duluth campus
university of minnesota
master plan

planning base
inventory

april, 1972
physical planning office

kenneth r. stebbins
consultant planner

bather, ringrose, wolsfeld
transportation
planning consultants
August 1, 1972

David R. Licht
Chairman, Duluth Planning Advisory Committee and
Assistant Director, Office of Physical Planning
503 Morrill Hall
University of Minnesota
Minneapolis, Minnesota 55455

Dear Mr. Licht:

Transmitted herewith is the Planning Base Inventory which is the second
in the series of reports comprising the University of Minnesota, Duluth
Long Range Master Plan.

The Planning Base Inventory has been prepared through the efforts, time
and knowledge of many people both within and without the University.
The report consolidates a wealth of information related to the existing
physical situation at UMD into a concise and convenient format.

The original data has been recorded on 30" x 40" clear acetate sheets
so that the various kinds of information can be easily compared. The
original data is available at the Office of Physical Planning, 503
Morrill Hall, University of Minnesota, Minneapolis. The Transportation
Study, compiled by Bather, Ringrose, Wolsfeld, Inc. is also included
as part of this document.

The material presented in this document relates to one point in time.
It is intended that the information be updated every two years so
that the information remains current and accurate.

From the information presented here as well as information revealed in
the issue analysis and meetings with various interest groups, we can
now begin to formulate planning directives which will guide the future
development of the UMD Campus.

Sincerely,

Kenneth R. Stebbins
Consultant Planner - UMD

KRS:rvo

Kenneth R. Stebbins
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The Inventory report serves as a collection of data, in graphic and written form, documenting the existing situation at University of Minnesota - Duluth (UMD). The original data has been recorded on 30" x 40" acetate sheets in an overlay format for ease of comparison and reproduction. The base data presented in the Inventory should be periodically updated and added to and therefore it should be understood that the following information pertains to one point in time.

The following diagram shows what portion of the planning process the Inventory report fulfills. In conjunction with the Tactical report, the documents summarize the basic issues and present conditions, and initiate the next phase of the planning process.

From the inventory information, issue analysis, and academic programming data, planning directives and policies will be formulated establishing the guidelines for future development at UMD.

Those who will be using the inventory data for future work should use the full size drawings from which this document was made. The original data is available from the University of Minnesota Physical Planning Office.
u.m.d. - planning methodology
acknowledgments

section 1

Robert Bridges - Vice Provost for Business Affairs
John Carlson - Biology Department
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Eric Clarke - UMD Plant Services
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City of Duluth
Minnesota Highway Department
Ole Wendfeldt - Campus Police
Duluth Parking and Transportation Committee

Special recognition and thanks are extended to John Andrews Architects of Toronto, Canada, for their suggestions and planning procedures as used in the St. Paul Campus Master Planning documents.
natural systems
The data presented in this section pertains to existing physical, functional, and aesthetic conditions of the Duluth Campus. The data possesses varying degrees of impact on future development at UMD. For example, the quality of views from and into the Campus might have less impact on future growth than the ability for certain types of soil to readily support construction would have. The data will be used to develop policies and directives for the physical growth of the Campus and at the same time identify the limitations the natural system factors will have on that growth.
The University of Minnesota, Duluth has been acquiring land for its Upper Campus expansion for approximately the last twenty years. The Campus is now approaching its expected physical size. An approximate listing of acreage is shown here. The Upper Campus statistics are only approximate since much of the peripheral land is in varying stages of acquisition.

<table>
<thead>
<tr>
<th>Landholding</th>
<th>Acreage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Upper Campus</td>
<td>221.3</td>
</tr>
<tr>
<td>Lower Campus</td>
<td>10.6</td>
</tr>
<tr>
<td>Alworth Apt., Provosts Res. &amp; School of Social Work</td>
<td>4.6</td>
</tr>
<tr>
<td><strong>subtotal</strong></td>
<td><strong>236.5</strong></td>
</tr>
</tbody>
</table>

In addition, the University also owns two Research Centers:

<table>
<thead>
<tr>
<th>Research Center</th>
<th>Acreage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Limnological Research</td>
<td>5.4</td>
</tr>
<tr>
<td>(Lester River)</td>
<td></td>
</tr>
<tr>
<td>Northeast Experiment Station</td>
<td>282.1</td>
</tr>
<tr>
<td><strong>approximate total</strong></td>
<td><strong>524.0</strong></td>
</tr>
<tr>
<td>of University land</td>
<td></td>
</tr>
</tbody>
</table>

NOTE: As of July 1, 1972, the control of the Northeast Experiment Station was transferred to the University of Minnesota Duluth Campus.
city land use and zoning

The data shown in the following table and on the accompanying drawing reflect the zoning regulations of the City of Duluth, Chapter 50 of the City Code.

<table>
<thead>
<tr>
<th>ZONE DESCRIPTION</th>
<th>MAX. ALLOWABLE DENSITY</th>
<th>MAX. HEIGHT (in stories &amp; feet)</th>
<th>HOUSING POTENTIAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>S Suburban</td>
<td>0</td>
<td>2 1/2, 35'</td>
<td>One Family Dwelling 1,2</td>
</tr>
<tr>
<td>R-1-a One Family Residential</td>
<td>3</td>
<td>2 1/2, 35'</td>
<td>One Family Dwelling 1,2</td>
</tr>
<tr>
<td>R-1-b One Family Residential</td>
<td>6.2</td>
<td>2 1/2, 35'</td>
<td>One Family Dwelling 1,2</td>
</tr>
<tr>
<td>R-1-c One Family Residential</td>
<td>8</td>
<td>2 1/2, 35'</td>
<td>One Family Dwelling 1,2</td>
</tr>
<tr>
<td>R-2 Two Family Residential</td>
<td>8.7 (2 Family)</td>
<td>2 1/2, 35'</td>
<td>Same as R-1, plus: Two Family Dwelling</td>
</tr>
<tr>
<td>R-3 Apartment Residential</td>
<td>Same as R-2, plus:</td>
<td>2 1/2, 36'</td>
<td>Same as R-3 plus: Apartment hotel,</td>
</tr>
<tr>
<td></td>
<td>Row Dwellings</td>
<td></td>
<td>multiple dwellings,</td>
</tr>
<tr>
<td></td>
<td>19.8</td>
<td></td>
<td>boarding house, fraternity</td>
</tr>
<tr>
<td></td>
<td>Multi-Family</td>
<td></td>
<td>or sororities,</td>
</tr>
<tr>
<td></td>
<td>26.7</td>
<td></td>
<td></td>
</tr>
<tr>
<td>R-4 Apartment Residential</td>
<td>Same as R-3 except:</td>
<td>300' +</td>
<td>Same as R-3 plus hotel</td>
</tr>
<tr>
<td></td>
<td>Multi-Family 79.2</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Efficiency 1/2.0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>C-1 Commercial</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>C-2 Highway Commercial</td>
<td>-</td>
<td>2 1/2, 35'</td>
<td>Hotel</td>
</tr>
<tr>
<td>C-3 Shopping Center</td>
<td>-</td>
<td>3, 45'</td>
<td></td>
</tr>
<tr>
<td>C-4 Business Center</td>
<td>-</td>
<td>See Art. XVII Hotel</td>
<td></td>
</tr>
<tr>
<td>M-1 Manufacturing</td>
<td>-</td>
<td>6, 60'</td>
<td></td>
</tr>
<tr>
<td>M-2 Manufacturing</td>
<td>-</td>
<td>6, 60'</td>
<td></td>
</tr>
<tr>
<td>U-1 Waterfront</td>
<td>-</td>
<td>6, 60'</td>
<td></td>
</tr>
</tbody>
</table>

1 Family defined as "one or more persons occupying a dwelling and living as a single housekeeping unit, as distinguished from persons occupying a boardinghouse, lodging house, hotel or hotel...

2 One Family Dwelling defined as "a building designed for exclusive occupancy by one family and not more than four roomers;"

3 Two Family Dwelling defined as "a building designed for exclusive occupancy by two families and not more than four roomers;"
Currently the city of Duluth's Planning Department is developing its own open space plan. This drawing shows recreational land, public parks and undeveloped areas which can be classified as open space. No differentiation is made as to whether or not these areas are developed or undeveloped, for recreational purposes. Duluth is in an enviable position with respect to foresighted acquisition of substantial amounts of land. The city abounds in beautiful recreational land and far exceeds average standards set up by the National Recreation Association. In 1965 Duluth had 100 acres of public open space per thousand population while 10 acres per thousand is the standard. However, much of this land is not yet developed or topographically unusable for recreation.

Implications:

- UMD's location in Duluth's open space development plan would greatly benefit both the Campus and the city and any planning for UMD should consider the city's open space planning policies.
neighborhoods

The Community Improvements Division of the Duluth Department of Research and Planning identify the area neighborhoods in the following manner:

The University's adjacent neighborhoods are:

kenwood

The Kenwood neighborhood is one of the more vital, growing, family residential districts in the city. It has had a large population increase and should continue to expand. The median income level is also rising and is already above the city average. It has a high occupancy rate and low aging tendency indicating that it is largely inhabited by younger families and families with children living at home.

hunters park

This is an old neighborhood with a steadily increasing population. It has a somewhat low stability index reflecting movement into the neighborhood as well as movement within the neighborhood. Hunters Park has a somewhat low proportion of families with children at home, a characteristic which is typical of older residential districts. It does, however, have a very high median income.

chester park

This older neighborhood still remains a vital residential neighborhood. Occupancy rates suggest a high proportion of families with children living at home. Chester Park has quite a high median income and high stability with a small population turnover. This neighborhood could change because it is an old neighborhood and because it is adjacent to the East Hillside area which is an area now in transition toward a more deteriorated condition.

Other University Influenced Neighborhoods:

congdon park

This is a strong slightly growing residential area with its largest growth occurring from 1950-1960. Congdon is a very stable neighborhood with low aging trends and the highest median income of any neighborhood within the city.

endidion

This is one of the city's oldest residential neighborhoods and is probably undergoing some transition. It is a district of middle aged to older persons with a large turnover, partly due to the large number of apartments. It has a low occupancy rate suggesting families whose children have left home and/or persons living alone. Endion has been decreasing in population.

