Australia's Underground Utility Safety Reckoning

If nothing changes, the next fatality or outage is not a surprise - it's a choice.

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Contents

Part I:
The Reality on the Ground

Part I shares the views of stakeholders from different levels, painting a rich tapestry of opinions, experiences, and challenges. By reading this section, you will understand the narrative around excavation and trenching safety, and the key issues that an aging, unfit-for-purpose system brings to high-risk works.

Part II:
The Gaps in Practice

Part II presents research done from academic sources and an international benchmarking review of ‘before you dig’ services. This section highlights just how far we lag other developed countries, and what we already know about service strike prevention.

Part III:
Decisions Australia Must Confront

Part III describes we can actually do about this problem and put the fire out on the burning platform. Recommendations for positive change, offered before Australia has a major infrastructure outage or fatality event, are shown and a call to action articulated.

Approach

This research included four key activities:

1. Background literature scan of underground service strike research.
2. International review of legislation and regulation for ‘before you dig’ services.
3. Consultation interviews with stakeholders across different levels.
4. An asset owner and user survey.

10

academic papers reviewed, plus additional secondary sources, identifying 33 unique causes of service strikes

20

stakeholder interviews conducted

78

4

countries’ legal frameworks and regulations analysed

asset owners participated in a survey

135

service users participated in a survey

Part I:
The Reality on the Ground

BYDA is the premier provider of plans and information about buried utility services in Australia, connecting asset owners/managers with end users to reduce the risk of strikes and associated injury and damages.

BYDA has over 850 asset owner/manager members, 400+ safety partners, and more than 700,000 registered service users. Over 2.7 million requests for plans and information are made each year, with more than 7,000 requests per day. Service utilisation continues to increase year-on-year.

Nevertheless, more than 15,000 service strikes occur in Australia per year, mainly affecting telecommunications but also impacting water, gas, and electricity services.

1.1
A 40-Year-Old System in a High-Risk, Digital Age

"In service strikes the person got information they didn't need, or not enough info, or the risks that were planned for weren't captured properly."

As illustrated above by a quote from an asset owner, and despite the significant nationwide adoption of BYDA services, inefficiencies and issues remain embedded across the information process. The system remains predominantly paper-based and static, with manual updates to plans and data typically required. Information provided by asset owners tends to be inconsistent and fragmented. The process is slow and difficult to navigate and apply, resulting in misinterpretation or lack of understanding among frontline workers responsible for implementing safe work practices.

"The final PDF [provided by asset owners] can be up to 50-60 pages. A lot to digest."

The above quote captures the essence of end users' concerns regarding the overwhelming and inefficient presentation of plans and information via referral cases.

Additional themes revealed by interviews that showcase the current state of before-you-dig service in Australia included:

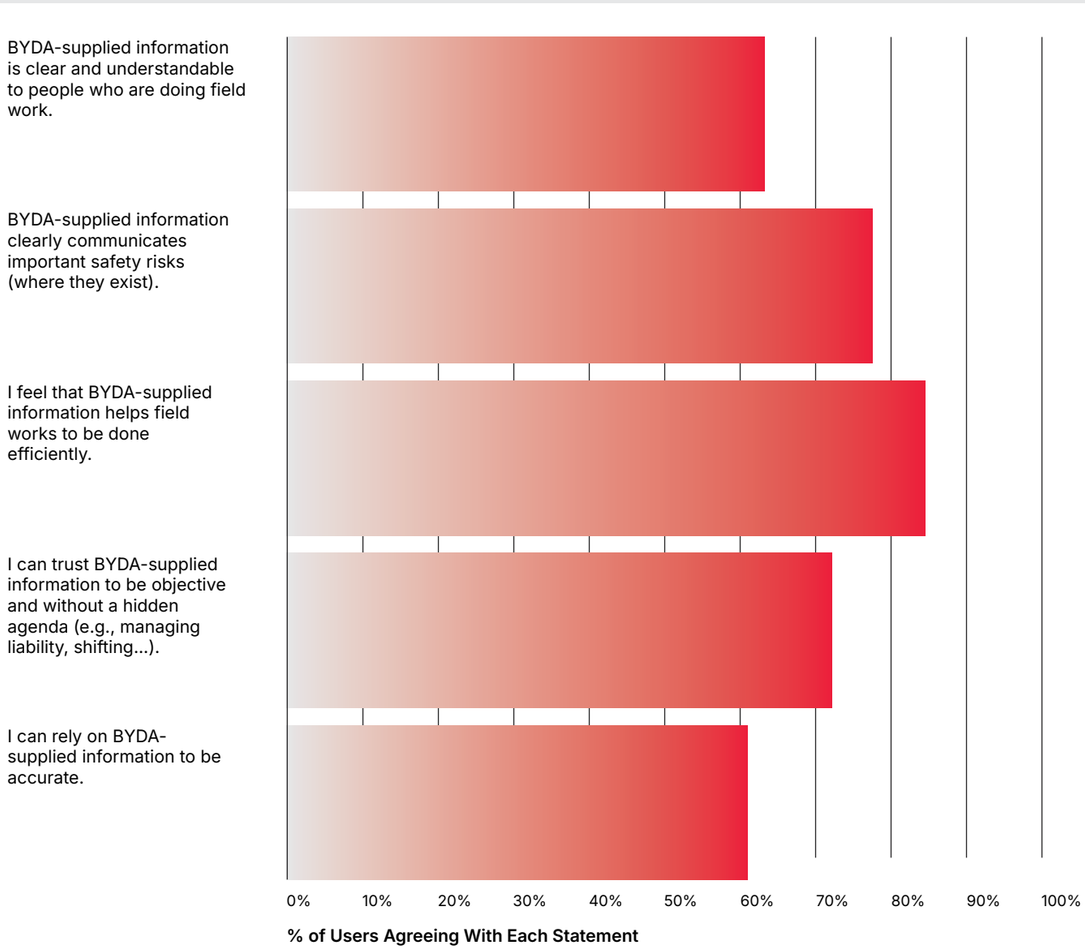
- Data completeness and update frequency vary widely across asset owner members, which can reduce end-user confidence in BYDA outputs.
- Data quality is constrained by cybersecurity and legal concerns raised by data custodians.
- Perception among end users that BYDA's service is informational rather than risk-mitigating, reducing application in the field, which is compounded by the absence of a GIS layer (which would enhance practicality).
- The volume of information shared with contractors can be overwhelming.
- Concerns were raised by asset owners with sharing detailed GIS or as-built data due to perceived security risks and liability concerns.
- Data currency and accuracy of plans and information are inconsistent, with plans often differing from actual field conditions experienced by workers.
- Practicality of safe excavation and service locating recommended practices vary between asset owners (e.g., hand trowelling entire length of service), which can result in workers dismissing or downplaying safety considerations during work.
- Weak feedback loops exist; in-field locating of services and strike events inconsistently trigger data corrections/updates to plans and information, and if feedback can be received by asset owners, it can be slow to implement.
- There is a contrasting culture between overhead and underground service strike prevention, with the "Look Up And Live" campaign and BYDA's safety planning tool being more evolved and accepted.

