

PROPOSED
HIGHWAY RESEARCH LABORATORY

Research Laboratory Section
Testing and Research Division
Research Report No. R-708

State of Michigan
Department of State Highways
Lansing, July 1969

OFFICE MEMORANDUM



MICHIGAN

DEPARTMENT OF STATE HIGHWAYS

To: R. L. Greenman, Engineer of Testing & Research
Testing and Research Division

From: L. T. Oehler

Subject: Review of Current Laboratory Facilities and Requirements for Proposed New Laboratory in Secondary State Complex.

This prospectus is submitted in anticipation of the need for new quarters specifications for Secondary State Complex planning, and also in response to a January 1969 verbal request from C. Fulkerson of the Property Management Section. It includes a brief summary of the current Laboratory organization and physical plant and, in addition, details the Laboratory's needs in any future facility. An attempt has been made in preparing the report to make adequate provision for a 25-year period of Laboratory operation.

The L-shaped building configuration is predicated on the possibility of the Ann Arbor Laboratory being relocated to the Secondary State Complex and placed in a contiguous building with the Research Laboratory. Earlier discussions pointed to a U-shaped building as being most efficient should the merger take place. In that event an additional L-shaped building would be joined to that detailed here for the Research Laboratory resulting in an overall U-shaped structure. Also, because of this possibility the Laboratory's Administrative Offices, Lobby, Conference Room, Publications Unit, Data Processing, and Graphic Presentation have been located so as to facilitate communication and sharing. However, the utility requirements and parking as presented do not include provision for the Testing Laboratory.

The Soil Density Kit Repair group have operated in close proximity to the Laboratory for a number of years now. Consequently, their needs have been determined and their facility is included with the Laboratory.

As pointed out earlier, the building configuration assumes joining with the Testing Laboratory facility. However, should the decision be made to leave the testing operations in Ann Arbor and place the Research Laboratory in

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it's own building, then some different building configuration and internal arrangement would be in order. These detailed plans will also prove useful if it is decided at some future time to construct a facility for the Research Laboratory on the Michigan State University Campus.

TESTING AND RESEARCH DIVISION

L. Roy T. Oubler

Engineer of Research
Research Laboratory Section

LTO:sjt

PREFACE

This prospectus presents a brief summary of the Research Laboratory's physical plant evolution up to and including the present Saginaw Street Offices location (Motor Wheel Building). Floor plans of the present facility, charts of the Laboratory's functions, organization and personnel are included.

After reviewing the Laboratory's past and current quarters, detailed drawings and specifications are presented for use in planning and designing the proposed new Laboratory in the Secondary State Complex.

The report was prepared at the request of C. G. Fulkerson of the Department's Property Management Section.

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PART 1

PRESENT RESEARCH LABORATORY

THE RESEARCH LABORATORY

The Research Laboratory first began operations 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 Figures 1, 2, 3, and 4.

The significant growth in Laboratory physical plant has been a direct result of the tremendous growth in 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.

Figures 5, 6, and 7, respectively, present the Laboratory's functions, its organization for accomplishing these functions, and the allocation of personnel to the various organizational groups.

