Inspection of Old Retaining Walls

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NYC Buildings

CONDITION ASSEMENT -Objectives

- Classification of retaining walls.
- Basic elements of a visual inspection of a retaining wall.
- Issues related to the assessment of old masonry retaining walls.

Older Building Codes - Retaining Wall

- A wall designed to prevent the lateral displacement of soil or other materials

- Too Broad
  - Basement Walls
  - Tunnel Walls
  - Pools

Short History

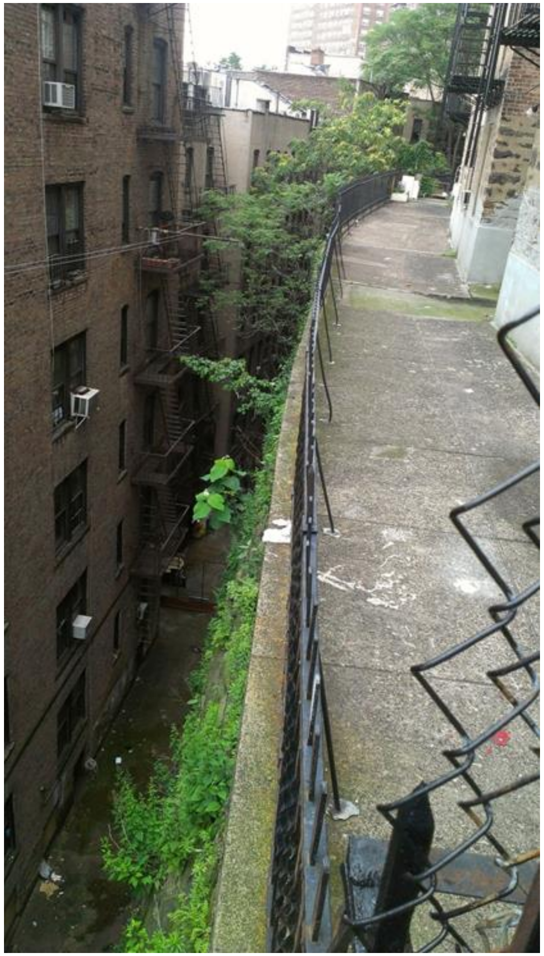
- The early building codes used the term – retaining wall – mainly to refer to basement walls.
- 1915 Building Code used the term closer to present day meaning and also required to be designed for water pressure.
- There was no significant requirement or reference to retaining walls in the 1938 Code –
- The 1968 code introduced the facot r of safety of 1.5 for overturning.

2014 Code Definition

- RETAINING WALL. A wall that resists lateral or other forces caused by soil, rock, water or other materials, thereby limiting lateral displacement and the movement of the supported materials. Basement walls and vault walls that are parts of buildings and underground structures, including but not limited to utility vault structures, tunnels and transit stations, are not considered retaining walls.

What Height?

Supporting Roads or Building Lots



NAVFAC CLASSIFICATION

- Gravity
- Semigravity
- Flexible
- Counterfort

Gravity Walls

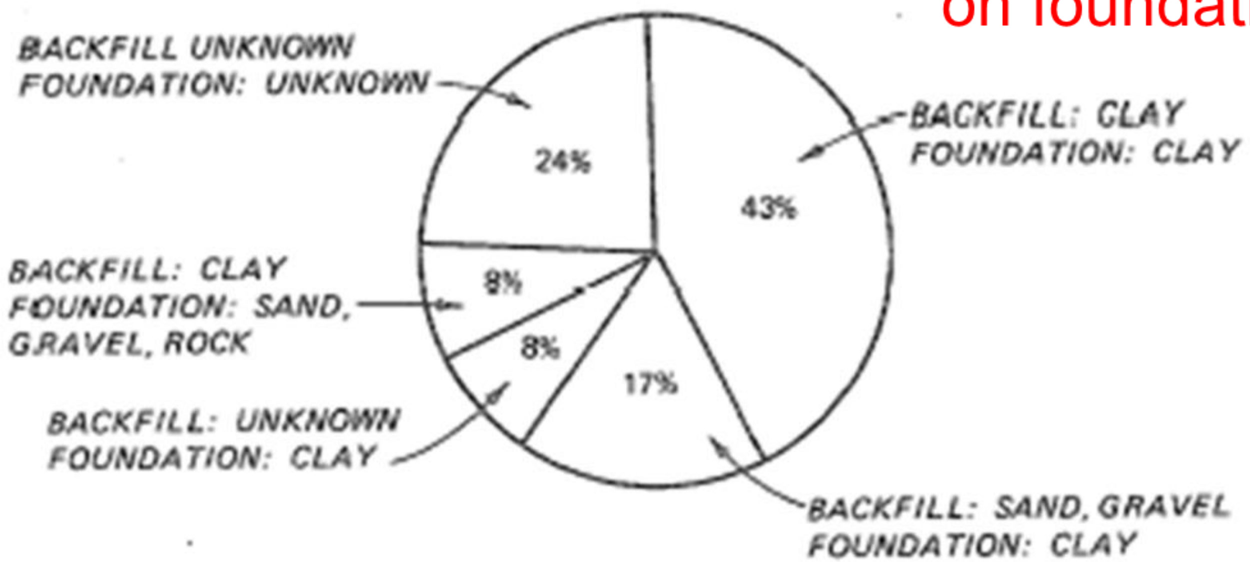
- Gravity walls resist overturning and sliding by the weight of the wall itself. These walls are usually constructed of solid concrete or rock rubble mortared together. These walls are not usually reinforced with steel since the massive nature of these walls develops little or no tension in the mass. Gravity walls are seldom constructed any more…
- The vast majority of retaining walls were gravity walls.

Fill Wall

- Earth retaining structure supporting **specified soil or aggregate backfill**. Fill walls are typically located below roadway grade on the outboard side of the roadway or parking area, but may also exist above travelway grade in locations commonly associated with cut walls.
- Were there “specifications” for the backfill of the old wall.
- Were they compacted or thrown down?

Causes Unsatisfactory Retaining Walls

43% backfill clay
on foundation clay



b. Foundation and backfill material of unsatisfactory retaining walls (Ireland 1964)

From EM-1110-2

Cut Walls

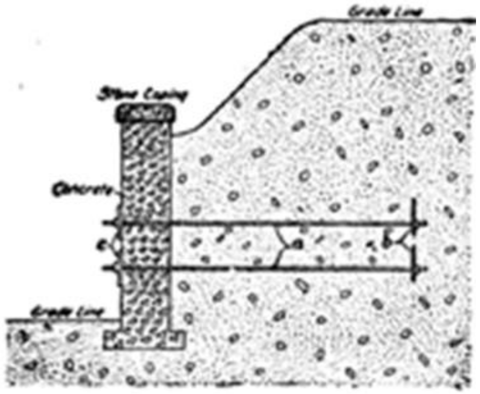
- Earth retaining structure directly supporting natural ground; either constructed directly against the excavated soil/rock mass, or against a minor volume of drainage backfill.

Cut Walls

Cut walls are constructed in areas where the finished grade will be substantially below existing grade. Cut walls are constructed with a top down construction sequence, which eliminates the need for temporary shoring…

Tiedback Walls or Deadman Anchored Walls

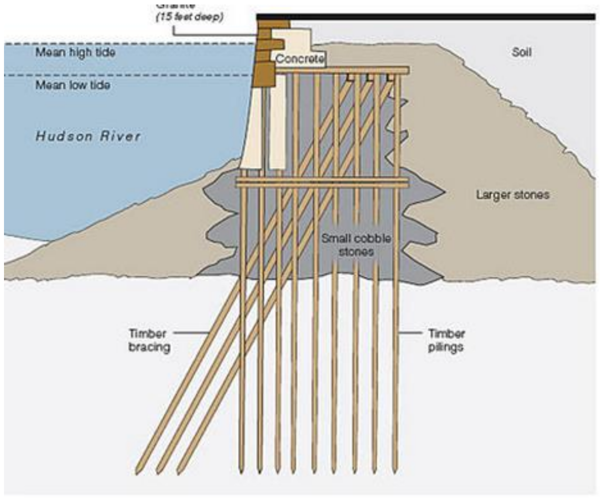
Bars or cables which pass through the face of the wall which are anchored to a large object buried behind the wall referred to as a "deadman, " which is usually either concrete or sheet piling. The force holding the wall back is generated by passive soil pressures acting on the deadman. The deadman must be located far enough behind the wall so that the active failure zone and the passive resistance wedge in front of the deadman do not overlap.



When excavating on top – protect deadmen and cables !

Waterfront Structures – retain or protect

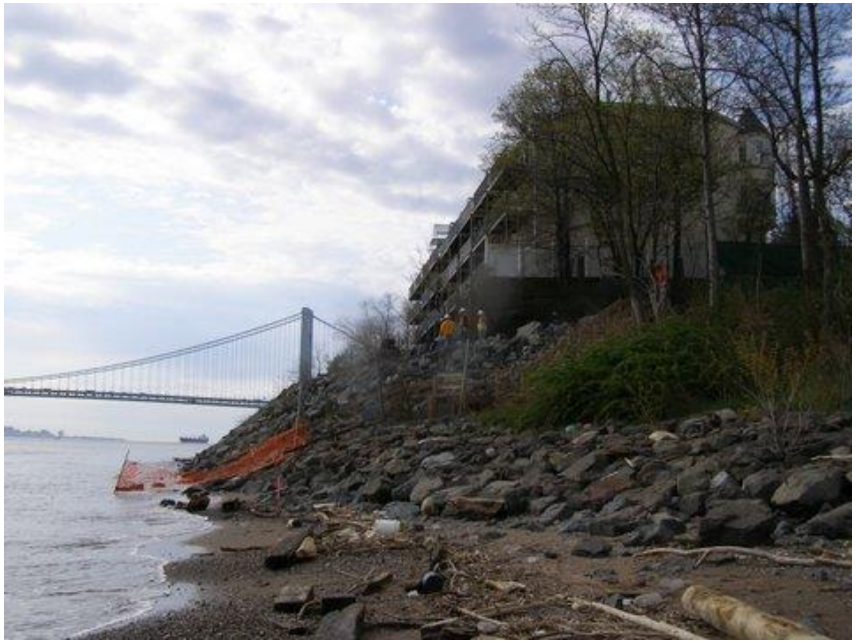
Old Bulkhead on Hudson **Sea Wall**

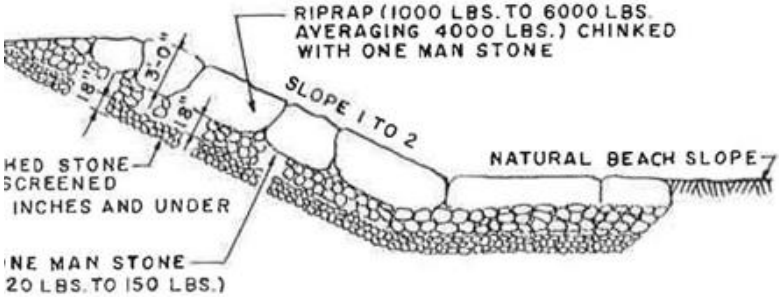


Revetment – retains fill

Riprap

Is this a wall?

