IMPROVING ACCESSIBILITY OF TRAILS AND CAMPGROUNDS

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ABSTRACT

New Zealand's conservation estate includes many campgrounds and walking trails that are at least partially accessible to people of all ages and abilities. Previous work has been done to assess the accuracy of the accessible information provided on the Department of Conservation's website. However, it is known that some of this information is inaccurate as updates are not always made following weather events and changes to the condition of the experience.

A smartphone-based system was used to conduct a physical audit of over 50 locations against the newly published Recreation Aotearoa outdoor accessibility design guidelines. The data capture included gradient, crossfall, roughness, stair locations, and many other parameters. Photos and descriptions of infrastructure and points of interest particular to the disabled community are automatically generated using AI algorithms and checked by humans through a "tagging" process. Location-specific and a national map display the information, which is also used in a navigation map that enables people to select the experiences most suitable for their particular mobility needs.

The audits are informing a prioritised capital programme that describes the improvements required to lower the barriers to participation in the most popular locations.

INTRODUCTION

Relevance to transportation engineering and planning

Transportation networks serve many trip purposes and some links in the network are more tourism and recreation oriented than others. A tourism and recreation focused road link such as SH94 Milford Road and a high-use campground or pedestrian trail are all key nodes or links in the network, just for different travel modes. This paper illustrates the extension of urban pedestrian planning and design principles and audit methods to the recreational back country parts of the network.

Project background

New Zealand's conservation estate includes many campgrounds and walking trails that are at least partially accessible to people of all ages and abilities. Previous work has been done to assess the accuracy of the accessibility information provided on the Department of Conservation's (DOC) website. However, it is known that some of this information is inaccurate as updates are not always made following weather events and changes to the condition of the experience.

Audits were conducted to inform a prioritised capital programme that describes the improvements required to lower the barriers to participation in the most popular locations. Thirty-one sites with over 50 individual experiences (campgrounds, trails, paths) were selected to represent high visitation locations across the country. All sites were defined as "walking" experiences and not suitable for cycling. Future work may include extending the audit methods to shared use trails.

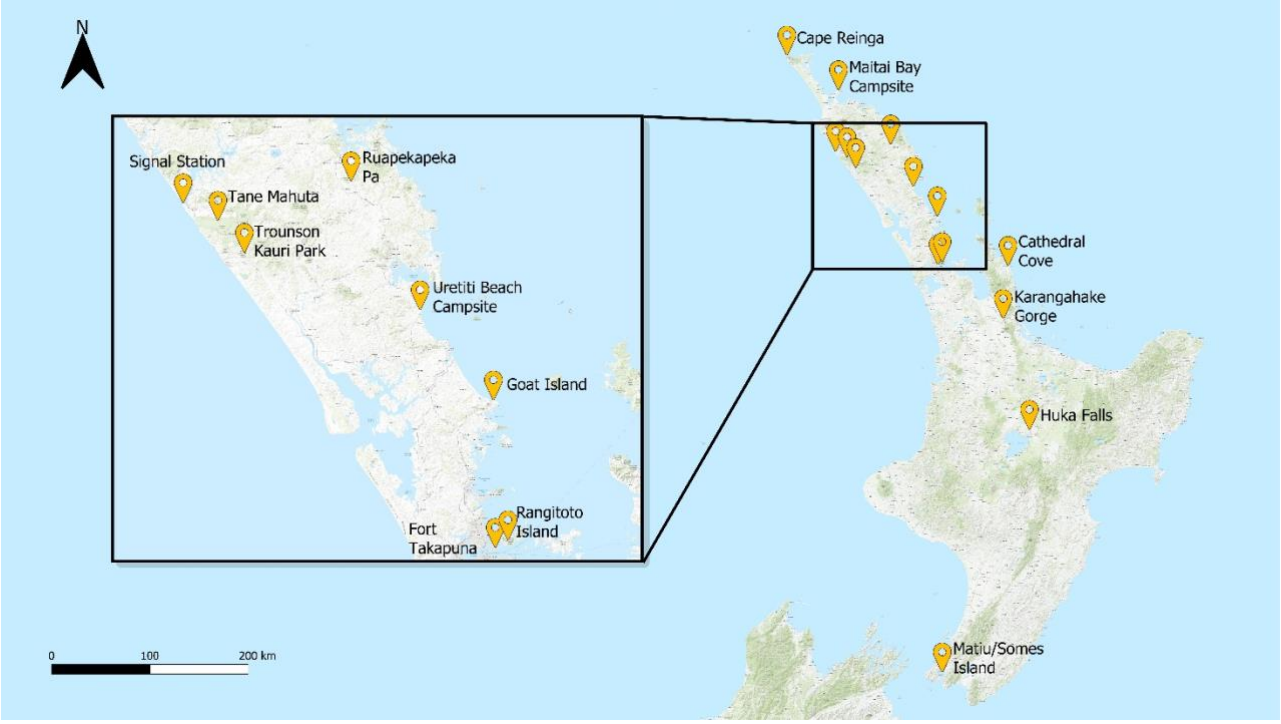

Figure 1: Audit locations on North Island

Figure 2: Audit locations on South Island

Accessibility is more than just whether a wheelchair can be used. Different users have diverse needs – vision impairments, the use of mobility aids such as wheelchairs, walking frames or a white cane, neurodivergence, and considerations for those travelling with young children – and combinations of these and other traits.

