

Accessways

- on coastal sand dunes

INTRODUCTION

Vegetation is vital to the stability of foredunes as it traps and anchors sand blown from the beach, helping to rebuild eroded dunes after storms. Damage or destruction of the vegetation cover on dunes often caused by human-use can lead to wind erosion with loss of sand landward and the lowering of foredunes. This potentially leaves foredunes as a less effective barrier against wave attack (Beach Protection Authority of Queensland, 1981).

To prevent damage to dune vegetation and to give any damaged dune areas a chance to recover, it is often necessary to fence off the damaged or vulnerable parts of the dune systems and to provide formalised accessways or tracks from inland sites to the beach. This is especially necessary where human disturbance is likely to have a severe impact on vegetation cover on the relatively unstable seaward foredunes.

This article discusses the necessity and purpose of accessways on dune systems relating to human use, particularly pedestrian and vehicular traffic. It covers the types and designs of different accessway options. The article also provides specifications for a range of designs and layouts, practical installation advice, and relative costs of different accessways.

Fencing to guide beach users is an essential component of accessways and is briefly covered in this article as it directly relates to access. However, detail on fencing options and their construction is given in the Dunes Restoration Trust of New Zealand Technical Handbook Article No. 9.1.

**HELP PROTECT
OUR DUNES**

USE MARKED ACCESS WAYS

This will protect fragile dune plants



**ONEMANA BEACH CARE
THANKS YOU.**



ROLE OF ACCESSWAYS

Accessways are used to allow pedestrians and vehicles access in a manner which protects both the dunes and adjoining vegetation. While simple pathways through the vegetation cover exist on most dunes to give access to the beach, it does become necessary on moderate-to-high use beaches to formalise such accessways to continue to provide access but at the same time protect the dune and vegetation from damage.

Formalising accessways generally refers to some form of fencing and signage to direct and confine the movement of traffic. Some accessways may also involve wooden structures or other material for pedestrians to walk over. For most accessways, the design and construction requirements change along the length of the accessway from the relatively unstable seaward foredune to the semi-stable landward dune.

Seaward foredunes vs landward dunes

On the mobile frontal dunes, the design and materials used in accessway construction must be adjustable so that the accessway can accommodate sand accretion or erosion at the same rate as occurring on the adjacent parts of the dune. If accessways are not allowed to develop to the same height as

Options for managing access over unstable seaward foredunes where sand levels fluctuate (above) are different from accessways through more stable landward dunes (inset).

the foredune, they create low spots which cause wind funnelling and increased wind velocity which results in dune blowouts. Low spots formed in foredunes can also predispose the dune to increased wave damage from high seas.

Although not always necessary, 'sand ladders' or board and chain walks, that are maintained so that they remain on top of the fluctuating dune, have often been favoured for use on mobile foredunes as a flexible walkway in high use areas. These structures that can be managed to move with the fluctuating levels of the foredune to allow natural dune form and function to continue with minimal disruption. In contrast, the semi-stable landward dunes are not likely to require the same design and construction specifications to that of mobile foredunes.

Accessways over rear dunes are not likely to have major fluctuations in sand levels and therefore may require only minimal input into the provision of an access track and maintenance. As with foredunes however, monitoring will be required to ensure that traffic along the accessway does not lead to any windblown sand erosion.



Consultation and education

Constructing fencing or formalising accessways on beaches is often not readily accepted by longtime residents or visitors to beaches. This is particularly evident where there has been no or minimal management of dune vegetation and access in the past. However, with increasing pressure on our beaches and consequently increased destruction of dune vegetation and dune erosion problems, management of beach users in the form of fencing and formalised accessways is inevitable.

Management programmes of public areas, involve local communities and end users. It is essential when implementing new strategies to provide information on the ongoing effects of uncontrolled access over dune systems on both vegetation cover and sand stability, and the advantages of agreed management policies and actions.

Are accessways necessary?

Not all beaches will require formalised accessways to protect existing dune vegetation cover. Dune systems with light usage are not likely to have erosion problems associated with beach user access. However, as many of our beaches become increasingly used for recreation, it is inevitable that some form of protection is required.

There are many examples where foredunes have been destroyed by uncontrolled access and indiscriminate use. Damage to dune vegetation results from even moderately concentrated pedestrian or vehicular traffic. Without management, natural recovery can be slow or ineffective.

