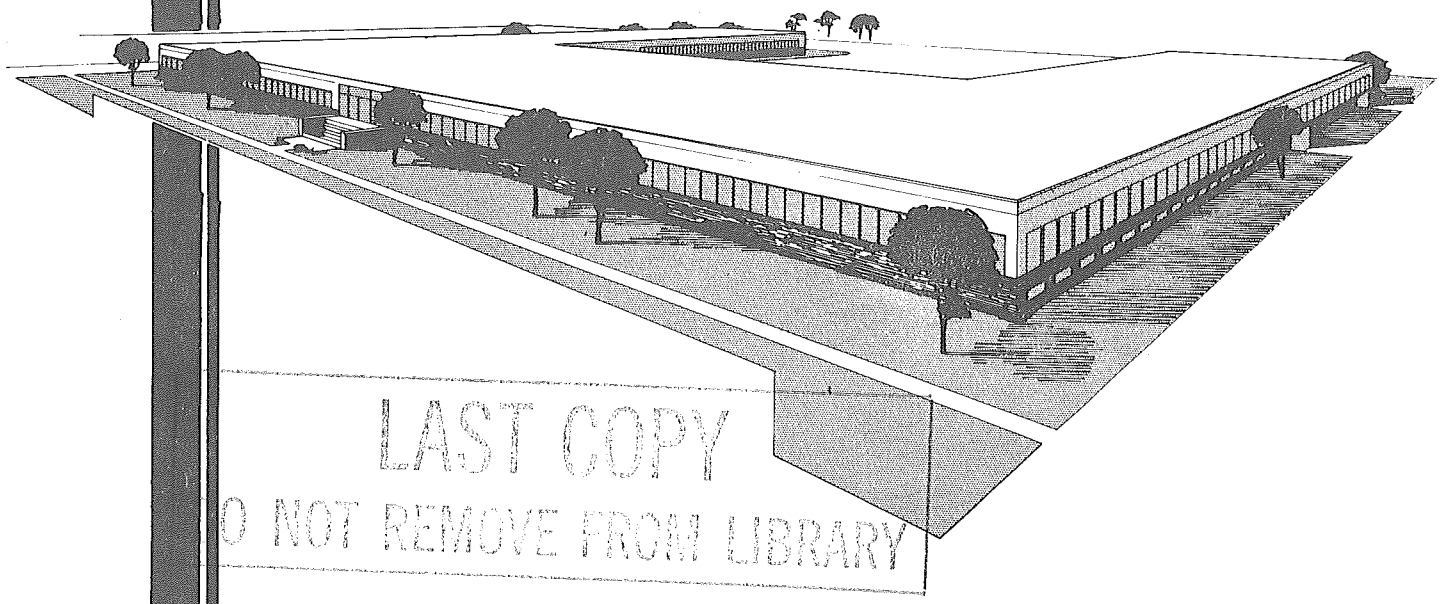
PROPOSED HIGHWAY TESTING LABORATORY AND RESEARCH LABORATORY



MICHIGAN DEPARTMENT OF STATE HIGHWAYS

STATE OF MICHIGAN

DEPARTMENT OF STATE HIGHWAYS

PROSPECTUS FOR TESTING AND RESEARCH LABORATORY BUILDING

TESTING AND RESEARCH DIVISION

LOCATION: Secondary State Facilities Center

ARCHITECTS:

APPROVED: DEPARTMENT OF STATE HIGHWAYS

By _____ Date _____

TRANSMITTED: DEPARTMENT OF STATE HIGHWAYS

TO BUILDING DIVISION, BUREAU OF THE BUDGET

By _____ Date _____

TO BUDGET DIVISION, BUREAU OF THE BUDGET

By _____ Date _____

PROPOSED HIGHWAY TESTING LABORATORY AND RESEARCH LABORATORY

Research Laboratory Section
Testing and Research Division
Research Report No. R-755

Michigan State Highway Commission
Charles H. Hewitt, Chairman; Wallace D. Nunn, Vice-Chairman;
Louis A. Fisher; Claude J. Tobin; Henrik E. Stafseth, Director
Lansing, November 1970

CONTENTS

CONTENTS (Cont.)

INTRODUCTION

Testing Laboratory

The Testing Laboratory Section was originally started in 1913 as a student course in materials testing by the Civil Engineering Department of the University of Michigan and, at that time, there was no affiliation with, nor participation by, the Department of State Highways. As highway construction increased, the importance of testing became more significant; consequently, the volume of samples became too great to be handled by students. Therefore, the Department of State Highways took over the Laboratory on a mutual agreement basis by putting all employees, except the Director, on the State's payroll and assuming responsibility for replacing all equipment as the University's equipment wore out or became obsolete. In 1933 the Department of State Highways appointed its own Engineer of Testing. This procedure has continued since that time.

Since December 1924, the University of Michigan has furnished rent free space and free utilities to the Department of State Highways in the East Engineering Building of Central Campus. The gross area comprises approximately 18,270 square feet, including offices. The increase in sample volume has necessitated an increase in equipment, office files, etc., to the extent that a very undesirable overcrowded condition has existed for a long time. Even the fire lanes have had to be encroached upon for additional space.

Two activities under the supervision of the Testing Laboratory Section, i.e., the Geophysical Unit and the Equipment Shop, are not located in the East Engineering Building, but are located in a leased building in another section of the city. The total area occupied by these two activities amounts to approximately 8,000 square feet. This area is also inadequate for efficient operation.

Organizationally, the Testing Laboratory Section is divided into the Administrative Unit, Bituminous Unit, Materials Unit, Soils Unit, and Geophysical Unit.

Following is a tabulation of the space presently occupied by the Testing Laboratory Section of the Testing and Research Division.

Gross area in square feet occupied at 1224 E. Engineering Building, and 310 West Ann Street, Ann Arbor, Michigan

ADMINISTRATIVE UNIT

Engineer of Testing	135 Sq. Ft.
Assistant Engineer of Testing and Office Manager	135 Sq. Ft.
Clerical Office	1,010 Sq. Ft.
SUBTOTAL	1,280 Sq. Ft.

BITUMINOUS UNIT

Office	1,010 Sq. Ft.
Laboratory	1,915 Sq. Ft.
Hallway (Storage) from Locker Room to Entrance	490 Sq. Ft.
Research Storage Room (Also share with Chemistry Laboratory)	110 Sq. Ft.
Hallway (Storage) (Adjacent to Chemistry Laboratory)	150 Sq. Ft.
Hallway (Storage) (Adjacent to Soils Laboratory)	370 Sq. Ft.
Compression Tester	185 Sq. Ft.
Saw Room	120 Sq. Ft.
SUBTOTAL	4,350 Sq. Ft.

MATERIALS UNIT

Offices	520 Sq. Ft.
Chemistry Laboratory	335 Sq. Ft.
Cement Laboratory	910 Sq. Ft.
Concrete Mix Design Hallway (Storage)	680 Sq. Ft.
Aggregate Laboratory and Hallway	2,545 Sq. Ft.
Concrete Laboratory with Hallway (Hallway Adjacent to Soils)	3,775 Sq. Ft.
SUBTOTAL	8,765 Sq. Ft.

SOILS UNIT

Shear Laboratory	575 Sq. Ft.
Office (Hallway Adjacent to Soils)	420 Sq. Ft.
Mechanical Analysis	965 Sq. Ft.
SUBTOTAL	1,960 Sq. Ft.

MISCELLANEOUS

Janitor Room	20 Sq. Ft.
Men's Room	185 Sq. Ft.
Locker Room	365 Sq. Ft.
File Room (Hallway Adjacent to File Room)	950 Sq. Ft.
Receiving (Hallway to Soils)	215 Sq. Ft.
Bladwin Comp. Room	170 Sq. Ft.
SUBTOTAL	1,915 Sq. Ft.
TOTAL IN ENGINEERING BUILDING	18,270 Sq. Ft.

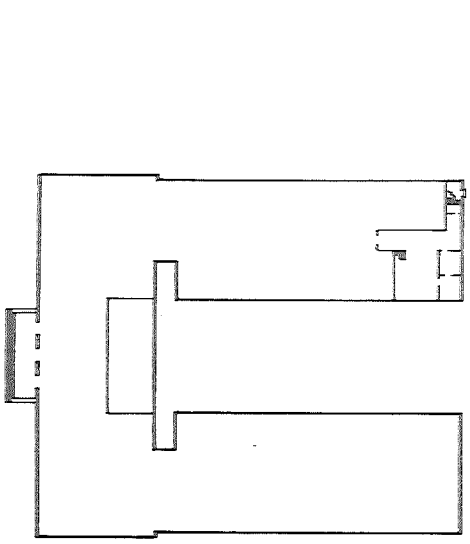
GEOPHYSICAL UNIT (310 W. Ann Street)

Offices and Drafting	1,500 Sq. Ft.
Storage Area	625 Sq. Ft.
SUBTOTAL	2,125 Sq. Ft.

EQUIPMENT SHOP (310 W. Ann Street)

Equipment Shop	5,785 Sq. Ft.
TOTAL ON ANN STREET	8,000 Sq. Ft.
GRAND TOTAL	26,270 Sq. Ft.

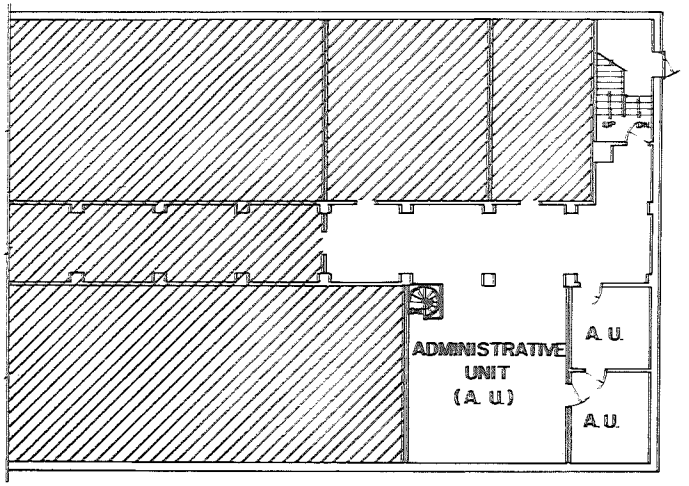
The arrangement of the space within the existing buildings is as shown on the following floor plans.



GENERAL LAYOUT PLAN

SCALE
0 10 20 30 40 50

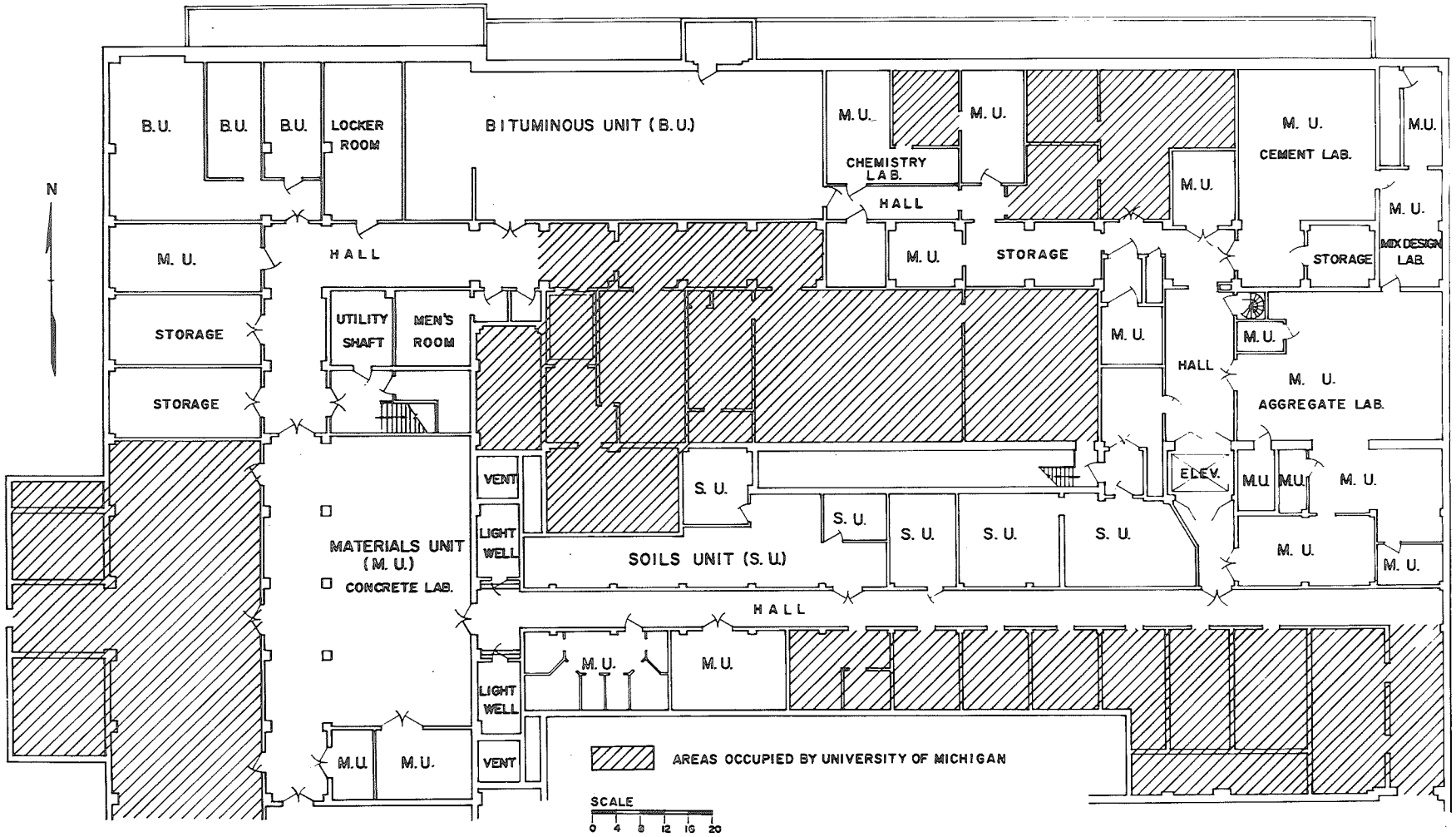
N



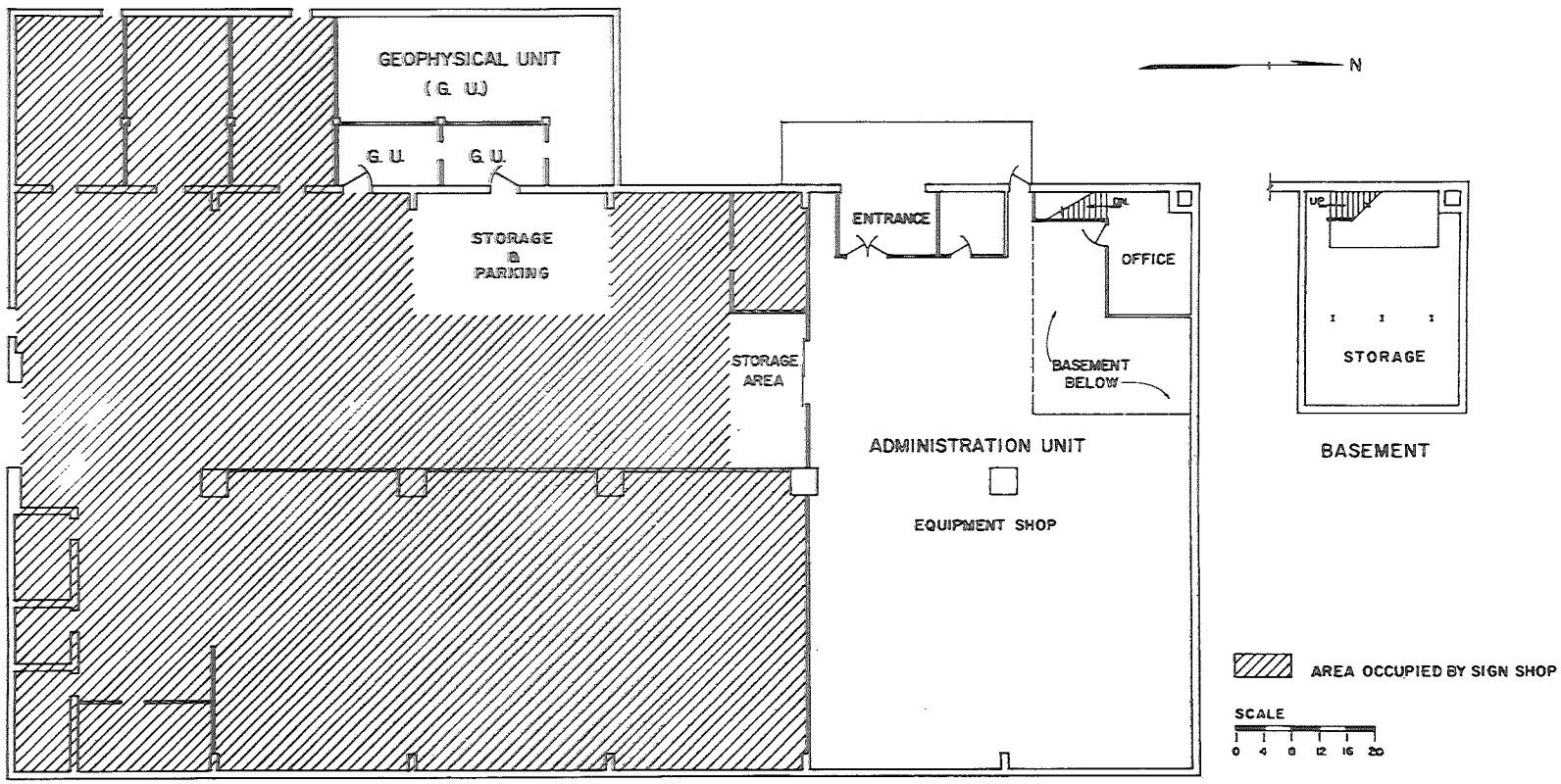
SCALE
0 4 8 12 16 20

AREA OCCUPIED BY UNIVERSITY OF MICHIGAN

FIRST FLOOR – EAST ENGINEERING BUILDING



BASEMENT - EAST ENGINEERING BUILDING



FLOOR PLAN - WEST ANN STREET

Research Laboratory

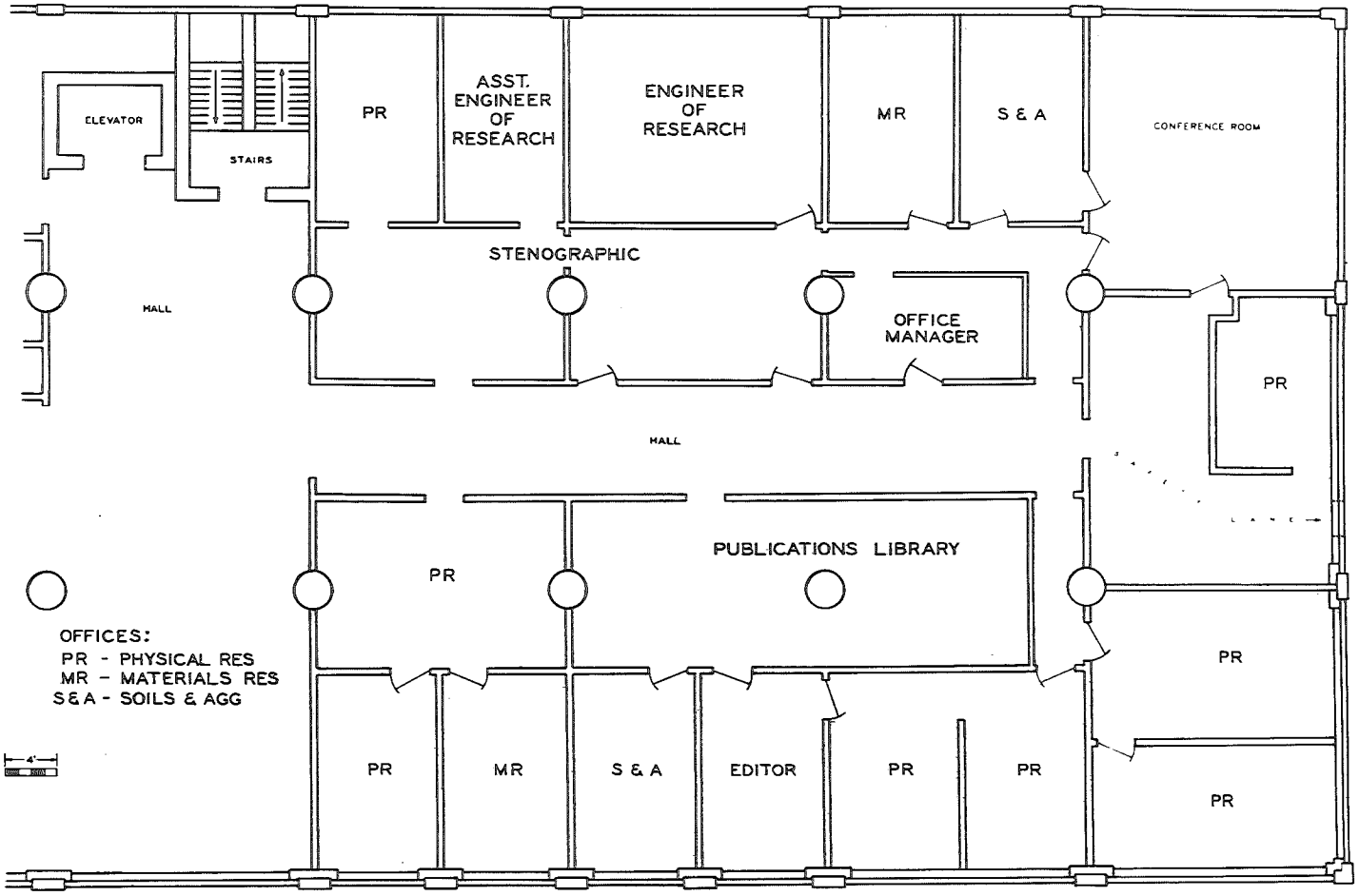
The Research Laboratory first began operation at Michigan State University in 1939. Its establishment resulted from a mutual agreement by the State Board of Agriculture, the State Administrative Board, and the State Highway Commissioner. The Laboratory's Assignment was to carry on the research work formerly done by the various divisions of the Department, and to initiate and execute a continuing program of research commensurate with the Department's needs.

In the beginning, the University accorded to the Laboratory its facilities and certain space in the Olds Hall of Engineering. This initial space allocation consisted of two rooms - one on the ground floor for an administrative office, and one in the Olds Hall basement for general laboratory work. The two rooms combined, provided a total floor space of approximately 2,350 square feet.

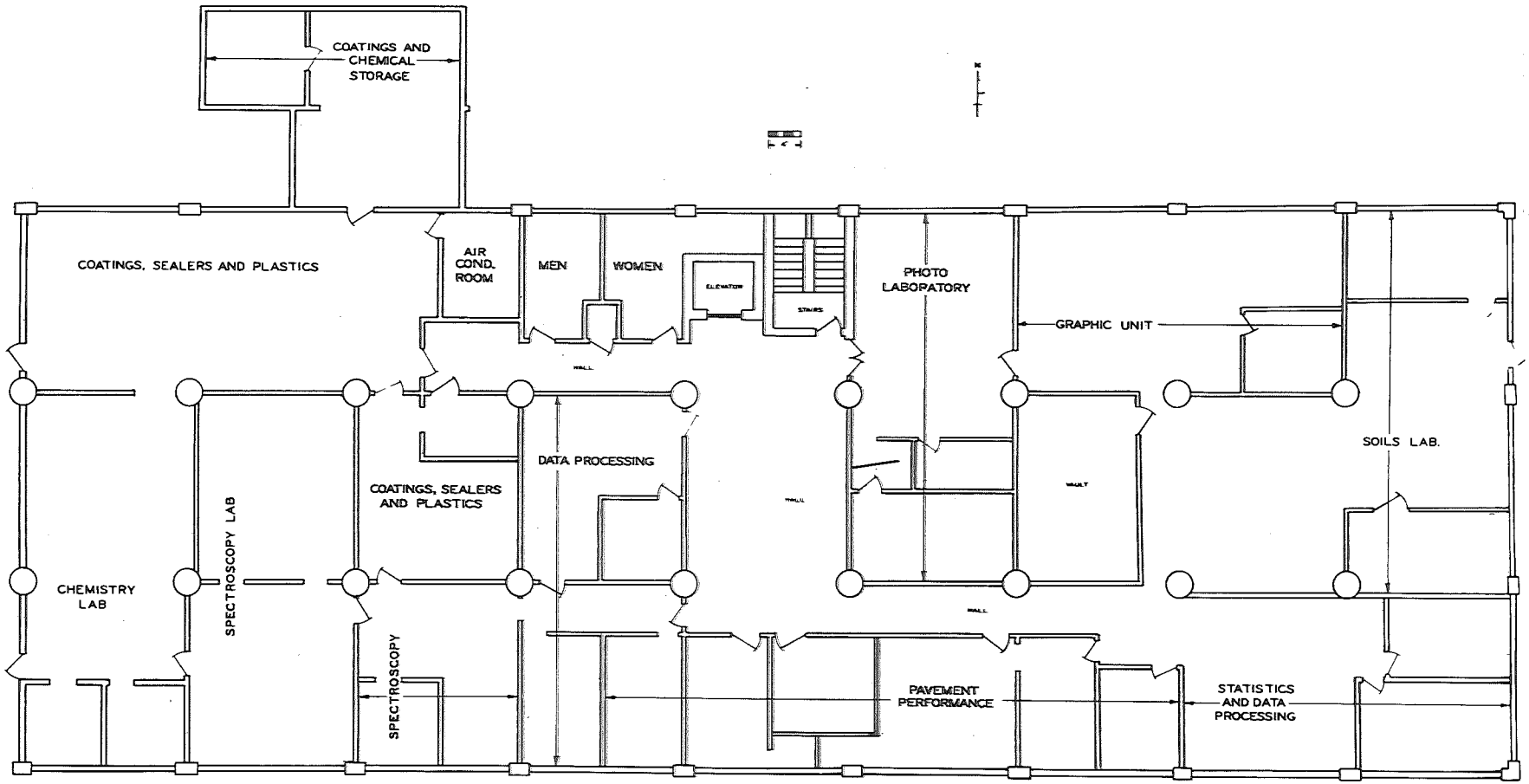
In the thirty years elapsed since that modest beginning the Laboratory grew into numerous areas of the University, ultimately occupying a net area of approximately 15,000 square feet. Then in 1962 with the move to the present Saginaw Street Offices location it was necessary to expand again to offset the losses in University facilities. The expansions to date have resulted in a current laboratory and office total net area of approximately 28,200 square feet and a gross of 37,700. The difference being accounted for by halls, lobbies, safety lanes, lavatories, etc. Floor plans of the current facilities are shown in the first four of the following figures.

The significant growth in Laboratory physical plant has been a direct result of the tremendous growth in the project load and, consequently, in research staff. At present the Laboratory is actively engaged in the performance of approximately 150 research, development, or testing projects. This work load is being carried by a staff of 37 professionals and 40 to 50 support personnel.

