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# Detailed Workplan for TxAPT Site Preparation

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**DETAILED WORKPLAN FOR TxAPT SITE PREPARATION**
**REVISED 28, June 2002***
**Project 5-1924-01-P2**

## Introduction

The Texas Department of Transportation (TxDOT)** has developed a Mobile Load Simulator (MLS), which has been operating on Texas' highways for the past several years (see web site http://www.utexas.edu/research/ctr/mls/ for background information). This device is used for rapidly testing pavements to estimate their performance. The device was designed to run on in-service roads throughout the State, however, there are a number of limitations in using the equipment on existing highways. As a result, TxDOT has contracted with The University of Texas, Center for Transportation Research (CTR) to operate the MLS at a five-year pavement test facility located at the J.J. Pickle Research Campus (PRC).

This Workplan outlines the site development of the Texas Accelerated Pavement Test Center (TxAPT) at PRC, and provides a step-by-step process for preparing the test facility.

## Movement of MLS:

Currently the MLS has load bogies and a prime mover capable of moving the MLS to the temporary site. In addition to the MLS, which is moved in two sections, four screw jacks that support the MLS must be transported on another truck. Two generators (400 kW and 100 kW), fuel, supply, and control trailers, 25-ton crane, and other miscellaneous equipment and hardware will also be transported to the temporary site (see Appendix B for complete equipment list).

## TxAPT Temporary Site Workplan:

A preliminary shakedown test of the renovated MLS equipment was to be carried out before the unit was transported from Livingston, Texas to PRC. TxDOT made the decision to move the device before reconstruction and shakedown is completed, and requested that CTR find a temporary space at PRC where the MLS can be completed. Locating and preparing a temporary site is outside the scope of the original proposal, however, CTR personnel has taken steps to find a suitable location at PRC where the renovation of the MLS can be completed and the shakedown performed. The details of the temporary site preparation are provided in Appendix C.

## TxAPT 5-Year Pavement Facility Preparation Workplan

While the reconstruction and shakedown of the MLS is being carried out, CTR staff will define the permanent TxAPT site. Regardless of the final location, the following Workplan identifies specific tasks that will be carried out to prepare the selected site for the installation of the TxAPT test pavements.

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* This document will be updated as needed, on a regular basis.
** See Appendix A for glossary of acronyms

Task 1 – Finalize TxAPT site location and obtain approval from UT and TxDOT to begin site preparation.

Task 2 – Assess special requirements for inclusion in the site preparation plan including:

- Rearrange and/or remove existing subgrade.
- Rearrange and/or remove existing embankment materials.
- Rearrange and/or remove equipment and other materials.
- Construction of access roads.
- Rework and/or realign existing drainage structures.

Task 3 - Develop Subgrade Testing and Installation Protocol to insure desired subgrade characteristics are achieved. The strength of the subgrade and other materials tests will be measured to characterize the soil. Multiple samples will be taken to insure uniformity.

Task 4 - Perform the testing on the insitu subgrade and determine the work needed to achieve the desired subgrade characteristics and uniformity.

Uniform subgrade material

If the existing subgrade is uniform and has acceptable material properties, then additional subgrade can be added to level the site and satisfy minimum depth criteria. If similar subgrade material cannot be found, or if the insitu subgrade material properties are not acceptable, then the existing subgrade will be removed to a sufficient depth and a suitable replacement subgrade installed. Provisions will be made for creating a subgrade stockpile in case additional material is required in the future.

Acceptable subgrade depth

In addition to subgrade material properties, the amount of available insitu subgrade material must be determined using a pattern of boreholes. According to PRC representatives and previous borehole tests (see Figure 1), the depth to bedrock at PRC varies from one to four feet depending on location. Subgrade depth on the east side of PRC is deeper in general than on the west. Therefore, the insitu subgrade does not have sufficient depth to satisfy minimum depth criteria.

There is a concern in setting up the MLS about the depth to bedrock and it′s impact on MLS test results. In general, based on scientific principals and supported by advice from OAG members, if there is five feet of subgrade or more, depth to bedrock will have little or no impact on the performance of the pavement. However, a five-foot depth to bedrock will have an impact on seismic tests, particularly on FWD and SASW results. This concerns many engineers because these two test devices are used to evaluate "in-service" pavements. This issue can be solved but must be addressed before final design decisions are made. It might be possible to provide additional subgrade depth to mitigate the effects of bedrock on seismic tests.

Number of subgrades

Two subgrades with different strength characteristics would provide desirable test conditions where subgrade could be evaluated as a variable. Another positive aspect of imported subgrade is the ability to control and test density and water content of the embankment (defined by the Subgrade Testing and Installation Protocol) The research team, including CTR, TxDOT and the Operating Advisory Group (OAG) must address this issue and weigh the benefits versus costs of two subgrades in developing final plans. It must also be remembered that moving from one subgrade type to another will produce a variation in subgrade support.

One possibility for the test facility is to setup two different subgrades side-by-side in a two-lane configuration. The material above bedrock for one of the site locations could be excavated and moved onto the other site to thicken the embankment to a depth of five or more feet. Another select subgrade could then be imported to create a new embankment with different subgrade characteristics. Imported subgrade would be subject to the subgrade testing developed in Task 3.

Task 5 – Prepare a Master Plan for the site layout. Analyze information from various sources and define the design characteristics that must be considered to optimize the operation and functionality of the TxAPT facility. These sources will include MLS operators, TxDOT pavement design engineers, TxDOT pavement installation inspectors, pavement contractors, OAG members, and other APT facility managers worldwide.