Implications:

- Any development at UMD should involve the residents in the adjacent neighborhoods through issue analysis and participatory planning.
planned land acquisition

As stated earlier, UMD has been acquiring land adjacent to the Upper Campus for the past twenty years. With recent land acquisitions the Campus is rapidly approaching the projected physical size. The following drawing shows the property now owned by UMD and the property intended for acquisition by UMD. UMD is currently in the process of acquiring many of the parcels of land to the north of the built-up area of the Campus between Ste. Marie Street and Arrowhead Road.

The Upper Campus now consists of approximately 221.3 acres, and the Lower Campus consists of 10.6 acres. The amount of land owned by UMD is only approximate due to the changing status of many pieces of property currently under acquisition.

The approximate total acreage of UMD property is 241.9 acres. In addition, the University of Minnesota owns 282.1 acres which is used as a Horticultural Research Center.
Bedrock Geology

The geological history of the Duluth area goes back approximately one billion years to the late Precambrian period when the area was buried by a widespread and thick basaltic lava sequence. These lavas were soon afterward intruded by the Duluth Gabbro Complex and smaller intrusive sheets or sills. Underlying the Campus are two types of these basic igneous rocks. A fine to medium fined grained diabasic gabbro part of the Endion Sill, underlies the eastern half of the Campus. Bedrock exposures south of the communications center and outcrops with glacial scratches and polish north of Chester Park School along Woodland Avenue support this. Underlying the western half of the Campus are basalt lava flows of the North Shore Volcanic Group. This basalt has been found in outcrops on Rock Hill and Hartley Field, as well as in the core sample survey and excavation for the Food Service Building on Campus. The presence of faults has not been proved nor has it been disproved.

Surficial Geology

The surficial geology of the Duluth area is largely influenced by the effects of the last glaciation in the late Pleistocene Epoch. The oldest deposits on Campus are the reddish brown sandy glacial till found in the areas north and west of East University Circle. These deposits are typical throughout the region and tend to be rolling lands with bedrock outcrops in the moraine area but the major surficial material consists of bouldery till, (of bedrock types from rock underlying the Lake Superior Basin), sand and gravel. The next deposits were clay loam tills of the Nickerson or Splitrock eras and are typical in the Duluth area. These deposits are more evident on the moderately sloping land from East University Circle to just below Midway and Lawn Drives. The dramatic steep, bedrock-defended hillsides of Duluth were an effective dam that contained glacial meltwaters during the final retreat of the ice from the Lake Superior Basin. As the Superior lobe melted, Glacial Lake Duluth established a visibly detectable beach at 483 feet above the present level of Lake Superior. The land below this beach is quite flat and is made up of red lacustrine clays from Glacial Lake Duluth.

The thickness of the glacial sediments varies across the Campus area. On Campus, the sandy till of the Highland Moraine is thin, while the lake deposits are thicker (70' plus behind the athletic field bleachers). Bedrock in the lower area has been noted as shallow as eight feet below the surface near Griggs Hall and as deep as fifty feet just 200 yards away. Since the bedrock formations are igneous in nature they will not be found at a constant elevation. However, the bedrock slopes south and east toward Lake Superior.
surficial geology:
- highland moraine
- glacial till
- nickelson or splitrock till
- lacustrine deposits

bedrock geology:
- endon sill gabro
- basalt lava flows

geology
surficial geology data sources: gott r. meander, scott gott
k. kinnaird, geologic survey publications by g.m. schafer
and f.o. nielson (1944)

university of minnesota
duluth campus
long range master plan
soils

The soil mapping of the Campus was made with the intention of showing the natural soil surfaces and so it does not portray the cutting and the extensive filling that has gone on in the past 30 years. Most of the excavation for academic buildings has been in the Duluth fine sandy loam (CL) area; consequently most of the fill on Campus is of this type (CL).

The soils found on Campus have been mapped into the following 6 units and are described below.

ALLUVIAL LAND (Al, Loamy Aouents) These are chiefly loamy soils formed in alluvial material along Tischer Creek. They are wet and frequently flooded. The soils have thin strata ranging in size from sand to clay loam material. Because the material is so variable it is impractical to estimate the physical and chemical properties of the areas mapped alluvial land.

AUTOMBA (SM, Fine Sandy Loam) This unit consists of reddish brown sandy loam (SM) glacial till containing many boulders and coarse fragments. This material ranges from about 10 to many feet thick. Included in this mapping unit are areas adjacent to bedrock outcrops that are shallow to bedrock. Adjacent to the Duluth (CL) mapping unit (which occur at a lower elevations) are inclusions of silt loam (ML) at relatively shallow depths.

BEDROCK OUTCROPS (BR) This unit consists of gabbro or basalt outcrops. In addition to bare rock with only lichens there are very shallow mineral soils with broken rock usually less than 24 inches deep.

DULUTH (CL, Clay Loam) This unit consists of reddish brown loam or clay loam glacial till that contains a few boulders and coarse fragments. Most areas typically have loam or clay loam (CL) material to depths ranging from 10 to more than 20 feet. The underlying material is generally silt loam (ML) or sandy loam (SM) included in this mapping are areas that are chiefly silt loam (ML) material throughout the upper 15 feet or have some silt loam material usually at shallow depths. In addition, bedrock may occur at depths ranging from 10 to many feet.

LOXLEY MUCK (Pt) This unit consists of highly decomposed black or dark reddish brown organic material. It is found in low areas with high water tables. Typically this material is 2 to 15 feet deep and is over clay loam (CL).

ONTONAGON (CH, Clay) This mapping unit consists of reddish brown clayey glacial lake Duluth sediments. In most places there is a cap of loam or clay loam (CL) material that ranges from 1 to 6 feet in depth. In some profiles this material shows strong evidence of being fill. However, in other places it is questionable. Below the cap of CL material is clayey material (CH) that ranges from 5 to more than 15 feet thick. Included in this mapping are areas with lower strata of silt loams (ML) and loam or clay loam (CL). In addition, there are areas adjacent to bedrock outcrops that are moderately shallow to bedrock.

Implications:

Automba (Sandy loam), is of some value as an engineering material. It is nonplastic, is well drained, has a low potential for shrink-swell, medium compressibility, medium shear strength, and will frost heave only if saturated. It can be problematic for workability due to its abundance of stones and boulders.

Bedrock areas have severe limitations due to the shallow depth to igneous rock formations.

Duluth (Clay loam) is a fairly good material for all around use. It is moderately well drained and medium compressibility, has moderate potential for frost heave, medium shear strength and moderate shrink-swell potential. It makes a fairly good mineral fill material but is slightly stoney. This material often is quite dense. The inclusions of silt loam are typically even more dense.

Loxley (Muck) has severe limitations for any use. It has low bearing capacity, poorly drained, high shrink-swell potential, high compressibility and is highly susceptible to frost heaving. It is of value as a topsoil if mixed with a mineral soil.

Ontonagon Clay is a problematic material in that it has high potentials for shrink-swell, compaction, compressibility and low shear strength. It is very plastic, has poor workability and very slow permeability. It is a mineral soil that is almost free of stone.
The accompanying drawing shows the watershed areas of the Duluth Area. From this drawing insights can be made into the source and quantity of water passing through University of Minnesota land as surficial drainage (streams or runoff) or as subsurface water movement.
This drawing shows the major surficial water routes and the watershed divide between the two drainage systems on Campus. The Campus generally drains South and East, towards Lake Superior. The water falling North and East of the watershed divide line is fed into Tischer Creek which runs through Congdon Park to Lake Superior. The water falling South and West of this line emerges from the storm sewer system at College St. and Fay Ave. and flows through the South campus on its way to Lake Superior. Spring melting regularly fills these streams and some overflow occurs. This overflow usually occurs at culverts where ice or other debris impedes proper water movement. Through the drier portions of the year these streams continue to flow though the amount is greatly reduced.

Implications:

- Care should be taken to not divert water from one watershed to another. If this happens, the stream donating the water could lose enough to reduce its value as an aesthetic resource downstream.

- Since all the storm water on Campus drains into streams, care should be exercised to prevent undue pollution of the water in the storm sewers. The erosion of soils in undeveloped areas or around construction sites should be avoided. All this water eventually returns to the city's source of water (Lake Superior).
The accompanying drawing identifies areas which have high ground water tables (less than 10'). The soil water level on Campus is generally less than 20', however, in the S.E. Corner of the Campus and on the Lower Campus it is probably even deeper. The sources of this ground water are: stream associated water tables, springs, organic soils with a high water holding capacity, and permeable mineral soils conducting ground water from the watershed towards Lake Superior. No information exists which explains how much water moves through the Campus. The quantity and depth of this water is subject to monthly and yearly variations dependent on time of year, amount of recent precipitation and the extent of man made drainage systems in the area.

Implications:

- The presence of high ground water tables on Campus suggests that care should be taken to not contaminate this water since it ultimately ends up in Lake Superior (the source of water for the City of Duluth).

- In areas where high ground water tables can be expected, precautions must be taken in the building excavations and the waterproofing of structures built below the water level. Such precautions would add to construction costs.
subsurface hydrology

include in revised final report 1950-07-01

university of minnesota
duluth campus
long range master plan

areas with high ground water (less than 10 feet)

direction of movement
This drawing indicates the majority of trees on Campus. The drawing does not precisely locate every tree but attempts to show approximate massing and densities of the wooded areas on Campus.

The vegetation on Campus is a mixture of native and introduced plant materials. The area in the northern half of Rock Hill is almost completely native and is representative of hardwood inclusions and their associated under stories. This area has both pioneer vegetation (poplar stands) and climax hardwoods (maple, basswood, ironwood, and oak). Varying aspects, soil moisture, and history have made this area quite unique and of excellent educational and aesthetic value. The natural area of Rock Hill is currently being used for educational purposes by several instructors in the Biology Department. The remaining bulk of Campus is a mixture of native, non-native and horticultural varieties. The number of species on Campus is quite impressive; both the woody and herbaceous plant materials are an educational resource and are used as such by the Biology Department.

Implications:

- If the ecological variation is to be maintained in the Rock Hill area, any Campus expansion in that area must be very carefully done. Haphazard expansion or uncontrolled use could result in the loss of that area as an educational resource although it may be still aesthetically satisfactory.

- When additional landscaping is done to the Campus, include species which are not now existing on Campus to supplement the educational resource. Identifying and tagging educational trees should be considered.

