

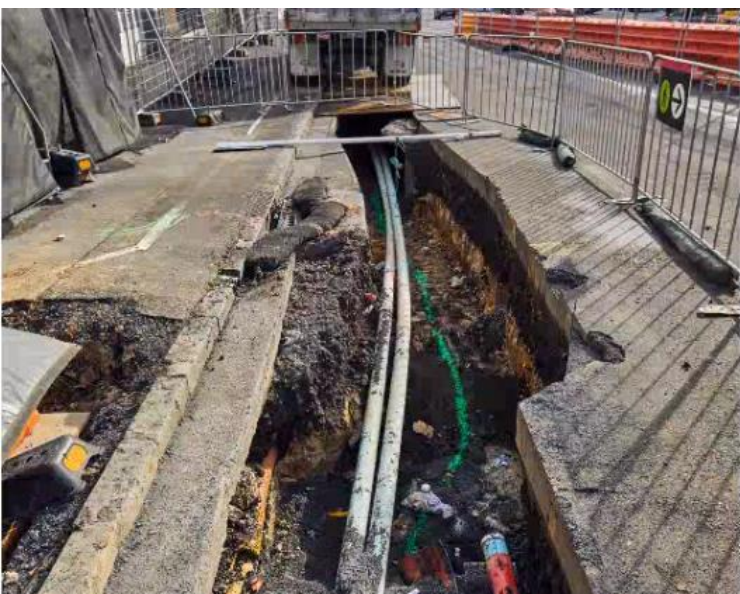


Safety in Design – Practice Forum:

CRL/ Link Alliance – SID implementation and some Lessons Learnt

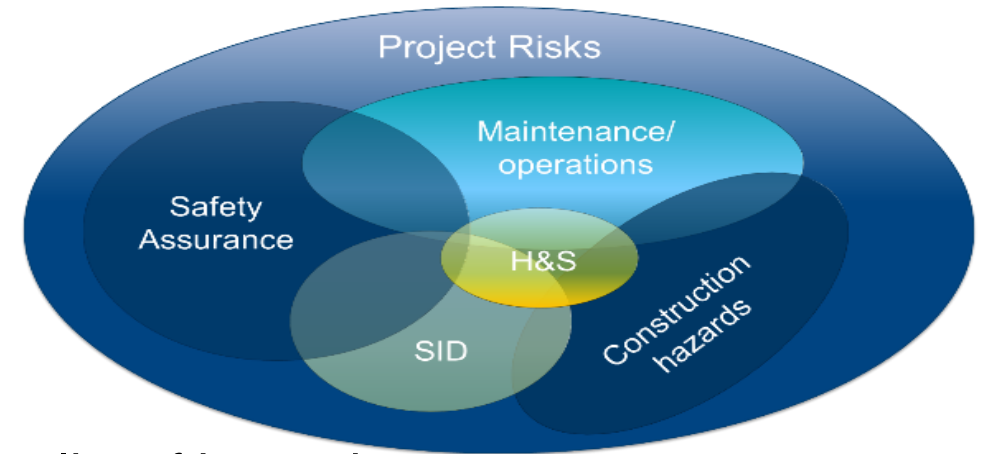


Andrew Richardson, Design Manager
24th August 2020

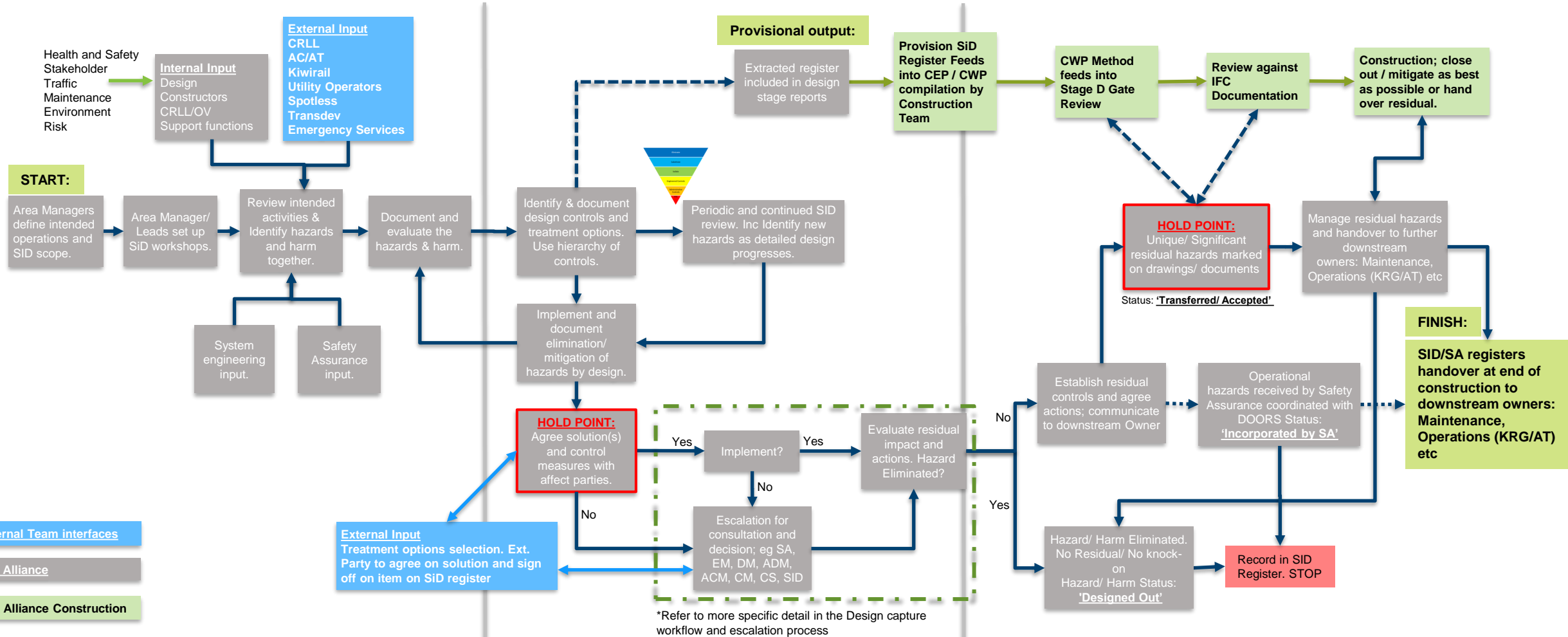


Safety in Design – A recap

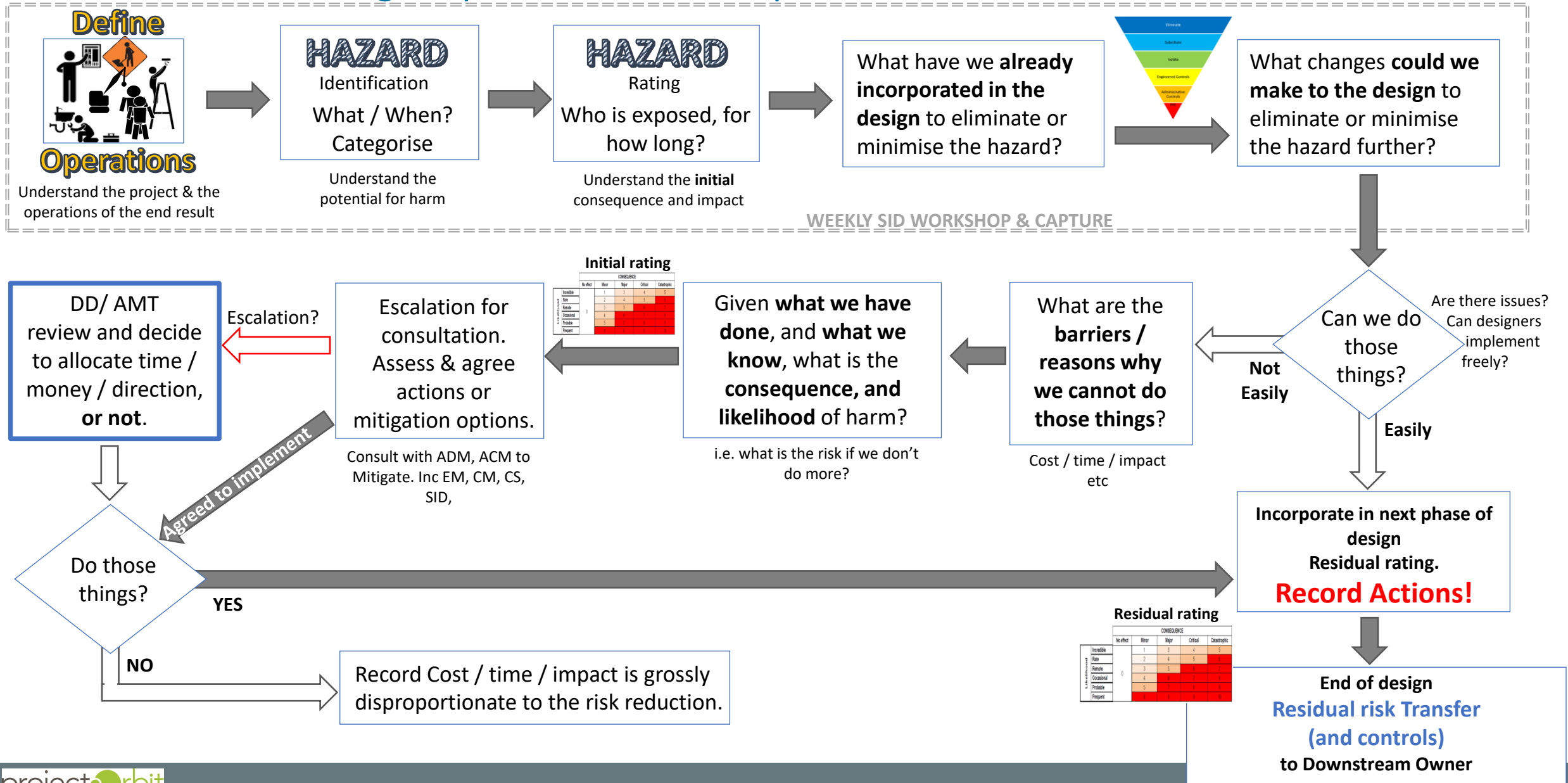
- Industry Practice
- Initial Tender submission
- Detailed Design updates
- Traditional approach (excel spreadsheet) with an exhaustive list of hazards
- Russell McMullan (CRLL) – GM Assurance & Integration
 - Masters: Focused on Transport Infrastructure SID outputs in NZ
 - Why CRL are revising the approach to Safety in Design risk registers: <https://youtube/EddA3hIKQG8>
 - Noted SID has 3 goals:
 1. Systematic identification and reduction of hazard risk,
 2. Communication of downstream hazards/risks, and
 3. Assurance that hazards have been eliminated or minimised, 'SFAIRP'.
- Working group was established to challenge the content of SID capture at LA.



Link Alliance Safety in Design workflow process



SID workflow - Design capture & escalation process



Link Alliance approach – The SID register (capture and record)

- Asked different questions.

Hazard Evaluation and Management Through Design								
First Occurrence	Lifecycle	Hazard Category	Hazard event/ activity description causing harm or ill health	Affected Parties	Who Is Exposed	Duration of Exposure	Σ Persons Affected	What are the Potential Causes



		CONSEQUENCE				
		No effect	Minor	Major	Critical	Catastrophic
Likelihood	Incredible	0	1	3	4	5
	Rare		2	4	5	6
	Remote		3	5	6	7
	Occasional		4	6	7	8
	Probable		5	7	8	9
	Frequent		6	8	9	10

Table 6-1 – Risk Matrix

The red cells indicate 'intolerable' risk as described further below. The beige coloured cells indicate a 'tolerable' range, noting that Risk is required to be reduced So Far As Is Reasonably Practicable (SFAIRP). The values within the matrix are provided to allow an indication of the effectiveness of controls at the time of assessment and to be recorded in the hazard log.



