ABA-83

DESIGN CRITERIA REPORT

FOR

END STATION "A"

REPORT TO STANFORD LINEAR ACCELERATOR CENTER - NO. ABA-83

STANFORD UNIVERSITY - ABA SUBCONTRACT S-136

UNDER STANFORD - AEC CONTRACT AT(04-3)-400

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FOR

END STATION "A"

CONTENTS

I. INTRODUCTION

This report presents the design criteria for performing the Title I design of the End Station "A" building, to a line five feet outside the building.

Included are criteria for:

A. The End Station "A" structure.

B. Mechanical house utilities.

C. Electrical house utilities.

D. Retaining walls.

Magnet power and cooling water utilities will be covered in a separate Target Area and Site Improvements Report.

The building is located in accordance with SLAC Drawing GP 863-305 R1.

Building mechanical, electrical and space requirements were defined in SLAC Drawing GP 863-302 R1 and an undated and unsigned "Proposed Criteria Relative to End Station "A" Building Criteria Report" received by ABA October 16, 1963. Additional and modified criteria were established in supplemental memoranda and in minutes of meetings.

II. DESIGN CRITERIA

A. GENERAL

End Station "A" will be a large single story structure located in the Target Area at the eastern end of the Beam Switchyard. Its basic function will be to house some of the research experiments for which the SLAC Project was intended.

No fixed number of occupants can be established, occupancy being determined by personnel required during set up of experiments within the building. Radiation safety dictates that the building shall not be occupied while experiments are in progress.

B. ARCHITECTURAL-STRUCTURAL

1. Design. The architectural design of this building is a departure from the vocabulary established for the Campus and Shops areas on the project site. This departure results from the functional and structural requirements of the building. However, the Target Area is far enough from Shop and Campus areas so that differences in architectural treatment will not be seen simultaneously.

2. Structure. The structure will be entirely of reinforced concrete and will be made up of precast, prestressed and poured-in-place elements. The use of concrete was predicated upon the requirement that all roof and wall areas provide a shielding mass of 300 pounds per square foot.

3. Roof. The use of prestressed concrete roof beams spanning the width of the building was brought about by the effort to reduce the weight of the roof system as much as possible and to maintain a column free floor area. It is intended that these beams be cast on the ground and lifted into position, thereby eliminating the need for high forming. Also, the top flange of these members will serve as a form and be tied into the poured-in-place portion of the slab, so that the entire slab acts structurally.

A 30 psf roof live load will be used in order to accommodate possible future random placement of mechanical equipment.

4. Floor. Maximum shielding loads will be 5600 psf distributed to the floor from 10 foot thick parallel walls spaced 15 feet apart. The 15 feet of floor space between these walls of shielding will be subjected to concentrated magnet loads amounting to a maximum of 20 tons each on 8-inch diameter bases spaced 3 feet on centers. The thickness of concrete floors will be kept to a minimum.

The floor will be founded on undisturbed soil wherever possible and will be kept structurally separate from the building walls. Underfloor ducts will be limited to those specified by SLAC.

5. Special Features. A 10% roof slope to a center ridge will be used in order to facilitate the flow of hydrogen gas to shielded exhaust openings provided through the roof slab between each beam.

The building will be windowless because of shielding requirements. 32 foot by 40 foot shielded openings will be provided to permit passage of large research assemblies into the building. One of these openings will be shielded by a 2 foot thick mechanically operated door. The other opening will be protected by removable shielding blocks which are to be covered in a separate Shielding Criteria Report.

105 foot long by 15 foot high clear openings will be provided in the north and south walls in order to provide maximum possible uninterrupted space for experimental set-ups which extend outside of the building. These openings, along with the one in the east wall, will be protected by removable shielding blocks which are to be covered in a separate Shielding Criteria Report. Three 4 foot by 8 foot man doors will be located in these shielding blocks for emergency exit and exhaust requirements.

Openings protected by removable shielding blocks will be sealed with weather proof siding.

Ports provided with removable concrete plugs will be located in the building walls to accommodate portable hydrogen exhaust systems.

The west wall of the building also serves as a retaining wall for the earth shielding over that portion of the Beam Switchyard abutting the End Station.

Three tunnels having 8 foot by 8 foot clear inside dimensions will be located under the floor for the purpose of bringing utilities and ventilation air into the building. Floor openings into the tunnels will be 3 feet by 6 feet and will be provided with two types of removable covers: a) One will be solid and capable of supporting the maximum floor loads and, b) the other will be an open grating type required to carry only moderate floor loads.

The superstructure will be designed to resist only those loads and forces acting on the present building. Foundations of the north wall, however, will be sized to accommodate both the present building and a future similar building.

6. Building Data:

Length (inside)	200 ft.
Width (inside)	125 ft.
Height (to bottom of roof beams)	65 ft.
Total Floor Area	25,000 square feet

C. MECHANICAL

1. Ventilation. The ventilation will be by means of a roof-ridge exhaust fan-plenum extending the length of the building. The fan-plenum will receive air from the highest point of the building through shielded openings in the 2-foot thick roof slab. Fans spaced along the length of the plenum will exhaust the air through automatic dampers. The fan motors will be explosion proof.