- The existing vegetation on Campus should be treated as the valuable resource which it is. Besides its aesthetic values it provides habitat for wildlife, is a part of the cities open space system, provides the setting for some of the outdoor campus use, and they are extremely valuable for teaching purposes.
note: trees shown indicate general massing and density only and do not indicate precise location of individual trees.
wildlife and habitat areas

1. Mammals

The Rock Hill area provides the most significant habitat for wildlife. This area provides habitat for transient big game animals as well as permanent habitat for rabbits, squirrels, chipmunks, and other small animals. These mammals are a valuable educational resource and are periodically studied by personnel in the Biology Department. If they are to continue being used as educational as well as aesthetic resources, further encroachment into their habitat should be avoided.

2. Birds

Three types of habitat areas for birds exist on campus. All three types of birds are of value as educational resources as well as aesthetically valuable.

Type I - Field birds. These birds nest and feed in the open fields. These species are not necessarily incompatible with human land use policies.

Type II - Birds of the woods and other song birds are primarily found in the Rock Hill area and other wooded stands where food and cover are available. They are not necessarily incompatible with human land use policies.

Type III - Water fowl are primarily found in the ponds flanking Vermilion and Burntside Halls. These birds, mostly ducks, will probably use the new pond at Rock Hill Park. They require moderate segregation from human activity areas; that is, they will only tolerate slight modification or development nearby or they will abandon these areas.

The annual migration of hawks and eagles is an interesting local phenomenon which may have implications to the University. Each fall, approximately from the first week of September through the second week of October, migrating hawks and eagles fly south along the North Shore of Lake Superior over Duluth, on their way to their winter habitats. This migratory skyway over the city attracts approximately 2000 amateur and professional ornithologists from the Great Lakes Region. The view from Rock Hill is periodically utilized for this purpose.

3. Other Aquatic Life

The ponds and streams on campus are only of slight educational value as habitat for fish, amphibians and other forms of aquatic life. These areas are probably more valuable for aesthetic reasons and of educational value for their associated birds, mammals and vegetation. The existing ponds and streams tend to be rather small and have been disturbed from their native state, losing much of their aquatic life. However, Tischer Creek (between Arrowhead Road and Ste. Marie) has remained nearly undisturbed and provides habitat for trout and other forms of aquatic life.
potential habitat areas:

- wooded
- grass/open fields
- ponds
- streams
- marsh or wet areas

wildlife types:

1. mammals
2. field birds
3. birds of the woods
4. waterfowl
5. aquatic life
6. insects
The built-up area of Campus generally slopes from the Northwest to the Southeast. The exceptions or areas of significance are:

a. The ridge below East University Circle.

b. The ridge below Brainard Street.

c. Rock Hill (high point of Campus) and the land to the East of Rock Hill.

d. The flat area near Griggs Field and the Physical Education Building.

e. The low "Bowl" between the Heating Plant and Chester Park School (lowest area on the upper campus).

f. The hill North of Chester Park School along Woodland Avenue.

Implications:

- The possibility of using the unique topographic features of the Campus should be considered as possible assets to any future development of the Campus.
section 1  rock hill to old main

section 2  brainerd to woodland

section 3  arrowhead to college
This drawing presents another way to look at the topography on Campus. The land has been categorized by its percent of slope into three categories (0-6, 6-12 and over 12 percent). The land in the 0-6 percent category is the land which is the most easily utilized for any purpose because the least amount of grade change is required. The land which has over a 12 percent slope can be a problem in development, in that circulation becomes very difficult. Also, these areas are very susceptible to erosion, especially if the natural ground cover is removed.

Implications:

- Any construction in areas with over 12 percent slopes can expect to have additional costs and/or some vehicular circulation problems, especially in the Winter.
topographical analysis

University of Minnesota
Duluth campus
Long-range master plan
The climate of the Duluth area is more moderate than that of the Minneapolis-St. Paul area yet it is more complex and is one of contrasts. Lake Superior is responsible for extreme seasonal temperature variations especially in the Spring and Summer. Passing pressure systems cause marked changes in climate, bringing alternating periods of warm and cool weather. Marked temperature differences often occur between downtown and the plateau above the City. The campus weather is usually more similar to that of the plateau unless under the control of the moderating Lake Superior winds. The major campus use occurs during the academic year from late September to early June. The accompanying drawing shows:

TEMPERATURE. Rapid daily changes often occur due to the influence of Lake Superior. Winter temperatures are cold but extremely cold temperatures are infrequent, on the average only one day every two years does the temperature go below -30°. Similarly the summers are moderate with only an average of two days/year with the temperature going over 90°. Fortunately, the extremes of temperature are usually accompanied by dry air. The moderate summer temperatures plus cool evening temperatures have earned Duluth the title of the "air conditioned" city.

PRECIPITATION. Duluth receives ample precipitation throughout the year with nearly 28" annually. Thirty nine % of the total precipitation occurs from June to August with over 4" occurring in June. Snowfall is a major factor of the Duluth climate; 229 days of the year have had some traces of snow. The Campus averages from 60-70 inches of snow per year.

WINDROSE AND WIND CHILL INDEX. As previously mentioned Lake Superior winds have a heavy influence on the Duluth weather. Fall and winter lake winds are from the east off of the lake in May, June, and August and from the west and Northwest from September through April and in July. The average wind velocity is a breezy 12.2 m.p.h. from either the West Northwest or East Northeast.

INCLEMENT WEATHER. This chart is a visual means to show that any month during the year almost one half of the days will be influenced by either thunderstorms, heavy fog, .01" or more of precipitation, 1" or more of snow/ice, or temperatures below 60°.

Implications:

- Adequate drainage and storm sewage must be provided to cope with Spring thaw and sudden storms.

- Vehicular circulation and parking must be designed to cope with special problems of the inclement weather (snow, fog, ice, rain, and cold temperatures).
temperature (20 year averages)

wind chill temperature

windrose averages

precipitation (20 year averages)

inclement weather

climatological data

university of minnesota
duluth campus
long range master plan
Within the general Duluth climatological pattern the Campus has its own specific problems and assets. They are:

a. Cold Winter winds, exposed walks, icing and snow drifting.

b. In the Spring and Fall the Campus has an advantage on its South facing slopes. The sun warms these slopes earlier in the Spring and keeps them warm longer in the Fall.

Implications:

- The connection of academic buildings serves a good purpose; the use of climate controlled routes between closely related, intensively used facilities should be considered in any new construction.

- The use of vegetation and earth forms should be considered to protect roadways and pedestrian paths from snow drifts and high winds.

- The protected slopes that receive early spring and late fall sun should be regarded as a valuable resource for passive recreation.

- The design of circulation and parking facilities should consider the maintenance practices for snow removal; the type of equipment to be used and whether the snow is to be hauled away or piled on the perimeter.

- Future structures and parking areas should be designed to respond to Minnesota climate conditions. They should have the capacity to accept weather protected linkage, and relate to open space. Any design and construction solution to a seasonal climatic problem must also be compatible with a different function and climatic situations the remainder of the year.
winter building shadows

The accompanying drawing shows the relative lengths of building shadows on December 22 and June 22 at 10:00 a.m. and 2:00 p.m. Winter building shadows cover much of the immediate area adjacent to buildings due to its low altitude on the horizon. Summer shadows are much shorter in length because the sun is at a high altitude on the horizon. The difference in shadow length of the four seasons is indicated in the legend of the drawing.

Implications:

- The particular building shadow conditions must be considered when planning adjacent outdoor space.

- The most severe shadow conditions occur in the winter months causing inadequate lighting and added icing of sidewalks and roads.

- The particular solar and topographic characteristics of the site must be considered in providing natural light inside buildings.

- Outdoor space free of either building or tree shadow deserves special consideration and possible preservation for athletics and sunbathing.

- Building shadow conditions should be considered in the selection of plant materials around and near buildings.
This drawing shows (in a stylized form), the existing relationships between the four major campus uses. These uses being: housing, academic, general and support, and natural vegetation. The unmapped areas tend to be parking and open space (as opposed to natural vegetation). On the Upper Campus, note the two existing academic nodes, the contiguous housing area and the general and support areas which link them.

For more complete data on specific areas of the Campus see additional drawings in Sections 1, 2, and 3 of this document.
The campus is fortunate that it has an abundance of open space which is available for outdoor use. The Southeast portion of the Campus (around the Physical Education Building and Griggs Field) is used year round for programmed active recreation. The areas around the dormitories are heavily used for nonprogrammed active recreation. However, the residents of the Village Apartments have almost no usable outdoor space adjacent to their dwellings. Passive recreation occurs at numerous places on Campus. These passive areas are usually warm, protected sites.

Programmed outdoor activities on Campus include:

- Field hockey, Field soccer, Softball, Baseball, Football, Tennis, Track, Cross Country practice,
- Fishing skills, Hiking, Broom ball, Skiing, and Skating.

Unprogrammed outdoor activities include:

- All of the above activities plus frisbies, sun-bathing, outdoor studying, sledding, snow sculpture and various passive warm season activities and other impromptu Summer and Winter activities.

Implications:

- The topography of the Campus is such that there is a limited number of suitable (flat) sites for formal outdoor sports. Most of these flat sites are already used for buildings, parking lots, or existing recreation areas. As the Campus expands the quantity of these areas will decrease but their demand will increase.

- Policies for the uses of the Rock Hill area should be carefully defined.

- The outdoor courts between buildings are a definite asset which should be more fully developed. Small scale informal gathering and recreation areas should be provided adjacent to student housing areas.

- Since the bulk of the school year is in a cold season, Winter recreation areas are essential as are the warm, protected areas essential for passive Spring and Fall recreation.
There are many views of high quality, both into and out from the Campus. The local vegetation and topography provide good long range visual variety. The significant long range views are over views to Lake Superior or views of the hills which are on three sides of the Campus area.

The significant views from Campus are:

1. The terrace outside of Kirby Student Center.
2. The terrace between Tweed Gallery and Education.
3. The terrace between the Education and the Home Economics Buildings.
4. The areas around the front and flanks of Griggs Hall.
5. Rock Hill observation stand.
6. The athletic grounds South of Griggs Field.

The best views into the Campus are from either side of Chester Park School, along College Avenue near the school or on the hill North of the school near Woodland Avenue. Poorer views into the campus exist at Woodland Avenue at Niagara, Rock Hill, and along Ste. Marie, College Streets and Brainard Avenue South of Niagara.

