Title
Chemical Sciences Addition

Author
Lawrence Berkeley National Laboratory

Publication Date
1978-05-01

CONCEPTUAL DESIGN REPORT

CHEMICAL SCIENCES ADDITION

BUILDING 62
LAWRENCE BERKELEY LABORATORY

MAY 1978

LAWRENCE BERKELEY LABORATORY
UNIVERSITY OF CALIFORNIA
BERKELEY, CALIFORNIA

Pub-242

DISCLAIMER

CONCEPTUAL DESIGN REPORT

CHEMICAL SCIENCES ADDITION

BUILDING 62
LAWRENCE BERKELEY LABORATORY

MAY 1978

Work done under Department of Energy
Contract No. W-7405-ENG-48

LAWRENCE BERKELEY LABORATORY
UNIVERSITY OF CALIFORNIA
BERKELEY, CALIFORNIA

Pub-242

Contents (continued)

SECTION X. DETAILED SUPPORTING DATA

SECTION I

SUMMARY OF CONCEPTUAL DESIGN PLAN

A. INTRODUCTION

An addition to the existing, overcrowded Building 62 is needed to house research groups and support facilities for programs in basic research in chemical sciences. The proposed new building will provide space for energy-related research that has been identified as high priority programs by DOE.

The proposed building addition will provide a better focus of ongoing programs presently being conducted in overcrowded conditions and dispersed over 12 different locations within LBL and on the University of California Berkeley campus, with only 150 of the total 500 Division staff members located in the Division headquarters, Building 62. The unique combination of multidisciplinary talent at the Laboratory will be used to bring to bear the most advanced experimental and theoretical techniques on problems relating to structural features and reaction mechanisms of chemical processes for energy technologies, such as the catalytic conversion of fossil fuels and combustion processes. New insights into the dynamics of chemical processes at the atomic level, required to advance the understanding of chemical processes in advanced energy technologies, will be generated where present understanding of crucial chemical reactions is not satisfactory.

Topics of investigations planned to be conducted in the building addition include the following: (1) Electron spectroscopy is to be developed and used for the determination of the electronic structure of matter. Of particular interest are the structure of high-temperature species and their interaction with radiation and surfaces. (2) The dynamics of elementary atomic and molecular processes and the energetics of exotic radicals, ions and ion clusters will be investigated by the crossed molecular beam method. This technique provides information on mechanisms and dynamics of chemical reactions. (3) New effective approaches will be investigated for the conversion of coal to liquid and gaseous products. Of particular interest is the elucidation of factors that control catalyst activity, selectivity and resistance to poisoning. (4) Ultraviolet, visible and infrared ellipsometry will be used as a new technique to follow the transition between physically and chemically adsorbed states of molecules on solid surfaces and to establish pathways of catalytic reactions. (5) A more precise comparison between homogeneous and heterogeneous catalysis will be devised from molecular research with metal clusters. (6) The selective excitation of molecules and chemical reactions of specifically excited states are to be investigated. Multiphoton absorption spectra will be interpreted and lifetimes of individual vibration-rotation levels determined. (7) Photon-assisted chemical reactions at semi-conductor surfaces will be investigated. In particular, the role of photoelectrons is to be determined in the reactions of water and carbon dioxide to produce hydrogen and hydrocarbons.

The Materials and Molecular Research Division is an interdisciplinary group composed of scientists and engineers from seven academic disciplines in six campus departments at the University of California, Berkeley; namely, Chemistry and Chemical Engineering in the College of Chemistry, Physics in the College of Letters and Sciences, Nuclear Engineering, Materials Science and Mineral Engineering (Metallurgy and Ceramics), and Mechanical Engineering in the College of Engineering.

The proposed building addition represents one of a three-phase plan to consolidate activiites within the Materials and Molecular Research Division. Integration of ongoing programs, presently being conducted in different locations and under overcrowded conditions, will allow the more efficient use of shared facilities and provide for improved interdisciplinary interaction on the conduct of collaborative efforts.

B. METHOD OF PRODUCING THE CONCEPTUAL DESIGN REPORT

1. Lawrence Berkeley Laboratory

The requirements for the Chemical Sciences Addition to the Materials and Molecular Research Laboratory were compiled by the LBL Plant Engineering Department in collaboration with the Materials and Molecular Research Division. This criteria is reflected in the drawings and project technical evaluation prepared by Gensler and Associates, Architects, San Francisco.

The quantity survey and estimate for the project was prepared by the Plant Engineering Department's Cost Consultant. LBL Safety Servics Department contributed the pollution and environmental assessments. A soils investigation, including boring logs and recommended foundation design were provided by consultants in 1975.

The Conceptual Design Report was prepared by the LBL Plant Engineering Department with editing and production by the LBL Technical Information Department.

2. Consultants

Consultants to the project in addition to Gensler Associates, Architects, include Syska and Hennessy, Inc., Mechanical and Electrical Engineers; Harding-Lawson Associates, Engineers and Geologists (Site Geology Report and foundation design recommendation); Engle and Engle, Structural Engineers (recommendation and review of the building's structural system for static and seismic resistance); and Consulting Cost Estimators, Inc. (quantity survey and cost estimate).

SECTION II

PROJECT DESCRIPTION AND DESIGN CRITERIA

A. PROJECT DESCRIPTION

This proposed addition will contain 35,000 gross square feet of floor area consisting of three major floors, and partial basements on two levels consisting of mechanical room, laboratory and loading dock.

Building 62, Materials and Molecular Research Laboratory, has proven to be functionally successful as a laboratory building. The planning and design concepts that were utilized in the existing building will be used also in the new addition. The underlying concept of this planning consists of a central service corridor accessible from adjacent laboratory modules, and which contains the necessary process piping, drainage, air supply and exhaust ducts that supply laboratories situated on either side of the corridor. These systems are easily accessible for manifolding behind laboratory furniture and for servicing equipment setups used in the Laboratory's research programs. Laboratories situted outside the service corridor zone will be provided with specific services as required for each laboratory useage. Offices that are affiliated with laboratory activities will be located along the outside walls of the building. The second and third floor levels of the building will contain laboratories and ancilliary offices; the first floor level will contain a seminar-conference room and administrative offices. It is anticipated that administrative offices and the conference room in Building 62 will be returned to research use in the future. The functions on the first floor will serve the combined laboratory complex including future additions.

The exterior appearance of the addition will be similar to the existing building. The facades will consist of form-board textured concrete wall panels, and where windows occur, the spandrels above and below the windows will consist of exposed aggregate embedded in a cement matrix. The building will incorporate ramps serving both buildings for use by the handicapped. The new addition will contain its own elevator serving all levels of the building.

Site utilities for the addition will consist of required water, sanitary sewer, natural gas, and electrical power. All utilities are available at the site. The immediate site environs will be landscaped with respect to both erosion control and appearance. The use of the building on a net square footage basis is given in Table 2-1 "Schedule of net areas, functions, and occupancy."

B. DESIGN CRITERIA

1. Architectural

Uniform Buidling Code criteria for the new addition are:

a. Site Designation:	Fire Zone 3
b. Estimated number of occupants:	91
c. Occupancy classification:	B-2
d. Type of construction:	Type II, F.R.

The space allocations for various uses are set forth in Table 2-1, Schedule of Net Areas, Functions, and Occupancy.

2. Structural

The structural system is composed of a vertical load carrying steel frame with concrete shear walls designed for full lateral loads. The floor and roof system consists of concrete slab supported by steel beams and girders. Construction of this type provides flexibility for the installation of additional utilities if future need occurs.

All floors have been designed for 125 pounds per square foot live load capacity. The roof has been designed for a live load of 50 pounds per square foot and can accommodate roof-mounted solar energy equipment.

The structural design is based upon LBL lateral force criteria, which are more stringent than the latest Uniform Building Code, 1976 Edition.

Foundation design utilizes drilled-in-place reinforced concrete caissons continuously tied together at grade with reinforced concrete grade beams.

3. Mechanical

The existing Molecular and Materials Research Laboratory Building is a guide for selection of the utilities required in the new addition. These utilities include the following systems: acid waste and monitoring, low conductivity water (extended from existing building), industrial hot and cold water, compressed natural gas, and demineralized water.

The perimeter offices and laboratories, corridors, interior office and conference/seminar room will be served by heating and ventilating systems. The interior laboratories, making up approximately 70% of the total programmed laboratory area, will be air conditioned. Cooling will be provided by chilled water from the existing building.

Heating will be provided by new boilers.

The design criteria and calculations for control of space temperatures are based on latest editions of ERDAM 6301 and the ASHRAE Guide.

Energy conservation and utilization of solar energy are included in this report in Sections VII and VIII.

New site services include city water and gas lines. The rainwater outfall and sanitary sewer system for the new addition will be connected to the existing storm drain and sanitary sewer located at west end of the existing building.

4. Electrical

New 480/277V main distribution panel shall be installed in the basement of the new laboratory building. Power shall be served from the existing 3000 amp, 380/277 switchgear 66A. See Electrical Single Line Diagram E2 and supporting calculation; for feeder and conduit routing from existing switchgear 66A to new 480/277V main distribution panel, see D Mechanical Drawing ME 1.

TABLE 2-1. Schedule of net areas, functions, and occupancy.

Chemical Sciences Addition to Building 62	Net Area ft^2 Labs	Offices	Other	People
Service Level and Coal Conversion Laboratory	640	144	---	4
First Floor:				
Lobby	---	---	670	--
Conference/Seminar-Foyer	---	---	3,390	--
Administration	---	2,360	---	14
Supply, storage, and misc. rooms	---	---	320	--
First floor subtotal	---	2,360	4,380	14
Second Floor:				
Conversion of Coal	1,310	280	---	14
Metal Clusters	1,310	290	---	10
Excited Molecules	630	280	---	6
Photon Assisted Surface Reactions	970	280	---	7
Supply, storage, and misc. rooms	---	---	90	--
Second floor subtotal	4,220	1,130	90	37
Third Floor:				
Photoelectron Spectroscopy	1,940	560	---	15
Crossed Molecular Beams	1,310	280	---	13
Molecules on Surfaces	970	290	---	8
Supply, storage, and misc. rooms	---	---	90	--
Third floor subtotal	4,220	1,130	90	36
Subtotal all floor nets	9,080	4,764	4,560	91

Total net functional floor area: 18,404 ft^2
Less Lobby, Conference-Foyer areas -4,060
Adjusted net area 14,344 ft^2/91 people = 158 ft^2/person

Lab Area of 9,080 ft^2/14,344 ft^2 = 63% Lab. Ratio

SECTION III

COST ESTIMATES

Contents

DEPARTMENT OF ENERGY Schedule 44

APPROPRIATION Energy

FY 1980 BUDGET REQUEST

(Tabular dollars in thousands. Narrative material in whole dollars.)

CONSTRUCTION PROJECT DATA SHEETS

UNIVERSITY OF CALIFORNIA
LAWRENCE BERKELEY LABORATORY

Mission Energy Supply - Research and Technology Development

Resource Basic Energy Sciences

Activity Chemical Sciences

1. Title and location of Project: Chemical Sciences Addition Building 62

2. Project No. 80-LBL-003

3. Date A-E Work Initiated: 1st Qtr. FY 1980

3a. Date Physical Construction Starts: 3rd Qtr. FY 1980

4. Date Construction Ends: 4th Qtr. FY 1981

5. Previous Cost Estimate: ($7,000)
Date: March, 1978

6. Current Cost Estimate:
Less Amount for CR&D None
Net cost Estimate: $7,000
Date: May 1978

7. Financial Schedule:

Fiscal Year	Authorizations	Appropriations	Obligations	Costs
FY 1980			$7,000	$ 800
81				5,700
82				500

3-1

DEPARTMENT OF ENERGY

APPROPRIATION ENERGY

FY 1980 BUDGET REQUEST

CONSTRUCTION PROJECT DATA SHEETS

Schedule 44
(Continued)

UNIVERSITY OF CALIFORNIA
LAWRENCE BERKELEY LABORATORY

1. Title and Location of Project: Chemical Sciences Addition Building 62

2. Project No.: 80-LBL-003

10. Details of Cost Estimate

A.	Engineering, Design and Inspection at about 15% of Construction Cost		$ 640
	SAN Operations Technical Support .2%		10
B.	Construction Costs		4,180
	1. Improvements to Land	$ 200	
	2. Building 35,000 Sq. Ft. gross at about $106/Sq. Ft	3,715	
	3. Special Facilities	145	
	4. Utilities	120	
C.	Standard Equipment		900
	Sub Total		$5,730
D.	Contingencies at about 22% (of which $815,000 is for building contingency)		1,270
	*Total Project Cost		$7,000

*Costs from current estimate summary have been escalated at 6% per annum, in accordance with DOE guidance, for a period of 2.5 years to the mid-point of the construction period for a total of about 16% (the project's Cost Consultant's present per annum escalation factor for this locality is approximately 9% per annum).

1. Title and Location of Project: Chemical Sciences Addition Building 62 **2. Project No.:** 80-LBL-003

10. Details of Cost Estimate (continued)

E. This estimate does not include the cost to add Solar Energy System. Refer to Section VIII for the cost of solar options and Section VII for variations in costs related to energy use. Cost contingencies include allowance for variations in cost related to the choice of mechanical systems.

(1) Revised Conceptual Design is about 90% complete. The final report will include an analysis of the Solar Facilities that may be added to this structure, and will also outline the considerations for energy conservation as required by DOE-6301.

ADDITION TO BUILDING #62 - MATERIALS AND MOLECULAR RESEARCH LABORATORY
UNIVERSITY OF CALIFORNIA - LAWRENCE RADIATION LABORATORY, BERKELEY, CAL.

SUMMARY OF THE ESTIMATED COSTS 1 MAY, 1978

1.00 IMPROVEMENTS TO LAND (SITEWORK)

Item	Cost	Location	Total
Demolition	$ 1,360	(2.10 1st 2 figures, Pg.7)	
Earthwork	73,455	(2.20, Pg.7)	
Paving-Curbs, Walks, Retaining Wall, Steps	29,002	(2.60, Pg.9)	
Landscaping & Irrigation	38,390	(2.70, Pg.9)	
Misc.	3,610	(2.20, Pg.9)	
Site Drainage	4,360	(2.50, Sect. a. Pg.8)	
Sub Total			150,177
Add General Conditions Pro Rata			12,010
Bond 5/8%			1,014
General Contractor's Fee 6%			9,792

Estimated Cost of Construction April, 1978 172,993

2.00 BUILDING

Item	Cost	Location
Alteration to Exist. Bldg.	6,950	(2.10, Pg.7)
Caissons	56,365	(2.30, Pg.7)
Dewater	15,000	(2.40, Pg.7)
Foundations	31,716	(3.10, Pg.10)
Structural/Architectural Concrete	646,150	(3.20, Pg.11)
Slab on Grade	21,563	(3.30, Pg.11)
Masonry	None	
Structural Steel	206,154	(5.10, Pg.12)
Misc.&Ornamental Mt'ls.	28,273	(5.20, Pg.12)
Carpentry, Rough	55,904	(6.10, Pg.12)
Carpentry, Finish	16,516	(6.20, Pg.12)
Moisture/Sound/Thermal Protection	37,790	(7.00 Total Pg. 13)
Doors, Sash, Glazing, Fin. Hardware	81,247	(8.00 Total Pg. 14)
Finishes, Inc. Fire Spray On	214,570	(9.00 Total Pg. 15)
Specialties	21,785	(10.00 " Pg. 16)
Furnishings (Non Lab)	10,590	(12.00 " Pg. 16)
Equipment & Cabinetry Lab.	See Schedules	
Conveyance - Elevator	69,000	(14.00 " Pg. 16)

ADDITION TO BUILDING #62 - MATERIALS AND MOLECULAR RESEARCH LABORATORY
UNIVERSITY OF CALIFORNIA - LAWRENCE RADIATION LABORATORY, BERKELEY, CAL.

SUMMARY OF THE ESTIMATED COSTS 1, MAY, 1978 - Pg.2 of summary

2.00	BUILDING - cont.		Location	
	Mechanical			
	Plumbing	$205,965	(15.10, Pg.17)	
	Heat,Vent & A.C.	468,000	(15.20, Pg.17)	
	Fire Sprinkler	45,000	(15.30, Pg.17)	
	Electrical	505,800	(16.00 Total, Pg. 17)	
	Sub Total		$2,744,338	
	Add General Conditions Pro Rata		267,072	
	Bond 5/8%		18,821	
	General Contractor's Mark Up 6%		181,814	
	Estimated Cost of Construction April, 1978			$3,212,045
3.00	SPECIAL FACILITIES		1978	$
			1981 (1.22)	
4.00	UTILITIES			
	Electrical	$ 70,600	(2.50 Sect. g. Pg.8)	
	Mechanical	11,050	(2.50 " b,c,d,e,f, Pg.8)	
	Relocation (At Link)	9,000	(2.50 " h,Pg.8)	
	Sub Total		$ 90,650	
	Add General Conditions Pro Rata		7,243	
	Add Bond 5/8%		612	
	Add General Contractor's Mark Up 6%		5,910	
	Estimated Cost of Construction April, 1978			$ 104,415
			TOTAL (CURRENT COST)	$3,489,453

BASIS OF ESTIMATE SUMMARY

A. GENERAL

The preceding Estimate Summary is from the detail cost estimate included in Section X. The May 1978 costs were escalated 6% per year compounded (16%) as noted on the Schedule 44 Construction Project Data Sheet (Financial Schedule) of this Section, in accordance with DOE guidance.

Special facilities and standard equipment costs are shown under Construction Costs in Section X, item B, are summarized and escalated (in accordance with above noted escalation) from the May 1978 prices of the facilities and equipment contained in Schedule 44 lists of Section X.

The breakdown of Engineering, Design, and Inspection costs during FT 1980 and FY 1981 is as follows:

Title I	$ 90,000
Title II	180,000
Title III	380,000
Total	$ 650,000

B. SPECIAL FACILITIES

The Special Facilities listed in Schedule I are the systems and special equipment required to support several experimental programs, interdisciplinary support laboratories, and work spaces planned for the new addition. Program investigators have analyzed the physical requirements of their activities and the special facilities provided in the existing building and have translated these analyses into the Special Facilities described. Costs have been estimated on the basis of known costs of the existing work and cost inquiries for known items of equipment.

C. STANDARD EQUIPMENT

The equipment estimates that appear in Schedule I for Standard Equipment were compiled form the latest catalogs, discussions with vendor representatives, and actual costs of recent purchases of similar equipment.

D. CONTINGENCIES

The contingency allowance is to provide relief form various uncertainties that may affect costs. These uncertainties may take several forms:

1. Unknown factors or discrepancies encountered during construction. One such item could be a variance in the amount of site work to be done depending upon geologic conditions or exact siting of the building.

2. Currently unknown changes in codes or environmental requirements that could increase costs.

3. Specifics in the Special Facilities or Standard Equipment may change by the time construction or procurement starts. The current lists reflect today's state of the art which may change at any time.

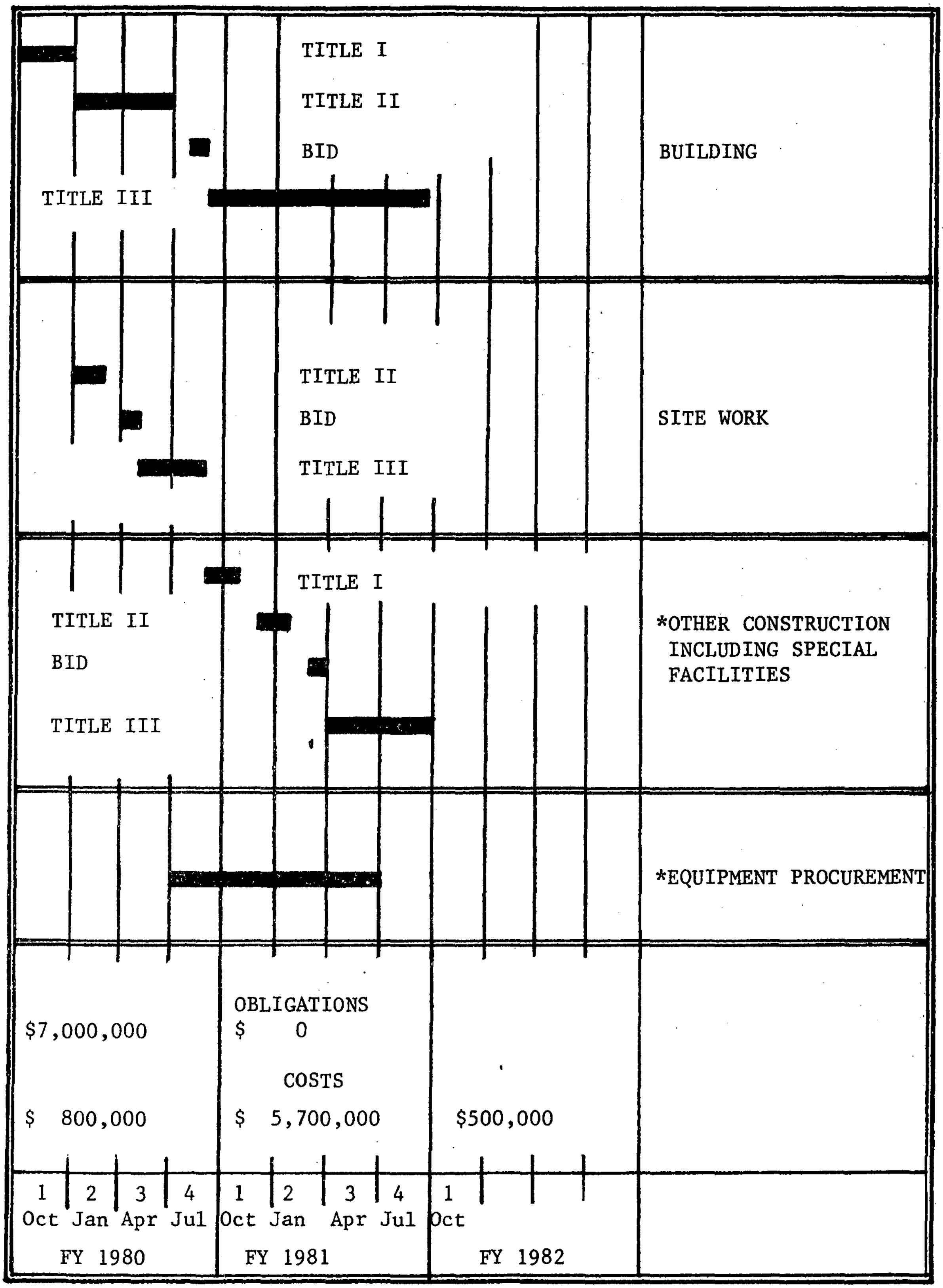
4. Escalation predictions follow the previously described guidelines and actual costs may be significantly different in future years.

SECTION IV

PROJECT TIME SCHEDULE, CONSTRUCTION SCHEDULE, AND METHODS OF PERFORMANCE

CHEMICAL SCIENCES ADDITION TO BLDG. 62 - PROJECT TIME SCHEDULE

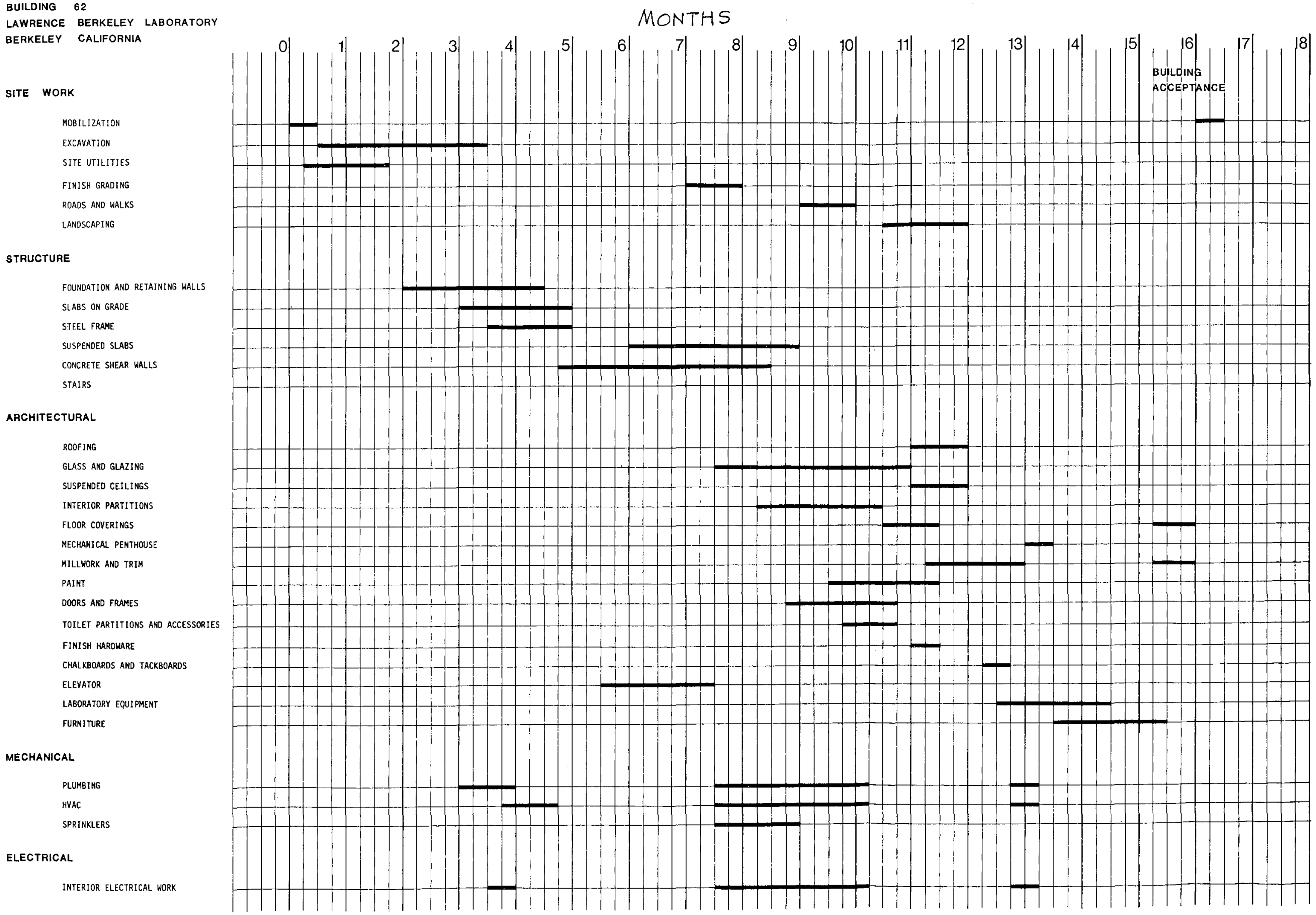
A-E SELECTED PRIOR TO FY 1980



*These items have been considered as to their integration into the Building Construction Program. At this time there are no known conflicts and no known items of unusually long delivery time.

CHEMICAL SCIENCES ADDITION
BUILDING 62

CONSTRUCTION SCHEDULE
CHEMICAL SCIENCES ADDITION
BUILDING 62
LAWRENCE BERKELEY LABORATORY
BERKELEY CALIFORNIA



MAY 1978

M. ARTHUR GENSLER AND ASSOCIATES Architects
SAN FRANCISCO, CALIFORNIA

ENGLE AND ENGLE Structural Engineers
SAN RAFAEL, CALIFORNIA

SYSKA AND HENNESSY Mech/Elec Engineers
SAN FRANCISCO, CALIFORNIA

MISSION ENGINEERS Civil Consultants
SANTA CLARA, CALIFORNIA

METHODS OF PERFORMANCE

1. Design

   a. A Design Program will be produced by the LBL Plant Engineering Department to direct the Architect-Engineer. This program will include design criteria for the architectural, mechanical and electrical aspects of the building as well as site work, utilities, special facilities, and equipment to be included in the construction subcontract documents.

   b. A competent Architect-Engineer firm experienced in this type and scale project will be selected by the University and a lump-sum subcontract will be negotiated and awarded by the University.

   c. LBL construction inspectors will perform inspection of construction (Title III).

2. Construction

   a. Major construction services will be performed under lump-sum subcontracts awarded after competitive bidding.

   b. Some construction, alterations, modifications and equipment installation will be done by LBL crafts.

3. Procurement

   Wherever feasible, LBL will procure standard equipment and some special facilities through competitive bidding.

SECTION V

ARCHITECTURAL/MECHANICAL/ELECTRICAL DRAWINGS

CHEMICAL SCIENCES ADDITION

BUILDING 62

LAWRENCE BERKELEY LABORATORY BERKELEY CALIFORNIA

M. ARTHUR GENSLER AND ASSOCIATES Architects
SAN FRANCISCO, CALIFORNIA
ENGLE AND ENGLE Structural Engineers
SAN RAFAEL, CALIFORNIA
SYSKA AND HENNESSY Mech/Elec Engineers
SAN FRANCISCO, CALIFORNIA
MISSION ENGINEERS Civil Consultants
SANTA CLARA, CALIFORNIA

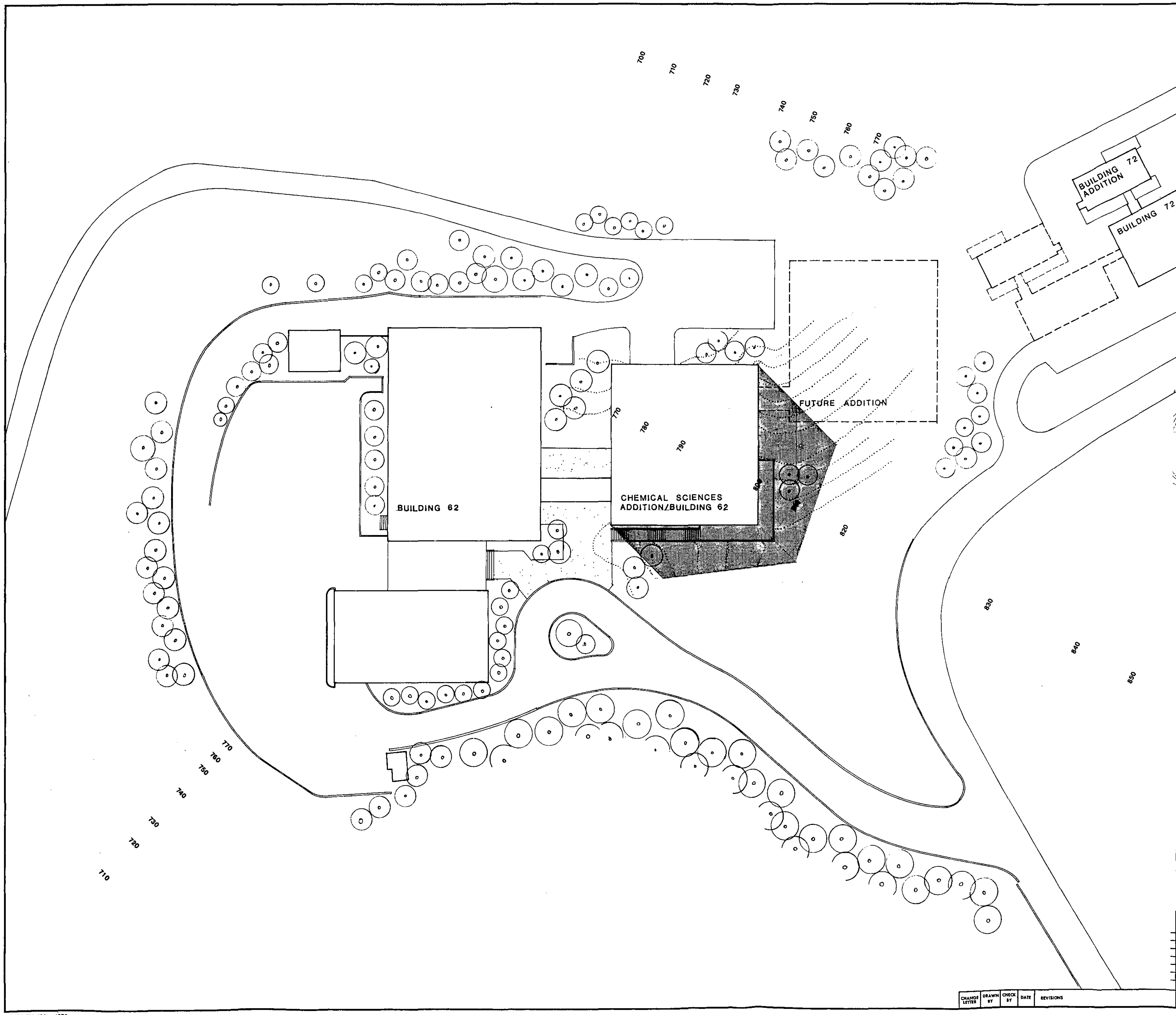
CHEMICAL SCIENCES ADDITION
BUILDING 62

DRAWING LIST

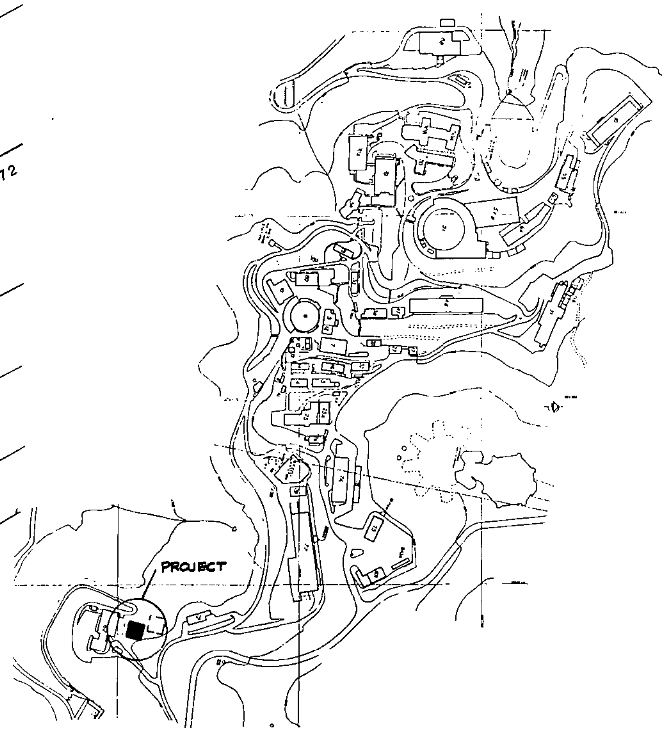
MAY 1978

CHANGE LETTER	DRAWN BY	CHECK BY	DATE	REVISIONS

CHEMICAL SCIENCES ADDITION				SHEET NO.
DRAWN BY	DATE	APPR. BY	DATE	SCALE
		CKD BY	DATE	ACC'T NO.
UNIVERSITY OF CALIFORNIA LAWRENCE BERKELEY LABORATORY PLANT ENGINEERING				SITE / DRAWING NUMBER 4B62B036



CHEMICAL SCIENCES ADDITION
BUILDING 62



SITE PLAN
scale: 1/16" = 1' – 0"

0 10 50 100 feet

Reference North

MAY 1978

M. ARTHUR GENSLER AND ASSOCIATES Architects
SAN FRANCISCO, CALIFORNIA

ENGLE AND ENGLE Structural Engineers
SAN RAFAEL, CALIFORNIA

SYSKA AND HENNESSY Mech/Elec Engineers
SAN FRANCISCO, CALIFORNIA

MISSION ENGINEERS Civil Consultants
SANTA CLARA, CALIFORNIA

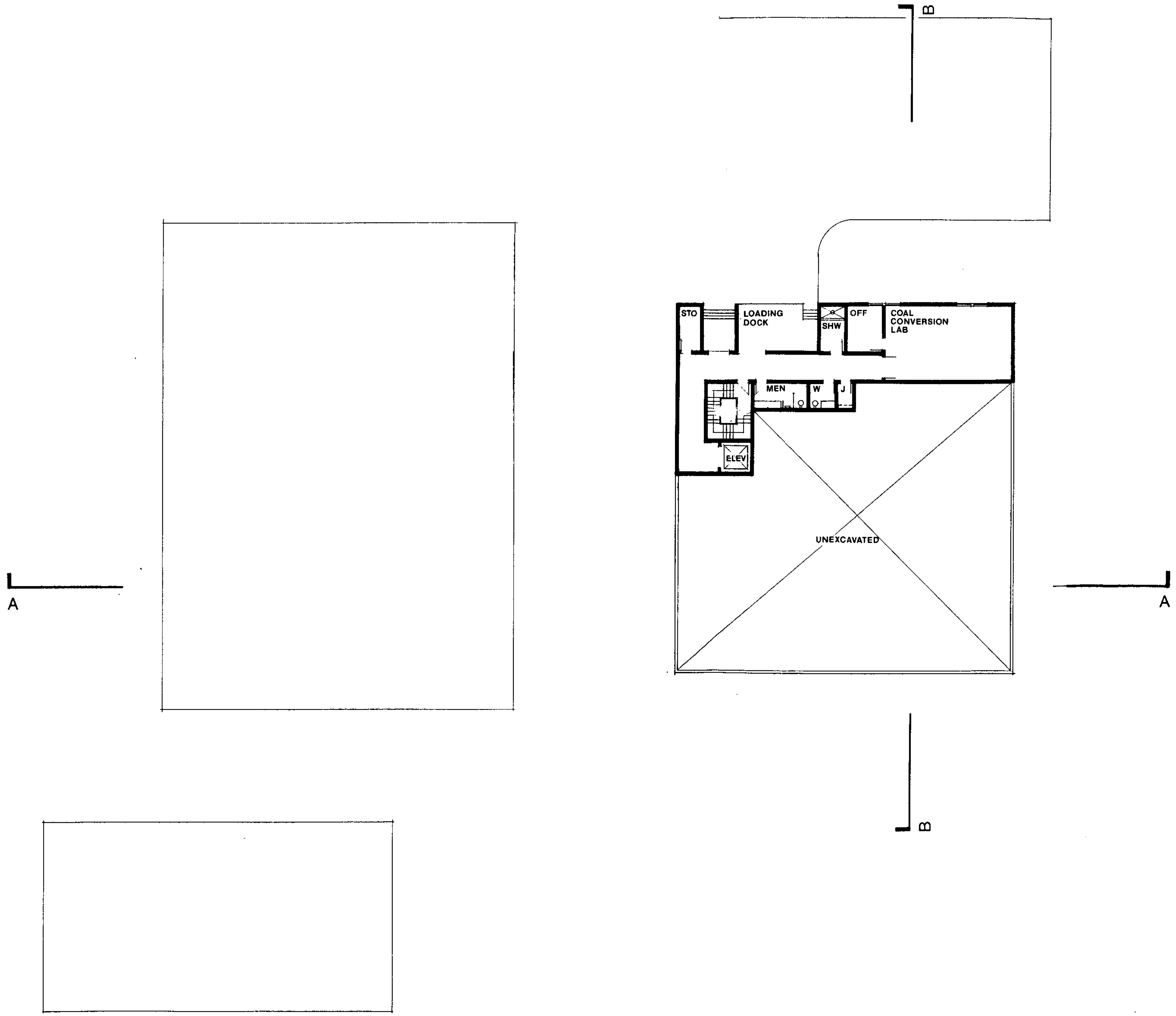
CHANGE LETTER	DRAWN BY	CHECK BY	DATE	REVISIONS

CHEMICAL SCIENCES ADDITION			SHEET NO. A1
DRAWN BY	DATE	APPR. BY / DATE	SCALE
		CKD BY / DATE	ACC'T NO.
UNIVERSITY OF CALIFORNIA LAWRENCE BERKELEY LABORATORY P L A N T E N G I N E E R I N G			SITE / DRAWING NUMBER 4B62B037

GGPO 691-402 — 1976

RL-1046 — SIZE 4

CHEMICAL SCIENCES ADDITION
BUILDING 62



LOADING DOCK FLOOR PLAN
scale: 1/16" = 1' - 0"

0 5 10 25 50 feet

Reference North

MAY 1978

M. ARTHUR GENSLER AND ASSOCIATES Architects
SAN FRANCISCO, CALIFORNIA

ENGLE AND ENGLE Structural Engineers
SAN RAFAEL, CALIFORNIA

SYSKA AND HENNESSY Mech/Elec Engineers
SAN FRANCISCO, CALIFORNIA

MISSION ENGINEERS Civil Consultants
SANTA CLARA, CALIFORNIA

CHANGE LETTER	DRAWN BY	CHECK BY	DATE	REVISIONS

CHEMICAL SCIENCES ADDITION

SHEET NO. A2

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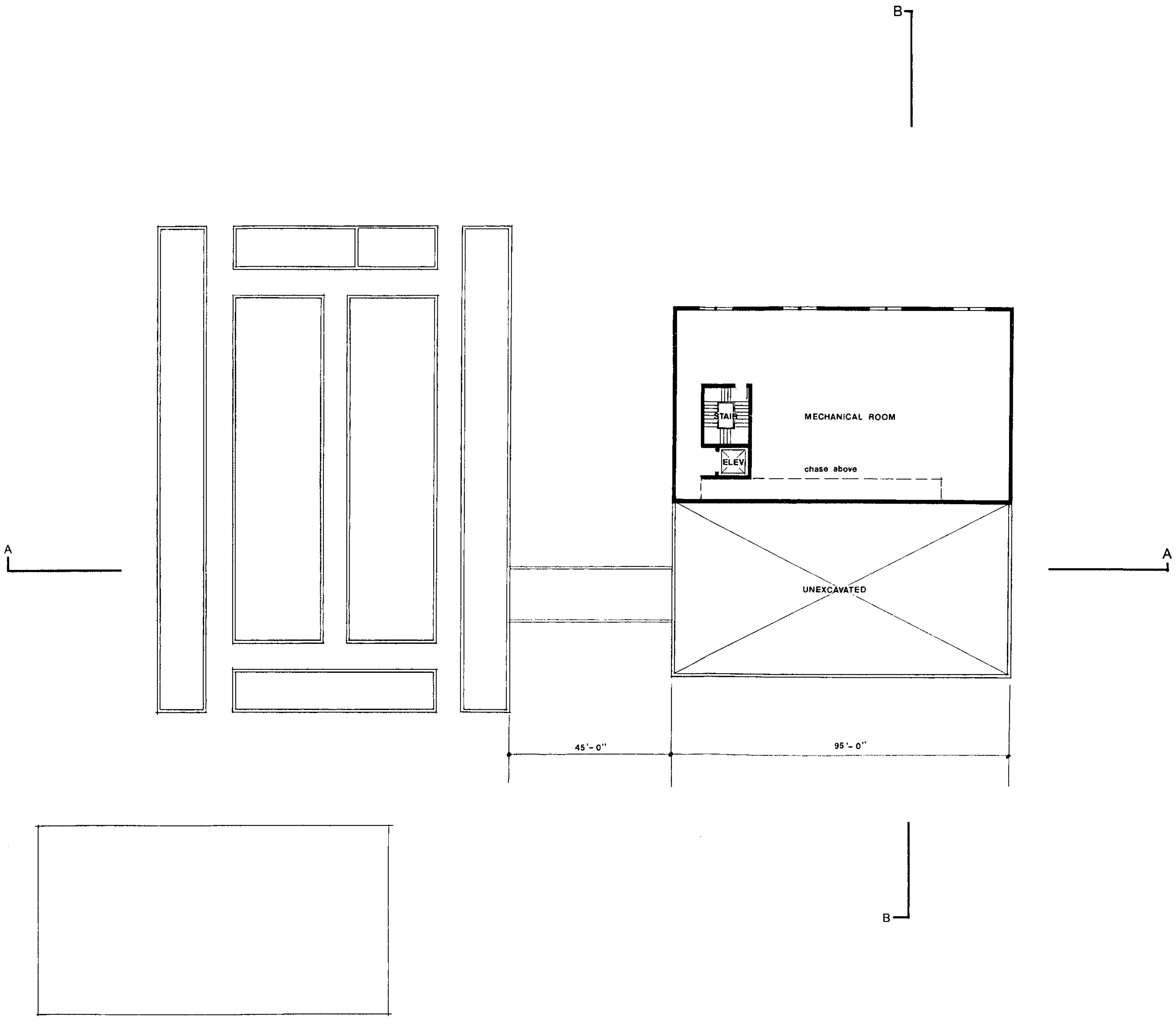
CKD BY | DATE | ACC'T NO.