Adding to this narrative, survey data we captured from end users explored an integral component of system uptake and adoption: trust. Trust is important for systems and processes because without it, workers will not feel secure to rely on information provided and be less likely to comply with recommended practices.

If the asset data is wrong, the worksite becomes the testing ground.

Figure 1 shows that whereas overall levels of trust in plans and information facilitated by BYDA on behalf of asset owners tended to be high, two specific aspects were lower, with only around 60% of users agreeing with two statements: information is clear and accurate for field workers, and users can rely on the accuracy of information.

Figure 1.
Percentages of BYDA users agreeing with each trust-relevant statement.



Further information provided by the user survey reinforces the current state of information and plans provided by asset owners via BYDA. Figure 2 shows that the highest levels of endorsement for causes of service strikes by end users concentrated on 1) inadequate skillsets of workers to interpret plans and information, 2) insufficiency of plans and information provided, and 3) inaccuracy of plans and information provided.

Comments provided by users within the survey explain these rating results in more detail:

"BYDA results now come with pages of accompanying information, key guides and disclaimers. Realistically, at that length and level of detail, the average tradie is not going to read them. To be useful, accompanying info needs to be succinct."

"Basic information by [asset owners] is not nearly as comprehensive as it should be. We are supposed to be supplied with all relevant information to make sure no service strikes occur, but the recent changes to simplifying information are making utility strikes more likely."

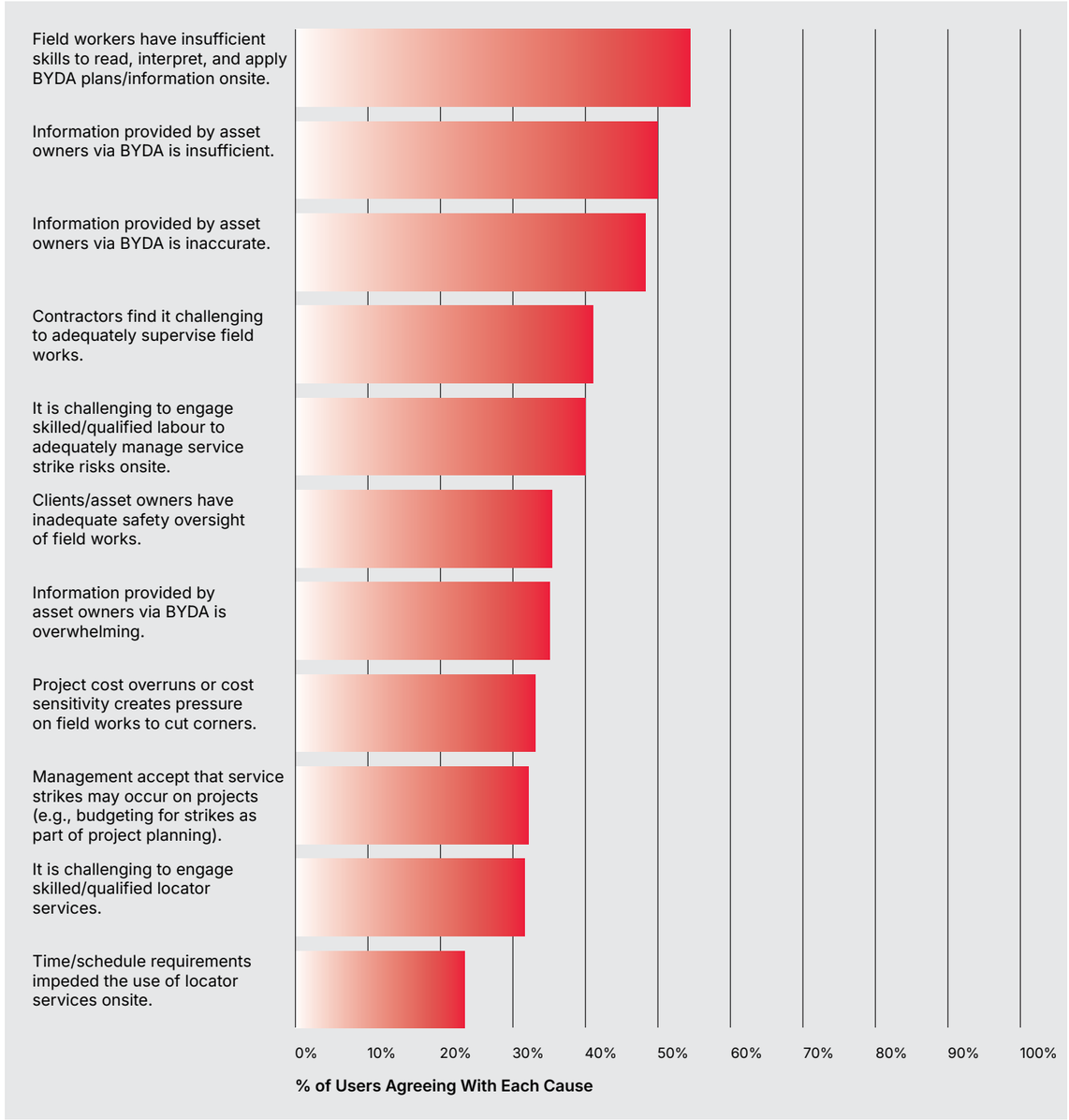
"BYDA info is only as good as what the asset owner has put in."

"Most information supplied from a BYDA does not contain accurate plans or location information of the asset. The information cannot be relied upon and clients need to contract further services for any reliable safety from damaging assets."

"[Asset owner] plans are very unclear. Generally, it would be of most use if alignments were provided in digital/GIS format to allow for best coordination."

The system has drifted from risk control to liability control.

Figure 2.
Perceived causes of service strikes as reported by end users (% agreement).



In summary, these findings highlight that the referral system as a whole is misaligned with the nature of infrastructure growth across Australia and has not scaled effectively as volume, complexity, and diversity of excavation and trenching works has increased.

Plans and information provided via the BYDA referral system can fail to translate into consistent and safer work practices, largely (from this research) due to perceived quantity and quality of the asset owner-provided data. Further, the data suggests that referral plans and information have drifted in their intent from a safety management and risk mitigation control measure into a more legally oriented liability management tool. The referral system as designed is rapidly running out of relevance in an increasingly digital world; GIS supports dynamic application of plans-in-field, enabling more detailed location (position and depth) data in practice, yet is hampered by the legacy static system. In short, the system in play is designed for a different era.

1.2
A Fragmented Ecosystem with Shared Consequences

BYDA doesn't exist in a vacuum. To reduce service strikes we must understand the broader context that sits around the system, enabling it to be successful and facilitate safer and more consistent work practices.