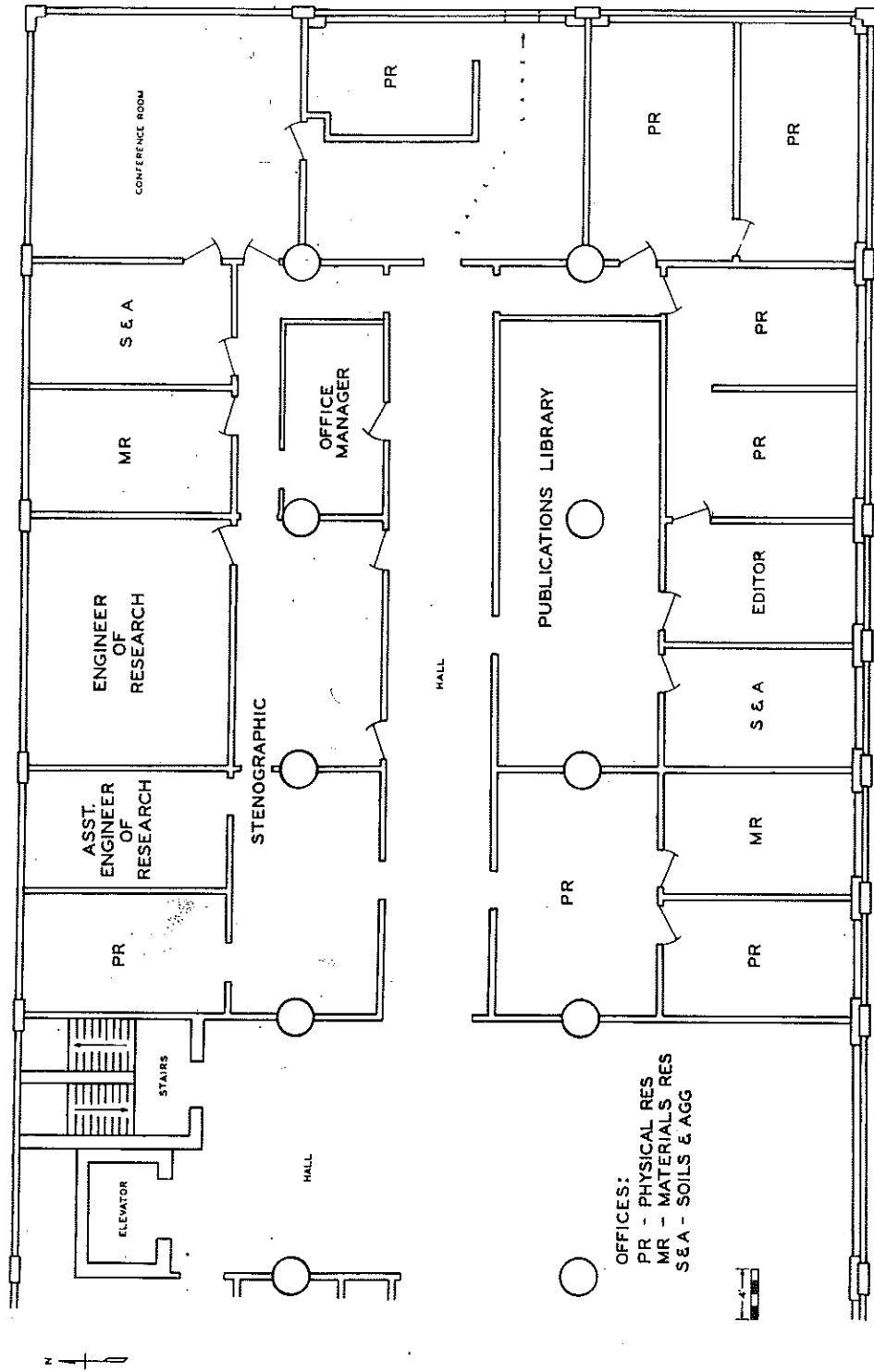


FIGURE 1
SECOND FLOOR - SAGINAW STREET OFFICE

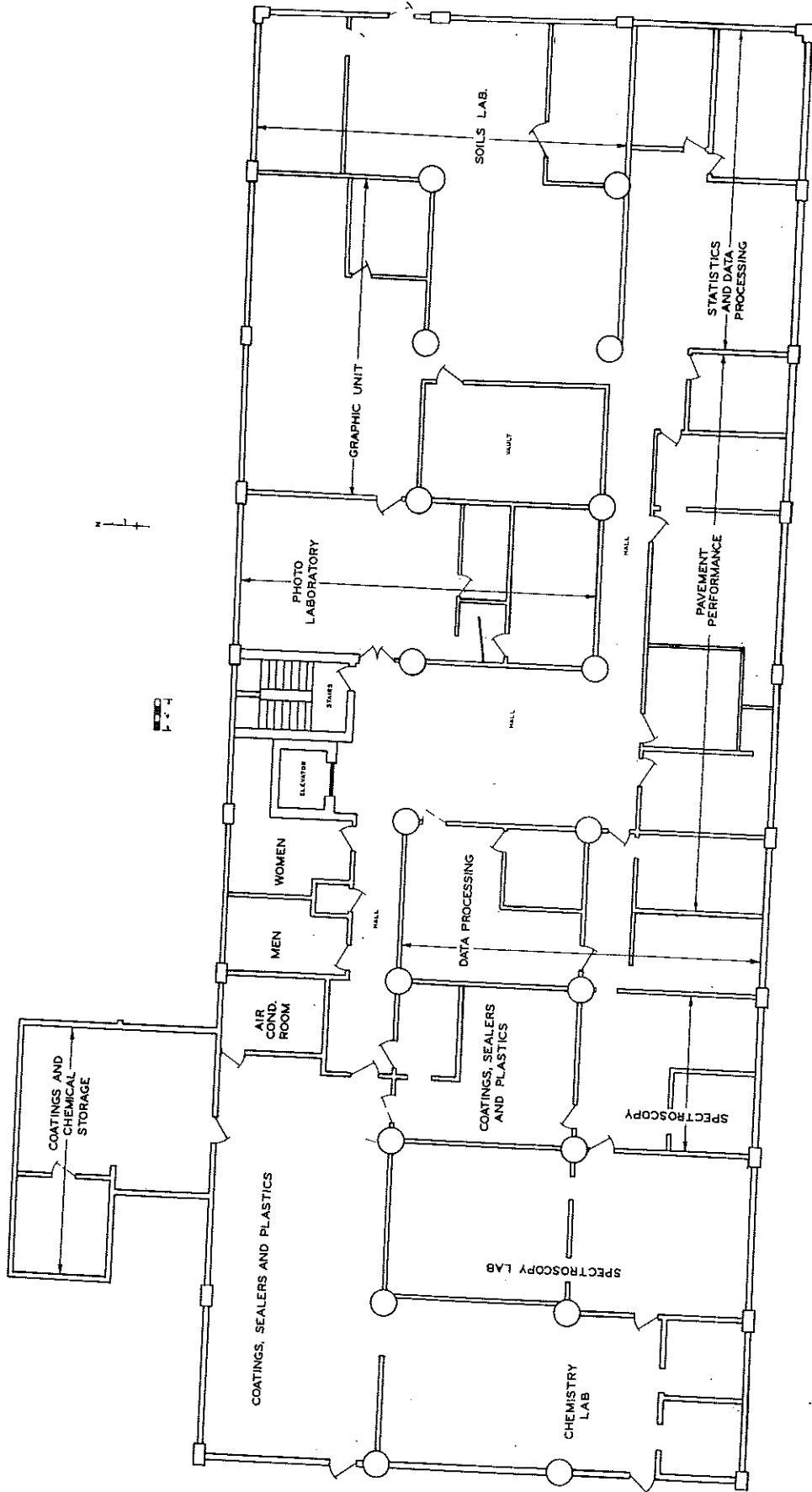


FIGURE 2
THIRD FLOOR - SAGINAW STREET OFFICE

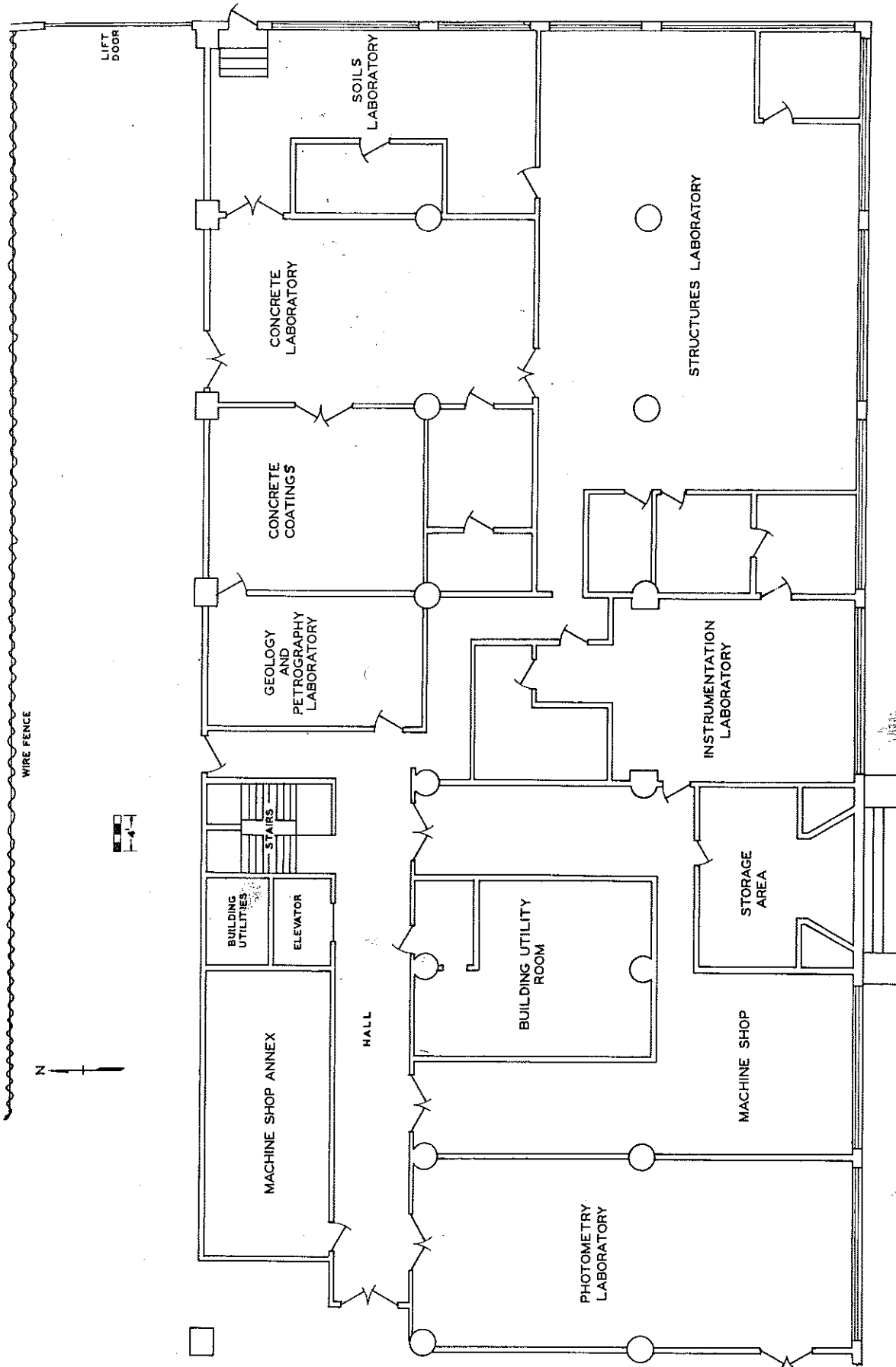


FIGURE 3
EAST BASEMENT - SAGINAW STREET OFFICE

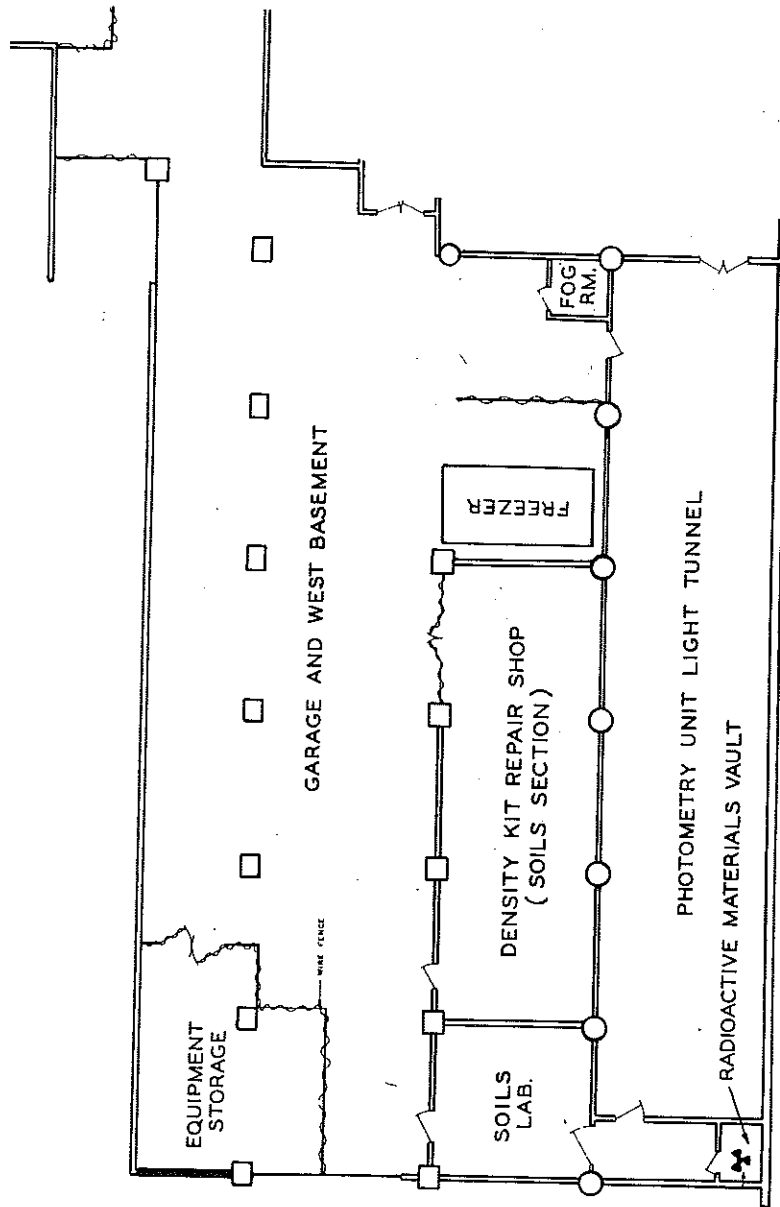


FIGURE 4
WEST BASEMENT - SAGINAW STREET OFFICE

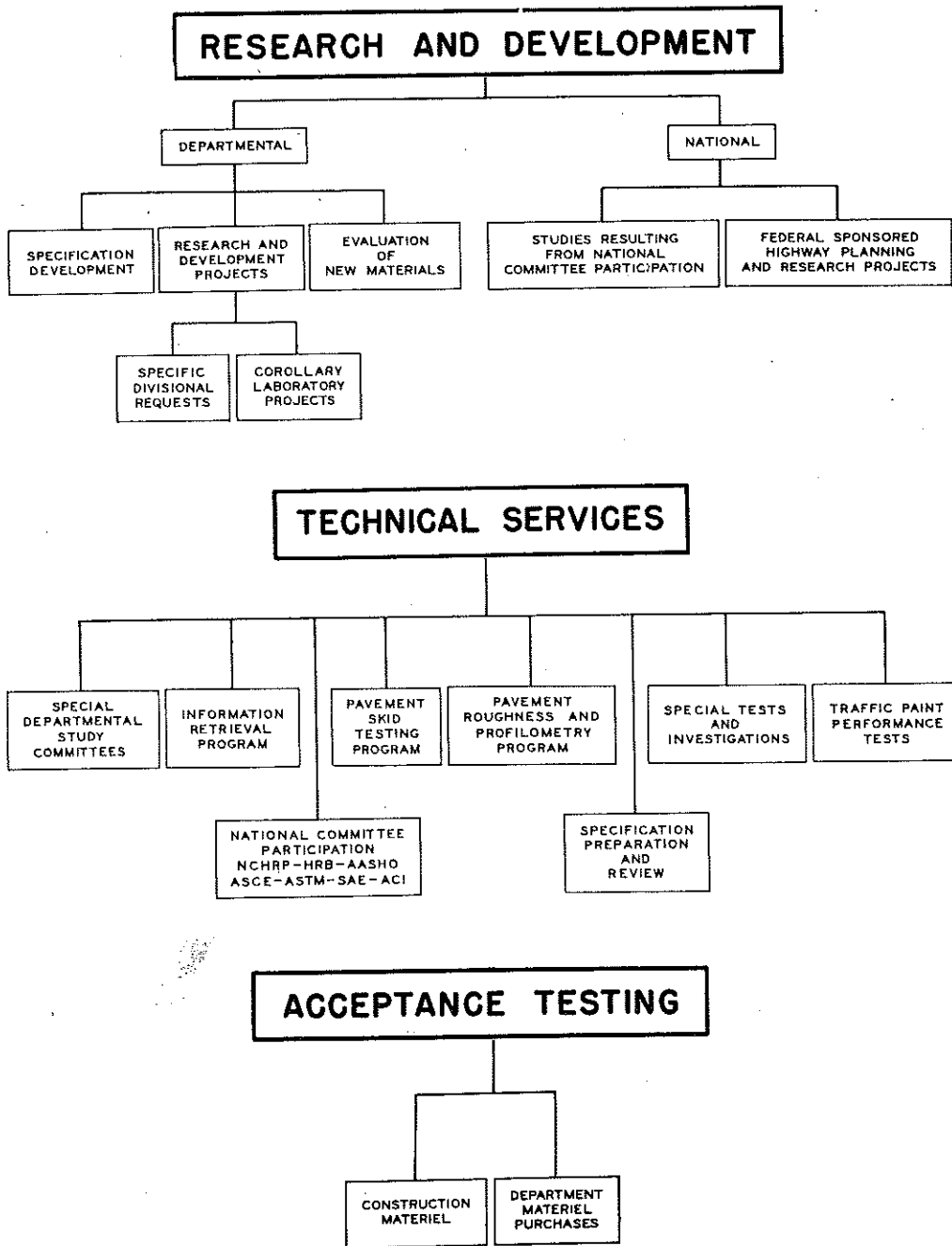


FIGURE 5
LABORATORY FUNCTIONS

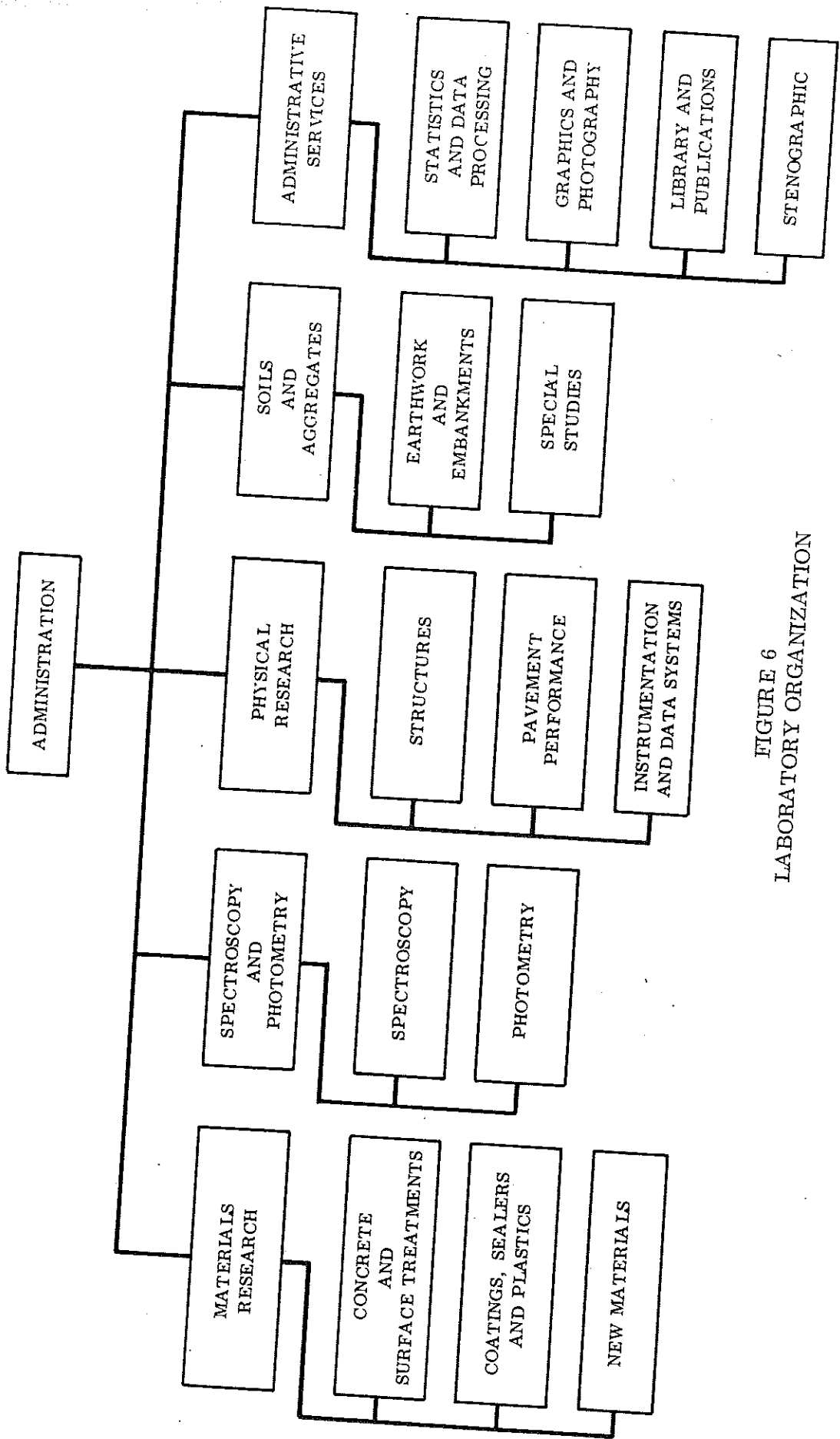
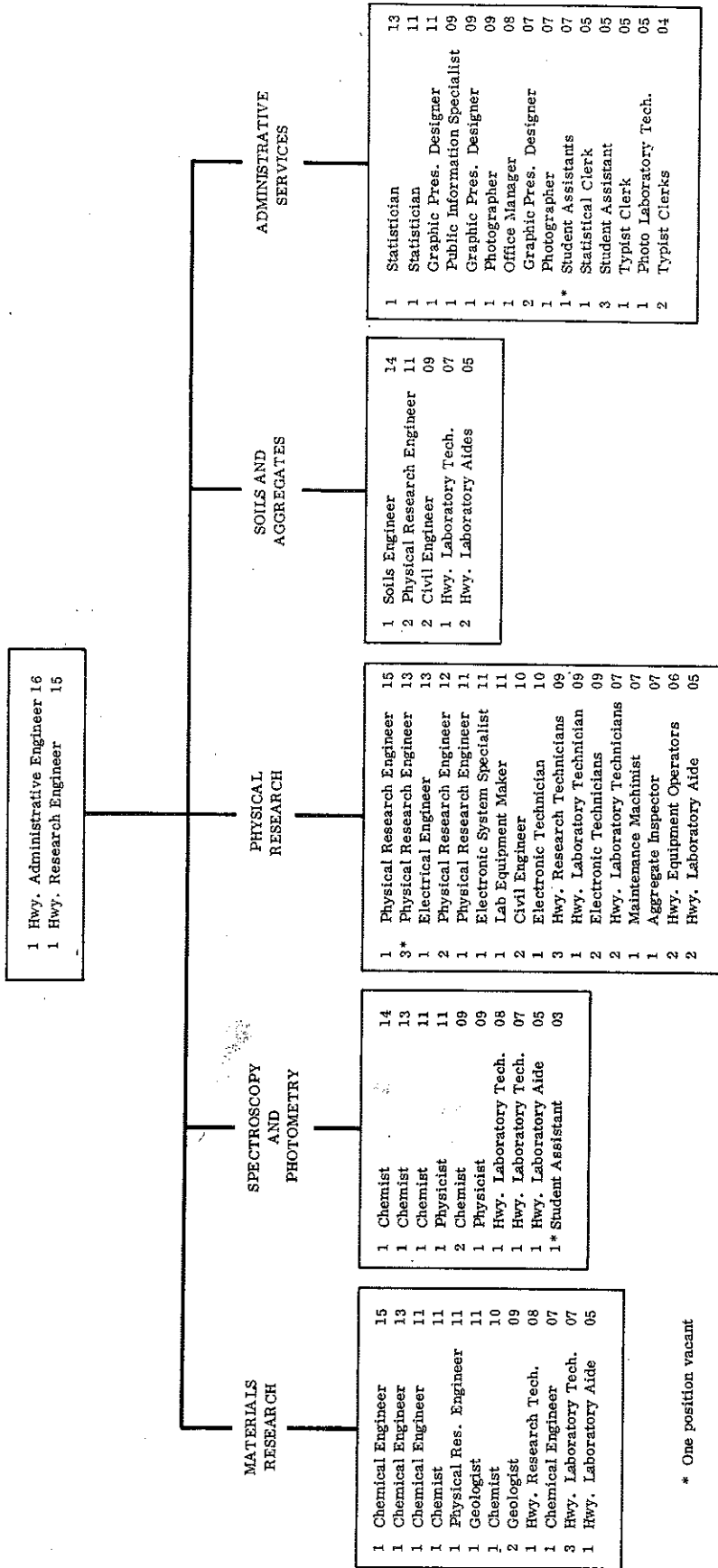