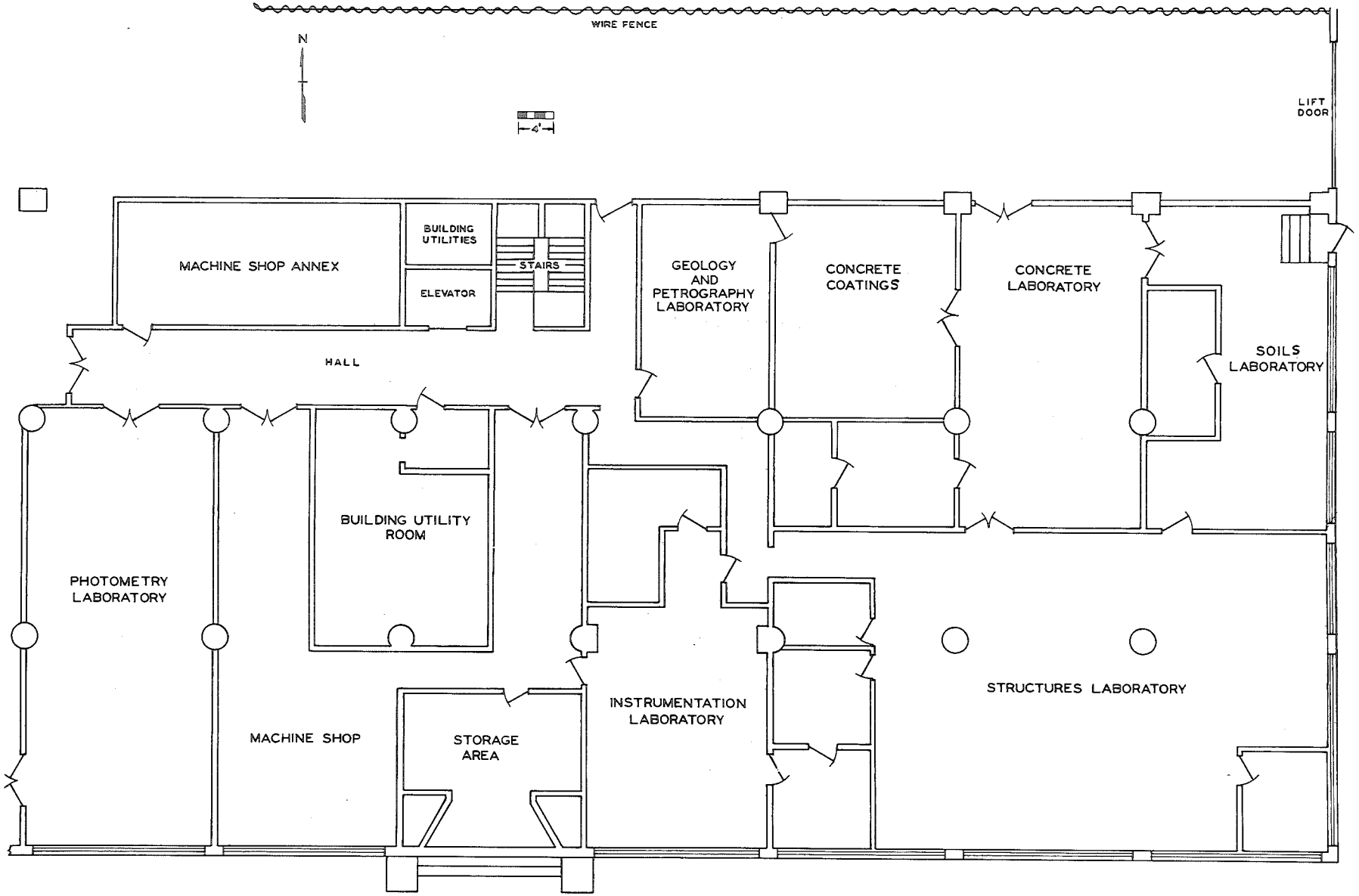
A set of three figures in the "Function" section of this report shows the Laboratory's functions, its organization for accomplishing these functions, and the allocation of personnel to the various organizational groups.



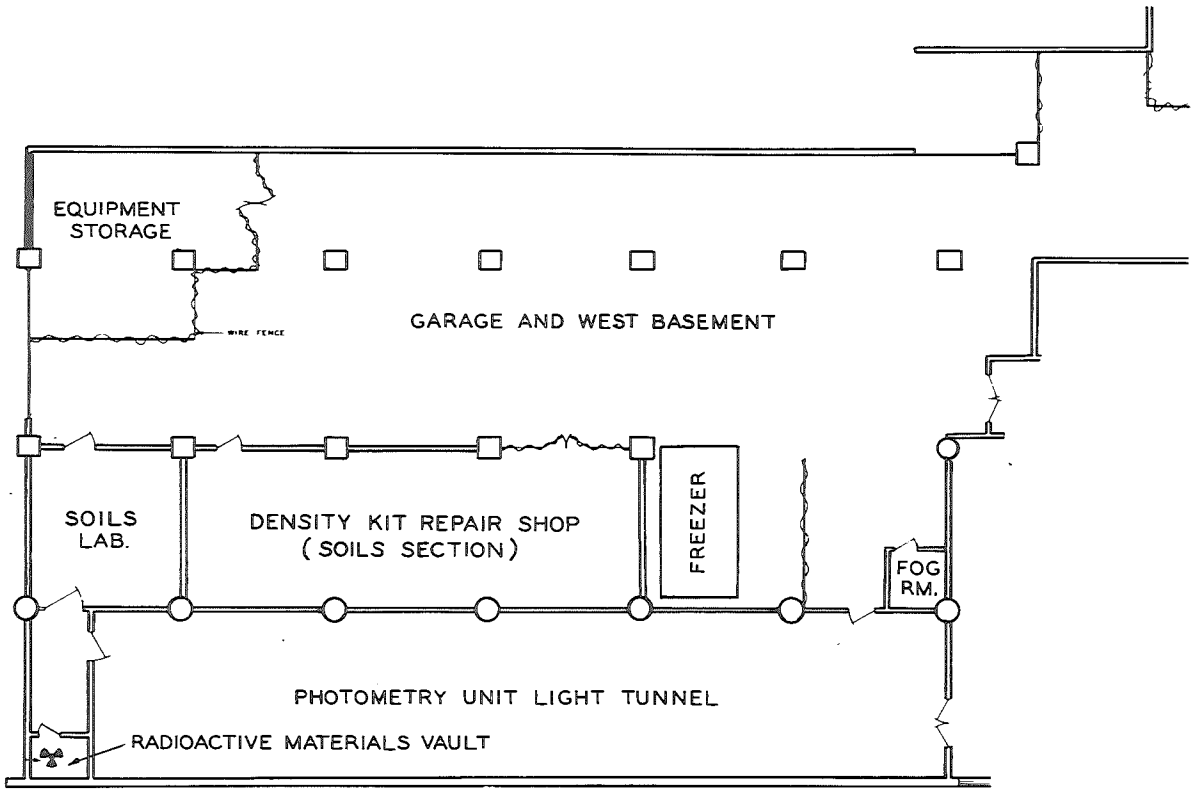
SECOND FLOOR - SAGINAW STREET OFFICE



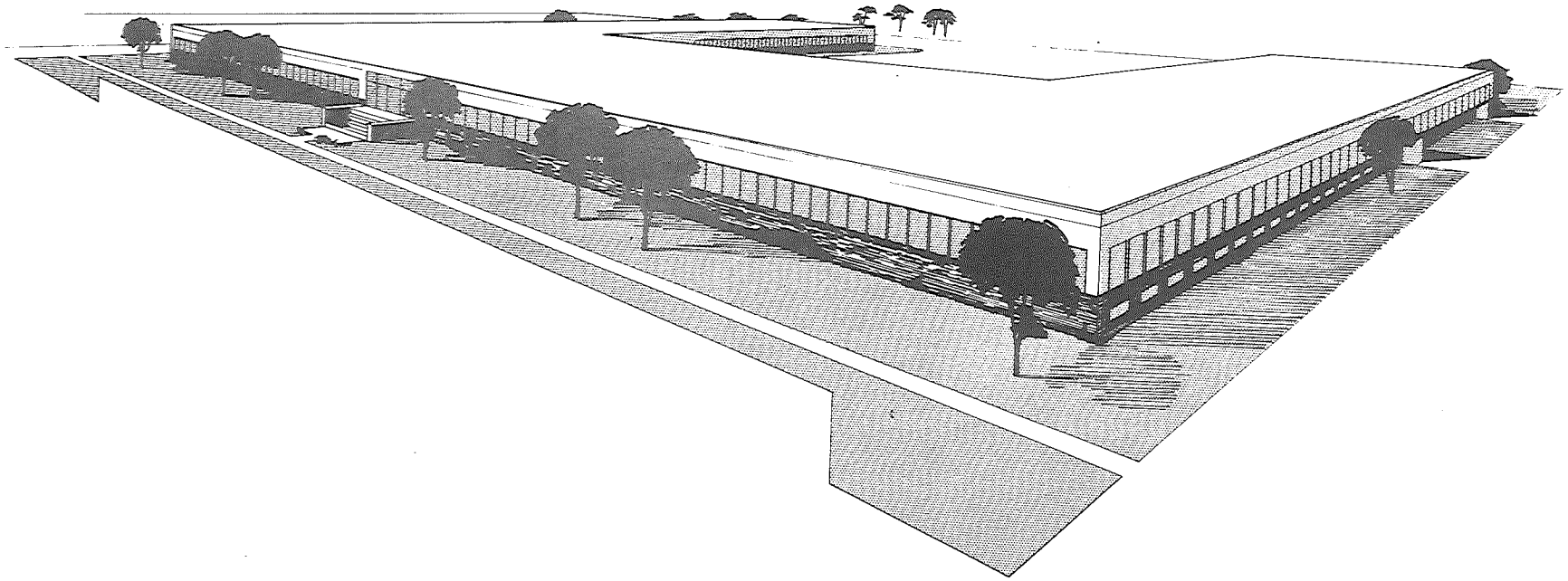
THIRD FLOOR - SAGINAW STREET OFFICE



EAST BASEMENT - SAGINAW STREET OFFICE



WEST BASEMENT - SAGINAW STREET OFFICE



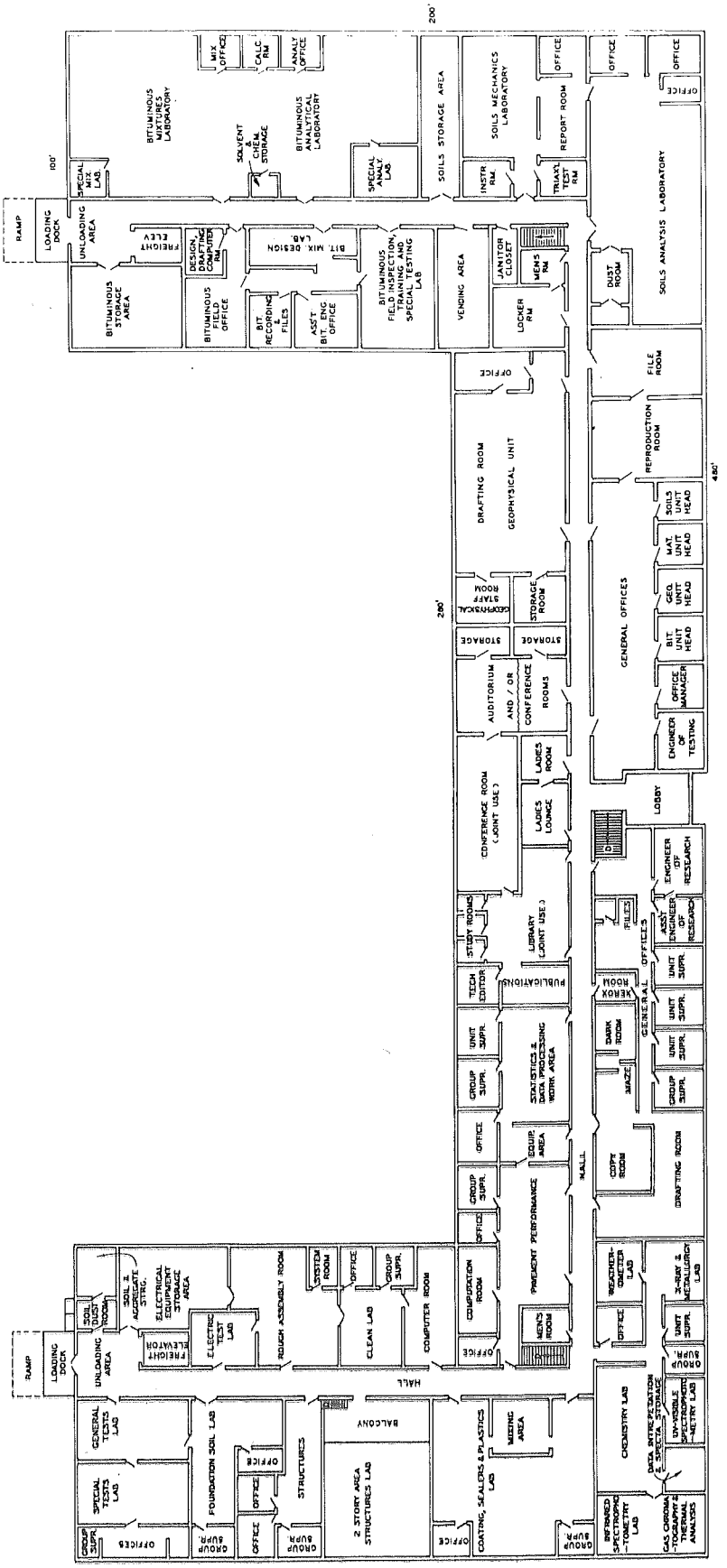
ARTIST'S DRAWING OF PROPOSED HIGHWAY TESTING LABORATORY AND RESEARCH LABORATORY BUILDING

LOCATION

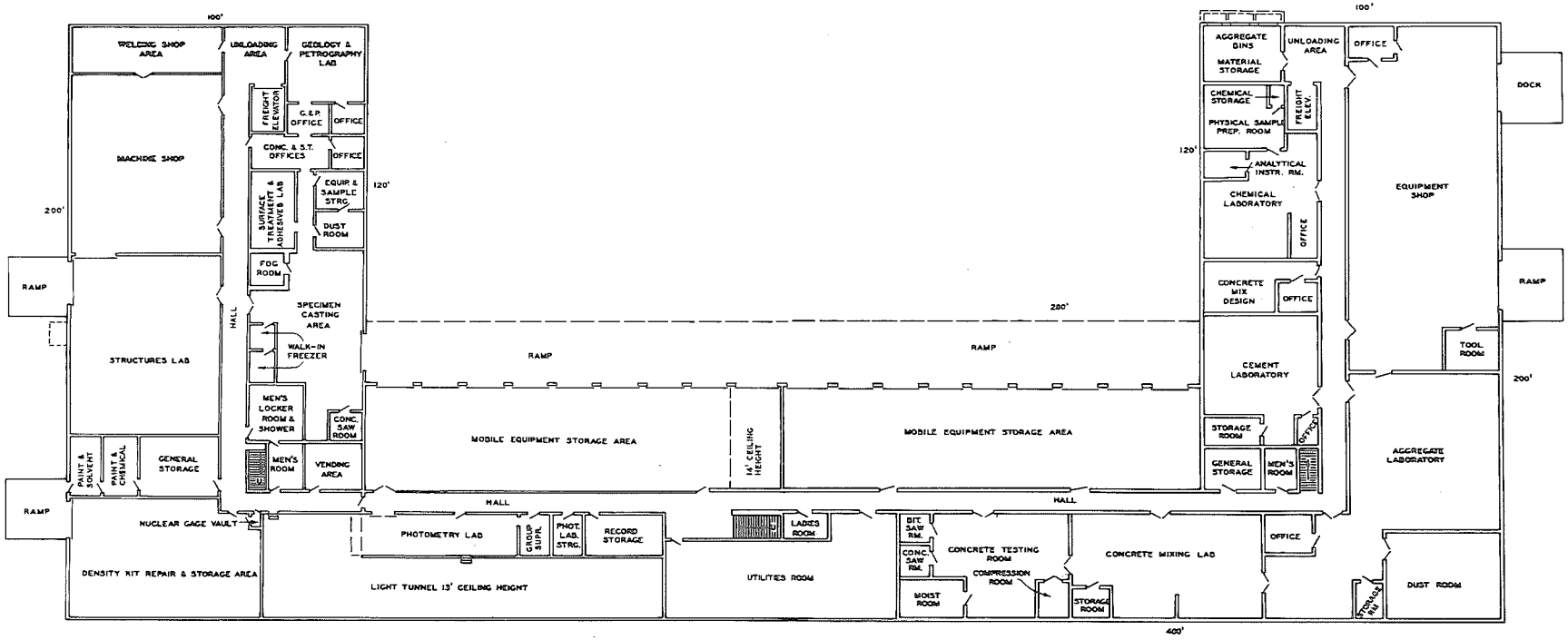
It is proposed to construct the new Testing and Research Laboratory Building in the Secondary Governmental Complex, located in the northwest quadrant of the Interchange of I 96 and M 78. The entrance road serving the approximately 31 acres allotted to the Department of State Highways will be from Billwood Highway.

The Warehouse and Maintenance Shops, Sign Fabrication and Construction Building, and Automotive and Equipment Garage should be located on the north half of the parcel along the railroad spur with the Testing and Research Laboratory Building in the southern portion.

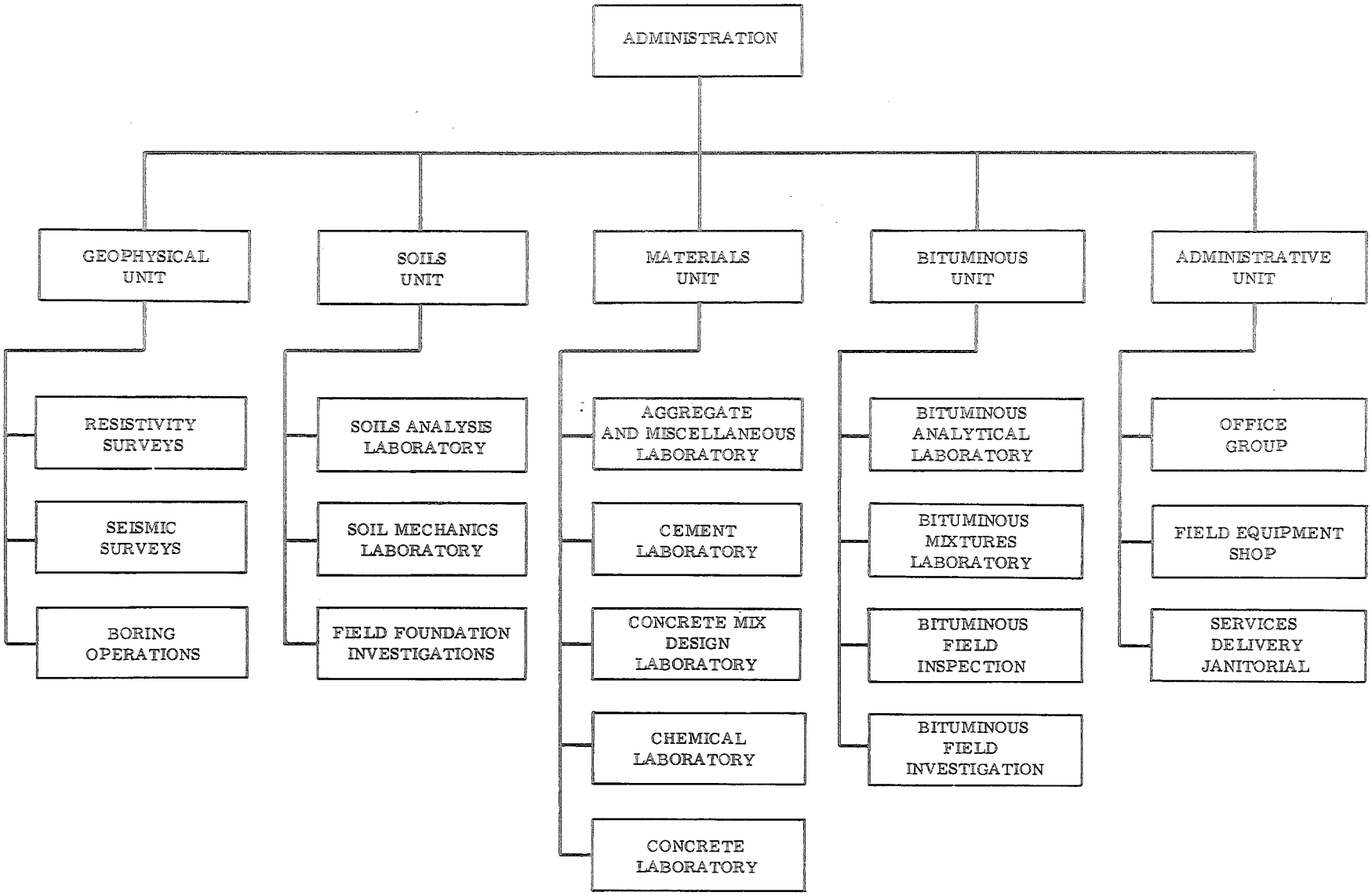
This building should be located on the site in such a manner that the Reproduction Services and Photography Laboratory can be in the immediate area and connected, if feasible, by an enclosed corridor.



FIRST-FLOOR PLAN, HIGHWAY TESTING LABORATORY AND RESEARCH LABORATORY BUILDING



BASEMENT PLAN, HIGHWAY TESTING LABORATORY AND RESEARCH LABORATORY BUILDING



TESTING LABORATORY ORGANIZATION

FUNCTION

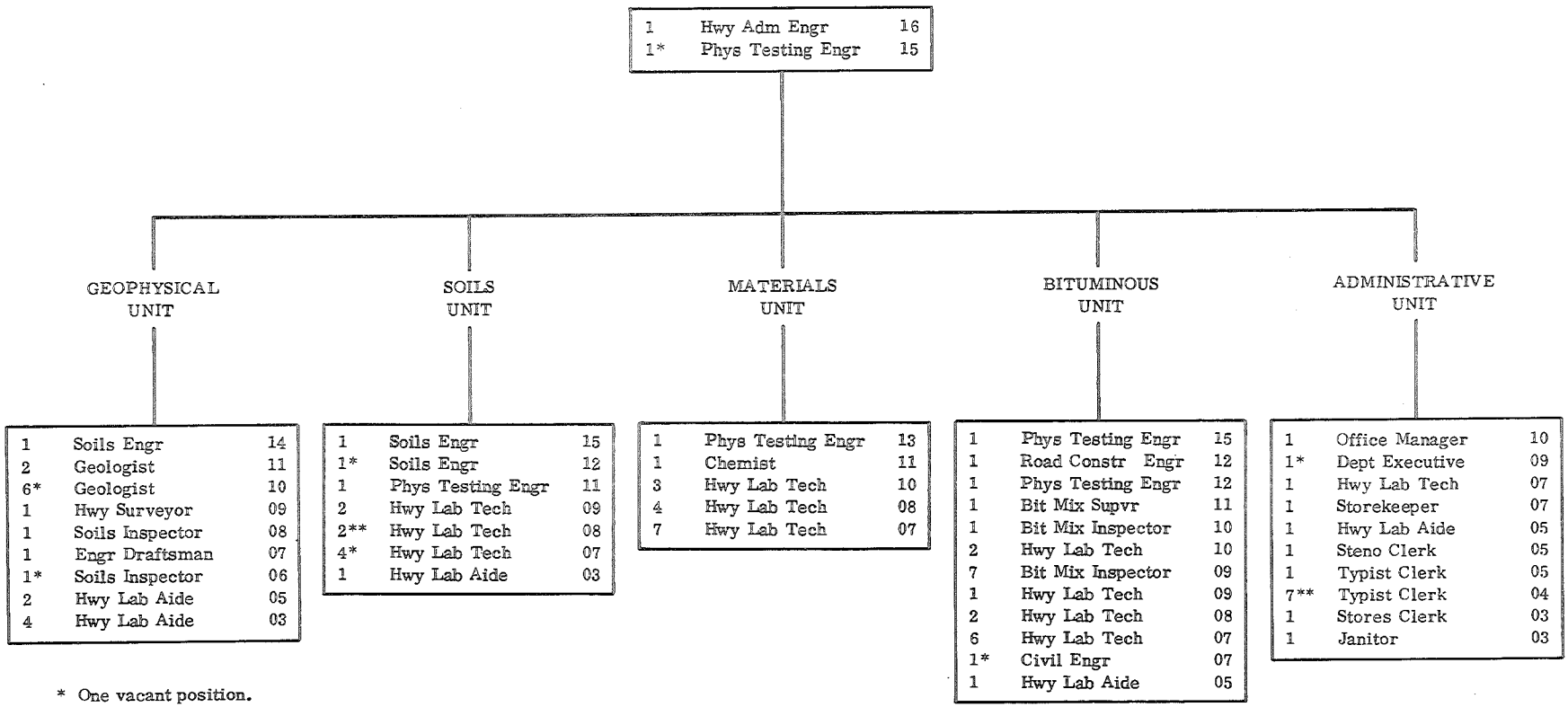
Testing Laboratory

The Testing Laboratory Section of the Testing and Research Division is located in the East Engineering Building of the University of Michigan and is operated in connection with the facilities of the Civil Engineering Department of the University with multi-functions of the daily operations of a staff of 100 to 125 full- and part-time employees. This staff, composed of engineers, chemists, geologists, and technicians, is called upon to perform the required laboratory tests and, from these test results, determine compliance of the various types of construction and maintenance materials with the Department's specification requirements. These Standard Specifications are as approved by the Federal Bureau of Public Roads, and all testing in connection with Federal Aid projects is subject to the audit of the Bureau.

One of the three functions of the Laboratory is to test representative samples of portland cement, aggregates, asphalts, soils, steel, paint, masonry units, pipe and tile, and other related construction and maintenance materials to determine acceptability. Preparing the design of portland cement concrete and bituminous mixtures is also a function of the Laboratory. Appropriate soil strength values for use in the design of structures and roads is an important responsibility of the Laboratory. Another important unit of this Section is the Geophysical Unit. This Unit conducts subsurface soil exploratory surveys, using such geophysical methods as earth resistivity and seismology. The information obtained consists of the quantity, depth, extent, and range of grain size of the various soils existing in the surveyed area. The information will also include the depth to bedrock if it is present within the construction excavation zone. All of this information is submitted to the Road and Bridge Design Office as an aid to highway construction planning.

A second function involves performing investigations and necessary testing of concepts regarding new materials, new procedures, new applications, determination of design values, etc., to prove or disprove the merits of these ideas prior to adoption by the Department. These investigations are not usually in the realm of research. During the years of the Laboratory's operation, many ideas have been studied, evaluated, and then adopted by the Department.

The third function consists of the great amount of consulting services to the Design and Construction Divisions which is provided by virtue of the knowledge acquired through many years of experience of the individual staff members.



* One vacant position.

** Two vacant positions.

TESTING LABORATORY PERSONNEL LEVELS, CLASSES, AND DISTRIBUTION

Research Laboratory

The Research Laboratory Section of the Testing and Research Division is located in the Motor Wheel Administration Building, 735 East Saginaw Street in Lansing. The Laboratory currently has a personnel compliment of 77 people, composed of Civil, Electrical, Chemical, and Mechanical Engineers, Physicists, Chemists, Geologists, Mathematicians, various support technicians and aides, including graphic designers, clerical personnel, and a technical editor.

The operation of the Research Laboratory can be subdivided into three basic functions as follows:

1) To execute a continuing program of research and development relative to all phases of highway engineering involving design, construction, and maintenance.

2) To provide a technical service agency for the Department.

3) Acceptance testing of construction materials for specification verification.