Next, we tell the story from different stakeholder perspectives: government and regulators, asset owners and managers, clients and principal contractors, subcontractors, locators, and homeowners.

1.2.1 Government and Regulators

There is currently no national legal mandate to engage and use BYD service in Australia. Most interviewees believed that this is a significant oversight and missed opportunity, with various concerns raised about the increasing gap in legal requirements between Australia and other developed countries.

"NSW only mandates BYD. No other states have mandated this."

"Should be legal to say anyone doing excavation must do BYDA. In VIC it is only suggested."

Interviewees emphasised that there are inconsistent regulatory activities (awareness/education and enforcement-related campaigns) between different Australian jurisdictions aimed at proactive damage prevention efforts.

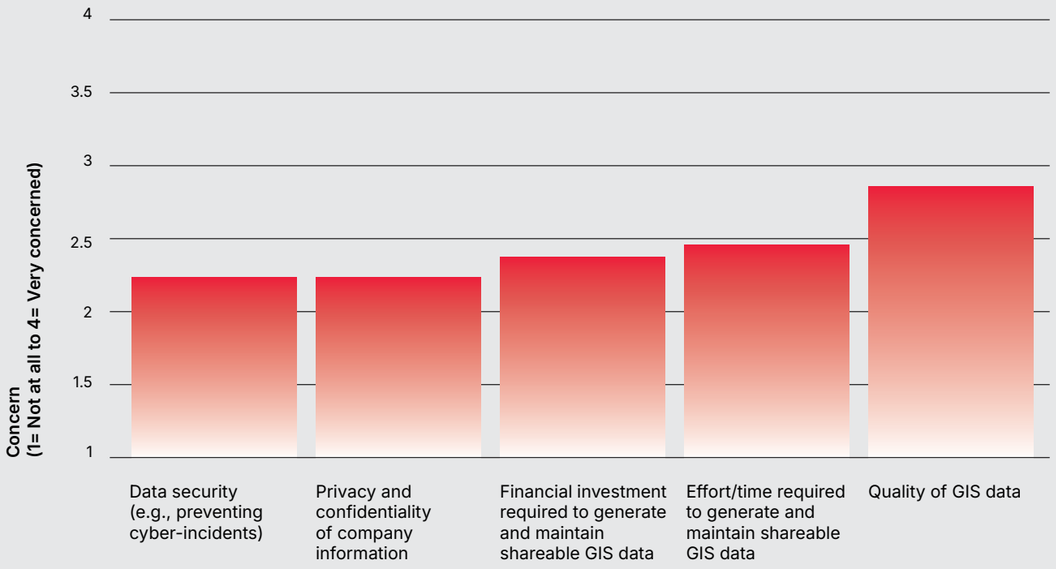
"Never hear from [regulators] unless we push it. I call them and then they jump on board. Send a lot of information to them and often don't hear back."

There was also a view of low visibility of the costs borne to stakeholder groups from both minor and major asset strikes. Interviewees suggested that government, and particularly regulators, could improve education and awareness campaigns highlighting the adverse impacts of service strikes and fostering a more proactive approach.

1.2.2 Asset Owners and Managers

Asset owners raised concerns with sharing detailed GIS or as-built data due to perceived security risks and liability concerns. Notably, this theme was more apparent among East Coast entities. Sharing of data is one important piece of the broader puzzle that needs to occur. Survey data (targeting asset owners) revealed that all five listed concerns were relevant and cause for some level of concern, with perceived issues around quality of shared GIS data, and effort/time required to share data rated as the two highest concerns. Figure 3 summarises these concerns.

Figure 3.
Average ratings of concerns sharing GIS data with BYDA.



Comments regarding GIS data revealed several insights, ranging from the anticipated 'false confidence' that end users may feel if GIS was implemented, through to the need for regular data updates (effort and time required), and potential error margins and tolerances in existing GIS mapping standards and data as implemented. Further concerns were raised regarding security and privacy issues.

"The quality of the asset data of BYDA utility members is not good enough to assume depth or alignment. Nor is it to scale. This can create false confidence in users that they know where the asset is based solely on GIS data."

"The heavy reliance on the GIS data does not remove the need to proceed with caution. 100% support advancements in this field but this is not the fix in itself."

"While I personally am not concerned about security and privacy, the City is very concerned with such matters (to the exclusion of all else)."

"Positional accuracy for inhouse mapping data can be ±1.5 m to 10 m or more. Combined with historical discrepancies in cadastral boundaries the further west in NSW (and QLD) that you move, discrepancies in spatial mapping becomes more noticeable."

"Asset owner participation, data quality/ standardisation, technology adoption, and organisational cultural resistance."

Another concern was data currency and accuracy. Data were viewed as inconsistent, with plans often differing from actual field conditions. This issue in part flows on from possible inconsistent assurance over contractors' installation quality and practices to ensure 'as built' service locations match 'as planned', as well as weak feedback loops (specifically, in-field locating of services and strike events inconsistently or failing to trigger data corrections/updates).

Finally, the practicality of safe excavation and service locating practices vary between asset owners (e.g., hand trowelling entire length of service). This issue highlights the 'legal drift' inherent in the referral system, which erodes end user trust and decreases meaningful compliance with recommended safe work practices.

"Even when someone tries to give [asset owners] the info, they don't do anything with it."

"Leads to impractical and behaviours – not even any guidance on how much pot holing to do, [asset owner] says to uncover the whole length with a trowel."

"[Contractors for asset owner] Won't have updated the plans when they took a shortcut. Rarely at depth. Telstra cable sticking out."

Service strikes are being normalised – even budgeted for – instead of prevented.

1.2.3 Clients and Principal Contractors

For clients and principal contractors, interviewees highlighted upstream factors implicated in service strikes such as the inconsistent inclusion of service locating requirements in tendering and procurement specifications. A further challenge downstream in the project hierarchy included weak or missing contractual specification of locating and verification requirements down the subcontracting chain.

Another raised issue was the perceived limited accountability placed on clients and principal contractors to verify services/plans data quality before issuing work packages and briefing subcontractors.

"The issue is the subbies – at hand off – no one gave [the plans/information] to me! Hand offs become an issue."

Feedback on contractors' performance in terms of installation quality and oversight over subcontractors appears to also be relevant in preventing service strikes. Interviewees mentioned that poorly performing contractors can be re-engaged due to ineffective or absent feedback loop following service strikes on projects.

Worryingly, some interviewees suggested that services strikes, with corresponding financial penalties, are being 'normalised' by including estimated costs of incidents up-front in project budgeting.

"Contractors use insurance or build the cost in, and wear it. The VIC government has quoted an 8-12% cost increase for project cost blow up. They have normalised the cost of strikes."

1.2.4 Subcontractors

Contractual arrangements with clients/asset owners often place full liability on subcontractors, discouraging open reporting of near-misses or strikes.

"Pass all costs back to the contractor, take them to court, how do we bring back a balanced shared responsibility, create collaboration."

