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A KRAFT FOODS DISTRIBUTION CENTER FOR BILLINGS, MONTANA

Part I

Undergraduate Thesis in Architectural Design

By

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fulfillment of the requirements for the
degree of Bachelor of Architecture

at

Montana State University

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PROPOSAL

During the five summers from 1962 to 1966, I worked for Kraft Foods and became well acquainted with their present facilities. During those busy summer months, the warehouse often became overloaded to the point that aisles were blocked off for lack of space to put the incoming products. The last two summers I worked for them, this situation was almost continuous from the first of the summer till the time I went back to school in the fall. As a result of this overcrowded situation, I developed the interest and the desire to do a new Kraft Foods warehouse and office building for a thesis project.

The development of a Kraft Foods Distribution Center as an architectural thesis has been divided into two parts. The first part of the thesis has been the compiling of the research information listed under the headings in the Table of Contents of this booklet.

The second part of the thesis will be the completion of a preliminary design solution for this problem based on the research data presented here. This final part of the thesis will be presented both visually and verbally.

CONDITIONS CREATING A NEED

The Growth of the Kraft Foods Company

The Kraft Foods organization has rapidly been developing new products. A summary of the history of the company makes this point very clear.

J. L. Kraft, the founder, started out in Chicago in July, 1903, with just \$65.00 to build a cheese business. "His goal was to develop a process for packaging this highly perishable commodity in convenient, marketable packages, with high keeping quality, no waste, and uniformity of flavor and texture." In 1907, the Kraft Company became the J. L. Kraft and Bros. Company as four of J. L.'s. brothers went to work for him. As early as 1909-1910, the company experienced a 125 per cent increase in business volume. The big item then was an early variety of club cheese. (1;1-3)

In 1912, the Kraft Company expanded its operations to the major cities of the East such as New York. Imported cheese was now becoming part of the Kraft line of fine cheeses. (1;4)

Just before the United States entered World War I, J.L. Kraft "perfected a method of blending and pasteurizing natural cheese to produce a standard product that would keep better, cook better, and could be packaged." This pasteurized cheese was introduced in tins which made it one of the biggest advances in cheese-making history.

Thus, Mr. Kraft obtained his original goal in the cheese industry. This cheese also became so popular that new production areas and plants had to be added. (1;5)

In 1921, Kraft introduced the five-pound loaf of pasteurized, blended cheese, which first appeared in wooden boxes. This development changed the nation's cheese eating habits. "Annual per capita cheese consumption in the U.S. rose from an average of 4.16 pounds per person in 1921, to 4.71 pounds in 1926, and 6.30 pounds in 1942." (1;5-6)

In 1924, the name of the company was changed to the Kraft Cheese Company. By now, Kraft had expanded from coast to coast. Also, they had developed a new cheese called Velveeta. "Today Velveeta is the most popular American-type cheese product in the nation." (1;7)

In 1928, the Kraft Cheese Company joined with the Phoenix Cheese Corporation to become the Kraft-Phoenix Cheese Corporation. This added a wider variety of products. One of the products added to the Kraft line was Philadelphia Brand Cream Cheese which today is the largest selling packaged cheese in the world. Furthermore, "Kraft is the only producer of genuine Philadelphia Brand Cream Cheese." (1;8)

Moreover in 1928, Kraft purchased several salad dressing companies in the South and East. After entering the salad dressing field, Kraft was able to achieve a great breakthrough in dressing which "combined the best

features of mayonnaise and old-fashioned boiled dressing." This product was named Miracle Whip and was put on the market in 1933. (1;8-9)

"In 1930, Kraft became an operating unit of National Dairy Products Corporation." This move was for the benefit of the Kraft Company and its employees. Through this corporation, Kraft was able to obtain better insurance programs and pension plans for its employees. The National Dairy Products Corporation conducts extensive research into dairy products which is helpful to Kraft. (1;9-10)

The 1930's brought about many new products for Kraft. The most outstanding were the Kraft Dinner; a macaroni and cheese dinner; and Parkay Margarine. Other new products were Kraft Dairy Fresh Caramels, Kraft Quick-Serve Cocoa Mix, and Kraft Swankyswig Cheese Spreads. (1;10)

On January 2, 1940, the Kraft-Phoenix Cheese Corporation name was changed to the Kraft Cheese Company. During the World War II years, Kraft concentrated on the war effort. Their products were put in dull containers for the Army and Navy, and these containers of Kraft products became known as "K" rations on the battlefields. The final name change of the company was made on September 1, 1945, when the name became the Kraft Foods Company. (1;11-12)

Besides developing new products for themselves,

Kraft during these years became the distributor for Pillsbury products. In 1951, the Ballard Biscuit Company was acquired by Pillsbury. In 1953, the Hunko label on institutional shortening was replaced with a Kraft label. Marshmallows were added to the Kraft line in 1954. In 1959, the Bedford Jellies and Preserves were discontinued as a separate division and became part of the Kraft line. Many new products are added to the Kraft line every year through either expansion or research. (1;14-16)

Kraft's expansion has not just been in the U.S. and Canada, but it has been international. Kraft has major processing operations in England, Australia, and Germany. Operations of lesser proportions are also conducted in Mexico, Panama, Caracas, Venezuela, Manila, and the Philippines. The company now has plans of marketing its products in Japan. These countries give Kraft distribution to most of the Free World. (1;19-20)

Inadequate Warehouse Space

As a result of the new products, the increase in operations, and the increase in sales, the present Kraft Foods warehouse in Billings is unable to handle the increased loads efficiently. The increase in volume of goods handled is indicated in the following table. The table compares the present floor area to what is needed for the volume of merchandise handled. (See figure 1)

Floor Area Comparisons

	Total load on floor per day (lb/day)	total floor area (sq. ft.)	total cooler area (sq. ft.)	total noncooler area (sq. ft.)
Present building conditions		20,000	8,000	12,000
Design live loads for required 18 ft. ceilings			540- lb/sq. ft.	1044- lb/sq. ft.
Average low month conditions	24,100,000	WHAT'S NEEDED	30,300	14,300
Average high month conditions	37,270,000		58,700	23,100
Over-all average conditions	26,779,000		33,700	16,500

Figure 1 (2&3)

Other Warehouse Needs

There is a need for more office space. At present the sales supervisor does not have an office of his own, and he is using a desk in the corner of the sales display room. This same room not only serves as a room for display of posters and other advertising material, but it also doubles as the warehousemen's coffee room. The xerox machine has also been placed in this room since there is no other place for it at the present time. This one room is inadequately doing what at least three and possibly

four rooms should do.

Furthermore, the present office area has no waiting room or conference room. A customer must now walk into the secretary's work area to be waited upon. The customer would feel more at ease if he could sit in a waiting area. In order to have a meeting with several people, the director of Kraft's Billings Division must either crowd extra chairs into his office or meet in the sales display room. Neither choice is an ideal situation because of the crowding.

At present, the advertising material is stored in a shed across the lot from the warehouse. (See figures 9 and 10.) This has proved to be inconvenient during good weather and even more inconvenient during bad weather. A location closer to the sales display room or connected with the main warehouse is preferred by the salesmen and warehousemen who use this sales material.

Mr. Sam Barger, Director of Kraft's Billings Division, states other needs include an enclosed area to store the trucks and semitrailers. They are presently left out in the open when not in use. Also, the warehouse cooler area does not include freezer space which will be needed as Kraft Foods expands into the frozen foods line in their Billings sales district. Mr. Barger states that that could happen within five years if a freezer area was provided.

Furthermore, there are only two doors for railroad unloading which has not met Kraft's needs. Three or

four times during the busy summer months, there are three or more railroad cars with merchandise needed in the same day from at least three of the cars. With only two doors, this means that the customer may have to wait an extra day for the railroad to change cars so he can get what he wants. Mr. Barger states that at least three doors for railroad unloading should be provided.

As can be seen from figure 1, almost 70 per cent more floor area is needed for the warehouse. With such a large increase in floor area needed, it would be very hard to expand the old warehouse due to property limitations. Furthermore, the present structure is not designed to allow for the addition of a second story to the building. In other words, the present structure is only designed for the normal roof loads which are the dead and live loads. Therefore, a new warehouse is the best answer to Kraft Foods' need for added space.



FIGURE 2; ENTRY

This is a view of the entry
to the offices.



FIGURE 3; PARKING

This is a view of the north
side with the parking area.



FIGURE 4; WEST SIDE

This is a view of the west
side with boxcars at the
two doors.



FIGURE 5; SOUTHWEST CORNER

This is a view of the southwest corner showing how there is no clearance.



FIGURE 6; SOUTH SIDE

This is a view of the south side where the semis park when not in use.



FIGURE 7; GAS PUMP

This is a view of the southwest corner showing the gas pump.



FIGURE 8; LOADING DOCK

This is a view of the south side showing the truck loading docks. The drive slopes down to the docks which causes drainage problems.



FIGURE 9; ADVERTISING SHED

This is a view of the advertising shed, first building, across the lot to the south of the warehouse. The shed next to it is used by another company.



FIGURE 10; ADVERTISING SHED

This is a view of the west side of the advertising shed.

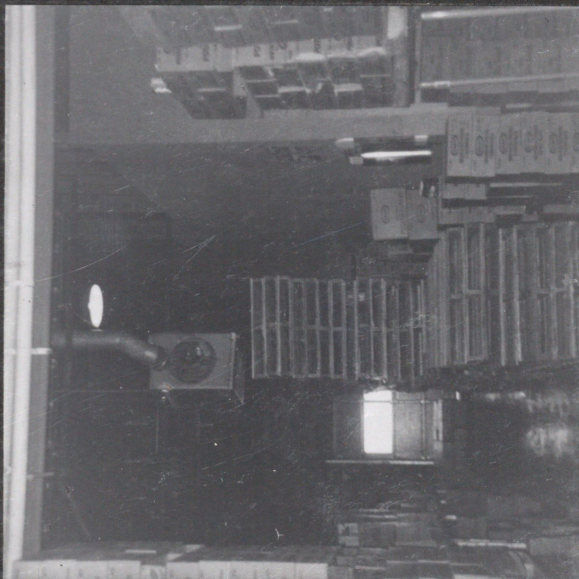


FIGURE 11; SOUTH RAMP

This is a view of the south ramp to the door for boxcar unloading. This shows crowded condition of the ramp.



FIGURE 12; BLOCKED AISLE

This is a view of the aisle to the east of the south ramp. This shows how the aisle has been blocked off for lack of room.



FIGURE 13; NORTH RAMP

This is a view of the north ramp to the door for boxcar unloading. This shows how crowded ramp is being used for storage space.

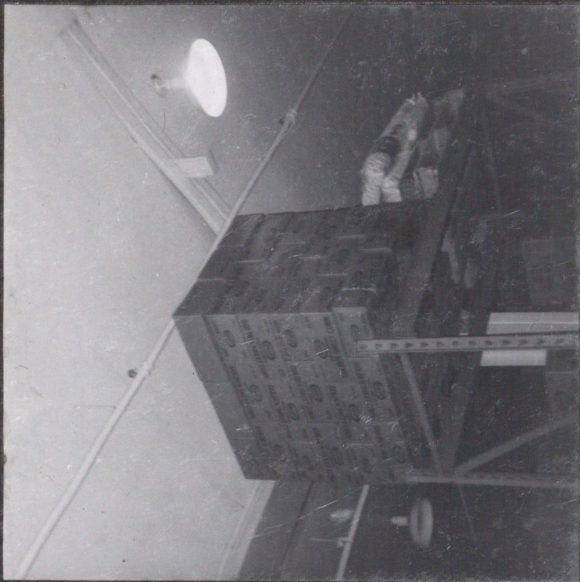


FIGURE 14; CEILING

This is a view up at the ceiling showing how close a loaded pallet is to the sprinkler system. More ceiling height is needed here.

