UNIVERSITY OF MINNESOTA
HEALTH SCIENCES EXPANSION

DESCRIPTION AND OUTLINE SPECIFICATION: UNIT K·E

The Architects Collaborative, Inc.

Health Sciences Architects and Engineers

Cerny Associates
Hammel, Green and Abrahamson, Inc.
Setter, Leach and Lindstrom, Inc.

12 January 1972

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INTRODUCTION

The material is arranged in sections consistent with the cost format, reflecting the primary parts of the building system. In general each section consists of an overall description of the systems involved followed by a more detailed outline specification. Since the material is in various stages of development and taken from more than one source we have allowed some minor deviations from this general format.

This building system is primarily based on the approach developed for Unit A, now under construction, and is only modified where necessary to accommodate to specific and unique conditions of the project.

Additional descriptive information describing the basic concept of the building system is included in the Appendix.

THE ARCHITECTS COLLABORATIVE, INC.

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MAJOR PLANNING ASSUMPTIONS, UNIT K/E

1. Unit K/E is planned for future expansion to 12 floors (including basement). Future floors will house cardiovascular research activities.

2. We were directed to plan one future elevator to accommodate a standard litter although it is our understanding that the expansion will not include patient care rooms.

3. Structural provisions are provided in Unit K/E for links to a possible future Unit J to the east and to Mayo to the north on floors 4 and 5. The program directive for planning Unit K/E assumes that animal activities on the 4th and 5th floors of Variety Club Heart Hospital will be relocated in new animal facilities in Unit K/E. Based on this, the existing animal freight elevator located in the east stair tower of VCHH will be removed to allow a new link to be made between Unit K/E and V.C.H.H.

5. The receiving dock is sized to accommodate 4 large and one small vehicle at any one time. Due to site restrictions large (40 ft. and above) semi trailer combinations are best accommodated in two easterly truck bays. We understand through discussions with Mr. Stanley Dew and Mr. Robert Foster that the frequency of this size vehicle presently approximates two to three per week. The remainder of vehicles expected at the K/E receiving dock consist of straight trucks up to 30 ft., small semi-trailor combinations up to approximately 35 feet and smaller panel and pick up trucks.

6. Access to radio therapy for ambulatory patients and space for parking for radiotherapy patients will be lost when K/E is under construction and when K/E is completed. Alternate access and parking must be worked out, since the area near the Powell Hall entrance will be disturbed during construction of K/E tunnel and Unit B/C. We suggest looking at the possibility of scheduling and transporting radio therapy patients utilizing central transportation service personnel. This would assume that patients would be received at the main O.P. entrance or at emergency entrance with the thought that parking space might be reserved in Mayo Garage for R.T. patients.

Major Planning Assumptions, Unit K/E

7. Tunnel to B/C

The present proposal indicates a two level tunnel between K/E and the point where Unit B/C is proposed to meet this tunnel. The lower level of the tunnel is intended for use primarily as a pathway for moving caged animals between Unit K/E Animal Holding areas and Mayo Animal receiving through an interim connection (before B/C is built) utilizing the existing service corridor on the lowest level of Diehl Hall until Unit B/C is built. The connection between the lower tunnel and Diehl Hall would be accomplished utilizing a small hydraulic elevator. This would also allow Diehl Hall to be serviced from Unit K/E before Unit B/C is completed.

8. Pedestrian Tunnel

We are not recommending that a pedestrian tunnel connecting a future Unit B/C, a future Unit J and Unit K/E be constructed at this time principally because of the fact that it would not be usable and its construction would require significant site development modifications in the Union Street-Essex Street area which would place limitations on the potential architectural development of the area when and if a new Unit J is built in the Powell Hall area.

9. Pedestrian Entrance

We do propose a pedestrian entrance to Unit K/E from the Union Street side. It is planned such that a future pedestrian tunnel can be connected into Unit K/E directly below the proposed Union Street entry.

10. Connections to Mayo (Elliott Wing)

a. There will be a service connection between Unit K/E and the basement of Elliott Hospital. This will replace an existing connection within Elliott Hospital. This has been approved by the director of hospital engineering.

b. There will be an internal service and service personnel connection between K/E and floor 1 of Elliott Hospital via a ramp.

Major Planning Assumptions, Unit K/E

10. c. There will be an on grade exterior connection between K/E and Elliott Hospital on Floor 1.

d. It is proposed that the primary staff connection between K/E and Elliott Hospital occur at floor 3, the main floor of University Hospitals. This connection implies that some office functions of the Medical School now located at the point of the proposed connection would be relocated by the time Unit K/E is completed.

Further assumptions agreed upon are recorded in the following meeting notes dated September 8, 1971, which outline several significant points with respect to Unit K/E planning.

MEMO TO: Unit "E"
MEMO BY: S. Whitney
SUBJECT: Meeting for Unit "E" - Powell Hall, Room 4112
DATE: 8 September 1971

PRESENT: B. Baker, R. DeRoos, B. Foster, D. Hendricks, G. Johnston, T. Jones, P. Maupin, Mrs. Nagley, T. Page, L. Schultz, G. Scheffler, B. Turner, D. Veara, S. Whitney

Review of high points of C.T. Main materials handling proposal for PHASE I and current recommendations.

Internal workings as they relate to Unit "E" (receiving, dispersal).

A. Assumptions by architects.

1. Organization of the materials management group to be resolved soon.
2. The scope of each part of materials management will be defined.
3. A zoned system of materials distribution will be employed.
4. Unit "E" will serve all units:
(Exceptions)
   a. Linen - both receiving and removal. Would mean double handling through Unit "E" now. Centralize at time of a new hospital.
   b. Animals - Animal Bedding - Animal Waste - to be handled through Mayo Garage
   c. In-Patient Food - directly to main Mayo Kitchen. Frozen and Vending items directly from Unit "E". Masonic beds not served from Mayo Kitchen.

B. Architects' diagrams of existing and proposed servicing.

1. Existing points of delivery and pick-up, grinders, flammable solvent and gas cylinder locations.

Major Planning Assumptions, Unit K/E

B. 2. Alternative service pathway for Unit "A" and existing basic sciences before unit "B-C" completed.

a. Main north-south corridor in Mayo Hospital. Has high pedestrian traffic - use only after hours.
b. Mayo Garage - could be controlled to facilitate movement.
c. Only man-powered carts to be used within alt. pathway.
d. Architect must provide enough holding space in Unit "E" for zones inaccessible during normal delivery hours.

3. Service pathway for Units "A", "B-C", "F" and existing basic sciences. Electric carts used from Unit "E" to drop-off zones.

4. Masonic serviced via Powell Hall, or its replacement.

5. Architects felt Lyon lab difficult to service. Client to verify.

6. Waste removal before unit "B-C" completed.

a. C. T. Main recommended retaining 6 docks and not to use alternate service pathway.
b. Client recommends using pathway and not using dock at Unit "A".

7. When Unit "B-C" completed, covered carts or pneumatic system is recommended.

II. Review of new factors influencing design of K/E.

A. Requirement that no beds on St. 12 or 22 be lost due to K/E construction.

1. Unit K/E shifted south - proposes removal of an elevator and stair at east end of V.C.H.H.
a. No anticipated use of animals in V.C.H.H.
b. Horizontal exit in Unit K/E should be acceptable.

2. 2 compactors to be located below grade.
a. Desirable to remove unit adjacent to dining.
b. One compactor might suffice with increased operation.
c. Must have isolation space and storage for 20 carts.

B. Request from department of environmental health and safety to provide receiving and storage facility for flammable liquids and compressed gases in or adjacent to Unit K/E.

B. 1. Inadvisable to develop facility adjacent to V.C.H.H. playground.

2. Alternate presented locates facility below grade - behind proposed compactor location.
   a. Flammable liquids and compressed gases could be received, stored, and removed at this facility.
   b. Radio-Active waste may be disposed of via this facility only.
   c. 1300 sq. ft. of storage required.
   d. Gus Scheffler: Explosion expansion space not necessary as shown.
      1. Possibility low of such a reaction.
      2. Only direct external opening would prevent structural damage.

3. 15% ramp to service dock questioned. (Ramp has since been eliminated.)
   a. Extra low range gear should solve problem.
   b. Size of trucks limited by 10'-7" clearance at bridge between Mayo and V.C.H.H.
   c. Ramp must be heated and textured.
   d. Hearse to use this dock also.

C. Reconsideration of Ground Floor receiving dock elevation and implications.

1. Av. El. of bedrock - 791'-2" is 4 to 5 ft. higher than anticipated.
2. Proposed to locate loading dock at 817'-4", down from 821'-1".
   a. Spaces below reduced in height.
   b. Facilitate truck access from E. River Road.

D. Considerations for future expansion and recommendations.

1. Dietary functions shifted from ground floor and centralized on basement floor.
2. Materials handling to exchange area with dietary.
3. Mail room in Unit "E" to be for gross sorting only.

III. Discussion of schedule and future meetings.

A. Paul Maupin requested one week lead time for all meetings by TAC.

B. University staff and areas of responsibility.

1. Bob Foster - ground floor and basement - materials management
2. Lee Schultz - maintenance space.
3. Lee Schultz, Roger DeRoos - waste disposal
4. Dietary department - dietary (Mrs. Coulter and others).
5. Don Veara, Gus Scheffler - Volatile Storage.

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GENERAL A

GENERAL

The proposed building system is specifically designed to accommodate the range of functions initially required in this health science facility, as well as to subsequent changes which will in all probability occur in both the space and environmental services.

To accomplish this a 12'-4" two-way grid is projected over the building site. In each sixth square is placed a riser containing mechanical services. Columns are located at the corners of the mechanical risers and in the E/W direction, midway between the risers. The remaining space is spanned with a 4'-4" deep structure consisting of girders and long span trusses through which mechanical services are distributed horizontally. The bottom surface of the plane consists of a suspended lighting/ceiling system to which light-weight partitions may be secured allowing walls, general mechanical services and casework in the laboratory areas to be moved with a minimum of disruption.

More detailed descriptions of the systems can be found in the Appendix.

Construction will conform to the requirements of local and national building ordinances where applicable and to the University of Minnesota Standards for Construction.

SITE DEVELOPMENT B

A report was submitted to the Health Sciences coordinator in November 1971 indicating potential costs/benefits for alternative approaches to constructing Unit K/E. At the Design Coordinating Committee meeting on 15 December 1971 authorization was received to proceed on development of documents for early excavation, rock removal, shoring and footings for Unit K/E.

Work is now in progress on these documents and is expected to be ready for review in March 1972.

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SUBSTRUCTURE C

SUBSTRUCTURE

1. GENERAL

The natural soils and bedrock occuring at the site have been investigated by soil borings, rock corings, and laboratory testing of samples.

Permissable design loadings for spread footings bearing on the natural soils in the upper portions of the site has been determined as 5000 pounds per square foot of area.

For foundations bearing on the relatively sound Platteville limestone bedrock occuring at the site a maximum loading of 50 tons per square foot of area is recommended.

In areas of the site where the limestone has been removed the foundations will bear on the St. Peter sandstone where a maximum loading of 20 tons per square foot of area is recommended.

2. FOUNDATION FOR COLUMNS

In the area north of Grid 566, between the main building tower and the existing hospital, the column foundations will be reinforced concrete spread footings bearing on natural soils. The lowest floor in this area coincides with the mezzanine floor level of the main building tower.

All other columns extending to the basement floor level or mechanical floor level of the main building tower will be supported on reinforced concrete footings bearing on the Platteville limestone and St. Peter sandstone bedrocks.

3. FOUNDATION WALLS

Foundation walls below grade levels will be of reinforced concrete. These walls will be designed to support a portion of the floor and wall loads as well as the lateral earth pressure loads. Where these walls encase building columns they will also resist a portion of the lateral wind pressure loads on the building frame above grade.

4. MATERIALS

a. Concrete (regular weight) - fc = 4000 psi minimum compressive strength at 28 days of age.
b. Reinforcing steel - Billet steel, ASTM - A615, Grade 60.

5. CODES FOLLOWED FOR DESIGNS

a. Minneapolis Building Code.
b. Uniform Building Code.
c. American Concrete Institute's "Standard Building Code Requirements for Reinforced Concrete".
d. Concrete Reinforcing Steel Institute "Manual of Standard Practice for Reinforced Concrete Construction".

SUPERSTRUCTURE D

SUPERSTRUCTURE

1. GENERAL

The floor slabs at the Mezzanine and First Floor levels in the main building tower will consist of 10 inch reinforced concrete two-way flat slabs. The selection of this type of construction is dictated by the low floor to floor heights and the necessity of providing a floor of high load-carrying capacity in the truck dock and materials handling areas.

Other floors in the building tower and the present roof construction, designed as a future floor, will be composite steel decks with a lightweight concrete topping. The selection of this type of construction is based on the economies inherent in the lightness of the floor itself as well as the supporting steel framing and foundations. Cellular decking will be used where electrical raceways are required.

In the area north of Grid S66, between the main building tower and the existing hospital the slabs at the First and Second Floor levels will be one-way reinforced concrete slabs to maintain as much clear headroom as possible and to provide the required load carrying strength.

Reinforced concrete box type underground tunnels at the Mezzanine and First Floor levels extending from the building to the existing Diehl hall building will be provided for the transfer of animals and animal supplies. A tunnel will also be provided for mechanical piping between the mechanical floor level and the existing heat shaft.

Above the First Floor level in the main building tower, open-web trusses will be used as typical floor supporting members to provide maximum flexibility for lateral distribution of the mechanical and electrical systems between the floor slab and ceiling below. Two beams will provide a horizontal slot at each floor level, above First Floor, between the corner columns of the mechanical and electircal shafts. This "slot" creates maximum size access openings to the areas between the floor and ceiling below. The upper, and shallower, beam supports the floor and shaft walls and acts together with the lower, deeper beam to provide a rigid-frame action with the steel columns to resist lateral wind loads on the building.

A walkway will be provided linking the building to the existing hospital at the Third Floor level and the building will be linked to the Variety Club Heart Hospital at all floor levels with reinforced concrete slabs and stairs.

The framing of the building will be designed for future vertical expansion. The present roof will become a future floor and an allowance will be made for an additional 7 floors above, for an ultimate building consisting of 12 floors above the Basement level.

2. DESIGN LOADS

a. Live Loads

1. Truck floor- 300 psf
2. Materials handling areas - 150 psf
3. Future Mechanical equipment room floor - 150 psf
4. Plaza areas over occupied spaces - 250 psf
5. Other floors
   a. Rooms - 80 psf (plus 20 psf for partitions)
   b. Corridors - 100 psf
   c. Stairs - 100 psf
6. Elevated walkways - 100 psf
7. Future roof - 40 psf

b. Lateral wind loads

Height zone above grade (feet)	Wind pressure (psf)
0 - 50	20
50 - 100	25
Above 100 (future)	30

3. FIREPROOFING

Fireratings of 3 hours for columns and primary steel framing members and 2 hours for secondary steel framing members and floors are required.

The solid, regular weight concrete slabs and steel floor decking with lightweight concrete topping fulfill this requirement with sprayed-on fireproofing required on the underside of the decking at floor depressions and electrical trench ducts only.

In general, the steel beams, trusses and columns will be sprayed with a cementitious fiber to attain the required fire ratings. Concrete, plaster or masonry encasement fireproofing will be provided in areas where the use of sprayed-on fireproofing is not practical or economical.

4. MATERIALS

a. Regular weight concrete - fc = 4000 psi minimum compressive strength at 28 days of age.

b. Lightweight concrete - fc = 3000 psi minimum compressive strength at 28 days of age and weighing not more than 110 lbs. / cubic foot.

c. Reinforcing steel - Billet steel, ASTM - A615, Grade 60.

d. Structural steel - Fy = 50,000 psi, ASTM - A572.

e. Steel decking - 3" deep sections with deformations in the hat sections to provide composite action with the lightweight concrete topping.

5. CODES FOLLOWED FOR DESIGNS

a. Minneapolis Building Code.

b. Uniform Building Code.

c. American Institute of Steel Construction's "Manual of Steel Construction".

d. American Concrete Institute's "Standard Building Code Requirements for Reinforced Concrete".

e. Concrete Reinforcing Steel Institute's "Manual of Standard Practice for Reinforced Concrete Construction".

f. American Iron and Steel Institute's "Code for Design of Light Gauge Steel Structural Members".

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STAIRS E

Stair configuration and construction for Unit K/E will be similar to those developed for Unit A.

ELEVATORS F

1. SUMMARY

Previously developed performance for elevators in the Health Sciences Expansion Complex would require the following:

AVERAGE INTERVAL:	UNDER 40 SECONDS
HANDLING CAPACITY:	90 PLUS PERSONS INITIAL 270 PERSONS WITH EXPANSION IN 15 MINUTES OF HEAVY 2-WAY TRAFFIC

Calculations indicate that 2 cars initially and 4-car ultimately are required to adequately meet this criteria.

Since it is necessary to have a side opening at a lower level and, hence, a cornerpost car, considertion whould be given to providing side opening above this level throughout the building so that service and passenger traffic could be separated.

2. ELEVATORING ANALYSIS AND RECOMMENDATIONS

A. Criteria

In previous reports covering Units A and B/C, elevator performance was reviewed and general criteria for elevator service was developed:

AVERAGE INTERVAL:	UNDER 40 SECONDS FOR ELEVATOR HANDLING STAFF TRAFFIC AND GRADUATE STUDENTS
HANDLING CAPACITY:	40% OF POPULATION IN 15 MINUTES OF 2-WAY TRAFFIC

This handling capacity requirement approximates 200 x 40% = 80 persons in 15 minutes initial and 650 x 40% = 260 persons in 15 minutes with expansion.

B. Calculations

Schematic plans indicate provisions for 4 elevators, one of which is arranged for service through side opening with 2 of these elevators for expansion purpose.

