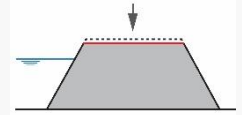
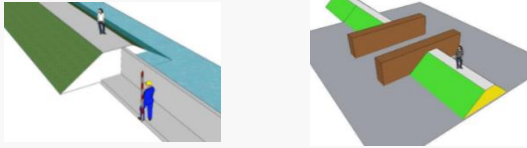


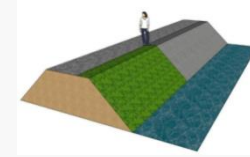
Tier 1 Assessment Crest height degradation



Type 1 - Longitudinal



Type 4 - Revetments



Q1. Are there visible signs of crest height degradation at the transition (i.e. a current low spot) relative to the adjacent asset(s)?

If response is "Yes", tier 2 assessment is required, and all information bulleted in top grey box needs to be gathered

YES

If YES to Q1 or any of Q2:

Inspector to gather the following information for Tier 2 assessment by engineer

- Photographs of the transition and neighbouring assets, including local features (e.g. trees or fences) and mitigation measures (e.g. rock or geotextile)
- Note the shape (e.g. square or circular) and dimensions of any embedded objects within 5 metres of the transition

NO

These questions assess the vulnerability of the transition to future crest height degradation

Answer all Q2 questions and follow the YES arrow if the answer is "yes" to any

YES

Q2a. Are there any animal burrows?

Q2b. Are there any ruts or furrows near the crest e.g. due to vehicles/ people/ animals/ surface water flow?

Q2c. Are there any signs of poorly compacted or disturbed soils? (This should only be "yes" if there are obvious cases where the embankment doesn't connect to the wall)

If response is "Yes" to any of these questions, tier 2 assessment is required, and all information in top grey box from 'Yes'-responded questions needs to be gathered

- If 'yes' to Q1: Record location and dimensions of any visible signs of overtopping at the crest
- If 'yes' to Q1 or Q2a: Record location and dimensions of animal burrows and any settlement to nearest 0.1m (i.e. relative to adjacent asset height).
- If 'yes' to Q1 or Q2b: Record location and dimensions of ruts or furrows at or near the crest
- If 'yes' to Q1 or Q2c: Record location and dimensions of poorly compacted or disturbed soils and any differential settlement across assets

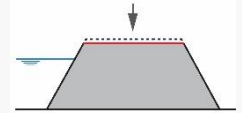
NO

If NO to Q1 and all of Q2:

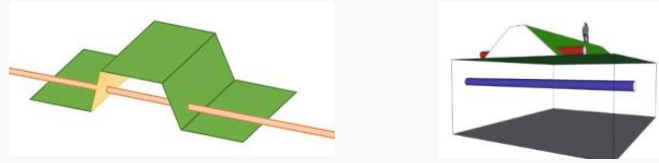
No further assessment needed

- Do not carry out Tier 2 assessment for crest height degradation
- Record results of Tier 1 assessment for crest height degradation
- Continue normal inspection and maintenance regime

Tier 1 Assessment Crest height degradation



Type 3 - Crossing infrastructure



Q1. Are there visible signs of crest height degradation at the transition (i.e. a current low spot) relative to the adjacent asset(s)?
If response is “Yes”, tier 2 assessment is required, and all information bulleted in top grey box needs to be gathered

YES

**If YES to Q1 or any of Q2:
Inspector to gather the following information for Tier 2 assessment by engineer**

- Photographs of the transition and neighbouring assets, including local features (e.g. trees or fences) and mitigation measures (e.g. rock or geotextile)
- Note the shape (e.g. square or circular) and dimensions of any embedded objects within 5 metres of the transition

NO

These questions assess the vulnerability of the transition to future crest height degradation

Answer all Q2 questions and follow the YES arrow if the answer is “yes” to any

YES

Q2a. Are there any animal burrows?

Q2b. Are there any signs of poorly compacted or disturbed soils? (This should only be “yes” if there are obvious cases where the embankment doesn’t connect to the wall)

If response is “Yes” to any of these questions, tier 2 assessment is required, and all information in top grey box from ‘Yes’-responded questions needs to be gathered

- If ‘yes’ to Q1: Record location and dimensions of any visible signs of overtopping at the crest
- If ‘yes’ to Q1 or Q2a: Record location and dimensions of animal burrows and any settlement to nearest 0.1m (i.e. relative to adjacent asset height).
- If ‘yes’ to Q1 or Q2b: Record location and dimensions of poorly compacted or disturbed soils and any differential settlement across assets

NO

**If NO to Q1 and all of Q2:
No further assessment needed**

- Do not carry out Tier 2 assessment for crest height degradation
- Record results of Tier 1 assessment for crest height degradation
- Continue normal inspection and maintenance regime

Tier 1 Assessment Surface Erosion



Type 1 - Longitudinal	Type 2 – Cross-sectional	Type 3 - Crossing infrastructure	Type 4 - Revetments

Q1. Are there visible signs of surface erosion at the transition?

If response is "Yes", tier 2 assessment is required, and all information bulleted in top grey box needs to be gathered

YES

NO

These questions assess the vulnerability of the transition to future surface erosion

Answer all Q2 questions and follow the YES arrow if the answer is 'yes' to any

Q2a. Are there any areas of poor grass cover e.g. due to shading or ponding water?

Q2b. Are there any signs of poorly compacted or disturbed soils? (This should only be "yes" if there are obvious cases where the embankment doesn't connect to the wall)

Q2c. Are there any ruts or furrows e.g. due to vehicles/ people/ animals/ surface water flow?

Q2d. Does the transition have irregular geometry, such that water is likely to flow over it in a more turbulent way than you would normally expect?

Q2e. Are there visible signs of crest height degradation (i.e. resulting in a low spot), relative to the adjacent asset(s)?

