TITLE I REPORT

ON

END STATION "A"

REPORT TO STANFORD LINEAR ACCELERATOR CENTER - NO. ABA-91
STANFORD UNIVERSITY - ABA SUBCONTRACT S-136
UNDER STANFORD - AEC CONTRACT AT(04-3)-400

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TITLE I REPORT

ON

END STATION "A"

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I. INTRODUCTION

A. SCOPE

This report presents the Title I work performed in regard to the End Station "A" Building. Included are preliminary drawings of site plans, building plans and elevations and mechanical and electrical schematics. Also included are outline specifications, schedule of work and a preliminary construction cost estimate.

B. FACILITIES

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 since occupancy will be determined by the number of personnel required during the set up of experiments within the building. No toilet facilities will be provided in the building. They will be provided in the area north of the building as part of the Target Area Utilities.

Included as part of the facilities will be a Counting House located atop the Beam Switchyard shielding fill outside of and adjacent to the west wall of End Station "A". Electronic equipment and personnel for control and compilation of experimental data on End Station "A" research will be housed in this structure. The building will be occupied by an average of six persons during normal operation.

Toilet facilities will be provided within the Counting House for the occupants of this building.

Other facilities related to the Counting House will be a stair and an elevator, each located on the face of the retaining wall west of End
Station "A". An accessway will be located in the fill behind the retaining wall from the elevator and stair to the End Station for personnel use.
II. BASIS FOR DESIGN

A. SITE

1. Location.

End Station "A" is located over the Target Area end of the "A" Beam which is 24.5° north of the Accelerator, or Central, Beam Axis. The "A" Beam is one of several diverted from the Central Beam Axis in the Beam Switchyard just west of the Target Area.

2. Preparation.

The End Station site will be rough graded and seal coated under another contract so that work can be accomplished in winter months. The concrete paving adjoining the building is intended to accommodate experimental set-ups which may extend outside the End Station, but is not included in this report.

B. END STATION "A"

1. General.

The End Station is sized to accommodate large experimental set-ups and equipment in a structure with a floor area uninterrupted by partitions or columns.

Future expansion, in the form of a similar building, is contemplated on the north side of End Station "A" for the A' Beam.

Pertinent Data

<table>
<thead>
<tr>
<th>Description</th>
<th>Value</th>
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<tbody>
<tr>
<td>Length (inside)</td>
<td>200 feet</td>
</tr>
<tr>
<td>Width (inside)</td>
<td>125 feet</td>
</tr>
<tr>
<td>Height (to low point of roof beams)</td>
<td>61 feet approximately</td>
</tr>
<tr>
<td>Total Floor Area</td>
<td>25,000 square feet</td>
</tr>
</tbody>
</table>

The building height is governed by the requirement for a 50-foot clearance under the overhead crane bridge and/or by the required 50-foot hook height.
2. Architecture.

The architectural design of the End Station 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.


Walls, columns and roof deck of the End Station will be of precast and poured-in-place reinforced concrete. 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.

The roof deck will be made up of poured-in-place concrete cast over precast slab units supported by structural steel beams.

The use of structural steel roof beams spanning the width of the building was introduced through efforts 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 shored in position until after the concrete roof deck is in place, complete, since they are designed to have composite action with the deck.

The roof will be designed for conventional roof loading plus an allowance for possible future placement of mechanical equipment.

The floor will be founded on undisturbed soil wherever possible and kept structurally separate from the building walls. The thickness of concrete floors will be kept to a nominal 6 inches. Heavy floor loads will be distributed by means of special bases or frames by the building occupants.
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. A broad horizontal concrete beam provides the upper support for west wall counterforts at the same time serving as subfloor for the Counting House removable floor panels. Also, the Counting House floor area remains uninterrupted by counterforts through use of the horizontal beam.

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.

4. **Special Architectural-Structural Features.**

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

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

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 concrete door equipped with a separate mechanical means of emergency opening. The other opening will be protected by removable shielding blocks which are to be covered in a separate Shielding 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 95-foot by 15-foot opening in
the east wall, will be protected by removable shielding blocks which are
to be covered in a separate Shielding Report. Three 4-foot by 8-foot man
doors will be located in these shielding blocks for emergency exit and ex-
haust requirements. Gates at these doors will permit emergency exit and
air intake while prohibiting personnel entry when experiments are in pro-
gress. The doors themselves, normally closed, will automatically open for
hydrogen purge or summer ventilation requirements.

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

Three underground utility housings having 8-foot by 8-foot clear
inside dimensions will be located under the floor for the purpose of bring-
ing utilities and ventilation air into the building. Floor openings into
the housings 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
heavy floor loads, and b) the other will be an open grating type required
to carry only moderate floor loads. Gates provided at the south end of
the housings will keep personnel from entering under the building when an
experiment is in progress while permitting emergency exit. The north
end of the housings will be removable in order to facilitate future expan-
sion.