DUTY	NUMBER OF ELEVATORS	15-MINUTE AVERAGE INTERVAL (SECONDS)	PERFORMANCE HANDLING CAPACITY (PERSONS)
4000# AT 500 F.P.M.	2	40	90
	4	35	280

Our calculations indicate that 2 cars initial and 4 cars expansion will provide service meeting the established criteria.

3. OUTLINE OF EQUIPMENT

	CAR NO. 2	CAR NO. 3	CARS NO. 4 AND 5
SPEED:	500 F.P.M.	500 F.P.M.	500 F.P.M.
CAPACITY:	3500#	3000#	3000# *
TRAVEL (INITIAL):	65'	52'	117'
TRAVEL (FINAL):	130'	117'	--
STOPS (INITIAL):	7	5	11
STOPS (FINAL):	13	11	--
OPENINGS (INITIAL):	12	5	11
OPENINGS (FINAL):	24	11	--
MACHINE:	OVERHEAD GEARLESS	OVERHEAD GEARLESS	OVERHEAD GEARLESS
CONTROL:	VARIABLE VOLTAGE	VARIABLE VOLTAGE	VARIABLE VOLTAGE
OPERATION:	GROUP AUTOMATIC	2 CARS INITIALLY WITH 2 FUTURE CARS = TOTAL OF 4 CARS	GROUP AUTOMATIC
PLATFORM SIZE:	7'-8" x 6'-8"	6'-8" x 6'-2"	6'-8" x 6'-2" *
DOOR SIZE:	42"	42"	48" or 42"
SIGNAL:	LIGHT UP HALL AND CAR BUTTON CAR AND HALL POSITION INDICATOR ACCESS SWITCH	SEPARATE RISER OF PUSHBUTTONS FROM SIDE OPENING	LIGHT UP HALL AND CAR BUTTONS

* NO. 3 MAY BE DEEPER WITH 4500# CAPACITY TO CARRY NONAMBULATORY PATIENTS

Outline of Equipment for the hydraulic elevator would be as follows:

	CLEAN FREIGHT CAR NO. 1	ANIMAL TUNNEL ELEVATOR CAR NO. 6
CAPACITY:	4500#	3000#
SPEED:	100 F.P.M.	100 F.P.M.
TRAVEL:	APPROXIMATELY 13'	APPROXIMATELY 13'
LANDINGS:	4	2
OPENINGS:	4	2
CONTROL:	HYDRAULIC	HYDRAULIC
OPERATION:	4-STOP COLLECTIVE	2-STOP COLLECTIVE
PLATFORM SIZE:	8'-0" x 8'-0"	6'-0" x 7'-0"
HOISTWAY ENTRANCES:	4'-0" x 7'-0"	3'-6" x 7'-0"
DOOR OPERATOR:	HEAVY DUTY, MASTER SPEED, DC	HEAVY DUTY, MASTER SPEED, DC
SIGNALS:	CAR POSITION INDICATOR ILLUMINATING CAR AND HALL PUSHBUTTONS SPECIAL DOOR HOLD OPEN BUTTON	CAR POSITION INDICATOR ILLUMINATING CAR AND HALL PUSHBUTTONS SPECIAL DOOR HOLD OPEN BUTTON

EXTERIOR SURFACES G

GENERAL DESCRIPTION OF EXTERIOR ENVELOPE

All the work pertaining to the following systems in included under the title of exterior surfaces: architectural precast concrete; support assemblies, protective coating, joint sealant, and spray-on insulation for the precast concrete panels; exterior architectural metal; aluminum windows and glazing; and hollow metal work with Venetial blinds, drapery tracks, and light-proof shades.

The above listed systems allow the same degree of planning flexibility that has been established by the other building systems which are used throughout the project.

ARCHITECTURAL PRECAST CONCRETE

The precast concrete is conceived as part of the modular envelope. All main joints in the precast concrete have been made continuous. Staggering of main joints has been avoided to insure flexibility and facilitate adjustments. The main vertical joints of the precast concrete panels are coordinated with the window joints and the 12' - 4" planning grid. The main horizontal joints are coordinated also with the window head joint at the suspended ceiling plane. Typical precast concrete panels are designed, as large as possible, within the limits for normal transportation and erection. Therefore, each panel covers the maximum area minimizing the amount of form work, casting, joint extension, and handling per panel.

Also, an effort has been made to keep down the amount of formwork and to standardize the types and locations of inserts and/or other metal items cast in the concrete and to take care of varying support conditions by modifying the support assemblies. Unnecessary changes in exterior texture and complicated formwork have been avoided.

SUPPORT ASSEMBLIES

The support assemblies for the precast concrete panels are designed to allow adjustments in the three planes. Dead load, bearing support assemblies transmit their loads vertically to the structure and can be adjusted micrometrically by using jack bolts; conversely, wind load forces, bearing on the panel surfaces, are transmitted horizontally to the structure and can be adjusted micrometrically also.

PROTECTIVE COATING

It is proposed to use a synthetic protective coating for exposed surfaces of the precast concrete. By totally waterproofing the precast concrete surfaces, the exposed aggregate will not be affected by extreme weather conditions. Spalling will be eliminated and moisture will not rust steel within the concrete.

JOINT SEALANT

The proposed joint sealant shall be a non sag, two part, poly-sulfide sealant that shall be chemically compatible with the protective coating. Sealant shall be gun applied. Backing material for the sealant shall be a non staining, compressible filler.

SPRAY-ON INSULATION

Precast concrete panel interior surfaces and support assemblies are to be covered by spray-on insulation, type and thickness as approved by the mechanical consultant. Spray-on insulation has been selected over other types of insulation to facilitate installation on irregular and difficult to reach surfaces.

ARCHITECTURAL METAL

For the exterior soffits, under the cantilevers, it is proposed to use a metallic suspended ceiling system. This exterior soffit system is to be composed of aluminum strips, prepainted with an alkyd enamel. The aluminum strips are clipped on a fixed module onto panel carriers which are v-shaped and prepared to hold the panels with a snap-on action. Aluminum snap-on closures are to be installed between the aluminum strips.

The undersides of the steel floor decks at all exterior areas, using this soffit system under the cantilevers, are to be insulated to avoid heat loss through the floors. Also, there will be closures, in the window plane, between the window head and the underside of the steel floor deck. These vertical closures are to be insulated also.

ALUMINUM WINDOWS

As stated before, the proposed window system is conceived to coordinate the window joints with the architectural precast concrete joints, both occurring on the 12'-4" planning grid. Each typical window frame unit is 12'-4" long. Wider window openings are made up of increments of 12'-4".

The typical units have been subdivided in five sections: Two fixed lights of 1'-6 1/2" each, located at the ends; one fixed light of 3'-1", at the center; and two lockable, fully reversible units of 3'-1" each, at the intermediate joints. This spacing provides the same degree of planning flexibility, for partition location, as the ceiling system provides.

After studying the window washing requirements, a decision has been made to avoid exterior window washing. Exterior rigs are very high priced, more so for this building, due to the deep recesses under the cantilevers. To have window washers in the outside, on the concrete ledge, there were several dangerous drawbacks: First the ledge is pitched to the outside and only 8" deep, and second the window is only 5'-8" high, which would force normal sized men to work in an uncomfortable position. Due to the desired planning flexibility, the proposed window is sub-divided in smaller panes than it was contemplated in the early stage of the project; therefore, all fixed panes can be washed from the inside.

Window frames are provided with thermal breaks, by using continuous neoprene gaskets, joining the inner and outer metal frames. Also, neoprene gaskets are used to hold the glass to the frames. Aluminum sections have been reduced to a minimum, mainly by eliminating aluminum beads and trim pieces.

GLAZING

It is recommended that double glazed, thermal windows be used with an insulating type glass, such as solar gray, for the exterior pane. Total thickness of the thermal pane is conceived to be 1". Since the largest typical pane is less than 5'-8" x 3'-1", glass thickness may be kept at the minimum, recommended by the manufacturer and structural consultant. As expressed above under aluminum windows, all thermal glass panes shall be held in position by using continuous neoprene gaskets.

HOLLOW METAL WORK

It is proposed that interior window soffits and heating coil covers be made of hollow construction, sheet steel, properly reinforced for the attachments to structural support, hardward, and grilles. To continue with the built-in flexibility provided by the previous systems, these closures have the same subdivisions as the windows, allowing partitions to be located at points where the closures are fixed and permitting access under the pivoted windows.

These closures, besides providing the necessary grille area required for the HVAC systems, are built with continuous recesses to receive vertical Venetian blind and drapery tracks. Where no blinds or draperies are required, these recesses shall be covered with snap-on, continuous, hollow metal closures strips.

Also, part of the hollow metal work are the insulated, hollowmetal sandwich panels which abut the window frames or the glazing where interior partitions are required.

VENETIAN BLINDS, DRAPERY TRACKS, AND LIGHT-PROOF SHADES

It is recommended to use vertical, traverse, and rotating, plastic Venetian blinds with recessed mounted, top and bottom aluminum tracks. Blinds shall be operated by stainless steel chains. Vertical Venetian blinds were selected over standard horizontal Venetial blinds for their lower maintenance cost and planning flexibility.

The proposed aluminum drapery track attachment shall have concealed cords in individual compartments and concealed self lubricating carriers.

It is believed that there will be very few rooms, if any, requiring lightproof shades. The recommended lightproof shades provide full and complete light exclusion if needed.

G2 ARCHITECTURAL PRECAST CONCRETE

G2.01 GENERAL

.01a Work under this section consists of furnishing and installing complete, all architectural precast concrete including all metal parts for support assemblies which are welded and embedded in the precast concrete panel as shown on the drawings and herein specified.

.01b The manufacture of the architectural precast concrete shall be by a specialty subcontractor or a team of specialty subcontractors.

.01c The erection of the architectural precast concrete panels shall be by a specialty subcontractor or a team of specialty subcontractors.

.01d Architectural precast concrete shall meet requirements of SS-S-00721a Type II or Type III and shall be the product of an established subcontractor or consortium of subcontractors having capacity and facilities for producing the quantity and quality required for this project.

G2.02 WORK NOT INCLUDED

.02a All support assembly parts not cast in precast concrete and not welded thereto are specified in the miscellaneous metal section.

.02b Caulking for joints in architectural precast concrete panels is included under the work of the sealant section.

.02c Weather proofing coating for all exterior precast concrete surfaces is included under the protective coating section.

G2.03 COMPOSITION OF PANELS

.03a Based upon a thickness of one inch minimum, the facing portion of the panels shall be complsed of the following materials:

aggregate and cement types, colors and quantities, and final water/cement ratio are to be selected in the future by the architects-engineers

.03b Aggregates shall be evenly distributed and shall occupy no less than 85% of the total exposed aggregate areas.

G2.03c Back-up portion shall consist of local aggregate to be selected by architects-engineers, meeting the same specific gravity and hardness test of ASTM C-330 and grey cement.

.03d Water/cement ratio shall not be greater than five gallons of water per sack of cement.

.03e Air entraining agents shall conform to ASTM C260. Air content in the light-weight structural back-up and the facing portion shall be within the limits of 5 to 7%.

G2.04 PHYSICAL REQUIREMENTS

Precast concrete panels shall have a minimum compressive strength of 7,500 PSI at 28 days of age for the facing portion and a maximum of 5% absorption when tested by suitable size cubes cast from the same material. The cubes shall consist of all facing mix, and the applied testing pressure shall be parallel to the face when tested according to the latest methods of ACI704. Evidence of freeze and thaw test shall be submitted in which after 250 cycles the percentage of volume loss shall not exceed 0.80%. Lightweight structural concrete back-up shall have a minimum compressive strength of 5,000 PSI when tested by 6" x 12" cylinders.

G2.05 STRUCTURAL DESIGN AND REINFORCEMENTS

.05a RESPONSIBILITIES
The architects-engineers are responsible for the reinforcement and physical properties of the precast concrete panel and the support assemblies when the panel is installed and attached to the building in its assigned position.
The precast concrete manufacturer shall be responsible for the recalculation of the panels for all structural stresses, strains and temperature changes, produced by lifting the panels from the forms, transportation and erection. Any structural changes produced by this recalculation shall be submitted for approval to the architects-engineers, at the shop drawing stage.

.05b REINFORCEMENTS
Precast concrete panels shall be reinforced with a built-up welded steel wire mesh, conforming to ASTM A-82 and ASTM A-185 and additional deformed bar reinforcement, conforming to ASTM A-15, intermediate or hard grade. All bends, angles, returns, and contours shall be preformed with suitable bending equipment. Anchor brackets, loops and plates shall be securely attached to reinforcing in the positions indicated on the drawings.

G2.05c LIFTING DEVICES

The precast concrete manufacturer shall provide for lifting devices such as threaded inserts or other approved devices for lifting the panels, at first, from the forms and also for transportation and erection.

Lifting devices are to be located in unexposed surfaces of the panels. No inserts, hooks or other lifting devices may be located in any of the exterior exposed surfaces of the panels. Lifting devices types and locations shall be submitted to the architects-engineers for approval in the shop drawing stage.

.05d COVER OF REINFORCEMENT

A minimum concrete cover of 1-1/4" shall be maintained over reinforcing steel for exterior exposed aggregate surfaces.

A minimum of 3/4" concrete cover shall be maintained for exterior smooth surfaces.

A minimum of 1/2" concrete cover should be obtained for interior surfaces.

G2.06 MIXING AND PLACING

.06a Mixing of concrete shall be done in a mixer of approved type. The concrete shall be mixed until there is uniform distribution and shall be discharged completely before the mixture is re-charged. The mixer shall be rotated at a speed recommended by the manufacturer and be equipped with meter for measurning water. All aggregates shall be preweighed before placing in mixer.

.06b Temperature of concrete shall be not less than 45° F. nor more than 70° F. and ambient casting area shall be not less than 45° F. and rising.

.06c Concrete shall be conveyed from the mixer to the form by methods which will not permit separation or loss of materials.

.06d Concrete shall be deposited as near to its final position as possible to avoid segregation in rehandling and flowing. High frequency, low amplitude vibration shall be used and shall be continuous to produce the required density and surface finish. When concreting is once started, it shall be carried on as a continuous operation until the casting of the panel or unit is completed.

.06e No concrete that has hardened or been contaminated by foreign materials shall be used.

G2.07 CURING

After casting and while still in the form, the precast concrete panels are to be kept moist with approved covering as recommended by manufacturer. Precast concrete panels are not to be removed from the forms before the concrete has attained 1500 PSI. Panels are to be kept moist in an approved manner for a minimum of 5 days after removal from form.

G2.08 WORKMANSHIP

All joints shall be continuous, with an even thickness of 1/2" and all arrises shall be clean and accurate. All simulated joints and/or drips shall be true to profiles and be continuous at the intersections with the joints.

G2.09 TOLERANCES

.09a POSITION OF CAST-IN ITEMS

Inserts, bolts, plates, angles, etc.	±3/8"
Flashing reglets	±1/4"
Electrical outlets, hose bibs, etc.	±1/2"

.09b PLACEMENT OF REINFORCEMENT

Bars and mesh to be ±1/2" of position shown on approved shop drawings and never to encroach on the specified minimum cover.

.09c CASTING TOLERANCES

Over-all height and width measured at the face adjacent to the mold when cast:

10'-0" or under	±1/8"
10'-0" to 20'-0"	+1/8" -3/16"
20'-0" to 30'-0"	+1/8" -1/4"
Each additional 10'-0"	±1/16" per 10'-0"
Angular deviation of plane of side mold	1/16" per 6" depth but at least 1/16"

G2.09c (cont.)

Thickness	+1/4" -1/8"
Out of square (difference in length of the two diagonal measurements)	1/8" per 6'-0" or 1/4" total, whichever is greater

.09d AFTER CASTING TOLERANCES--BOWING AND WARPING

Without intermediate support	1/240 panel dimension
With intermediate support	1/360 panel dimension

.09e ERECTION TOLERANCES
Precast panels to be located in the center of their theoretical location on the building and adjusted to accommodate adjacent elements, proper joint width, and alignment with adjacent precast members.

1. Face width of joint	
Panel dimension (normal to joint) 10'-0" or under	±3/16"
Panel dimension (normal to joint) 10'-0" to 20'-0"	+3/16" -1/4"
Each additional 10'-0" (normal to joint)	±1/16"
2. Joint taper (panel edges not parallel)	1/40" per ft. length or 1/16" total, whichever is larger, but not greater than 3/8"
3. Panel alignment	
Jog in alignment of edge	1/4" maximum
Offset in face of panel (exterior face unless otherwise noted)	1/4"

G2.10 ANCHORS AND DOWELS
Anchors, bolts, threaded inserts, plates, angles, etc., shall be as shown on the drawings and shall be fabricated from corrosion resisting materials.

G2.11 SAMPLES

The contractor shall submit two 18" X 18" X 2" samples for approval to the architect.
A sample indicating the texture, color and finish may be seen at the office of the architect.
No material shall be fabricated prior to complete approval of the architect as to texture, color, finishes and other characteristics.

G2.12 TESTS

All precast concrete furnished under this section shall be subject to test by an approved independent testing laboratory for compressive strength and absorption from cubes taken at the manufacturer's plant. Refer to PHYSICAL REQUIREMENTS paragraph above for method of tests, strength, and absorption limits. Submit certification, in triplicate, of compliance with these requirements.

G2.13 PROTECTION

Precast concrete panels shall be handled in a nearly vertical plane at all times. Panels shall be stored vertically and leaned against proper supports until used. Any chipped, spalled, or stained pieces shall be redressed with approval of the architect and such redressing shall be guaranteed by the precast manufacturer.

G2.14 ERECTION

a) All precast concrete panels shall be cleaned just before setting.
b) Panels shall be set plumb, level, and true to line.
c) All joints shall be 1/2" wide.
d) Panels shall be lowered in place and support assemblies adjusted, as many times as necessary, so that panels are true horizontally and vertically.
e) Each panel shall be securely braced until all its support assembly connections have been secured.
f) All anchorages and/or dowels shall be accurately adjusted and the holes and sinkages filled with the approved mortar, as shown on the drawings.
g) Welding shall be done in accordance with the Standard Code for Arc and Gas Welding in Building Construction of the American Welding Society.

