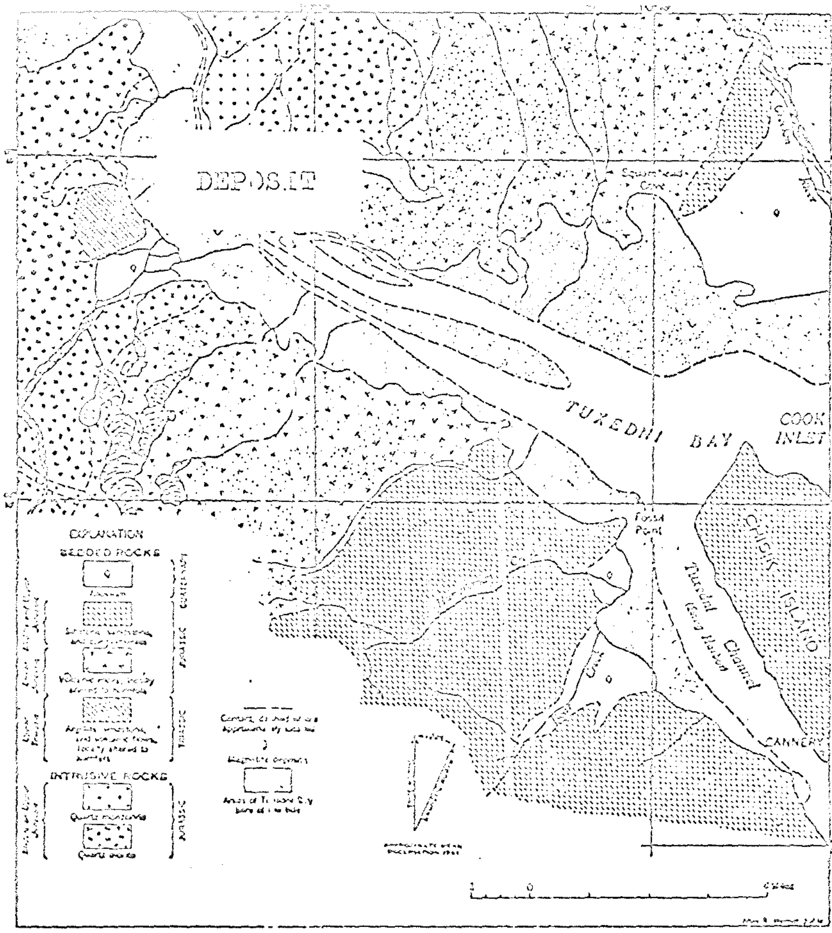

FIGURE 7

Geological Map of Tuxedni Bay area showing limestone formation.

TABLE 14

CHEMICAL ANALYSES OF LIMESTONE SAMPLES+

(Ursus Cove and Iliamna Bay)

Sample	1	2	3	4	5	6	7	8
SiO_2	18.24	49.76	32.60	42.72	11.45	11.37	70.32	58.72
Fe_2O_3	.44	5.71	4.14	5.11	.82	.54	1.46	2.25
Al_2O_3	.33	21.57	9.66	16.41	.57	4.33	13.62	16.75
CaO	44.99	10.17	28.24	13.69	47.95	45.15	3.89	7.43
Na_2O	0.00	2.30	1.42	1.08	.04	.46	6.30	4.00
K_2O	0.00	1.65	.58	1.50	.02	1.40	1.76	.44
MgO	.84	3.45	3.67	9.43	2.97	.99	.24	5.94
Loss	35.67	5.10	20.02	10.36	37.65	37.65	2.40	5.10
$CaCO_3$	79.7	8.60	46.5	22.0	84.4	80.2	6.8	5.3

+ Samples 1 - 4 from Ursus Cove; 5 - 8 from Iliamna Bay. See Figures 5 and 6 for locations.

Analyses by Commercial Laboratories, Denver, Colorado.

Exploration. Exploratory work to completely evaluate the deposit is necessary, particularly with regard to the quality of the limestone and the extent of the deleterious inclusions. The pattern of drilling required would be indicated from further field geological examination. Depending on initial results, between 500 and 2000 feet of drilling could be required at a cost of $15.00 per foot.

