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HANDOUT

ON

RETAINING WALL ALTERNATES

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Over the past few years, several new types of RETAINING WALL systems have been developed. The advent of these new systems has greatly increased COMPETITION particularly among proprietary wall systems. Many highway agencies are taking advantage of this increased competition to REDUCE WALL COSTS. Those who are not taking advantage of it - - should. FHWA experience indicates that cost savings of 25 percent or more are being achieved on highway projects through the BIDDING OF "ALTERNATE" wall designs.

At the same time, highway agencies must be cautious with regard to"new" systems that have little proven performance history. Such systems should be subjected to rigorous technical evaluation before being accepted for use. Those found to be technically acceptable should then only be used on an experimental basis until sufficient performance history is obtained to allow routine use of the system.

This handout was developed to supplement a slide presentation titled "Retaining Wall Alternates" which describes the design and construction of different types of retaining walls available and provides guidelines to the DESIGNER on wall selection and the design process. The following information is provided:

1. A brief outline of the major items to be considered in evaluating and selecting wall alternates.

2. FHWA's recommendation on the best way to bid alternates to optimize cost savings.

3. A summary of recommended retaining wall "alternate" types suitable for cut, fill, or cut/fill situations.

Wall Selection and Design Process (Questions to Ask Yourself)

1. What type of retaining walls are available?

2. What type of retaining wall will fit the site?

3. When and why should alternate retaining wall designs be considered?

4. How should alternate retaining walls be designed and contracted?

5. How are alternate designs made equal?

6. How are designs done by others evaluated?

1. What Type of Retaining Walls Are Available?

a. Gravity

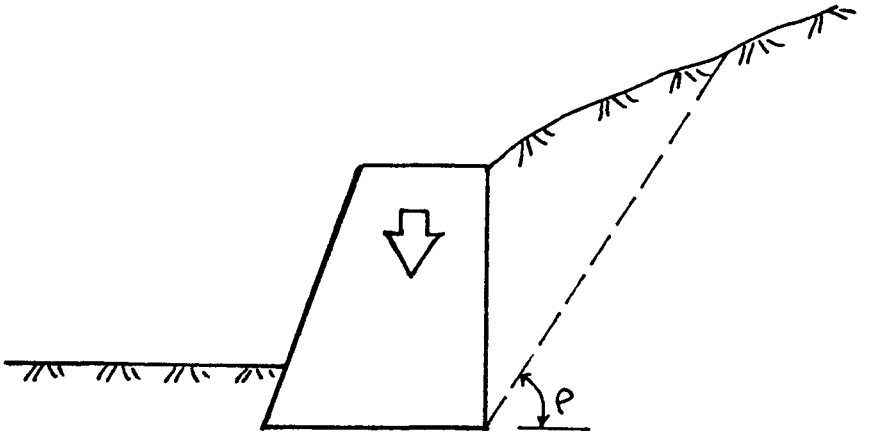
b. Reinforced Backfill

c. Cantilever

d. Anchored

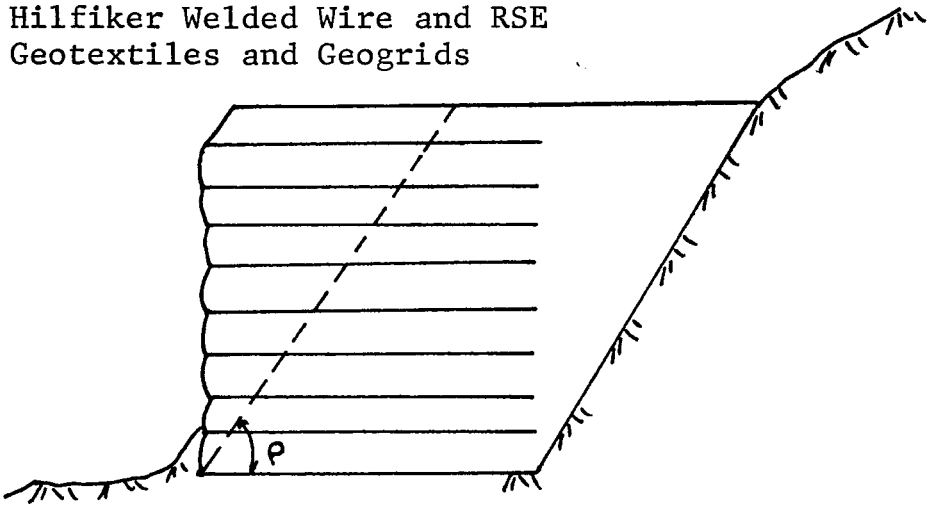
Examples of GRAVITY Walls:

Concrete (gravity and cantilever)
Bin Walls (different shapes and materials)
Crib Walls (different shapes and materials)
Gabions



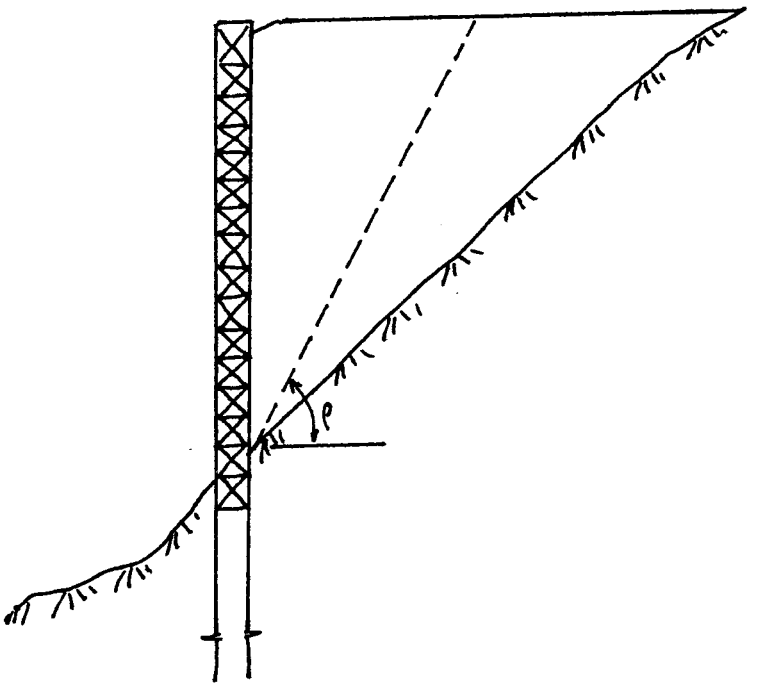
Examples of REINFORCED BACKFILL Walls:

Reinforced Earth
VSL Retained Earth
MSE Mechanically Stabilized Embankment (Caltrans)
GASE (Georgia)
Hilfiker Welded Wire and RSE
Geotextiles and Geogrids



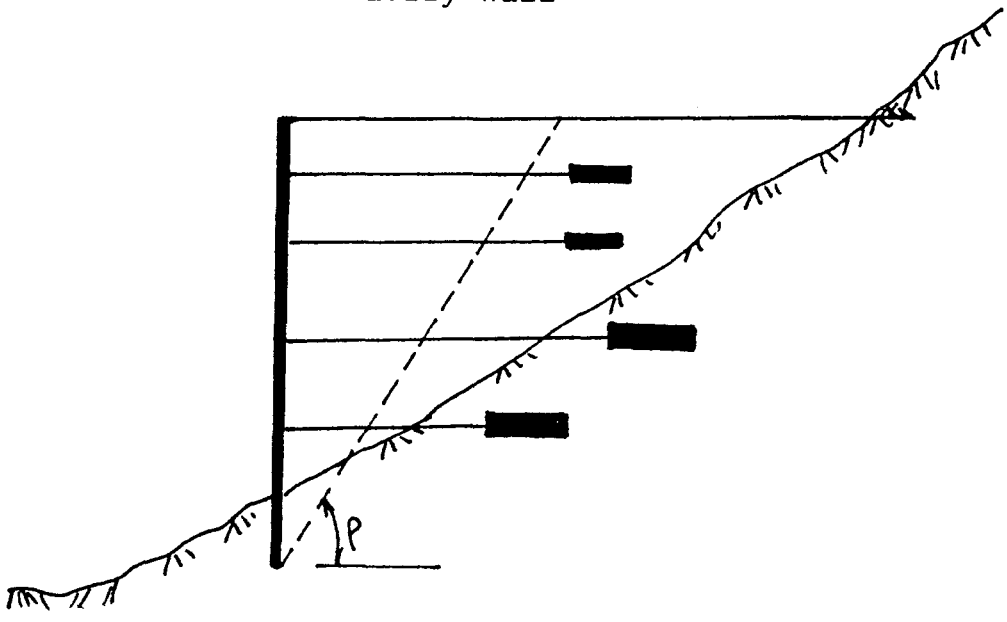
Examples of CANTILEVER Walls:

Vertical Sheet Pile
H-Pile and lagging
Concrete Cylinder Pile
Concrete Slurry Wall



Examples of ANCHORED Walls:

H-Pile and lagging (different lagging materials)
Sheet Pile
Gravity Structures
Concrete Cylinder Pile
Concrete Slurry Wall



2. What Type of Retaining Walls Will Fit the Site?

The wall types that will fit the site will depend on the following specific wall performance variables:

a. Availability
b. Service life, maintenance, future use
c. Deflection tolerance
d. Ease of construction
e. Construction changes
f. Environmental and visual considerations
g. Special loading requirements

3. When and Why Should Alternate Retaining Wall Designs Be Considered?

Alternate wall designs should be considered when more than one wall type is acceptable and the acceptable wall types appear to be cost-competitive. Bidding of alternate designs will:

a. Prevent elimination of an acceptable alternate based on erroneous engineering estimates.

b. Stimulate competitive bidding.

c. Provide a satisfactory retaining wall at the lowest possible cost.

4. How Should Alternate Retaining Walls Be Designed and Contracted?

The following two DESIGN OPTIONS are available:

a. PRELIMINARY ENGINEERING STAGE - Alternates are selected and designed during the preliminary engineering stage.

Advantages:

- Less confusion regarding alternates during bid evaluation.
- Agency controls engineering.
- Optimize competition and cost savings.

- Design is integrated into contract.
- Site specific conditions such as subsurface conditions, construction sequencing, traffic control, etc., are input in design.

Disadvantages:

- Requires additional engineering time and funds during design.

b. CONTRACT ADVERTISEMENT STAGE - The design and selection are performed by the contract bidders.

Advantages:

- Minimizes contracting agency design effort.

Disadvantages:

- Shifts engineering responsibility to the contractor.
- Requires design review during bid analysis phase.
- Contractor will mark up retaining wall cost to cover design cost.
- All design parameters and site specific details must be incorporated in the plans and specifications.

FHWA RECOMMENDATION - PRELIMINARY ENGINEERING STAGE SHOULD BE USED TO SELECT AND DESIGN APPROPRIATE ALTERNATES. FULLY DETAILED PLANS AND SPECIFICATIONS SHOULD BE INCLUDED IN THE BID PACKAGE FOR ALL ALTERNATES.

5. How Are Alternate Designs Made "Equal"?

Where alternate designs will be prepared, certain minimum physical and design criteria that all alternates must meet should be established by the owner agency, in order to make the alternate designs acceptable and equal. In particular, this should be done for proprietary wall systems where the wall design is prepared by the wall supplier. The minimum physical and design criteria which should be established by the owner agency are:

a. Retaining wall dimensions including wall appurtenances.

b. Minimum S.F. for: overturning, sliding, and stability of the overall slope.

c. Tolerable total and differential defections.

d. Minimum design life.

e. Minimum S.F. of internal wall mechanism (pull-out, steel stress).

f. Magnitude and direction of external loads and subsurface drainage.

g. Method of payment and unit of measurement.

6. How Are Designs Done By Others Evaluated?

Where designs for proprietary systems are prepared by the wall supplier, the owner agency should, at a minimum, perform an engineering evaluation of the design with careful attention to the following major items:

a. Design packages should include plans, specifications, cost estimate and site specific computations.

b. Each component should agree with established project criteria.

c. Designs should follow established procedures or technically supported deviations.

d. Specifications should be compatible with contracting agency standards.

MOST SUITABLE RETAINING WALL TYPE

FILL SITUATIONS

1. Reinforced Backfill
   - Reinforced Earth, Retained Earth, Hilfiker, GASE, Fabric, Tensar
2. Doublewal

CUT SITUATIONS

1. Soil Anchors
2. Drilled Shaft
3. Doublewal
4. H-Pile and Lagging
5. Concrete Slurry Wall
6. Vertical Sheet Pile

FILL/CUT SITUATIONS

1. All of the above could be "cost effective" plus
2. Gabions
3. Bin Walls
4. Crib Walls