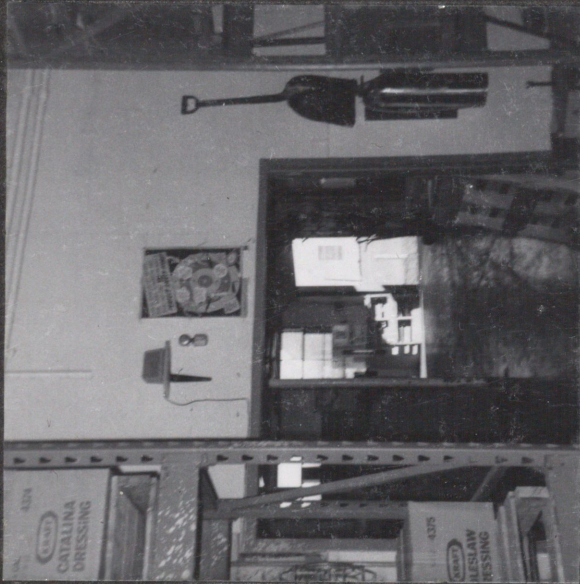


FIGURE 15; TRUCK LOADING

This is a view showing the entry to the truck loading area from the storage area. The low clearance is bothersome at times.



FIGURE 16; COOLER DOOR

This is a view showing the aisle leading into the cooler with the doors open. The door height gives poor clearance for a loaded forklift.

LOCAL CONDITIONS

Geographical

"The Billings of today, named after Frederick Billings, Sr., President of the Northern Pacific Railroad from 1879 to 1881, is a city with a land area of slightly over 11 square miles and a population (according to 1960 census figure) of 58,100. The urban population numbered 66,000 and the county 84,600 as of 1960." (4;6) Billings is located on the "Clark's Fork Bottom" of the rich Yellowstone Valley which is in south central Montana. This location is midway between St. Paul and Seattle at an elevation of 3100 to 3600 feet. The city is bounded to the south by the Yellowstone River and on the east and north by the "Rimrocks" which are Eagle sandstone cliffs 85 million years old. (4;3,6) The city has been growing primarily to the west.

Historic

In the 1800's the Yellowstone Valley was inhabited by the Absarokee or Crow Indians. The first recorded visit by white men was in 1743 by French fur traders, Pierre and Francois de la Verendrye. In 1806 Lewis and Clark visited the area, and northeast of Billings at Pompey's Pillar, Capt. Clark carved his name and the date, July 25, 1806. In 1875, the steamer Josephine sailed up the Yellowstone River and docked at what is now Billings' Josephine Park. (4;3)

Caulson, the forerunner of Billings, was established two miles down river from where Billings was to be by P.W. Mc Adow in 1876. A stage line was established from Miles City to Bozeman, and by 1880 there were 200 men, women, and children living in the valley. In 1882, the Northern Pacific Railroad established Billings as arrangements could not be reached for the desired Caulson land. On May 1, 1882, the first structure was built to house the railroad engineers. Billings earned the title of "The Magic City" as it grew almost overnight to a town of 1500-2000 inhabitants. On September 11, 1882, 700 head of cattle were shipped, and this was the start of Billings becoming the trade center that it remains today. (4;4-5)

February 26, 1883, Yellowstone County was established with Billings as the county seat. On April 2, 1885, the people accepted a charter of incorporation from the territorial legislature. In June of 1885, the construction of a water plant was begun, and Billings was on its way to becoming a city. (4;5)

With the coming of a dependable water supply in 1906, the sugar beet industry flourished. "By 1907 Billings' economy was firmly founded on agriculture, trading, and manufacturing. From 1910 to 1930, Billings developed as a wholesale and retail trade center." The oil industry has also added to the city's growth since 1929. (4;6)

Climate

Billings, Montana has a climate that takes some of the characteristics of both the Great Plains and the Rocky Mountain regions. The area is classified as semiarid with an average rainfall just slightly over 13 inches; however, spring and fall rains plus irrigation permit production of a variety of crops. One third of the total precipitation falls during May and June. November through February has the least amount of precipitation, but heavy snows of from six to twelve inches are not uncommon, particularly during November and December. During the spring and fall months when the temperature and moisture conditions are most favorable, the heaviest snows occur. Snows seldom accumulate to great depth because of frequent thawing periods. (5;1)

Thunderstorms are frequently accompanied by strong gusty winds and occasionally by hail, but destructive hailstorms are quite infrequent. Thunderstorms are restricted mostly to the warm season, May through September. With east and northeast winds during the colder two-thirds of the year, upslope fog and low clouds are common, and occasionally these conditions occur during warmer months. (5;1) (See figures 17 & 18)

Social

Billings has a total of 77 churches with every major denomination represented. Also, there are a total of 38

20

NORMALS, MEANS, AND EXTREMES

To 8 compass points only.

FIGURE 13

AVERAGE TEMPERATURE

Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
1935	24.3	36.1	33.1	41.7	52.3	64.2	75.7	71.6	63.4	48.3	32.7	32.3	48.0
1936	24.1	2.6	36.0	45.0	64.6	70.2	81.0	72.6	62.0	50.4	37.3	28.2	47.8
1937	24.0	21.2	36.6	47.6	60.4	64.5	76.0	73.8	64.3	52.1	35.8	26.7	46.9
1938	31.6	24.0	37.4	47.7	58.1	66.6	71.8	71.0	67.2	51.6	33.6	31.0	49.0
1939	33.1	18.2	36.4	48.0	58.9	59.6	73.6	69.4	60.4	49.2	42.6	37.6	48.9
1940	24.3	26.8	30.8	42.4	52.9	62.6	74.6	73.2	66.2	53.2	27.0	32.6	48.3
1941	29.8	30.0	35.6	45.2	59.3	64.5	72.9	70.8	54.0	46.0	39.8	28.3	48.0
1942	25.8	22.2	35.7	46.8	51.7	60.4	72.2	68.4	58.8	50.8	34.9	30.2	46.7
1943	13.6	32.6	25.4	51.8	51.2	60.4	72.4	71.3	60.2	53.2	37.6	32.0	47.0
1944	30.8	25.8	37.4	48.6	59.2	67.3	69.4	67.6	59.3	54.2	35.2	26.8	47.1
1945	27.3	26.7	37.6	41.2	51.8	58.1	72.7	70.9	57.1	51.9	34.8	23.6	46.1
1946	30.8	31.2	42.0	52.8	57.2	61.5	73.7	68.8	58.9	42.6	31.8	27.4	48.1
1947	26.5	24.3	39.2	48.5	56.0	59.4	74.8	71.8	59.3	52.9	30.9	28.1	46.6
1948	28.9	27.9	39.1	48.0	57.1	60.4	70.4	72.0	63.8	50.8	36.2	20.4	47.0
1949	24.2	17.8	32.0	42.8	52.1	63.4	71.4	73.4	58.6	41.9	47.4	22.6	45.8
1950	24.1	33.8	30.2	42.6	49.9	60.9	74.8	74.8	67.8	51.8	31.9	31.4	48.2
1951	20.5	27.6	22.5	42.0	57.0	56.9	71.8	67.3	54.5	44.7	35.2	19.2	43.3
1952	17.7	28.9	11.9	51.3	56.2	65.8	70.2	70.4	64.2	51.1	33.2	32.4	47.9
1953	36.2	32.3	38.4	40.6	51.2	63.0	74.3	71.6	61.2	54.7	43.5	32.9	50.2
1954	17.5	40.3	27.6	42.8	53.8	60.9	75.4	69.7	59.9	48.1	43.9	34.3	47.8
1955	27.3	20.5	26.2	46.6	56.4	62.6	71.7	73.9	59.6	53.4	24.1	22.6	45.1
1956	21.9	25.0	35.5	41.3	56.9	69.3	72.1	68.4	57.0	51.1	37.5	30.9	47.6
1957	11.2	27.2	34.6	42.3	56.2	62.7	74.5	70.4	59.3	44.7	34.3	37.3	46.2
1958	35.1	26.5	33.7	44.6	63.4	60.1	66.5	73.7	61.4	52.0	36.5	28.8	48.6
1959	23.0	22.0	30.4	44.2	50.7	65.5	72.8	71.5	59.0	47.2	30.8	34.1	45.9
1960	23.2	23.5	35.0	44.8	50.4	60.2	71.9	69.8	62.2	51.5	36.9	30.3	48.3
1961	32.2	38.6	41.0	42.8	56.6	72.7	75.0	76.2	52.5	47.3	31.2	24.5	49.2
1962	19.6	23.9	29.5	50.7	55.0	65.0	69.6	69.4	59.0	53.7	41.4	32.7	47.5
1963	13.9	36.8	40.8	44.4	53.9	62.1	71.4	71.0	65.2	54.8	38.0	22.4	47.9
1964	29.1	31.4	31.8	45.2	56.7	62.7	75.6	68.1	56.4	51.5	31.2	17.9	46.5
1965	28.1	25.2	21.4	45.8	52.6	61.4	71.5	69.5	47.1	54.4	38.0	28.5	45.3
1966	15.1	25.7	37.1	40.1	55.4	61.6	76.2	68.3	65.5	50.4	34.5	29.2	46.6
RECORD													
MEAN	23.0	26.7	33.4	45.5	55.7	63.3	73.0	70.8	60.1	50.4	35.7	28.7	47.2
MAX	32.6	36.7	43.8	57.2	67.8	75.5	87.4	85.0	73.0	62.3	45.3	37.8	58.7
MIN	13.3	16.3	23.0	33.8	43.6	51.1	58.6	65.4	47.1	38.4	26.1	19.6	35.6