Development and mining. The proposed development plan for the Iliamna Bay quarry is given in Figure 8. The main considerations in the development of the deposit are selection of the quarry site, and the location of storage and loading facilities. The topography of the area demands a careful balance between the grade of material required, operating costs, and capital expenditures for plant and site development. The steep cliffs, rugged hinterland, and flat beach are all unfavorable though not obviating conditions for the operation. Felsite inclusions in the deposits could necessitate selective mining in part but this would not be a major consideration.

The mining operation proposed is simple and conventional. Track mounted wagon drills would be used to break rock in an open face quarry. The broken rock would be loaded on dump trucks by a shovel loader and transported to a primary crusher at the dock site. The crushed rock would be discharged to a conveyor for stockpiling. By utilization of a reclaim tunnel it would be conveyed to the barge loading facility on the dock.

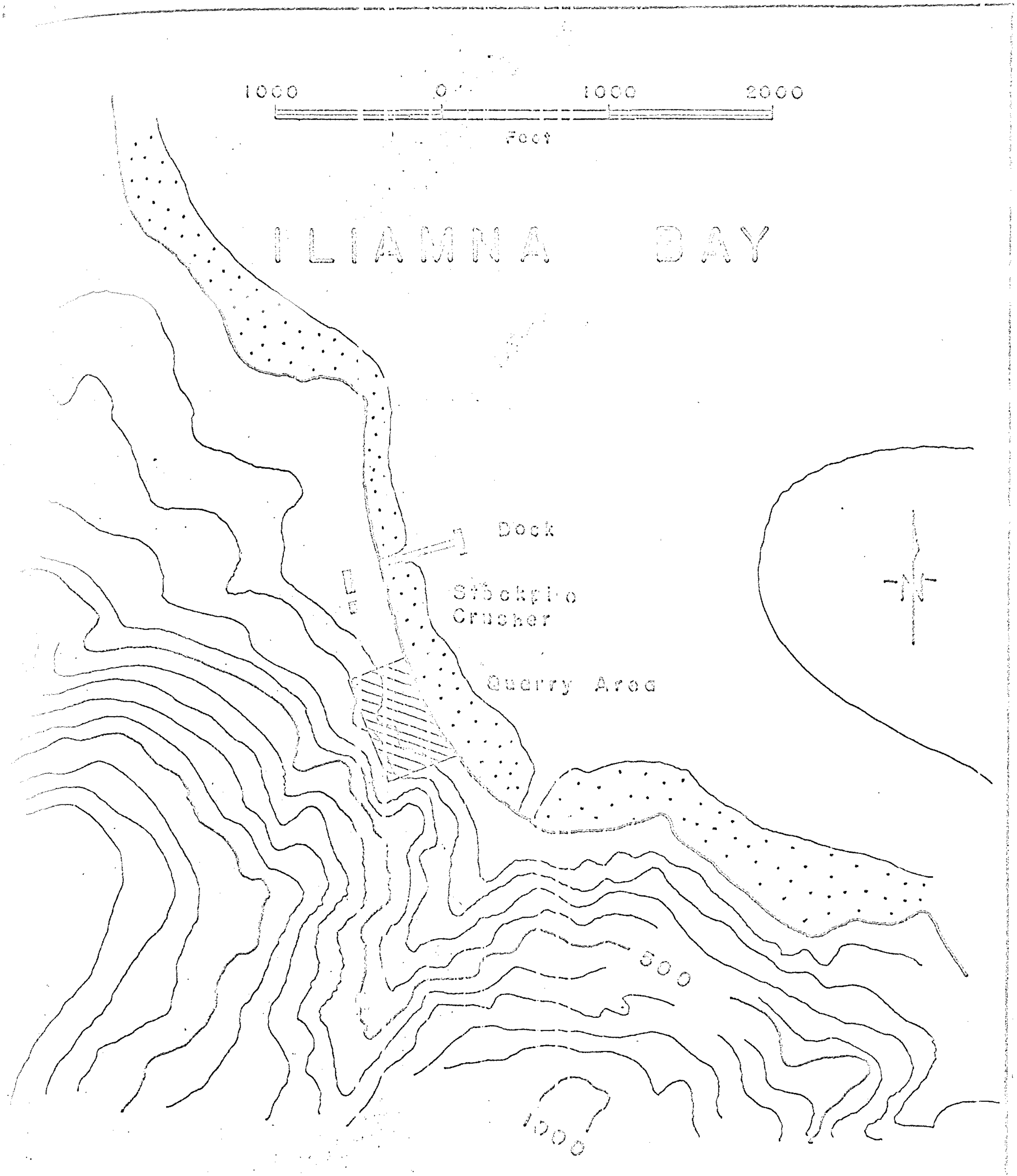

FIGURE 8
Iliamna Bay Quarry and Loading Facilities Showing Proposed Development.