The main underground utility housing south of the building and
housing extending over to the End Station "B" header housing will be in-
cluded in the End Station "A" construction package. Cost estimates for these
housings will be included in a separate Target Area and Site Improvements
Report.

Four viewing ports will be provided in the west wall between
the End Station and Counting House. These are to be 36 inches in dia-
meter and will be spaced evenly along the wall, thereby providing two
openings at the present Counting House and two for a similar future extension. Sleeves will also be placed in the west wall at the level of the Counting House subfloor cable space.

A crane access cat-walk, running the full length of the building, will be provided at the south wall.

5. Mechanical.

a. Ventilation. The exhaust system will include roof-mounted fans, one fan being provided in each bay for the length of the building. The fans will receive air from the highest point of the building through shielded openings in the 2-foot thick roof slab. Fans will be a non-sparking type with explosion proof motors and will exhaust the air through automatic dampers.

In order to meet hydrogen safety requirements, the exhaust system 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 over-ride 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 underground utility housings up through the grating-covered floor openings. Air inlets to the utility housings will be outside the building and will have weather protection in the form of movable filter housing structures. Filters will be the roll type, similar to those used in Accelerator Housing air intakes.

Additional air for hydrogen purge or summer ventilation requirements will be obtained through the accessway at the west end of the building and the 4-foot by 8-foot man doors located in the shielding blocks. The doors will be opened automatically for hydrogen purge or when more than 50% of the fans are operated to meet the air intake requirements for summer ventilation. Radiation safety dictates that gates be provided at
these doorways in order to prevent personnel entry when experiments are in progress while permitting emergency exit.

b. Heating. The building will be heated, when occupied, by means of electric heating units which will re-circulate the air in the building. Air movement will be generated in the occupied space by drawing the air from near the ceiling and discharging it low so as to blanket the building openings with warm air. The inside design temperature for heating is 65° F at an outdoor temperature of 35° F. During cold weather, the exhaust fans will operate only when necessary for the removal of fumes or other contaminants. Normal infiltration should be adequate for ventilation in cold weather, in view of the low occupancy and the high cubic content of the building. The heating equipment will be sized to heat only the infiltration air plus the building transmission losses.

c. Piping. Piping for 110 psig general-purpose compressed air will be included in the underground utility housings from 5 feet outside the building with valved connections at each of the floor opening manholes. A condensate trap and air filter will be provided in the air supply line to ensure delivery of air free of any contaminants which may have been picked up in the lines between the compressors and End Station. Domestic water will be handled in a similar manner with threaded hose connections being provided just below the floor openings. Waste lines will also be provided in the housings, with connections at each manhole, for carrying used domestic water to a central sump located in the exterior underground utility housing. The extension of the house utilities outside and beyond the 5 foot line, condensate trap and air filter included, will be covered in the Target Area Utilities and Site Improvements Report.

d. Other Services. Low conductivity water will be provided in the underground utility housings. It will be included in the Target Area
Utilities and Site Improvements Report. Low conductivity water service, 10-inch supply and return, will be stubbed-up and blind flanged inside the building near the southwest corner, for future connection.

There will be no drinking water or toilet facilities within the End Station building. Limited toilet facilities will be provided in the Counting House. Others will be provided outside the building and be included as part of the Target Area Utilities and Site Improvements Report.

6. **Electrical.**

   a. Power. Electrical house power will be supplied from the Research Area Substation at 480-volt, 3-phase, 4-wire, 60 cycles. Distribution of power will be made from a Control Center to be located on the south wall of the building. The estimate includes the cost of 480-volt service from the Research Area Substation to End Station "A".

   b. Power Distribution. Power at 480-volt, 3-phase will be provided for the 480-volt receptacles, bridge crane service, motor operated concrete door, and for service to the roof mounted ventilation fans and the electrical heating units. Control of the fans will be from the Control Center, the Counting House and from outside the building. Control of the heaters will be from the Control Center and outside the building. Controls for the motor operated concrete door will be provided both inside and outside the door. The 480-volt power will also be transformed to 208Y-120 volts for service to the 120-volt receptacles and for the supplementary incandescent lighting.

   c. 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. Two receptacles will be connected to a circuit. Also, two duplex 120-volt, single-phase, 20-ampere receptacles on separate circuits will be installed at each of these locations. A demand load of approximately 500 kw total house power shall thus be provided.
d. Emergency Power. Two 75 KVA services at 480-volt, 3-phase 60 cycles will be provided from the Beam Switchyard Substation emergency generator unit. This emergency power will terminate at panelboards, and it will provide service for exhaust fans, specific research equipment, and about 15% of general lighting. Provisions will be made for using cables from the emergency panel for the research equipment. The emergency power will be switched on automatically upon failure of the conventional power or it may be manually switched on to provide power for certain critical experiments. Costs for the emergency power system beyond the 5-foot building limit are covered under the Target Area Utilities and Site Improvements Report, ABA-86.

e. Lighting. Pressurized mercury-vapor fixtures with about 15% 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. Control of lighting will be from the Counting House and from the entrance to the accessway. Also, control of the general lighting will be such that approximately 85% may be shut off by means of a contactor for warning purposes.