If response is "Yes" to any of these questions, tier 2 assessment is required, and all information in top grey box from 'Yes'-responded questions needs to be gathered

YES

NO

If YES to Q1 or any of Q2:

Inspector to gather the following information for Tier 2 assessment by engineer

- Photographs of the transition and neighbouring assets, including local features (e.g. trees or fences) and mitigation measures (e.g. rock or geotextile)
- Note the shape (e.g. square or circular) and dimensions of any embedded objects within 5 metres of the transition

- If 'yes' to Q1 or Q2a: Record location and dimensions of areas of poor grass cover or exposed surfaces noting any differences with the main length of the embankment
- If 'yes' to Q1 or Q2b: Record location and dimensions of poorly compacted or disturbed soils, including any differential settlement
- If 'yes' to Q1 or Q2c: Record location and dimensions of ruts or furrows
- If 'yes' to Q1 or Q2d: Record basic dimensions of adjacent structures (e.g. height/ base width/ crest width/ slope angle) and any surface irregularities
- If 'yes' to Q1 or Q2e. Assess as precisely as practical (ideally to the nearest 0.1m) any reduction of crest height of the embankment asset at the transition compared with the adjacent part of the embankment

If NO to Q1 and all of Q2:

No further assessment needed

- Do not carry out Tier 2 assessment for surface erosion
- Record results of Tier 1 assessment for surface erosion
- Continue normal inspection and maintenance regime

TIER 1 ASSESSMENTS

TYPE 1 : LONGITUDINAL

ASSET ID:

GENERAL ASSET INFORMATION – data collection for all users

Subject	Evidence required	Evidence from inspection
	Photographs of the transition and neighbouring asset (including local features)	Details:
	Estimated dimensions of adjacent embankment and transition	Adjacent embankment crest width (m): Crest width at transition (m): Waterward adjacent embankment slope (1 in X): Waterward transition slope (1 in X) if different: Landward adjacent embankment slope (1 in X): Landward transition slope (1 in X) if different: Wall / hard structure top width (m): Is wall/hard structure crest at a higher or lower level than the adjacent embankment: Difference in level between embankment and wall/hard structure crest (m): Length of ‘embedment’ (i.e. overlap) of wall within embankment at crest (m): Length of ‘embedment’ (i.e. overlap) of wall within embankment at embankment base (m):

TYPE 1 : LONGITUDINAL

Subject	Evidence required	Evidence from inspection
	Overall condition of Transition relative to the condition of the adjacent embankment	Equivalent: Better than the adjacent embankment: Worse than the adjacent embankment:

‘HIDDEN’ FAILURE MODES – data collection for all users

Subject	Evidence required	Evidence from inspection
Global instability	Record nature of evidence of stability failure or incipient failure (note – photos likely to be suitable)	
	Record nature of transition detailing (note – photos likely to be suitable)	
Seepage and piping	Record nature of evidence of failure or incipient failure due to seepage / piping (note: describe and photos)	
	Record nature of poor detailing for seepage (note: describe and photos)	
	Record nature of deterioration in the condition of the transition (note: describe and photos)	
	Record nature of increase in hydraulic gradient – i.e. does the transition create a shorter flow path from waterward to landward side of the defence (note: describe, photos and / or sketch)	
	Evidence of surface cracking at the transition (note: describe and photos):	Maximum surface crack width (supported by photographic evidence):

‘SURFACE’ FAILURE MODES– data collection if AIMS App is not available

TYPE 1 : LONGITUDINAL

Identifying and managing risks arising from defence structure transitions: FRS17181 Appendix B

Subject	Evidence required	Evidence from inspection
Crest height degradation (AIMS app / Type 1,4 flowchart)	Record visible signs of crest height degradation at the transition (i.e. resulting in a low spot) relative to the adjacent asset(s)	
	Record trees, fences and mitigation measures (e.g. rock or geotextile)	
	Note the shape (e.g. square or circular) and dimensions of any embedded objects within 5 metres of the transition	
	Record location and dimensions of any visible signs of overtopping at the crest	
	Record location and dimensions of animal burrows and any related crest settlement to nearest 0.1m (i.e. relative to adjacent asset height)	
	Record location and dimensions of ruts or furrows at or near the crest	
	Record location and dimensions of poorly compacted or disturbed soils and any differential settlement across assets	
Surface erosion (AIMS app / Type 1,2,3,4 flowchart)	Record visible signs of surface erosion at the transition	
	Record trees, fences and mitigation measures (e.g. rock or geotextile)	
	Note the shape (e.g. square or circular) and dimensions of any embedded objects within 5 metres of the transition	
	Record location and dimensions of areas of poor grass cover or exposed surfaces noting any differences with the main length of the embankment	

Subject	Evidence required	Evidence from inspection
	Record location and dimensions of poorly compacted or disturbed soils, including any differential settlement	
	Record location and dimensions of ruts or furrows	
	Record basic dimensions of adjacent structures (e.g. height/ base width/ crest width/ slope angle) and any surface irregularities	
	Assess as precisely as practical (ideally to the nearest 0.1m) any reduction of crest height of the embankment asset at the transition compared with the adjacent part of the embankment	

TIER 1 ASSESSMENTS

TYPE 2 – CROSS-SECTIONAL

ASSET ID:

GENERAL ASSET INFORMATION – data collection for all users

Subject	Evidence required	Evidence from inspection
	Photographs of the transition and neighbouring asset (including local features)	Details:
	Estimated dimensions of adjacent embankment and transition	Embankment crest width at transition (m): Waterward embankment slope (1 in X): Landward adjacent embankment slope (1 in X): Wall / hard structure top width (m):
	Overall condition of Transition relative to the condition of the adjacent embankment	Equivalent: Better than the adjacent embankment: Worse than the adjacent embankment:

‘HIDDEN’ FAILURE MODES – data collection for all users

Subject	Evidence required	Evidence from inspection
Seepage and piping	Record nature of evidence of failure or incipient failure due to seepage / piping (note: describe and photos)	
	Record nature of poor detailing for seepage (note: describe and photos)	
	Record nature of deterioration in the condition of the transition (note: describe and photos)	
	Record nature of increase in hydraulic gradient – i.e. does the transition create a shorter flow path from waterward to landward side of the defence (note: describe, photos and / or sketch)	
	Evidence of surface cracking at the transition (note: describe and photos):	Maximum surface crack width (supported by photographic evidence):