UNIVERSITY OF CALIFORNIA LAWRENCE BERKELEY LABORATORY
PLANT ENGINEERING

SITE | DRAWING NUMBER 4B62B038

CHEMICAL SCIENCES ADDITION
BUILDING 62



BASEMENT FLOOR PLAN
scale: 1/16" = 1' - 0"

0 5 10 25 50 feet

Reference North

MAY 1978

M. ARTHUR GENSLER AND ASSOCIATES Architects
SAN FRANCISCO, CALIFORNIA

ENGLE AND ENGLE Structural Engineers
SAN RAFAEL, CALIFORNIA

SYSKA AND HENNESSY Mech/Elec Engineers
SAN FRANCISCO, CALIFORNIA

MISSION ENGINEERS Civil Consultants
SANTA CLARA, CALIFORNIA

CHEMICAL SCIENCES ADDITION	SHEET NO. A3
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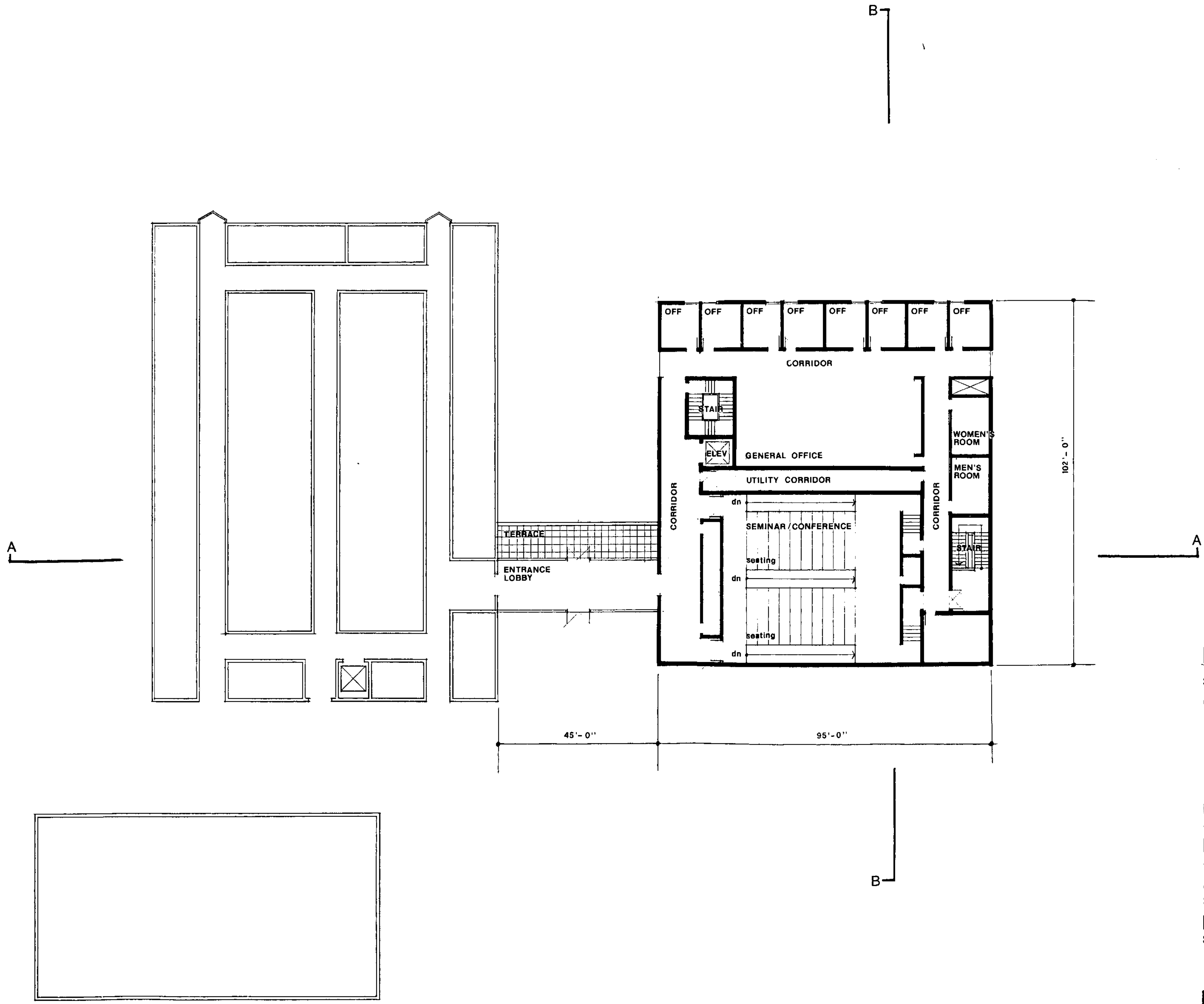
CHANGE LETTER | DRAWN BY | CHECK BY | DATE | REVISIONS

GGPO 691-402 — 1976

RL-1046 — SIZE 4

CHEMICAL SCIENCES ADDITION

BUILDING 62



ENTRY FLOOR PLAN

scale: 1/16" = 1' - 0"

0 5 10 25 50 feet

Reference North

MAY 1978

M. ARTHUR GENSLER AND ASSOCIATES Architects
SAN FRANCISCO, CALIFORNIA

ENGLE AND ENGLE Structural Engineers
SAN RAFAEL, CALIFORNIA

SYSKA AND HENNESSY Mech/Elec Engineers
SAN FRANCISCO, CALIFORNIA

MISSION ENGINEERS Civil Consultants
SANTA CLARA, CALIFORNIA

CHEMICAL SCIENCES ADDITION		SHEET NO. A4
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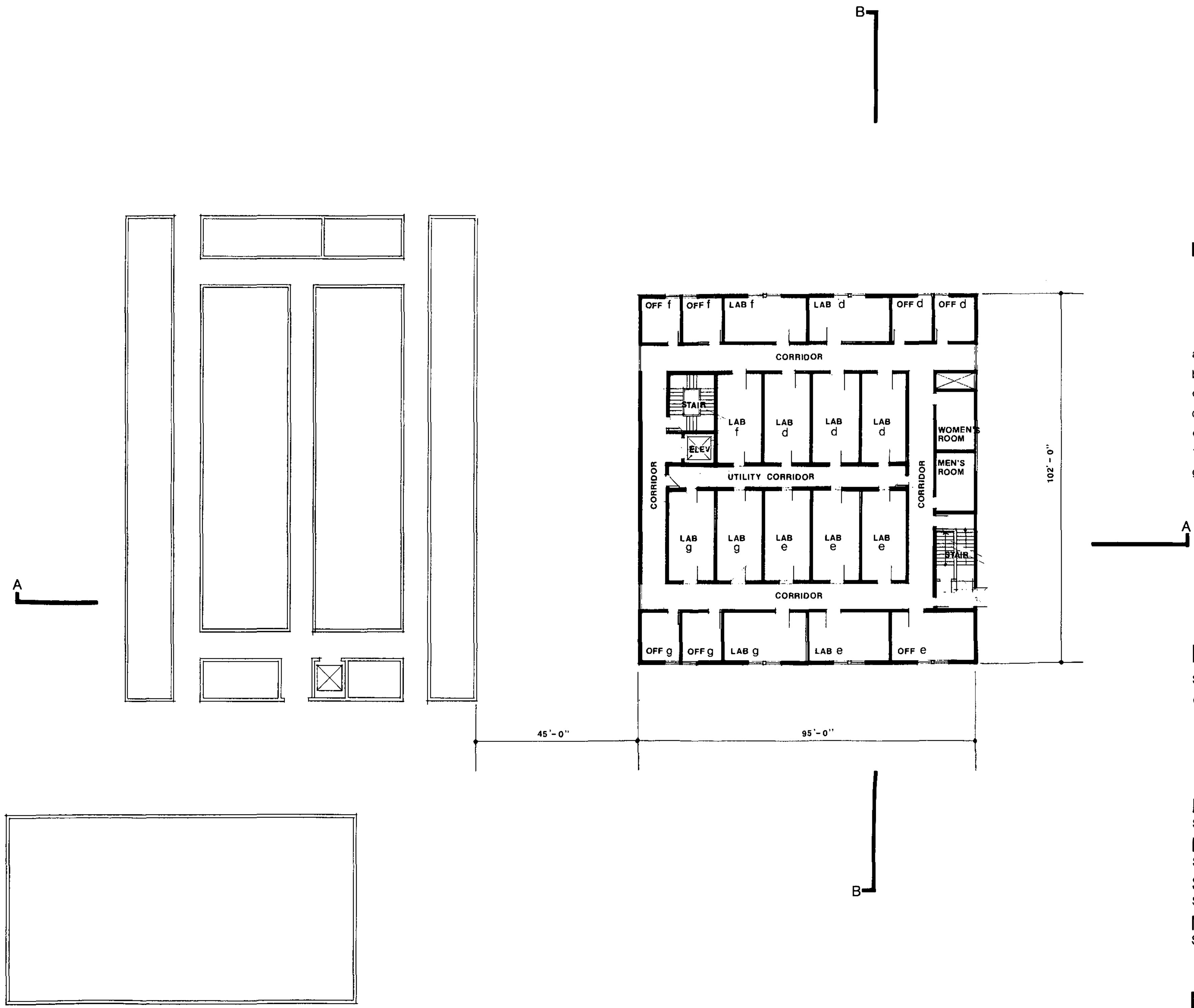
	CKD BY / DATE	ACC'T NO.
UNIVERSITY OF CALIFORNIA LAWRENCE BERKELEY LABORATORY PLANT ENGINEERING		SITE / DRAWING NUMBER 4B62B040

CHANGE LETTER	DRAWN BY	CHECK BY	DATE	REVISIONS

GPO 691-402 — 1976

RL-1046 — SIZE 4

CHEMICAL SCIENCES ADDITION
BUILDING 62



LEGEND

	PROGRAM	LAB UNITS	OFFICE UNITS	PEOPLE
a	PETROLEUM SPECTROSCOPY	6	4	15
b	CROSSED MOLECULAR BEAMS	4	2	13
c	MOLECULES ON SURFACES	3	2	8
d	CONVERSION OF COAL	4	2	14
e	METAL CLUSTERS	4	2	10
f	EXCITED MOLECULES	2	2	6
g	PHOTON ASSISTED SURFACE REACTIONS	3	2	7
	TOTALS	26	16	73

FOURTH FLOOR PLAN

scale: 1/16" = 1' - 0"

0 5 10 25 50 feet

Reference North

MAY 1978

M. ARTHUR GENSLER AND ASSOCIATES Architects
SAN FRANCISCO, CALIFORNIA

ENGLE AND ENGLE Structural Engineers
SAN RAFAEL, CALIFORNIA

SYSKA AND HENNESSY Mech/Elec Engineers
SAN FRANCISCO, CALIFORNIA

MISSION ENGINEERS Civil Consultants
SANTA CLARA, CALIFORNIA

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CHEMICAL SCIENCES ADDITION

SHEET NO. A5

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CKD BY | DATE | ACCT NO.

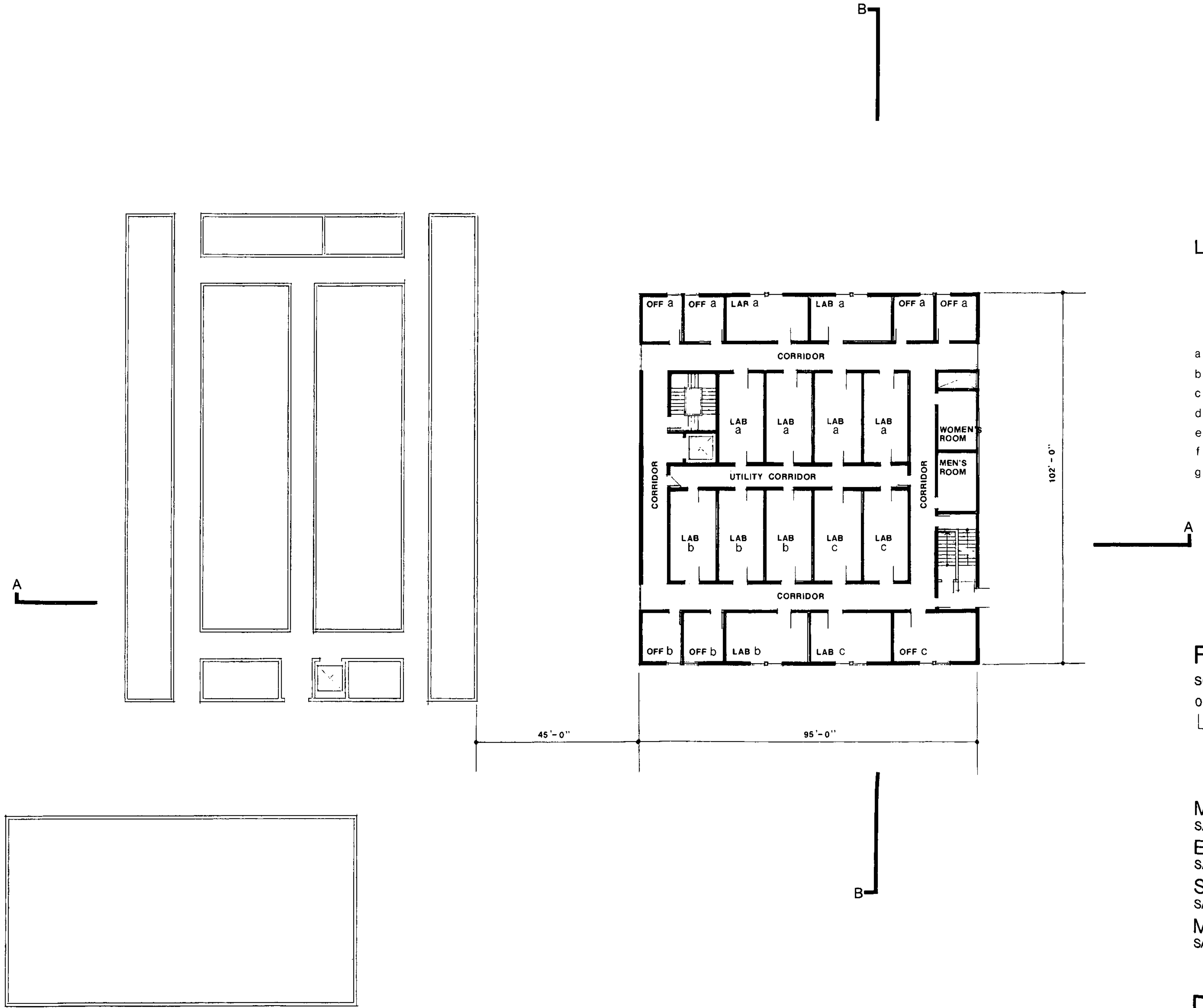
UNIVERSITY OF CALIFORNIA LAWRENCE BERKELEY LABORATORY
PLANT ENGINEERING

SITE | DRAWING NUMBER 4B62B041

GGPO 691-403 — 1976

RL-1048 — SIZE 4

CHEMICAL SCIENCES ADDITION
BUILDING 62



LEGEND

	PROGRAM	LAB UNITS	OFFICE UNITS	PEOPLE
a	PETROLEUM SPECTROSCOPY	6	4	15
b	CROSSED MOLECULAR BEAMS	4	2	13
c	MOLECULES ON SURFACES	3	2	8
d	CONVERSION OF COAL	4	2	14
e	METAL CLUSTERS	4	2	10
f	EXCITED MOLECULES	2	2	6
g	PHOTON ASSISTED SURFACE REACTIONS	3	2	7
	TOTALS	26	16	73

FIFTH FLOOR PLAN
scale: 1/16" = 1' - 0"

0 5 10 25 50 feet

Reference North

MAY 1978

M. ARTHUR GENSLER AND ASSOCIATES Architects
SAN FRANCISCO, CALIFORNIA

ENGLE AND ENGLE Structural Engineers
SAN RAFAEL, CALIFORNIA

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CHEMICAL SCIENCES ADDITION	SHEET NO. A6
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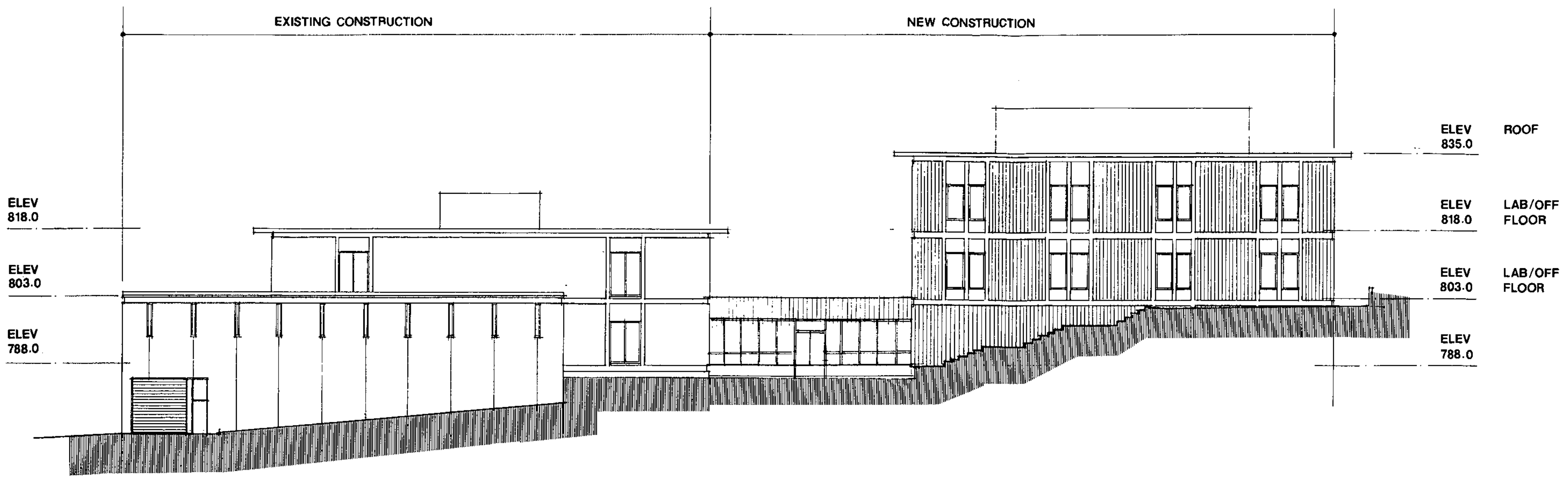
UNIVERSITY OF CALIFORNIA LAWRENCE BERKELEY LABORATORY PLANT ENGINEERING	DRAWING NUMBER 4B62B042

CHANGE LETTER | DRAWN BY | CHECK BY | DATE | REVISIONS

GPO 691-403 — 1978

RL-1046 — SIZE 4



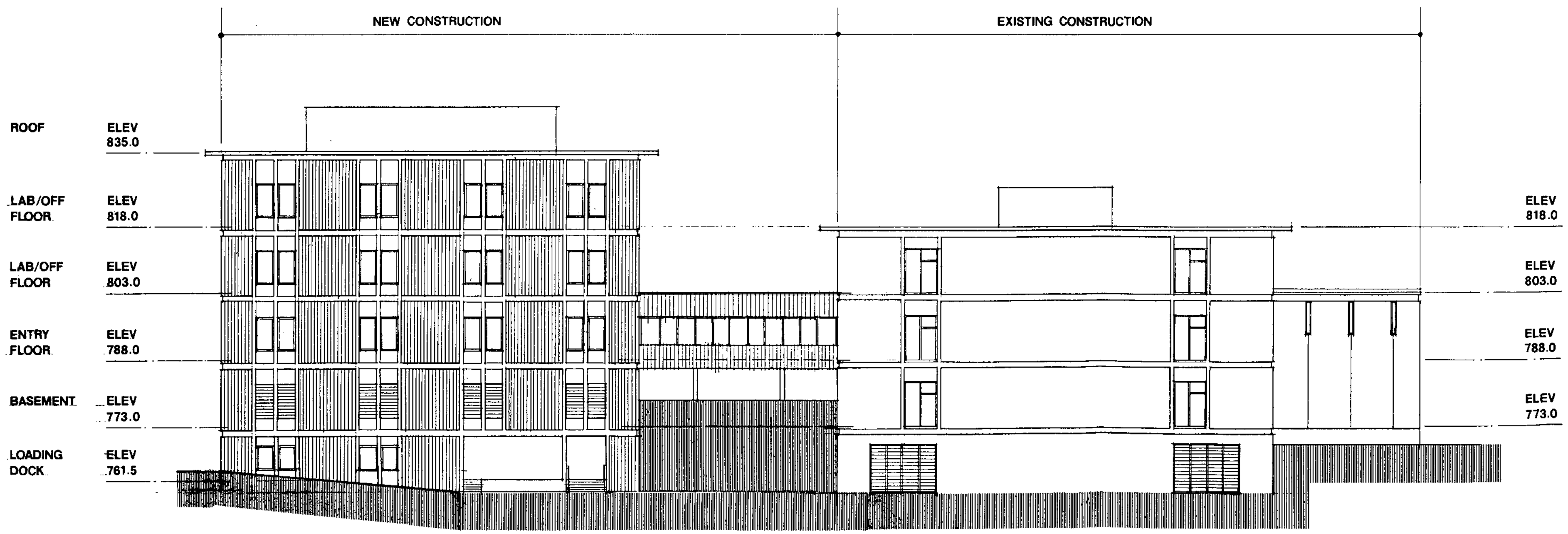
CHEMICAL SCIENCES ADDITION

BUILDING 62

EAST ELEVATION

scale: 1/16" = 1' - 0"

0 5 10 25 50 feet



WEST ELEVATION

scale: 1/16" = 1' - 0"

0 5 10 25 50 feet

MAY 1978

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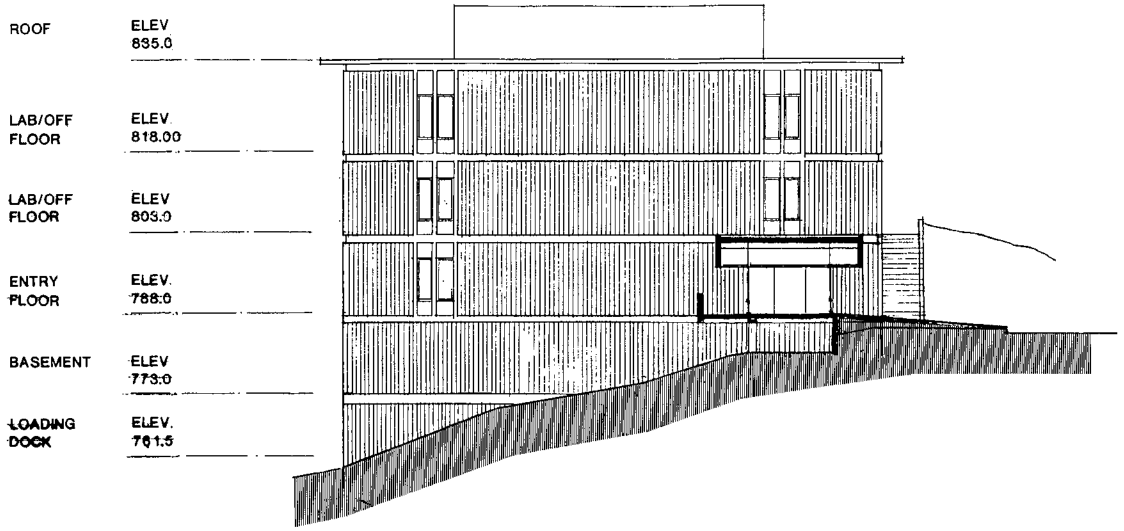
CHEMICAL SCIENCES ADDITION			SHEET NO. A7
DRAWN BY	DATE	APPR. BY	DATE
		CKD BY	DATE
			SCALE
			ACC'T NO.
UNIVERSITY OF CALIFORNIA LAWRENCE BERKELEY LABORATORY			SITE / DRAWING NUMBER 4B62B043
PLANT ENGINEERING			

GPO 891-402 — 1975

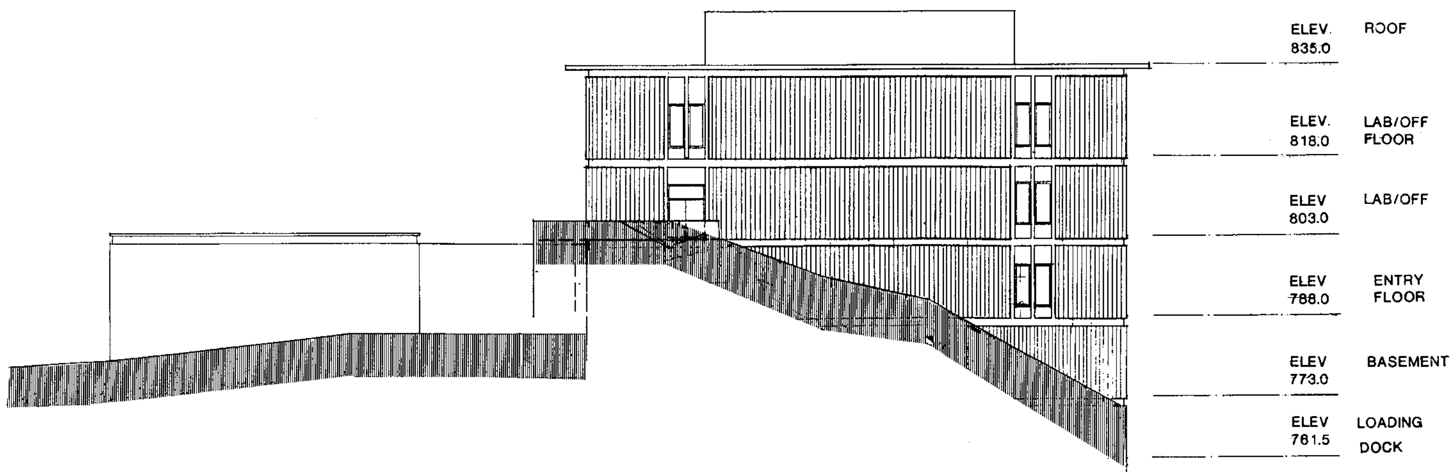
RL-1046 — SIZE 4

CHEMICAL SCIENCES ADDITION
BUILDING 62



SOUTH ELEVATION
scale: 1/16"= 1'- 0"

0 5 10 25 50 feet



NORTH ELEVATION
scale: 1/16"= 1'- 0"

0 5 10 25 50 feet

MAY 1978

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CHEMICAL SCIENCES ADDITION	SHEET NO. A8
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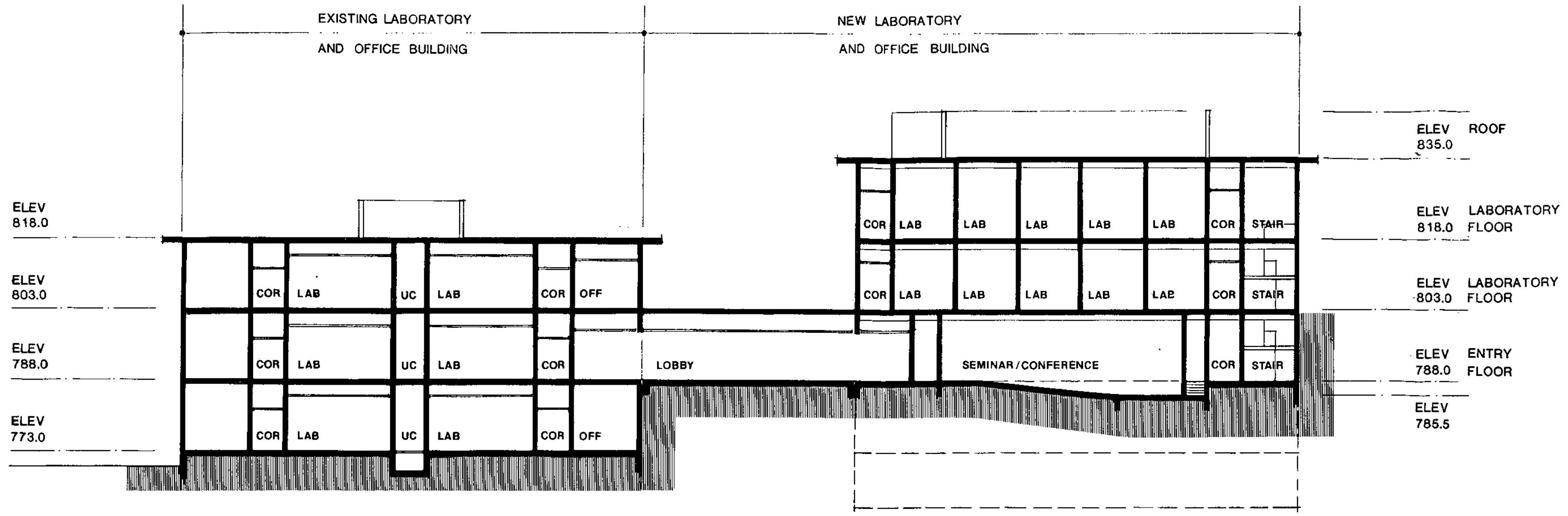
CKD BY / DATE	ACC'T NO.
UNIVERSITY OF CALIFORNIA LAWRENCE BERKELEY LABORATORY PLANT ENGINEERING	SITE / DRAWING NUMBER 4B62B044

CHANGE LETTER | DRAWN BY | CHECK BY | DATE | REVISIONS

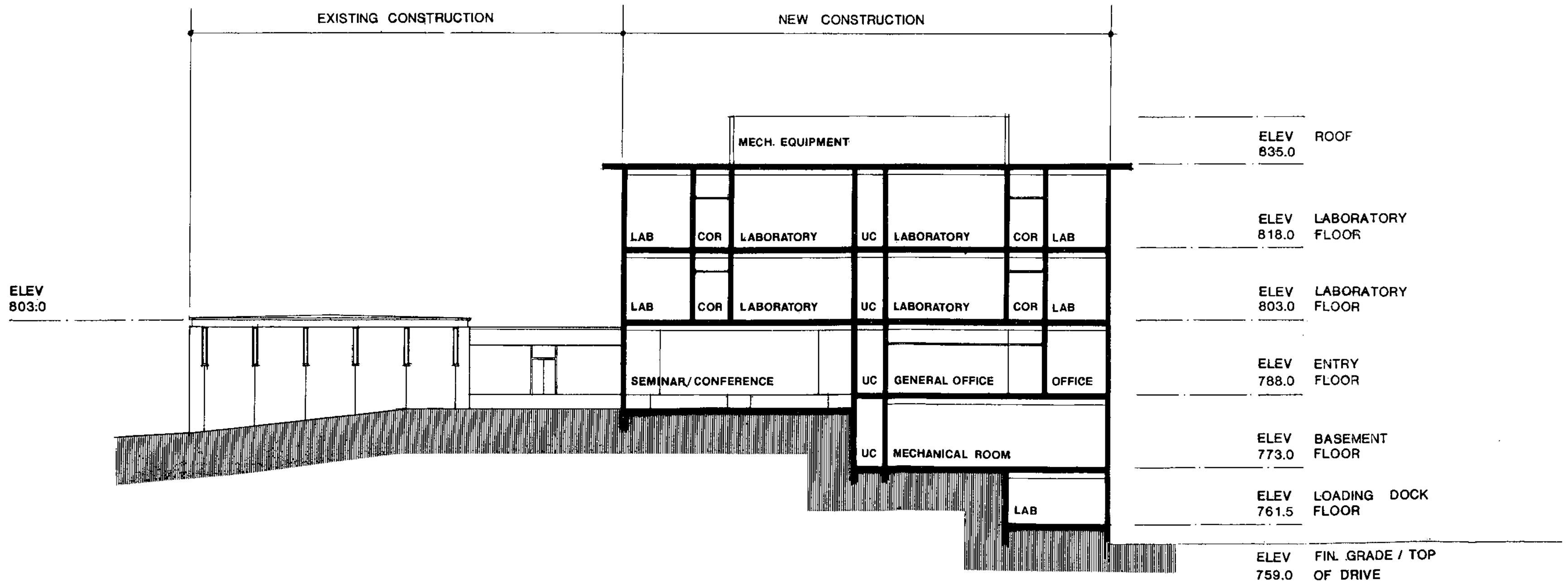
GPO 691-402—1976

RL-1046—SIZE 4

CHEMICAL SCIENCES ADDITION
BUILDING 62



TRANSVERSE SECTION
scale: 1/16" = 1' - 0"
0 5 10 25 50 feet



LONGITUDINAL SECTION
scale: 1/16" = 1' - 0"
0 5 10 25 50 feet

MAY 1978

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SYSKA AND HENNESSY Mech/Elec Engineers
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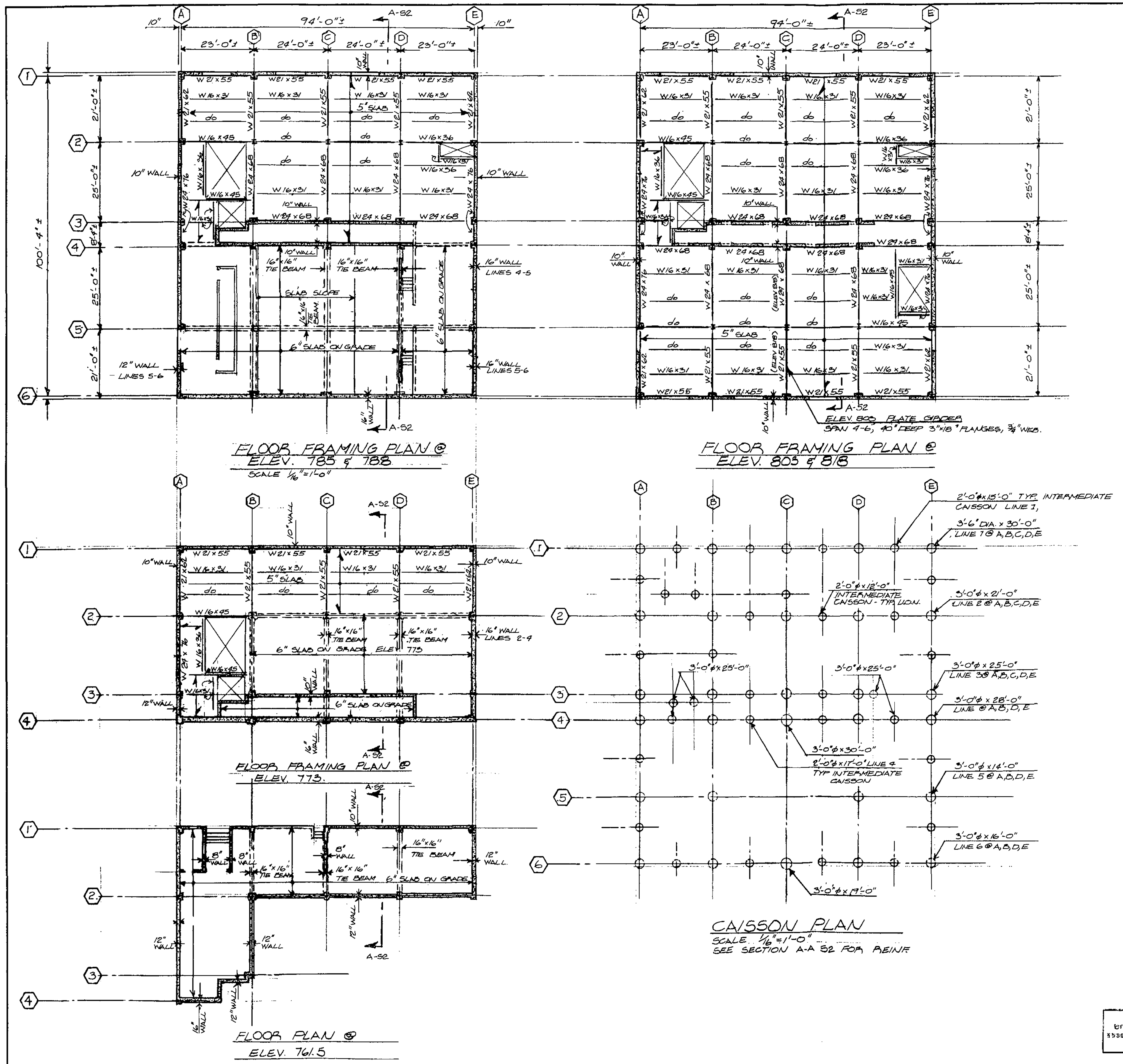
CHEMICAL SCIENCES ADDITION		SHEET NO. A9
DRAWN BY / DATE	APPR. BY / DATE	SCALE
	CKD BY / DATE	ACCT NO.
UNIVERSITY OF CALIFORNIA LAWRENCE BERKELEY LABORATORY		SITE / DRAWING NUMBER
PLANT ENGINEERING		4B62B045

CHANGE LETTER | DRAWN BY | CHECK BY | DATE | REVISIONS



CHEMICAL SCIENCES ADDITION

BUILDING 62

STRUCTURAL FRAMING PLANS

scale: 1/16"= 1'- 0"

0 5 10 25 50 feet

Reference North

MAY 1978

M. ARTHUR GENSLER AND ASSOCIATES Architects
SAN FRANCISCO, CALIFORNIA

ENGLE AND ENGLE Structural Engineers
SAN RAFAEL, CALIFORNIA

SYSKA AND HENNESSY Mech/Elec Engineers
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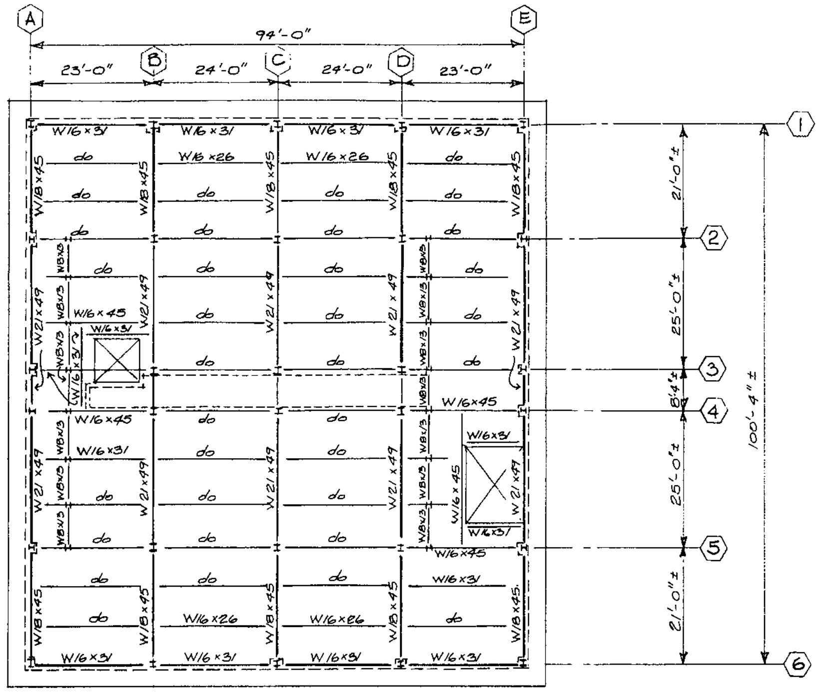
ENGLE and ENGLE
CIVIL & STRUCTURAL ENGINEERS
5330 - 4th ST. SAN RAFAEL
LICENSE NO. ....