Rather than trying to say a facility is accessible or not, the aim is to provide information that allows people to make their own choices on whether to visit.

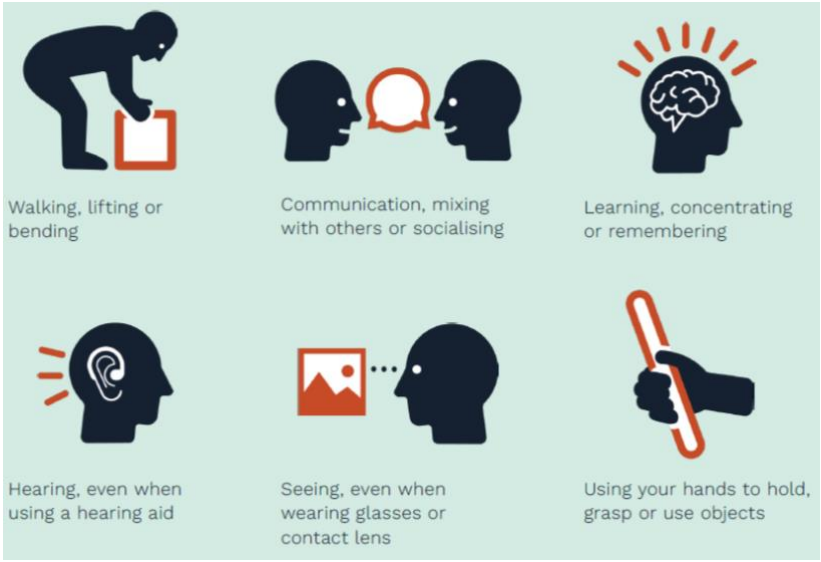

Figure 3: Common types of impairments (Recreation Aotearoa OADG)

For example, many of the DOC experiences lack information that could help the public determine how far they will be able to go at each location before reaching a barrier. At the pilot audit location, Kura Tawhiti Canterbury, the track is wide, smooth and well graded – but only for the first half of the experience. Currently, people have to guess and discover how far they can go, and then turn around on a narrow and busy track.

The audits created information that will be provided to the public so that individuals can determine for themselves whether a particular experience is accessible.

Figure 4: a member of the public on the Kura Tawhiti (Castle Hill) walk - the pilot audit site

This paper begins with a brief review of accessibility related guidance within New Zealand, then describes the methods used for the DOC project, and concludes with initial findings of the first few audits.

TARGET AUDIENCE

The principal guide of relevance to this project is the recently published Outdoors Accessibility Design Guidelines (OADG) (Recreation Aotearoa, 2025b). The Department of Conservation was a contributor to these guidelines, and one project objective was to align the audit process and resulting recommendations with them. The guidelines describe all forms of mobility assistance devices including walking frames and wheelchairs through to the highly capable e-MTB trikes that can climb steep gradients, traverse rough terrain, and are now opening up new outdoor opportunities for people who cannot walk.

Figure 5: Types of equipment and supports (Recreation Aotearoa OADG)

The wide variety of assistive devices makes definition of what is permitted on any given DOC

walking trail difficult. Many of the audit sites will by their topography and natural or cultural context never be suitable for cycles of any type. The main issue is that walking trails are typically two-way with constrained forward visibility, so catering for higher speed travel will not be possible unless new separate cycling trails can be developed.

However there are still improvements that can be made for people using devices that have a maximum speed compatible with pedestrians. This speed was not defined in the project, and will need to be considered by DOC when determining permitted devices, creating signage, and the practicability of enforcement.

Therefore, the audits focused on identification of the barriers quantitatively (such as but not limited to maximum gradient, crossfall, surface type and condition) and sought to classify the experiences according to the A0 – A3 specifications in the OADG (Figure 6).

NZCT		NZCT 1		
RA MTB grading		RA Grade 1		
DOC cycle track		DOC Grade 1		
Track standard SNZHB 8630:2004	SNZHB 8630:2004 **Path for PWMD**	SNZHB 8630:2004 **Short Walks**	SNZHB 8630:2004 **Walking Tracks**	SNZHB 8630:2004 **Easy Tramping Track/Great Walk**
Specification	**A0 All Abilities – Easiest**	**A1 All Abilities – More Challenging**	**A2 Inclusive Walking Trail - Intermediate**	**A3 Inclusive Easy Tramping Trail | Great Walk - Advanced**

Figure 6: Defining accessibility is very difficult - the OADG outlines one simple classification

EXISTING GUIDANCE

The OADG provides useful measures for audit purposes. It defines the top six factors people with impairments consider when choosing a trail activity. In order of importance, these are:

1. Trail structures (barriers, gates, bridges, steps, fences, ditches)
2. Trail surface
3. Trail gradient
4. Trail camber
5. Trail length
6. Trail width.