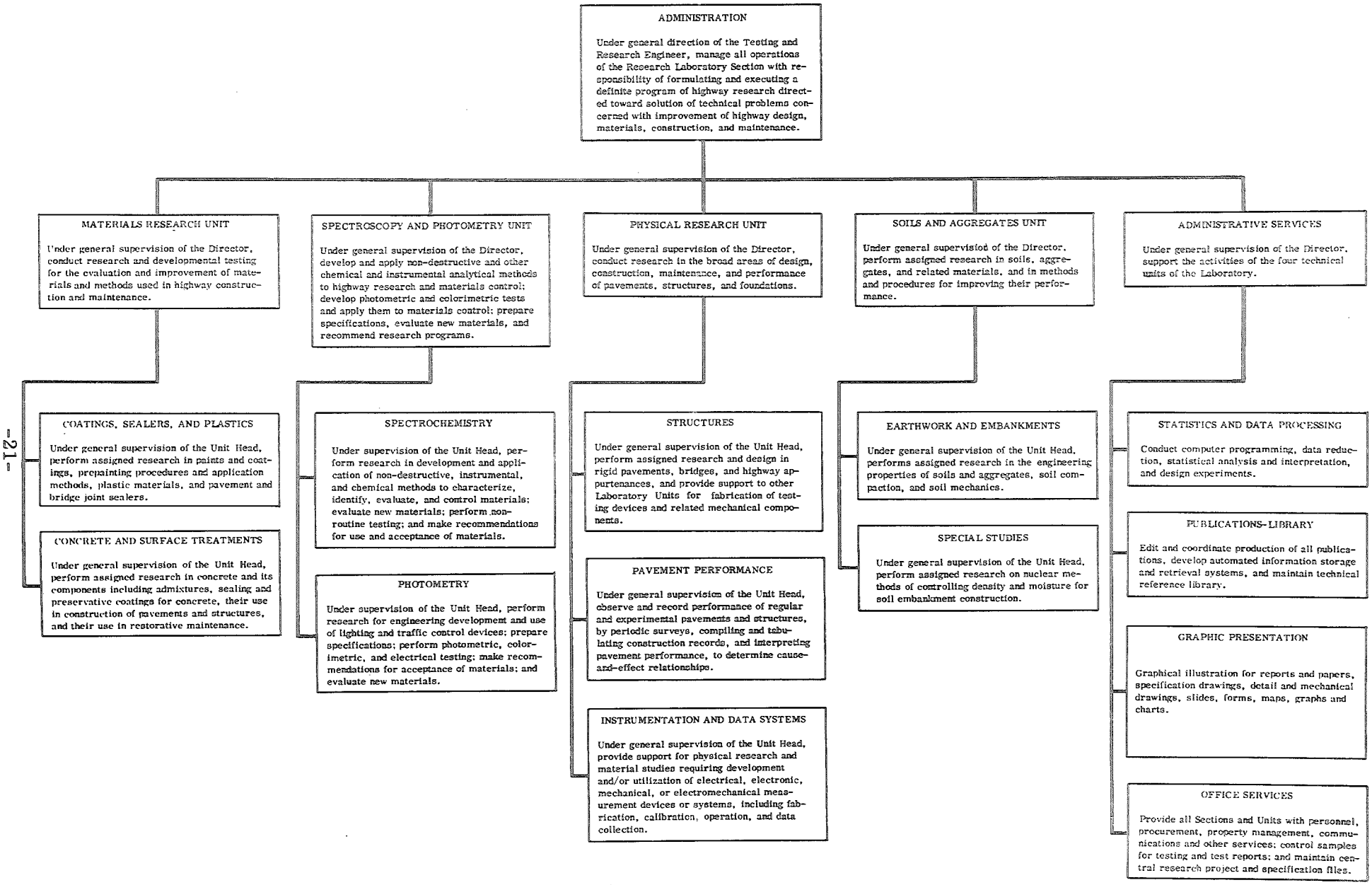
The research and development activities are subdivided into Departmental oriented studies and Federally sponsored Highway Planning and Research Projects, the latter of which encompasses studies of national highway interest. Departmental studies originate through requests from the Divisions and through the Department's Research Policy and Pavement Selection Committees. In addition, the Laboratory conducts necessary research and evaluations and prepares recommendations for new materials, devices and products submitted for study through the Department's New Materials Committee. It is the function of the Research Laboratory to prepare the research study proposal, conduct the necessary experimentation and analytical development required, and to write and publish the final reports.

The technical service aspect includes participation of laboratory personnel on Special Department Study Committees, participation and dissemination of current research activities through membership in various national technical committees and societies, preparation of new and revision of existing Departmental construction and material specifications, and to conduct and evaluate various short duration studies, and special tests for other State agencies as well as for the Highway Department. Also included in this function is a continuing program of pavement performance measure-

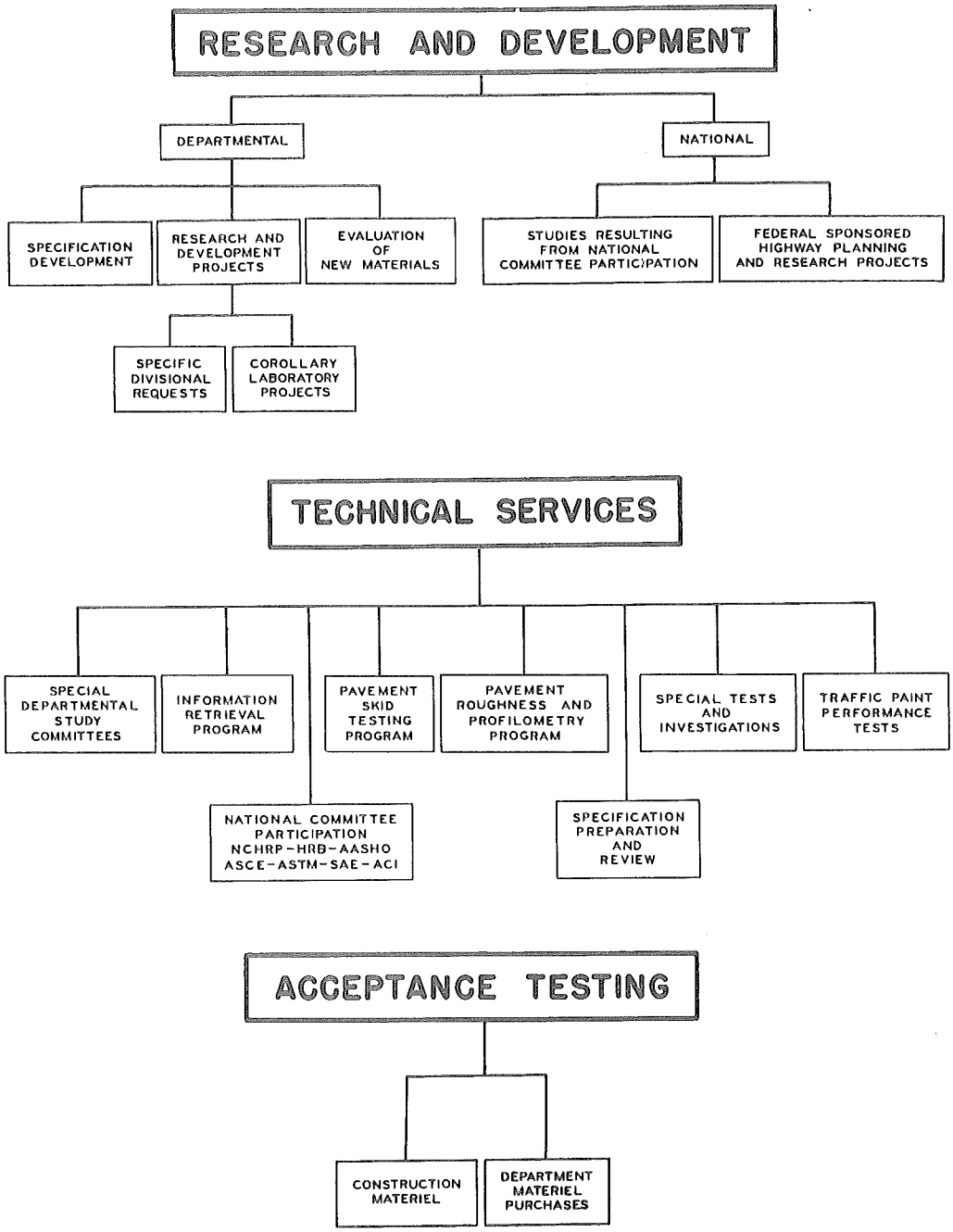
ments, involving the use of Laboratory developed instrumentation for the determination of the wet coefficient of sliding friction of pavement surfaces for use in connection with skid proofing material evaluation, and the programming of pavement resurfacing in areas of high accident occurrence. Two other pieces of equipment, the roughometer and profilometer are used for the determination and comparison of pavement surface roughness and rideability characteristics, and the determination of the serviceable life of these pavements.

The third function of the Laboratory is to perform the numerous physical and chemical tests required in the Department's construction and materials specifications for job use. These materials include concrete cores, paints and pigment, cable and wire, neoprene, rubber and two-component joint seal, glass beads, epoxies, lubricants, reflectorized buttons and sheeting, concrete curing compounds, traffic control devices, weld prequalification, luminaires, signs and light standards, and various miscellaneous items.

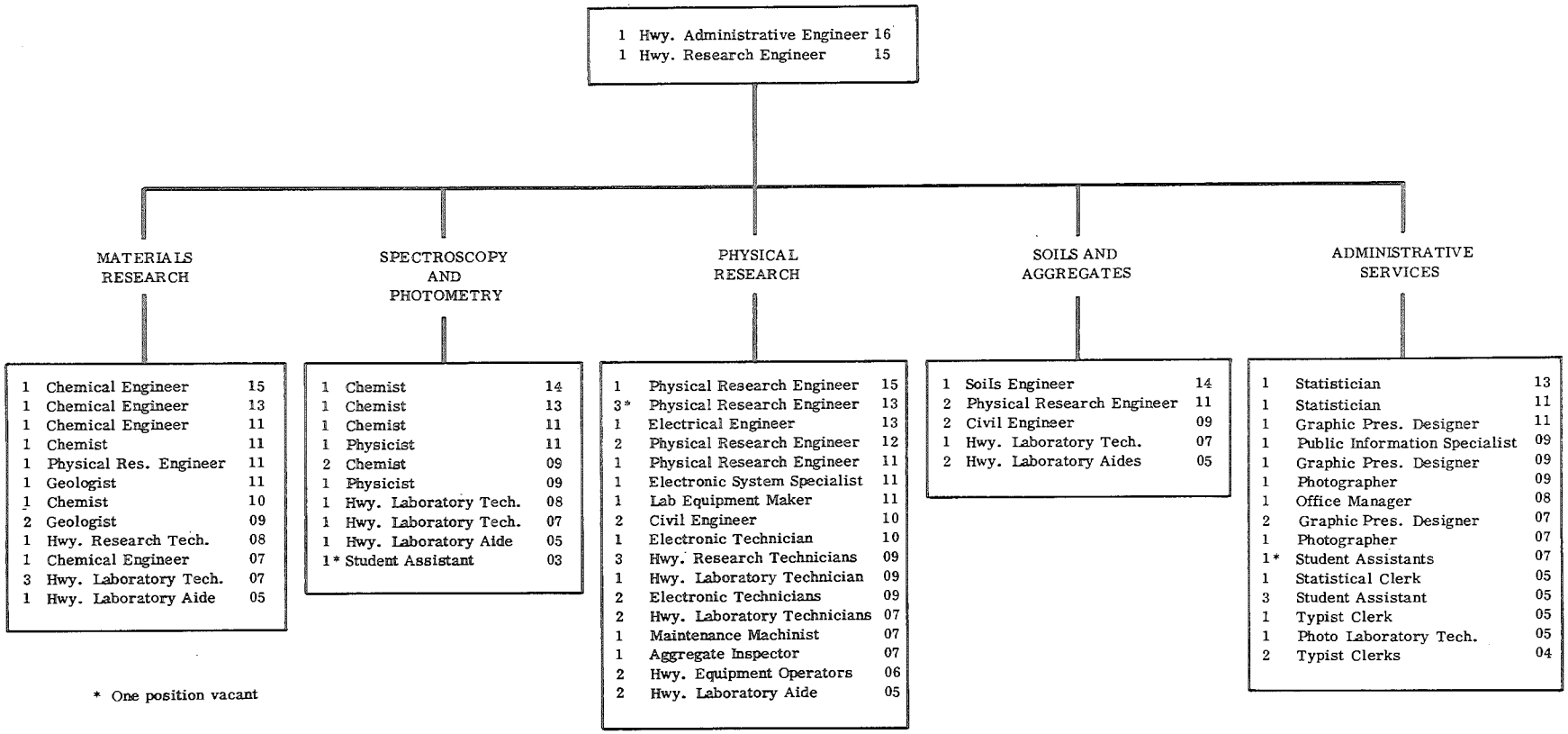
A summary of the operation and function of the Research Laboratory is depicted in the following organization chart.



RESEARCH LABORATORY ORGANIZATION CHART



RESEARCH LABORATORY FUNCTIONS



* One position vacant

RESEARCH LABORATORY PERSONNEL LEVELS, CLASSES, AND DISTRIBUTION

DESCRIPTION

The Highway Testing Laboratory and Research Laboratory Building should be a fire resistant building with the basement area at grade at various locations as shown on the plans if the terrain and soil conditions are suitable.

Of utmost importance in the design of this laboratory building, aside from efficiency of operation, is durability, adequate heating and cooling, control of foreign materials in the air, an adequate exhaust system, reduction of vibration caused by heavy testing equipment, and availability of central compressed air, water, electricity, gas, etc., where required in laboratory areas.

An outline of the specifications for building construction is as follows:

STRUCTURE:	Reinforced concrete columns and beams with pan type concrete floors and roof deck construction
EXTERIOR:	Face brick veneer with concrete block back of masonry
ROOF:	Built-up 20 year bonded gravel roof
WINDOWS:	Aluminum sash, insulated glass (offices), screened vent sections
FLOORING:	Lobby, Offices, and Corridors: Vinyl asbestos tile. Toilets, Lavatories, and Service Rooms: Ceramic (Quarry) tile Laboratories - General: Elastoplastic or Vinyl Seamless flooring Laboratories - Testing, Aggregates, and Heavy Equipment, including traffic corridors: Concrete with hardener finish
INTERIOR WALLS:	Offices: Movable Metal Partitions Laboratory and Storage Areas: Concrete tile fire-wall construction Toilets and Service Rooms: Ceramic tile
CEILINGS:	Suspended accoustical and perforated metal panels

PLUMBING:	Standard plumbing and sanitary fixtures, separate storm and sanitary sewers (Special fixtures, traps, and drains for laboratories)
HEATING AND AIR CONDITIONING:	Forced air heating, ventilating, and air conditioning; zoned and separate units for special applications and exhausts
ELECTRICAL:	Standard power and lighting systems; fluorescent fixtures flush and recessed in suspended ceiling strips. In the outdoor testing area, provision should be made for 115 volt electrical power source
SPECIAL REQUIREMENTS:	Compressed air supply Natural gas supply Three-phase electrical service Fume hoods and exhaust systems Dust collecting and exhaust systems Tempered fresh air make-up heating units Summer-winter controlled temperature and humidifying unit 100% humidifying systems Deep freeze systems Isotope storage Storage for paints and explosives

There will be a heated corridor between the Testing Laboratory and Research Laboratory Building and the Duplicating and Photography Building to facilitate easy transporting of photographic equipment and/or research projects to be photographed between the two buildings.

In the preliminary planning for this facility and other studies of the Testing Laboratory and the Research Laboratory, it became evident that three things must be considered before a determination can be made between a two story or a single story building.

1. Much of the heavy equipment must be set on isolated bases to absorb the shock or conversly eliminate any vibration being transmitted to sensitive equipment. This can best be accomplished on floors on grade.

2. Most of the laboratories require extensive exhaust systems which can best be provided in a one story building.

3. The proposed site for the Testing and Research Laboratory Building may preclude the concept of a two story building with the upper story at grade in the front of the building and the lower level at grade at the rear of the building because of soil conditions and the terrain.

PROPOSED PLANS--TESTING LABORATORY

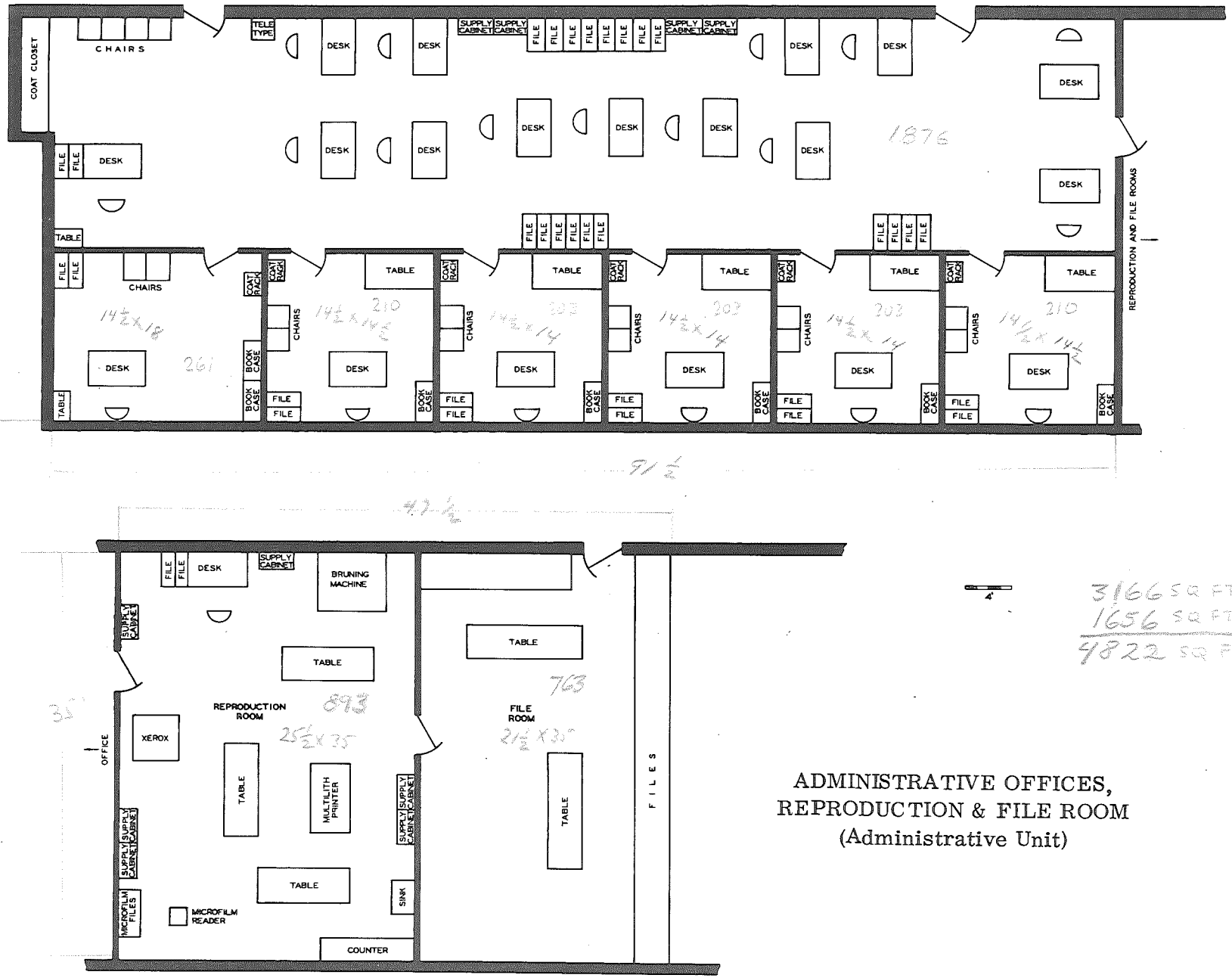
Detailed Plans

The following plans are the detailed floor plans of each individual laboratory or other facility with all major equipment items shown.

In the initial planning stages this list will be carefully reviewed to determine items of equipment that have been replaced, items that are obsolete and should be purchased new for economy reasons rather than be moved, and/or are partially or entirely the property of the University of Michigan.

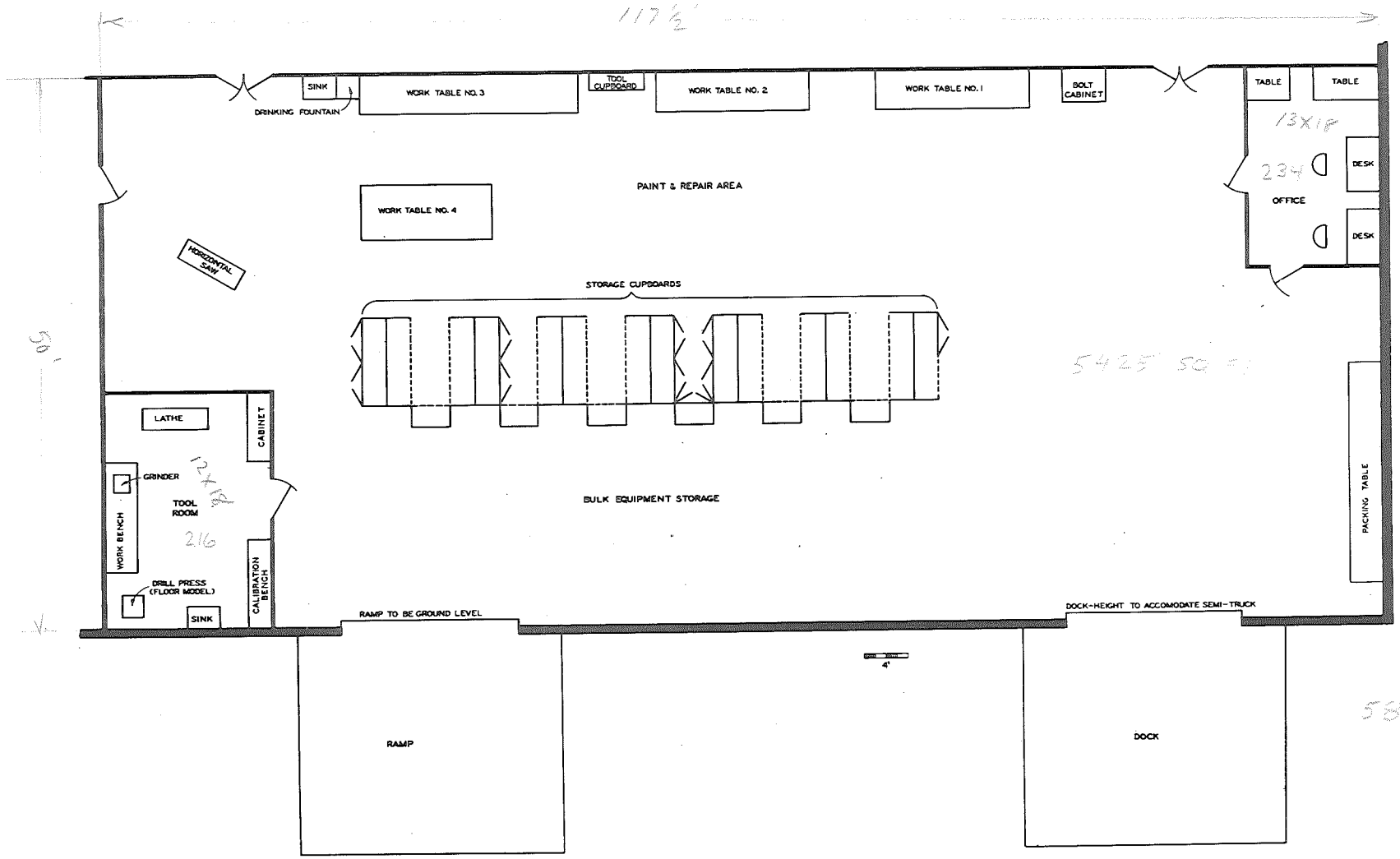
Utility Plans

Following the detailed floor plans are the tabulations of the special requirements for the various administrative and testing laboratory units.