G2.15 CLEANING

After the completion of the setting, all precast concrete panels shall be cleaned with stiff fiber brushes, using soap powder, boiled in water, and the panels rinsed with clean water. Cleaning work shall not start until all the panels are erected and sealant installed in all the joints. Cleaning shall commence at the top and continue progressively down the face of the building.

G3 PRECAST CONCRETE--SUPPORT ASSEMBLIES

G3.01 SUPPORT ASSEMBLIES

.01a All support assemblies for architectural precast concrete panels shall be fabricated from rolled steel shapes as detailed on the drawings. All inserts and other metal items which are embedded and/or welded to the precast concrete are included under the work of the arcitectural precast concrete section.

.01b All metal items under this section shall be shop painted with primer and rust preventive paints as specified under miscellaneous metal section. All areas of steel which have been welded in the field and/or abraded shall be touched up with prime paint as specified above.

G4 PRECAST CONCRETE--PROTECTIVE COATING

G4.01 GENERAL

This section describes materials and methods of application for coating exterior surfaces of precast concrete panels.

G4.02 MATERIALS

Surface coating shall be clear, durable, capable of being absorbed into the concrete surface and permit relatively easy cleaning of surface dirt. Surface coating should not produce a glossy, reflective appearance, shall not discolor, oxidize or change chemical composition on exposure to sunlight and/or atmospheric contaminants. Surface coating should not attract atmospheric contaminants.
The sealer coating system shall consist of one or several coats of low viscosity acrylic resins, based on methyl methacrylate with ethyl acrylate copolymer or butyl methacrylate copolymer, as recommended by one of the following manufacturers:

Adheron Coatings Corporation
Franklin Park, Illinois 60131

Sonneborn Building Products, Inc.
70 North Street
Park Forest, Illinois 60466

Coatings and Adhesives Corporation
1912 Lehigh Avenue
Box 29
Glenview, Illinois 60025

G4.03 CERTIFICATIONS

Contractor shall furnish manufacturer's certification attesting that material meets specified performance tests requirements.

G4.04 APPLICATION OF PROTECTIVE COATING

.04a Application of protective coating shall be executed at the precast concrete plant.

.04b Handling and application of the approved protective coating shall be executed following the directions of the manufacturer.

G5 PRECAST CONCRETE--JOINT SEALANT

G5.01 GENERAL

.01a This section describes materials and methods of application for sealing precast concrete joints. Application shall be coordinated with requirements as described in other sections and noted on the drawings.

.01b Materials shall be delivered to the project site in sealed containers and shall be used in strict accordance with manufacturer's printed directions.

G5.02 MATERIALS

.02a Sealant shall be a gun-grade class B, non-sag two-part polysulfide sealant licensed by Thiokol Chemical Corporation as conforming to Thiokol Building Trade Performance Specification, such as Tremco "Lasto-Meric", 3M "Weatherban", Dewey & Almy "Hornflex", or approved equal. Sealant shall be chemically compatible with precast concrete protective coating.

.02b Backing materials for sealant shall be inorganic, non-oil, non-grease and non-asphaltic, non-staining, resilient type filler and chemically compatible with sealant.

G5.03 CERTIFICATION

Contractor shall furnish certificates from an approved laboratory attesting that materials meet specified perfomance test requirements.

G5.04 SPECIALTY SUBCONTRACTOR

Sealant application shall be made by a specialty subcontractor.

G5.05 LOCATIONS & TYPES

.05a Exterior joints around perimeters of all types of metal frames adjacent to architectural precast concrete.

.05b Joints of all architectural precast concrete.

G5.06 PREPARATION

.06a Joints shall be cleaned of all dust, surface dirt, oil, and surface protection on metal items before applying sealant.

.06b Protective coatings on metallic surfaces shall be removed by solvent that leaves no residue.

.06c For joints up to 1/2" wide, the depth of the sealant should equal the width of the joint. For joints over 1/2" wide the depth should equal one-half the width, but not less than 1/2" and not more than 1". Voids or recesses beyond the above established depths shall be previously filled with backing material as specified for sealant.

G5.07 APPLICATION

.07a Sealant shall be forced into the joints mechanically, with pressure to expel all air and provide a solid filling. Surface of sealant shall be uniformly smooth and free of wrinkles. All joints shall be filled slightly convex.

.07b Joints shall be filled to within specified depth from the surface with specified backing filler and the remainder of joint then filled with sealant.

.07c Color of sealant shall be as selected by the architects.

G5.08 CLEANING

.08a Masking tape shall be used to prevent smears on materials such as architectural precast concrete and aluminum frames which would be difficult to clean.

.08b Surfaces of materials adjacent to sealed joints shall be cleaned free of smears of sealant or other soiling due to sealing operations as work progresses.

INTERIOR SURFACES H

CEILING SYSTEM DESCRIPTION

The ceiling system will facilitate a degree of planning flexibility equal to that afforded by the structural and mechanical system. The ceiling is conceived as a continuous suspended plane extending from exterior wall to exterior wall under which partitions can be located and relocated as necessary. Above the ceiling ducted mechanical services can be arranged and rearranged as required without interference from walls or other vertical barriers.

To accomplish this the ceiling has to embody the following characteristics:

1. The suspension system must be capable of supporting the head of all partitions and door frames and provide adequate lateral stability without additional bracing. Walls must be attached and detached without damage to the ceiling. Although most walls occur in modular locations, attachment at random locations must be possible.

2. The suspension system must provide a framework in which light fixtures, air supply and return elements, sprinklers, smoke detectors, speakers, laboratory service columns and infill panels can be located and rearranged in various combinations.

3. The ceiling must offer architectural characteristics suitable for small, intermediate and large areas.

4. The ceiling must be accessible to allow routine maintenance and rearrangement of mechanical equipment at any location above the ceiling.

The proposed ceiling system is composed of continuous service strips and of infill. The service strips are oriented in an east-west direction and are located 6' -2" o.c. at the quarter points of the 12' -4" architectural grid. The infill closes the space between the all purpose strips and provides for access to the plenum and acoustical separation of rooms.

The service strip furnishes the location for all mechanical service penetrations in the ceiling system. It is made up of alternating 4' -0" flourescent light fixture locations and 2' -2" service panel locations. The modular locations of a 4' -0" flourescent fixture is centered on the quarter points of the architectural grid but such a fixture must be relocatable at any point in the strip to accommodate non-modular rooms.

The service panel provides locations for sprinklers, smoke detectors, speakers, laboratory service columns and down lights.

Linear supply air handling elements are located as required, perpendicular to the service strip astride the cross runners with point returns located as required at the service panels.

N-S and E-W partitions may be attached to the ceiling system by bolting the partition head to cross runners which run perpendicular to the service strip on 2'-2/3" centers. E-W walls may thus be attached along any line in the zone between service strips. N-S partitions are located astride the cross runners. Non-modular N-S partitions require an additional cross runner for support.

In order to insure that partitions can be freely moved without unnecessary difficulty or damage to the ceiling system mechanical services passing between partition and plenum above are minimized. Plumbing fixtures located in areas not subject to change are loop-vented underfloor. We recommend low-voltage switch legs be used in these areas. In areas subject to extensive future change, piped services to laboratory benches shall be fed down from the plenum space in umbilical chases.

Detailed study of code requirements regarding fire rated walls indicates that each level be divided by only one partition which must interrupt the suspended ceiling plane. In each case the penetrating wall has been choosen as being the one least likely to be relocated.

The wall system has been designed to provide an STC of 45 (plaster) 54 (drywall). A one inch sound blanket increases these ratings respectively to 49 and 58. The ceiling typically provides an STC rating of 43. This may be increased by the use of acoustically backed board and hold-down clips. Areas which require additional isolation will be separated from adjoining areas by acoustical blanketing hung directly above the wall in the ceiling plenum. Alternatively, walls surrounding non-flexible areas such as auditoria may be extended to the structural slab to insure acoustical isolation.

CEILING SYSTEM/OUTLINE SPECIFICATION

SCOPE OF WORK

Furnish all plant, labor, materials, appliances, transportation, equipment and services necessary to properly perform the work or the contract as shown on the drawings hereinafter specified or reasonably inferred.

WORK INCLUDED

Installation of Aluminum Suspension System, Air Diffusers, Flexible Air Duct, Lighting Fixtures and Lamps, metal and acoustical ceilings of all spaces where indicated on drawings and/or finish schedule as "integrated ceiling." Flexible duct shall be connected by this contractor to the ceiling air diffusers (downstream end) and main or branch feeder lines (upstream end). This contractor shall furnish and install all lamps in integrated ceilings including service modules as detailed and shown on plans. Integrated lighting fixtures shall be connected by this contractor to conduit entry boxes located in plenum area as indicated on electrical drawings.

WORK NOT INCLUDED

Wiring from panel board to conduit entry boxes in plenum area necessary to connect the integrated lighting fixtures and all circuits as per electrical specification. Primary main and branch air ducting as outlined in the mechanical section. Work as outlined in other sections of this specification.

PERMITS, CODE RULES AND SAFETY ORDERS

Contractor shall secure all necessary permits and pay all costs or fees for prosecution of the work. All work and materials shall be in full accordance with the latest rules of the Uniform Building Code, the National Electrical Code. Where the above rules call for any work over and above that shown on the drawings or called for herein, the Contractor shall furnish all equipment and labor required for necessary installation to meet these requirements.

INSPECTION

All work and materials covered by these specifications shall be subject to inspection at any and all times by authorized representatives of the Architect, Engineer or Owner.

SUPERVISION AND WORKMANSHIP

This contractor shall personally or through an authorized competent representative satisfactory to the Architect, constantly supervise the work and shall, whenever possible, keep the same foreman on the work from commencement to completion. All workmanship shall be first class and the best type in every case. Nothing herein is to be construed as calling for other than first class workmanship and any not so fulfilling this requirement shall be revoced and replaced with proper material and workmanship.

RESPONSIBILITY AND COOPERATION

Contractor shall consult architectural, structural, engineering and mechanical plans and check them with his work, as he will be held responsible for conditions shown on one or called for by one and not indicated or called for on the other that may affect his contract. Contractor shall consult with the superintendent of other trades and general contractor's superintendent to insure complete coordination of all the work.

CUTTING AND REPAIRING

The Contractor shall do all cutting necessary for the proper installation of this work and shall repair any damage done by himself or his workman and shall coordinate his work with that of other subcontractors. The contractor shall patch and repair all surfaces where existing equipment is removed. The patch surfaces shall match the existing surrounding surfaces in material and finish, and all repairs shall be done to the satisfaction of the Architect.

QUALIFICATIONS

Due to the complexity and scope of this phase of the project, the successful contractor shall present evidence that he is capable of installing the various components within his own organization, and without resorting to additional subcontractors. In addition, he shall present written evidence that he is experienced in the satisfactory installation of the products specified, including a written approval from the maunfacturer of the products he proposes to use, that he is the acceptable and authorized applicator of these products.

MATERIAL

A. Aluminum Suspension System shall be compatibly designed to function as a structural supporting system for the related ceiling system components and also serve as an indirect means of partition connectors without preordained partition locations. The 6'-2" modular layout shall be rigidly adhered to with the exception of air distribution diffuser locations which shall remain flexible to accommodate room interior air distribution requirements as set forth further on. The main ceiling grid members shall interlock with the cross runners by means of a removable clipping device which will allow relocation of cross runners along the plain of the main runner for future interior building occupancy requirements. The primary ceiling grid members shall have not less than a 3/8" deep 1/4" - 20 thread extruded linear slot which will form a continuous opening to accept National coarse threaded 1/4" - 20 screws. The slot which terminates into any primary tee grid member shall be through to the opposing slot opening. Where slots are located at primary grid cross intersections, the slots shall 'run' through the intersection in both directions. All exposed joints of the ceiling grid members shall be drawn tight and not exceed the allowed tolerances as set forth in the American Society for Testing and Material ASTM designation: C 635-69. The fully constructed ceiling system shall be designed so as not to deflect in each plane the maximum dimensions as set forth in ASTM: C 635-69. All primary sub and strutting suspension members of the ceiling grid system shall be of extruded aluminum alloy 6063-T5. The exposed surfaces shall be chemically treated and painted in accordance with procedures as outlined in ASTM-B117-61. Finish shall match within allowable tolerances the same color as the service panel. Location of ceiling grid members shall be as shown on architectural reflected ceiling plans.

B. Recessed fluorescent light fixtures noted as Type_____ to be specifically designed to fully integrate with the ceiling suspension members without reconstruction of the basic elements of either component structure. Fixture bodies shall be of steel, processed with a five stage bonderite pre=coating in conformance with Military Specification C-490-A. The finish coats shall have a hi-bake epoxy primer applied under the organic hi-bake acrylic top coat. The minimum reflectance shall be 87% within the reflectance with Underwriter's Laboratories, Inc. 57-1969 and bear evidence of listing by Underwriter's Laboratories, Inc. Fixtures shall be either 2 or 3 lamp as indicated on Electrical drawings, 430MA Rapid Start, operating on 277 volt current. Ballast shall be HPF, CBM certified, E.T.L. Approved and P-rated. All outside fixture conduit, connectors and interconnecting

conduit and circuit wiring within the fixture raceway shall be the responsibility of the Integrated Ceiling Contractor. Lens shall be of not less quality than Virgin Acrylic non-blended materials and shall be constructed with a frameless appearance and positive hinging devices. Prismatic pattern shall be L-12. Lamps for the integrated fluourescent lighting fixtures shall be Rapid Start types as manufactured by General Electric, Westinghouse or Sylvania. Successful bidder shall be required to furnish the following data or samples within three days after receipt of request from Electrical Engineer. One sample of lighting fixture, test from recognized independent laboratory indicating ballast case temperature after initial warm up period. Candle-power distribution and coefficients of utilization.

C. Acoustical flat metal pans which lay in suspended ceiling system shall be constructed of .025 metal pin perforated face panels and non-perforated back panels laminated to a cellular core, with a sound absorbing element of non-dusting glass fiber wool. Panels shall have a noise reduction coefficient of no less than 0.65 - 0.75 and average sound attenuation value of (39.3 DB) (45.4 DB). Panel thickness shall average a nominal one inch when measured over its entire plain. Metal preparation and painted surfaces shall be in accordance with ASTM-B117-61. Finish shall be commercial white as considered a 'Standard' by manufacturers.

D. Service modules shall be of such design and construction to allow supplementary lighting, service drops, communication outlets, fire sprinkler openings, aesthetic departure metered and ducted return air venting. Such Return Air panels shall include flexible duct connected by this contractor as described in this Specification Section. Such panels shall remain open in design concept to provide additional services as required for completion of project. Materials and finish shall match that of adjoining ceiling materials and inserts provided so that the common color scheme may be included in special areas as indicated on plans.

E. Flexible duct shall be Lok-Products Co. QC-41 or equal. The upstream end assembly shall include a volume damper internally mounted to the spin in fitting and the down stream connector shall be of the quick connect type to mate with the inlet collars provided with the Air Distribution devices. The flex duct assembly shall meet the Class I Fire Hazard requirements of the National Fire protection Association Bulletin #90A with Flame spread rating of 25 or less and a smoke development rate of 50 or under.

F. The air diffuser incorporated in the integrated ceiling system shall be of the same manufacturer as the ceiling suspension system, or if the product of another manufacturer, it shall be the responsibility of the prime manufacturer to insure adequate fit, color, match, etc. It shall utilize the ceiling suspension member as a part of the air diffuser and shall be mechanically locked to said system. The diffuser shall incorporate horizontal adjustable air control weir for control of the throw

and angle of discharge of the air from the linear slot. It shall include a flexible duct and manual volume control damper for field adjustment to design air quantities. The performance of the air diffuser will be such that it can provide proper air motion rate within the occupied space when operating within the CFM range indicated on the plans. The flexible duct and inlet collar shall be of such size as not to exceed 900 FPM velocity when operating at the maximum CFM specified.

The diffuser assembly shall be easily relocatable in the field, and shall be supported at both ends by the grid system. The system shall have been completely compatibility tested. The air distribution system including lighting ceiling panels, service module, etc. shall be tested as a system and shown to fulfill the design criteria set forth by the plans and specifications.

All tests and performance data of the Air Distributing Devices shall be made in accordance with procedures set forth in the equipment test code #1062R2 of the Air Diffusion Council and ASHRAE.

INSTALLATION

Hanger wires for the suspended ceiling system shall be attached to the building structure in an approved manner. Wires shall be threaded through the ceiling grid members and wrapped a minimum of 4 full turns to insure gaining full strength of the suspension system. Hanger wire spacing shall average no more than 4' maximum along any major load carrying member. The entire ceiling system installation shall be closely coordinated with all other trades involved. Air diffuser installation and flexible duct connections shall be the responsibility of the Integrated Contractor and shall be installed with the proper trades. The integrated lighting fixture installation is the responsibility of the Integrated Contractor and shall be installed with the proper trades.

AIR BALANCE RESPONSIBILITY

This Contractor shall cooperate with the selected test and balancing agency in the following manner:

He shall coordinate his schedule with the Air Conditioning Contractor to have his system in operating condition in sufficient time before final completion date so that the testing and balancing can be accomplished.

He shall provide the labor and tools to make corrections when required, without undue delay at no additional cost to the Owner, and he shall install balancing dampers if they are a part of his system as required by the Test and Balance Contractor at no additional cost to the Owner.

He shall advise the Test & Balance Contractor of any major changes made in his system during construction.

He shall be responsible for removing and replacing ceiling panels necessary to the testing and balancing of the air distribution system.