Implications:

- There is a need for more short range views on Campus. More visual variety can be created with buildings or vegetation to break up the large peripheral open spaces on the Campus. A lack of such visual barriers makes these large areas visually 'bleed' one into another.

- Care should be taken to preserve the long range views.
Program relationships

2
The program relationship data as presented in the following section has been reduced from a large volume of information related to space utilization of the existing facilities at UMD. The background data used for the completion of this section is of much greater detail. It describes the types and quantities of space within each building and who uses them.

As planning progresses, it will be of great importance to establish policies regarding the efficient use of existing and future space on Campus.
This drawing shows existing and planned buildings on campus. The shown locations of planned buildings is, at this point, somewhat speculative. This page lists planned buildings either previously appropriated or those yet to be requesting legislative appropriation. There is a need for a detailed space audit of the campus to provide a rational basis for assessment of the resources. All building requests are subject to legislative approval and therefore are only tentative.

<table>
<thead>
<tr>
<th>Year</th>
<th>Building Request</th>
<th>Appropriation or Request</th>
</tr>
</thead>
<tbody>
<tr>
<td>1969</td>
<td>Appropriated buildings not yet constructed:</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Plant Services Center Phase I</td>
<td>$460,000</td>
</tr>
<tr>
<td></td>
<td>Student Housing (400 Students)</td>
<td>635,000</td>
</tr>
<tr>
<td></td>
<td>25% state funding</td>
<td></td>
</tr>
<tr>
<td>1971</td>
<td>Classroom Lab Building</td>
<td>3,500,000</td>
</tr>
<tr>
<td></td>
<td>Physical Education Building</td>
<td>1,375,000</td>
</tr>
<tr>
<td></td>
<td>Remodel Science Building</td>
<td>526,000</td>
</tr>
<tr>
<td></td>
<td>Remodeling (general)</td>
<td>85,000</td>
</tr>
<tr>
<td></td>
<td>Campus Improvements and Utilities</td>
<td>210,000</td>
</tr>
<tr>
<td>1973</td>
<td>Social Science - Phase I</td>
<td>4,900,000</td>
</tr>
<tr>
<td></td>
<td>Library Addition</td>
<td>632,000</td>
</tr>
<tr>
<td></td>
<td>Remodel Chemistry (Phase III)</td>
<td>411,000</td>
</tr>
<tr>
<td></td>
<td>Music Rehearsal Hall</td>
<td>230,000</td>
</tr>
<tr>
<td></td>
<td>Heating Plant</td>
<td>550,000</td>
</tr>
<tr>
<td></td>
<td>Student Housing (320 Students)</td>
<td>924,550</td>
</tr>
<tr>
<td></td>
<td>Medical Education Building (30% state funding)</td>
<td>2,940,000</td>
</tr>
<tr>
<td></td>
<td>Campus Improvements &amp; Utilities</td>
<td>687,500</td>
</tr>
<tr>
<td>1975</td>
<td>Physical Education Building Expansion and Remodeling</td>
<td>637,000</td>
</tr>
<tr>
<td></td>
<td>Music Facilities</td>
<td>492,000</td>
</tr>
<tr>
<td></td>
<td>Social Science - Phase II</td>
<td>5,495,000</td>
</tr>
<tr>
<td></td>
<td>University Resource Center</td>
<td>1,352,000</td>
</tr>
<tr>
<td></td>
<td>Plant Services Support Building</td>
<td>720,000</td>
</tr>
<tr>
<td></td>
<td>Residence Hall Commons</td>
<td>1,041,000</td>
</tr>
<tr>
<td></td>
<td>Student Housing (400 Students)</td>
<td>960,000</td>
</tr>
<tr>
<td></td>
<td>Improvements &amp; Utilities</td>
<td>791,000</td>
</tr>
<tr>
<td>1977</td>
<td>Classroom Building Office Addition</td>
<td>944,000</td>
</tr>
<tr>
<td></td>
<td>Lake Superior Basin Studies Lab</td>
<td>2,569,000</td>
</tr>
<tr>
<td></td>
<td>Life Sciences Building Addition</td>
<td>1,772,000</td>
</tr>
<tr>
<td></td>
<td>Science Building Addition</td>
<td>516,000</td>
</tr>
<tr>
<td></td>
<td>Social Science - Phase III</td>
<td>6,000,000</td>
</tr>
<tr>
<td></td>
<td>Student Housing (400 Students)</td>
<td>960,000</td>
</tr>
<tr>
<td></td>
<td>Campus Improvements</td>
<td>300,000</td>
</tr>
<tr>
<td>1979</td>
<td>Library Addition</td>
<td>2,111,000</td>
</tr>
<tr>
<td></td>
<td>Science-Math Addition</td>
<td>999,000</td>
</tr>
<tr>
<td></td>
<td>Kirby Addition</td>
<td>1,498,000</td>
</tr>
<tr>
<td></td>
<td>Student Housing (400 Students)</td>
<td>960,000</td>
</tr>
<tr>
<td>1981</td>
<td>Industrial Education Addition</td>
<td>2,614,000</td>
</tr>
<tr>
<td></td>
<td>Living Learning Facility</td>
<td>4,565,000</td>
</tr>
<tr>
<td></td>
<td>Student Housing</td>
<td>960,000</td>
</tr>
<tr>
<td>1983</td>
<td>Classroom-Laboratory Office Building</td>
<td>7,000,000</td>
</tr>
<tr>
<td></td>
<td>Student Housing (400 Students)</td>
<td>960,000</td>
</tr>
</tbody>
</table>
buildings: existing, planned, and obsolete

buildings not shown on drawing

<table>
<thead>
<tr>
<th>no.</th>
<th>name</th>
<th>location</th>
<th>status</th>
</tr>
</thead>
<tbody>
<tr>
<td>510</td>
<td>provost's residence</td>
<td>2631 e. 7th st</td>
<td>existing</td>
</tr>
<tr>
<td>511</td>
<td>darling observatory</td>
<td>591 w. 3rd st</td>
<td>obsolete</td>
</tr>
<tr>
<td>512</td>
<td>alworth toolhouse</td>
<td>2615 e. 7th st</td>
<td>obsolete</td>
</tr>
<tr>
<td>513</td>
<td>alworth garage, east</td>
<td>2627 e. 7th st</td>
<td>existing</td>
</tr>
<tr>
<td>514</td>
<td>alworth garage, west</td>
<td>2615 e. 7th st</td>
<td>existing</td>
</tr>
<tr>
<td>515</td>
<td>east alworth residence</td>
<td>2617 e. 7th st</td>
<td>existing</td>
</tr>
<tr>
<td>516</td>
<td>west alworth residence</td>
<td>2605 e. 7th st</td>
<td>existing</td>
</tr>
<tr>
<td>517</td>
<td>biological research</td>
<td>6006 london rd</td>
<td>existing</td>
</tr>
<tr>
<td>518</td>
<td>cottage 'h'</td>
<td>6004 london rd</td>
<td>existing</td>
</tr>
<tr>
<td>547</td>
<td>cottage 'g'</td>
<td>519 w. 6th st</td>
<td>existing</td>
</tr>
<tr>
<td>548</td>
<td>cottage 'f'</td>
<td>701 gold st</td>
<td>obsolete</td>
</tr>
</tbody>
</table>
This drawing shows the distribution of departments and divisions on the Duluth Campus in terms of the percentage of buildings occupied. The listing on this page also shows the location (or locations if split) of the departments by building numbers.

<table>
<thead>
<tr>
<th>Division of divisions and departments</th>
<th>Bldg. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Division of Education and Psychology</td>
<td></td>
</tr>
<tr>
<td>Ed Psy Ad Division Administration</td>
<td>534</td>
</tr>
<tr>
<td>El Ed Elementary Education</td>
<td>534, 540</td>
</tr>
<tr>
<td>H E Home Economics</td>
<td>540, 515</td>
</tr>
<tr>
<td>Ind Industrial Education</td>
<td>535</td>
</tr>
<tr>
<td>P E Physical Education</td>
<td>521</td>
</tr>
<tr>
<td>Psy Psychology</td>
<td>534</td>
</tr>
<tr>
<td>S Ed Secondary Education</td>
<td>534, 540</td>
</tr>
<tr>
<td>Sp Ed Special Education</td>
<td>534</td>
</tr>
<tr>
<td>SPA Speech Pathology &amp; Audiology</td>
<td>540</td>
</tr>
<tr>
<td>Division of Humanities</td>
<td></td>
</tr>
<tr>
<td>Hum Ad Division Administration</td>
<td>528</td>
</tr>
<tr>
<td>Art Art</td>
<td>528, 550, 529, 540</td>
</tr>
<tr>
<td>Engl English</td>
<td>528</td>
</tr>
<tr>
<td>Lan Languages</td>
<td>528, 522</td>
</tr>
<tr>
<td>Mu Music</td>
<td>528</td>
</tr>
<tr>
<td>Phil Philosophy</td>
<td>528, 550</td>
</tr>
<tr>
<td>SCTA Speech, Communications &amp; Theater Arts</td>
<td>501, 528, 550, 522</td>
</tr>
<tr>
<td>Division of Science and Mathematics</td>
<td></td>
</tr>
<tr>
<td>SM Ad Division Administration</td>
<td>527</td>
</tr>
<tr>
<td>Biol Biology</td>
<td>544</td>
</tr>
<tr>
<td>Chem Chemistry</td>
<td>520</td>
</tr>
<tr>
<td>Geol Geology</td>
<td>527, 544</td>
</tr>
<tr>
<td>M E Mathematics &amp; Engineering</td>
<td>527</td>
</tr>
<tr>
<td>Phys Physics</td>
<td>520</td>
</tr>
<tr>
<td>Division of Social Sciences</td>
<td></td>
</tr>
<tr>
<td>S S Ad Division Administration</td>
<td>529</td>
</tr>
<tr>
<td>B A Business Administration</td>
<td>529, 540, 522</td>
</tr>
<tr>
<td>Econ Economics</td>
<td>529, 522, 540</td>
</tr>
<tr>
<td>Geog Geography</td>
<td>529</td>
</tr>
<tr>
<td>Hist History</td>
<td>550, 522</td>
</tr>
<tr>
<td>Pol Political Science</td>
<td>550</td>
</tr>
<tr>
<td>Soc An Sociology/Anthropology</td>
<td>550</td>
</tr>
<tr>
<td>Special</td>
<td></td>
</tr>
<tr>
<td>Med Ed Medical Education Program (fall 1972)</td>
<td>502</td>
</tr>
</tbody>
</table>
This drawing shows proportionately the kinds of space in the major existing and planned buildings on Campus. Further information as to the amount of square footage is given by four size categories. The categories for the kinds of space are:

1. Institutional Service
2. Administrative & Student Services
3. Physical Education
4. Library
5. General Purpose Classrooms
6. Laboratories, Studios, and Special Purpose Classrooms
7. Research
8. Offices
9. Services, Custodial, Mechanical, and Misc. Storage Rooms
10. Circulation

* Relate to direct academic usage.
This drawing shows the size and location of existing General Purpose and Special Purpose Classrooms, together with Library locations.

