HS1
Rev 11

ARUP

Hazard Identification and Risk Assessment

Job Number	233985
Page Number	1 of 26

Project	**N6 Galway City Transport Project**			**Design Issue or Element**			Table 1: Traffic Management		
Stage	**Scheme Stage**			**Pre-Tender Stage**			**Other (Clarify)**		
	Name	Hand Initial	Date	Name	Hand Initial	Date	Name	Hand Initial	Date
Designer	Michael Gaughan	MG	08/08/2017						
Project Manager	Eileen McCarthy	EMC	11/12/17						

	Hazard	**Design Mitigation measures**	**Other Possible Mitigation Measures (including measures by Contractor on site)**	**Residual Risk Assessment following mitigation measures**		
				Likelihood	**Severity**	**Risk Rating**
1.1	Hazard: Transport of construction material with mobile plant machinery and construction vehicles movements during construction. Risk: Collision causing injury or death to public or construction personnel.	Acquire sufficient lands in MO/PRO to facilitate construction and the movement of machinery and materials. Hazard is unavoidable, however access/egress from the site will be restricted to identified locations and all haul routes have been identified. Measures can also be used to reduce risk at access/egress point to the works. Design appropriate traffic management measures, e.g. speed restrictions adjacent to work site, diversions etc. Ensure adequate construction traffic management plan is in place and personnel are equipped properly and trained to operate heavy machinery.		L	H	M
1.2	Hazard: Falling debris from supply vehicles during construction project. Risk: Injury or damage to public vehicles.	Considered low on the basis that suitable site controls would be put in place such as temporary traffic management (TTM), appropriate construction methodologies, all in accordance with national and international best practice. Suitable haul routes have been identified and vehicle access will be restricted to these routes.	Risk assessments, traffic management plans and appropriate construction methodologies to be determined before works commence.	L	M	L

Likelihood of Hazard occurring
L = Low (Seldom)
M = Medium (Reasonably Likely)
H = High (Certain/Nearly certain)

Severity of Harm
L = Minor Injury/Illness
M = Injury/Illness causing short term disability
H = Fatality or major injury/illness causing long term disability

Risk Assessment
L = Low Risk (No action)
M = Medium Risk (Action required unless good reason not to)
H = High Risk (Action required e.g. Design Change)

Refer to Arup Health & Safety Designer's Handbook ; Detailed Design Project Flowchart for guidance on form sign off and issue to PSDP.

Risk Table	***Severity***		
Likelihood	**H**	**M**	**L**
H	H	H	M
M	H	M	L
L	M	L	L

	Hazard	Design Mitigation measures	Other Possible Mitigation Measures (including measures by Contractor on site)	Residual Risk Assessment following mitigation measures		
				Likelihood	Severity	Risk Rating
1.3	Hazard: Public Driver/cyclist/pedestrian confusion during temporary road layouts/diversions. Risk: Collision/injury/death risk to general public during temporary diversions.	Design traffic management measures in accordance with best practice. Adequate signage & management of traffic flows throughout construction phase. Ensure adequate construction traffic management plan is in place and personnel are equipped properly trained to operate heavy machinery.	Appropriate Contractor safe systems of work for traffic management procedures to be implemented. Traffic volumes to be monitored during diversion period.	L	H	M
1.4	Hazard: Construction personnel working in the vicinity of live traffic lanes. Risk: Injury or death	Design appropriate traffic management measures, e.g. speed restrictions adjacent to work site, diversions etc. Ensure adequate construction traffic management plan is in place and personnel are equipped properly and trained to operate heavy machinery.	Appropriate Contractor safe systems of work for traffic management procedures to be implemented for all staff.	L	H	H
1.5	Hazard: Bridge structures for motorists & pedestrians during operation. Risk: Falling from a height/bridge during operation, debris being thrown on live traffic.	Discourage stopping on bridges. Designate safe stopping areas in case of emergency away from bridge crossings on a height. Design appropriate vehicle and personnel containment systems and parapets. Design in accordance with best practice.		L	H	M
1.6	Hazard: Major collision during construction. Risk: Gridlock and delays throughout the entire city, death or injury to personnel or the public.	Temporary traffic management (TTM), appropriate construction methodologies to be implemented, all in accordance with national and international best practice. Ensure adequate construction traffic management plan is in place and personnel are equipped properly trained to operate heavy machinery.	Contractor to monitor traffic levels and implement emergency measures for traffic relief if major incident occurs during construction.	L	H	M

Likelihood of Harm
L = Low (Seldom)
M = Medium (Reasonably Likely)
H = High (Certain/Nearly certain)

Severity of Harm
L = Minor Injury/Illness
M = Injury/Illness causing short term disability
H = Fatality or major injury/illness causing long term disability

Risk Assessment
L = Low Risk (No action)
M = Medium Risk (Action required unless good reason not to)
H = High Risk (Action required e.g. Design Change)

Risk Table	*Severity*		
Likelihood	**H**	**M**	**L**
H	H	H	M
M	H	M	L
L	M	L	L

Hazard	Design Mitigation measures	Other Possible Mitigation Measures (including measures by Contractor on site)	Residual Risk Assessment following mitigation measures		
			Likelihood	Severity	Risk Rating

HS1
Rev 11

ARUP

Hazard Identification and Risk Assessment

Job Number	233985
Page Number	3 of 26

Project	**N6 Galway City Transport Project**			**Design Issue or Element**			Table 2: Homes, Businesses & Property Owners, General Public		
Stage	**Scheme Stage**			**Pre-Tender Stage**			**Other (Clarify)**		
	Name	Hand Initial	Date	Name	Hand Initial	Date	Name	Hand Initial	Date
Designer	Clíodhna Ní Mhurchú	CNM	08/08/17						
Project Manager	Eileen McCarthy	EMC	11/12/17						

	Hazard	Design Mitigation measures	Other Possible Mitigation Measures (including measures by Contractor on site)	Residual Risk Assessment following mitigation measures		
				Likelihood	Severity	Risk Rating
2.1	Hazard: Work sites in vicinity of public areas e.g. public roads and footpaths Risk: Collision between operatives/vehicles/equipment entering or leaving the site with public traffic or members of the public	Work sites to be designed and sized in accordance with best practice. Areas to be set out in the contract drawings. Designer to acknowledge that areas will be constrained by the requirement to maintain traffic flows on existing roads and streets. Design to consider available workspace for the contractor to compete the work safely using safe systems of work and suitable vehicles, equipment and resources. Key access points to be identified by designers and outlined to contractor. The accesses to the sites will be from public roads, and the sites themselves are located on or adjacent to roads so risk cannot be fully mitigated by design. Develop Traffic Management Plan. Haul routes and access/egress points to the site have been identified and will be restricted to these routes only.	Contractor to implement the traffic management plan. Contractor to obey all road traffic laws with particular with regard to turning movements and traffic safety. Particular care is to be taken in relation to traffic movements on the adjacent public road and warning signs as appropriate. Detailed control measures are to be developed by the contractor to mitigate all risks to health and safety, including a planned sequence of work, and issue of suitable PPE such as high visibility vests, etc, and as per the requirements of: • Safety Health and Welfare at Work (Construction) Regulations 2006 • HSA Information Sheet – Use	L	H	M

Likelihood of Harm
L = Low (Seldom)
M = Medium (Reasonably Likely)
H = High (Certain/Nearly certain)

Severity of Harm
L = Minor Injury/Illness
M = Injury/Illness causing short term disability
H = Fatality or major injury/illness causing long term disability

Risk Assessment
L = Low Risk (No action)
M = Medium Risk (Action required unless good reason not to)
H = High Risk (Action required e.g. Design Change)