Design and cost analysis. A mining cost analysis is given in detail (Exhibits 1, 2, 3 and 4). Allowance has been made in the estimate of capital expenditures for development and site preparation. The major item which makes the operation exceptional is the requirement of dock facilities capable of withstanding the rigorous ice conditions encountered in this area during the winter. Costs have been calculated using current local information, and in more detail than is normally required for preliminary planning. The determined cost of $2.05 per ton f. o. b. Iliamna, agrees closely with original estimates using stateside costs with appropriate adjustment for the given locality.

EXHIBIT 1

CAPITAL REQUIREMENTS

(Iliamna Limestone Operation)

	Cost
Capital equipment*	$ 566,500
Property acquisition**	20,000
Initial exploration and development+	50,000
Working capital	50,000
1 months' payables	
Inventories	
Explosives & supplies	
Spare parts	
Miscellaneous	
Pre-operating overhead during exploration and development periods++	15,000
TOTAL	$ 701,500

* See Capital Equipment Cost Estimate
**Arbitrary allowance
\+ Site preparation, foundations, exploratory drilling, etc.
++ $5,000 per month for 3 months

EXHIBIT 2

CAPITAL EQUIPMENT COST ESTIMATE*

(Iliamna Limestone operation)

Mining rate 20,000 - 25,000 tons/month

	Cost
Quarry	
2 Jaeger J D 4 B rock drills	$ 40,000
1 900 cfm rotary compressor	30,000
1 -1 1/2 yd. loader, rubber tired	22,000
2 - 6 yd. dump trucks	16,000
1 Bulldozer, D-6 type	30,000
Crusher	
1 Crusher 160T/hr. minus 6"	23,000
1 Drive & power unit	11,000
1 Feeder & hopper	12,000
Stockpiling and Loading	
1 Conveyor and auxiliaries, 1500 ft.**	22,500
1 Generator, 65 kw	9,000
1 Dock+	300,000
Maintenance and Office	
Maintenance shop, power house change room, office and store, magazine, bunkhouse. Total 2,550 sq. ft.++	51,000
TOTAL	$ 566,500

*From Yukon Equipment Inc. except where specified.
** At $15.00 per ft. inclusive.
+ From H. R. Peyton, Associate Professor of Geophysics and Civil Engineering, University of Alaska.
++ At $20.00 per sq. ft.

EXHIBIT 3

LABOR REQUIREMENTS

(Iliamna Limestone Operation)

Catagory	Number	Hourly rate*
Mining		
Drill operators	2	$5.73
Equipment operators	2	5.27
Dump truck operators	2	4.89
Primary Crushing		
Operator	1	5.37
Stockpiling and Loading		
General labor	1	5.00
Maintenance and Office		
Mechanics, heavy*+	1	5.37
Mechanics, heavy, helper	1	4.74
Office and stores clerk**	1	4.82
Superintendent**	1	6.00
TOTAL LABOR+	12	

* From U.S. Department of Labor Wage Determinations AC-25702, South Alaska, April 1964, July 1st increase of 3% not included. Wage scales exclude construction workers and reflect current mine workers earnings.

** On 12 month's basis.

\+ Does not include bunkhouse staff. Catering to be on a contract basis.

*+ Heavy mechanic may be brought in from main plant but savings per ton would be insignificant.

EXHIBIT 4

OPERATING COSTS

(Iliamna Limestone Operation)

6 months/year

22,524 T/month

	Labor	Supplies & Equipment*	Total	Cost/Ton
Mining	5,772	10,140	15,912	.71
Crushing	944	2,300	3,244	.14
Stockpiling & Loading	880	17,160	18,040	.80
Maintenance & Office	5,580	1,530	7,110	.31
	13,176	31,130	44,306	
Payroll taxes and fringe benefits**			1,980	.09
			46,286	

Total cost of coarse crushed limestone, F.O.B. Iliamna Bay. $2.05/Ton

*Equipment costs calculated as percentage of capital cost. From Contractors' Equipment Ownership Expense, 5th edition, 1962. Covers depreciation, overhead, major repairs, painting, interest, taxes, insurance, storage.