FIGURE 6
LABORATORY ORGANIZATION

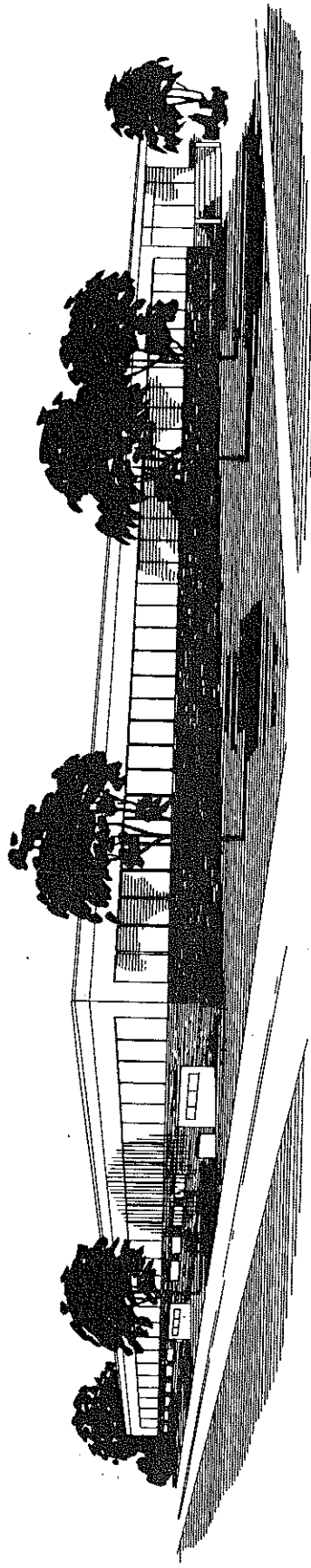


* One position vacant

FIGURE 7
LABORATORY PERSONNEL LEVELS, CLASSES, AND DISTRIBUTION

PART 2

PROPOSED RESEARCH LABORATORY



ARTIST'S DRAWING OF PROPOSED LABORATORY

PROPOSED RESEARCH LABORATORY FACILITY

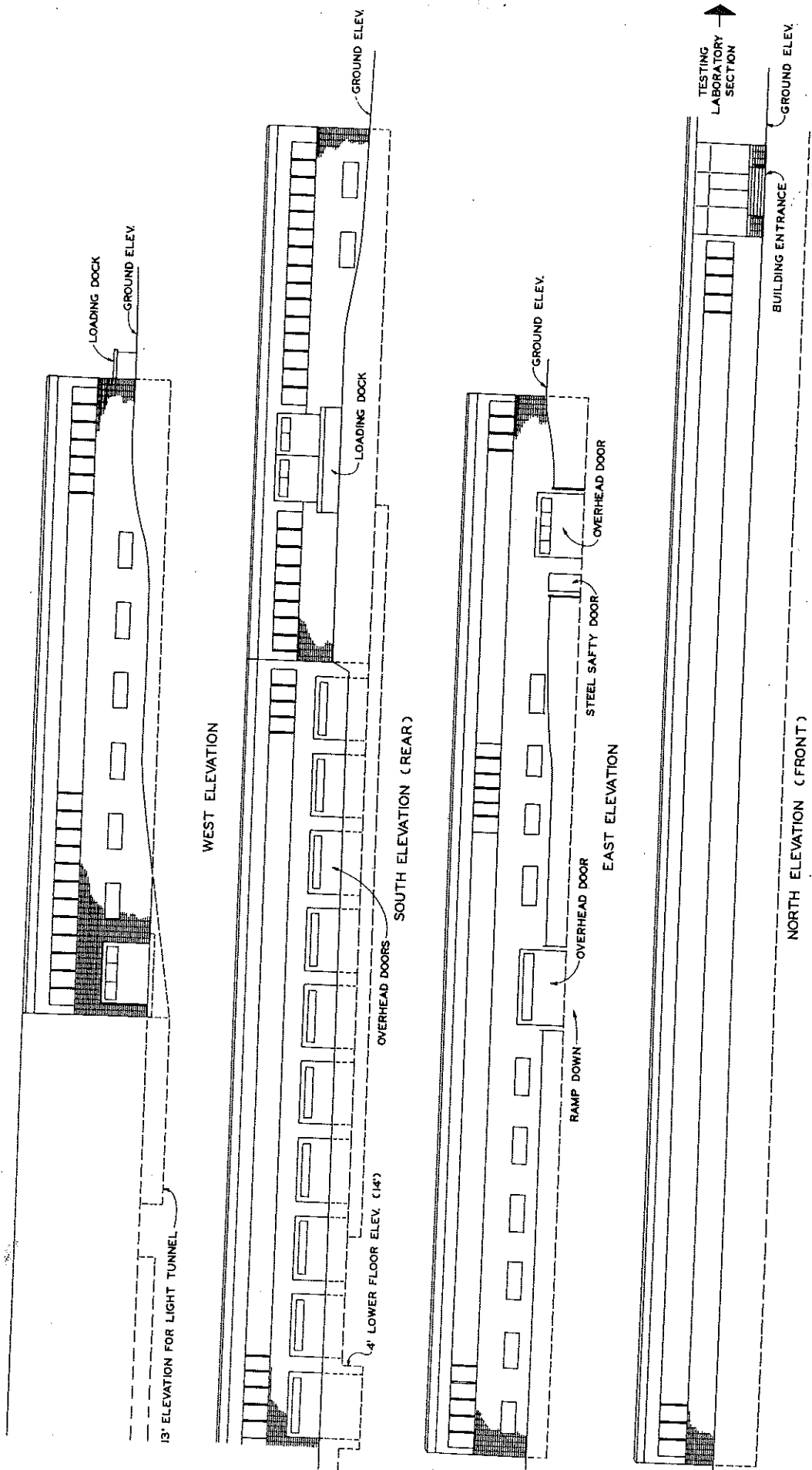
The following pages present a perspective drawing, elevation drawings, and a plan view of the proposed structure as it might be located with respect to access, grounds, parking, etc. Following this are floor plans of the building's two floors, and then detailed floor plans of each individual laboratory or other facility with all major equipment items shown.

The Laboratory comprises inside and outside areas as follows:

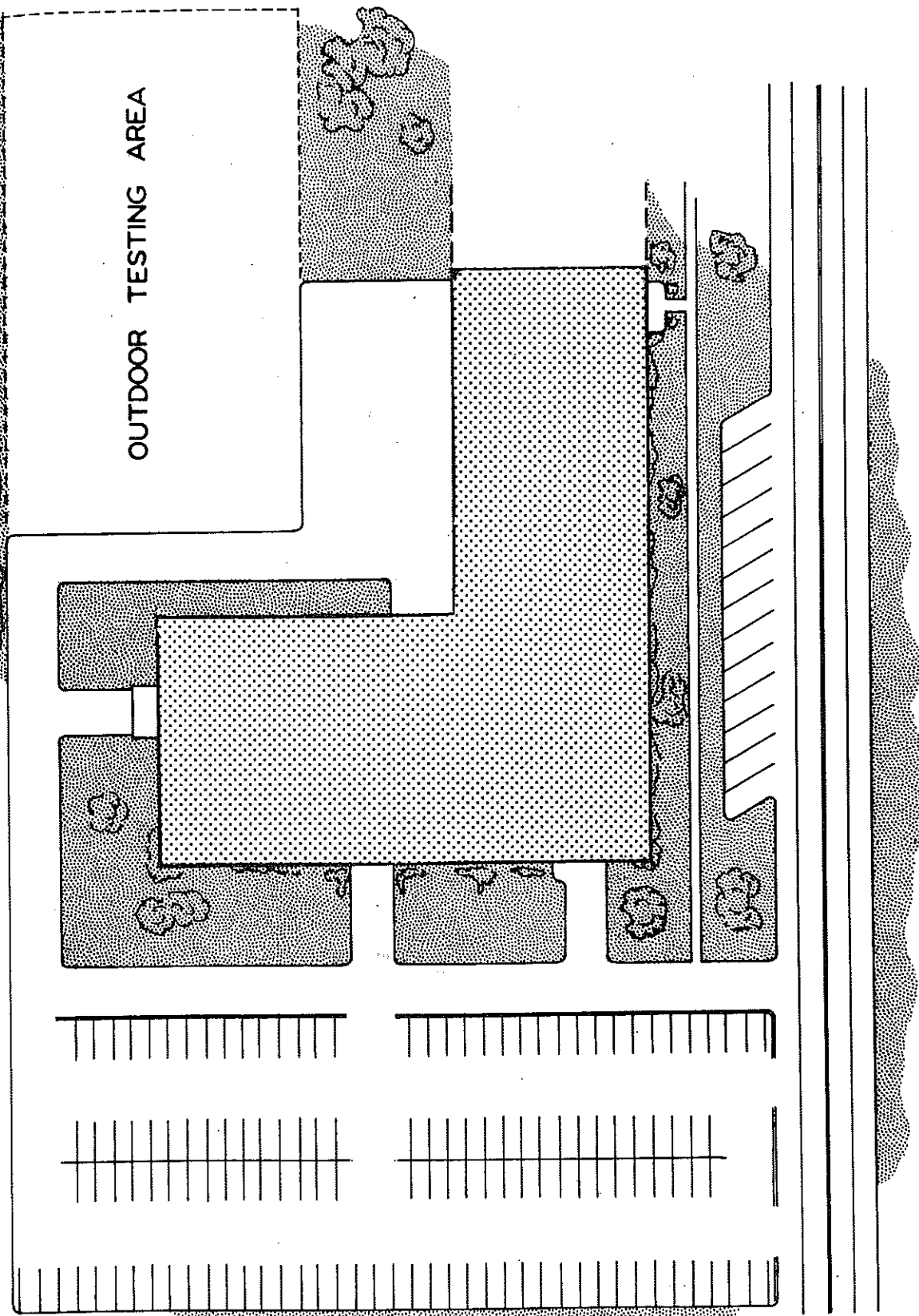
A.	Building - two levels	62,400 sq ft
B.	Outside areas	
	1. Parking ⁽¹⁾	28,750 sq ft
	2. Outside Testing and Storage	43,560 sq ft
	3. Drives, Grounds, etc.	<u>40,000 sq ft</u>
	TOTAL	174,710 sq ft (4.0 acres)

The normal cost for research facilities is in the range of \$30 to \$40 per square foot. Therefore, the structure proposed here will probably require a capital outlay of from \$1,872,000 to \$2,496,000. This will provide a superior facility of long life, constructed basically of steel and concrete with maintenance free, durable, terrazo-type floors and tiled walls, sound, fume, and odor proofed throughout, well illuminated, all areas readily accessible, adequately conditioned air, inside storage for all mobile test equipment and other necessary provisions and features.