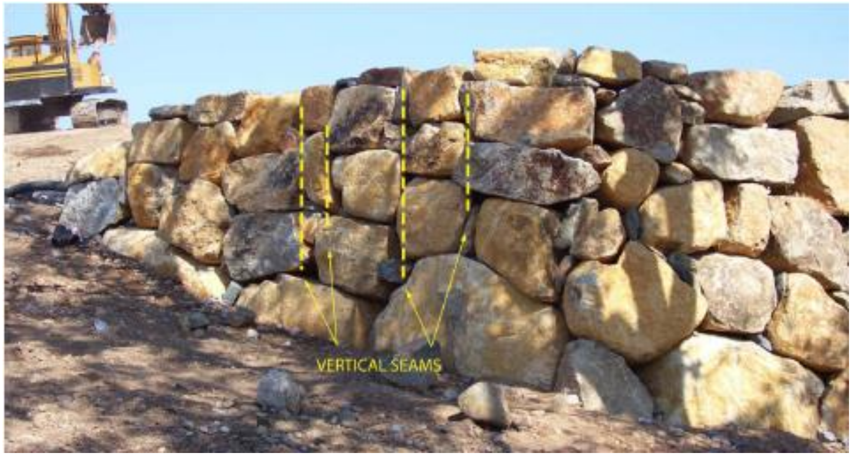


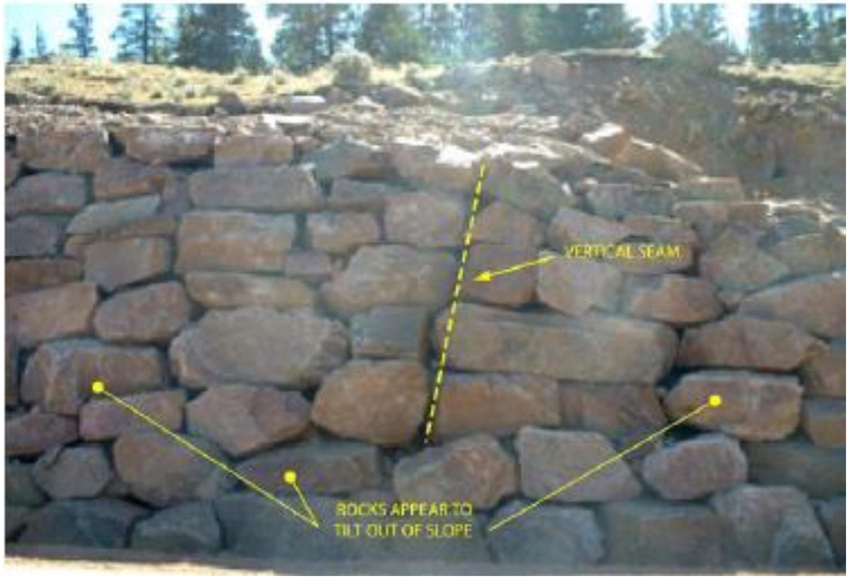


Is this a retaining wall?

Dry Retaining Wall –no mortar

Rockery Installation



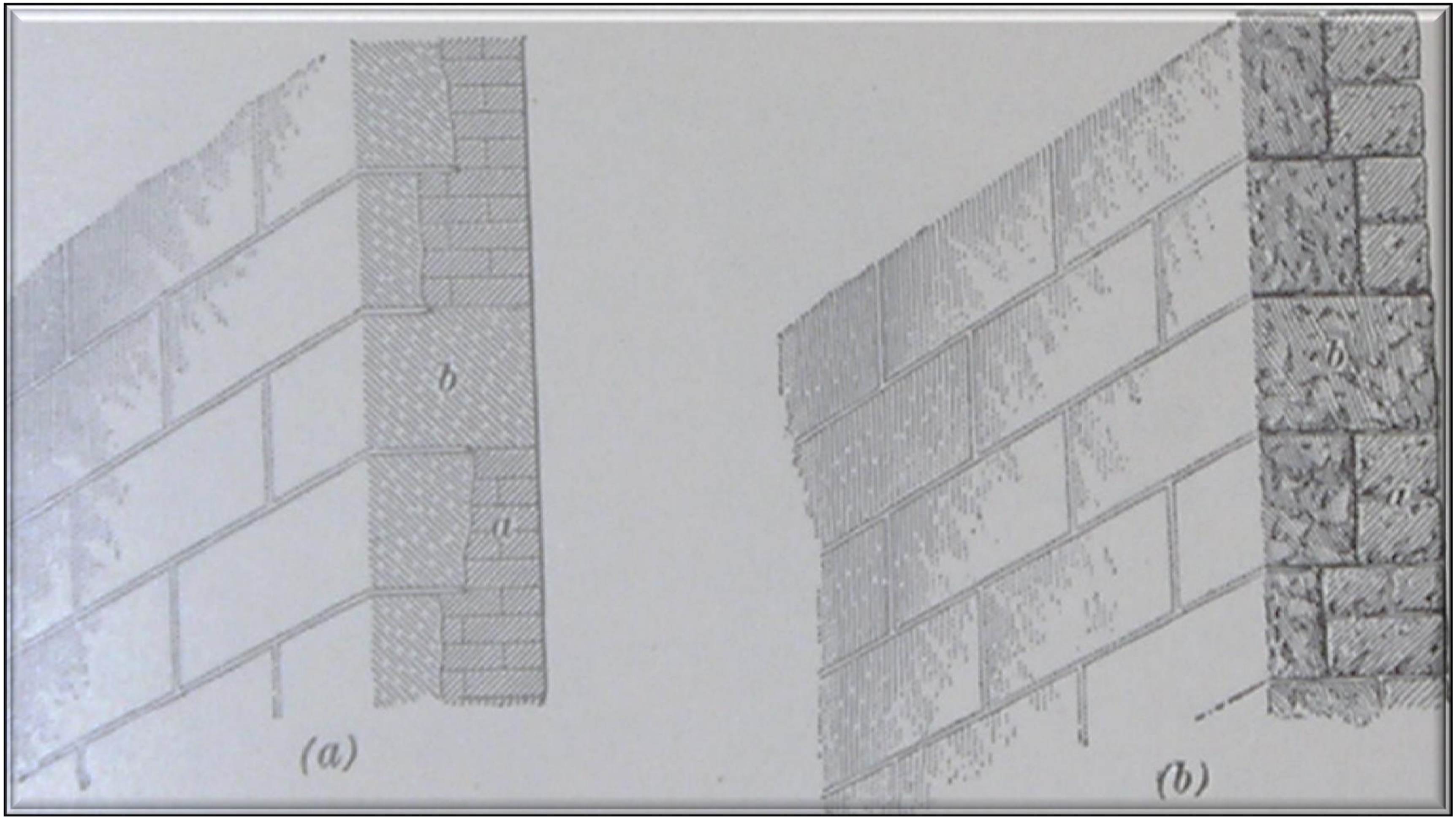


http://flh.fhwa.dot.gov/innovation/td/geotech/rockeries/documents/09_Chapter_6_Construction_Inspection.pdf

Mortared Retaining Wall – Rubble Masonry

?????   Ashlar   it is a veneer

Bearing Masonry Construction Requires Headers



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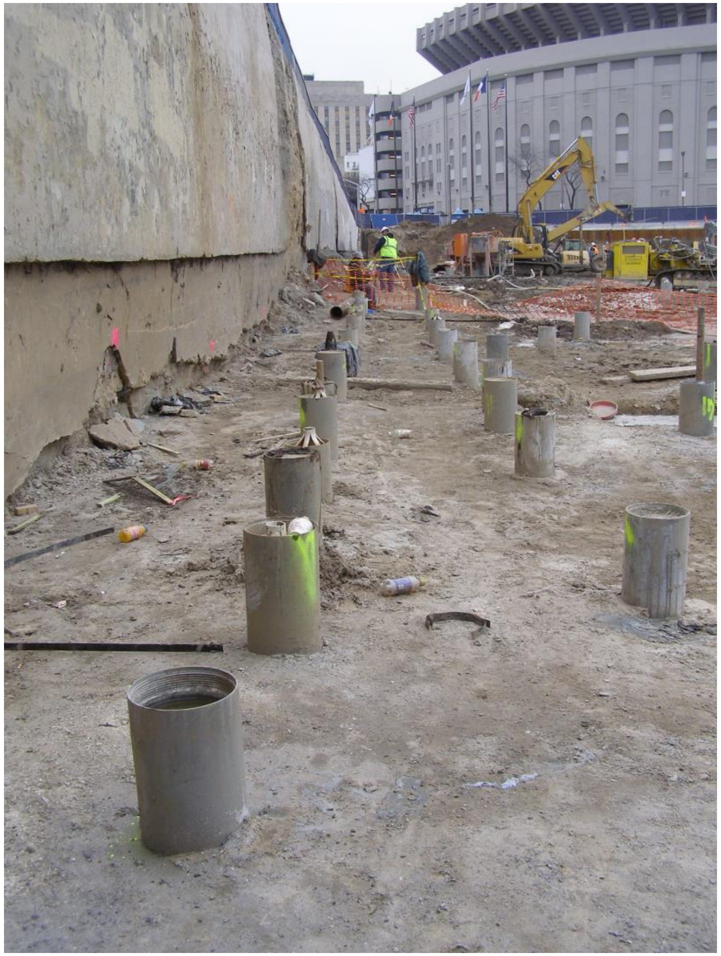


Rubble wall

WIP – Wall Types

RETAINING WALL INVENTORY AND CONDITION ASSESSMENT PROGRAM (WIP)
National Park Service Procedures Manual

Publication No. FHWA-CFL/TD-10-003

Wall Function Codes		
[FW] Fill Wall [CW] Cut Wall [BW] Bridge Wall [SW] Switchback Wall [HW] Head Wall [SP] Slope Protection [FL] Flood Wall		
Wall Type Codes		
[AH] Anchor, Tieback H-Pile	[CC] Crib, Concrete	[MG] MSE, Geosynthetic Wrapped Face
[AM] Anchor, Micropile	[CM] Crib, Metal	[MP] MSE, Precast Panel
[AS] Anchor, Tieback Sheet Pile	[CT] Crib, Timber	[MS] MSE, Segmental Block
[BC] Bin, Concrete	[GB] Gravity, Concrete Block/ Brick	[MW] MSE, Welded Wire Face
[BM] Bin, Metal	[GC] Gravity, Mass Concrete	[SN] Soil Nail
[CL] Cantilever, Concrete	[GD] Gravity, Dry Stone	[TP] Tangent/ Secant Pile
[CP] Cantilever, Soldier Pile	[GG] Gravity, Gabion	[OT] Other, User Defined
[CS] Cantilever, Sheet Pile	[GM] Gravity, Mortared Stone	[NO] None
Architectural Facing Type Codes		
[BV] Brick Veneer	[PF] Planted Face	[SS] Simulated Stone
[CO] Cementitious Overlay	[SC] Sculpted Shotcrete	[SV] Stone Veneer
[FF] Fractured Fin Concrete	[SH] Shotcrete (nozzle finish)	[TI] Timber
[FL] Formlined Concrete	[SM] Steel/Metal	[OT] Other, User Defined
[PC] Plain Concrete (float finish or light texture)	[SO] Stone	[NO] None

WIP Design Criteria

The engineer should be knowledgeable of AASHTO wall design standards and aware of historic construction practices and workmanship sufficient to select from one of the following levels of applied design criteria:

- *None: Does not meet any known design standards or systematic construction methods commonly used at the time of construction;*
- *Non-AASHTO: Does not meet AASHTO design standards , but is consistent with other structures of its type and period of construction exhibiting established construction workmanship and good performance; or*
- *AASHTO: Appears to meet AASHTO geometric, design, materials, and construction*