There is no obvious trend as to the physical locations of general or special purpose classrooms. The classrooms are well distributed throughout the Campus. This dispersion of classrooms may be heavily influential on the between class pedestrian movements within the academic building complex.

Library locations do not reflect the private collections of books by faculty members which are offered on loan to students within specific departments.
The data for this section has been assembled to give a beginning insight into the origin of the student population and what facilities are available to the students once they begin their academic life at UMD. In addition, the inventory has shown that the physical facilities at UMD are not used to their fullest possible potential, particularly in providing a non-academic learning environment. This suggests that a major decision must be made to provide this type of environment if UMD is to succeed in providing a totally viable educational community.
These maps show the geographic origins of students attending UMD based on Fall 1970 enrollment records.

Male/Female Breakdown (as of Fall 1971)

<table>
<thead>
<tr>
<th></th>
<th>undergraduates</th>
<th>graduates</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male students</td>
<td>2893 56.3%</td>
<td>57 41.6%</td>
</tr>
<tr>
<td>Female students</td>
<td>2337 43.7%</td>
<td>80 58.4%</td>
</tr>
<tr>
<td>Total enrollment</td>
<td>1970-71 5,477</td>
<td>Fall 1971 5,267</td>
</tr>
</tbody>
</table>

Implications:

- Similar to studies done on the Twin Cities Campus, UMD draws students from almost everywhere in Minnesota, yet its majority of students are from the immediate area. It seems likely that the option of living at home will continue to be exercised by a majority of students while the remainder move into private or public housing facilities where available.

- Statistics tend to indicate that increasing numbers of students at UMD are coming from areas outside the immediate 5 county area. The impact of this change in origin will affect greatly the types and quantity of facilities required to attract and serve these new students. It should be noted that over the last five years, there has been a substantial increase in the number of students coming from the Minneapolis/St. Paul area.

- Further studies using the 1970 Census Data would be of value, providing further demographic information to make accurate projections on student enrollment and regional population trends.
geographic origin of umd students, 1970-71

canada: 33
north america: 2,618
south america: 2
west indies: 3
central america: 5
europe: 5
asia: 2
australia: 2
antarctic: 0

origin of students by county

<table>
<thead>
<tr>
<th>County</th>
<th>1970-71</th>
<th>1965-66</th>
</tr>
</thead>
<tbody>
<tr>
<td>Zone 1</td>
<td>2 - 50</td>
<td>82.5%</td>
</tr>
<tr>
<td>Zone 2</td>
<td>50 - 100</td>
<td>15%</td>
</tr>
<tr>
<td>Zone 3</td>
<td>100 - 150</td>
<td>5%</td>
</tr>
<tr>
<td>Zone 4</td>
<td>150 - 200</td>
<td>3%</td>
</tr>
<tr>
<td>Zone 5</td>
<td>200 - 250</td>
<td>2%</td>
</tr>
<tr>
<td>Zone 6</td>
<td>over 250</td>
<td>5%</td>
</tr>
</tbody>
</table>

number of students from minnesota | 5,153 |
from other states | 76 |
from other countries | 46 |
total enrollment, 1970-71 | 5,277 |

university of minnesota
long range master plan
This drawing shows the distribution and approximate densities of off campus student accommodations. Students who live with their parents are located throughout the city with the same distribution as the general city population. Students who establish their residence in the city expressly for the purpose of enrollment at UMD tend to locate closer to the Campus. The densities around the Campus illustrate this. City zoning restrictions and the density of housing units is heavily influential on the distribution pattern. Additional information can be found in the Transportation Section (origins of Auto-Driver Trips to Campus and Origins of Bus Trips to Campus).
Students per 1/4 mile sq.

- 1 to 9 students per 1/4 mile sq.
- 10 to 24 students per 1/4 mile sq.
- 25 to 49 students per 1/4 mile sq.
- 50 to 74 students per 1/4 mile sq.
- Over 75 students per 1/4 mile sq.
- U.M.D. campus

Distribution of student accommodations

University of Minnesota Duluth Campus
Long-range master plan
cost and location of on campus housing

This drawing shows:

a) The location of on Campus housing.
b) The maximum "possible paying" residents per housing unit.
c) The occupancy rate of each housing unit.
d) The cost of one student space in a double room per month.
e) The cost of room and board per student per quarter.

Implications:

- Single students not housed on Campus and all married students are forced to live at some distance from the Campus by the lack of rental units adjacent to the Campus.

- Despite inadequacies in the information, it appears that for the single student there is little economic advantage in living on Campus; convenience, degree of service and environmental character, probably have more influence on his or her decision or choice than cost. Although on campus room rates are similar to off campus rates, on campus rates are established by the Business Office and are based on operating costs and amortization of the facilities. The whole question of the economic self-sufficiency of University housing must be carefully examined.

- More data on off campus housing including the cost of accommodation in fraternities, sororities, and co-operatives, would help to clarify the potential contributions toward the inventory of living space which could be expected from these options.
93.9% occupancy of 296 coeducational spaces
$240/qtr. dbl. room
$80/month for dbl. room

93.7% occupancy of 383 spaces available to women
$375/qtr. rm. & bd. (dbl. room)
$51/month aver. for dbl. room

96.9% occupancy of 392 spaces available to men
$375/qtr. rm. & bd. (dbl. room)
$51/month aver. for dbl. room

95.2% occupancy of 63 spaces available to men
$375/qtr. rm. & bd. (dbl. room)
$51/month aver. for dbl. room

87.7% occupancy of 114 spaces available to women
$375/qtr. rm. & bd. (dbl. room)
$51/month aver. for dbl. room

total campus enrollment: 5104
total dormitory spaces: 1363
students in dormitories: 27%
occupancy of dorms: 94%

on campus housing

90.5% occupancy of 42 spaces available to women
$95/qtr. room & board
$43/month aver. for room

95.6% occupancy of 72 spaces available to men
$350/qtr. room & board
$43/month aver. for room

university of minnesota
duluth campus
long range master plan
This drawing shows the community support facilities adjacent to the Duluth Campus. Extensive community support facilities are not immediately adjacent to the Campus. The Kenwood Shopping Center is the largest nearby facility but it fails to fulfill all of a student needs. The Mt. Royal shopping area is probably more accessible, but offers even less services.

Implications:

- If the life that commercial and community support facilities brings is considered desirable, they should be introduced within the campus boundaries or be readily accessible to on Campus residents. This will reinforce efforts to better utilize Campus facilities on a year round, full day, University-Community basis.

- Although the Duluth Campus provides a certain amount of support services to students, the Campus is not being utilized to its highest potential in providing these services.

- The lack of convenient support facilities within and/or adjacent to the Campus has additional ramifications for Campus development. The automobile and its use by students for even the simplest of activities produces parking requirements, movement conflicts, and land utilization both on and off Campus of an unsatisfactory nature.
university of minnesota

duluth campus

long range master plan

community support facilities

areas indicate 1.2 mile radius or 10 minutes walking distance from the center of campus.
This drawing shows the elements that currently compose the non-academic or informal learning environment at UMD. Also shown is the location of distribution of these elements.

Data is provided on the following types of facilities and services:

   a) Food service facilities
   b) Commercial and servicing facilities
   c) Vending machine servicing
   d) Lounge and recreational facilities

Implications:

- The distribution of these communal support facilities seems to be satisfactory at this time. Unfortunately their efficiency is difficult to measure, as only limited data is available. When enrollment increases and/or teaching facilities shift to new locations the new needs (for non-academic support facilities) will have to be met with additional or more efficient facilities.
This drawing shows the extent and distribution of the following:

a) Formal academic learning environment
b) Informal learning environment (non-academic space)
c) Academic support

It emphasizes the limited nature of the informal learning environment that is provided at the Duluth Campus.

Implications:

- The most obvious implication is that the "informal or non-academic learning environment" has not been recognized as a significant aspect of the total university experience. In most instances it has evolved in a fragmented way.

- Before coordinated development can take place, the University must decide whether the educational experience can indeed be substantially enhanced by the existence of a vital non-academic environment, and it must be aware of all the implications of providing such an environment.
night-time usage

Considering the non-housing structures on Campus there are only five buildings on Campus that are used in any extensive way at night; the Library, Student Center, the Village Service Center, the Physical Education Building, and the High Rise Student Lounge. Other buildings are used for special instruction or in minor ways for occasional classes and study. This is an extremely limited evening or night usage of the Campus. The number of classroom hours scheduled by the Extension Division in each building is also shown.

Implications:

- The questions everyone involved should be asking are "How can the University better utilize the tremendous capital investment represented by the physical development on Campus?"

- "Can the development of additional housing and/or innovative academic planning in such areas as the extension and continuing education programs be examined for their potential to influence the levels of night time usage on the Campus?"
services and utilities
The utility and services data included in this section catalogues the location, size, and condition of the various systems.

In the past, no rational plan was conceived for the location of the utilities and services on Campus. As the Campus expanded, many utilities had to be moved to accommodate new construction. The systems are now under consolidation and revision in an effort to prevent this from happening in the future.
The original low pressure steam distribution system developed with the construction of the Physical Education Building in 1952. In 1959 the high pressure heating plant was put into operation.

At present, the steam distribution system is a combined high and low pressure system with high pressure steam available from the Heating Plant through a 6" direct burial granular insulated steam line to the Physical Education Building, and low pressure steam available from the low pressure boilers in the Physical Education Building and from the Heating Plant via an 8" direct burial steam line through the Administration Building and Concourse area to Kirby Student Center.

The low pressure steam system originating at the Physical Education boilers is obsolete and its continued use is questionable.