In order to meet hydrogen safety requirements, the ventilation design

will be based upon a two minute air change of the upper 20 feet of the building. The exhaust fans will be manually controlled. An override control will provide for full capacity operation when called for by the hydrogen detection system.

Normal ventilation requirements will be met by air supplied from the utility tunnels up through the grating covered floor openings. The three 4 foot by 8 foot man doors, or equivalent area, located in the shielding blocks will be opened automatically when more than 50% of the fans are operating to meet high summer ventilation or hydrogen purge air intake requirements. Radiation safety requirements dictate that safety barriers be provided at these openings in order to prevent personnel entry while permitting emergency exit.

2. Piping. Piping for 110 psig general purpose compressed air will be included in the tunnels from 5 feet outside the building to the floor opening manholes. Domestic water will be handled in a similar manner with threaded hose connections being provided just below the floor openings. Provision of these utilities to the 5 foot line outside the building will be covered in a separate Target Area Utilities and Site Improvements Report.

3. Other Services. Low Conductivity water will be provided in the tunnels and included in the Target Area Utilities and Site Improvements Report.

There will be no drinking water or toilet facilities provided within the building. Toilet facilities will be provided outside the building and included as part of the Target Area Utilities and Site Improvements Report.

D. ELECTRICAL

1. Power. Electrical house power will be supplied from the Research Area Substation (which will be covered in the Target Area Utilities and Site Improvements Report) at 480 volts, 3 phase, 60 cycles. Power will be transformed down to 110/208 volts at various locations as required.

2. Lighting. Pressurized mercury-vapor fixtures with about 10% pressurized incandescent fixtures will provide a minimum illumination of 10 foot-candles at floor level. The fixtures are to be pendant mounted from the ceiling to just above crane level.

Explosion-proof emergency lighting will be provided from a separate battery powered system.

A minimum amount of exterior security lighting will be provided at door and wall locations. Mounting heights will be 35 foot maximum, and lighting will be just enough to permit viewing of the entire building perimeter.

3. Receptacles. A 480 volt, 3-phase, 100 ampere receptacle will be provided in each utility manhole in the floor and on building columns and walls 4'-0" above the floor. Also, at each of these locations, two duplex 120 volt, single-phase, 20 ampere receptacles on separate circuits will be installed. A demand load of approximately 500 kw total house power shall thus be provided.

4. Power Distribution. Power at 480 volts, 3-phase will be provided for bridge crane service and for service to roof mounted ventilation fans.

5. Emergency Power. Approximately 50 kw of emergency power will be provided and automatically switched to designated receptacles, emergency lighting and exhaust fans during periods of conventional power outage. Emergency power beyond the 5 foot limit will be covered under the Target Area Utilities and Site Improvements Report.

6. Electric Heating. About 200 kw of heating will be provided from infra-red lamps or quartz fixtures mounted on the walls and suspended from the ceiling.

7. Grounding System. The separate copper grounding bus system in the Klystron Gallery will be extended to End Station "A" and will be covered

under the Target Area Utilities and Site Improvements Report. This bus system will be extended into the building through the underfloor tunnels and is to be available at each manhole for equipment grounding. The craneways are to be connected to this bus system. The grounding of the neutral bus of the electrical power system will be kept separate from the equipment grounding system.

8. Magnet Power. Additional high voltage power will be provided for magnets at the utilities manholes in the floor. This power will be covered in the Target Area Utilities and Site Improvements Report and is not included in house power.

E. HYDROGEN DETECTION SYSTEM

1. Detectors. Individual head type detectors will be installed under the roof to detect hydrogen before explosive concentrations can accumulate. A separate alarm system will be provided to denote when hydrogen has been detected.

2. Power Interlocks. Powers for the crane, heating, general lighting and other hazardous circuitry will be interlocked with the hydrogen detection system so as to be disconnected when hydrogen has been detected.

Exhaust fans and 4 foot by 8 foot man doors in the shielding will also be interlocked with the detection system. Upon detection of a hydrogen concentration, all fans will be actuated and the doors opened.

Emergency lighting and exhaust fans will remain operative at all times.

F. FIRE ALARM SYSTEM

The project fire alarm system will be extended into the building. Auxiliary boxes and alarm horns will be provided. The master fire alarm box will be provided at an exterior location.

G. COMMUNICATIONS

Provisions will be made for telephone and intercom systems. Cable and communication equipment is not included in the report.

H. CRANE

The crane will be a cab operated electric overhead crane consisting of one 50-ton capacity bridge carrying two trolleys, each with a 25-ton main hoist and a high speed 5-ton auxiliary hoist. Spark hazards are to be minimized. The crane is to be located high enough to provide a minimum 50 foot clearance under the bridge or 50 foot hook height.