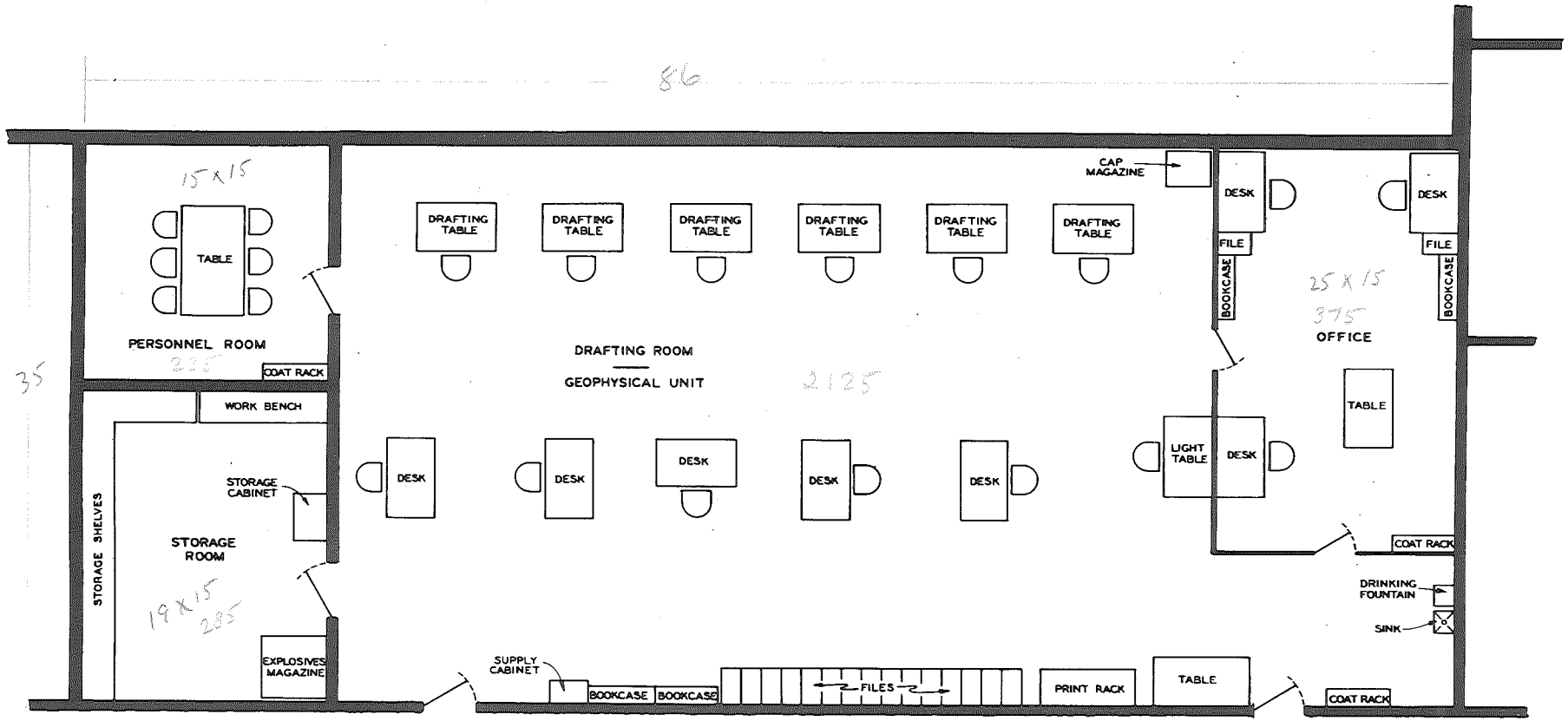


3166 SQ FT.
1656 SQ FT.
4822 SQ FT.

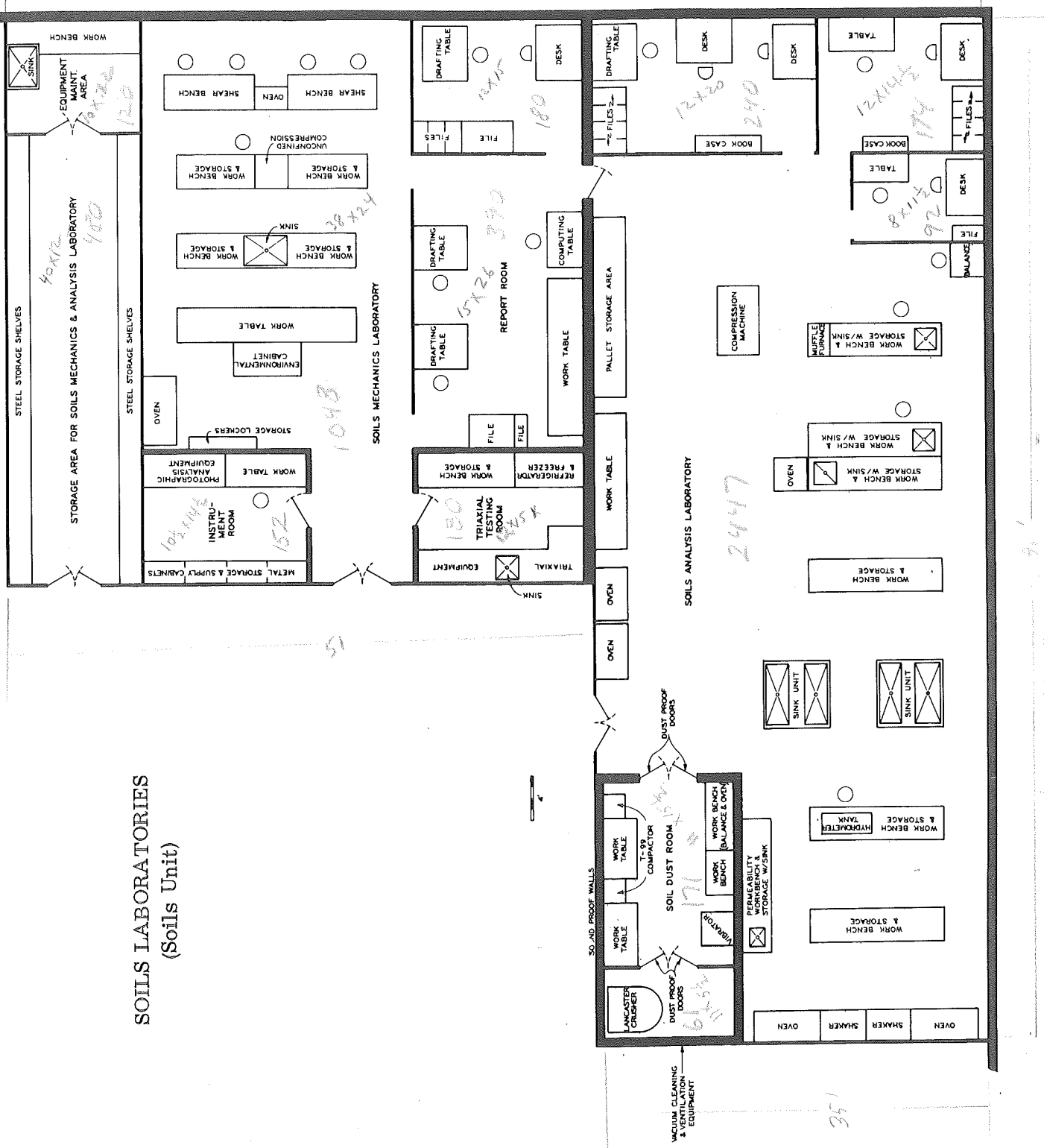
ADMINISTRATIVE OFFICES,
REPRODUCTION & FILE ROOM
(Administrative Unit)



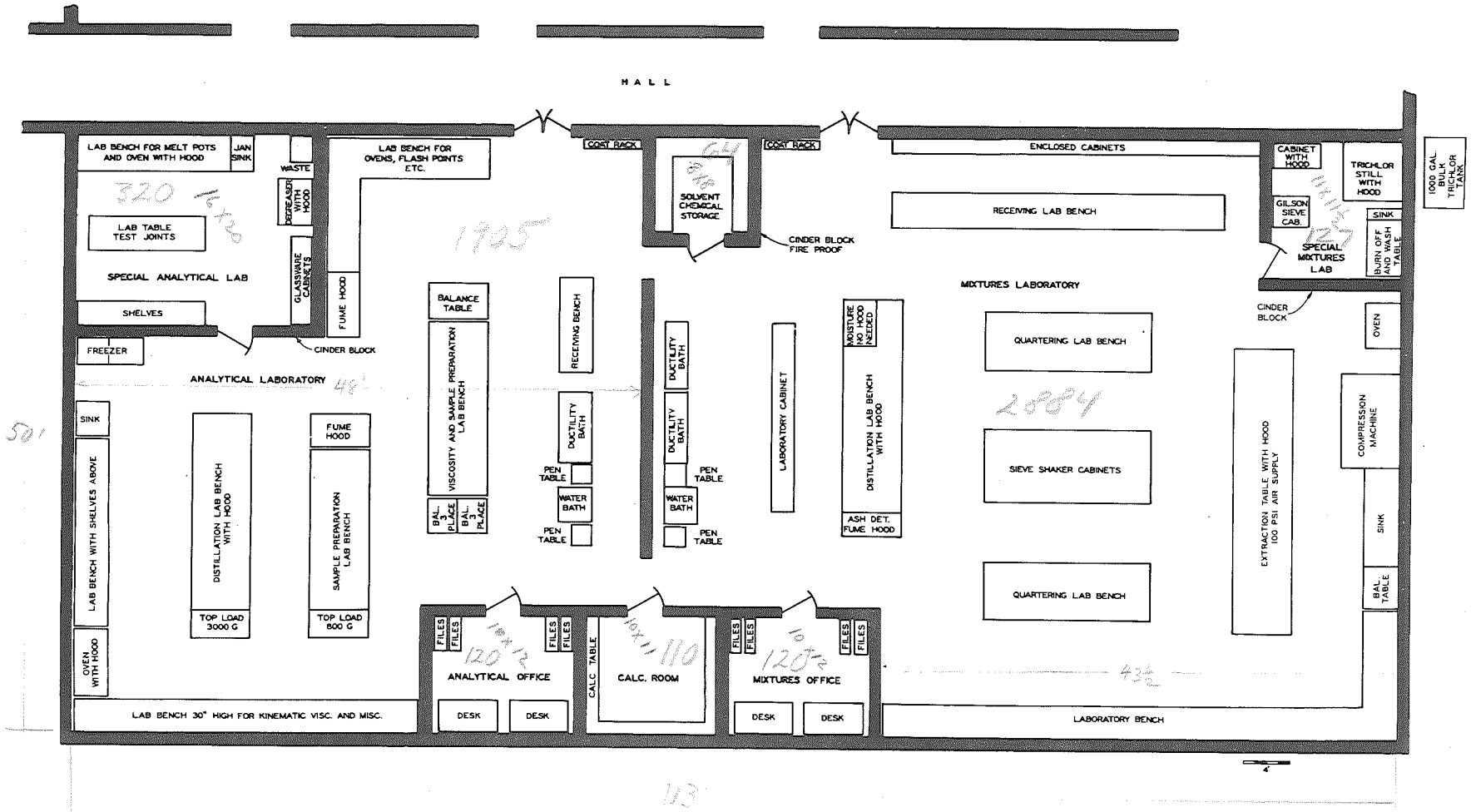
FIELD EQUIPMENT SHOP
(Administrative Unit)



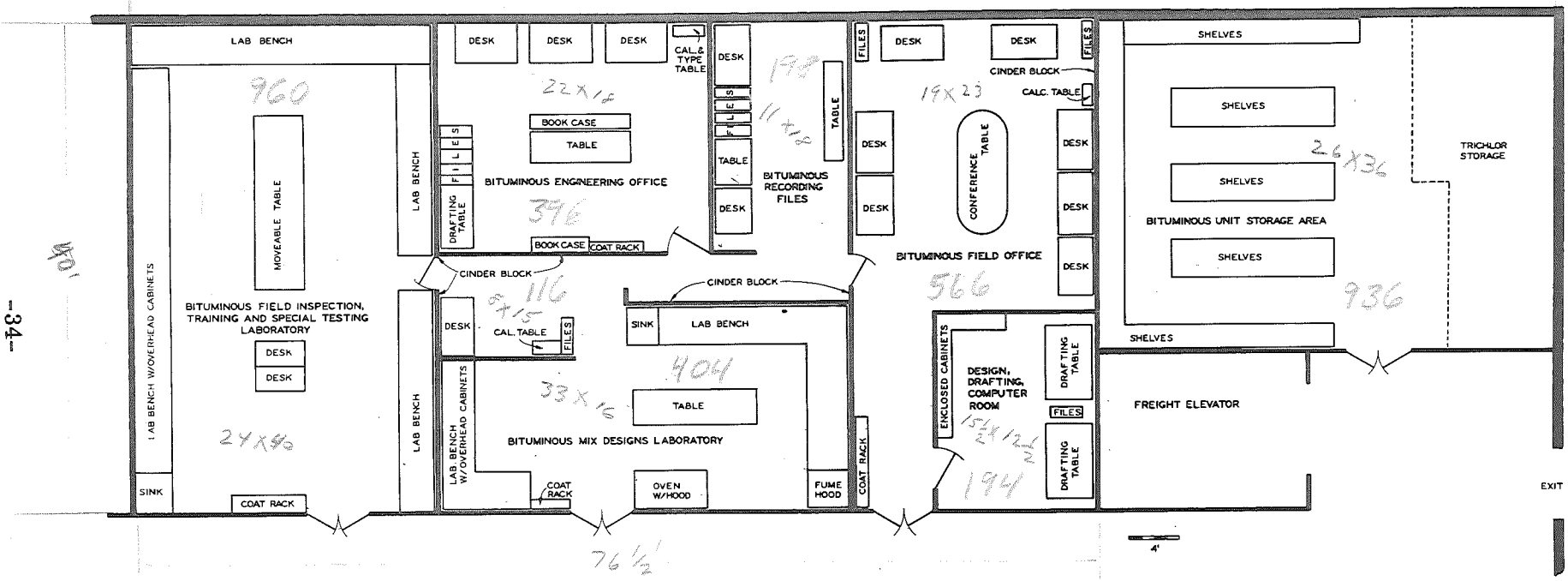
GEOPHYSICAL UNIT



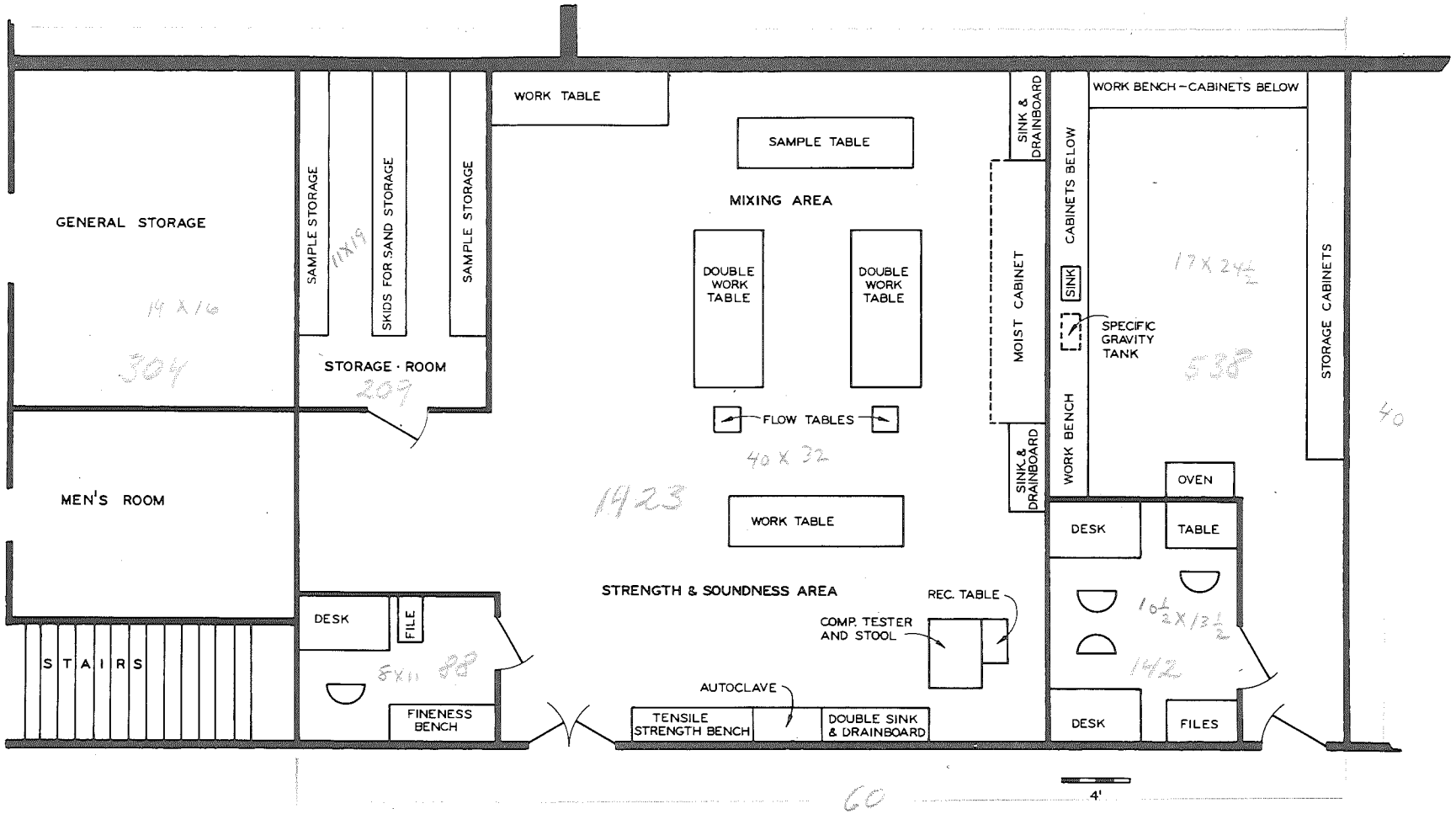
SOILS LABORATORIES
(Soils Unit)



BITUMINOUS LABORATORIES
(Bituminous Unit)

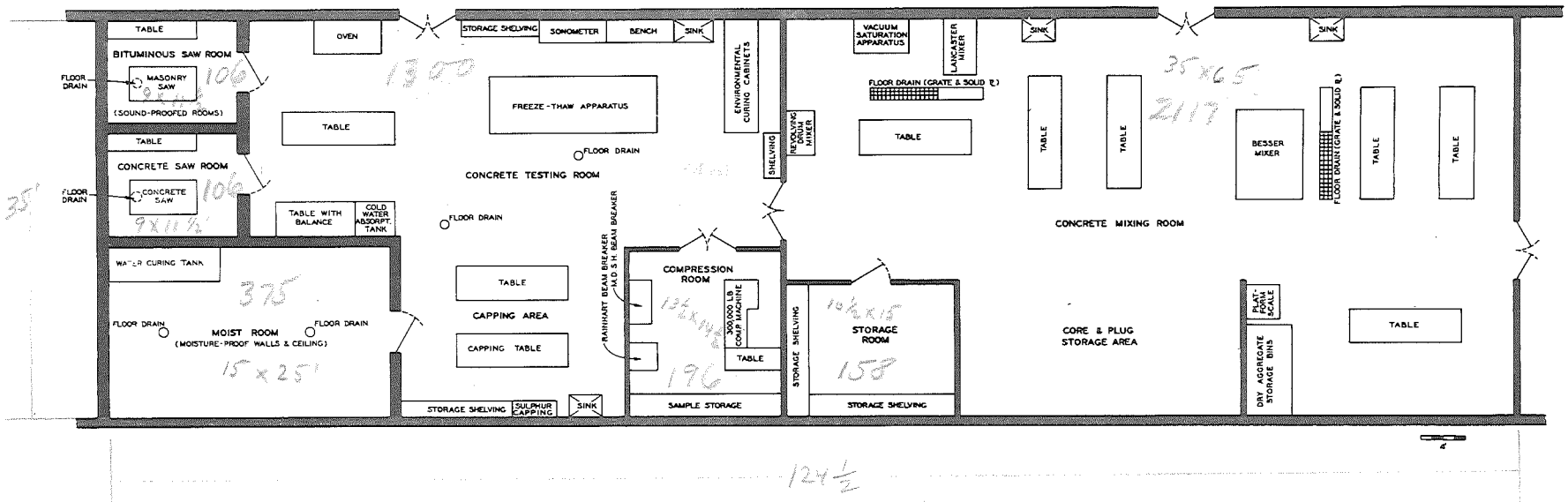


BITUMINOUS FIELD INSPECTION & INVESTIGATION
(Bituminous Unit)



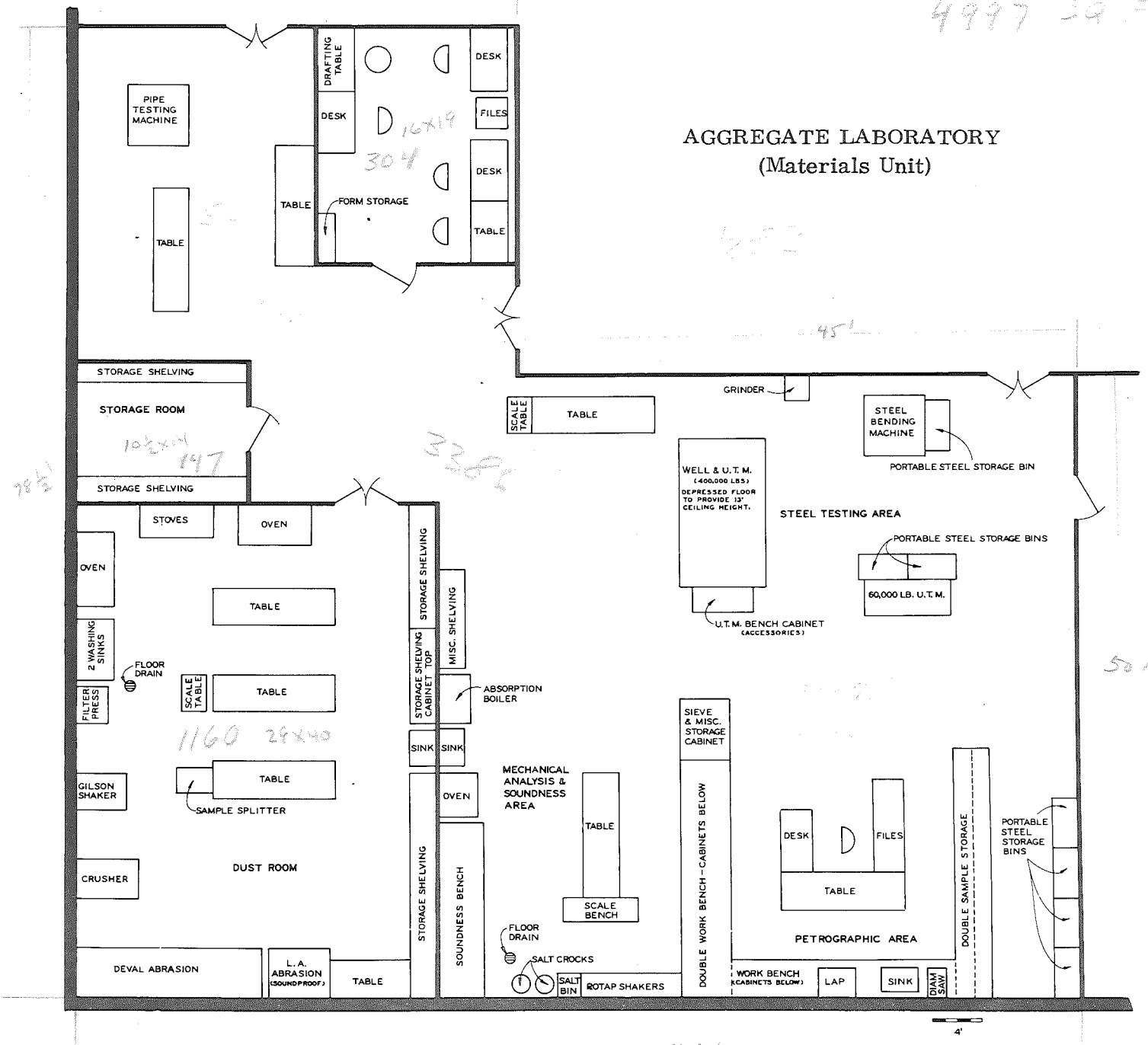
CEMENT & CONCRETE MIX DESIGN LABORATORIES
(Materials Unit)

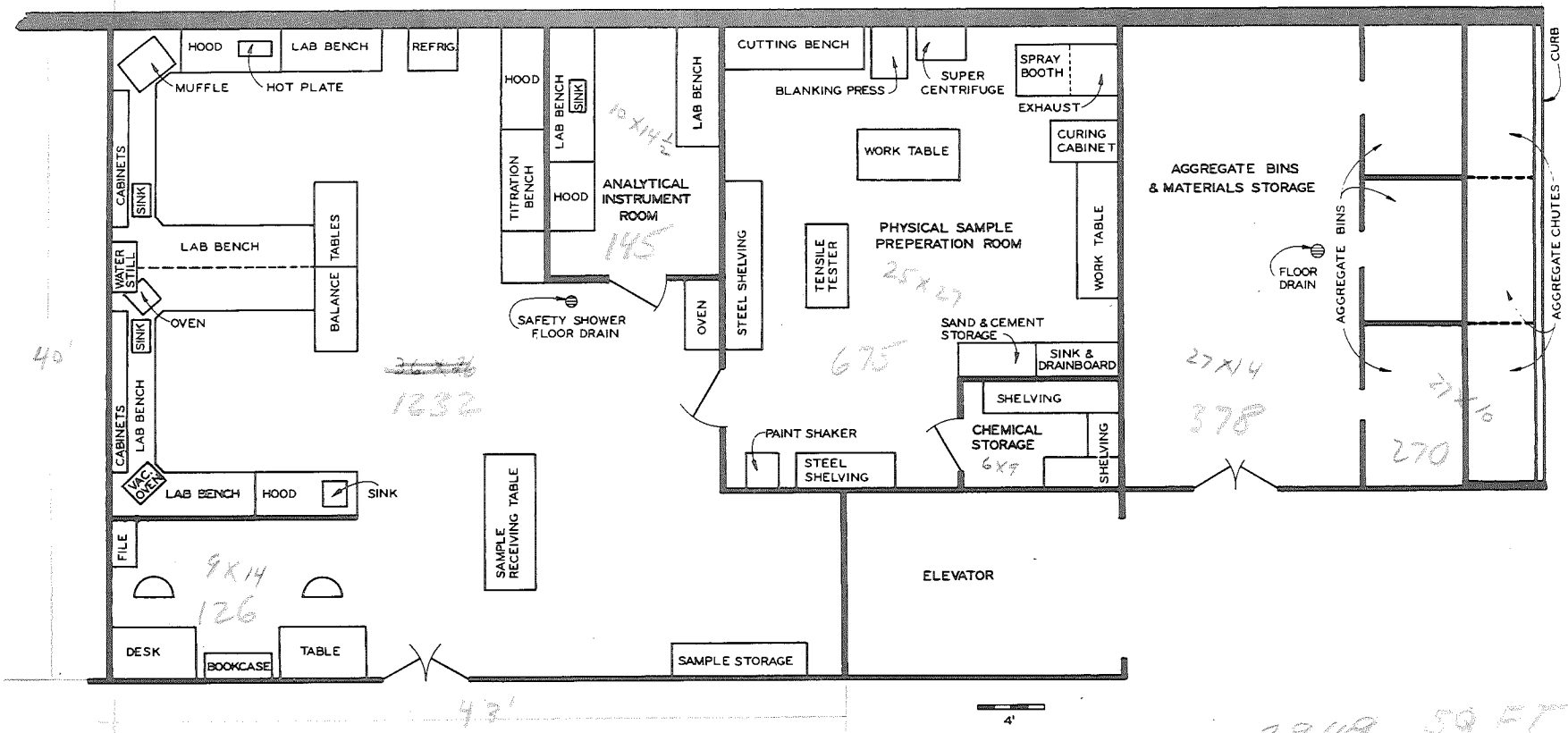
2704 SQ FT



CONCRETE LABORATORY
(Materials Unit)

AGGREGATE LABORATORY
(Materials Unit)





CHEMICAL LAB & AGGREGATE STORAGE
(Materials Unit)

ADMINISTRATIVE UNIT

AREA	ITEM	Quantity	ELECTRICITY											LIGHT	WATER			DRAINS			Compressed Air	Gas
			Voltage						Current			Power	Duty									
			D.C.	A.C.	Phase	115	230	440	Full Load	Locked Rotor	Fused Amps	Horse Power	Estimated hrs/week	Level in f.c.	Hot	Cold	Distilled	Covered	Open	Sump		
Main Office																						
General	Duplex Outlets	21		X	1	X					20			200								
Supervisors	Duplex Outlets	24		X	1	X					20			150								
Reproduction Rm	Duplex Outlets	9		X	1	X					20			200								
Xerox	Outlet	1		X	1	X					30											
Multilith	Outlet	1		X	1	X					30											
Bruning	Outlet	1		X	1		X				15											
Sink		1													X	X		X				
File Room	Duplex Outlets	7		X	1	X					20											
Equipment Shop																						
Office	Duplex Outlets	5		X	1	X					20			200								
Shop	Duplex Outlets	18		X	1	X					20			150								
	Bandsaw	1		X	1	X					20											
	Work Table #4	1		X	1	X					20											
	Sink														X	X		X				
	Drink. Fountain															X		X				
	Work Table #3																				X	X
Tool Room	Duplex Outlets	5		X	1	X					20			200								
	Work Bench																				X	X
	Calib. Bench																				X	X
	Sink														X	X		X				

GEOPHYSICAL UNIT

AREA	ITEM	Quantity	ELECTRICITY											LIGHT	WATER			DRAINS			Compressed Air	
			Voltage						Current			Power	Duty									
			D.C.	A.C.	Phase	115	230	440	Full Load	Locked Rotor	Fused Amps	Horse Power	Estimated hrs/week	Level in f.c.	Hot	Cold	Distilled	Covered	Open	Sump		Gas
Geophysical Unit																						
Office	Duplex Outlets	4		X	1	X					20			100								
Drafting Room	Duplex Outlets	33		X	1	X					20			200								
	Drinking Fountain	1														X		X				
	Sink	1													X	X		X				
Personnel Room	Duplex Outlets	3		X	1	X					20			100								
Storage Room	Duplex Outlets	2		X	1	X					20			100								

SOIL UNIT

AREA	ITEM	Quantity	ELECTRICITY											LIGHT	WATER			DRAINS			Compressed Air	Gas
			Voltage						Current			Power	Duty									
			D.C.	A.C.	Phase	115	230	440	Full Load	Locked Rotor	Fused Amps	Horse Power	Estimated hrs/week	Level in f.c.	Hot	Cold	Distilled	Covered	Open	Sump		
Soils Analysis Sub-Unit																						
Office (Main)	Duplex Outlets	7		X	1	X					15			200								
Office (Corner)	Duplex Outlets	5		X	1	X					15			200								
Office (Small)	Duplex Outlets	4		X	1	X					15			200								
Special Requirements: Bank type walls around offices with lower 4-ft solid and glass to ceiling (semi-soundproof and dust proof).																						
Soil Comp. Room	Duplex Outlets	9		X	1	X					20			100								
	Duplex Outlets	2		X	1		X															
	Lancaster Mixer	1		X	3			X	6.7													
Special Requirements: Soundproof walls with sound absorbent interior surfaces. Exhaust ventilation. Ceiling Height 10 ft minimum over T-99 compactors or provision for hole for upper end of rammer.																						
Laboratory	Duplex Outlets	21		X	1	X					20			100								
	Duplex Outlets	5		X	3		X															
	Sink	4										Special Sand Traps			X	X		X				
	Sink	4	(Multiple Spray Heads)												X	X		X				
	Hydrometer Tank	1													X	X	X	X				
	Air	5																			X	
	Gas	4																				
	Duplex Outlets	1		X	1		X															
Special Requirements: Distilled water faucet 20 inches above bench at hydrometer tank. Aspirators at two sinks shown. 3 double doors for fork lift access to outside hall and into dust rooms. Open space over 10 ft wide past pallet storage area for fork lift truck operation and open test area.																						