‘SURFACE’ FAILURE MODES– data collection if AIMS App is not available

Subject	Evidence required	Evidence from inspection
Surface erosion (AIMS app / Type 1,2,3,4 flowchart)	Record visible signs of surface erosion at the transition	
	Record trees, fences and mitigation measures (e.g. rock or geotextile)	
	Note the shape (e.g. square or circular) and dimensions of any embedded objects within 5 metres of the transition	
	Record location and dimensions of areas of poor grass cover or exposed surfaces noting any differences with the main length of the embankment	

Subject	Evidence required	Evidence from inspection
	Record location and dimensions of poorly compacted or disturbed soils, including any differential settlement	
	Record location and dimensions of ruts or furrows	
	Record basic dimensions of adjacent structures (e.g. height/ base width/ crest width/ slope angle) and any surface irregularities	
	Assess as precisely as practical (ideally to the nearest 0.1m) any reduction of crest height of the embankment asset at the transition compared with the adjacent embankment	

TIER 1 ASSESSMENTS

TYPE 3 : CROSSING INFRASTRUCTURE

ASSET ID:

GENERAL ASSET INFORMATION – data collection for all users

Subject	Evidence required	Evidence from inspection
	Photographs of the transition and neighbouring asset (including local features)	Details:
	Estimated dimensions of adjacent embankment and transition	Crest width at transition (m): Waterward embankment slope (1 in X): Waterward transition slope (1 in X) if different: Landward embankment slope (1 in X): Landward transition slope (1 in X) if different:
	Overall condition of Transition relative to the condition of the adjacent embankment	Equivalent: Better than the adjacent embankment: Worse than the adjacent embankment:

'HIDDEN' FAILURE MODES – data collection for all users

Subject	Evidence required	Evidence from inspection
Slope instability	Record diameter/depth of cover of pipes (note: measurements and photos)	
	Record nature of evidence of stability failure or incipient failure (note: description and photos)	
	Record nature of transition detailing (note: description and photos)	
Seepage, piping and concentrated leak erosion	Record nature of evidence of failure or incipient failure due to seepage / piping (note: describe and photos)	
	Record nature of poor detailing for seepage (note: describe and photos)	
	Record nature of deterioration in the condition of the transition (note: describe and photos)	
	Record nature of increase in hydraulic gradient – i.e. does the transition create a shorter flow path from waterward to landward side of the defence (note: describe, photos and / or sketch)	
	Evidence of surface cracking at the transition (note: describe and photos):	Maximum surface crack width (supported by photographic evidence):

‘SURFACE’ FAILURE MODES– data collection if AIMS App is not available

Subject	Evidence required	Evidence from inspection
Crest height degradation (AIMS app / Type 1,4 flowchart)	Record visible signs of crest height degradation at the transition (i.e. resulting in a low spot) relative to the adjacent asset(s)	
	Record trees, fences and mitigation measures (e.g. rock or geotextile)	
	Note the shape (e.g. square or circular) and dimensions of any embedded objects within 5 metres of the transition	
	Record location and dimensions of any visible signs of overtopping at the crest	
	Record location and dimensions of animal burrows and any related crest settlement to nearest 0.1m (i.e. relative to adjacent asset height)	
	Record location and dimensions of ruts or furrows at or near the crest	
	Record location and dimensions of poorly compacted or disturbed soils and any differential settlement across assets	
Surface erosion (AIMS app / Type 1,2,3,4 flowchart)	Record visible signs of surface erosion at the transition	
	Record trees, fences and mitigation measures (e.g. rock or geotextile)	
	Note the shape (e.g. square or circular) and dimensions of any embedded objects within 5 metres of the transition	
	Record location and dimensions of areas of poor grass cover or exposed surfaces noting any differences with the main length of the embankment	
	Record location and dimensions of poorly compacted or disturbed soils, including any differential settlement	

Subject	Evidence required	Evidence from inspection
	Record location and dimensions of ruts or furrows	
	Record basic dimensions of adjacent structures (e.g. height/ base width/ crest width/ slope angle) and any surface irregularities	
	Assess as precisely as practical (ideally to the nearest 0.1m) any reduction of crest height of the embankment asset at the transition compared with the adjacent embankment	

TIER 1 ASSESSMENTS

TYPE 4 : REVETMENTS

ASSET ID:

GENERAL ASSET INFORMATION – data collection for all users

Subject	Evidence required	Evidence from inspection
	Photographs of the transition and neighbouring asset (including local features)	Details:
	Estimated dimensions of adjacent embankment and transition	Crest width at transition (m): Waterward embankment slope (1 in X): Waterward transition slope (1 in X) if different: Landward embankment slope (1 in X): Landward transition slope (1 in X) if different:
	Overall condition of Transition relative to the condition of the adjacent embankment	Equivalent: Better than the adjacent embankment: Worse than the adjacent embankment:

TYPE 4 : REVETMENTS

‘HIDDEN’ FAILURE MODES – data collection for all users

Subject	Evidence required	Evidence from inspection
Backfill washout	Record trees, fences and mitigation measures (such as rock, geotextile)	
	Size (height, depth and width) and location of gaps, interruptions in the filter structure	
	Size (height, depth and width) and location of washout features	
	Presence and location of toe protection/ cut-off	

‘SURFACE’ FAILURE MODES– data collection if AIMS App is not available

Crest height degradation (AIMS app / Type 1,4 flowchart)	Record visible signs of crest height degradation at the transition (i.e. resulting in a low spot) relative to the adjacent asset(s)	
	Record trees, fences and mitigation measures (e.g. rock or geotextile)	
	Note the shape (e.g. square or circular) and dimensions of any embedded objects within 5 metres of the transition	
	Record location and dimensions of any visible signs of overtopping at the crest	
	Record location and dimensions of animal burrows and any related crest settlement to nearest 0.1m (i.e. relative to adjacent asset height)	
	Record location and dimensions of ruts or furrows at or near the crest	

	Record location and dimensions of poorly compacted or disturbed soils and any differential settlement across assets	
Surface erosion (AIMS app / Type 1,2,3,4 flowchart)	Record visible signs of surface erosion at the transition	
	Record trees, fences and mitigation measures (e.g. rock or geotextile)	
	Note the shape (e.g. square or circular) and dimensions of any embedded objects within 5 metres of the transition	
	Record location and dimensions of areas of poor grass cover or exposed surfaces noting any differences with the main length of the embankment	
	Record location and dimensions of poorly compacted or disturbed soils, including any differential settlement	
	Record location and dimensions of ruts or furrows	
	Record basic dimensions of adjacent structures (e.g. height/ base width/ crest width/ slope angle) and any surface irregularities	
	Assess as precisely as practical (ideally to the nearest 0.1m) any reduction of crest height of the embankment asset at the transition compared with the adjacent part of the embankment	

Tier 2 Assessment Global instability



Type 1 - Longitudinal



Review site information obtained from Tier 1 with the detailed non-intrusive site information.
Is sufficient and reliable data available to undertake the assessment?

