

## SHEETING AND SHORING REQUIREMENTS

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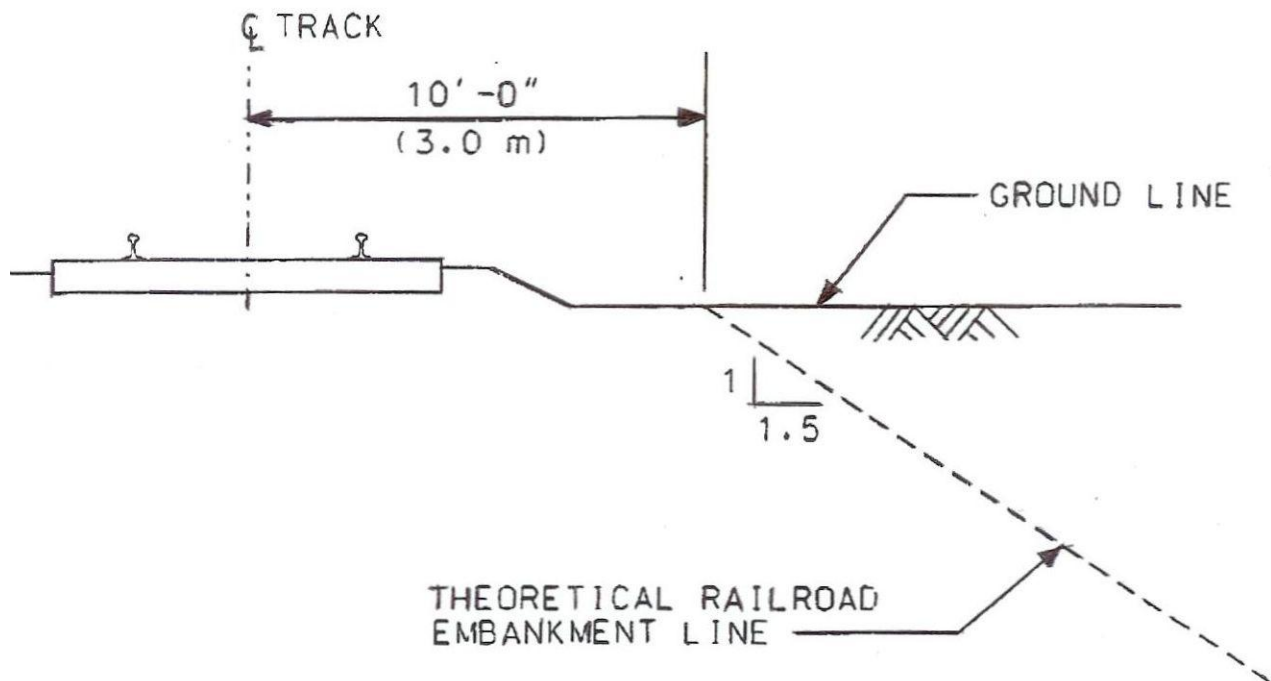
The following items are to be included in the design and construction procedures for all permanent and temporary facilities adjacent to railroad tracks.

1. Footings for all piers, columns, walls, or other facilities shall be located and designed so that any temporary sheeting and shoring for support of adjacent track or tracks during construction shall not be closer than twelve (12) feet from the centerline of the nearest track.
2. When excavation for construction of the above mentioned facilities is within the theoretical embankment line (see drawing SK-1), interlocking steel sheet piling, driven prior to excavation, must be used to protect track stability. The use of trench boxes or similar devices is not acceptable. Soldier piling and lagging will be considered for supporting adjacent track(s) only when its use is approved by the Railroad's Engineer. Consideration for the use of soldier piling and lagging will be made if the required penetration of steel sheet piling cannot be obtained and when dry, non-running, stable material will be encountered.
3. The sheeting shall be designed to support all lateral forces caused by the earth, water, railroad and other surcharge loads. The railroad loading to be applied is an E-80 loading. This loading consists of 80 Kip axles spaced five (5) feet on centers. The lateral forces acting on the sheeting shall be computed as follows.
  - a. The Boussinesq analysis shall be used to determine the lateral pressure caused by the railroad loading. The load on the track shall be taken as a strip load with a width equal to the length of the ties (8'-6"). The vertical surcharge,  $q$ (psf), caused by each axle, shall be uniform and equal to the axle weight divided by the tie length and the axle spacing (5'-0"). For an E-80 loading, this results in:  $q=80,000 / (8.5 \times 5) = 1882$  psf. The horizontal pressure due to the live load surcharge at any point on the sheet piling wall is  $P_h$  and can be calculated by the following:  $P_h=(2q/\pi)(\beta-\sin \beta \cos 2\alpha)$  (see drawing SK-2).
4. The Engineer responsible for design of the sheeting and shoring shall provide estimated lateral deflection of the proposed system along with supporting calculations.
5. In order to maintain safe operation of the railroad, the Railroad's Engineer may recommend that the Contractor monitor the railroad tracks for movement. When requested, the Contractor will be required to submit survey data taken at specified locations and according to a schedule to be established by the Railroad's Engineer.
6. The allowable stresses for the sheet piling and other steel members (wales, struts, etc.) shall be in accordance with AREMA Chapter 15, Part 1. These allowable stresses may be increased ten percent (10%) due to the temporary nature of the installations.
7. Where soil or rock anchors are used, all anchors must be tested. Testing shall be in accordance with industry standards with ten percent (10%) of the anchors "Performance Tested" and all other "Proof Tested." Design of soil and rock anchors shall conform to

