Client: Department of Infrastructure
Project Name: Isle of Man - Sea defence options
Design Element: DH1 - Raised Harbour Wall

Design Stage: Concept **Date**
Author: A. Dane 08/09/2014
Check: G. Kenn 11/09/2014
Review: G Kenn 16/12/2014

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

Nr	Activity	Hazard	Receptor				Eliminate by design?	Mitigation measures	Residual risk	Impracticable solutions
			Task workers	Other workers	Public	Environ-ment				
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 acccess through narrow streets around Douglas Harbour.	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.
1.1.2 Movement of plant around site										
2	Movement of site traffic on public rights of way.	Disturbances to North Quay road. Heavy traffic, disturbances to shops and local services.	Y	Y	Y	N	N	Traffic Management Plan (TMP) required. Contractors to consult with local resident groups. Compensation for shops and services if full closure is required. One-way traffic diversions to be developed around Douglas.	Traffic Management Plan to be developed. Risk to be identified in Pre Construction Information Pack.	None.
3	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.
4	Movement of site traffic on public rights of way.	Disturbances to vessel users, and no access to boats during construction of the new wall.	Y	Y	Y	N	N	Early consultation with vessel users. Provide sufficient notice to advise of the likely downtime of the North Quay during construction. Consider phasing development so only part of the quay is inaccessible at any one time. Re-home vessels during construction.	Consultation with vessel users. Risk to be identified in Pre Construction Information Pack.	None.
5	Movement of plant on and around site.	Plant falling into the harbour.	Y	Y	Y	Y	N	All movement of plant to be controlled by a banksman and areas at risk to be corndoned off by Heras fencing.	Risk to be identified in Pre Construction Information Pack.	None.
6	General movement around site.	Slips, trips and falls.	Y	Y	N	N	N	All work areas to be kept clean and tidy. Designated pedestrian routes to be demarcated.	Slips, trips and falls.	None.
7	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										
8	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.	Contractor to advise on most suitable location and the associated risks.	Remote compound.

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9	Shared use of walkways 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 fronting Douglas Harbour during construction, however this may be impracticable due to requirements of shop owners and vessel users. May require phased working.	Unauthorised access.	None.
10	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 Trimming the quay wall to form the new defence										
11	Trimming quay wall to form the new defence.	Structural collapse of quay wall.	Y	Y	Y	N	N	The quay wall is of unknown condition. During trimming of the wall, there is the potential for full structural collapse. It is recommended that the fill behind the wall is removed (to the required depth) prior to trimming the walls. Full tactile survey of the existing walls to be undertaken prior to detailed design to ensure that there is sufficient structural capacity.	Risk to be identified in Pre Construction Information Pack.	Leaving the quay walls in place.
1.4 Working at height										
12	Trimming the quay wall to form the new defence.	Falls, falling tool / debris.	Y	Y	N	N	N	Methods of construction to reduce risk - 1. Construct a scaffold platform. 2. Vessel based work. 3. Harnessed workers.	Contractor to advise on best method for this element of the work. Risk to be identified in Pre Construction Information Pack.	Leaving the quay walls in place.
13	Falling hazard working around existing harbour wall.	Falls, falling tools.	Y	Y	N	N	N	Contracter 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.
1.5 Working near water (Coastal location)										
14	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.
15	Flooding of works during construction.	Water damage risk to site and workers.	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.
1.6 Groundwork										

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16	Excavation through existing fill material and promenade area.	Structural collapse of promenade area.	Y	Y	Y	N	N	A full geotechnical investigation should be undertaken before further design development. Where possible avoid loading the rear of the quay wall or excavating immediately adjacent to the quay 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 quay wall edge.	Risk to be identified in Pre Construction Information Pack.	None.
17	Harbour wall 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 harbour wall to minimise the risk of destabilisation of structure. Contractor to ensure construction plant is sited a suitable distance from the harbour wall edge.	Risk to be identified in Pre Construction Information Pack.	None.
1.7 Existing services										
18	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.
1.8 Unexploded ordnance										
19	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.
1.9 Confined Spaces										
	N/A									
2. CONSTRUCTION PHASE - HEALTH HAZARDS										
2.1 Manual handling										
20	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										
21	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.
22	Demolition over water body.	Environmental pollution of watercourse, debris in harbour and damage to vessels below.	N	N	Y	Y	N	Careful planning to ensure all debris is captured, consideration of safety nets for larger debris particles. All attempts to limit leaching into watercourse undertaken.	Risk to be identified in Pre Construction Information Pack.	None.
2.3 Noise and vibration										

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23	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.
29	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										
24	Biological hazards due to water (eg.Leptospirosis).	Illness to personnel.	Y	Y	Y	N	N	Staff awareness, avoid contact, good hygiene practice.	None.	None.
25	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.
26	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.
27	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.
28	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 slippy conditions.	None.
29	Wet concrete leading to burns.	Personal injury.	Y	Y	N	Y	N	Staff awareness, PPE.	None.	Alternative materials.
30	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.
3. DECOMMISSIONING										
31	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.
32	Working near water during defence inspection.	Water entry.	Y	Y	N	N	Y	All inspections can be completed during calm periods using a vessel. No requirement to inspect structures during storm conditions.	None.	None.
4. PUBLIC SAFETY										
33	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.
34	Unauthorised climbing on promenade wall.	Falls from the wall.	N	N	Y	N	Y/N	Partly mitigated by design through an inclusion of a stainless steel handrail to raise the defence to the 1100mm recommended by design guides. Access cannot be eliminated but could be discouraged through the use of signage.	DoI should consider installing warning signage.	None.

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35	Accessing vessels from the quayside.	Falls from the wall.	N	N	Y	N	Y/N	Possible options include 1) providing ladder access over new walls, 2) raised concrete platforms or 3) gaps in the wall with demountable fittings.	Best option to be developed further during detailed design.	None.