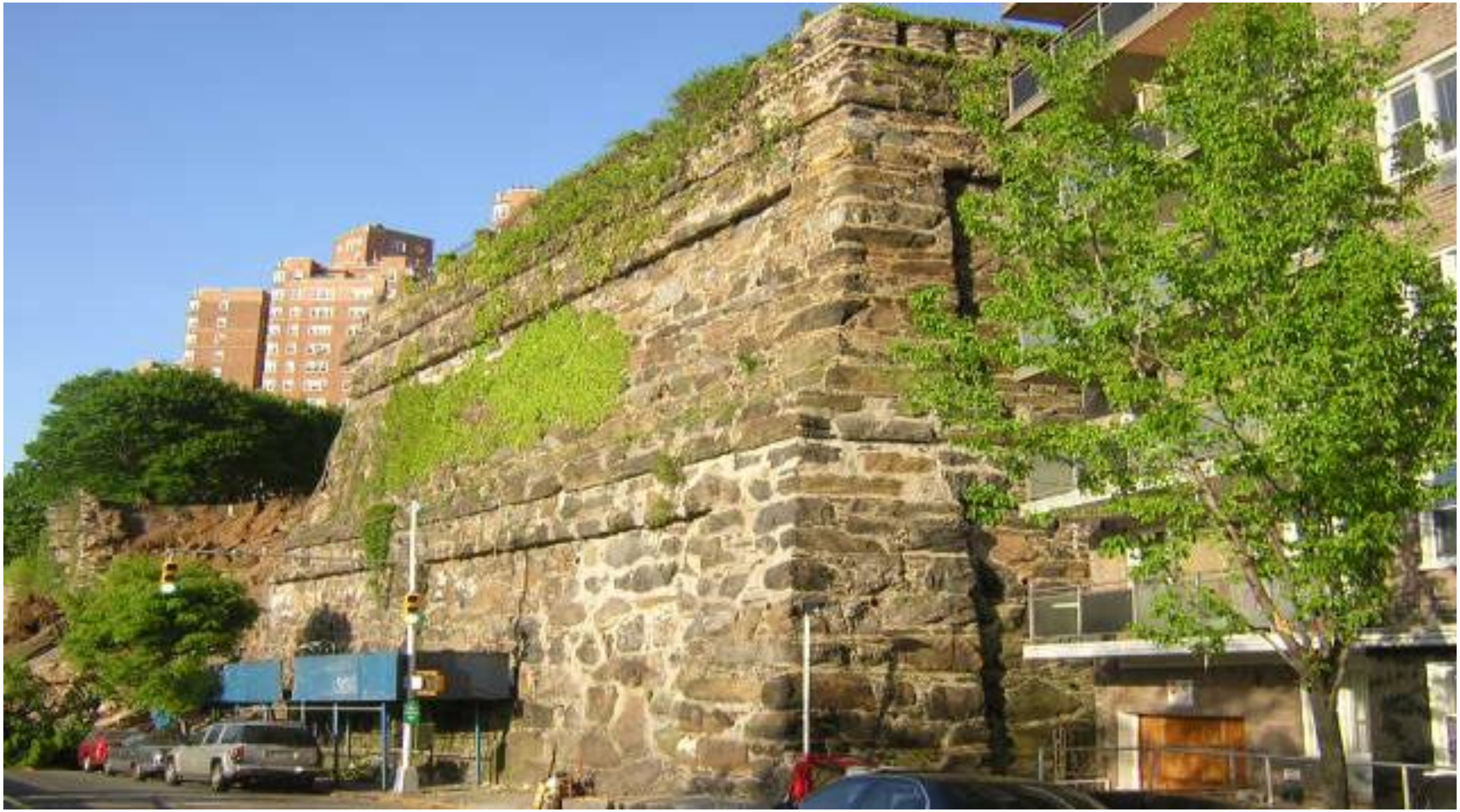
WIP Consequence of Failure – NOT NYC

- Low – No loss of roadway, no to low public risk, no impact to traffic during wall repair/replacement
- Moderate – Hourly to short-term closure of roadway low-to-moderate public risk, multiple alternate routes available
- High – Seasonal to long-term loss of roadway, substantial loss-of-life risk, no alternate routes available.

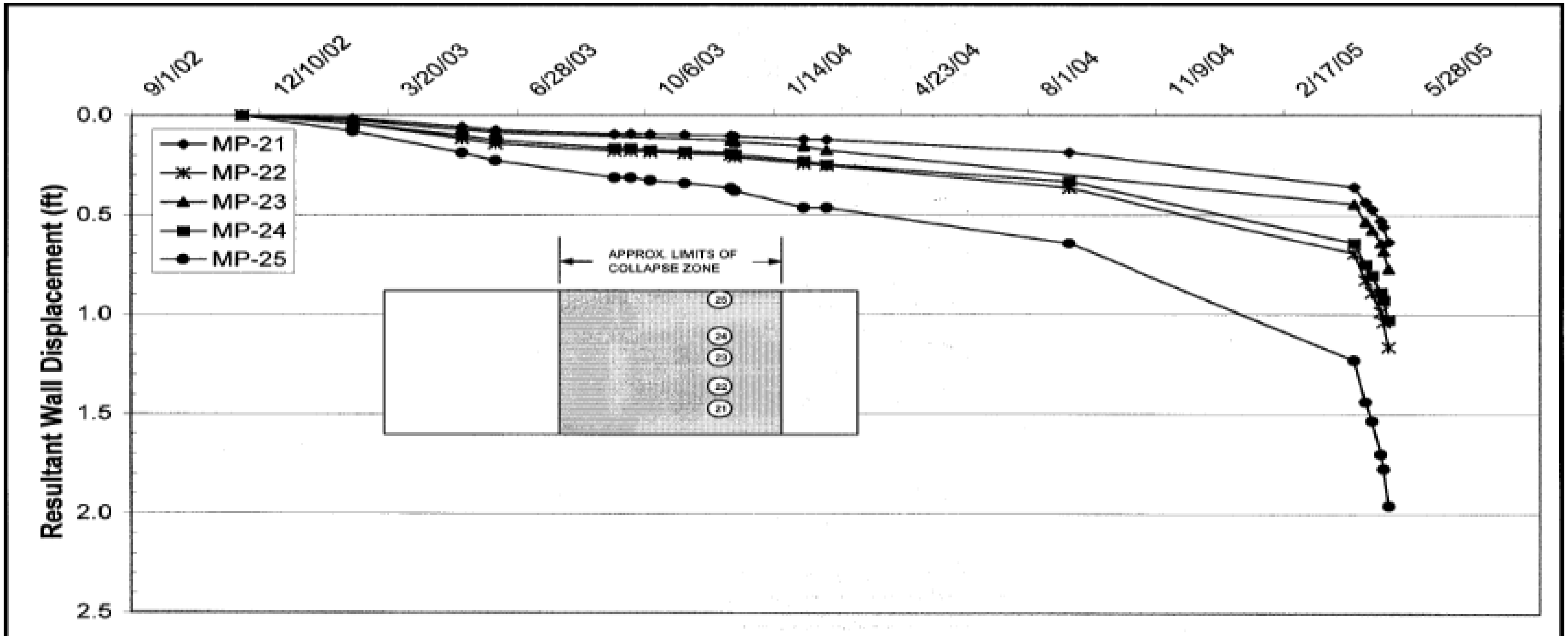
WIP Data Reliability – NOT NYC

- Estimate of how well observed conditions represent wall performance and if additional investigations may be warranted.
  - 1-Poor Conditions cannot be sufficiently observed to rate element(s), warranting additional investigations to better define element performances and/or to determine the cause(s) or poor performance.
  - 2-Good Observed conditions are sufficient to rate the conditions of wall element(s); however, additional investigations would be useful to better understand element performance.
  - 3-Very Good Observed conditions clearly describe wall performance. Additional investigations are not needed.

Castle Village



Wall Displacement –Castle Village



Displacement evolution in time of several points of wall on same vertical.

EVERY MONITORING NEEDS PREESTABLISHED ACTION PLANS

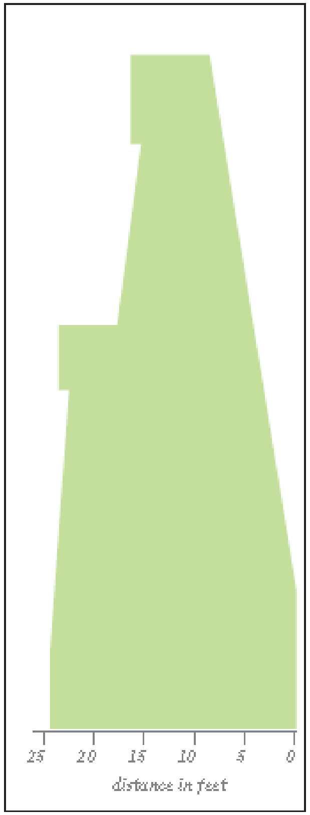


Figure 1
The above drawing represents a cross section of the Castle Village retaining wall after construction.

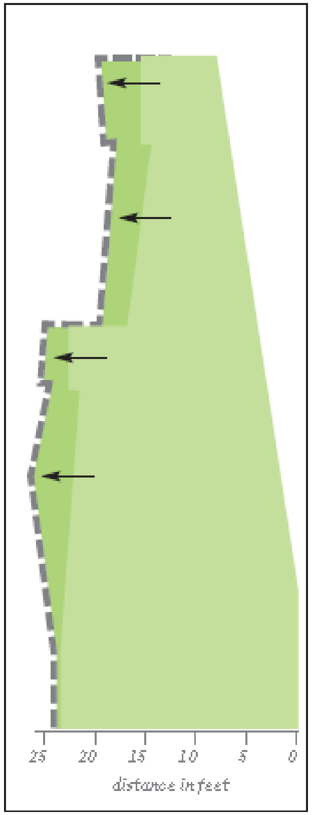


Figure 2
The darker outline in this drawing shows how the Castle Village retaining wall had moved and the deformed shape it had taken in the months prior to its collapse.

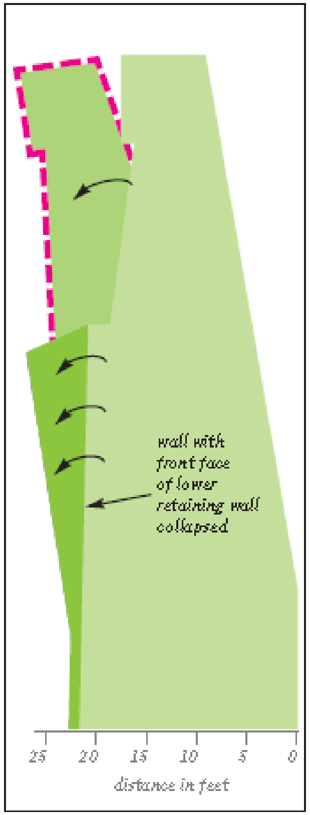


Figure 3
This drawing shows the lower portion of the wall once the bulging front face has been removed and illustrates how the wall was in imminent danger of collapse without that support.

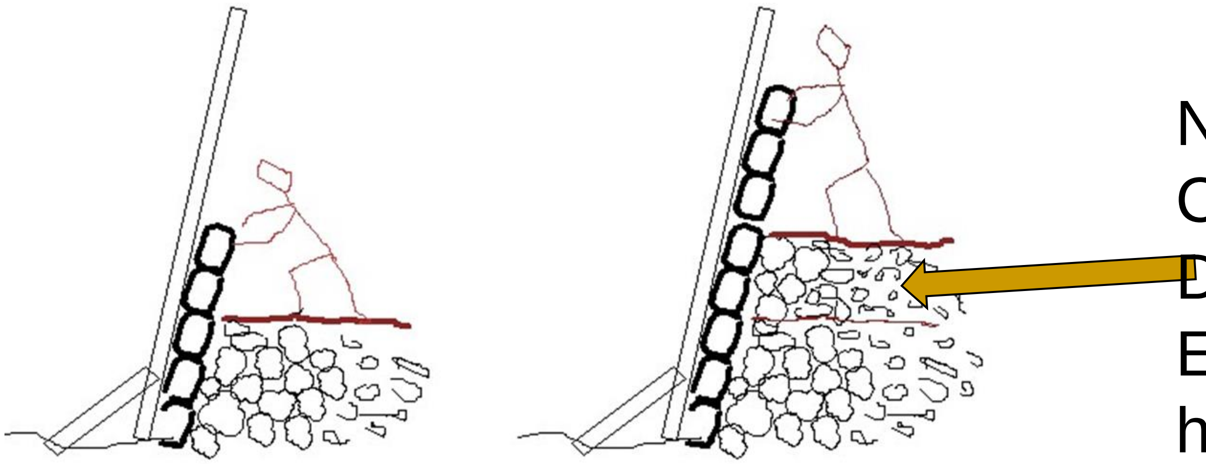
Important lessons

- Monitoring has to have a plan that include limits that will trigger immediate protective actions.
- Call 311 in case of emergencies

Sections through wall

Back of Face Wythe

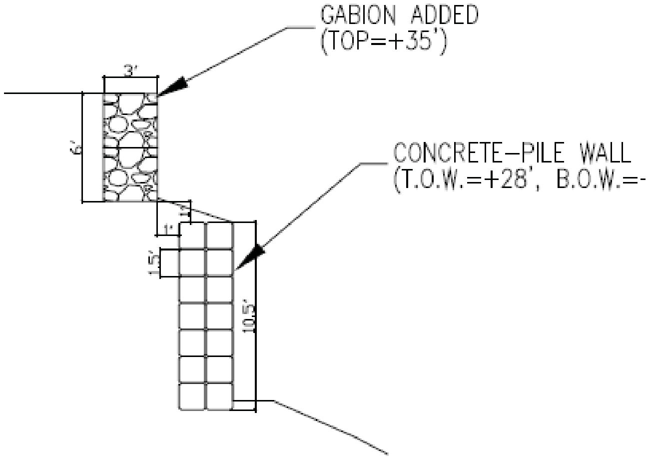
Method of Construction



New layer backfill.
Compacted?
Dropped?
Engaging
headers?