“Recommendations for Prestressed Rock and Soil Anchors,” Post Tensioning Institute, Current Edition.

8. Exploratory trenches, three (3) feet deep and fifteen (15) inches wide in the form of an “H” with outside dimensions matching the outside of sheeting dimensions are to be hand dug, prior to placing and driving steel sheeting, in areas where railroad underground installations are known to exist. These trenches are for exploratory purposes only and are to be backfilled with the backfill compacted immediately. This work must be done in the presence of a Railroad representative.
9. All applicable laws and regulations governing excavations and pile driving operations shall be adhered to including notifications to underground utility alert centers as applicable. The Railroad makes no warranty as to the location of underground utilities located on or near their rights-of-way and shall be held blameless in the event of damage to them. Damage to underground utilities shall be reported immediately to the proper authority and repaired at no expense to the Railroad.
10. Absolute use of track is required while driving sheeting within fifteen (15) feet from centerline of a live track. The procedure for arranging the use of track shall be as outlined in the railroad service agreement.
11. Cavities adjacent to the sheet piling, created by the driving of sheet piling, shall be filled with sand and any disturbed ballast must be restored and tamped immediately.
12. Sheet piling shall be cut off at the top of tie during construction. After construction and backfilling has been completed, piling within twelve (12) feet from centerline of track or when bottom of excavation is below a line extending at a 1:1 slope from the end of tie to point of intersection with sheeting, shall be cut off eighteen (18) inches below existing ground line and left in place.
13. Any excavation adjacent to track shall be covered, ramped and provided with barricades as required by the Railroad. A lighted walkway with a handrail must be provided adjacent to the track for any excavation within twelve (12) feet of the centerline.
14. Final backfilling of excavation shall be as required by project specifications.
15. The Contractor is to advise the Railroad of the time schedule of each operation and obtain approval for all work to be performed adjacent to tracks so that it may be properly supervised by Railroad personnel.
16. All drawings and design computations for temporary sheeting and shoring shall be prepared in English units, stamped by a Licensed Professional Engineer, and submitted for the Railroad’s approval. The submitting Engineer will be responsible for the accuracy for all controlling dimensions as well as the selection of soil and groundwater design values which will accurately reflect the actual field conditions. Approval of the submitted materials by the Railroad’s Engineer does not relieve the submitting Engineer or the Contractor from that responsibility.

17. The drawings shall contain details of the temporary sheeting and shoring system showing sizes of all structural members, details of connections, and embedment depth. The drawings shall include a plan view showing all the proposed excavations and distances from centerline of track to face of excavation. Drawings shall include a section normal to the track showing the shoring location relative to the centerline of track and showing the height of sheeting, anchorage systems, and railroad track elevation, relative to the bottom of excavation. The plans must be complete and accurately describe the nature and sequence of the work.
18. Three (3) copies of the submission are to be sent to the Railroad's Engineer. The sponsor is advised to expect a minimum thirty (30) day review period from the day the submission is received by the Engineer.
19. The Railroad's representative must be present at the site during the entire sheeting and shoring procedure period. The sponsor must notify the railroad representative at least seventy-two (72) hours in advance of the work. No changes will be accepted after that time.