With loss of vegetation cover from trampling, wind erosion can be severe and result in loss of sand, including scouring, leading to funnelling by prevailing onshore winds. This can lead to major blowouts with sand deposited on vegetated dunes inland - all from a single uncontrolled informal pedestrian or vehicle accessway. These problems can occur on any dune system and can occur within weeks on dynamic exposed coastlines.

Hard structures on dunes – a dilemma!

Dune systems, and in particular the most seaward foredunes, are a flexible barrier of sand between the sea and the land. Dunes move up and down and in and out influenced by wave and wind action. While appropriate sand binding vegetation along foredunes acts to reduce these effects, particularly of wind, such vegetation cover has evolved to work with the flexible natural form and function of dunes.

Hard structures on foredunes and beaches however have a profound influence on the way winds and waves move sand.

While rock formations or headlands along sandy coastlines naturally affect sand movement, it is the effect of human-made artificial structures on dunes and beaches that can significantly influence wind and waves and in turn, sand movement and levels on beaches and foredunes. There are many examples of poorly designed and sometimes unnecessary structures on sandy coastlines such as concrete drainage systems, seawalls, and dumped rocks that have resulted in major changes to sand levels and movement.

Construction of formalised accessways such as wooden steps and viewing platforms at or near high water mark and over foredunes are hard structures that will potentially influence sand movement and natural dune form and function. Careful planning and care is therefore required in determining the objectives for such structures and in choosing practical design options that minimise impacts on wind and wave action on dune systems and beaches. This includes the use of structures that are designed to have a low wind resistance resulting in less accumulation of sand or scouring around large fixed objects.



Uncontrolled pedestrian accessways can become major erosion problems resulting in blowouts. The cover of native sand binders spinifex and pingao are easily destroyed by trampling allowing wind funnelling leading to blowouts and sand blown inland by onshore winds.

ACCESSWAY LOCATION AND DESIGN

Formalised accessways, including guiding fences and the various options for providing material or structures to walk on, can vary from simplified low-cost construction to elaborate expensive structures. In addition, careful consideration must be given to the location and alignment of accessways in order that they remain functional and do not initiate erosion.

Location

Pedestrian accessways must be located at points which:

- are convenient direct access for beach users from landward facilities such as carparks and road ends;

- give maximum possible protection to vegetated areas on the dunes;
- are practical to ensure ease of construction and safe access such as low sloping dunes with minimal risk of erosion;
- are isolated from vehicle accessways wherever possible, minimising chances of injury to pedestrians; and
- avoid high risk dynamic areas of dune systems such as near meandering river or stream mouths.

Where possible, accessways should be constructed where the public usually cross the dunes. Providing access at these locations will lead to greater public acceptance of the role of formalised constructed accessways.

A sufficient number of accessways will be required to cope with the numbers of beach users at the busiest time of the year, usually the summer holiday period. If there are not enough formalised accessways provided, or they are not conveniently located, the public will inevitably ignore any fencing or signage and walk over dunes to the beach. In more isolated and low-use areas, only a small number of accessways at greater distances may be sufficient compared to higher use areas.

Existing informal tracks can give an indication of 'desire lines' for establishing new or further accessways along dunes to prevent damage to dune vegetation. Access points may need restoration such as reshaping and planting with native sand binders if foredune damage has been severe. Alternatively the access track may need to be realigned to avoid the worst areas of erosion.





Alignment and layout

Choosing the most appropriate alignment and layout design for an accessway across the foredune is an important consideration (Figure 1). While accessways aligned at right angles to the dunes provide the shortest distance across the dune to the beach, this may not always be the best option if prevailing onshore winds are also in the same direction.

The aim should be to align the most seaward section of the accessway at right angles to the direction of the prevailing onshore wind. Where the prevailing wind occurs at an angle to the beach, a zigzag or angled accessway design is likely to be more effective than one aligned at right angle to the beach. Accessways aligned away from onshore winds are likely to reduce wind funnelling and scouring of sand along the seaward face of the foredune of the accessway and reduce accumulation of sand on the accessway further landward. Angles in accessways will be longer than straight routes over the dunes to the beach and therefore will require more design specifications, materials and construction time.