GUARANTEE

Upon completion of work the Contractor shall furnish the Owner a written guarantee covering the satisfactory repair and/or replacement free of charge of all workmanship and material that proves defective within a period of one (1) year from date of completion.

CLEANING AND TOUCHING-UP

After installation of entire suspended ceiling system has been completed, the Contractor shall clean the entire surfaces thereof, removing any discolorations or foreign matter, and shall touch up all abraded spots and edges (if any) with the same paint as was used in the factory - applied finish of the tile.

PARTITIONING SYSTEM

The partitioning system achieves the degree of economy and flexibility at the planning level provided by the basic mechanical and structural systems.

The total project was studied to find the basic sets of functions to be served by partitioning systems. The basic approach to the partitioning system as seen in conjunction with the ceiling system, is that it should be floor to ceiling light-weight space division. The partitions should be removable without damaging the floor or ceiling and without interrupting the activities in adjoining spaces. In this approach, doors and glass are treated as panels in the partitioning system and attached at the ceiling and floor in the same manner. The partitioning system must be locatable according to the module developed by the ceiling system - and the mechanical services provided by it, but it also must be able to adjust to non-modular conditions when functional requirements necessitate it. Prefabricated cold rooms, freezers and the like will be used and the partitioning system must accept them. There will also be several spaces which require x-ray or RF shielding and partitioning systems must be able to provide this.

Several alternatives for each required basic type were proposed and studied. The cost of each proposal was compared to the requirements for adequate sound isolation, flexibility, durability and the particular requirements of each type. Resulting from this study a selection was made.

1. Drywall on channel studs is proposed as the basic system for the research and office functions located on floors 1 through 3. These functions may require future rearrangement of plan and will be used by a limited number of staff and graduate personnel.

2. Fireproof gypsum paneling is proposed to achieve the required fire rating around the floor to floor penetrations at stairs, mechanical cores and elevator shafts.

3. Masonry is proposed for two applications:

   a. Masonry will be used for the basement mechanical, dietary and materials management storage areas.

   b. Both finished and unfinished masonry is proposed in the animal quarters.

   In areas of high humidity and/or where a high degree of cleanliness is required a glazed coating is proposed such as the animal OR's and holding rooms. This application may be used on plaster, dry wall and masonry.

INTERIOR FINISHES

Public spaces, waiting areas

ceiling: acoustically absorbent materials in panels

walls: appropriate for the special considerations to be considered in such areas.

base: architecturally compatible with flooring material.

floor: terrazzo or special treatment such as pavers and/or carpeting as determined by aesthetic considerations.

Administrative offices, lounges, conference, seminar library

ceiling: acoustically absorbent

walls: wood paneling and/or fabric wall coverings in special areas, plaster painted, drywall painted and fixed, the drywall painted.

base: resilient at fixed partitions.

floor: 1/8" vinyl or vinyl asbestos-carpeting in limited areas.

Research laboratories

ceiling: acoustically absorbent

walls: plaster partitions glazed coating

base: resilient

floor: steel trowelled concrete with hardener

Research corridors and lab offices

ceiling: acoustically absorbent

walls: partitions painted drywall

base: resilient

floors: 1/8" resilient floor tile

Animal quarters and animal ORS:

ceiling: suspended portland cement plaster with flush recessed lights

walls: masonry block or plaster with chemically resistant monolithic waterproof finish similar to "Glazetite Type II."

base: monolithic, seamless, chemically resistant

floor: same as base such as "Dex-o-Tex."

"Hot" areas, radio decay, etc.

ceiling: plaster

walls: plaster on lead lined rock lath, corners coved

base: seamless, resilient

floor: seamless, resilient

Stairs

soffits: steel painted

walls: plaster or drywall painted

treads: concrete fill, abrasive nosing

risers: (metal painted)

handrail: metal painted, vinyl hand rail

Mechanical rooms, service areas, storage areas

ceiling: exposed structure unpainted

walls: exposed masonry unpainted

base: SGT (structural glazed tile)

floor: steel trowelled concrete with hardener

Trash room, cart wash, and isolation storage rooms

ceiling: exposed structure unpainted

walls: glazed coating

base: coved

floor: steel trowelled concrete with hardener

Toilets

ceiling: suspended metal or fiber acoustic

walls: glazed wall coating

base: coved ceramic

floors: ceramic tile thinset chalk composition-monile dexotex

Janitor closets

ceiling: acoustic

walls: plaster or drywall glazed, painted

base:

floors: VAT or hard conc.

UNIVERSITY OF MINNESOTA
HEALTH SCIENCES EXPANSION

MATERIALS HANDLING I

Unit K/E is planned as a central receiving, staging and dispatching point for the health-sciences complex with the following exceptions:

1. Clean and soiled linen will continue to be processed through existing hospital docks until such time as a new hospital facility is built, at which time Unit K/E receiving dock would be expanded to the east to accommodate this receiving function.

2. Animals, animal food, bedding and waste will be received and processed through the Mayo garage.

3. Daily use perishable foods for inpatient food program would continue to be received at University Hospitals dock until such time as a new patient care facility is built.

   The dietary freezer, cooler and dry goods storage area in Unit K/E will serve as back up for inpatient food program and for existing and proposed vending and cafeteria areas in the health sciences complex.

4. Cadavers for medical school use will continue to be received at Jackson Receiving dock.

5. Removal of cadavers from hospital autopsy area could be through an exit adjacent to the compactor dock or over the main dock.

6. First, second, third and fourth class mail will be received at Unit K/E where it will be sorted and distributed. Outgoing first class mail will be picked up at Unit K/E. Second, third and fourth class mail will not be picked up at Unit K/E due to postal regulations which require that the mail facility be fully accessible to the public in order to have all mail picked up.

7. Items of equipment too large to be moved conveniently through existing or proposed service corridors would be delivered directly to the point of use.

MATERIALS HANDLING

Incoming materials at Unit K/E will be received by materials management personnel, unpacked, checked, then placed in a staging zone according to geographic location. Materials will be picked from staging zones for delivery to the several zones. Delivery vehicles will consist of

manually pushed units until such time as the link (Unit B/C to Unit A) is completed. At which time consideration should be given to developing a more efficient system of moving materials. Charles T. Main has recommended consideration of a battery powered rubber-tired tractor unit to pull 4 or 5 carts at one time -- details of the specific cart type etc. were not determined at the time of the C. T. Main report and will have to be further investigated prior to completion of the B/C/A link.

Slope for ramps will be held to a maximum of 6% in those areas where battery or self-guided system might be employed. It does not appear feasible to consider battery or self-guided systems within existing buildings without very major modifications.

The accompanying diagrams illustrate proposed material delivery pathways for the following time frame.

A. After 'A' is completed but before B/C is completed
B. After B/C is completed
C. After Unit J is completed

It is clear from the diagrams that Unit A, in order to be served from Unit K/E before B/C is completed, will require servicing through the Mayo Garage.

TRASH HANDLING

Unit K/E is provided with an enclosed compactor dock to accommodate two compactors, a trash room, an isolation room for contaminated red bag waste, a cart and barrel washing area and storage areas for trash carts.

The Unit K/E trash handling facility will receive general and contaminated isolation waste from all health sciences units except the student health service which is serviced separately.

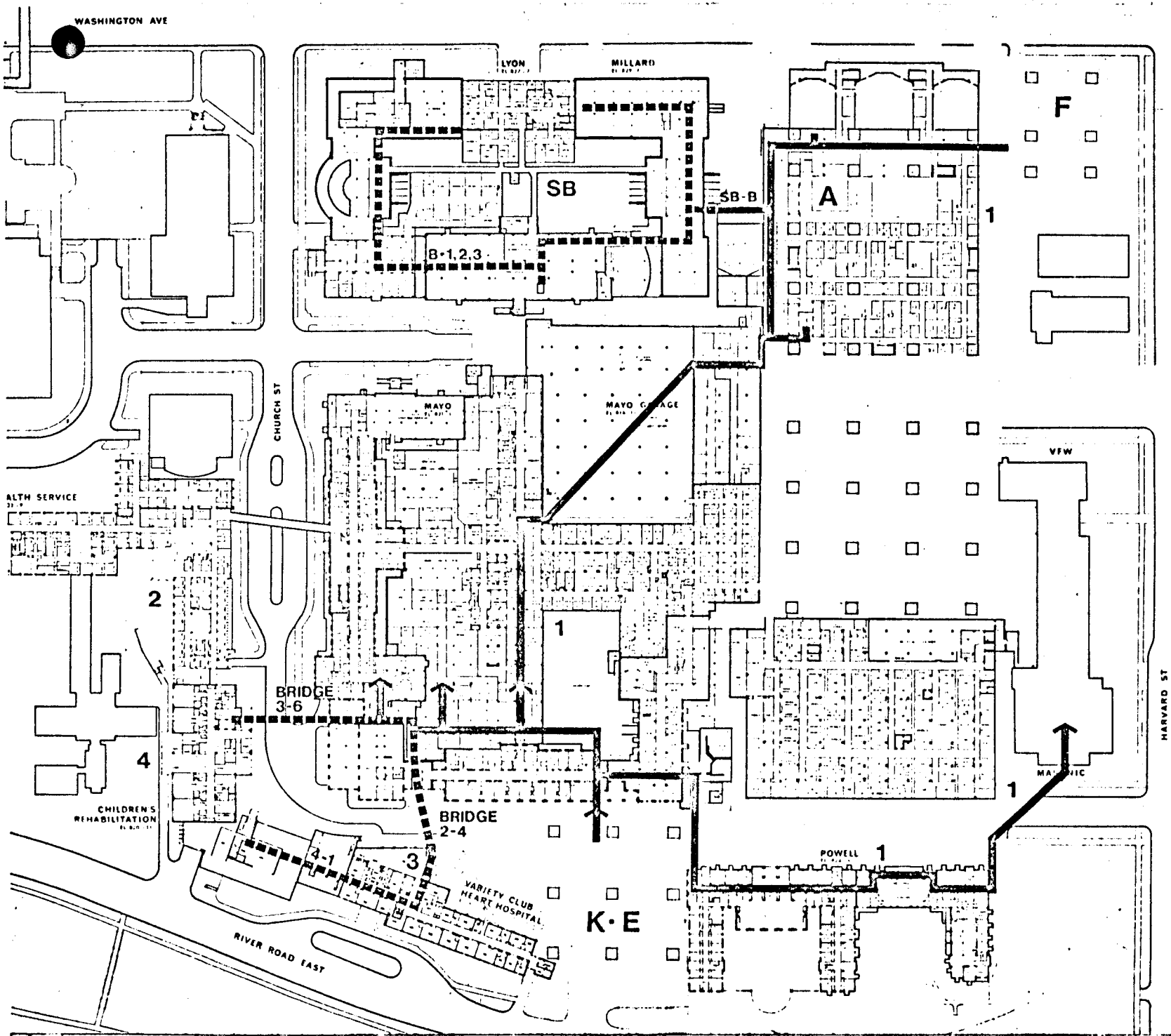
Animal waste will be handled through the Mayo Garage, at Diehl Hall and at VFW service areas.

Radioactive and chemical waste will continue to be handled by a special environmental health and safety handling group.

Although it may be desirable to consider as the long range objective a single point for collection and initial processing of general and contaminated waste (other than animal) this will not be realizable totally until such time as the B/C link connects to Unit A.

JIM SIMON

432-



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REVISED PHASE 1 SCHEMATICS

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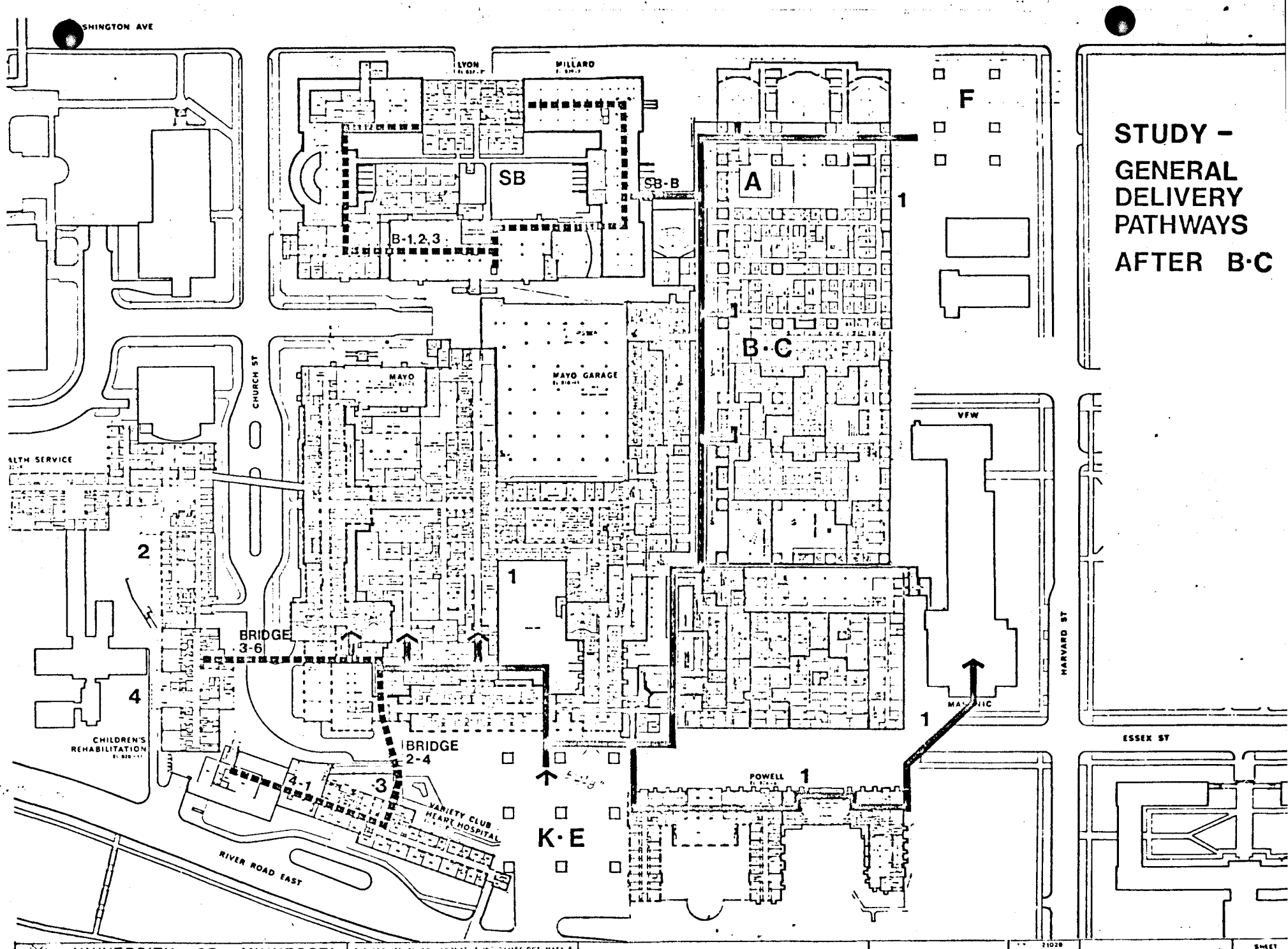

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REVISED PHASE 1 SCHEMATICS

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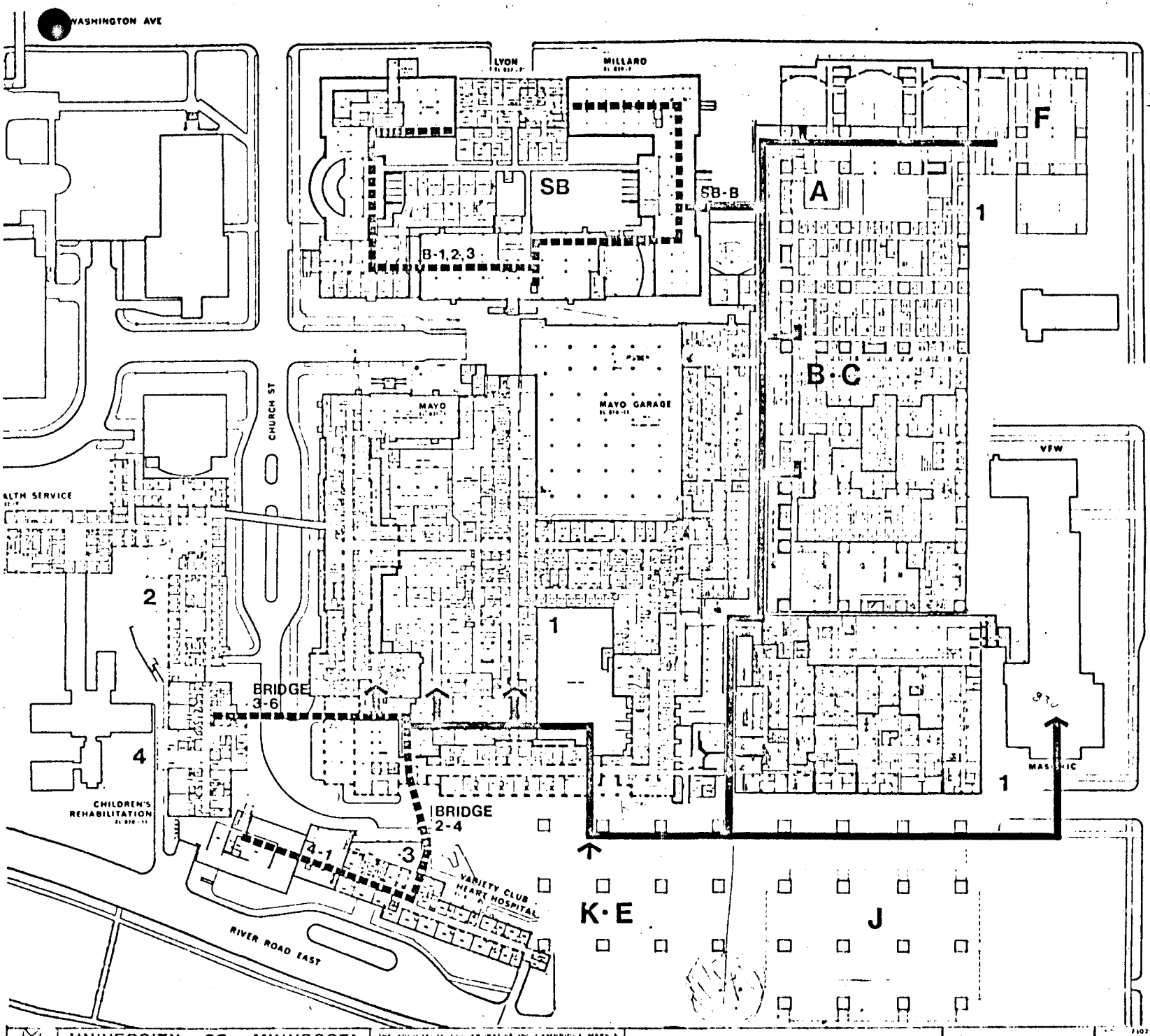

STUDY –
GENERAL
DELIVERY
PATHWAYS
WITH J

UNIVERSITY OF MINNESOTA
HEALTH SCIENCES EXPANSION

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THE HEALTH SCIENCES ARCHITECTS & ENGINEERS INC

REVISED PHASE 1 SCHEMATICS

The trash facility in Unit K/E, in terms of volume capability, should adequately serve the general needs for Phase I but the K/E facility should be supplemented when new clinical facilities are developed to the east of Unit K/E. At such time it would be appropriate to consider the possibility of developing a pneumatic trash tube running north-south under the NS Service Tunnel connecting Units A, B/C, F, Diehl and Millard and terminating in a major trash collecting center adjacent to expanded truck dock facilities in Unit K/E.

