Small Diameter Tunnels and Pipejacks

A Reference Guide for New Zealand

First Issue: October 2017

Introduction

Worksafe New Zealand and the New Zealand Tunnelling Society (NZTS) have identified the need to document and promote the use of 'good practice' in the planning, design and construction of projects that incorporate small diameter tunnels and pipejacks in New Zealand. Small diameter tunnels and pipejacks are defined as those less than or equal to 3m inside diameter.

Accordingly, this guide ('the Guide') has been developed and defines roles and responsibilities and the assessments required during the planning, procurement and construction of small diameter tunnel and pipejack works.

The Guide is for persons conducting a business or undertaking (PCBUs), workers, upstream PCBUs, and competent people involved in the construction of small diameter tunnels and pipejacks and provides practical guidance on how they can meet obligations under the Health and Safety at Work Act 2015 (HSWA) and its associated regulations.

Some tunnels and pipejack projects maybe subject to the Health and Safety at Work Mining Operations and Quarrying Operations) Regulations 2016.

Information about the hierarchy of the legislation and the relationship with other guidance documents is detailed in Section 1.4 of WorkSafe's special guide 'Introduction to the Health and Safety at Work Act 2015' (the 'Act'.)

A list of relevant legislation and standards is given in Appendix 1.

The specific hazards of small diameter drill and blast tunnels are not addressed, although this document may provide some useful guidance. Refer also to BS 6164 Code of Practice for Health and Safety in Tunnelling in the Construction Industry for good practices in the construction of drill and blast tunnels.

Project Timeline

Project Development Stage

- Assessment and evaluation of project options assessing the risks associated with different alignments and construction techniques in view of regional geotechnical conditions
- Project development design studies
    - Site investigations (geology, hydrogeology, utilities, existing buildings and structures)
    - Preliminary design
    - Risk Assessment
    - Constructability Assessments
    - RMA Consent Requirements

Design Stages

- Development of design
- Transfer of information between designers
- Geotechnical Assessment
- Constructability Assessment
- Design risk assessment and 'Safety-in-Design' process as an 'upstream' PCBU.

Construction Contract Procurement Stage

- Preparation of contract documentation and works information for tendering purposes, including transfer of risk assessment/register
- Selection of contractors for tendering
- Tender assessment

Construction Stage

- Health and Safety Management System and Risk Management Plan
- Construction plans, safe work methodology development and documentation
- Further development of Project Risk Register

Competency

It is considered essential that each person involved in the project is competent to carry out their role and that each organisation involved in the project should ensure that their employees or agents are competent to carry out the work required of them. Competency may be assessed by consideration of relevant experience and skill, development training and academic qualifications and/or certifications.

Given the critical role of the client during the development stage, the client (definition below) should have or procure technical and contract management competence appropriate to the nature and scale of the project and only select competent designers and constructors.

For the purposes of the Guide a competent person[1] is a person who has the relevant knowledge, experience, and skill to carry out a task required by the project. During construction in particular a competent person is also a person who is able to recognize hazards associated with a particular task, and has the ability and authority to mitigate those hazards.

Roles and Responsibilities

The following are definitions of the roles of the principal parties involved in a project. All parties are obliged to confirm and inform the others of their roles and responsibilities in relation to the Health and Safety at Work Act ('the Act'). For further information on primary duties of care refer to section 36 to 43 of the HSWA.

- Client
    - The final owner of the project to be constructed and/or the procurer of goods or services including design services whether a public entity or a private agency or developer, and responsible for:
        - The information issued to design or construction tenderers as "works information".
        - The adequacy and suitability of designs prepared by or on behalf of the Client, construction supervision and monitoring of the project. Therefore the Client should assess the competency of Designers. (Refer also procurement stage below).
        - Where necessary because a pipejack or tunnel falls under the scope of the Act and the corresponding Regulations appoints the Mine Operator as required by the Act.[2]
- Designer
    - The individual/organization appointed to undertake the planning and design process. Different designers may be appointed for different stages of the design process. It is noted that significant design activities may be undertaken by Clients, particularly at the early stages of project planning, e.g., route selection, consenting, etc.