TOTAL DEGREE DAYS

BILLINGS, MONTANA
LOGAN FIELD

Season	July	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	Total
1934-35							1274	809	789	670	391	85	
1935-36	0	18	107	521	948	1013	1229	1808	895	597	124	64	7386
1936-37	0	7	139	449	835	1143	1825	1231	945	510	168	143	7412
1937-38	0	3	119	400	879	1187	1325	1125	856	513	354	39	6550
1938-39	7	23	17	420	760	1050	986	1308	895	521	218	195	6575
1939-40	3	61	177	485	670	852	1567	1110	812	675	138	84	6674
1940-41	4	2	73	363	1079	1063	1688	980	913	574	293	122	6424
1941-42	3	27	336	589	760	1137	1218	1197	928	484	419	146	7224
1942-43	4	30	235	668	822	1082	1593	907	1225	378	636	178	7466
1943-44	7	5	169	317	761	1051	1662	1167	1112	442	229	204	6771
1944-45	20	30	192	336	883	1182	1169	1072	868	715	400	284	7418
1945-46	8	23	279	407	908	1278	1063	946	711	367	276	91	6895
1946-47	8	42	211	675	975	1107	1195	1140	1112	586	476	177	7547
1947-48	0	14	214	379	1075	1166	1119	1223	1091	511	288	94	7109
1948-49	10	1	124	445	863	1385	1729	1333	1028	362	416	106	7659
1949-50	19	2	203	317	525	1315	1851	865	1072	665	463	159	7893
1950-51	32	20	286	409	984	1035	1376	1041	1313	685	249	246	7674
1951-52	54	45	312	620	884	1413	1398	1063	1021	412	264	49	7522
1952-53	25	31	75	427	947	1001	886	906	915	334	424	125	6450
1953-54	0	7	112	320	639	790	1449	684	1142	661	356	168	6568
1954-55	3	11	174	518	626	944	1169	1243	1199	695	320	115	6918
1955-56	22	0	240	368	1223	1305	1331	1155	959	704	286	16	7558
1956-57	7	50	140	425	820	1050	1063	1050	969	673	275	107	7198
1957-58	3	25	188	623	916	851	913	1073	962	643	125	154	6416
1958-59	44	11	162	403	848	1116	1297	1200	755	612	436	63	6756
1959-60	23	3	251	543	1043	950	1291	1145	925	600	281	53	7094
1960-61	1	37	150	416	836	1067	1010	733	738	660	285	6	5939
1961-62	2	3	379	543	1008	1267	1407	1148	1076	823	324	89	7649
1962-63	4	46	187	342	701	790	1566	781	750	612	263	124	6448
1963-64	10	7	61	333	802	1316	1107	972	1025	587	275	111	6658
1964-65	0	67	253	415	1009	1454	1135	1110	1347	570	381	125	7851
1965-66	3	33	533	327	806	1125	1545	1094	860	742	319	155	7542
1966-67	0	54	83	446	910	1104							

TOTAL PRECIPITATION

Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
1935	0.16	0.23	1.73	0.97	2.78	0.80	1.90	0.47	0.29	0.59	0.51	0.71	11.14
1936	0.40	1.04	0.13	0.78	1.07	1.80	0.96	0.47	1.32	0.41	0.56	0.26	9.20
1937	0.40	0.56	0.76	0.72	0.53	4.93	0.67	0.18	1.83	2.45	0.75	0.59	14.37
1938	0.06	0.20	1.95	0.50	4.09	5.23	2.07	1.07	0.56	1.74	1.15	0.07	18.69
1939	0.19	0.35	0.91	0.83	1.75	5.31	0.11	0.76	0.22	0.92	0.05	0.12	11.72
1940	0.68	0.74	0.60	3.16	0.84	2.49	0.53	0.13	1.09	2.47	0.71	0.06	13.50
1941	0.04	0.20	0.63	2.00	2.00	3.09	1.17	1.11	4.99	1.24	1.20	1.13	18.00
1942	0.40	0.75	0.98	1.28	4.93	2.30	0.56	1.07	1.66	1.20	1.09	0.12	16.34
1943	1.54	0.99	1.80	0.49	1.24	3.28	0.48	0.68	0.55	0.29	0.51	0.07	11.92
1944	0.31	0.57	0.33	0.10	0.73	7.64	1.29	0.97	4.01	0.03	0.29	1.17	15.44
1945	0.26	0.32	0.65	0.64	1.86	2.21	0.68	1.18	1.33	0.50	0.57	0.66	10.86
1946	0.14	0.19	1.35	0.28	1.09	1.49	0.91	0.95	1.68	2.14	0.65	0.93	11.80
1947	0.15	0.66	1.08	1.24	1.09	3.84	0.27	1.04	1.39	0.52	0.63	0.81	12.72
1948	0.46	0.35	0.79	0.74	1.25	1.66	0.95	0.48	0.40	0.02	0.09	0.71	7.90
1949	1.55	0.62	0.92	0.74	1.53	2.12	1.72	0.22	2.26	2.72	0.03	0.83	15.26
1950	0.65	0.41	1.26	1.17	2.07	1.98	0.85	0.68	1.46	0.83	0.71	0.69	13.76
1951	0.64	0.64	1.01	0.88	1.46	1.70	0.64	1.95	1.01	0.86	0.16	1.04	11.99
1952	0.16	0.93	0.41	0.87	3.40	1.11	0.80	0.83	1.07	0.47	0.39	0.15	10.79
1953	0.62	0.81	0.96	1.32	2.28	1.77	0.40	1.02	0.88	1.15	0.28	0.21	11.70
1954	1.24	0.13	2.70	1.19	1.90	1.25	0.23	0.76	1.06	1.15	1	0.14	11.75
1955	0.07	1.57	1.60	4.42	4.27	1.72	1.41	0.05	0.82	1.26	0.81	1.89	19.89
1956	0.56	0.43	0.30	1.59	2.47	0.66	1.07	0.87	0.55	0.60	0.97	0.51	10.58
1957	0.82	0.55	1.52	3.55	3.39	4.49	0.25	1.47	1.24	2.58	1.31	0.05	21.22
1958	0.48	1.66	1.35	2.07	0.65	3.28	0.12	0.42	0.50	0.55	1.16	1.50	16.74
1959	1.02	1.13	0.23	2.36	1.07	0.97	0.31	0.19	1.38	0.69	1.92	0.33	11.60
1960	0.66	0.53	0.53	1.00	1.31	1.11	0.17	1.95	0.16	0.81	0.55	0.61	9.39
1961	0.15	0.20	0.72	2.33	1.57	2.04	0.85	0.23	3.99	1.47	1.55	0.22	13.52
1962	1.90	1.26	1.23	0.06	3.67	1.72	0.86	1.19	0.95	0.29	0.86	0.23	14.22
1963	2.23	0.31	0.39	2.38	2.49	3.16	0.49	0.39	1.29	0.31	0.05	1.43	14.92
1964	0.11	0.35	1.38	4.11	3.91	5.13	0.10	2.08	0.06	0.22	0.72	0.59	18.76
1965	0.66	1.18	0.90	1.18	1.89	2.30	1.28	3.50	2.17	0.09	0.66	0.74	16.55
1966	0.43	0.32	1.58	1.10	0.84	1.56	1.45	1.09	2.46	0.50	1.07	0.95	13.35
RECORD MEAN	0.61	0.63	1.02	1.44	2.04	2.57	0.92	0.92	1.33	0.97	0.69	0.61	13.75

schools in Billings.

27 Public schools

8 Parochial schools

2 Four year colleges

1 Business college

Billings also has a total of 16 developed parks with a total area of 195 acres. Outdoor recreation facilities include three swimming pools, five wading pools, playgrounds, tennis and badminton courts, lighted baseball park, picnic grounds, water skiing and motor boating on Lake Elmo, a public and two private golf courses. Furthermore, the new Y.M.C.A. offers a complete schedule of activities, including a large indoor pool and two gymnasiums.

Economics

Billings has an advantageous inland location in an area richly endowed with natural resources. This has established the city as the economic center of the state. Some of the basic factors that account for this are:

1. "A central location well served by interstate and local transportation facilities.
2. A natural location for processing and distributing the mineral fuels produced in surrounding areas.
3. A productive and stable agricultural hinterland.
4. The development of a city that functions in an extremely concrete and fundamental way--and, as a result, is responsive to a much larger population base than its own." (6;1-2)

A. WHOLESALE TRADE

In 1963 Yellowstone County contained 12 per cent

of the state's population. Yet, one-fourth of the state-wide total of merchant wholesale establishments and nearly one-third of the state's wholesale sales receipts were generated by that 12 per cent. (6;3)

B. MINERALS

The primary mineral resources of the trade area, areas surrounding Yellowstone County, are petroleum, natural gas, and coal. As a result of being close to petroleum fields, Billings serves as a refining and distributing center. Large coal reserves are still available but have not been used to any great extent since the railroads converted from coal to diesel fuel. (6;15)

C. TRANSPORTATION

Billings is well served by transportation as is shown below.

- 39 regulated motor carriers
- 139 private and exempt carriers
- 3 large railroads
- 3 scheduled airlines
- 8 charter air services
- 5 intrastate buslines
- 3 interstate buslines
- 11 household goods movers (6;16)

The three railroads are the Northern Pacific; Chicago, Burlington and Quincy; and the Great Northern. The three scheduled airlines are Northwest, Western, and Frontier.

To and from Billings, highway access is provided by two Montana highways and three federal highways. When

Interstates 90 and 94 are completed, Billings will have both north-south and east-west access via the interstate system. This will be important to reinforcing and enlarging the truck-served wholesale trade area. (6;17)

D. EMPLOYMENT AND LABOR FORCE

Employment opportunities, especially in the skilled and white collar occupations, are concentrated in Yellowstone County. The following table indicates this fact. (6;18) (See figures 20 & 21)

Labor Force by Occupational Grouping, 1960

	State	Yellowstone County	City of Billings
White collar	39.5%	49.4%	57.3%
Skilled	10.1%	11.4%	11.6%
Unskilled	50.4%	39.2%	31.1%

Figure 19

E. AGRICULTURE

Agriculture is one of the foundations of Billings' economy. The products from agriculture are responsible for much of the employment in the manufacturing and transportation industries of the city. Furthermore, much of the consumer funds for the retail and wholesale industries are derived from these products. (6;25)

As a result of technology, the average size of farms is increasing both in the irrigated and dryland areas. The agricultural operations is becoming highly mechanized and, thus, more efficient which is resulting in decreasing labor requirements and increased production. This has

Figure 20

Employees by Type of Industry - 1950

	Yellowstone County Employees	Yellowstone County % Total	Billings Urban Area Employees	Billings Urban Area % Total	City of Billings Employees	City of Billings % Total
Agricultural	2,373	11.0	230	1.6	201	1.5
Mining	78	0.4	55	0.4	48	0.4
Manufacturing	2,026	9.5	1,518	10.3	1,333	10.2
Construction	1,866	8.7	1,326	9.0	1,156	8.8
Transportation, Utilities and Communications	2,633	12.3	1,514	10.3	1,329	10.2
Wholesale	1,576	7.4	1,350	9.1	1,180	9.0
Retail	4,483	21.0	3,608	24.4	3,193	24.4
Services	3,046	14.2	2,460	16.7	2,220	17.0
Public Services	2,960	13.8	2,471	16.7	2,231	17.0
Other	361	1.7	229	1.5	200	1.5
Total	21,402	100.0	14,767	100.0	13,097	100.0

(6;20)

Figure 21

Employees by Type of Industry - 1960

	Yellowstone County Employees	County % Total	Billings Urban Area Employees	Urban Area % Total	City of Billings Employees	% Total
Agriculture	1,928	6.5	352	1.5	307	1.5
Mining	404	1.4	388	1.7	364	1.8
Manufacturing	3,360	11.4	2,699	11.7	2,360	11.6
Construction	1,985	6.7	1,596	6.9	1,311	6.5
Transportation, Utilities and Communications	3,265	11.1	2,153	9.4	1,866	9.2
Wholesale	2,060	7.0	1,799	7.8	1,569	7.7
Retail	5,706	19.4	4,819	20.9	4,232	20.9
Services	5,455	18.5	4,204	20.4	4,249	21.0
Public Services	4,492	15.2	3,806	16.6	3,452	17.0
Other	815	2.8	702	3.1	567	2.8
Total	29,470	100.0	23,018	100.0	20,277	100.0