It is conceivable that the Unit K/E trash facility could be phased out at that time. It is possible within the framework of Unit K/E to provide a spur connection from the base of the proposed trash chute in K/E to a major north south pneumatic tube terminating at Unit J.

This approach would allow access to a great range of trash collecting devices whereas the severe overhead clearance limitations existing along the access route to the K/E trash compactor docks limit this selection substantially.

Trash movement to Unit K/E would be accomplished initially (i.e. before B/C) utilizing a manual cart system -- carts serving V.C.H.H., Children's Rehab., Unit A and the Mayo complex would enter on Level 1 through Mayo floors into a service corridor in Unit K/E and then directly into the trash receiving dock. Carts serving Diehl, Powell, Masonic and VFW would also use a manual trash cart system and would approach Unit K/E via Powell Hall Corridor and Powell Hall tunnel. Upon arrival at Unit K/E the trash carts would negotiate a 6.6% ramp to the trash dock or if the carts are covered there is a freight elevator available.

When the B/C service tunnel is completed a tow cart or guided cart system should be investigated which can accommodate to the movement needs of both unsoiled and soiled materials.

TRASH CHUTE

A 20 inch diameter trash chute operated as a gravity system is being provided in Unit K/E extending from Floor 3 to Floor 1 with a collection cart on Floor 1. The chute will be housed in a 2 hour fire enclosure next to the animal-freight elevator vestibule with stations on each floor, accessible from the receiving room for the elevator. The collection room on Floor 1 will open directly into the Trash Room. Initially the trash chute will be operated as a gravity system but it will be designed with the capability of future conversion to a pneumatic system extending to a remote collection point, probably in Unit J.

EQUIPMENT J

CASEWORK

The flexibility afforded by the structural/mechanical system, interior partitions and ceilings will be matched by the system of casework. Elements will be dimentionally coordinated and capable of simple re-arrangement to suit changing needs.

Historically casework for a project such as this has assumed five distinct forms--namely, hospital casework, laboratory cabinetry, special cabinetry such as that used in darkrooms and dental labs, dental operatory casework and station concept units as in medication and nourishment units. This has been so, primarily due to the sources of manufacture and a preoccupation on the manufacturers part to limit his production to one, two or three types of the specialized casework mentioned above.

This procedure has resulted in several different specifications. The architect is left with only one option, that is to select casework from several manufacturing sources and endeavor to find similarities in design that will least emphasize the shortcomings of the traditional system. Choices of finish and methods of installation have by tradition also differed which as led to jurisdictional disputes and consequent delays at the building site.

We propose to develop a single specification for all of the casework. The attempt would be to consolidate all of the inconsistencies of the traditional system and to develop a truly interchangeable cabinetry. This would appear to be particularly desirable in view of the fact that the whole tendency in good health science planning, is to stress the interrelationship of patient care, teaching and research. If the cabinetry to accommodate these disciplines can be coordinated, the esthetic and utilitarian possibilities are manifold. A consistency of design detail, fittings and finish would be assured. The maintenance management would be made consistent and simpler. And last, the initial cost should be less, due to the magnitude of the order.

The recommendation is to produce a non-proprietory performance specification which will lay emphasis on the consistency of design and detail to be maintained and that will delineate the differences of working surfaces and base conditions that can be accommodated. This specification will be accompanied by a catalogue of modular coordinated casework components. Elevations and basic dimensions of units that will be used consistently throughout the facility.

ELECTRON MICROSCOPE

Electron microscope facilities are presently programmed in laboratory areas on Floor 2 of Unit KE. With this in mind, we have visited facilities at Harvard Medical School and The University of Chicago, as well as The University of Minnesota, and have consulted with their staffs in order to identify the factors involved in providing an effective environment for electron microscopy. A number of these factors are summarized below:

1. Resolution

   The useful limit of magnification is dependent upon the ability to obtain extremely fine resolution of the image being viewed or photographed. The required level of resolution will vary according to the kind of study being made. In a good working environment, it should be possible to obtain resolution in the order of 10 Angstrom units or better (one A equals 1/100,000,000 cm). In a highly specialized clean room environment, researchers at The University of Chicago have obtained resolutions of less than 2A.

2. Room Dimensions

   Room size is dependent upon the type of scope employed. Minimum dimensions are often determined by the service access requirements of the scope. For most electron microscopes at 10' x 12' room would be adequate, but manufacturer's recommendations should be considered in any case. A ceiling height of 9' or more may be required depending on the scope. Adequate door size should also be considered.

3. Room Equipment

   a. Electron microscope
   b. Work counter and cabinet storage adjacent to the operator

4. Room Environment

   Electron microscope and electron microscope prep rooms should be dust free and under positive pressure. Constant temperature and low humidity (50%) are highly desirable. High humidity will affect the pump down time for the scope. For this reason a sink in the electron microscope room itself is not desirable. Floor, wall, and ceiling surfaces should be smooth to limit dust accumulation. Open storage of books, files and other sources of dust accumulations should also be avoided in the electron microscope and preparation areas. Chalkboards are likewise undesirable.

5. Electromagnetic Fields

Electron microscopes should be located in areas remote from potential sources of electromagnetic disturbance. A minimum distance of 20 feet in all directions from such sources should be maintained. Typical sources of electromagnetic fields are as follows:

a. Elevator machinery
b. Power transformers and primary switchgear
c. Primary AC power busses
d. Large mechanical fans and air conditioning units
e. Large pumps
f. Electronic equipment

The power unit for the electron microscope itself is also a possible source of interference and should be located at least 10 feet from the scope, preferably in an adjoining room. The connection from the power unit to the scope should not be run near other power lines.

Fluorescent lights are another source of interference but may be used in the electron microscope room since they can be switched off when the scope is in use. Supplementary low level incandescent light should also be provided.

R.F. shielding of the electron microscope room should not be required in most cases. The scope itself is internally shielded to protect the operator and this should give adequate protection from interference from small motors and other typical laboratory equipment.

6. Vibration

Isolation of the scope from sources of vibration is essential for high resolution microscopy. Since vibration, particularly in the low frequencies, can be transmitted a considerable distance through the structure it is best to isolate it at its source wherever possible. Potential vibration sources within the building include:

a. Elevators
b. Major mechanical equipment, fan units, pumps
c. Centrifuges and other laboratory equipment
d. Sound systems, particularly when operated at low frequency and high volume.

Outside sources of vibration would include vehicular traffic and wind loads.

While a concerted attempt should be made to isolate vibration at its source, it will also be necessary to mount the scope itself on damping pads to isolate it from the structure of the building. Grounding wires and other connections should be flexible to avoid transmitting vibration. Special vibration problems may require additional provisions for satisfactory isolation such as a floating floor within the electron microscope room.

7. Summary

The proposed location of electron microscope facilities on Floor 2 seems feasible according to information obtained thusfar, although some possible sources of interference have been identified which will require additional study. These facilities have been placed well away from the elevator shafts and their location on upper floors should minimize interference from street traffic. Placing the column footings on bedrock will also reduce transmission of vibration from outside the building. On the other hand, wind loads will have to be considered and sufficient bracing provided to limit lateral movement of the structure. Also, the cooling tower fans on the upper roof level are a potential source of vibration and will have to be considered in vibration studies.

Our investigation thus far indicates that it would be extremely difficult if not impossible to analyze all the factors involved to be able to predict the precise operating conditions which can be expected in the electron microscope facilities. Rather than planning in advance elaborate and expensive means of dealing with a situation involving a number of indeterminate factors, we will continue to consult with our engineers, equipment manufacturers, and other knowledgeable sources in order to identify and resolve potential problems.

SPECIALTIES K

HVAC L

UNIVERSITY OF MINNESOTA
HEALTH SCIENCES EXPANSION

UNIT KE

1. AIR CONDITIONING, HEATING, VENTILATION AND TEMPERATURE CONTROL SYSTEMS

A. General Description

1. Installation of an all-air system with terminal room reheat will be provided. The systems shall consist of central type built-up air handling units with air conveyed through low velocity duct work and distributed to each room through ceiling located air diffusing devices. A forced hot water system will provide the heat source for the reheat coils.
2. Heating media, in the form of high pressure steam, will be supplied to the building from external central source. Steam flow meters will be used to record steam consumption.
3. Entrance vestibules, corridors, stairways and other miscellaneous rooms will be heated with cabinet unit heaters and/or fin tube radiation as required.
4. Mechanical and electrical equipment will be grouped and located in equipment rooms which have adequate maintenance. Major equipment rooms will be provided in this unit at the Basement and Roof Penthouse.
5. The central air handling unit of the systems will deliver air at the fan outlet at a constant temperature the year around. The outlet temperature may be varied between summer and winter seasons, however, once set it remains constant. Components making up each of the central air handling systems will vary to provide fan outlet conditions to result in space design conditions being maintained.

   Further variation in components is required to result in air filtration consistent with the requirements of the space supplied.

6. The animal section system will be designed to provide room change rates as indicated under "Air Circulation Rates". The difference between the exhaust rate will be supplied in the corridor and relieved from the corridor to the room. This scheme maintains corridor conditions as free as possible from odor. Each floor will be balanced in supply and exhaust volumes with animal sections negative as compared to adjacent areas.

7. Balance of supply to return plus exhaust air volume in laboratory and office areas will be maintained on each floor. Laboratories will be supplied directly and when odors are not a problem this air will be returned. Where hoods exist in laboratories and the hood exhaust volume exceeds the direct air supply, a means of make-up of this air will be provided.

8. All laboratories with fume hoods will be 100% exhausted.

B. Exhaust Systems

1. Toilet areas and janitors' closets will be exhausted by a common fan and duct system.

2. Hood exhaust will be by individual fan or by grouping several hoods to a fan, depending on hood locations. Galbestos or Type 316 stainless steel will be used for duct material from hoods. Type 316 stainless steel duct material will be used for perchloric acid hoods. Exhaust fans will be located in the Roof Penthouse equipment room to create negative pressure in the exhaust duct work.

C. Miscellaneous Ventilation

1. Certain areas such as tunnel to animal quarters in adjacent buildings, elevator penthouses, equipment rooms, electrical equipment spaces, flammable

storage vaults, sterilizer rooms and similar spaces will require either mechanical or natural ventilation provisions for satisfactory and safe operations. Each such location will be provided with a system to satisfy its characteristic function.

D. Exhaust Hoods

1. General fume hoods, with "air foil" inlet designs, will be exhausted at a rate to produce 100 FPM over the face area of the hood. Perchloric acid hoods, with "air foil" inlet design, will be exhausted at a rate to also produce 100 FPM over the face area of the hood. Perchloric acid hood and duct work will have a wash down spray.
2. Radio-Isotope hoods of the "air foil" type will be exhausted at a rate to produce a face velocity of 150 FPM. Radio-Isotope hood ducts will be routed around counting rooms or other areas where interference could be a problem. Radio-Isotope hoods will require absolute filters at the hoods.
3. Hoods for use with infectious materials will have an absolute filter at the hood fan discharge.
4. It is recommended that hoods operate continuously so as not to disrupt or complicate the air balance within the building and provide the maximum safety for the hood operators.

E. Animal Quarters Exhaust

1. The inlet of exhaust fans serving animal rooms will be equipped with a built-up type unit housing. These housings will contain automatic roll type impingement air filters to remove particular matter. Space for the future addition of odor removal equipment will be provided.

F. Duct Design

1. Duct work will be designed on the basis of equal friction using an average resistance value of 0.08 inches of water per 100 feet of equivalent length.
2. Maximum air velocities in the main ducts will not exceed 2500 FPM and branch mains will not exceed 2000 FPM.
3. When sizing main ducts, especially mains having long runs, the sizing resistance will be reduced along the run from the supply unit to the last outlet on the run.
4. Outdoor air and exhaust air louvers will be sized on the basis of 500 FPM velocity across the gross area. Inlet or discharges without louvers may be sized on higher velocities. Velocities over gross area of motorized dampers will not exceed 1500 FPM.
5. Duct material, bracing, and hangers will be in accordance with the recommendations of the ASHRAE Guide.
6. Animal area exhaust ducts will be galvanized iron with ducts hung with trapeze type hangers. Access doors will be provided at short intervals to provide for inspection and vacuum cleaning of hair and other particles.

G. System Components

1. Hot water reheat and radiation systems will include convertors, pumps, piping, air separators, individual room reheat coils and fin tube radiation.
2. Steam and condensate return system will include pressure reducing valves, strainers, traps and piping to central station unit heating coils, chillers, convertors, water heaters, humidifiers, sterilizers, stills and lab outlets.
3. Chilled water system will include chiller, cooling towers, chilled water pumps, condensor water pumps, secondary pumps, piping and central station unit cooling coils.

1. Pneumatic temperature control system will include compressor, dryer, piping, thermostats, valves, gauges and connections as required for individual and central control.
5. Supply air systems will include built-up supply units, fans, duct work and air outlets.
6. Exhaust air systems will include air inlets, duct work, fans and built-up filter units where required.
7. Return air systems will include air inlets, duct work, fans and mixing chambers.
8. Acoustical and thermal insultation will be provided on ducts and piping as required.
9. Radiant panel heating system will include pumps, convertors, piping and accessories for required areas in Animal Labs.

H. System Installation

1. Reheat System
   a. A forced water heating system to supply the individual room reheat coils will be provided. Quality of temperature control, simplicity of operation, and adaptability to future remodeling are features offered by this system.
   b. The systems will be reverse-return two-pipe, to provide equal pressure differential across all control valves. The water will be heated in the shell and tube convertors with building steam providing heat. Standby pump and convertor capacity will be provided.
2. Radiation System
   A hot water radiation system separate from the air reheat system will be provided for certain exterior rooms andbuilding entrances. This system will supply hot water to fin tube radiation and unit heaters in such

rooms or spaces. Standby pump and convertor capacity will be provided. Fin tube elements will be by the Mechanical Contractor and the enclosures will be by the General Contractor.

3. Supply Air Units

   a. These units will be located in the basement equipment room and fed through duct work to the various spaces. The units will be walk-in types, built on the job, with adequate space provided between sub-items of equipment for servicing and maintenance. Walk-in access doors located to permit access to each item of equipment will be provided with lights located in the unit interiors. All lights for a praticular unit will be controlled from a single switch with a pilot light.

   b. Components will consist of outside air louvers, mixing chambers, pre-heat coils, dampers, filters, cooling coils, drain pans, humidifier, vibration isolators, and supply fan.

   c. Units will be as large as is consistent with operational flexibility and space limitations.

4. Air Handling System Division

   a. Animal sections primarily for reasons of odor control will be supplied by separate systems using 100% outside air and 100% exhaust. This system is to be independent of all other building air systems.

   b. Laboratory areas will be supplied by units with components capable of handling 100% outdoor air. The initial layout will incorporate a return air system if the function of the room is acceptable and sufficient area exists within laboratory area to justify installation. Areas such as laboratories with fume hoods will not be returned. Corridors will not be used for air return.

c. Office areas will be supplied by air handling systems incorporating return air relief fans. Toilets, Janitors' Closets and similar areas directly associated with these areas will be exhausted. The amount of air returned will result in a balance of systems. Corridors will not be used as air returns.

d. All systems outlined in (b) and (c) above which have return air relief fans will be designed to automatically increase the percentage of outdoor air as outdoor temperature conditions allow. This scheme will result in minimum steam and refrigeration demand throughout the year.

5. Air Balance

a. The air systems for the building will be designed to result in outside air being supplied through the various air handling units to balance the exhaust from the building.

b. Each room will have planned openings for air to enter and leave at a balanced rate. Where the air removed from the space exceeds the direct supply rate, such as in animal rooms and laboratories with hoods, a means of introducing the additional air into these spaces will be provided.

6. Temperature Control

a. A pneumatic automatic control system will be used for the control of all air temperature and humidity conditions.

b. Room humidity will be controlled on a zone basis. A zone will consist of all rooms supplied by a single air handling unit.

c. Room temperature will be controlled on an individual basis. A room thermostat will control a valve regulating the water flow to the reheat coil serving the room.

7. Centralized Control

. To accommodate planned future central control and surveillance of the

mechanical systems of this building, all features and devices necessary for remote central control shall be provided.