SOIL UNIT

AREA	ITEM	Quantity	ELECTRICITY											LIGHT	WATER			DRAINS			Compressed Air	
			Voltage						Current			Power	Duty									
			D.C.	A.C.	Phase	115	230	440	Full Load	Locked Rotor	Fused Amps	Horse Power	Estimated hrs/week	Level in f.c.	Hot	Cold	Distilled	Covered	Open	Sump		Gas
Soil Mechanics Sub-Unit																						
Office	Duplex Outlets	4		X	1	X					15			200								
Report Room	Duplex Outlets	7		X	1	X					15			200								
Triaxial	Duplex Outlets	5		X	1	X					15			100								
	Duplex Outlets	1		X	1		X				40											
	Sink	1													X	X		X				
	Gas	1																				X
	Air	2																			X	
Instrument	Duplex Outlets	7		X	1	X					15			100								
	Gas	1																				X
	Air	1																			X	
Laboratory	Duplex Outlets	18		X	1	X					15			100								
	Gas	1																				X
	Air	1																			X	
	Sink	1													X	X		X				
	Oven	1		X	3		X		20													
Storage	Duplex Outlets	8		X	1	X					15			50								
	Duplex Outlets	1		X	1		X				40											
	Sink	1													X	X		X				
	Gas	1																				X
	Air	1																			X	

Special Requirements: Bank type walls with lower 4-ft solid and glass to ceiling(semi-soundproof) separating office and report room from laboratory proper. Double doors where shown to permit access by fork lift truck, one door 3 ft and other 2 ft. Shear tables(benches) must be very sturdy and provide comfortable space for operators knees underneath. Sink in storage room-low, janitor type for rough washing. All faucets mixer type.

BITUMINOUS UNIT

AREA	ITEM	Quantity	ELECTRICITY											LIGHT	WATER			DRAINS			Compressed Air	Gas
			Voltage						Current			Power	Duty									
			D.C.	A.C.	Phase	115	230	440	Full Load	Locked Rotor	Fused Amps	Horse Power	Estimated hrs/week	Level in f.c.	Hot	Cold	Distilled	Covered	Open	Sump		
Bituminous Laboratory																						
Mixtures Lab.	Duplex Outlets	43		X	1	X					15			100	X	X		X			X	X
	Ro-tap	4		X	1		X		3													
	Comp. Machine	1		X			X		5													
	Despatch Oven	1		X	1		X		19.9													
	Muffle	1		X	1		X		22													
	Centrifuge	3		X	1	X			3													
	Hot Plate	2		X	1	X			16.4													
	Window Fan	1		X	1	X			2.6													
	Desk Fan	1		X	1	X			2													
	Metler Bal.	2		X	1	X			0.2													
	Heating Mantle	5		X	1	X			7.5													
	Heating Mantle	6		X	1	X			2.4													
	Heating Mantle	5		X	1	X			1.3													
	Hand Saw	1		X	1	X			10													
	Drill	1		X	1	X			3													
	Sabre Saw	1		X	1	X			2.5													
	Analytical Bal.	1		X	1	X			0.1													
	Duct. Machine	2		X	1	X			2.3													
	Penetration Bath	1		X	1	X			10													
Special Requirements: 100 psi air at a rate of 144 CFM free air and floor covering resistant to trichloroethylene.																						
Bituminous Laboratory																						
Mixtures Office	Duplex Outlets	3		X	1	X					15			100								
Analytical	Duplex Outlets	3		X	1	X					15			100								
Office																						
Calc. Room	Duplex Outlets	6		X	1	X					15			100								
	Calculators	3		X	1	X			1													
Sp. Mixtures	Super Centrifuges	3		X	1	X								70	X	X		X			X	
Lab.	Gilson Sieve	1		X	1	X			3													
	Duplex Outlets	5		X	1	X					15											
Special Requirements: Steam for trichloroethylene still, outside ventilation, and concrete floor.																						
Sp.Analytical	Duplex Outlets	4		X	1	X					15			70	X	X		X				
Lab.	Melting Pots	1		X	1	X			11													
	Degreaser	1		X	1	X			15													
Special Requirements: Outside ventilation and concrete floor.																						
Solvent Storage	Duplex Outlets																					
Special Requirements: Outside ventilation and concrete floor must be fireproof.																						

BITUMINOUS UNIT

AREA	ITEM	Quantity	ELECTRICITY												LIGHT	WATER			DRAINS			Compressed Air	Gas
			Voltage						Current			Power	Duty										
			D.C.	A.C.	Phase	115	230	440	Full Load	Locked Rotor	Fused Amps	Horse Power	Estimated hrs/week		Level in f.c.	Hot	Cold	Distilled	Covered	Open	Sump		
Bituminous Laboratory																							
Analytical	Duplex Outlets	52		X	1	X					15				100	X	X	X	X			X	X
	Muffle	1		X	3		X		15.45														
	Flow Oven	1		X	1	X			6														
	Std.Loss Oven	1		X	1	X			7.8														
	Thin Film Oven	2		X	1	X			18														
	Drying Oven	1		X	1	X			7.2														
	Despatch Oven	1		X	1		X		20														
	Kinematic Oven	1		X	1	X			11														
	Cleaning Oven	1		X	1	X			14														
	Float Test Water Bath	1		X	1	X			9														
	WOA Bath	1		X	1	X			14.5														
	Penetration Bath	1		X	1	X			10														
	Trichlor. Still	1		X	1	X			10														
	Cold Finger	1		X	1	X			3														
	Floor Fan	2		X	1	X			1														
	Window Fan	1		X	1	X			2.6														
	Duct. Machine	2		X	1	X			2.3														
	Hot Plate	1		X	1		X		14.5														
	Hot Plate	3		X	1	X			14														
	Hot Plate	1		X	1	X			5.5														
	Kinematic	2		X	1	X			10														
	Saybolt	2		X	1	X			6.5														
	Vac. Pump	1		X	1	X			6.4														
	Spot Test Bath	2		X	1	X			5														
	Freezer(-20)	1		X	1	X						0.5											
	Freezer(0)	1		X	1	X			5.5														
	Analytical Bal.	2		X	1	X			0.1														
	Top Loading Bal.	2		X	1	X			0.2														
	Cold Temp.Bath	1		X	1	X			13														

Special Requirements: Floor covering resistant to trichloroethylene.

BITUMINOUS UNIT

AREA	ITEM	Quantity	ELECTRICITY											LIGHT	WATER			DRAINS			Compressed Air	Gas
			Voltage						Current			Power	Duty									
			D.C.	A.C.	Phase	115	230	440	Full Load	Locked Rotor	Fused Amps	Horse Power	Estimated hrs/week	Level in f.c.	Hot	Cold	Distilled	Covered	Open	Sump		
Bituminous Laboratory																						
Engr. Office	Duplex Outlets	5		X	1	X					15			100								
Field Office	Duplex Outlets	5		X	1	X					15			100								
Drafting Room	Duplex Outlets	3		X	1	X					15			200								
Recordings Room	Duplex Outlets	4		X	1	X					15			100								
Field Insp. Lab.	Duplex Outlets	14		X	1	X					15			100	X	X		X			X	X
Mix Design Lab.	Duplex Outlets	12		X	1	X					15			100	X	X		X			X	X
	Water Bath	1		X	1	X			25													
	Marshall Breaker	1		X	1	X			5			1/4										
	Despatch Oven	1		X	1		X		20													
	Marshall Comp.	1		X	1	X			5.6			1/4										
	Calculator	1		X	1	X			1													
- Special Requirements: Floor covering resistant to trichloroethylene.																						
Storage Room	Duplex Outlets	4		X	1	X					15			70								
- Special Requirements: Floor covering.																						

AREA	ITEM	Quantity	ELECTRICITY											LIGHT	WATER			DRAINS			Compressed Air	Gas
			Voltage						Current			Power	Duty									
			D.C.	A.C.	Phase	115	230	440	Full Load	Locked Rotor	Fused Amps	Horse Power	Estimated hrs/week	Level in f.c.	Hot	Cold	Distilled	Covered	Open	Sump		
Aggregate Laboratory																						
Office	Duplex Outlets	5		X	1	X					20			100								
Dust Room	Duplex Outlets	8		X	1	X					20			70							X	
	Drain, Floor	1																	X			
	Sink	1													X	X		X				
	Sink, Washing	2													X	X		X				
	Filter Press	1														X		X			X	
	Oven	2		X	3		X		20													
	Gas Stoves																					X
	Gilson Shaker	1		X	1	X			5			1/2										
	Crusher	1		X	3		X		8.2			3										
	Deval Abrasion	1		X	3		X		8			3										
	L.A.Abrasion	1		X	3		X		5			2										
Pipe Test Area &	Pipe Test. Mach.	1		X	1	X					20			70								
Storage Room	Duplex Outlets	10		X	1	X					20			50								
Special Requirements: The sample splitter, Gilson shaker and crusher to be vented for dust control. Deval and L.A. Abrasion machines to be enclosed in sound proof enclosures with venting for dust control. The gas stoves to be exhausted for heat and fumes. All sinks to have settling basins for periodic aggregate particle clean-out.																						
Mechanical Anal.	Duplex Outlets	6		X	1	X					20			100								
& Sound. Area	Duplex Outlets													(200 in area of work bench)								
	(Drop)	1		X	1	X					20											
	Drain, Floor	1																	X			
	Sink	1													X	X		X				
	Soundness Bench	1													X	X		X				
	Soundness Bath																					
	Temp. Control	1		X	1	X					20											
	Ro-tap Shakers	2		X	1		X		2			1/4										
	Absorp. Boiler	1													X	X		X			X	X
Petrogr. Area	Duplex Outlets	4		X	1	X					20			200								
	Duplex Outlets																					
	(Floor)	1		X	1	X					20											
	Sink	1													X	X		X			X	X
	Lap	1		X	1	X					20					X		X				
Special Requirements: Sink and lap to have settling tank for periodic clean-out of aggregate particles.																						
Steel Testing	Duplex Outlets	8		X	1	X					20			70							X	
Area	Duplex Outlets																					
	(Floor)	1		X	1	X					20											
	U.T.M.(400,000)	1		X	3		X		20.5													
	U.T.M.(60,000)	1		X	3		X		20.5													
	Steel Bend.Mach.	1		X	3		X		25			5										
Special Requirements: 400,000 lb. U.T.M. to be placed in a well with ample walking and maneuverability around the machine, to provide 13-ft. ceiling height.																						

MATERIALS UNIT

AREA	ITEM	Quantity	ELECTRICITY											LIGHT	WATER			DRAINS			Compressed Air	Gas
			Voltage						Current			Power	Duty									
			D.C.	A.C.	Phase	115	230	440	Full Load	Locked Rotor	Fused Amps	Horse Power	Estimated hrs/week	Level in f.c.	Hot	Cold	Distilled	Covered	Open	Sump		
Chemistry Laboratory																						
Office	Duplex Outlets	4		X	1	X					20			100								
Chemistry Area	Duplex Outlets	23		X	1	X					20			100								
	Duplex Outlets(Fl.)	1		X	1	X					20											
	Muffle	1		X	1		X		11													
	Vacuum Oven	1		X	1	X			6.5													
	Despatch Oven	1		X	1	X			16.4													
	Drying Oven	1		X	1	X			6													
	Water Still	1		X	1		X		28							X		X				
	Large Hot Plate	1		X	1		X		15													
	Centrifuge	1		X	1	X			7			3/4										
	Chemical Hood	2		X	3		X		4												X	X
	Chem.Hood/Sink	1		X	3		X		4						X	X		X			X	X
	Sink	2													X	X	X	X				
	Lab. Benches															X		X			X	X
	Refrigerator and																					
	Ice Maker	1		X	1	X					20					X						
	Safety Shower	1														X			X			
Special Requirements: Exhaust vents for all fume hoods and ovens.																						
Analytical Room	Duplex Outlets	8		X	1	X					20			100								
	Lab. Benches															X	X	X			X	X
	Sink	1													X	X		X				
	Hood	1		X	1	X					20					X		X			X	X
Physical Sample	Duplex Outlets	10		X	1	X					20			70								
Preparation Room																						
	Tensile Tester	1		X	1		X		3													
	Spray Booth	1		X	1	X			3.6												X	
	Super Centrifuge	1																			X	
	Sink	1													X	X		X				
Chem. Storage	Duplex Outlets	1		X	1	X								50								
Sam.Storage Area	Duplex Outlets	4		X	1	X					20											
Special Requirements: Sink in physical sample preparation room to have setting basin for periodic clean-out. Exhaust vents required for super centrifuge and spray booth.																						

MATERIALS UNIT

AREA	ITEM	Quantity	ELECTRICITY											LIGHT	WATER			DRAINS			Compressed Air	Gas
			Voltage						Current			Power	Duty									
			D.C.	A.C.	Phase	115	230	440	Full Load	Locked Rotor	Fused Amps	Horse Power	Estimated hrs/week	Level in f.c.	Hot	Cold	Distilled	Covered	Open	Sump		
Concrete Laboratory																						
Bituminous	Duplex Outlets	2		X	1	X					20			70								
Saw Room	Masonry Saw	1		X	3		X		25							X			X			
Concrete	Duplex Outlets	2		X	1	X					20			70								
Saw Room	Concrete Saw	1		X	3		X		25							X			X			
Special Requirements: Bituminous and Concrete Saw Rooms to be sound proofed. Both rooms to have drop cord sources of power and cold water lines dropped over head.																						
Moist Room	Vapor Proof Light																					
	and Switch	1		X	1	X																
Special Requirements: Moist Room to be temperature controlled at 73.4°F ± 3° and maintained at 95 to 100 percent relative humidity.																						
Conc.Test.Room	Duplex Outlets	10		X	1	X					20			70							X	
	Oven	1		X	3		X		20													
	Cold Water																					
	Absorp. Tank	1													X	X		X				
	Drain, Floor	2																	X			
	Sink	2													X	X		X				
	Envir. Cabinet	1		X			X		10							X		X				
	Envir. Controls	1		X		X			35													
	Freeze-Thaw Appar.	1		X	1		X		35							X		X				
Special Requirements: Sulphur capping table to be equipped with exhaust hood.																						
Compression Room	Duplex Outlets	4		X	1	X					20			100								
	Compression Mach.	1		X	3		X		20.5													
Conc.Mixing Room	Duplex Outlets	14		X	1	X					20			70							X	
Storage Room	Duplex Outlets	2		X	1	X					20			50								
	Duplex Outlets																					
	(Drop)	4		X	1	X					20											
	Vac.Saturation	1														X		X				
	Lancaster Mixer	1		X	3		X		7.8			3									X	
	Besser Mixer	1		X	3		X		21			7.5				X						
	Sink	2													X	X		X				
	Drain, Floor	2																	X			
Special Requirements: Sinks and floor drains of concrete mixing area to have special grate or solid plate covered drain and settling basins for periodic clean-out of cement and aggregate particles. Sinks also to have hot and cold hose connections. Besser mixer to have drop cold water line over mixer. Lancaster mixter to have cold water hose connection mounted adjacent to mixer.																						

AREA	ITEM	Quantity	ELECTRICITY												LIGHT	WATER			DRAINS				
			Voltage						Current			Power	Duty										
			D.C.	A.C.	Phase	115	230	440	Full Load	Locked Rotor	Fused Amps	Horse Power	Estimated hrs/week		Level in f.c.	Hot	Cold	Distilled	Covered	Open	Sump	Compressed Air	Gas
Cement Laboratory																							
Office	Duplex Outlets	3		X	1	X					20				100								
Mixing Area	Duplex Outlets	5		X	1	X					20				100							X	
	Sink & Drainboard	2														X	X		X				
	Double Work Table	2																X					
	Double Work Table Duplex Outlets on Tables	4		X	1	X					20												
	Flow Tables	2		X	1	X					20	1/20											
	Moist Cabinet	2		X	1		X				30					X	X		X			X	
Special Requirements: Sinks to have settling basins for periodic particle clean-out. If distilled water not supplied in building, an electric water still must be added. Specified as follows:																							
	Water Still	1		X	1		X				20						X		X				
Strength and Soundness Area	Duplex Outlets	4		X	1	X					20				100							X	X
	Autoclave	2		X	1	X			18														
	Double Sink	1														X	X		X				
	Comp.Tester	1		X	1		X		2.1			5											
Storage Rm.Area	Duplex Outlets	6		X	1	X					20				50								
Special Requirements: Sink to have settling basin for periodic particle clean-out. Entire Cement Lab. to be controlled at 73.4 ± 3F and 50-60 percent R.H.																							
Aggregate Bins and	Material Storage																						
	Duplex Outlets	5		X	1	X					20				50		X						
	Drain, Floor	1																		X			
Special Requirements: Exterior covered chutes for direct dumping of aggregates from trucks.																							

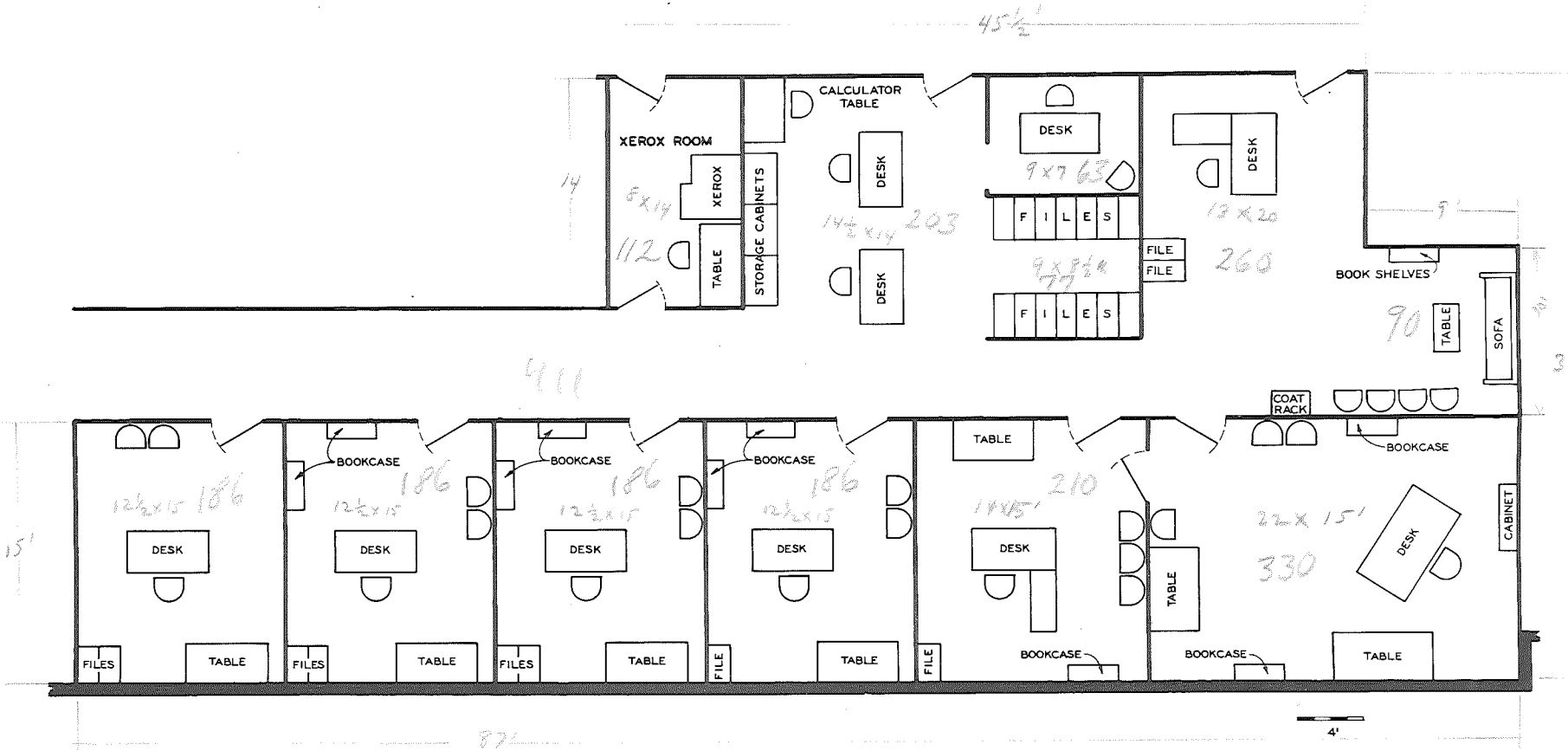
PROPOSED PLANS--RESEARCH LABORATORY

Detailed Plans

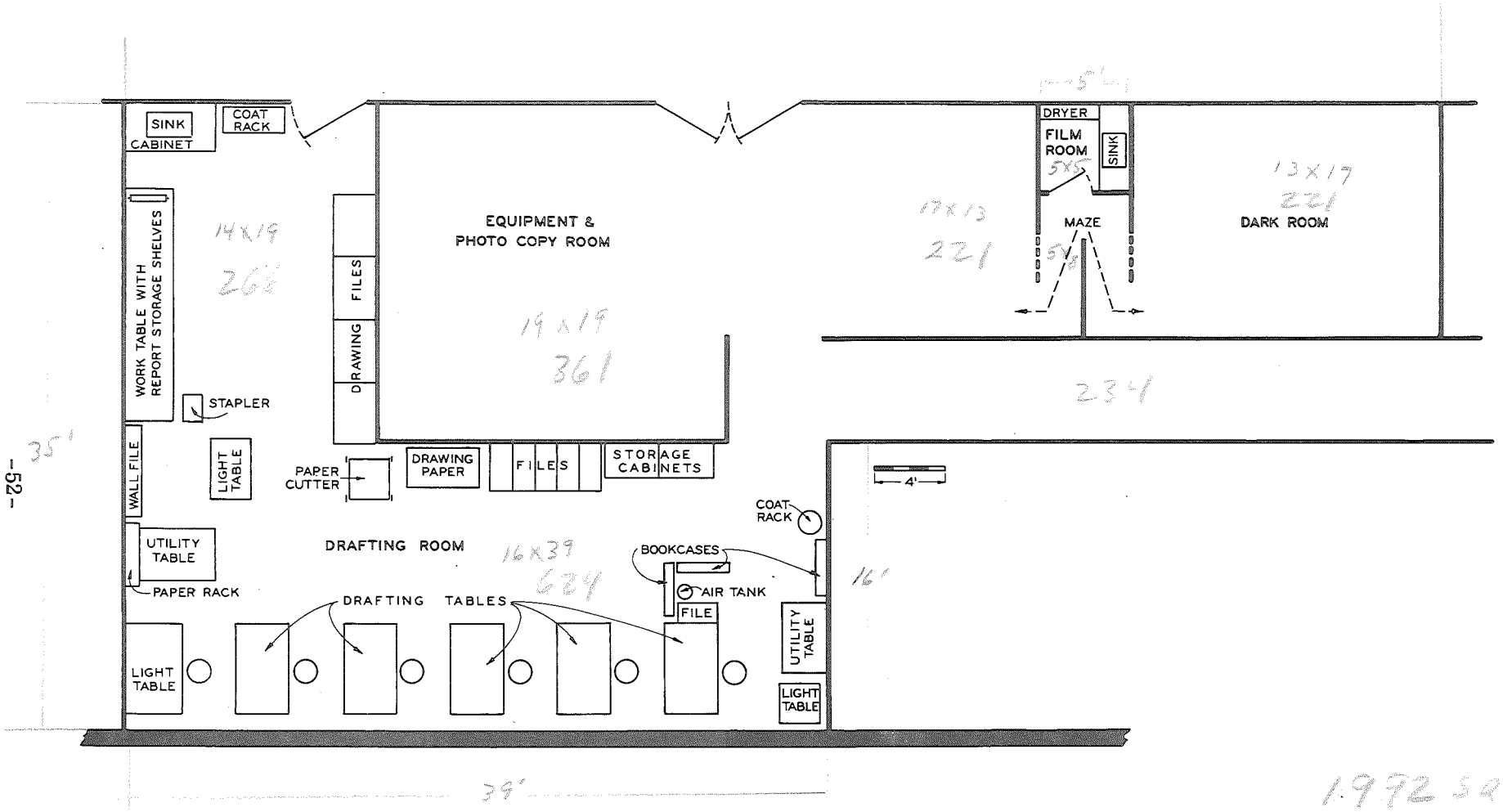
The following plans are the detailed floor plans of each individual laboratory or other facility with all major equipment items shown.

Utility Plans

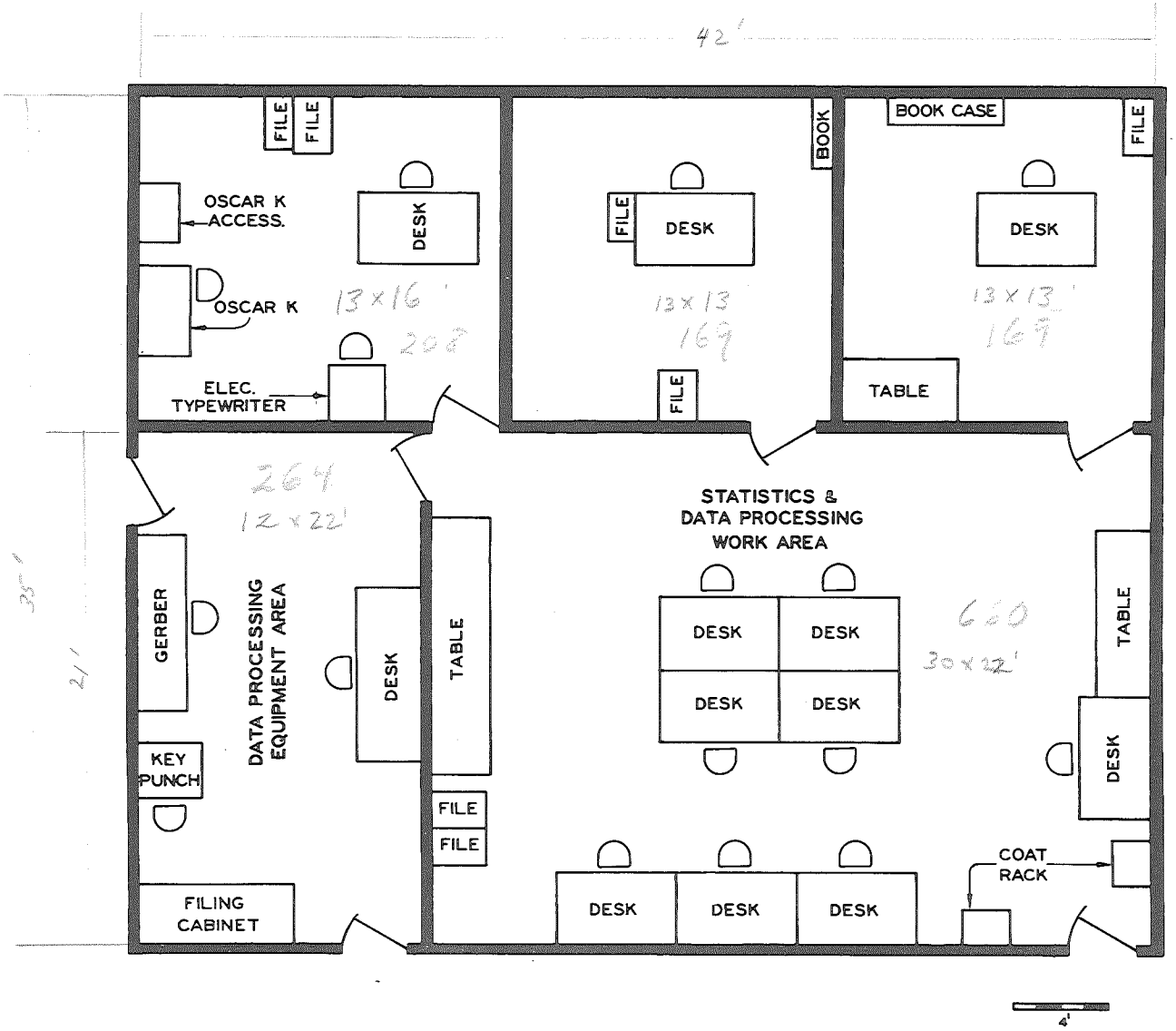
Following the detailed floor plans are the tabulations of the special requirements for the various administrative and research laboratory units.