Risk Table	*Severity*		
Likelihood	**H**	**M**	**L**
H	H	H	M
M	H	M	L
L	M	L	L

	Hazard	Design Mitigation measures	Other Possible Mitigation Measures (including measures by Contractor on site)	Residual Risk Assessment following mitigation measures		
				Likelihood	Severity	Risk Rating
			of Mobile Machinery on Construction Sites (2008) • S.I. No. 423 of 2008 Safety Health and Welfare at Work (Construction) (Amendment) (No. 2) Regulations 2008 • Safety Health and Welfare at Work (General Application) Regulations 2007 HSA Guidance documents on Workplace Transport Safety			
2.2	Hazard: Construction of bridge on or close to River Corrib Risk: Risk of collision to amenity users of the river e.g. boating or rowing, fishing boats etc. during bridge construction with temporary structures, barge or proposed bridge. Risk of injury from falling debris or equipment from bridge.	A constructability report has been developed to ensure the safe construction of this bridge. These measures are to be included in the contract documents. The designers to provide sufficient headroom and clearance for recreational boats passing beneath structure.	A suitable warning system regarding water levels in river to be put in place. Implement management of water traffic using appropriate signage to highlight the presence of any obstacles in the River. Detailed control measures are to be developed by the contractor to mitigate all risks to health and safety, including a planned sequence of work, and issue of suitable PPE for working at height and in the vicinity of water. Installation of nets between beams of bridge during construction to prevent injury from falling debris or equipment. Implement closures or access restrictions to members of public crossing beneath bridge during the bridge beam installation.	L	M	L
2.3	Hazard: Members of Public in close proximity to work sites	The nature of the works requires work site to be in vicinity of public roads, footpaths and public	Contractor is responsible for site security. Appropriate	L	H	M

Likelihood of Harm
L = Low (Seldom)
M = Medium (Reasonably Likely)
H = High (Certain/Nearly certain)

Severity of Harm
L = Minor Injury/Illness
M = Injury/Illness causing short term disability
H = Fatality or major injury/illness causing long term disability

Risk Assessment
L = Low Risk (No action)
M = Medium Risk (Action required unless good reason not to)
H = High Risk (Action required e.g. Design Change)

Risk Table	*Severity*		
Likelihood	**H**	**M**	**L**
H	H	H	M
M	H	M	L
L	M	L	L

	Hazard	Design Mitigation measures	Other Possible Mitigation Measures (including measures by Contractor on site)	Residual Risk Assessment following mitigation measures		
				Likelihood	Severity	Risk Rating
	Risk : Injury sustained or death from falling into an open manhole/chamber or excavation	amenity areas. Site security fencing to be designed to prevent unauthorised access to the construction site.	pedestrian/cyclist management to be implemented in vicinity of worksites.			
2.4	Hazard: Illegal entry onto the work site after hours Risk: Damage/vandalism to construction plant & machinery	Design adequate hoarding and fencing to prevent unauthorised access to the site when not in operation.	All works to be left in a safe condition at end of working day. All construction materials, plant, fuel and other substances to be kept in a locked and secure locations, which cannot be accessed by the public at any time. Consider employment of security team to monitor construction site 24hrs.	M	M	M
2.5	Hazard: Noise & Dust created during construction Risk: Noise & dust affecting health, comfort & peaceful enjoyment of homes and businesses during construction period. This may be concentrated in communities or areas of high numbers of homes throughout scheme	The depth of excavation in vicinity of homes and businesses has been minimised. This in turn will minimise the requirement for deep noisy excavation using blasting or rock breaking machinery. Design appropriate haulage roads and access points to minimise creation of dust in vicinity of homes and businesses.	Contractor will work within the criteria set out in Chapter 17 of the EIA Report and be obliged to take specific noise abatement measures and comply with the recommendations of BS 5228-1:2009+A1:2014 Code of Practice for Noise and Vibration Control on Construction and Open Sites - Noise and the European Communities (Noise Emission by Equipment for Use Outdoors) Regulations, 2001 Contractor to employ suitable dust reduction techniques during construction e.g. wheel wash facilities and dampening of site during periods of extended dry/windy weather.	L	M	L
2.6	Hazard: Construction site located in NUIG Campus with approx. 17,000 students in attendance. Risk: Collision or injury between construction plant and machinery and high levels of pedestrian/cyclist and private vehicle traffic in close proximity to construction site	Designers to liaise with NUIG representatives in relation to the timing of works and construction phasing. Design appropriate traffic management and mobility plans for university to be implemented during construction activities.	Construction phasing and timing of work to be specified in the contract documents so that some works can be completed during off peak semesters when the majority of students and sports teams are not using the sport facilities.	M	M	M

Likelihood of Harm
L = Low (Seldom)
M = Medium (Reasonably Likely)
H = High (Certain/Nearly certain)

Severity of Harm
L = Minor Injury/Illness
M = Injury/Illness causing short term disability
H = Fatality or major injury/illness causing long term disability

Risk Assessment
L = Low Risk (No action)
M = Medium Risk (Action required unless good reason not to)
H = High Risk (Action required e.g. Design Change)

Risk Table	*Severity*		
Likelihood	**H**	**M**	**L**
H	H	H	M
M	H	M	L
L	M	L	L

	Hazard	Design Mitigation measures	Other Possible Mitigation Measures (including measures by Contractor on site)	Residual Risk Assessment following mitigation measures		
				Likelihood	Severity	Risk Rating
		Mainline runs through sports facility, the risk cannot be fully mitigated by design	Suitable signage and pedestrian provision to be provided for connectivity during construction by Contractor			
2.7	Hazard: Proposed Road Development (N6GCRR) in operation through NUIG sporting campus Risk of impacting the usage of other pitches and facilities in proximity to the mainline due to noise, visual impact, altered pedestrian provision etc. Risk of interaction between the sports facility users and mainline traffic on viaduct i.e. sports equipment	Design to be developed further to provide suitable fencing/barriers and consideration for the type of activities. e.g. nettings/meshes to prevent balls entering carriageway Suitable environmental mitigation measures to be implemented to reduce the impact of the road on the sport facility environment such as Noise Barrier to reduce impact on pitches; structure as a via-duct to enhance permeability, re configuration of the sports pavilion, provision of 2 no. 3G training pitches.	Contractor to implement pedestrian way-finding maps for duration of the construction.	M	M	M
2.8	Hazard: Vibrations due to rock excavation (e.g. Granite or Limestone Excavation) Risk: Damage to personal property, homes or business premises due to vibration.	Pre-condition and post construction surveys to be undertaken of properties in the vicinity of the works and at risk properties identified. Detailed ground investigations to be undertaken to determine the physical features of the rock present. Employ appropriate blasting, drilling, excavations techniques to minimise level of vibrations	Level/Crack Monitors to be assessed and checked during construction period. Contractor to carry out works associated with loud noises at appropriate times and in a controlled manner. Vibration monitoring to be undertaken during works with vibration limits set out in the Environmental Impact Assessment Report. Drill blasts to be undertaken by the contractor to inform the blast design	L	M	L
2.9	Hazard: Access to Farms during construction Risk: Impact on agricultural farms due to reduced accessibility, limited livestock movements, diversions etc.	A detailed temporary Traffic Management plan is to be designed and implemented by the Contractor. A specialist traffic management plan is to be operational as part of the works involving appropriate signage, traffic control, measures,	Contractor to employ safe systems of work in accordance with national and international best practice.	L	M	L

Likelihood of Harm
L = Low (Seldom)
M = Medium (Reasonably Likely)
H = High (Certain/Nearly certain)

Severity of Harm
L = Minor Injury/Illness
M = Injury/Illness causing short term disability
H = Fatality or major injury/illness causing long term disability

Risk Assessment
L = Low Risk (No action)
M = Medium Risk (Action required unless good reason not to)
H = High Risk (Action required e.g. Design Change)

