

Client: Department of Infrastructure
 Project Name: Isle of Man - Sea defence options
 Design Element: ROC2 - Rock Revetment

Design Stage: Concept Date
 J. Skanberg-
 Author: Tippen 28/11/2014
 Check: G. Kenn 19/12/2014
 Review: G.Kenn 19/12/2014

TABLE 3-1: DESIGNER'S HAZARD INVENTORY (Revision 1.0, 30 January 2013)

Nr	Activity	Hazard	Task workers	Receptor		Environ-ment	Eliminate by design?	Mitigation measures	Residual risk	Impracticable solutions
				Other workers	Public					
1. CONSTRUCTION PHASE - SAFETY HAZARDS										
1.1 Access and egress										
1.1.1 Delivery of plant and materials and access to site										
1	Plant and material delivery access to site.	Restricted access around Mooragh Promenade.	Y	Y	Y	N	N	Early contractor involvement to consider best access routes for plant and deliveries. Development of a traffic management plan. Consider design options that minimise large plant access.	Traffic Management Plan to be developed. Risk to be identified in Pre Construction Information Pack.	None.
2	Delivery from sea.	Collision with offshore hazards, potential to cause oil spills and related damage. Damage from adverse weather conditions. Disruption to normal vessel traffic.	Y	Y	Y	Y	N	Early Contractor involvement to assess underwater and offshore hazards for sea-based delivery, identify potential drop-off site at an early stage. Up to date bathymetric charts to be supplied and oceanographic conditions (currents, tidal range etc) supplied. Investigate whether a license from MMO will be necessary.	Vessel Traffic Management Plan to be developed. Risk to be identified in Pre Construction Information Pack	None.
1.1.2 Movement of plant around site										
3	Movement of site traffic on public rights of way.	Disturbances to the Promenade; heavy traffic.	Y	Y	Y	N	N	Traffic Management Plan required. Contractors to consult with local resident groups. One-way traffic diversions to be developed along Mooragh Promenade and Old River Rd.	Traffic Management Plan to be developed. Risk to be identified in Pre Construction Information Pack.	None.
4	Movement of site traffic on public rights of way.	Public struck by site traffic.	Y	Y	Y	N	N	Traffic Management Plan required. Contractors to consult with local resident groups. Consider constructing works during periods when promenade area is less busy e.g. avoid summer months. Site Management plan will need to consider demarcation of promenade area and fencing etc to prevent public access. All emergency access to be maintained at all times.	Traffic Management Plan to be developed. Risk to be identified in Pre Construction Information Pack.	None.
5	Movement of site traffic on public rights of way.	Disturbances to beach users, and no access during construction of the new revetment.	Y	Y	Y	N	N	Early consultation with local resident groups. Provide sufficient notice to advise of the likely downtime of the promenade and beach during construction. Consider phasing development so only part of the beach is inaccessible at any one time.	Consultation with resident groups. Risk to be identified in Pre Construction Information Pack.	None.
6	Movement of plant around beach area.	The beach area is a highly popular area for the public, so there is the risk of people fishing, exercising, walking pets or deliberately accessing the site to watch the construction process. Any access by the public will increase the risk of being struck by plant.	Y	Y	Y	Y	N	Site Management plan will need to consider demarcation of beach area and fencing etc to prevent public access.	Site Management Plan to be developed. Risk to be identified in Pre Construction Information Pack.	None.

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7	Movement of plant on and around site.	Risk of damage water damage working in a dynamic coastal environment.	Y	Y	Y	Y	Y	Tidal and weather plan for both methods would be required so work plant is not caught by the tide or adverse weather conditions. Works to be carried out by competent contractor with experience in handling barges in a dynamic environment next to a fixed structure. Investigate whether a license from MMO will be necessary.	Tidal and weather works plan to be developed. Risk to be identified in Pre Construction Information Pack.	
8	Movement of plant on and around site.	Plant getting stuck on the beach.	Y	Y	Y	Y	N	All movement of plant to be controlled by a banksman and areas at risk to be comdoned off by Heras fencing.	Risk to be identified in Pre Construction Information Pack.	None.
9	General movement around site.	Slips, trips and falls.	Y	Y			N	All work areas to be kept clean and tidy. Designated pedestrian routes to be demarcated.	Slips, trips and falls.	None.
10	Mud on road.	Hazard to other road users.	Y	Y	Y	Y	N	Contract requirements to include wheel wash; road sweeper.	Mud accumulates between road sweeping operations.	None
1.2 Adjacent land users										
11	Location of site compound.	Limited space due to site proximity to urban area. Could cause impact on local residents and business owners.	Y	Y	Y	N	N	Careful consideration of site compound positioning. Early contractor involvement would be beneficial.	None.	Remote compound.
12	Shared use of walkways, beach access ramps and promenade access routes.	Injury to public.	Y	Y	Y	N	N	Physical separation of pedestrians and site traffic. Designated safe corridors for public to access the promenade area and clear signage of the work site is required. It would be beneficial to completely close the promenade area fronting Ramsey beach during construction, however this may be impracticable due to requirements of public and home owners. May require phased working.	Unauthorised access.	None.
13	Public access to areas surrounding work area.	Injury to public.	Y	Y	Y	N	N	Fencing to site compound and work areas and signage to inform about risks present on site.	Trespassers.	None.
1.3 Excavating the foreshore at the sea wall to form the new defence										
14	Excavating the foreshore at the sea wall to form the new defence.	Structural collapse of sea wall.	Y	Y	Y	N	N	The sea wall is of unknown condition. During excavation of the foreshore at the toe of the sea wall, there is the potential for structural collapse. It is recommended that the sea wall is inspected for structural weaknesses and the foreshore inspected for structural importance. A full structural survey of the foreshore and sea wall to be undertaken prior to detailed design.	Risk to be identified in Pre Construction Information Pack.	Leaving the foreshore intact.
15	Levelling during rock placement.	Site personnel climbing on rock to gain level data.	Y	Y	N	N	N	Plant based level equipment to be used e.g. Grab levels. Personnel should not be required to climb on rock armour.	None.	None.
1.4 Scabbling and pilot drilling the existing sea wall to form the new defence										