[1] Refer also competent person defined by Worksafe – http://www.worksafe.govt.nz/worksafe/information-guidance/all-guidance-items/best-practice-guidelines-for-demolition-in-new-zealand/definitions

[2] In most cases it is expected that the contractor would be appointed to this role.

  - Responsible for being competent in their area of practise as applied to the design and conversely not practising outside their area of competency, and adhering to the code of ethics of their practise.
- Contractor
  - The organization contracted by the Client to construct the project, i.e., to carry out or manage construction work.
  - Responsible for the adequacy and suitability of designs prepared by or on behalf of them, covering in particular temporary works designs.
  - Responsible for Principal Hazard Management Plans, Principal Control Plans, and provision of safety-critical roles defined under the Act.
  - Responsible for the provision of competent personnel for construction.
- Plant and equipment manufacturers and providers
  - Providers of mechanical and electrical plant for the construction of a project on either a hire or purchase basis, elements of which may be governed by requirements of the Act and any relevant New Zealand Standards
- Worksafe New Zealand
  - New Zealand's Workplace Health and Safety Regulator responsible for:
    - Monitoring and enforcing compliance with the Act
    - Providing guidance, advice and information on work health and safety
    - Fostering a co-operative and consultative relationship between the people who have health and safety duties and the persons to whom they owe those duties and their representatives.
    - Collecting, analysing and publishing statistics and other information relating to work health and safety
- Mines Rescue Services
  - A specialist rescue service that covers all coal mines, metalliferous mines and tunnels longer than 150m long, responsible for:
    - Training rescue brigades
    - Responding to emergencies
    - Assisting Mine Operators within scope with emergency planning
- Emergency Services
  - Police, Fire and Ambulance emergency services may be involved in an emergency response situation. The nature of their response and the role that they play is defined by the New Zealand Coordinated Incident Management System (CIMS) protocol.

Collaboration

It is considered best practice that all parties to a project cooperate to achieve and maintain safe places of work.

Input from the public emergency services and utility providers during the project development stage is recommended and is input from experienced contractors and specialist plant and equipment designers and suppliers.

Health and Safety Hazards

Health and safety hazards to be assessed may include but may not be limited to:

- Noise
- Manual handling
- Vibration
- Hand Arm Vibration Syndrome
- Heat
- Dust & Chemicals present during construction
- Hazardous materials
- Contaminated water or soils
- Inundation
- Toxic or explosive gases from the ground, adjacent infrastructure or from the construction processes
- Other atmospheric contaminants
- Stored energy
- Lifting operations
- Working at height
- Fire & smoke
- Access & rescue
- Oxygen deficiency
- Working space
- Fatigue
- Radiation
- Biological hazards
- Plant and people interaction
- Adjacent activities
- Explosives
- Asbestos
- Ground support failure
- Mechanical hazards
- Electricity

Consideration of the above may impact the diameter and length of a small diameter tunnel or pipejack and the associated construction methods (e.g., excavation techniques) that are selected.

Design Assessments

Designers should understand how construction processes are achieved and what the associated and inherent hazards are. The assessments should include the properties of construction materials (including the ground and the influence of groundwater) related to or defined and specified by the design.

Detailed risk assessments must be carried out for all projects at the Project Development Stage and for the Contract Procurement Stage and subsequently with risks and their controls clearly allocated between the parties involved in the construction process.

It is recommended that Designers should undertake risk assessments for the following subjects (as a minimum) modify the design as necessary and that the risks are communicated to downstream PCBU's:

- Natural hazards which the project is exposed to
- Hazards present at the site and arising from the design;
- Sufficient space for safe working, noting adjacent activities and associated hazards, temporary traffic management including pedestrian movements and property access, and any demolition processes;
- Requirements for the provision of a safe temporary works environment, i.e., elimination, isolation or minimization of hazards, operational and emergency ventilation, emergency access, moving plant equipment;
- Potential for harm from materials specified;
- Processes, which can release potentially harmful agents;
- Existing utilities and their potential interaction with the excavations
- Existing buildings and structures and their potential interaction with excavations

Procurement Stage Assessments

During procurement it is essential that a comprehensive understanding of the project constraints and all hazards and risks previously identified is obtained by all parties. The Client should assess the competency of all downstream PCBU's associated with the Project and select accordingly.

