

AETRON-BLUME-ATKINSON

MEMORANDUM


August 24, 1962

TO: K. Copenhagen  
FROM: L. W. Swanson  
SUBJECT: ACCELERATOR HOUSING - ACCESSWAYS

Forwarded for your review and comment are 20 copies of "Design Report for the Accelerator Housing Accessways", ABA No. 53 dated August 24, 1962. As stated therein, the purpose of the report is to review all criteria associated with the accessways and to recommend the most desirable location and design of the accessways.

The conceptual designs discussed in the report deviate from both the criteria outlined in SLAC memorandum, Gould to Sharpe dated July 16, 1962, and from the SLAC sketches received on July 23, 1962. The ABA report recommends location of the accessways at the edge of the shielding fill rather than adjacent to the Klystron Gallery as proposed by SLAC. This ABA recommendation is based on minimizing or eliminating design problems such as utility location, shielding, radioactive gas containment, and method of construction.

It is requested that SLAC review the accessway design criteria and its associated problems as soon as possible so that comments may be incorporated into the Title I Design Report for the Accelerator Housing, scheduled for issuance on September 11, 1962. We will be glad to discuss the details of the report at your convenience.

  
L. W. Swanson  
Chief Engineer  
Electrical-Mechanical

LWS/WNH/mas  
cc: SLAC (20)  
R. L. Sharpe  
G. G. Bawden (4)

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DESIGN REPORT  
FOR THE  
ACCELERATOR HOUSING  
ACCESSWAYS

REPORT TO STANFORD LINEAR ACCELERATOR CENTER - NO. APA - 53

STANFORD UNIVERSITY - ABA SUBCONTRACT S-128

UNDER AEC CONTRACT AT (04-3) - 400

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August 24, 1962

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## ACCELERATOR HOUSING ACCESSWAYS

1. INTRODUCTION

The purpose of this study is to review all criteria associated with the Accelerator Housing accessways and to recommend the most desirable location and design of these accessways. Figures 1, 2, and 3 indicate alternate designs which are discussed herein. The designs are conceptual only and are for the purpose of illustrating special features or problems associated with each concept.

2. PURPOSE OF ACCESSWAYS

Accessways will be constructed for each sector and will serve as the primary means of personnel entrance to and exit from the Accelerator Housing under both routine and emergency conditions. Accessways will also serve as entrances for portable equipment, instruments and tools; and for construction, installation, and maintenance materials. It is anticipated that the accessways will be used not only during ABA construction of the Accelerator Housing, waveguide conduits and utilities installation, but also during the SLAC installation of the Accelerator, wave guides and experimental equipment. During Accelerator shutdown periods, the accessways will serve as convenient Housing entrances to check the accelerator alignment, to service instrumentation for beam characteristics, to calibrate radiation instruments, and to make adjustments to equipment.

A horizontal passageway connects each access shaft to the Accelerator Housing. This passageway can serve as storage space for wheeled vehicles, materials, equipment, tools, fire and safety apparatus, radiation instruments and temporary shielding blocks.

In addition the accessways will serve as ducts for ventilation and for running ABA utilities such as electrical conduit for lighting, emergency lighting and receptacles and fire detection.

### 3. LOCATION

There will be 31 access shafts or manways. Six of these access shafts (located near Stations 0, 20, 40, 60, 80 and 100) will include rectangular material handling shafts.

Accessways will be located slightly upstream from each drift section. The access shafts can be located either adjacent to the Gallery or at the edge of the shielding fill as indicated in the attached sketches. Interconnecting passageways between the Accelerator Housing and manways will be perpendicular to the beam axis.

### 4. TYPE OF ACCESSWAY

Consideration has been given to various methods of access in an attempt to provide the most utilizable type. This has included review of spiral stairways, inclined ramps, hydraulic lifts, conventional stairways and vertical steel ladders. For reasons of economics a vertical steel ladder is preferable.

During construction and Accelerator installation, vertical steel ladders can be used in all access shafts.