Backfill is dry to support construction operation. Less pressure originally.

Collapse after Noreaster (water from the top)



Gabion vs Placed Stone

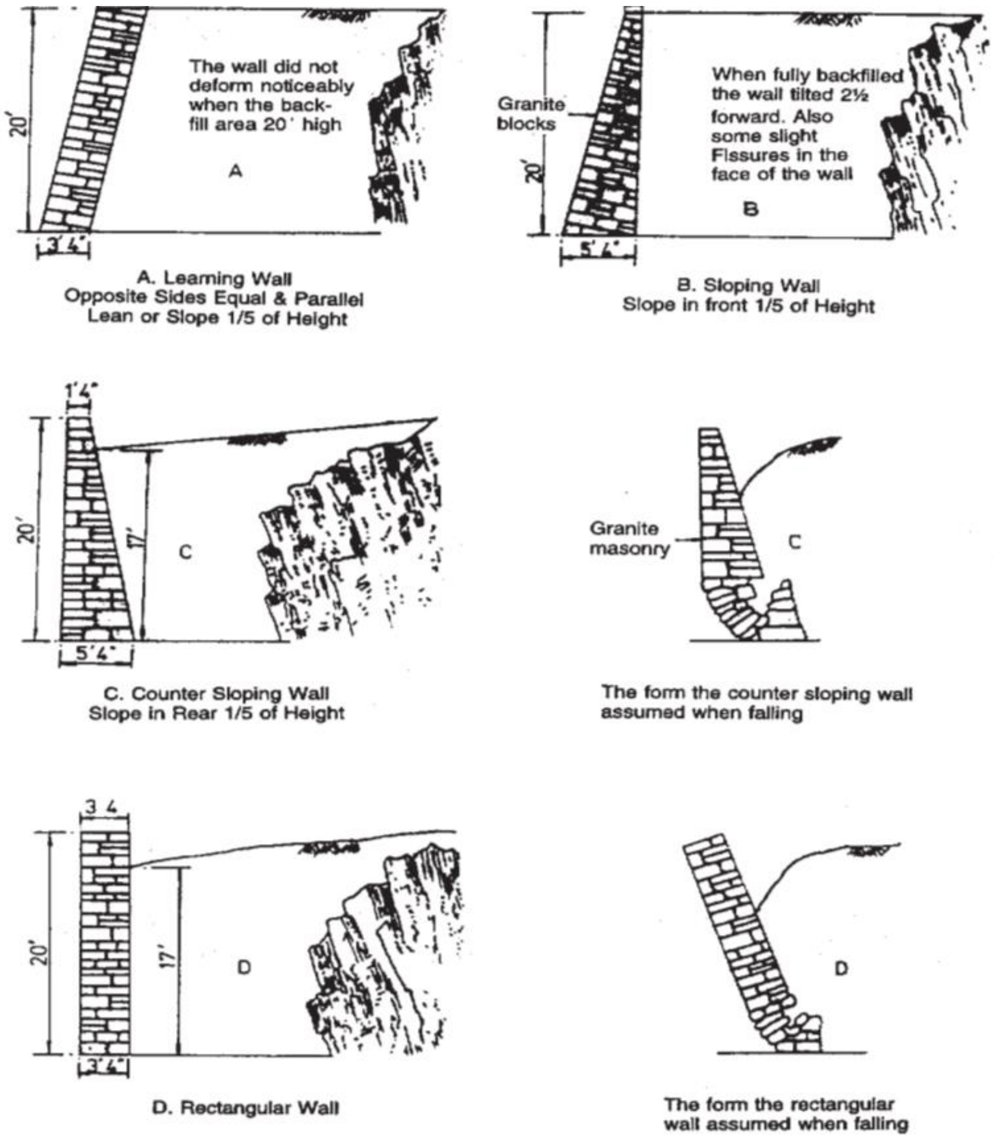
Slope Failure After Sandy (water at base)

General Burgoyne's Experiments 1853

Dry walls with same volume of stone.

Walls type C & D collapsed at 15 ft

Type A – INCLINED WALL & FACE BATTER MOST STABLE



Empirical Methods –English Rule

- **547 English Rule.** “Experience has shown that a wall [to sustain earth having a level top surface], whose thickness is one fourth of its height, and which batters 1 or 2 inches per foot on the face, possesses sufficient stability when the backing and foundation are both favorable. This allows a factor of safety of about two to cover contingencies. It has also been proved by experience that under no ordinary conditions of surcharge or heavy backing is it necessary to make a retaining wall on a solid foundation more than double the above, or one half of the height in thickness. Within these limits the engineer must vary the strength according to the conditions affecting the particular case. Outside of these limits, the structure ceases to be a retaining wall in the ordinary acceptation of the term. …….the thickness of retaining walls in ground of an average character equal to one third of the height from the top of the footings.

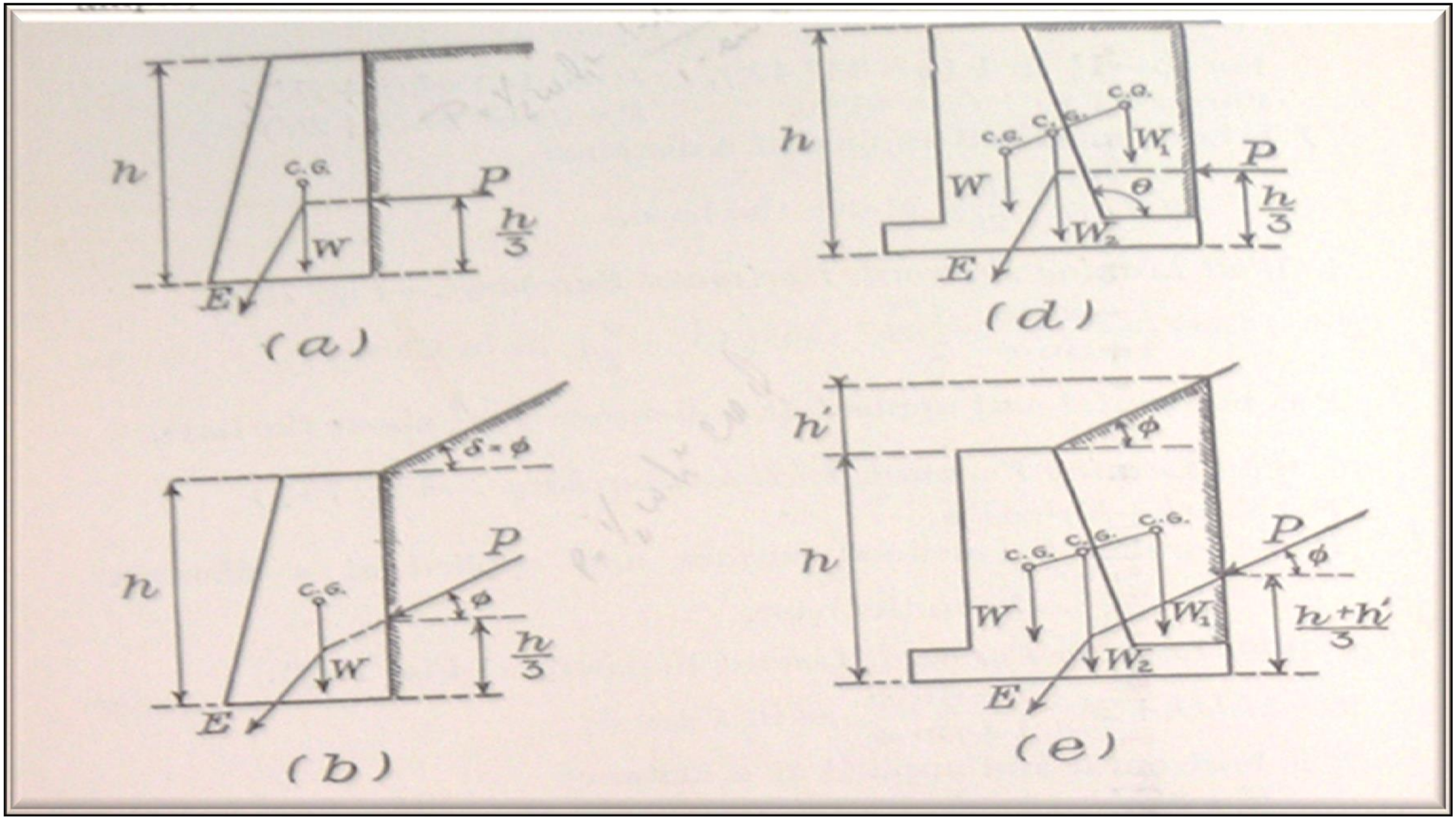
Empirical Methods - Trautwine Proportions

Table III. Proportions of Retaining-Walls

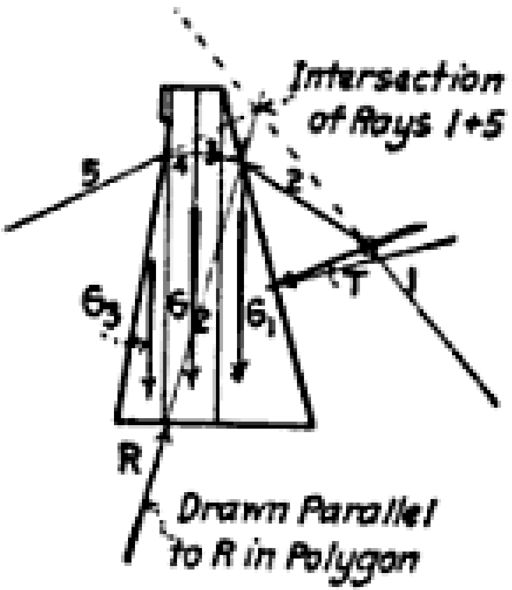
(Thickness of wall at the base in parts of the height, *AB*, Fig. 18)

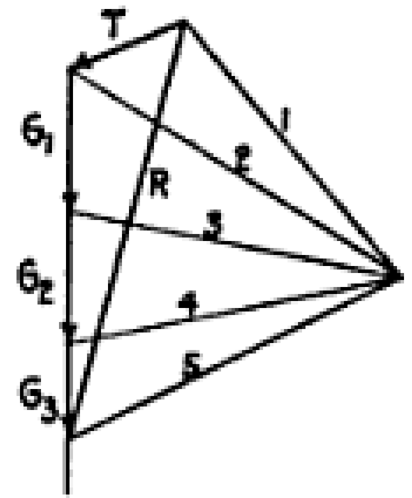
…al height of the earth …pared with the height …he wall above ground	Wall of cut stone in mortar	Wall of rubble or brick, good mortar	Wall of good, dry rubble
1	0.35	0.40	0.50
1.1	0.42	0.47	0.57
1.2	0.46	0.51	0.61
1.3	0.49	0.54	0.64
1.4	0.51	0.56	0.66
1.5	0.52	0.57	0.67
1.6	0.54	0.59	0.69
1.7	0.55	0.60	0.70
1.8	0.56	0.61	0.71
2	0.58	0.63	0.73
2.5	0.60	0.65	0.75
3	0.62	0.67	0.77
4	0.63	0.68	0.78
6	0.64	0.69	0.79
14	0.65	0.70	0.80
25	0.66	0.71	0.81
or more	0.68	0.73	0.83

Engineering calculations based on theories



Graphic Analysis





Historic Data

Coef. Friction
Angle of Repose
Allowable Pressure
- foundation
- masonry

COEFFICIENTS OF FRICTION.