Ten 100-watt protected emergency lighting fixtures will be provided. DC power is supplied from the 125-volt battery in the Research Area Substation. This lighting will be connected to the dc battery charging circuit in parallel with the substation battery. The cost of the battery and charger are not included in this report.

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.
Some lighting will be installed in the underground utility housings. This lighting will consist essentially of porcelain socket fixtures, equipped with 200 watt lamps and wire guards, spaced at 20-foot centers. Fixtures at utility housing intersections will be on emergency battery powered circuits, as is the emergency lighting.

f. Grounding System. The Main Equipment Ground Bus, the 3/16 inch by 14 inch copper bus in the Klystron Gallery, will be extended by SLAC to End Station "A" as covered under the Target Area Utilities and Site Improvements Report, ABA-86. This bus system will be extended into the building through the underground utility housings and is to be available at each manhole for equipment grounding. Another bus will also be extended up the cableway adjacent to the elevator shaft to the level of the Counting House. The craneways are to be connected to the main bus system. The grounding of the neutral bus of the electrical power system will be kept separate from the equipment grounding system. Costs for the 3/16 x 14 inch bus within the building area are included in this report.

g. Magnet Power. Additional high voltage power will be provided in the underground utility housings for magnets. This power is covered in the Target Area Utilities and Site Improvements Report, ABA-86, and is not included in house power.


a. Detectors. Individual sensing heads with positive sample flow type detectors, close-coupled to individual analyzers, will be installed just below the roof and adjacent to the exhaust holes to the roof-mounted fans provided in each bay.

b. Pump and Flow Meters. A panel containing a common pump and individual flow meters that adjust the flow or air through each detector head will be installed at floor level.
c. Alarm System. An alarm system will be provided to denote when hydrogen has been detected. The system will be a dual-alarm type and shall be calibrated to sound for both 20% and 25% of the lower explosive limit for hydrogen. In addition to the sounding of the alarm system, the relays for the power interlocks will be energized when the 25% point is reached.

d. Power Interlocks. Power for the crane, heating, general lighting and other hazardous circuitry will be interlocked with the hydrogen detection system so as to be disconnected when 25% of the lower explosive limit for hydrogen has been reached.

Exhaust fans, accessway door and 4-foot by 8-foot man-doors in the shielding will also be interlocked with the detection system. Upon reaching the 25% noted above, all fans will be actuated and the doors opened.

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


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.

A fire detection system, utilizing rate of temperature rise detectors, will be installed in the underground utility housings.


Conduit only is included for telephone and intercom systems. Cable and communication equipment is not included in this report.

10. Crane.

The electric overhead bridge crane rails will be provided as part of the building contract package. The crane itself will be furnished and installed under a separate contract.
11. Retaining Walls.

The retaining wall north of the building and the west end shear extensions of the north and south walls of End Station "A" are included in this report. Also included is Beam Switchyard shielding fill which cannot be placed until after the north retaining wall, shear wall extensions and west wall of the End Station are completed.

Iron shielding and concrete fill required between the Beam Dump at the eastern end of the "A" Beam Housing and the End Station west wall will be included in the End Station construction package. Also included will be the housing extension from the "A" Housing to the End Station west wall and housing extension from the A' Housing to the retaining wall north of the building. The cost estimate for the items covered in this paragraph are included with the Beam Switchyard.

The estimate for the retaining wall which runs westward on a line with the south building wall, starting at the western end of the shear wall extension, and ending at the north-south wall that goes toward End Station "B", is also included in this report. Construction of this wall will be accomplished as part of the Beam Switchyard package.

12. 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.

C. COUNTING HOUSE

1. Location.

The Counting House is located outside the End Station for three reasons: (1) the Counting House requires occupancy when the beam is on, and radiation safety dictates that the End Station shall not be occupied while experiments are in progress; (2) it is more economical to build a
steel frame and metal siding structure outside the End Station than to
collect the heavily shielded structure which would be required if the
Counting House were inside; and (3) valuable End Station floor area is
retained for experimental purposes.

Minimum shielding requirements for well graded, densely packed
rock fill over the beam housing beneath the building establish the Count-
ing House floor elevation.

Counting House site grading will be a part of the End Station
contract since the Counting House will be located over backfill against
the west End Station wall.

2. General.

The building consists of a rectangular structure planned to
expand to the north. Toilet and mechanical facilities are located at the
north end in order to facilitate expansion of these elements at the time
of the contemplated future Counting House expansion.