5.1 Develop configuration options for the subgrade embankment. Design the TxAPT embankment layout based on the size of the area available, available funding, and other issues to be decided such as number of subgrade types and the number and configuration of test pads. Prepare site drawings for TxDOT and PRC approval detailing the embankment preparation and construction (see Appendix D for a design example). The embankment design will include provisions for the following:

- Number of subgrade types installed.
- Plan and profile drawings that define the earth to be moved/removed and replaced.
- Reworking of existing drainage channels and culverts if needed.
- Construction of access roads and ramps for ingress/egress to the test pads.
- Embankment slope stabilization and reseeding.
- Installation of instrumentation during embankment construction (i.e. soil moisture sensors).
- Installation of conduit and pull box infrastructure to run power, instrumentation, lighting and telephone leads to appropriate locations.

5.2 Establish possible test pad configurations for the pavement facility to include:

- Number and dimensions of test pads
- Space for MLS assembly/disassembly
- Space for support equipment
- Provisions for movement of MLS from one test pad to the next
- Provisions for equipment ingress and egress

Task 6 – Prepare an RFQ to hire a contractor to prepare the site based on the results from the previous tasks. The RFQ will have provisions for:

- Embankment installation with requirements for moisture content, density, and material sources.
- Constructing ingress and egress access roads for the MLS and ancillary equipment.
- Drainage structure realignment and construction.
- Conduit and pull box infrastructure for site wiring.
- Lightning and surge suppression.
- Provisions for moisture control of the installed embankment.
- Lighting for possible night testing.

Task 7 – Evaluate sensor instrumentation for the TxAPT facility. This task will be performed concurrently with previous tasks so various instruments can be installed during the construction of the pavement facility starting with the embankment and continuing with the construction of the test pads.

**Options:**

MLS transport system

It may be desirable at some point in the future to install a transport system that can move the MLS from one test pad to another (possibly including lateral movement) without using the transport dollies and prime mover. If this system could be installed for a reasonable price, it would have several potential benefits:

1. It would eliminate the need to store the transport dollies on site.
2. It would reduce the amount of equipment needed to move the MLS from one test pad to the next.
3. It should enable operators to move the MLS more quickly after testing on one pad is complete.
4. It eliminates potential damage to test sections caused by the MLS transport dollies.
5. Provides greater mobility for the MLS on the test pad embankment.
6. With good mobility, it could be possible to alternate loading sequences between two test pads say on a biweekly basis, thereby reducing the effects of variable environments on the test results.

## Summary:

Experience to date has shown that the detailed Workplan for the TxAPT Site Preparation must be a fluid document, changing as conditions warrant. Recommendations and suggested revisions will be considered as the final work proceeds. Much of the site development depends on the renovation schedule of the MLS.

CTR staff will move forward on the implementation of this Workplan. This includes getting approvals for the temporary and permanent sites, development of the subgrade testing protocol, site layout master plans, and sensor instrumentation.

Continuous attention to these tasks will help insure the timely preparation of the TxAPT facility.

# APPENDIX A

Master List

Acronyms

| **Acronym** | **Name** |
|---|---|
| API | Annual Program of Implementation |
| CTR | Center for Transportation Research |
| MLS | Mobile Load Simulator |
| OAG | Operating Advisory Group |
| PRC | Pickle Research Campus |
| RFQ | Request for Quotes |
| RMC | Research Management Committee |
| RTI | Research and Technology Implementation Office |
| TAP | Technical Assistant Panel |
| TxAPT | Texas Accelerated Pavement Test Center |
| TxDOT | Texas Department of Transportation |

# APPENDIX B

The following TxDOT support equipment and data collection equipment is assigned to the TxMLS Branch. Please note that the data collection equipment (e.g. FWD and portable pavement analyzer) are on site during MLS data collection operations; however, this equipment is also used to support forensic investigations and other activities. Other equipment, such as the Grove Crane are occasionally loaned to the Districts or used for other projects when not needed by MLS operations.

<u>Support Equipment</u>

- Crew trailer for MLS operation. Trailer includes a computer to operate the MLS and a data acquisition system for collecting/storing data.
- Wells Cargo Repair Trailer. This is a portable shop that is used to make in-field repairs.
- 1-1/2 ton utility truck.
- 4 Transporter dollies. These are used to move the MLS either short- or long haul.
- 12,000 Gal. Fuel Trailer. Holds fuel for a 400 kW generator and a 100 kW generator.
- 400 kW generator. Used to power the MLS in the field.
- 100 kW generator. Provides power to the Crew Trailer.
- IH truck. Used to move the MLS for short-hauls only on site.
- Core rig trailer. Includes a storage compartment that holds a concrete saw and other tools.
- Grove TMF 25 ton crane.
- Lincoln welder on trailer
- Portable welder
- Portable air compressor
- Data collection Equipment
- Dynatest FWD. (1)
- Portable seismic pavement analyzer {PSPA} (1)
- Transverse / longitudinal profile beam (1)
- Dynamic Cone Pentrometer (1)
- Multi-Depth Deflectometer (1)
- Automatic Crack Monitoring system (1)
- French Captel Weigh-in-motion system (1)
- Weather station (1)

# APPENDIX C

The process of selecting the temporary site took into consideration the size of the MLS as well as the space required by the associated equipment. A shakedown test will be conducted at the temporary site and some of the support equipment including the generators, control trailer and supply trailer must be setup within 200 ft. of the MLS.