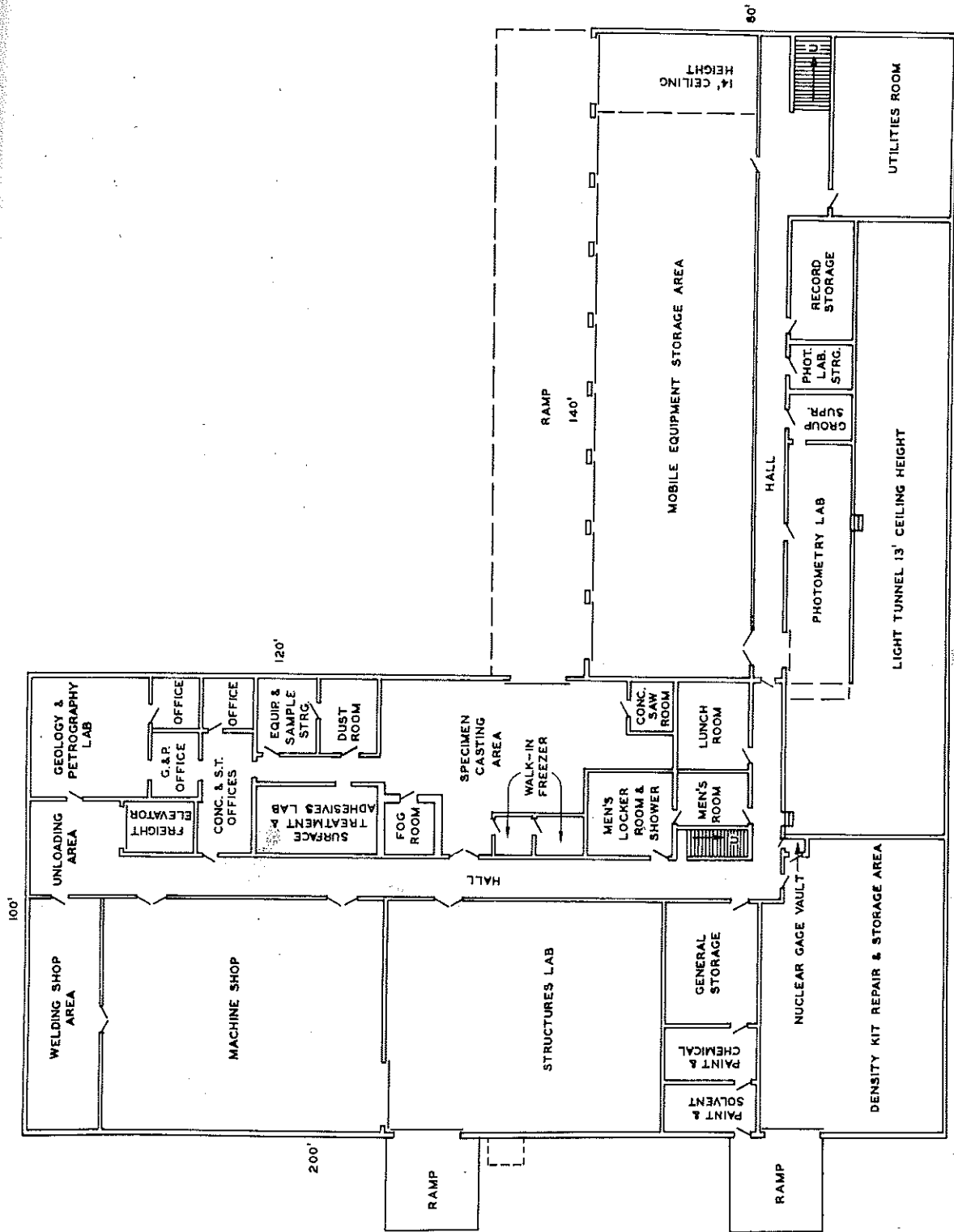
⁽¹⁾ Parking area is based on the following:		
a.	15 spaces @ 250 sq ft/space for Highway and Visitor vehicles	3,750 sq ft
b.	100 spaces @ 250 sq ft/space for employee vehicles	<u>25,000 sq ft</u>
	TOTAL	28,750 sq ft



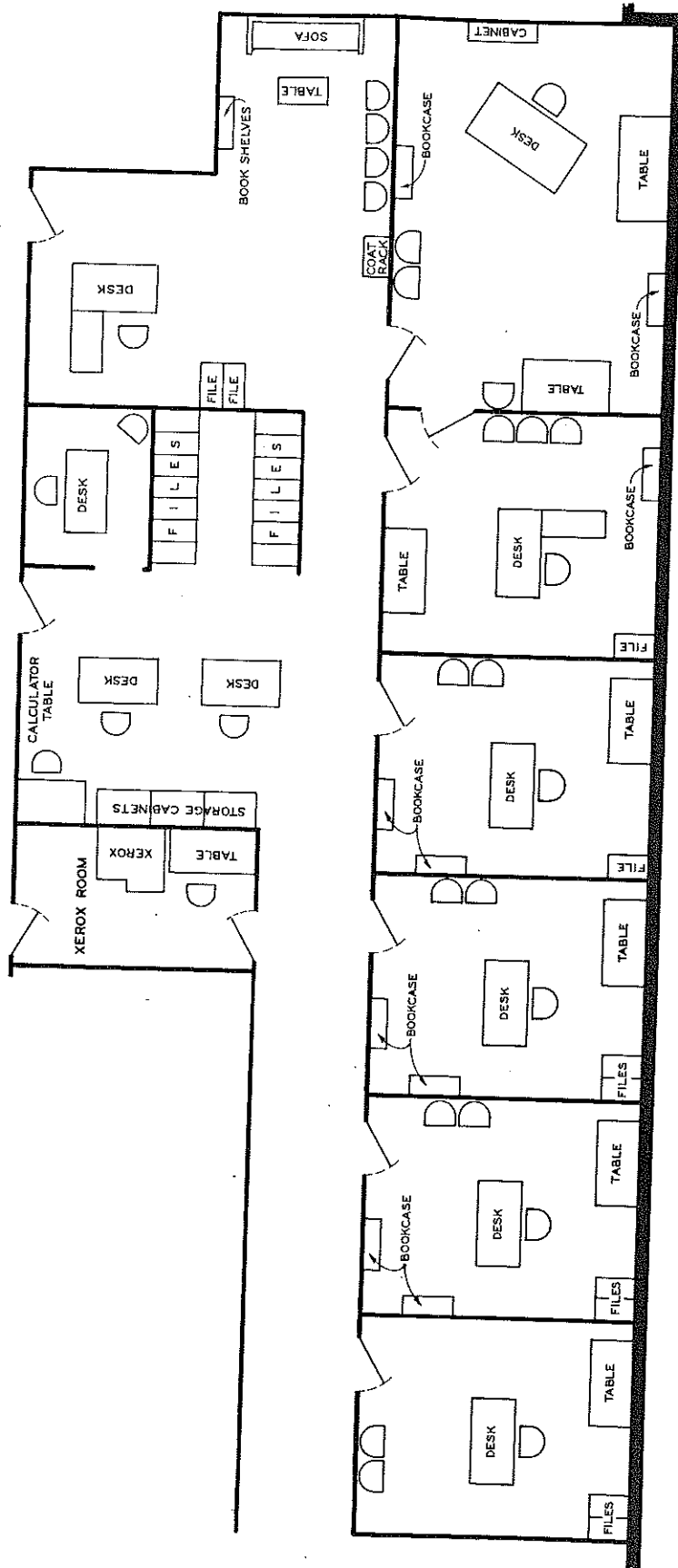
PROPOSED LABORATORY ELEVATIONS



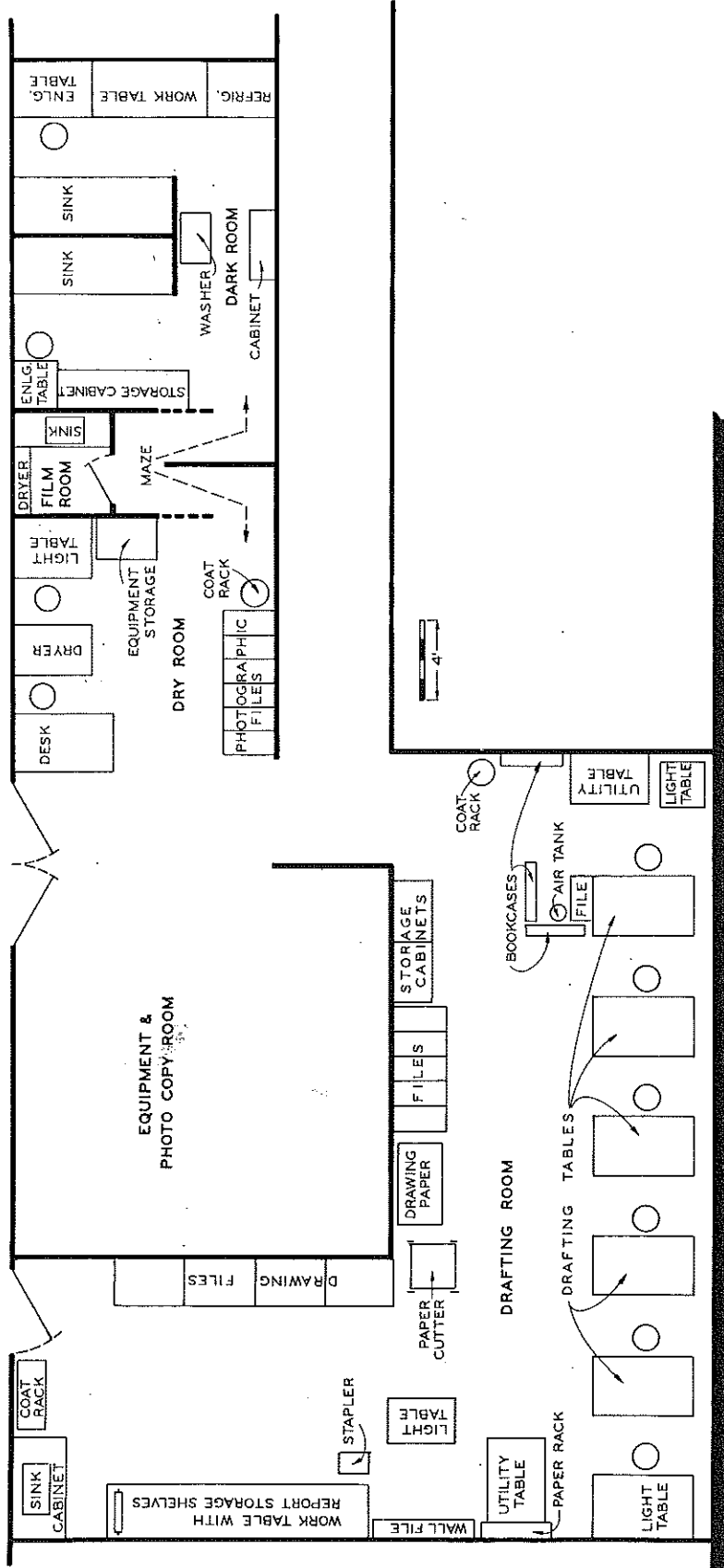
PROPOSED LABORATORY WITH ACCESS AND GROUNDS
(TOTAL INSTALLATION)