NO

Data input

Minimum data required to undertake the assessment:

- Geometrical data e.g. topographic data or LIDAR
- Geology / ground conditions (BGS Geology Viewer, geological maps, BGS boreholes)

Other useful information:

- *Aerial photography, historic maps, as-built records*
- *Previous condition/inspection reports*
- *Maintenance regime/usage*
- *Available local knowledge – is instability a known problem and has the asset deteriorated?*

YES

Assess if the transition reduces **strength**:

1. Are there signs of stability failure or incipient failure of the transition? e.g. backscarps, tension cracks, toe bulging
2. Is the transition geometry steeper than typical design standards (1V:3H) or steeper than its adjacent asset?
3. Are there any signs of disturbed, weak or poorly compacted soils?
4. Is there evidence of significant deterioration in the condition of the transition? e.g. crest settlement, separation between soil/structure, voids etc
5. Does the information indicate any potentially adverse geomorphological features e.g. meanders, oxbows, terraces, fans, roddons etc
6. Are there any potentially adverse geological/geotechnical conditions within the embankment or sub-strata at the location of the transition? e.g. peat, soft organic or high plasticity clay, high permeability sand/gravel, buried valleys, karsts/swallow holes etc

Based on these questions, using engineering judgement and available tools: are improvement works required in the short term?

Flag up additional asset data required

Yes, improvement needed

- Identity type of improvement method
- Prioritisation

Uncertain, Tier 3 assessment required

- Identity type of analysis

No, but increased monitoring required

- Record results of Tier 2 assessment for global instability
- Schedule next Tier 1 inspection

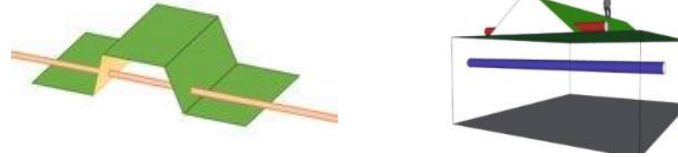
No improvement needed

- Record results of Tier 2 assessment for global instability
- Continue normal inspection and maintenance regime

Tier 2 Assessment Global instability



Type 3 – Crossing infrastructure



Review site information obtained from Tier 1 with the detailed non-intrusive site information.
Is sufficient and reliable data available to undertake the assessment?

NO

Data input:

Minimum data required to undertake the assessment:

- Geometrical data e.g. topographic data or LIDAR
- As-built records, previous condition/inspection reports, CCTV surveys
- Geology / ground conditions (BGS Geology Viewer, geological maps, BGS boreholes)

Other useful information:

- *Aerial photography, historic maps, as-built records*
- *Maintenance regime/usage*
- *Available local knowledge – is instability a known problem and has the asset deteriorated?*

YES

Assess if the transition reduces **strength**:

1. Are there signs of stability failure or incipient failure of the transition? e.g. backscarps, tension cracks, toe bulging, crest settlement, culvert collapse, pipeline heave etc.
2. Is there evidence of poor transition detailing? e.g. poor compaction or weak fill around structures etc
3. Is there inadequate depth of cover to the conduit? (which could cause stress distributions adverse to global stability)
4. Does the information indicate any potentially adverse geomorphological features at the transition e.g. meanders, oxbows, terraces, fans, roddons
5. Are there any potentially adverse geological/geotechnical conditions within the embankment or sub-strata at the location of the transition? e.g. peat, soft organic or high plasticity clay, high permeability sand/gravel, buried valleys, karsts/swallow holes etc

Based on these questions, using engineering judgement and available tools: are improvement works required in the short term?