**Pertinent Data**

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
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</thead>
<tbody>
<tr>
<td>Length</td>
<td>60 feet</td>
</tr>
<tr>
<td>Width</td>
<td>25 feet</td>
</tr>
<tr>
<td>Height (to top of roof beams)</td>
<td>15 feet</td>
</tr>
<tr>
<td>Total Floor Area</td>
<td>1,500 sq. feet</td>
</tr>
</tbody>
</table>

3. Architecture.

Elements of the architectural vocabulary approved for use
throughout the site are used in the design of the Counting House. These
include typical walls of pressed metal siding, standard sash and a roof
overhang for protection from sun and rain.

Partitions will not be used other than at the toilet and me-
chanical rooms. All areas will have exposed construction overhead.

An elevated, free access, removable panel floor supported 2
feet above the concrete subfloor on adjustable screw jacks is used in
the Counting Room to permit flexibility in equipment location and wiring.
Drains will be provided in the concrete subfloor in order to prevent the accumulation of water and possible water damage to electrical cabling.

Double doors are provided at the loading dock to permit passage of large pieces of equipment. These doors will be protected against driving rains during times of equipment handling through use of a roll-up canvas attached to the outer edge of the loading dock canopy.

4. Structure.

The Counting House will have a structural steel frame. Roof beams will be supported by the End Station west wall at one end and by steel columns supported on the concrete subfloor at the other.

5. Special Architectural-Structural Features.

a. A stair and elevator are provided between the End Station "A" and Counting House floor levels for convenience of the occupants and movement of light equipment. Space is also provided in the elevator enclosure for use as a cableway between these floor levels.

b. The 6-foot wide by 8-foot high accessway located behind the retaining wall provides a covered passage between the elevator-stair and the End Station. It also serves as an enclosure for cable into the End Station from the elevator shaft cableway. A gate provided at the retaining wall entry will permit emergency exit and air intake while prohibiting personnel entry when an experiment is in progress. The door at the End Station entry will normally be closed but will open automatically for hydrogen purge or summer ventilation requirements.

6. Mechanical.

The Counting House will be air conditioned, by means of packaged air conditioners, to maintain a temperature of $70^\circ \pm 3^\circ$. Humidity will not be controlled, but will normally be less than 55%. Heating will be electric. Toilet and mechanical rooms will be ventilated with air from the Counting room by means of an exhaust fan.
Plumbing will be conventional, with office building type fixtures.

7. Electrical.
   a. Lighting. The main room will be illuminated to 50 foot-candle level with fluorescent lighting fixtures. At least two switches will be provided, each controlling half the lights.

   The toilet and mechanical rooms will be illuminated to 25 foot-candle level.

   The exterior lighting will consist of lights at the loading dock, elevator entrance and stairways.

   Two battery operated lights will be provided in the main room for emergency lighting.

   b. Electrical Power Supply and Grounding. The electrical power will be supplied from the Research Area Substation at 480 volts, 3-phase. Provisions will be made for distribution of approximately 75 KW of power for use in the electrical cabinets, racks and convenience outlets.

   No provisions will be made for emergency power.

   Grounding shall consist of a normal grounding system for structural steel framing and steel floor framing. System will be interconnected with substation ground system. The last 20 feet of conduit entering the building shall be rigid steel and shall be grounded.

   a. The project fire alarm system will be extended to the Counting House. A fire detection system, utilizing rate of temperature rise detectors, will be installed. A fire alarm horn and manual fire alarm boxes will be located for adequate coverage and in compliance with the National Fire Codes.

   b. No sprinkler system is to be installed. Portable fire extinguishers will be provided by SLAC.

Provisions will be made for extension of telephone and intercom systems to the Counting House.

The telephone system will consist of conduit and outlets only, located in the building for nominal coverage.

The intercom system will consist of conduit and other cable raceway only, for connection to the project systems.
III. OUTLINE SPECIFICATIONS

A. GENERAL


2. Types of Construction - Type I, End Station "A"
   Type IV (n), Counting House.

3. Number of Stories - One.

4. Location on Property - Each separated on three sides.

5. Area Limitations
      Occupancy Group F-2, Type I, Fire Zone III, Unsprinklered.
      Area requirements are unlimited.
      Occupancy Group F-2, Type IV (n), Fire Zone III, Unsprinklered. Maximum allowable area of 12,000 sq. feet.
   b. Per Atomic Energy Commission Criteria.
      Restriction of maximum allowable unsprinklered area of 15,000 sq. feet waived by SLAC for End Station "A".
      Counting House conforms to AEC regulations.

B. UNDERGROUND UTILITY HOUSINGS

Reinforced concrete waterproofed with polyvinylchloride membrane.
Unistrut pipe supports in walls and ceiling at 10-foot centers.

C. FOUNDATIONS

Reinforced concrete spread footings for End Station "A".
Horizontal concrete beam at top of counterforts on the End Station west wall for the Counting House.

D. STRUCTURAL FRAME

End Station "A" - Structural steel roof beams, having composite action with the concrete roof deck, supported by load bearing concrete walls and columns.
Counting House - Structural steel. Working floor to be an elevated, free access, removable panel floor supported on the broad concrete beam at the top of counterforts on the End Station west wall.