It is recommended that the design risk assessments and associated documentation are provided to tenderers. It is further recommended that interactive meetings with the Designer and the tenderers are undertaken.

Establishing a reasonable programme allowance for implementation of the project should be an objective of the procurement process. Reasonable timeframes to allow proper assessment of the tender documentation and associated tender queries from the tenderers should therefore be provided by the Client.

Alternative designs must be assessed to a similar level in terms of the Health and Safety hazards and risks previously identified.

Construction Phase Assessments

During the construction phase it is essential that robust and sufficiently detailed final planning is carried out in advance of works commencing.

Construction stage risk assessment and management should involve competent people including representatives from the workforce who will be involved in delivering the works.

Development of construction execution plans, work plans, method statements, Principal Hazard Management Plans (PHMP's) and Principal Control Plans PCP's) that incorporate the risk assessments and consequent hazard management measures is essential. Trigger Activated Response Plans (TARP's) should be developed to identify responses to changing conditions identified by monitoring of the works. All of these documents will then form the basis of ensuring a clear understanding of how the works will be delivered by all of those involved, and how to respond to a change in working conditions. This should not be a one-off exercise: the plans should be regularly reviewed and revised as appropriate, following on-site experience in addressing the actual health and safety risks underground.

The following are key considerations during the construction phase which are particularly relevant to small tunnel and pipejack projects:

Planning and Predefined Responses

- Risk assessment and review
- Development of safe work methods
- Competency management
- A clear process for managing change
- Trigger Action and Response Plans (TARP's)
- Emergency Response Plans and testing of these

Monitoring and Reporting

- Existing buildings structures and utilities settlement and ground movement monitoring, reporting and analysis
- Gas and air quality monitoring
- Ongoing checks and audits for compliance against plans and expected performance or conditions
- Validation of the design through monitoring and inspection

References

- Worksafe New Zealand – http://www.worksafe.govt.nz/worksafe
- Guidance and ACOPs for tunnelling operations http://www.worksafe.govt.nz/worksafe/information-guidance/guidance-by-industry/extractives/extractives-documents
- ITIG A code of Practice for Risk Management of Tunnel Works', 2nd Edition, 2012.
- Code of Practice for Health and Safety in Tunnelling in the Construction Industry', BS 6164, 2011.
- The Pipe Jacking Association: An introduction to pipe jacking and microtunelling design
- National Utility Contractors Association: Guide to Pipejacking and Microtunneling

Appendix A

NZTS Tunnelling and Pipejacking Table and Notes

NZTS Small Diameter Tunnels and Pipejacks Table and Notes:

Internal dimensions and indicative drive lengths for pipejacks and tunnels below 3.0m diameter

DEFINITIONS
Acceptable – PCBUs should undertake an assessment of the risks normally associated with small size pipejacking/tunnelling and specify the appropriate mitigation control measures.
Avoid – PCBUs should undertake a robust technical assessment and risk assessment to justify decisions to deviate from "acceptable" criteria. PCBUs should identify appropriate risk mitigation measures and involve Worksafe.
Not acceptable – Larger diameter or different excavation technique to be used.