Risk Table	*Severity*		
Likelihood	**H**	**M**	**L**
H	H	H	M
M	H	M	L
L	M	L	L

	Hazard	Design Mitigation measures	Other Possible Mitigation Measures (including measures by Contractor on site)	Residual Risk Assessment following mitigation measures		
				Likelihood	Severity	Risk Rating
		diversion routes and phased construction.				
2.10	Hazard: Contamination of public drinking water supply or private wells due to construction Risk: Illness due to consumption of contaminated water Risk: Physical damage to private wells, percolations areas or geothermal systems due to construction.	Design has minimised construction in vicinity of water supplies e.g. minimise in-stream works at River Corrib bridge crossing. Minimise/avoid interaction between construction site and private wells, percolation areas and geothermal systems sources Water quality samples to be taken and recorded prior to construction commencement and after construction completion	Contractor to liaise with Galway City and County Councils/Irish Water in relation to the proposed works and monitor water quality levels at intake to Public Water Supply Quality testing of wells to be undertaken throughout construction period. Relevant bodies to be notified of any problems with water quality. e.g. Local Authorities or EPA etc.	L	M	L
2.11	Hazard: Construction and Operation of Major Road in close proximity to local businesses. Risk: Risk of directly impacting the commerciality of local businesses in proximity to the proposed works	Liaison with local businesses in relation to design of appropriate accesses, diversions, road closures during construction phasing. Suitable environmental mitigation measures such as boundary treatments for noise and or visual screening to be designed and developed.	Contractor to put in place traffic management measures. Contractor to implement construction sequencing to minimise the impact to local businesses.	M	M	M
2.12	Hazard: Construction of Major Road during operation of Galway Races Festival Risk: Cancellation of 3 no. racing festivals annually. In particular the summer meeting that attracts 140,000 visitors to Galway City and is a major factor in the local economy of Galway.	Extensive liaison and consultation has been undertaken with Galway Racecourse in relation to design of appropriate accesses, diversions, road closures and boundary treatments for noise/screening during construction. Construction phasing and scheduling of work in the Galway Racecourse has been designed and will be specified in the contact documents so that works can be completed during off peak racing season. Festival Traffic Management Program to be developed for racing festivals.	Contractor to implement construction sequencing strictly in accordance with the EIA report and program to minimise impact to festivals. Contractor to implement appropriate temporary traffic management techniques for pedestrian & private car traffic during racing festivals.	L	H	M

Likelihood of Harm
L = Low (Seldom)
M = Medium (Reasonably Likely)
H = High (Certain/Nearly certain)

Severity of Harm
L = Minor Injury/Illness
M = Injury/Illness causing short term disability
H = Fatality or major injury/illness causing long term disability

Risk Assessment
L = Low Risk (No action)
M = Medium Risk (Action required unless good reason not to)
H = High Risk (Action required e.g. Design Change)

Risk Table	*Severity*		
Likelihood	**H**	**M**	**L**
H	H	H	M
M	H	M	L
L	M	L	L

Hazard	Design Mitigation measures	Other Possible Mitigation Measures (including measures by Contractor on site)	Residual Risk Assessment following mitigation measures		
			Likelihood	Severity	Risk Rating

HS1
Rev 11

ARUP

Hazard Identification and Risk Assessment

Job Number	233985
Page Number	8 of 26

Project	**N6 Galway City Transport Project**			**Design Issue or Element**			Table 3: Utilities & Services			
Stage	**Scheme Stage**			**Pre-Tender Stage**			**Other (Clarify)**			
	Name	Hand Initial	Date	Name	Hand Initial	Date	Name	Hand Initial	Date	
Designer	Eimear Keane	EK	01/09/17							
Project Manager	Eileen McCarthy	EMC	11/12/17							

	Hazard	Design Mitigation measures	Other Possible Mitigation Measures (including measures by Contractor on site)	Residual Risk Assessment following mitigation measures		
				Likelihood	Severity	Risk Rating
3.1	Hazard: Working in vicinity of overhead power lines. Risk: Electrocution or death.	Indicative locations of existing services have been sought from service providers and accounted for in the design. All known electrical services are highlighted on drawings. It is not possible to eliminate all excavations or works near known or suspected existing services. It is considered that these risks will be capable of safe management and control by a competent Contractor using safe systems of work and the appropriate levels of resources and equipment. Diversion of 110 and 38 kV lines will be undertaken as advanced works where possible.	The contractor shall confirm the existence, nature and location of all existing services. All work to be carried out in accordance with the ESB Networks COP for avoiding danger from overhead electricity lines. On each site a site-specific risk assessment is to be carried out by the Contractor and a Method Statement shall be prepared to address the necessary site-specific mitigation measures. Detailed control measures are to be developed by the contractor to mitigate all risks to health and safety, including a planned sequence of work, and issue of suitable PPE and as per the requirements of legislation and the HSA.	L	H	M

Likelihood of Harm
L = Low (Seldom)
M = Medium (Reasonably Likely)
H = High (Certain/Nearly certain)

Severity of Harm
L = Minor Injury/Illness
M = Injury/Illness causing short term disability
H = Fatality or major injury/illness causing long term disability

Risk Assessment
L = Low Risk (No action)
M = Medium Risk (Action required unless good reason not to)
H = High Risk (Action required e.g. Design Change)

Risk Table	*Severity*		
Likelihood	**H**	**M**	**L**
H	H	H	M
M	H	M	L
L	M	L	L

	Hazard	Design Mitigation measures	Other Possible Mitigation Measures (including measures by Contractor on site)	Residual Risk Assessment following mitigation measures		
				Likelihood	Severity	Risk Rating
3.2	Hazard: Working in vicinity of excavations near underground services. Risk: Loss of service or injury or death due to • Contact with ESB power cables. • Contact with Gas Networks Ireland mains • Contact with watermains on site • Contact with telecoms. • Contact with sewers.	Indicative locations of existing services have been sought from the service providers. Site walkovers have been carried out by the designers and the ESB to discuss proposals for high voltage cable diversions. Where possible the design to avoids areas directly adjacent to the services. However, it is not possible to eliminate all excavations or works near known or suspected existing services. Service diversions to be agreed by designers in advance with the service providers. It is considered that these risks should be capable of safe management and control by a competent Contractor using safe systems of work and the appropriate levels of resources and equipment. Diversions of the HV ESB and the gas mains will be undertaken as advanced works where possible.	Contractor shall confirm the existence, nature and location of all existing services. All excavation works to be carried out in accordance with the HSA COP for avoiding danger from underground services. Contractor to remain vigilant for the possible presence of unknown and undocumented existing services. On each site a site-specific risk assessment is to be carried out by the Contractor and a Method Statement shall be prepared to address the necessary site-specific mitigation measures. Detailed control measures are to be developed by the contractor to mitigate all risks to health and safety, including a planned sequence of work, and issue of suitable PPE and as per the requirements of legislation and the HSA.	L	H	M

Likelihood of Harm
L = Low (Seldom)
M = Medium (Reasonably Likely)
H = High (Certain/Nearly certain)

Severity of Harm
L = Minor Injury/Illness
M = Injury/Illness causing short term disability
H = Fatality or major injury/illness causing long term disability

Risk Assessment
L = Low Risk (No action)
M = Medium Risk (Action required unless good reason not to)
H = High Risk (Action required e.g. Design Change)

Risk Table	*Severity*		
Likelihood	**H**	**M**	**L**
H	H	H	M
M	H	M	L
L	M	L	L

Hazard	Design Mitigation measures	Other Possible Mitigation Measures (including measures by Contractor on site)	Residual Risk Assessment following mitigation measures		
			Likelihood	Severity	Risk Rating

HS1
Rev 11

ARUP

Hazard Identification and Risk Assessment

Job Number	233985
Page Number	10 of 26

Project	**N6 Galway City Transport Project**			**Design Issue or Element**			Table 4: Drainage & Flood Risk			
Stage	**Scheme Stage**			**Pre-Tender Stage**			**Other (Clarify)**			
	Name	Hand Initial	Date	Name	Hand Initial	Date	Name		Hand Initial	Date
Designer	Hazel King	HK	01/09/17							
Project Manager	Eileen McCarthy	EMC	11/12/17							