Live Loads:

<table>
<thead>
<tr>
<th>Description</th>
<th>Load (psf)</th>
</tr>
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<tbody>
<tr>
<td>Roof</td>
<td>30 psf</td>
</tr>
<tr>
<td>Elevated Counting House Floor</td>
<td>250 psf</td>
</tr>
<tr>
<td>End Station Floor</td>
<td>5,600 psf from 10 ft. thick parallel walls spaced 15 ft. apart; the 15 ft. of space between walls having concentrated loads of 20 tons each spaced 3 ft. on centers.</td>
</tr>
<tr>
<td>Underground Utility Housing Manhole Covers</td>
<td>5,600 psf for solid covers 250 psf for grating covers</td>
</tr>
</tbody>
</table>

Wind and Seismic: UBC

E. ROOF

Built up roof and gravel (colored granular material) over concrete deck for End Station "A" and over 1-inch rigid insulation on metal deck for the Counting House.

F. EXTERIOR WALLS

End Station "A" - Reinforced concrete with exterior surface treatment on inset wall panels.

Weather-proof siding at openings- galvanized metal.

Counting House - Insulated galvanized metal siding with exposed surfaces painted. No painting in Mechanical room.

Windows - fixed glass, metal sash.

G. INTERIOR WALLS AND PARTITIONS

No partitions in End Station.
Sheetrock on wood studs in Counting House with painted surface in main room and toilet. Mechanical room unpainted.

H. FLOORS
End Station "A" - Concrete with floor hardener and sealer.
Counting House - Insulating resilient covering on elevated floor.
   Toilet Room - ceramic tile.
Mechanical Room - open to concrete sub-floor. Equipment supported on steel frame.

I. CEILINGS
End Station "A" - Exposed steel beams, painted, and concrete deck.
Counting House - Exposed metal deck and steel roof beams, painted.

J. DOORS
End Station "A" - Mechanically operated concrete door at 32 by 40 ft. opening.
Man doors in shielding blocks and accessway - metal, automatically opening upon hydrogen detection or when more than 50% of the exhaust fans are operating.
Gates at shielding block, accessway, and in underfloor utility housing - will prevent personnel entry, while permitting emergency exit when an experiment is in progress.
Counting House
   Exterior - Hollow metal.
   Interior - Hollow core flush panel.

K. WINDOWS
Counting House - See Exterior Walls, DSB clear glass in sash.
L. MECHANICAL

End Station "A"

Exhaust Fans - 24,000 CFM, 3/8" SP, 5 HP low silhouette dome type centrifugal exhausters with aluminum wheels, static proof belt drive, and 440-volt, 3-phase, explosion-proof motors. Discharge through gravity dampers.

Heating Units - 75 KV, 6000 CFM cabinet-centrifugal-type, wall mounted, belt drive from 440-volt, 3-phase, explosion-proof motor, spark-proof belts, aluminum wheels, replaceable-media filters, accoustical discharge plenum with adjustable grilles. Electrical heating elements to be 440-volt, 3-phase, finned sheath type with surface temperature below 500°F, manual control. Units are interlocked to shut off when hydrogen is detected.

Compressed Air Piping - Threaded galvanized iron pipe and fittings, bronze valves.

Domestic Water Piping - Threaded galvanized iron pipe and fittings, bronze valves.

Counting House

Air Conditioning - Packaged, self-contained, water cooled cabinet unit, thermostatic control. Cooling for internal heat gain of 75 kw.

Plumbing - In accordance with Uniform Plumbing Code. Office building type fixtures.

Hot Domestic Water - Electric water heater.

Domestic Water Piping - As for End Station.

M. ELECTRICAL

End Station "A" - House power will be supplied from the Research Area
Substation at 480 volts, 3-phase, 60 cycles.

Emergency power will be provided by means of two 75 KVA services at 480 volts, 3-phase, 60 cycles from the Beam Switchyard Substation emergency generator unit.

Emergency lighting and fixtures at underground utility housings will be provided with power from 125-volt battery in the Research Area Substation.

Illumination at End Station floor level. 10 f.c.

Building Load Requirements in kva:

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<th>Normal</th>
<th>Connected</th>
<th>Maximum Demand</th>
</tr>
</thead>
<tbody>
<tr>
<td>120-volt receptacles</td>
<td>68</td>
<td>34</td>
</tr>
<tr>
<td>480-volt receptacles</td>
<td>1,160</td>
<td>460</td>
</tr>
<tr>
<td>General Lighting</td>
<td>25</td>
<td>25</td>
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<tr>
<td>Security Lighting</td>
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<tr>
<td>Ventilation Fans</td>
<td>50</td>
<td>5</td>
</tr>
<tr>
<td>Crane</td>
<td>65</td>
<td>50</td>
</tr>
<tr>
<td>Door Motor</td>
<td>15</td>
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<tr>
<td>Heaters</td>
<td>320</td>
<td>320</td>
</tr>
<tr>
<td>TOTAL</td>
<td>1,707</td>
<td>913</td>
</tr>
</tbody>
</table>

| Emergency           |           |               |
| 120-volt panels     | 34        | 17             |
| Emergency Lighting  | 5         | 5              |
| Ventilation Fans    | 50        | 50             |
| TOTAL               | 89        | 72             |

| Battery Emergency   |           |               |
| General Lighting    | 1.0       | 1.0            |
| Utility Housing     | 0.3       | 0.3            |
| TOTAL               | 1.3       | 1.3            |
Counting House - Electrical power will be supplied from the Research Area Substation at 480 volts, 3-phase.