(6;21)

resulted in a population decline in rural areas and the growth of urban Billings. (6;25)

The primary agricultural income is derived from cattle since 70 per cent of the value of all agricultural commodities is from the sale of livestock. After cattle, the agricultural income is derived from irrigated crops. (6;26-27)

F. INCOME AND RETAIL SPENDING

In Billings and Yellowstone County, the average income is exceptionally high. "This is a reflection of its function as a center for retail, wholesale, and professional services, rather than heavy economic dependence on raw material production or manufacturing industries." (6;32) (See figure 22)

INCOME - 1960

<u>County</u>	<u>Median Income-Families</u>	<u>Mean Income/Worker</u>
Big Horn	\$ 4,375	\$ 2,670
Carbon	4,336	2,747
Golden Valley	4,044	3,313
Musselshell	4,927	3,122
Stillwater	4,790	2,983
Treasure	4,538	3,006
Yellowstone	6,150	3,910
Billings	6,638	4,176
State	5,403	3,544

Figure 22

"Higher per capita retail expenditures in Yellowstone County reflect two things: higher incomes per capita and its role as a retail center for various items; particularly, heavy durable goods." Even though on a state-wide scale this is true, the increase in retail trade in Billings

and Yellowstone County has slowed since 1958. This has been attributed to the decline of the oil boom. (6;33-35)

G. MANUFACTURING

From 1958 to 1963, the increase in manufacturing establishments in Yellowstone County was 6.3 per cent as against 5.2 per cent for the state. The value these establishments added to the county was \$45,751,000 or an increase of 36.6 per cent since 1958. "Yellowstone County accounted for 24 per cent of the value added by manufacturing in the state from 1958 to 1963." (6;37)

As is expected, Yellowstone County dominates the petroleum refining industry of the state. In 1958, of the 1,065 people employed in petroleum refining in the state, 710 were employed in Billings. "Billings industry also accounted for over 16 million out of the \$24,081,000 added in value within the state." (6;37)

H. AUTOMOBILE OWNERSHIP

The increase in retail sales of automobiles strongly indicates a prosperous economy in Yellowstone County. Between 1950 and 1960, the number of registered automobiles increased by 44 per cent in the county. Also, the number of automobiles per household has risen from 1.10 to 1.44. (6;38)

I. POPULATION

"Billings and Yellowstone County have grown steadily since the earliest census in 1890 and quite rapidly since

1940." This growth rate has greatly exceeded that of the state for a similar period of time. (See figure 23)

Oil, cattle, manufacturing, and trade in the Billings area are the reasons behind this population growth. (6;51)

Population and Growth Rates

	1930		1940	
	<u>Pop'n.</u>		<u>Pop'n.</u>	<u>Pct.Incr.</u>
Billings	16,380		23,261	42.0
Yellowstone	30,785		41,182	33.8
Montana	537,606		559,456	4.1
	1950		1960	
	<u>Pop'n.</u>	<u>Pct.Incr.</u>	<u>Pop'n.</u>	<u>Pct.Incr.</u>
Billings	31,834	36.9	52,851	66.0
Yellowstone	55,875	35.7	79,016	41.4
Montana	591,024	5.6	674,767	14.2

Figure 23

History of Kraft Foods in Montana

The Kraft Foods Company first came to Montana in 1945. Their first warehouse in the state was in Butte. The company moved to Billings in 1956 as a result of the realignment of the territories for the Montana Division. The eastern part of Montana and the western part of the Dakota's were added to the Montana Division while Missoula and Kalispell went to the Spokane Division. Furthermore, Wyoming and the northern part of Nebraska became part of the Montana territory for distribution. Billings became the site for their warehouse because of its central location and excellent transportation facilities. (7)

At first Kraft rented two buildings in Billings. One building was the old Ryan Groceries Company warehouse at Montana Avenue and 27th street which was strictly for dry storage. The second building was for refrigerated products, and it was located across from the Railroad depot. This building formerly belonged to the Sayer Grocery Company. (7)

In 1962, Kraft moved to their present location in the N.P. Industrial Site. (See figure 25) The need for a new warehouse resulted from the inefficiency that developed from traveling between two warehouses in order to load one truck. The building they moved into was originally a machine shop which Kraft had remodeled into a warehouse with office space on the north side. (7)

SITE CONDITIONS

Orientation

The site is located in the N.P. Industrial Site. The industrial site is located west of the city of Billings just off the interstate. My site in this industrial area is across Edward Street from the Public Works Department and north of the new Keil warehouse. Specifically, it is located in block seven of the Industrial Subdivision. (See figures 25-30)

Adjacent Environment

To the northwest of the site is the Billings cemetery which provides a nice wooded area. To the northeast is a residential housing area which is fairly new. Directly to the east of the site is an open, flat, and undeveloped field. To the south is the new Keil Groceries warehouse. On the west is the City Dog Pound and the Public Works Department with its large storage garages for the city trucks. (See figures 27-30)

Topography and Vegetation

The site is essentially flat with a slight sloping to the north, but not a great enough slope so that it would influence the design.

The site has no trees, and the vegetation is limited to weeds and range grasses. (See figures 27-30)

Zoning Regulations

The N.P. Industrial Site is outside of the city, and the city zoning regulations do not apply. There are also no county regulations that would apply to this area. The Northern Pacific Railroad decides what industries they will allow to lease land in their industrial site. (8)

Soil Analysis

A commercial testing laboratory, who tested this area gave seven recommendations for placing foundations.

1. "That, for minor footings set in the silty sand stratum, the soil be modified by over-excavating two feet below, and outside the footing line and backfilling with clean three inch minus pitrum gravel, compacted to 95 per cent of ASTM 698 Method D. With this modification, an allowable bearing value of 1500 psf may be used.
2. That, for footings set in the silty clay layer, an allowable bearing capacity of 500 psf be used, with an anticipated settlement of two inches.
3. That, for footings set in the sandy gravel stratum, you use an allowable bearing value of psf, provided one foot penetration into the gravel is achieved.
4. That, for footings carried to the shale formation, an allowable bearing value of 18,000 psf should be penetrated at least one foot.
5. That, the base of footings be set at least 42 inches below finish grade.
6. For slabs on grade, streets, and driveways, you should provide a minimum of twelve inches of clean, compacted, pitrum gravel base course on a compacted subgrade.
7. That, all structures below elevation 95.0 be designed for water tightness and to provide for bouyant forces." (9) (See figure 24)

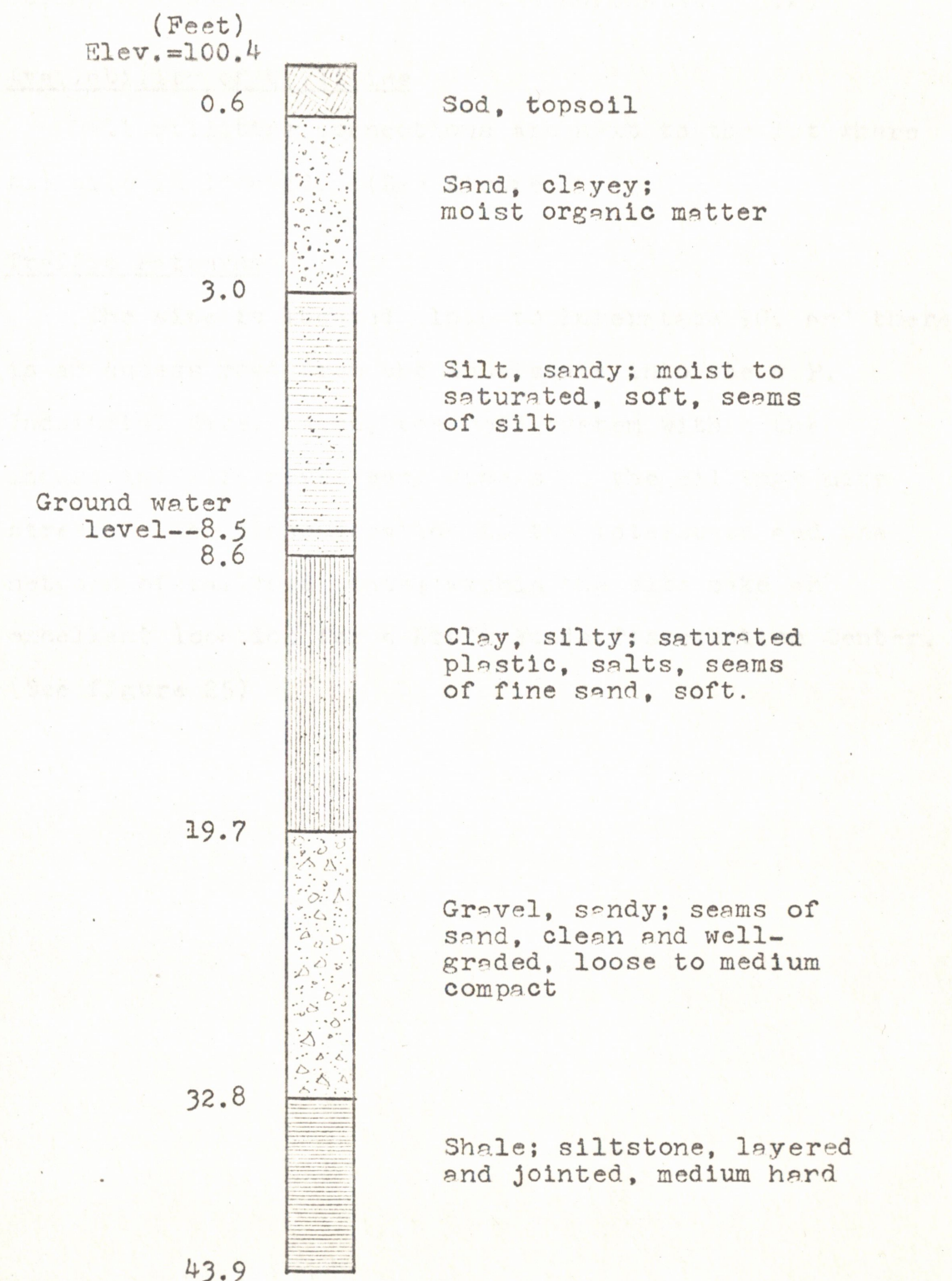
Diagram of Test Boring

Figure 24 (no scale)