	Hazard	Design Mitigation measures	Other Possible Mitigation Measures (including measures by Contractor on site)	Residual Risk Assessment following mitigation measures		
				Likelihood	Severity	Risk Rating
4.1	Hazard: Working in vicinity of deep and fast flowing waters. Risk: Drowning/falling from a height	Major river crossing of River Corrib is required. Minimise heights of structures above water, minimise length and number of crossing of watercourses. Design cannot eliminate the risk entirely.	Contractor to operate appropriate working practices for operation in vicinity of water. e.g. utilise safety netting and fall prevention equipment where necessary Area of work adjacent to watercourse to have protective fence installed.	L	H	M
4.2	Hazard: Contamination of drinking water supply **during construction** Risk: Illness due to contamination of drinking water	Minimise the number of interactions between water source locations and the works area.	Contractor to operate appropriate working practices to prevent accidental spillages. Contractor to consider appropriate storage/disposal areas for chemicals, debris and waste on works site.	L	M	L
4.3	Hazard: Contamination of drinking water supply **during operation** Risk: Illness due to contamination of drinking water	Design in accordance with best practice. Utilise appropriate Sustainable Drainage Systems (SUDS) & use appropriate spill containment	Regular inspection of pollution control measures as part of the maintenance regime for the road.	L	M	L

Likelihood of Harm
L = Low (Seldom)
M = Medium (Reasonably Likely)
H = High (Certain/Nearly certain)

Severity of Harm
L = Minor Injury/Illness
M = Injury/Illness causing short term disability
H = Fatality or major injury/illness causing long term disability

Risk Assessment
L = Low Risk (No action)
M = Medium Risk (Action required unless good reason not to)
H = High Risk (Action required e.g. Design Change)

Risk Table	*Severity*		
Likelihood	**H**	**M**	**L**
H	H	H	M
M	H	M	L
L	M	L	L

	Hazard	Design Mitigation measures	Other Possible Mitigation Measures (including measures by Contractor on site)	Residual Risk Assessment following mitigation measures		
				Likelihood	Severity	Risk Rating
		areas ,petrol interceptors (oils & fuels) & wetland treatment ponds (sediments) Prepare a maintenance schedule and detail operational maintenance requirements for each pollution control device.				
4.4	Hazard: Flooding caused by the construction works during period of construction. Risk: Drowning/injury to construction personnel & general public	Investigate areas of historic flood risk. Utilise all available information regarding flood risk e.g. CFRAM mapping, anecdotal flooding information. Design appropriate mitigation measures in accordance with best practice.	Throughout works, contractor to obtain necessary weather forecasts & weather warning alerts to facilitate appropriate responses to potential flood risk to the works site & general public.	L	H	M
4.5	Hazard: Flooding caused as a result of the works during the operational period. Risk: Drowning/injury to general public	Design all watercourse crossings in accordance with best practice. i.e. cater for 1 in 100 return period flow +CC as per OPW requirements. Propose a minimum of 900mm diameter culvert on watercourses to mitigate against blockage. Subject crossings of significant watercourses to Section 50 approval by the OPW. Design debris screens where appropriate and screen & fence deep water ponds to prevent blockage of the drainage networks. Prepare a maintenance schedule and detail operational maintenance requirements for each element of the drainage infrastructure.	Monitor Flood Risk warnings. Operational maintenance checks of culverts, outfalls, flow control, ponds/basins to be undertaken by operation management as per best practice guidelines.	L	H	M
4.6	Hazard: Deep excavations required to carry out diversions to existing public sewers. Risk: Risk of engulfment / collapse of excavations	Minimise length & depth of excavations required where possible. Acquire sufficient land to facilitate construction where possible Design cannot fully mitigate the risk	Contractor to operate safe working practices i.e. adequately support face of excavations, prevent working in vicinity of excavations until they have been adequately protected. Secure the site appropriately to prevent unauthorised access	L	H	M
4.7	Hazard: Water logged or bog lands & stagnant water Risk: Construction worker falling into bog holes, injury or	Identify known areas of bog lands. Minimise interaction between bog land and construction site.	Contractor to operate safe working practices i.e. prevent lone working, toolbox talks to inform workers of	L	H	M

Likelihood of Harm
L = Low (Seldom)
M = Medium (Reasonably Likely)
H = High (Certain/Nearly certain)

Severity of Harm
L = Minor Injury/Illness
M = Injury/Illness causing short term disability
H = Fatality or major injury/illness causing long term disability

Risk Assessment
L = Low Risk (No action)
M = Medium Risk (Action required unless good reason not to)
H = High Risk (Action required e.g. Design Change)

Risk Table	*Severity*		
Likelihood	**H**	**M**	**L**
H	H	H	M
M	H	M	L
L	M	L	L

	Hazard	Design Mitigation measures	Other Possible Mitigation Measures (including measures by Contractor on site)	Residual Risk Assessment following mitigation measures		
				Likelihood	Severity	Risk Rating
	drowning	Due to the location of the site and constraints in the study area the risk may not be eliminated by the design completely.	presence of bog holes and typical terrain			
4.8	Hazard: Working on drainage infrastructure located in public road Risks of injury or death to operatives/equipment entering/exiting manholes or other work areas in trafficked areas from live public traffic Risks of causing accident between public vehicles due to actions of contractor in opening manholes or other activity in the vicinity of public roads Risks of public traffic colliding with construction traffic or personnel Risk of collision between site traffic and traffic on the public road when travelling between different site locations, or delivering materials from site compounds, or in the process of carrying out the works Risk of public traffic breaching through excavation protection barrier into open excavations, chambers etc. or onto footpath.	Design to minimise requirements for construction in public road. A detailed temporary Traffic Management plan (including pedestrians and cyclists) to be designed and to be implemented by the Contractor as noted in the specifications. It is the Contractor's responsibility to put in place the required mitigating measures to ensure the safe construction of the works without harm or injury to construction staff or members of the public whether on foot or travelling in vehicles in public spaces.	Contractor to implement appropriate traffic management plan. Contractor to liaise with local council, Gardaí, relevant authorities in the areas of the works and obtain appropriate permits for work. Contractor to provide the required protection to the works in the form of barriers etc. On each site a site-specific risk assessment is to be carried out by the Contractor prior to commencement of the maintenance task and the Method Statement is to address the necessary site-specific mitigation measures. Detailed control measures are to be developed by the contractor to mitigate all risks to health and safety of construction workers, including a planned sequence of work, and issue of suitable PPE and as per the requirements of: • Safety Health and Welfare at Work (Construction) Regulations 2006 • Safety Health and Welfare at Work (General Application) Regulations 2007 • S.I. No. 423 of 2008 Safety Health and Welfare at Work (Construction) (Amendment) (No. 2) Regulations 2008	L	H	M

Likelihood of Harm
L = Low (Seldom)
M = Medium (Reasonably Likely)
H = High (Certain/Nearly certain)

Severity of Harm
L = Minor Injury/Illness
M = Injury/Illness causing short term disability
H = Fatality or major injury/illness causing long term disability

Risk Assessment
L = Low Risk (No action)
M = Medium Risk (Action required unless good reason not to)
H = High Risk (Action required e.g. Design Change)

Risk Table	*Severity*		
Likelihood	**H**	**M**	**L**
H	H	H	M
M	H	M	L
L	M	L	L

	Hazard	Design Mitigation measures	Other Possible Mitigation Measures (including measures by Contractor on site)	Residual Risk Assessment following mitigation measures		
				Likelihood	Severity	Risk Rating
			HSA Information Sheet – Use of Mobile Machinery on Construction Sites (2008)			
4.9	Hazard: Surface water runoff entering the proposed tunnels due to the storm event exceeding the design requirements during operation Risk of collision to motorists within the tunnel.	Network drainage in the vicinity of the tunnel portals designed to cater for higher return period storm event than indicated by drainage standards to mitigate against flooding of the carriageway Assess and design appropriate overland flow routes to remove water from the carriageway where possible	Provide VMS with warnings of surface water ahead	L	M	L
4.10	Hazard: Surface water runoff accumulating at low points on the N83 Tuam Road Risk of collision to motorists if surface water accumulates on carriageway.	Network drainage at the low point designed to cater for higher return period storm event than indicated by drainage standards to prevent flooding of the carriageway Flood mitigation measures to be designed to compensate for flood storage loss in this area.		M	M	M
4.11	Hazard: Surface water runoff accumulating at low points in a cutting on the alignment Risk of collision to motorists if surface water accumulates on carriageway.	Minimise the contributing catchment to low points in cutting Network drainage within the catchment of the low point to be oversized to give resilience for exceedance rainfall events and reduce the likelihood of blockage against blockage. Design appropriate overland flow routes if possible Design cannot fully mitigate the risk		M	M	M