Nominal internal diameter and indicative maximum drive lengths (e.g. between shafts) for pipeline or tunnel linings

Excavation Technique	<1.2m	>1.2m-1.35m	>1.35m-1.5m	>1.5m – 1.8m	>1.8m
Trenchless – machine; remote operation (See Note 9)	Drive length only limited by equipment capability. (See note 9)	500m			>500m See note 8
Pipejack – machine; operator controlled at the face (See Note 7)	Not acceptable	125m	250m	500m	>500m See note 8
Pipejack – hand dig (See note 7)	Not acceptable	*75m	*75m	*75m	*100m
Tunnel – machine operator controlled at the face + mechanical erector	Not acceptable			*500m	>500m See note 8
Tunnel – hand dig + mechanical erector (See note 7)	Not acceptable			*50m	*100m
Timber heading – hand dig (See note 7)	Not acceptable	*25m			

Notes: Refer Page A2

1. This New Zealand guidance is only to be used by those competent to plan, design and construct pipejacks and tunnels.

2. This guidance has been developed by the NZTS based on experience of the occupational health and safety risks arising from heavy physical work in a confined space to enable rescue if necessary in a range of reasonably foreseeable incident scenarios.

3. Complying with the guidance does not relieve any PCBU of the duty to consider the risks arising from the foreseeable hazards of pipejacking/tunnelling, including manual handling, noise, heat, vibration and confined space working. Neither does it relieve any PCBU of the duty to ensure there is potentially adequate space to allow a safe means of access and egress along with adequate working space within the tunnel/pipejack. The minimum diameter required for construction may in some cases be determined by the construction methodology rather than by consideration of the hydraulic requirements for or the intended use of the pipejack/tunnel.

4. When using the table the term 'nominal internal diameter' refers to the actual minimum diameter of the pipes used allowing for manufacturing tolerances in accordance with AS/NZS 4058.

5. Indicative drive length and the number of drives of that length have been determined from a consideration of access and escape requirements. Again, complying with the guidance does not relieve any organisation of the duty to consider the risks arising from the range of foreseeable emergency events which could arise and which could necessitate escape or rescue of those underground.

6. The drive lengths given in the Table are indicative and subject to a robust risk assessment process. For entries not marked * it is **acceptable** to exceed the indicative drive lengths by up to 25% however exceeding these drive lengths by over 25% should be **avoided**.

7. All hand dig is categorised as "not acceptable" or "avoid" – the lengths given in Table 2 for items marked * are indicative and are already in the category "avoid". It is further noted for small diameter tunnels and pipejacks, in terms of individual worker risk exposure, that hand excavation is less preferable than mechanical excavation and remote control of mechanical excavation is preferable to manual intervention in mechanical excavation. The risks associated with worker intervention in the mechanical excavation process should be carefully considered and the physiological demands of small diameter working and ability of workers to self-rescue or to be rescued shall be carefully considered and documented in the PHMP. It is recommended that clients when assessing alternative methods of excavation should also carefully consider the risk benefits to workers of the risk hierarchy described above.

8. Drive lengths exceeding 1000m should be considered **not acceptable** unless the pipe/tunnel is of sufficiently large cross section to allow the Contractor to incorporate an access envelope 0.9m wide by 2.0m high within the pipe/tunnel and clear of services e.g ventilation, spoil handling systems and pumping systems.

9. Planned worker entry during excavation is **not acceptable**. Access in this size range after excavation is complete or for extra-ordinary reasons during excavation should be **avoided.**