Prevailing Winds

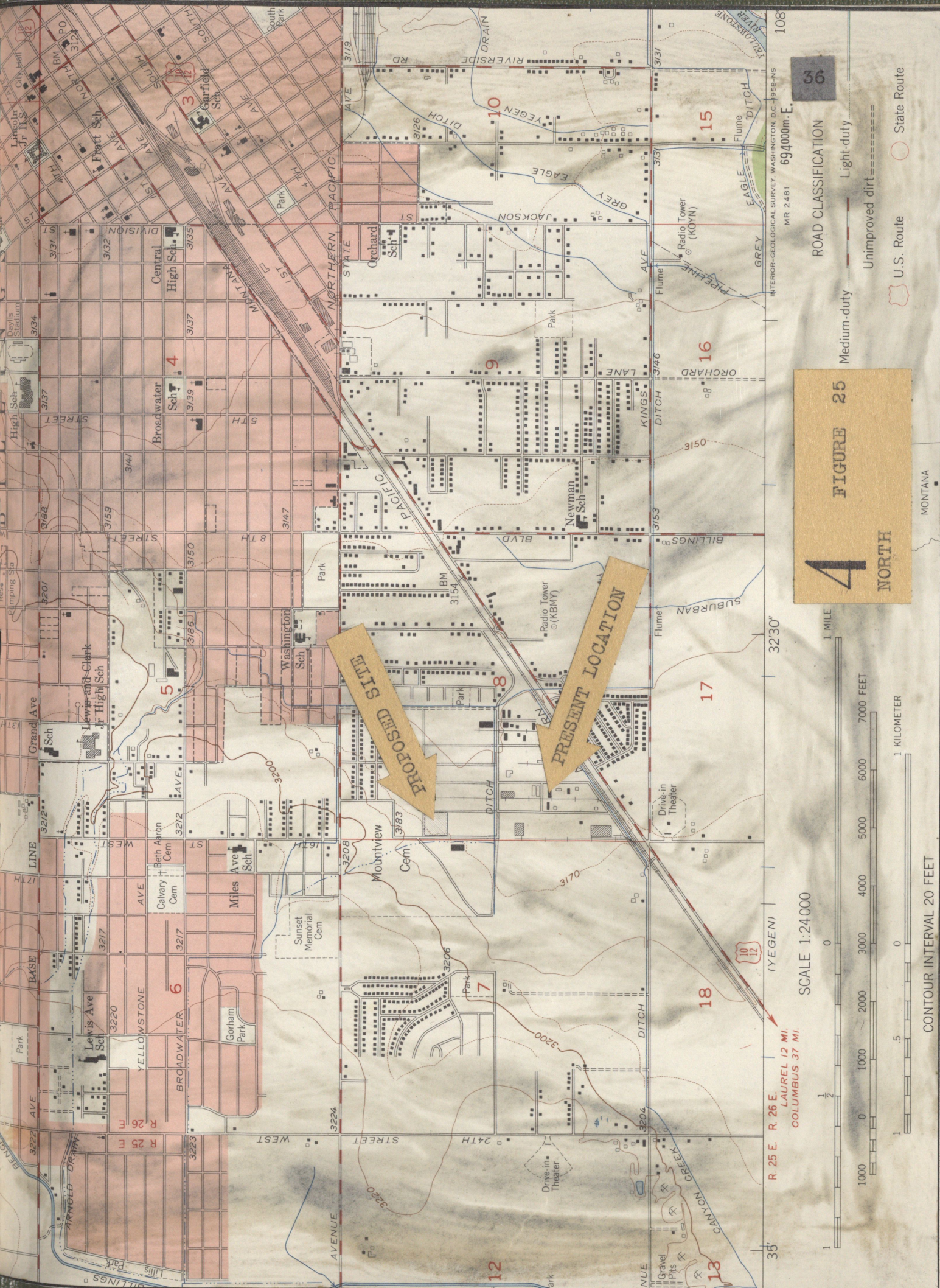
The prevailing winds are from the southwest except during May when they are from the northwest. (5;2)

Availability of Utilities

All utilities connections are next to the lot where the site is located. (See figure 26)

Traffic Patterns

The site is located close to Interstate 90, and there is an access road from the Interstate into the N.P. Industrial Site. Also, the road system within the industrial site gives easy access to the Billings city streets. The close location to the interstate and the network of railroad tracks within the site make an excellent location for a Kraft Foods Distribution Center. (See figure 25)



36

ROAD CLASSIFICATION

Light-duty
Medium-duty
Unimproved dirt

U.S. Route

State Route

FIGURE 25

4 NORTH

SCALE 1:24000

R. 25 E. R. 26 E.
LAUREL 12 MI.
COLUMBUS 37 MI.

INTERIOR-GEOLOGICAL SURVEY, WASHINGTON, DC-1958-NS
MR 2481 694000m.-E.

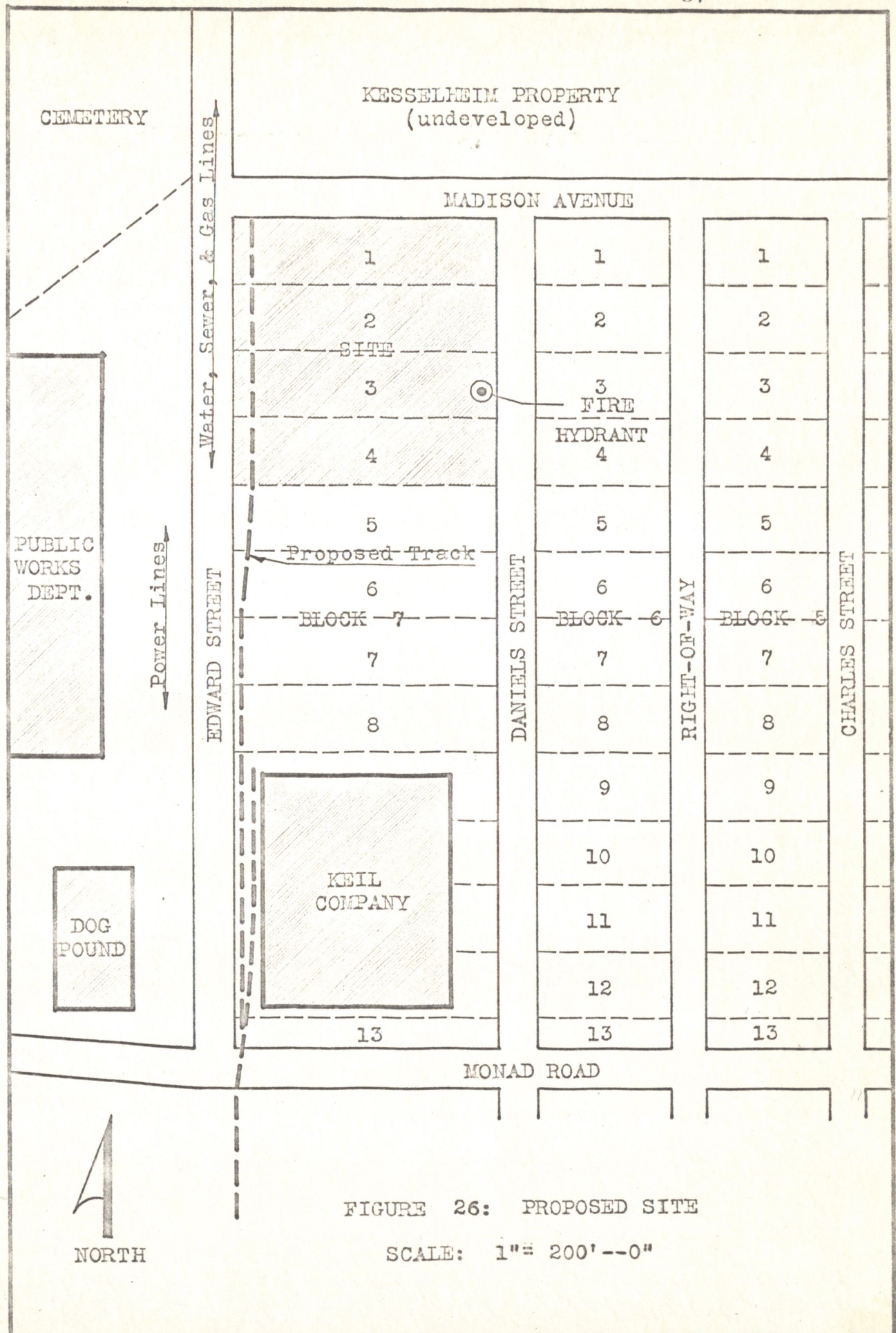
3230'

(YEKEN)

35'

CONTOUR INTERVAL 20 FEET

MONTANA



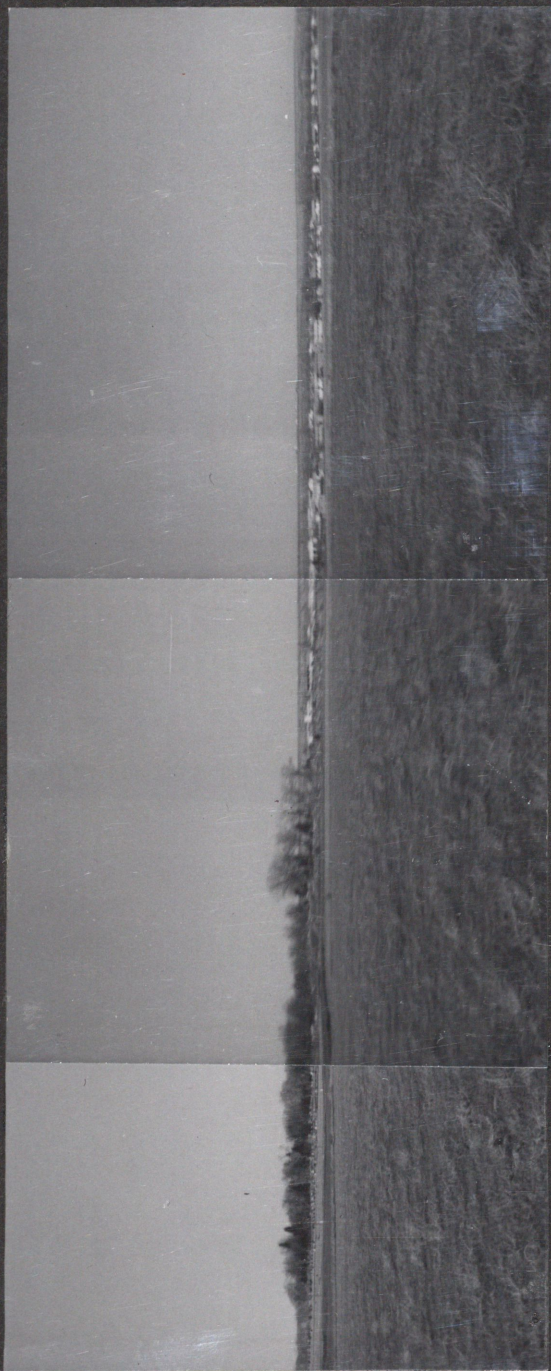


FIGURE 27; VIEW OF SITE LOOKING NORTH
This is a view of the site looking north. The wooded cemetery and residential area are in the background.