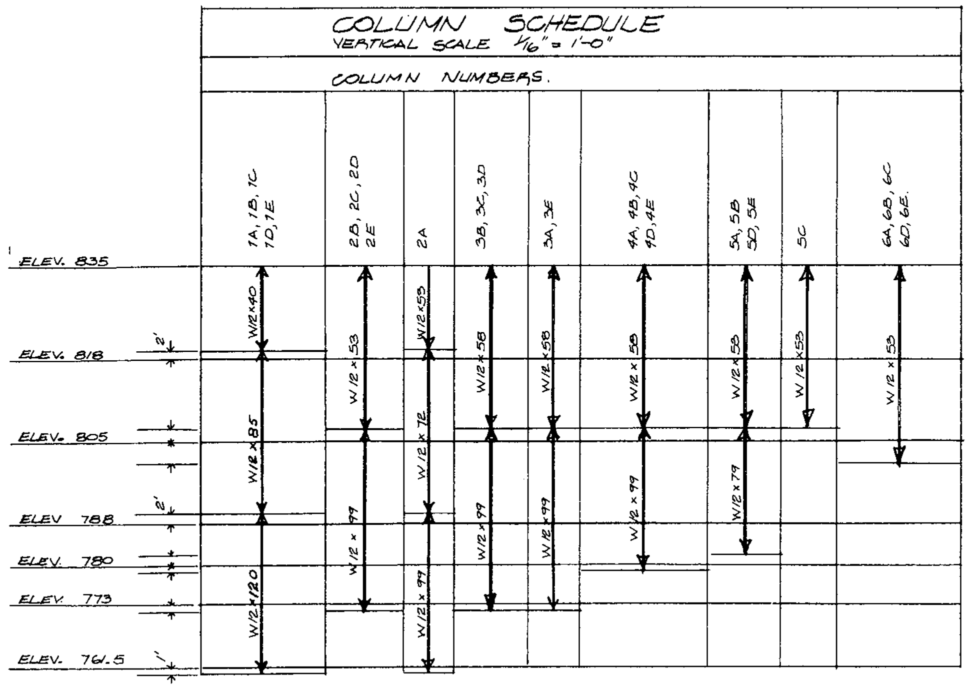
Preliminary 4/13/78

CHANGE LETTER	DRAWN BY	CHECK BY	DATE	REVISIONS 4/17/78, 4/20/78

CHEMICAL SCIENCES ADDITION				SHEET NO. S1
DRAWN BY	DATE	APPR. BY	DATE	SCALE
		CKD BY	DATE	ACC'T NO.
UNIVERSITY OF CALIFORNIA LAWRENCE BERKELEY LABORATORY PLANT ENGINEERING				SITE / DRAWING NUMBER 4B62B046



ROOF FRAMING PLAN ②
ELEV. 835 SCALE 1/16" = 1'-0"



ALL BEAMS ARE COMPOSITE ACTION . . . . 3/4"φ x 3" ASC - 30 PER BEAM

GIRDERS COMPOSITE ACTION
GIRDERS SPAN 21'-0' . . . . 3/4"φ x 3" ASC - 51 PER GIRDER
GIRDERS SPAN 25'-0' . . . . 3/4"φ x 3" ASC - 62 PER GIRDER

ALL CONNECTIONS - DOUBLE ANGLE STANDARD CONNECTIONS WITH ADDITION 5 x 5 x 5/8 CLIP ANGLE TOP & BOTTOM AT BEAM TO COL. & GIRDER TO COL. CONN.
ALL BOLTS 3/4"φ H.S. ASTM A325

ALL STRUCTURAL STEEL ASTM A36
ALL CONCRETE (EXCEPT 12" & 16" WALLS) . . . . f'_c = 3000 PSI
ALL REINFORCING (EXCEPT 12" & 16" WALLS) . . . . ASTM A615-40
CONCRETE AT 12" & 16" WALLS . . . . f'_c = 4000 PSI
REINFORCING AT 12" & 16" WALLS . . . . ASTM A615-60

CHEMICAL SCIENCES ADDITION

BUILDING 62

STRUCTURAL FRAMING PLANS

scale: 1/16" = 1'-0"

0 5 10 25 50 feet

Reference North

MAY 1978

M. ARTHUR GENSLER AND ASSOCIATES Architects
SAN FRANCISCO, CALIFORNIA

ENGLE AND ENGLE Structural Engineers
SAN RAFAEL, CALIFORNIA

SYSKA AND HENNESSY Mech/Elec Engineers
SAN FRANCISCO, CALIFORNIA

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SANTA CLARA, CALIFORNIA

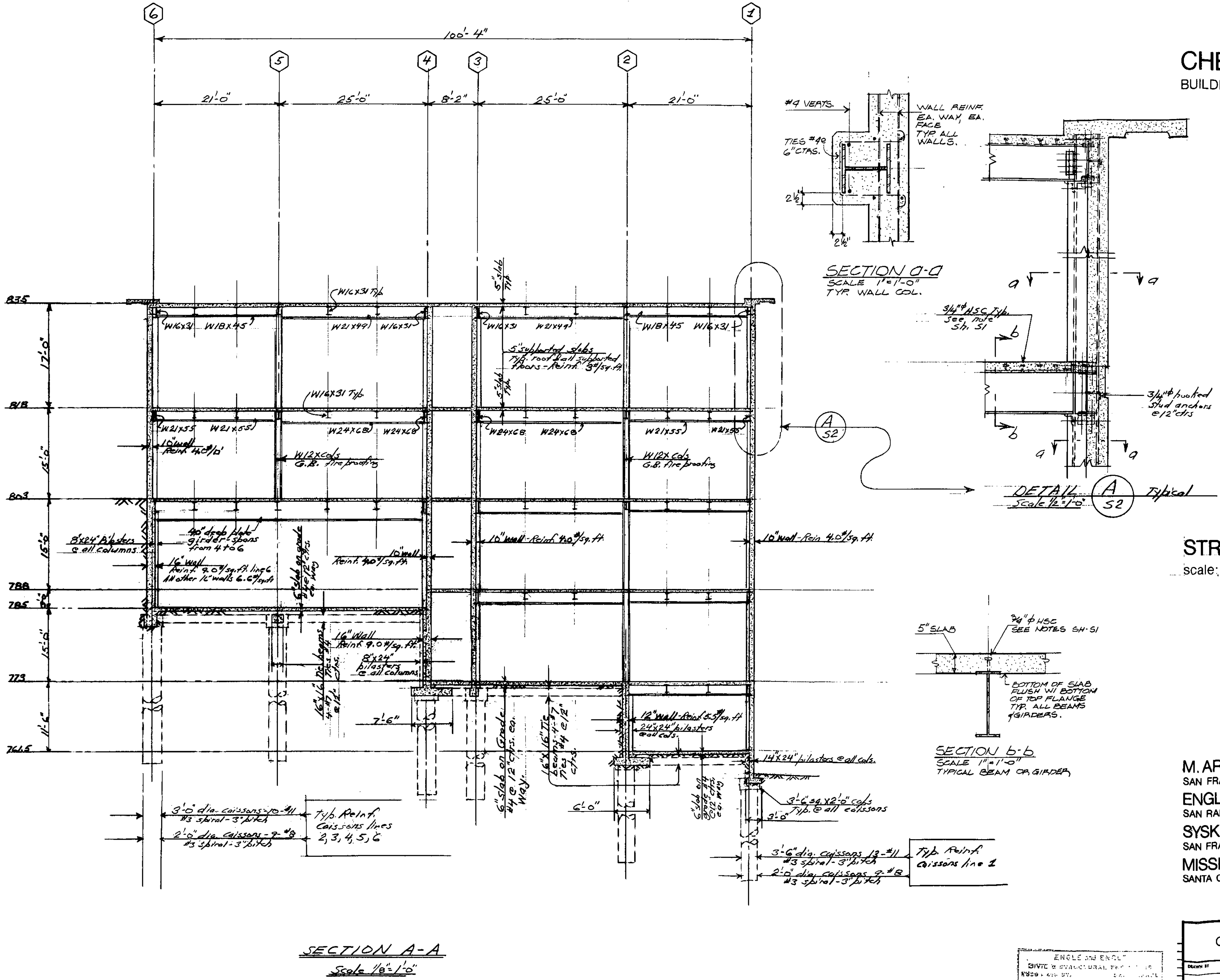
ENGLE and ENGLE
CIVIL & STRUCTURAL ENGINEERS
1830 - 4TH ST. SAN RAFAEL
LICENSE NO.

CHANGE LETTER	DRAWN BY	CHECK BY	DATE	REVISIONS

CHEMICAL SCIENCES ADDITION				SHEET NO. S2
DRAWN BY	DATE	APPR. BY	DATE	SCALE
		CKD BY	DATE	ACC'T NO.
UNIVERSITY OF CALIFORNIA LAWRENCE BERKELEY LABORATORY				SITE / DRAWING NUMBER 4B62B047
PLANT ENGINEERING				

RL-1046 — SIZE 4

CHEMICAL SCIENCES ADDITION
BUILDING 62



STRUCTURAL SECTIONS
scale: varies

MAY 1978

M. ARTHUR GENSLER AND ASSOCIATES Architects
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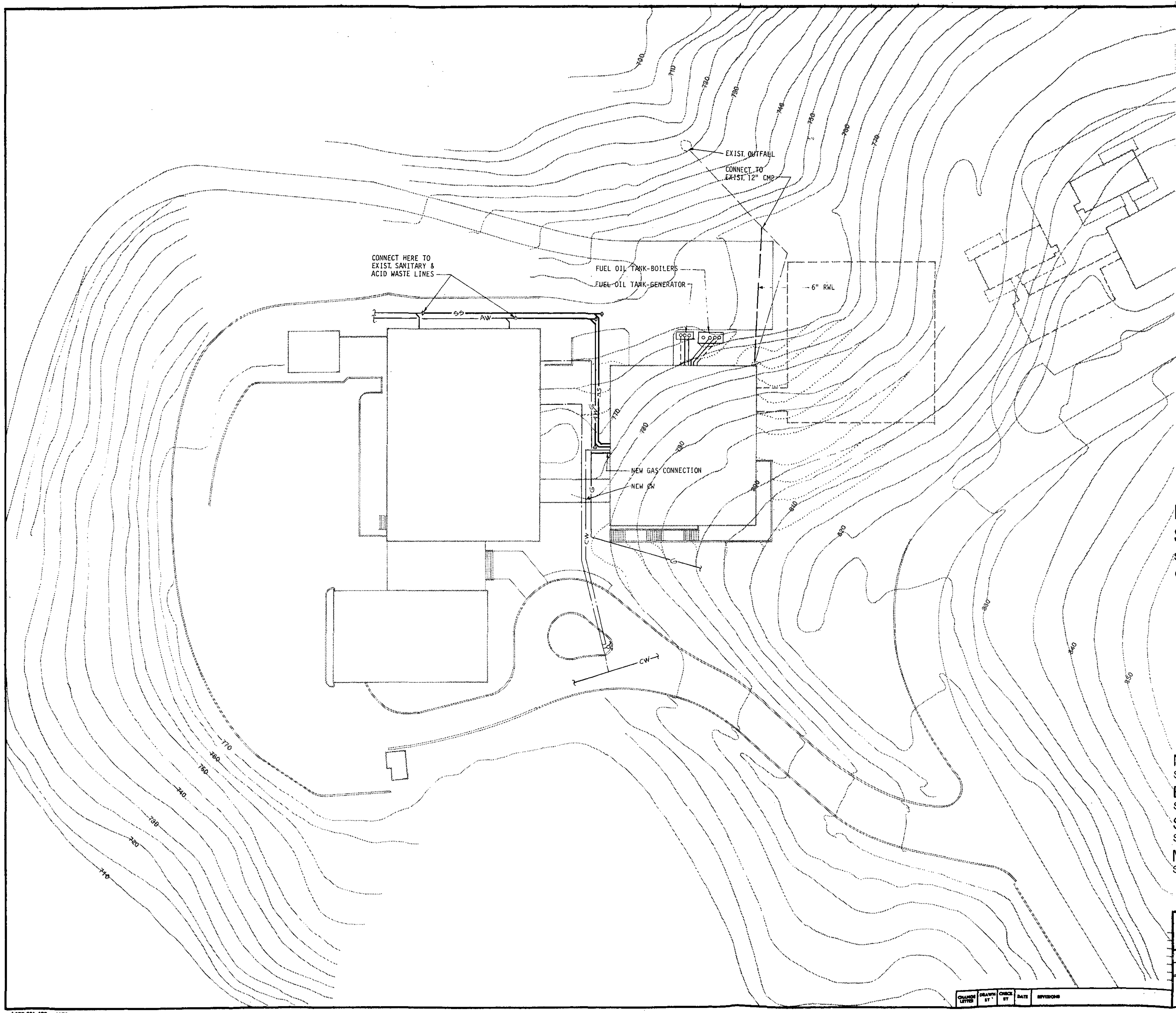
Preliminary 4/17/78 | REVISIONS 4/20/78

CHEMICAL SCIENCES ADDITION	SHEET NO. S3
UNIVERSITY OF CALIFORNIA LAWRENCE BERKELEY LABORATORY PLANT ENGINEERING	DRAWING NUMBER 4B62B048



CHEMICAL SCIENCES ADDITION

BUILDING 62

MECHANICAL & ELECTRICAL SITE PLAN

scale: 1" = 30' - 0"

0 10 50 100 feet

Reference North

MAY 1978

M. ARTHUR GENSLER AND ASSOCIATES Architects
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ENGLE AND ENGLE Structural Engineers
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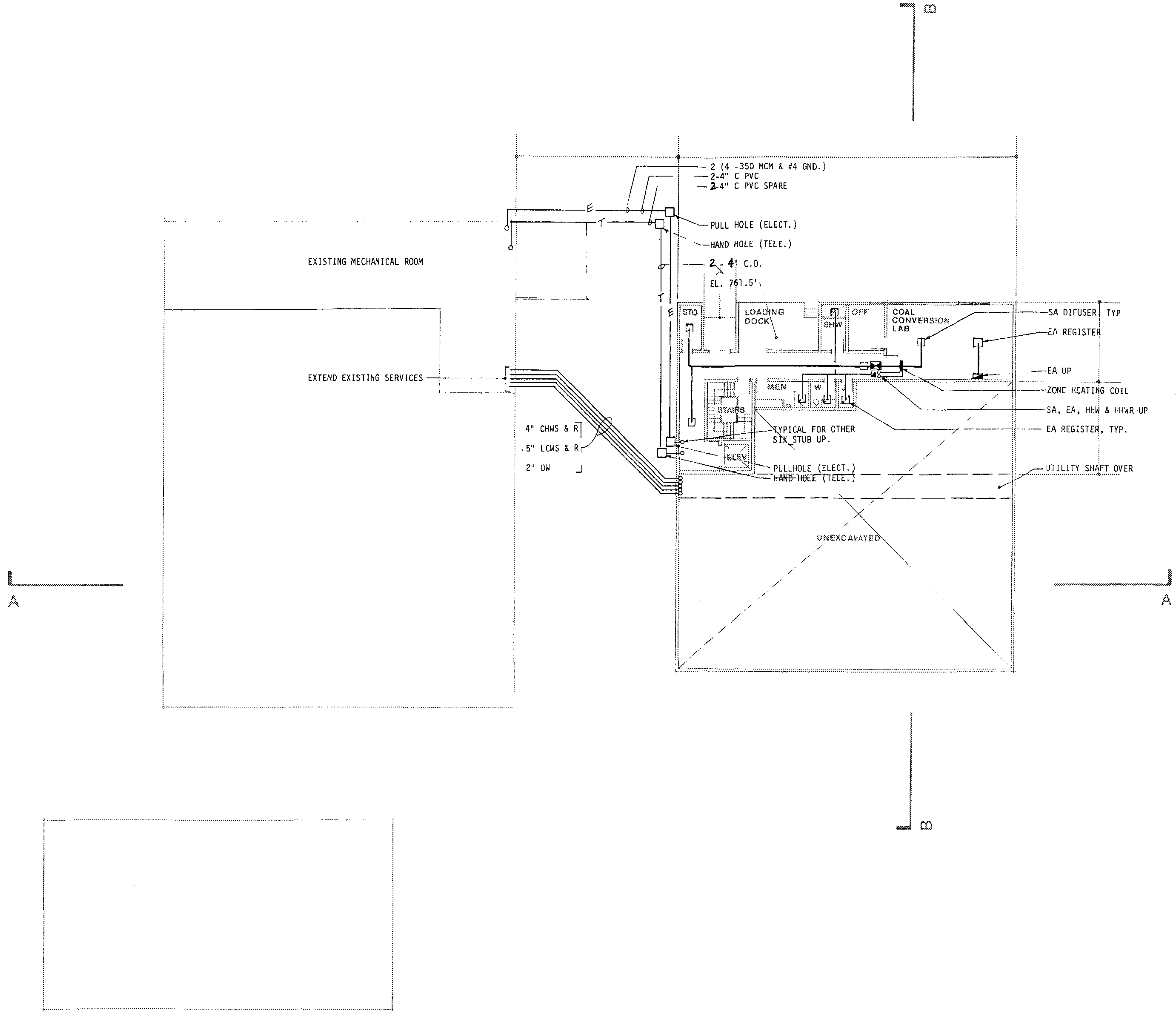
CHEMICAL SCIENCES ADDITION	ME1
UNIVERSITY OF CALIFORNIA LAWRENCE BERKELEY LABORATORY PLANT ENGINEERING	4B62B049

CHEMICAL SCIENCES ADDITION
BUILDING 62



LOADING DOCK FLOOR PLAN
scale: 1/16" = 1' - 0"

0 5 10 25 50 feet

Reference North

MAY 1978

M. ARTHUR GENSLER AND ASSOCIATES Architects
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ENGLE AND ENGLE Structural Engineers
SAN RAFAEL, CALIFORNIA

SYSKA AND HENNESSY Mech/Elec Engineers
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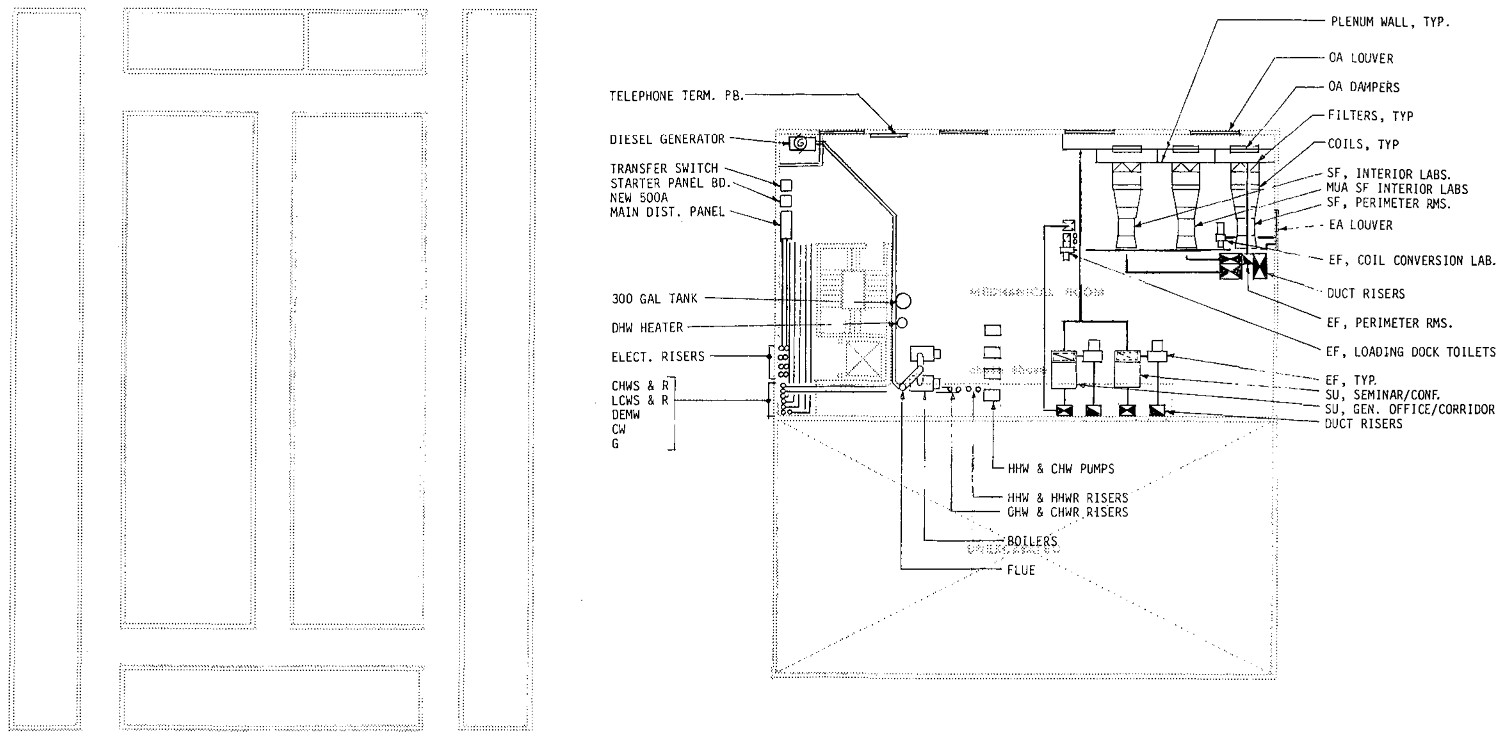
CHEMICAL SCIENCES ADDITION				SHEET NO. ME2
DRAWN BY	DATE	APPR. BY	DATE	SCALE
		CKD BY	DATE	ACCT NO.
UNIVERSITY OF CALIFORNIA LAWRENCE BERKELEY LABORATORY PLANT ENGINEERING				SITE / DRAWING NUMBER 4B62B050

CHEMICAL SCIENCES ADDITION

BUILDING 62



BASEMENT MECHANICAL & ELECTRICAL PLAN

0 5 10 25 50 feet

Reference North

LEGEND

CHW	CHILLED WATER SUPPLY PIPING	RWL	RAIN WATER LEADER
CHWR	CHILLED WATER RETURN PIPING	SA	SUPPLY AIR
CW	COLDWATER PIPING	SF	SUPPLY FAN
DEMW	DEMINERALIZED WATER PIPING	SU	SUPPLY AIR HANDLING UNIT
DHW	DOMESTIC WATER HEATER	PVC	POLY VINYL CHLORIDE
EA	EXHAUST AIR	PNL	PANEL
EAD	EXHAUST AIR DAMPER	BKR	BREAKER
EF	EXHAUST FAN	C	CONDUIT
G	GAS PIPING	C.O.	CONDUIT ONLY
HHW	HEATING HOTWATER SUPPLY PIPING	GFI	GROUND FAULT INTERRUPTER
HHWR	HEATING HOTWATER RETURN PIPING	E	EXISTING
LCW	LOW CONDUCTIVITY WATER		CIRCUIT BREAKER
MUA	MAKE-UP AIR		TRANSFORMER
OA	OUTSIDE AIR		CIRCULATING PUMP
OAD	OUTSIDE AIR DAMPER	HUM	HUMIDIFIER
RA	RETURN AIR		
RAD	RETURN AIR DAMPER		

MAY 1978

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CHEMICAL SCIENCES ADDITION

ME3

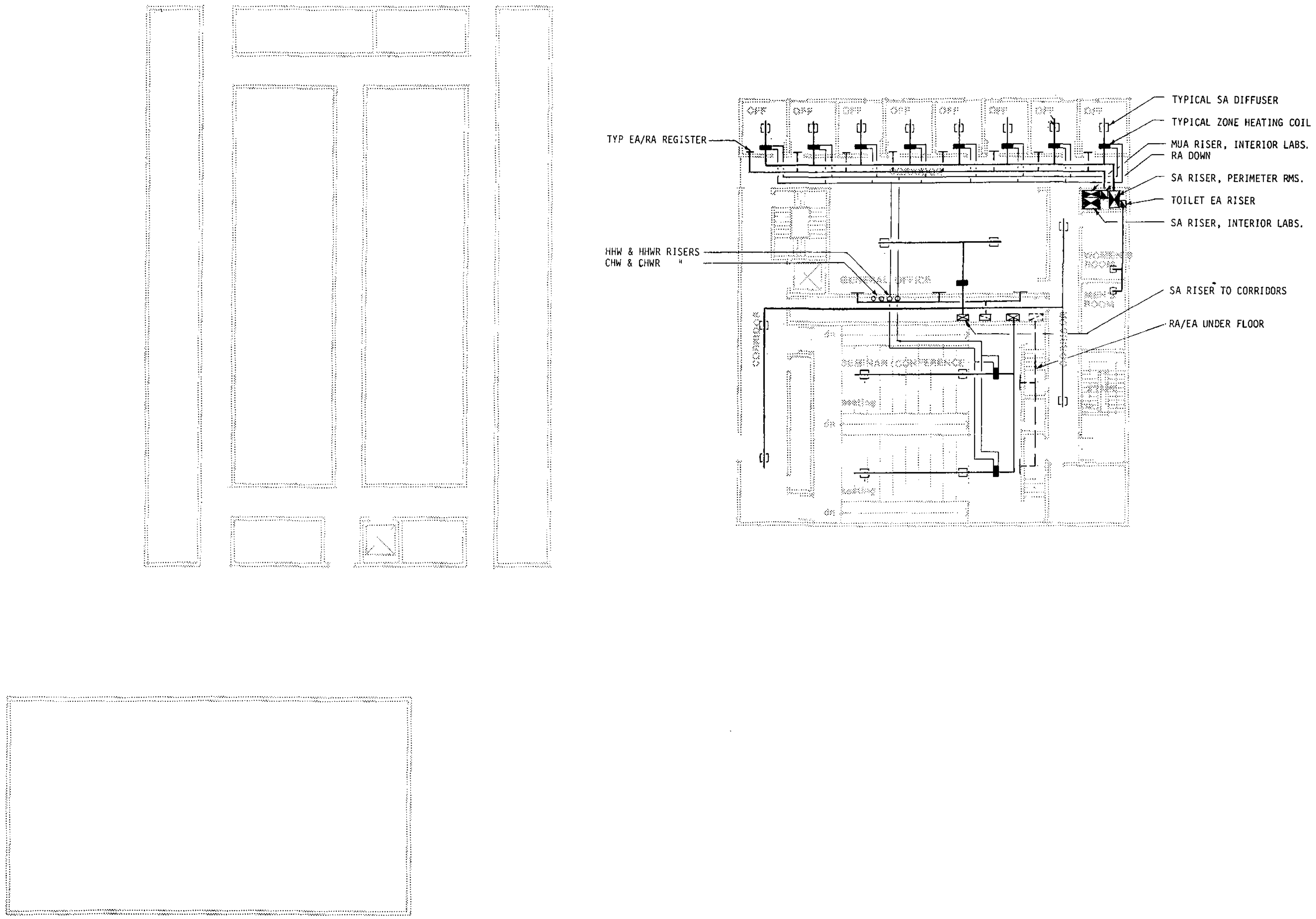
UNIVERSITY OF CALIFORNIA LAWRENCE BERKELEY LABORATORY

PLANT ENGINEERING

4B62B051

CHEMICAL SCIENCES ADDITION

BUILDING 62



ENTRY LEVEL MECHANICAL PLAN

scale: 1/16"= 1' - 0"

0 5 10 25 50 feet

Reference North

MAY 1978

M. ARTHUR GENSLER AND ASSOCIATES Architects
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ENGLE AND ENGLE Structural Engineers
SAN RAFAEL, CALIFORNIA

SYSKA AND HENNESSY Mech/Elec Engineers
SAN FRANCISCO, CALIFORNIA

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UNIVERSITY OF CALIFORNIA LAWRENCE BERKELEY LABORATORY PLANT ENGINEERING		DRAWING NUMBER 4B62B052

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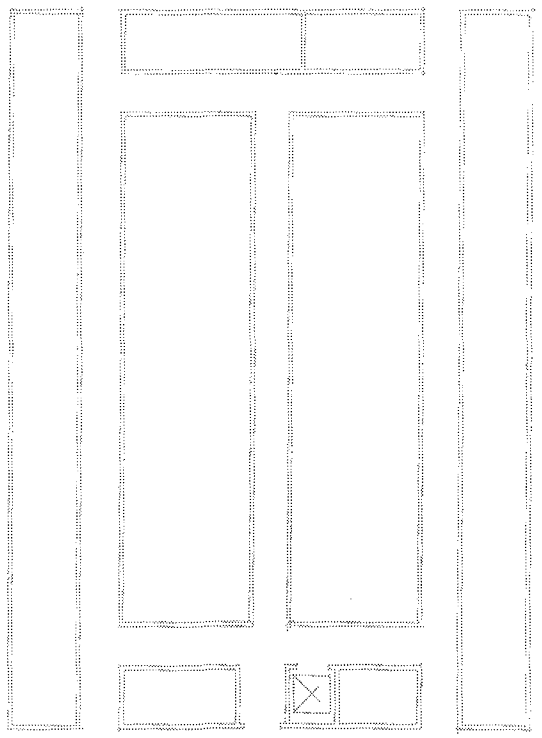
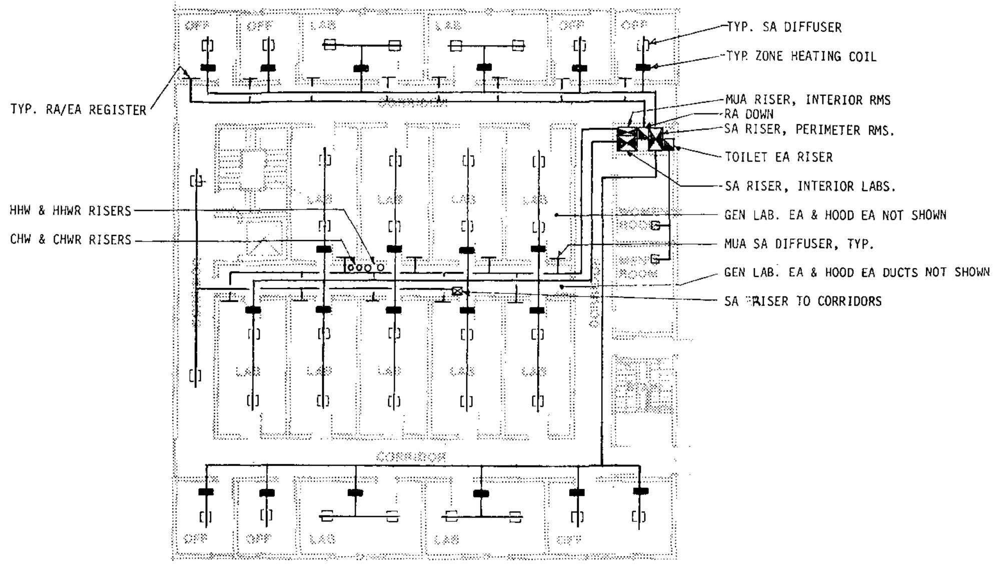
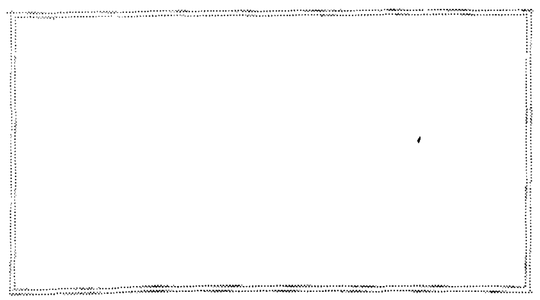
CHEMICAL SCIENCES ADDITION

BUILDING 62







TYPICAL LABORATORY FLOOR MECHANICAL PLAN

scale: 1/16"= 1'- 0"

0 5 10 25 50 feet

Reference North

MAY 1978

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CHEMICAL SCIENCES ADDITION	SHEET NO. M2
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UNIVERSITY OF CALIFORNIA LAWRENCE BERKELEY LABORATORY P L A N T E N G I N E E R I N G	SITE DRAWING NUMBER 4B62B053

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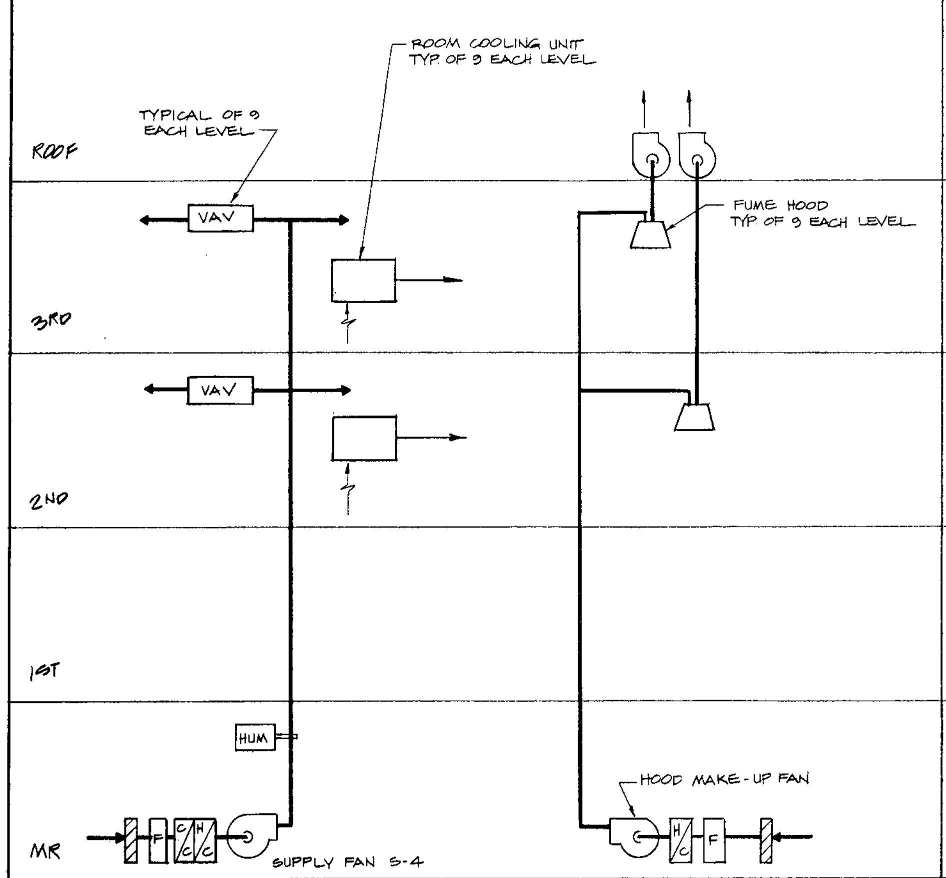
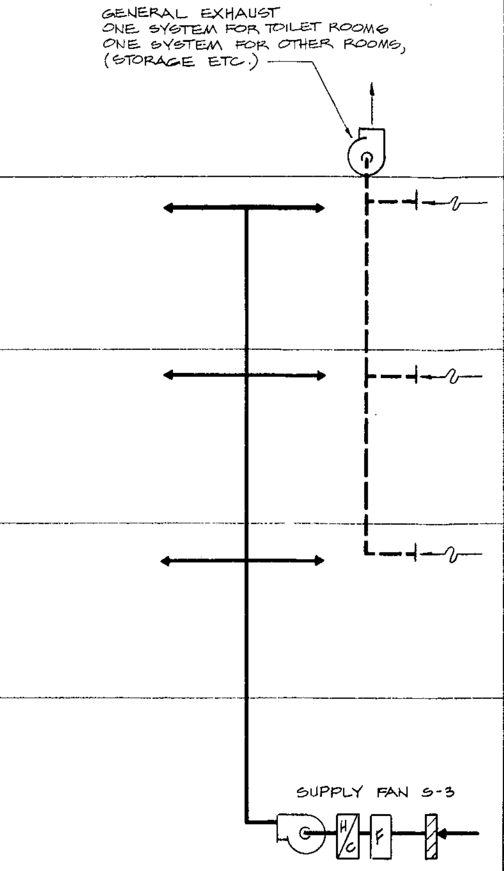