Materials.	Coefficients.	Materials.	Coefficients.
Dry masonry on dry masonry	0.6 to 0.7	Masonry on dry clay	0.5 to 0.6
Masonry on masonry with wet mortar	0.75	Masonry on moist clay	0.33
Timber on stone	0.4	Earth on earth	0.25 to 1.0
Iron on stone	0.3 to 0.7	Hard brick on hard brick	0.7
Timber on timber	0.2 to 0.5	Concrete blocks on concrete blocks	0.65

TABLE II.

ANGLES OF REPOSE, ϕ, FOR MATERIALS.

Materials.	ϕ	Materials.	ϕ
Earth, loam	30° to 45°	Clay	25° to 45°
Sand, dry	25° to 35°	Gravel	30° to 40°
Sand, moist	30° to 45°	Cinders	25° to 40°
Sand, wet	15° to 30°	Coke	30° to 45°

TABLE III.

ALLOWABLE PRESSURE ON FOUNDATIONS.

Material.	Pressure in Tons per Sq. Ft.
Soft clay	1 to 2
Ordinary clay and dry sand mixed with clay	2 to 3
Dry sand and clay	3 to 4
Hard clay and firm, coarse sand	4 to 6
Firm, coarse sand and gravel	6 to 8
Bed rock	15 and up.

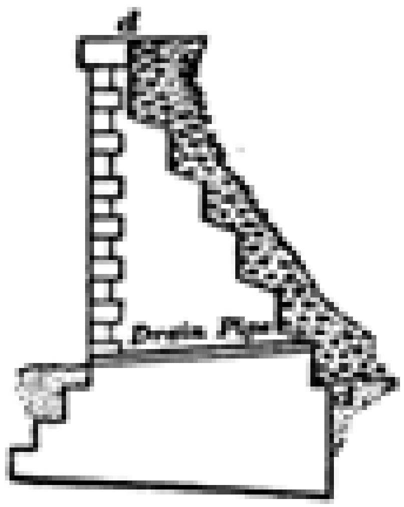
TABLE IV.

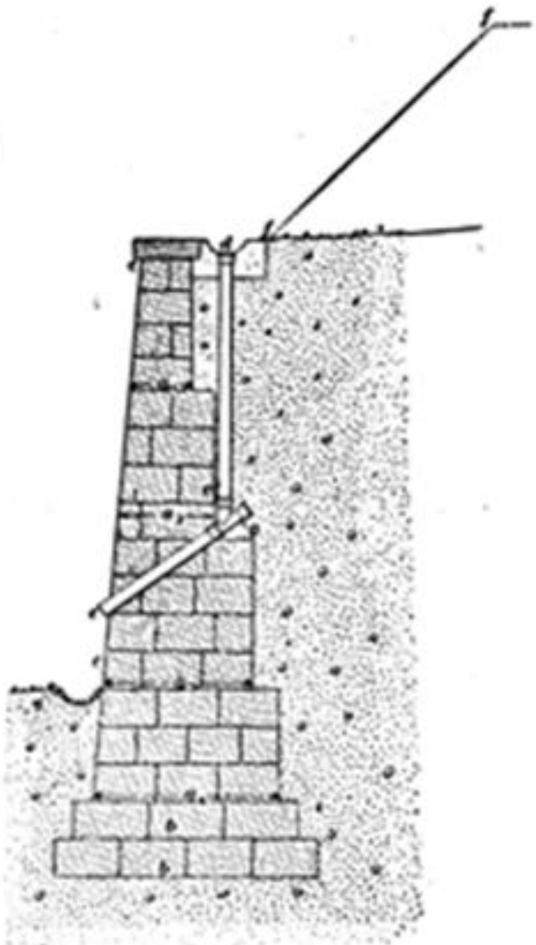
ALLOWABLE PRESSURE ON MASONRY.

Materials.	Pressure in Tons per Sq. Ft.
Common brick, Portland cement mortar	12
Paving brick, Portland cement mortar	15
Rubble masonry, Portland cement mortar	12
Sandstone, first class masonry	20
Limestone, first class masonry	25
Granite, first class masonry	30
Portland cement concrete, 1-2-4	25
Portland cement concrete, 1-3-6	20

Old Drainage Systems –

Influence of water pressure on failures has been recognized at least since 1900.





Present Day Theories

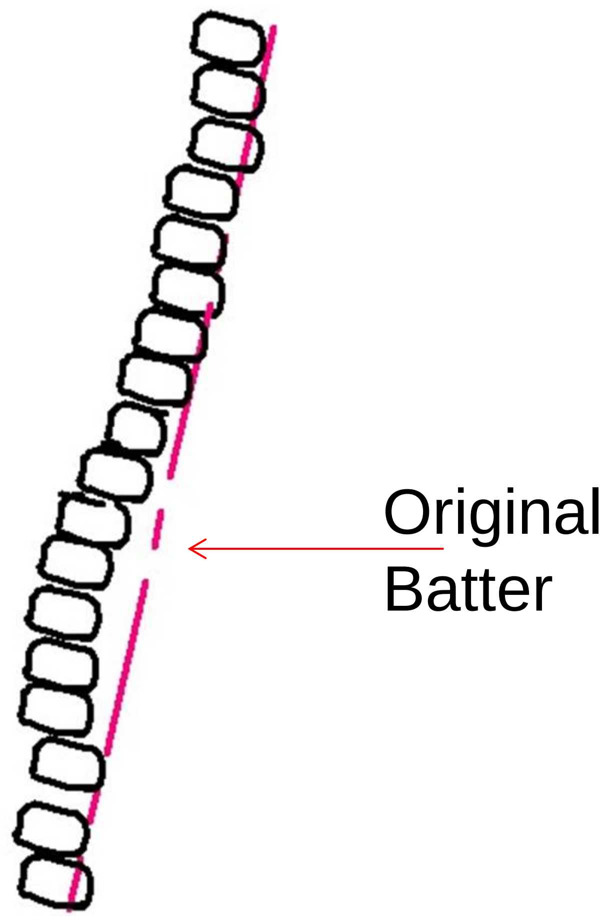
Rankine Theory

The Rankine Theory is based on the assumptions that the wall introduces no changes in the shearing stresses at the surface of contact between the wall and the soil. It is also assumed that the ground surface is a straight line (horizontal or sloping surface) and that a plane failure surface develops.

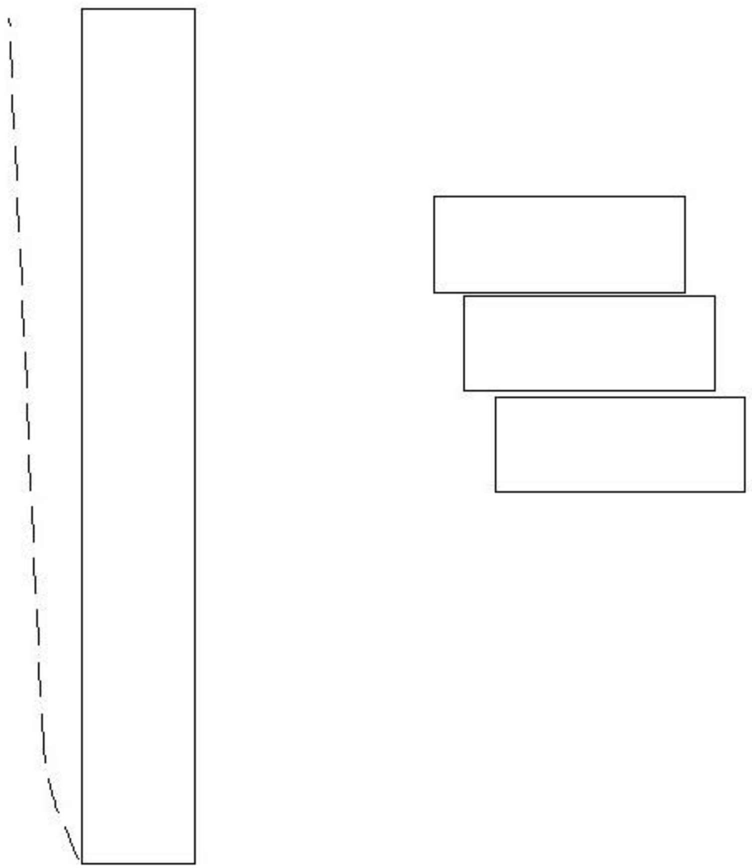
Coulomb Theory

An inherent assumption of the Rankine Theory is that the presence of the wall does not affect the shearing stresses at the surface of wall contact. However, since the friction between the retaining wall and the soil has a significant effect on the vertical shear stresses in the soil, the lateral stresses on the wall are actually different than those assumed by the Rankine Theory. Most of this error can be avoided by using the Coulomb Theory, which considers the changes in tangential stress along the contact surface due to wall friction.