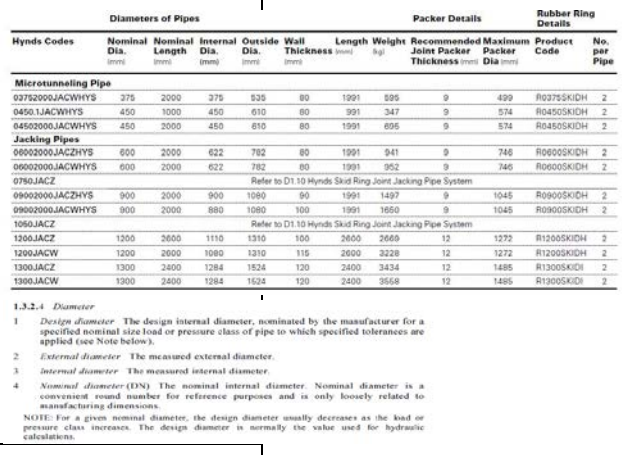
Appendix B

Consultation Feedback and Response

Draft circulated to initial workshop attendees on 15/06/17

From: Priscilla Page
To: Joe Edwards; Trevor Watts; Esitone Pauga (esitone.pauga@fire.org.nz); Purcell, Geoff; Nicholas Gulley; 'SMcIntosh@tonkintaylor.co.nz'; 'matiaha@gmail.com'; 'dietmar.londer@aucklandcouncil.govt.nz'; 'Tim.Macintosh@hynds.co.nz'; 'John.G.Eaton@mwhglobal.com'; 'Dragan.Jovanovic@ghd.com'; Mohamed Imtiaz (mohamed.imtiaz@water.co.nz)
Cc: Tom Ireland; 'Bill Newns'; SGrace (Stephen); Matt Mules (mmules@abergeldieharker.co.nz); Jim Benson; Cooper, John Q.; Romero, Victor S.; Rory Bishop; King, Damian; Mark Pizey; Dave Bellett; Jeff Trevella
Subject: DRAFT guidance table for small diameter tunnels and pipejacks [UNCLASSIFIED]