Controls and Treatment Management			
Controls --- What have we incorporated in the design?	Further Controls --- What more could we do?	Barriers --- Why cant we do more?	Actions --- What arises as a result of assessment?

SFAIRP ?

Link Alliance approach – SiD and SA

Complementarity and demarcation between SiD approach and Operational Hazards management (as per EN50126, and detailed in chapter 8) is illustrated as per the following flowchart:

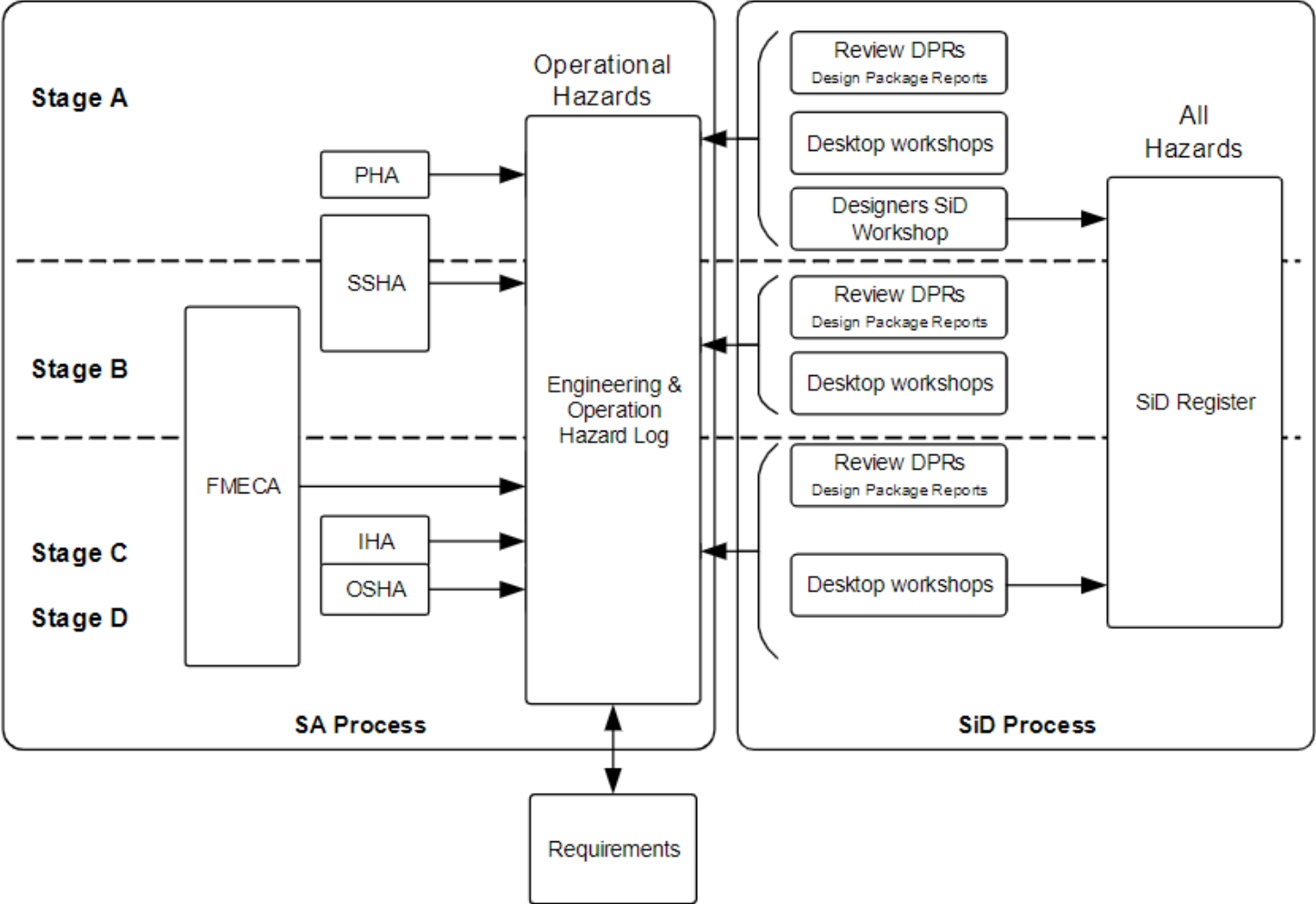


Figure 13 – Complementarity of SiD approach into E&O Hazard Log Management

Link Alliance : Home



projectorbit RISK H&S **SID** HELP

Search this site

Alliance Project Risk Register*

H&S Hazard Register*

Safety In Design Hazard Register



NEWS

Welcome to the Project Orbit Site

USEFUL LINKS

IT Helpdesk Guide

SID Hazard Register

linkalliance.projectorbit.com/SID/Lists/Hazard/PersonalViews.aspx?PageView=Personal&ShowWebPart={A302CD5F-3287-4B9D-83CB-F638B9782B8D}

Link Alliance : SID : Hazard

projectorbit RISK H&S SID HELP

SID Hazard Register (AllData) + new item or edit this list

Other Views: All Items 1-2-1 (Alan/Rail) Workshop Find an item

Count= 1448

Hazard Owner: John Cooper

Status: Construction

Discipline: Construction / Maintenance

DOOR: (Dropdown menu)

Hazard event/ activity description causing harm or ill health: Limited NZ experience with rail tunnel fit out construction

Attached Parties: Rail operations/ Kiwirail, Station operations/ AT, Maintenance, Public

Who is Exposed: Passengers - Able-bodied, Passengers - non able-bodied, Drivers, Emergency services

Duration of Exposure: >100

Persons Affected: Limited NZ experience

What are the Potential Consequences: Major (20)

Conseq: Major (20)

Likelihood: Probable (32)

C Rating: 7

Controls --- What have we incorporated in the design? Engage NZ experienced rail construction experts

Further Controls --- What more could we do? Provide signage to warn of potential slip trips and falls during evacuation.