Likelihood of Harm
L = Low (Seldom)
M = Medium (Reasonably Likely)
H = High (Certain/Nearly certain)

Severity of Harm
L = Minor Injury/Illness
M = Injury/Illness causing short term disability
H = Fatality or major injury/illness causing long term disability

Risk Assessment
L = Low Risk (No action)
M = Medium Risk (Action required unless good reason not to)
H = High Risk (Action required e.g. Design Change)

Risk Table	*Severity*		
Likelihood	**H**	**M**	**L**
H	H	H	M
M	H	M	L
L	M	L	L

Hazard	Design Mitigation measures	Other Possible Mitigation Measures (including measures by Contractor on site)	Residual Risk Assessment following mitigation measures		
			Likelihood	Severity	Risk Rating

HS1
Rev 11

ARUP

Hazard Identification and Risk Assessment

Job Number	233985
Page Number	14 of 26

Project	**N6 Galway City Transport Project**			**Design Issue or Element**			Table 5: Structures & Tunnels			
Stage	**Scheme Stage**			**Pre-Tender Stage**			**Other (Clarify)**			
	Name	Hand Initial	Date	Name	Hand Initial	Date	Name		Hand Initial	Date
Designer	Gerard O'Dea	GOD	01/09/17							
Project Manager	Eileen McCarthy	EMC	11/12/17							

	Hazard	Design Mitigation measures	Other Possible Mitigation Measures (including measures by Contractor on site)	Residual Risk Assessment following mitigation measures		
				Likelihood	Severity	Risk Rating
5.1	Hazard: Deep excavation of cut and cover tunnel. Coming into contact with buried services such as electricity, gas mains, sewers, etc. Risk: Electrocution, gas or water leaks	Indicative locations of existing services have been sought from the service providers. Site walkovers have been carried out by the designers and the ESB to discuss proposals for high voltage cable diversions. Where possible the road design proposals avoid areas directly adjacent to the services. It may not be possible to eliminate all excavations or works near known or suspected existing services. Service diversions have been agreed in advance with the service providers by the designers. It is considered that these risks should be capable of safe management and control by a competent Contractor using safe systems of work and the appropriate levels of resources and equipment.	Contractor shall confirm the existence, nature and location of all existing services. All excavation works to be carried out in accordance with the HSA COP for avoiding danger from underground services. Contractor to remain vigilant for the possible presence of unknown existing services. On each site a site-specific risk assessment is to be carried out by the Contractor and a Method Statement shall be prepared to address the necessary site-specific mitigation measures. Detailed control measures are to be developed by the contractor to	L	H	M

Likelihood of Harm
L = Low (Seldom)
M = Medium (Reasonably Likely)
H = High (Certain/Nearly certain)

Severity of Harm
L = Minor Injury/Illness
M = Injury/Illness causing short term disability
H = Fatality or major injury/illness causing long term disability

Risk Assessment
L = Low Risk (No action)
M = Medium Risk (Action required unless good reason not to)
H = High Risk (Action required e.g. Design Change)

Risk Table	*Severity*		
Likelihood	**H**	**M**	**L**
H	H	H	M
M	H	M	L
L	M	L	L

	Hazard	Design Mitigation measures	Other Possible Mitigation Measures (including measures by Contractor on site)	Residual Risk Assessment following mitigation measures		
				Likelihood	Severity	Risk Rating
			mitigate all risks to health and safety, including a planned sequence of work, and issue of suitable PPE and as per the requirements of legislation and the HSA.			
5.2	Hazard: Poor ground conditions; Collapse of excavation face Risk: Collapse of excavations and injury or death by Burial/engulfment under earth.	Detailed ground investigations have been carried out in the area and this information has been incorporated into the design proposals Any inadequate material in the vicinity of the structure to be removed and replaced with appropriate compacted granular material. Design to consider site conditions such as nearby structures, possible sources of surcharges. Design to show how excavation can be either shored or tapered back to ensure safety.	Provide an adequate working platform for all machinery and cranes. Provide adequate working area with controlled access and egress. Contractor to operate safe working practices i.e. adequately support face of excavations, prevent working in vicinity of excavations until they have been adequately protected. e.g. safety fencing/barriers	L	H	M
5.3	Excavation – Working adjacent to open excavations Risk: Fall from height causing serious injury or death	Given the nature of the project, the hazard cannot be completely eliminated from the design. The length & depth of excavations required to be reduced and minimised to the greatest degree possible in the design proposals.	Contractor to assess and inspect excavation slopes on ongoing basis. Open excavations and trenches to be adequately protected. Contractor to operate safe & appropriate working practices to prevent accidental spillages. Contractor to consider appropriate storage/disposal areas for chemicals, debris and waste on works site. No work to be carried out adjacent to unstable slopes/material before stabilising the material.	L	H	M

Likelihood of Harm
L = Low (Seldom)
M = Medium (Reasonably Likely)
H = High (Certain/Nearly certain)

Severity of Harm
L = Minor Injury/Illness
M = Injury/Illness causing short term disability
H = Fatality or major injury/illness causing long term disability

Risk Assessment
L = Low Risk (No action)
M = Medium Risk (Action required unless good reason not to)
H = High Risk (Action required e.g. Design Change)

Risk Table	*Severity*		
Likelihood	**H**	**M**	**L**
H	H	H	M
M	H	M	L
L	M	L	L

	Hazard	Design Mitigation measures	Other Possible Mitigation Measures (including measures by Contractor on site)	Residual Risk Assessment following mitigation measures		
				Likelihood	Severity	Risk Rating
			It is considered that these risks should be capable of safe management and control by a competent Contractor using safe systems of work and the appropriate levels of resources and equipment.			
5.4	Hazard: Noise/vibrations and rock fly from excavation in rock i.e. blasting. Risk: Noise and air pollution/disruption to local environment Risk: Serious Injury or death in vicinity of explosions from rock fly-off	Minimise the length and depth of excavation required in rock within the design proposals Given the nature of the project, the hazard and risk cannot be completely eliminated from the design. It is considered that these risks should be capable of safe management and control by a competent Contractor using safe systems of work and the appropriate levels of resources and equipment	Each rock cut area to be assessed and a specific and suitable excavation methodology shall be developed Ensure all rock blasting is carried out in a controlled manner in accordance with the relevant regulatory standards, guidelines and current practice safety guidelines. Settlement and vibration monitors to be installed in adjacent properties. Results to be monitored and assessed by appropriate personnel throughout construction.	L	H	M
5.5	Hazard: Groundwater ingress and flooding caused by the construction works during period of excavation. Risk: Drowning/injury to construction personnel & general public	Design horizontal and vertical alignment to avoid known locations with high groundwater levels and identify areas from Flood Risk Assessment where groundwater flooding is a risk. Design cannot fully mitigate the risk	During construction monitor groundwater paths in order to minimise risk of interfering with natural flow paths. Monitor areas of historic groundwater flood risk and design appropriate mitigation measures in accordance with best practice. Throughout works, contractor to obtain necessary weather forecasts & alerts to facilitate appropriate responses to potential flood risk to the works site & general public. Groundwater well level monitoring to be undertaken during construction.	L	H	M
5.6	Hazard: Contamination of groundwater during excavation of bedrock.	Design horizontal and vertical alignment to avoid known locations with high groundwater levels. Design cannot fully mitigate the risk	Monitor interactions between water source locations and the works area during construction. Design	M	M	M

Likelihood of Harm
L = Low (Seldom)
M = Medium (Reasonably Likely)
H = High (Certain/Nearly certain)

Severity of Harm
L = Minor Injury/Illness
M = Injury/Illness causing short term disability
H = Fatality or major injury/illness causing long term disability

Risk Assessment
L = Low Risk (No action)
M = Medium Risk (Action required unless good reason not to)
H = High Risk (Action required e.g. Design Change)