** 15% of labor. Mining industry standard.

+ Depletion allowances are not considered in this section.

Sand. Since the availability of sand was not considered a critical factor, selected deposits were not visited. Representative data (Table 11) was utilized from previous engineering reports.

Iron ore. The source of supply and cost data in previous reports have been accepted as reasonable. These specify a West Coast iron ore at a delivered cost of $15.00 per ton.

Gypsum. The source of supply and cost data in previous reports have been accepted as reasonable. These indicate a state-side source at a delivered cost of $20.00 per ton.

Transportation

Scope. Transportation methods and operating schedules required to move limestone from the Iliamna Bay area to the hypothetical plant location and cement from the plant site to Anchorage have been examined. A limited amount of original design has been incorporated with applicable portions of previous cost studies to arrive at the cost for materials movement.

Equipment and operating methods. The following summary is subject to the qualifications given at the end of the section. Two 1,000 ton deck barges are required to transport limestone from Iliamna Bay to the plant site. An 8,000 barrel self-unloading cement barge is required to transport cement from the plant to a distribution station at Anchorage. The movement of limestone and cement has been scheduled so that both operations can use a single tugboat.

The necessary operating schedule follows:

(1) Round-trip, plant to Iliamna Bay (limestone)

Loading time, 2 barges @ 200 tph.	10 hrs.
Towing time, 230 miles @ 5 mph.	46 hrs.
Total	56 hrs.

(2) Round-trip, plant to Anchorage (cement)

(Tug picks up cement barge and proceeds to Anchorage while limestone barges are unloaded).

Towing time, 100 miles @ 5 mph.	20 hrs.
Unloading time.	8 hrs.
Total	28 hrs.

(3) Total time for complete cycle. . . . . 84 hrs.

(4) Required round trips per year at 7 days per week, 24 hours per day, 36 weeks per year. . . . . 72 round trips.

This scheduling allows maximum delivery of 144,000 tons of limestone and 576,000 barrels of cement per year. Both capacities exceed expected requirements.

<u>Dock facilities.</u> The proposed design requires the following dock facilities:

Plant site:

Unloading dock -
Dock access 180 feet long and 10 feet wide; dock area 70 feet long and 20 feet wide; to support raw material belt conveyor over the total access length and to support and maintain a stiff-leg derrick, storage hopper and vibrating feeder on the dock area. No material specifications given.

Loading dock -
Dock access 180 feet long and 10 feet wide; dock area 140 feet long and 20 feet wide; to carry a cement transport line over the total access length, and support an 8 foot square control building, alleviator and tank, dust collector and auxiliary equipment on the dock area. No material specifications given.

Anchorage:

Unloading dock -

Dock access 90 feet long and 10 feet wide; dock area 40 feet long and 20 feet wide; to carry a pneumatic transport line over the total access length. No material specifications given.

Iliamna Bay:

Loading dock -

Dock access 135 feet long and 10 feet wide; dock area 120 feet long and 20 feet wide; to support covered belt conveyor over the entire access length. No material specifications given.

Transportation costs. Exhibit 5 presents the barge transportation cost summary.

Design qualifications. Although the proposed transportation system is sufficiently detailed to indicate general feasibility, the following factors should be noted which would likely affect its implementation.

(1) The tug and barges could not operate in Cook Inlet above the Tyonek area for at least a 60 day period each year because of ice conditions. An idle period of up to 120 days could result from a decision not to operate in marginal situations. Therefore, combined haulage schedules for both limestone and cement, utilizing the same tug and requiring 36 weeks of haulage per year, would probably not be realistic.

(2) Tug and barge operations in upper Cook Inlet are limited by tidal action and current speed and are not a function of tug speed alone.

EXHIBIT 5

BARGE TRANSPORTATION COST SUMMARY

Tugboat Operating Costs	Cost/Towing Hour
1. Fuel, oil and greases.	$10.00
2. Labor (not including payroll taxes & insurance) (approximate 7 man crew). . . .	15.00
3. Miscellaneous supplies, food, etc . . .	2.00
4. Repairs, maintenance, painting, etc. .	1.50
Total Cost/Towing Hour	$28.50

Towing Cost Per Barrel of Production	
1. 72 round-trips/year @ 66 towing hrs/round trip and $28.50/towing hour.	$ 135,432
2. Cost per barrel @ 500,000 bbl/year . . .	0.27/bbl

(3) Arrivals at Anchorage usually coincide with high water slack (riding up the inlet with the benefit of flood tide). Departures usually take advantage of ebb tide.