Feedback Item	Feedback Detail	Feedback from	Date feedback received	Review Response
1	One thing which I want to flag - that came out of a discussion just after our last workshop - is that the handjack max lengths for 1200mm to 1800mm should really all be the same, set at 75m. The rational for this is that we are saying that a 1200mm pipe with machine operator at the face can be 125m, so we are accepting that this length is ok for a rescue, ventilation, access, etc in this diameter. The additional hazard we have in the hand jack is really confined manual working and harm arm vibration. Speaking to the guys, if anything these get worse as you move from 1200mm to 1800mm in size, and the way we deal with thin is through rotation of personnel which would be just the same approach across all pipe sizes. Keen to discuss, but this is certainly one thing I think we need to look at and adjust.	Matt Mules Abergeldie Harker	15/06/2017	Adjust all lengths for handjacks from 1200 - 1800mm to 75m.
2	I am not sure that there should be a hard and fast top diameter to this guidance. I would have thought that this would be set on whether the TBM had a built in refuge chamber or not. This may see the diameter change.	Joe Edwards McConnell Dowell	16/06/2017	Noted
3	The dimensions should not be set on diameters. Many hand excavations in the past were set on the mucker ie 1.25w x 2.3h. There should be a setting for rectangular tunnel cross sections and note that hand drilled tunnels using explosives have a lot less hazards when using compressed air equipment. (But more risk with strata, and explosives)	Joe Edwards McConnell Dowell	16/06/2017	It was agreed that the draft document was not intended for and does not address drill and blast tunnels. The issue maybe addressed in subsequent revisions following further industry feedback.
4	Check the work and descriptions of the designers. I would have thought that within reason a Client should be able to rely on the competency of a designer and the designer could be relied on to assist with the selection of contractors	Joe Edwards McConnell Dowell	16/06/2017	Noted
5	I have a real concern with TBMs where the operator is trapped inbye by the muck tub and train. I do not see any easy way to Rescue the operator unless the train is moved and if that is the cause of the fire the operator is at high risk. This configuration of TBM should not be considered going forward	Joe Edwards McConnell Dowell	16/06/2017	It was agreed that this document was to give guidance and that regulatory requirements address how emergency egress and rescue is to be managed. Any contractor procuring plant will have to meet these requirements
6	Tunnels are also in conditions with CH4 greater than 0.25% and should be looked at if CH4 could be present, ie close to gas pipes and rubbish tips including old ones.	Joe Edwards McConnell Dowell	16/06/2017	Noted.
7	And designs during the design phase must fully comply with the guideline	Joe Edwards McConnell Dowell	16/06/2017	Noted.
8	Where TBMs are manned while the TBM is powered up there must be due consideration of all safety aspects on the machine	Joe Edwards McConnell Dowell	16/06/2017	Noted
9	The competency description is very broad and should be better defined	Joe Edwards McConnell Dowell	16/06/2017	Noted
10	I believe that the designers have a responsibility to inform clients, especially when the client has experts that may not have all the skills needed	Joe Edwards McConnell Dowell	16/06/2017	Noted. Document amended.
11	It is useful to note that it is easier to have the contractor nominated as the Mine Operator so that they are responsible to put the competent people and systems in place to manage the works.	Joe Edwards McConnell Dowell	16/06/2017	Agreed
12	Plant and equipment is also covered by a number of other Acts and Regulations including electrical guiding etc. these do not always comply with all overseas standards.	Joe Edwards McConnell Dowell	16/06/2017	Noted. Document amended.
13	It is important to note that the MRS and emergency services need to see and be involved with emergency plans and in exercises on site	Joe Edwards McConnell Dowell	16/06/2017	Agreed
14	It is a difficult decision whether to name some gasses or not. I feel leaving out CO and CO2 is not good as these are often impacted surface environments.	Joe Edwards McConnell Dowell	16/06/2017	Noted. Document amended.
15	You have an I in the paragraph above design assessment.	Joe Edwards McConnell Dowell	16/06/2017	Noted. Document amended.
16	Design assessments during the design phase should include other experts to get a wide field of input	Joe Edwards McConnell Dowell	16/06/2017	Noted.
17	Designers need to consider the space around the surface of shafts and tunnels. In more than one instance very tight space to set up and other constraints have been a cause of fatalities.	Joe Edwards McConnell Dowell	16/06/2017	Noted
18	Can Clients assess competency of others without the guidance of experts such as designers?	Joe Edwards McConnell Dowell	16/06/2017	Noted and discussed that competency is a personal ethical obligation of professionals
19	Small diameter drives can often eliminate the risk of people in the tunnel. Great. But they often put risks within the shafts ie power packs, tight space and the shafts are less than 15m these need to be considered as much as small manned TBMs as egress can easily be limited and hence have a very high risk of injury and fatality.	Joe Edwards McConnell Dowell	16/06/2017	Noted
20	I would be careful on exclusivity of branding and statements.	Joe Edwards McConnell Dowell	16/06/2017	Noted
21	Only one small comment - need to look at ventilation at design stage.	Bryan Harrington WorkSafe	16/06/2017	Noted
22	At the top of the guidance table combine the <0.9, 0.9-1.0m and 1.0-1.2m columns into one column, <1.2m	Nicholas Gulley March Cato	26/06/2017	Agreed. Amalgamate these columns with title <1.2m
23	In the guidance table, row 2 refers to a note 10, which does not exist	Nicholas Gulley March Cato	26/06/2017	Noted. Document amended.
24	3. Pipe jack – hand digs need to be increase to allow a road crossing under a motorway, arterial road etc. A large number of these projects that have been coming out have been for NZTA projects crossing motorways/state highways	Nicholas Gulley March Cato	26/06/2017	Noted.
25	Timber headings need to be increased and should match the 'pipejack – hand dig'	Nicholas Gulley March Cato	26/06/2017	Noted
26	In the guidance table the heading refers to nominal. This needs to be better defined as the 1200NB pipe from hynds can be small as 1085mm	Nicholas Gulley March Cato	26/06/2017	See response 38 below
27	With regard to the small (1.2m diameter)machine controlled pipe jacks did the drafting panel consider the need for an operator to climb into the machine, especially if it is congested with conveyors, guarding, safety critical equipment etc and how this meets the emergency management sections of the regulation.	Nicholas Gulley March Cato	26/06/2017	Noted