The OADG recommendations need to be considered alongside the Track Service Standards (Standards New Zealand, 2004) that are used by DOC to:

- Define visitor groups and associated track requirements; all audit sites cater to the Short Stop Traveller (SST) and the Day Visitor (DV).
- Design paths, tracks and structures; the focus of the audit sites was on paths in and around campsites or to major destinations (Cape Reinga, Tane Mahuta) or short walking tracks.
- Set minimum dimensions for “paths for people with mobility difficulties”; many of the audit sites do not currently meet these dimensions.

Interpretation elements need to be of a sufficient font size and if multi-media at a position that can be reached by a person in a wheelchair (Department of Conservation, 2005). Although technology has advanced markedly since 2005, the standard suggests the following considerations that remain relevant and useful:

- *Develop multi-sensory experiences.*
- *Provide an audio option e.g. a CD player, listening post, or panel with sound.*
- *Create clearly structured text with big headings or provide a large print brochure*

- *Think of colours. Many people are red/ green colour blind; yellow is the last colour to remain when sight loss occurs; dark colours on a light background are the most clear. Use white instead of a photo background.*
- *Create tactile interpretation such as maps and models; a winner for everyone.*
- *Place signs at appropriate heights and for best light.*
- *Make a simple step to give short people and children better viewing.*
- *Make sure information about what is accessible for everyone is available. A simple list in visitor centres and on the website may suffice.*

Urban guidance such as the Building Code Clause D1 Access, NZS 4121:2011 Design for Access and Mobility – Buildings and Associated Facilities, NZTA Urban Design Guidance, Auckland Council Universal Design Manual, NZTA Pedestrian Network Guidance and Austroads Guide to Road Design Part 6A are less applicable in the campground and trails context but fill-in whenever the preceding three documents don't have explicit guidance.

Other guides such as the NZ Mountain Bike Trail Design Guidelines (Recreation Aotearoa, 2025a), the Adaptive MTB Basics of aMTB Accessible Trails Guide (AdaptMTB, undated), and the Accessible Cycling Infrastructure Design Guidance Note (Waka Kotahi NZ Transport Agency, 2024) may be useful for future audits but were not consulted in this project due to the site selection orientation towards walking rather than shared use.

AUDIT METHODS

Technology

A smartphone-based system was used to conduct a physical audit of over 50 locations against the newly published Recreation Aotearoa outdoor accessibility design guidelines.

The Access Cart (Figure 3) is 3D printed and mounted on a radio control car chassis. Upgrades over the model originally designed for urban footpaths included larger wheels and tyres, stiffer springs, a redesigned body for easier carrying and secure phone mounting, and improved metal-reinforced pusher stick. The current version is sturdy and rolls over most obstacles encountered, although no wheeled device can make it over the volcanic scoria of the tougher Rangitoto Island tracks or over the many steps encountered throughout the DOC estate.

The data capture includes gradient, crossfall, roughness, stair locations, and other parameters. Photos are recorded at a rate of one per second. A key feature is the ability to record data with or without an internet or mobile data connection; all data is recorded with GPS coordinates and synced when a connection is available.

After data is uploaded to the cloud, a tagging process is undertaken in the backend. Data is smoothed to obtain average gradient and crossfall over 10 m segments. Selected representative photos and descriptions of infrastructure and points of interest particular to the disabled community are automatically generated using AI algorithms and checked by humans.

Figure 7: The Access Cart upgraded for trails use with a stronger body, suspension and larger tyres

The software also went through a continuous improvement process and re-calibrations to match the changing cart characteristics and accommodate the large files generated.

Additional information was recorded using ArcGIS FieldMaps and added to a web map with locations and routes of all audited tracks and campsites and the audit findings. Point features contain the recorded information which can be accessed by selecting a point. This opens a pop-up containing the information and photos. A photo viewer application enables users to see all recorded photos at once and by selecting a photo they can access the recorded audit findings. Zooming in and out of the map will make more (or less) points and photos visible.