Permission has been granted to temporarily locate the TxDOT Mobile Load Simulator (MLS) on property controlled by Ferguson Labs at PRC. This property, which is located north and east of the Construction Bullpen access gate and west of Neils Thompson Drive (see Figure 1), is currently used by Ferguson Labs to store surplus materials and items awaiting disposal.

Ferguson Labs currently stores various equipment and other materials in this area. The Center for Transportation Research (CTR) will rearrange and/or remove these materials to make room for the MLS and related equipment. This work will be carried out under the guidance of a Ferguson Labs representative.

In addition to the site cleanup, a section of the site will be overlaid with asphalt. This improvement will allow a shakedown test to be performed after the MLS is fully assembled. The proposed construction will encompass installing an asphalt overlay extending from the north side of the Construction Bullpen gate to the gore point where the spur road and Neils Thompson Drive meet plus a segment from Neils Thompson Drive to the Bullpen gate. This work includes the following (see Figure 1):

1. Clean existing surface of loose stones and remove vegetation from the area to be paved.
2. Roll the prepared surface as needed to re-compact loose material.
3. Apply a prime/tack coat and level up as needed to cover exposed base material and produce a consistent pitch (cross slope). The final cross slope will not exceed 1% nor vary by more than 10% over the length of the section.
4. Apply a tack coat to the resulting surface and lay 1.5-inches of asphalt over the entire section with tapers as shown for transitions to existing surfaces.
5. Remove and dispose of all waste material and excavated material and clean up the site.

The asphalt will be Type D with a maximum aggregate size of 3/8″. The final asphalt thickness will vary along the length of the site as shown in Section A-A and Section B-B (see Figure 2) from 1.5″ up to a maximum thickness of 5-6″. This design will reduce the variable cross slope that must be removed over the length of the site.

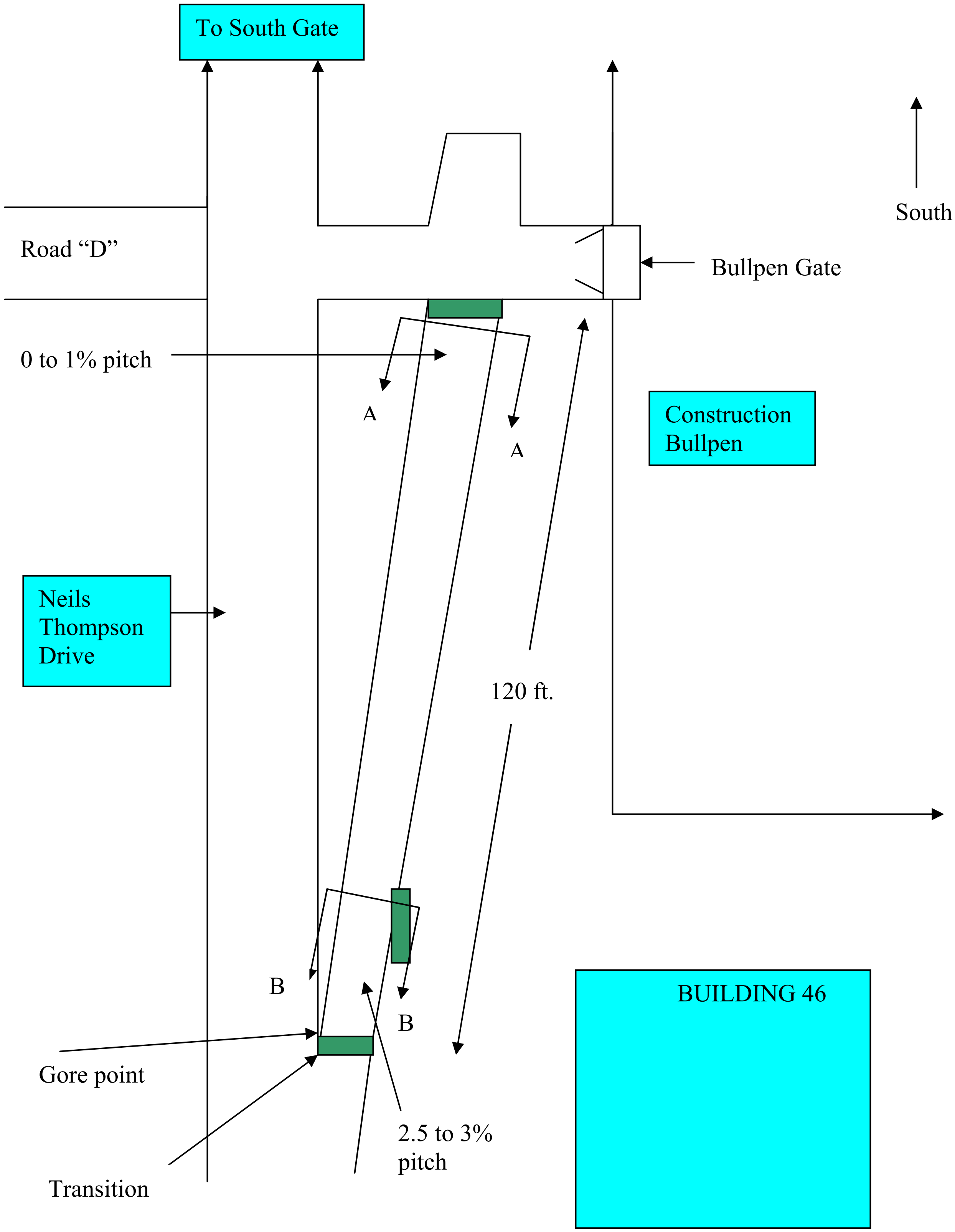
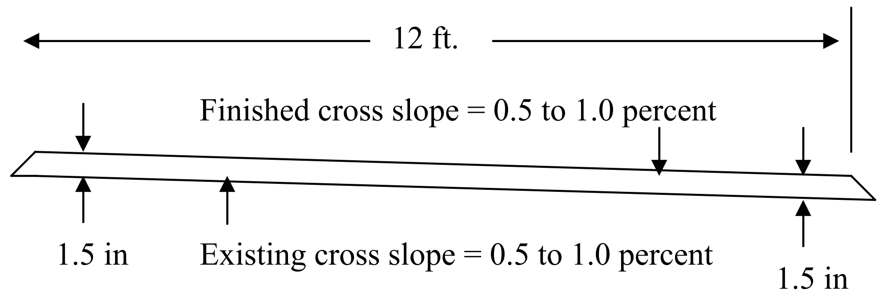
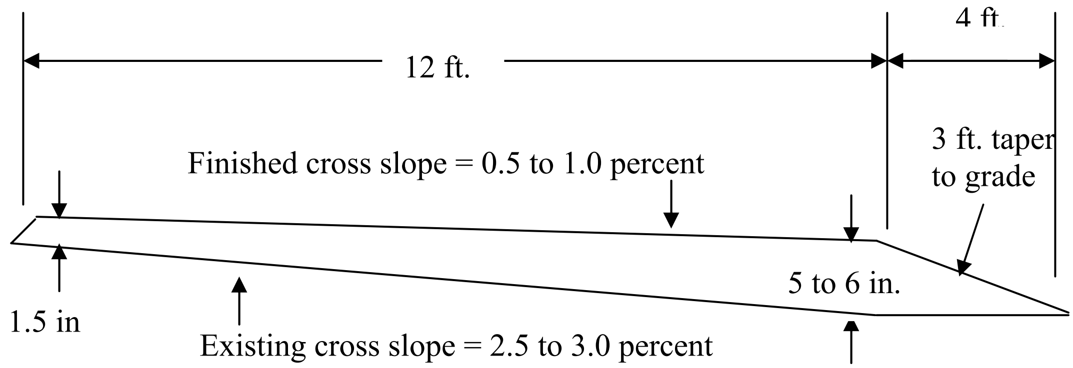