Flag up additional asset data required

Yes, improvement needed

- Identity type of improvement method
- Prioritisation

Uncertain, Tier 3 assessment required

- Identity type of analysis

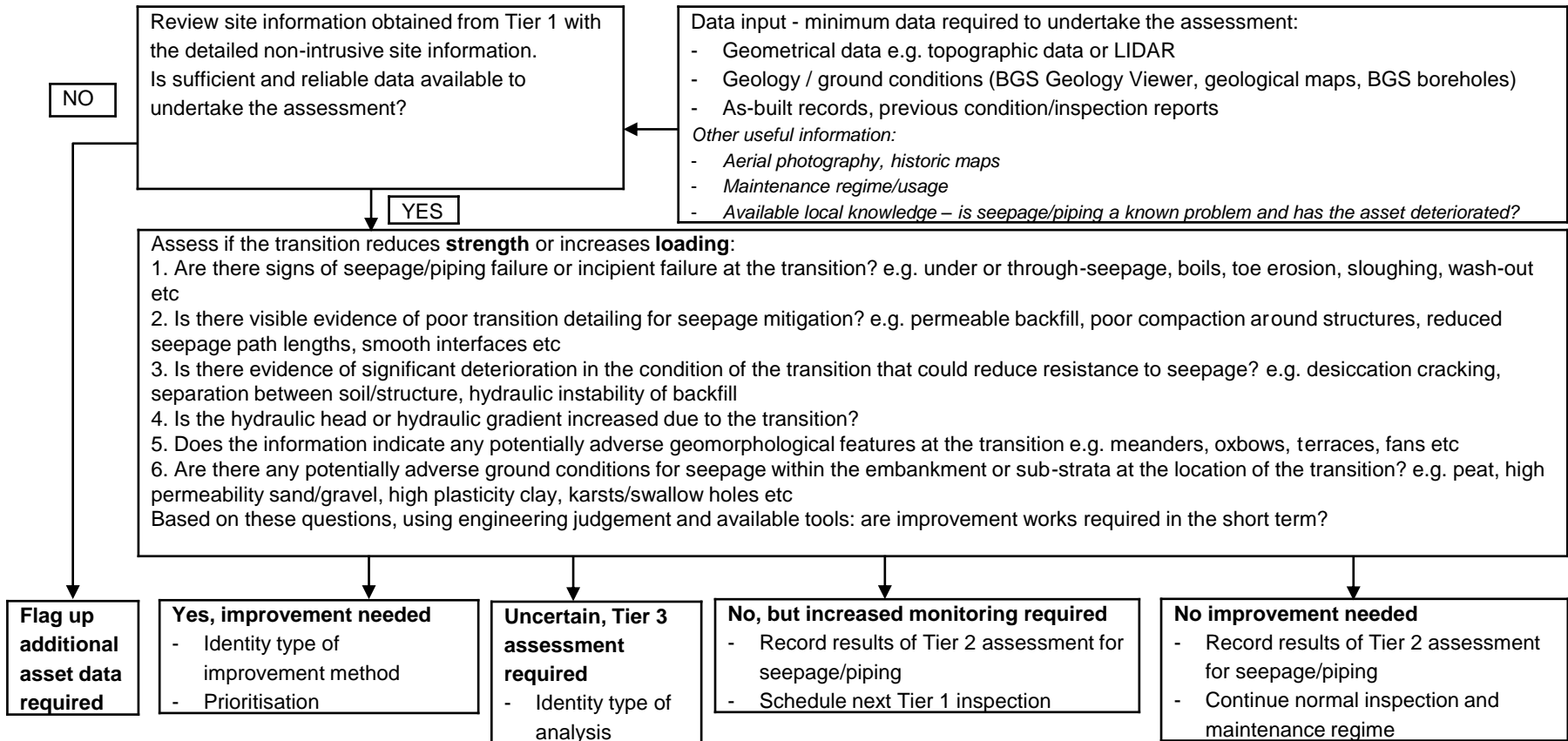
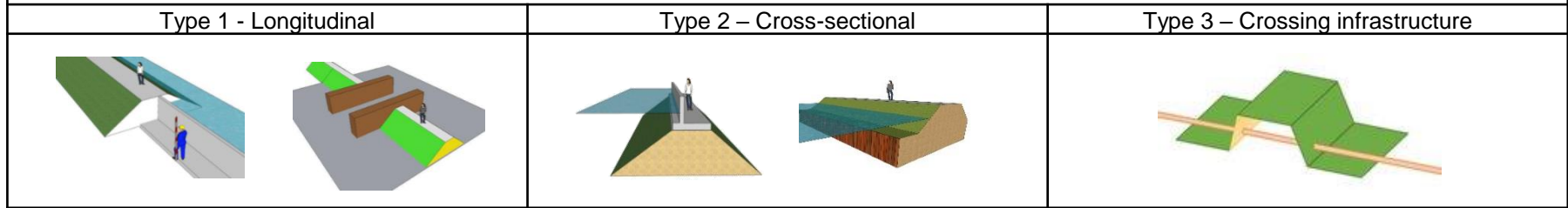
No, but increased monitoring required

- Record results of Tier 2 assessment for global instability
- Schedule next Tier 1 inspection

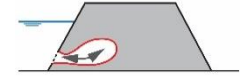
No improvement needed

- Record results of Tier 2 assessment for global instability
- Continue normal inspection and maintenance regime

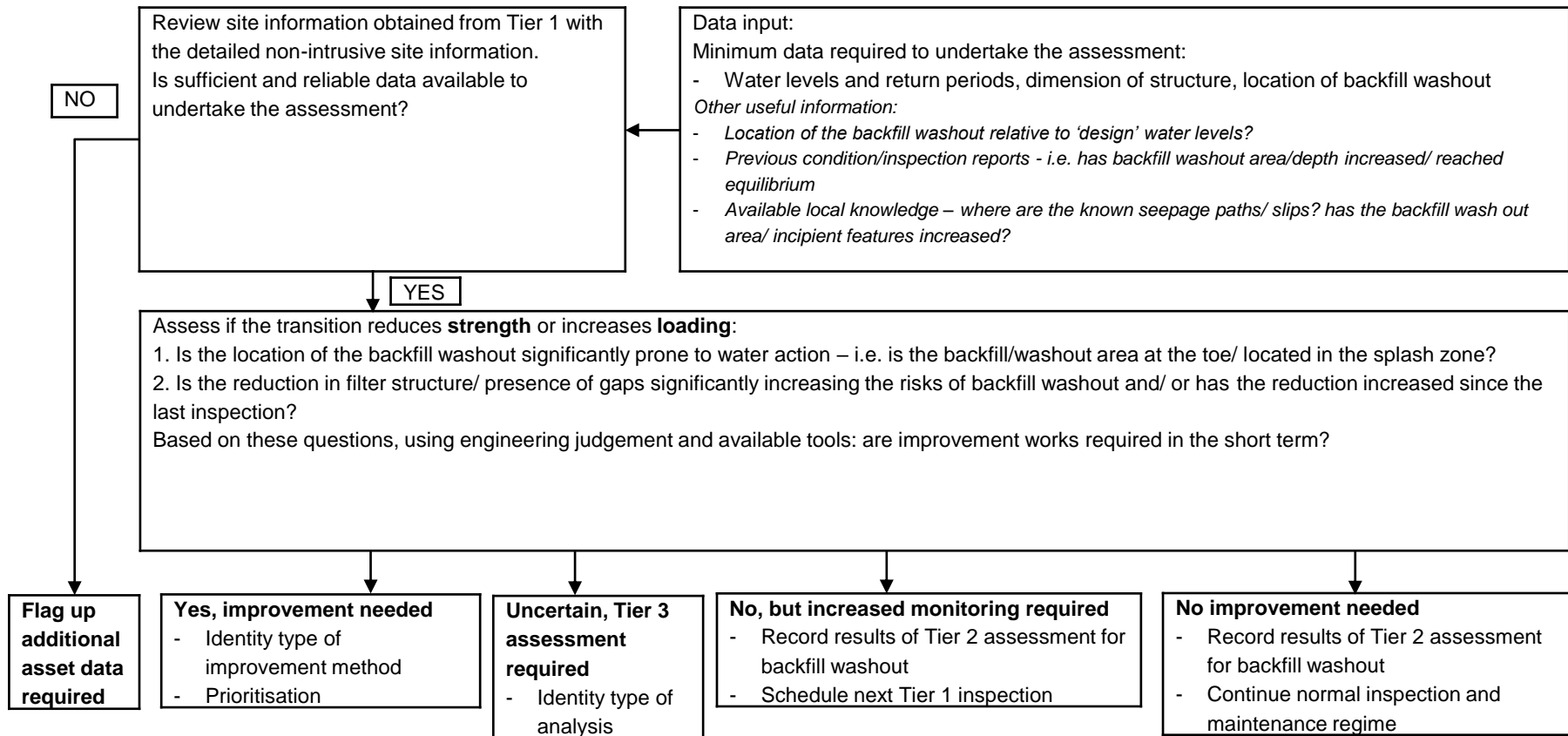
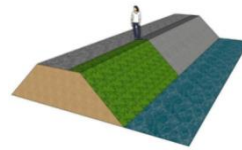
Tier 2 Assessment Seepage and piping