Steam and return piping is generally installed in pipe spaces or tunnels, with the exception of the following segments (with dates of installation), which should be considered "temporary" for planning and operational purposes:

1) High pressure steam only - Heating Plant to Physical Education Building (1959). The longevity of the line is questioned.

2) Physical Education Building to Industrial Education Building (1962). This line has had recent failures.

3) Low pressure steam only - Heating Plant to Administrative Building (1964, 1971). A new 8" high pressure line paralleling this line and extended to Kirby Center is to be completed by October 1972.

4) Food Service to Dormitories (1956, 1972).

5) Library to Dormitories (1972) (Temporary during construction of Food Service).

The permanent future steam distribution system must include a heating tunnel from the Heating Plant to the Administration Building and planning of future buildings must include extensions of existing tunnels and piping systems to future buildings.

The steam distribution system between the heating plant in the Laboratory Building and Old Main, Torrence and Washburn Halls will require extensive rehabilitation. The existing boilers do not comply with PCA regulations and if retained, will require extensive work to meet these regulations and provide economical operation.

The problems are currently under study and a report with recommendations will be completed by October 1972.
steam distribution

Legend:
- Steam lines (buried)
- Equipment loop
- Monitors
- Releasing station
- Control station
- Steam flow
- Pipe code
  - black: main
  - white: heat loss

University of Minnesota
Duluth campus
Long range master plan
The basic electric service for the Duluth Campus is a University owned and operated primary electric distribution system. The system originates at a University-owned substation, which derives its supply from the Minnesota Power and Light Company. Exceptions to this are overhead services to the Griggs Field Area and the new residence hall. Each of these are served from separate Minnesota Power and Light Company meters.

The original system developed as a radial-type, operating at 4160/2400 volts. It is a three-phase, four-wire, ungrounded neutral system consisting basically of paper or varnish cambric insulated lead-covered underground feeders installed in concrete encased ducts.

A decision was made recently to convert the original system to 13,800/8,000 volt system. This would eliminate transformation equipment and power losses at the University Substation which the utility company serves and meters at a standard 13,800 volt level. This also required the installation of additional system capacity which was urgently needed to accommodate campus growth.

To date, conversion of the system has consisted of the extension of two 13.8 kv three-phase, four-wire, grounded neutral feeder cables in concrete encased ducts from the existing University Substation to the Life Science Building and in crawlspaces under Science and Mathematics, Kirby Student Center, and into the Library Building. The Social Science Building and Administration Building vaults are presently operating on a 13.8 kv service. Present planning and funding includes extension of the 13.8 kv underground system to the new Performing Arts Building, Kirby Center, and the Science Building.

An overhead line operating at 13.8 kv also extends from a substation on the west property line to housing and residence facilities in the northeast sector of the Campus.

Planning for future conversion and expansion of the Campus primary electric distribution system will need to include provisions for conversion of existing 4 kv transformer vaults to 13.8 kv operation, service to sights of future construction, and a permanent substation location. An early decision for a permanent substation is needed to minimize costs.

The new system is being installed in building crawlspaces and tunnels to prevent them from being moved or interrupted by future construction.

Services for the Griggs Field area and the residence hall area now served by separately metered services would be incorporated into the campus system when it becomes economically feasible.

Electric service to the Lower Campus is supplied by the utility company at the Lab School Building. The balance of the campus is served from a transformer vault in the Lab School Building via underground secondary services. Much of this service is reaching the end of its useful life, and if the Lower Campus Buildings are to remain in operation in the future, it will need rehabilitation.
The Campus is served by gas from five separate and independent locations from the City of Duluth municipal system.

The only major user of gas in the Heating Plant. The existing system is adequate except at the Food Service Building where low capacity has been experienced.

The services to the Heating Plant and the Science Building are high pressure. The other systems are low pressure.

It is recommended that the various segments be tied together into a looped system to provide greater reliability and increased supply for future Campus development.

The cost of relocation of up-grading for future building construction is not a major consideration.
gas distribution

This map is prepared for planning purposes and should not be used where exact measurements are required.

Legend:
- Gas main, low pressure
- Gas main, high pressure
- Gas emergency generator

Legend:
- Code of construction:
  - PI: Painted iron
  - PI: Painted steel

University of Minnesota Duluth Campus Long Range Master Plan
The sanitary sewer system connects to the City of Duluth at four points. Three of these connections are to the City interceptor sewer that was constructed along the East side of the Campus. The fourth connection is to a City sewer at Lawn Drive and College Avenue.

The system was designed for the originally planned Campus and it is adequately serving the Campus today. Except for some potential weak spots it should be adequate for the limited future. Depending on the location of future development the possible weak spots are:

1. The 8" sewer from the stadium to the City interceptor. This line is undersized and should be upgraded if extensive development should occur in the area it serves.

2. The 15" sewer connecting to the City sewer at Lawn Drive and College Avenue has some structural failures and needs to be replaced in the future. This could be done in stages as development takes place.

Relocation of sanitary sewers for building construction is generally not a major cost consideration. A radical relocation of a portion of a trunk sewer should be avoided because its capacity could be greatly limited.
The Campus is divided into two local watersheds. The South half is collected by a sewer system that empties into a City storm sewer at a number of points roughly along College Avenue. The North half empties into a creek that flows across the northeast corner of the Campus. Both of these systems have reached their design capacity and future campus expansion will require upgrading of the trunk lines.

The original sewers were designed to more than serve the ultimate Campus as first envisioned. However, development both current and future is much greater than originally planned, therefore the system is no longer adequate.

The areas of future development that would place the greatest strain on the system are:

1. The vicinity of Oakland and College Avenues.

2. The area generally West of the Industrial Education Building.

The cost to relocate the larger sewers for future buildings could be significant especially in densely built-up areas. It would be very costly to up-grade the sewers on the South half of the Campus.
Most of the Campus water mains are connected to the City water system through two master meter locations on Ste. Marie Street. The westerly connection serves only the temporary student housing west of University Circle and Griggs Hall. There is an emergency connection point for the rest of the system in Lawn Drive just north of College Avenue.

The system was designed to serve the originally planned Campus only, but was gradually expanded to serve other buildings as the Campus developed. It was brought to our attention by the State Fire Marshall that the water system is seriously deficient in its ability to provide adequate fire protection.

A master distribution system has been designed to meet the water capacity required for fire fighting needs. The new system has been divided into three construction phases. Phase one construction funds are included in the 1973 Legislative request.

The location of the new distribution system is somewhat flexible and can be located to accommodate future development if a master plan is adopted before construction of Phase one begins.

The cost to relocate water mains for building construction is not excessive.
transportation inventory is organized into three major sections - transportation facilities serving the Campus, characteristics of travel to the Campus, and parking and transportation within the Campus - and a number of subsections. Within each subsection, important transportation data and their implications to the study area are presented. A description of each transportation survey conducted is in the Appendix.
This section presents information on the relationship of the Campus to the regional street network, the physical characteristics of streets near the Campus, the bus service to the Campus, and the parking facilities on the Campus. The major purpose in presenting the transportation facilities that serve the Campus is to document the capability of the facilities to satisfy the travel demand.

The accessibility of a major traffic generator such as the Duluth Campus is greatly determined by the relationship of the Campus to the regional highway system.

This relationship of the Campus to the regional street network is illustrated on the following figure which shows the minimum travel time paths to the Campus from locations throughout the region. The travel paths illustrate the routes Campus users would be expected to take to access the Campus if they used minimum travel time as the criteria for route choice.

Analysis of the paths indicates the directness or indirectness of access routes and defines the major access points.

**Assessment**

- Access from the West, which involves routing over Arrowhead Road or Interstate Highway 35, is circuitous.

- Many Campus users travel away from Campus before reaching an access road to take them to the Campus.

- Motorists who approach the Campus from the South on Interstate Highway 35 must travel over several local streets to access the Campus.

- The relationship between the Campus and arterial access roads requires improvement.
local streets

The "Physical Characteristics" figure illustrates traffic control devices, street widths, and parking regulations in the Campus area.

Traffic control devices help define the hierarchical function of streets by restricting the access via signals, stop signs, or yield signs. As presently controlled, College Street, Woodland Avenue and Ste. Marie Street are the major access streets.

Buffalo Street, West of University Circle, has a dirt surface and width of just 20 feet. Brainard Avenue has a 20 foot width between College and Buffalo Streets. Neither of these streets are designed to function as access roads.

Assessment

- The role of the streets around the Campus as they relate to the neighborhoods and the access function requires further definition.
Bus routes and daily volumes for both the City and Campus bus systems serving the Campus are shown in the following figures.

A review of the City bus schedules revealed that both City bus routes operate between the Campus and downtown Duluth from about 6:00 a.m. to 11:30 p.m. Bus headways vary from about 15 minutes during peak periods to two hours late at night.

The Campus bus operates from the Kirby Student Center between 7:30 a.m. and 4:00 p.m., with buses arriving at that location at approximately 15 and 45 minutes after the hour and departing at 35 and 5 minutes after the hour. This schedule is quite well-coordinated with the schedule for classes, which begin on the half hour and end 20 minutes after the hour. The only conflict occurs at the time of the first class period; the first bus to the Kirby Center arrives at about the same time this period begins (7:30 a.m.)

A number of other City bus routes connect with the routes shown to provide public transportation service between the Campus and locations throughout the City.

Assessment

- The relationship between extended transit use and the provision of additional parking spaces must be analyzed.
- The concept of the University providing bus service that loops through student living areas and focuses on the Campus should be evaluated for further use.
A documentation of the type and supply of parking spaces is a required input to studying the Campus parking situation. An inventory of parking spaces presently available on the Campus is shown in the following figure. The supply of parking spaces includes several lots for dormitory students, five large lots for faculty/staff and general usage, and a few metered spaces for short-term parkers.

Since there is a parking fee to park in University lots, some parking occurs on College and Ste. Marie Streets where approximately 170 spaces are available. The total number of parking spaces available on Campus, including College and Ste. Marie Streets is 2481.

**Assessment**

- Parking facilities provided on-Campus are basically of three types - reserved, general, and dormitory - with a few metered spaces for short-term parkers.