Risk Table	*Severity*		
Likelihood	**H**	**M**	**L**
H	H	H	M
M	H	M	L
L	M	L	L

	Hazard	Design Mitigation measures	Other Possible Mitigation Measures (including measures by Contractor on site)	Residual Risk Assessment following mitigation measures		
				Likelihood	Severity	Risk Rating
	Risk: Illness due to consumption of contaminated ground waters via well abstractions		appropriate temporary construction mitigation measures if required. Contractor to operate safe & appropriate working practices to prevent accidental spillages. Contractor to consider appropriate storage/disposal areas for chemicals, debris and waste on works site.			
5.7	Hazard: Excessive noise and vibration impacts due to tunnel excavation using road header / blasting at Menlough Risk: Ground movements could occur during tunnel excavation. Damage to buildings In close proximity. Localised ground settlements or subsidence and noise nuisance.	Minimise the length of tunnel construction required and provide sufficient cover to tunnel soffit to reduce vibration Monitor construction of all structures in the vicinity of blast sites / excavation areas. Conduct pre-condition structural surveys prior to and post rock blasting. Identify and monitor ground levels for settlement	Conduct pre-condition structural surveys prior to and post rock blasting. Monitor construction of all structures in the vicinity of blast sites / excavation areas. Identify and monitor ground levels for settlement Settlement monitors to be installed in adjacent properties. Results to be monitored and assessed by appropriate personnel throughout construction. Trail blasts to be undertaken in advance to inform the blasting design	L	M	L
5.8	Placing prefabricated large tunnel segment components – falling objects Temporary support of excavations – collapse of temporary supports Risk: Injury or death	Given the nature of the project, the hazard cannot be completely eliminated from the design. Segment lifting locations to be designed by manufacturer for safe controlled lifting of the precast elements in both the factory and site situations. Lifting points and temporary supports point to be clearly identified on the drawings	Ensure all operatives are briefed and trained on lifting operations. It is considered that these risks should be capable of safe management and control by a competent Contractor using safe systems of work and the appropriate levels of resources and equipment.	L	H	M
5.9	General Construction – erecting scaffolding, formwork, propping, etc.	Minimise the extent of structures required. Given the nature of the project, the hazard cannot be completely eliminated from the	It is considered that these risks should be capable of safe management and control by a	L	H	M

Likelihood of Harm
L = Low (Seldom)
M = Medium (Reasonably Likely)
H = High (Certain/Nearly certain)

Severity of Harm
L = Minor Injury/Illness
M = Injury/Illness causing short term disability
H = Fatality or major injury/illness causing long term disability

Risk Assessment
L = Low Risk (No action)
M = Medium Risk (Action required unless good reason not to)
H = High Risk (Action required e.g. Design Change)

Risk Table	*Severity*		
Likelihood	**H**	**M**	**L**
H	H	H	M
M	H	M	L
L	M	L	L

	Hazard	Design Mitigation measures	Other Possible Mitigation Measures (including measures by Contractor on site)	Residual Risk Assessment following mitigation measures		
				Likelihood	Severity	Risk Rating
	Risk: Injury or death	design.	competent Contractor using safe systems of work and the appropriate levels of resources and equipment.			
5.10	Placing prefabricated components – falling objects Temporary support of beams – collapse of temporary supports Risk: Injury or death	Minimise the extent of structures required. Given the nature of the project, the hazard cannot be completely eliminated from the design. Beam lifting locations designed by manufacturer for safe controlled lifting of the precast beam elements in both the factory and site situations. Lifting points and temporary supports point to be clearly identified on the drawings.	Ensure all operatives are briefed on lifting operations. It is considered that these risks should be capable of safe management and control by a competent Contractor using safe systems of work and the appropriate levels of resources and equipment.	L	H	M
5.11	Concreting and steel fixing– Risk: Injury to operatives from protruding reinforcement bars	Minimise the extent of structures required.	It is considered that these risks should be capable of safe management and control by a competent Contractor using safe systems of work and the appropriate levels of resources and equipment.	L	M	L
5.12	Hazard: Fire in tunnel during operation Risk: Injury or death as a result of smoke/fire	Establish the Tunnel Design and Safety Consultation Group in accordance with TII publication standards Ensure only appropriate vehicles are permitted to use the tunnel e.g. banning of hazardous and dangerous good from entering tunnel. Design advanced warning signage Prepared fire and emergency evacuation strategy for tunnels. Liaision and consultation has been undertaken with emergency services and appropriate firefighting facilities, ventilation etc. E.g. extinguishers, hose reels, hydrants have been incorporated into the design. Implement intelligent transportation systems (ITS) to monitor incidents and automatically close tunnel and prevent unauthorised access in	N/A	M	H	H

Likelihood of Harm
L = Low (Seldom)
M = Medium (Reasonably Likely)
H = High (Certain/Nearly certain)

Severity of Harm
L = Minor Injury/Illness
M = Injury/Illness causing short term disability
H = Fatality or major injury/illness causing long term disability

Risk Assessment
L = Low Risk (No action)
M = Medium Risk (Action required unless good reason not to)
H = High Risk (Action required e.g. Design Change)

Risk Table	*Severity*		
Likelihood	**H**	**M**	**L**
H	H	H	M
M	H	M	L
L	M	L	L

	Hazard	Design Mitigation measures	Other Possible Mitigation Measures (including measures by Contractor on site)	Residual Risk Assessment following mitigation measures		
				Likelihood	Severity	Risk Rating
		times of emergency. Variable messaging signs (VMS).				
5.13	Hazard: Vehicle collision within tunnel bores during operation Risk: Injury or death	Design appropriate advanced warning signs, keep in lane signs etc. Variable messaging signs (VMS) Design lanes and visibility in accordance with latest geometry design standard requirements. Implement intelligent transportation systems (ITS) to monitor incidents and automatically close tunnel and prevent unauthorised access in times of emergency.	Implement intelligent transportation systems (ITS) to monitor incidents and automatically close tunnel and prevent access in times of emergency.	M	H	H

Likelihood of Harm
L = Low (Seldom)
M = Medium (Reasonably Likely)
H = High (Certain/Nearly certain)

Severity of Harm
L = Minor Injury/Illness
M = Injury/Illness causing short term disability
H = Fatality or major injury/illness causing long term disability

Risk Assessment
L = Low Risk (No action)
M = Medium Risk (Action required unless good reason not to)
H = High Risk (Action required e.g. Design Change)

Risk Table	*Severity*		
Likelihood	**H**	**M**	**L**
H	H	H	M
M	H	M	L
L	M	L	L

Hazard	Design Mitigation measures	Other Possible Mitigation Measures (including measures by Contractor on site)	Residual Risk Assessment following mitigation measures		
			Likelihood	Severity	Risk Rating

HS1
Rev 11

ARUP

Hazard Identification and Risk Assessment

Job Number	233985
Page Number	19 of 26

Project	**N6 Galway City Transport Project**			**Design Issue or Element**			Table 6: Earthworks			
Stage	**Scheme Stage**			**Pre-Tender Stage**			**Other (Clarify)**			
	Name	Hand Initial	Date	Name	Hand Initial	Date	Name		Hand Initial	Date
Designer	Daniel Mangan	DM	08/08/17							
Project Manager	Eileen McCarthy	EMC	11/12/17							

	Hazard	Design Mitigation measures	Other Possible Mitigation Measures (including measures by Contractor on site)	Residual Risk Assessment following mitigation measures		
				Likelihood	Severity	Risk Rating
6.1	Hazard: Working adjacent to open excavations and boreholes Risk: Injury or death from falling	Design to minimise excavation depths. Design cannot fully eliminate the risk It is considered that these risks should be capable of safe management and control by a competent Contractor using safe systems of work and the appropriate levels of resources and equipment.	Open excavations and boreholes to be secured using appropriate fencing and protection barriers. Detailed control measures are to be developed by the contractor to mitigate all risks to health and safety, including a planned sequence of work, and issue of suitable PPE and as per the requirements of legislation and the HSA.	L	H	M
6.2	Hazard: Poor ground conditions; Collapse of excavation face Risk: Injury or death by Burial/engulfment under earth.	Detailed ground investigations were carried out and informed the design development. Unsuitable material shall be removed from site where required. Appropriate ground stabilisation techniques to been incorporated into the design. Acquire sufficient lands in MO/PRO to facilitate construction.	Inspect and assess excavation slopes on ongoing basis during construction and operation. Provide adequate working area with controlled access and egress. Open excavations and trenches to be adequately protected during construction and operation.	L	H	M