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16	Scabbling and pilot drilling the existing sea wall to form the new defence.	Structural collapse of sea wall.	Y	Y	Y	N	N	The sea wall is of unknown condition. During scabbling and pilot drilling of the promenade sea wall, there is the potential for localised structural collapse. It is recommended that the sea wall is inspected for structural weaknesses and echo sounded to locate current rebar. A full structural survey of the existing promenade wall to be undertaken prior to detailed design to ensure structural capacity.	Risk to be identified in Pre Construction Information Pack.	Leaving the promenade intact.
1.5 Working at height										
17	Falling hazard working around existing sea wall.	Falls, falling tools.	Y	Y	N	N	N	Contractor to setup temporary barriers and employ banksmen in areas at risk of working at height.	Contractor to advise on best method for this element of the work. Risk to be identified in Pre Construction Information Pack.	None.
18	Levelling during rock placement.	Site personnel climbing on rock to gain level data.	Y	Y	N	N	N	Plant based level equipment to be used e.g. Grab levels. Personnel should not be required to climb on rock armour.	None.	None.
1.6 Working near water (Coastal location)										
19	General works and operations near the sea.	Accidental water entry.	Y	Y	N	N	N	Contractor to provide life saving equipment. Toolbox talks and training to be completed.	Risk to be identified in Pre Construction Information Pack.	None.
20	Flooding of works during construction.		Y	Y	N	N	N	Contractor to register for Environment Agency flood warning and any other local flood warning services. Remove plant and materials from at risk area, if a flood warning is given.	Risk to be identified in Pre Construction Information Pack.	None.
21	Working in a tidal location during construction works.	Drowning / inundation of works.	Y	Y	N	N	N	Ensure careful planning of work activities around tidal cycle. Ensure daily weather monitoring and forecasting is undertaken to provide early warning of storm events. Ensure temporary works are in place to mitigate the risk of tidal inundation to working areas. Provide life jackets for all personnel working in close proximity to the sea. Training and tool box talks covering working in a tidal environment.	Risk to be identified in Pre Construction Information Pack.	None.
22	Wave damage during construction.	Water damage risk to site and workers.	Y	Y	N	N	N	Work on the foreshore to be within prescheduled windows around low tide. Contractor to register for Environment Agency flood warning services, and response measures to developed for securing site works and equipment during risk of wave attack.	Risk to be identified in Pre Construction Information Pack.	None.
1.7 Groundwork										