Bursting or Bulging

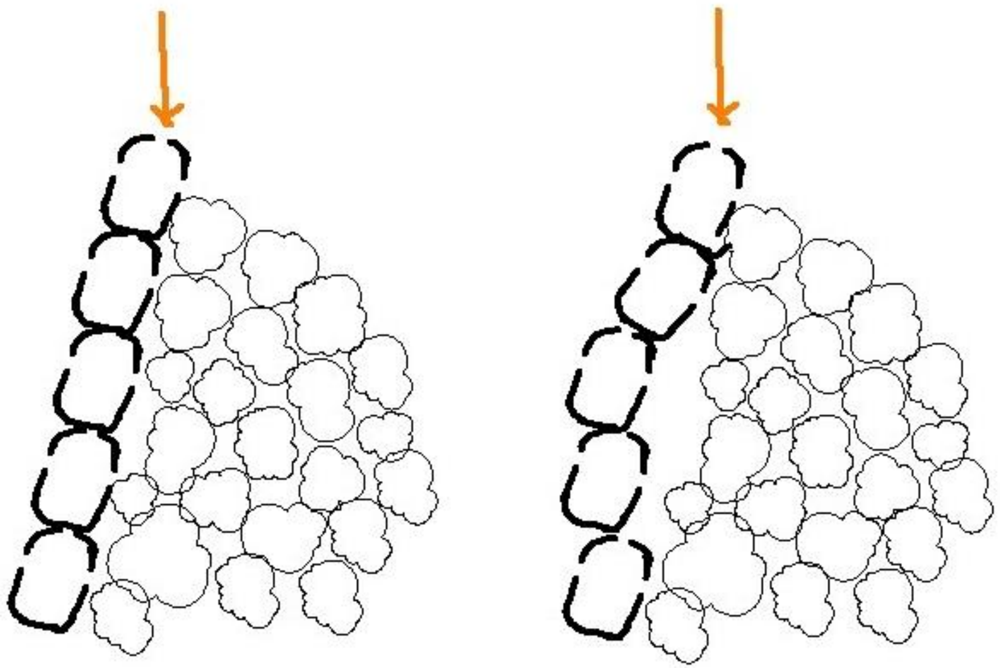


Shear Displacement along the Bed



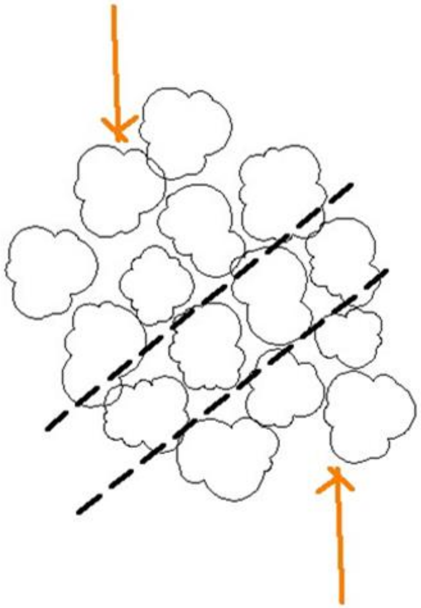
Buckling Under Compression

- FACE OF STONE MIGHT SEPARATE –largest compression is on exterior wall

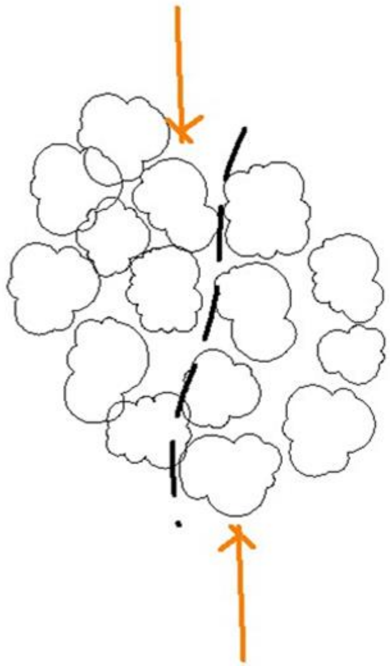


Plane of sliding

- Sliding is not possible

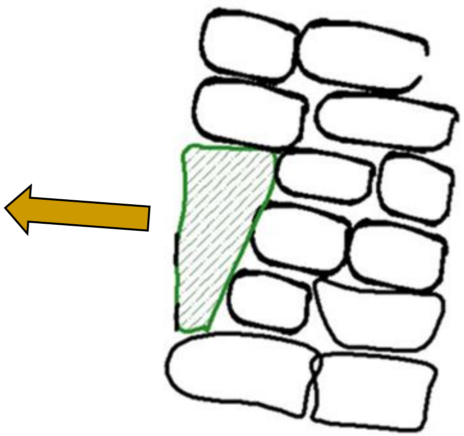


- Rotation of stones and movement creates a plane where sliding is possible

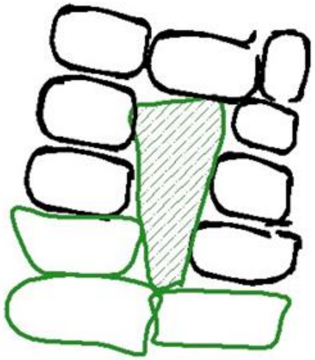


Improper Place Triangular Stones Under Compression

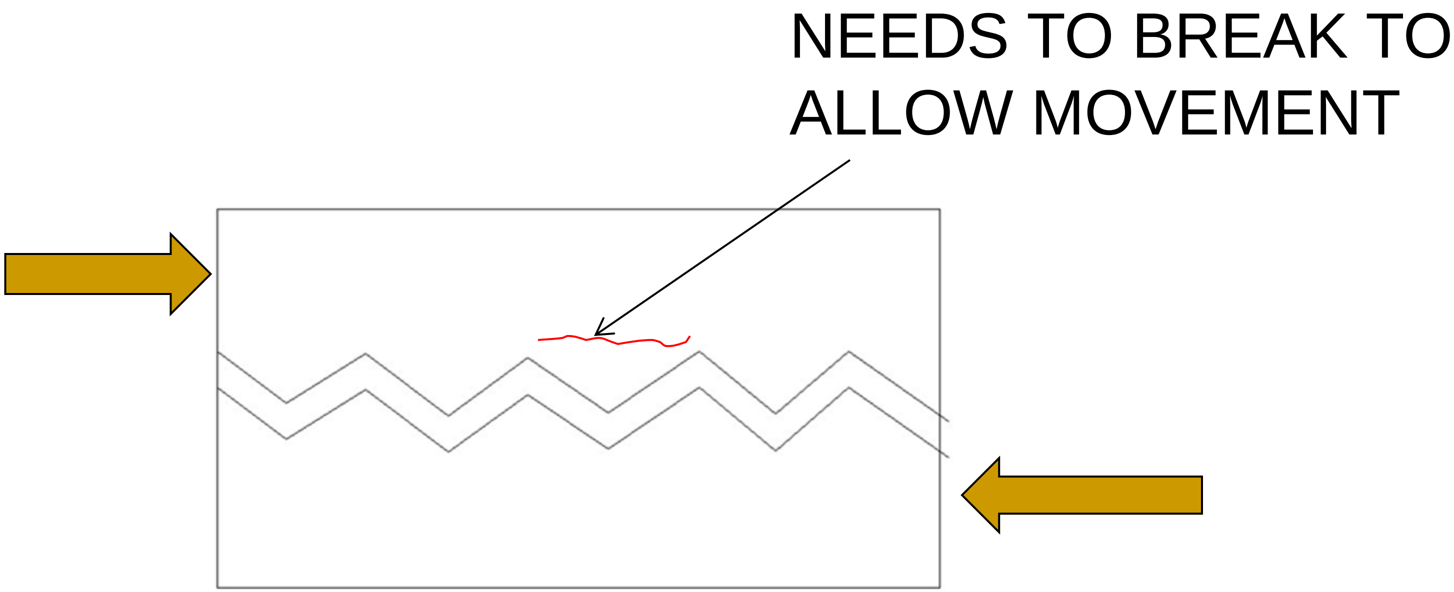
AT FACE - DISLODGES



INTERIOR STONE BULGES



Resistance to sliding – friction ++



+ **interlock**

Failures Modes of Retaining Walls

- Sliding
- Rotating
- Crushing
- General Sliding of the Soil

Possible Modes Sliding Failures

- Sliding along a slip surface that cuts through the wall.
- Sliding along a slip surface that runs behind and beneath the wall.
- Sliding along the base of the wall.

Sliding at base – visuals

Sliding failure is a failure at the soil at the base.

Buckling or swelling of soil at the bottom of RW usually accompanies it.

In some cases there is a separation of soil at top of the wall.

Sliding of portions of the wall will be accompanied by warping of the RW face.

Note that sliding can occur also by rupture of surface of the bottom of the wall itself.

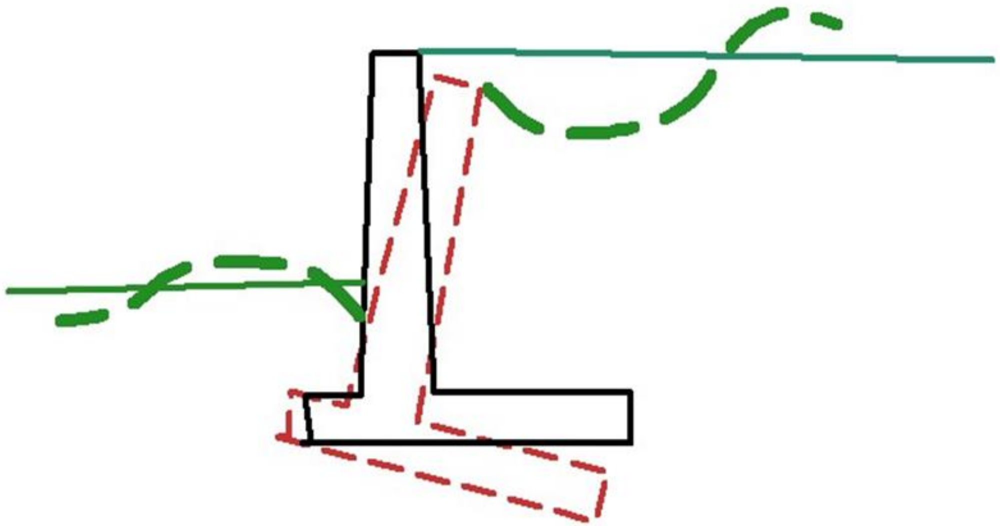
Rotation - Collapse by overturning - Visuals.

Rotation of the RW could occur inward or outward as the wall is overcome by passive or active earth pressure. Bearing failure of the underlying soil usually precedes it.

- OUTWARD rotation is preceded and accompanied by sink holes and tensions cracks at the top of the wall. At the bottom of the wall one could observe swelling and sloping towards the wall.
- INWARD rotation could be accompanied also by swelling at top of RW. Observation of the alignment of the top of the wall can indicate rotation of wall segments. It will also allow clarify any confusion between walls built with batter or walls inclined inward.

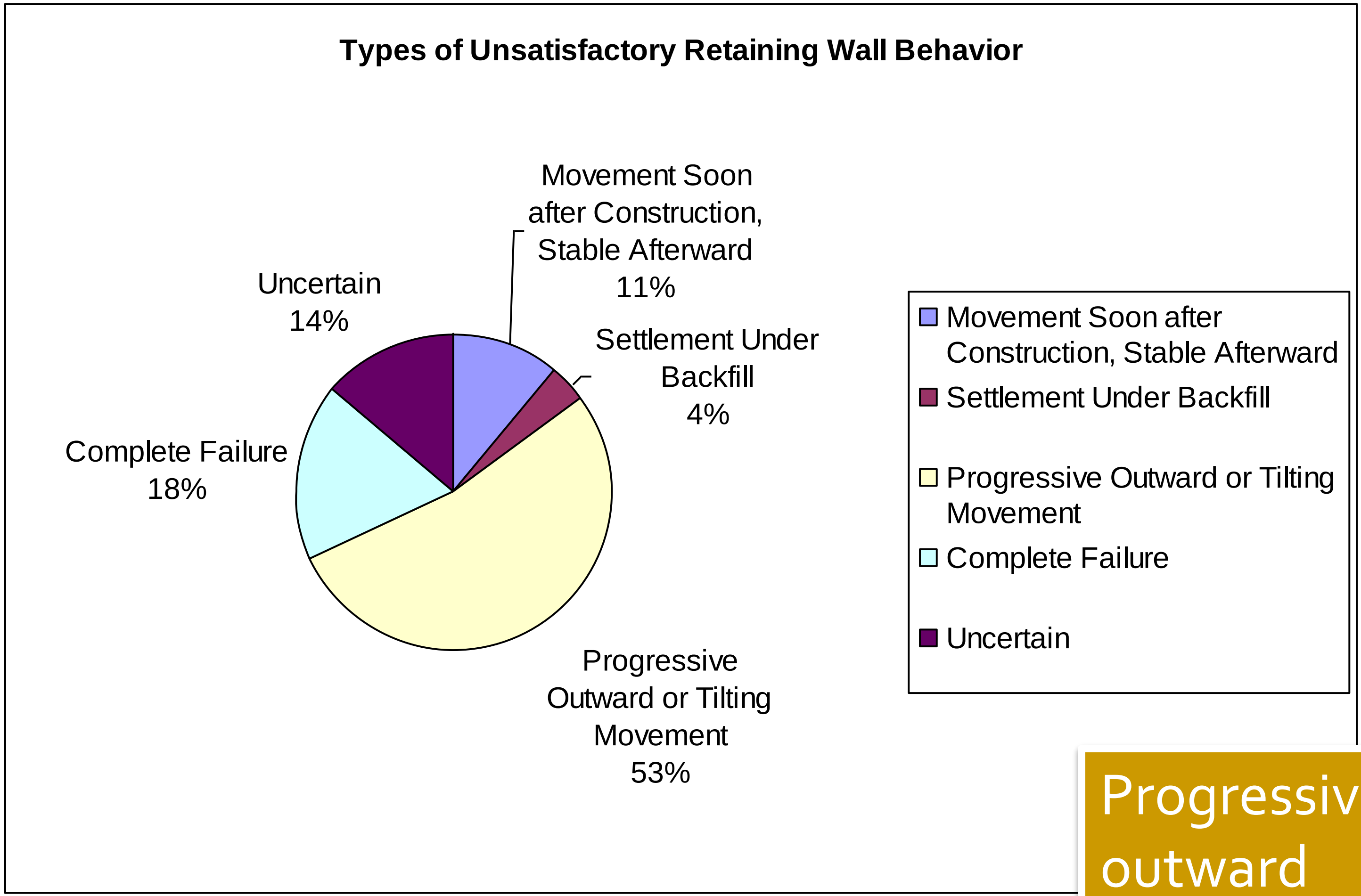
General Failure & Loss of Stability

- **General loss of stability** describes a failure where the general area that includes soil and retaining wall fails. It is very much similar to a loss of slope stability



Heaving at base /
Settlement on top

Unsatisfactory Behavior



Progressive outward

Crushing

Crushing is a traditional terms for RW failure that covers failure of RW structural components due to stresses exceeding the carrying capacity. Such failures could be the result

- of design errors,
- stresses due to loads greater then those considered at design time
- or reduction of the carrying capacity of the RW caused by aging,
- exposure to corrosive atmosphere, etc.