Illumination requirements:

Main Room 50 f.c.
Toilet and Mechanical Rooms 25 f.c.

Load Requirements in kva:

<table>
<thead>
<tr>
<th>Building</th>
<th>Connected and Maximum Demand</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lighting</td>
<td>6.7</td>
</tr>
<tr>
<td>Air Conditioning</td>
<td>35.0</td>
</tr>
<tr>
<td>Water Heater</td>
<td>1.0</td>
</tr>
<tr>
<td>Elevator</td>
<td>15.0</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>57.7</strong></td>
</tr>
<tr>
<td>Research</td>
<td>75.0</td>
</tr>
<tr>
<td><strong>COMBINED TOTAL</strong></td>
<td><strong>132.7</strong></td>
</tr>
</tbody>
</table>

N. FIRE PROTECTION

General - The project fire alarm system will be extended to buildings. Also, alarm horns and manual alarm boxes will be provided. Portable hand extinguishers will be provided by SLAC. Rate of temperature rise fire detectors will be used in the Counting House and underground utility housings.

O. HYDROGEN DETECTION

Detectors will be located near each exhaust opening in the roof.

See also "Hydrogen Detection System" on page 11.

P. COMMUNICATIONS SYSTEMS

Project telephone switchboard is in the Administration-Engineering Building.
Conduit only is provided in the End Station and Counting House for telephone and intercom systems. Connection and equipment will be furnished under other contracts.

Q. UTILITIES

All utilities to the End Station and Counting House will be underground or in underground utility housing.

<table>
<thead>
<tr>
<th>Service</th>
<th>Off-Site Location</th>
<th>Direction of On-Site Supply</th>
</tr>
</thead>
<tbody>
<tr>
<td>Electricity, normal</td>
<td>480-volt Distribution</td>
<td>Research Area Sub-station, west of End Station &quot;A&quot;</td>
</tr>
<tr>
<td>Electricity, emergency, ac</td>
<td>480-volt Distribution</td>
<td>From Emergency Generator in Beam Switchyard Substation.</td>
</tr>
<tr>
<td>Electricity, emergency, dc</td>
<td>125-volt Distribution</td>
<td>Battery in Research Area Substation, west.</td>
</tr>
<tr>
<td>Telephone, I.C. &amp; P.A.</td>
<td>Underground utility housings</td>
<td></td>
</tr>
<tr>
<td>Fire Alarm</td>
<td>Underground utility housings</td>
<td>South</td>
</tr>
<tr>
<td>Domestic Water</td>
<td>Underground utility housings</td>
<td>South</td>
</tr>
<tr>
<td>Shop Air</td>
<td>Underground utility housings</td>
<td>South</td>
</tr>
<tr>
<td>Sewer (Counting House)</td>
<td>Gravity drain</td>
<td>North</td>
</tr>
<tr>
<td>Fire Protection Water</td>
<td>In research yard and BSY around building</td>
<td>----</td>
</tr>
</tbody>
</table>

R. 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 by keeping such items as electrical control cabinets as low as possible on the crane. The crane is to be located high enough to provide a minimum 50-foot clearance under the bridge or 50-foot hook height.

S. ELEVATOR

The elevator will be hydraulic with a 5-foot wide by 7-foot long cab capable of accommodating 8-foot high objects. It will have a load capacity of 1,500 pounds and be of industrial quality.
### IV. SCHEDULE

<table>
<thead>
<tr>
<th>Title</th>
<th>Event Description</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Title I</td>
<td>Preliminary Draft Submittal</td>
<td>10 March 1964</td>
</tr>
<tr>
<td>Title I</td>
<td>Draft Review Completed by SLAC</td>
<td>27 March 1964</td>
</tr>
<tr>
<td>Title I</td>
<td>Final Submittal</td>
<td>10 April 1964</td>
</tr>
<tr>
<td>Title I</td>
<td>Review and Approval by SLAC &amp; AEC</td>
<td>1 May 1964</td>
</tr>
<tr>
<td>Title II</td>
<td>50% Submittal</td>
<td>7 July 1964</td>
</tr>
<tr>
<td>Title II</td>
<td>90% Submittal</td>
<td>1 September 1964</td>
</tr>
<tr>
<td>Title II</td>
<td>Revised and Ready For Bid</td>
<td>15 October 1964</td>
</tr>
<tr>
<td></td>
<td>Bid Opening</td>
<td>13 November 1964</td>
</tr>
<tr>
<td></td>
<td>Notice to Proceed</td>
<td>15 December 1964</td>
</tr>
<tr>
<td></td>
<td>Construction Completed</td>
<td>25 November 1965</td>
</tr>
</tbody>
</table>