(4) Combined scheduling of limestone and cement transportation will unbalance the quarry operations by extending the shipping interval several weeks beyond the quarry operating period.

Manufacturing Process

Scope. The purpose of this section is to determine the approximate cost of cement manufacture under the assumed conditions of raw material source and plant location for a 500,000 barrel capacity plant. Such determination consists chiefly of analysis and verification of design specifications of previously proposed plants.

Process description and analysis. The plant design capacity would be 1500 barrels per day and 500,000 barrels per year, at 91 percent availability. A "dry process" plant incorporating the basic steps of raw material preparation, clinker burning, finish grinding, and shipment preparation has been assumed. Use of the dry rather than the wet process is justified by the lower heat requirements of the former, and the use of air blending of dry raw materials to overcome the higher quality control advantages of the wet process. Although individual plants and processes vary in equipment and operating detail, the recommended equipment and plant procedures meet standard specifications.

Design analysis. The design analysis summarized below is wholly that of previous cement plant proposers with only slight modifications.

(1) Raw Material Requirements

Limestone	2545 tons/wk
Sand	651 tons/wk
Iron.	59 tons/wk
Gypsum	84 tons/wk

(2) Limestone Quarry Operating Requirements

Six months per year, single shift, 5 day/week basis - 128 tons/hr.

(3) Limestone and Sand Hauling

(a) Limestone (120,000 tons required per year): Two 1000 ton barges, 72 round trips/year 56 hours/round trip 144,000 tons/year (if also hauling finished cement to Anchorage the required operating time would increase from 24 weeks/year to 36 weeks/year).

(b) Sand (31,000 tons required per year): 6 - ton capacity truck, .25 hours/trip, single shift operation, 960 tons/week, 35 1/4 weeks/year. -- 33,852 tons/year

(c) Fuel requirements for sand drying 35 tons/hour wet sand containing 20% moisture, 1,000,000 BTU/MCF of gas, 40 hours/week -- 108 MCF/week.

(4) Storage Requirements

(Assume 2280 ft/ft of pile; 60 ft. for slopes)

(a) Limestone
4 weeks supply - 149 ft of pile - 10,180 tons

(b) Sand
4 weeks storage - 83 ft of pile - 2,604 tons

(c) Clinker
4.3 weeks storage - 145 ft of pile - 8,640 tons

(d) Gypsum
14.3 weeks supply - bin storage - 1,200 tons

(e) Iron Ore
15.3 weeks supply - 70 ft of pile - 1,000 tons

(5) Raw Grinding

(a) Same mill used for grinding of raw materials and for grinding of cement clinker. Operated in closed circuit with air separator - all equipment sized to 50 tons/hour raw feet - power requirements of 25 H.P. - hours/ton-operated 10 hours/day, 7 days/week.

(b) Hot air furnace fuel consumption sized to dry raw materials of 7% moisture content - at requirement of 2,000 BTU/lb. water and gas of 1,000,000 BTU/MCF -- 980 MCF/week.

(6) Kiln Feed Blending

Blending capacity 3200 barrels, storage capacity 10,200 barrels giving maximum capacity 13,400 barrels . . . . 8.9 days

(7) Clinker Burning

(a) Kiln feed
Required capacity 19.3 tons/hour - equipment capacity 25 tons/hour.

(b) Clinker production
Required output 12 tons/hour - equipment capacity 25 tons/hour.

(c) Kiln fuel consumption
900,000 BTU/bbl at 1,000,000 BTU/MCF . . . . 9450 MCF/week.

(8) Finish Grinding

(a) Mill operated in closed circuit with air separator 10 hours/day . . . . 150 bbl/hour

(9) Cement Storage and Shipping

(a) Storage
48,000 bbl at plant, 24,000 bbl at distribution station . . . . 48 production days supply.