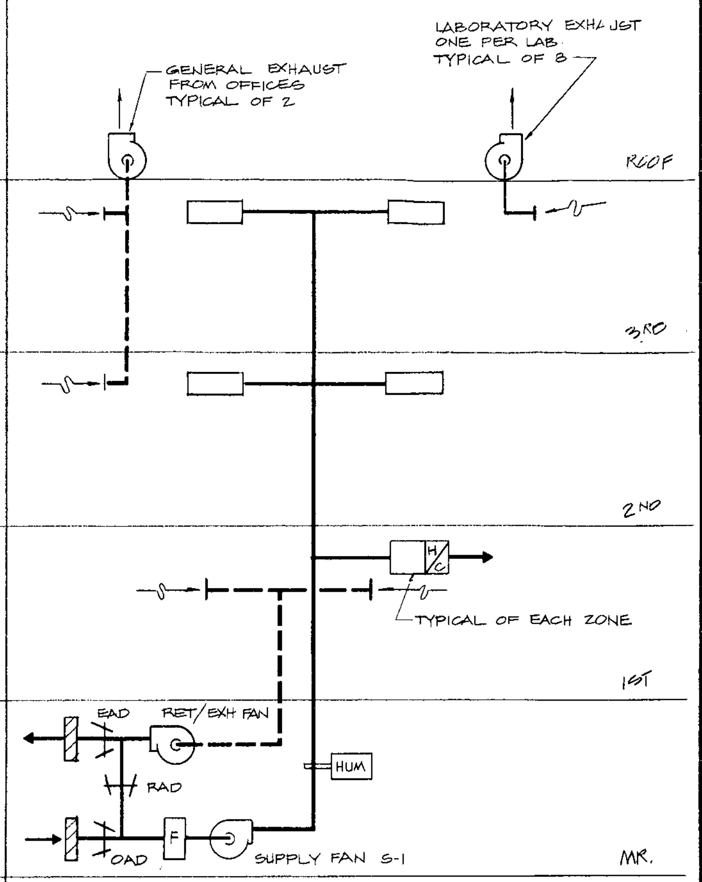
AIR CONDITIONED

INTERIOR LABS



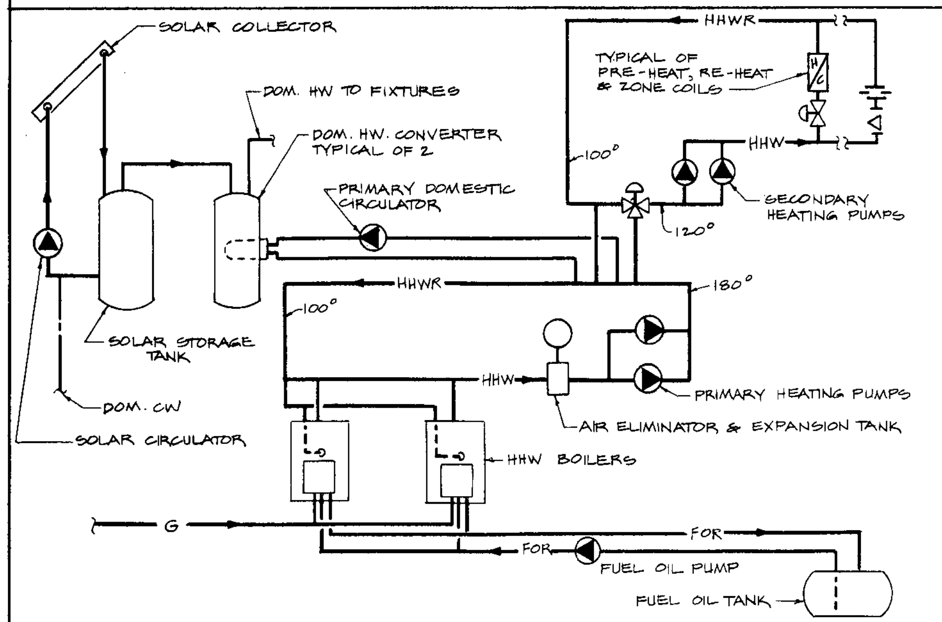
H & V ONLY

CORRIDOR & GEN. OFFICE SYSTEM

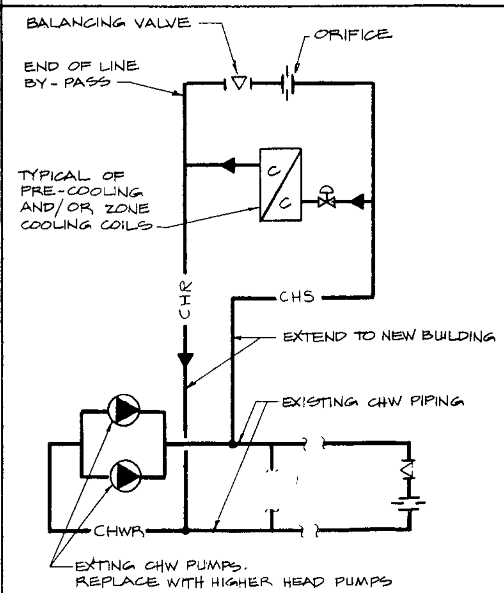


H & V ONLY

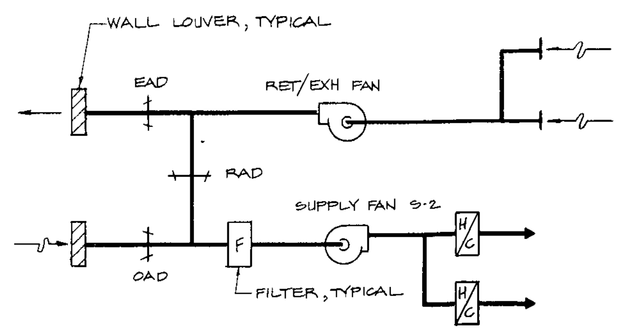
PERIMETER OFFICE & LABORATORY SYSTEM



HEATING WATER SYSTEM



CHILLED WATER SYSTEM



H & V ONLY

CONFERENCE / SEMINAR SYSTEM

CHEMICAL SCIENCES ADDITION

BUILDING 62

MECHANICAL SYSTEM DIAGRAMS

MAY 1978

M. ARTHUR GENSLER AND ASSOCIATES Architects
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CHEMICAL SCIENCES ADDITION	SHEET NO. M3
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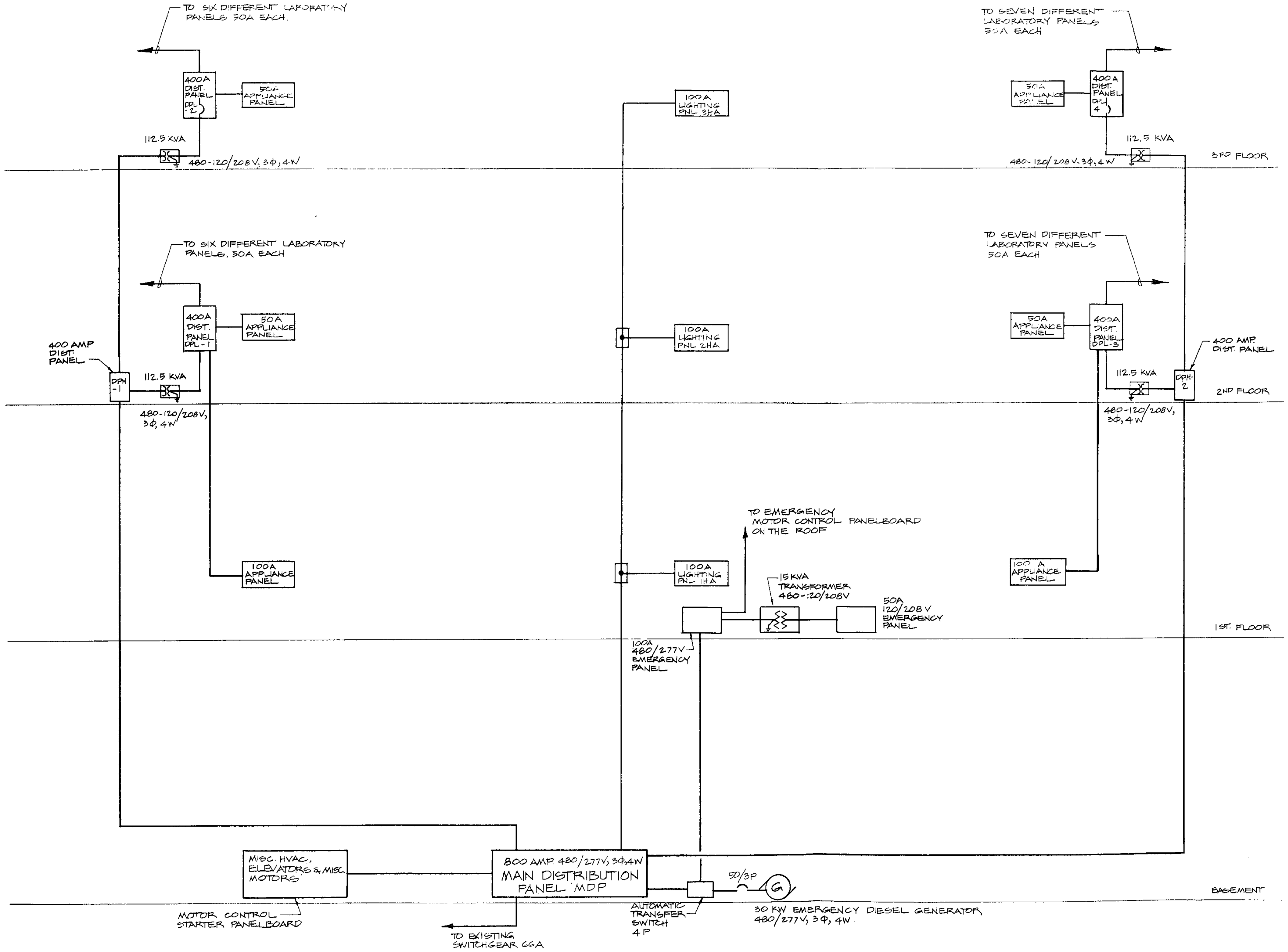
UNIVERSITY OF CALIFORNIA LAWRENCE BERKELEY LABORATORY PLANT ENGINEERING	SITE / DRAWING NUMBER 4B62B054

CHANGE LETTER	DRAWN BY	CHECK BY	DATE	REVISIONS



POWER RISER DIAGRAM

NO SCALE

CHEMICAL SCIENCES ADDITION

BUILDING 62

SHEET NOTES

1. ALL THE PNL'S & TRANSF'S EXCEPT BSMT SHALL BE IN THE CENTER OF THE RISER SHAFT SPACE AND SHALL BE STAGGERED TO MEET N.E.C. REQUIREMENT FOR WORKING SPACE.

ELECTRICAL POWER RISER DIAGRAM

MAY 1978

M. ARTHUR GENSLER AND ASSOCIATES Architects
SAN FRANCISCO, CALIFORNIA

ENGLE AND ENGLE Structural Engineers
SAN RAFAEL, CALIFORNIA

SYSKA AND HENNESSY Mech/Elec Engineers
SAN FRANCISCO, CALIFORNIA

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CHEMICAL SCIENCES ADDITION		SHEET NO. E1
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	CKD BY / DATE	ACC'T NO.
UNIVERSITY OF CALIFORNIA LAWRENCE BERKELEY LABORATORY		SITE / DRAWING NUMBER
PLANT ENGINEERING		4B62B055

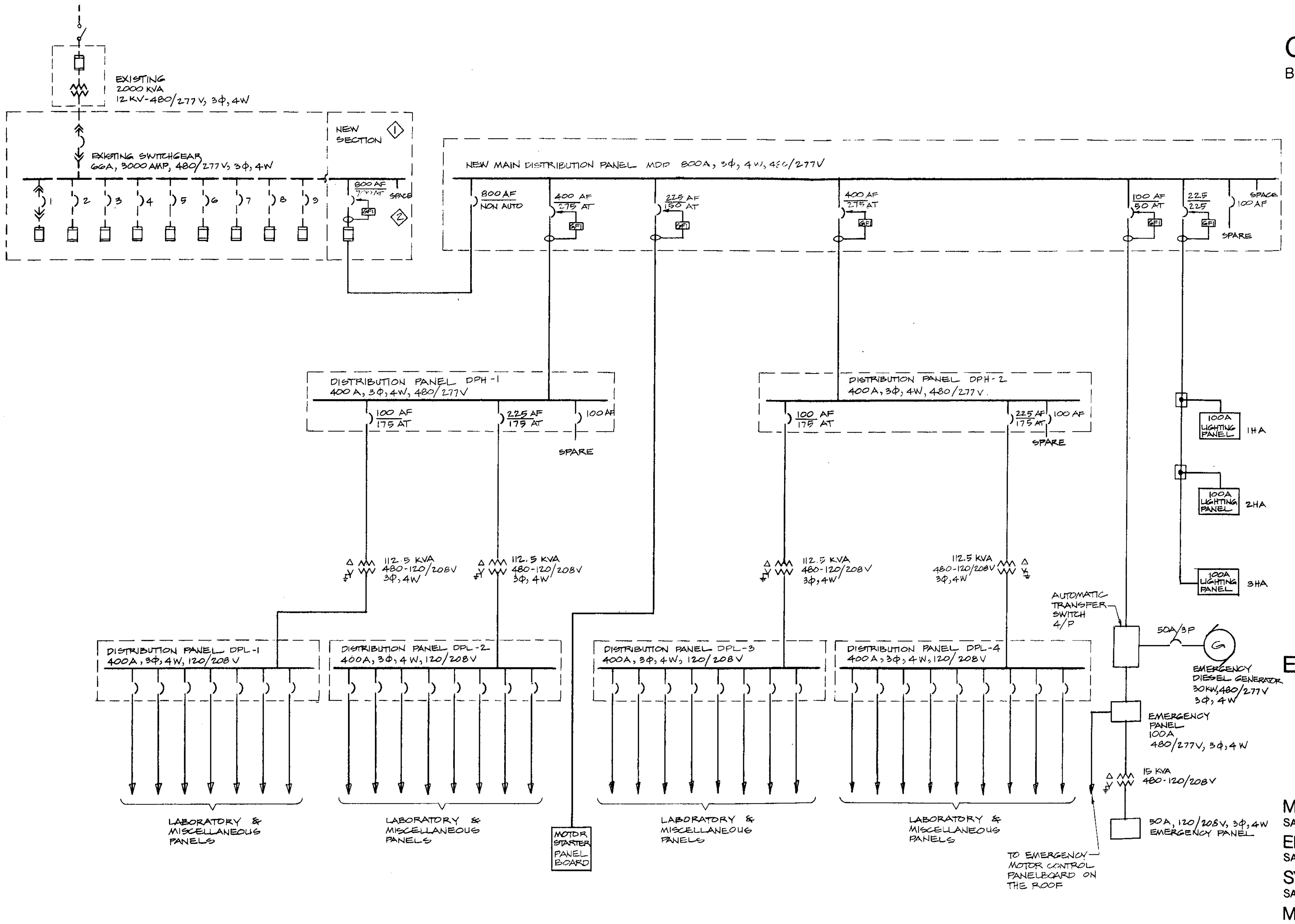
CHANGE LETTER | DRAWN BY | CHECK BY | DATE | REVISIONS

GPO 691-402-1976

PL 1046 - SIZE 4

CHEMICAL SCIENCES ADDITION

BUILDING 62



SINGLE LINE DIAGRAM

NO SCALE

SHEET NOTES

1. FURNISH & INSTALL NEW SECTION TO MATCH EXISTING.
2. FURNISH & INSTALL NEW 800 A FEEDER BREAKER TO MATCH THE EXISTING TRIPAC BREAKER.

ELECTRICAL SINGLE LINE DIAGRAM

MAY 1978

M. ARTHUR GENSLER AND ASSOCIATES Architects
SAN FRANCISCO, CALIFORNIA
ENGLE AND ENGLE Structural Engineers
SAN RAFAEL, CALIFORNIA
SYSKA AND HENNESSY Mech/Elec Engineers
SAN FRANCISCO, CALIFORNIA
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CHANGE LETTER	DRAWN BY	CHECK BY	DATE	REVISIONS

CHEMICAL SCIENCES ADDITION				SHEET NO. E2
DRAWN BY	DATE	APPR. BY	DATE	SCALE
		CKD BY	DATE	ACC'T NO.
UNIVERSITY OF CALIFORNIA LAWRENCE BERKELEY LABORATORY				SITE / DRAWING NUMBER
PLANT ENGINEERING				4B62B056

SECTION VI

OUTLINE SPECIFICATIONS

Contents

Contents (continued)

SECTION VI

OUTLINE SPECIFICATIONS

DIVISION 1 - GENERAL REQUIREMENTS

SECTION 1A - SUMMARY OF WORK

A. Scope

This project entails the following major categories of work.

1. Site development, including earthwork, excavation, finished grading and landscaping.

2. New building construction, including a new Chemical Sciences addition to Building 62 and enclosed connecting corridor, is part of the new construction and provides the required support and tie-in with the existing facility.

3. Alteration work is required at the exterior of the existing facility to accommodate the above mentioned tie-in.

B. Materials and Systems

New construction will match the existing and shall be steel and reinforced concrete. New Laboratory Building shall be partially air conditioned.

C. Execution

All work will conform to highest standards of construction practices, and will conform to special Lawrence Berkeley Laboratory design standards. Applicable provisions of the following codes are hereby referred to and made a part of this work. All work performed shall be in accordance with such laws, regulations, and the latest edition of all applicable codes including, but not limited to:

1. 29 CFR Part 1926, Safety and Health Regulations for Construction, Department of Labor.

2. 29 CFR Part 1910, Occupational Safety and Health Standards, Department of Labor.

3. General Safety Requirements, EM 385-1-1, U.S. Corps of Engineers (Department of Army).

4. National Fire Codes.

5. National Electrical Safety Code.

6. Lists of Inspected Appliances, Equipment and Materials (U.L.).

7. Approved Equipment Listing (FM).

8. Handbook of Rigging (Rossnagel).

9. Safety Code for Building Construction, ANSI A10.2.

10. California Administrative Code, Title 8, General Industry Safety Orders, Construction Safety Orders.

11. California Administrative Code, Title 19, Chapter 1, Title 24; Part 2, and Title 24, Part 6, Division T-19.

12. Uniform Building Code.

13. National Plumbing Code, ANSI A.40.8.

14. National Bureau of Standards "Design and Evaluation Criteria for Energy Conservation in New Buildings", No. NBSIR 74-452, latest edition.

Where codes or standard specifications other than those listed in this paragraph are referred to in the different Divisions of these specifications, it is understood that they apply as fully as if cited here.

Where differences exist between codes affecting this work, the code affording the greatest protection shall govern.

DIVISION 2 - SITE WORK

SECTION 2A - CLEARING

A. Scope

Accomplish all clearing and grubbing of existing topography as required to accommodate the new construction.

B. Materials

Clearing will be accomplished by power operated equipment for appropriate type for the task required and by hand equipment for close work.

SECTION 2B - DEMOLITION

A. Scope

Demolition work will include removal of pavement, curbs and walks. Also included will be the cutting of new opening in the existing building wall to accommodate new circulation tie-in.

B. Materials

Demolition will be accomplished with power tools, as required. New wall openings in existing construction will be cut with conrete power saw as required.

SECTION 2C - EARTHWORK

A. Scope

1. Work includes all excavation, fill, and backfill, as well as site preparation. Work also encompasses slope grading and stabilization, drilling for reinforced concrete piles, trenching, neat excavations for footings and retaining walls, roadway preparation, backfilling of trenches, foundations and retaining walls, and the placing of base materials for slabs on grade and roadways.

2. ASTM Standards will be applied for the testing and control of earthwork.

3. Testing will be done by an independent laboratory selected by the Lawrence Berkeley Laboratory.

4. Shoring and lagging will be the responsiblity of the Subcontractor.

B. Materials

1. Backfill in trenches to be paved and behind retaining walls will be previous fill.

2. Base under slabs on grade and roadways will be Class 2 aggregate base.

3. All backfill will be a non-expansive material. On-site excavated materials meeting these requirements may be used.

SECTION 2D - SITE DRAINAGE

A. Scope

Work includes interceptor trench drains, installation of perforated pipe subsurface drains, culvert, erosion control channels and ditches, storm water inlets and junction boxes, and storm water conduits.

B. Materials

1. Perforated pipe will be corrugated galvanized pipe that has been protected with a bituminous coating.

2. Manholes, catch basins, and junction boxes will be precast heavy duty type; lids and grating will sustain highway loading wheel loads.

3. Shallow culverts will be galvanized corrugated steel pipe with a bituminous coating.

4. Storm water piping at depths greater than 4 ft will be reinforced concrete pipe.

SECTION 2E - SITE MECHANICAL WORK

A. Scope

1. Furnish and install the following:

   a. New city water service for the Chemical Sciences Addition.

   b. New natural gas service extended from the Laboratory service to the Chemical Sciences Addition.

   c. New rainwater leader system for the Chemical Sciences Addition, including the connection to the existing storm sewer system.

   d. New sanitary sewer system for the Chemical Sciences Addition, including the connection to the existing site sanitary sewer system.

B. Material

1. Piping

Piping materials will be as follows:

Symbol	Service	Pressure (psig)	Temperature (^{o}F)	Construction
CW	City Water	120	60	Class 200 pipe, Class 250 fittings. Mechanical joints.
L	Rainwater leader	atm	--	Cement Asbestos.
SS	Sanitary sewer	atm	--	Vitrified clay with bell and spigot compression joints.
G	Natural gas	1, and 5 psi	--	Schedule 40 steel with butt welded fittings.

SECTION 2F - SITE ELECTRICAL WORK

A. Scope

1. The existing electrical services to the facility are located in unimproved areas to be occupied by a portion of the new building. The required grading will not disturb these services. In order to maintain a continuity of electrical and communication services, these relocations should be accomplished and/or temporary connections made before removal of the existing work.

SECTION 2G - ASPHALT PAVING

A. Scope

1. Work includes all new paving and patch paving for roadways, pathways and access drives.

2. Materials and paving methods will conform to the Standard Specifications of the State of California, Division of Highways.

B. Materials

1. Asphalt concrete surface will consist of a two(2) inch minimum layer of Type B aggregate, 85 - 100 percent penetration, steam refined asphalt.

2. Penetration prime coat, asphalt paint binder, and seal coat will conform to the Standard Specifications.

SECTION 2H - LANDSCAPING

A. Scope

Provide new landscapiing as indicated on the drawings to include the following erosion control:

1. Trees

2. Ground Cover

3. Accent Planting

Automatic irrigation system will be provided where required.

B. Materials

All landscaping materials will be native to the area, and/or such that will adapt well to the locale. Materials, in general, will be evergreen, except for certain flowering varieties that are seasonal. All materials will be selected for low maintenance after initial establishment.

DIVISION 3 - CONCRETE

SECTION 3A - CONCRETE WORK

A. Scope

1. Includes supply and placement of concrete for cast-in-place caissons, foundations, footings, slabs on grade, walls, suspended beams and slabs, and miscellaneous concrete structures, including membraned and concrete-topped roof at the new Laboratory Building.

2. Preparation of mix designs.

3. All concrete work and materials will conform to applicable ASTM and ACI Specifications.

B. Materials

1. Concrete will have the following minimum 28 day compressive strengths:

Foundations and Footings	3,000 psi
Slabs on Crade	3,500 psi
Beams and Girders	4,000 psi
Suspended Slabs	4,000 psi
Walls	3,000 psi

2. Reinforcing steel will be intermediate grade deformed bars.

DIVISION 4 - MASONRY

SECTION 4A - CONCRETE MASONRY WORK

A. Scope

Provide concrete masonry sight screen on roof of new Laboratory Building as indicated on the drawings.

B. Materials

Color and type of masonry units will match sight screen construction on the roof of the existing building.

DIVISION 5 - METALS

SECTION 5A - STRUCTURAL AND MISCELLANEOUS STEEL

A. Scope

1. Includes all structural and miscellaneous steel such as columns, beams, purlins, girts, framing for equipment and supports, and metals cast in concrete.

2. Shop drawings will be submitted for all fabricated steel.

B. Materials

1. All steel will conform at ASTM A-36.

2. Field connections will be made with ASTM A-325 high strength bolts.

3. Welds will be made by certified welders and will conform to AWS Standards.

DIVISION 6 - WOOD AND PLASTICS

SECTION 6A - ROUGH AND FINISH CARPENTRY

A. Scope

This section includes all rough and finish carpentry work for interior nonbearing wood stud partitions, related fasteners and all other miscellaneous carpentry and mill work items.

B. Materials

Wood studs and miscellaneous wood framing will bear Underwriters Laboratories, Inc. FR-S Label indicating compliance with applicable regulations pertaining to use of noncombustible wood in building construction.

Cabinet work exclusive of Laboratory furniture will conform to WIC Standards for "Custom Grade" construction.

DIVISION 7 - THERMAL AND MOISTURE PROTECTION

SECTION 7A - ROOFING AND ROOF INSULATION

A. Scope

Furnish and install roofing and roof insulation at all roof areas.

B. Materials

1. Roofing insulation will be rigid board insulation over lightweight concrete fill, sloped to drains and meeting prescribed "U" value for the roof construction in accordance with applicable regulations.
2. Roofing shall be 4-ply asphalt, 20-year bondable type with aggregate surface. Color of aggregate to match existing.
3. Roofing shall include additional cap sheet within screened mechanical area.

SECTION 7B - FLASHING AND SHEET METAL

A. Scope

Flashing and sheet metal work will include all metal flashing, reglets, wall louvers, collars, and other miscellaneous items.

B. Materials

All flashing and sheet metal work will be fabricated from "Armco Zincgrip-Paintgrip" copper-bearing sheet steel, or approved equal. Reglets will be plastic, precaulked.

SECTION 7C - CAULKING AND SEALANTS

A. Scope

All joints at exterior surfaces subject to water penetration will be sealed.

B. Materials

Sealants will be either polysulfide, butyl, or silicone, as appropriate. Oil base compounds will not be permitted.

SECTION 7D - EXTERIOR WALL THERMAL INSULATION

A. Scope

Furnish and install exterior wall insulation for full height of wall at the exterior wall furring system (metal studs).

B. Material

Insulation will be 3-1/2 inch glass fiber batt insulation meeting prescribed "U" value for the exterior wall construction in accordance with applicable regulations.

SECTION 7E - WATERPROOFING

A. Scope

Furnish and install waterproof membrane at walls of rooms below grade and between structural slab and topping at slab on grade.

1. Below grade wall waterproofing membrane will be asphalt, gun applied, with glass fiber mat reinforcing.
2. Slab water proofing shall be 50 mil liquid applied self-curing polyurethane membrane.

DIVISION 8 - DOORS AND WINDOWS

SECTION 8A - HOLLOW METAL DOORS AND HOLLOW METAL FRAMES

A. Scope

Furnish and install hollow metal door frames at all door openings and hollow metal doors at all exterior locations and at rated interior openings, such as at stair enclosures and mechanical spaces. Furnish and install hollow metal trim at exterior windows to match existing detailing, except at connection between existing Molecular Research Building and Chemical Sciences Addition where doors shall be aluminum to match adjacent store front construction.

B. Materials

1. Door frames will be fully welded construction, 16 gauge steel.
2. Hollow metal doors will be flush seamless construction with incombustible core, 18 gauge steel.

3. Hollow metal window trim will be 18 gauge steel.

4. All hollow metal work will be job-delivered with a baked-on shop primer.

SECTION 8B - WOOD DOORS

A. Scope

Wood doors will be provided at all interior openings except at certain locations where metal doors are required at fire rated openings.

B. Materials

All interior wood doors will be flush face solid core, select white birch, conforming to Commercial Standard CS-171, Grade 1.

SECTION 8C - ALUMINUM WINDOWS, DOORS AND ENTRANCES

A. Scope

Furnish and install aluminum windows, storefront construction, and new aluminum entrances.

B. Materials

1. Windows in the new Laboratory Building will be aluminum, and will match exactly the existing window design.

2. New storefront construction will be fabricated from stock aluminum rectangular extrusions, flush glazed.

3. New aluminum entrances will be fabricated from aluminum extrusions, narrow line design.

SECTION 8D - GLAZING

A. Scope

Furnish and install glass at all new windows, store front construction, and aluminum entrances. Furnish and install glass at door lights and interior view windows.

B. Materials

1. Glass at exterior windows will be "B" quality, 7/32-inch thick.

2. Lights, less than 9 square feet at interior doors, entrance doors, and view windows will be 1/4-inch thick, type 1 safety glazing.

3. Lights at hollow metal doors will be 1/4-inch thick, polished wire glass with welded diamond mesh.

4. Glass at store front doors and store front panels will be 1/4-inch type II safety glazing.

SECTION 8E - SPECIAL DOORS

A. Scope

Metal roll-up door will be provided at loading dock.

B. Materials

Doors will be electrically operated with safety toe piece, flat faced slats. Door assembly will be factory shop primed.

SECTION 8F - HARDWARE

A. Scope

Finish hardware will be provided at all new door openings.

B. Materials

1. Locksets and latches will match existing construction and will be Schlage Type C, Saturn design, dull chrome (US 26D) finish.

2. Great grand master key all cylinders to existing system.

3. Closers, kickplates, butts, stops, and all other miscellaneous hardware will match existing design and quality.

DIVISION 9 - FINISHES

SECTION 9A - GYPSUM DRYWALL

A. Scope

1. Provide gypsum drywall finish surfaces at all interior nonbearing partitions, and exterior wall furring.

2. Provide 3-1/2 inch metal studs at all exterior walls (for 3-1/2 inch batt insulation), and metal furring channels at interior concrete walls where indicated on the drawings.

3. Provide suspended gypsum board ceilings in toilets and other designated areas.

B. Materials

1. Wall and ceiling gypsum board will be 5/8 inch thick.

2. Metal studs will be 3-1/2 inch, 25 gauge, galvanized.

3. Suspended ceiling system will be comprised of wire hangers, runner channels and furring channels with seismic bracing system per applicable standards.

SECTION 9B - RESILIENT FLOORING

A. Scope

Furnish and install resilient flooring and top-set resilient base at all room spaces except toilets, carpeted areas and mechanical areas.

B. Materials

1. Resilient flooring will be 12 inch by 12 inch vinyl asbestos, 1/8 inch thick.

2. Base will be vinyl or rubber, 4 inch high, coved, with preformed exterior corners.

SECTION 9C - CERAMIC TILE

A. Scope

Ceramic tile floors and wainscots will be provided in all toilet rooms. Mortar set method at floor tile,and inorganic adhesive setting method at wall tile.

B. Materials

Wall tile will be matt glazed 4-1/4 inch by 6 inch. Floor tile will be unglazed vitreous porcelain mosaic, one inch by one inch.

SECTION 9D - ACOUSTIC TREATMENT

A. Scope

Furnish and install suspended acoustical ceiling system in all laboratory and office spaces. Provide acoustical sound attenuation blanket in partition cavities of all toilet room partitions, office to laboratory separating partitions, mechanical and compressor room partitions, and other locations where sound attenuation is required.

Gypsum wall board will be installed on resilient sound attenuating channels over metal ceiling suspension system at mechanical equipment and compressor rooms, with a vinyl-faced sound attenuation blanket attached thereto.

B. Materials

1. Suspended acoustical ceiling system will consist of 2 foot by 4 foot lay-in washable face acoustical board in an inverted, factory finished metal tee-grid. Space above ceiling will be completely accessible. Seismic bracing system will be provided per applicable standards.

2. Acoustical sound deadening material will be 3 inches thick at walls, 2-inches thick at mechanical room setting.

SECTION 9E - PAINTING

A. Scope

Provide finish painting at all exposed nonfactory finished surfaces, interior and exterior, as follows:

1. Woodwork
2. Metals
3. Sheet Metal
4. Concrete Surfaces (Sealer at Exterior Concrete)
5. Gypsum Board
6. Exposed Piping and Duct Work

B. Materials

All paint materials will be of one manufacturer, with the exception of certain specialty items that may be required. Paints will be delivered to the site in manufacturer's unopened containers, and no thinning will be allowed unless specifically authorized by the manufacturer.

C. Execution

All paint work shall be three-coat except a four-coat stain and lacquer system will be used at wood doors, and exterior concrete sealer will be a two-coat system.

SECTION 9F - FIREPROOFING

A. Scope

Furnish all materials, labor, equipment and supervision to install steel spray fireproofing.

B. Materials

Steel spray fireproofing materials will be a mill mix, cementitious-only compound, bearing proper U.L. Inc. label.

C. Application

Application shall be to structural steel which is not encased in concrete, and the underside of steel floor and roof decking:

Thicknesses for a minimum rating of 2 hour fire resistance shall be provided in accordance with applicable codes and regulations. Material shall be sprayed to surfaces which are clean of dust, grease, and oil base paint. Ducts, piping, conduit and other equipment which could cause interference with uniform application are to be positioned after fireproofing spray application.

SECTION 9G - LATHING AND PLASTERING

A. Scope

Furnish and install metal plaster studding, ceiling suspension system, metal lath, and cement plaster at balcony soffits and window spandrels.

B. Materials

1. Window spandrels:

   a. 18 gauge metal studs with paper backed metal lath.

   b. Scratch, brown and finish coat of cement plaster, with finish coat "Marblecrete," color of aggregate to match existing building. Total thickness, 1 inch.

2. Cement plaster soffits:

   a. Metal furring suspension system with expanded metal lath.

   b. Scratch, brown and finish cots of cement plaster. Total thickness, 1 inch.

DIVISION 10 - SPECIALTIES

SECTION 10A - METAL TOILET COMPARTMENTS

A. Scope

Furnish and install metal toilet compartments, urinal screens and sight screens as indicated on the drawings.

B. Materials

Toilet compartments will be ceiling supported type, baked enamel finish. Urinal and sight screens will be wall hung type, finish and construction to match the toilet compartments.

SECTION 10B - TOILET ROOM ACCESSORIES

A. Scope

In each toilet room provide mirror and shelf units, toilet paper dispensers, seat cover dispensers, and combination paper towel dispenser/disposal units.

B. Materials

All accessories will be stainless steel. Paper towel dispenser/disposal unit will be wall-mounted, and semi-recessed type.

SECTION 10C - FIRE EXTINGUISHER CABINETS

A. Scope

Furnish and install wall-mounted fire extinguisher cabinets in locations as required by Code and Lawrence Berkeley Laboratory.

B. Materials

Cabinets will be of size and type as required by Lawrence Berkeley Laboratory.

DIVISION 11 - EQUIPMENT

SECTION 11A - LABORATORY FURNITURE

A. Scope

Manufacture, deliver, assemble and install all Laboratory furniture, including work tops and reagent shelves, base cabinets, work benches, storage cabinets and fume hoods.

B. Materials

Laboratory furniture will be modular, plastic laminate clad as manufactured by Hamilton Manufacturing Company, Laboratory Furniture Company, Permalab Equipment Corporation or other approved fabricator. Stainless steel stops will be provided where required.

DIVISION 12 - FURNISHINGS

SECTION 12A - FURNITURE AND CARPETING

A. Scope

Provide commercial grade specialty furniture items to include Reception Area seating, and tablet arm chair for the Conference/ Seminar Room. Provide commercial grade carpeting in same areas.

B. Materials

Furniture and carpeting will be design coordinated for color and texture to properly define the special areas discussed above.

DIVISION 13 - SPECIAL CONSTRUCTION

None

DIVISION 14 - CONVEYING SYSTEMS

SECTION 14A - ELEVATOR

A. Scope

Furnish and install combination freight and passenger elevator with single automatic push button operation.

B. Materials

1. Car platform will be 7 ft wide and 8 ft 4-inch deep, resulting in an effective usable area of 6 ft 8-inches wide by 7 ft 7-inches deep.
2. Maximum capacity will be 5,000 pounds and minimum "up" speed shall be 80 feet per minute.
3. Car entrance will be 4 ft 6-inches by 7 ft clear with two-speed horizontal sliding doors.
4. Car ceiling panels will be readily removable to accommodate transport of excessively long test specimens.
5. Elevator operation will be hydraulic.

DIVISION 15 - MECHANICAL

SECTION 15A - PLUMBING

A. Scope

1. Furnish and install the following:

a. New building acid waste system.

b. New building plumbing system, including plumbing fixtures, hot and cold water system.

c. Extension of the low conductivity water system from the existing Laboratory building.

d. New industrial hot and cold water system.

e. New compressed air system.

f. New building natural gas system.

g. Extension of demineralized water system from existing to new Laboratory building.

B. Materials

1. Piping:

Piping materials will be as follows:

Symbols	Service	Pressure (psig)	Temperature (°F)	Construction
CW	City Water,	80		Type L copper with 95-5 solder fittings.
HW	Domestic Hot Water,		60-120	
ICW, IHW,	Industrial Cold and Hot Water,		60-120	
LCWS&R	Low Conductivity Supply and Return			
CA	Compressed Air	100	60	Type L copper with 95-solder fittings.

Piping materials (continued.)

Symbols	Service	Pressure (psig)	Temperature (^{o}F)	Construction
G	Natural Gas	7-inch Water column	60	Schedule 40 steel with butt welded and/or threaded fittings.
L,	Rainwater Leader,	atm	--	Cast Iron No-HUB
SS	Sanitary Sewer			Cast Iron No-HUB
AW	Acid Waste	atm	--	Polypropylene drainage pipe with "Fuseal" joints.
DES DER	Demineralized Water Supply and Return	55	--	Schedule 80 PVC with socket weld fittings.

2. Valves

a. All-bronze or bronze-trimmed iron disk or butterfly type as manufactured by Nibco, Kennedy or equal.

b. Natural gas valves will be lubricated plug type.

c. Demineralized water valves will be Hills McCanna or Cabot, PVA ball values with teflon seats.

d. Pressure reducing valves will be C. M. Bailey Model 30 or equal.

e. Backflow preventers will be Watts or Beeco reduced pressure type.

3. Water Heaters

Vertical storage type, steel cement lined, ASME code stamped, with copper "U" type heat exchangers.

4. Pumps

   a. Domestic water circulating pumps will be all-bronze in-line with aquastat and time clock, Bell & Gosset, Taco, or approved equal.

   b. LCW booster pumps will be Pacific Pumping Company or approved equal, Type L, end suction centrifugals. The pumps will have flexibly coupled motors mounted on the pump base. The pumps shall be resiliently mounted.

5. Air Compressors

   Ingersoll-Rand or DeVilbiss tank mounted type, with ASME code stamped tanks, pressure relief valves, and air cooled integral aftercoolers. The compressors will be supplied with drain traps.

6. Refrigerated Air Dryer

   Ingersoll-Rand or equal air-cooled refrigerated type capable of cooling twice the air compressor capacity of air to 35^{o}F at 100 psig. All components will be rated for 100 psig.

SECTION 15B - HEATING, VENTILATING AND AIR CONDITIONING

A. Scope

   1. Furnish and install the following:

      a. General and toilet exhaust systems.

      b. Laboratory hood and room exhaust systems.

      c. Central supply air systems.

      d. Hood make-up and supply system.

      e. Central hot water heating system.

      f. Extension of chilled water system from existing laboratory to new laboratory building.

B. Materials

   1. Main supply fans: Joy Series 1000 or approved equal, vane-axial fans. The fans will be supplied with inlet ball, explosion proof motor, outlet cone, and adjustable pitch blades. They shall be mounted on spring-type vibration isolators with 1-inch minimum static deflection and lateral restraints.

2. Heating and Ventilating Units: Trane "Torrivent," or approved equal, factory assembled cabinet unit with fan, coil, and filter.

3. Cooling Units: Trane "Climate Changer," or approved equal, factory assembled unit complete with fan, cooling coils, drip pan and filter.

4. Exhaust Fans:

   a. General Exhaust and Return Fans: American Standard, Trane, or approved equal, utility set.

   b. Laboratory and Hood Exhaust fans: American Standard or approved equal, Series 106 industrial exhaust fans with corrosion resistant epoxy coating on all parts in the air stream. The fans will be supplied with motor housing, bolt guard and vibration mounts.

5. Variable Volume Boxes: Barber-Colman, or approved equal.

6. Vibration Isolation: All fan equipment to be mounted on earthquake restrained spring isolators, minimum static deflection of 1 inch.

7. Air filters: High capacity extended media type, Cambridge Hi-Flo or approved equal with maximum face velocity of 250 fpm and minimum media of 60 square feet net area per 1,000 cfm. The filters shall be 93 to 97 percent efficient when tested according to the ASHRAE method. The filters shall be NFPA Class II.

8. Ductwork:

   a. Sheet Metal duct work and build-up fan and coil plenums: galvanized steel, fabricated according to the low velocity section of the SMACNA Manual. It will be insulated and sound lined where necessary. The fan and coil plenums will be lined with minimum 1-inch thick six pound per cubic foot density, rigid fiberglass board, with air side coating, Fiberglass type 705 or equal.

   b. Laboratory exhaust system ducting: Black sheet metal flanged at 4 ft 0-inch maximum centers and epoxy coated inside for corrosion resistance.

   c. Hood Supply air system: Factory fabricated fiberglass ducting.

9. Heating boilers: Type L or CL water tube with forced draft burners for natural gas and #2 fuel oil.

10. Expansion tanks: American Tube and Controls Extrol or approved equal diaphragm type with accompanying air eliminator and makeup water inlet fittings. The expansion tank pressure will be 12 psig higher than the highest water column in the pipe lines above the boilers.

11. Chilled and Heating Water Pumps: Pacific Pumping Company, or approved equal, Type L end-suction centrifugals or Type KP split case centrifugals. The pumps will have flexibly coupled motors mounted on the pump base. The pumps will be resiliently mounted.