Figure 1. Temporary site work diagram.




Section A-A.  Transverse profile of ACC overlay.




Section B-B.  Transverse profile of ACC overlay.

Figure 2.  Transverse profiles of MLS sections.

After the MLS shakedown operation, provisions will be made to repair any damage done by the MLS to the temporary site. Conditions at the temporary site necessitate improvements to be made (i.e. overlay, base work, etc.) prior to the shakedown; this work is being organized in addition to follow-up site work/repairs, as needed, to return the site to an acceptable condition. The estimated cost is $8-10k.

Equipment Storage

TxDOT has provided a list of support and data collection equipment assigned to the TxMLS Branch (Appendix A). Some of this equipment must be on the temporary site during the completion of the system assembly and shakedown, and is shown on the temporary site layout diagram (Figure 3). Other equipment does not need to be on site and can be stored by TxDOT until the 5-year test facility is prepared. There are a few items that should be stored locally as this equipment will be used fairly frequently. The proposed storage location of the MLS support equipment is shown below.

| Support Equipment | Storage Location* |
|---|---|
| • Crew trailer for MLS operation. | On site |
| • Wells Cargo Repair Trailer. | On site |
| • 1-1/2 ton utility truck. | On site |
| • 400 kW generator. | On site |
| • 100 kW generator. | On site |
| • Lincoln welder on trailer | On site |
| • Portable welder | On site |
| • Portable air compressor | On site |
| • 4 Transporter dollies. | PRC |
| • Grove TMF 25 ton crane. | PRC |
| • 12,000 Gal. Fuel Trailer. | TxDOT |
| • IH truck. Used to move the MLS short distances. | TxDOT |
| • Core rig trailer. | TxDOT |
| • Data collection Equipment | TxDOT |
| • Dynatest FWD. (1) | TxDOT |
| • Portable seismic pavement analyzer {PSPA} (1) | TxDOT |
| • Transverse / longitudinal profile beam (1) | TxDOT |
| • Dynamic Cone Pentrometer (1) | TxDOT |
| • Multi-Depth Deflectometer (1) | TxDOT |
| • Automatic Crack Monitoring system (1) | TxDOT |
| • Load cell weigh-in-motion system (1) | TxDOT |
| • Weather station (1) | TxDOT |