28	Roles and Responsibilities – Collaboration (pg 5). It was pleasing to see this section, particularly the reference to input from the public emergency services during the project development stage. In my opinion this is very important and I would like to see the word recommended replaced with a statement using "shall or must engage" to make this point stronger (I appreciate that there are rules around the use of these types of words in legislative instruments)	Trevor Watts Mines Rescue	14/07/2017	Noted
29	H&S Considerations (pg 6). This appears to be a comprehensive list. I do note that a few gases have been mentioned – I would like to see CO added to this bullet point or be more broad to just say "explosive and toxic gases"	Trevor Watts Mines Rescue	14/07/2017	Document amended
30	Design Assessments (pg 7). Pleasing to note emergency access included as a bullet point associated with risk assessments	Trevor Watts Mines Rescue	14/07/2017	Noted
31	Construction Phase Considerations – Planning and Pre-defined Responses (pg 8). Pleasing to note that the key considerations include emergency response plans and testing of these. The HSWA (MOQO) Regs clearly define engagement with emergency services in the development and testing of the EMP's which is of critical importance so I guess not required to be repeated here	Trevor Watts Mines Rescue	14/07/2017	Noted
32	5. Table of Internal Dimensions and Indicative Drive Lengths. I note that this states for pipejacks and tunnels below 3.0m diameter. If it is possible for a larger diameter tunnel to have refuge chambers fitted to a TBM or installed as part of the tunnel construction, I would like to see a reference to refuge noted in point 5 of the table notes	Trevor Watts Mines Rescue	14/07/2017	The requirement for refuge is covered by the regulations and does not need to be addressed in this document.
33	I note that there is provision to extend drive lengths by up to 25%. Note 6 references that the lengths in the table are indicative and subject to robust risk assessment. I presume that there will be a process of notification to extend a tunnels length by up to 25% and this will also be supported by robust risk assessment. Perhaps this could be made clear in note 6.	Trevor Watts Mines Rescue	14/07/2017	Tunnels that exceed the lengths by 25% may be 'acceptable' although interaction with Worksafe is strongly recommended. Any organisation adopting a longer length without consultation with Worksafe would be proceeding at their risk. No further text is required within these guidelines.
34	I see there is reference to note 10 but there was no note 10.	Trevor Watts Mines Rescue	14/07/2017	Noted. Document amended.
35	Various comments on attached pdf	Mohamed Imtiaz Watercare	13/07/2017	Noted and documents amended where necessary.
36	I think Joe makes a very good point in Comment 17. I have seen a number of Conceptual Designs over the years, where the surface working space is insufficient. I appreciate it's slightly off topic in terms of what these guidelines are specifically trying to achieve and how proper risk assessment processes would help prevent this in future, but maybe, bearing in mind some of the target audience, an additional note is worth consideration?	Damian King Aecom	6/07/2017	At the end of bullet point 3 in the design assessments section adjust to "…property access, any demolition processes and ensuring sufficient working area for safe site operations."
37	Bryan's comment 21 reminds we that we talked about this in the initial workshop. Having a feel for the size of ventilation ducting to allow for is a bit of a weakness of mine and possibly others who deal mainly with smaller diameter water conveyance tunnels. Perhaps a sentence could be inserted into the opening paragraphs to remind designers of the importance of considering ventilation requirements?	Damian King Aecom	6/07/2017	Covered in 4th bullet in Design Assessments section - note that a comar is needed after "…emergency ventilation".
38	Nicholas's Comment 26, makes me see that Note 4 isn't clear enough. It's the perennial problem of the definition of 'nominal diameter' between Australasian, US and European standards. A case in point being Hynds 1200 Jacking Pipes: Cleary the intent of the guidelines is to rule out both the 1200JACZ and 1200JACW wherever personnel are required at the face, but a lack of clarity could fail in this respect or at very least cost Contractors money if pipes are rejected on site. Could I suggest an alternative approach and change the wording of Point 4 to: 'When using the table, the term 'nominal internal diameter' refers to the actual minimum diameter of the pipes used, plus or minus manufacturing tolerances not exceeding 1.1%' Hopefully, this is less ambiguous and sits nicely with manufacturing tolerances in ASNZS4058 for concrete pipes. See Table 3.2 of the attached for the background. I had tried to avoid this approach previously, but the reason we can't simply refer the designer to ASNZS 4058 for diameters by the way is clause 1.3.2.4, as follows (see table alongside) If steel pipes are used instead of concrete, manufacturing tolerances should also fit within these tolerances. If the group decides to stick with point 4 as it is though, there is a typo; NB needs to be corrected to DN as in 'When using the table the term 'nominal internal diameter' refers to the European designation DN (diamètre nominal/nominal diameter/Durchmesser nach Norm) and standard sizes as defined by European Standards, i.e. where for instance a manufacturer's literature states a pipe internal diameter of 1530mm, this equates to a nominal internal diameter of 1.5m.	Damian King Aecom	6/07/2017	
39	I note, quite rightly, that this specifically does not include for operation or maintenance of the utility pipe post construction. I wonder if this should be noted/clarified and the relevant legislation that applies to O & M noted. Just for clarity.	ASTT (NZ)	18/07/2017	Noted
40	Again for clarity "what is not acceptable/what we don't want" in line with the Guidelines, could also be included.	ASTT (NZ)	18/07/2017	Noted
41	Note: The Engineer or ER/ERA is not referred to here, again quite correctly. Most Clients/Principals need to understand better the role of the Engineer versus someone carrying out Construction Monitoring on behalf of the Principal/Client.	ASTT (NZ)	18/07/2017	Noted
42	– is this not just a specific form of a hazardous material	ASTT (NZ)	18/07/2017	Noted. Document amended.
43	Consideration of a responsible, pragmatic construction timeframes also need to be made. Undue haste time pressure can lead to poor decisions being made by all parties.	ASTT (NZ)	18/07/2017	Noted. Document amended.
44	To meet auditing process this needs to be clearly explained that it is one of the considerations to be made under Methodology. Consideration of the weighting to be applied to this aspect in relation to all other Non price attributes needs to be considered.	ASTT (NZ)	18/07/2017	Noted
45	As per previous note, sufficient construction period timeframe consideration needs to be allowed for.	ASTT (NZ)	18/07/2017	Noted. Document amended.