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23	Promenade load bearing capacity and excavation area.	Structural collapse of promenade area and wall.	Y	Y	Y	N	N	A full geotechnical investigation should be undertaken before further design development. Where possible avoid loading the rear of the promenade sea wall or excavating immediately adjacent to the sea wall below the required level, to minimise the risk of destabilisation of structure. Contractor to ensure construction plant is sited a suitable distance from the promenade wall	Risk to be identified in Pre Construction Information Pack.	All works to take place on the foreshore.
24	Soft ground.	Sinking plant.	Y	Y	N	N	N	Site investigation to be undertaken prior to detailed design.		
1.8 Existing services										
25	Excavation	Striking unknown services.	Y	Y	Y	Y	N	Full services search to be completed prior to detailed design. CAT scan before excavation; hand excavation for first 0.5m.	Risk to be identified in Pre Construction Information Pack.	None.
1.9 Unexploded ordnance										
26	Excavation	Striking unexploded ordnance.	Y	Y	Y	N	N	Conduct desk based study for identification of unexploded objects and survey before construction.	Risk to be identified in Pre Construction Information Pack.	None.
1.10 Confined Spaces										
	N/A									
2. CONSTRUCTION PHASE - HEALTH HAZARDS										
2.1 Manual handling										
27	Manual handling of materials.	Injury to personnel.	Y	Y	N	N	N	Where possible all elements specified should be suitable for lifting and positioning by mechanical means. Suitable access routes to construction areas to allow delivery directly to working area with lifting and handling equipment, competent personnel. Manual handling tool box talks and training.	None.	None.
2.2 Environmental and weather conditions										
28	Working on site during dark, cold, wet and rainy conditions.	Personnel not being visible during short or dark days (due to limited daylight) and being hit by plant, getting wet and cold, slipping or tripping in the wet and cold.	Y	Y	N	N	N	Appropriate lighting to be installed if working during evening conditions, all personnel to wear appropriate PPE, including wet weather clothing.	None.	None.
29	Demolition over water body	Environmental pollution of sea.	N	N	Y	Y	N	Careful planning to ensure all debris is captured, consideration of safety nets for larger debris particles.	Risk to be identified in Pre Construction Information Pack.	None.
2.3 Noise and vibration										
30	Placement of rock.	Noise and disruption to local resident groups.	Y	Y	Y	N	N	Rock placement to be undertaken during normal working hours to reduce impact on houses in proximity. Care taken to limit maximum drop height.	Noise and vibration.	None.

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31	Demolition of any relic structural components (road base, concrete footings).	Hand arm vibration.	Y	Y	N	N	N	Use mechanical methods for demolition wherever possible. If hand demolition is required then ensure adherence to guidance. All noise and vibration to be monitored and controlled around construction site.	Noise and vibration.	None.
32	Noise and vibration from construction process e.g. drilling or piling.	Disturbance to locals and risk of damage to surrounding structures.	Y	Y	Y	N	N	All noise and vibration to be monitored and controlled around construction site.	Noise and vibration.	None.
2.4 Materials										
33	Biological hazards due to water (eg. Leptospirosis).	Illness to personnel.	Y	N	N	N	N	Staff awareness, avoid contact, good hygiene practice	None.	None.
34	Dust due to construction plant and vehicles.	Health and visual impact to personnel and public.	Y	Y	Y	Y	N	Dust-management measures: tarpaulins on lorries, water sprays.	None.	None.
35	Fuel spillage.	Fire hazard. damage to flora (limited), fauna (fish and marine/aquatic species) and coastal waters.	Y	Y	Y	Y	N	Fuel storage remote from waters, all fuel storage areas to be bunded and containers located on drip trays; spill kit available.	Damage to fauna or groundwater.	None.
36	Hydraulic oil spillage.	Fire hazard. damage to flora, fauna and watercourse.	Y	Y	Y	Y	N	Regular maintenance of plant; biodegradable hydraulic oil in plant working near watercourses (optional); spill kit.	Damage to fauna or groundwater.	None.
37	Mud due to construction plant and vehicles.	Dangerous road conditions.	Y	Y	Y	Y	N	Contract requirements to include wheel wash; road sweeper.	Mud accumulation between road cleaning leading to slippery conditions.	None.
38	Wet concrete leading to burns.	Personal injury.	Y	Y	N	Y	N	Staff awareness, PPE.	None.	Alternative materials.
39	Wet concrete spillage or surplus concrete.	Damage to flora, fauna and watercourse.	Y	N	N	Y	N	Spill kit; offsite disposal of surplus concrete and washing out of lorry.	None.	Alternative materials.
40	Rock Armour placement.	Splintering during rock armour placement.	Y	Y	Y	Y	N	Rock armour placement method statement to be developed. PPE to be worn at all times.	None.	None.
3. DECOMMISSIONING										
41	Decommissioning of structure.	Hazards associated with decommissioning coastal defence during 100 year design life.	Y	Y	N	N	Y	Careful consideration during detailed design to simplify future decommissioning.	None.	None.
42	Working near water during defence inspection.	Water entry.	Y	Y	N	N	Y	All inspections can be completed during calm weather conditions. No requirement to inspect structures during storm conditions.	None.	None.
4. PUBLIC SAFETY										
43	Walking on uneven ground.	Slips, trips and falls.	N	N	Y	N	N	Ground reinstated to a level surface following construction. No severe changes in level.	Construction team to ensure all surface are reinstated appropriately.	None.
44	Unauthorised climbing on promenade wall and rock armour.	Falls from the wall/rock armour.	N	N	Y	N	Y/N	Fencing could be provided around the top of the structure to discourage unauthorised access. Access cannot be eliminated but could be discouraged through the use of signage.	DOI should consider installing warning signage.	None.