Concerns were raised regarding cost and schedule priorities driving high risk tolerance. Specifically, cost pressures can foster a belief among subcontractors of 'getting the job done' outweighing pre-dig locating and verification activities (including engaging skilled locators).

"For contractors under time pressure, cost pressure – just take the risk. Trying to meet the expectations – will take the risk."

Capability gaps were raised by interviews, with the view that frontline operators require skill development in interpreting and applying information from drawings/plans. As a follow-on, overconfidence in plan data can lead to a "false sense of security" once drawings are obtained. These findings highlight a complex relationship between competence and confidence: subcontractors need to balance the certainty afforded by extensive training with the uncertainty of underground services locating practices. In other words, subcontractors need to strike a balance between promoting certainty versus uncertainty to ensure sufficiently cautious work practices are developed and implemented.

"Shovel tech vs engineer, simplifying asset information into a platform that is easily digestible by those breaking ground – can they read and interpret it."

Finally, subcontractors indicated there are a lack of reporting mechanisms to inform authorities and asset owners about service strike-related incidents.

"So many near misses are not reported. In reality, the network is being compromised all the time."

1.2.5 Locators

Professional service locators are a crucial control when implementing plans and information from BYDA. Three key themes emerged from interviews with industry stakeholders: inconsistent technical capability among locating personnel, equipment limitations, and time pressure. Interviewees reported that locators vary in their professional background, qualifications, and corresponding capabilities to accuracy and consistently locate buried services. Compounding this issue are technical challenges when locating equipment is implemented, such as interference, ground conditions, and materials used to construct and indicate underground services.

"Can be qualified locator, doing a short course, but you need more than that. Industry needs a standard to deem what would make a qualified locator."

"This was a near miss. Bit of scare. Service locator did not pick it up. Nothing on BYDA plan from asset owner."

1.2.6 Homeowners and Small Contractors

Homeowners are an important, albeit smaller player in service strikes and BYDA service engagement. Homeowners and smaller contractors were seen to be unaware of the importance of service locating before digging (public awareness tends to be lacking). An additional challenge for this group was a lack of access to simple, intuitive mobile tools that decreases use of BYDA among end-users, and information from asset owners that assumes technical understanding and know-how among all end-users (rather than a profile or archetype-based approach to information tailoring and provision).

"Damage is done by homeowners. Bury a dead pet and you go through a service."

"Plumbers they think they know everything. Don't listen. Should go to their regulatory body or union for an advertising campaign."

Our research, conducted directly with stakeholders across the work system, significantly expands the existing insights available from academic sources.

Legally, reform is needed to keep pace with international standards and also ensure that BYD services are engaged proactively and consistently by stakeholders before high-risk works commence. Asset owners and managers raised concerns about digital innovation and evolution, all valid, but not insurmountable. Addressing security and privacy concerns will be integral to moving towards a dynamic digital solution that incorporates GIS data. At lower levels of the work system, clients and principal contractors can improve contracting, procurement, and assurance over their subcontracting network, ensuring construction, installation, and maintenance activities adhere to best practice. Reporting culture should also be fostered at this level, improving the likelihood of strikes and near-misses being investigated and learnings shared broadly to improve work safety. Everyday work pressures that result in poor supervision, rushed decision-making, and trade-offs between efficiency and safety being mismanaged need to be addressed by subcontractors, as well as raising the capability of frontline workers to read, interpret, and apply plans in practice. Competence of service locators was a key issue, and finally, awareness of homeowners and smaller contractors to engage with BYDA even in residential and perceived 'low risk' contexts.

1.3
Shared Responsibility, Unequal Power

Maintaining safety throughout works on underground services is often described as a ‘shared responsibility’. Yet, to truly be a shared responsibility there needs to be a distribution of power that enables stakeholders within the ecosystem to effectively uphold their responsibilities.

Currently, responsibility for service strike prevention is shared. Yet, power and influence are not.

Across high-risk industry, we see a consistent pattern. Regulators establish standards and requirements, which are pushed to organisations, which are in turn passed to frontline workers. Workers then inherit the risk that is created not only by their own actions but also by the decisions and actions at higher levels of the system. Those who hold the power to design out the risk can pass the responsibility for safety ‘down the line’.

In practice, responsibility for service strikes is routinely pushed downwards and onto those with the least capacity to influence the ecosystem where the risk was originally created. In the underground services context, governments establish mandates around BYD and enshrine legal requirements, regulators enforce these requirements and educate industry, asset owners control the quality and accessibility of data, clients and principal contractors shape subcontractors’ practices through incentives and constraints, and subcontractors carry out the work under considerable pressure and competing demands.

An important debate in safety science has centred on a key dilemma in explaining and preventing incidents: do we change the worker, or the workplace?

Broadening this question, we can start to explore the role of power and authority in shaping our answer.

From one perspective, the ‘responsibilisation’ of workers has meant that organisations emphasise the duty that individuals have to be safe in the workplace. In this scenario, stakeholders higher in the chain can apply power and influence to push responsibility for safety down to lower levels in the system. Legitimised through behavioural safety programs and messaging such as ‘90% of incidents are caused by unsafe acts’, the role of the organisation in the prevention of injuries becomes diffused. In some ways, this use of power can be described as coercive.

On the other hand, contemporary safety suggests a more nuanced answer. Yes, workers’ acts can trigger the release of hazardous energies but the contributing factors that precipitated the incident will always lie upstream and deeper within the work system. From this angle, it is less helpful to control and constrain workers through their behaviour, and more helpful to change the broader system in which work is carried out.

Competing goals and pressures will inevitably push work towards less safety: this is the reality of doing business where resources are limited, projects urgent, and priorities constantly shift. We can use power to legitimise frontline responsibility through language such as ‘violations’ and ‘unsafe acts’. Or, we can seek to learn why workers inherited trouble and instead treat non-compliance as (mostly) functional strategies that workers use to accomplish their tasks under real-world conditions.

Through this research, we have shown that the answer to underground service strike safety must reflect the current context. The status quo is characterised by a priority on liability minimalisation, which encourages the use of power and influence to push safety responsibility downwards. To achieve meaningful change, honest reflection on this dynamic is needed, and all stakeholders recognise the need to not only ‘push down’ in terms of expectations and requirements, but also ‘pull up’ by empowering the lower levels of the system to speak up and challenge the status quo.

Part II:
The Gaps in Practice

2.1
Service Strikes Are a System Problem - Not a Worker Problem

Reviewing the existing research on service strikes highlighted a focus on the lowest levels of the system; in particular, the work environment and frontline work practices. Half of the identified reasons why service strike happen related to the frontline, with far fewer causes at higher levels such as industry, asset owners, and government (see Table 1).

Table 1.
Frequency of service strike causes at each system level.