Barriers --- Why cant we do more?

Likelihood	Consequence				
	No effect	Minor	Major	Critical	Catastrophic
Incredible		1	3	4	5
Rare		2	4	5	6
Remote	0	3	5	6	7
Occasional		4	6	7	8
Probable		5	7	8	9
Frequent		6	8	9	10

Hazard ID	Design Package ID	Discipline	Hazard Owner	First Occurrence	Lifecycle	Hazard Category	Hazard event/ activity description causing harm or ill health	Attached Parties	Who is Exposed	Duration of Exposure	Persons Affected	What are the Potential Consequences	Conseq	Likelihood	C Rating	Controls --- What have we incorporated in the design?	Further Controls --- What more could we do?
H-01674	ALB - 20.ALB.020 - ALB Tunnel Internal Works	Construction / Maintenance	John Cooper	Construction	Construction / Maintenance	Accessibility/ access	Limited NZ experience with rail tunnel fit out construction	Rail operations/ Kiwirail, Station operations/ AT, Maintenance, Public	Passengers - Able-bodied, Passengers - non able-bodied, Drivers, Emergency services	>100	Limited NZ experience	Major (20)	Major (20)	Probable (32)	7	Engage NZ experienced rail construction experts	Provide signage to warn of potential slip trips and falls during evacuation.
H-01673																	
H-01672							Test										
H-01671						Accessibility/ access	Slips, trips and falls by passengers during evacuation.	Design, Rail operations/ Kiwirail, Station operations/ AT, Public	Passengers - Able-bodied, Passengers - non able-bodied								
H-01670						Interface (inc External)	X103 signalling cabinet impacted in within construction works site										
H-01669						Excavation*	Construction vibration damage to watermain	Construction	Construction								
H-01668						Interface (inc External)	Construction activities and placement of Hoarding may result in inadequate signal sighting by train drivers leading to overrunning signals, collisions, etc.	Rail operations/ Kiwirail, Station operations/ AT	Passengers - Able-bodied, Operators/ suppliers	During construction	Multiple injuries and fatality	SLR works adjacent Construction works. Driver distracted by construction works or activities.	Catastrophic (80)	Frequent (64)	10	Design (2D analysis with OLE / Hoarding for signal sighting), trial runs prior to operation, existing operational controls. Kiwirail consult with driver representative. Existing signalling system. Signal sighting assessed to track line speeds and speed restrictions.	Speed restriction during construction works considered, timing of restrictions or return to normal. Inclusion of banner repeater. Close the level-crossing.
H-01667						Electric shock*	Equipment removals and equipment that is placed out of service for the OC 2,1 Signalling temporary works may provide potential for electrical shock to Maintainers.	Construction, Rail operations/ Kiwirail, Maintenance	Maintenance Staff, Construction	Until major refurbishment	Fatalities	Modification of existing system for the purposes of SRL requirements	Critical (40)	Rare (4)	5	Cables are isolated prior to removals. Testing process followed removals.	
H-01666	NAL - 40.NAL.000 - OHLE Stage OC2.1		David Portley	Construction	Construction / Operation	Electric shock*	The auxiliary feeder wire runs along the rail corridor boundary outside of the project boundary between CHVS NAL/010/49 and NAL/010/51 a LV distribution circuit also runs parallel, as such there is an electrical hazards as these are two separate circuits which could result in electric shock, electrocution or damage to infrastructure.	Construction, Rail operations/ Kiwirail, Maintenance	Maintenance Staff, Construction, Bystanders/ visitors, Others	For the operational life	If there was a phase fault there is a possibility for electrical shock or electrocution to maintainers or constructors		Critical (40)	Rare (4)	5	KiwiRail standard maintenance procedures. The AUX FW is positioned as far away as possible such that the static clearance provides appropriate separation of the circuits.	No further design mitigations are available
H-01665	NAL - 40.NAL.045 - Mount Eden Station 2 - NAL Platform Egress, Retaining Wall MTE-02	GEOT*	Mathew Brown	Construction	Construction	Electric shock*	New wall construction MTE-02 is under and interfaces with generator cabinet WOC106 causing hazard to construction and maintenance replacement activities	Construction	Construction	During construction		Construction activity in close proximity to existing equipment and supply cables	Critical (40)	Occasional (16)	7	Hit and miss design construction with precast Retaining wall designed to meet the 'containment' height and loading (Car park loading standards) requirements outlined in the memo Reference...XXXX	Supply the signalling (power) from the A and B supplies rather than generator. Temporary relocation of generator during construction
H-01664	NAL - 40.NAL.045 - Mount Eden Station 2 - NAL Platform Egress, Retaining Wall MTE-02	GEOT*, STRU*	Mathew Brown	Operation	Operation	Roads	Vehicle driving into rail corridor	Public, Rail operations/ Kiwirail	Drivers, Passengers - Able-bodied, Passengers - non able-bodied	For the operational life		Errant vehicle in car parks adjacent to rail corridor boundary	Critical (40)	Rare (4)	5	Assessment of barrier requirements by civils team	Review extending L wall to coordinate traffic barrier, fence removal and wall upstand.