However, space is available so that a stairway can be installed in six of the larger material accessways at a later date, if, concurrently, above grade entrance structures and additional ventilation are added. This system will initially provide maximum space for lowering construction materials and equipment to the Accelerator Housing level. During Accelerator operation stairs would allow more convenient access and enable research and development personnel to hand carry portable instruments and tools to work areas.

In Figures 1, 2 and 3, 40 inches has been selected by ABA as the optimum size for the 31 manhole accessways. This is the maximum pipe size which does not require caging around a vertical ladder. This will also provide space for ABA utilities and for material access. A method of installation similar to that proposed for the waveguide conduits will be used; i.e., drill an oversized hole in the compacted shielding fill and weld the steel pipe in place to a steel collar embedded in the passage-way ceiling.

To facilitate handling of heavier and larger material, six rectangular shafts 6' by 12' will be constructed. These six shafts will be covered with airtight, gasketed hatches located above the top of the shielding fill and will be accessible from the Klystron Gallery level. Hoisting of materials will be accomplished by using temporary A-frames or by using winch equipped vehicles parked along the roadway. The manway shafts shown in figures 1, 2 and 3 can be used to handle small material such as tools and other gear. Provisions can be made for future installation of a permanent hoist over each manway within the ventilation structures.

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A 4 by 12 foot rectangular opening will be provided at each junction between the Accelerator Housing and passageways for storage of wheeled vehicles, equipment and material. Passageways for manway-material shaft accessways will be 5 feet wide by 8 feet high. Passageways for manway access will be 4 feet wide by 8 feet high.

Exhaust fans will be located at the top of alternate manway access shafts to ventilate each Accelerator Housing sector. Ventilation will be provided for the Housing only prior to and while personnel are working in that area. During Accelerator operation, the access doors will be interlocked shut and the ventilation fans will be stopped. Since no personnel access will be permitted into the Accelerator Housing until radiation levels have been reduced below AECM and SLAC requirements, no filters for exhaust air will be provided. Consideration will be given in the exhaust stack location to minimize introduction of exhausted air into the Gallery.

5. SPECIAL FEATURES

PASSAGEWAY DOORS - During construction and Accelerator installation, when both combustibles and welding equipment will be located in the Accelerator Housing, temporary doors should be erected at the entrance to each access passageway to prevent any chimney effect of the shafts in case of fire. Doors are considered unnecessary during operation of the Accelerator and could prove detrimental to the proposed ventilation system.

RADIOACTIVE GASES - Despite the absence of forced air circulation during Accelerator operation, convection currents may tend to cause warm, radioactive gases to concentrate at high points in the access shafts and in the ventilation structure.

These gases would consist of  $O^{15}$  (2.1 minute half life),  $N^{13}$  (10.0 minute half life) and  $Cl^{38}$  and  $Cl^{39}$  (37.3 and 55 minute half lives respectively.)

A criterion of a maximum of one air change per week has been established by SLAC for the Accelerator Housing, passageways, access shafts and ventilation structures. Most of the air loss will occur at the ventilation structure. To minimize any radioactive gas leakage to the Gallery interior, no direct access should be provided between the shaft-ventilation structure and the Gallery. A remotely operated, leak tight hatch may be necessary at the top of each manway shaft to control the radioactive gases. Review of the accessway configuration during Title II design work may even indicate as an alternate, a remotely operated leaktight door at the base of each manway and material shaft.

SHIELDING - During Accelerator operation, temporary shielding may be required in the horizontal passageways as determined by radiation surveys. An offset at the end of each horizontal passageway will be used to minimize the radiation sky shine. However, since the below grade access structures adjacent to the Gallery are within the 25 foot shielding fill radius, high energy particles causing secondary emissions may affect occupancy of the Gallery. Therefore, special shielding may be required for the above grade structures and hatchways adjacent to the Gallery (Figure 1). A comparison of shielding designs indicates that location of the accessways at the edge of the fill is preferable.

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CONSTRUCTION - Location of the accessways adjacent to the Gallery will pose a more difficult problem of backfilling in a critical shielding fill area. Any below grade concrete structures regardless of location will require special compaction equipment since heavy vibratory or sheepsfoot rollers can't be used. However, the proximity of the material access shafts to the Accelerator Housing will prove to be an additional uncertainty in the prediction of shielding fill settlement.