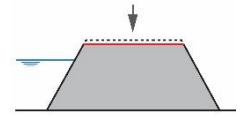
Tier 2 Assessment Backfill washout



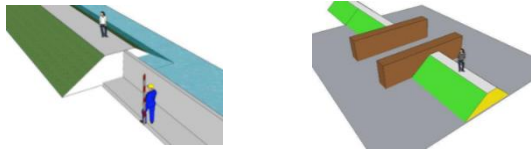
Type 4 - Revetments



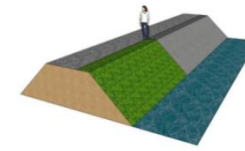
Tier 2 Assessment Crest height degradation



Type 1 - Longitudinal



Type 4 - Revetments



Review site information obtained from Tier 1 with the detailed non-intrusive site information.
Is sufficient and reliable data available to undertake the assessment?

NO

Data input:

Minimum data required to undertake the assessment:

- Water levels and return periods, dimension of structure, (degraded) crest level

Other useful information:

- Location of crest degradation relative to the 'design water levels'/required standard of protection ?
- Previous condition/inspection reports/topographic surveys - i.e. Where there previous signs of degradation - has the size increased or has it reached equilibrium?
- Maintenance regime/usage and loads - does this exacerbate the degradation?
- Available local knowledge – Has the degradation increased recently (is it progressive or catastrophic)? Is it known for this location to overflow/overtop?

YES

Undertake assessment for each of the Tier 1 questions answered Yes, including:

1. Is there a significant chance of overtopping, e.g. in relation to the assets' standard of protection? Compare crest levels with available water level information (daily, design, extreme) to make this judgement.
 2. Q2a. do the animal burrows increase the likelihood of significant degradation, settlement or overtopping erosion and has it degraded/settled more since the last inspection?
 3. Q2b. do the areas of rutting or furrows near the crest increase the likelihood of significant (increased) degradation, settlement or overtopping erosion?
 4. Q2c. do the loose soils increase the likelihood of significant crest height degradation, settlement or overtopping erosion
- Based on these questions, using engineering judgement and available tools: are improvement works required in the short term?

Flag up additional asset data required

Yes, improvement needed

- Identity type of improvement method
 - Prioritisation
- See also flowchart for surface erosion

Uncertain, Tier 3 assessment required

- Identity type of analysis

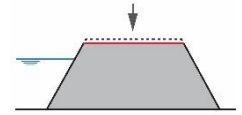
No, but increased monitoring required

- Record results of Tier 2 assessment for crest height degradation
- Schedule next Tier 1 inspection

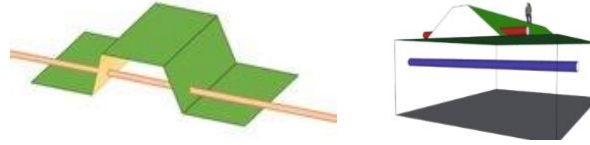
No improvement needed

- Record results of Tier 2 assessment for crest height degradation
- Continue normal inspection and maintenance regime

Tier 2 Assessment Crest height degradation



Type 3 - Crossing infrastructure



Review site information obtained from Tier 1 with the detailed non-intrusive site information.
Is sufficient and reliable data available to undertake the assessment?

NO

YES

Data input - minimum data required to undertake the assessment:

- Water levels and return periods, dimension of structure, (degraded) crest level

Other useful information:

- Location of crest degradation relative to the 'design water levels'/required standard of protection ?
- Previous condition/inspection reports/topographic surveys - i.e. Where there previous signs of degradation - has the size increased or has it reached equilibrium?
- Maintenance regime/usage and loads - does this exacerbate the degradation?
- Available local knowledge – Has the degradation increased recently (is it progressive or catastrophic)? Is it known for this location to overflow/overtop?

Undertake assessment for each of the Tier 1 questions answered Yes, including:

1. Is there a significant chance of overtopping, e.g. in relation to the assets' standard of protection? Compare crest levels with available water level information (daily, design, extreme) to make this judgement.
2. Q2a. do the animal burrows increase the likelihood of significant degradation, settlement or overtopping erosion and has it degraded/settled more since the last inspection?
3. Q2b. do the loose soils increase the likelihood of significant crest height degradation, settlement or overtopping erosion

Based on these questions, using engineering judgement and available tools: are improvement works required in the short term?