Hynds Codes	Diameters of Pipes: Nominal Dia. (mm)	Nominal Length (mm)	Internal Dia. (mm)	Outside Dia. (mm)	Wall Thickness (mm)	Packer Details: Length (mm)	Weight (kg)	Recommended Joint Packer Thickness (mm)	Maximum Packer Dia (mm)	Rubber Ring Details: Product Code	No. per Pipe
Microtunneling Pipe											
03752000JACWHYS	375	2000	375	535	80	1991	595	9	499	R0375SKIDH	2
0450.1JACWHYS	450	1000	450	610	80	991	347	9	574	R0450SKIDH	2
04502000JACWHYS	450	2000	450	610	80	1991	695	9	574	R0450SKIDH	2
Jacking Pipes											
06002000JACZHYS	600	2000	622	782	80	1991	941	9	746	R0600SKIDH	2
06002000JACWHYS	600	2000	622	782	80	1991	952	9	746	R0600SKIDH	2
0750JACZ	Refer to D1.10 Hynds Skid Ring Joint Jacking Pipe System										
09002000JACZHYS	900	2000	900	1080	90	1991	1497	9	1045	R0900SKIDH	2
09002000JACWHYS	900	2000	880	1080	100	1991	1650	9	1045	R0900SKIDH	2
1050JACZ	Refer to D1.10 Hynds Skid Ring Joint Jacking Pipe System										
1200JACZ	1200	2600	1110	1310	100	2600	2669	12	1272	R1200SKIDH	2
1200JACW	1200	2600	1080	1310	115	2600	3228	12	1272	R1200SKIDH	2
1300JACZ	1300	2400	1284	1524	120	2400	3434	12	1485	R1300SKIDI	2
1300JACW	1300	2400	1284	1524	120	2400	3568	12	1485	R1300SKIDI	2

1.3.2.4 *Diameter*

1 *Design diameter* The design internal diameter, nominated by the masufacturer for a specified nominal size load or pressure class of pipe to which specified toleranees are applied (see Note below).

2 *External diameter* The measured external diameter.

3 *Internal diameter* The measured internal diameter.

4 *Nominal diameter* (DN) The nominal internal diameter. Nominal diameter is a convenient round number for reference purposes and is only loosely related to manufacturing dimensions.

NOTE: For a given nominal diameter, the design diameter usually decreases as the load or pressure class increases. The design diameter is normally the value used for hydraulic calculations.