- The relationship between parking lot access points and the circulation/access roads requires analysis.
characteristics of travel to the campus

The second major section documents the travel patterns of the Campus users in accessing the Campus. Defined are Campus population, aggregate travel to the Campus, mode of travel, location of trip origins and traffic volumes.

campus population and tripmaking

1971 Campus population and daily tripmaking to the Campus are summarized in the following figure. It may be noted that the average number of trips/person/day to the Campus is 1.7 for off-Campus students, 2.1 for the faculty, and 1.6 for the staff, with the overall average for these three groups being 1.7 trips/person/day to the Campus. This tripmaking frequency contrasts with a frequency of 1.5 trips/person/day for the Minneapolis and Saint Paul campuses, as determined in an earlier study.1/

Assessment

- The off-Campus population, consisting of faculty, staff, and off-Campus students of 4,970 persons presently makes 8,600 person trips per day to the Campus.

- The relatively high frequency of tripmaking to the Duluth Campus is due, largely, to the greater ease of travel and parking and the closer proximity of homes and other activity centers to the Campus.

CAMPUS POPULATION

TOTAL CAMPUS POPULATION - 5935

SOURCE:
UNIVERSITY OF MINNESOTA
DULUTH CAMPUS 9/11

* IN HIGH RISE, VERMILLION, BURNTSIDE AND GRIGGS HALLS

CAMPUS TRIPMAKING

TOTAL PERSON TRIPS / DAY TO CAMPUS - 8600

university of minnesota
duluth campus
long range master plan
campus population and tripmaking

data collected
NOV. 3, 1971
Mode of travel to the Campus is summarized on the following two figures, the first of which is an overall Campus summary and the second of which is by user type.

The dominance of the automobile as a means of transportation is clearly shown; 77 percent of all person trips to the Campus arrive by car. The automobile occupancy rate of 1.2 persons per car is low for these conditions; for the entire metropolitan area, the average car occupancy is 1.5 people/car. Walking is a major mode of travel to the Campus; the number of walkers (excluding those coming from the Upper Campus dormitories) exceeds the number of auto passengers.

Other interesting features are that 84 percent of all trips to the Campus are made by students and that the automobile is the predominant mode of travel for all types of users.

Assessment

- The Campus is heavily auto-oriented with only nine percent of all trips to the Campus utilizing public transportation.
- Modal choice behavior is similar for students and faculty/staff.
TOTAL PERSON TRIPS/DAY TO CAMPUS - 8,600

TOTAL NUMBER OF PERSON TRIPS TO CAMPUS

- AUTO DRIVERS: 5,530
- AUTO PASSENGERS: 1,090
- CAMPUS BUS: 470
- CITY BUS: 290
- BIKE - MOTORBIKE: 120
- WALK: 1,100

university of minnesota
duluth campus
long range master plan

mode of travel to campus

data collected

NOV. 3, 1971
OFF-CAMPUS STUDENT

TOTAL - 7190

FACULTY/STAFF

TOTAL - 1240

OTHER

TOTAL - 170

university of minnesota

duluth campus

long range master plan

mode of travel to campus by user type

data collected

NOV. 3, 1971
Origins of auto driver and bus trips to the Campus are illustrated on the following two figures. A major concentration of auto driver trip origins is located in an area just south of the Campus, with other trip origins distributed throughout the region. The number of daily auto driver trips to the Campus from Wisconsin is 39.

Campus bus trip origins are distributed all along the route, with a major concentration near the lower Campus.

City bus trip origins are clearly fewer in number and more dispersed. A significant number of City bus trip origins are from south of the area shown and involve transfers to the two routes serving the Campus.

Auto and bus trip origins, together with the minimum travel time network of routes serving the Campus which was previously shown, led to the figure entitled, "Vehicle Approach Volumes to Campus by Direction." This figure shows that the major approach directions are from the West on College Street, from the South on Woodland Avenue, and from the North on Woodland Avenue.

Assessment

- A major concentration of auto trip origins is in central Duluth, near the area served by the Campus bus route. Other origins are dispersed throughout the region.

- A significant number of bus trips origins are from the Southwestern portion of the metropolitan area, indicating possible demand for an express bus service to the Campus.
first morning pickup prior to start of campus bus route

-1 city bus passenger
-1 campus bus passenger
95 trips from outside area shown
--- campus bus route
--- city bus routes
totals: daily city bus trips to campus > 290
daily campus bus trips to campus > 470

origins of bus trips to campus

university of minnesota north campus
long range master plan
other major utilities incorporated

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total daily number of vehicles to campus = 5530

note: approach volumes are based on the assumption that motorists take the minimum travel time routes to the campus.
Traffic volumes are an important input to transportation analysis because they indicate the demand that street system has to satisfy.

The two following figures illustrate 1964 Average Daily Traffic Volumes and 1971 Daily Traffic Volumes on streets in the Campus area. A comparison of these figures shows that volumes have increased 220 percent on Ste. Marie Street, 190 percent on College Street, and 25 percent on Woodland Avenue.

A comparison of these figures to the preceding figures, entitled "Vehicle Approach Volumes to Campus by Direction," indicates the proportion of total travel on these streets that is oriented to the Campus.

**Assessment**


- Approximately 85 percent of the total daily travel on College Street is oriented to the Campus, as is 85 percent on Ste. Marie Street and 15 percent on Woodland Avenue.
Street capacity, i.e., the capability of a street to accommodate traffic demand, is a function of physical and traffic characteristics. In analysis volumes are compared to capacities (forming volume to capacity ratios) to gain an assessment of the location and extent of traffic problems.

An analysis of streets in the vicinity of the Campus resulted in the volume to capacity ratios shown in the following figure. Volume to capacity ratios of less than 0.70 represent free flow traffic conditions, with negligible delay, and ratios between 0.70 and 0.85 represent conditions of stable flow with slight delay.

Assessment

- All streets in the Campus area presently operate below capacity, although delays are experienced during the peak periods.

- Close consideration should be given to traffic demand of future Campus growth and its capacity requirements.
volume to capacity ratios

Note: Level of Service (C) used in computation of capacity.
The time variation in auto trips to the Campus is summarized in the following figure. The peak hour for all auto trips to the Campus occurred between 8 and 9 a.m., which is also the peak hour for just student auto trips. The peak hour for faculty/staff auto trips is shown to be 7 - 8 a.m.

Assessment

- The sharp early morning peak in trips to the Campus is a major factor in determining capacity requirements on access roads to the Campus.

- The increase in tripmaking from 12 noon - 1 p.m. indicates that a significant number of persons leave the Campus for lunch.
ALL AUTO TRIPS

NUMBER OF TRIPS

TOTAL - 3992

7-8 A.M.  710
8-9 A.M. 1188
9-10 A.M. 486
10-11 A.M. 367
11-12 321
NOON 274
12-1 P.M. 484
1-2 P.M. 171

STUDENT AUTO TRIPS

NUMBER OF TRIPS

TOTAL - 2904

7-8 A.M.  316
8-9 A.M.  939
9-10 A.M. 423
10-11 A.M. 309
11-12 NOON 292
12-1 P.M. 186
1-2 P.M.  353
2-3 P.M.  86

FACULTY/STAFF AUTO TRIPS

NUMBER OF TRIPS

TOTAL - 1051

7-8 A.M.  378
8-9 A.M.  249
9-10 A.M. 48
10-11 A.M. 58
11-12 29
NOON 88
12-1 P.M. 116
1-2 P.M.  85

OTHER AUTO TRIPS

NUMBER OF TRIPS

TOTAL - 37

7-8 A.M.  7
8-9 A.M.  15
9-10 A.M. 15
10-11 A.M. 15
11-12 NOON
12-1 P.M.
1-2 P.M.
2-3 P.M.

TOTAL AUTO TRIPS TO CAMPUS
7 A.M. TO 3 P.M. - 3992
24 HOUR TOTAL - 5530

university of minnesota

duluth campus

long range
master plan

time variation in auto trips to campus
data collected

NOV. 3, 1971
This third section presents the transportation situation within the Campus. Presented are data on parking accumulation, pedestrian movements, and servicing.

Peak parking demand on Campus is shown on the following figure which indicates the number of cars parked in each parking facility at the time of peak parking accumulation on Campus. On the day surveyed, the peak parking accumulation was 2045 vehicles, about 400 less than the number of available parking spaces.

Hourly parking accumulation is illustrated on figures entitled, "Time Variation in Parking Accumulation on Campus" and "Time Variation in Parking Accumulation by Lot." The first of these shows that parking demand on Campus remains high from 9:00 a.m. to 2:00 p.m. The second indicates variations in the time of peak accumulation and in the proportion of available spaces utilized among the four largest lots on Campus.

Assessment

- Overall parking capacity on Campus is presently sufficient, but needs to be evaluated in terms of future Campus growth and transit service.

- Lots A and D are preferred parking locations as indicated by their earlier peaking and greater utilization of available spaces.

- The parking on the Campus access streets must be evaluated in relationship to the street access function.
total cars parked: 2045

Time: 11:00 a.m.

total supply of parking spaces: 2481

maximum parking accumulation on campus

Drawn by: [Name]

Date: [Date]

University of Minnesota Duluth Campus

Long Range Master Plan

[Scale information]
University of Minnesota
Duluth Campus
Long Range Master Plan

Time variation in parking accumulation on campus

Data collected
Nov. 3, 1971 and April 26, 1972
University of Minnesota
Duluth Campus
Long Range Master Plan

Time variation in parking accumulation by lot

Data collected
Nov. 3, 1971
One of the most important concerns regarding pedestrian movements on Campus is the conflict between vehicles and pedestrians. The major pedestrian/vehicle conflict points are shown on the following figure, together with the predominant directions of pedestrian movement.

Pedestrian volumes from dormitories to Campus buildings and from parking lots to Campus buildings are illustrated in subsequent figures. Approximately 1/4 of all pedestrian movements from the dormitories are destined to the Kirby Student Center, which reflects its food service function. Two characteristics of pedestrian movements from parking lots to Campus buildings are that persons generally park in lots near their destination and that Lot C receives considerable usage.

Assessment

- Serious conflicts occur between vehicles and pedestrians at a number of locations.
total daily number of pedestrians walking from dorms to campus buildings: 3095
The location of services for the pickup and delivery of materials and supplies, for garbage collection, and for fire protection for the Campus are shown in the following figure. All materials and supplies are distributed to Campus buildings from four "pickup and delivery" locations. Garbage is collected at centralized locations within the buildings and then transported to the four "pickup and delivery" locations for removal from the Campus.