System Level	No.	%
Government	3	9
Regulators	2	6
Industry associations, unions	0	0
Asset owners	0	0
Contractors	7	21
Site Management	4	12
Workers	8	24
Work Environment	9	27
Total	**33**	**100**

In line with modern safety thinking, this finding suggests that more research is needed to identify broader factors that can shape the practices of workers and impact on the work environment, if more sustainable and effective solutions for the service strike problem are to be found.

Detailed analysis of the research, aligning each service strike contributing factor (derived from incident investigations, interviews, and surveys conducted mainly in the USA and Canada) identified that there is a complex network of service strike causes.

Looking at all levels implicated in service strikes, our research highlights the need to move beyond simple explanations (such as complacency) at the worker level, and towards appreciating the challenges and difficulties that workers tend to inherit from higher up in the work system (see Table 2).

Note: Our framework was derived from Rasmussen (1997).

Table 2.
Multi-level contributing factors of service strikes (from previous research).

Government	Weak or inconsistent statutory deterrents
	No national program for abandoned utilities
	Inconsistent enforcement of standards in design
Regulators	Incomplete coverage of referral services
	Incident systems focus on direct (not root) causes
Industry associations	No causes found
Utility owners	No causes found
Contractor Organisations	Incentives/time pressure and cost-cutting
	Poor as-built documentation processes
	Workforce shortages and rushed locates
	Tracer-wire issues on plant
	No/slow ticket response by owners/locators
	Inter-party communication breakdowns
	Document control not ensuring latest drawings are made available onsite
Management (project/site management)	Outdated/incorrect mark-out practice
	Proceeding with outdated or unproved plans
	Inadequate supervision/inspection of site conditions
	GIS/process misuse (e.g., not ensuring “most recent” data used)
Workers (front-line practices/competence)	No locate request made
	Digging before start date/after ticket expiry
	Digging outside ticketed area/wrong information on ticket
	Failure to verify marks by pothole
	Failure to maintain clearance
	Improper excavation techniques
	Inadequate capability to manage risk
	Lack of awareness of utility existence/position
Work (physical task & environment)	Temporary surface marks fade or are removed
	Missing depth information on markers
	Inaccurate/incomplete utility location data at site
	Abandoned/unknown facilities
	Unlocatable facilities (non-metallic, no tracer)
	Congestion/coupling/material interference with asset detection
	Vegetation/soil/ground conditions degrade asset detection
	Weather erodes markings
	Unregistered/private assets

This research highlights the complexity of services strike prevention. For example, weak legislated deterrents such as penalties for non-compliance with safe work practices, combined with inconsistent regulator monitoring and enforcement, with cost cutting pressures at the contractor organisation, flow down to affect site management (e.g., inadequate resourcing for supervision, poor workforce training), and ultimately, frontline practices (e.g., failing to verify markings, not making a local request).

Positive, sustainable, and impactful change requires a whole-of-system perspective.

2.2
How Australia Compares - and Why We're Falling Behind

Australia lags other countries in 'before you dig services'. Legal requirements, the availability of industry guidance and codes of practice, and enforcement mechanisms and penalties in countries such as the United Kingdom, France, Canada and the USA are all more advanced than what we currently have available here in Australia.

In this section, the current Australian context is summarised, followed by a comprehensive international legal review.

The aim of this section is to highlight the gaps in Australia's safety laws and regulations with respect to mandating the effective use of before-you-dig services and associated risk control measures.

Australia's buried asset risk is governed by fragmented laws, weak mandates, and limited accountability.

2.2.1
Australia: Fragmented Laws, Weak Mandates, Limited Accountability

In Australia, there is no federally mandated legal requirement around 'before you dig' services. Instead, only one state (New South Wales) has made this action a legal requirement (but only for gas and electricity works). Requirements are baked into the existing Electricity Supply Act (1995) and Gas Supply Act (1996) rather than being added to existing WHS law. Safework NSW also provides a detailed guidance document (see: Work Near Underground Assets – Guide) that outlines the requirement to engage with BYDA before digging activities and emphasises the uncertainty inherent within the process of locating underground services.

In Victoria, the 2017 Grimes independent review of Victoria's electricity and gas network safety framework specifically addressed the issue of buried network risk, making a recommendation (see: #31) that BYDA should be made mandatory, bringing the state into alignment with NSW and international best practice.

This recommendation has not yet been implemented. Like NSW, Energy Safe Victoria published a guidebook (see: Guidebook – Undertaking Work Near Underground Services) in 2022 that recommends use of the BYDA service and also emphasises the uncertainty of location data.

In sum, there is significant opportunity to modernise and evolve the Australian landscape for buried network infrastructure safety. The absence of a federal legal framework requiring and governing 'before you dig' services, the lack of government-endorsed detailed best practice on underground service works and safety, and little to no mechanism to ensure high quality location data are available means there is much work to be done in this space.

2.2.2
United Kingdom: Guidance Without Mandate

The UK does not have a single mandated national ‘before you dig’ hotline or one-call system. Instead, and similarly to the Australian federal law, the legal onus is on anyone excavating to take reasonable steps to avoid damaging underground services. Excavators must fulfill general duties under the Health and Safety at Work etc. Act 1974 to plan and carry out work safely, which includes identifying and avoiding buried utilities.

The UK Health and Safety Executive’s guidance HSG47 “Avoiding Danger from Underground Services” recommends consulting utility owners for location information before digging. Additionally, the New Roads and Street Works Act 1991 and its regulations require utility operators and contractors to coordinate and share information about underground apparatus when doing street works.

Overall, the UK state of play is similar to the current situation in Australia; an absence of a nationally mandated and legally required ‘before you dig’ service, supported by guidance in codes of practice and industry standards.

Emphasis is placed on the end user performing the works in large part, to comply with locating best practices and ensure safe excavation and trenching works are undertaken.

2.2.3
France: A National, Mandated, Data-Driven Model

France has a comprehensive legal regime mandating ‘before you dig’ notifications at the national level. Reforms in 2011–2012 (often referred to as the “DT-DICT” system) established strict requirements to prevent damage to networks. Before any excavation or ground work, the responsible parties must go through a two-step notification process using a centralised one-stop portal. First, the project owner files a Declaration of Work Project (DT) during the planning phase. This DT notifies all relevant network operators of the intended work and requests information on existing utilities. Second, the executing contractor (or person doing the digging) must submit a Declaration of Intent to Commence Work (DICT) before breaking ground.

A joint DT-DICT can be filed if work is critical and imminent. Through the online portal, these declarations are automatically routed to all utility operators in the vicinity of the site. Each network operator is legally obliged to respond, providing the best available maps of their underground infrastructure and safety instructions for working near their lines.

Importantly, asset owners/operators are required to continuously improve the accuracy of their mapping (the law mandates that all networks must be surveyed to high precision by 2032). Certain minor works (e.g., very shallow farming activities or emergency repairs) are exempt from the DT/DICT requirement.