Flag up additional asset data required

Yes, improvement needed

- Identity type of improvement method
- Prioritisation

See also flowchart for surface erosion

Uncertain, Tier 3 assessment required

- Identity type of analysis

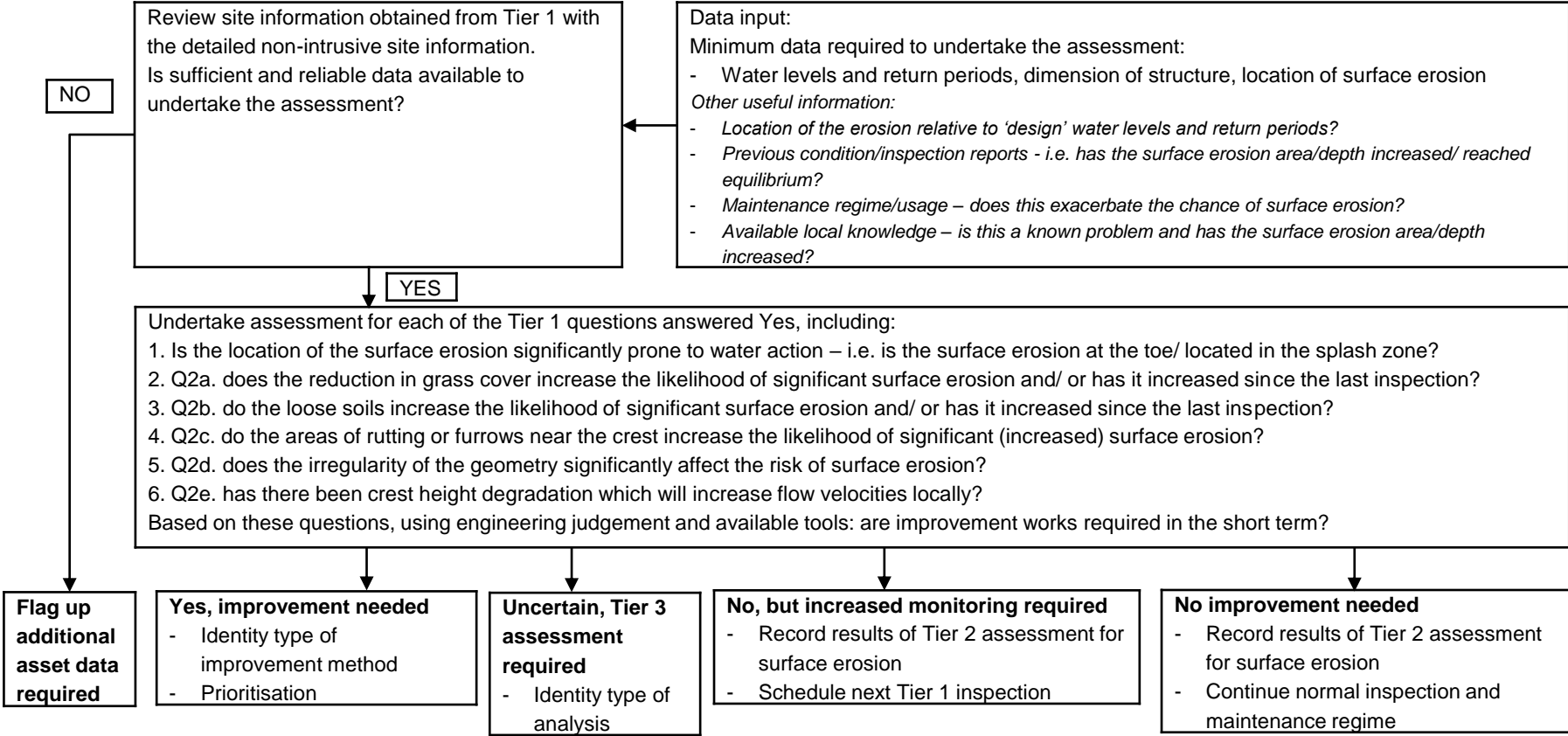
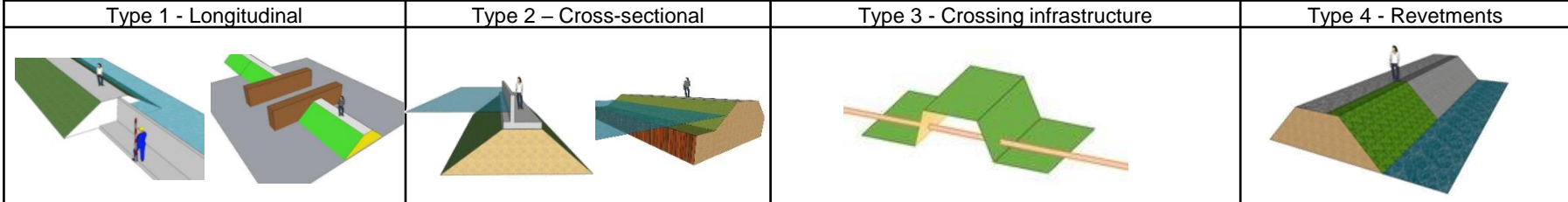
No, but increased monitoring required

- Record results of Tier 2 assessment for crest height degradation
- Schedule next Tier 1 inspection

No improvement needed

- Record results of Tier 2 assessment for crest height degradation
- Continue normal inspection and maintenance regime

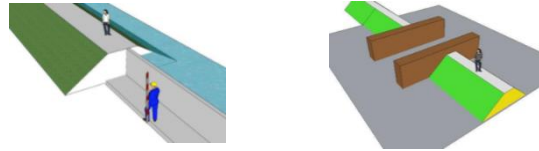
Tier 2 Assessment Surface Erosion



Tier 3 Assessment Global instability



Type 1 - Longitudinal



1. Obtain information from Tier 1 and Tier 2 assessments

2. Review Tier 1 and Tier 2 information, further potential methods:

- Expert and / or quantitative assessment or analysis of global stability at transition
- Assessment of residual strength and resilience (i.e. if global instability failure occurred, is this likely to result in a full breach, partial breach or damage to the asset?)

Improvement needed

Prioritisation

No improvement needed

- Record results of Tier 1, Tier 2 and Tier 3 assessment for global instability
- Continue normal inspection and maintenance regime

Tier 3 Assessment Global instability



Type 3 – Crossing infrastructure



1. Obtain information from Tier 1 and Tier 2 assessments

2. Review Tier 1 and Tier 2 information, further potential methods:

- Expert and / or quantitative assessment or analysis of global stability at transition
- Assessment of residual strength and resilience (i.e. if instability failure occurred, is this likely to result in a full breach, partial breach or damage to the asset?)