(b) Bagging at distribution station
30% sold in bags, 20 bags/min. . . 10.5 hours/week
(c) Bulk loading at distribution station
70% sold in bulk, 400 bbls/hour . . 18.5 hours/week

The projected power consumption of 22 kw - hr/bbl and fuel requirement of 1,000,000 BTU/bbl parallel the national averages of 18-20 kw-hr/bbl and 900,000 BTU/bbl respectively.[8]

Cost Analysis

The cost projections shown rest on the following assumptions:

(1) The operating schedule, plant capacity, manufacturing operations, distribution station requirements, and the costs of administration, insurance, and water contained in the previous reports are accepted as being reasonably accurate.

(2) The cost of quarried raw materials has been increased in the light of current wage rates published and in effect in the general area, and the preliminary design of mining procedures representative of those required to excavate the pertinent raw materials.

(3) The hourly labor rates used in the original calculation of plant operating costs are not representative of the current Alaskan rate structure. Consequently, these rates have been increased by a factor of 1.65. This factor is based on current geographical cost variations and average unit prices reported in the technical literature[9], and on comparison of the rates used in the original report with those in effect for the first 8 months of 1964 in the southern Alaska area supplied by the Department of Commerce.

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[8] See "Cement Plants of the Sixties", Rock Products, May, 1964.

[9] Civil Engineering, (August, 1964), pp. 75-77.

(4) The cost of barge and tugboat operations has been revised since the raw material deposits identified as sources of primary raw materials are different than those originally analyzed.

(5) The manpower requirements for the entire operation are as follows:

Employment Catagory	
Administration and sales	10
Production and control	40
Limestone Quarry	12
Distribution station	5
Tugboat and barge	14
Total	81

This number exceeds by 9 the requirements set forth in previous reports due to increases in the numbers required in transportation and quarrying operations.

(6) The fuel and power costs used are those cited by previous cement plant proposers. Brief investigation indicates the assumed cost of power (0.01 per kw-hr) may be high, and the assumed fuel costs ($0.20 per million BTU) may be low. Since fuel and power costs constitute small, approximately equal portion of total cement cost, and since these adjustments would be largely offsetting, lack of detailed estimates is not critical.

(7) The projected capital cost of 6.5 million dollars advanced in previous reports by cement plant proposers is in line with the current national average capital requirements of $7.00 per barrel capacity. It is doubtful that appreciable savings in capital cost would result from building a plant of less than one million barrel capacity.

It should be stressed that the proposed capital cost does not seem to reflect the high cost of the dock facilities which would have to be installed at the plant site and at Anchorage. Minimum dock facilities at these locations could conservatively add 2.0 million dollars to the original capitalization figure; thereby requiring a total capital investment of 8.5 million dollars.

EXHIBIT 6

ADMINISTRATIVE, SALES, RAW MATERIAL, TRANSPORTATION AND PLANT OPERATION COST

500,000 Bbl/yr. - 91% of Available Time

	Annual Wages	Annual Expense	Total	Cost Per Barrel
1. Administrative & Sales				
General Office	$71,980	$18,000		
Accounting	32,700			
Sales	15,000	10,000		
Office Supplies & Expense		34,000		
TOTAL	$119,680	$62,000	$181,680	$0.3634
2. Production and Control (Plant)				
Plant operating supervision	78,131			
Laboratory	93,664	6,000		
Storeroom	7,000	1,000		
Laborers	53,539			
Maintenance crew	100,691			
Griding & kiln dept.	131,381			
Repair parts		70,000		
Barge loading & unloading	21,182			
TOTAL	$485,588	$77,000	$562,588	$1.1252
3. Raw Material Procurement				
Limestone-quarrying and crushing			250,428	
Sand			31,248	
Iron ore - purchase			42,480	
Gypsum - purchase			80,640	
TOTAL			$404,796	$0.8096
4. Transportation Cost of Raw Material and Finished Cement	71,280	64,152		
TOTAL	$71,280	$64,152	$135,432	$0.2709
5. Distribution Station				
Labor	52,317			
Power		16,477		
Supplies, Expense & Maintenance		5,000		
Insurance		1,500		
TOTAL	$52,317	$22,977	$75,294	$0.1506

Exhibit 6 (continued)

	Annual Wages	Annual Expense	Total	Cost Per Barrel
6. Other Manufacturing and Miscellaneous Cost				
Power				0.2200
Fuel				0.2000
Insurance				0.0700
Property tax				-nil-
Payroll taxes and insurance @ 10% of annual wages			72,887	0.1456
TOTAL			$ 72,887	
TOTAL COST PER BARREL				$ 3.3553