Clear Filters from Discipline

- (Empty)
- ACOU
- ARCH
- CIVL
- DIGI
- DURA

This column type cannot be sorted

Hazard Entry Forms

Hazard Entry
Hazard Evaluation
Hazard Management

SID ID

Source

Area * (None) v

Design Package ID * (None) v
First select Area

Hazard Category * Discipline
(Choose no more than 3)

ACOU '
 ARCH '
 CIV '

Hazard Status * New

Hazard Owner *

DOORs Reference

Date for next review

Hazard event/ activity description causing harm or ill health *

First occurrence

Hazard Entry
Hazard Evaluation
Hazard Management

Hazard evaluation and management through design

<p>Who is exposed? <small>(Choose no more than 3)</small></p> <ul style="list-style-type: none"> <input type="checkbox"/> Station Staff <input type="checkbox"/> Maintenance Staff <input type="checkbox"/> Retail staff <input type="checkbox"/> Passengers - Able-bodied <input type="checkbox"/> Passengers - non able-bodied <input checked="" type="checkbox"/> Construction <input type="checkbox"/> Bystanders/ visitors <input type="checkbox"/> Demolition <input type="checkbox"/> Operators/ suppliers <input type="checkbox"/> Drivers <input type="checkbox"/> Emergency services <input type="checkbox"/> Trespassers <input type="checkbox"/> Others 	<p>Affected Parties</p> <ul style="list-style-type: none"> <input type="checkbox"/> Design <input checked="" type="checkbox"/> Construction <input type="checkbox"/> Rail operations/ Kiwirail <input type="checkbox"/> Station operations/ AT <input type="checkbox"/> Maintenance <input type="checkbox"/> Demolition <input type="checkbox"/> Public 	
---	---	--

Quantum of persons affected / Potential Consequences Injury

Duration of exposure? During construction v

Potential Causes

1. Negligence and carelessness of maintenance personnel.
2. insufficient training and education of maintenance staff, subcontractors

Use the Tables to rate the hazard, the existing controls into consideration.

Initial Consequences Major (20) v
What is the level of Harm?

Likelihood Occasional (16) v
Given what we have done & know how likely is the resultant harm?

Current rating 6

Proposed Controls
What have we incorporated in the design to eliminate or minimise the hazard?

- Durable concrete mix design to ensure that design life is achieved.
- Waterproofing to reduce cracking/spalling due to water ingress

Hazard Status:

Transferred/ Accepted – Hazard management complete through to residual actions and rating completed/ agreed. Owner amended to new downstream owner and reference added to ‘Transferred/Accepted Reference’ eg Date meeting held, drawing or report reference.

Designed Out – Controls documented and implemented have eliminated the harm/hazard.

Incorporated by SA – For Residual Operational hazards transferred to SA team and now incorporated in to E&O / DOORS

ProjectOrbit Reports

SID Hazard Register (AllData) + new document or drag files here

Other Views All Documents ... Find a file

Ownerless/ Incomplete entries Name

My SID Hazards LA - CRL SID Register - Design Report - All Hazards

Escalated Hazards

All New/Open

All Designed-Out

All Transferred (Residual)

Tools

Printable Reports

SID Register Tables

LA - CRL SID Register - Design Report - All Hazards.xlsx [Read-Only] - Excel

File Home Insert Page Layout Formulas Data Review View Developer ProjectWise Power Pivot PDF-XChange V6

Clipboard Font Alignment Number

P11 Partial collapse, Fatal or Serious Injury

Link Alliance - Safety in Design Hazard Register

Package Name (to be amended prior to printing)

Document Revision: 6/05/2020

Document Owner: Name (to be amended prior to printing)

Template Owner: A Richardson

Hazard Source and Identification				Hazard Evaluation and Management Through Design									
Hazard ID	Source	Design Package Ref Name	Record Owner	Design Lead	Design Discipline	Design Status	Record Status	Record Description	Affected Parties	Who is Exposed	Duration of Exposure	Persons Affected	What are the Potential
H10201	Construction	KRD-10-KRD-071-010 - Mercury Lanes Drivels	Crig Pungelis	Crig Pungelis	STRU	Complete	Complete	Concur D-Vall Connection Failure	Construction, BM vehicles	Construction	For the operational life	Water ingress, durability	Cracking of the unconfined wall
H10202	Construction	KRD-10-KRD-071-010 - Mercury Lanes Drivels	Crig Pungelis	Crig Pungelis	STRU	Complete	Complete	Foundation Failure	Construction	Construction	During construction	Partial collapse, Fat or Serious Injury	Poor concrete quality (heavy accidental loading)
H10203	Construction	KRD-10-KRD-071-010 - Mercury Lanes Drivels	Crig Pungelis	Crig Pungelis	STRU	Complete	Complete	Collapse Caused by Accidental Load Due to heavy Construction vehicle collision	Construction	Construction	During construction	Design for the Plunge Column	Accidental impact from road access
H10204	Construction	KRD-10-KRD-071-010 - Mercury Lanes Drivels	Crig Pungelis	Crig Pungelis	STRU	Complete	Complete	Reinforcement cage being handling	Construction	Construction	During construction	Fatal or Serious Injury	Equipment Failure
H10205	Construction	KRD-10-KRD-071-010 - Mercury Lanes Drivels	Crig Pungelis	Crig Pungelis	GEOT	Complete	Complete	Excavation without sufficient adjacent Mercury Trestles	Construction	Construction	During construction	Design to property	Excavate cutbank & tribut
H10206	Construction	KRD-10-KRD-071-010 - Mercury Lanes Drivels	Crig Pungelis	Crig Pungelis	GEOT	Complete	Complete	D-Vall unconfined	Construction	Construction	During construction	Partial collapse, Fatal or Serious Injury	Over excavation, unstable rock
H10207	Construction	KRD-10-KRD-071-010 - Mercury Lanes Drivels	Crig Pungelis	Crig Pungelis	STRU	Complete	Complete	Hydrul die to failing connection between two or more cages of concur D walls or a rock of placing loads inside the cages.	Construction	Construction	During construction	Disability	Accidental drop of the cages, lifting equipment failure or movement of cages in different direction.
H10208	Construction	HAL-40-HAL-050-10 Rail only - Drivings, Cull	Shawn Good	Shawn Good	STRU	Complete	Complete	Closing of rock drulu in vicinity of BR bridge	Construction, BPV	Construction	During construction	Delay, Disrupts	Insufficient secondary lining thickness due to poor workmanship and forward positioning
H10209	Construction	KTN-20-KTN-075-010 Secondary Lining (MC2050 MC2050)	John Cooper	John Cooper	TUNN	Complete	Complete	Tunnel lining cracking leading to potential collapse	Construction, BPV	Construction	During construction	Injury, Fatality	Localized cartilage failure and major cartilage occurrence.
H10210	Construction	KTN-20-KTN-075-010 Secondary Lining (MC2050 MC2050)	John Cooper	John Cooper	TUNN	Complete	Complete	Failure of lining due to cartilage vibration	Construction, BPV	Construction	During construction	Injury, Fatality	Localized cartilage failure and major cartilage occurrence.
H10211	Construction	KTN-20-KTN-075-010 Secondary Lining (MC2050 MC2050)	John Cooper	John Cooper	TUNN	Complete	Complete	Ability for gull, vehicle, equipment and personnel to access road through the tunnel lining	Construction	Construction	During construction	Injury	Insufficient waterproofing provisions