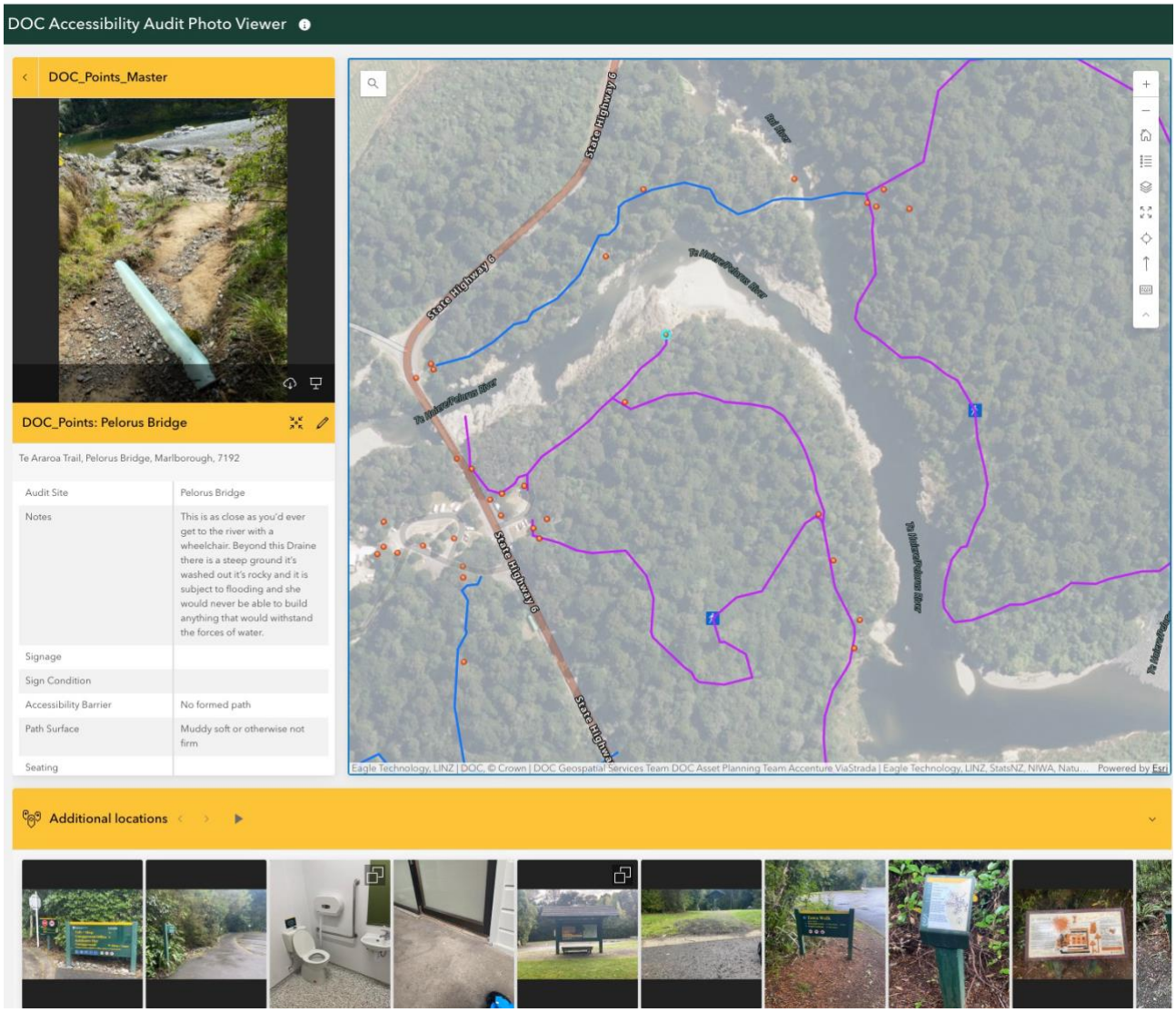

Figure 8: Full screen view of the Photo Viewer application

The information is displayed on a national map and on location-specific maps. It is also used in a navigation map that enables people to select the experiences most suitable for their capabilities.

The technology has been developed to be easily repeatable and the data refreshed in response to changing conditions such as storm damage. Any smartphone will work, and DOC will receive six trail-optimised Access Carts for follow-up auditing.

Data management

Data collected during the project is used in different ways as shown in Figure 9.