ADMINISTRATIVE OFFICES

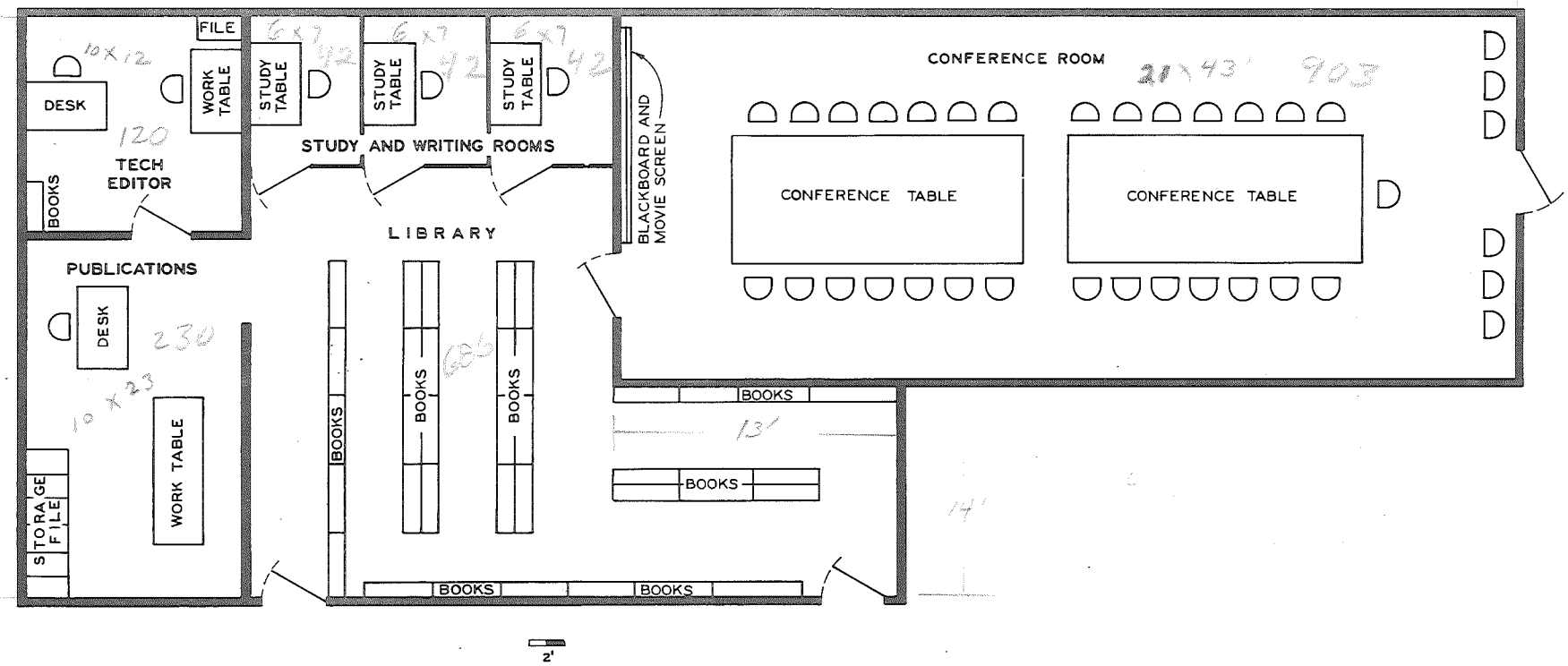


GRAPHICS UNIT WITHIN LABORATORY PHOTO AREA

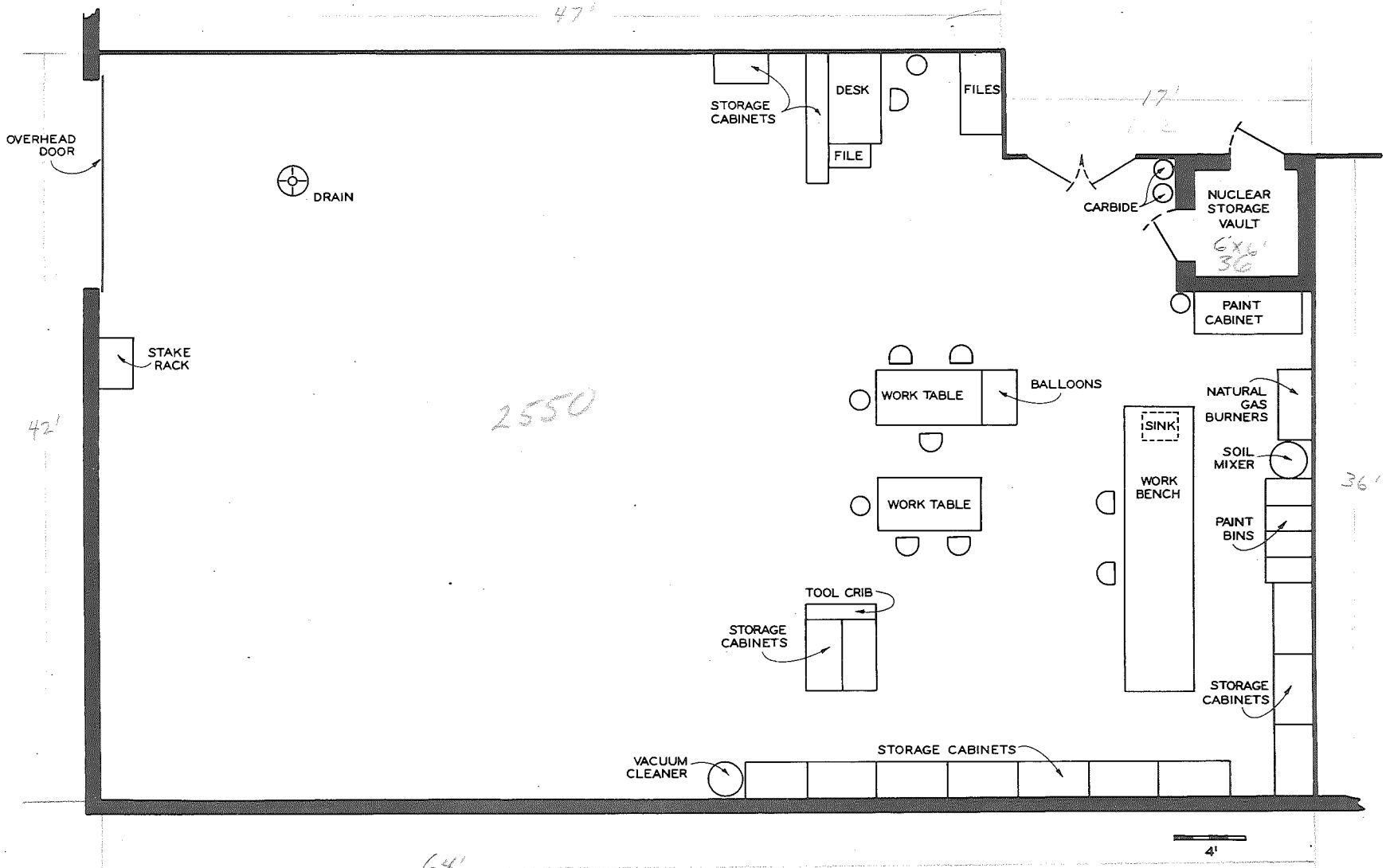


STATISTICS AND DATA PROCESSING UNIT

1470 SQ FT



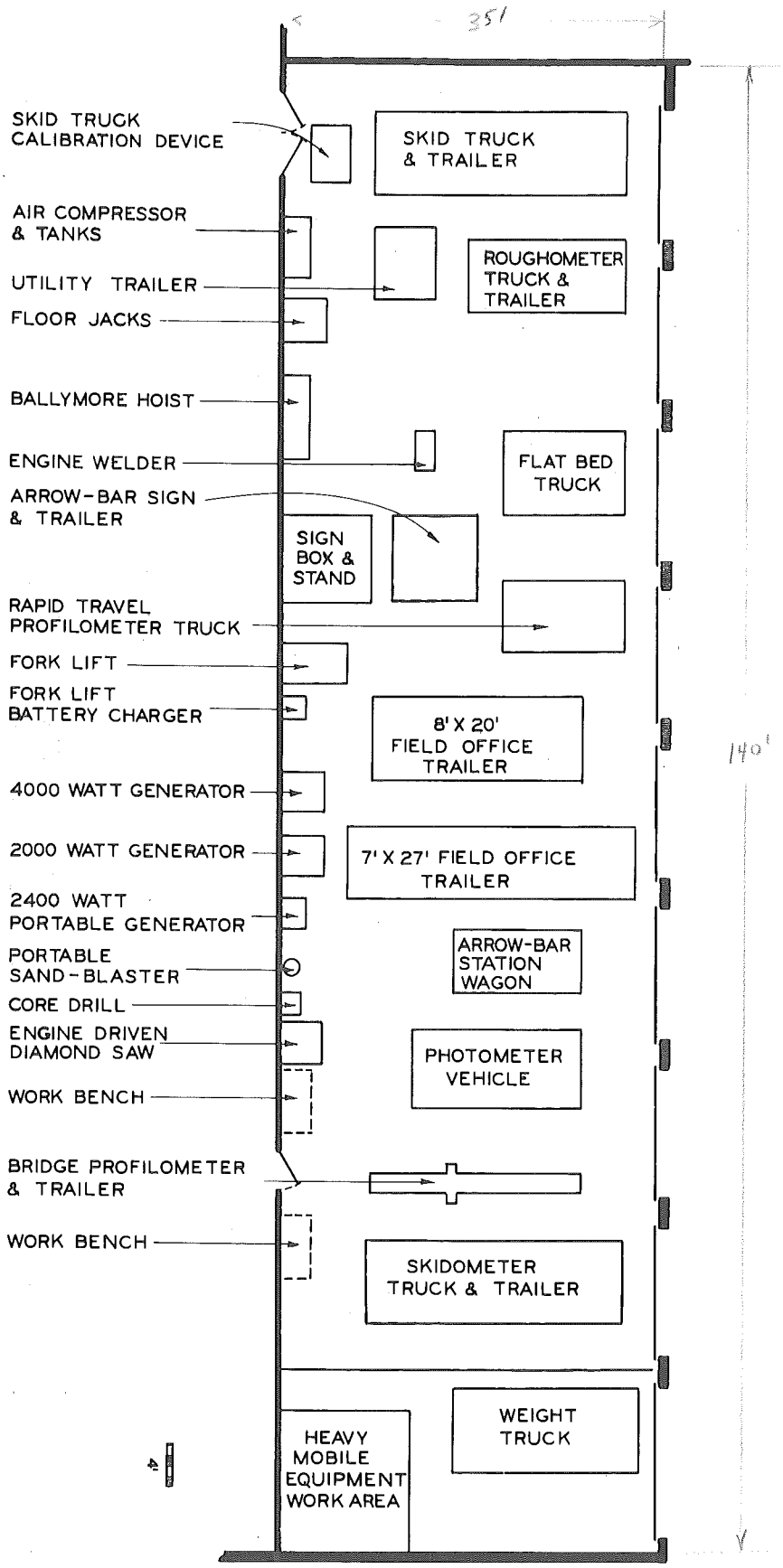
PUBLICATIONS UNIT, LIBRARY AND CONFERENCE ROOM



DENSITY KIT REPAIR AND STORAGE
(T&R Soils Section)

2586 Sq Ft

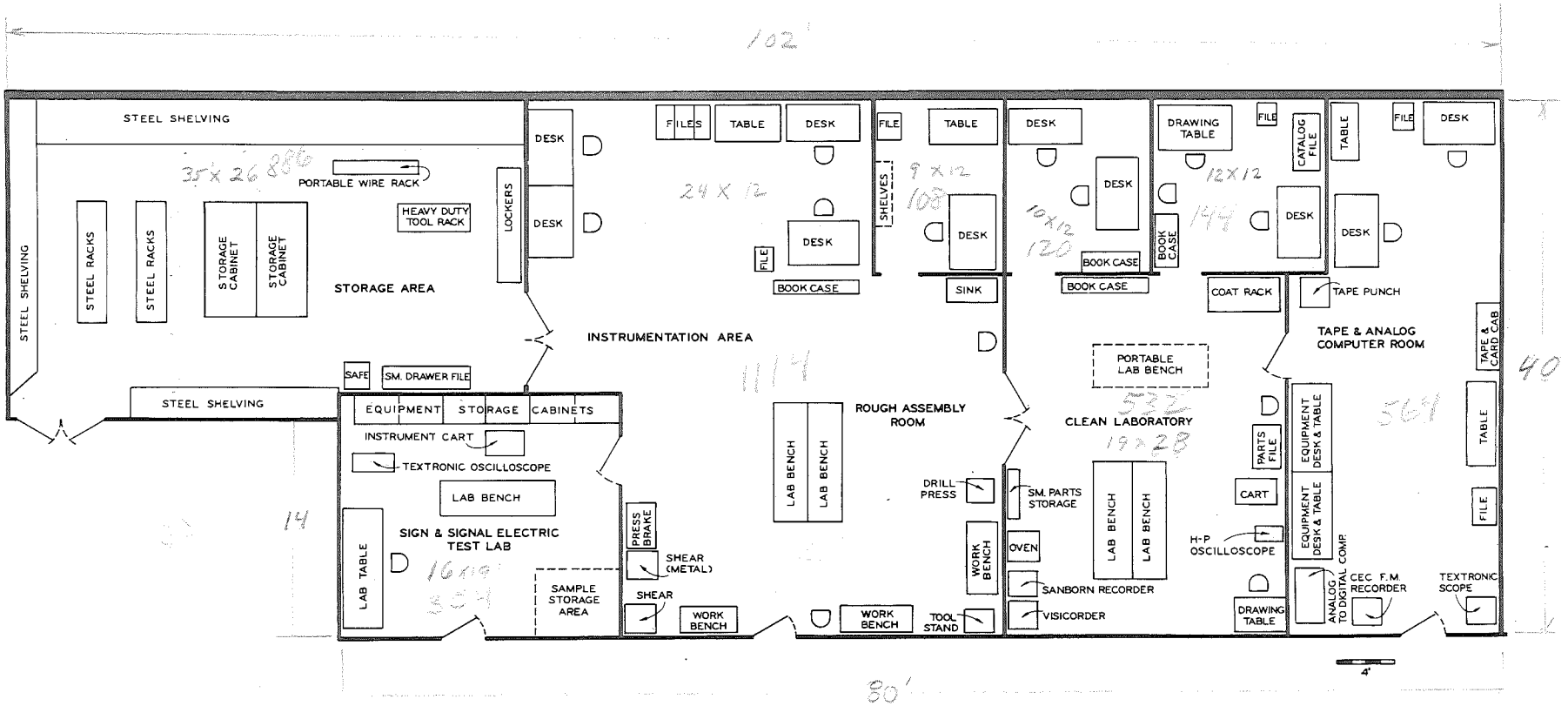
MISCELLANEOUS FACILITIES



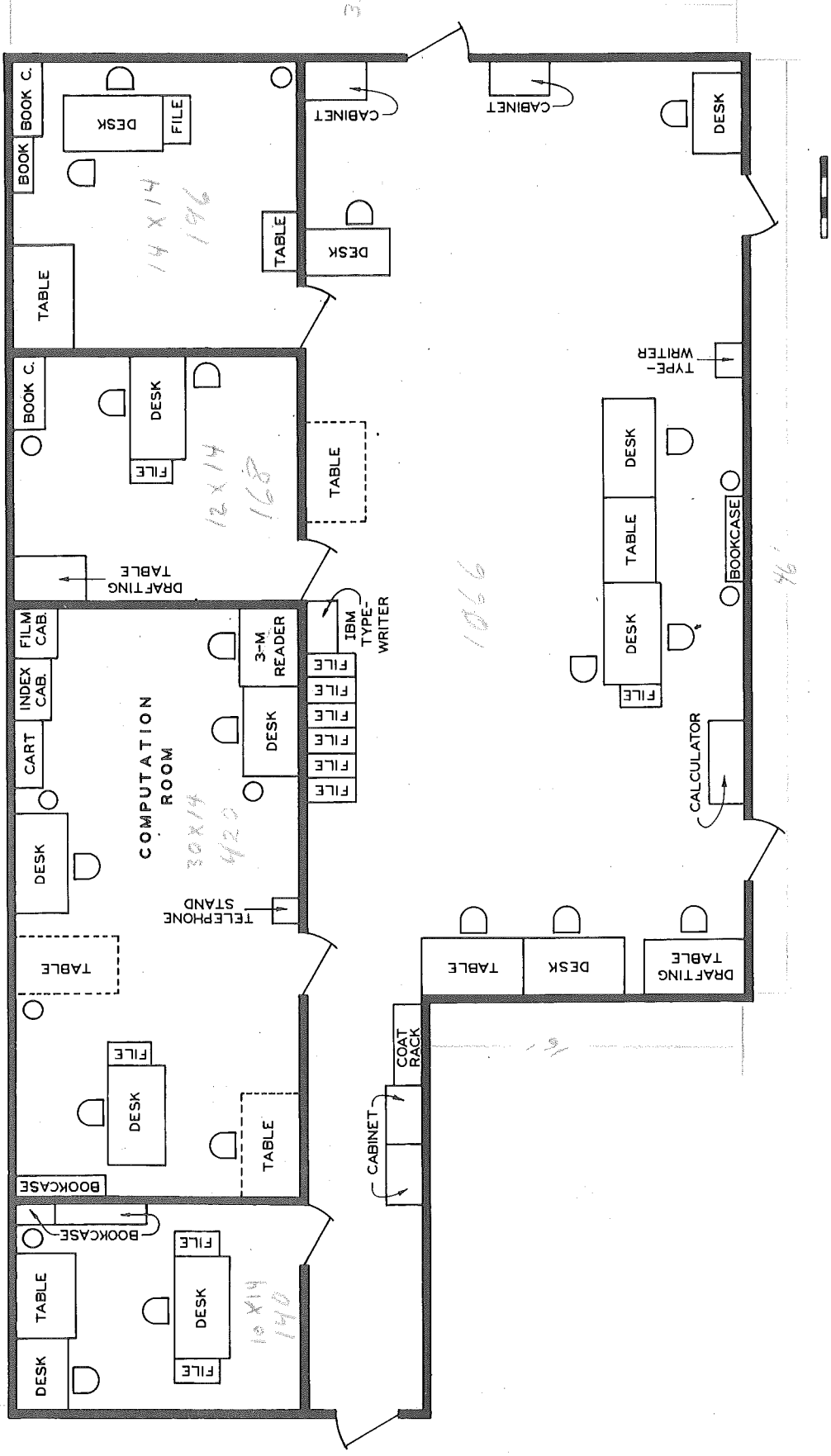
MOBILE EQUIPMENT STORAGE AREA *

4900 SQ FT

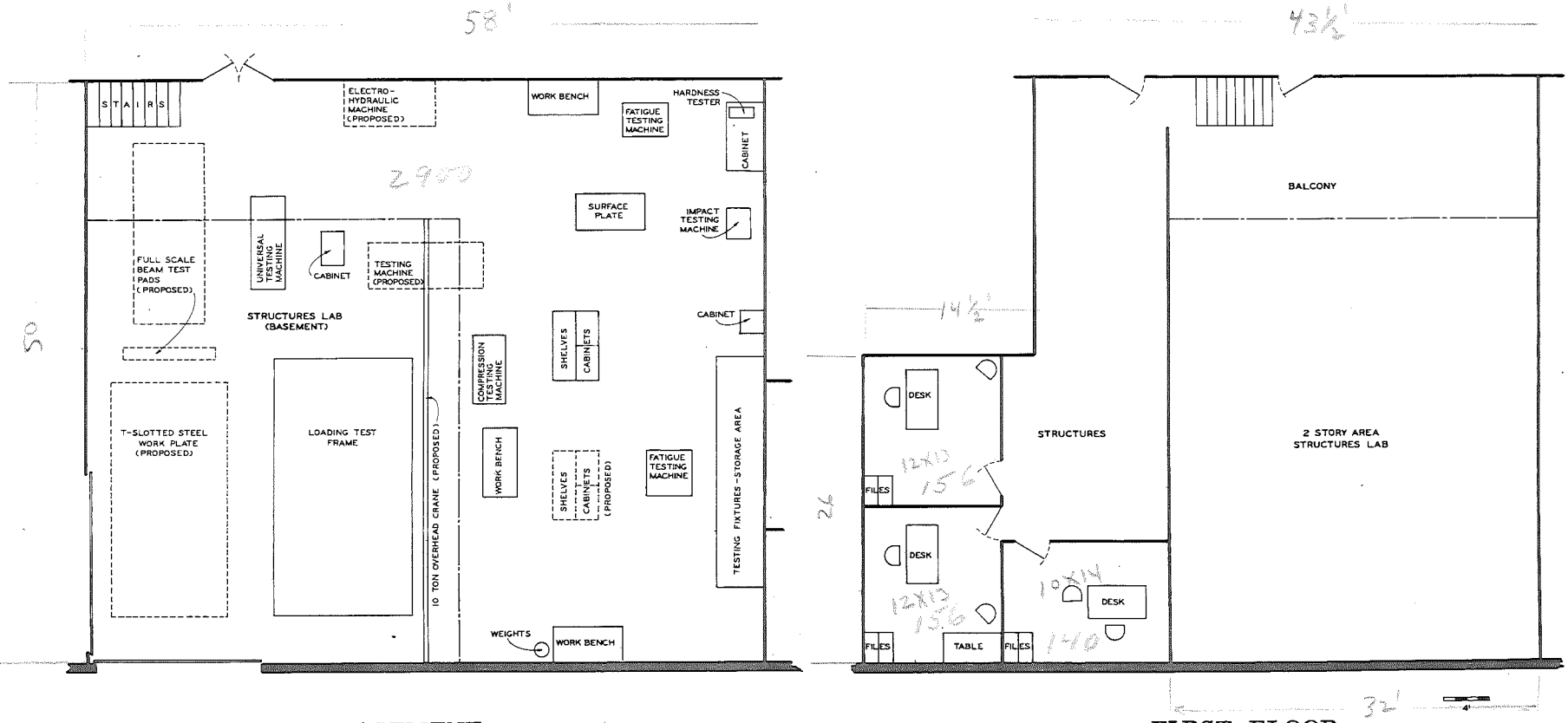
* Testing LAB - Has similar area.