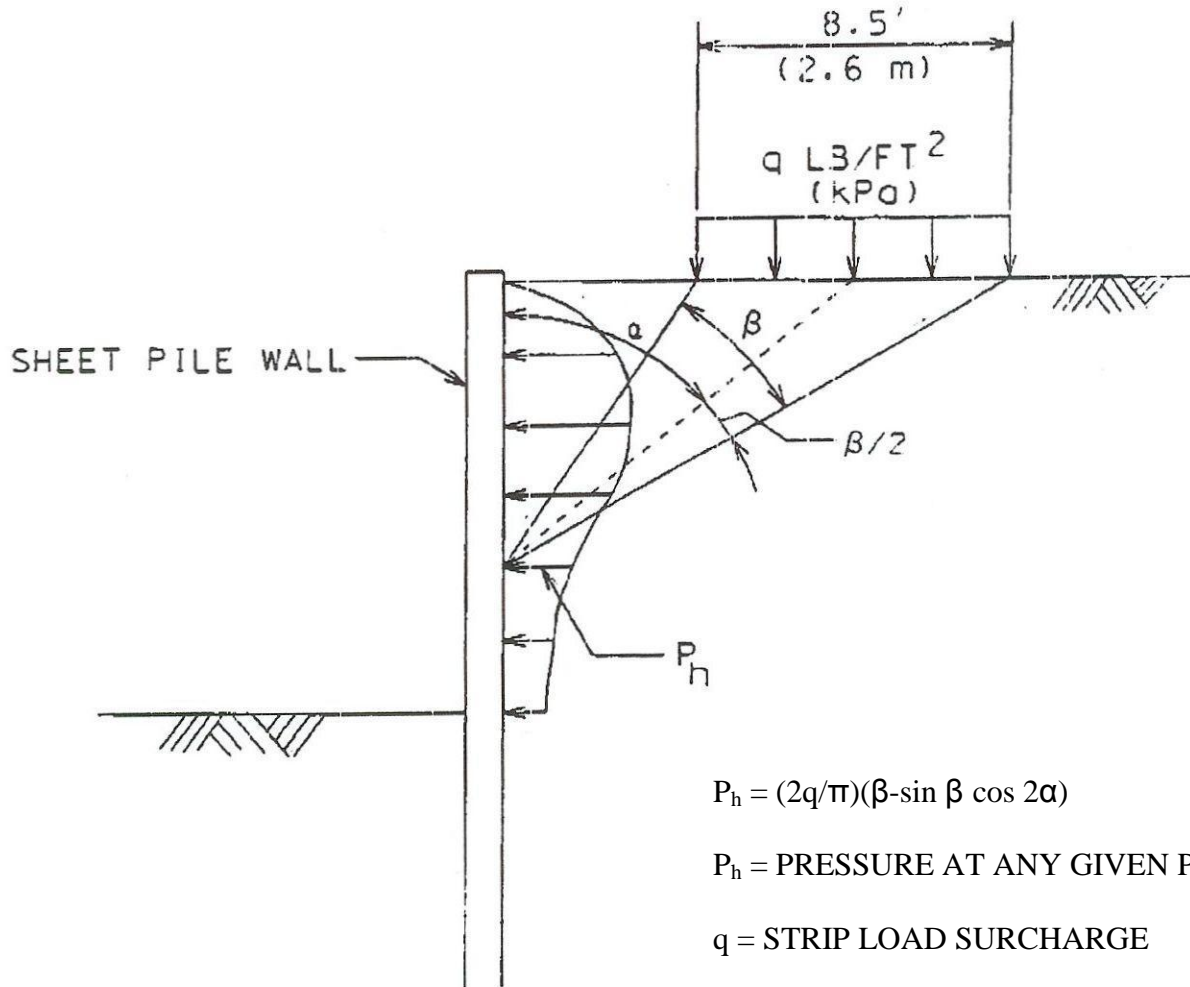
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REQUIREMENTS FOR TEMPORARY SHEET PILING ADJACENT TO TRACK

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1. Steel sheet piling for track support is not required for excavation outside the theoretical railroad embankment line. Shoring in accordance with OSHA requirements shall be used in this area.
2. Steel sheet piling driven prior to excavation is required when excavation is within the theoretical railroad embankment line.
3. All sheet piling is to be designed for an E-80 loading. The Boussinesq analysis is to be used to determine the lateral pressure caused by the railroad loading.

DWG. NO. SK-2  
LATERAL PRESSURE DIAGRAM



$$P_h = (2q/\pi)(\beta - \sin \beta \cos 2\alpha)$$

$P_h$  = PRESSURE AT ANY GIVEN POINT

$q$  = STRIP LOAD SURCHARGE

$\alpha$  = ANGLE IN DEGREES

$\beta$  = ANGLE IN RADIANS

LATERAL PRESSURE DUE TO STRIP LOAD