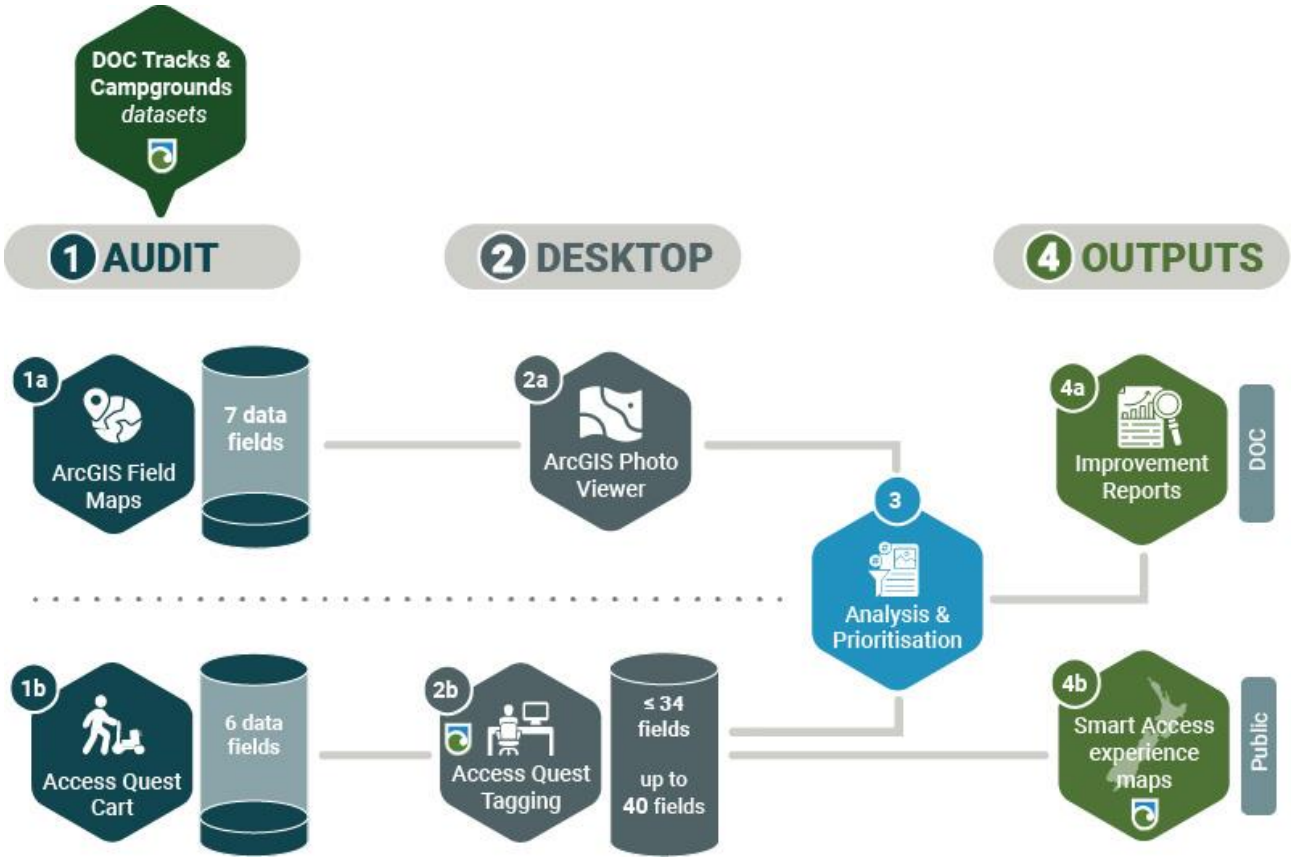

Figure 9: Data management schematic

Usage and limitations

The features have been mapped to inform priorities for infrastructure investment to make walks more accessible for more people. Accessibility features affect everyone's experience, and can make a journey possible, or not, for many, particularly for disabled people. Given the subjective lived experience of every potential visitor, we aim to provide information for people to make their own decisions about whether or not to embark on a walk, and in some cases, for how much of it to attempt. There is no way to know which combination any individual might need. We have made assumptions about the improvement priorities in each location based on our experience working on transport and inclusion in a variety of contexts.

FINDINGS

Existing trail features and facilities

The audit process enabled the quick production of gradient (Figure 10) and cross fall/camber figures that would take much longer to develop using other methods such as LiDAR. With this data available to users, they can make more informed decisions when selecting their next outdoor experience. Both the average (presented in a range bin) and the maximum gradient offer vital context. For example, the Tōtara Walk has a maximum gradient of 6.86° (12% or 1:8 slope). That section is short and most of the walk has a shallower gradient. From this information, one user might assess the maximum gradient for the Tōtara Walk as too steep, while another user might consider the walk an acceptable challenge as it is steep only over a short distance. Future work that investigates accessibility challenges for shared paths and trails will need to consider the differing needs of those using wheeled devices, and in particular, powered devices that can comfortably handle gradients of 8° or higher.