12. Heating Water and Chilled Water Piping:

    a. Schedule 40 steel pipe with butt welded steel fittings or 125 pound flanged fittings for pipes 2-1/2 inches and larger. Use 125 pound cast iron screwed fittings for smaller pipes. All piping will be resiliently mounted in the Mechanical Room and resiliently isolated from rotating machinery with flexible connectors.

    b. All connections to machinery will be made with unions or flanges for ease of disconnection.

    c. Piping will be insulated with 1-inch minimum thickness glass fiber insulation with fire retardant jacket and molded glass fiber pipe fitting insulation, except chilled water piping which will be cellular glass 1-inch thick.

13. Valves:

    a. Stop valves: 125 pound standard, all bronze disk type, lug style butterfly type, or stainless steel ball type, Nibco, Kennedy, Dezurik, Wooster or equal.

    b. Check valves: Swing type, all bronze screwed or bronze trimmed, flanged Nibco or approved equal.

    c. Heating and cooling coils shall have Dezurik or approved equal Series 100 eccentric balancing valves with memory stops.

    d. Control valves: 125 pound standard screwed or flanged with equal percentage characterized ports for heating water and linear characterized ports for chilled water. Valves will be provided with pressure taps on all sides for balancing flows.

SECTION 15C - AUTOMATIC FIRE SPRINKLERS

A. Scope

1. All spaces of new building will have fire sprinklers.

2. Water service for fire sprinklers including connection to existing site water main.

3. Design of the entire system including submisson to fire protection authorities.

B. Materials

1. Piping

Below Grade	Class 200 cast iron pipe with mechanical joints.
Above Grade	Schedule 40 steel with 175 pound banded cast iron threaded fittings.

2. Valves — Underwriters' Laboratories listed OS&Y type.

3. Sprinkler Heads — Pendant or upright type where piping is exposed, flush type in areas with ceilings.

4. Sprinkler Riser — Underwriters' Laboratories listed flow and control devices.

DIVISION 16 - ELECTRICAL

SECTION 16A - INTERIOR ELECTRICAL WORK

A. Scope

a. Modify existing Switchgear No. 66A and add a new section to provide circuit breaker with current limiting fuse, to feed new 800A distribution panel to be located in the new addition of Building 62.

b. Extend telephone system.

c. Extend fire alarm system.

d. Extend paging system.

e. Install laboratory power distribution system as follows:

(1) Install two main 480 volt power panels on second floor, one at each end of the service corridor.

(2) Install two 112.5 KVA 480 - 208Y/120 volt, 3 phase, 4 wire step down transformers on each floor.

(3) Install a 208Y/120 volt, 3 phase, 4 wire 400 ampere distributon panel for each of these transformers.

(4) Install 208Y/120 volt, 2 phase, 4 wire 100 ampere panelboards and feeders in each laboratory and where required to provide 208Y/120 volt power for general building use.

f. Install lighting panels at 277/480 volts on each floor. These panels will be tapped to a main lighting riser.

g. Install 480 volt, 3 phase, 4 wire 400 ampere. Machine Shop panelboard and feeder.

h. Install a 480 volt, 3 phase motor control center and feeder for building mechanical equipment.

i. Install emergency power system as follows:

(1) Install 100 KW 277Y/480 volt, 3 phase, 4 wire diesel-generator complete with automatic transfer switch.

(2) Install 277Y/480 volt, 3 phase, 4 wire emergency power distribution panel.

(3) Install 480 volt, 3 phase emergency motor control center for hood exhaust fans.

j. Install 120 volt, 208 volt, and 480 volt power outlets as required for laboratory and general use.

k. Install lighting system complete with all fixtures, switches and necessary auxiliary apparatus.

l. Install all motor branch circuits complete with motor connections and control devices as required.

m. Install a system of underfloor ducts in the machine shop for power distribution to machine tools.

n. Install power feeder and disconnect switch for elevator equipment.

o. Install a system of raceways and outlets for telephone equipment.

p. Install raceways and outlets for paging system.

q. Extend existing fire alarm system into the new Laboratory Building and connect up sprinkler system flow switches. Install manual fire alarm stations as required.

r. Install system and equipment grounding.

B. <u>Materials</u>

1. <u>Panelboards</u>

Panelboards will be installed where required and shall be flush or surface mounted as required by building construction. Trim shall be of the door-in-door type. Panels will be equipped with equipment grounding blocks.

a. Panelboards for 277/480 volt, three phase, four wire and 480 volt, three phase, three wire shall be Westinghouse Type CDP, or approved equal. Circuit breakers shall have a minimum interrupting rating of 22,000 amperes RMS.

b. Lighting panelboards will be 277/480 volt, three phase, four wire, Westinghouse Type WEHB, or equal. Circuit breakers shall have a minimum interruping rating of 14,000 amperes RMS. Main breakers will be current limiting type Westinghouse Tri-Pak, or equal.

c. The 208Y/120 volt, three phase, four wire panelboards for receptacles and miscellaneous equipment shall be Westinghouse Type WEB, or approved equal.

2. <u>Motor Control Panel Boards</u>

Motor panel boards will be installed where required for building mechanical equipment. Control voltage will be 120 volts with control transformer in each unit. A ground bus, full length of the motor control panel board, will be provided. The motor control panel boards will be General Electric type CLB or approved equal.

3. <u>Lighting Fixtures</u>

a. Offices: 2 x 4 ft. lay-in fluorescent troffers, return air type, with acrylic prismatic lenses.

b. Laboratories: 2 x 4 ft. lay-in fluorescent troffers with acrylic prismatic lenses.

c. Conference Room: Same type as offices equipped with dimming controls.

d. Service Corridors: Industrial two lamp fluorescent fixtures with baked enamel finish.

4. Receptacles

Receptacles at 120 volt, single phase and 208 volt, three phase will be provided as required for building services, research equipment and for convenience outlets.

a. Duplex receptacles will be rated 20 ampere, 125 volt, three wire Hubbell No. 5362, or approved equal.

b. Three phase receptacles shall be rate 20 amperes, 120/208 volt, three phase wye, four pole, five wire, Hubbell Twistlock No. 2510, or approved equal.

5. Conductors

All conductors will be copper as follows:

a. Conductors No. 10 AWG and smaller will be solid; No. 8 AWG and larger will be stranded.

b. Conductors No. 6 AWG and smaller will be Type THWN or THHN; No. 4 AWG and larger will be Type THWN or THHN.

c. Control conductors will be Type TWM, stranded copper.

6. Conduits

Conduits will be rigid galvanized steel, polyvinyl chloride or electrical metallic tubing, or as required.

C. Execution

1. Conduit Installation

a. Conduits will be installed concealed where possible. Outlet boxes in laboratories, offices, corridors and other finished areas will be installed flush. In service corridors, shops, equipment rooms, etc., boxes may be surface mounted.

b. All wiring will be installed in conduit. Electrical metallic tubing, 2 inches and smaller, will be used in all concealed work. Complete runs of exposed conduit, 2 inches and smaller, in protected areas, more than 5 feet above the floor may be electrical metallic tubing.

2. Grounding

   a. Main ground shall be a 3/8-inch galvanized strand, minimum 25-feet long, within 2 inches of bottom of building foundations. This conductor will be center-tapped and brought out of foundation to connect to the building and service grounding system.

   b. System and equipment grounding

      (1) Connections will be made to the above grounding system for grounding the various 208Y/120 volt transformers.

      (2) The equipment ground block in each panel will be connected to the ground system.

      (3) Each feeder and branch circuit will have a bare copper equipment grounding conductor in the same raceway as the circuit power conductors. The grounding conductor will be electrically and mechanically connected to the panelboard equipment grounding block.

3. Fire Alarm System

   a. The building will be protected by a sprinkler system. Flow switches will be provided under the Mechanical Division. These switches will be connected into the LBL fire alarm system with transmitters to properly indicate location.

   b. Manual fire alarm stations, as required, will be provided.

4. Telephone System

   Telephone terminal cabinets will be provided on each floor in the riser spaces. Conduits sized to suit the system needs will be run from the terminal cabinets to telephone outlets in the offices, laboratories and elsewhere as required. The outlets will be consist of a flush 4-11/16 in. square box with double device plaster ring and double device plate with cable hole.

5. Mechanical Equipment Connections

   Necessary power and control wiring, starters, contactors, relays, push buttons and switches will be installed and connected for the mechanical equipment furnished under Mechanical Section.

6. Equipment Identification

Each panelboard, motor control switch, starter, wiring device, etc., will be identified by circuit number with an engraved nameplate. Transformers will be identified by number, KVA and voltage ratings and primary circuit number.

D. Quality Assurance

The installation will comply with the requirements of the State of California Administrative Code, Title 8, Subchapter 5, Electrical Safety Orders, California Occupational Safety Health Act, applicable City and County rules and regulations, and the National Electrical Code, latest edition.

SECTION VII

ENERGY CONSERVATION REPORT

This Analysis is currently under review and will be issued as a Supplement to this Report.

SECTION VIII

SOLAR ENERGY ANALYSIS

This Analysis is currently under review and will be issued as a Supplement to this Report.

SECTION IX

SAFETY, POLLUTION, AND ENVIRONMENTAL ASSESSMENTS

A. ANALYSIS OF PRINCIPAL HAZARDS AND RISKS

1. Potential Injury and Property Damage Accidents

a. Fire/Safety

Combustible gases besides H_2: Coal gasification/liquefaction experiments will be conducted batch-wise in high-pressure reactors containing several grams of powdered coal and several hundred atmospheres of a reactant gas, usually hydrogen. After cycling the reactor to an elevated temperature, the operator will relieve the pressure and the gaseous, liquid, and solid fractions will be analyzed to determine the nature of the reactions that have taken place. The total volume of gases released will be tenths of a cubic meter and may contain both cyclic and aliphatic compounds. Those gases not required for analysis will not constitute a fire hazard because of their small volume. In the case of high sulfur coals there will be an odor problem and wet scrubbing techniques will be used for gas disposal and dilution to below the lower flammable limit.

Similar hazards are associated with the synthesis of hydrocarbons using hydrogen and carbon monoxide in the presence of a catalyst and the conversion of water to H_2 and O_2 utilizing photon (light) energy to promote electrolysis with gallium phosphide and titanium dioxide as electrodes. These operations also will be limited to small volumes (cm^3's) and disposal of the combustible gases will present no problems. The same situation obtains with the production of methane and acetylene on platinized graphite. Given the sensitivity of today's analytical techniques, literally microliters of gas constitute a sufficient sample for the tests, and this is true of all catalysis research proposed.

b. Radiation/Safety

No special facilities will be required for studies involving radioisotopes. The chief operations which include radiation will be studies of corrosion and radiation damage of fuel cladding, and surface composition analysis with x-ray, electron, and Auger electron spectroscopy. Although the studies of fuel cladding will involve sampling of cladding surfaces, the specimens will contribute little to the environmental background because the samples will have decayed to levels low enough to prevent the induced activity from interfering with the spectroscopic measurements. Exposures to personnel will be within the guidelines and consistent with LBL's "As Low As Practicable" policy. No penetrating radiation will reach off-site personnel, and any radioactive particulates generated in sample preparation will be captured in the HEPA filters which are part of the ventilation systems. Perimeter fallout trays and continuous air sampling heads confirm that radioactivity is contained and does not threaten the surrounding community. As further confirmation of the integrity of the contamination controls, sewage leaving the project is continuously sampled, as are nearby streams and other water sources. These measurements are routinely reported at less than 10% of the guideline values. Lastly, both neutron and gamma field measurements are made at the Laboratory perimeter, and these also show excursions only slightly above background characteristic of this location. X-ray spectroscopy is generally accomplished with relatively small (microcurie) radioactive sources which provide discrete low-energy (soft) gammas not readily available from x-ray machines, even with filtering. In those instances where x-ray machines are used, interlocks and administrative controls will ensure that personnel exposures are kept as low as possible and that leakage radiation will not influence on-site or off-site backgrounds.

c. <u>Structural Failure and Seismic Activity</u>

The building site has been investigated and found satisfactory for seismic stability and construction. The soils and geology report is included in Section X. Structural damage may result in the release of some toxic chemicals. The structural design will minimize the possibility of damage due to seismic activity by applying the following criteria.

Maximum potential earthquakes causing ground shaking at the LBL site would be a Richter magnitude 8.3 at the San Andreas Fault, which is about 20 miles away, and a magnitude 7.0 on the Hayward Fault, about half a mile away. Intensity of ground shaking at the site is estimated to be VIII on the Modified Mercelli Scale.

The data on hand will be adequate to incorporate into the building design the present criteria for safety from seismic disturbances.

The building proper will be designed to structural criteria thta will provide lateral force resistance above that required by the latest Uniform Building Code. Final design will be reviewed independently by structural engineers specializing in seismic design and earthquake damage surveys. These engineers have reviewed the conceptual design.

Specific design criteria for tie-downs will be applied to all critical equipment and emergency utility suppliers to ensure that damage to the equipment and support systems would be minimized.

d. Flood and Slide Hazards

The site location is not subject to flooding. Seismic, geologic, and hydrologic studies have been made in connection with the siting of the present structure. One slide, located between the existing building (62), and building 72 (not part of the proposed site for this addition) has been stabilized by excavation, addition of drainage structures, and recompaction; a technique that has been successfully used for other slides at LBL site. No difficulties have been encountered in the present structure and none are anticipated for the addition.

e. Operating Error

The chief risks for serious injury and property damage are those associated with material handling during the construction phase. The controllable hazards associated with operations of high voltage experimental apparatus must also be considered. The potential for operating errors involving fire and explosions have been mentioned in the previous section.

The MMRL has a very low incidence of injuries and an effective internal Safety Organization. Analysis of MMRL injuries over the past three years reveals a preponderance of minor injuries that are typical shop and laboratory-types. These were self-inflicted cuts to fingers with sharp objects; bruises and abrasions where the injured part was struck by an agent were 25% of the total. OSHA recordable injuries were approximately 7% of the total injuries with a three-year average recordable rate of less than 1 per 100 employees.

2. Predicted Consequences and Measures Proposed for Prevention of Accidents

a. Fire/Safety

All facilities will be sprinklered. Maximum fire loss is predicted to be in the $5,000 range when controlled by the sprinklers or other automatic suppression/alarm systems. Response to automatic alarms will be by an on-site professional department at less than a half mile distance.

Areas using hydrogen as a reactant will be equipped with diffusion head-type monitors that will sound alarms before explosive limits are reached in the event of uncontrolled release of hydrogen gas. In addition, adequate exhaust venting will be installed.

b. Radiation/Safety

Interlocks, shielding, and access controls with alarms will prevent inadvertent exposures to laser light and the possibility of eye damage. Medical surveillance of laser operators for base line eye conditions and retinal damage has been routine for LBL laser controls.

B. POLLUTION CONTROL AND TREATMENT MEASURES

1. Air

In addition to the instrumentation required in the research studies, the Safety Services Industrial Hygiene Section will conduct surveys of air and water pollution potentials to evaluate the adequacy of control measures and to determine corrections of deficiencies if they occur.

Radioactive particles that may become airborne are controlled with closed systems fitted with high-efficiency filters. In the experimental areas continuous sampling of the ambient breathing air for particulate contamination assures the researchers that the containment systems are intact. Filtered exhausts from the closed systems are discharged through stacks monitored continuously with membrane filters to assess the efficiency of the systems. Reports of total release are made to governmental agencies and routinely show average concentrations one-tenth or less than the guidelines set by the regulatory authorities. Area heating for LBL buildings is accomplished with hot air or hot water systems fired by natural gas whose sulfur content is limited to the added ppm's of odorant.

2. Water

At LBL each laboratory building has two separate sewage systems. The wastes from the restrooms, janitorial closets, drinking fountains, and other non-laboratory sources are collected as sanitary wastes and piped directly into the municipal sewage system. The wastes from lab sinks and other research areas are consigned to the "acid waste" system which provides for collection and monitoring. The waste stream is sampled in proportion to its flow rate. Procedures for analyzing the samples for radioactive substances and chemical elements are established so that proper treatment and handlng techniques can be applied for the disposal of the acid wastes accumulated in the holding tanks. No acid wastes are released unless the contaminants are within the municipal sewage guidelines for deleterious substances or the federal guidelines for radioactive liquid wastes. Liquid wastes known to contain radioactivity are sequestered in small containers before they reach the sinks and are solidifed for perpetual storage at an approved site.

C. ENVIRONMENTAL ASSESSMENT

The new addition will be constructed on a presently undisturbed site of rocky soil covered with native grasses. Although the new five-story (stepped) structure will cover an area approximately equal to that of the present four-story building, the net additional total rainfall runoff will be less than 20% of the present runoff when parking and access roads are included. The present Building 62 is one of the few LBL buildings visible from the campus 1 mile below and this fact will influence the architectural design so that no negative visual impact will be added.

Control of air and water pollution was discussed in a preceding section. Storm runoff will drain naturally into Strawberry Creek and eventually into San Francisco Bay. Repeated samplings taken over many years from precipitation and from natural streams in the LBL environs have shown concentrations of undesirable materials well below the guidelines for sewage and drinking water.

An increase of about 90 additional people will not add significantly to the economy of the East Bay communities nor will provision of a seminar room accommodating up to 150 conferees have any but a transitory impact on local commerce. Because the proposal involves changes to existing facilities, no controversy is anticipated. Similarly, there will be no displacement of historical, archeological, or esthetic values. Depletion of resources, mainly electric power, will not be noticed on a national or a local basis. Alternative facilities are unavailable either on the campus or from commercial sources.

D. FALLOUT SHELTERS

No special design features will be added to provide additional shelter spaces. The hillside location and the central core of laboratories and utility corridors with offices on the outside walls, characteristic of the addition as well as the present structure, will provide more than adequate spaces of sufficient protection factor to accommodate the new personnel housed in the addition. The new addition to Building 62 will enhance the fallout protection afforded to adjacent Building 72, a wood frame structure, because more space selection will be available at a closer distance.

SECTION X

DETAILED SUPPORTING DATA

Contents

ADDITION TO BUILDING #62 MATERIALS & MOLECULAR RESEARCH LABORATORY

UNIVERSITY OF CALIFORNIA - LAWRENCE RADIATION LABORATORY - BERKELEY, CALIFORNIA

ESTIMATED CONSTRUCTION COSTS

SCHEMATIC ESTIMATE

PREPARED BY

CONSULTING COST ESTIMATORS

2156 North Main Street

P.O. Box 5367

Walnut Creek, California 94596

Phone No. 415/935-3545

Current Cost Index
2698.1

FILE CCE#805-4-10

Consulting Cost Estimators, Inc.
BUILDING & ENGINEERING COSTS
PROJECT MANAGEMENT
CONSTRUCTION COST CONTROLS
415 935-3545
2156 N. Main Street
Walnut Creek
CA 94596

Prepared by: J.W.COOK Checked by: M.F.E.	SUMMARY OF ESTIMATED CONSTRUCTION COSTS ADDITION TO BUILDING #62 MATERIALS & MOLECULAR RESEARCH LABORATORY-UNIVERSITY OF CALIFORNIA LAWRENCE RADIATION LABORATORY, BERKELEY, CALIFORNIA	File CCE#80541O Phase: Schemati Date: 4/17/78 Revision #
SPEC. SECT.	**CLASSIFICATION**	**AMOUNT**
1.0	GENERAL REQUIREMENTS	286,325
2.0	SITE DEVELOPMENT	319,142
3.0	CONCRETE	699,429
4.0	MASONRY	None
5.0	METALS	234,427
6.0	CARPENTRY	72,420
7.0	THERMAL, SOUND AND MOISTURE PROTECTION	37,790
8.0	DOORS, WINDOWS AND GLAZING	81,247
9.0	FINISHES	214,570
10.0	SPECIALTIES	21,785
11.0	EQUIPMENT	See Special Facil.
12.0	FURNISHINGS	10,590
13.0	SPECIAL CONSTRUCTION	None
14.0	CONVEYING SYSTEMS	69,000
15.0	MECHANICAL WORK	718,965
16.0	ELECTRICAL WORK	505,800
17.0		

Consulting Cost Estimators, Inc.
BUILDING & ENGINEERING COSTS
PROJECT MANAGEMENT
CONSTRUCTION COST CONTROLS

415/935-3545

2156 N. Main Street
Walnut Creek
CA 94596

Prepared by: J.W. COOK Checked by:	SUMMARY OF ESTIMATED CONSTRUCTION COSTS ADDITION TO BUILDING #62 MATERIALS & MOLECULAR RESEARCH LABORATORY-UNIVERSITY OF CALIFORNIA LAWRENCE RADIATION LABORATORY, BERKELEY, CALIFORNIA	File CCE#805410 Phase: Schematic Date: 4/17/78 Revision #

SPEC SECT.	CLASSIFICATION	AMOUNT
	SUB TOTAL (Direct Cost)	3,271,490
	* CONTINGENCY	----------
	SUB TOTAL	3,271,490
	FEES & BONDS	217,963
	TOTAL (CURRENT COST)	$3,489,453

*Contingency is included in the escalated estimate summary of Schedule 44 Construction Project Data Sheet of Section III.

ADDITION TO BUILDING #62 - MATERIALS AND MOLECULAR RESEARCH LABORATORY
UNIVERSITY OF CALIFORNIA - LAWRENCE RADIATION LABORATORY, BERKELEY, CAL.

SUMMARY OF THE ESTIMATED COSTS 1 MAY, 1978

1.00 IMPROVEMENTS TO LAND (SITEWORK)

		Location	
Demolition	$ 1,360	(2.10 1st 2 figures, Pg.7)	
Earthwork	73,455	(2.20, Pg.7)	
Paving-Curbs, Walks, Retaining Wall, Steps	29,002	(2.60, Pg.9)	
Landscaping & Irrigation	38,390	(2.70, Pg.9)	
Misc.	3,610	(2.20, Pg.9)	
Site Drainage	4,360	(2.50, Sect. a. Pg.8)	
Sub Total			150,177
Add General Conditions Pro Rata			12,010
Bond 5/8%			1,014
General Contractor's Fee 6%			9,792

Estimated Cost of Construction April, 1978 172,993

2.00 BUILDING

Alteration to Exist. Bldg.	6,950	(2.10, Pg.7)
Caissons	56,365	(2.30, Pg.7)
Dewater	15,000	(2.40, Pg.7)
Foundations	31,716	(3.10, Pg.10)
Structural/Architectural Concrete	646,150	(3.20, Pg.11)
Slab on Grade	21,563	(3.30, Pg.11)
Masonry	None	
Structural Steel	206,154	(5.10, Pg.12)
Misc.&Ornamental Mt'ls.	28,273	(5.20, Pg.12)
Carpentry, Rough	55,904	(6.10, Pg.12)
Carpentry, Finish	16,516	(6.20, Pg.12)
Moisture/Sound/Thermal Protection	37,790	(7.00 Total Pg. 13)
Doors, Sash, Glazing, Fin. Hardware	81,247	(8.00 Total Pg. 14)
Finishes, Inc. Fire Spray On	214,570	(9.00 Total Pg. 15)
Specialties	21,785	(10.00 " Pg. 16)
Furnishings (Non Lab)	10,590	(12.00 " Pg. 16)
Equipment & Cabinetry Lab.	See Schedules	
Conveyance - Elevator	69,000	(14.00 " Pg. 16)

ADDITION TO BUILDING #62 - MATERIALS AND MOLECULAR RESEARCH LABORATORY
UNIVERSITY OF CALIFORNIA - LAWRENCE RADIATION LABORATORY, BERKELEY, CAL.

SUMMARY OF THE ESTIMATED COSTS 1, MAY, 1978 - Pg.2 of summary

2.00	BUILDING - cont.		Location	
	Mechanical			
	Plumbing	$205,965	(15.10, Pg.17)	
	Heat,Vent & A.C.	468,000	(15.20, Pg.17)	
	Fire Sprinkler	45,000	(15.30, Pg.17)	
	Electrical	505,800	(16.00 Total, Pg. 17)	
	Sub Total		$2,744,338	
	Add General Conditions Pro Rata		267,072	
	Bond 5/8%		18,821	
	General Contractor's Mark Up 6%		181,814	
	Estimated Cost of Construction April, 1978			$3,212,045
3.00	SPECIAL FACILITIES		1978	$
			1981 (1.22)	
4.00	UTILITIES			
	Electrical	$ 70,600	(2.50 Sect. g. Pg.8)	
	Mechanical	11,050	(2.50 " b,c,d,e,f, Pg.8)	
	Relocation (At Link)	9,000	(2.50 " h,Pg.8)	
	Sub Total		$ 90,650	
	Add General Conditions Pro Rata		7,243	
	Add Bond 5/8%		612	
	Add General Contractor's Mark Up 6%		5,910	
	Estimated Cost of Construction April, 1978			$ 104,415
			TOTAL (CURRENT COST)	$3,489,453

SPEC. SECT.	ADDITION TO BUILDING #62 MATERIALS & MOLECULAR RESEARCH LABORATORY - UNIVERSITY OF CALIFORNIA LAWRENCE RADIATION LABORATORY, BERKELEY, CALIF. DIVISION	QUANTITY	UNIT	UNIT COST	Schematic 4/17/78 TOTAL COST
1.00	GENERAL CONDITIONS				
	Non Distributable Labor				
	Superintendent	20	MO	3900.	78,000
	Engineering and Layout	JOB	LOT	LS	4,500
	Permits, License and Fees				None
	Temporary Utilities				
	Power/Lighting	20	MO	150.	3,000
	Sewerage	20	MO	46.	920
	Heat	3	MO	410.	1,230
	Telephone	20	MO	125.	2,500
	Water	20	MO	60.	1,200
	Temporary Structures				
	Office Trailer	20	MO	175.	3,500
	Tool Trailers 2	20	MO	250.	5,000
	Storage Buildings - Sub Trades	5	EA	250.	1,250
	Material Handling				
	Cranes	12	MO	4800.	57,600
	Hoisting Towers	2	EA	LS	8,200
	Concrete Pumping and Conveying	With Concrete Unit Price			
	Other General Conditions				
	Temporary Fencing	900	LF	1.25	1,125
	Scaffolding	JOB	LOT	LS	5,500
	Debris Removal	20	MO	175.	3,500
	Cleanup, Maintenance	20	MO	250.	5,000
	Cleanup, Final	36,000	SF	.03	1,080
	Sm.Tools & Consumable Supplies	ALLOWANCE	LOT	LS	2,500
	General Office Charges	20	MO	240.	4,800
	Trucks and Autos	20	MO	300.	6,000
	Signs	2	EA	150.	300
	Dewatering (Maintenance)	JOB	LOT	LS	2,000
	Quality Control	JOB	LOT	LS	36,000
	C.P.M./Scheduling	JOB	LOT	LS	9,500
	Fringes on Line 1	54	%	Gross	42,120
	TOTAL - ITEM #1.00 GENERAL CONDITIONS COMBINED				286,325

SPEC. SECT.	ADDITION TO BUILDING #62 MATERIALS & MOLECULAR RESEARCH LABORATORY - UNIVERSITY OF CALIFORNIA LAWRENCE RADIATION LABORATORY, BERKELEY, CALIF. DIVISION	QUANTITY	UNIT	UNIT COST	Schematic 4/17/78 TOTAL COST
2.00	SITE WORK				
.10	Demolition				
	Break and Remove Existing-Walk From Exist. Bldg. North	646	SF	.75	485
	" & Remove Exist. Retaining Wall 45' W. of Exist. Bldg. N.E. Corner	35	LF	25.	875
	No Salvage of Planting Mat'l. Indicated	-	-	-	-
	No Other Demolition Included	-	-	-	-
	Cut Existing Bldg. Wall for Link Passage	150	SF	13.	1,950
	Provide Closures-Dust/Dirt etc. Protection	JOB	LOT	LS	5,000
					8,310
.20	Earthwork-Testing Excluded				
	a. Strip Top 6" & Stockpile 54,650 SF	1,012	CY	3.85	3,896
	b. Cut - Machine	6,433	CY	5.80	37,311
	c. Fill - Using Native Cut Material	1,060	CY	2.95	3,127
	d. Dispose - Off Haul	5,373	CY	3.80	20,417
	e. Bldg. Engrd. Pad (18") Factor Compact 1.5	1,088	TON	8.00	8,704
					73,455
.30	Drilled Caissons/Piers-No Belling				
	2-4'ϕ Av. 25 VF	50	VF	23.	1,150
	27 - 3'ϕ x Av. 25 VF	675	VF	13.	8,775
	32 - 2.5' ϕ x Av. 25 VF	800	VF	9.	7,200
	Off Haul	450	CY	5.	2,250
	Rebar @ 120#	54,000	#	.26	14,040
	Concrete in Place	450	CY	51.	22,950
					56,365
.40	Dewatering and Shoring	Allowance	JOB	LOT	15,000

SPEC. SECT.	ADDITION TO BUILDING #62 MATERIALS & MOLECULAR RESEARCH LABORATORY - UNIVERSITY OF CALIFORNIA LAWRENCE RADIATION LABORATORY, BERKELEY, CALIF. DIVISION	QUANTITY	UNIT	UNIT COST	Schematic 4/17/78 TOTAL COST
2.50	Site Utilities - Existing @ S.Side				
	a. Drainage 8" Loop @ N&E Sides	240	LF	11.	2,640
	Catch Basins	6	EA	225.	1,350
	Area Drains @ N.Retain Wall Area	2	EA	185.	370
	Assumed Surface Run Off @ Service Area	-	-	-	-
	" Surface Run Off & South Service Area	-	-	-	-
					4,360
	b. Sanitary Sewer				
	Break and Connect to Exist.Plus COTG	JOB	LOT	LS	1,050
	c. Domestic Water to 5'≠ 3" Line				
	Cut - Insert T & Valve W/Box	JOB	LOT	LS	3,700
	d. Gas - Ditto Water	JOB	LOT	LS	1,200
	e. CW - LCW - DMW - Ditto (c) and (d)	JOB	LOT	LS	3,000
	f. Fire Hydrant and 3" Line	JOB	LOT	LS	2,100
	g. Electrical Distribution				
	Feeders	JOB	LOT	LS	25,000
	Primary Gear	JOB	LOT	LS	36,000
	Secondary Distribution	JOB	LOT	LS	9,600
					70,600
	h. Relocation At Link Structure	JOB	LOT	LS	9,000
	Item 2.50 Site Utilities Combined				95,010

SPEC. SECT.	ADDITION TO BUILDING #62 MATERIALS & MOLECULAR RESEARCH LABORATORY - UNIVERSITY OF CALIFORNIA LAWRENCE RADIATION LABORATORY, BERKELEY, CALIF. DIVISION	QUANTITY	UNIT	UNIT COST	Schemati 4/17/78 TOTAL COST
2.60	General Site Work				
	a. A.C. Paving - Service Area Heavy				
	Duty 2" on 4" on 8"	6,500	SF	.80	5,200
	b. Concrete Paving (North & N.E.)AreaWay)	1,250	SF	1.50	1,875
	c. Curbs - Service Area Perimeter	360	LF	5.75	2,070
	d. Sidewalk-Area Btwn.New & Exist.Bldgs.	3,000	SF	1.70	5,100
	e. Retaining Wall (E&N.E.) 5 VF	195	LF	58.50	11,407
	f. Stair/Steps 30R x 10'x6½"	300	LF	9.50	2,850
	g. Striping and Wheel Stops	ALLOW	LOT	LS	500
					29,002
2.70	Misc. Site Work				
	Fencing	-	-	-	None
	Landscaping and Irrigation Minimal	34,900	SF	1.10	38,390
	Railing @ Stair Steps/2 Sides	110	LF	26.	2,860
	Signs and Graphics	ALLOW	LOT	LS	750
					42,000
	TOTAL - ITEM #2.00 SITE WORK COMBINED				319,142
3.00	CONCRETE P.I.P.				
.10	Foundations				
	a. Excavations	200	CY	8.90	1,780
	b. Forms				
	Pile Caps	2,088	SF	1.70	3,550
	Grade Beams	3,300	SF	1.40	4,620
	Tie Beams-No Form-Rebar Hgr.Only	464	LF	1.10	510
	Sub Total a. and b.				8,680
	c. Rebar 95# x 1 CY	20,140	#	.31	6,243
	d. Concrete - Material in Place	212	CY	63.	13,356

SPEC. SECT.	ADDITION TO BUILDING #62 MATERIALS & MOLECULAR RESEARCH LABORATORY-UNIVERSITY OF CALIFORNIA LAWRENCE RADIATION LABORATORY, BERKELEY, CALIF. DIVISION	QUANTITY	UNIT	UNIT COST	Schematic 4/17/78 TOTAL COST
3.10	Foundations - cont.				
	e. Backfill - Walls (Granular to F.G.-1.0)	73	CY	14.	1,022
	f. Off Haul	127	CY	5.	635
	Sub Total - Foundations - 3.1 combined				31,716
.20	Structural and Architectural Concrete				
	a. Forms - Footing Walls /Lower Level	5,000	SF	2.14	10,700
	Forms - Walls Above) Elevator/Hall) Link Wall)	75,562	SF	2.90	219,130
	Columns	4,160	SF	2.75	11,440
	Forms-Suspended Including Shoring	35,910	SF	2.40	86,184
	Ledgers/Bearing	2,970	LF	1.50	4,455
	Link Floor and Roof	2,565	SF	2.60	6,669
	Column Covers - 6 SF Per VF	9,216	SF	2.80	25,804
	Sub Total - Item a.				364,382
	b. Rebar - Walls Single Curtain #5 @ 14") BW)	155,565	#	.30	46,670
	Columns (Jackets)	8,320	#	.33	2,746
	Decks (Suspended)	89,775	#	.35	31,421
	Landings - Steps and Misc.	8,300	#	.30	2,490
	Sub Total - Item b.				83,327
	c. Concrete Material - Walls	1,112	CY	68.	75,616
	Columns	120	CY	76.	9,120
	Decks & Joists &) Fillers)	1,001	CY	65.	65,065
	Sub Total - Item c				149,801

SPEC. SECT.	ADDITION TO BUILDING #62 MATERIALS & MOLECULAR RESEARCH LABORATORY-UNIVERSITY OF CALIFORNIA LAWRENCE RADIATION LABORATORY, BERKELEY, CALIF. DIVISION	QUANTITY	UNIT	UNIT COST	Schematic 4/17/78 TOTAL COST
3.20	d. Concrete Finish - Suspended Slabs	36,000	SF	.33	11,880
	Patch & Plug Walls & Columns	163,885	SF	.17	27,860
	Sub Total - Item d.				39,740
	e. Misc. - Stairs Concrete 5'	180	R	37.	6,660
	Curbs-Including Roof Screen	560	LF	4.	2,240
	Sub Total - Item e.				8,900
	Item #3.20 combined Struct.&Arch. Concrete				646,150
.30	Slab on Grade				
	Fine Grade	9,690	SF	.03	291
	Capillary Base 4"	247	TON	8.75	2,161
	Membrane 6 Mil Sheet	10,000	SF	.08	800
	Sand Cushion 2"	90	TON	6.50	585
	Screeds - Key - Const. and Exp.Joints	970	LF	.85	825
	Rebar	9,000	#	.28	2,520
	Concrete - Material	188	CY	60.	11,280
	Concrete-Finish,Cure,Protect	9,690	SF	.32	3,101
					21,563
	TOTAL - ITEM #3.00 CONCRETE WITHOUT CAISSONS COMBINED:				699,429
4.00	MASONRY - NONE-ROOF SCREEN CHANGED TO METAL		-	-	-
	HIGH ROOF ENCLOSURE - SUBSTITUTE METAL - SEE SECTION 5.0				

SPEC. SECT.	ADDITION TO BUILDING #62 MATERIALS & MOLECULAR RESEARCH LABORATORY-UNIVERSITY OF CALIFORNIA LAWRENCE RADIATION LABORATORY, BERKELEY, CALIF. DIVISION	QUANTITY	UNIT	UNIT COST	Schematic 4/17/78 TOTAL COST
5.00	METALS				
.10	Structural Steel				
	Columns C A W/HSC	110,047	#	.54	59,425
	Beams	238,840	#	.56	133,750
	Detail Steel	27,039	#	.48	12,979
					206,154
.20	Misc. and Ornamental Metals				
	Roof Screen 6 VF x 22'x56'	936	SF	17.	15,912
	Railings - Link,ext.	45	LF	28.	1,260
	Railings - Link @ Window Wall	90	LF	13.	1,170
	Railings - Loading Dock Steps(Pipe)	3	PCS	55.	165
	Railings - Int. Stairs - Wall	240	LF	11.	2,640
	Railings - Baluster	60	LF	23.	1,380
	Railings - Roof - Access to Hatch	1	EA	LS	65
	Ladders - Roof With Hatch	1	UNIT	LS	355
	Loading Dock Edge Angle	20	LF	6.50	130
	Elev. Opg. Angle	24	LF	6.50	156
	Allow Misc. Angles-Clips-Frames	36,000	SF	.14	5,040
					28,273
	TOTAL - ITEM #5.00 METALS COMBINED				234,427
6.00	CARPENTRY				
.10	Rough Carpentry				
	Partitions - Studs - Plates - Blocking(FRT)	33,984	BM	1.02	34,664
	Drop Ceiling Furring-See Sect. 9.0	Metal Runners			-
	Blocking and Layout for All Trades	800	HRS	26.55	21,240
					55,904
.20	Finish Carpentry - Installation Labor For:				
	a. Doors and Frames	96	UNITS	123.	11,808
	Ditto Hardware	96	UNITS	28.	2,688
	Ditto Toilet Accessories	6	UNITS	175.	1,050
	Ditto Fire Ext./Cabts. 2 Per Fl.	10	EA	22.	220
	Ditto Rm. #s - Labels Signs,etc.	JOB	LOT	LS	750
					16,516

SPEC. SECT.	ADDITION TO BUILDING #62 MATERIALS & MOLECULAR RESEARCH LABORATORY-UNIVERSITY OF CALIFORNIA LAWRENCE RADIATION LABORATORY, BERKELEY, CALIF. DIVISION	QUANTITY	UNIT	UNIT COST	Schematic 4/17/78 TOTAL COST
	TOTAL - ITEM #6.00 CARPENTRY COMBINED				72,420
7.00	MOISTURE-SOUND-THERMAL PROTECTION				
.10	a. Membrane N.Wall-E.Walls to 803	3,170	SF	.80	2,536
	b. Wall Treatment Above Grade(See Sect.9)	-	-	-	-
	c. Drain Line @ Footings N.S.&E.	300	LF	4.70	1,410
	Sub Total - Water Proofing				3,946
.20	Sound and Thermal Protection				
	a. Roof 2" Rigid	11,022	SF	.66	7,275
	b. Sash Section Fillers R-19	3,360	SF	.25	840
	c. Int. Partitions-Sound R-11 Batts to 10'	14400	SF	.20	2,880
	d. " of Conc.Walls-Lab/Office,etc.	17,460	SF	.17	2,968
					13,963
.30	Roofing				
	Built Up T&G 20 Yr.Bond Type - Inc.Link	127	SQS	78.	9,906
.40	Sheet Metal				
	Gravel Stop	510	LF	2.15	1,097
	Roof Penetrations & Flashing	126	SQS	15.	1,890
	Ctr.Flash Monitor Section	140	LF	2.70	378
	Pitch Pockets & Flashing @ Roof Screen	JOB	LOT	LS	300
	Louvers - Machine Room	4	EA	990.	3,960
	Louvers - Interior Spaces-Allow	200	SF	8.	1,600
					9,225
.50	Caulking and Sealants	JOB	LOT	LS	750
	TOTAL - ITEM #7.00 MOISTURE,SOUND,THERMAL PROTECTION COMBINED				37,790