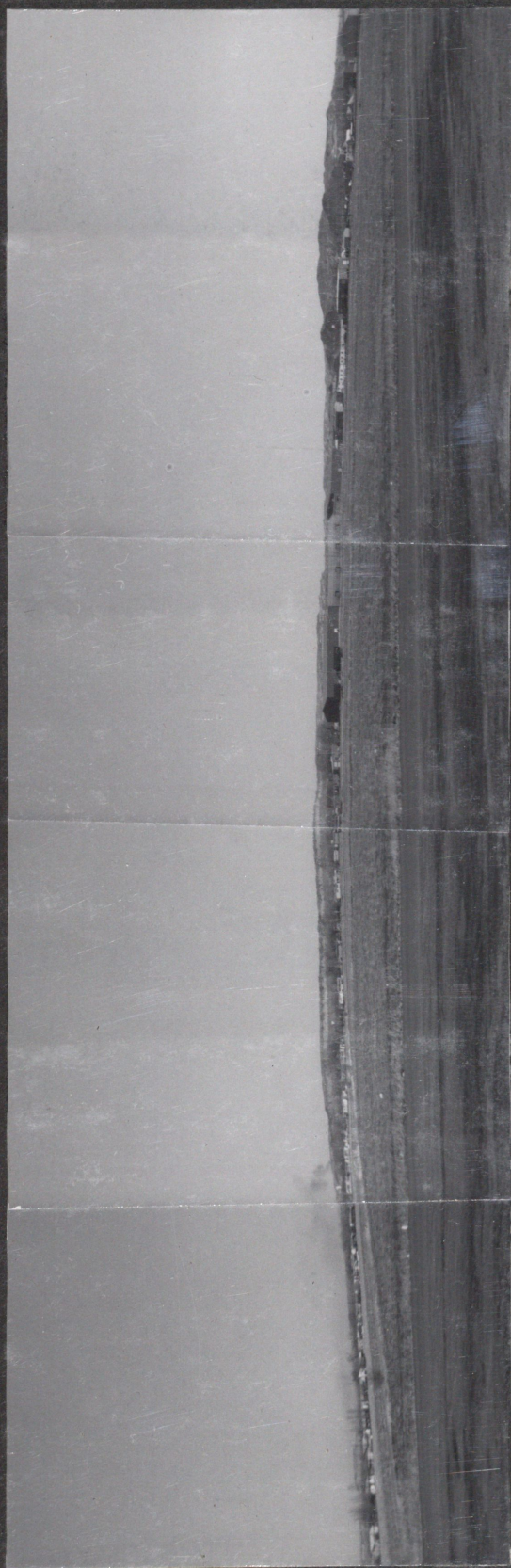


FIGURE 28; VIEW OF SITE LOOKING EAST

This is a view of the site looking east across Edward Street. The open field and the Associated Grocers warehouse are in the background.



FIGURE 29; VIEW OF SITE LOOKING EAST

This is a view of the site looking south across Madison Avenue. The Keil Grocery Company warehouse is in the middle of the background.

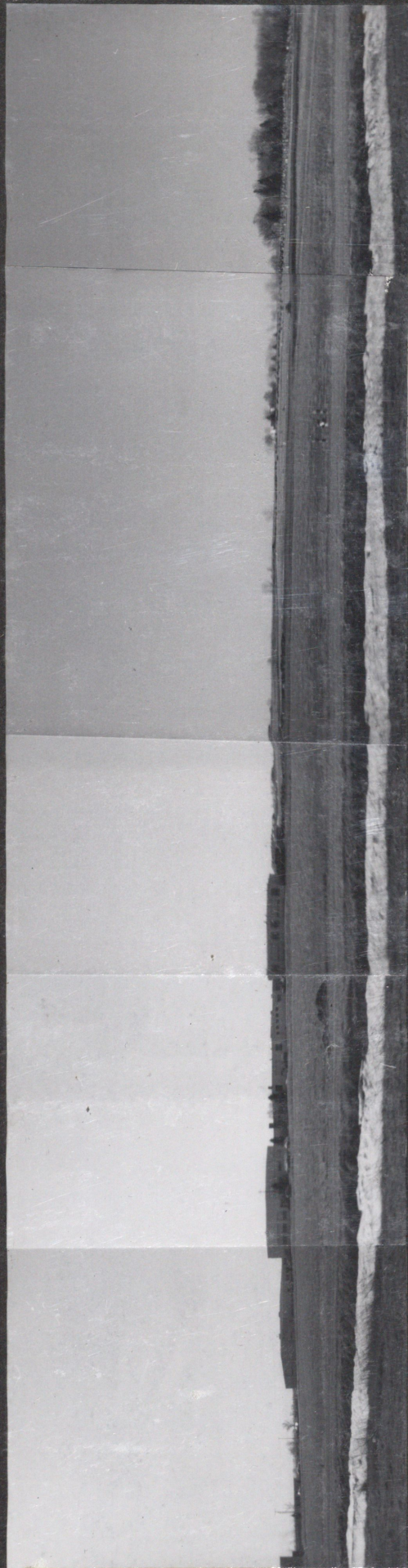


FIGURE 30; VIEW OF SITE LOOKING WEST

This is a view of the site looking west across Daniels Street. The Public Works Department and the wooded cemetery are in the background.

FUNCTION OF THE BUILDING

General

The Kraft Foods Distribution Center serves two groups of people: its customers and its employees. The main function of the center will be to provide the best means for serving these two groups.

The customers can best be served if their needs are met promptly. This can only be accomplished by a staff that has the most modern methods at their disposal. Furthermore, the working areas must provide the incentive to produce good work. The building that houses the Kraft Foods staff must be able to meet these two needs.

The employees are divided into two groups. One group contains the office employees, and the other group contains the warehouse employees. Thus, the Distribution Center will be divided into two areas: the offices and the warehouse.

Five Principles for the Employees

For the benefit of their employees, Kraft recognizes five principles.

Recognition of Individual

"Kraft Foods not only recognizes, but cherishes, the freedom and dignity to which each individual worker is entitled. We shall endeavor to so conduct our business that each employee will be recognized as an individual, and that his personal freedom, responsibility, and dignity will be accorded full consideration. We believe that there is a definite relationship between the happiness of the individual worker and the success of the company. We shall attempt to keep each Kraft employee informed on

all important matters which affect his individual relationship with the Company."

Recognition of Various Groups

"When any of us joins a working group, we voluntarily limit the exercise of our rights and freedoms to the extent that we recognize that the success of the group can be jeopardized by an unreasonable exercise of individual action. Whenever people are gathered together to live or work, certain rules and regulations must be established for the protection and good of the group.

Therefore, the Company assumes that every individual associated with it recognizes the dependence of one worker on another, of one department on another, and the dependence of the whole Company on the plants, branches, departments, and the individual employee, all of which comprise the Kraft Foods Company."

Recognition of Legal Processes

"The Company believes in the orderly process of law. Where laws apply to our relationship with our employees, we shall be governed accordingly. We do not believe that representatives of management or of the unions should coerce an individual in the favor of or against his participation in the activities of organized labor."

Fair Wages

"It is our intention that each employee shall be paid a fair wage consistent with community standards within our industry."

Good Working Conditions

"We believe that Kraft employees should have a clean and healthful environment in which to work." (10;1)

Numbers and Types of Employees

There are a total of nineteen people who work at the Billings warehouse. The following is a list of the number and types of employees.

Number	Type
1	Director of Kraft at Billings
4	Secretaries
1	Office Manager
1	Sales Supervisor
1	Warehouse Manager
4	Warehousemen
4	Truck Drivers
3	Local Salesmen

Figure 31 (7)

The director, the secretaries, the office manager, the sales supervisor, and the local salesmen are associated with the office areas. The warehousemen and the truck drivers work mainly in the warehouse area. The warehouse manager is equally associated with both areas.

Activities and Their Spaces

The office areas will be for the conducting of business transactions and the proper recording of these transactions. This area must provide spaces for the workers and the storage of their work. Furthermore, areas must be provided for the equipment the employees use. This equipment does include the teletype machine and the Xerox machine plus the normal office equipment, such as typewriters, adding machines, and phones.

The warehouse will be for the storing of the Kraft products. There will be five main parts to the dry storage area; the cooler area, the freezer area, the

railroad unloading area, and the truck loading area. Efficient circulation between these areas is vital to an economical operation.

Items Stored in Warehouse

The items were selected to give an idea of the products stored in the warehouse area, and the amount of space needed for them. The list gives an idea as to the amount of area, both horizontally and vertically, taken up by different products. During the design stage, the list will be used to select the best locations in the warehouse for the different products. These locations will determine where the aisles for circulation in the warehouse will be located. This list is only a partial list, of selected products with representative sizes, as the list of the 450 different products stored in Billings can be obtained from Krafts during the design stage.

Cooler Items (Figure 32)

cases per layer layers per pallet cases per pallet weight per pallet (inc. pallet) height per pallet no. of pallets high	8 oz. Soft Margarine 8 5 40 1260 lbs. 49-3/4 in. 3 or more	6 oz. Blue Chips 20 15 300 1750 lbs. 65 in. 1
cases per layer layers per pallet cases per pallet weight per pallet (inc. pallet) height per pallet no. of pallets high	3 oz. Philly 10 7 70 2305 lbs. 55 in. 2	5 lb. Loaf Process Ch. 20 3 60 2020 lbs. 40.9 in. 3 or more
cases per layer layers per pallet cases per pallet weight per pallet (inc. pallet) height per pallet no. of pallets high	3 lb. Ribbon Sliced Ch. 20 4 80 2140 lbs. 42 in. 2	8 oz. Refrigerated Dr. 22 9 198 2575 lbs. 57 in. 3 or more
cases per layer layers per pallet cases per pallet weight per pallet (inc. pallet) height per pallet no. of pallets high	5 lb. Parkay Chiplets 11 6 66 1527 lbs. 42 in. 2	4 oz. Party Snack 11 6 66 1090 lbs. 45 in. 3 or more

Dry Storage Products (Figure 33)

	14 oz. Bottle Ketchup	5 oz. Swank
cases per layer	10	22
layers per pallet	5	12
cases per pallet	50	264
weight per pallet (inc. pallet)	1900 lbs.	2212 lbs.
height per pallet	49-1/8 in.	61 in.
no. of pallets high	3 or more	3 or more
	12 oz. Peanut Brittle	12 pz. Preserves
cases per layer	10	18
layers per pallet	7	9
cases per pallet	70	162
weight per pallet (inc. pallet)	1605 lbs.	2358 lbs.
height per pallet	65-1/2 in.	53 in.
no. of pallets high	2	3 or more
	14 oz. Caramel Bag	8 oz. Pourable Dressing
cases per layer	13	20
layers per pallet	7	7
cases per pallet	91	140
weight per pallet (inc. pallet)	2239 lbs.	1980 lbs.
height per pallet	79-1/16 in.	61-3/4 in.
no. of pallets high	2	3 or more
	16 oz. Pourable Dressing	12 oz. Salad Dressing
cases per layer	13	17
layers per pallet	6	9
cases per pallet	78	153
weight per pallet (inc. pallet)	2011 lbs.	2472 lbs.
height per pallet	64-1/4 in.	54-1/4 in.
no. of pallets high	3 or more	3 or more
	8 oz. Salad Products	Pint Salad Products
cases per layer	22	14
layers per pallet	10	9
cases per pallet	220	126
weight per pallet (inc. pallet)	2410 lbs.	2494 lbs.
height per pallet	54 in.	57 in.
no. of pallets high	3 or more	3 or more