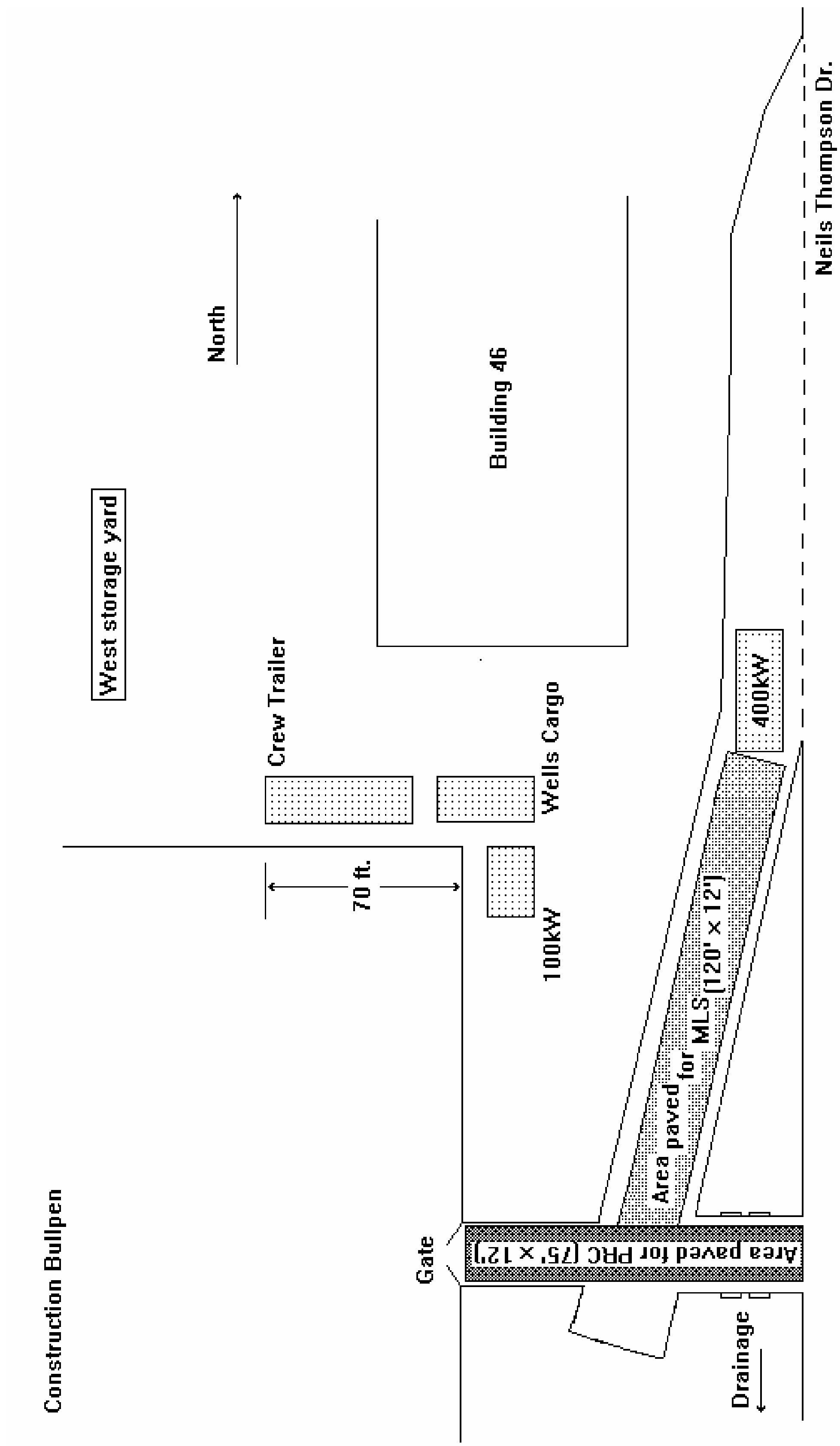



Figure 3. Temporary site layout.

# APPENDIX D

<u>Pavement Test Facility Sample Site Layout</u>

Design Parameters:

1. Dimensions of MLS are as shown in Figure D1.
2. Embankment slope = 1/3
3. Number of Subgrade types = 2
4. Number of test pads = 6
5. Length of MLS in transport mode = 132 ft.

Design Assumptions:

1. The existing subgrade at PRC is a suitable material for use at the TxAPT facility.
2. Average insitu subgrade depth is 3′.
3. Minimum subgrade depth = 5 ft. over bedrock
4. Minimum distance from screw jacks to edge of embankment = 10 ft.
5. MLS in transport mode must be on flat surface to properly position the MLS.
6. Maximum grade for access ramp = 8 percent.
7. The MLS will be moved in one piece between test pads.
8. Rolling assembled MLS over new and/or previously loaded test sections one time will not affect subsequent test results.
9. When moved to a new test section, the MLS must not block access of test equipment to previous section (i.e. coring drilling rig, FWD, seismic testing device, etc).
10. The MLS will be backed onto the embankment in two pieces and assembled over the first test pad.

Based on these design parameters and assumption, the minimum embankment size would be as shown in Figures D2 and D3. The 75 ft. width at the top of the embankment is based on:

- Ten (10) feet from the left edge of the embankment to the left side screw jacks (Design Assumption 4).
- Transverse distance between screw jacks over subgrade number one (SG1) = 19.5 feet (Figure D2).
- Sixteen (16) feet for subgrade transition.
- Transverse distance between screw jacks over subgrade number two (SG2) = 19.5 feet.
- Ten (10) ft. from the right side screw jacks to the edge of the embankment.

The width of the embankment at it base is 105 feet assuming the embankment were placed directly on bedrock (Design Parameter 2)

Subgrade number 1 (SG1) is the existing subgrade and SG2 is the imported subgrade (Design Parameter 3). Proceed by removing topsoil from the entire site (depth of top soil removal determine by Subgrade Testing Protocol).

Excavate as needed to obtain a minimum SG1 subgrade depth of 5 feet. Excavate area for subgrade SG2 to bedrock (Design Assumptions 2 and 3). With SG1 in place, place imported subgrade as shown in Figure D2.

The 300′ embankment length is based primarily on the length of the MLS device and on the following considerations (Figure D3):

- Seventy (70) feet is provided from the ingress point at the top of the embankment to the first test section. This allows the MLS and transport truck to be completely on top of the embankment as the MLS reaches the first test section to ease the placement process (Design Assumption 5). The lead in area also provides room to build a transition into the first test section and staging grounds for other TxAPT activities.
- The 36.5′ length of the test sections is the actual length of pavement loaded by the MLS bogies (see Figure D1).
- The 25.5′ transitions provide enough space to transition between two different pavement designs and to provide room for follow up testing while the MLS is loading the next test pad.
- Another 70′ are provided at the end to provide for the final transition, and to leave room to remove the transport dolly when the MLS is moved to the test pads furthest from the access ramp (Figure D4).