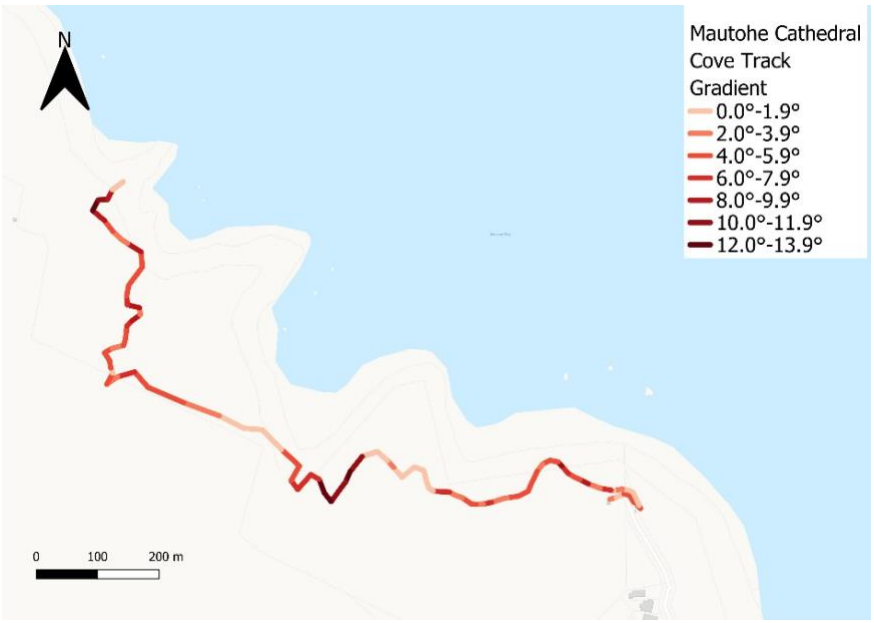

Figure 10: Typical output: a gradient map (for internal use to determine possible track improvements)

Data includes photographs and notes detailing surfaces, structures (such as bridges or steps), and a range of features and facilities such as orientation panels, accessible toilets, mobility car parks, and bench seats (Figure 11). The audits showed that many short walks and campsites do not have SOS – Safe, Obvious and Step-Free routes (NZ Transport Agency, 2025). Few sites had baby changing tables, rubbish bins, water fountains, or seating outside toilets for people waiting on other members of their party. By adding such facilities, experiences become accessible to a wider range of users.

Figure 11: Typical conditions photo showing the presence and condition of a feature or amenity – in this case a ramp that has a buildup of sand before reaching the beach

Trail length and width were assessed, rounding out the top six factors that people with impairments consider when choosing a trail activity per OADG guidelines.

Recommendations

The audits also revealed that while entire experiences may never be accessible for everyone, there

are logical "turnaround" points at scenic locations (Figure 12) that could be improved and added to orientation boards, maps and wayfinding signs. These locations offer most of the views and experience of the full routes without steps and within much shorter walk times.