* Title II and Construction CPM networks are being restudied and revised to incorporate the Counting House and related appurtenances and portions of the Beam Switchyard (see paragraph B 11 on page 13 of this report).
V. DRAWING LIST

SK-561-001       Site Plan
SK-561-101       Floor Plan
SK-561-102       Counting House Plan and Roof Plan
SK-561-103       Exterior Elevations
SK-561-104       Exterior Elevations
SK-561-105       Building Sections
SK-561-701       Single-Line Diagram
## END STATION "A"

### TITLE I ESTIMATE, DETAILS

<table>
<thead>
<tr>
<th>ACCOUNT NUMBER</th>
<th>ITEM NUMBER</th>
<th>DESCRIPTION</th>
<th>QUANTITY</th>
<th>UNIT COST</th>
<th>ITEM COST</th>
</tr>
</thead>
<tbody>
<tr>
<td>5-610</td>
<td>STRUCTURE</td>
<td>Earthwork</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Excavation</td>
<td>11,200 CY</td>
<td>$3.00</td>
<td>$33,600</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Backfill</td>
<td>16,500 CY</td>
<td>$3.80</td>
<td>62,700</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Backfill (Rock)</td>
<td>2,300 CY</td>
<td>$7.00</td>
<td>16,100</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Conc. Foundations &amp; Floor Slab (Incl. provision for future exp.)</td>
<td>2,870 CY</td>
<td>$50.00</td>
<td>143,500</td>
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<tr>
<td></td>
<td></td>
<td>Walls &amp; Columns (Incl. exterior treatment)</td>
<td>7,900 CY</td>
<td>$83.00</td>
<td>655,700</td>
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<tr>
<td></td>
<td></td>
<td>Roof Slab, Pre-Cast Units &amp; Fascia</td>
<td>2,560 CY</td>
<td>$70.00</td>
<td>179,200</td>
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<tr>
<td></td>
<td></td>
<td>Struct. Steel Beams</td>
<td>9 EA</td>
<td>22,100.00</td>
<td>198,900</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Tunnels, Manholes &amp; Covers</td>
<td>440 LF</td>
<td>$310.00</td>
<td>136,400</td>
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<tr>
<td></td>
<td></td>
<td>Mechanical Conc. Door</td>
<td>1 EA</td>
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<td>76,000</td>
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<tr>
<td></td>
<td></td>
<td>Roofing &amp; Downdrains</td>
<td>25,000 SF</td>
<td>0.64</td>
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<tr>
<td></td>
<td></td>
<td>Metal Siding</td>
<td>5,900 SF</td>
<td>$0.80</td>
<td>4,700</td>
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<tr>
<td></td>
<td></td>
<td>Portable Hyd. Posts, Blocks &amp; Sleeves</td>
<td>----</td>
<td>L.S.</td>
<td>11,000</td>
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</table>

**SUBTOTAL, STRUCTURE**

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<tr>
<th>ACCOUNT NUMBER</th>
<th>ITEM NUMBER</th>
<th>DESCRIPTION</th>
<th>QUANTITY</th>
<th>UNIT COST</th>
<th>ITEM COST</th>
</tr>
</thead>
<tbody>
<tr>
<td>5-610</td>
<td>MECHANICAL</td>
<td>Heating &amp; Ventilation</td>
<td></td>
<td>$45,000</td>
<td>14,000</td>
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<tr>
<td></td>
<td></td>
<td>Piping</td>
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</table>

**SUBTOTAL, MECHANICAL**

<table>
<thead>
<tr>
<th>ACCOUNT NUMBER</th>
<th>ITEM NUMBER</th>
<th>DESCRIPTION</th>
<th>QUANTITY</th>
<th>UNIT COST</th>
<th>ITEM COST</th>
</tr>
</thead>
<tbody>
<tr>
<td>5-610</td>
<td>ELECTRICAL</td>
<td>Power, Lighting &amp; Grounding</td>
<td></td>
<td>$115,000</td>
<td>20,000</td>
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<tr>
<td></td>
<td></td>
<td>Hydrogen Detection System</td>
<td></td>
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<td>6,500</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Communication &amp; Fire Alarm System</td>
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</table>

**SUBTOTAL, ELECTRICAL**

<table>
<thead>
<tr>
<th>ACCOUNT NUMBER</th>
<th>ITEM NUMBER</th>
<th>DESCRIPTION</th>
<th>QUANTITY</th>
<th>UNIT COST</th>
<th>ITEM COST</th>
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</thead>
<tbody>
<tr>
<td>5-610</td>
<td>RETAINING WALLS</td>
<td>North Wall</td>
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<td></td>
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<td>South Wall</td>
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**SUBTOTAL, RETAINING WALLS**