EXHIBIT 7

PROJECTED INCOME AND EXPENSE

500,000 Barrels Annual Production - 33 Days/Year

Operating 91% of Allowable Time

		End of 1st Year		End of 15th Year		End of 25th Year
NET SALES						
500,000 barrels @ $5.00/barrel		$2,500,000		$37,500,000		$62,500,000
OPERATING EXPENSES						
500,000 barrels @ $3.36/barrel		1,680,000		25,200,000		42,000,000
GROSS EARNINGS		$ 820,000		$12,300,000		$20,500,000
LESS:						
Interest*	269,000		2,926,167		3,462,000	
Depreciation*	292,500		4,387,500		5,850,000	
		561,500		7,313,677		9,312,000
NET TAXABLE INCOME		258,500		4,986,333		11,188,000
FEDERAL INCOME TAX+		86,000		2,144,000		5,079,000
NET PROFIT AFTER TAXES		171,500		2,842,000		6,109,000
ACCUMULATION OF FUNDS						
NET PROFIT AFTER TAXES		171,500		2,842,000		6,109,000
Depreciation		292,500		4,387,500		5,860,000
TOTAL AVAILABLE FOR DEBT SERVICE		464,000		7,229,000		11,969,000

Exhibit 7 (continued)
Projected Income and Expense

		End of 1st Year	End of 15th Year	End of 25th Year
DEBT SERVICE:				
Repayment of 1st Mortage Loan	99,288		1,300,000	1,300,000
Repayment of 2nd Mortgage Loan	112,000		1,988,168	4,225,000
Repayment of Barge & Tugboat			550,000	550,000
		$211,288	$3,838,168	$6,075,000
BALANCE TO SURPLUS		$252,712	$3,391,000*+	$5,894,000*+

* Presuming no change in the composition of assets in the initial pro form-balance sheet and no change in the debt load requirement. In fact, this results in a light understatement of expenses and consequent overestimation of taxable income shown on this financial statement.

+ Taxes, excluding property, license, sales and state income taxes; otherwise estimated including tax credits on "mining" operations on "owned" land which are not specifically separated from other costs of operation in the initial report. Rounded to nearest $1,000.

*+ Due to time span involved and price-wage uncertainties at future dates, the authors are extremely skeptical of the usefulness of long range pro forma financial statement. Similarly a 20 to 30 year "payout" is considered unrealistically founded, 8 to 10 years being more appropriate.

r Rounded to nearest $1,000.

APPENDIX A

CEMENT STUDY QUESTIONNAIRE

Firm Name ____________________ Designation: ____________________

Location: ____________________ Corporation/Partnership/Other

Gross Volume (by quantity) of Sales: ____________________

SUPPLY

Purchases from: __________ Price: __________ By what units? __________

Mode of transportation: ____________________ Lots Size: __________

Freight rate: __________ Timing: __________ Brand: __________

Comments: ____________________

PRODUCTION AND HANDLING

Inventory of (amounts & unit size): Seasonal variation?

Sorting from __________ to __________. Ready mix in what units? __________

Other inputs: ____________________ Acquired from: __________

Portable Production: __________ Delivery: ____________________

Capital equipment (description) and employment composition: __________

MARKETING

Types of products sold: ____________________

Territories: ____________________ General types of buyers and contracts:

Price list: ____________________ Discounts: ____________________

Seasonal sales pattern: __________ Stability of buyer classes: __________

Credit: ____________________ by types of customers: __________

Volume by territory: ____________________

Comments: ____________________

APPENDIX B

Selected Limestone Deposits of Alaska

The purpose of this listing and brief description of selected deposits to enable assessment of the Iliamna Bay deposits in relation to other limestone occurrences throughout the state. It is not intended to be a comprehensive list of all known deposits. The individual deposits have been indexed on map on page .

Windy Limestone Deposit - (Index A)

The Windy Limestone deposit is located on the southern slope of the Alaskan Range in the southeastern corner of Mt. McKinley National Park. The lower outcrops are approximately one mile northwest of Mile 323.1 on the Alaska Railroad. The outcrop is exposed for a length of 2,400 feet. Estimated deposit thickness is 800 feet. The average of the analyses of core samples representing the low magnesia bed is within the limits required for Portland Cement.