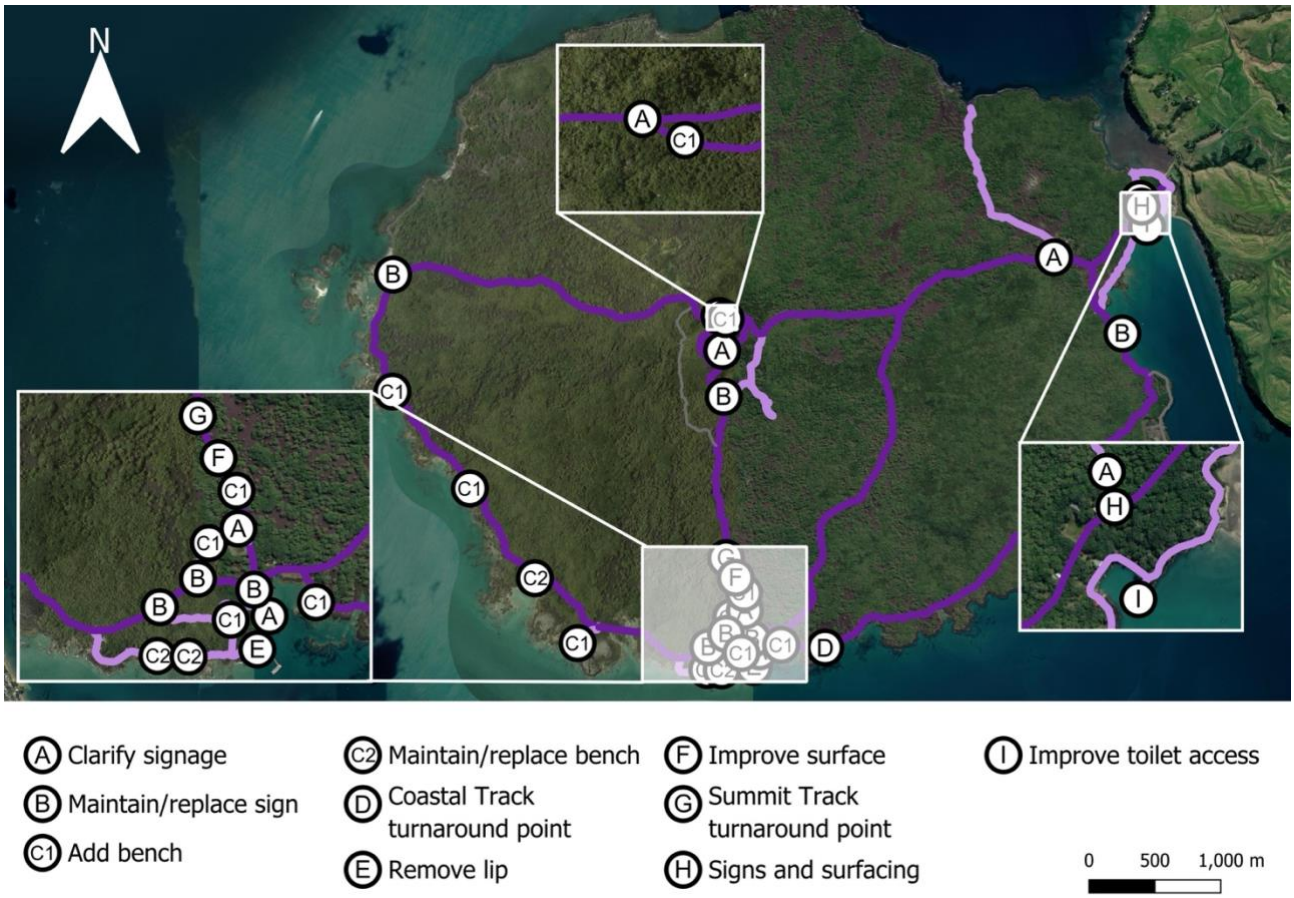

Figure 12: Rangitoto Island has two shorter segments of the Summit Walk (G) and Coastal Track (D) that have no steps

Key findings and recommendations from a selection of the audited sites follows in Table 1. The comprehensive site reports include maps, photos, summary data, and rough order costings.

Table 1: Example key findings and recommendations for five of the 30 sites

Site	Typical conditions and barriers	Key recommendations
Fort Takapuna Historic Reserve	<1.0 m wide broken concrete historic footpaths around the site. Rough surface carpark with potholes and no clear pedestrian circulation routes.	Retain historic fabric of site but undertake minor footpath repairs and build up grassed edges to eliminate trip hazards. Signpost the accessible route into the Officers Mess building and ensure edge of deck and ramp are a contrasting colour.
Rangitoto Island	Rough scoria surfaces especially on longer walks; many steps. Roads that form part of the walking network are on the ferry company's walking maps but not DOC maps.	Create and signpost shorter step-free routes on the Summit Walk and Coastal Track. Work with the ferry operator to clarify and publicise accessibility options.
Arai te Ura Signal Station	Exemplary interpretive boards but only accessible via steps. Barrier gates cannot be easily operated from a wheelchair. Steep cliffs with no signs / barriers.	Provide a ramp to access interpretive displays and a lever actuated gate. Provide steep cliff warnings at carpark and prior to first cliff adjacent to the path. Fill deep hole at the central path junction in

Site	Typical conditions and barriers	Key recommendations
	Protruding wooden peg and drain pipe hole in middle of path junction.	otherwise firm and well-formed path surface.
Kura Tawhiti (Castle Hill) Walk	Wide and firm crusher fines surface leads from the carpark to the base of the rock formations where a fork in the trail is not signposted. Left leads immediately to steps, while right enables a wheeled pedestrian to ascend to a better viewpoint with no flat area to turn around.	Provide additional information via wayfinding and/or the orientation board at the carpark on what parts of the path can be accessed without steps. Just prior to the first steep switchback (that cannot feasibly be improved due to the topography and geology), provide a level turnaround point with a bench.
Pelorus Bridge Scenic Reserve	Forest and river-view walks are complemented by a campground. More challenging sections have steeper gradients and roots or rough ground.	Fix the drainage issues in the Kanuka Picnic Area car park as water is ponding. Add mobility parking in both carparks so that users do not have to cross State Highway 6 on foot, or advocate to NZTA for a crossing facility.

Across all sites, five issues were often found: a lack of baby changing tables, water fountains/taps, QR codes (or other interactive signage); signage at trail forks, and many raised edges (Table 2).

Table 2: Five common features and why they matter – with page reference to the OADG

Feature	Why it matters
Baby changing tables	"No baby changing facilities in accessible toilets can be a significant barrier for some people. Baby change tables should not affect the manoeuvring space within the toilet facility, or block access to the transfer space beside the toilet. If provided, they should be in toilet facilities that are bigger than the minimum footprint, and not in the way of the entrance door…" (p. 137).
QR codes	"Adding QR codes to your sign is a useful way to share more information with trail users, if mobile service is available at your site … add a QR code to your trail signage that links back to your detailed online trail information or access guide. This keeps trail-users up to date with changes and allows the information to be downloaded to refer to during the trail journey." (p. 50).
Water fountains	"The fourth most important facility or service when choosing an outdoor recreation location is access to a potable water supply (drinking water). Drinking water, and water to help clean off wheelchair wheels, or adaptive/mobility equipment were frequently mentioned as additional services that would most improve the outdoor recreation experiences of survey respondents." (p. 156).
Lips / raised edges	"The most accessible bridge or structure can be inaccessible if the trail surface on either end erodes to create a rise from the trail surface to the structure greater than 25mm. This makes it very difficult for many wheelchair users to pass and can cause a trip hazard for many trail users." (p. 103). In the case of picnic tables and bench seats, the issue was often the built height of the concrete pad underneath and the surrounding land not being high enough.
Wayfinding at loops, forks, and minor paths	"Wayfinding and navigation in outdoor environments can be a significant barrier for people with impairments in the outdoors, particularly for people with vision or cognitive impairments. This challenge can be heightened for individuals with dementia or an intellectual impairment, who may have an increased risk of getting lost" (p. 57).