The situation in France is interesting for the Australian context, especially in relation to the emphasis on asset owners and operators to provide detailed mapping data and the requirement to meet a high standard of service location quality by 2032. A further requirement ensures data quality through a requirement to document buried services to a Class A standard (i.e., within 40cm of accuracy). The DT/DICT system is flexible enough to ensure that low-risk, emergency, and irrelevant works are not held up in bureaucracy, and the effective use of a completely digital system boosts efficiency.

2.2.4
Canada: Shared Responsibility Embedded in Law

There is no single nationwide one-call number in Canada; instead, each province and territory has its own service. To simplify access, a national ‘Click Before You Dig’ web portal directs users to the appropriate provincial one-call service. At the federal level, the primary legal requirements focus on federally regulated infrastructure (such as interprovincial pipelines and power lines), whereas provinces legislate requirements for other underground utilities within their jurisdiction. The Canadian Energy Regulator (CER) Act and associated regulations impose ‘before you dig’ obligations for pipelines and powerlines under federal authority.

The Pipeline Damage Prevention Regulations require any person planning to excavate within the prescribed safety zone of a federally regulated pipeline to make a locate request at least three working days in advance. Similarly, the Power Line Damage Prevention Regulations contain parallel provisions for federal high-voltage lines. Pipeline companies themselves are also obliged to join the local ‘before you dig’ networks and respond to locate requests. On receiving a notice, they must mark the pipeline or otherwise provide detailed location information and safety guidance to the excavator. In addition, federal law was strengthened in 2015 to enhance damage prevention.

For example, it became a requirement that federally regulated pipeline operators register with provincial one-call centres and that excavators must place a one-call request before any activity near those pipelines. Although a comprehensive federal bill was introduced in 2017 to expand one-call requirements to all federally regulated utilities (and to mandate ‘before you dig’ membership more broadly), it has not yet been enacted.

Canada’s federal emphasis is clearly on electricity and pipeline integrity and safety, which is understandable given the predominance of oil and gas operations in the country. Province-based services facilitate location data to diggers in each area, with legal requirements for asset owners and operators to become members of local ‘before you dig’ services, respond to locate requests, and in some cases, facilitate physical marking of services on-site if needed. Across Canada, there seems to be a balance on responsibility for safety across asset owners and entities performing excavation/ trenching activities.

2.2.5
United States: Enforcement with Real Consequences

Every US state has its own one-call notification law requiring excavators to contact the state’s service in advance of digging. These state laws are uniform due to consistent implementation of federal standards; effectively, ‘before you dig’ services are enshrined in law across all 50 states. The federal government drives consistency through legislation and oversight.

For a state to receive federal pipeline safety grants, its ‘before you dig’ program must cover all excavators and all underground utility operators (including government operators) without exempting certain groups. States must also have effective enforcement provisions for their one-call laws. Federal pipeline safety law also reinforces excavation requirements.

Under various amendments, each state’s enforcement of excavation damage prevention can be evaluated. If a state’s enforcement is deemed inadequate, federal authorities can directly enforce excavation safety standards against violators in that state.

The USA situation is similar to the Canadian context, with federal laws and standards supported by state-based ‘before you dig’ services. The USA equips federal regulators with powers to reinforce or address violations of pipeline safety over and above state responses, which may succeed in adding deterrence to diggers. Interestingly, ‘before you dig’ compliance is also linked to the approval process for federally funded infrastructure grants, again adding a push factor to compliance.

Part III: Decisions Australia Must Confront

We must act now, before a major service outage or fatality event. For too long, we have been discussing the issue, dismissing or downplaying the evidence, or just been plain ‘stuck in the mud’ on this issue.

The research in this report highlights an unavoidable situation: incremental improvement will not be enough. Decisions must be made now to prevent what we see as an inevitable serious incident involving an underground service strike.

Only through acknowledging the problems and working collaboratively, moving beyond a liability, culpability, and adversarial approach, can this complex issue be solved.

In this section, we summarise extra findings from asset owner and end user surveys that suggest solutions and ways forward. Recommendations derived from research and evidence are also presented.

3.1
Legal Framework

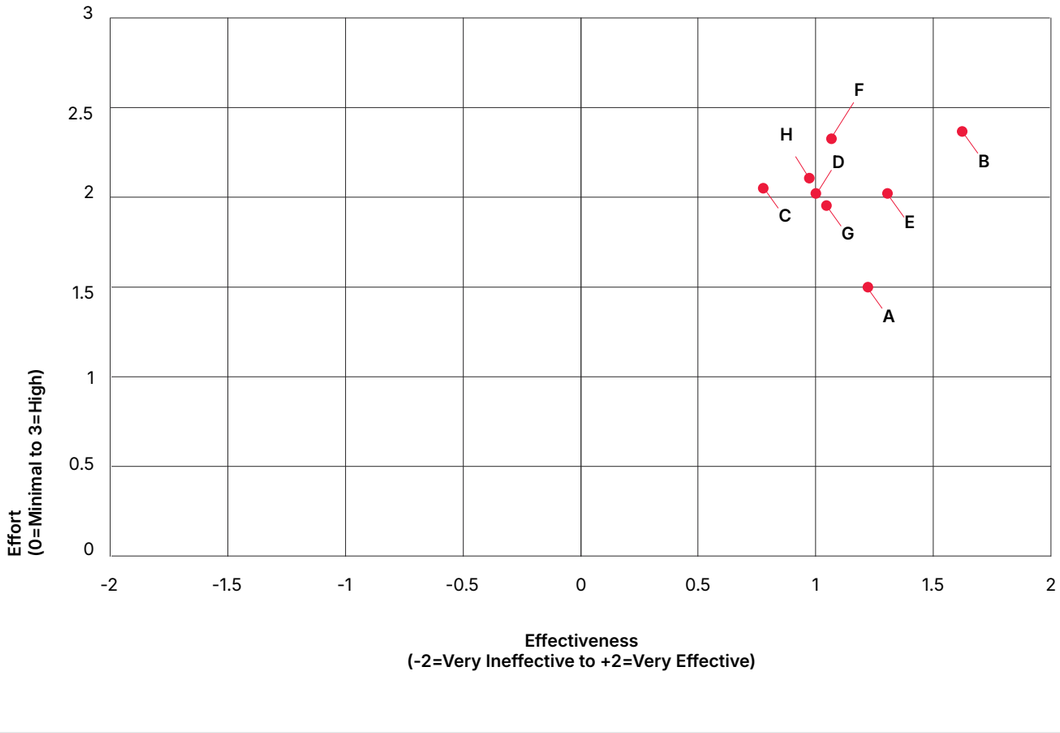
The international review highlighted the positive impact that legislative change could make in Australia. But what specifically can we change?

In the survey done as part of this project, asset owners rated the anticipated effectiveness and effort of several proposed legislation reforms related to safety.

All proposed changes were, on average, perceived to be effective mechanisms to improve safety and security of network assets. Effort scores highlighted that there are no ‘silver bullets’; however, two proposed changes may have the most impact: (B) Requirement to verify asset locations using potholing or non-destructive excavation, and (A) Mandatory BYDA enquiry before excavation or ground penetration.