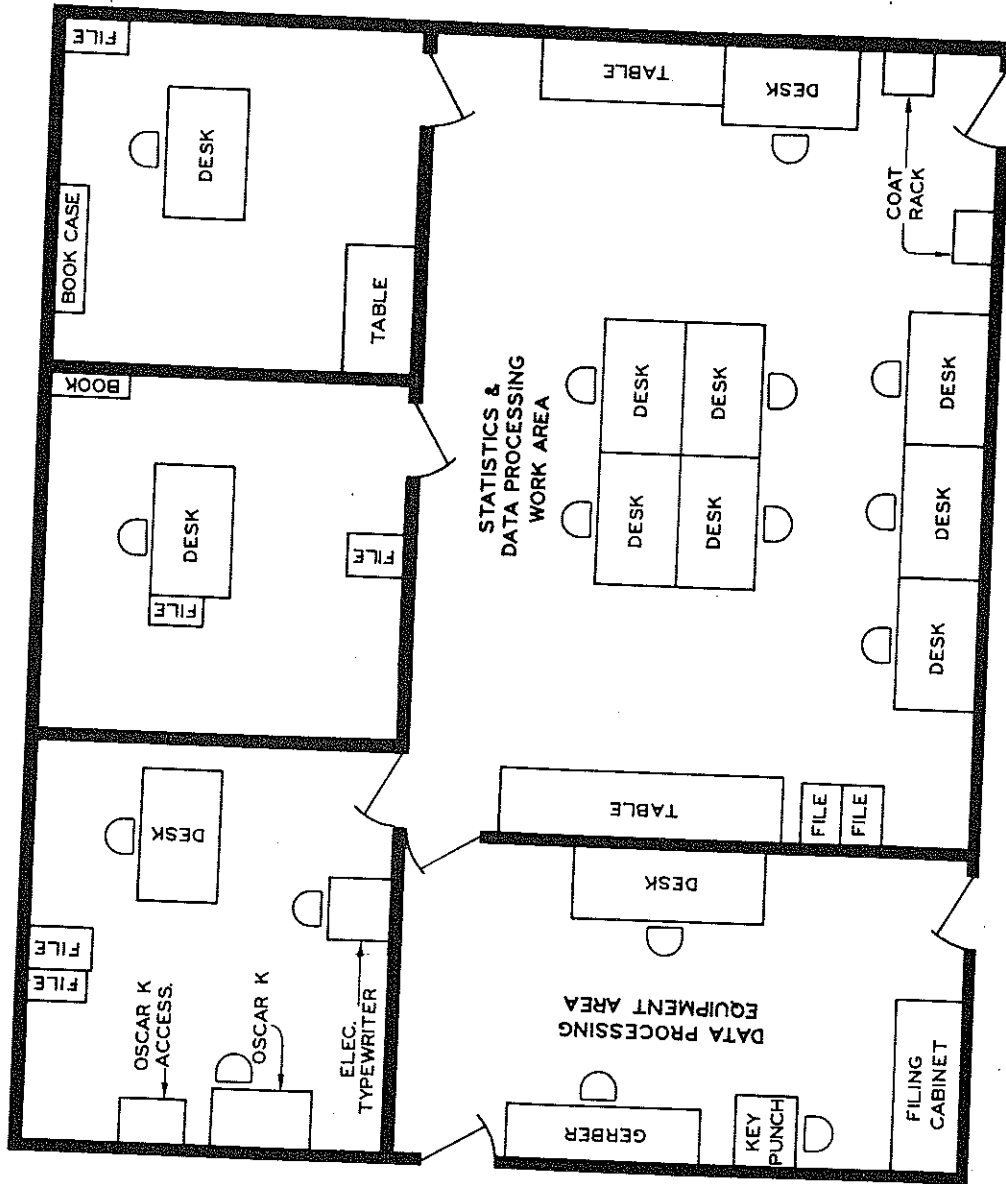
BASEMENT PLAN



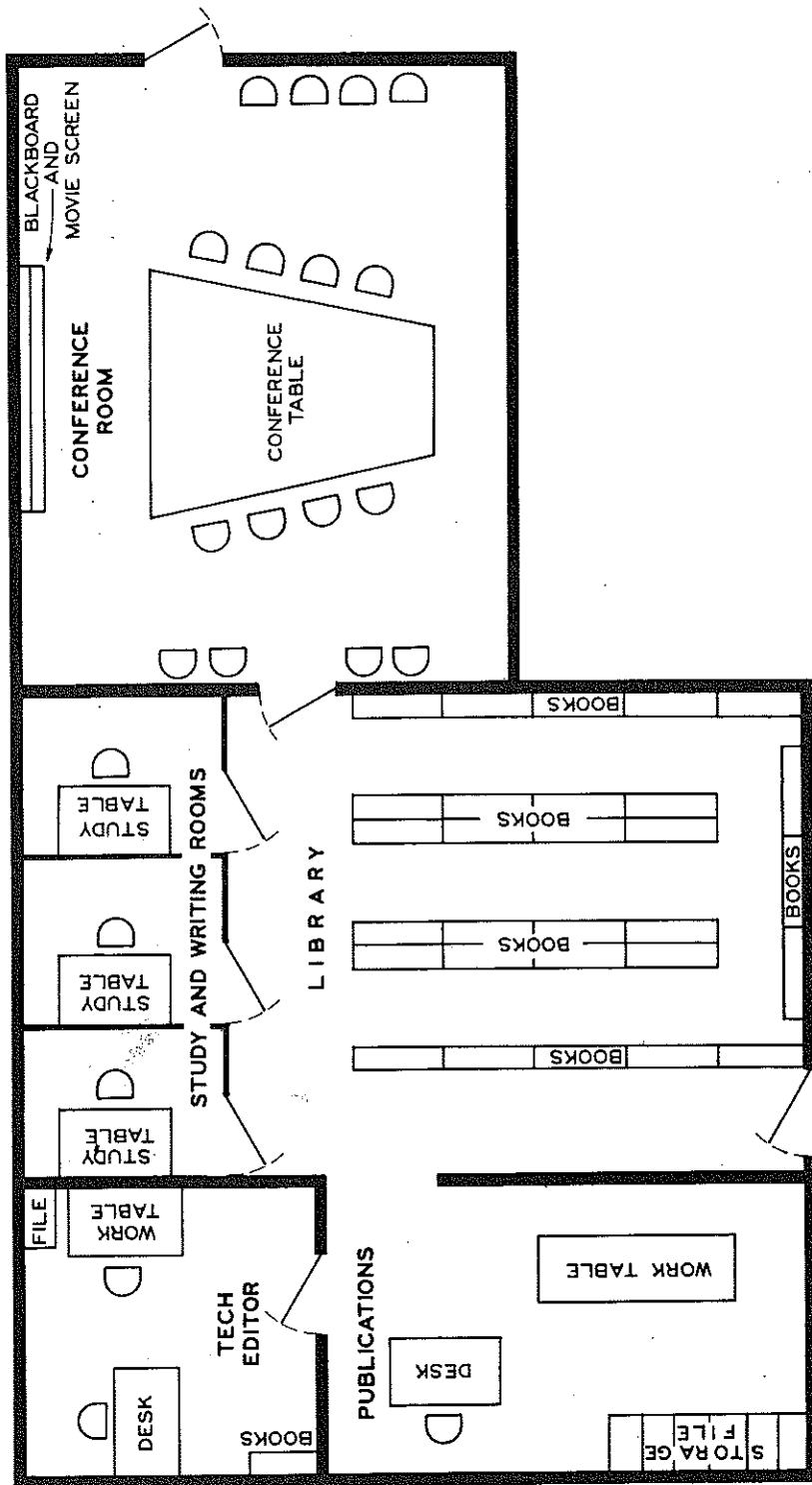
ADMINISTRATIVE OFFICES



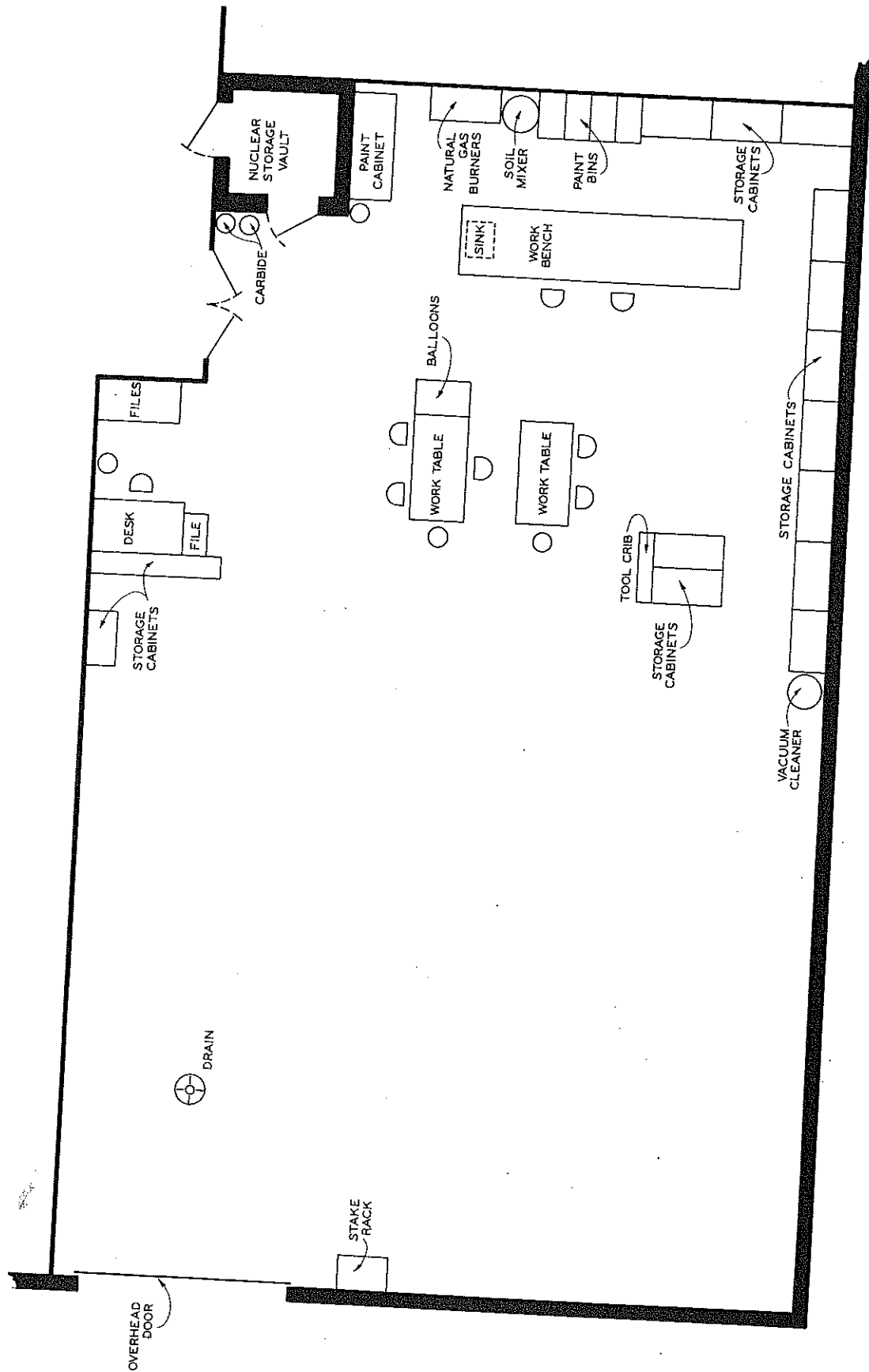
GRAPHICS AND PHOTOGRAPHY UNIT



STATISTICS AND DATA PROCESSING UNIT

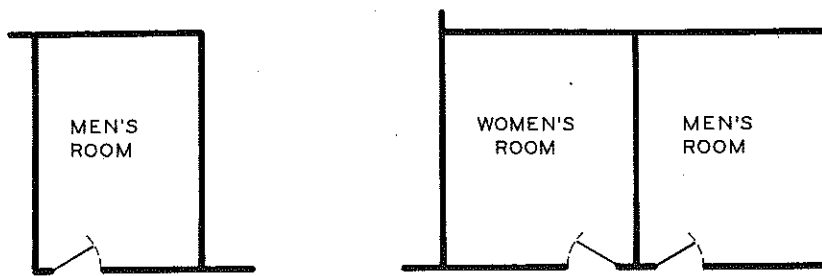
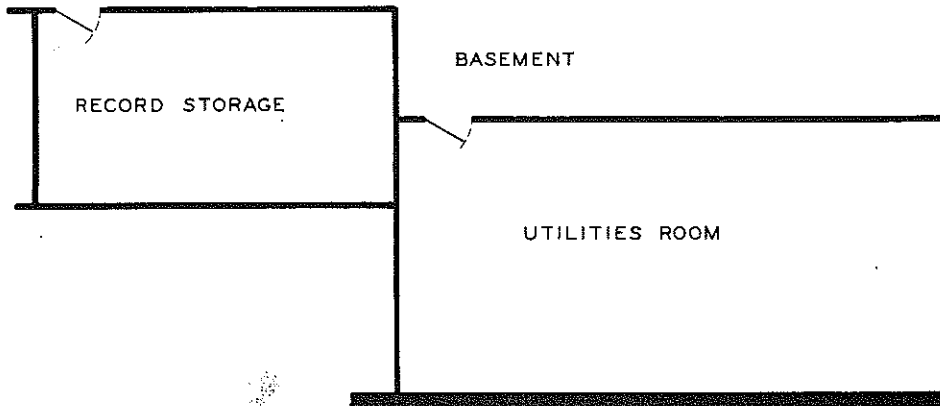
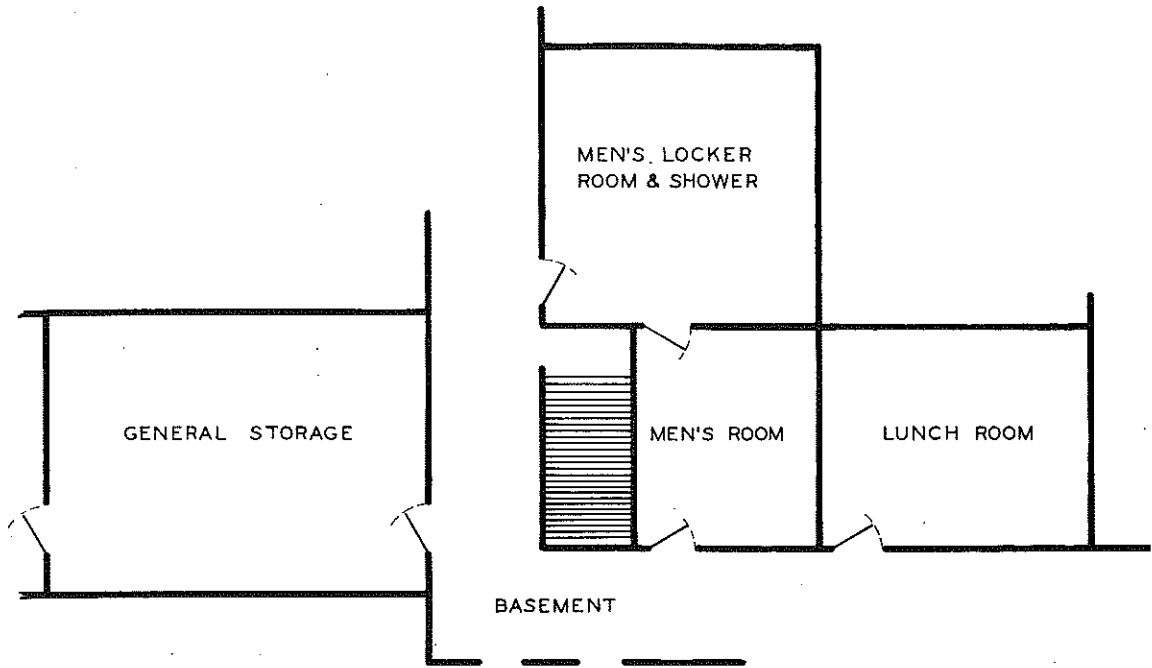