Improvement needed

Prioritisation

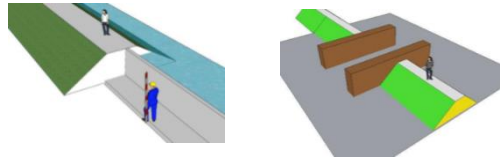
No improvement needed

- Record results of Tier 1, Tier 2 and Tier 3 assessment for global instability
- Continue normal inspection and maintenance regime

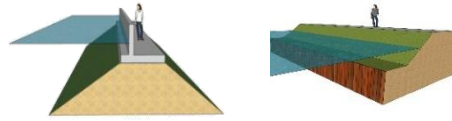
Tier 3 Assessment Seepage and piping



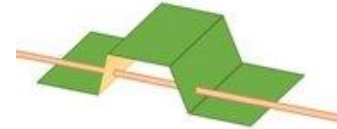
Type 1 - Longitudinal



Type 2 – Cross-sectional



Type 3 – Crossing infrastructure



1. Obtain information from Tier 1 and Tier 2 assessments

2. Review Tier 1 and Tier 2 information, further potential methods:

- Expert and / or quantitative assessment or analysis of seepage flow at transition
- Assessment of residual strength and resilience (i.e. if seepage/piping failure occurred, is this likely to result in a full breach, partial breach or damage to the asset?)

Improvement needed

Prioritisation

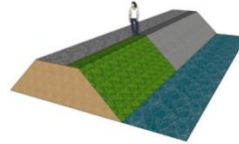
No improvement needed

- Record results of Tier 1, Tier 2 and Tier 3 assessment for seepage / piping failure
- Continue normal inspection and maintenance regime

Tier 3 Assessment Backfill washout



Type 4 - Revetments



1. Obtain information from Tier 1 and Tier 2 assessment

2. Review Tier 1 and Tier 2 information, further potential methods:

- Geohydrological analysis to determine loading, including allowing for transition impacts on groundwater pressure
- Expert and / or revetment stability analysis
- Assessment of residual strength (embankment core strong or wide enough to prevent breach)

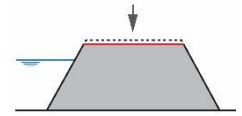
Improvement needed

Prioritisation

No improvement needed

- Record results of Tier 1, Tier 2 and Tier 3 assessment for backfill washout
- Continue normal inspection and maintenance regime

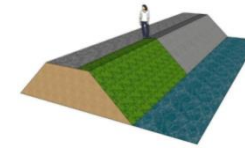
Tier 3 Assessment Crest height degradation



Type 1 - Longitudinal



Type 4 - Revetments



1. Obtain information from Tier 1 and Tier 2 assessment

2. Review Tier 1 and Tier 2 information, further potential methods:

- Expert geotechnical analysis (cause and prognosis of settlement)
- Expert overtopping analysis (chance; consequences for the asset)
- Assessment of residual strength (embankment core strong or wide enough to prevent breach)

Improvement needed

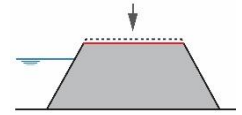
- See also flowchart for surface erosion

Prioritisation

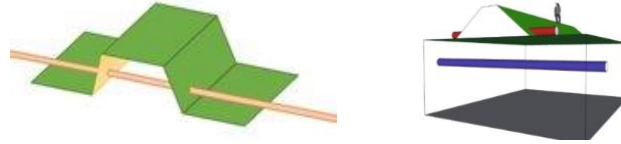
No improvement needed

- Record results of Tier 1, Tier 2 and Tier 3 assessment for crest height degradation
- Continue normal inspection and maintenance regime

Tier 3 Assessment Crest height degradation



Type 3 - Crossing infrastructure



1. Obtain information from Tier 1 and Tier 2 assessment

2. Review Tier 1 and Tier 2 information, further potential methods:

- Expert geotechnical analysis (cause and prognosis of settlement)
- Expert overtopping analysis (chance; consequences for the asset)
- Assessment of residual strength (embankment core strong or wide enough to prevent breach)

Improvement needed

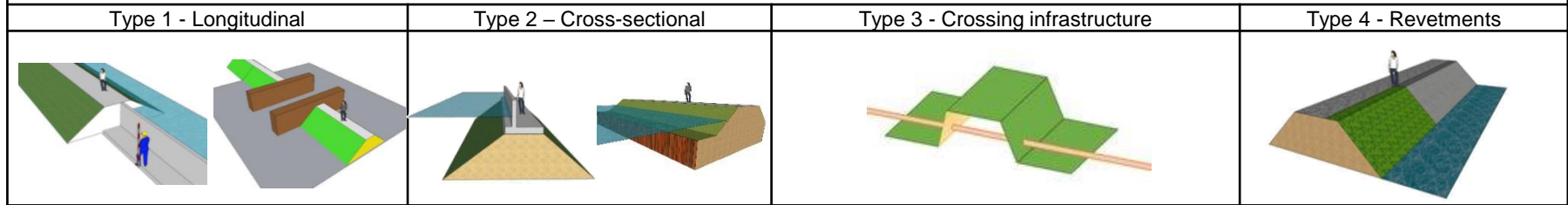
- See also flowchart for surface erosion

Prioritisation

No improvement needed

- Record results of Tier 1, Tier 2 and Tier 3 assessment for crest height degradation
- Continue normal inspection and maintenance regime

Tier 3 Assessment Surface Erosion



1. Obtain information from Tier 1 and Tier 2 assessment

2. Review Tier 1 and Tier 2 information, further potential methods:

- Hydraulic analysis to determine loading, including allowing for transition impacts
- Expert and / or quantitative analysis of vegetation quality (species, coverage, root structure)
- Assessment of residual strength (embankment core strong or wide enough to prevent breach)

Improvement needed

Prioritisation

No improvement needed

- Record results of Tier 1, Tier 2 and Tier 3 assessment for surface erosion
- Continue normal inspection and maintenance regime