Regarding (B), the perception was that this may be a long-term ‘big investment’, with the highest effectiveness score but also the highest perceived effort score. Regarding (A), this was seen as having moderate effectiveness but lower effort (a ‘quicker win’). Remaining changes were seen as generally favourable. Figure 4 shows the average ratings of effectiveness versus effort for asset owners.

Figure 4.
Asset owners’ average ratings of effectiveness and effort (perceived).



Legislative Change	#
Mandatory BYDA enquiry before excavation or ground penetration.	A
Requirement to verify asset locations using potholing or non-destructive excavation.	B
Requirement to conduct risk assessment and create specific control plans for buried infrastructure.	C
Minimum competency and training requirements for those performing excavation work.	D

Legislative Change	#
Establishment of on-site evidence of asset location and controls.	E
Consultation with utility asset owners when planned work may affect their networks.	F
Integrated data sharing and reporting of services safety trends between regulators, industry, and BYDA.	G
Embed utility risk management as a core unit of competency across relevant industry qualifications	H

3.2
Compliance, Enforcement, and Capability-Building

Of course, any solution to the service strike risk problem requires a broader system change than merely laws and regulations. Further improvements at lower levels are needed to ensure risk is controlled effectively, key stakeholders and system participants have the required awareness and capabilities, and plans and information are clear, usable, and efficient. As shown by Figures 5a and 5b, the surveys conducted with asset owner and end users collected comparable data on the anticipated risk reduction of various improvements across the work system. All suggestions were on average, perceived as likely to have some positive risk impact, with four potential ideas having the most consensus across both user groups: (E) Improving the quality/availability of locator services onsite, (D) Mandating the use of BYDA by law across all states and territories, (F) Integrating GIS data into the BYDA platform, and (I) Improved industry awareness of underground service strike risks.

Overall, the survey data supports the underlying thesis of this report: that we need to move beyond simplistic solutions to the service strike problem and instead adopt a multi-pronged suite of changes across the work system to achieve the best results. Legislative change, supported by competent and accessible work-site locating services, combined with high quality GIS data provided through the BYDA system, and reinforced with awareness and education campaigns, were suggested by consulted stakeholders as the most valuable ideas to reduce risk.

Ideas to Improve the Safety of Field Works	#
Increased WHS regulator actions (e.g., education and enforcement activities)	A
Introduction of new laws and regulations targeting asset owners (e.g., incorporating onsite location data into plans and drawings)	B
Introduction of new laws and regulations targeting contractors and subcontractors (e.g., enforcing installation and locating standards)	C
Mandating the use of BYDA by law across all states and territories	D
Improving the quality/availability of locator services onsite	E
Integrating GIS data into the BYDA platform	F
Published industry guidelines or best practices in service strike prevention	G
Changing contracting practices to encourage shared liability/responsibility	H
Improved industry awareness of underground service strike risks	I

Figure 5a.
Anticipated impact of ideas to improve safety – average ratings from asset owners.

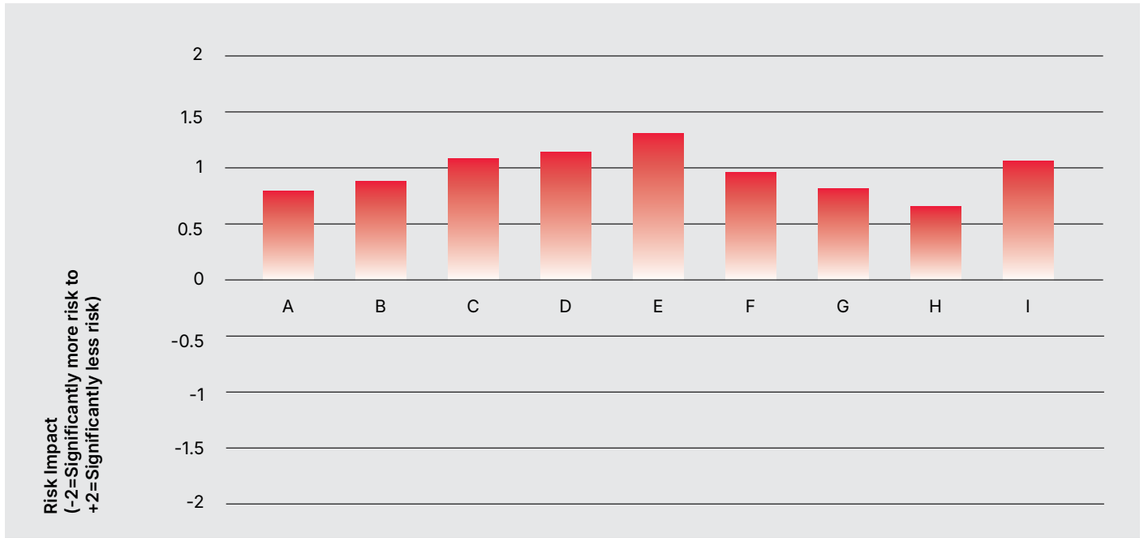
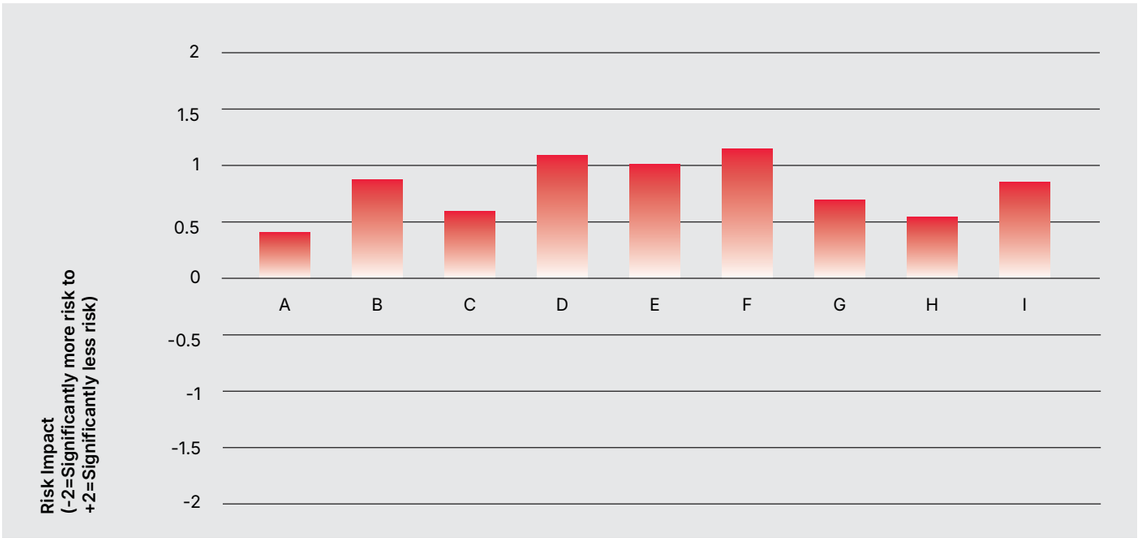


Figure 5b.
Anticipated impact of ideas to improve safety – average ratings from end users.