SPEC. SECT.	ADDITION TO BUILDING #62 MATERIALS & MOLECULAR RESEARCH LABORATORY-UNIVERSITY OF CALIFORNIA LAWRENCE RADIATION LABORATORY, BERKELEY, CALIF. DIVISION	QUANTITY	UNIT	UNIT COST	Schematic 4/17/78 TOTAL COST
8.00	BUILDING CLOSURES				
	Hollow Metal Doors & Frames (All Except Entry)	92	UNITS	LOT	20,102
	Rollup Door at Dock	1	EA	LS	1,100
	Metal Sash Anod Alum W/Casement Section	40	EA	256.	10,240
	Finish Hardware	96	SET	135.	12,960
	Glass & Glazing-Sash, Insulating	1,200	SF	8.	9,600
	Window Wall-Link-Anod Alum.&T/Glass	900	SF	10.76	9,684
	Entries-Link to New and Existing	2	EA	1040.	2,080
	Fixed Section @ Corridor End Walls 7x10	8	EA	415.	3,320
	Interior Fixed Sections in Corr.Walls	-	-	-	None
	Mirrors - Allow	226	SF	4.80	1,085
	Borrowed Lights Allow	144	SF	4.	576
	No Automatic Doors Included	-	-	-	-
	Folding Partition 50 LF ≠	1	EA	LS	10,500
	TOTAL - ITEM #8.00 BUILDING CLOSURES COMBINED				81,247
9.00	FINISHES				
.10	4" Metal Studs - At Ext. Wall Sash Opgs.-Elev.Shaft & Stairs Only All Others - Wood Studs	811	SY	9.55	7,745
	Furred Ceilings-See Acoustical	-	-	-	-
	2½" Furring Studs @ Conc. Walls	1,940	SY	7.90	15,326
					23,071
.20	Gypsum Board 5/8-Taped Wall	61,680	SF	.69	42,559
	Suspended " 5/8-Taped Ceilings	5,312	SF	2.30	12,218
					54,777
.30	Ceramic Tile-Rest Rms. Only to 6 VF				
	Floors	1,020	SF	4.50	4,590
	Walls	1,800	SF	3.25	5,850
	Base	294	LF	2.85	838
					11,278

SPEC. SECT.	ADDITION TO BUILDING #62 MATERIALS & MOLECULAR RESEARCH LABORATORY-UNIVERSITY OF CALIFORNIA LAWRENCE RADIATION LABORATORY, BERKELEY, CALIF. DIVISION	QUANTITY	UNIT	UNIT COST	Schematic 4/17/78 TOTAL COST
9.40	Resilient Floor Covering (All Except Conf. and R.Rms. - Shop, Dock & Mech. Rms. and Chase)	23,980	SF	.75	17,985
	Base	3,098	LF	.68	2,107
					20,092
.50	Acoustical				
	Suspended Grid 2x4 V/Faced	27,180	SF	1.37	37,237
	Mech. RoomW/Channels-Blanket & Gyp	6,600	SF	2.77	18,282
					55,519
.60	Fire Proofing All Horiz.Steel 3/4/1"	23,378	SF	.83	19,404 *
.70	Painting				
	Seal All Ext. Conc. Surfaces	35,106	SF	.22	7,723
	Paint All Exposed G.I. Metal Flashing	650	LF	.60	390
	Paint Drywall	66,000	SF	.26	17,160
	Doors and Frame	92	UNITS	18.	1,656
	Mech/Elect. & Coding IncAll Exposed	JOB	LOT	LS	2,750
	Painters Graphics	ALLOW	LOT	LS	750
					30,429
	TOTAL - ITEM #9.00 FINISHES COMBINED				214,570
10.00	SPECIALTIES				
	Toilet Partitions (2 @ M - 3@ W)	15	EA	220.	3,300
	Urinal Screens	3	EA	75.	225
	Shelf/Mirror Unit	15	EA	37.	555
	Paper Towel Dispenser/Waste Built In	6	EA	185.	1,110
	Toilet Paper Dispenser	15	EA	8.	120
	Sanitary Napkin Dispenser	3	EA	85.	255
	Sanitary Napkin Disposal	6	EA	17.	102
	Seat Cover Dispenser	15	EA	12.	180
	Grab Bars	6	UNIT	48.	288
*	COLUMNS ARE CONC. JACKETED				

CCE#805-4-10

SPEC. SECT.	ADDITION TO BUILDING #62 MATERIALS & MOLECULAR RESEARCH LABORATORY - UNIVERSITY OF CALIFORNIA LAWRENCE RADIATION LABORATORY, BERKELEY, CALIF. DIVISION	QUANTITY	UNIT	UNIT COST	Schematic 4/17/78 TOTAL COST
10.00	SPECIALTIES - continued				
	Fire Ext. Cabts. 2 Per Floor	8	EA	50.	400
	Seating	150	EA	65.	9,750
	Chalk - Tack - Bulletin Boards & Directory	LOT	LS	LS	4,000
	Buy Out Graphics & Misc.(Proj.Screens,etc.)	LOT	LS	LS	1,500
	TOTAL - ITEM #10.00 SPECIALTIES COMBINED				21,785
11.00	LABORATORY EQUIPMENT	SEE SPECIAL FACILITIES			
12.00	CARPET - Conference/Seminar	320	SY	13.25	4,240
	Blinds and Darkening Curtains	840	SF	5.	4,200
	Vanities	6	EA	375.	2,150
	TOTAL - ITEM #12.00 CARPET COMBINED				10,590
13.00	SPECIAL CONSTRUCTION	-	-	-	NONE
14.00	ELEVATOR - HYDRAULIC				
	Combo F/P 7x8.33 5000# 80'Sec. 5 Stop	1	EA	LS	69,000
15.00	MECHANICAL				
.10	Plumbing				
	a. Domestic				
	Fixtures - W.C.	15	EA	425.	6,375
	Fixtures - Urinals	3	EA	315.	945
	Lavatories	15	EA	275.	4,125
	Service Sink	4	EA	340.	1,360
	Drinking Fountains	4	EA	515.	2,060
	Piping-Waste-Vent-Sup./Return	LOT		LS	36,900
	Insulation	LOT		LS	3,600
	Sterilization - Testing and Misc.	LOT		LS	1,500
	For Emergency Eye Wash-Showers-See Special Equipment				-
	Roof Drainage - Drains - Downspout,etc.	JOB	LOT	LS	3,600
					60,465

SPEC. SECT.	ADDITION TO BUILDING #62 MATERIALS & MOLECULAR RESEARCH LABORATORY - UNIVERSITY OF CALIFORNIA LAWRENCE RADIATION LABORATORY, BERKELEY, CALIF. DIVISION	QUANTITY	UNIT	UNIT COST	Schematic 4/17/78 TOTAL COST
15.10	Plumbing - cont.				
	b. Industrial Plumbing				
	Fixtures - Fittings - Valving	JOB	LOT	LS	32,400
	Piping	JOB	LOT	LS	104,400
	Support Work	JOB	LOT	LS	9,100
					145,500
	Sub Total Plumbing				205,965
.20	c. Heat, Vent and A.C. Exhaust & Supply Air) Only to Ext. Labs - Shop - Mech. Rm.) Etc., Including HW System)	36,000	SF	13.00	468,000
.30	Automatic Fire Sprinkler	36,000	SF	1.25	45,000
	SUB TOTAL - ITEM #15.00 MECHANICAL COMBINED				718,965
16.00	ELECTRICAL - General	36,000	SF	11.27	405,720
	Special Facilities	36,000	SF	2.78	100,080
	SUB TOTAL - ITEM #16.00 ELECTRICAL COMBINED				505,800

DEPARTMENT OF ENERGY

Schedule 44
(Continued)

APPROPRIATION ENERGY

FY 1980 BUDGET REQUEST

CONSTRUCTION PROJECT DATA SHEETS

UNIVERSITY OF CALIFORNIA
LAWRENCE BERKELEY LABORATORY

1. Title and Location of Project: Chemical Sciences Addition Building 62

2. Project No.: 80-LBL-003

SCHEDULE I

	FY 1978* EST. COSTS
SPECIAL FACILITIES	
1. Laboratory Fume Hoods & Exhaust Ducts (10)	$ 50
2. Laboratory Furniture (Built-in)	75
TOTAL	$125
STANDARD EQUIPMENT	
1. Auger Microprobe with Field Emission Source, Environmental Chamber, X-ray and UV Photoelectron Spectroscopy (ESCA, UPS), and Secondary Ion Mass Spectrometry (SIMS)	$260
2. Molecular Beam Electron Spectrometer	170
3. Gas-chromatograph with Mass Spectrometer (2)	130
4. Molecular Beam Scattering Chamber	175
5. Microdensitometer-scanner with Computer Interface	45
TOTAL STANDARD EQUIPMENT	$780

*The above estimated costs appear in Section 3 on an escalated basis, an estimated 16% increase to mid-point of construction.

PRELIMINARY SOIL INVESTIGATION
PROPOSED ADDITIONS
BUILDING 62
LAWRENCE BERKELEY LABORATORY
BERKELEY, CALIFORNIA

HLA Job No. 2000,100.01

Prepared for

Lawrence Berkeley Laboratory
Berkeley, California

by

Lyle E. Lewis,
Civil Engineer - 16360

Richard S. Harding,
Civil Engineer - 9841

Harding-Lawson Associates
55 Mitchell Boulevard, P.O. Box 3030
San Rafael, California 94902
415/472-1400

July 7, 1975

INTRODUCTION

This report presents the results of our preliminary soil investigation for the proposed additions to Building 62 at the Lawrence Berkeley Laboratory, Berkeley, California. We understand that these building additions are included in the proposal for FY1977 building projects and that design and construction funds have not yet been authorized.

The locations of the proposed additions to Building 62 are as shown on Plate 1. They consist of an office and laboratory portion (four stories and basement) and a reception area on the northeast side of Building 62, and a 59-foot extension of the existing high bay on the southwest side. The structures will be steel-frame with reinforced concrete shear walls. Loads will be as high as 500 kips (total load) for interior columns and 480 kips for exterior columns. Column loads for the high bay extension will be about 30 kips.

The object of our work was to provide preliminary foundation recommendations based on data from soil borings drilled in the area previously and supplemented if necessary by new boring information.

FIELD AND LABORATORY INVESTIGATION

A review of the existing test boring information indicated that additional subsurface data should be obtained and two new borings were drilled and two test trenches were excavated in the locations shown on Plate 1. The test borings were drilled with a six-inch-diameter flight auger to depths of 47-1/2 and 32 feet; the test trenches were 20 feet and 82 feet in length. The borings and test trenches were logged by our geologist and undisturbed samples were obtained for visual identification and laboratory testing. The boring and trench logs are illustrated on Plates 2 through 4. A geologic cross section is presented on Plate 5. The soil has been classified in accordance with the Unified Soil Classification System presented on Plate 6. Physical properties of the rock have been identified according to the Physical Properties Criteria table, Plate 7.

The samples were reexamined in our laboratory and moisture/density determinations and triaxial shear strength tests were performed on representative samples. The laboratory test data are presented on the boring logs as explained by the Key to Test Data, Plate 6.

SITE CONDITIONS

The proposed office and laboratory addition to Building 62 will be located in a sloping area north of and adjacent to the existing building. At the present time, the terrain slopes to the southwest with the natural slope at approximately three horizontal to one vertical. Elevations vary from 755 to 810 feet. The surface is covered by grasses and occasional pine trees. An access road and parking area are present along the west boundary of the proposed addition. The proposed high bay extension is to be located southwest of the existing Building 62 in a nearly level paved parking area.

SOIL AND GEOLOGIC CONDITIONS

Soils

The surface soils in the proposed multistory building addition area consist of shallow clays and silts which are residual components of the underlying sedimentary bedrock. In general, the soils are stiff and about five feet in maximum thickness.

Weak and potentially unstable soils are present on the steeper slope west of the proposed office and laboratory addition. In this area, shallow wet-weather sloughing and erosion have occurred in the past and more recently a shallow landslide has developed in the corner of the existing parking area. The limits of the weak and unstable surface soils are shown on the Site Plan.

Bedrock

Two bedrock units are present in the area. The older unit, the Knoxville formation of Cretaceous age, consists of massive to blocky sandstones with occasional shale interbeds. The sandstones are generally well consolidated; however, the shales are frequently weak and of low hardness.* Temporary cut slopes in this rock unit failed during excavations for the existing Building 62. Failures generally occurred along weak planes associated with the shale interbeds.

Sedimentary rock of the Orinda formation is present in the north half of the proposed office and laboratory addition area and consists of poorly consolidated siltstones, claystones, sandstones

* Qualitative descriptions are based on the Physical Properties Criteria table, Plate 7.

and occasional conglomerate. Characteristically, the Orinda formation is a weaker unit and rock strength and hardness are generally lower than rock of the Knoxville formation.

An ancient fault separates the two geologic formations at the approximate location shown on the Site Plan and the Geologic Cross Section. The fault was exposed in Test Trench 2 and consists of crushed rock and weak clay in a zone up to several feet in width. The small landslide located in the corner of the existing parking area is associated with the weak clays in the fault zone. Highly fractured rock exposed in the Building 62 excavation indicates the presence of numerous weak planes associated with the fault.

Ground Water

The ground-water levels in the test borings a few hours after drilling were at +751 feet in Boring 1 and +783 feet in Boring 2 (LBL Datum).

DISCUSSION AND CONCLUSIONS

On the basis of our past work in the area and our current studies we conclude the following.

High Bay Extension Addition

The Cretaceous bedrock in the area of this proposed structure should provide excellent foundation support for shallow spread footings. Little or no settlement is anticipated from the proposed building loads.

Office and Laboratory Addition

The proposed location of this building addition is in an area where there are two rock types with a fault contact between them. Much of the Knoxville formation contains competent sandstone which should provide adequate support for the proposed building using spread footings; however, the upper weathered portion of the poorly consolidated Orinda formation sediments, the weak shale interbeds of the Knoxville formation, and the crushed rock and weak clay in the fault zone could settle under the loads imposed by shallow spread footings. This settlement would be differential between footings in the competent sandstone and footings in other areas. Essentially the same weak conditions were found during previous work by Dames & Moore in the rock underlying the north and west wall footings of the existing Building 62. Therefore, we conclude that the proposed structure should be founded on drilled, cast-in-place concrete piles similar to those supporting portions of the existing building.

On the basis of the test borings and test trench data, as well as our knowledge of the characteristics of the Orinda sediments, we believe that the fault separating the Knoxville and Orinda formations is not active and dips steeply to the northeast as shown on the Geologic Cross Section.

Cut slopes in the Orinda formation behind the proposed addition should be no steeper than two horizontal to one vertical. The presence of weak material in the fault zone creates a higher than normal risk of instability for cut slopes. If potentially unstable conditions are exposed during grading, some modification of the slope and/or correction could be required to improve stability. Since the total height of cut slope may be close to 50 feet, an intermediate drain bench will be required to reduce surface water runoff.

We judge that both rock units can be excavated without blasting; however, some difficult ripping may be encountered in the deeper portions of the Cretaceous rock. Temporary cut slopes excavated for construction of basement walls may require shoring or flattening where weak materials are encountered. Ground water may be encountered in the deepest portion of the cuts for the proposed building and dewatering may be necessary to improve working conditions and reduce the risk of temporary cut slope failures.

The proposed office and laboratory addition will be located close to the weak, unstable soils on the west slope. Although believed to be relatively shallow, these soils could experience deep instability in the event of severe ground shaking from earthquakes, particularly during the winter months when the weak soils are saturated. It is possible that slope failure could reduce support of the west wall of the proposed building; therefore, a careful analysis of this area will be necessary during the final investigation.

RECOMMENDATIONS

Foundation Support

On the basis of this preliminary investigation and previous work in the area, we recommend that

1. The high bay extension addition be supported on spread footings founded on the Cretaceous bedrock. The footings can be designed for dead load bearing pressures of 6000 psf and total design loads of 9000 psf. The spread footings should be a minimum of 18 inches wide and 18 inches below lowest adjacent grade.

2. The office and laboratory addition be supported on drilled, cast-in-place concrete piles. For the purposes of preliminary design, use a skin friction value of 1500 pounds per square foot (psf) for dead load and 2500 psf for total design loads. We believe that these friction values are conservative for the Cretaceous rock and may be increased after further investigation. The drilled, cast-in-place concrete piles should be spaced no closer than three diameters center-to-center.

Future Work

After authorization of funds for the building addition, a final investigation should be performed including one or two additional test borings, laboratory testing, and engineering analyses to provide or determine

1. A more definitive determination of skin friction values for the drilled, cast-in-place concrete piles located in the various rock conditions

2. Estimates of foundation settlements

3. Ground-water conditions in the deepest portion of the excavation

4. Potential unstable zones in the permanent cut slope

5. A judgment of the amount of instability which might occur in the slope west of the office and laboratory addition during severe earthquake ground shaking

PLATES

Plate 1	Site Plan
Plates 2 and 3	Logs of Borings 1 and 2
Plate 4	Test Pit Profiles
Plate 5	Geologic Cross Section
Plate 6	Soil Classification Chart and Key to Test Data
Plate 7	Physical Properties Criteria For Rock Descriptions

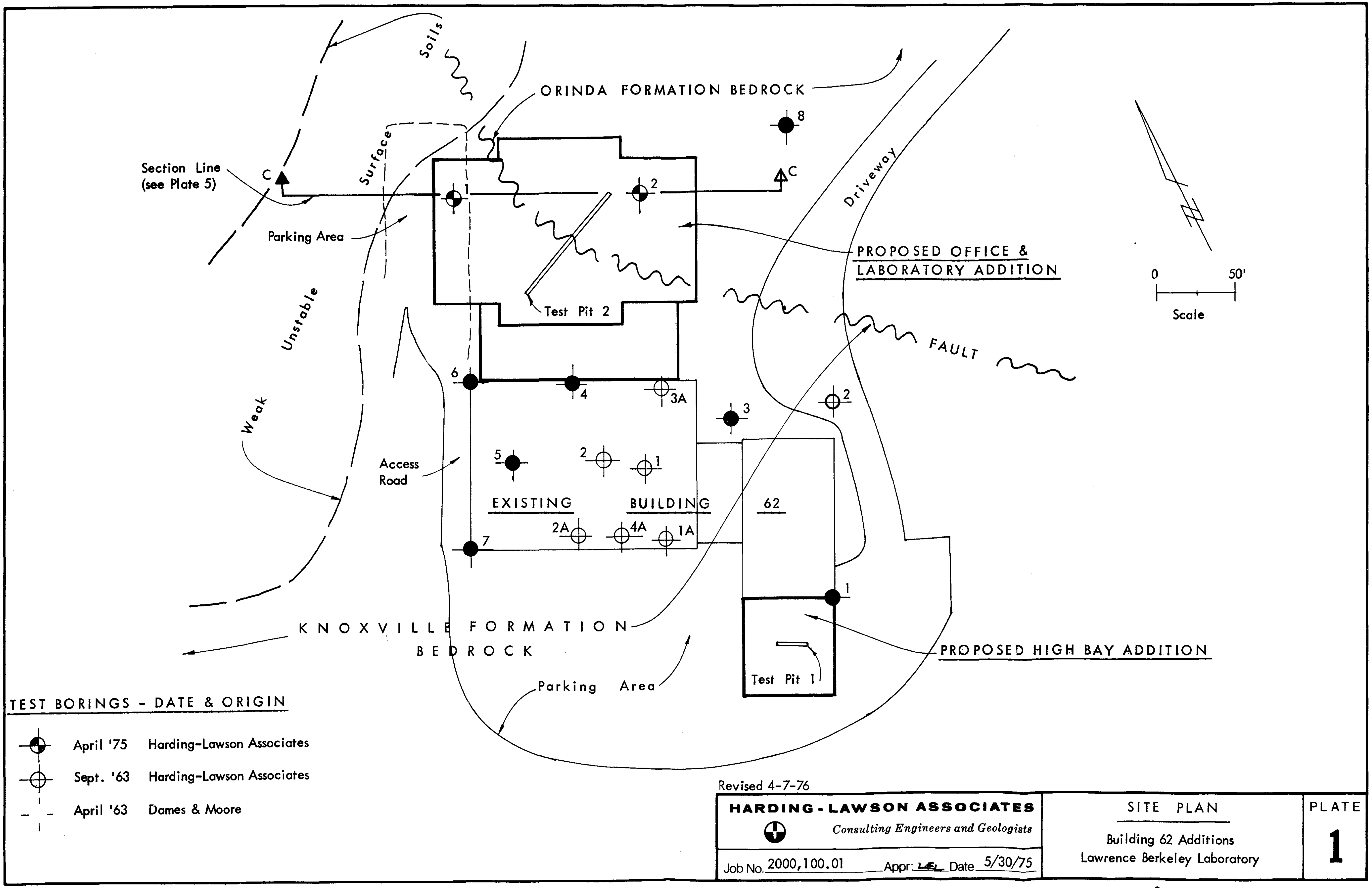
DISTRIBUTION

3 copies: Lawrence Berkeley Laboratory
Berkeley, California

Attention: Mr. Donald Eagling,
Plant Engineer
Building 90

LEL/SRK/RSH/jd

RF2


ORINDA FORMATION BEDROCK
Soils
Surface
Section Line
(see Plate 5)
C
C
Parking Area
Unstable
Weak
Driveway
PROPOSED OFFICE &
LABORATORY ADDITION
Test Pit 2
FAULT
0
50'
Scale
Access
Road
EXISTING BUILDING 62
1
2
3
4
5
6
7
8
2
3A
3
2
1
2A
4A
1A
1
KNOXVILLE FORMATION
BEDROCK
Parking Area
PROPOSED HIGH BAY ADDITION
Test Pit 1
TEST BORINGS - DATE & ORIGIN
April '75 Harding-Lawson Associates
Sept. '63 Harding-Lawson Associates
April '63 Dames & Moore
Revised 4-7-76
HARDING-LAWSON ASSOCIATES
Consulting Engineers and Geologists
Job No. 2000,100.01
Appr:
Date 5/30/75
SITE PLAN
Building 62 Additions
Lawrence Berkeley Laboratory
PLATE
1

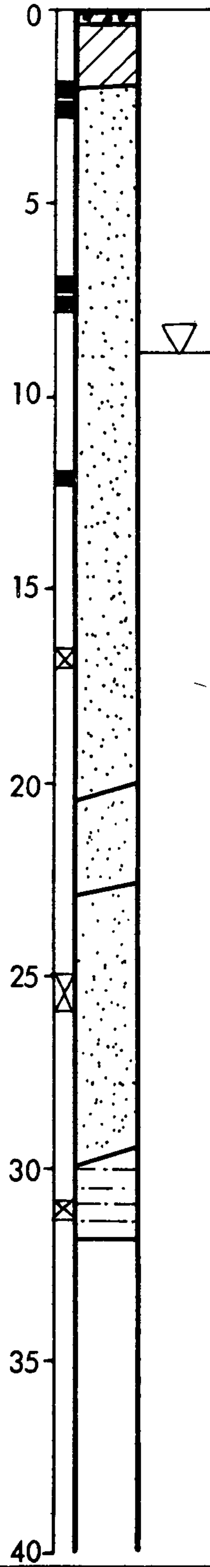
RF11

LOG OF BORING 1

Equipment Flight Auger

Elevation 760 Date 4/10/75

Shear Strength (lbs/sq ft)	Moisture Content (%)	Dry Density (pcf)	Depth (ft)
	7.8	121	2



FILL

GRAY-BROWN SILTY GRAVEL (GM) - dense, wet

KNOXVILLE FORMATION

DARK BROWN SANDY CLAY (CL) stiff, wet, with occasional gravel

LIGHT BROWN SILTY SANDSTONE closely fractured, moderately hard, moderately strong, deeply weathered
change to dark brown, strong, moderately weathered @ 7'
water level 4/16/75

change to hard, with occasional clay-filled fractures

GRAY SANDSTONE hard, strong, little weathered

VARIEGATED GRAY-BROWN SILTY FINE SANDSTONE - moderately hard, moderately strong, little weathered

GRAY SILTSTONE low hardness, moderately strong, little weathered

HARDING - LAWSON ASSOCIATES
Consulting Engineers and Geologists

Job No. 2000,100.01 Appr: LEL Date 5/29/75

LOG OF BORING 1
Building 62 Addition
Lawrence Berkeley Laboratory

PLATE 2

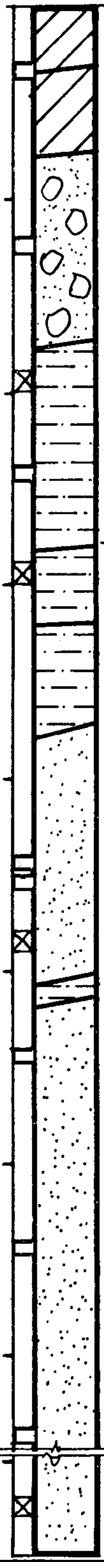
LOG OF BORING 2

Equipment: Flight Auger

Elevation: 797 Date: 4/10/75

Shear Strength (lbs/sq ft)

Moisture Content (%)	Dry Density (pcf)	Depth (ft)
		0
21.3	97	
		5
		10
		15
		20
		25
		30
		35
11.6	128	
		45



FILL

BROWN GRAVELLY CLAY (CL)
stiff, wet

MOTTLED DARK BROWN & YELLOW SILTY CLAY (CL)
stiff, wet

ORINDA FORMATION

GRAY-BROWN CONGLOMERATE
moderately hard, strong, little weathered

LIGHT GREEN-GRAY SANDY SILTSTONE - low hardness, moderately strong, little weathered

water level 4/16/75

RED-BROWN CLAYSTONE
low hardness, friable, little weathered

GRAY CLAYSTONE
intensely fractured, low hardness, weak, little weathered, with occasional slickensides

BLUE-GRAY SILTY SANDSTONE
low hardness, weak, fresh

BROWN CLAYSTONE
low hardness, weak

LIGHT GRAY SANDSTONE
low hardness, moderately strong, fresh

change to strong

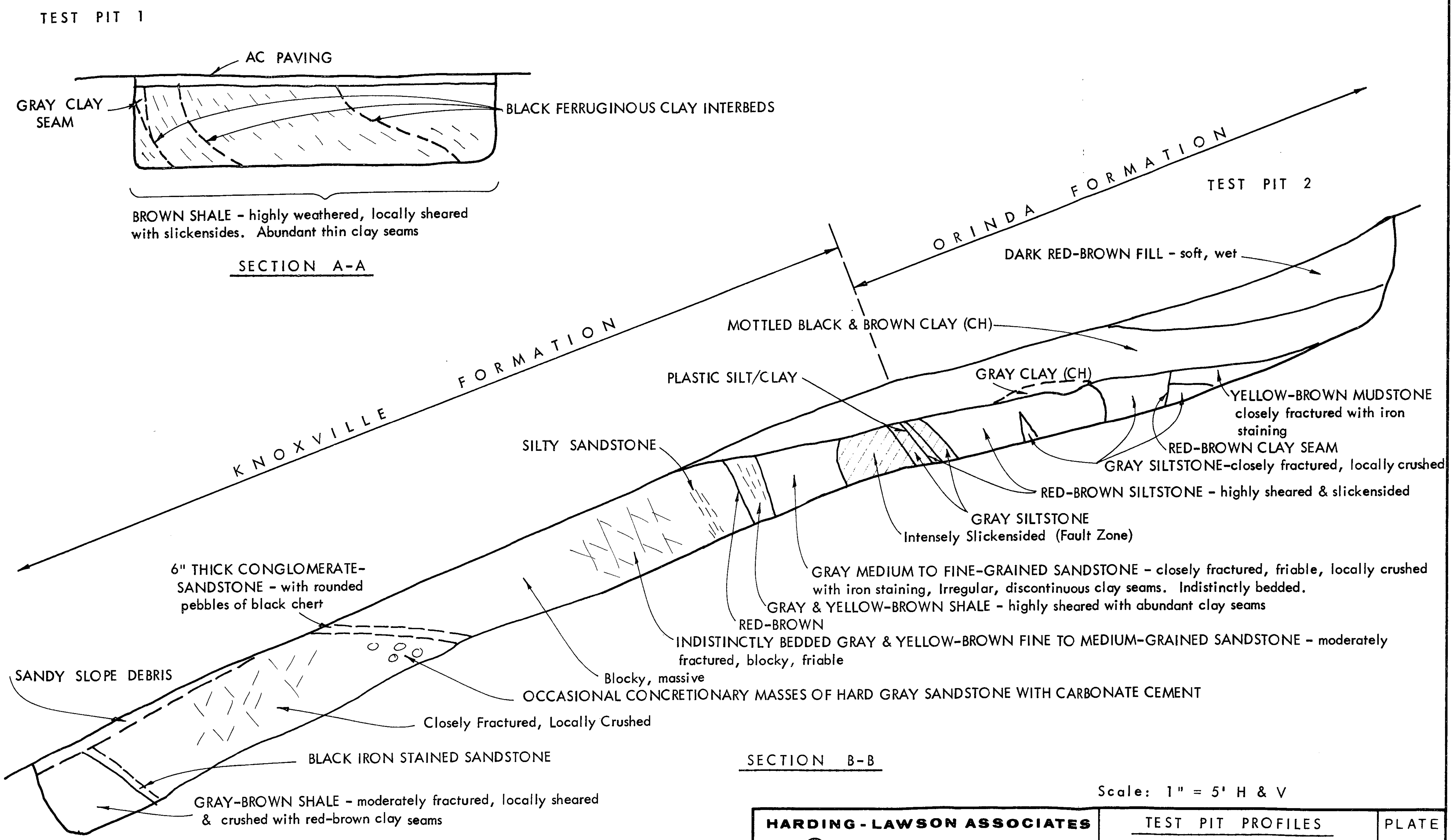
HARDING - LAWSON ASSOCIATES
Consulting Engineers and Geologists

Job No. 2000,100.01 Appr: LEL Date 5/29/75

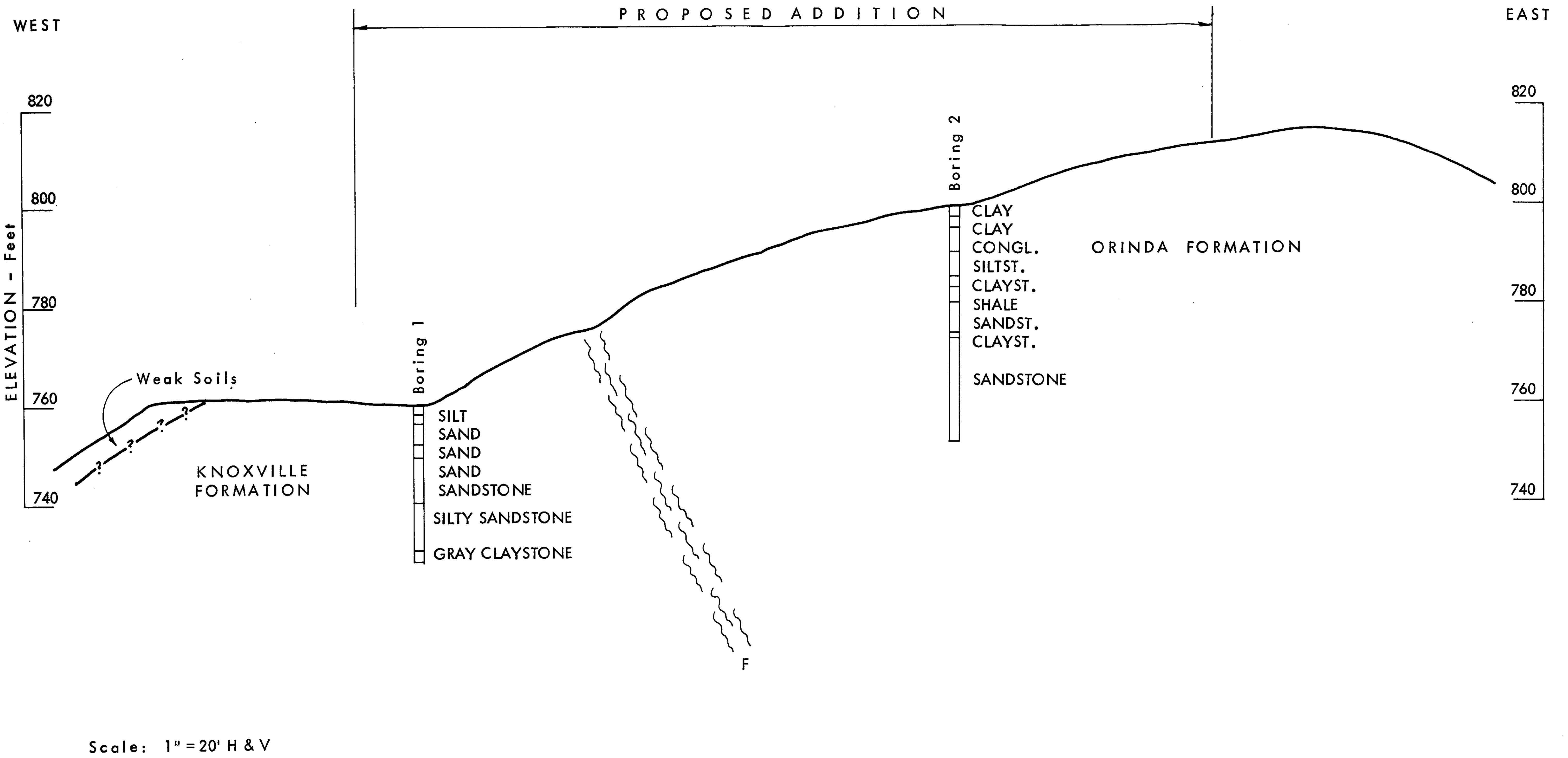
LOG OF BORING 2
Building 62 Addition
Lawrence Berkeley Laboratory

PLATE 3

RF2



HARDING-LAWSON ASSOCIATES *Consulting Engineers and Geologists*	TEST PIT PROFILES	PLATE
Job No. 2000,100.01 Appr: LEL Date 5/30/75	Building 62 Addition Lawrence Berkeley Laboratory	4



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Consulting Engineers and Geologists

Job No. 2000,100.01 Appr: LEL Date 5/30/75

GEOLOGIC CROSS SECTION

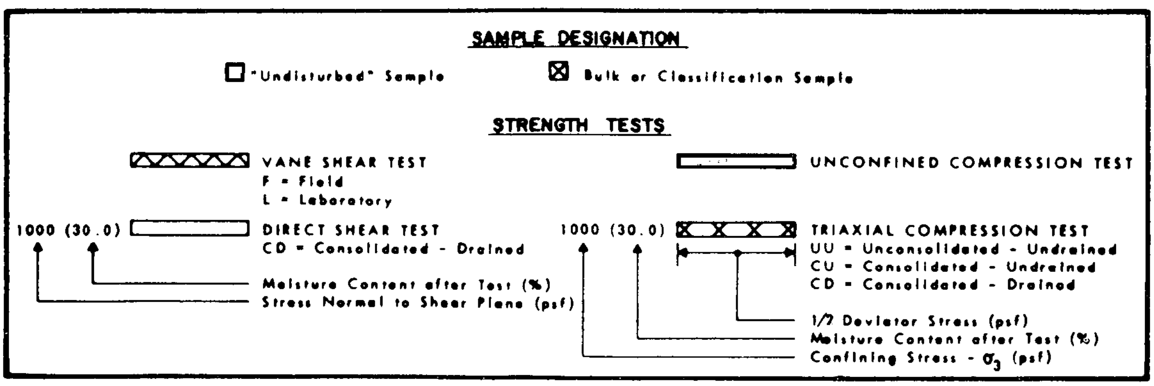
Building 62 Addition
Lawrence Berkeley Laboratory

PLATE **5**

RF3

MAJOR DIVISIONS					TYPICAL NAMES
COARSE GRAINED SOILS (MORE THAN HALF IS LARGER THAN #200 SIEVE)	GRAVELS (MORE THAN HALF COARSE FRACTION IS LARGER THAN NO. 4 SIEVE SIZE)	CLEAN GRAVELS WITH LITTLE OR NO FINES	GW		WELL GRADED GRAVELS, GRAVEL - SAND MIXTURES
			GP		POORLY GRADED GRAVELS, GRAVEL - SAND MIXTURES
		GRAVELS WITH OVER 12% FINES	GM		SILTY GRAVELS, POORLY GRADED GRAVEL - SAND - SILT MIXTURES
			GC		CLAYEY GRAVELS, POORLY GRADED GRAVEL - SAND - CLAY MIXTURES
	SANDS (MORE THAN HALF COARSE FRACTION IS SMALLER THAN NO. 4 SIEVE SIZE)	CLEAN SANDS WITH LITTLE OR NO FINES	SW		WELL GRADED SANDS, GRAVELLY SANDS
			SP		POORLY GRADED SANDS, GRAVELLY SANDS
		SANDS WITH OVER 12% FINES	SM		SILTY SANDS, POORLY GRADED SAND - SILT MIXTURES
			SC		CLAYEY SANDS, POORLY GRADED SAND - CLAY MIXTURES
FINE GRAINED SOILS (MORE THAN HALF IS SMALLER THAN #200 SIEVE)	SILTS AND CLAYS (LIQUID LIMIT LESS THAN 50)		ML		INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTY OR CLAYEY FINE SANDS, OR CLAYEY SILTS WITH SLIGHT PLASTICITY
			CL		INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS
			OL		ORGANIC CLAYS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY
	SILTS AND CLAYS (LIQUID LIMIT GREATER THAN 50)		MH		INORGANIC SILTS, MICACEOUS OR DIATOMACIOUS FINE SANDY OR SILTY SOILS, ELASTIC SILTS
			CH		INORGANIC CLAYS OF HIGH PLASTICITY, FAT CLAYS
			OH		ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILTS
HIGHLY ORGANIC SOILS			Pt		PEAT AND OTHER HIGHLY ORGANIC SOILS

UNIFIED SOIL CLASSIFICATION SYSTEM



KEY TO TEST DATA

HARDING - LAWSON ASSOCIATES
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Job No. 2000,100.01 Appr: LEL Date 5/29/75

SOIL CLASSIFICATION CHART AND KEY TO TEST DATA
Building 62 Addition

PLATE 6

N02470

RF1

I Consolidation of Sedimentary Rocks; usually determined from unweathered samples. Largely dependent on cementation.

U = unconsolidated
P = poorly consolidated
M = moderately consolidated
W = well consolidated

II Bedding of Sedimentary Rocks

Splitting Property	Thickness	Stratification
Massive	Greater than 4.0 ft.	very thick bedded
Blocky	2.0 to 4.0 ft.	thick-bedded
Slabby	0.2 to 2.0 ft.	thin-bedded
Flaggy	0.05 to 0.2 ft.	very thin-bedded
Shaly or platy	0.01 to 0.05 ft.	laminated
Papery	less than 0.01 ft.	thinly laminated

III Fracturing

Intensity	Size of Pieces in Feet
Very little fractured	Greater than 4.0
Occasionally fractured	1.0 to 4.0
Moderately fractured	0.5 to 1.0
Closely fractured	0.1 to 0.5
Intensely fractured	0.05 to 0.1
Crushed	Less than 0.05

IV Hardness

1. Soft - Reserved for plastic material alone
2. Low hardness - can be gouged deeply or carved easily with a knife blade
3. Moderately hard - can be readily scratched by a knife blade; scratch leaves a heavy trace of dust and is readily visible after the powder has been blown away.
4. Hard - can be scratched with difficulty; scratch produces little powder and is often faintly visible.
5. Very hard - cannot be scratched with knife blade; leaves a metallic streak.

V Strength

1. Plastic or very low strength
2. Friable - crumbles easily by rubbing with fingers
3. Weak - An unfractured specimen of such material will crumble under light hammer blows.
4. Moderately strong - Specimen will withstand a few heavy hammer blows before breaking.
5. Strong - Specimen will withstand a few heavy ringing hammer blows before breaking into large fragments.
6. Very strong - Specimen will resist heavy ringing hammer blows and will yield with difficulty only dust and small flying fragments.

VI Weathering - The physical and chemical disintegration and decomposition of rocks and minerals by natural processes such as oxidation, reduction, hydration, solution, carbonation, and freezing and thawing.

D. Deep - Moderate to complete mineral decomposition; extensive disintegration; deep and thorough discoloration; many fractures, all extensively coated or filled with oxides, carbonates and/or clay or silt.

M. Moderate - Slight change or partial decomposition of minerals; little disintegration; cementation little to unaffected. Moderate to occasionally intense discoloration. Moderately coated fractures.

L. Little - No megascopic decomposition of minerals; little to no effect on normal cementation. Slight and intermittent, or localized discoloration. Few stains on fracture surfaces.

F. Fresh - Unaffected by weathering agents. No disintegration or discoloration. Fractures usually less numerous than joints.