INSTRUMENTATION AND DATA SYSTEMS
(Physical Research Unit)



PAVEMENT PERFORMANCE
(Physical Research Unit)



BASEMENT

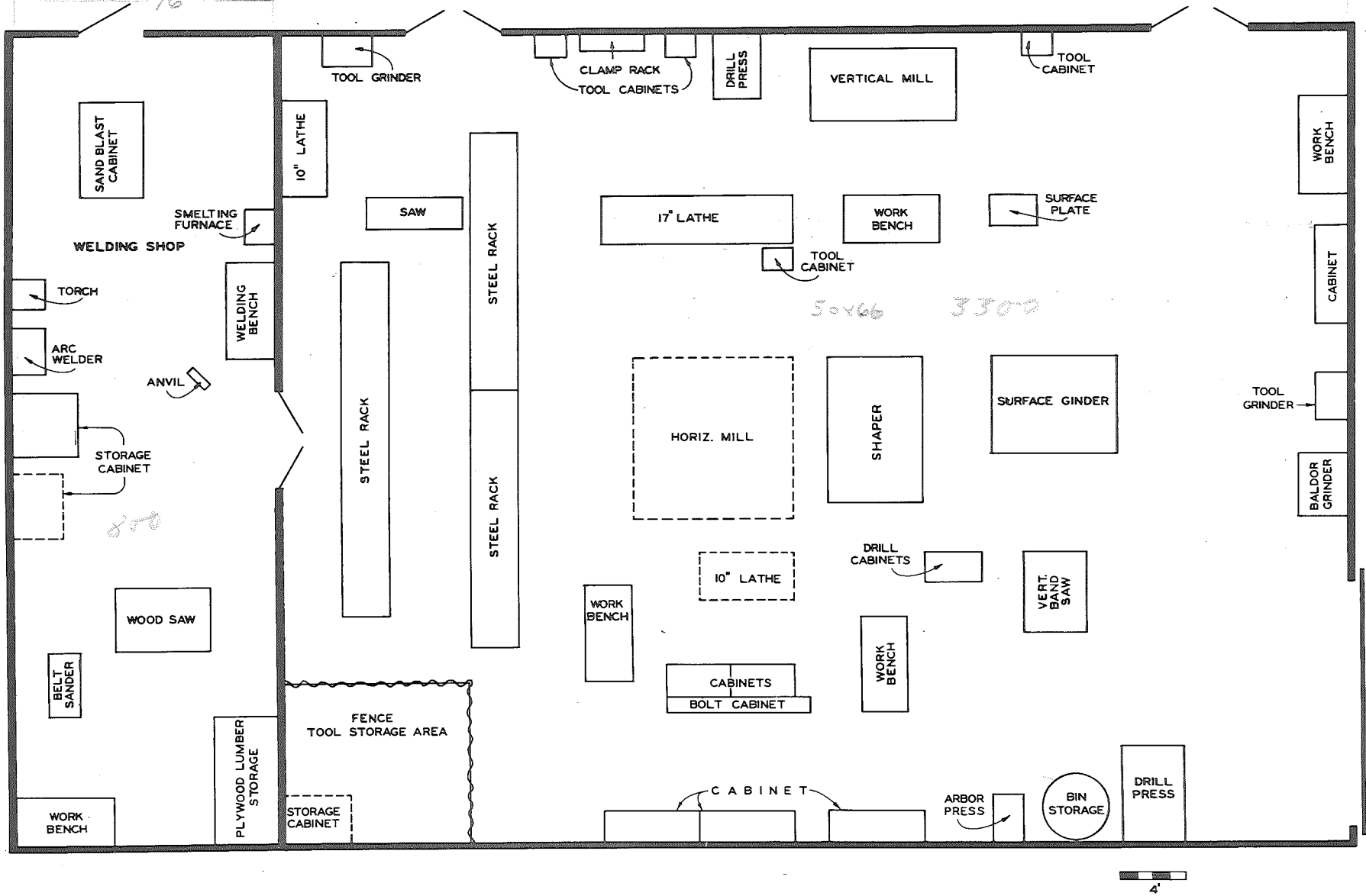
2900 SQ FT

FIRST FLOOR

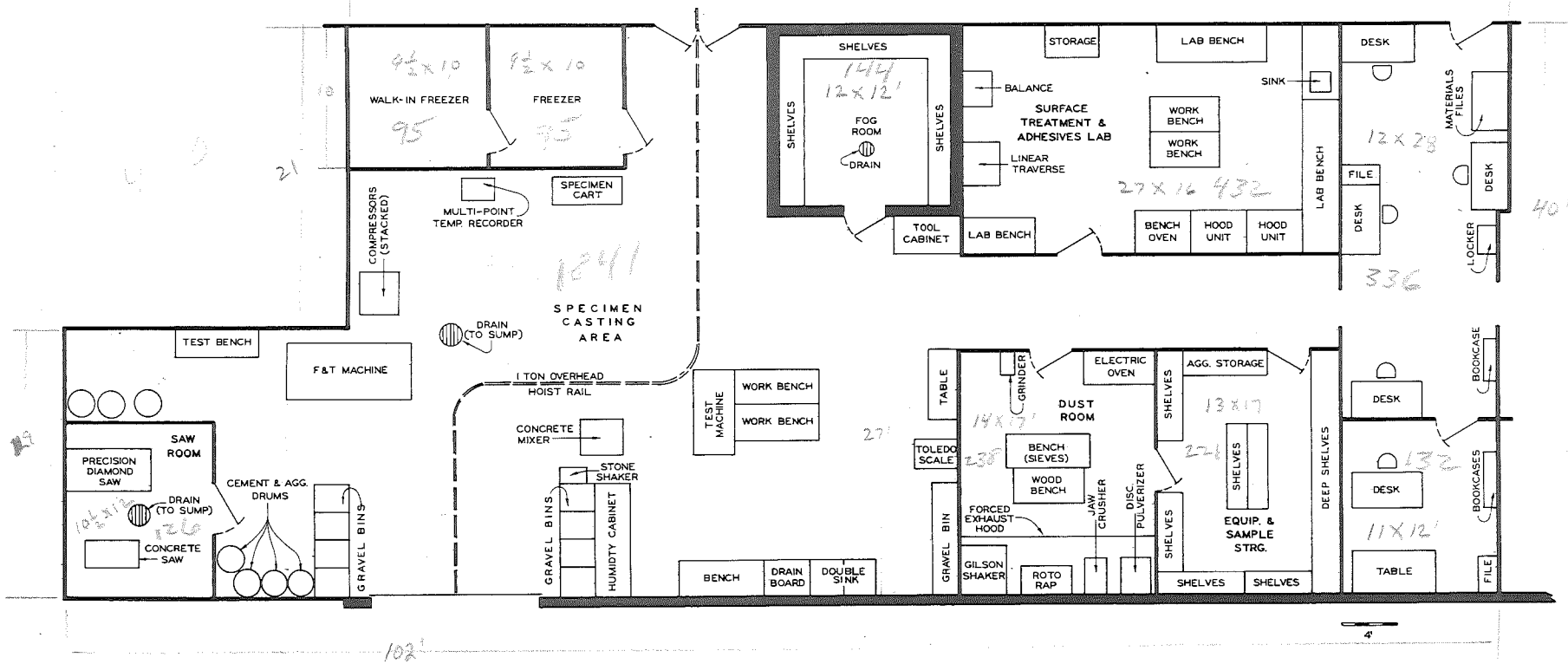
2552 SQ FT

STRUCTURES
(Physical Research Unit)

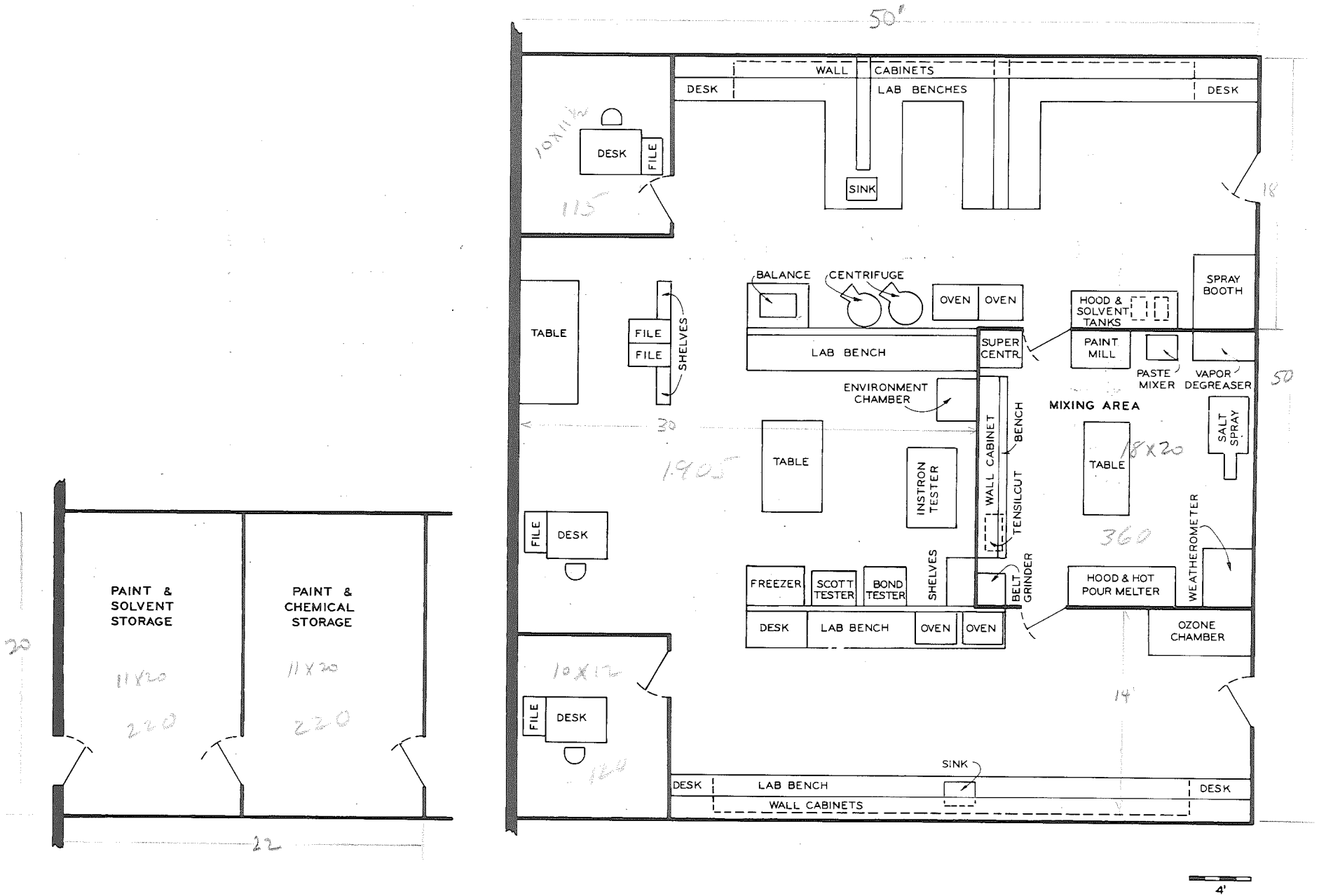
2900 SQ FT
2552 SQ FT
5452 SQ FT



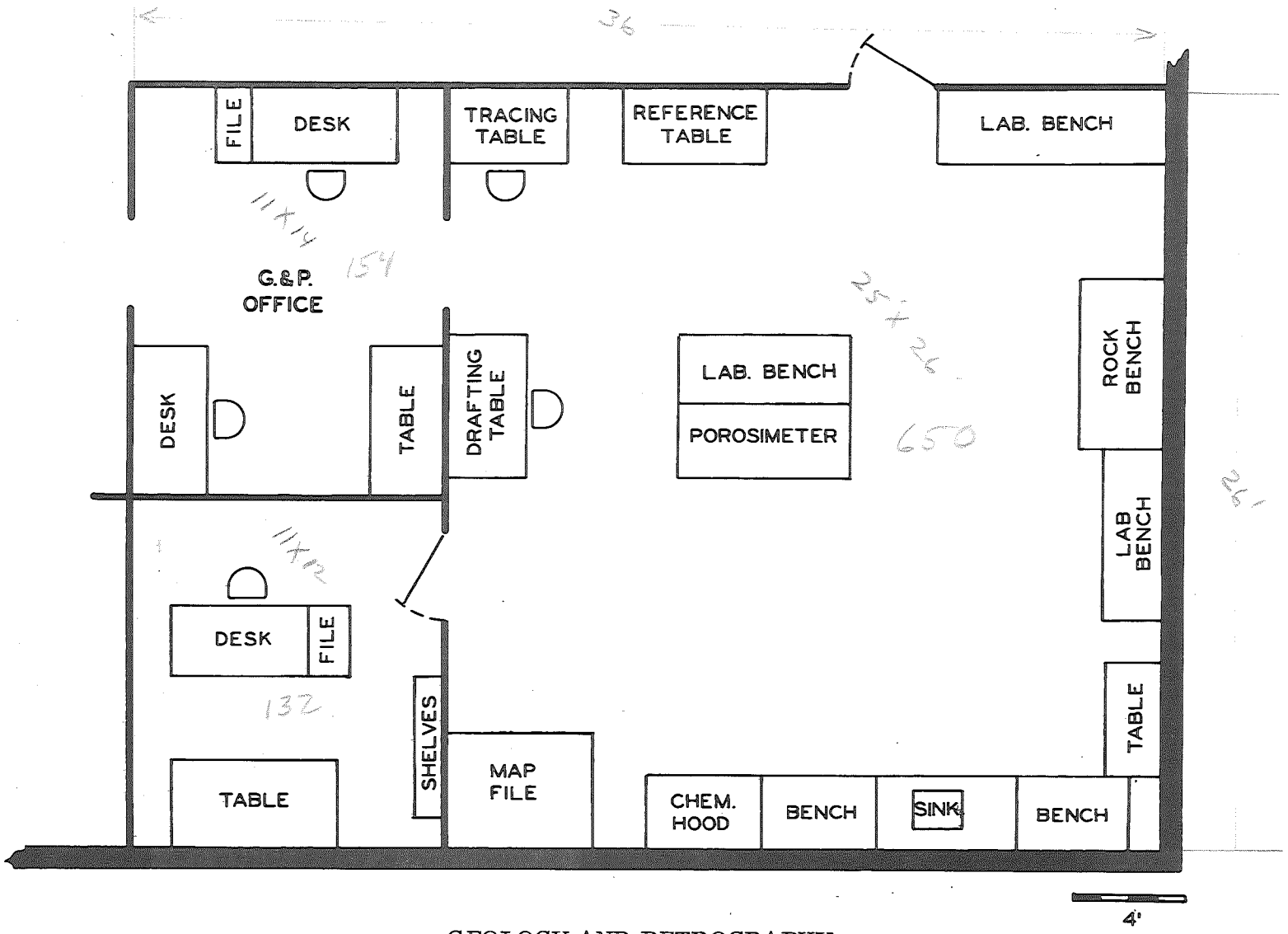
MACHINE SHOP
(Physical Research Unit)



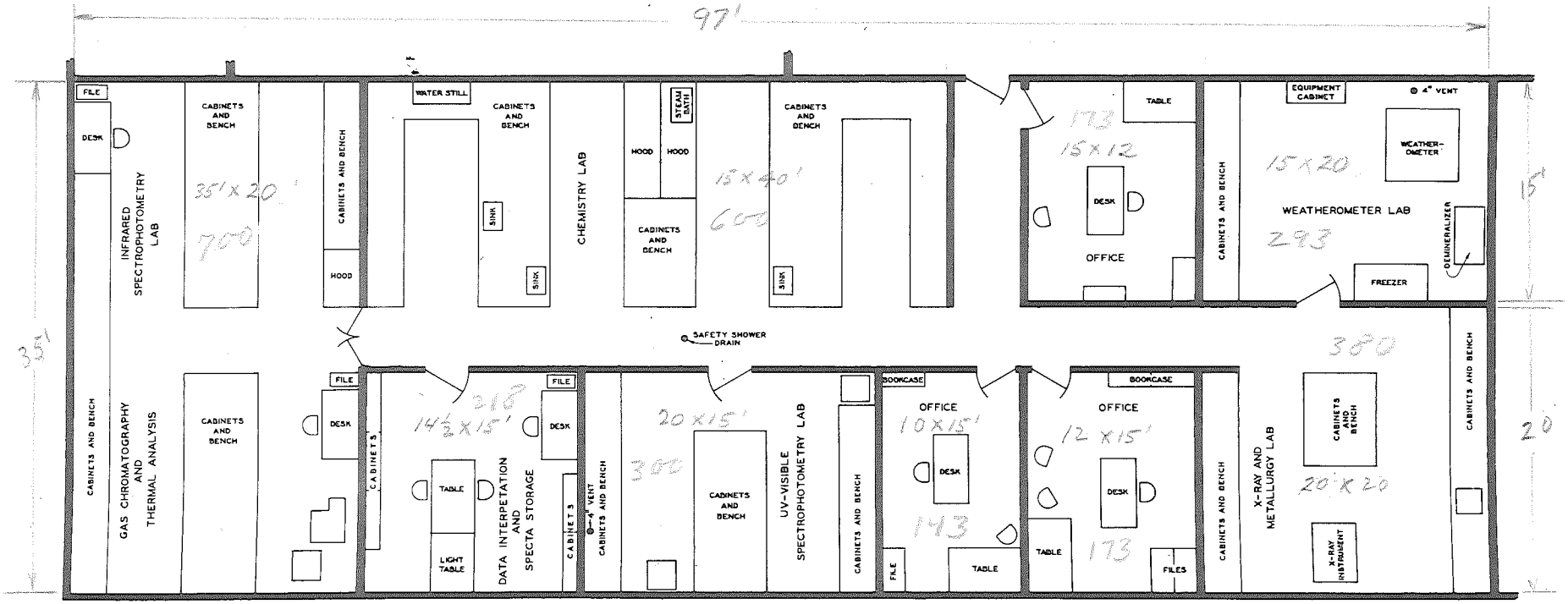
CONCRETE AND SURFACE TREATMENT
(Materials Research Unit)



COATINGS, SEALERS AND PLASTICS
(Materials Research Unit)

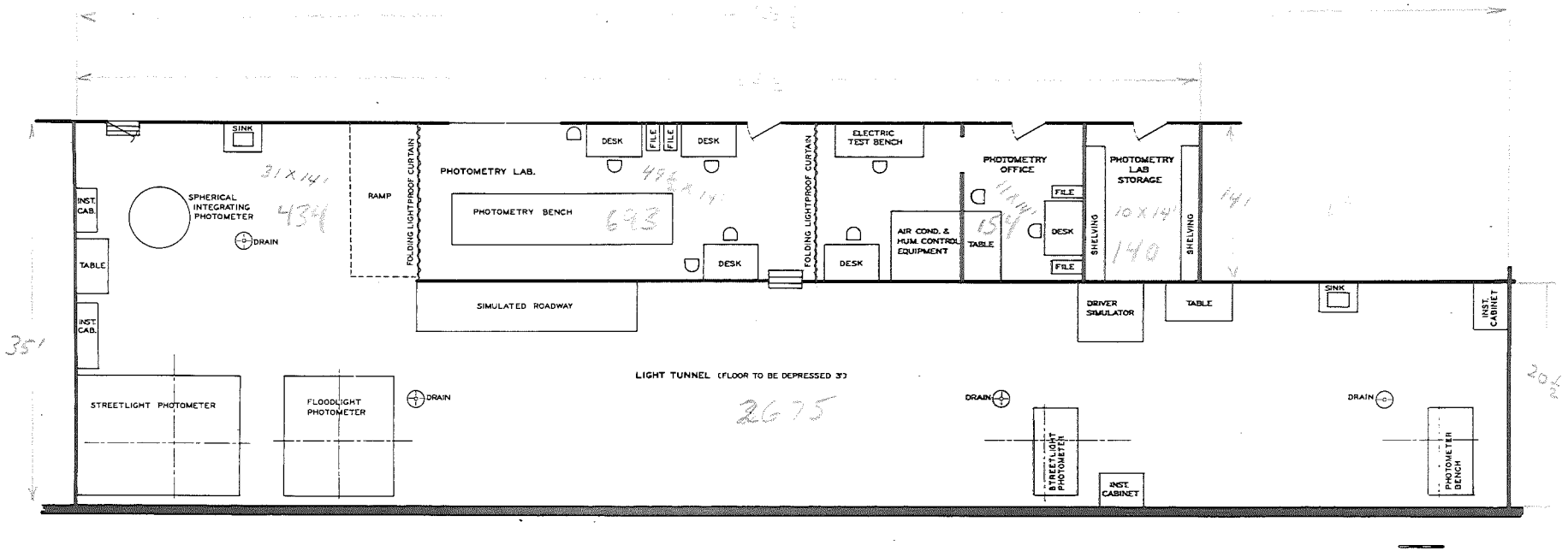


GEOLOGY AND PETROGRAPHY
(Materials Research Unit)

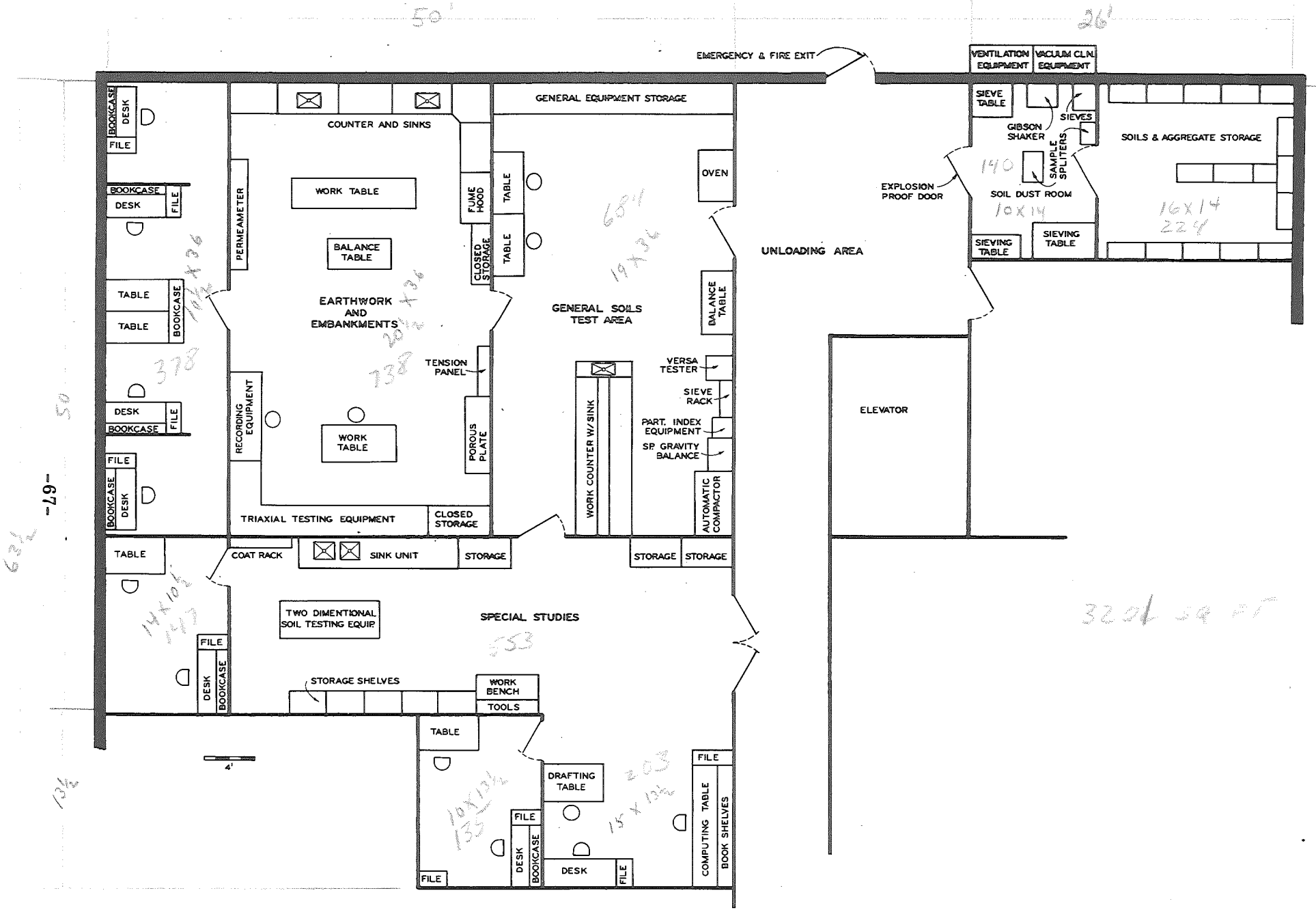


SPECTROSCOPY
(Spectroscopy and Photometry Unit)

3395 SQ FT



PHOTOMETRY
(Spectroscopy and Photometry Unit)



SOILS AND AGGREGATES UNIT

LABORATORY ADMINISTRATION AND SERVICE UNITS

AREA	ITEM	Quantity	ELECTRICITY											LIGHT	WATER			DRAINS			Compressed Air	Gas
			Voltage						Current			Power	Duty									
			D.C.	A.C.	Phase	115	230	440	Full Load	Locked Rotor	Fused Amps	Horse Power	Estimated hrs/week	Level in f.c.	Hot	Cold	Distilled	Covered	Open	Sump		
LABORATORY ADMINISTRATION																						
Research Engr.	duplex outlet	4		X	1	X					15			100								
Ass't Research Engr.	duplex outlet	2		X	1	X					15			100								
Unit Supervisor	duplex outlet	2		X	1	X					15			100								
Unit Supervisor	duplex outlet	2		X	1	X					15			100								
Unit Supervisor	duplex outlet	2		X	1	X					15			100								
Group Supervisor	duplex outlet	2		X	1	X					15			100								
General Offices	duplex outlet	6		X	1	X					15			100								
Copy Room	duplex outlet	1		X	1	X					15			50								
GRAPHIC PRESENTATION UNIT																						
Drafting Room	duplex outlet	10		X	1	X					15			200							X	
	sink	1													X	X		X				
Copy Room	duplex outlet	8		X	1	X					15			20								
Drying Room	dryer	1		X	1	X					15			50								
	duplex outlet	3		X	1	X					15											
Film Developing	duplex outlet	2		X	1	X								10								
	sink	1													X	X	X	X				
Dark Room	sink	2												10	X	X		X				
	washer	1		X	1	X			3.2			1/20										
	refrigerator	1		X	1	X			13.0													
	duplex outlet	11		X	1	X					15											
Special Requirements: Double doors from hall to copy room; exhaust ducts from film developing and dark rooms. Temperature regulated water supply to washer in dark room. Swing-away maze door into dark room.																						
STATISTICS AND DATA PROCESSING UNIT																						
Unit Supvr.	duplex outlet	2		X	1	X					15			100								
Sub-Unit Supvr.	duplex outlet	2		X	1	X					15			100								
Work Area	duplex outlet	10		X	1	X					15			100								
Equip. Area	duplex outlet	6		X	1	X					15			100								
Special Requirements: Four of the duplex outlets in the work area are to be floor outlets for desks at those locations.																						
PUBLICATIONS UNIT																						
Editor's Office	duplex outlet	2		X	1	X					15			100								
Staff Office	duplex outlet	3		X	1	X					15			100								
Library	duplex outlet	1		X	1	X					15			70								
	duplex outlet(floor)	2		X	1	X					15											
Conference Room	duplex outlet	6		X	1	X					15			30								

LABORATORY ADMINISTRATION AND SERVICE UNITS (cont.)

AREA	ITEM	Quantity	ELECTRICITY											LIGHT	WATER			DRAINS			Compressed Air	Gas
			Voltage						Current			Power	Duty									
			D.C.	A.C.	Phase	115	230	440	Full Load	Locked Rotor	Fused Amps	Horse Power	Estimated hrs/week	Level in f.c.	Hot	Cold	Distilled	Covered	Open	Sump		
DENSITY KIT REPAIR & NUCLEAR GAGE VAULT																						
Nuclear gage vault														20							X	X
Density Kit Repair &	duplex outlet	15		X	1	X					15			70								
Storage	sink	1													X	X		X				
	vacuum cleaner	1		X	1	X					15											
Special Requirements: Radio-active shielding to reduce radiation to 1.0 mr/hr in the nuclear gage vault.																						
STORAGE & UTILITY AREAS																						
General Storage	duplex outlet	6		X	1	X					15			20								
Record Storage	duplex outlet	6		X	1	X					15			20								
Utility Room	duplex outlet	6		X	1	X					15			50								
Mens Rest Room	duplex outlet	2		X	1	X					15			20	X	X		X				
Mens Rest Room	duplex outlet	2		X	1	X					15			20	X	X		X				
Mens Rest Room	duplex outlet	2		X	1	X					15			20	X	X		X				
Womens Rest Room	duplex outlet	2		X	1	X					15			20	X	X		X				
Locker Room	duplex outlet	4		X	1	X					15			20	X	X		X				
Lunch Room	duplex outlet	4		X	1	X					15			50								
MOBILE EQUIPMENT STORAGE AREA														70							X	
	duplex outlet	12		X	1	X					15			20								
	floor drains	7																X				
Special Requirements: Seven 20-ft wide bays -- 6 bays with 12-ft wide by 10-ft high overhead doors and one bay with special ceiling height to accommodate an overhead door 12-ft wide by 14-ft high. Double 10-ft width doorway for access to hallway.																						

PHYSICAL RESEARCH UNIT

AREA	ITEM	Quantity	ELECTRICITY											LIGHT	WATER			DRAINS			Compressed Air	
			Voltage						Current			Power	Duty									
			D.C.	A.C.	Phase	115	230	440	Full Load	Locked Rotor	Fused Amps	Horse Power	Estimated hrs/week	Level in f.c.	Hot	Cold	Distilled	Covered	Open	Sump		Gas
PAVEMENT PERFORMANCE GROUP																						
Group Suprv. Office	duplex outlet	2		X	1	X					15			100								
Office	duplex outlet	2		X	1	X					15			100								
Office	duplex outlet	2		X	1	X					15			100								
Computation Room	duplex outlet	6		X	1	X					15			100								
General Work Area	duplex outlet	8		X	1	X					15			70								
Special Requirements: Lighting in vicinity of microfilm reader is to be controlled independently of other computation room lighting.																						
INSTRUMENTATION & DATA SYSTEMS GROUP																						
Group Suprv. Office	duplex outlet	2		X	1	X					15			100								
Office	duplex outlet	2		X	1	X					15			100								
Systems Room	duplex outlet	2		X	1	X					15			100								
Computer Room	duplex outlet	6		X	1	X					15			100								
Clean Room	duplex outlet(floor)	3		X	1	X					15			70								
	duplex outlet(wall)	5		X	1	X					15											
Rough Assembly Room	chemical hood	1		X	1	X					15			70		X		X			X	X
	duplex outlet(wall)	1		X	1		X				15											
	sink	1													X	X		X				
	drill press	1		X	3			X	1.3													
	duplex outlet (floor)	2		X	1	X					15											
	duplex outlet(wall)	10		X	1	X					15											
	duplex outlet(floor)	2		X	1	X					15											
Electronic Test Lab	duplex outlet(floor)	1		X	1	X					15			70								
	duplex outlet(wall)	6		X	1	X					15											
Electronic Equip. Storage Area	duplex outlet(wall)	5		X	1	X								20								
Special Requirement: Clean lab and computer room are to be supplied with cooled, filtered air; double doors between rough assembly room, clean lab and rough assembly and storage area and also storage to unloading area.																						

PHYSICAL RESEARCH UNIT (cont.)