I. RETAINING WALLS

The retaining wall north of the building and the portion of wall between End Stations "A" and "B" that is in line with the south wall of End Station "A" are included in this report. Also included is Beam Switchyard shielding fill which cannot be placed until after the retaining wall and building are completed.

J. EXTERIOR CONCRETE PAD

The exterior concrete pad on the north, east and south sides of the building will be included in the Target Area Utilities and Site Improvements Report.

III. DESIGN AND CONSTRUCTION SCHEDULE

Criteria	Preliminary Draft Submittal	14 November 1963
Criteria	Review and Comments from SLAC	2 December 1963
Criteria	Final Submittal	6 December 1963
Criteria	Review and Approval by SLAC & AEC	24 December 1963
Title I	Preliminary Draft Submittal	28 February 1964
Title I	Draft Review Completed by SLAC & AEC	27 March 1964
Title I	Final Submittal	10 April 1964
Title I	Review and Approval SLAC & AEC	1 May 1964
Title II	50% Submittal	7 July 1964
Title II	90% Submittal	1 September 1964
Title II	Revised and Ready for Bid	15 October 1964
Bid Opening		13 November 1964
Notice to Proceed		15 December 1964
Construction Completed		25 November 1965

IV. DRAWING LIST

SKA-12063-A	Rev. 1	Site Plan
SKA-11143-B	Rev. 1	Floor Plan - Section
SKA-11143-C	Rev. 1	Elevations
SKA-11143-D	Rev. 1	Elevations

V. PRELIMINARY COST ESTIMATE

END STATION "A"

ACCOUNT NUMBER	ITEM	AVERAGE UNIT COST	QUANTITY	ITEM COST	TOTAL COST
561	STRUCTURAL				
	Foundation Excavation & Backfill	$ 2.89	46,000 CY	$ 132,800	
	Foundation Concrete - including provision for future expansion and floor slab.	60.00	3,230 CY	193,800	
	Wall & Columns - including exterior treatment	101.50	6,740 CY	684,100	
	Roof Slab, Beams, Fascia, Vent. Baffles	97.50	3,605 CY	351,500	
	Tunnels and Manholes	325.70	420 LF	136,800	
	Mechanical Concrete Door	-	1 EA.	72,000	
	Roofing and Downdrains	-	-	16,200	
	Miscellaneous Metal - including shielding block attachments, man doors, site screens, crane rail attachments.	-	-	20,400	
	Weatherproof Siding - including seals	2.50	6,000 SF	15,000	
	SUB TOTAL				$1,622,600
561	MECHANICAL				
	Ventilation - including hydrogen exhaust	-	-	$ 40,000	
	Piping	-	-	4,000	
	SUB TOTAL				$ 44,000
561	ELECTRICAL				
	Building Electrical - including grounding	-	-	$ 80,500	
	Electric Infra-red Heating	-	-	12,000	
	Hydrogen Detection System	-	-	20,000	
	Communications and Fire Alarm	-	-	5,000	
	SUB TOTAL				$ 117,500
561	RETAINING WALLS				
	SUB TOTAL	-	-	$ 60,000	
					$ 60,000*
		TOTAL COST			$1,844,100
7-934	50-TON CRANE AND RAILS	TOTAL COST			$ 173,500

* The budgeted allowance of $60,000 is shown and is subject to changes since the final configuration of the retaining walls has yet to be determined.

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V. PRELIMINARY COST ESTIMATE

END STATION "A"

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561	STRUCTURAL				
	Foundation Excavation & Backfill	$ 2.89	46,000 CY	$ 132,800	
	Foundation Concrete - including provision for future expansion and floor slab.	60.00	3,230 CY	193,800	
	Wall & Columns - including exterior treatment	101.50	6,740 CY	684,100	
	Roof Slab, Beams, Fascia, Vent. Baffles	97.50	3,605 CY	351,500	
	Tunnels and Manholes	325.70	420 LF	136,800	
	Mechanical Concrete Door	-	1 EA.	72,000	
	Roofing and Downdrains	-	-	16,200	
	Miscellaneous Metal - including shielding block attachments, man doors, site screens, crane rails and attachments.	-	-	23,900	
	Weatherproof Siding - including seals	2.50	6,000 SF	15,000	
	SUB TOTAL				$1,626,100
561	MECHANICAL				
	Ventilation - including hydrogen exhaust	-	-	$ 40,000	
	Piping	-	-	4,000	
	SUB TOTAL				$ 44,000
561	ELECTRICAL				
	Building Electrical - including grounding	-	-	$ 80,500	
	Electric Infra-red Heating	-	-	12,000	
	Hydrogen Detection System	-	-	20,000	
	Communications and Fire Alarm	-	-	5,000	
	SUB TOTAL				$ 117,500
561	RETAINING WALLS	-	-	$ 60,000	
	SUB TOTAL				$ 60,000*
		TOTAL COST			$1,847,600
7-934	50-TON CRANE	TOTAL COST			$ 170,000

* The budgeted allowance of $60,000 is shown and is subject to changes since the final configuration of the retaining walls has yet to be determined.