Without legal guardrails, “good practice” remains optional – even when the risk is fatal.

3.3
A Modern, Digital System

Modernising and enhancing the BYDA system to bring it in-line with international standards, and embrace the potential of emerging and established digital technologies will be key to improving both safety and efficiency of work on or near underground services.

A modern, high-fidelity ‘before you dig’ system could include the following characteristics:

Digital mapping: incorporating high quality GIS data through open sharing and leveraging data feedback loops to improve plan quality with ‘as built’ data.

Integrated data feeds: automatically connecting to and integrating multiple sources of data.

Standardised data formats: facilitating easy sharing and data quality checks with a system of data standards.

Automated risk intelligence: leveraging artificial intelligence to identify critical risks that are relevant to site and improving the quality of risk assessment and safety of work.

Transparency, not disclaimers: reducing the legal ‘clutter’ inherent within the current BYDA system and providing open and candid information with practical advice to maintain site safety.

Importantly, evolving the system to take advantage of latest technology, while also upholding high standards of security and reliability, would reposition BYDA from a document repository to a world-class safety-creating process: a system where safety decisions are based on up-to-date digital information combined with local expertise.

3.4
A Practical Path Forward

There is a clear way through this situation. But, success hinges on changing the status quo on how we all view, interact, and collaborate with each other as part of this ecosystem. If all stakeholders pull together, cooperate, and focus on the long-term benefits of change, we will improve safety, integrity, and ultimately, cost effectiveness and efficiency.

3.4.1
Legislative Changes

We recommend introducing specific provisions within Part 4: Hazardous Work of the model WHS Regulations to address risks associated with excavation and ground disturbance. These provisions should require:

1. Mandatory BYDA enquiry before excavation or ground penetration.
2. Verification of asset locations using potholing or non-destructive excavation.
3. Risk assessment and control plans for buried infrastructure.
4. Competency and training requirements for those performing excavation.
5. On-site evidence of asset location and controls.

This would align Australia's WHS approach with international best practice models such as the Canadian Common Ground Alliance Best Practices and the U.S. Common Ground Study.

Managing utility risks requires shared accountability. We recommend that consultation duties under section 46 of the WHS Act explicitly reference consultation with utility asset owners when planned work may affect their networks. This would formalise a critical control already recognised in industry best practice.

We also recommend legislating minimum data standards for asset owners (such as leveraging AS 5488 and subsurface utility engineering practices), mandating the need to share GIS layer data with BYDA, and having appropriate processes in place to receive and act on location data supplied by field workers.

3.4.2
Technology & System Changes

BYDA's data provides unique national visibility into systemic utility safety trends. We recommend formal mechanisms for data integration and reporting between regulators, Safe Work Australia, and BYDA to:

- Target enforcement and education based on incident patterns.
- Identify sectors and regions with persistent non-compliance.
- Measure long-term effectiveness of WHS reforms.

We recommend BYDA explore the use of end-user profiles (e.g., homeowners versus commercial constructors) to ensure that provided data is clear and interpretable to the different stakeholders engaging with the service.

3.4.3
Awareness & Capability Changes

We recommend embedding utility risk management as a core unit of competency across relevant construction, civil, and trade qualifications. Harmonised training standards will ensure consistent understanding of excavation and trenching hazards.

The existing codes of practice available for excavation and trenching safety would be enhanced through review and incorporation of specialised information already developed by the Canadian Common Ground Alliance Best Practices document.

3.5
A Commitment Challenge

In this report we have shared a disturbing 'current state of play' for excavation and trenching in Australia. The question is no longer whether improvement is possible. It is whether current service strike rates are acceptable.

Our laggard legal framework means that there are only weak mandates to engage with 'before you dig' services. Without these guardrails and boundaries, what teeth do we have to ensure at least the bare minimum is done?

An ageing and ineffective referral system desperately needs modernisation through leveraging digital technologies and industry data sharing, transparency, and collaboration. Without GIS layers, user-friendly and dynamic interfaces, and applicable and practical information, how can frontline workers use safe practices?

A legally-oriented, liability-focused, and adversarial environment for asset owners, contractors, and subcontractors mean that service strike safety is the only loser: responsibility is pushed down to the lowest level. The 'paper-safe' approach to service strike prevention and focus on compliance (safety work) over practice (the safety of work) will only leave asset owners, clients, and principal contractors liable when something does go wrong.

Governments, regulators, asset owners, and industry leaders are invited to publicly commit to the reforms outlined in this report. If these reforms are not progressed, stakeholders should be transparent about the level of service strike risk they consider acceptable, and why.

We can do better here. By resetting the emphasis to safety and service integrity, rather than shifting the responsibility, work will become safer and more efficient.

In short, serious underground service strikes are an insidious, hidden problem that we are just waiting to happen. This report has set out what must change, who must act, and why continued inaction is no longer defensible. If a major service outage or fatal incident occurs in the future, it will not be because the risks were unknown, but because known weaknesses were left unaddressed.

BYDA can enable reform, but it cannot carry a system it does not control.

The responsibility now sits with those who hold the power to change the conditions that create the risk.

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Appendix

Project Approach

Background peer-reviewed academic literature was search and summarised, with leading causes of service strikes mapped onto a multilevel framework. Causes that originate at each level (e.g., societal, government, industry etc.) were identified as the starting point. Then, this information was used to create interview questions used in the consultation process. Interview notes were analysed and themes extracted, resulting in a richer understanding beyond the academic scan. An international benchmarking review provides comparisons with best practice across the globe in legislation, regulation, and provision of before you dig services. The final research activity involved two separate online surveys; one for asset owners (staff employed by organisations involved in the construction, operation, and/or maintenance of utility services) and 'end users' (people who engage with BYDA-supplied information to design, plan, and perform excavation and trenching works).

In total, 20 individual interviews were conducted with stakeholders across the work system, including: BYDA representatives, asset owners and managers, and contractors. Further consultation was carried out through attendance at BYDA-organised virtual industry networking forums, whereby initial findings were discussed and validated, and ideas regarding potential solutions explored.

For the surveys, 78 asset owners participated, which were drawn from primarily local councils (26%), water (21%), and electricity (12%) sectors. A sizeable percentage (27%) of asset owners represented 'other' industries not listed such as state government.

The end user survey included 135 respondents, from the following contexts: civil construction (31%), utility locating services (22%), engineering (11%), commercial trade or construction (9%), consultant (3%), surveyor (3%), and utility contractor (2%). Approximately 16% of the end user sample selected 'other', with responses including WHS personnel, self-employed business owner, and training/ assessment professional.

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