HARDING - LAWSON ASSOCIATES *Consulting Engineers and Geologists*	PHYSICAL PROPERTIES CRITERIA FOR ROCK DESCRIPTIONS	PLATE
Job No. 2000,100.01 Appr: LEL Date 5/30/75	Building 62 Addition	7

CONSULTANT RESUMES

1. Engle and Engle, Structural Engineers.

   This firm has specialized in earthquake engineering and hazard evaluato for many years. The Engles and Mr. Donald F. Moran, Consulting Structural Engineer associated with Engle & Engle, recently completed an investigation of three of Pacific Gas & Electric Company's largest power plants for earthquake safety.

2. Harding-Lawson Associtės, Soils Engineers, Geologists and Geophysicists.

   This firm has carried out extensive work in foundation and earthquake engineering for seismic restraint design for numerous large projects throughout the local area, including soil dynamics for major slide repair at LBL.

3. Gensler & Associates, Architects

   This firm has extensive experience and expertise in buildings and facilities analysis and planning, in functional relationships, and in architectural planning and design. The firm has executed numerous projects encompassing a broad rangeof office, commercial, educational, and laboratory facilities, including site development and master planning. They have an impressive record of performing on projects for General Services Administration, the Post Office Department, and municipalities as well as on many projects in the private sector of business.

4. Syska & Hennessy, Inc., Engineers

   This firm has an impressive background in both mechanical and electrical engineering for design and construction projects. They possess extensive expertise in laboratory facility design, energy conservtion computer program analysis, planning and programming skills, and have performed well on numerous major projects both public and private.

5. Consulting Cost Estimators, Inc.

   This firm has extensive experience in producing schematic, preliminary, and final cost estimates for large scale construction projects, included among which are projects for GSA, Departments of the Army and Navy, University of California, various California school districts, and many for the private sector of business.

ENGLE and ENGLE
CIVIL & STRUCTURAL ENGINEERS
1530 — 4TH ST. SAN RAFAEL
LICENSE NO'S. 5156

H M Engle

UCLBL - Bldg 62 Add. - Preliminary Design

Preliminary Design Criteria
1976 UBC & as noted below

Seismic ------- 0.29
Wind --- 20# wind zone
Reinf steel fy = 40 & 60 ksi
Conc. f'c = 3000 & 4000 psi
Struct. steel --- A36
Applicable Code UBC -- 1976 with seismic as noted above.
Bracing System - Box System, Concrete shear walls with vertical load carrying structural steel frame.
Super-structure supported on drilled conc. piles. Preliminary skin friction values 1500 psf D.L., 2500 psf total load.

Roof loads

Roofing = ---------- 6.5
Vermiculite Drainage Fill --- 12.5
5" slab ---------- 62.5
Suspended Ceiling --- 5.0
Misc. Mech & Elec. --- 5.0
Roof Deck D.L. ---- 91.5 #/□'
L.L. = ---- 50.0
Roof Deck D.L. + L.L. = -- 140.5 #/□'

Roof Deck D.L. = -- 91.5
Framing (Beams) ---- 5.0
Roof Deck D.L. + Beams -- 96.5 #/□ -- Roof Deck D.L. + Girders --- 101.5 #/□'
L.L. = ---- 50.0 ---- 50.0
Roof D.L. + L.L. --- 146.5 #/□' ---- 161.5 #/□'

Floor Loads

Partitions = --- 20.0
Flr. Covering = --- 1.0
5" slab = ----- 62.5
Suspended Ceiling --- 5.0
Misc. Mech & Elec. -- 5.0
93.5
L.L. = ---- 125.0
Flr. D.L. + L.L. = --- 218.5 #/□'

Flr. D.L. = ------ 93.5
Framing (Beams) --- 5.0
Flr. D.L. + Beams --- 98.5 -- Flr. D.L. + Beams & Girders --- 103.5 #/□
L.L. = ---- 125.0 ---- 125.0
Floor + Beams D.L. + L.L. --- 223.5 --- Flr. + Beams & Girders - 228.5 #/□'

UCLBL - Bldg 62 Add. - Preliminary Design

Floor slab Max. span 8'-4"

$F'_c = 3{,}000$, $F_s = 40{,}000$

$-M = 218.5 \times 8.33^2/10 = 1516$ 1#

$+M = 218.5 \times 8.33^2/12 = 1263$

$d = \sqrt{\frac{1516}{236}} = 2.53"$

$h = 5"$

$d = 3.75"$

Main Reinf.
- Top #4 @ 8" ctrs.
- Bott. #4 @ 10" ctrs.
- Temp. #4 @ 18" ctrs. top & Bottom.

$-A_s = 1.52 \times .693/3.75 = 0.28$ □"

$+A_s = 1.26 \times .693/3.75 = 0.23$ □"

Temp. $A_s = 5 \times 12 \times .002 = 0.12$ □"

Shrinkage = - - - - 0.27 □"/ft
Main Reinf. = - 0.54 □"/ft
total = - - - - 0.81 □"/ft, $0.81 \times 12 \times .284 \approx$ 3#/□'

Floor Beams, 8'-4" ctrs., span 24'-0" composite with 5" slab

$W = 8.33 \times 223.5 = 1862$ #/ft

$M = 1.862 \times 24^2/8 = 134$ K'

$S = 134 \times .545 = 73$ in³ — **use W 16x31 composite** — $S_{tr} = 77.9$

$b = 16t + b_f = 85.5" < 100"$ ok

use 3/4"φ x 0'3 A.W. HSC

Nc coef = 0.111
" = 0.461

$A_c = 85.5 \times 5$ - - - - 427.5

$W_s = 31$

$N_c = 0.111 \times 427.5 = 47.5$

$N_s = 0.461 \times 31 = 14.3$

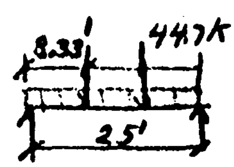
$N_1 = 14.3$

use 30 - 3/4"φ x 3" HSC per beam

Floor Girders - span 25'-0"

Beam Reaction = $8.33 \times 24 \times 223.5 = 44.7$K

Girder Uniform load - - - - - 0.075 K/ft



$M = 8.33 \times 44.7 + 0.075 (25)^2/8 = 378$ K'

$S = 378 \times .545 = 206$ in³ — **Use W24x68 composite** — $S_{tr} = 220$

$b = 89" < 100"$ ok

$A_c = 5 \times 89 = 445$

$N_c = 0.111 \times 445 = 49.4$

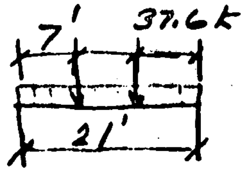
$N_s = 0.461 \times 68 = 31.35$

use 62 - 3/4"φ x 3' HSC per Girder

Note final design check number req'd from conctr. load point to end per 1.11-6

UCLBL - Bldg 62 Add. - Preliminary Design

Floor Girders span 21'-0"



Beam Reaction = 7' x 24' x 223.5 = 37.6K
Girder uniform load - 0.075 K/ft

M = 37.6 x 7 + 0.075 x 21²/8 = 267.3K'
S = 267.3 x .545 = 145.7 in³
b = 88.2" < 100"
Ac = 5 x 88.2 = 441
Nc = 0.111 x 441 = 49
Ns = 0.461 x 55 = 25.36

USE W21X55 Composite — Str 163

USE 51 - 3/4" Φ x 3" HSC per girder — check per 1.11-6

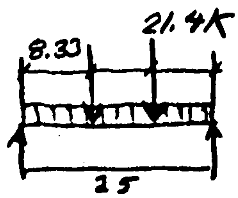
Spandrels @ lines 1&6 span 24'-0"

w =
wall = 125 x 15 = - - - 1.875 K
slab = 3.5 x 223.5 = - - .782 K
2.657 K

M = 2.66 x 24²/8 = 191.5 K'
S = 191.5 x .545 = 104.4 in³

USE W21X55 — S_s = 110
non composite
use typ HSC for beam

Spandrels @ lines A&E span 25'-0"



w = wall = 125 x 15 = - - - - - - 1.875K
Beam Reaction = 8.33' x 11.5' x 223.5 = 21.4K
M = 21.4 x 8.33 + 1.875 x 25²/8 = 324.75 K'
S = 324.75 x .545 = 177 in³

USE W24X76 — S_s = 176
non composite
use typ. HSC for W24X68 composite Girder

Spandrels @ lines A&E span 21'-0"

w =
wall = - - - - - 1.875
Beam Reaction = 7 x 11.5 x 223.5 = 18K
M = 18 x 7 + 1.875 x 21²/8 = 229K'
S = 229 x .545 = 125 in³

USE W21X62 — S_s = 127
non composite
use typ HSC for W21X55 composite girder

UCLBL - Bldg 62 Add. - Preliminary Design

Beams @ lines 3 & 4 - span 24'-0"

w wall = — — — — — 1.875
slab = 8.33 x .2235 = — — 1.86
w = — — — — 3.74 k/ft

M = 3.74(24)²/8 = 269k'
S = 269 x .545 = 146.6 in³

Use W 24x68
non composite
use typ. HSC for W24x68 girder

Roof

Beams span 23'-0" @ 8'-4" ctrs

w = 8.33 x 146.5 = 1.22 k/ft
M = 1.22 (23)²/8 = 80.7 k'
S = 80.7 x .545 = 43.98 in³

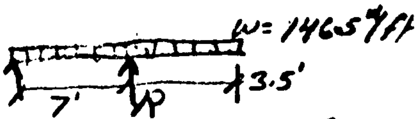
Use W16x31
non composite
use 3/4"ϕ x 3" HSC @ 18" ctrs on ℄ beam

Roof Beams span 24'-0" @ 8'-4" ctrs

M = 1.22 x 24²/8 = 87.8k'
S = 47.87

Use W16x26
Composite
30 - 3/4"ϕ x 3" HSC per beam

Roof spandrels lines 1 & 6 span 24



R = .147 x 10.5² / 2 x 7 = 1.15 K/ft
M = 1.15 x 24²/8 = 82.8
S = 45.1 in³

Use W16x31
non composite
use 3/4"ϕ x 3" HSC
same number as floor beams

UCLBL-Bldg 62 Addl-Preliminary Design

Roof Girders span 21'-0"

Beam Reaction = 7'x24'x146.5 = 24.61 K
Girder Uniform load = - - - - - 0.075 k/ft

M = 7x24.61 + 0.075x21²/8 = - - 176.4
S = 176.4x.545 - 96.14

Use W18x45 composite S_{tr} = 121

Roof Girders span 25'-0"

Beam Reaction = 8.33x24x146.5 = 29.3 k
Girder Uniform load - - - 0.075 k/ft

M = 8.33x29.3 + 0.075x25²/8 = 249.93 K'
S = 249.93x.545 = 136.2 in³

Use W21x49 composite S_{tr} = 143

Floor Girder - Elev. 803 line C - Span 46'-0" (4-6)

Reduce Rf. L.L. to 30#/□' for all column loadings

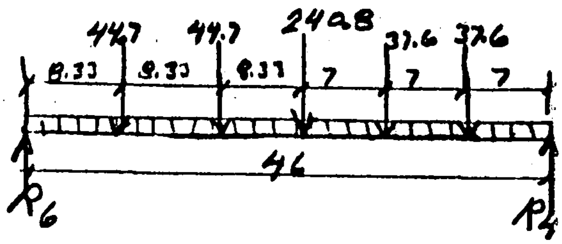
Loads to Col. C5

	D.L.	L.L.	D.L.+L.L.
Roof: 24'x23'x(101.5 & 30) =	56028	16560	
3rd Flr. 24x23 (103.5 & 125) =	57132	69000	
2nd Flr. 24x7.67 (103.5 & 125) =	19052	23010	
Concentrated load @ C5 →	132212	108570	240782#

Beam concentration

	D.L	L.L.	D.L.+L.L.
8.33x24x(98.5 & 125) =	19692	24990	44682
7.00x24 (98.5 & 125) =	16548	21000	37548

w ≈ 300#/ft



R_6 = 44.7x37.67/46 + 44.7x29.33/46 + 240.8x21/46 + 37.6x14/46 + 37.6x7/46 + 23x.3 = 199.10 k

R_4 = - - - - - 220.1 K

M_{c5} = 199.1x 25 - 44.7x16.67 - 44.7x8.33 - 0.3x25²/2 = 3766 k'

S = 3766x.5 = 1883 in³

Pl. Girder d = 40", b_f = 18", t_f = 3.0, t_w = 0.75, y = 18.5, 2y² = 684.5

I = 3.0x18(684.5) + 0.75(34)³/12 = 39419, S = 1971 in³ ok

UCLRL - Bldg 62 Add. - Preliminary Design

Columns: Use 30# Roof L.L. for all columns.

Column 1C

	D.L.	L.L.	D.L.+L.L.
Roof 24X10.5 (101.5 & 30) =	25578	7560	
Roof overhang = 24X3.5X8.75/7 (101.5 & 30) =	10657	3150	
Wall = 15'X24'X125 =	45000	—	
load to 3rd →	81235	10710	91,945
3rd Floor = 24X10.5 (103.5 & 125) =	26082	31500	
Wall = 15'X24'X125 =	45000	—	
load to 2nd →	152317	42210	194,527
2nd Floor = do	26082	31500	
Wall = do	45000	—	
load to 1st →	223399	73710	297,109
1st Floor do	26082	31500	
Wall do	45000	—	
load to Mech Rm →	294481	105210	399,691
Mech Rm Floor do	26082	31500	
load to Col @ loading Rm →	320563	136710	457,273

Column 2C

	D.L.	L.L.	D.L.+L.L.
Roof = 24X23 (101.5 & 30) =	56028	16560	
3rd Flr. 24X23 (103.5 & 125) =	57132	69000	
load to 2nd →	113160	85560	198,720
2nd Flr do	57132	69000	
load to 1st →	170292	154560	324,852
1st Flr do	57132	69000	
load @ Mech Rm Flr level →	227424	223560	450,984

UCLBL-Bldg 62 Add.-Preliminary Design

Column 3C

	D.L.	L.L.	D.L.+L.L.
Roof-16.66x24(101.5 & 30) =	40584	11995	
Wall = 17'x24' x 125 =	51000	—	
load to 3rd →	91584	11995	→ 103579
3rd Flr. = 16.66x24(103.5 & 125) =	41383	49980	
Wall = 15'x24' x 125 =	45000	—	
load to 2nd →	177967	61975	→ 239942
2nd Flr. = do	41383	49980	
Wall do	45000		
load to 1st →	264350	111955	→ 376305
1st Flr. = do	41383	49980	
load to Mech. Rm. Mezz. →	305733	161935	→ 467668

Col. 4C

	D.L.	L.L.	D.L.+L.L.
Roof = 16.66x24 (101.5 & 30)	40584	11995	
Wall =	51000	—	
load to 3rd →	91584	11995	→ 103,579
3rd Flr. =	41383	49980	
Wall =	45000	—	
load to 2nd →	177967	61975	→ 239,942
2nd Flr. = 27.16x24(103.5 & 125) =	67465	81480	
load to 1st →	245432	143455	→ 388,887

Col 6C

	D.L.	L.L.	D.L.+L.L.
Roof = 24x10.5 (101.5 & 30)	25578	7560	
Roof overhang =	10657	3150	
Wall =	45000	—	
load to 3rd →	81235	10710	→ 91945
3rd Flr. = 24x10.5(103.5 & 125)	26082	31500	
Wall =	45000		
load to 2nd →	152317	42210	→ 194,527
2nd Floor = 24x23 (103.5 & 125) =	57132	69000	
load to retaining wall =	209449	111210	→ 320,659

UCLBL-Bldg 62 Add

Col. 6B & 6D

	D.L.	L.L.	D.L.+L.L.
Roof = 23.5 x 10.5 (101.5 & 30)	25045	7403	
Roof overhang =	10435	3084	
Wall	44100	---	
load to 3rd →	79580	10487	→ 90,067
3rd Flr.	25560	30870	
wall	44100	---	
load to 2nd →	149240	41357	→ 190,597

✓ Steel Columns line 1

loading dock to 1st

load @ dock = 457K x 1.15 (all. for ecc.) = 526K, l = 11.5'

Use W12X99 dock to 1st

1st to 3rd

load @ 1st = 297K x 1.15 = ---- 342K l = 15'

Use W12X72 1st to 3rd

load @ 3rd = 92 x 1.15 = ---- 105.8K l = 15'

Use W12X40 3rd to roof

✓ Steel Columns line 2

Mech Rm to 2nd

load @ mech. room = 451K x 1.1 = --- 496K, l = 15

Use W12X99 mech rm to 2nd

load @ 2nd = 199K x 1.1 ---- 219K, l = 15'

Use W12X53 2nd to roof

UCLBL - Bldg 62 Add.

Cols line 3

Mech Rm Mezz to 2nd

load @ Mezz = 468K x 1.15 = ----- 538K, l = 8'

Use W12X99 Mezz to 2nd

load @ 2nd = 240 x 1.15 = ----- 276 K, l = 15'

Use W12X58 2nd to roof

Cols line 4

1st to 2nd

load @ 1st = 389 x 1.15 = ----- 447 K l = 18'

Use W12X99 1st to 2nd

load to 2nd = 240 x 1.15 = ----- 276 K l = 15'

Use W12X58 2nd to roof

Cols line 5

1st to 2nd

load to 1st = 325 x 1.10 = 357K l - 18'

Use W12X79 1st to 2nd

load to 2nd = 199 x 1.1 = 219K l = 15'

Use W12X53 2nd to roof

Cols line 6

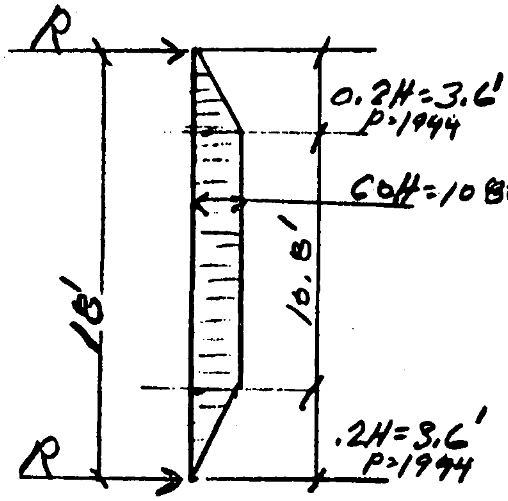
2nd to roof

load @ 2nd = 195 x 1.15 = 224K l = 15'

Use W12X53 2nd to roof

LCLBL - Bldg. 62 Add - Preliminary Design

Retaining Walls - Basement Type walls use 60H soil pressure
H = 18'



$R = \frac{1080 \times 10.8}{2} + \frac{1080 \times 3.6}{2} = 7776^{\#}$

$M = 7776 \times 9 - 1944 \times 6.6 - 1080 \times 5.4 \times 2.7$

$M = 41.4$

use $f'_c = 4000$

$f_y = 60{,}000$, $n = 8$

$d = \sqrt{\frac{41{,}400}{295}} = 11.8''$

$h = 16''$; $d = 13.5''$

Rebar #/□' = 31.2 × .284 = 8.86 ≈ 9.0#/□'

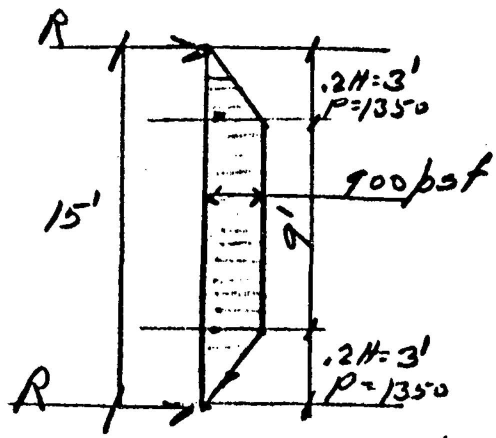
I.F. Verts = $\frac{41.4 \times 12}{24 \times .875 \times 13.5} = 1.75^{\square''}/ft$

use #9 @ 7" ctrs. I.F.

use #5 @ 14" ctrs. O.F.

Horiz. #5 @ 12" ctrs. ea. face

Retaining Walls - Basement Type
H = 15'



$R = \frac{900 \times 9}{2} + \frac{900 \times 3}{2} = 5400^{\#}$

$M = 5400 \times 7.5 - 1350 \times 5.5 - 900 \times 4.5 \times 2.25$

$M = 24K'$ use $f'_c = 4000$

$f_y = 60{,}000$

$h = 16''$, $d = 14''$

I.F. verts. = $\frac{24 \times 12}{24 \times .875 \times 13.5} = 1.016^{\square''}/ft$

Rebar #/□' = 22.7 × .284 = 6.4 ≈ 6.6#/□'

use #9 @ 12" ctrs. I.F.

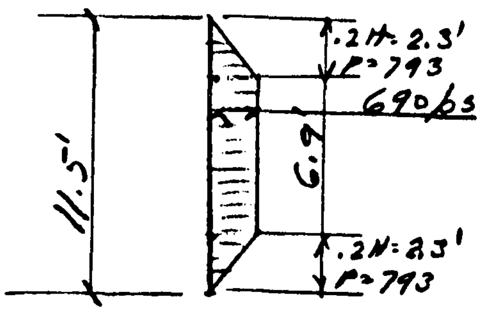
" #5 @ 14 " O.F.

Horiz. #5 @ 12" ctrs.

LCLBL - Bldg. 62 Add. - Preliminary Design

Retaining Walls - Combination basement type & cantilever "T" wall
H = 11.5'

Use 60# soil pressure for final loading
45# equiv fluid pressure for "T" wall action



$R = \frac{690 \times 6.9}{2} + \frac{690 \times 2.3}{2} = 3174^{\#}$

$M = 3175 \times 5.75 - 793 \times 4.217 - 690 \times 3.45 \times 1.725$

$M = 10.8\,K'$

Cantilever Stem' $M = \frac{45 \times 11.5^2}{2}\left(\frac{11.5}{3}\right) = 11.4\,K'$

$d = \sqrt{\frac{11{,}400 \times 12}{295 \times 12}} = 6.2$ use $h = 12''$
$d = 10.5''$

O.F $A_s = \frac{11.4 \times 0.571}{10.5} = 0.62^{\square''}/ft$

I.F $A_s = \frac{10.8 \times 0.571}{10.5} = 0.587^{\square''}/ft$

Use #6 @ 8" O.F
Use #6 @ 9" I.F
Horiz #4 @ 14" Ea. face

Rebar #/□' = 19 × .284 = 5.4 ≈ **5.5 #/□'**

UCLBL - Bldg 62 Add - Preliminary Design

Drilled Caissons @ Columns
& intermediate caissons @ wall supports

HLA - skin friction values 1500 psf D.L.
2500 psf total load
for length of caisson in
rock.
Rock located within 5'± of
existing ground surface

Caisson capacities

		D.L.	D.L.+L.L.
2'-0" =	2π(1.5 & 2.5) =	9.4	15.7 K/ft
2'-6" =	2.5π(1.5 & 2.5) =	11.8	19.6
3'-0" =	3.0π(1.5 & 2.5) =	14.1	23.6 K/ft
3'-6" =	3.5π(1.5 & 2.5) =	16.5	27.5 K/ft

Caissons line 1

	D.L.	D.L.+L.L.
Column load =	321	457
Hs & Mech Rm. wall = 16'×12'×0.125 =	24	24
load to Caisson =	345	481 K

3'-0" dia $l = \frac{345}{14.1} + 5 = 29.5 \approx 30'$

3'-6" dia. $l = \frac{481}{23.6} + 5 = 25.4'$ [Use 3'-6" dia. × 30'-0"] use 3'-6" dia. for overturning.

Longitudinal Reinf = $0.015 \times \pi 21^2 = 20.8\,\square''$ use 13 #11 $A_s = 15.6\,\square''$

[#3 cold drawn spiral 3" pitch]

Intermediate Caissons line 1

	D.L.	D.L.+L.L.
wall	24	24

Use 2'-0" dia. Caisson $l = \frac{24}{9.4} + 5 = 7.6'$, [Use 2'-0" dia. × 12'-0" caisson]

long. Reinf. $= 0.015\,\pi 12^2 = 6.79\,\square''$

[use 9-#8
#3 spiral 3" pitch]

UCLBL - Bldg 62 Add. - Preliminary Design

Drilled Caissons

Caissons line 2

	D.L.	D.L.+L.L.
column load @ Mech. Rm flr. =	227	451
12" retaining wall = 12'x12'x.150 =	22	22
retaining wall ftg = 6'x12'x.20 =	14	14
load to caisson =	263	487

use 3'-0" dia Caisson $l = \frac{263}{14.1} = 18.7'$

$l = \frac{487}{23.6} = 20.6'$

Use 3'-0" dia. x 21'-0" Caissons ✓

3'-0" dia. $A_s = 0.015 \times \pi \times 18^2$ = use 10-#11, #3 spiral 3" pitch

Intermediate Caisson line 2

wall & ftg =	36	36

use 2'-0" dia. $l = \frac{36}{9.4} = 3.83'$ **use 2'-0" dia x 12'-0" caisson**

Caissons line 3

	D.L.	D.L.+L.L.
Column load @ Mech Rm Mezz.	306	468
12" retaining wall 12'x7'x.150	13	13
" " ftg = 12'x4'x.2 =	10	10
10" wall = 8'x12'x.125	12	12
	341	503

use 3'-0" dia Caisson $l = \frac{341}{14.1} = 24.2$

$l = \frac{503}{23.6} = 21.3$

use 3'-0" dia. x 25' Caisson ✓

Intermediate Caissons line 3

use 2'-0" dia x 12'-0" caisson

UCLBL - Bldg 62 Add - Preliminary Design

Caissons line 4 (except 4c)

	D.L.	L.L.
Col. load to 1st =	264	376
1st Flr. = 12 X 4.16(.103 & .226) =	5	11
12" wall = 12' X 8' X .15 =	14	14
ftg = 12' X 4' X .2 =	10	10
load to Caisson =	293	411

use 3'-0" dia caisson $l = \frac{293}{14.1} + 7 \doteq 28'$

$l = \frac{411}{23.6} + 7 = 24.4$ ✓

use 3'-0" X 28' caissons

Intermediate Caissons line 4 - use 2'-0" X 17 caissons

Caisson 4C

	D.L.	L.L.
Col. load to 1st =	245	389
10" wall 1st to 2nd = 24X15X.125	45	45
12" wall =	14	14
ftg =	10	10
load to Caisson	314	458

3'-0" dia $l = \frac{314}{14.1} + 7 = 29.27$

$l = \frac{458}{23.6} + 7 = 26.4$ ✓

use 3'-0" X 30' caisson

Caissons line 5

	D.L.	L.L.
Col. load to 1st =	170	325

3'-0" dia $l = \frac{170}{14.1} = 12.06$

$l = \frac{325}{23.6} = 13.77$ ✓

use 3'-0" X 14' caissons

HCLBL - Bldg 62 Add - Preliminary Design

Caissons line 6 - except 6C

	D.L.	D.L.+L.L.
Col. load to 2nd =	149	191
2nd Flr.	26	57
16" wall = 11.75' × 18' × .2 =	42	42
wall ftg = 11.75 × .45 =	5	5
load to Caisson	222	295

3'-0" dia $l = \frac{222}{14.1} = 15.7$

$l = \frac{295}{23.6} = 12.5$ ✓

use 3'-0" × 16' Caissons

Caisson 6C

	D.L.	D.L.+L.L.
Col load to wall =	209	321
16" wall = 12 × 18 × .2 =	43	43
wall ftg = 12 × .45 =	5	5
load to Caisson =	257	369

3'-0" dia $l = \frac{257}{14.1} = 18.2$ ✓

$l = \frac{369}{23.6} = 15.6$

use 3'-0" × 19' Caisson

Intermediate caissons line 6

	D.L.	D.L.+L.L.
16" wall =	43	43
wall ftg =	5	5
	48	48

2'-0" dia. $l = \frac{48}{9.4} = 5.11$

use 2'-0" × 12'-0" Caissons

UC LBL - Bldg 62 Add - Preliminary Design

Lateral Forces 0.2g

Roof = 101.5×.2 =	20.3#/□'
Supported Flrs = 103.5×.2 =	20.7
10" walls = 125×.2 =	25.0
12" walls = 150×.2 =	30.0
16" wall 200×.2 =	40.0

Floor area = 100.33×94 = 9431□', Roof area = 10840□'

Forces N-S (Approximate base shear)

Roof - 10840 × 20.3# =	220
Wall = 2×100.3×7.5×25#	38
3rd Floor = 9431 × 20.7# =	195
wall = 2×100.3× 15×25#	75
2nd Floor = 9431× 20.7# =	195
wall = 2×100.3×15'×25# =	75
	798 K

Estimate 30% to west wall = 798×.3 = 239k @ 2nd

1st Flr = 23×94×20.7# =	45
wall = 2×23××15×25#	17
Mech Rm flr. = 10.5×94×20.7	20
wall = 2×10.5× 13.25× 30# =	8
wall (in plane) = 94×71.5×25×.8 =	134
shear @ Elev. 761.5 =	463K

$$v_u = \frac{2\times 463}{0.85\times 10\times 0.8\times 46\times 12} = 0.24\ ksi$$

assume all shear forces taken by reinf., bar spacing 10" c-c

$$A_v = \frac{240\times 10\times 10}{40{,}000} = 0.6$$ use #5 @ 10" ctrs ea. face $\rho_h = \frac{.62}{.82\times 120} = .0063$

Verts. $\rho_n = .0025 + 0.5\left(2.5 - \frac{71.5}{94}\right)(.0063 - .0025) = .0058$

Verts. $A_s = 10\times 12\times .0058 = 0.696$ □"/ft — use #5 @ 10" ea. face

UCLBL-Bldg 62 Add. - Preliminary Design

lateral forces

10" wall reinf.

For estimating purposes use #5 @ 14" ctrs. ea. way, ea. face as average wall reinf.

$A_s = 4 \times .31 = 1.24 \square''/sq.$

$\#/sq.ft. = \frac{1.24}{1.16} \times 12 \times .284 = 3.64\#/\square' \approx \boxed{4.0\#/\square'}$

Overturning line 1

$M_{O.T.} = 463 \times 73.5 \times 2/3 = 22687 k'$

$M_R =$

col. = 320 × 22.5' = 7200

col = 320 × 45' = 14400

21600 × 2/3 = 14400 k'

$C = \frac{22687 - 14400}{45} + 457 = 641 k$ - D.L. + L. + EQ

use W12×120 all cols line 1

13st/l.ft elev 761.5 - 788

use W12×85 Elev. 788 to 818

Caissons line 1

3'-6" dia., effective length = 25'

capacity = 27.5 K/ft × 25 = 687.5 k ok

BASIS OF MECHANICAL DESIGN

A. SITE

1. City Water Service

A new CW connecton will be made in the 8-in. main on the east side of the new building. The new CW service will be brought underground to the new Materials and Molecular Research Laboratory building. A curb shut-off valve will be installed in the new service.

2. Natural Gas Service

A new natural gas service will be installed to accommodate the total gas load. The gas will be piped at 1 psig to the boilers in the new laboratory building and at 5 psig underground to the existing laboratory.

3. Rainwater System

The new rainwater system will bring the rainwater collected in the new building out underground to connect into the existing storm drainage system at the west side of the new building.

4. Sanitary Sewer System

The sewer will be run in stacks in the new building and brought out and connected to the existing site sanitary sewer at the west side of the existing laboratory.

B. BUILDING

1. Acid Waste System

All waste outlets in laboratories will be connected to a central acid waste system within the building that is to be completely isolated from the sanitary sewer system. This waste system will connect into the sanitary sewer system at a point remote from the building.

2. Plumbing System

The new plumbing system will have American Standard or equal plumbing fixtures. The new water heater will be a vertical storage type converter with the domestic water heated to 120°F by heating hot water. The hot water system will be recirculating with a pump in the Mechanical Room. The domestic water will be connected to the water service with a pressure reducing valve.

3. Low Conductivity Water System (LCW)

The LCW system in the existing laboratory building will be extended to the new laboratory building. The system will be installed on each floor for laboratory equipment cooling. The water wil be boosted two new LCW pumps in the new Mechanical Room.

4. Industrial Hot and Cold Water System

Industrial hot and cold water will be supplied on each floor of the new building. The hot water will have a balanced recirculating loop. A pressure reducing valve and reduced pressure backflow preventer will connect the industrial hot and cold water system to the cold water service.

5. Compressed Air System

Source of supply will be two new tank mounted air compressors with supply pressures of 90 to 100 psig. The system will include a distribution piping to furnish 75 psig within laboratory areas. System shall be dried to dew point temperature of 40^{o}F by a refrigerated air dryer.

6. Natural Gas System

Natural gas will be distributed within the new building to laboratory areas at a distribution pressure of 7 inc. W.C. Extension from the pressure regulator installation point of building connections will be provided.

7. Demineralized Water System

The demineralized water system will be using the water that is both cooled and conditioned in the LCW System and will be extended form the existing laboratory building. This system shall have non-metallic pipe and fittings. The system will be looped with a booster pump in the Mechanical Room of the new building.

Project Name: LAWRENCE BERKLEY LABORATORY	Syska & Hennessy
Project No.	

1. ASSUMPTIONS

A. GROSS AREA FROM THE ARCHITECTURAL DRAWING = 33,000 SQ FT

B. ASSUMING THE OCCUPANCY AS SCHOOL MAINLY WITH OFFICES & LABORATORIES.

C. THE MECHANICAL LOAD AS FURNISHED BY MECHANICAL GROUP = 107 KVA.

D. EXISTING BUILDING CONNECTED LOAD AS FURNISHED IN THE CONCEPTUAL DESIGN REPORT = 1,456 KVA.

E. RESEARCH EQUIPMENT LOAD AS FURNISHED IN THE CONCEPTUAL DESIGN REPORT = 680 KVA BASED ON WHICH THE LOAD DERIVED = 350 KVA

2. REFERENCES

A. IEEE RECOMMENDED PRACTICE FOR ELECTRIC POWER SYSTEMS IN COMMERCIAL BUILDING STANDARD 241-1974.

B. NATIONAL ELECTRIC CODE - 1978.

C. ESTIMATING TOTAL DEMAND LOADS WILLIAM K.Y. TAO.

System: ELECTRICAL LOAD ANALYSIS (NORMAL)						Sheet No. 1 of 3 Sheets
Hvac	Elec	Sanit	Transp.	CUD	A. & S.	By DKG Date 4/7/78

Project Name	
LAWRENCE BERKLEY LABORATORY	**Syska & Hennessy**
Project No.	

D. CONCEPTUAL DESIGN REPORT FOR AN ADDITION TO THE MATERIALS AND MOLECULAR RESEARCH LAB L.B.L U.C. CALIFORNIA.

3. CALCULATION FOR NEW BLDG LOADS (NORMAL)

TYPE OF LOADS	GROSS SQFT	CONN LOAD KVA	DEMAND FACTORS	DEMAND LOAD KVA
LIGHTING 5W/SQFT	33,000	165.00	1	165.00
RECEPTACLES 1.5W/SQFT	33,000	49.5	.3	14.85
RESEARCH EQUIPMENT 18 LABS @15KVA 10 " @10KVA	—	350	.4	142.00
ELEVATORS	—	75	.6	45.00
MECHANICAL HEATING & A/C & MISC LOADS		112	.8	89.00
SUB TOTAL NEW BLDG		751.5		455.85
SUB TOTAL EXISTING		1456	.5 (SEE 2D)	728.00
SUB TOTAL EXISTING & NEW BLDG DEMAND LOAD				1183.85
FUTURE RESERVE CAPACITY @ 20%				236.77
GROSS OVER-ALL DEMAND				1419.62
ESTIMATED DIVERSITY FACTOR				1.2
NET OVER-ALL DEMAND				1183.01

System	Sheet No.	of	Sheets
ELECTRICAL LOAD ANALYSIS	2	3	

Hvac	Elec	Sanit	Transp.	CUD	A. & S.	By	Date
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LOAD	TOTAL KVA
1. EXHAUST FANS	
18 @ 1/4 H.P.	4.2
2 @ 2 H.P.	2.0
2. LABORATORY LIGHTING	10.0
3. GENERAL LIGHTING	7.4
INCLUDES EMERGENCY EXIT, LIGHTS FOR EGRESS	
	25.6.
4. FUTURE LOAD 20%	5.0
	30.00

CHOOSE 30KW DIESEL GENERATOR.

System	Sheet No.	of	Sheets
ELECTRICAL LOAD ANALYSIS (EMERGENCY)	3	3	

Hvac	Elec	Sanit	Transp.	CUD	A. & S.	By	Date
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Project Name: LAWRENCE BERKLEY LABORATORY

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Syska & Hennessy

1.0 GENERAL

1.1 ASSUMPTIONS

A. UTILITY SHORT CIRCUIT MVA AT EXISTING SUBSTATION PRIMARY SIDE = 249 KVA. (PER LBL DATA), MENTIONED IN CONCEPTUAL DESIGN REPORT.

B. EXISTING TRANSFORMER AS NOTED IN THE FIELD VISIT = 2000 KVA.

C. SYSTEM RESISTANCE IS NEGLECTED.

D. BASE KVA IS 1000 KVA.

E. SHORT CIRCUIT AMPERE CONTRIBUTION DUE LIGHTING LOADS ARE NEGLECTED.

F. CABLE DATA ARE GIVEN IN OHMS PER 1000 FT AT 75°C AND 60HZ FROM I.P.S.D, SECTION 123 PAGE 4.

1.2 REFERENCES

A. I.E.E.E. RECOMMENDED PRACTICE FOR ELECTRIC POWER SYSTEMS IN COMMERCIAL BUILDINGS - STANDARD 241-1974.

B. I.E.E.E. RECOMMENDED PRACTICE FOR PROTECTION AND COORDINATION FOR INDUSTRIAL AND COMMERCIAL POWER SYSTEMS - STANDARD 242-1975

System	Sheet No.	of	Sheets
SHORT CIRCUIT CALCULATION	1	9	

Hvac	Elec	Sanit	Transp.	CUD	A. & S.	By	Date
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Project Name LAWRENCE BERKLEY LABORATORY
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C. ENGINEERING DEPENDABLE PROTECTION FOR AN ELECTRICAL DISTRIBUTION SYSTEM PART III

D. G.E. SHORT-CIRCUIT CURRENT CALCULATIONS

PUBLICATION GET-3550A.

E. INDUSTRIAL POWER SYSTEM - BY BEEMAN

1.3 DEFINITIONS

X_S = SOURCE
X_T = TRANSFORMER
X_M = MAIN CIRCUIT BREAKER
X_F = FEEDER CIRCUIT BREAKER
X_B = BRANCH CIRCUIT BREAKER
X_D = DIST. PANELBOARD
X_{MT} = MOTOR LOAD CONTRIBUTION
X_C = FEEDER CABLE
X_G = STANDBY GENERATOR ($X_D'' = 0.09$)

I_{SCA} = SHORT CIRCUIT AMPERES
Z = IMPEDANCE IN OHMS
X = REACTANCE IN OHMS
X_{PU} = PER UNIT IMPEDANCE

System						Sheet No.	of	Sheets
SHORT CIRCUIT CALCULATION						2	9	
Hvac	Elec	Sanit	Transp.	CUD	A. & S.	By DKG	Date 4/10/78	

Project Name: LAWRENCE BERKLEY LABORATORY
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EXISTING
M.C.C. :- 66A4A
MOTORS ONLY

	HP
ELEVATOR	75
COOLING TOWER FAN	15
TOWER WATER PUMP #1	7½
TOWER WATER PUMP #2	7½
CHILLED WATER PUMP #1	7½
CHILLED WATER PUMP #2	7½
HEATING WATER PUMP #1	3
HEATING WATER PUMP #2	3
BUILDING SUPPLY FAN S1	50
HEATING VENT UNIT UV1	1
OFFICE EXHAUST FAN E-1	5
L.C.W PUMP # 1	20
L.C.W PUMP # 2	20
BUILDING AIR COMPRESSOR	10
SUB TOTAL	232

EXISTING
M.C.C. :- 66A4A1A1A
MOTORS ONLY

	HP
EXH FAN 350	1
EXH FAN E-348	1½
EXH FAN 344	1
EXH FAN 342 AND EXH-338	2
EXH FAN 320	1
EXH FAN 316	1½
EXH FAN 310	1
EXH FAN 308 AND EXH 220	2
EXH FAN E214A	1½
EXH FAN E 208	½
EXH FAN E 138	1
EXH FAN E-135	¾
EXH FAN E-127-2	½
EXH FAN E-127-1	½
EXH FAN E-108	1½
LAB EX FAN E-3	3
LAB EX FAN E-2	3
EX FAN E 101	¾
	24

TOTAL MOTOR LOAD ON EXISTING SWITCHGEAR

= MOTORS FOR MCC'S (66A4A + 66A4A1A1A) + EXISTING CHILLERS (1+2)

= 232 + 24 + 405 + 60 = 721 HP.