	Qt. Salad Products	18 oz. Jelly & Preserves
cases per layer	10	14
layers per pallet	7	7
cases per pallet	70	98
weight per pallet (inc. pallet)	2585 lbs.	2295 lbs.
height per pallet	54-3/4 in.	50 in.
no. of pallets high	3 or more	3 or more
	6 oz. Grated Romano	6 oz. Mustard
cases per layer	14	12
layers per pallet	10	11
cases per pallet	140	132
weight per pallet (inc. pallet)	1640 lbs.	2476 lbs.
height per pallet	65-15/16 in.	52-3/4 in.
no. of pallets high	3 or more	3 or more
	8 oz. Sz. Bottle Mustard	6 oz. Mustard
cases per layer	12	12
layers per pallet	7	11
cases per pallet	84	132
weight per pallet (inc. pallet)	1511 lbs.	2476 lbs.
height per pallet	59 in.	52-3/4 in.
no. of pallets high	3 or more	3 or more
	4 gal. Canton Salad Dr.	12 oz. Marshmallow Creme
cases per layer	20	9
layers per pallet	3	8
cases per pallet	60	72
weight per pallet (inc. pallet)	2200 lbs.	1587 lbs.
height per pallet	44-1/4 in.	67-1/2 in.
no. of pallets high	3 or more	3 or more
	16 oz. Salad Oil	5 lb. Malted Milk
cases per layer	5	12
layers per pallet	6	5
cases per pallet	20	60
weight per pallet (inc. pallet)	1407 lbs.	1515 lbs.
height per pallet	59 in.	56 in.
no. of pallets high	3 or more	3 or more

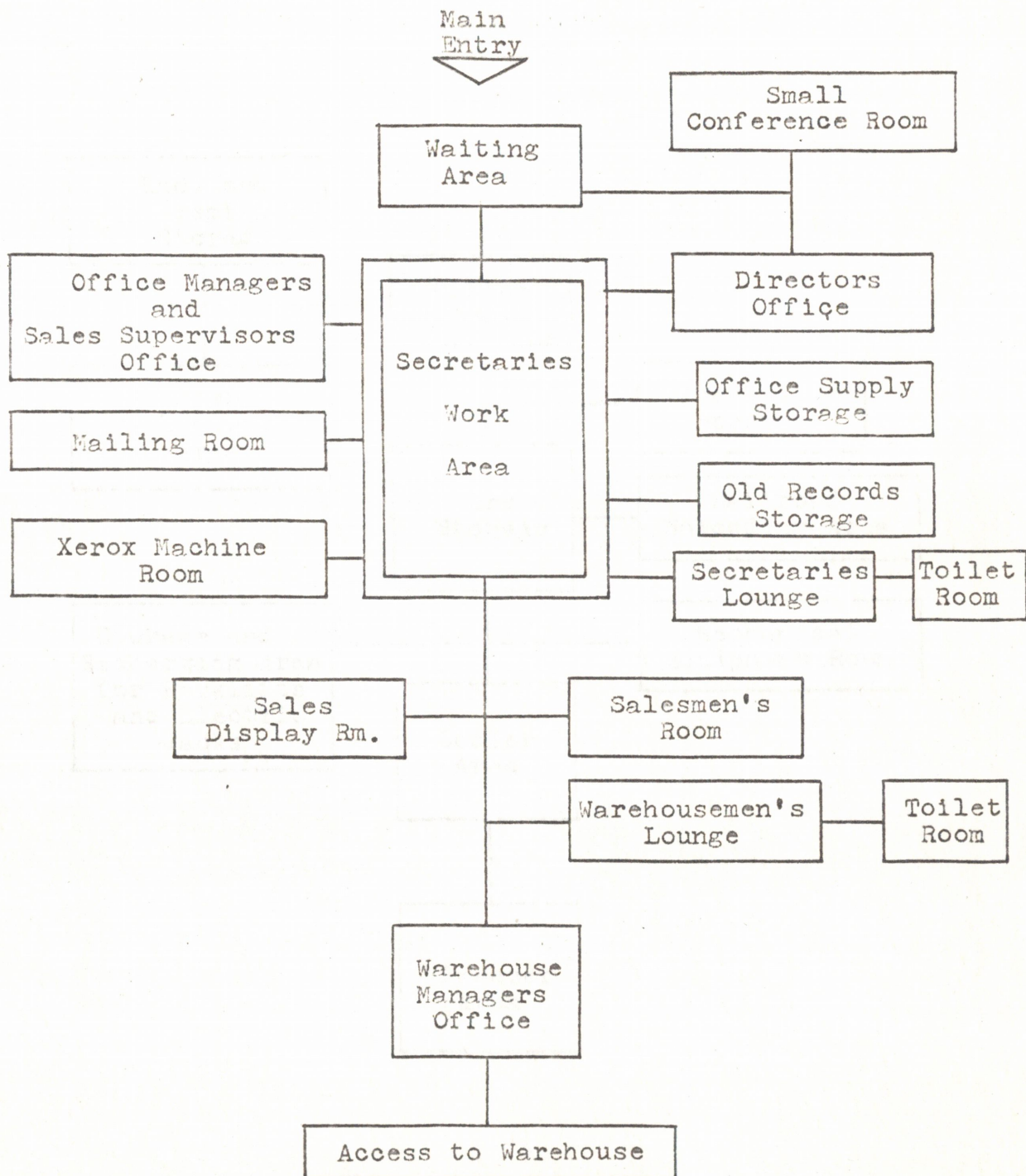
Circulation of Equipment

The circulation of equipment will take place within the warehouse area and around this area. Within the warehouse, adequate aisles must be provided for the circulation of the electric forklifts and electric "jacks" (small electric pallet movers). Outside the warehouse, enough area must be provided so that the trucks can turn around and back into the docks to load and unload.

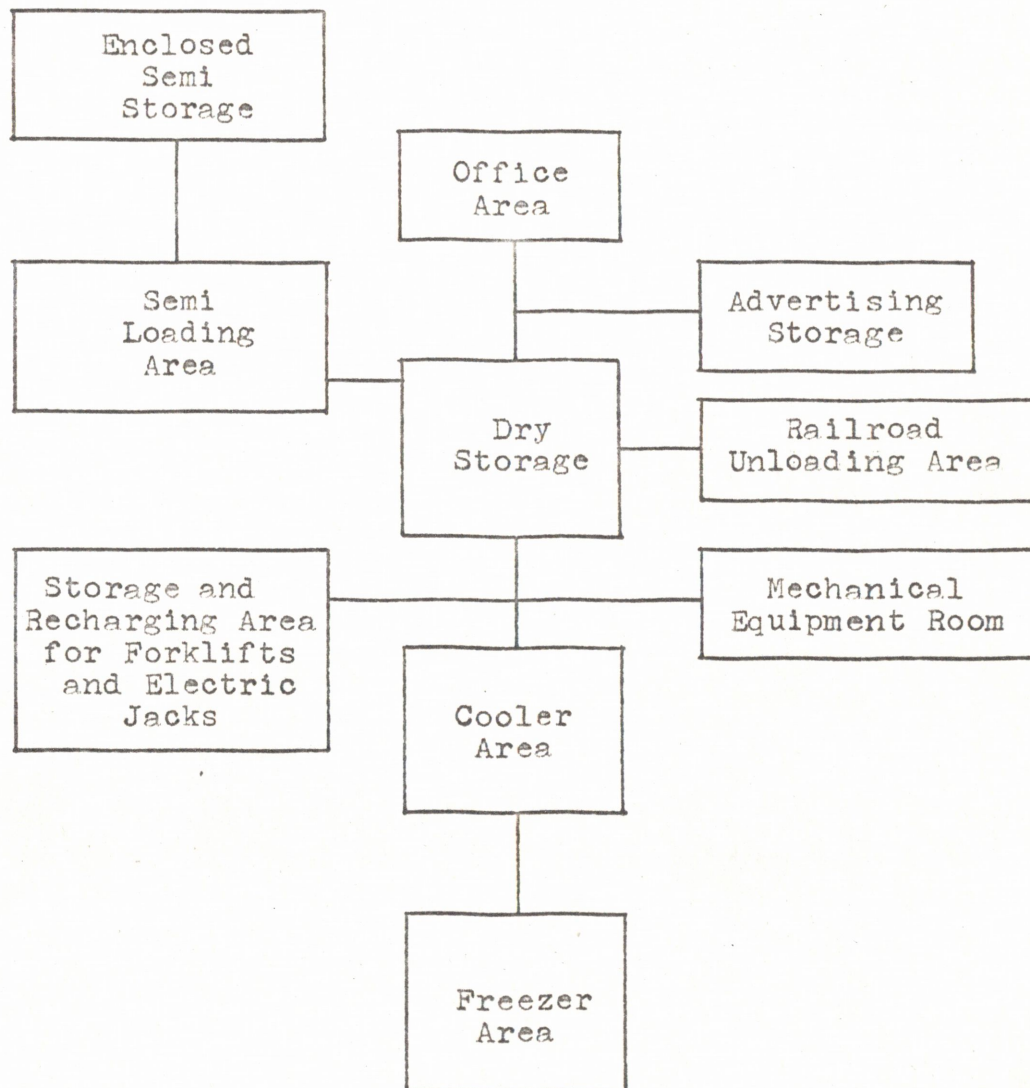
Organization of Area

The possible organization of the office and warehouse areas is shown in the following two diagrams. (See figures 34 & 35) For a description of these areas see the program section of this booklet.

Office Area (Figure 34)



Warehouse Area (Figure 35)



PROGRAM

Office AreaProposed Area

Director's office 190 sq. ft.

Description: This is a private office where the Director keeps his files and does his work. It will include the finer furnishings that go with an executive office.

Office Manager's and Sales Super-

visor's Office 220 sq. ft.

Description: These two people will share the same office according to Mr. Barger, Director at Billings. *The office manager supervises* The secretaries work and make sure the sales records are properly taken care of. The sales supervisor is also concerned with sales which gives him his close tie with the office manager. Both should have their own desks and files.

Warehouse Manager's office 160 sq. ft.

Description: The warehouse manager oversees the warehousemen and the truck drivers. He has to keep track of all the products that go in and out of the warehouse so he can properly fill orders. He will have a desk and files plus an area for his adding machine.

Secretaries work area 300 sq. ft.

Description: This room will house space for four secretaries. This area must work in conjunction with the waiting area as one of the secretaries will have to work as a receptionist. This area will include four desks and all the other equipment that the secretaries use.

Salesmen's room 220 sq. ft.

Description: This area will house three salesmen.. Three desks will be in this room.

Sales Display room 600 sq. ft.

Description: This room is used to display the new advertising posters and other sales help which the salesmen can place in stores. This room is also used to show promotional movies and hold large meetings on selling.

Mailing room 130 sq. ft.

Description: This room is used for processing the mail that is to be sent out. Furthermore, boxes are provided in which memos and

newsletters can be put for each sales employee.

Secretaries Lounge and rest room . . . 170 sq. ft.

Description: The lounge should include a couch and chairs for the secretaries to relax in during coffee breaks and lunch hours.

The rest room is connected since only the secretaries will use this area. One lavatory and one toilet will be included.

Warehousemen's Lounge 180 sq. ft.

Description: This area will provide space for the warehousemen to relax during coffee breaks and lunch hours. An area for the coffee pot will have to be provided here.

Men's Rest Room 160 sq. ft.

Description: This room will be used by all the male employees at Krafts. There should be at least two toilets and two urinals, one shower, and one lavatory. The shower is used by the truck drivers after a long trip before going home.

Xerox Machine room 100 sq. ft.

Description: This room will house the Xerox machine which is used by the office personnel.

Office Supply Storage 150 sq. ft.

Description: All the sales material and office forms, plus any other office supplies will be stored here.

Old Records Storage 200 sq. ft.