8. Vibration Isolation

Special foundation and support designs will be provided for all fans, pumps, compressors, etc., to reduce vibration to a minimum.

9. Miscellaneous Work and Equipment

a. Insultaion work and acoustic treatment will be provided, as required for all systems.

b. Sheet metal work as required for ducts, plenums, special hoods, vents, etc. will be provided.

II. MATERIALS AND EQUIPMENT

1. Air Filters

Control of air cleanliness in most areas of this building is critical and two stage filters will be provided, resulting in a 90% dust spot efficiency. In areas requiring higher efficiency, "polishing" filters at the air outlets will be installed.

2. Preheat Coils

a. Steam distributing type coils with 1" diameter tube coils will be used for all preheat coil applications. These coils permit the use of modulating steam control and have good freeze protection design. Steam distributing coils will be selected for correct temperature rise and freeze protection through the entire heating range required for the heating season. Coils will be copper tubes and non-ferrous fins.

b. Face velocities will be within the range of 500 to 700 feet per minute.

c. The coils shall be installed so that the condensate outlet is a minimum

of 12 inches above the trap inlet to extablish a good head of water between the coil outlet and trap inlet.

3. Cooling Coils

   a. Cooling coils will be sized to have a face area resulting in a velocity of not more than 500 feet per minute. Coils will be copper tubes with copper fins.

   b. Coils shall be satisfactorily stacked and be provided with 16 gauge galvanized iron soldered water-tight condensate drip pans. Individual drain pans for each tier of coils is desirable with upper pans piped to lowest pan for drainage out of the unit.

   c. Tube circuiting of the coils will be carefully selected to satisfy the heat transfer characteristics and equalize pressure drops. Coils will be arranged for counterflow of air and water.

   d. Balancing cocks will be provided for the cooling coil banks in each supply air unit. A Venturi or orifice system with pressure taps will be provided on each unit to measure flow through the cooling coil.

4. Humidifiers

   a. Humidifiers will be of a steam multiple manifold type when used in central air units.

   b. Humidifiers at terminal locations where required shall be duct installed steam manifold type.

5. Reheat Coils

   a. Reheat coils will be the hot water type installed in the branch duct serving each room or space. The surface of the coild will be adequate to heat the room to the thermostat setting when heat gains are not present for interior rooms. For exterior rooms, reheat coils will have additional capacity to offset transmission losses.

b. Coils will be sized for approximately identical air pressure drops, and tube circuiting selected for adequate heat transfer and specific water pressure drops, so all coils have approximately the same water side pressure drop.

6. Supply Fans

Supply fans will have air foil blades, single or double inlet as required for specific application. Outlet velocities and tip speeds will be in accordance with recommendations of the ASHRAE Guide in relation to operating static pressures. Fan intakes will be approximately centered on the cooling coil face to result in a uniform velocity over the coil. All fans on systems having humidifiers or cooling coils shall have interiors painted with rust inhibitive coatings.

7. Return Exhaust Fan

Return exhasut fans will be similar in characteristics to the supply fans.

8. Exhaust Fans

a. Exhaust fans for general service will be the same as described for supply fans.

b. Exhaust fan for hoods shall be protected with a factory applied baked-on protective coating.

9. Duct Installation will be provided as follows:

a. Supply Ducts in Equipment Rooms

(In area of the Equipment Rooms and beyond, if required, ducts shall be treated with interior sound insulation).

b. Supply Ducts concealed in shafts or ceiling spaces surrounded by air conditioning areas.

These ducts will be insulated to reduce the temperature rise between the first and last take-off. Vapor barrier will not be installed on these

ducts because they are surrounded by air conditioning areas.

c. Exposed supply ducts through air conditioned areas.

Where ducts are exposed to view they shall be insulated in a manner that results in a satisfactory appearance. These supply ducts can be insulated either on the interior as described above or on the exterior with a canvas jacket.

d. Return Ducts

Return ducts generally will not be insulated; however, it they pass through spaces having higher or lower than normal temperatures, insulation will be applied to reduce heat gains or losses.

e. Fresh air ducts and mixed air plenums.

Generally, these ducts will be insulated using a double wall sheet metal construction with board type insulation and welded between surfaces.

f. Acoustical Duct Insulation

The interior of inlet ducts to return - exhaust fans and discharge ducts from supply fans will be insulated on the interior surface for required length, for sound attenuation, with a fireproof glass fiber sound insulation protected by a coating to prevent erosion.

In general, the same treatment shall be given to relief ducts between rooms, supply, return and exhaust duct work in areas where sound transmission between rooms would be objectionable, and duct work from the equipment rooms to adjacent areas.

g. Supply Air Unit Housings

These shall be constructed from either double wall sheet metal panels with insulation board sandwiched between,or concrete block with precast roofs and insulation on interior walls.

10. Temperature Control

a. Motorized Dampers

For 100% outdoor air units, automatic motorized dampers to open and close with supply fan operation will be provided.

For units using a mixture ofoutdoor and return air, automatic modulating motorized outdoor air and return air dampers will be controlled by a mixed air duct stat set to maintain 55°F. Minimum open position of outdoor air dampers shall be maintained to provide the outside air percentages of supply air units. A high limit stat will be provided to return the outdoor air dampers to the minimum open position when outdoor air temperature reaches 75°.

Motorized dampers will be used with all exhaust fans and controlled to open and close with fan operation.

b. Steam Preheat Coils

Preheat coil control will be provided on each unit to result in a leaving air temperature in winter of not less than 55°F at minimum winter design temperature.

c. Cooling Coils

Cooling coil control will be provided to regulate the volume of chilled water supplied to the coils. The control instruments may be located in the discharge duct from the supply unit set to control at approximately 55°F depending upon design air volumes.

A freezer stat will be installed on cooling coil inlet to shut-down fan operation when temperature drops below 40°F.

d. Humidifiers

Humidifiers located in supply air units will be controlled from a space or duct located humidistat operating a modulating steam valve supply on a

manifold type humidifier. The control shall be piped to prevent operation of the humidifier when the supply fan is off and when the cooling valve is open. For general supply units the control stat shall be located in return or exhaust ducts from representative spaces.

Each duct type terminal humidifier shall be controlled by room located humidistat positioning humidifier valve to maintain stat setting. Humidifier valves shall close on fan shut-down.

e. Individual Room Temperature Control

Each room or space will be provided with a hot water reheat coil and a room thermostat operating a modulating water valve on the coil. Valves wil be selected to meet static head and differential heads imposed upon them by the design of the system piping and pumps. These valves need not be positive positioning type.

In certain instances of identical offices, i.e. same exposure, same area, etc., it may be possible to group several of these rooms on one thermostat and reheat coil. Care will be taken in having identical air volume to each room where this scheme is employed.

f. Forced Hot Water Radiation System

The water temperature in the system will be controlled automatically, and varied inversely with the outdoor air temperature to compensate for the transmission heat loss. The water flow rate in the system will be constant.

g. Forced Hot Water Reheat System

Pumps will operate 100% of the time. Water temperature will be controlled same as above except at a smaller temperature range variation.

11.. Refrigeration

a. Refrigeration for air conditioning will be accomplished with the use of steam absorption type machine. A central facility will be originated in

the basement equipment room. Space will be provided in the central plant for the addition of one more chiller. The absorption units will be approximately 1,150 tons each for an ultimate plant capacity of 2,300 tor

b. A primary-secondary type chilled water loop will be designed with circulating pumps located in the basement equipment room as shown on the drawings. Space will be provided for future condenser water pumps and future chilled water pumps.

c. Two cooling towers will be located on the roof. Space will be provided for two future towers.

12.. Coolers and Freezers

These units will operate with self-contained mechanical and electrical devices to provide optimum dependability and control.

DESIGN CRITERIA — UNIT K/E

A. OUTDOOR DESIGN DATA

1. Winter - -20°F, 15 MPH northwest prevailing wind velocity.

2. Summer - 95°F dry bulb
75°F wet bulb

B. INDOOR DESIGN DATA

1. Winter - All occupied areas 75°F ± 2°F, approximately 30% relative humidity.

2. Summer - All occupied areas 75°F ± 2°F, approximately 50% relative humidity.

CONNECTION TO EXISTING VARIETY CLUB HEART HOSPITAL UNIT K/E

A. RELOCATION OF EXISTING MECHANICAL EQUIPMENT IN STAIR TOWER EQUIPMENT ROOM

1. Relocate temporarily, animal quarters exhaust fan, Unit No. 3.

2. Relocate in mechanical room, exhaust fans No. 11, 17, 14 and 15.

3. Remove all radiation, piping and related equipment in the stair tower. Cap piping in crawl space under Heart Hospital.

4. Remove roof drains and 3" downspout, cap storm drain in crawl space under Heart Hospital.

AIR CIRCULATION RATES — UNIT K/E

The air change rates listed below govern the quantity of air supplied to or exhausted from a particular space unless calculated heat gains indicate that a greater volume is necessary or unless local codes require larger volumes.

Air change rates are given in air changes per hour unless otherwise indicated.

AIR CIRCULATION RATES IN AIR CHANGES PER HOUR

Type of Space	Supply Rate	Return Rate	Exhaust Rate	Remarks
Offices	8	8		
Reception Rooms, Waiting Rooms	10	10		
Clerical	8	8		
Conference Rooms, Seminar	10-12	10-12		
Lounges	12	8-10		
Computer Rooms, Data Processing Rooms, Programmers Key Punch Rooms	8-15	8-15		Note 2
Dark Rooms	10		10	Note 3
Color Developing Dark Rooms, Photo Micrography	10		10	Note 4
X-Ray	12		12	
Lobby Elevator	7	7		
Telephone Switchboard	8	8		
Telephone Equipment	8	8		
Sterilization and Sterilizer Rooms	12		20	Note 5

Type of Space	Supply Rate	Return Rate	Exhaust Rate	Remarks
Glassware, Reagent Prep. and Dispensing	8		8	
Electron Microscope Room	12	12		Note: Special Use
Glass Washing	12		12	
Tissue Culture Lab	10		10	
Chemistry Lab	12		12	Note 7
Tissue Staining & Preparation	12		12	
Faculty Lab	12-15		12-15	Note 7
Graduate Lab	12		12	
Instrument Rooms	10		10	
General Store Rooms, Storage Rooms, and Vaults	0-6	0-6	0-6	Note 1
Volatile Liquid Storage			12	
Toilets			12	
Janitors' Closet			12	
Receiving			6	
Locker Rooms	4		12	
Vending	8		10	
Cold Room (Prefab Room)	25 CFM		25 CFM	
Cage Washing	15		20	Note 11
Diet Preparation (Animal)	8		8	
Animal Operating	15		14	Note 12
Nutrition & Food Storage (Animal)	8		8	
Germ Free Room (Animal)	17		15	Note 9
Animal Rooms - Small Primates	20		22	

Type of Space	Supply Rate	Return Rate	Exhaust Rate	Remarks
Animal Rooms - Dogs	20		22	
Animal Rooms - Rabbits & Cats	15		17	
Animal Rooms - Mice, Hamsters Guinea Pigs	15		17	
Animal Rooms - Invertebrates, Chickens and Snakes	18		20	
Animal Receiving	12		13	
Animal Holding Rooms	18		20	

Note 1 Storage areas will be supplied only if temperature or humidity control is required. Storage areas will be returned or exhausted depending upon material stored.

Note 3 Dark room equipment generally requires special exhausts to remove chemical fumes, heat, and humidity.

Note 4 Color developing dark rooms require precise control of temperature and humidity.

Note 5 Sterilizing areas should be heavily exhausted. Exhaust ventilation rate should be 250 to 1500 CFM per sterilizer, depending upon size and type.

Note 7 Exhaust air through fume hood(s) as applicable. Volume to maintain slightly negative room pressure.

Note 9 Provide an air filter in supply duct to lab having a minimum efficiency of 90% N.B.S. dust spot. Provide booster fan as required to overcome filter resistance.

Note 10 All animal rooms will be exhausted slightly more than supplied to provide a negative pressure within the space.

Note 11 Cage washing room has high latent load from washing apparatus.

Note 12 Exhaust air directly from room in volume to maintain slightly positive pressure. Room ventilation should conform to applicable NFBU requirements.

PLUMBING M

PLUMBING SYSTEMS UNIT K/E

A. GENERAL DESCRIPTION

1. Plumbing systems will be installed in accordance with State and municipal codes plus requirements of governing agencies. The systems will be arranged and constructed to be readily expanded and/or modified to meet changing building requirements. Plumbing fixtures, laboratory services, fire protection equipment, drains and laboratory equipment connections will be provided.

2. All plumbing services necessary for toilet rooms, janitors' closets and miscellaneous fixtures will be provided, including cooling tower water treatment and future water system pressure booster equipment. Drainage and services will be provided in certain animal areas for wash-down operations and cage washing.

3. The following risers and/or services will be provided:

   a. Waste stack (acid)

   b. Vent stack (acid)

   c. Domestic cold water

   d. Domestic hot water

   e. Domestic circulating hot water

   f. Laboratory cold water

   g. Laboratory hot water

   h. Laboratory circulating hot water

   i. Gas

   j. Compressed air (laboratory)

k. Vacuum (laboratory)

l. Deionized water

m. Distilled water

n. Standpipes, hose cabinets and sprinklers

o. Oxygen

p. Nitrogen

q. Nitrous oxide

r. Downspouts

Tees with shut-off valves or wyes will be provided on the risers for each service at every floor to facilitate future remodeling.

B. SCOPE OF WORK

1. Sanitary drainage system - connection will be made to existing system.

2. Storm drainage system - connection will be made to existing system.

3. Acid resistant drainage system will tie into sanitary sewer after proper dilution.

4. Domestic water piping systems (hot, cold and circulation), including connections with cold water main, future booster pumps and connections to hot water generating equipment. A domestic hot water heating system will be installed.

5. Non-potable water supply system for laboratories system to incorporate central barometric loop at penthouse equipment room. System to include hot water, cold water, and circulating hot water. A laboratory hot water heating system will be installed.

6. Natural gas - Minneapolis Gas Company will be source of supply. Meters and pressure regulators will be provided.

7. Compressed air (laboratory) - a central compressed air system will be provided.

8. Vacuum (laboratory) - a central vacuum system will be provided.

9. Deionized water and distilled water. A central deionized water system will feed a still located in the penthouse.

10. Fire standpipe system, including fire department connections, hose cabinets, and future fire pump. Limited sprinkler system for areas required by Code and Owner.

11. Oxygen - piping system as required with connections to central system on the river flats.

12. Nitrogen - piping system as required with connections to tank manifold.

13. Nitrous oxide - piping system as required with connections to tank manifold.

C. INSTALLATION

1. Piping systems serving laboratory equipment shall have risers run vertically in mechanical shafts provided with horizontal mains running at the centerline of the bays within the suspended ceiling.

   Each service or drain not extended to connecting location shall be provided with capped or valved connection at each vertical shaft.

   Piping systems for laboratory equipment will be terminated at floor or walls with valves or capped connections: final connections will be by the mechanical contractor.

   The hot water systems shall be completely recirculating systems with reversed return as much as possible to eliminate the need for balancing various branches.

D. MATERIALS

1. Sanitary and storm drainage system

   a. Below grade: extra heavy cast iron soil pipe and fitting.

b. Above grade: schedule 40 galvanized wrought iron or galvanized alloy pipe with black drainage fittings.

2. Acid drainage system

Pyrex or Kimex type glass pipe and fittings.

3. Domestic water

Below grade - cast iron. Above grade - Type L copper tubing with solder joint fittings; joints made with 50-50 solder.

4. Gas piping

a. Schedule 40 black steel pipe with black malleable fittings.

b. Gas piping 3" and over to be welded.

5. Compressed air and vacuum (laboratory use)

Galvanized steel or Type L copper tubing with solder joint fittings: joints made with 50-50 solder.

6. Oxygen, Nitrogen, and Nitrous Oxide

Type K tubing with solder joint fittings; 15% silver alloy brazed joints (pre-cleaned tubing for oxygen service).

7. Deionized water

Polyvinyl chloride pipe and fittings, Type 11.

8. Fire protection systems

Schedule 40 black steel pipe with black malleable or cast iron coupling fittings.

9. Hot water storage tanks

125 pound design flange quality steel and with lining consistent with the institution's practice.

10. Distilled water

Tin lined brass.

11. Pipe insulation

All domestic laboratory hot and cold water lines shall be insulated. The cold water pipe insulation shall have a vapor barrier covering.

12. Distilled and deionized water

a. Deionized water produced shall have a minimum resistance of 1,000,000 ohms per cubic centimeter. The deionizer will be a mono-bed type complete with PVC lined steel reactor, cation and anion resins, regeneration equipment, conductivity meter, PVC piping and valves. Influent will be from the high pressure system and sodium zeolite softened.

b. Above deionizer will deliver its effluent through a solenoid operated discharge valve to each water still. Water still will be located at the roof penthouse, to control quality of water to meet specific departmental demands.

c. Deionized water piping will be polyvinyl chloride pipe and fittings. Valves will be Grinnell-Saunders, or equal, rigid polyvinyl chloride Teflon diaphragm. Valves for distilled water service will be stainless steel with Teflon diaphragm.

13. Plumbing fixtures

a. Water closets

Wall hung, elongated siphon jet, closet with chair carrier and flush valve.

b. Urinals

Wall hung, vitreous china urinal with flush valve and carrier.

c. Lavatories

20" X 18" vitreous china lavatory combination supply fitting, loose key operated valve supplies and "B" trap.

d. Service sink

Floor receptor, poured-in-place with floor drains.

UNIVERSITY OF MINNESOTA
HEALTH SCIENCES EXPANSION

ELECTRICAL N

ELECTRICAL OUTLINE SPECIFICATION UNIT K/E

A. CODES AND STANDARDS

1. All installations will meet the minimum requirements of the latest National Electric Code and University of Minnesota Standards.