The width of the test pavement is 12′ allowing use of a standard asphalt lay down machine. If edge effects were a concern, the embankment would allow shoulders to be constructed to mimic field structural conditions.

Regardless of embankment size, the entire surface of the embankment should be paved to reduce the intrusion of surface moisture into the base, sub-base, and subgrade structures. Some treatment of the embankment slope should also be considered, as this could also be a source for variability of moisture content in the supporting layers of the pavement test pads during testing.

Figure D4 provides a schematic of the proposed access ramp. The ramp is designed with an eight percent slope (Design Assumption 6). This makes the length of the ramp 62.5′.

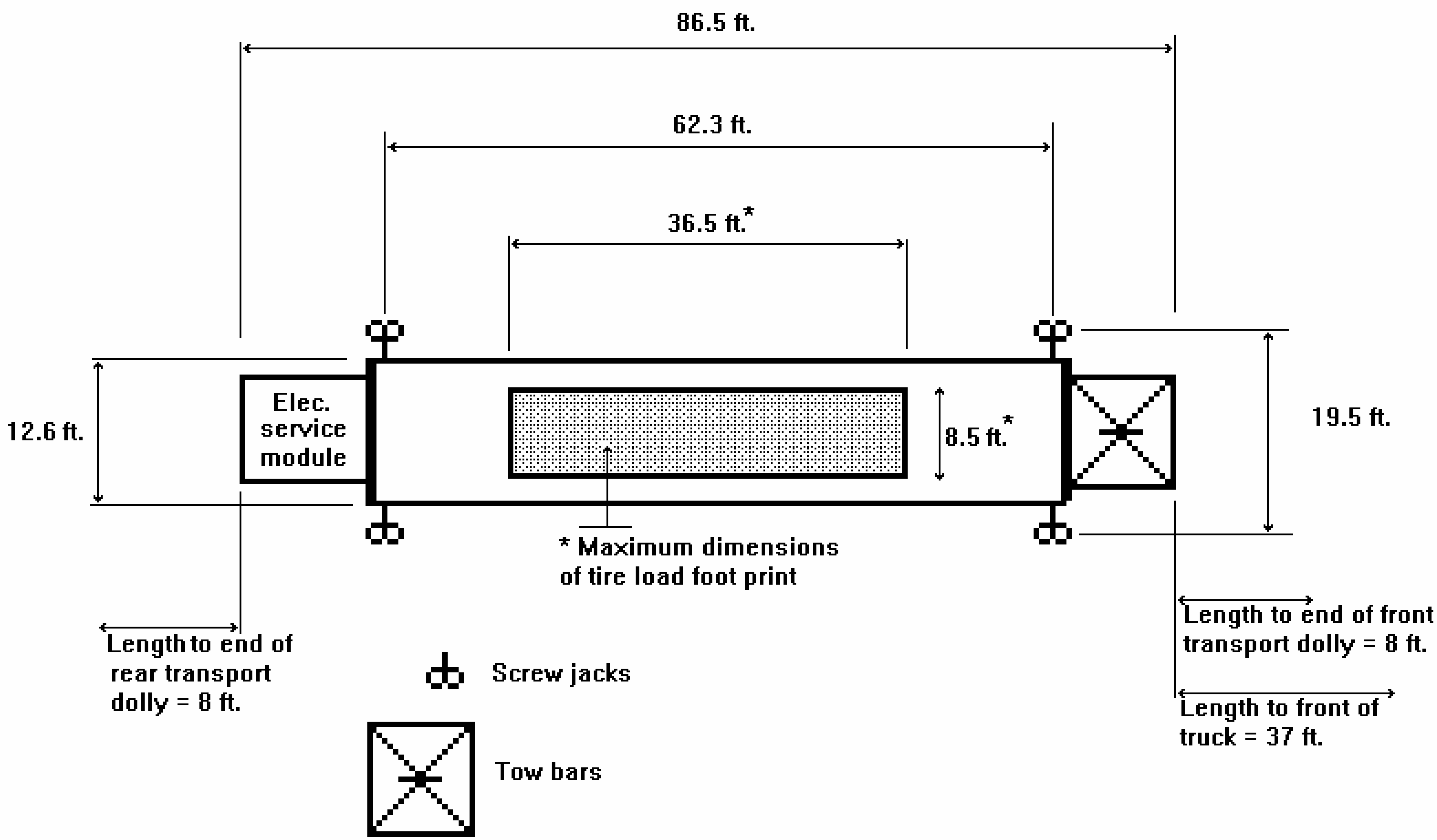



Figure D1. Mobile load simulator dimensions.