**Assessment**

- A comprehensive program is provided to meet the servicing needs of the Campus. This program should be built upon in planning future Campus growth.
transportation surveys

The transportation surveys conducted on the Campus included inventories of traffic volumes, physical characteristics, public transportation service (Campus and City buses), Campus tripmaking characteristics, and parking supply/usage. The purpose of each survey, the source of information, and the manner in which information was collected are summarized in the following paragraphs.

traffic volumes

Traffic volumes are an important input to transportation analysis because they are an indication of the demand the street system has to satisfy. In analysis, volumes are compared to street capacities to gain an assessment of the location and extent of capacity problems. Historical traffic volume information was obtained from the City Traffic Engineering Department.

This was supplemented by a series of 24-hour traffic volume counts taken on streets in the Campus vicinity.

campus tripmaking characteristics

Sufficient understanding of Campus travel patterns requires information on the number of trips made to the Campus, the mode of travel, trip origins and destinations, and the time variation in trips to the Campus. To obtain this information for travel to the Campus, three levels were: 1) counting by hour all vehicles that entered and left the Campus over a 24-hour period; 2) counting all persons that entered the Campus between 7 a.m. and 3 p.m., and; 3) distributing postcard questionnaires to about 40 percent of the persons entering the Campus between 7 a.m. and 3 p.m.

These surveys were conducted on Wednesday, November 3, 1971, utilizing the cordon line and interview stations shown in the following figure. With this information it was possible to factor the questionnaire returns to represent total travel to the Campus.
Physical Characteristics

Information on the regional accessibility of the Campus was obtained through a review of the "Duluth-Superior Metropolitan Area Planning and Transportation Study" and a field survey. Also needed to assess the quality of the existing transportation system is information on street widths, parking regulations, and the location and type of traffic control devices in the Campus area. This data was gathered from a field survey.

Public Transportation Service

Information on the routes and frequency of service for both Campus and City buses and on the ridership for both is needed to assess an existing role of public transportation and its future possibilities. Schedules for City buses that serve the Campus were obtained from the Duluth Transit Authority. Information on the Campus bus service was provided by the University; a Campus bus driver provided a summary of the number of persons boarding at each stop for every run made on a particular day. Information on the ridership of City buses was obtained in the trip-making characteristics survey.

Parking Supply/Usage

To evaluate the adequacy of the existing parking program information obtained included University parking policies, the number of spaces presently available, and parking space usage. Each hour of the survey day the number of vehicles parked was counted.

Transportation Survey Questionnaire

A questionnaire survey was conducted to gain information on the travel characteristics of persons who utilize the Duluth Campus. The following questionnaire was distributed to a sample of all persons who entered the Campus on November 3, 1971.
TRANSPORTATION SURVEY QUESTIONNAIRE

We need to learn about your travel habits so that we may better plan the transportation system at the University of Minnesota, Duluth. You can help by telling us about the trip you were taking when given this card. All information is confidential and will be used for statistical purposes only. Thank you for your cooperation.

Vice Provost for Business Affairs

1. TRAVEL ORIGIN: The place I came from is:

   Address, Dorm Name, etc.

2. TRAVEL MEANS: The means of travel to the Campus was:

   □ Auto Driver  □ Inter-campus Bus  □ Bicycle/Motorbike
   □ Auto Passenger □ City Bus  □ Walk

3. PARKING LOCATION: If an auto driver, the place I parked the car was:

   Lot Letter, Lot Name, Street Name, etc.

4. CAMPUS DESTINATION: The location within the campus I am going to is:

   Building Name

5. CLASSIFICATION: I am:

   □ Student  □ Staff  □ Faculty  □ Other

NOTE: Drop the completed card in campus mail, information desk at the Kirby Student Center, or U. S. mail.
Since the survey data represents a sample of the total population, it is necessary to factor the sample to control totals.

Two different types of control totals were used. The first was a manual count of all persons entering the Campus, which was made during the survey hours (7 a.m. - 3 p.m.) at each of the survey stations. The second was an automatic machine count of all vehicles entering and leaving the Campus over a 24-hour period. Through a process described later, the two types of control totals enabled results of the questionnaire survey to be expanded to represent overall tripmaking to the Campus.

The factoring process is predicated on two major assumptions:

1. Persons who utilized different modes of travel to the Campus (i.e., automobile driver, automobile passenger, bus passenger, or pedestrian) returned the questionnaire cards at the same rate.

2. Students, faculty, staff, and visitors returned the cards at the same rate.

The basic steps in the factoring process are as follows:

1) Combine the interview stations that are served by the same approach to the Campus. This step, which was needed to avoid errors due to small samples at several stations, resulted in the combination of stations one and two; three, four, and five; six and seven; and eight and nine.

2) Sort the base data by combined interview station by hour of the day. This resulted in hourly data for 7 a.m. to 3 p.m.
3) Expand the completed interviews to 24-hour totals. An example of this expansion for stations one and two is shown in the following table. An explanation follows:

- The first column contains the hourly manual counts of all persons entering the Campus from 7:00 a.m. - 3:00 p.m., which total 1991 persons and the estimated number of persons who entered the Campus from 3:00 p.m. - 7:00 a.m., which was derived from hourly vehicle counts and equaled 783 persons. Thus, the total number of persons who entered the Campus at these stations over a 24-hour period is 2774 persons.

- The second column lists the number of completed interviews (i.e., valid questionnaires returned) by hour.

- The third column lists the hourly factors and is obtained by dividing the completed interviews into the manual counts by hour.

- The fourth column lists the factors required to expand the 8-hour interview period to a 24-hour total. Inherent in this factor is the assumption that trips to the Campus during the non-interview period have the same characteristics as during the interview period.

- The last column lists the hourly factors to be applied to the appropriate returned questionnaires to represent tripmaking characteristics for all trips that enter the Campus through these stations on a 24-hour basis.
### SAMPLE FACTORING SHEET

**STATION NUMBERS ONE AND TWO**

**Hourly Factor x 24-Hour Adjustment**

<table>
<thead>
<tr>
<th>Hour</th>
<th>Hourly Manual Person Count</th>
<th>Hourly Manual Cards Handed Out</th>
<th>Interview Completed Interviews</th>
<th>Hourly Factor</th>
<th>24-Hour Factor Adjustment</th>
<th>24-Hour Factor</th>
</tr>
</thead>
<tbody>
<tr>
<td>7-8am</td>
<td>234</td>
<td>117</td>
<td>65</td>
<td>3.60</td>
<td>1.39</td>
<td>5.00</td>
</tr>
<tr>
<td>8-9</td>
<td>622</td>
<td>310</td>
<td>120</td>
<td>5.18</td>
<td>1.39</td>
<td>7.20</td>
</tr>
<tr>
<td>9-10</td>
<td>293</td>
<td>146</td>
<td>69</td>
<td>4.25</td>
<td>1.39</td>
<td>5.91</td>
</tr>
<tr>
<td>10-11</td>
<td>232</td>
<td>90</td>
<td>29</td>
<td>8.00</td>
<td>1.39</td>
<td>11.12</td>
</tr>
<tr>
<td>11-12noon</td>
<td>136</td>
<td>66</td>
<td>28</td>
<td>4.86</td>
<td>1.39</td>
<td>6.76</td>
</tr>
<tr>
<td>12-1pm</td>
<td>133</td>
<td>55</td>
<td>21</td>
<td>6.33</td>
<td>1.39</td>
<td>8.80</td>
</tr>
<tr>
<td>1-2</td>
<td>188</td>
<td>62</td>
<td>22</td>
<td>8.55</td>
<td>1.39</td>
<td>11.88</td>
</tr>
<tr>
<td>2-3</td>
<td>153</td>
<td>76</td>
<td>30</td>
<td>5.10</td>
<td>1.39</td>
<td>7.09</td>
</tr>
<tr>
<td>Total</td>
<td>1991</td>
<td>922</td>
<td>384</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Estimated Person Count for 3pm - 9am**

*derived from hourly vehicle counts - 783*

**24-Hour Total - 2774**
After this factoring process was completed for each interview station, the number of factored daily trips per person for each user type was tabulated to check the validity of the two key assumptions previously described. This tabulation is shown in the following table together with the number of trips/person/day for the Minneapolis and St. Paul Campuses as calculated in an earlier study.

In comparison with values for the Minneapolis and St. Paul Campuses trip frequencies for the Duluth Campus, with one exception are greater. This seems reasonable in light of the greater convenience of parking and ease of travel in Duluth. Therefore, it is concluded that the two major assumptions in the factoring process - that the rate of questionnaire returns is the same for persons of different classifications and persons who utilized different modes of travel - are acceptable.

At the request of the Planning Advisory Committee, a special traffic survey was conducted on April 25 and 26, 1972. The survey included:

- 24-hour vehicular counts on all campus entrances and exits. The resultant total two-way traffic volume on all entrances and exits over a 24-hour period was 10,105 vehicles. This result compares closely with figures from the November survey, which showed a total of 9,980 vehicles.

- Hourly counts of parking accumulation in each campus parking facility. The results are summarized in the parking accumulation section.

- Peak hour turning movement counts at the intersections of Woodland Avenue with College Street and Kent Road. The results are summarized in the capacity analysis section.
INDIVIDUAL TRIP FREQUENCY FOR DULUTH, MINNEAPOLIS,
AND ST. PAUL CAMPUSES

<table>
<thead>
<tr>
<th>Classification</th>
<th>1971-72&lt;sup&gt;1/&lt;/sup&gt; Population</th>
<th>Factored Daily Trips</th>
<th>Trips/Person/Day</th>
</tr>
</thead>
<tbody>
<tr>
<td>Student</td>
<td>430&lt;sup&gt;2/&lt;/sup&gt;</td>
<td>7190&lt;sup&gt;2/&lt;/sup&gt;</td>
<td>1.67 0.93 0.83</td>
</tr>
<tr>
<td>Faculty</td>
<td>336</td>
<td>720</td>
<td>2.14 1.74 2.08</td>
</tr>
<tr>
<td>Staff</td>
<td>332</td>
<td>520</td>
<td>1.57 1.30 2.08</td>
</tr>
</tbody>
</table>

<sup>1/</sup> As provided by University of Minnesota, Duluth Campus

<sup>2/</sup> Off-Campus students

<sup>3/</sup> As presented in "Inventory of Transportation, University of Minnesota," May 1971.