AREA	ITEM	Quantity	ELECTRICITY											LIGHT	WATER			DRAINS			Compressed Air	
			Voltage						Current			Power	Duty									
			D.C.	A.C.	Phase	115	230	440	Full Load	Locked Rotor	Fused Amps	Horse Power	Estimated hrs/week	Level in f.c.	Hot	Cold	Distilled	Covered	Open	Sump		Gas
STRUCTURES GROUP																						
Group Suprv. Office	duplex outlet	2		X	1	X					15			100								
Office	duplex outlet	2		X	1	X					15			100								
Office	duplex outlet	2		X	1	X					15			100								
Structures(computation)	duplex outlet	5		X	1	X					15			100								
Structures Lab	duplex outlet	15		X	1	X					15			70								
	Riehle Compression																					
	Testing Machine	1		X	3			X	3.1			2										
	Timus-Olsen Univ.																					
	Testing Machine	1		X	3			X	10													
	Budd Fatigue Testing																					
	Machine	1		X	3		X		2.0													
	Rockwell Hardness																					
	Tester	1		X	1	X					15											
	sink	1													X	X		X				
	Neoprene Fatigue																					
	Testing Machine	1		X	3			X	2.8			1-1/2										
	Future																					
	Electro-hydraulic																					
	Testing System	1		X	3			X	26			20										
	High Capacity Univ.																					
	Testing Machine	1		X	3			X	14			10										
	10 ton overhead																					
	crane	1		X	3			X	14			10										
	outlet	1		X	3			X	4.5			3										

Special Requirements: Reinforced floors in two story area, 14' by 14' overhead door to outside, 15' sliding door between Structures Lab and Machine Shop. Double door between Structures Lab and hallway.

PHYSICAL RESEARCH UNIT (cont.)

AREA	ITEM	Quantity	ELECTRICITY											LIGHT	WATER			DRAINS			Compressed Air	Gas
			Voltage						Current			Power	Duty									
			D.C.	A.C.	Phase	115	230	440	Full Load	Locked Rotor	Fused Amps	Horse Power	Estimated hrs/week	Level in f.c.	Hot	Cold	Distilled	Covered	Open	Sump		
WELDING SHOP & MACHINE SHOP																						
Welding Shop														100							X	
	welder, arc	1		X	1		X		37													
	gas burner	1																				X
	woodsaw, Delta	1		X	1		X		9.6			1-1/2										
	belt sander	1		X	1		X		2.4			1										
	vacuum	1		X	1	X																
	duplex outlet	4		X	1																	
	exhaust fan	1		X	1	X					20											
Machine Shop	lathe, 10"	2		X	3			X	1.3			3/4		100								
	lathe, 17"	1		X	3			X	2.5													
	band saw, Kalamazoo	1		X	1	X			11			3/4										
	Clausing drill press	1		X	3			X	2.3													
	mill, vertical	1		X	3			X	1.8													
	Grand Rapids																					
	surface grinder	1		X	3			X	8													
	shaper	1		X	3			X	10.5			7-1/2										
	vertical band saw	1		X	3			X	2.3			1										
	Baldor grinder	1		X	3			X	3.7			2										
	tool grinder	1		X	1	X			3.4													
	drill press,																					
	Rockford	1		X	3			X	5.5													
	mill, horizontal	1		X	3			X	11													
	sink	1													X	X		X				
	compressed air																				X	
	duplex outlet	15		X	1	X					15											
	duplex outlet	5		X	1		X				40											
	tool grinder	1		X	1	X			5.0			1/2										
	sand blaster	1		X	1	X			6-8			1/2										
	outlet	1		X	3			X	4.5			3										
	cutter grinder	1		X	1	X			9.3			1/2										
	compressor	1		X	3			X	10.9			7-1/2										
Special Requirements: Three double doors -- one between welding and machine shops and two to hallway. Fenced tool storage area. Bus bar arrangement desirable in certain areas for convenient use of tools -- overhead crane.																						

MATERIALS RESEARCH UNIT

AREA	ITEM	Quantity	ELECTRICITY											LIGHT	WATER			DRAINS			Compressed Air	Gas
			Voltage						Current			Power	Duty									
			D.C.	A.C.	Phase	115	230	440	Full Load	Locked Rotor	Fused Amps	Horse Power	Estimated hrs/week	Level in f.c.	Hot	Cold	Distilled	Covered	Open	Sump		
CONCRETE & SURFACE TREATMENT GROUP																						
Group Suprv. Office	duplex outlet (wall)	2		X	1	X					15			100								
General Offices	duplex outlet (wall)	4		X	1	X					15			100								
Surface Treatment &	Chemical hoods	2		X	1	X					20			100		X		X			X	X
Adhesive Lab	sink	1													X	X		X				
	lab benches	4		X	1	X					15					X					X	X
	bench oven	1		X	1	X					20											
	duplex outlet (1drop)	2		X	1	X					15											
Equip & Sample	duplex outlet	4		X	1	X					15			20								
Storage	Gilson Shaker	1		X	1	X			3.0		20	1/4		50								
	Roto-tap sieve																					
	shaker	1		X	1	X			3.0	1.6	20	1/4										
	jaw crusher	1		X	3			X	4.8		20	1										
	disc pulverizer	1		X	3			X	4.8		20	3										
	oven	1		X	3			X			15											
	exhaust hood	1		X	1	X			13.0		20	1										
	duplex outlet	1		X	1	X					15											
Fog Room	vapor proof light																					
	& switch	1		X	1	X					15			20	X	X		X			X	
Specimen Casting Area	automatic freeze &																					
	thaw	1		X	3		X		21.0		45	7-1/2	168	70								
	automatic freeze &																					
	thaw	1		X	1	X					20		168									
	humidity cabinet	1		X	1			X			20	5										
	humidity cabinet	1		X	1	X					60											
	sink, double	1													X	X			X			
	drain, floor	2																	X			
	duplex outlet(1 drop)	6		X	1	X					15											
Concrete Saw Room	diamond saw	1		X	1	X			13.0		15	1		50								
	concrete saw	1		X	3			X	2.8		30	2										
	duplex outlet	2		X	1	X					15											
	drain, floor	1																X				
Walk-In Freezer	duplex outlet	4		X	1	X					20											
	1 compressor motor	2		X	1	X			5.0	31	20	1/2	168									
	compressor motor	1		X	3			X	2.3	13.5	20	1	168									
	compressor motor	1		X	3			X	6.4	30	20	3	168									
	control circuits			X	1		X				20		168									

Special Requirements: Specimen casting area: 12 foot wide by 8 foot high overhead door; 1 ton overhead hoist rail from overhead door through specimen casting area to structures laboratory. Dust Room to be sound proofed. Sink & floor drain of mixing area need special drain and settling basin for periodic clean-out of cement and aggregate particles.

MATERIALS RESEARCH UNIT (Continued)

AREA	ITEM	Quantity	ELECTRICITY											LIGHT	WATER			DRAINS			Compressed Air	Gas
			Voltage						Current			Power	Duty									
			D.C.	A.C.	Phase	115	230	440	Full Load	Locked Rotor	Fused Amps	Horse Power	Estimated hrs/week	Level in f.c.	Hot	Cold	Distilled	Covered	Open	Sump		
COATINGS, SEALERS & PLASTICS GROUP																						
Group Suprv. Office	duplex outlet	2		X	1	X					15			100								
Office	duplex outlet	2		X	1	X					15			100								
Laboratory	benches	3		X	1	X					15			70							X	X
	duplex outlet	15		X	1	X					15											
	sinks	2													X	X		X				
	hood w/solvent tank	1		X	1	X					15					X		X			X	X
	freezer	1		X	1	X			3.0			1/5	Cont									
	tester, Scott	1		X	1	X			5.0			1/4										
	weatherometer	1		X	1		X		34.0			1/4	120									
	tester, bond	1		X	1	X			4.1 6.4			1/4 1/2	Cont									
	tester, Instron	1		X	1	X			15.0				30									
	environmental system																					
	for Instron	1		X	1		X		15.0				8									
	centrifuge	2		X	1	X			7.0			3/4	20									
	shaker, paint	1		X	1	X			5.5			1/4	10									
	degreaser, vapor	1		X	3		X		30.0				2									
	mill, paint	1		X	3		X		3.0			3/4	0-5									
	mixer, paint	1		X	3		X		1.6			1/4	0-5									
	salt spray	1		X	1	X			6.0				20									
	oven, Elcomap	1		X	1	X			20.0				168									
	oven, Thelco	1		X	1	X			8.0				100									
	oven, Blue M	1		X	1		X		6.2				168									
	oven (future	1		X	1	X			20.0				168									
	belt grinder	1		X	1	X			8.6		15	1/2	10									
	temp, recorder	1		X	1	X					15		168									
	ozone chamber	1		X	1	X			30.0				70									
	melter, hot pour	1		X	3		X		25.0				1									
	hydraulic press,																					
	heated	1		X	1	X			27		30		5			X			X			
	super centrifuge	1											2								X	
	compressor	1		X	3		X		25			7-1/2	40									
Paint & Solvent Storage													50									
Paint & Chemical Storage													50									

Special Requirements: Coatings, Sealers & Plastics laboratory to be temperature controlled at 75°F with 50 percent (20 fcm @ 120 psi) relative humidity; paint & solvent storage vented to outside; both storage areas to be fireproof. Siphon proof drains for paint mill, weatherometer, and chemical hood. Safety shower and carbon dioxide fire extinguisher system in chemical storage area.

AREA	ITEM	Quantity	ELECTRICITY												LIGHT	WATER			DRAINS				
			Voltage						Current			Power	Duty										
			D. C.	A. C.	Phase	115	230	440	Full Load	Locked Rotor	Fused Amps	Horse Power	Estimated hrs/week		Level in f.c.	Hot	Cold	Distilled	Covered	Open	Sump	Compressed Air	Gas
GEOLOGY & PETROGRAPHY GROUP																							
Group Suprv. Office	duplex outlet	2		X	1	X					15				100								
G. & P. General Office	duplex outlet	3		X	1	X					15				100								
G.R.P. Lab	duplex outlet (drop)	10		X	1	X					15				100								
	chemical hood	1		X	1	X					20						X	X	X			X	X
	sink	1														X	X		X				
Special Requirements: Compressed air, vacuum and gas at one lab bench location in addition to chem. hood.																							

SPECTROSCOPY AND PHOTOMETRY UNIT

AREA	ITEM	Quantity	ELECTRICITY											LIGHT	WATER			DRAINS			Compressed Air	Gas
			Voltage						Current			Power	Duty									
			D.C.	A.C.	Phase	115	230	440	Full Load	Locked Rotor	Fused Amps	Horse Power	Estimated hrs/week	Level in f.c.	Hot	Cold	Distilled	Covered	Open	Sump		
SPECTROSCOPY UNIT																						
Unit Head Office	duplex outlet	2		X	1	X					15			100								
Group Suprv. Office	duplex outlet	2		X	1	X					15			100								
Group Suprv. Office	duplex outlet	2		X	1	X					15			100								
Chemistry Lab	duplex outlet	28		X	1	X					15			80								
	chemical hoods	2		X	1	X				8.0			40			X		X				X
	sink	3													X	X	X	X				
	muffle furnace	1		X	1		X		8.0				10									
	oven	2		X	1	X			8.0				168									
	Barnstead water still	1		X	1		X		28.0				16			X			X			
	steam bath	1		X	1	X			9.0				10									
	large hot plate	1		X	1		X		11.5				30									
	hood outlet	1		X	1		X															
	safety shower	1														X		X				
	laboratory benches															X		X			X	X
Infrared Spectro-																						
photometry lab	duplex outlet	12		X	1	X					15			80								
	Infrared spectro-																					
	photometer	1		X	1	X			4.0				30									
	vacuum drying oven	1		X	1	X			0.5				168									
	air purifier-infrared																					
	vacuum pump	2		X	1	X			6.0				5									
	chemical hood	1		X	1	X				4.0			10			X		X			X	X
	hot plate	1		X	1	X			6.5													
Gas Chromatography	duplex outlet	12		X	1	X					16			80								
& Thermal Analysis	thermal analysis																					
Lab	(instru proposed)	*1		X	1	X			10.0													
	GC-4 gas chromato-																					
	graph w/recorder	1		X	1	X			30.0		30		30									3 cyl
Data Interpretation &	duplex outlet	4		X	1	X					15			100								
Spectru Storage																						
UV-Visible Spec-	duplex outlet	10		X	1	X					15			80								
trophotometry Lab	centrifuge	1		X	1	X			1.0													
	DK-1 Spectro-																					
	photometer with																					
	record	*1		X	1	X			8.0					10								
	DU Spectrophoto-																					
	meter	*1		X	1	X			9.0					20								2 cyl
X-Ray & Metallurgy	duplex outlet	6		X	1	X					15			80								
Lab	X-Ray (proposed)	*1		X	1	X			22.0		30	6.7	30			X		X				
	cut-off wheel	1		X	3		X		4.6							X						
	grinder	1		X	1	X			6.5													
	polisher	1		X	1	X			4.5													

SPECTROSCOPY AND PHOTOMETRY (cont.)

AREA	ITEM	Quantity	ELECTRICITY											LIGHT	WATER			DRAINS			Compressed Air	Gas
			Voltage						Current			Power	Duty									
			D.C.	A.C.	Phase	115	230	440	Full Load	Locked Rotor	Fused Amps	Horse Power	Estimated hrs/week	Level in f.c.	Hot	Cold	Distilled	Covered	Open	Sump		
SPECTROSCOPY UNIT (Con't.)																						
X-Ray & Metallurgy	sink	1													X	X		X				
Chemical Storage**	auto CO_2 fire																					
	extinguisher	1		X	1	X			5		15		0	80		X		X				
	duplex outlet	2		X	X	X					15											
Weatherometer Lab	duplex outlet	5		X	1	X					15			80								
	weatherometer	1		X	3		X		45	50	60		10			X		X				
	demineralizer	1		X	1	X					15		10									
	freezer(proposed)	1		X	1	X			10				5									
PHOTOMETRY LAB																						
Group Suprv. Office	duplex outlet	2		X	1	X					15			100								
Photo Lab Storage	duplex outlet	1		X	1	X					15			20								
Photometry Lab	duplex outlet	10		X	1	X					15		40	100								
	bench duplex outlet	8		X	1	X					15		10									
	bench duplex outlet	8		X	1	X	(Regulated)				15											
	bench duplex outlet	8	X			X																
	Humidity Control	1		X	3			X		62	70		84			X		X(Fresh Air Duct)				
Light Tunnel	duplex outlet	16		X	1	X							20									
	duplex outlet	8		X	1	X	(Regulated)															
	duplex outlet	8	X			X																
	photo bench	2		X	1	X					15		20									
	photo bench	2		X	1	X	(Regulated)															
	photo bench	2	X			X																
	photo bench	1		X	1	X							10	100								
	simulated roadway	1												100								
	streetlight photometer	1		X	1	X	X		22.0				6	100								
	floodlight photometer	1		X	1	X	X		22.0				10	100								
	spherical integ. photometer	1		X	1	X	X		22.0				1	80								
	floor drains	4																X				
	sink	2													X	X		X				

Special Requirements: * Isolated Circuit - instruments must be isolated from general use circuits but may be combined with one another.

** Raised door still required.

50% relative humidity in the infrared lab. Corrosion resistant hood exhaust vents - two 12" in chem lab, one 4" in UV-Visible spec lab, and one 4" in Weatherometer-Utility room. X-Ray instrument requires a minimum of 30 gal/hr. of water at 35 to 90 psi and 35° to 90°F. It is possible to reach a power consumption of 40 K watts exclusive of lighting and some small appliances during peak periods of activity. Ten foot sliding door between photometry lab and hallway. Light tunnel floor to be depressed three feet to give a thirteen foot ceiling height. Two folding wall curtains in the photometry lab.

SOILS AND AGGREGATES UNIT

AREA	ITEM	Quantity	ELECTRICITY											LIGHT	WATER			DRAINS			Compressed Air	Gas
			Voltage						Current			Power	Duty									
			D.C.	A.C.	Phase	115	230	440	Full Load	Locked Rotor	Fused Amps	Horse Power	Estimated hrs/week	Level in f.c.	Hot	Cold	Distilled	Covered	Open	Sump		
Group Suprv. Office		2		X	1	X					15			100								
Group Suprv. Office		2		X	1	X					15			100								
Office		4		X	1	X					15			100								
Office		2		X	1	X					15			100								
General Tests Lab.	duplex outlet	7		X	1	X					15			100							X	X
	Versa Tester	1		X	1	X			5			1/4										
	oven	1		X	1			X	60													
	auto compactor	1		X	1	X			7		15	1/3										
	sink	1													X	X	X	X				
Special Tests	duplex outlet	7		X	1	X					15			100								
	fume hood	1		X	1	X					15					X		X			X	X
	porous plate	1															X	X			X	
	permeameter	1														X	X	X				
	sink	2													X	X	X	X				
	triaxial test	1		X	1		X		10							X	X	X				
	water heater	1		X	1		X		26													
Soil Dust Room	shaker, Gibson	1		X	1	X					15	1/4		30								
	mixer, soil	1		X	1		X		10			1.5										
	duplex outlet	4		X	1	X					15											
	ventilation equip	1		X	1	X					20											
Soil & Agg Storage	duplex outlet	2		X	1	X					15			20								
Foundations Soils Lab	duplex outlet	6		X	1	X					15			100								
Special Requirements: Vacuum (20 foot of water) for special tests and general tests labs.																						

SUMMARY OF LABORATORY UTILITIES

I	ELECTRICAL[1]	
	1. 115 VAC, 1Ø (outlets)	20 KVA
	2. 115 VAC, 1Ø (Equip)	27 KVA
	3. 230 VAC, 1Ø (Equip)	21 KVA
	4. 230 VAC, 3Ø (Equip)	16 KVA
	5. 440 VAC, 1Ø (Equip)	11 KVA
	6. 440 VAC, 3Ø (Equip)	42 KVA
	7. Lighting[2]	374 KVA
	8. Air Conditioning[3]	232 KVA
	9. Air Compressor and Elevator	20 KVA
	TOTAL	765 KVA
II	WATER	
	1. Cold Taps	40
	2. Hot Taps	20
	3. Distilled Taps	9
	4. Covered Drains	45
	5. Open Drains	4
	(Estimated maximum water usage per month 100,000 cu. ft.)	
III	COMPRESSED AIR OUTLETS	21
	(Pressures required include 30, 75, 90 and 100 psi.)	
IV	NATURAL GAS OUTLETS	15

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(1) A 0.3 load demand factor has been applied.

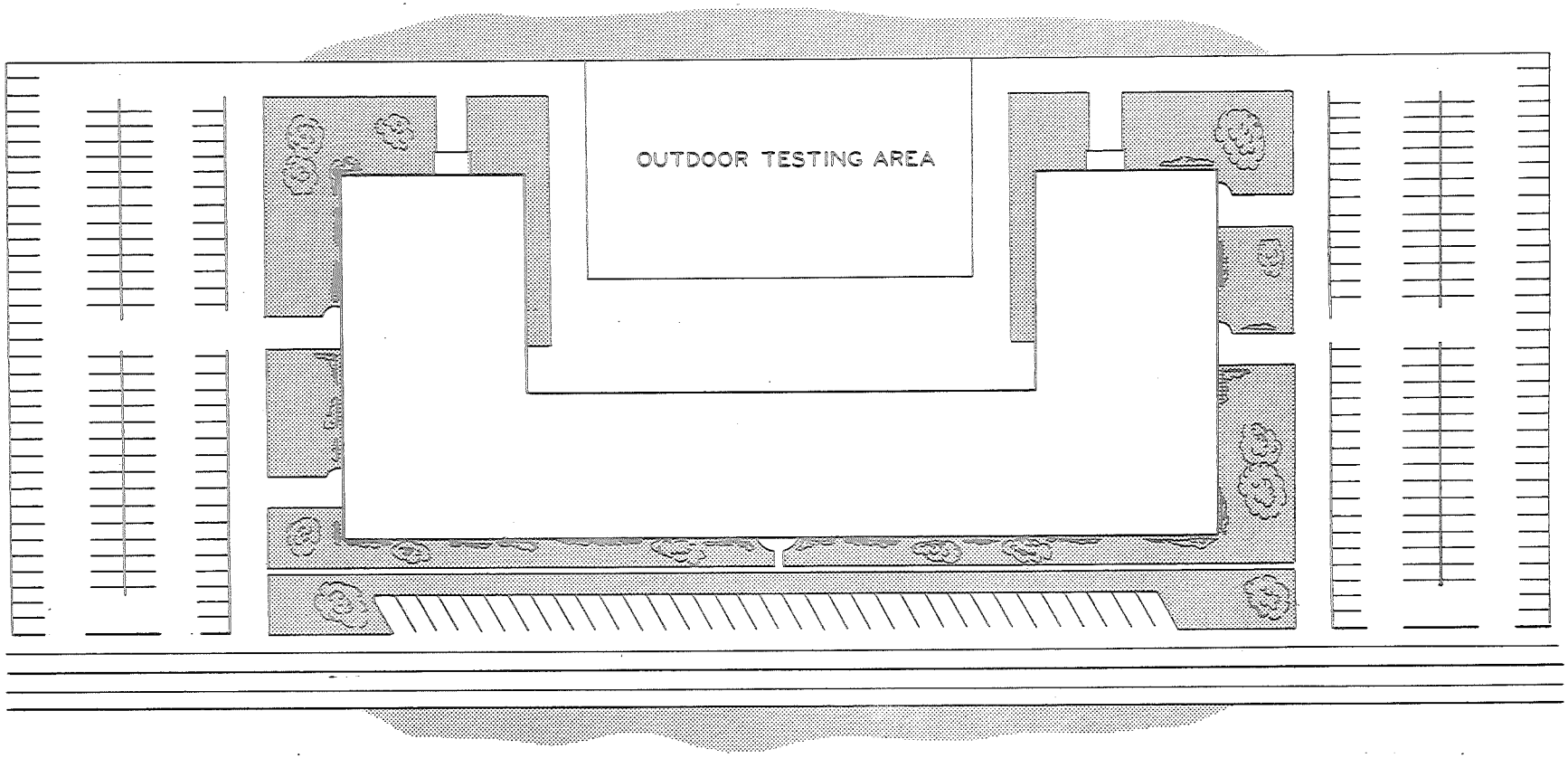
(2) Assume an average of 6 volt-amperes/sq ft. This will be high for some areas requiring low levels but low for other areas requiring 100 fc or more. The excess capacity should be desirable for future growth.

Assume area of 62,400 sq ft total

$$\text{KVA for lighting} = \frac{62,400 \times 6}{1,000} = 374 \text{ KVA}$$

(3) 6 volt amperes/sq ft of air conditioned space (estimated) area to be air conditioned 10,190 sq ft office area 28,400 sq ft laboratory area excluding storage areas.

KVA for air conditioning = 232 KVA



PROPOSED HIGHWAY TESTING LABORATORY AND RESEARCH LABORATORY GROUNDS AND PARKING AREA

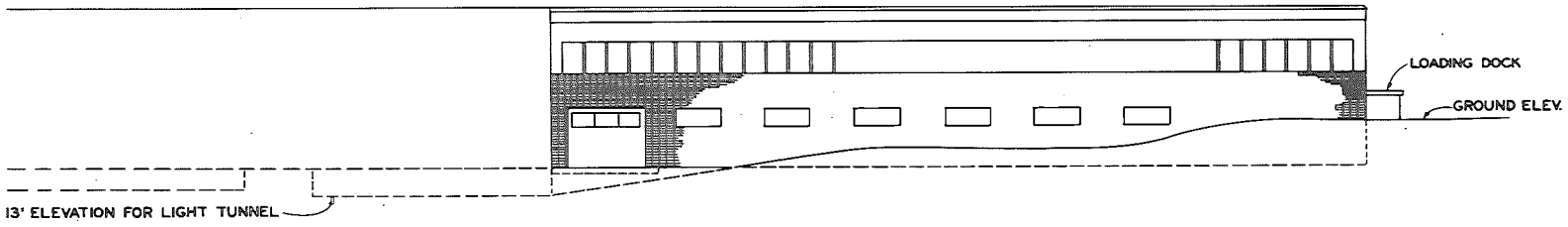
GROUNDS AND PARKING AREA

The proposed Testing and Research Laboratory Building should be located on the site to provide the optimum in orientation, accessibility to the building entrances from the parking area, and the most efficient use of the available land.

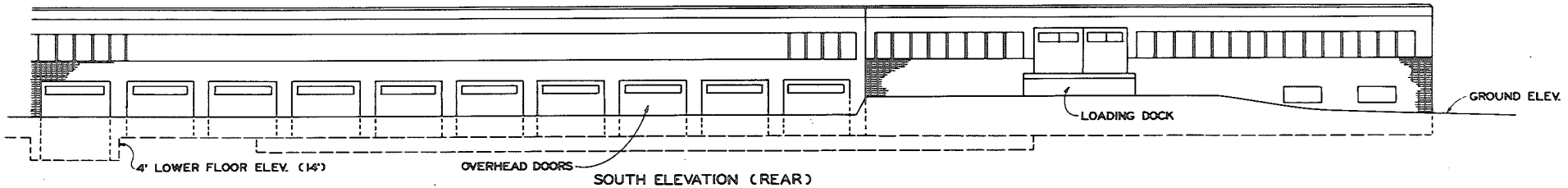
Approximately one-half acre should be provided for outdoor storage and testing. This area should be readily accessible to both laboratory sections.

The lawn area and plantings should be designed to require minimal maintenance and ease of snow removal. An automatic underground sprinkler system should be provided. The electrical and telephone entrance service lines should be underground.

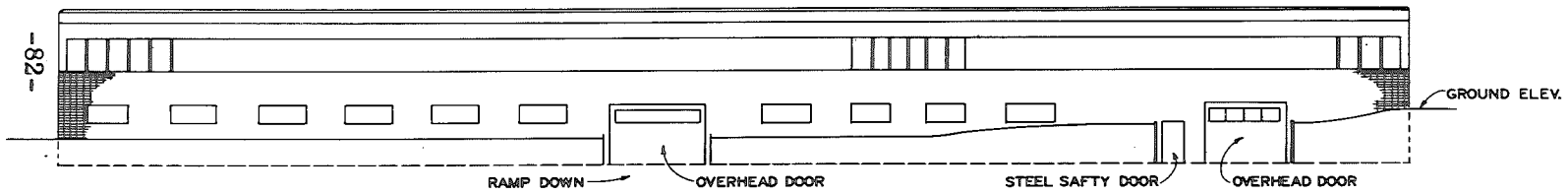
There should be a paved parking area for approximately 200 employees and 30 visitors. The drives should be designed with a traffic pattern separating employee parking from delivery services and visitor parking. All parking areas, building entrances, and drives should be adequately lighted.



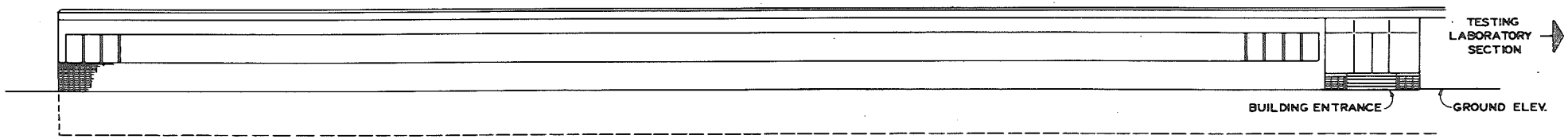
WEST ELEVATION



SOUTH ELEVATION (REAR)



EAST ELEVATION



NORTH ELEVATION (FRONT)

PROPOSED LABORATORY ELEVATIONS