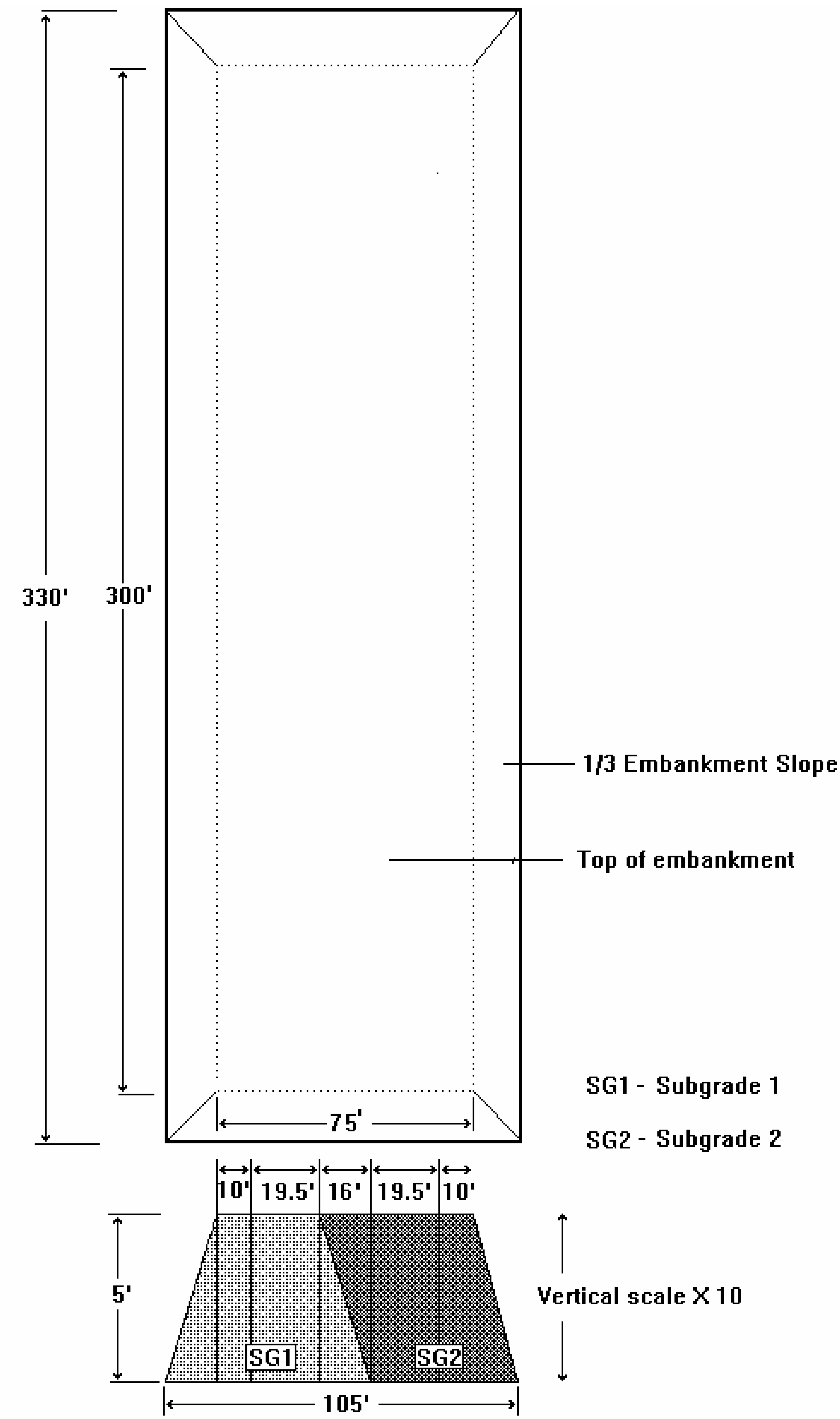



Figure D2. Plan and transverse profile of embankment.