PUBLICATIONS UNIT, LIBRARY AND CONFERENCE ROOM



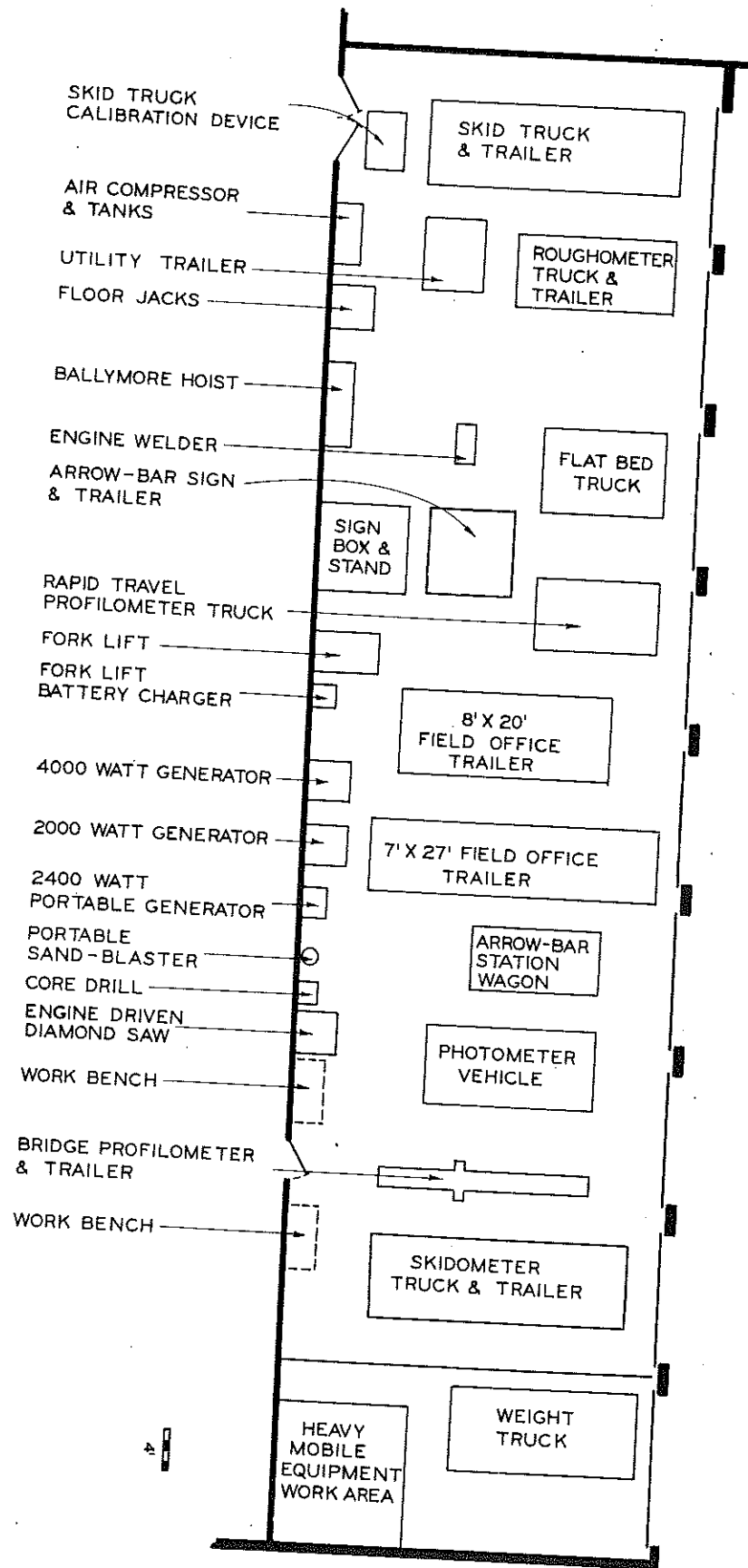
4'

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

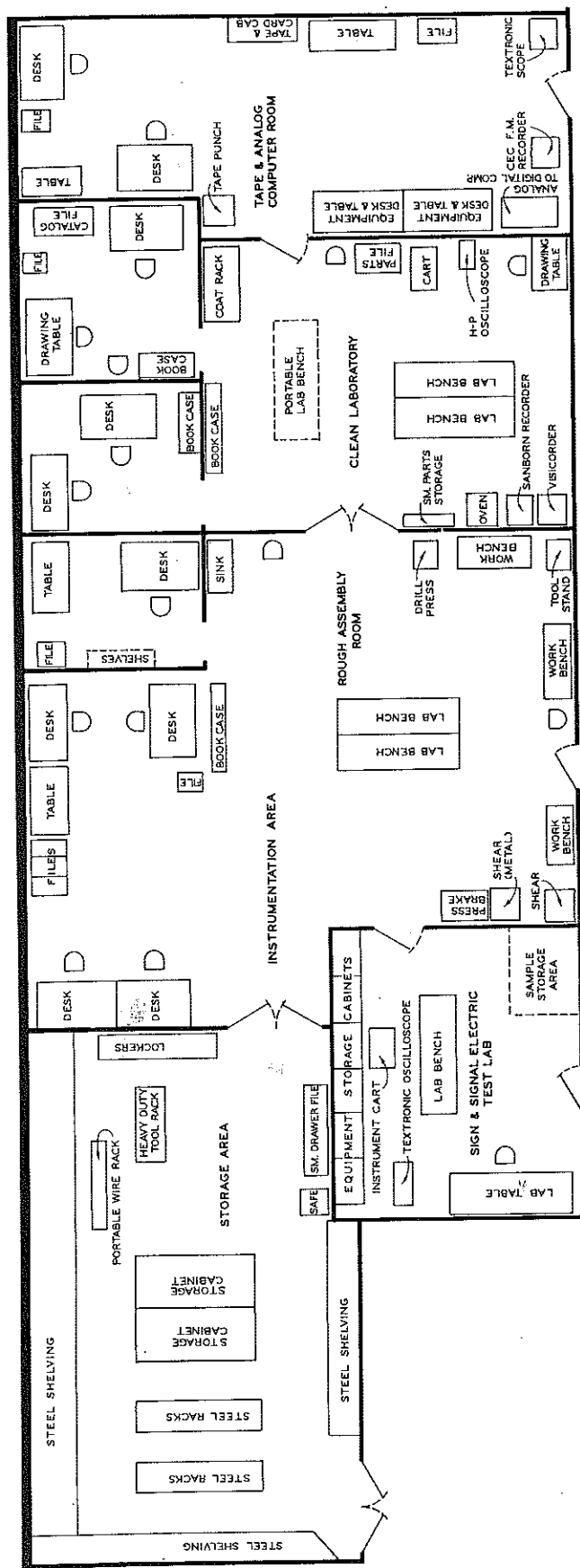


FIRST FLOOR

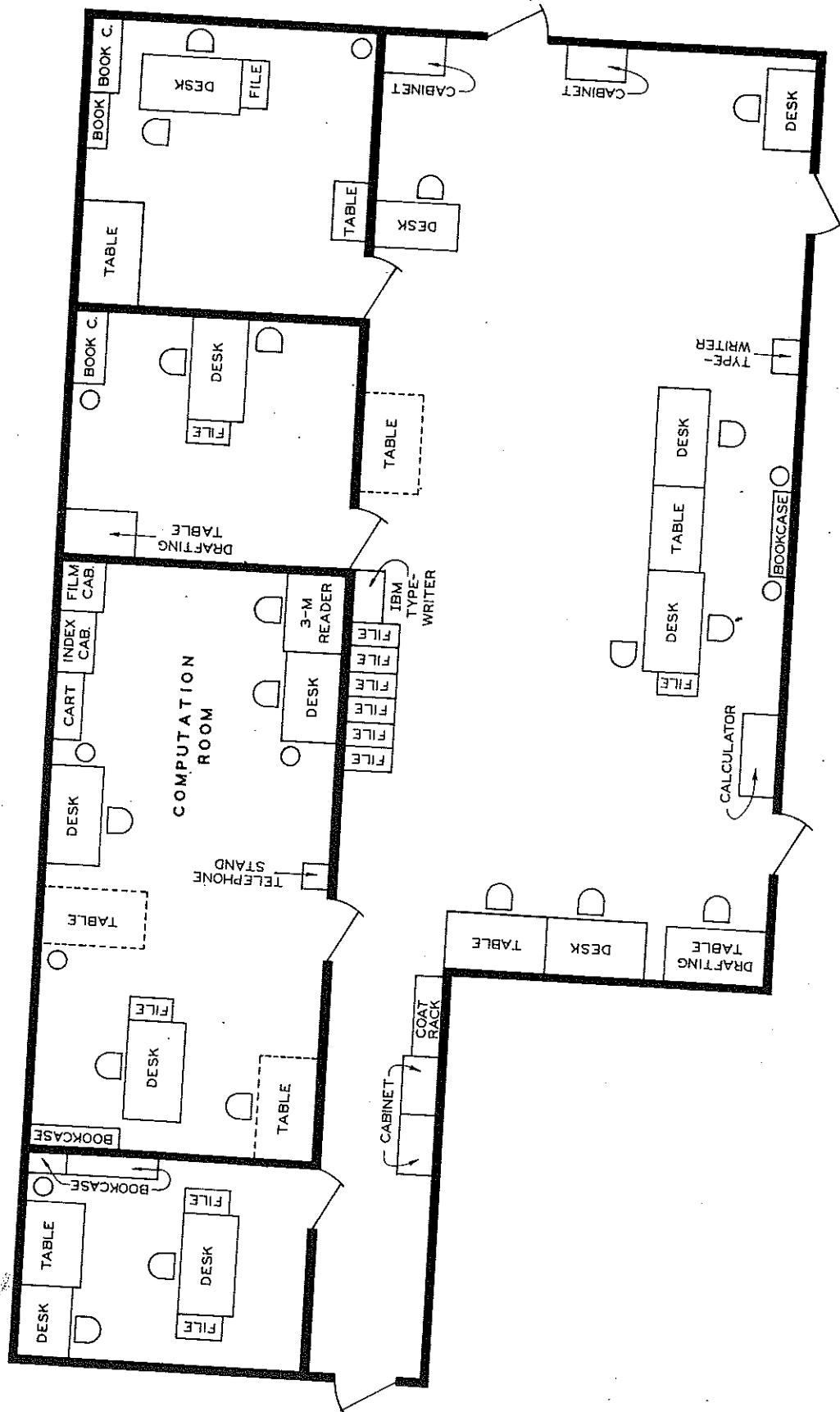
MISCELLANEOUS FACILITIES



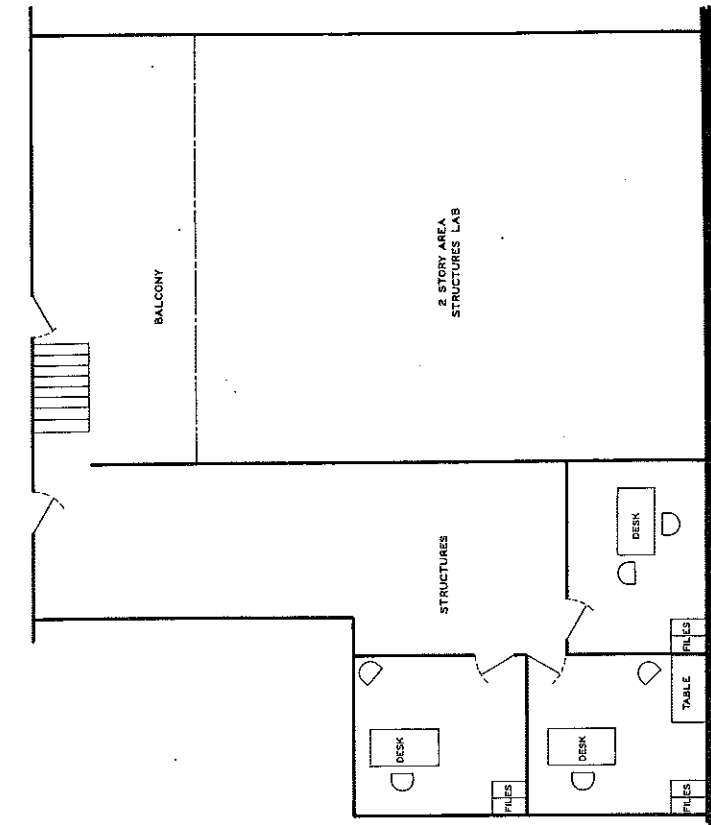
MOBILE EQUIPMENT STORAGE AREA



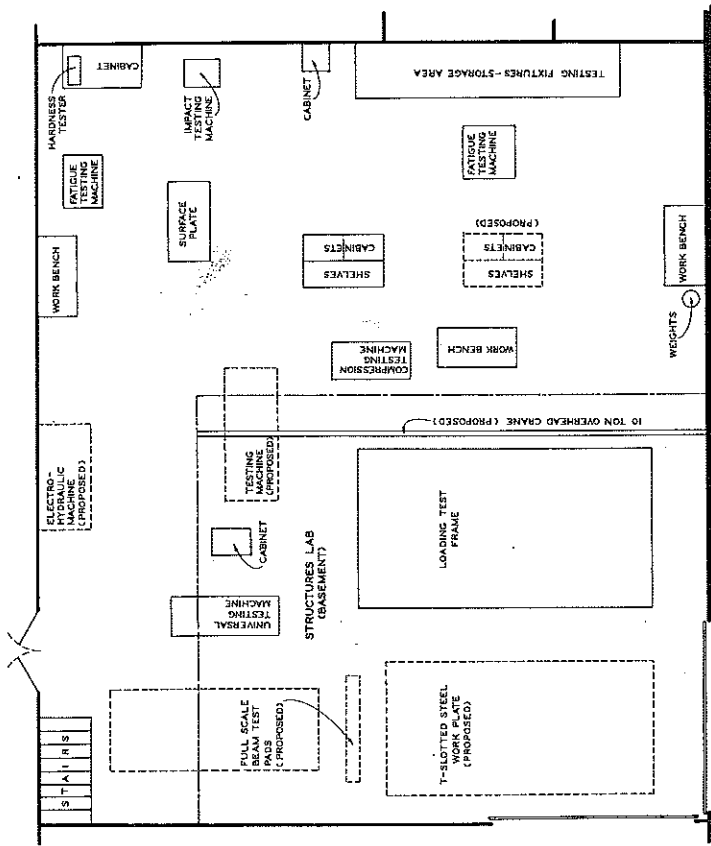
INSTRUMENTATION AND DATA SYSTEMS
(Physical Research Unit)



PAVEMENT PERFORMANCE
(Physical Research Unit)