Likelihood of Harm
L = Low (Seldom)
M = Medium (Reasonably Likely)
H = High (Certain/Nearly certain)

Severity of Harm
L = Minor Injury/Illness
M = Injury/Illness causing short term disability
H = Fatality or major injury/illness causing long term disability

Risk Assessment
L = Low Risk (No action)
M = Medium Risk (Action required unless good reason not to)
H = High Risk (Action required e.g. Design Change)

Risk Table	*Severity*		
Likelihood	**H**	**M**	**L**
H	H	H	M
M	H	M	L
L	M	L	L

	Hazard	Design Mitigation measures	Other Possible Mitigation Measures (including measures by Contractor on site)	Residual Risk Assessment following mitigation measures		
				Likelihood	Severity	Risk Rating
			No work to be carried out adjacent to unstable slopes/material before stabilising the material. Detailed control measures are to be developed by the contractor to mitigate all risks to health and safety, including a planned sequence of work, and issue of suitable PPE and as per the requirements of legislation and the HSA.			
6.3	Hazard: Rock Blasting Risk: Damage to personal property, homes or business premises due to vibration. Risk of injury due to 'fly rock' Risk: Injury or death in vicinity of explosions from 'fly-rock'	Minimise the length and depth of excavation required in rock within the design proposals Given the nature of the project, the hazard and risk cannot be completely eliminated from the design. It is considered that these risks should be capable of safe management and control by a competent Contractor using safe systems of work and the appropriate levels of resources and equipment.	Each rock cut area to be assessed and a specific and suitable excavation methodology shall be developed. Ensure all rock blasting is carried out in a controlled manner in accordance with the relevant regulatory standards, guidelines and current practice safety guidelines. Settlement and vibration monitors to be installed in adjacent properties. Results to be monitored and assessed by appropriate personnel throughout construction. Trail blasts to be undertaken in advance to inform the blasting design	L	H	M
6.4	Hazard: Working adjacent to overhead power lines. Risk: Danger of electrocution from working in vicinity/underneath overhead power lines.	Indicative locations of existing services have been sought from service providers and to be highlighted in the design proposal drawings. It is not possible to eliminate all excavations or works near known or suspected existing	The contractor shall confirm the existence, nature and location of all existing services. All work to be carried out in accordance with the ESB Networks	L	H	M

Likelihood of Harm
L = Low (Seldom)
M = Medium (Reasonably Likely)
H = High (Certain/Nearly certain)

Severity of Harm
L = Minor Injury/Illness
M = Injury/Illness causing short term disability
H = Fatality or major injury/illness causing long term disability

Risk Assessment
L = Low Risk (No action)
M = Medium Risk (Action required unless good reason not to)
H = High Risk (Action required e.g. Design Change)

Risk Table	*Severity*		
Likelihood	**H**	**M**	**L**
H	H	H	M
M	H	M	L
L	M	L	L

	Hazard	Design Mitigation measures	Other Possible Mitigation Measures (including measures by Contractor on site)	Residual Risk Assessment following mitigation measures		
				Likelihood	Severity	Risk Rating
		services. It is considered that these risks will be capable of safe management and control by a competent Contractor using safe systems of work and the appropriate levels of resources and equipment.	COP for avoiding danger from overhead electricity lines. On each site a site-specific risk assessment is to be carried out by the Contractor and a Method Statement shall be prepared to address the necessary site-specific mitigation measures. Detailed control measures are to be developed by the contractor to mitigate all risks to health and safety, including a planned sequence of work, and issue of suitable PPE and as per the requirements of legislation and the HSA.			
6.5	Hazard: Striking unknown underground power lines, gas mains or services during construction Risk: Injury or death	Indicative locations of existing services have been sought from the service providers and to be highlighted on the design proposal drawings Topographical survey drawings have been consulted and site walkovers carried out by designers where necessary. Additional site walkovers have been carried out by the designers and the ESB to discuss proposals for high voltage cable diversions. Where possible the design to avoid areas directly adjacent to the services. However, it is not possible to eliminate all excavations or works near known or suspected existing services. Service diversions to be agreed in advance with the service providers by the designers.	Contractor shall confirm the existence, nature and location of all existing services. All excavation works to be carried out in accordance with the HSA COP for avoiding danger from underground services. Contractor to remain vigilant for the possible presence of unknown existing services. On each site a site-specific risk assessment is to be carried out by the Contractor and a Method Statement shall be prepared to address the necessary site-specific mitigation measures. Detailed control measures are to be developed by the contractor to mitigate all risks to health and	L	H	M

Likelihood of Harm
L = Low (Seldom)
M = Medium (Reasonably Likely)
H = High (Certain/Nearly certain)

Severity of Harm
L = Minor Injury/Illness
M = Injury/Illness causing short term disability
H = Fatality or major injury/illness causing long term disability

Risk Assessment
L = Low Risk (No action)
M = Medium Risk (Action required unless good reason not to)
H = High Risk (Action required e.g. Design Change)

Risk Table	*Severity*		
Likelihood	**H**	**M**	**L**
H	H	H	M
M	H	M	L
L	M	L	L

	Hazard	Design Mitigation measures	Other Possible Mitigation Measures (including measures by Contractor on site)	Residual Risk Assessment following mitigation measures		
				Likelihood	Severity	Risk Rating
		It is considered that these risks should be capable of safe management and control by a competent Contractor using safe systems of work and the appropriate levels of resources and equipment.	safety, including a planned sequence of work, and issue of suitable PPE and as per the requirements of legislation and the HSA.			
6.6	Hazard: Operating heavy plant and equipment. Risk: Injury or death	Acquire sufficient lands within the MO/PRO to facilitate construction. Ensure adequate construction traffic management plan is in place and personnel are equipped properly trained to operate heavy machinery.	It is considered that these risks should be capable of safe management and control by a competent Contractor using safe systems of work and the appropriate levels of resources and equipment.	L	H	M
6.7	Hazard: Piling Operations - Noise generation Risk : Noise nuisance from driven piles	Consider alternative supporting mechanisms in the vicinity of sensitive noise receptors.	It is considered that these risks should be capable of safe management and control by a competent Contractor using safe systems of work and the appropriate levels of resources and equipment. No holes to be left open without adequate protection. Ear defenders to be worn at all times	M	L	L

Likelihood of Harm
L = Low (Seldom)
M = Medium (Reasonably Likely)
H = High (Certain/Nearly certain)

Severity of Harm
L = Minor Injury/Illness
M = Injury/Illness causing short term disability
H = Fatality or major injury/illness causing long term disability

Risk Assessment
L = Low Risk (No action)
M = Medium Risk (Action required unless good reason not to)
H = High Risk (Action required e.g. Design Change)

Risk Table	*Severity*		
Likelihood	**H**	**M**	**L**
H	H	H	M
M	H	M	L
L	M	L	L

Hazard	Design Mitigation measures	Other Possible Mitigation Measures (including measures by Contractor on site)	Residual Risk Assessment following mitigation measures		
			Likelihood	Severity	Risk Rating

HS1
Rev 11

ARUP

Hazard Identification and Risk Assessment

Job Number	233985
Page Number	23 of 26

Project	**N6 Galway City Transport Project**			**Design Issue or Element**			Table 7: Structures - Bridges & Viaducts		
Stage	**Scheme Stage**			**Pre-Tender Stage**			**Other (Clarify)**		
	Name	Hand Initial	Date	Name	Hand Initial	Date	Name	Hand Initial	Date
Designer	Finian Burke	FB	08/08/17						
Project Manager	Eileen McCarthy	EMC	11/12/17						