**TOTAL COST, END STATION "A"**

<table>
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<tr>
<th>ACCOUNT NUMBER</th>
<th>ITEM NUMBER</th>
<th>DESCRIPTION</th>
<th>QUANTITY</th>
<th>UNIT COST</th>
<th>ITEM COST</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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</table>

$1,568,500

$59,000

$141,500

$86,000

$1,855,000
## END STATION "A" - COUNTING HOUSE

### TITLE I ESTIMATE - DETAILS

<table>
<thead>
<tr>
<th>ACCOUNT NUMBER</th>
<th>ITEM DESCRIPTION</th>
<th>QUANTITY</th>
<th>UNIT</th>
<th>COST</th>
</tr>
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<tbody>
<tr>
<td>5-610</td>
<td>STRUCTURE</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Earthwork</td>
<td>---</td>
<td>L.S.</td>
<td>$ 450</td>
</tr>
<tr>
<td></td>
<td>Concrete Work</td>
<td>40 CY</td>
<td>$ 65.00</td>
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<tr>
<td></td>
<td>Struct. Steel and Misc. Iron</td>
<td>9.5 TONS</td>
<td>550.00</td>
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<tr>
<td></td>
<td>Metal Siding &amp; Decking (Incl. Insul. Panels)</td>
<td>3,300 SF</td>
<td>0.90</td>
<td>2,970</td>
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<tr>
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<td>Floor (Computer Type)</td>
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<td>5.00</td>
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<td>Ceramic Tile</td>
<td>80 SF</td>
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<td>Partitions</td>
<td>500 SF</td>
<td>0.95</td>
<td>480</td>
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<td>Roof-Built Up w/Insul</td>
<td>2,200 SF</td>
<td>0.60</td>
<td>1,320</td>
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<tr>
<td></td>
<td>Doors-Frames-Hdwe.</td>
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<td>L.S.</td>
<td>870</td>
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<tr>
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<td>Fixed Sash &amp; Glazing</td>
<td>210 SF</td>
<td>4.00</td>
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<td>Painting-Caulking</td>
<td>9,700 SF</td>
<td>0.16</td>
<td>1,550</td>
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<tr>
<td></td>
<td>Building Specialties</td>
<td>---</td>
<td>L.S.</td>
<td>1,130</td>
</tr>
<tr>
<td></td>
<td>Elevator &amp; Structure</td>
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<td>L.S.</td>
<td>19,000</td>
</tr>
<tr>
<td></td>
<td>Exterior Stairways</td>
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<td>L.S.</td>
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<td>Conc. Accessway</td>
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<td>$ 54,500</td>
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<tr>
<td>5-610</td>
<td>MECHANICAL</td>
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</tr>
<tr>
<td></td>
<td>Air Conditioning</td>
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<td></td>
<td>Plumbing</td>
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<td>$ 23,000</td>
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<td>50-610</td>
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<td></td>
</tr>
<tr>
<td></td>
<td>Light &amp; Power</td>
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<td>$10,500</td>
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<tr>
<td></td>
<td>Dist. SLAC Power</td>
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<td>6,000</td>
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<tr>
<td></td>
<td>Fire Alarm</td>
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<td></td>
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<td></td>
<td>$ 18,000</td>
</tr>
<tr>
<td></td>
<td>TOTAL COST, COUNTING HOUSE</td>
<td></td>
<td></td>
<td>$ 95,500</td>
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<tr>
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<td>TOTAL COST, END STATION &quot;A&quot;</td>
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<td></td>
<td>$1,855,000</td>
</tr>
<tr>
<td></td>
<td>TOTAL COST, CONTRACT</td>
<td></td>
<td></td>
<td>$1,950,500</td>
</tr>
<tr>
<td>7-934</td>
<td>50-TON CRANE</td>
<td></td>
<td></td>
<td>$ 170,000</td>
</tr>
</tbody>
</table>
A - CIRCUIT
    1 - Crane, Est., 60 H.P.

B - CIRCUITS
    14 - For 28, 100 A, 480 V Receptacles

C - CIRCUIT
    1 - Motor operated door, 15 H.P.

D - CIRCUITS
    4 - Electric heaters, 4-75 KW

E - CIRCUIT
    1 - 480/277 V General lighting, 25 KW

F - CIRCUITS
    2 - For 480-208Y/120 V transformers for
        120 V receptacle & supplementary
        lighting panels.

G - CIRCUITS
    10 - Vent. fans, 10-5 H.P. (Estimated)

H - CIRCUITS
    1 - 480-208Y/120 V transformer for
        emergency lighting panel.

I - CIRCUITS
    1 - 480-208Y/120 V transformer for
        emergency panels.

J - CIRCUITS
    480 V 3Ø emergency as required.

SIMPLIFIED SINGLE-LINE DIAGRAM
END STATION "A"