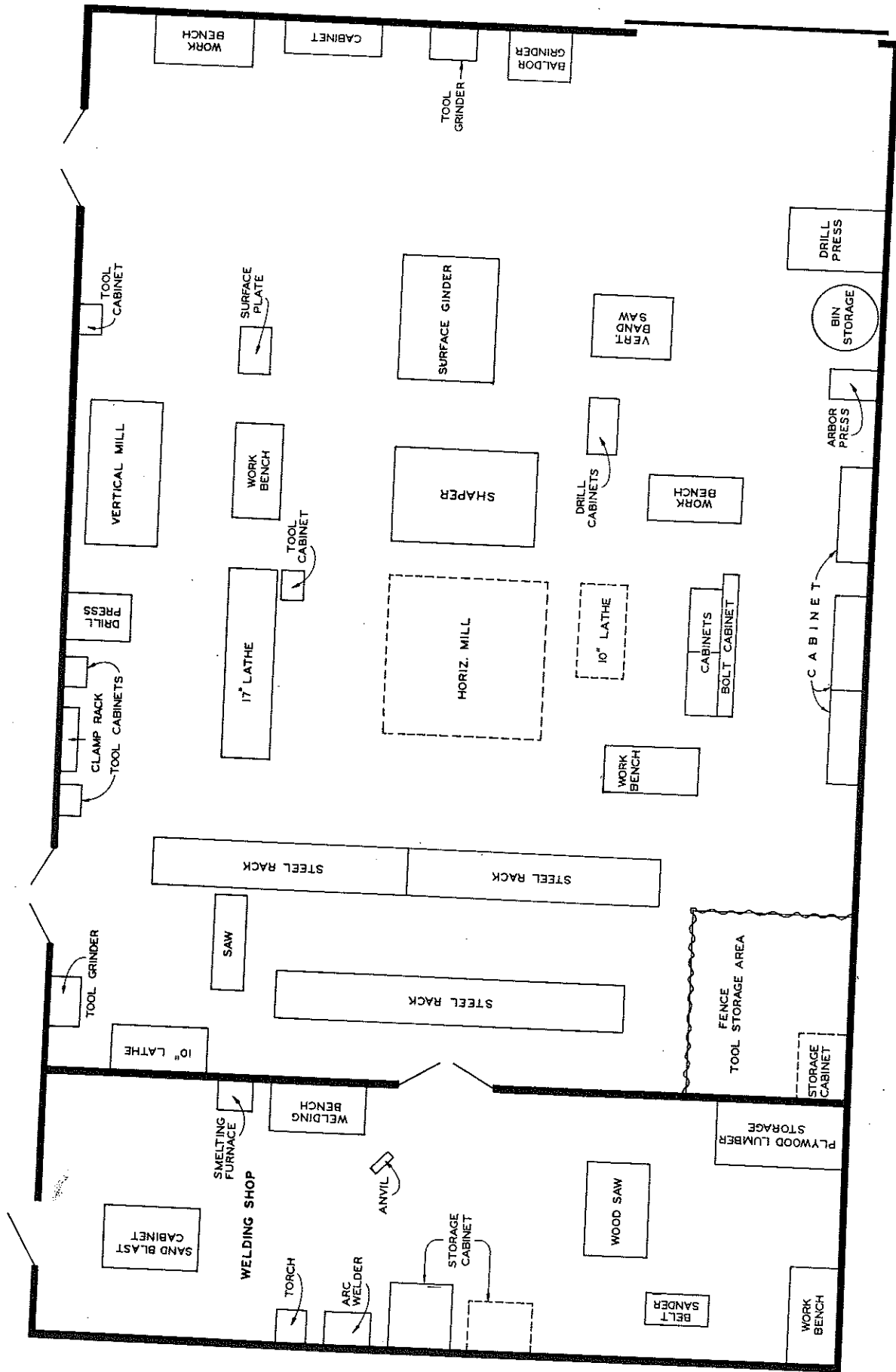


FIRST FLOOR

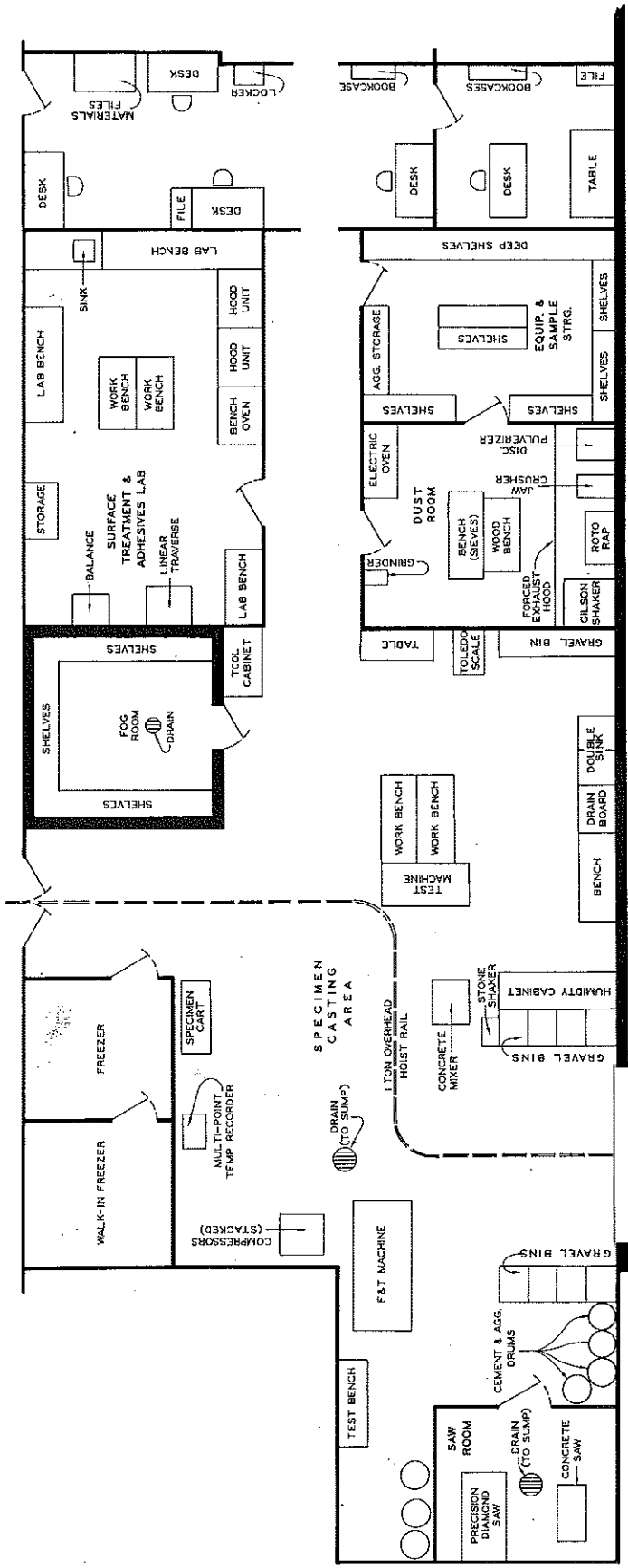


BASEMENT

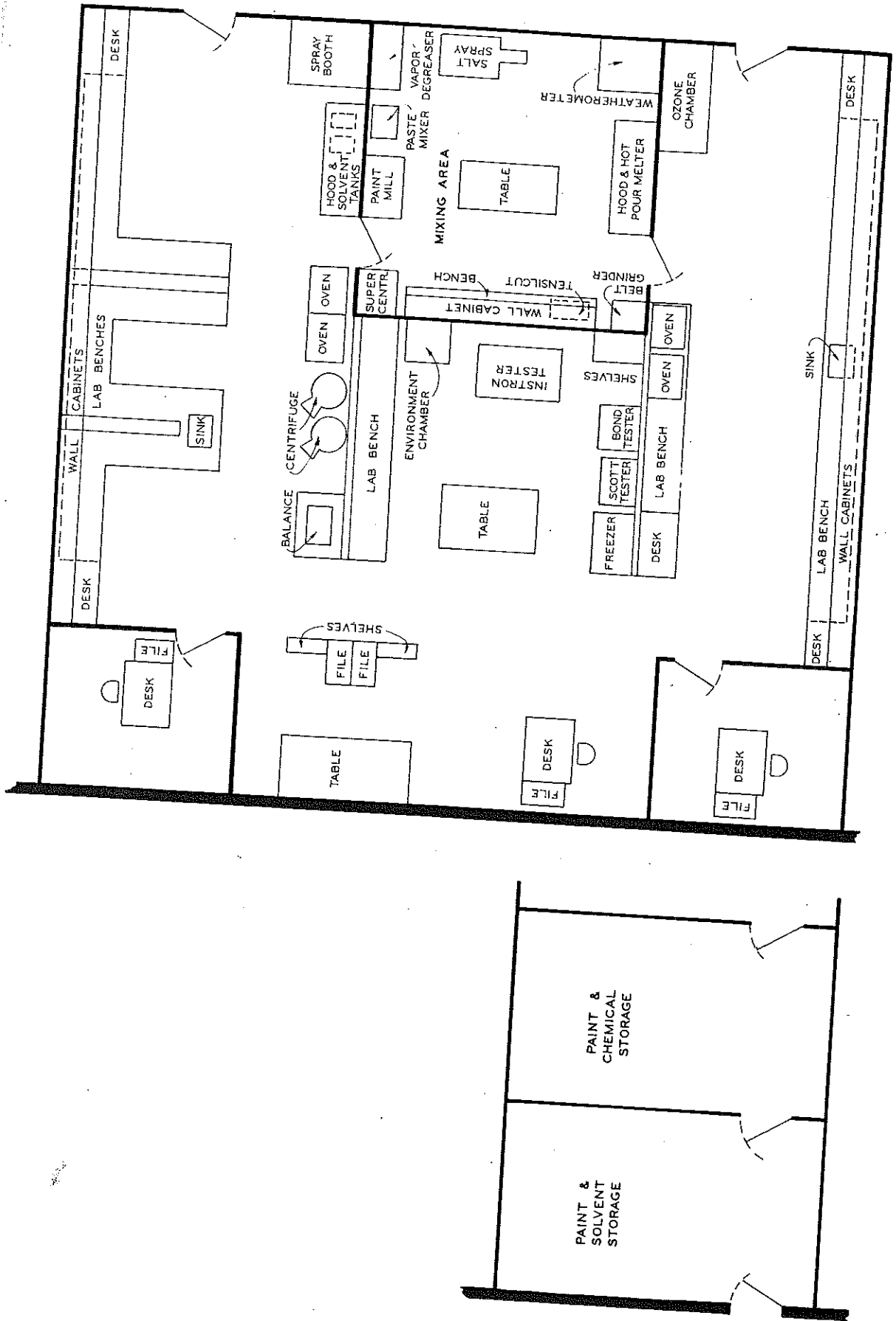
STRUCTURES
(Physical Research Unit)



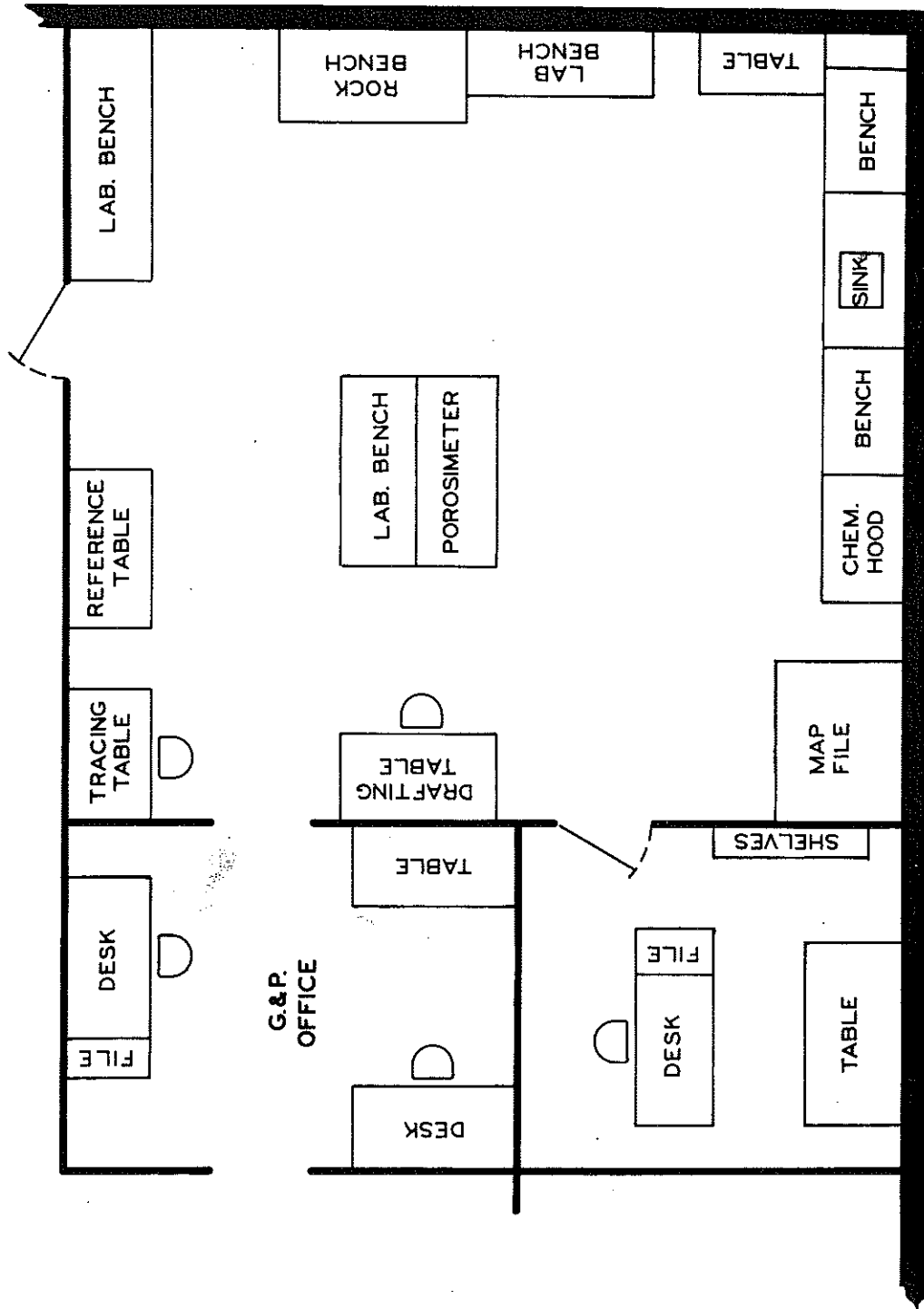
MACHINE SHOP
(Physical Research Unit)