NEW MOTOR LOADS TO
TO BE ADDED = 217 HP

TOTAL MOTOR LOADS NEW & EXISTING = 721 + 217 = 938 HP

System: SHORT CIRCUIT CALCULATION
Sheet No. 3 of 9 Sheets
Hvac | Elec | Sanit | Transp. | CUD | A. & S.
By: DKG
Date: 4/10/78

Project Name: LAWRENCE BERKLEY LABORATORY

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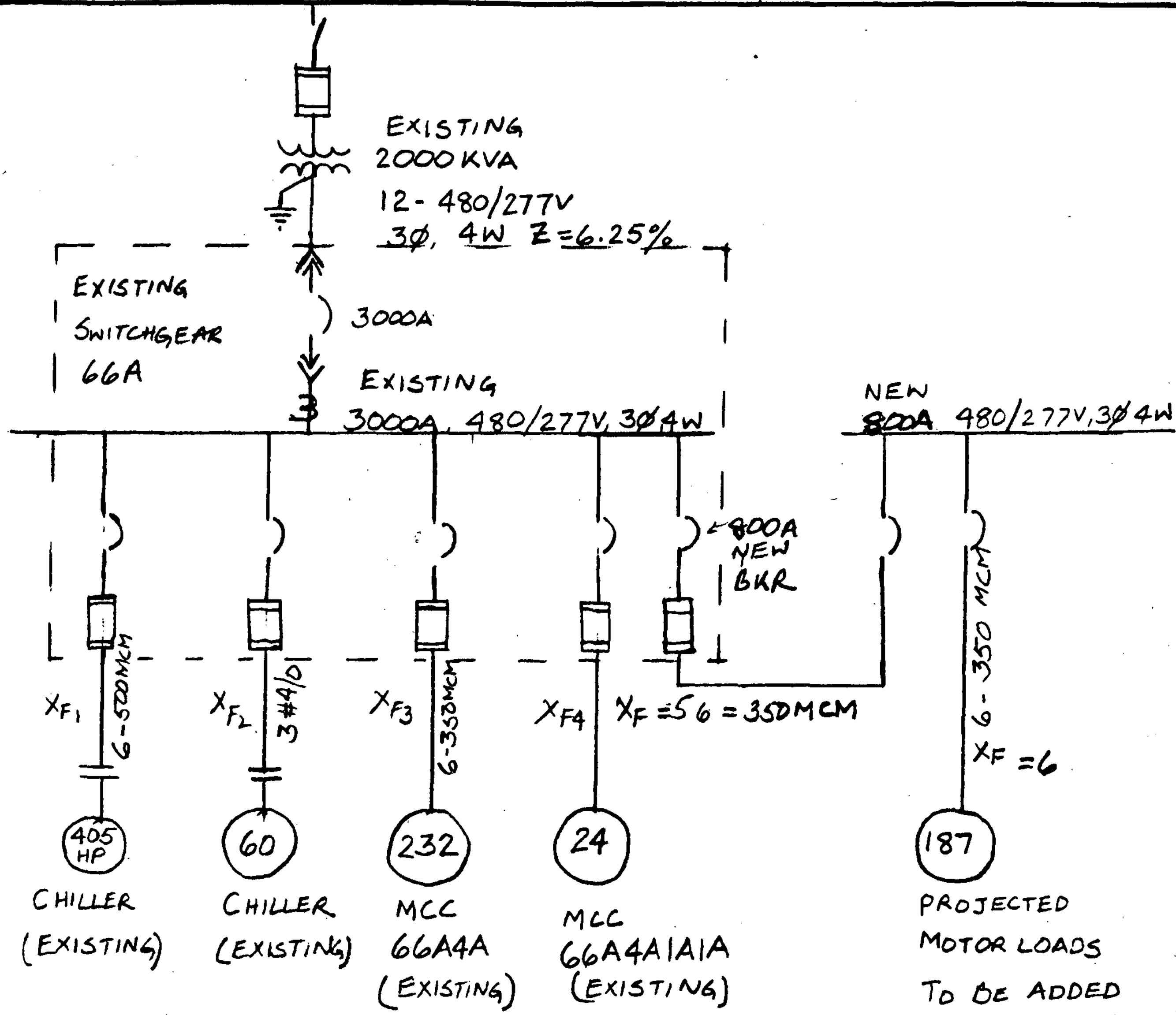

System: SHORT CIRCUIT CALCULATION

Sheet No. 4 of 9 Sheets

Hvac	Elec	Sanit	Transp.	CUD	A. & S.	By	Date
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Project Name: LAWERENCE BERKLEY LABORATORY
Project No.

Syska & Hennessy

2.0 IMPEDANCES

ELEMENT			PER UNIT IMPEDANCE
2.1 UTILITY	$I_S \times \sqrt{3} \times KV$	249 MVA PER L.BL DATA	
2.2 SOURCE	$X_{PU} = \frac{KVA_b}{KVA_{UTILITY}}$	$\frac{1000}{249,000}$	·004
2.3 TRANSFORMER	$X_{PU} = \frac{(\%Z)(KVA_b)}{100\,(TRF\ KVA)}$	(FURNISHED BY MR TEGAN 4/11/78) $\frac{5.4 \quad 1000}{(100)\,(2000)}$	·027
2.4 SWITCH $X = .000113\Omega$	$X_{PU} = \frac{(\Omega)(KVA_b)}{(KV)^2(1000)}$	$\frac{.000113 \times 1000}{(12)^2 \times 1000}$	·00000078 (NEGLECT)
2.5 MAIN CIRCUIT BKR $X = \frac{.2}{\text{BREAKER RATING}}$ REF BEEMAN PG 110.	$X = \frac{.2}{3000} = .00006$ $X_{PU} = \frac{(\Omega)(KVA_b)}{(KV)^2(1000)}$	$\frac{.0006 \times 1000}{(.48)^2 \times 1000}$	·0026
2.6 C.T. REACTANCE $X = 7 \times 10^{-5}\Omega$ ON 1000 KVA BASE REF BEEMAN PG 71, 111	FOR 3 CT'S	$\frac{3 \times 7 \times 10^{-5} \times 1000}{(.48)^2 \times 1000}$	·0009
2.7 BUS REACTANCE FOR APPROX 10' = 2.7% ON 1000 KVA BASE	BEEMAN PG 101	$\frac{2.7 \times 10}{100 \times 1000}$	·00027

System: SHORT CIRCUIT CALCULATION

Sheet No. 5 of 9 Sheets

Hvac | Elec | Sanit | Transp. | CUD | A. & S.

By DKG Date 4/10/78

Project Name	Syska & Hennessy
LAWRENCE BERKLEY LABORATORY	
Project No.	

ELEMENT			PER UNIT IMPEDANCE
2.8 MOTOR REACTANCE $X = .25$ X_{MT1} MCC-66A4A	$X_{PU} = \frac{KVA_b X .25}{HP}$	$\frac{1000 \times .25}{232}$	1.07
2.9 MOTOR REACTANCE X_{MT2} MCC 66A4A 1A1A	$X_{PU} = \frac{KVA_b X .25}{HP}$	$\frac{1000 \times .25}{24}$	10.41
2.10 CHILLER X_{MT3} 405 HP	$X_{PU} = \frac{KVA_b X .25}{HP}$	$\frac{1000 \times .25}{405}$	.617
2.11 CHILLER 60HP X_{MT4}	$X_{PU} = \frac{KVA_b X .25}{HP}$	$\frac{1000 \times .25}{60}$	4.16
2.12 NEW BLDG MCC LOAD X_{MT5} = 217HP	$X_{PU} = \frac{KVA_b X .25}{HP}$	$\frac{1000 \times .25}{217}$	1.15
2.13 FEEDER TO NEW BLDG SWITCHGEAR = 160'	$X_{PU} = \frac{(\Omega)\ KVA_B}{(KV)^2 \times 100}$ 6 # 350MCM 2 PER PHASE $Z = .0617/1000$ FT	200' CABLE 2 SETS $= \frac{.0617}{1000} \times \frac{160}{2} =$ $= .0049 \times 1000 / (.48)^2 \times 1000$	.021
2.14 FEEDER BKR FEEDING NEW SWITCHGEAR	$X = \frac{.2}{800} = .00033$	$\frac{.00033 \times 1000}{(.48)^2 \times 1000}$	.0014

NOTE:- THE IMPEDANCE OF THE CABLES FEEDING MCC'S AND CHILLERS FROM EXISTING MAIN SWITCHGEAR ARE NEGLECTED SINCE THE EQUIPMENT ARE WITHIN 15' FROM SWITCH GEAR. THE REACTANCES OF FEEDERS XF1, XF2, XF3, XF4, XF6 NEGLECTED.

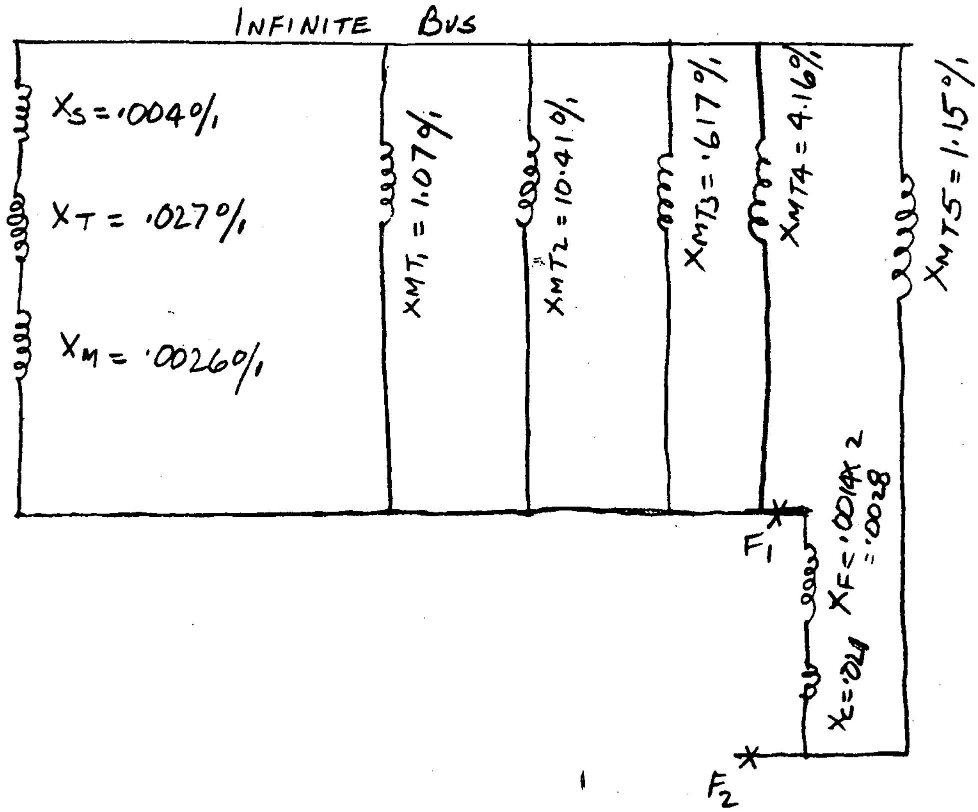
System						Sheet No.	of	Sheets
SHORT CIRCUIT CALCULATION						6	9	
Hvac	Elec	Sanit	Transp.	CUD	A. & S.	By DKG	Date 4/10/78	

Project Name: LAWRENCE BERKLEY LABORATORY

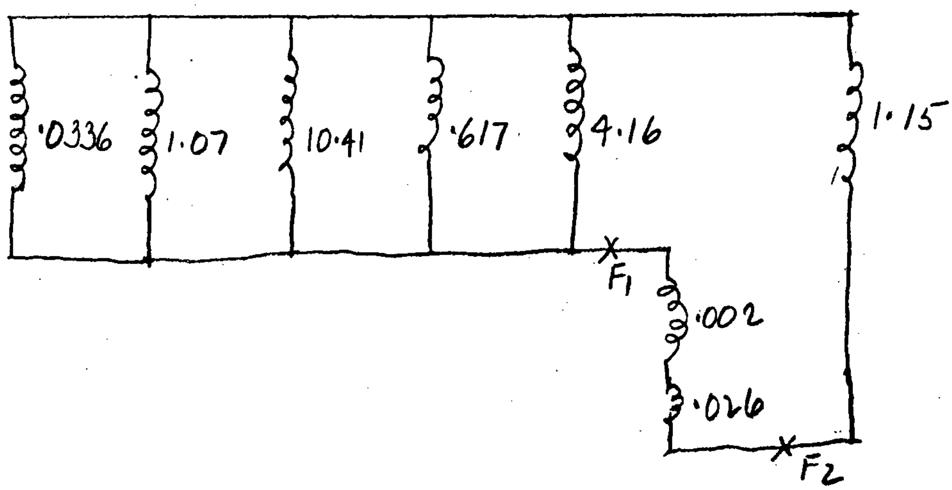
Project No.

Syska & Hennessy

IMPEDANCE DIAGRAM



OR



System						Sheet No.	of	Sheets
SHORT CIRCUIT CALCULATION						7	9	
Hvac	Elec	Sanit	Transp.	CUD	A. & S.	By: DKG	Date: 4/10/78	

Project Name: LAWRENCE BERKLEY LABORATORY	Syska & Hennessy
Project No.	

$$\frac{1}{X_1} = \frac{1}{.0336} + \frac{1}{1.17} + \frac{1}{10.41} + \frac{1}{.617} + \frac{1}{4.16} = 32.573$$

$$X_1 = .03069$$

$$X_2 = 1.15 + .021 + .0028 = 1.1738$$

$$\frac{1}{X_3} = \frac{1}{.03069} + \frac{1}{1.1738} = 33.435$$

$$X_3 = .02990$$

WHERE X_3 = TOTAL SYSTEM IMPEDANCE FOR A FAULT AT F1

SHORT CKT AMPS FOR FAULT AT F1 $= \frac{1000}{\sqrt{3} \times .48 \times .02990}$

$= 40,229$ AMPS

TOTAL SHORT CKT IMPEDANCE FOR A FAULT AT F2

$= .02990 + .0028 + .021 = .0537$

SHORT CKT AMPS FOR FAULT AT F2 (NEW 800A SWITCHGEAR) $= \frac{1000}{\sqrt{3} \times .48 \times .0537} = 22,399A$

NOTE:- THIS SHORT CKT AMPS ARRIVED DO NOT INCLUDE PEAK

System: SHORT CIRCUIT CALCULATION						Sheet No. 8 of 9 Sheets
Hvac	Elec	Sanit	Transp.	CUD	A. & S.	By DKG Date 4/10/78

Project Name
LAWRENCE BERKLEY LABORATORY
Project No.

Syska & Hennessy

LET THRU AMPS AND PROSPECTIVE SYMMETRICAL AMPS.
SINCE CALCULATION MADE FOR STD MOLDED CASE BREAKER.
HOWEVER IF A TRIPAC BREAKER IS USED IN THE EXISTING SWITCHBOARD (AS IN THIS CASE), THE 600A FUSED TRIPAC BREAKER IN THE LINE SIDE WILL SEE 15,000 AMPS PROSPECTIVE SHORT CIRCUIT CURRENT (SEE BUSSMAN GRAPH AS ENCLOSED) WITH AVAILABLE 40,229 AMPS. SHORT IN THE EXISTING SWITCHGEAR 66A.

CONCLUSION

1. THE NEW BREAKER IN THE EXISTING SWITCHGEAR FEEDING THE NEW BUILDING SWITCHBOARD SHALL BE 800A FUSED TRIPAC.

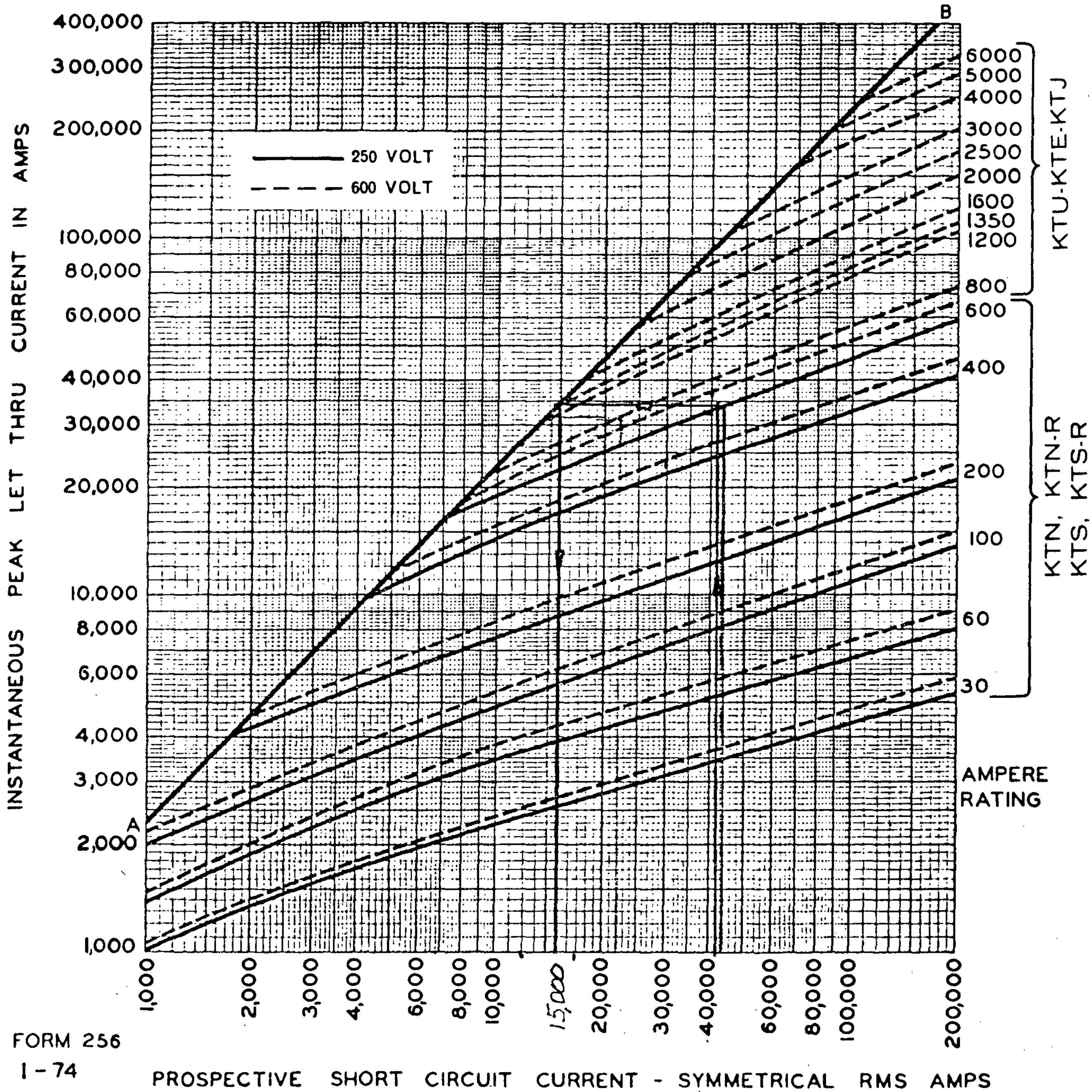
2. THE NEW MAIN DIST PANEL SHALL HAVE MAIN BREAKER STANDARD WITH NON AUTOMATIC TRIP.

3. THE FEEDER BREAKERS OF THE MAIN DIST PANEL SHALL BE ALL STANDARD MOLDED CASE BKRS WHICH HAS STD SHORT CKT WITHSTANDABILITY OF 22,000A.

System						Sheet No. 9 of 9 Sheets
SHORT CIRCUIT CALCULATION						
Hvac	Elec	Sanit	Transp.	CUD	A. & S.	By DKG Date 4/10/78

DATA SECTION—CHART NO. 2

Current Limiting Effect of LIMITRON Fast-Acting Fuses
KTN, KTN-R (250 Volts a-c); KTS, KTS-R, KTU (600 Volts a-c)



FORM 256
1 - 74

NOTE: F.C. = FOOT CANDLE
hRC = ROOM CAVITY HEIGHT

ILLUMINATION CALCULATIONS

RM. NAME	L=LENGTH W=WIDTH L×W (L=FT W=")	TOTAL AREA IN SQ.FT.	TITLE #24 TASK #	FT^2/OCC / #/OCC	TASK AREA / GEN. AREA	TASK WATTS/FT^2 / GEN. WATTS/FT^2	WATTS ALLOWED / WATTS USED	LAMP, FIXT. & F.C. DETAIL: COEFF. OF UTILIZ.	MAINT. FACTOR	LUMENS/LAMP / WATTS/FIX	#FIX / #LPS	F.C. I.E.S / F.C. DERIVED	RM. CAVITY RATIO: 5 × hRC × (L+W) / L × W	RCR
GENERAL OFFICE ENTRY LEVEL	50×32	1600	240	100	1600	5	8,000	.61	.85	3150 / 184	30 / 3	100	5 × 7 × (82)	1.8
				16	X	X	5520	AREA: 1600				92	1600	
OPTION (A) CENTER LABS	13×24	312	154 #1	80	200	4.1	200×4.1+112×1.4 820+157=977	.49	.8	3150 / 184	8 / 4	100	5 × 7 × (37)	4.1
				4	112	1/3 (4.1) = 1.4	1472	AREA: 312				137	312	
OPTION (B) CENTER LABS CHOOSE	"	"	"	"	"	"	977	.49	.8	3150 / 147	8 / 3	100	5 × 7 × (37)	4.1
				"	"	"	1176	AREA: 312				95	312	
END BUILDING LAB OPTION (A)	12×23	276	154 #1	80	170	4.7	170×4.7+1.6×106 799+170=969	.46	.8	3150 / 184	8 / 4	100	5 × 7 × (35)	4.4
				3.4	106	1/3 (4.7) 1.6	1472	AREA: 276				134.4	276	
" OPTION (B)	"	"	"	"	"	"	969	.46	.8	3150 / 147	8 / 3	100	5 × 7 × (35)	4.4
				"	"	"	1176	AREA: 276				100.4	276	
OPTION (C) " CHOOSE	"	"	"	"	"	"	969	.46	.8	3150 / 184	6 / 4	100	5 × 7 × (35)	4.4
				"	"	"	1104	AREA: 276				100.4	276	
OPTION (D)	"	"	"	"	"	"	969	.46	.8	3150 / 184	6 / 3	100	" " "	4.4
				"	"	"	882	AREA: 276				75.6	"	

Project L.B.L. U.C. CALIF.
Job No 690-01 Sheet 1 of 2
Date 4/18/78 By: DKG

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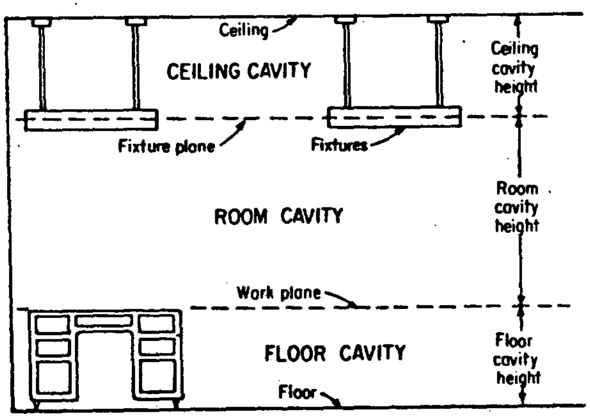
ILLUMINATION CALCULATIONS

NOTE: F.C. = FOOT CANDLE
h_{RC} = ROOM CAVITY HEIGHT

RM. NAME	L=LENGTH W=WIDTH L×W (L=FT, W=")	TOTAL AREA SQ FT	TITLE #24 TASK #	FT^2/OCC / #/OCC	TASK AREA / GEN. AREA	TASK WATTS/FT^2 / GEN. WATTS/FT^2	WATTS ALLOWED / WATTS USED	COEFF OF UTILIZ.	MAINT. FACTOR	LUMENS/LAMP / WATTS/FIX	#FIX / #LPS	F.C. I.E.S / F.C. DERIVED	RM. CAVITY RATIO $\frac{5 \times h_{RC} \times (L+W)}{L \times W}$	RCR
END OFFICE	11×12	132	240	100	50	6	50×6 + 82×2 300 + 164 = 464	.41	.85	3150 / 184	2 / 4	100	5× 7 × (23)	6.09
				1	82	2	368	AREA: 132				70.4	132	
END OFFICE OPTION (A)	23×14	322	240	100	150	6	150×6 + 172×2 900 + 344 = 1244	.49	.85	3150 / 184	3 / 4	100	5× 7 × (37)	4.02
				3	172	2	552	AREA: 322				49	322	
" OPTION (B) CHOOSE	"	"	"	"	"	"	1244	.49	.85	3150 / 184	6 / 4	100	5× 7 × (37)	4.02
				"	"	"	1104	AREA: 322				97.8	322	

NOTE ① SEE PAGE 3 FOR DERIVED FOOT CANDLE OF GENERAL OFFICE
OTHER FOOT CANDLES CAN BE FOUND SIMILARY.



ZONAL CAVITY NOMENCLATURE

② MOUNT ALL THE FIXTURES NOT MOR THAN 10' FROM THE FLOOR.

Project L.B.L. U.C. CALIF
Job No. L90-01 Sheet 2 of 2
Date 4/18/78 By: DKG

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FIG. 1—Zonal cavity calculations

Date	Designed by	Job	Room
4/18/78	DKG	L90-01-000	GENERAL OFFICE

A. Room data

Room dimen.	Length	1	50 ft
	Width	2	32 ft
	Floor area	3	1600 sq ft
	Ceiling ht.	4	10 ft
Surface reflect.	Ceiling	5	80 %
	Wall	6	50 %
	Floor	7	20 %
Fixture mounting ht.		8	10 ft

B. Cavity data

Room cavity	Height	9	7 ft
	Ratio	10	1.8
Ceiling cavity	Height	11	0 ft
	Ratio	12	0
	Eff. reflectance	13	80 %
Floor cavity	Height	14	3 ft
	Ratio	15	.79
	Eff. reflectance	16	27%

C. Fixture data

Mfr.	17	WESTINGHOUSE
Cat. No. etc.	18	LIGHTING HANDBOOK
Lamps per fixture	19	4
Lumens per lamp	20	3150
Coeff. of utilization	21	.5
Maintenance factor	22	.85

D. Footcandles

No. of fixtures required to produce a given number of footcandles

Desired lighting level	23	/ fc
No. of fixtures	24	30

No. of footcandles produced by a given no. of fixtures

Option a	25 30 fixtures	28 fc
Option b	26 fixtures	29 fc
Option c	27 – fixtures	30 – fc

E. Calculating cavity ratios

$$\text{Cavity ratio} = \frac{5 \times \text{cavity height} \times (\text{length} + \text{width})}{\text{length} \times \text{width}}$$

ROOM:

$$\frac{5 \times \text{line 9} \times (\text{line 1} + \text{line 2})}{\text{line 1} \times \text{line 2}} = \frac{5 \times 7 \times (50 + 32)}{50 \times 32} = 1.8 \text{ (Line 10)}$$

1

CEILING:

$$\frac{5 \times \text{line 11} \times (\text{line 1} + \text{line 2})}{\text{line 1} \times \text{line 2}} = \frac{5 \times \_\_ \times (\_\_ + \_\_)}{\_\_ \times \_\_} = \_\_ \text{ (Line 12)}$$

FLOOR:

$$\frac{5 \times \text{line 14} \times (\text{line 1} + \text{line 2})}{\text{line 1} \times \text{line 2}} = \frac{5 \times \_\_ \times (\_\_ + \_\_)}{\_\_ \times \_\_} = \_\_ \text{ (Line 15)}$$

F. Calculating number of fixtures

$$\text{No. fixtures} = \frac{\text{floor area} \times \text{desired footcandles}}{\text{lamps per fixture} \times \text{lumens per lamp} \times \text{coeff. of utilization} \times \text{maintenance factor}}$$

$$= \frac{\text{line 3} \times \text{line 23}}{\text{line 19} \times \text{line 20} \times \text{line 21} \times \text{line 22}} = \frac{\_\_ \times \_\_}{\_\_ \times \_\_ \times \_\_ \times \_\_} = \_\_ \text{ (Line 24)}$$

G. Calculating footcandles

$$\text{Footcandles} = \frac{\text{no. of fixtures} \times \text{lamps per fixture} \times \text{lumens per lamp} \times \text{coeff. of utilization} \times \text{maintenance factor}}{\text{floor area}}$$

Option a:

$$\frac{\text{line 25} \times \text{line 19} \times \text{line 20} \times \text{line 21} \times \text{line 22}}{\text{line 3}} = \frac{30 \times 4 \times 3150 \times .5 \times .85}{1600} = 100.4 \text{ (Line 28)}$$

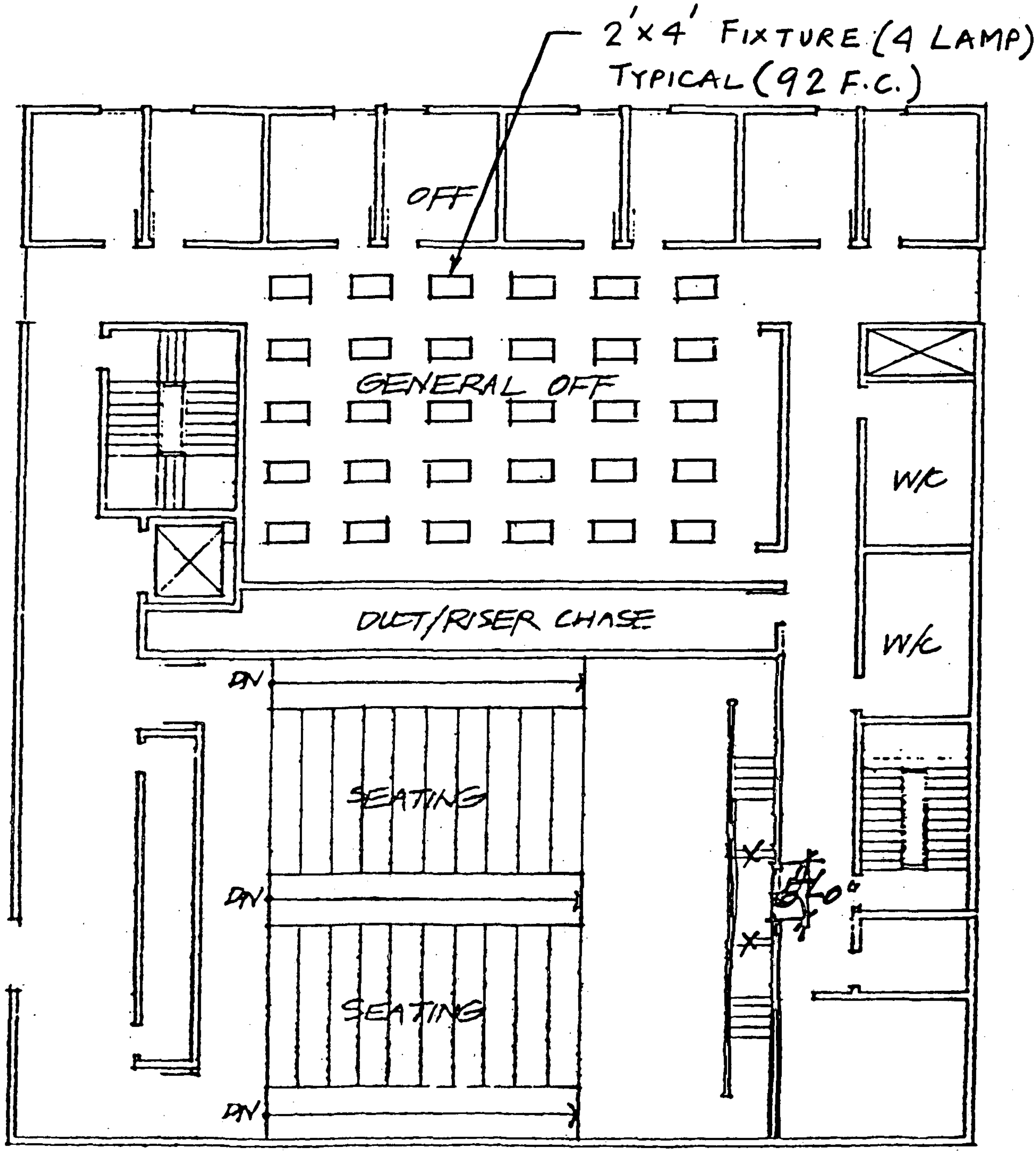
Option b:

$$\frac{\text{line 26} \times \text{line 19} \times \text{line 20} \times \text{line 21} \times \text{line 22}}{\text{line 3}} = \frac{\_\_ \times \_\_ \times \_\_ \times \_\_ \times \_\_}{\_\_} = \_\_ \text{ (Line 29)}$$

Option c:

$$\frac{\text{line 27} \times \text{line 19} \times \text{line 20} \times \text{line 21} \times \text{line 22}}{\text{line 3}} = \frac{\_\_ \times \_\_ \times \_\_ \times \_\_ \times \_\_}{\_\_} = \_\_ \text{ (Line 30)}$$

Project Name LAWRENCE BERKLEY LABORATORY	Syska & Hennessy
Project No.	

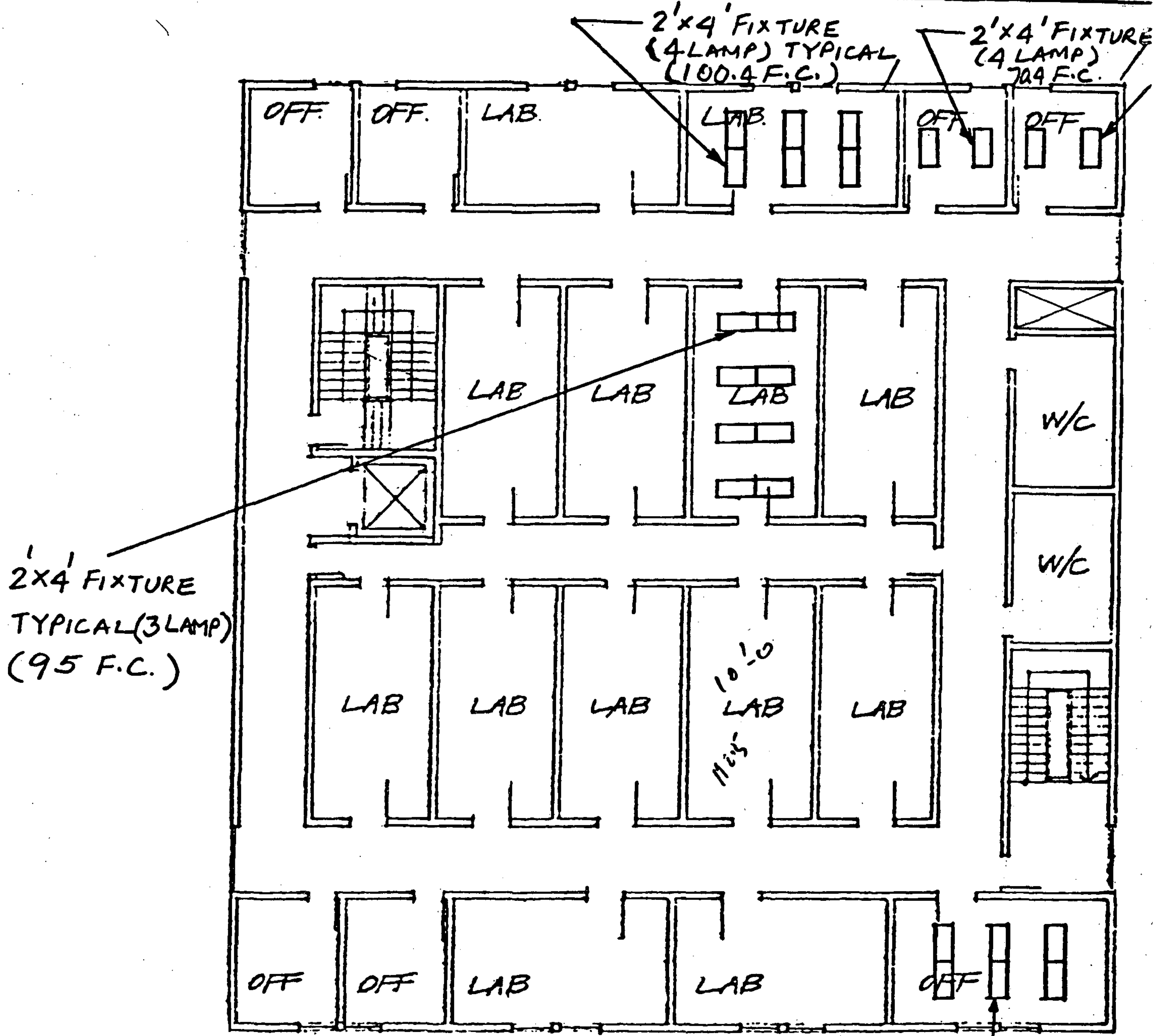


SCALE = 1/16" = 1'=0"

FIGURE – 1

ENTRY LEVEL

Project Name LAWRENCE BERKLEY LABORATORY	Syska & Hennessy
Project No.	



SCALE = 1/16" = 1'=0"

FIGURE - 2

2ND FLOOR

2'x4' FIXTURE (3 LAMP) TYPICAL (97.8 F.C.)

BASIS OF ELECTRICAL DESIGN CALCULATIONS

A. Existing switchgear No. 66A of existing building shall feed the main distribution panel to be located in the basement of the new Addition as indicated in the Riser Diagram.

B. Lighting shall be served form 277/480 volts lighting panels at each floor. A main lighting feeder shall run from basement to the third floor. Branch feeders from lighting panels shall be tapped from main feeder as indicated in the Riser Diagram.

C. Two main risers at 480 V, one at each end of the building shall serve the distribution panels which will feed the transformers 480-120/208V to be located in the duct/riser space at end of the floors. Power shall be fed from these transformers to 120/208V distribution panelboards located in the same space. These distribution panels shall feed respective laboratory appliance panels located in the laboratories as indicated in the Riser Diagram. Laboratory power outlets shall be served at 120 volts single phase.

D. Mechanical equipment shall be from a motor control panelboard in the basement connected to main distribution panel. Critical exhaust fans shall be served from motor control panelboard on the roof connected to the emergency power panel to be located in the 1st floor, as indicated in the Riser Diagram.

E. Emergency power for the new laboratory building will be supplied by a new 30KW Diesel-Generator set, complete with automatic transfer switch.

F. For load analysis of normal and emergency power refer to electrical load calculation.

G. Lighting:

1. The lighting shall be based on Title #24 Energy Standard and IES Standard. General lighting fixtures in the offices, laboratories, corridors, Conference Room, and areas with 2' x 4' modular acoustical ceilings will be 2' x 4' recessed fluorescent fixtures with acrylic, prismatic lenses and two, three or four rapid-start lamps to give the following intensities:

   (1) Laboratories - 90-100 F.C.
   (TASK)

   (2) Offices, 70-100
   (TASK)

   (3) Corridors, lobby, and means of egress, 10 FC to 20 FC.

   (4) Conference Room, 30 FC to 50 FC with dimming controls.

2. Lighting fixtures in the offices and laboratories shall be controlled by two switches to provide two distributed levels of lighting for energy conservation.

3. Lighting in rest rooms and toilets will be 15 to 30 FC using surface-mounted fluorescent fixtures with acrylic wrap-around lenses.

4. Lighting in the service corridors and other areas without finished ceilings will be 10 FC to 20 FC using industrial fluorescent fixtures.

5. Incandescent accent lighting will be provided in public areas as required for architectural effect.

6. Outdoor lighting will be provided where required for use and architectural accent.

7. Outdoor lighting will be provided in corridors, laboratories, stairwells and other public areas by connected selected fixtures of the general lighting system to emergency circuits.

8. Exit lights, connected to the emergency system, will be provided where required by codes.

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