Description: All the old sales receipts are stored here until they become old enough to throw away. All other old office records are stored here also.

Small Conference room 160 sq. ft.

Description: This room probably will not be used by more than eight people at a time. Its use would be for small office conferences and small meetings with clients.

Waiting Area 130 sq. ft.

Description: This would be the entrance area to the office area. Seating would be provided for two or three with a possible display

case or area.

Corridors 400 sq. ft.

Description: These are the
circulation areas between rooms.

Total Office Area 3470 sq. ft.

Warehouse Area

Dry Storage 17,200 sq. ft.

Description: This area contains
all the items that do not require
refrigeration.

Cooler Storage 16,500 sq. ft.

Description: This area contains
the items that need refrigeration
but must not be frozen.

Freezer Storage 5,500 sq. ft.

Description: This area will con-
tain all the items that need to be
kept frozen.

Advertising Storage 1,000 sq. ft.

Description: This area will be
for storing the boxes of sales
advertising material.

Storage and Recharging Area for
Forklifts and Electric "Jacks" . . . 80 sq. ft.

Description: In the evening the forklifts and "jacks" must be plugged into the chargers so they will be ready to use the next day. There are four electric "jacks" which require two chargers and two forklifts which require two chargers.

Mechanical Equipment room 400 sq. ft.

Description: This room will house all the heating and cooling equipment.

Semi Loading Area 210 sq. ft.

Description: This will be the loading dock area, and should have at least three doors and three power operated ramps for loading the trucks.

Railroad Unloading Area (if enclosed) 4000 sq. ft.

Description: This is where the boxcars are unloaded, and there should be at least three doors so three cars can be unloaded at one

time. This area could be totally enclosed or just partially.

Aisles _____

(The area for the aisles is included in the storage area figures.)

Description: The aisles are for circulation in the warehouse.

Total Warehouse Area 44,890 sq. ft.

Enclosed Semi Storage 3,800 sq. ft.

Description: This area will house the three semitrailers and tractors, and the one straight bed truck that Kraft now has operating out of the Billings warehouse.

Total Office Area 3,470 sq. ft.

Grand Total 52,160 sq. ft.

(2;322 & 7)

AESTHETICS

Statement of Aesthetics

Aesthetics I believe to be the expression that a building gives to the individual who looks at the building. The impression the person receives, good or bad, has caused him to evaluate in his mind what the building symbolizes to him. By causing the beholder to evaluate its qualities, the building has expressed itself to the individual. The expression is usually generated by the materials and, or the shape of the building. Therefore, aesthetics is closely related to or produced by shapes and materials.

To give a pleasing expression to the beholders, the building should not give a false representation of itself. By this I mean that if the structure is a food warehouse it should symbolize this, and not give the person a false feeling that the structure is, for example, an office building. This does not mean that the building must look like the typical food warehouse. The expression is not in being typical, but the expression is in the nature of the structure.

Thus, in the design stage I will be striving to achieve a building that expresses Kraft Foods as a food warehouse, and as a warehouse that is pleasing to see and to work in. To say now how this will be achieved, I do not believe is possible at this time. I believe the expression of the building is only achieved during

the design process which will take place next quarter. I can, though, discuss some of the considerations that could effect the aesthetics of the Kraft Foods Distribution Center.

Height of the Structure

The site I have selected has plenty of area for building. Therefore, the Distribution Center will probably be one story. Another reason which will probably be the deciding factor for one story, is that "horizontal transport has been more highly developed than vertical." (11;41) This is not to say that an economical vertical method could not be developed, but since I will be designing for present day warehouse systems, the transportation within the warehouse becomes a limiting factor.

Types of Structure

The structure of the building could be of reinforced concrete, prestressed and precast which is common in Britain today. "This medium is very suitable for warehouse construction; it is cheap, rapid to erect, and clean." For food storage this type is especially desirable as the interior will be smooth, dustfree, and rustfree. Little maintenance is needed for reinforced concrete, and it is flexible and readily expandable if a light cladding or precast siding is used on the interior. "The large spans which are possible with reinforced concrete are economical and give maximum internal flexibility." (11;34)

In America structural steel is the common form for warehouses. (11;45) Even though reinforced concrete is fairly rapid to erect, structural steel is even a faster method when a prefabricated siding is used to enclose the space. As a result of the fast pace of life in America, speed of erection many times is the deciding factor for building construction. If steel is to be used for the Kraft Foods warehouse, I believe that it will be because of its ability to fulfill the needs of a warehouse and not just for its speed of erection. These needs of a warehouse are flexibility and pleasant surroundings for working in.

Shape of the Structure

The shape of the building must also be considered as shapes can be very expressive. But, in warehouses odd shapes must be avoided, and the length must not be more than three times the width in order to limit the building from becoming uneconomical. (11;55) This is obvious since storage items must be easily reached and quickly moved from one area to another. To meet these requirements the building is likely to be of a rectangular nature.

Interior of the Structure

The interior of the Distribution Center will have to be pleasant for the employees so that they will desire to do their work efficiently. This may possibly be

achieved by the use of color. Colors are known to have psychological effects on the feelings of people. "Yellow, the color of sunlight, brings good cheer; green has little effect upon human emotions; blue is definitely calming; purple is depressing; red excites to courageous endeavor; and orange is the most powerful stimulant of all." (12;20) "It has been proven that bright, cheerful, attractive color pays dividends in better tempers throughout an organization." (12;21) Color can also "improve visual efficiency and comfort, strike the proper note for the type of product manufactured, highlight certain areas, and prevent excessive contrast." (11;51)

Another area that has psychological effects on people is light. Today many warehouses are being made windowless because of the flexibility of planning that is permitted. "Designing of factories to utilize daylight restricts areas, distances, and types of construction; whereas, the width and length of artificially lit buildings are unlimited." This situation though, has produced adverse psychological effects on the employees as people are very oriented to natural light. (11;41-42) I believe that natural light and artificial light should both be used to their best advantage.

"No matter how refined and advanced the architectural expression may be, the factory will still be an aesthetic failure unless it achieves flexibility while

still expressing the character of the product manufactured." (11;45) I believe this is what I will have to do for the Kraft Foods Distribution Center. Being a warehouse the building will require flexibility, but it must also express or symbolize what type of warehouse it is. In other words, people should be able to tell by lookin at the building that it is a food warehouse and not, for instance, a machine shop.

ECONOMIC CONSIDERATIONS

Financing

The Kraft Foods Company whose home office is in Chicago, Illinois, is a privately owned organization which will finance the new Distribution Center for Billings, Montana. They will finance the building through their profits, and the sale of the present facility. Of course, one would hope that the new structure in Billings would pay off the initial investment of the mother company after a few years, through the increased volume of business the Billings branch would be able to handle.

Site Cost

In the N.P. Industrial Site, the land is rented from the Northern Pacific Railway. Through correspondence with the Northern Pacific Railway Industrial Development Department, I learned that the site I selected would have a rental of \$2,575 per annum. This figure includes track construction for the site. This is more rent that Krafts is presently paying since there is more land involved, but I will assume that the increase in the volume of business handled will compensate for the paying of more rent. "In addition to the rental, the leasee is obligated to assume taxes and any assessments applicable to the leased premises." (13)

Warehouse Cost

Until a preliminary design has been done, an accurate cost estimate for the warehouse will be hard to obtain. A preliminary cost estimate can be found by using the square footage figures presented in the Program Section. One must remember that this estimate cannot be a rigid figure at this early stage as the estimated cost for the building could be either too high or too low. For instance, if the estimate was found to be low and this estimate was used as the ultimate cost, then the quality of the building desired might have to be sacrificed.

To estimate the cost, I will use the Calculator Method in the Marshall Evaluation System. In this system buildings are classified as follows:

"Class 'A' buildings have fireproofed structural steel frame with reinforced concrete or masonry floors and roofs."

"Class 'B' buildings have reinforced concrete frames and concrete or masonry floors and roofs."

"Class 'C' buildings have masonry exterior walls, and wood or steel roof and floor structures or slab on ground."

"Class 'D' buildings have wood or light steel frame and roof structures." (14)

Most warehouses of good quality are of class 'C' construction. Therefore I will assume the Kraft Foods Distribution Center to be class 'C' construction in order to estimate the cost. I will also use an average cost per square foot as I will not know what the construction

materials will be until I do the preliminary design.

The average cost per square foot in good class 'C' construction is \$8.22. This figure will allow good quality materials to keep the cost of maintenance at a minimum. Since this warehouse will require a sprinkler system for fire protection, 38 cents will be added to \$8.22 to get a final cost of \$8.60 per square foot. As figured in the Program Section, the warehouse area is 48,360 sq. ft. Thus, at \$8.60 per sq. ft., the total cost is \$416,000.

I have also proposed an enclosed semi storage garage, and the average cost per square foot for this type of garage is \$7.26. I have estimated that 3,800 sq. ft. is needed. Therefore, the cost of the garage will be \$27,600.

The Billings area has a local multiplier of 1.03. This multiplier takes into account the cost of labor and other construction costs that vary from city to city and state to state. Furthermore, the current cost multiplier is 0.97 for the western part of the United States. This multiplier brings the cost of construction up to date for any particular area of the United States. Thus, the total cost estimate for the warehouse and garage is \$443,600.

This final figure takes into account the office area as the Marshall Evaluation System allows for three to eight per cent of the total area to be office area when figuring the cost per square foot. The Kraft Foods warehouse's estimated office area is seven per cent of the total area which is within the allowable range.

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Summary Of Design Solution

In the design stage, I felt that the warehouse for Kraft Foods should be determined by economics and function. Since the food industry is mainly a low profit margin business, the cost for the building should be kept to a minimum. But, I did not feel that the cost should be kept so low that the design of the structure would be limited or hindered. Therefore, I tried to keep the cost down by the choice of material used. Thus, I decided to use a steel structure and siding material. The building is not large enough to make a concrete structure economically feasible.

In deciding on a floor plan, I felt that the determining factor was the function of the areas as they related to each other. Therefore, no predetermined shapes were used into which the areas were placed. The function was what determined the final shape of the floor plan.

As was stated in the Aesthetics section of the thesis, natural light is psychologically very desirable. Since wall area on the interior is usually blocked out by the stacked merchandise; logically, if there is to be natural light, it must come from the roof area. Since skylights on flat roofs can become blocked off by snow and the like during the winter, I felt the saw toothed roof over the dry storage areas would be the best solution to let light in. Furthermore, the saw toothed roof gives the warehouse variety which is lacking in many modern day warehouses.

I chose to place the structure on the exterior of the building to give even more variety to the building by breaking up the large areas into smaller ones. Tension rods were used on the east and west sides of the building in order not to destroy the effect of the saw toothed roof which would have happened if a beam were placed near the top of the roof. A normal column to beam structure is used on the north and south sides as was used on the office area since there was no need for a departure from normal construction there. But, the structure is on the exterior as there is still the need for a break-up of areas.

In the Aesthetics section of the thesis, I stated that I would "be striving to achieve a building that expresses Kraft Foods as a food warehouse, and as a warehouse that is pleasing to see and work in." The sharp, clear lines of the building, I believe, are pleasing to see and the brightness of the building indicates a place that would be desirable for the storage of food. In this way the warehouse was designed to be pleasing and desirable to the employee and visitor alike.

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