Increase in loads can be due to

- unexpected water accumulation behind the wall,
- traffic and vibrations from traffic,
- undesired pressure from improper backfill -especially clay.

Crushing

Reduction in bearing capacity can be the result of

- loss or separation of interlock,
- loss of mortar,
- corrosion of cables of anchors,
- corrosion of reinforcement.

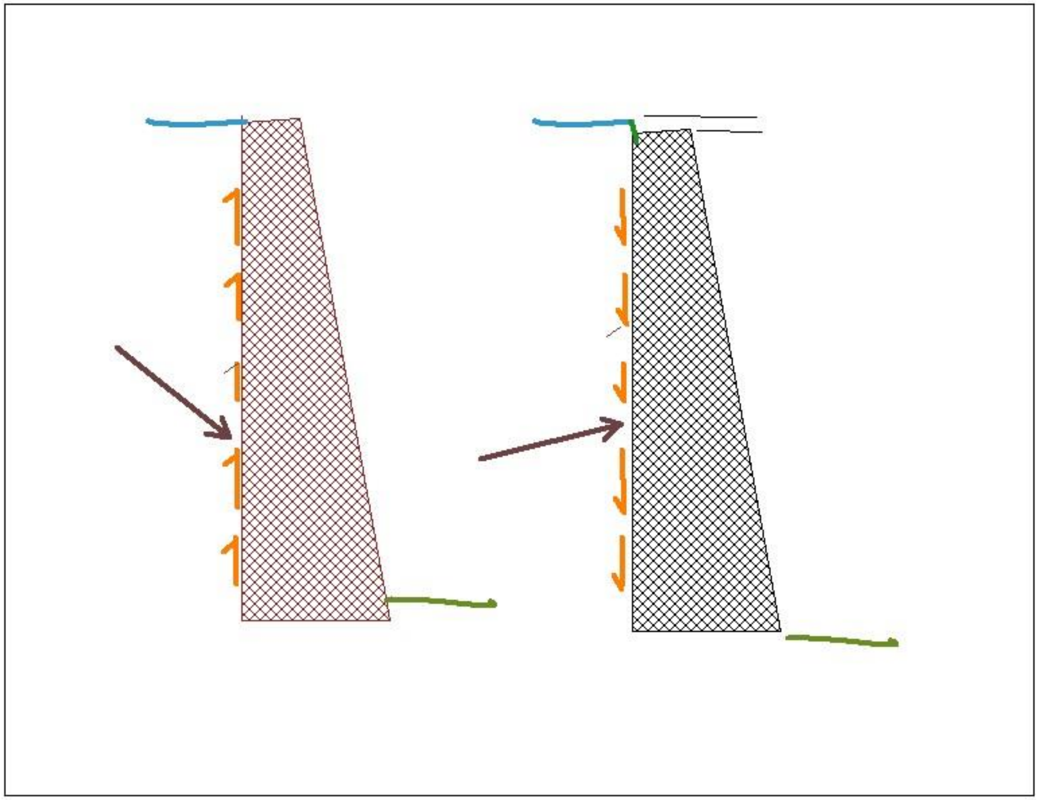
Many of the distress symptoms such as cracking are the same as to those of concrete, masonry and stone building walls or facades.

Gravity walls fail usually in shear –horizontal or vertical. Observation of cracks on the face of RWs can often indicate the type of crushing.

Note that rotations of anchored RWs are often preceded by punching or cracks around the area of the anchor attachment to the stem.

Settlement (Wall Dropping) Reverses Friction

Resultant may change direction



Slope Failure after Rush Flood

Slope Failure

Slope Failures

Water Related Causes

- Intense rainfall
- Perched water table
- Rapid draw-down
- Flood
- Extreme infiltration
- Seepage

Geological Causes

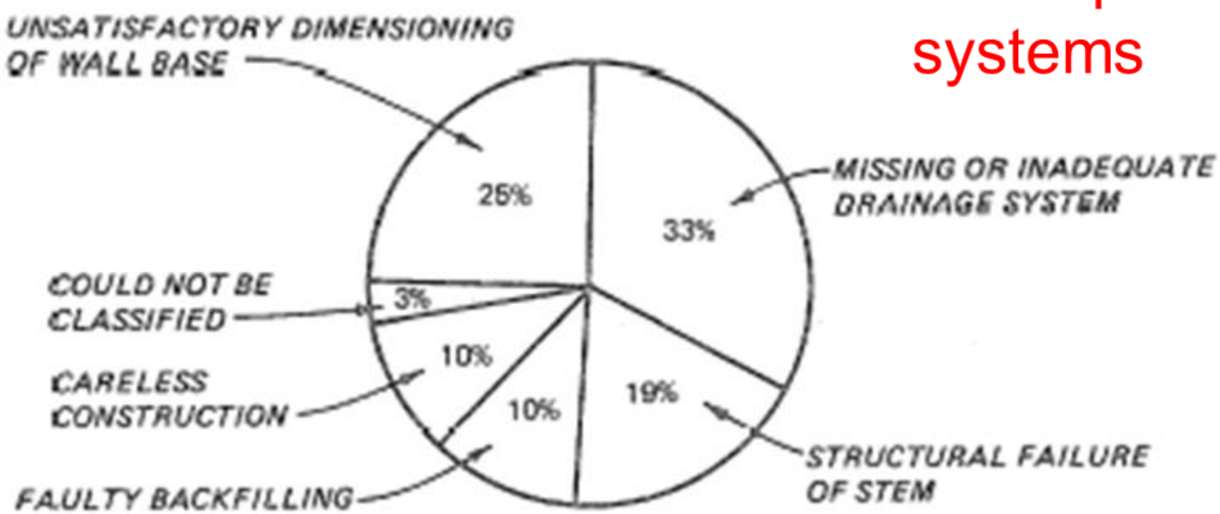
- Erosion
- Weathered materials
- Weak materials
- Contrast in permeability
- Contrast in stiffness

Slope Failures Human Causes

- Excavation of slope at it’s toe
- Loading of slope at it’s crest
- Irrigation
- Deforestation
- Artificial vibration (blasting, piling, etc.)
- Water leakage from utilities

Causes Unsatisfactory Retaining Walls

33% missing or inadequate drainage systems



a. Causes of failure of rigid concrete retaining walls (Techeng and Iseux 1972)

From EM-1110-2

Inspection Instructions for Rockeries

- Each rock is in contact with at least two rocks below it.
- The first contact point between an upper rock and a lower rock is located within 150 mm (6 in) of the face of the rockery.
- There are no “columns” of rocks; i.e., no continuous vertical seams exist.
- There are no continuous horizontal planes in the rockery.
- Rocks are inclined back into the slope.
- Rocks are free of obvious signs of distress, including significant weathering, fracturing,or disintegration.

http://flh.fhwa.dot.gov/innovation/td/geotech/rockeries/documents/09_Chapter_6_Construction_Inspection.pdf

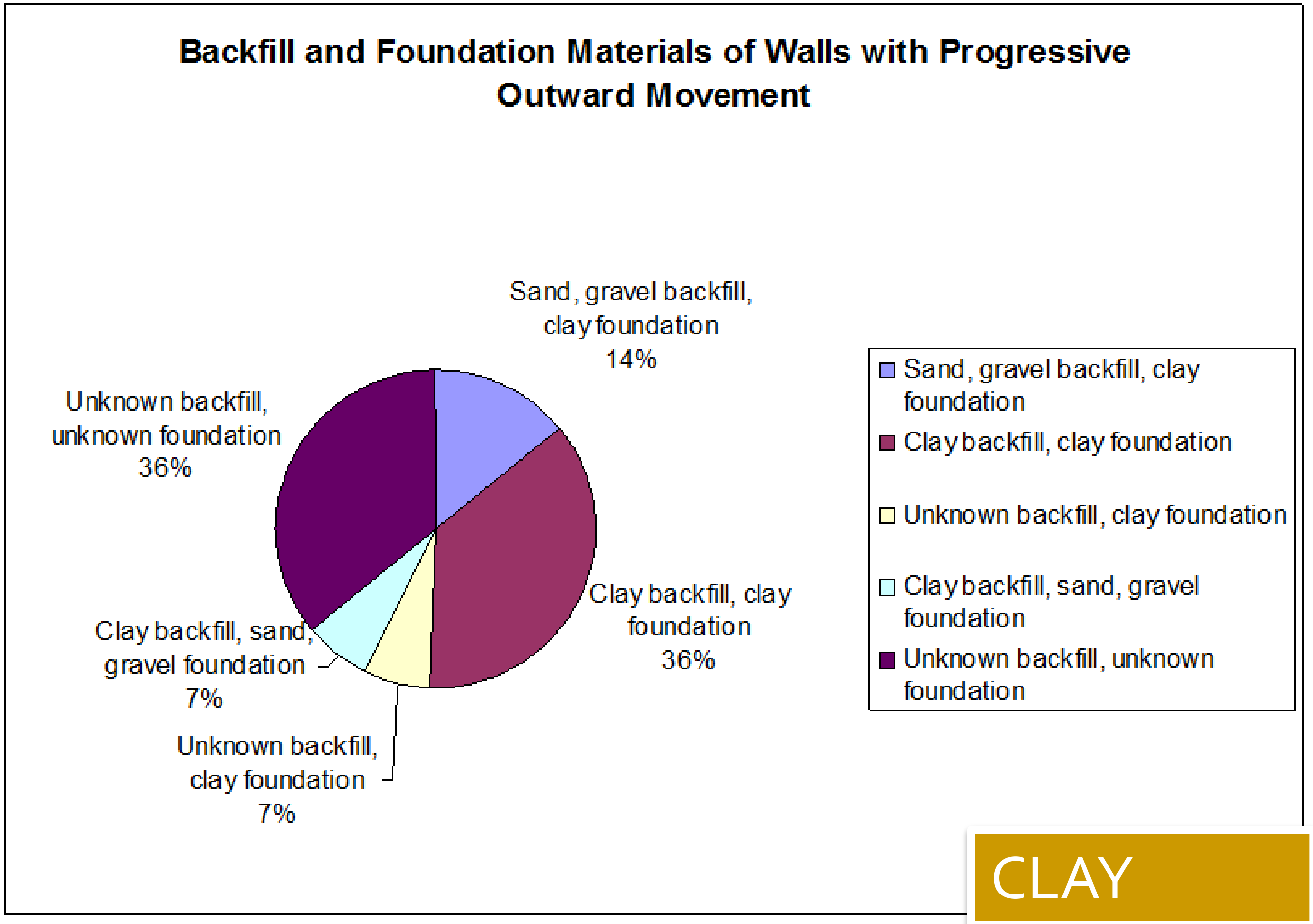
Inspection Instructions for Rockeries

- All voids greater than 150 mm (6 in) are chinked.
- Chink rocks, where present, cannot be removed by hand.
- There are no loose cap rocks or rocks that can otherwise be moved by hand.
- There is no soil spalling or piping through the voids in the face of the rockery.
- Base rocks are larger than upper rocks

Limitations of the Visual Inspection of Retaining Walls

- When the RW has a veneer, in most cases the condition of the backup cannot be observed. On the positive side experience shows that usually veneers deteriorate faster than the backups.
- Many RWs were built on plies. (The literature shows that even rubble RW's could have been placed on pile foundations). The presence or condition of piles cannot be observed.