2. All equipment shall be manufactured and tested in accordance with national standards: UL, NFPA, IPCEA, ASTM, NBFU, NEMA, IEEE, NECA, NELA.

B. ELECTRIC SERVICE

1. Owner to provide dual feed, 13,800 volt, 3 phase power.

2. Contract work - dual feed, 13,800 volt, 3 phase power source for building to be tapped from Owner's system at Mayo Vault No. 2 and extended into a 13,800 volt switching center via transite encased in concrete duct line system. Cable to be paper insulated, lead covered, shielded cable.

C. PRIMARY TO SECONDARY POWER TRANSFORMATION

- Double ended unit substations.
- 1500 KVA, 13,800 volt delta to 277/480 volt grounded star transformers (5-3/4% impedance) with 2-2 1/2% taps above and below nominal voltage.
- Braced for 500 MVA of fault interruption.
- Primary switches to be 15 KV, 95 KV BIL, 3 phase, 200 amperes, loop feed load interrupting with current limiting fuses coordinated with line side electrical system.
- To be totally enclosed, free standing and metal clad.
- Manufactured so that the transformers can be removed without moving the primary or secondary switchgear.
- All busing to be copper or aluminum.
- All secondary feeders and transformer mains to be protected by fused bolted pressure switches.

- Automatic trip amperage ground detection equipment to shunt trip main breakers in the event of a phase to ground fault of a magnitude below main device.
- Tie breaker operation between secondary sections of unit substations.
- Switchboards to be equipped with all collar and bus bar extensions for connection to the distribution bus ducts.
- Switchboards shall be dead front and back connected.
- Switchboards to be equipped with Kilowatt-hour, indicating demand, ampere and voltage meters and test blocks for attaching recording type instruments to secondary feeders.

D. SECONDARY POWER SYSTEMS

1. Secondary Distribution

   - 277/480 volt, 3 phase, 4 wire grounded basic system.
   - 120/208 volt, 3 phase, 4 wire grounded subsystems from dry type transformers connected to the 277/280 volt panelboards of the basic system.
   - Bus duct risers from unit substation switchboards.
   - Bus duct to be 4 pole, low impedance, 100% neutral, plug-in type.
   - Fusible switches for connection and protection from 277/480 volt bus duct risers to 277/480 volt panelboards.

2. Dry type transformers-shall be indoor type, 3 phase, 480 volt to 120/280Y, Class H insulation, fully enclosed and suitable for wall or floor mounting with lifting rings.

3. Panelboards

   - All panelboards to be circuit breaker bolted type, 3 phase, full capacity neutral and with a separate ground bus.
   - Panelboards to be door-in-door type construction keyed alike.
   - Panelboards to have an accurate directory and shall be visibly numbered.
   - All laboratories defined as Class A in the A & E guide dated July 1, 1966, shall have separate panelboards with a capacity of not less than 40 volt-ampere per net square foot of room area.

- All laboratories defined as Class B in the A & E guide dated July 1, 1966, shall have separate panelboards with a capacity of not less than 40 volt-amperes per net square foot of the area served.
- All panels sized for future 50% load increase.

E. GROUNDING

- Main ground bus in each substation and primary switchgear room.
- All ground bus tied to water main and ground grid.
- Connect service primary and secondary neutrals to the main ground bus only at each substation.
- All conduit bonded together with standard fittings for a continuous ground also connected to all electrical equipment housing.
- Ground conductors to nearest water pipe or vertical ground bus for 120 volt neutral of step-down systems.
- Separate (pure) ground for special research laboratories and instrumentation.

F. EMERGENCY SYSTEM

1. Generation

- Natural gas, 250 KW, 480 volt, 3 phase, 60 hertz, motor generator set.

2. Distribution

- 277/480 volt, 3 phase, 4 wire grounded basic distribution system.
- 120/208 volt, 3 phase, 4 wire grounded subsystems from dry type transformers connected to 277/480 volt panelboards of the basic system.
- Low impendance, 100% neutral, 4 pole, plug-in type bus duct risers from each generator.

3. Automatic transfer

- Automatic transfer capability from preferred source to emergency source.

4. Lighting

   - Battery lighting units in operatories and other critical areas.

5. Wiring

   - All emergency wiring separate from other systems.

G. BASIC MATERIAL AND SYSTEMS

1. Wire and Cable

   - All conductors 98% conductivity copper.
   - All primary service high voltage cable to be 15 KV paper insulated lead cable.
   - All building primary distribution high voltage cable to be 15 KV crosslinked polyethylene insulated.
   - All low voltage wiring to be 600 volt thermoplastic insulation, type THW or THHN.
   - All wiring to be color coded.
   - All wiring to be in conduit.
   - All branch circuit wire shall be #12 or larger.
   - All branch circuit wiring for ungrounded systems shall be cross-linked polyethylene, 600 volt, 4/64" thick insulation.
   - All branch circuit wiring installed in wiring channels of continuous fluorescent fixture runs shall be fixture wiring type approved for wiring at temperatures not lower than 90C.

2. Conduit and Fittings

   - Conduit in building 3/4" or larger.
   - Rigid steel except EMT in casework, interior, hollow partitions and for special conditions.
   - Aluminum conduit shall be limited to feeder conduits 2 inches and larger.
   - Galvanized and cast steel boxes and standard galvanized fitting.
   - Flexible conduit for connection to motors and recessed light fixtures.
   - Conduit expansion fittings for crossing building expansion joints.

3. Wiring Devices

- Switches shall be 20 ampere, A.C. rated, quiet mechanical type.
- Duplex receptacles shall be 3 wire grounding type rated 20 amperes.
- Special receptacles latest NEMA "U" ground type.
- Plates shall be satin finish, stainless steel.

4. Underfloor Systems

- A trench header - cell system on all floors above ground level for branch circuit receptacles.
- Floor outlets to be low profile or flush type.

H. COMMUNICATIONS AND SIGNAL SYSTEMS

1. Telephone System

- Empty conduits, cable trays and wall or floor outlets.
- Pay telephones at convenient locations.
- Telephone equipment to be mounted on 3/4" fire resistant plywood panels in electrical closets.

2. Clock System

- Clocks shall operate from 120 volts, 60 hertz with power source connected to nearest 120 volt convenience outlet.
- All clocks shall have synchronous motor movements and manual reset.

3. Fire Alarm System

- A closed circuit, zoned, non-coded annunciated, electrically supervised system with manual fire stations, horns, fixed temperature detectors, rate of rise detectors, ionization type smoke detectors and annunciators located as required by the Building Exits Code, NFPA No. 101.
- Provision for connection to the municipal fire dept.
- Provision for supply fan shut-down and smoke evacuation.

4. Television Distribution

- An emply conduit and cable tray system for television monitors and cameras for closed circuit television.

- An empty conduit and cable tray system for a master antenna system for commercial television.

5. Projection Systems

   - Empty conduit for sound outlets and speakers in designated areas for cable and equipment installations by the University Audio Visual Department.

6. Public Address and Intercom Systems

   - Empty conduit and cable tray outlets for public address system in designated areas for lecture, intercom or paging. Cables and equipment may be provided by University.

I. LIGHTING

- Generally 277 volt fluorescent; incandescent in special areas.
- Lighting levels in accordance with IES, 4th Edition, minimum requirements. Briefly, general lighting levels designed for 100 foot candles maintained at desk top in laboratories, office and laboratories.
- Some space will require solid state, radio frequency free incandescent dimming equipment.
- Exit lights, selected corridor lighting, stairwell lighting, operatory lighting and lighting in other critical areas to be on the emergency system.
- Walkways and exterior to be illuminated with 277 volt mercury vapor units with photo-electric control.
- Exterior building lighting shall be controlled by seven-day time switches and photocells.

J. SPECIAL POWER SOURCES

- Includes a separate ground system, isolating transformer, voltage regulator and filters for selected equipment or combinations of the above in designated research areas .

K. LIGHTNING PROTECTION

- Complete lightning protection system on roof to meet U.L. master label requirements.

L. PHYSIOLOGICAL MONITORING

- Wireways and cellways to designated locations.

M. MOTOR AND EQUIPMENT CONNECTIONS

1. Motor and Motor Control

- Motor control centers in large equipment spaces.
- Motor control centers shall be front access, dead front.
- Motor starters tied to scanner-activator devices of the central monitor control panel.

2. Mechanical Equipment

- Connect humidifiers, electronic filtering equipment and miscellaneous mechanical control equipment.

3. Elevator Control

- Wiring to each bank of elevators and conduit for passenger control points.

4. Lab and Special Equipment

- Power outlets provided by Electrical contract.
- All final connections to one point on each piece of equipment furnished by others.
- All controls to be complete with equipment furnished.
- Convenience outlets on lab tables and fume hoods to be furnished with tables but installed and wired by Electrical.

N. HEATING AND COOLING

1. Electric Heat

- Snow melting at entrance walkways, stairs and ramps.

O. SPECIALIZED AREAS

1. Dark Rooms

- Provision for incandescent lighting with occupancy lights, safety lights and film storage light cut-out switches.

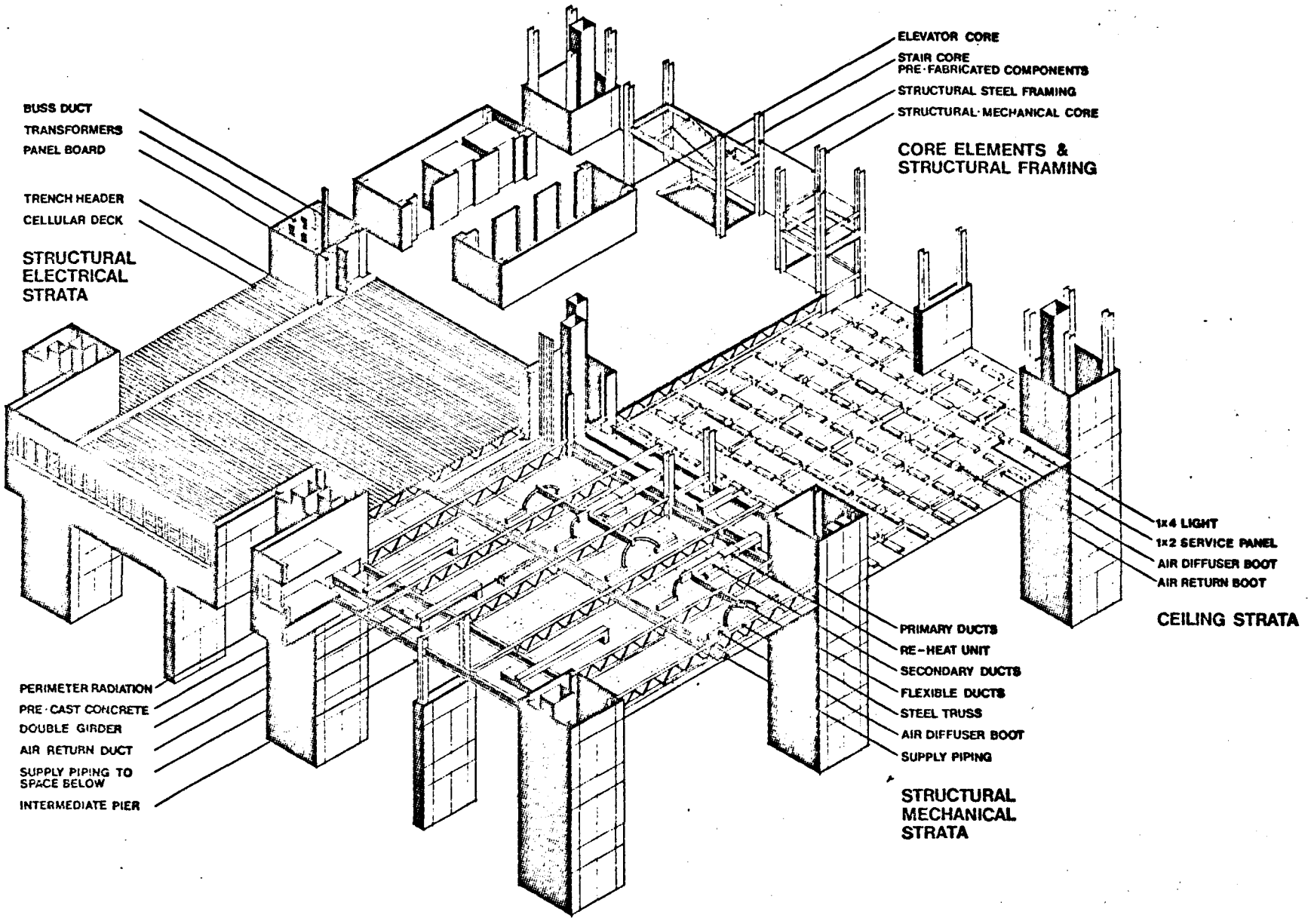
2. Pre-fabricated Rooms

   - Wiring and final connections to cold rooms, environmental rooms and shielded rooms.

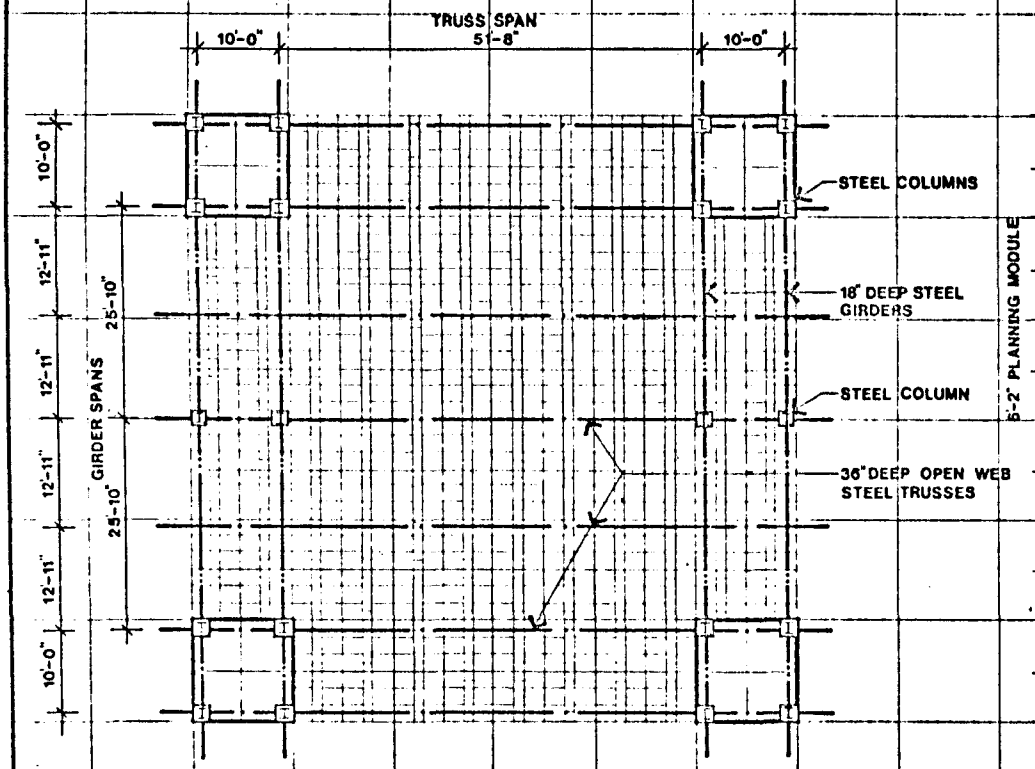
3. Electron Microscope Rooms

   - Provision for separate power source, fluorescent lighting and supplementary incandescent lighting on a dimmer. Direct current power source for electron microscope to be located at least 20 to 30 feet from microscope.
   - Electron microscope to be located at least 30 feet from elevator.
   - Electron microscope to be located at least 20 feet from power bus duct, transformers, primary switchgear and large electronic equipment.