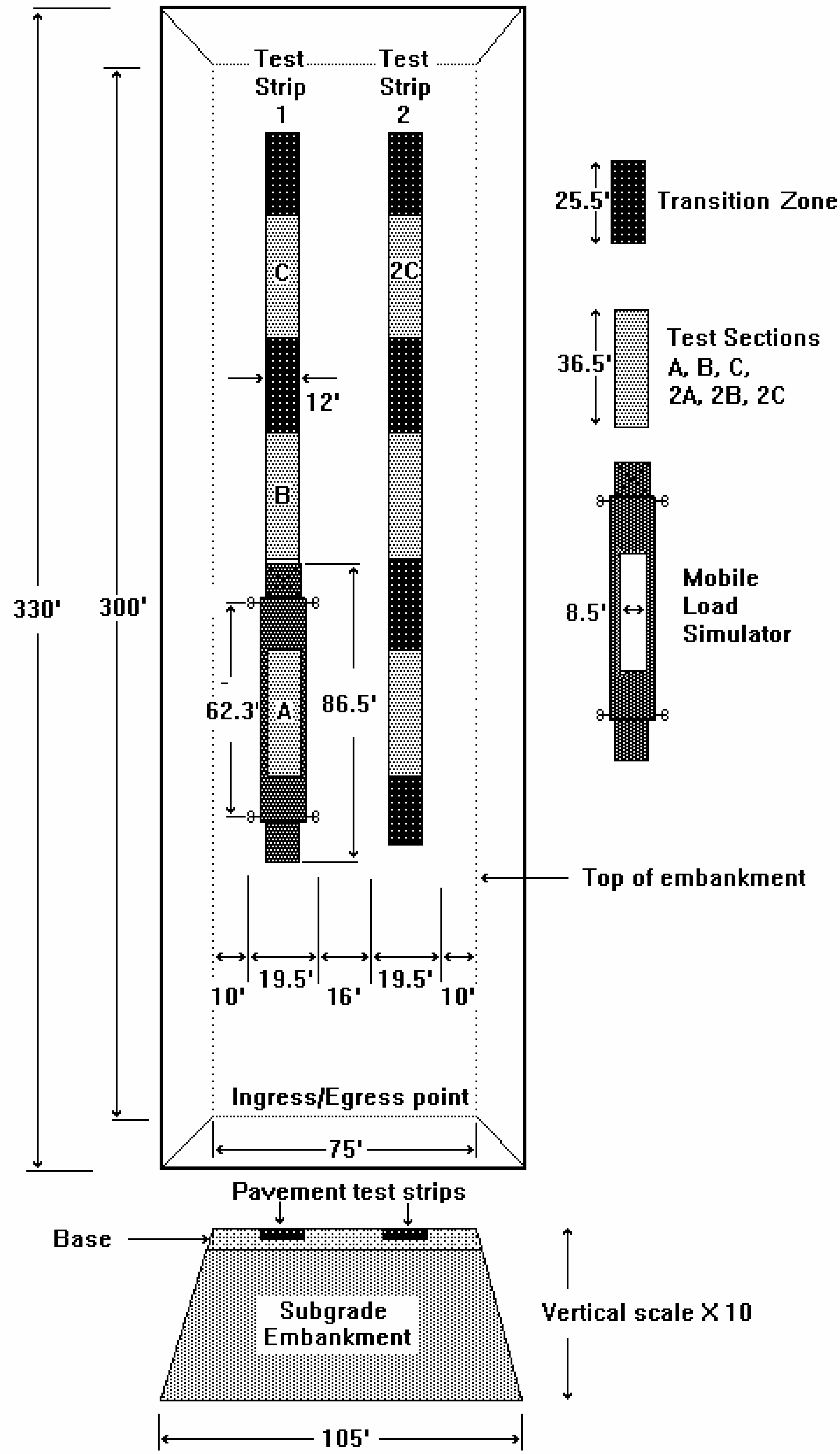



Figure D3. Plan and transverse profile of test pad layout.

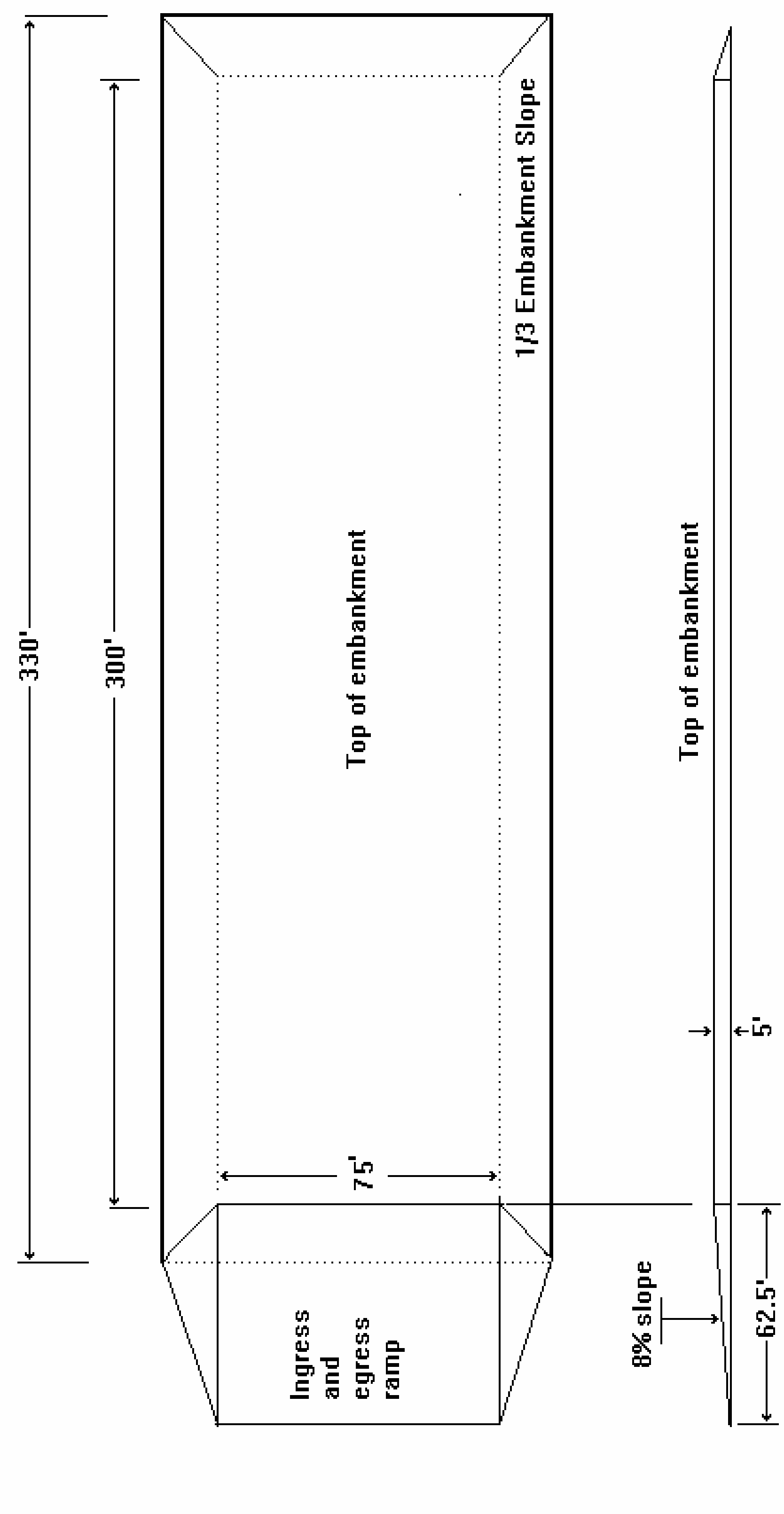



Figure D4. Embankment plan and profile with access ramp.