Backfill & Foundation Materials



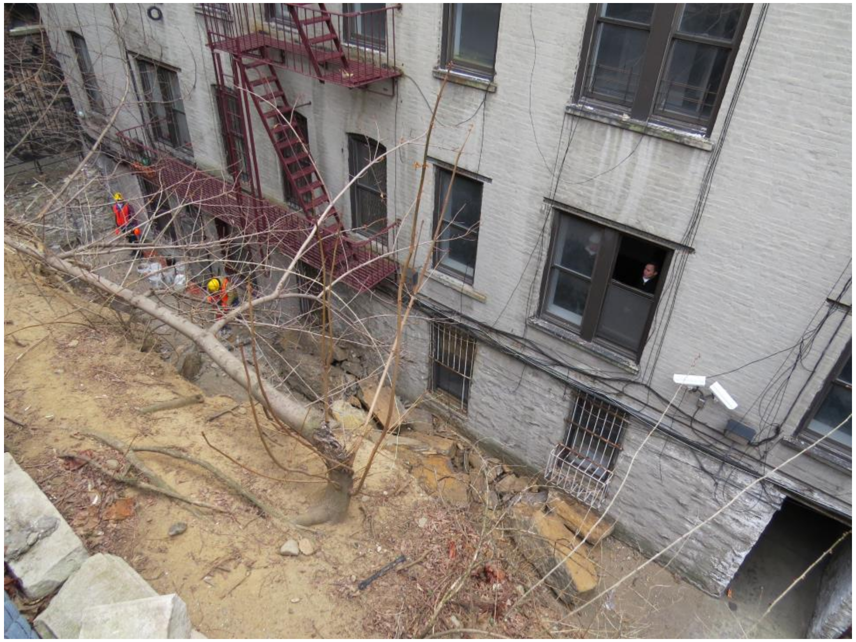
CLAY

Vegetation

Hides condition RW

Actually deteriorates RW

Wall thickness? Fill?



Various accidents

More

Effect of Vegetation

Mortar Condition

Cracks

Wall Movement - Corner Condition

Crest symptoms

Crest symptoms

Tension Cracks

Stone Fragments at Base of Wall

SINKHOLES

Out of Plumb

Bulging

Irregularities at coping level

Stone Spalling

Stone Masonry RW - Form Rapid Assessment

☐ Rubble	☐ Coursed	☐ Random	☐ Rough	☐ Dry [no mortar]
☐ Cutstone	☐ Coursed	☐ Random	☐ Rough	☐ Dry [no mortar]
☐ Counterfort	☐ Don't Know	☐ No	☐ Yes	
☐ Buttressed [w. piers]				
☐ Tiedback [anchored] wall	☐ Rock Anchor		☐ Deadman	
☐ RW on piles	☐ Don't Know	☐ No	☐ Yes	
☐ RW foundation on soil type	________________	☐ Don't Know		

EXAMPLE

I. Structural Condition Assessment continued…

EXAMPLE

☐ **CMU Retaining Wall**			
☐ **Brick Retaining Wall**			
☐ **Veneers on Concrete**	☐ **Ashlar**	☐ **Brick**	☐ **CMU**
☐ **Ashlar Veneer on Rubble**			
☐ **Veneer on Natural Rock**			
☐ Counterfort	☐ Don't Know	☐ No	☐ Yes
☐ Buttressed [w. piers]			
☐ Tiedback [anchored] wall	☐ Rock Anchor	☐ Deadman	
☐ RW on piles	☐ Don't Know	☐ No	☐ Yes
☐ Steel Reinforced	☐ Don't Know	☐ No	☐ Yes
☐ RW foundation on soil type	________________	☐ Don't Know	

During the course of the Visual Inspection, the condition of the back-up structure was:

- ☐ Reliably Assessed
- ☐ Partially Assessed
- ☐ Not Assessed

I. Structural Condition Assessment

EXAMPLE

S1	**Top of Wall Outward**	☐	**No**	☐	**Out of plumb/height_______**		**Note #_______**			
S2	**Top of Wall Inward**	☐	**No**	☐	**Out of plumb/height_______**		**Note #_______**			
S3	**Bulging/Warping of Wall**	☐	**No**	☐	**Minor**	☐	**Moderate**	☐	**Severe**	**Note #_______**
S4	Top of Wall Aligned	☐	No	Note #_______		Desc. _______________________				
S5	Tiebacks	☐	No	☐	Loose	☐	Corroded	☐	Missing %___	Note #_______
S6	Settlement of Wall	☐	No	☐	Minor	☐	Moderate	☐	Severe	Note #_______
S7	**Displaced Large Stone**	☐	**No**	☐	**Minor**	☐	**Moderate**	☐	**Severe**	**Note #_______**
S8	Displaced Small Stone	☐	No	☐	Minor	☐	Moderate	☐	Severe	Note #_______
S9	Horizontal Cracks	☐	No	☐	Minor	☐	Moderate	☐	Severe	Note #_______
S10	Vertical Cracks	☐	No	☐	Minor	☐	Moderate	☐	Severe	Note #_______
S11	Diag. Cracks at Mortar Joint Only	☐	No	☐	Minor	☐	Moderate	☐	Severe	Note #_______
S12	Diag. Cracks through Joint & Stone	☐	No	☐	Minor	☐	Moderate	☐	Severe	Note #_______
S13	Cracked Stones	☐	No	☐	Minor	☐	Moderate	☐	Severe	Note #_______
S14	Spalled Stone	☐	No	☐	Minor	☐	Moderate	☐	Severe	Note #_______
S15	Condition of Mortar	☐	Good	☐	Sandy	Missing pct. ____________________				
S16	Coping of Wall	☐	None	☐	Sound	☐	Deteriorated	☐	Displace	Note #_______
S17	Corner Cracks	☐	No	☐	Both Sides	☐	One Side	☐	Mortar	Mortar & Stone Note # _______
S18	Previous Repair	☐	None Visible	☐	Minor	☐	Moderate	☐	Major	Failed Note # _______
S19	Other	______________________________								

I. Structural Condition Assessment continued…

EXAMPLE

BB1	**Top of Wall Outward**	☐	**No**	☐	**Out of plumb/height_______**			**Note #_______**		
BB2	**Top of Wall Inward**	☐	**No**	☐	**Out of plumb/height_______**			**Note #_______**		
BB3	**Bulging/Warping of Wall**	☐	**No**	☐	**Minor**	☐	**Moderate**	☐	**Severe**	**Note #__________**
BB4	Top of Wall Aligned	☐	No	Note #_______		Desc. ______________________				
BB5	Tiebacks	☐	No	☐	Loose	☐	Corroded	☐	Missing %___	Note #__________
BB6	Settlement of Wall	☐	No	☐	Minor	☐	Moderate	☐	Severe	Note #__________
BB7	Expansion Construction Joint	☐	None	☐	Sound	☐	Deteriorated % Det. __________			Note #__________
BB8	Horizontal Crack	☐	None	☐	Sound	☐	Deteriorated % Det. __________			Note #__________
BB9	Vertical Cracks	☐	No	☐	Minor	☐	Moderate	☐	Severe	Note #__________
BB10	Corner Crack	☐	No	☐	Both Sides	☐	One Side	☐ ☐	Mortar Jt. Mortar Jt. & Blk.	Note #__________
BB11	Stepped Cracks at Mort. Jnt. only	☐	No	☐	Minor	☐	Moderate	☐	Severe	Note #__________
BB12	Stepped Crack through Jnts & Blk	☐	No	☐	Minor	☐	Moderate	☐	Severe	Note #__________
BB13	Crack Due Steel Corrosion	☐	No	☐	Minor	☐	Moderate	☐	Severe	Note #__________
BB14	Steel Reinforcement Exposed	☐	No	☐	Rusted	☐	Sect. Loss	Note #________________________________		
BB15	Displaced Blocks/Bricks	☐	No	☐	Minor	☐	Moderate	☐	Severe	Note #__________
BB16	Spalled Brick/Block	☐	No	☐	Minor	☐	Moderate	☐	Severe	Note #__________
BB17	Conditions of Mortar	☐	Sound	☐	Sandy	☐	Missing %______________________________________			
BB18	Freeze/Thaw Damage [crazing]	☐	No	☐	Minor	☐	Moderate	☐	Severe	Note #__________
BB19	Efflorescence/Calcium/Chloride	☐	Yes	☐	Description____					
BB20	Veneer Not Attached Back-up	☐	None	☐	Sound	☐	Deteriorated	☐	Displaced	Note #__________
BB21	Veneer Separated Back-up	☐	None	☐	Sound	☐	Deteriorated	☐	Displaced	Note #__________
BB22	Coping of Wall	☐	None	☐	Sound	☐	Deteriorated	☐	Displaced	Note #__________
BB23	Previous Repair	☐	None Visible	☐	Minor	☐	Moderate	☐ ☐	Major Failed	Note #__________
BB24	Other	____								

II. Condition Assessment of Soil / Pavement Adjoining Wall

EXAMPLE

1. Buckling of Road Sidewalk at Bottom ☐ No ☐ Minor ☐ Moderate ☐ Severe Note #
2. Tension Cracks in Soil at Top ☐ Yes – Width of Crack ____________________
3. Sink Holes in Soil/Pavement ☐ Yes – Dimensions ____________________
4. Soil/Pavement at Base of Wall ☐ Acceptable ☐ Defective Describ. ____________________
5. Soil/Pavement at Top of Wall ☐ Acceptable ☐ Defective Describ. ____________________
6. Spoil Separating from Back of Wall ☐ No – Width of Separation____________________
7. Other ____________________

III. Condition Assessment of Water Management Area Surrounding Wall

EXAMPLE

1. Weeps ☐ No ☐ Functioning?________________________________
2. Erosion of Wall/Soil by Water ☐ No ☐ Describe__________________________________
3. Water/Silt Filtering through Water ☐ No ☐ Minor ☐ Moderate ☐ Severe **Note # __________**
4. Area Drains/Piping Present ☐ No ☐ Functioning?________________________________
5. Drywell Catch Basin ☐ No ☐ Describe__________________________________
6. Hydrant ☐ No ☐ Describe__________________________________
7. Downspouts/adj/ Buildings ☐ No ☐ Describe__________________________________
8. Soil Drains Away from Wall ☐ No ☐ Describe__________________________________
9. Other ____

IV. Attachments to Wall

EXAMPLE

1. Balustrade/Handrail ☐ No ☐ Describe_______________ ☐ Condition______________
2. Ramp/Steps ☐ No ☐ Describe_______________ ☐ Condition______________
3. Tunnels ☐ No ☐ Describe_______________ ☐ Condition______________
4. Light Structure (shed/garage) ☐ No ☐ Functioning?____
5. Fence ☐ No ☐ Describe____
6. Trees/Vegetation ☐ No ☐ Describe____
7. Equipment/Storage at near Top of Wall ☐ No ☐ Describe____
8. Other ____

Stabilization -Shoring

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- Questions?