Link Alliance - Safety in Design Hazard Register

Document Revision: 6/05/2020

Document Owner: Name (to be amended prior to printing)

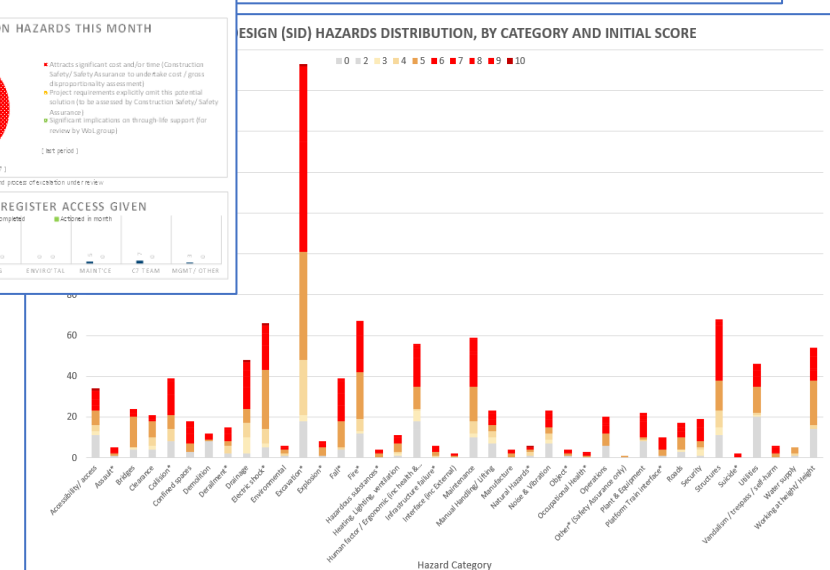
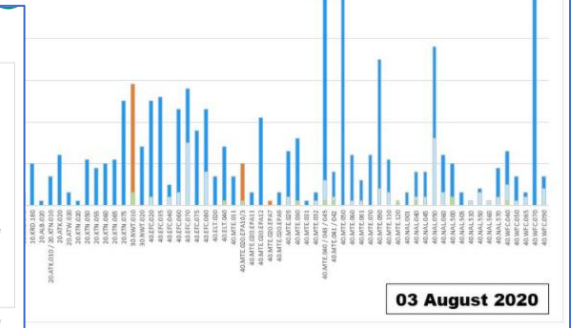
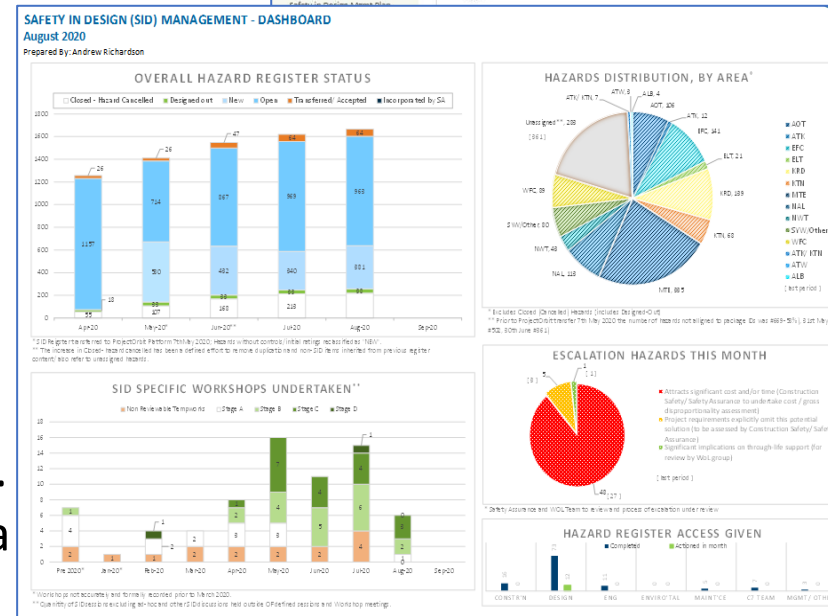
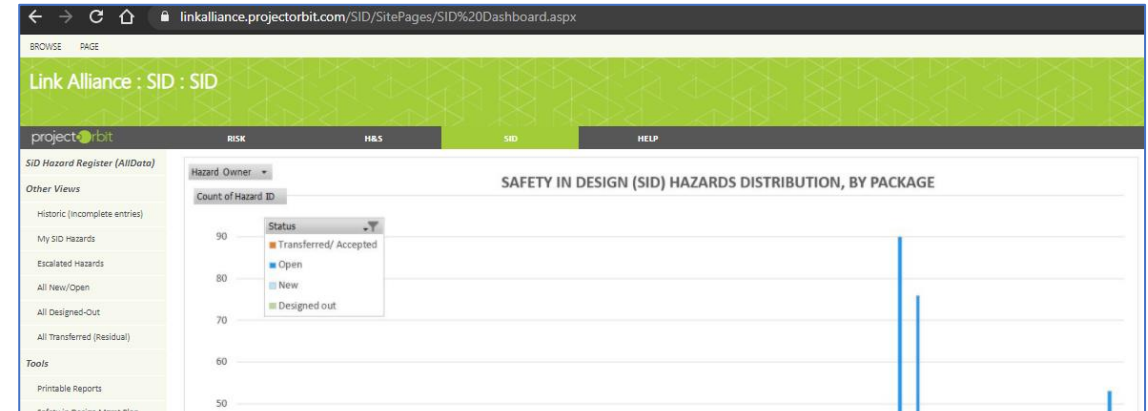
Template Owner: A Richardson