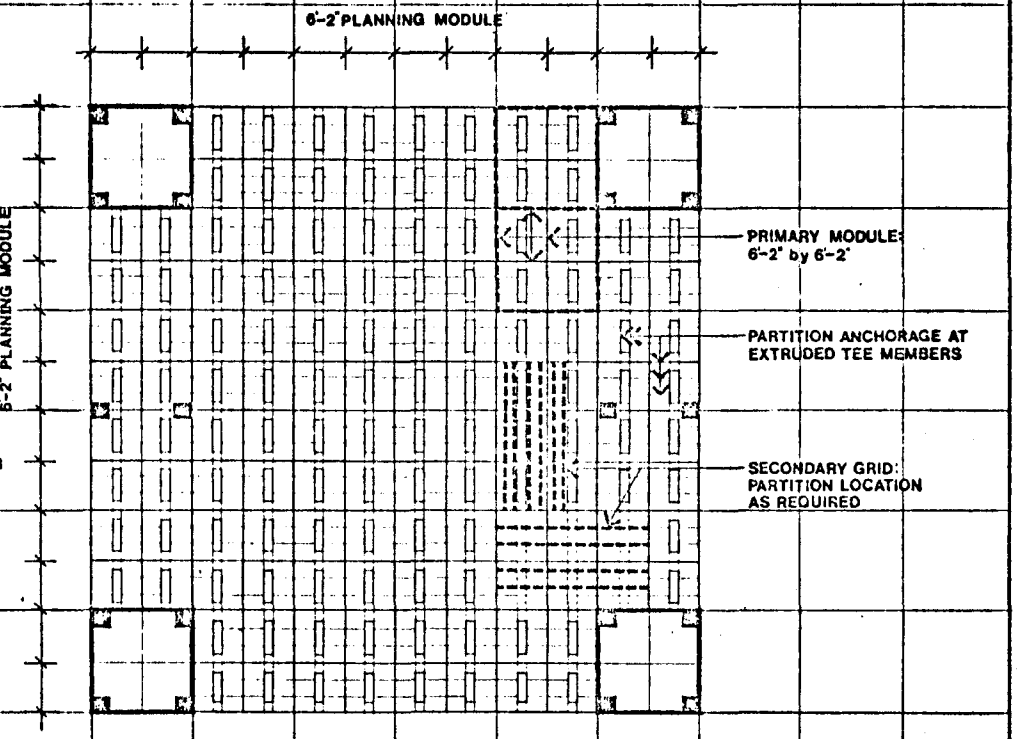
APPENDIX



BUILDING SYSTEMS FRAMEWORK



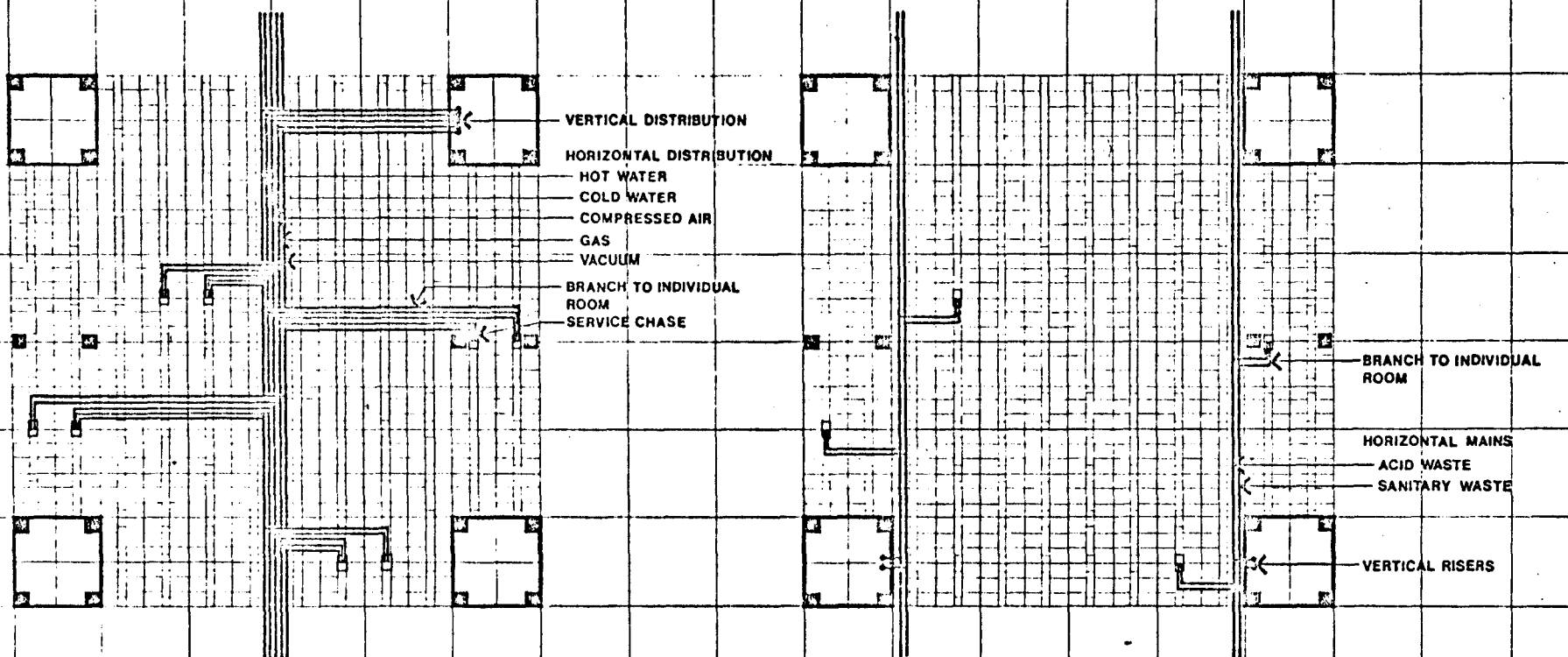
STRUCTURAL GRID



PLANNING GRID

FOR MODULAR OR NON-MODULAR FUNCTIONS

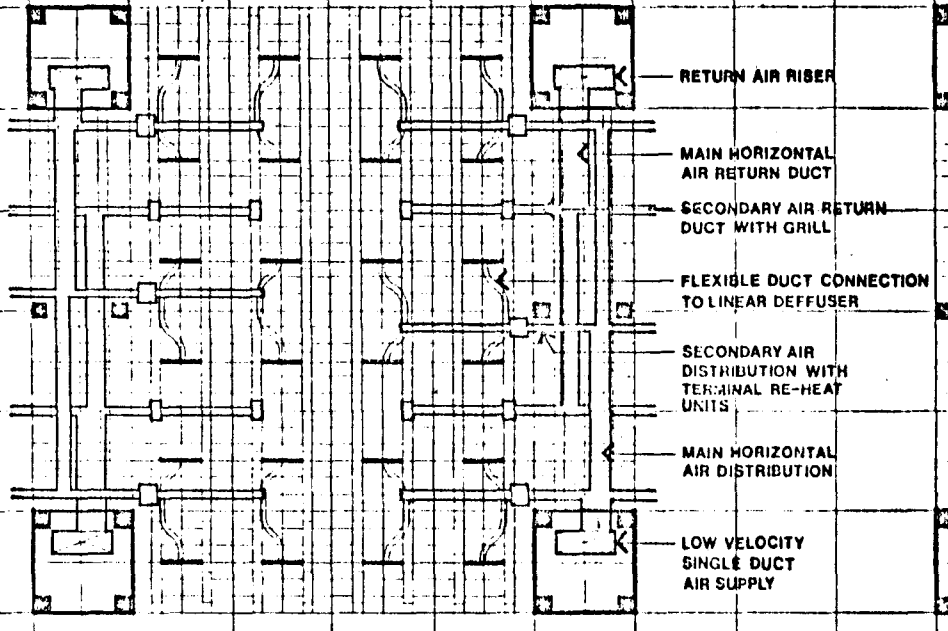
DIMENSIONAL CHARACTERISTICS



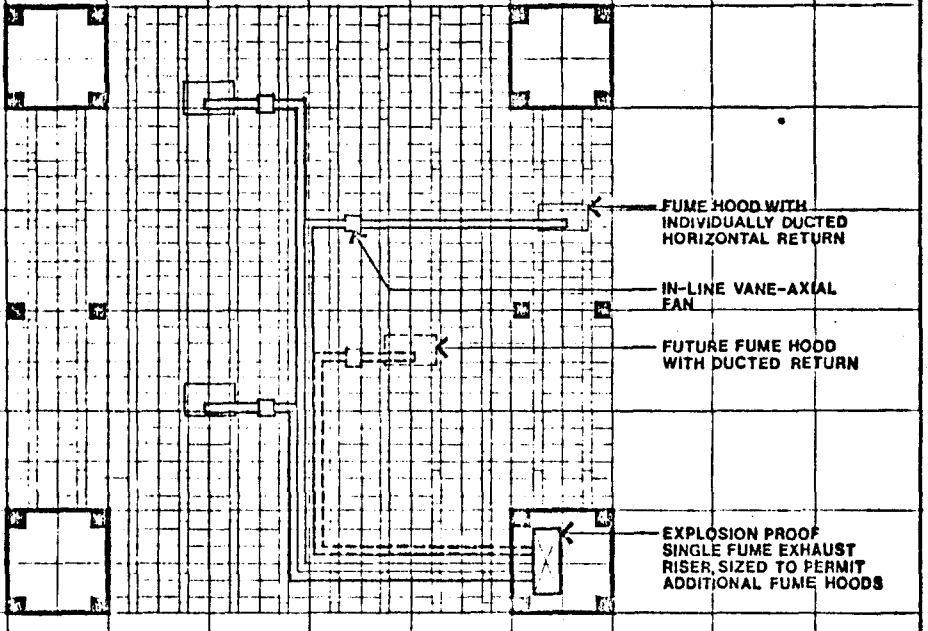
SUPPLY

WASTE

PIPED SERVICES

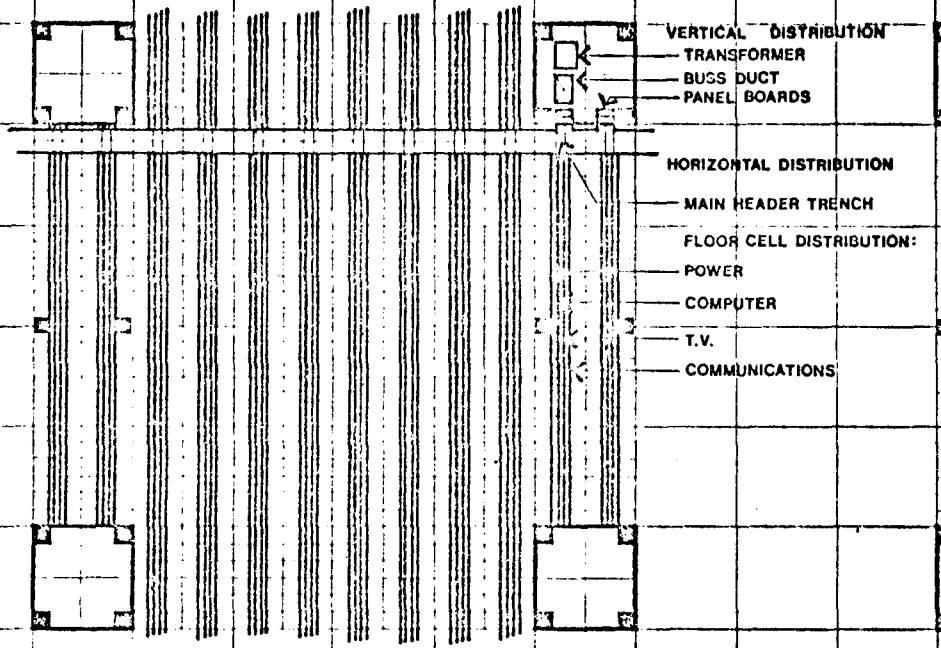


AIR DISTRIBUTION

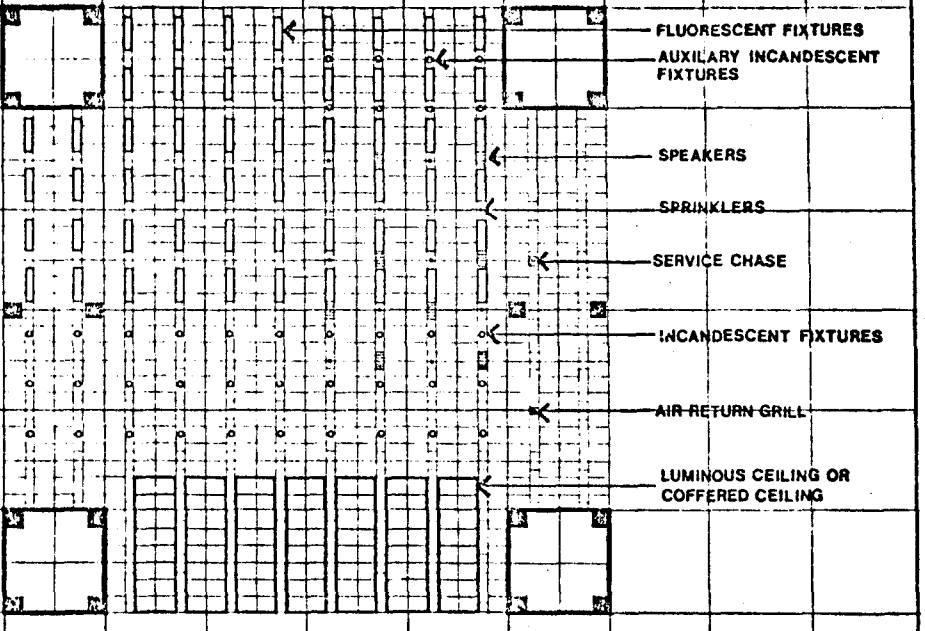


FUME HOOD EXHAUST

H-V-AC



DISTRIBUTION OF SERVICES



LIGHTING PATTERNS - REFLECTED CEILING

ELECTRICAL SERVICES

WILLIAM J. CAVANAUGH & LAWRENCE G. COPLEY
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(617) 969-2871

12 January 1972

University of Minnesota
Health Sciences Expansion, Unit K/E

Acoustical Review - Design Development Phase

This constitutes a summary of general recommendations based on our review of the design documents developed to date. Our further detailed studies have indicated no significant changes from the basic recommendations discussed in our conference of 12 December 1971 with Bob Turner and Steve Whitney at TAC.

A. General

Except for those special areas discussed below the standard room acoustics finish treatments and partition/ceiling system details developed for Unit A should prove adequate for Unit KE.

We propose to review periodically the contract documents as they progress to be certain that all acoustical details are satisfactorily incorporated. This procedure worked out extremely well during the contract document phase of Unit A and would appear to be the most efficient procedure for this unit.

B. Truck Dock Noise Isolation

The spaces on the 2nd floor above the truck dock area all deserve a reasonably quiet environment. The offices and election microscope suite all should be in the range NC 30-35. This is about 40-45 dBA whereas sound levels in the truck dock are expected to reach 95 dBA. (This will be checked further by measurements in a similar truck dock at Children's Hospital in Boston).

For design development purposes, it is recommended that the floor-ceiling construction above the truck dock provide sound isolation to at least STC 55. The windows on the south side 2nd floor should be rated at STC 45 or greater.

To achieve STC 55 in the floor-ceiling using the standard deck and truss system (44 PSF) it will be necessary to install a ceiling below the trusses. This can be plaster or gypsum board to a total thickness at least 1". The ceiling must be

resiliently supported either with spring clips from the trusses or resilient hangers from the deck. Fiberbatts 3" thick should be placed above the ceiling between the trusses. The ceiling should have no uncaulked cracks or holes. To assure airtight construction it would be preferable to carry all utilities below the ceiling in this area.

Special STC 45+ windows are available for the second floor. Acceptable products include Amerada "Acousta-Pane" I45 (1-3/4" thick for STC 45) and Sitelines "Acoustaglaze" (4-1/2" thick for STC 49). Other thickness of double glazing can be discussed with the manufacturers to be compatible with the window system used elsewhere in the building.

One other feature is recommended for the truck dock area. The opening on the east side from 574 to 76 should be closed off to reduce the noise exposure of Powell Hall. It is suggested that special acoustical masonry blocks ("SOUND-BLOX") be used here. They will provide the necessary sound barrier while also reducing noise levels within the truck dock itself. Sound absorbing treatment is also recommended for the ceiling area of the truck dock ("Tectum" or equiv. applied to the underside of the suspended ceiling construction).

C. Mechanical Equipment Vibration Isolation

The type of usage for many spaces in Unit K-E is critical in terms of structural vibration and associated airborne noise. For this reason high standards of equipment vibration isolation will be necessary. It is recommended that the speeds of all rotating equipment in excess of 5 HP be kept above 400 rpm. All items in excess of 1/4 HP will be candidates for vibration isolation details.

The basement MER will not cause any special problems. Conventional vibration isolation techniques would apply to the basement equipment. In addition, however, a floor isolation joint around the perimeter of the mechanical room is recommended. A similar edge isolation joint is recommended for the basement and mezzanine electrical equipment rooms.

D. Electron Microscope Vibration Control

Floor vibration in the EM suite on the 2nd floor should be limited to less than 0.001 G acceleration in the entire frequency range above 0.1 Hz. This is the same vibration criterion applied in Unit A based on an extensive evaluation of EM user requirements.

In Unit K-E, wind-induced vibration does not appear to be a problem, even with possible later additional upper floors 4 through 10. Foot-fall induced vibrations will be of the same magnitude as in Unit A because of the similar floor structure. Thus, it is recommended that the floor of the EM suite on the second floor should be a 6-1/4" dense aggregate r.c. slab with area density 80 PSF or greater. With

the EM suite located as on the November 4, 1971 Design Development prints, the heavy slab should extend from S72-6 S76 between W13 and W14.

The truck dock on the first floor creates vibration problems not encountered in Unit A. A preliminary calculation indicates that truck-induced vibrations of the EM suite floor could reach as high as 0.01 G or ten times higher than the acceptable level. For this reason, it is planned to conduct vibration measurements in a similar truck dock at Children's Hospital Medical Center in Boston. Depending on the outcome of these tests and further calculations, it may be necessary to consider special structural features in the truck deck. For example, the entire dock floor slab might be supported at its edges by neoprene pads, like bridge bearing pads. These would be detailed to eliminate bending moment transfer into the columns and also provide substantial isolation of vertical and horizontal vibrations in the edge of the slab.

The need for any such special structural features will be carefully evaluated at the earliest possible opportunity. If they are needed, suitable details will be worked out in close collaboration with Jack Larsen during the early phases of contract document development.

E. Animal Areas - Mezzanine

Unit masonry portion construction appears to be most appropriate for acoustically isolating the dog, primate and small animal holding rooms from other spaces on this floor. The drawings have already incorporated sound lock arrangements at these room entrance points and at the corridors to achieve the desired isolation. In addition, special double wall construction is desirable to separate the primate and dog rooms. Careful detailing of the airhandling systems serving these areas will be required to avoid problems of "crosstalk" and acoustical flanking.

F. Compactor Dock - Trash Room, 1st Fl.

It is recommended that the purchase specifications for the compactor units include noise and vibration limits. We can assist in the preparation of these at the appropriate time.

The compactor dock area and trash room should have extensive sound absorbing treatment. Sound blox are recommended for these areas and Tectum or some other durable treatment for the ceiling.

To minimize disturbance to outside areas and adjacent buildings, the two overhead doors should be kept closed during operation of the compactor units. In addition, the doors should be fitted with perimeter gasketting.

G. Receiving Area/Administrative Area, 1st Fl.

Solid unit masonry construction (equiv 8" concrete block) appears necessary for

the partition along column line W15 to adequately separate these areas. In addition, the interior of the large conference room should be provided with separately framed gypsum board inner construction. This inner "furred" construction should be carried out on all walls and ceiling of the conference room.