UTILITIES - Buried utility lines run parallel to the Gallery on both the North and South sides. To the South approximately 20 feet of width must be reserved for electrical ducts and cooling water lines. Figure 4 shows the preferred, minimum cost utility location with respect to the Gallery. If the accessways are adjacent to the Gallery (Figure 1), the utilities must be moved 8 feet southward (away from the Gallery) resulting in additional lengths of piping and conduit. If the accessways are at the edge of the shielding fill, the utilities will be located as shown in Figure 4. However, additional costs will be incurred for extensions to ABA utilities (electrical conduits and fire detection lines) which will be run through the accessways to the Accelerator Housing. The total net cost of utilities will be approximately \$6,000 greater if the accessways are located adjacent to the Gallery rather than at the edge of the shielding fill.

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6. COMPARISON OF DESIGNS

Figures 1, 2, and 3 show two locations for the accessways: adjacent to the Gallery and at the edge of the shielding fill. Advantages and disadvantages of each design are listed below:

ACCESSWAY COMPARISONADVANTAGESDISADVANTAGESADJACENT TO  
GALLERYFIGURE 1

- |    |                               |    |   |
|----|-------------------------------|----|---|
| 1. | Most accessible from Gallery. | 1. | Visible above grade structure and ventilation stack.                  |
| 2. | 25' shorter route to surface  | 2. | Conflicts with underground utilities.                                 |
|    |                               | 3. | Possible radioactive contamination of Gallery or excessive sky shine. |
|    |                               | 4. | Interference with removable wall panels and Gallery ventilation.      |
|    |                               | 5. | Inside 25 foot shielding radius.                                      |
|    |                               | 6. | Longer vertical ladder structure.                                     |

EDGE OF FILLFIGURES 2&3

- |    |  |    |  |
|----|--|----|--|
| 1. | No visible structure                   | 1. | Distant from Gallery                   |
| 2. | Shorter vertical ladder structure      | 2. | Longer escape route to surface         |
| 3. | Outside 25 foot shielding radius       | 3. | Longer ABA utility runs in accessways  |
| 4. | No conflict with underground utilities | 4. | Visible above grade ventilation stack. |

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COST COMPARISON - During the July budget review the cost of 15 accessways (9 manways and 6 material shafts) was estimated to be \$223,000. This assumed location of the accessways at the edge of the shielding fill. A re-estimate of the structural costs based on conceptual designs shown in Figures 1 and 2-3 indicates the following:

<u>UNIT COSTS</u>	<u>ADJACENT TO GALLERY</u>	<u>EDGE OF FILL</u>
Manways	\$ 6,200	\$ 5,900
Manway-Material shaft	15,700	15,600
 <u>TOTAL COST</u>		
25 Manways	155,000	147,500
6 Manway-Material Shafts	94,200	93,600
Net Utilities Cost, Increase	6,000	-
	<u>\$255,200</u>	<u>\$241,100</u>

Assumptions used in the above cost estimates are as follows:

1. No installed hoists.
2. Special earthwork costs not included.
3. Costs for leak tight doors or hatches in accessways are not included.
4. No temporary shielding in accessways.
5. No ventilation equipment.
6. 20 feet clear required for utilities.
7. Design and inspection costs are not included.
8. No contingency.

7. CONCLUSIONS AND RECOMMENDATIONS

The designs sketched in Figures 1 and 2-3 have been discussed herein for the purpose of revealing potential design problems in advance of Title II work. These problems include utility location, shielding design, radioactive gas containment and construction methods. A qualitative review of these problems indicates that they will be minimized or eliminated by locating the accessways at the edge of the fill.

The comparison of construction costs shows a slightly lower cost for the "edge of fill" design, but no substantial cost advantage over the "adjacent to Gallery" design. However, certain items which were excluded from the estimate basis support the "edge of fill" design. These items are special earthwork, temporary shielding, additional engineering and inspection. Based on the latest available information concerning design, construction, installation, and operation of the Accelerator and the criteria discussed herein, ABA recommends the "edge of fill" design for the Accelerator Housing Accessways.

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