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H10203	Construction	KRD-10-KRD-071-010 - Mercury Lanes Drivels	Crig Pungelis	Crig Pungelis	STRU	Complete	Complete	Collapse Caused by Accidental Load Due to heavy Construction vehicle collision	Construction	Construction	During construction	Design for the Plunge Column	Accidental impact from road access
H10204	Construction	KRD-10-KRD-071-010 - Mercury Lanes Drivels	Crig Pungelis	Crig Pungelis	STRU	Complete	Complete	Reinforcement cage being handling	Construction	Construction	During construction	Fatal or Serious Injury	Equipment Failure
H10205	Construction	KRD-10-KRD-071-010 - Mercury Lanes Drivels	Crig Pungelis	Crig Pungelis	GEOT	Complete	Complete	Excavation without sufficient adjacent Mercury Trestles	Construction	Construction	During construction	Design to property	Excavate cutbank & tribut
H10206	Construction	KRD-10-KRD-071-010 - Mercury Lanes Drivels	Crig Pungelis	Crig Pungelis	GEOT	Complete	Complete	D-Vall unconfined	Construction	Construction	During construction	Partial collapse, Fatal or Serious Injury	Over excavation, unstable rock
H10207	Construction	KRD-10-KRD-071-010 - Mercury Lanes Drivels	Crig Pungelis	Crig Pungelis	STRU	Complete	Complete	Hydrul die to failing connection between two or more cages of concur D walls or a rock of placing loads inside the cages.	Construction	Construction	During construction	Disability	Accidental drop of the cages, lifting equipment failure or movement of cages in different direction.
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H10210	Construction	KTN-20-KTN-075-010 Secondary Lining (MC2050 MC2050)	John Cooper	John Cooper	TUNN	Complete	Complete	Failure of lining due to cartilage vibration	Construction, BPV	Construction	During construction	Injury, Fatality	Localized cartilage failure and major cartilage occurrence.
H10211	Construction	KTN-20-KTN-075-010 Secondary Lining (MC2050 MC2050)	John Cooper	John Cooper	TUNN	Complete	Complete	Ability for gull, vehicle, equipment and personnel to access road through the tunnel lining	Construction	Construction	During construction	Injury	Insufficient waterproofing provisions

LA - CRL Register - Design Report - All Hazards [D] xls

Safety in Design – ProjectOrbit

- ProjectOrbit Dashboard and monthly monitoring reporting
 - Part of OV SID tracked matrices.
 - Regular auditing for compliance.
- Embedded auto-workflows functions, reports and filtered views exist :-
 - Email notification of new hazard owner(s) or status change
 - Monitoring/ review of escalations and closures through SA/ WOL other.
 - Hazards defined by package and area parameters.
 - Filter of Designed-Out hazards