Foggy Pass Limestone -(Index B)

The Foggy Pass Limestone deposit occurs near the headwaters of the West Fork of Windy Creek. The deposit is approximately 15 miles northwest of Cantwell, Alaska. It is composed of gray, recrystallized limestone. The outcrop length is approximately 3,000 feet. Magnesia content (average) of a limited number of samples is 0.48 percent.

Seldovia Limestone - (Index C)

Seldovia lies 16 miles southwest of Homer. The face of the cliff forming the point on the east side of the entrance of Seldovia Bay is composed of limestone. The deposit is a massive gray to white crystalline limestone. The face of the deposit rises 60 feet above mean high tide and is exposed across the entire face of the point. Two samples have shown an average magnesia content of 5.3 percent.

Kings River Limestone - (Index D)

The King's River Limestone deposits in the Matanuska Valley are situated close to Anchorage, the Matanuska coal field, and the Glenn Highway. Chemical analyses indicate that the rock is nearly pure calcium carbonate with less than 0.1 percent magnesia oxide. These deposits contain huge reserves of nearly pure limestone suitable for almost any use.

Dall Island Limestone - (Index E)

The Dall Island limestone deposits located at View Cove, on Dall Island, in southeastern Alaska. Between 1928 and 1949 approximately 150,000 tons of limestone were quarried and shipped to other locations by the Pacific Coast Cement Company and the Permanente Cement Company for utilization in the manufacture of cement. Resources at the quarry are estimated to be 25 million tons of limestone containing 96.6 percent calcium carbonate.

Upper Lynn Canal Limestone - (Index F)

Limestone is known to occur in the upper Lynn Canal area at Mile 41 on the Haines cut-off on the Alaskan side of the international boundary. Thick beds of massive white limestone crop out adjacent to the highway and in high, steep bluffs above road level. U. S. Geological Survey analyses of two samples indicate an average of 2.28 percent magnesia.

Waterfall Bay, Dall Island - (Index G)

The deposit is located 60 miles west-southwest of Ketchikan. The limestone outcrops along the shoreline, on the north shore at the head of Coco Harbour. The outcrop is 1,000 feet long and 200 feet thick. The deposit is estimated to contain 3,000,000 tons. Recommended economic uses include cement, agricultural and metallurgical products.

View Cove, Dall Island - (Index I)

The deposit is located 60 miles west-southwest of Ketchikan. It occurs on the north shore of View Cove approximately 2 miles from the mouth. The limestone outcrops on the beach and has a 2,000 foot thickness. The deposit is estimated to contain 25,000,000 tons above mean sea level. This rock has been utilized in the manufacture of Portland cement.

Mouth of Green Bay, View Cove, Dall Island - (Index J)

The deposit is located 60 miles west-southwest of Ketchikan. The thickness exceeds 1,500 feet with an estimated quantity of 100,000,000 tons. The recommended usages include cement, agricultural, water treatment and possibly metallurgical products.

Breezy Bay, Dall Island-South Bay-South Side - (Index K)

The deposit location is 60 miles southwest of Ketchikan. The limestone outcrops as a 50 foot bluff at the beach and is exposed for a length of 5,000 feet. The thickness is 900 feet with an estimated tonnage of 125,000,000 tons above mean sea level. Chemical and physical analyses indicate suitability for cement, agriculture and possibly metallurgical uses.

Wadleigh Island Limestone - (Index L)

The deposit location is in San Alberto Bay, opposite Klawak, on the upper west coast of Prince of Wales Island. The limestone deposit has an estimated thickness of 600 feet, and is continuous for 2 miles. The estimated tonnage is 40,000,000 tons above mean sea level. It is a chemically pure limerock with many economic industrial uses.

Mud Bay Limestone - (Index M)

The deposit is located at Mud Bay, Shrubby Island, Kashevarof Islands, Clarence Strait, northwest corner of Shrubby Island. The limestone is exposed as a 1,500 foot beach outcrop forming a low bluff. The estimated tonnage is 15,000,000 tons. The chemical and physical analyses indicate a possibility of usage in cement.

Kuiu Island Limestone-(Index N)

The deposit is located opposite Halleck Harbour. It is exposed as a 1,500 foot beach outcrop with a 1,000 foot thickness. The chemical and physical analyses indicate it to be a burning limerock with possibilities for the cement industry.

INDEX MAP

ALASKAN LIMESTONE DEPOSITS

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