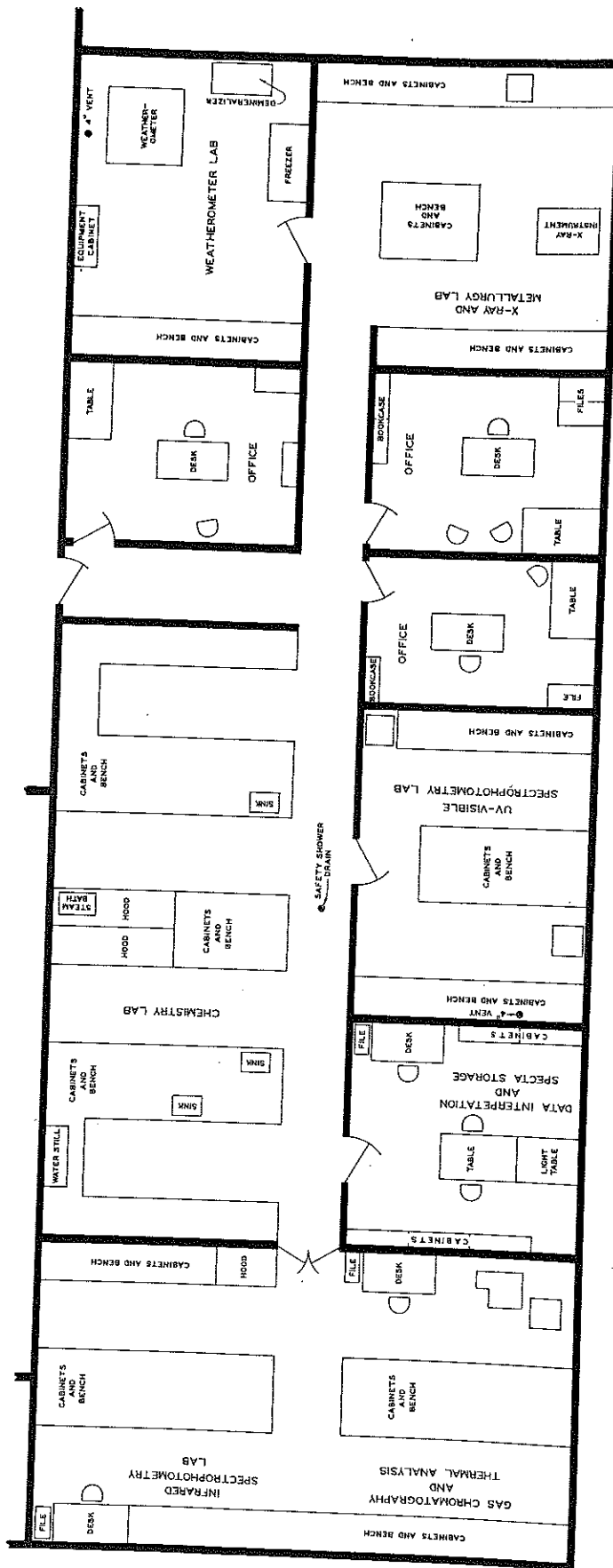
CONCRETE AND SURFACE TREATMENT
(Materials Research Unit)



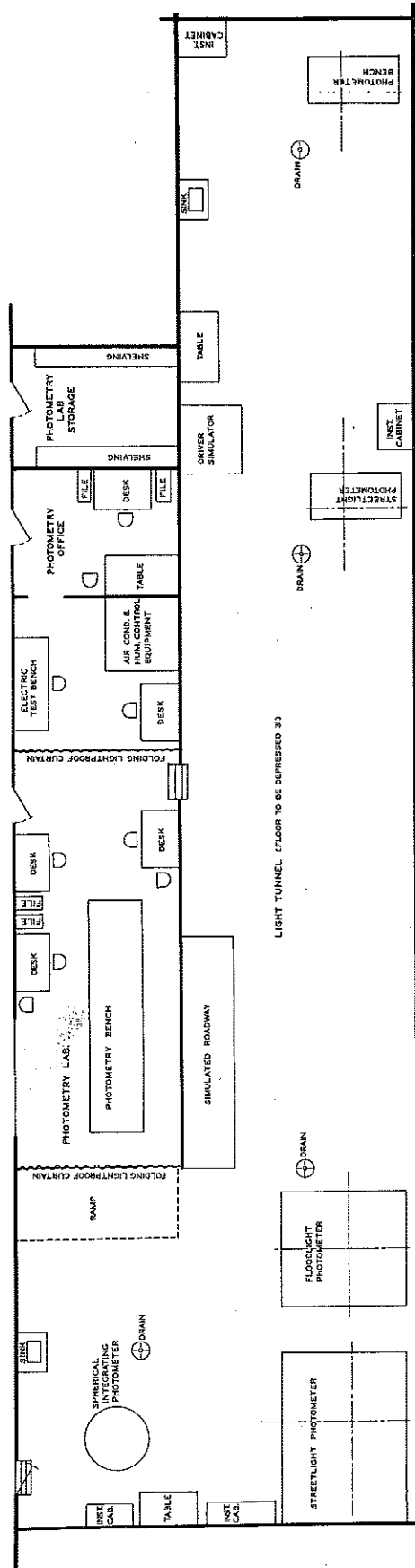
COATINGS, SEALERS AND PLASTICS
(Materials Research Unit)



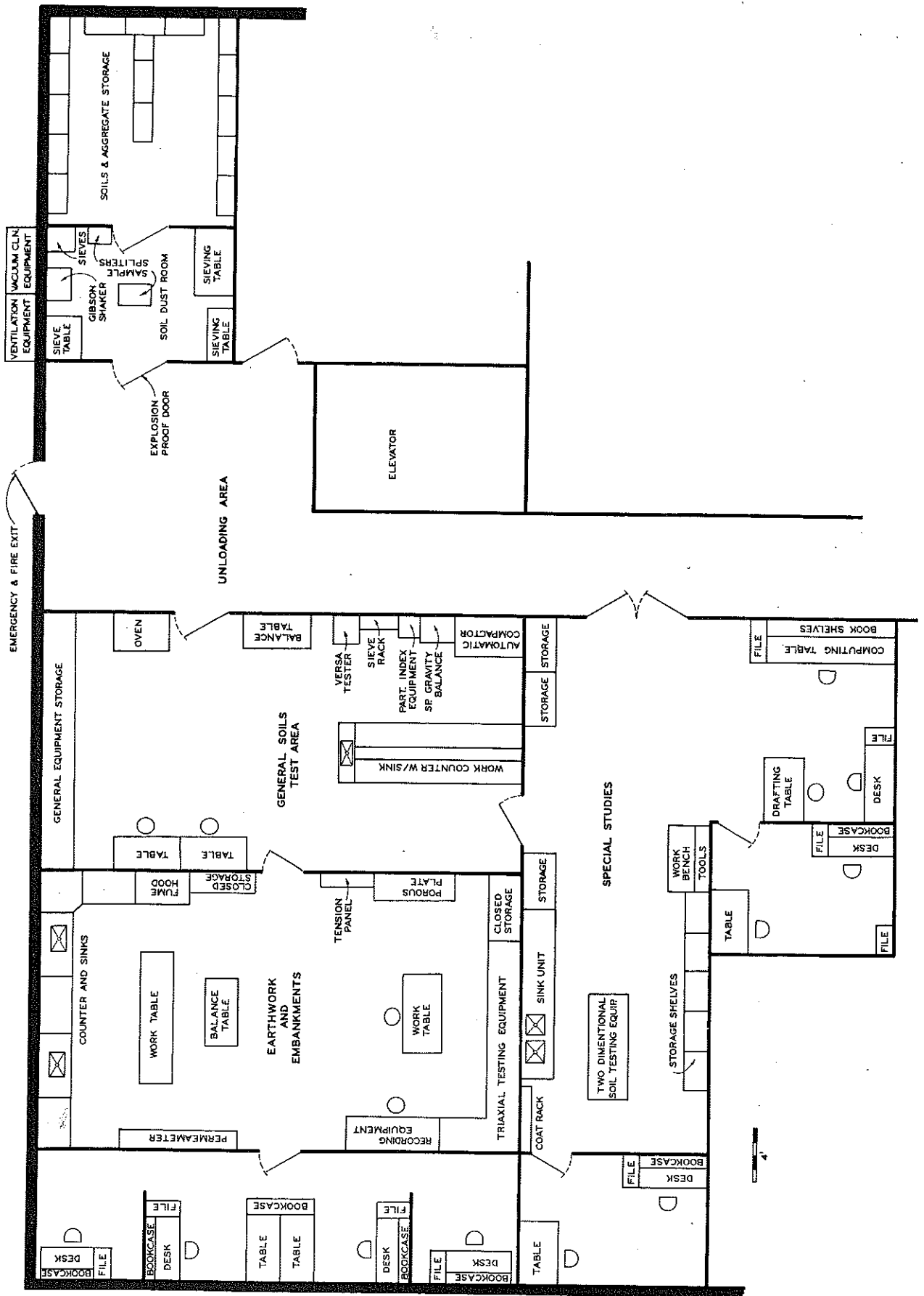
GEOLOGY AND PETROGRAPHY
(Materials Research Unit)



SPECTROSCOPY
(Spectroscopy and Photometry Unit)



PHOTOMETRY
(Spectroscopy and Photometry Unit)



SOILS AND AGGREGATES UNIT

PROPOSED LABORATORY
UTILITY SPECIFICATIONS

The following pages detail all of the Laboratory's specific utility requirements. These tabulations locate each requirement in the pertinent facility but do not, in every case, specify the exact location within that facility. However, this will be required when the final plans are prepared as, in many instances, equipment must be placed in specific locations and therefore the utility must be located accordingly.

Central air conditioning has been assumed and central sources of 115 volt direct current, distilled water, and compressed air are highly desirable. In addition a source 115 VAC power should be available in the outside testing area.

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	<u>20 KVA</u>
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

(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

LABORATORY ADMINISTRATION AND SERVICE UNITS

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

MATERIALS RESEARCH UNIT (cont.)

AREA	ITEM	Quantity	ELECTRICITY									LIGHT	WATER			DRAINS					
			Voltage			Current			Power	Duty	Level in f. c.	Hot	Cold	Distilled	Covered	Open	Sump	Compressed Air			
			D. C.	A. C.	Phase	115	230	440	Full Load	Locked Rotor									Fused Amps	Horse Power	Estimated hrs/week
GEOLOGY & PETROGRAPHY GROUP																					
Group Suprv. Office	duplex outlet	2		X	1	X															
G. & P. General Office	duplex outlet	3		X	1	X															
G. R. P. Lab	duplex outlet (drop)	10		X	1	X															
	chemical hood	1		X	1	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		Level in f. c.	Hot	Cold	Distilled	Covered	Open			Sump
			D. C.	A. C.	Phase	115	230	440	Full Load	Locked Rotor												
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	23		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			5.0				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
			Voltage					Current			Power	Duty	Level in f. c.	Hot	Cold	Distilled	Covered	Open	Sump		
			D. C.	A. C.	Phase	115	230	440	Full Load	Locked Rotor	Fused Amps	Horse Power								Estimated hrs/week	
SPECTROSCOPY UNIT (Con't.)																					
X-Ray & Metallurgy	sink	1																			
Chemical Storage**	auto CO ₂ fire extinguisher	1		X	1	X					5										X
	duplex outlet	2		X	X	X						15		0	80		X		X		
Weatherometer Lab	duplex outlet	5		X	1	X						15									
	weatherometer	1		X	3		X		45	50	60			10	80		X		X		
	demineralizer	1		X	1	X								10							
	freezer (proposed)	1		X	1	X			10					5							
PHOTOMETRY LAB																					
Group Suprv. Office	duplex outlet	2		X	1	X						15									
Photo Lab Storage	duplex outlet	1		X	1	X								100							
Photometry Lab	duplex outlet	10		X	1	X						15		20							
	bench duplex outlet	8		X	1	X						15		40	100						
	bench duplex outlet	8		X	1	X	(Regulated)					15		10							
	bench duplex outlet	8	X			X															
	Humidity Control	1		X	3						X										
Light Tunnel	duplex outlet	16		X	1	X				62	70			84		X		X (Fresh Air Du			
	duplex outlet	8		X	1	X	(Regulated)							20							
	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															
	simulated roadway	1												10	100						
	streetlight photo-meter	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									
	floor drains	4												1	80						
	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		Level in f. c.	Hot	Cold	Distilled	Covered	Open			Sump		
			D. C.	A. C.	Phase	115	230	440	Full Load	Locked Rotor	Fused Amps	Horse Power											Estimated hrs/week	
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.																								