Safety in Design – Residual Hazard Communication

2.4.2. Hazard triangle template

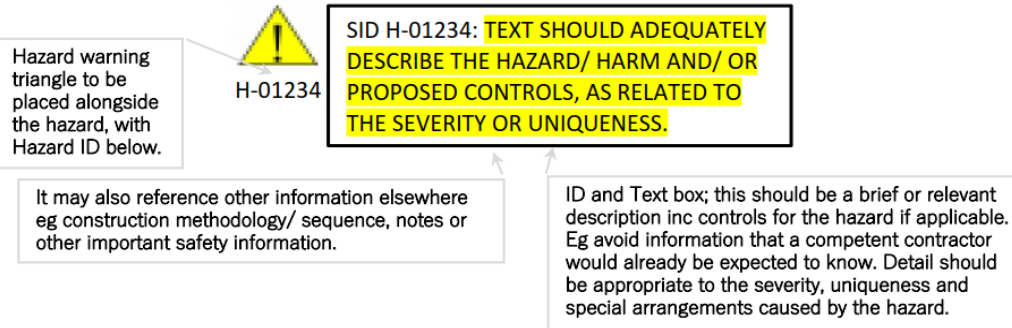
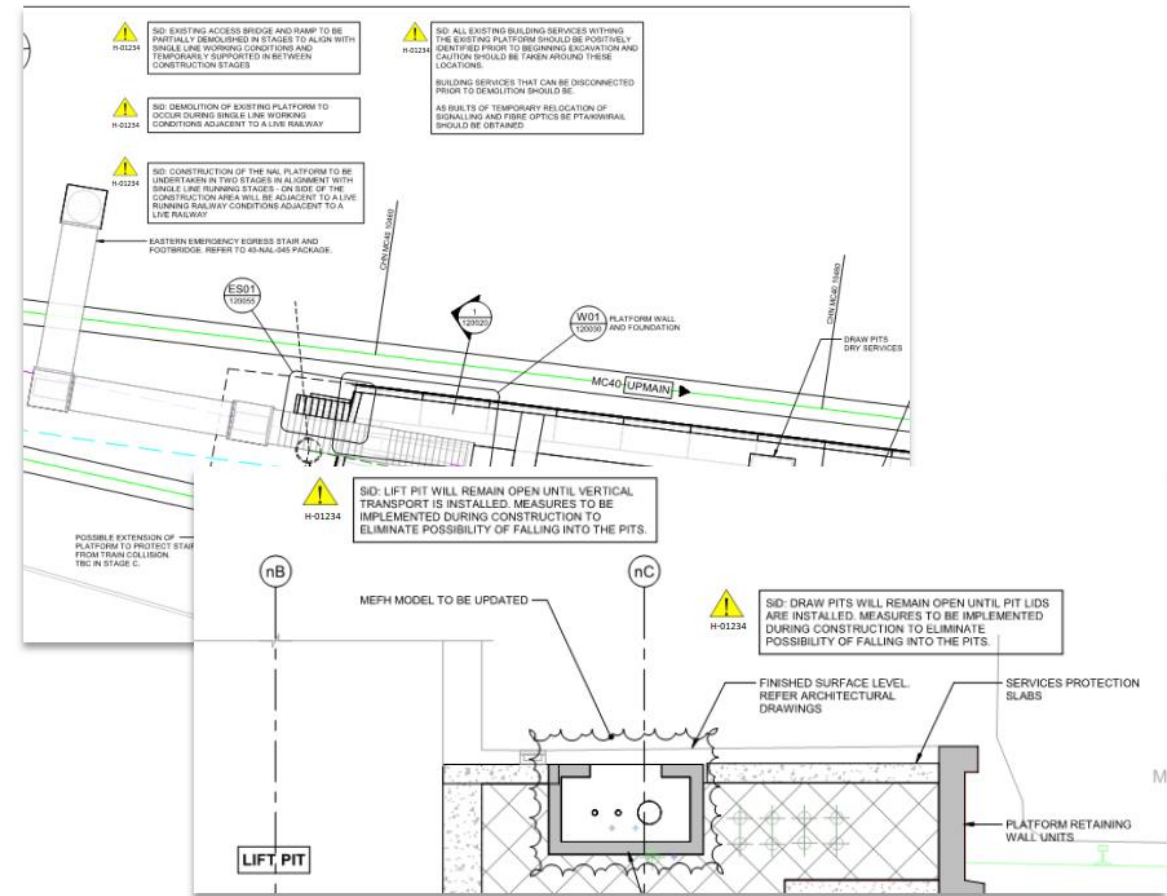


Figure 2: Typical SID Hazard image and text box

Practical Note: At least the hazard triangles logo with IDs must be located as close to the hazard(s) location as reasonably practical.



SAFETY IN DESIGN INFORMATION RESIDUAL HAZARD IDENTIFIED		
FOR FULL DETAILS OF HAZARDS AND CONTROLS RELEVANT TO THIS PACKAGE REFER TO THE SAFETY IN DESIGN REGISTER CONTAINED WITHIN THE DESIGN REPORT APPENDIX DOC No. CRL-XXX-XXX-LKA-RPT-1XXXX		
SID No.	HAZARD	PROPOSED CONTROLS
H-01111	POTENTIAL TO FALL/TRIP OVER OPENING WITHIN SW MANHOLE SHAFT	WARNING SIGN ON THE SAFETY GRILL AT THE MANHOLE ENTRANCE ADVISING OF OPENINGS IN MANHOLE FLOOR.
H-01234	INJURY FROM CARRYING HEAVY PIPES	INSTEAD OF CARRYING THE PIPES, TROLLIES ARE TO BE USED TO ASSIST THE TRANSPORTATION OF PIPES WITHIN THE SW PIPE.
H-04567	WORKING IN CONFINED SPACE TO OPERATE VALVES	VALVES HAVE BEEN POSITIONED SO THAT THEY CAN BE OPERATED FROM THE SURFACE WITHOUT THE NEED FOR SOMEONE TO ENTER THE 1950mm PIPE.
EVERYDAY & BUSINESS AS USUAL HAZARDS WHICH ARE CONSIDERED OBVIOUS TO A COMPETENT CONTRACTOR HAVE NOT BEEN INDICATED BUT SHOULD BE CONSIDERED BY THE CONTRACTOR WITHIN THE WORK METHODS.		
SHOULD ANY ADDITIONAL HAZARDS BE IDENTIFIED DURING THE CONSTRUCTION WORKS THE CONTRACTOR SHALL NOTIFY THE RELEVANT MEMBER OF THE PROJECT TEAM.		

Figure 3: Examples of a SID Hazard notes table

Safety in Design – A few Lessons Learnt (1)

- Regular SID workshops embed SID into the process; focus on all design stages by discipline/ geographic areas. SID Champion. Covid-19 WFH MS Teams.
- Managed metadata, 'hazard' better defined allowing control and/or free text fields.
- ProjectOrbit platform / interface is easy to use (multi access/ secure); can be updated quickly (setup or additions). Significant improvement than traditional Excel registers.
- Amended questions allows designers to:
 - Document those things that are 'ordinarily done' outside of modifying the design.
 - Leave fields blank; if there is nothing in the design minimises the hazard.
 - Understand hazard-activity-worker relationship & lets designers use their creativity.
 - Identify what they might do in the next design stage and/or escalate for support.

Safety in Design – A few Lessons Learnt (2)

- Improved data management offers better analysis potential of hazard information, inc for compliance/auditing.
- Filtered reports and extracts of hazard register/ database are presented within each design pack.
- Supports collective review and scoring (not just left to the Designers)
- SID integrated with Systems Safety Assurance for Operational hazard management.
- Formalise drawing and document hazard notification – Residual communication inc handover meetings (inc workflow notifications within the platform).
- Showing positive results: Designed-out hazards; multi-person feedback from both internal and external respondents.



Question?



PROUDLY DELIVERING

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