	Hazard	Design Mitigation measures	Other Possible Mitigation Measures (including measures by Contractor on site)	Residual Risk Assessment following mitigation measures		
				Likelihood	Severity	Risk Rating
7.1	Hazard: Site clearance – Overhead Electricity Lines Excavation – Buried Services Risk: Electrocution, injury or death	Indicative locations of existing services have been sought from service providers and to be highlighted in the design proposal drawings. Given the nature of the project, the hazard cannot be completely eliminated from the design.	It is considered that these risks should be capable of safe management and control by a competent Contractor using safe systems of work and the appropriate levels of resources and equipment.	L	H	M
7.2	Hazard: Poor ground conditions; Collapse of excavation face Risk: Collapse of excavations and injury or death by Burial/engulfment under earth.	Detailed ground investigations have been carried out in the area and this information has been incorporated into the design. Any inadequate material in the vicinity of the structure shall be removed and replaced with appropriate compacted granular material.	Provide an adequate working platform for all machinery and cranes. Provide adequate working area with controlled access and egress.	L	H	M
7.3	Hazard Excavation – Working adjacent to open excavations.	The length & depth of excavations required to be reduced and minimised to the greatest degree possible in the design proposals.	Assess excavation slopes on ongoing basis.	L	H	M

Likelihood of Harm
L = Low (Seldom)
M = Medium (Reasonably Likely)
H = High (Certain/Nearly certain)

Severity of Harm
L = Minor Injury/Illness
M = Injury/Illness causing short term disability
H = Fatality or major injury/illness causing long term disability

Risk Assessment
L = Low Risk (No action)
M = Medium Risk (Action required unless good reason not to)
H = High Risk (Action required e.g. Design Change)

Risk Table	*Severity*		
Likelihood	**H**	**M**	**L**
H	H	H	M
M	H	M	L
L	M	L	L

	Hazard	Design Mitigation measures	Other Possible Mitigation Measures (including measures by Contractor on site)	Residual Risk Assessment following mitigation measures		
				Likelihood	Severity	Risk Rating
	Risk: Fall from height causing serious injury or death	Given the nature of the project, the hazard cannot be completely eliminated from the design.	Open excavations and trenches to be adequately protected. No work to be carried out adjacent to unstable slopes/material before stabilising the material. It is considered that these risks should be capable of safe management and control by a competent Contractor using safe systems of work and the appropriate levels of resources and equipment.			
7.4	Hazard: General Construction Activity- Working over and adjacent to live Road Traffic Risk: Injury or death.	Given the nature of the project, the hazard cannot be completely eliminated from the design. Design appropriate traffic management measures, e.g. speed restrictions adjacent to work site, diversions etc. Ensure adequate construction traffic management plan is in place and personnel are equipped properly and trained to operate heavy machinery.	It is considered that these risks should be capable of safe management and control by a competent Contractor using safe systems of work and the appropriate levels of resources and equipment. e.g. utilise safety netting and fall prevention equipment where necessary	L	H	M
7.5	Hazard: General Construction Activity– Erecting scaffolding, formwork, propping, etc. Risk: Injury or death	Given the nature of the project, the hazard cannot be completely eliminated from the design.	It is considered that these risks should be capable of safe management and control by a competent Contractor using safe systems of work and the appropriate levels of resources and equipment.	L	H	M
7.6	Hazard: General Construction Activity – Working at heights Risk: Falls from height, injury or death	Hazard is unavoidable for a bridge, however by incorporating precast/prefabricated units in the design and utilising permanent formwork, work at heights is minimised and as a result the need for scaffolding is reduced.	It is considered that these risks should be capable of safe management and control by a competent Contractor using safe systems of work and the appropriate levels of resources and equipment. e.g. utilise safety netting and fall prevention equipment where necessary	L	H	M

Likelihood of Harm
L = Low (Seldom)
M = Medium (Reasonably Likely)
H = High (Certain/Nearly certain)

Severity of Harm
L = Minor Injury/Illness
M = Injury/Illness causing short term disability
H = Fatality or major injury/illness causing long term disability

Risk Assessment
L = Low Risk (No action)
M = Medium Risk (Action required unless good reason not to)
H = High Risk (Action required e.g. Design Change)

Risk Table	*Severity*		
Likelihood	**H**	**M**	**L**
H	H	H	M
M	H	M	L
L	M	L	L

	Hazard	Design Mitigation measures	Other Possible Mitigation Measures (including measures by Contractor on site)	Residual Risk Assessment following mitigation measures		
				Likelihood	Severity	Risk Rating
7.7	Hazard: Placing prefabricated components and temporary supporting of beams Risk: Injury or death from falling objects or collapse of temporary supports	Minimise the number and extent of structures required. Given the nature of the project, the hazard cannot be completely eliminated from the design. Beam lifting locations designed by manufacturer for safe controlled lifting of the precast beam elements in both the factory and site situations. Lifting points and temporary supports point to be clearly identified on the drawings	Ensure all operatives are briefed on lifting operations. It is considered that these risks should be capable of safe management and control by a competent Contractor using safe systems of work and the appropriate levels of resources and equipment. e.g. utilise safety netting and fall prevention equipment where necessary	L	H	M
7.8	Hazard: Concreting and steel fixing– Risk: Injury to operatives from protruding reinforcement bars	Minimise the number and extent of structures required. Given the nature of the project, the hazard cannot be completely eliminated from the design.	It is considered that these risks should be capable of safe management and control by a competent Contractor using safe systems of work and the appropriate levels of resources and equipment.	L	M	L
7.9	Hazard: - Exposure to hazardous chemical and biological organisms - Working with resin mortars Risk: Illness or injury	Hazard considered but no design mitigation possible.	It is considered that these risks should be capable of safe management and control by a competent Contractor using safe systems of work and the appropriate levels of resources and equipment.	L	H	M
7.10	Hazards: Health Hazards - Noise/Vibration - Dust inhalation - Fumes - Manual Handling Risk: Illness or injury	Hazard considered but no additional design measures particular to strucutres provided in combination with those presented in the EIA report.	Provide operatives with guidance for working with hazardous materials and working with machinery. Ensure manufacturers guidelines are being adhered to on site	L	M	L
7.11	Hazard: Working in vicinity of Deep Water Risk: Drowning/falling from a height	Major river crossing of River Corrib is required. Minimise heights of structures above water, minimise length and number of crossing of watercourses. Design cannot eliminate the risk.	Contractor to operate appropriate working practices for operation in vicinity of water. e.g. utilise safety netting and fall prevention equipment where necessary Contractor to ensure all necessary	L	H	M

Likelihood of Harm
L = Low (Seldom)
M = Medium (Reasonably Likely)
H = High (Certain/Nearly certain)

Severity of Harm
L = Minor Injury/Illness
M = Injury/Illness causing short term disability
H = Fatality or major injury/illness causing long term disability

Risk Assessment
L = Low Risk (No action)
M = Medium Risk (Action required unless good reason not to)
H = High Risk (Action required e.g. Design Change)

Risk Table	*Severity*		
Likelihood	**H**	**M**	**L**
H	H	H	M
M	H	M	L
L	M	L	L

	Hazard	Design Mitigation measures	Other Possible Mitigation Measures (including measures by Contractor on site)	Residual Risk Assessment following mitigation measures		
				Likelihood	Severity	Risk Rating
			signage is in place to advise workers of the dangers of working near a watercourse. Area of work adjacent to watercourse to have protective fence installed.			
7.12	Hazard: Operation of Structures and Maintenance of structures Risk: Falls from height at structure ends	Design permanent parapet barriers along all wing walls and parapet edge beams to reduce the risk to maintenance operatives or members of the public falling onto the pavement/rivers below.		L	H	M

Likelihood of Harm
L = Low (Seldom)
M = Medium (Reasonably Likely)
H = High (Certain/Nearly certain)

Severity of Harm
L = Minor Injury/Illness
M = Injury/Illness causing short term disability
H = Fatality or major injury/illness causing long term disability

Risk Assessment
L = Low Risk (No action)
M = Medium Risk (Action required unless good reason not to)
H = High Risk (Action required e.g. Design Change)

Risk Table	*Severity*		
Likelihood	**H**	**M**	**L**
H	H	H	M
M	H	M	L
L	M	L	L