Table 3 presents a site-by-site breakdown of where key features were present and where there are opportunities to address raised lips/edges and lack of junction signage. This gives an overview of the prevalence of the features and issues. Green shading indicates that a positive feature is

present, and reddish shading indicates that there are barriers or issues to be improved upon.

Table 3: Key findings at each site, including features and opportunities

SITE	FEATURE				IMPROVEMENT OPPORTUNITY		
	Baby changing	QR code	Water fountain	Shelter	Fix lips on trails	Fix lips on furniture	Signage
Aoraki Mount Cook	**YES**	NO	**YES**	**YES**	**YES**	NO	NO
Blue Pools	NO	NO	NO	NO	**YES**	NO	**YES**
Cape Reinga	NO	NO	**NP-Tap**	**YES**	**YES**	NO	NO
Castle Hill	NO	NO	NO	**YES**	NO	NO	**YES**
Cathedral Cove	NO	NO	NO	**YES**	**YES**	NO	NO
Curio Bay	NO	NO	NO	NO	NO	NO	NO
Fort Takapuna	NO	NO	NO	NO	**YES**	NO	NO
Goat Island	NO	NO	NO	**YES**	NO	NO	NO
Godley Head	NO	NO	**NP-Tap**	NO	NO	NO	NO
Hokitika Gorge	NO	NO	NO	**YES**	**YES**	NO	**YES**
Huka Falls	**YES**	NO	NO	NO	**YES**	NO	**YES**
Kaikoura Peninsula	**YES***	**YES**	**YES**	**YES**	**YES**	**YES**	**YES**
Karangahake Gorge	NO	NO	NO	**YES**	**YES**	NO	NO
Lake Gunn	NO	NO	NO	**YES**	**YES**	**YES**	**YES**
Lake Matheson	NO	NO	NO	**YES**	**YES**	NO	**YES**
Maitai Bay	NO	NO	**NP-Tap**	NO	**YES**	NO	**YES**
Matiu Somes	**YES**	NO	NO	**YES**	**YES**	NO	NO
Milford Sound	NO	NO	NO	**YES**	**YES**	NO	**YES**
Momorangi Bay	NO	**YES**	**NP-Tap**	**YES**	**YES**	NO	NO
Pelorus Bridge	NO	NO	**NP-Tap**	**YES**	**YES**	NO	**YES**
Punakaiki	NO	NO	NO	NO	NO	NO	**YES**
Rangitoto Island	NO	NO	NO	**YES**	**YES**	NO	**YES**
Ruapekapeka Pā	NO	NO	NO	NO	NO	**YES**	**YES**
Ship Creek	NO	NO	NO	**YES**	**YES**	NO	**YES**
Signal Station	NO	NO	NO	NO	**YES**	NO	NO
Tāne Mahuta	NO	NO	NO	**YES**	NO	NO	NO
Tauranga Bay	NO	NO	NO	**YES**	**YES**	**YES**	NO
Tōtaranui	NO	NO	**NP-Tap**	NO	NO	**YES**	NO
Trounson Kauri Park	NO	NO	**NP-Tap**	**YES**	**YES**	NO	**YES**
Uretiti Beach	NO	NO	**YES**	**YES**	NO	NO	NO

*Notes. NP-Tap means non-potable water tap (treat before use). * At Seal Swim Kaikōura (not in the DOC estate).*

CONCLUSIONS

The technology and auditing methods have been designed to be simple for DOC field staff to use and repeat with changing conditions such as after storm damage repairs or capital improvements. The project has demonstrated how smartphone-based sensors and GIS technology can accelerate the process of accessibility auditing across a large number of sites, but has also revealed the many pitfalls in attempting to define accessibility or quantify benefits. The key recommendation is to present the "worst" data measures (steepest grade, narrowest trail) both in the existing conditions and after recommended improvements are made. Then members of the public can decide for themselves if the experience is within their capabilities.

Ultimately the audit recommendations must be balanced against financial costs and potential social, cultural and natural environment impacts of any improvements. An upgrade that is less expensive, offers clear benefits, and has few negative impacts is an easy choice. However, other recommendations may be more complex especially given the range of stakeholders involved in the natural and cultural environmental context.

To balance these challenges, the recommendations are to be prioritised using a cost versus benefit analysis, giving weight to a range of factors including estimated costs, anticipated benefits to users (the level of expected improvement e.g. major vs minor), and feasibility from an environmental impact standpoint. At the time of writing, the 30 draft reports are being circulated amongst the field operations staff for comment and input. A summary report, auditor's guide, and rough order costing table have also been drafted for departmental review.

ACKNOWLEDGMENTS

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