Beach-front property access

Accessways for beach front property owners can be problematic especially if there is an established culture of each owner using individual tracks leading from their property to the beach. While traffic is usually considerably less than public accessways, localised erosion especially along the foredune can be significant where these tracks exit onto the beach at or near the high water mark.

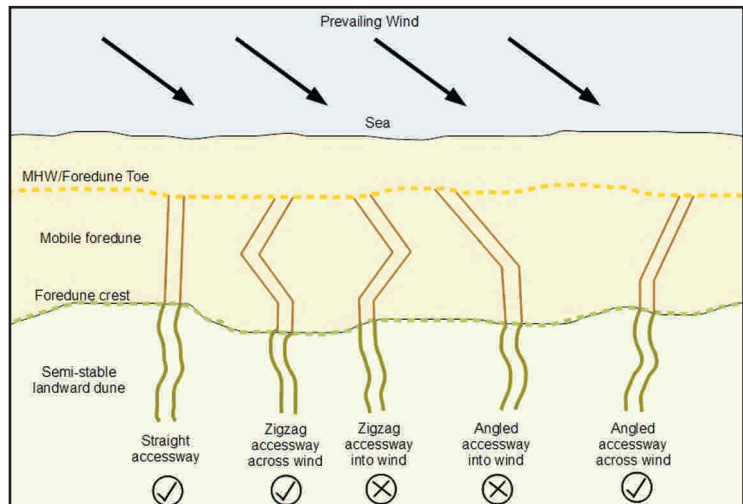
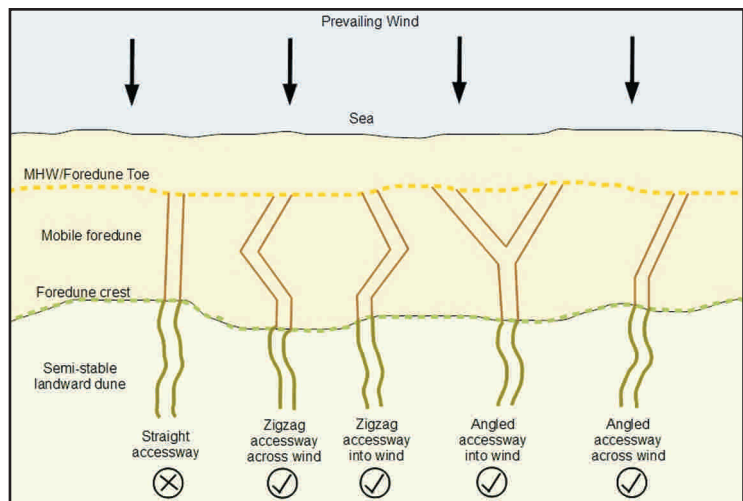


Figure 1: Alignment of accessways that avoid funnelling of wind-blown sand from the prevailing wind will reduce erosion at the toe and up to the crest of the foredune and reduce sand accumulation landward. Good and poor options for the alignment and layout of accessways are shown. Aligning at least the seaward end of each accessway perpendicular either to oblique prevailing winds (above) or to direct onshore winds (below) is likely to require less maintenance compared to aligning entrances at the foredune toe to prevailing winds.



Consultation with landowners, including discussion about localised erosion causing sand to blow inland and understanding movement of the foredune, is likely to lead to practical solutions that result in reducing the number of tracks across the dunes, and management to ensure erosion is not exacerbated. Sharing tracks or using nearby well-managed public accessways are options that generally suit most landowners.



CONSTRUCTING ACCESSWAYS

Fencing

Fencing on either side of accessways is usually necessary in high use areas, as traffic, if not controlled, tends to divert from the track. This is particularly evident with pedestrian traffic that will often stray onto adjacent mature or establishing dune vegetation.

Often accessways are fanned out to allow beach users a convenient shortcut to the beach (Figure 2). This can lead to an embayment or indentation in the vegetation cover along the toe of the foredune, where a continuous cover of native sand binding plants just landward of the high tide mark is most critical in maintaining a naturally functioning dune system. When erecting fencing to guide beach user traffic along accessways, it is therefore essential that fences do not splay outwards at or near the seaward toe of the foredune.

Where there is a board walk or other material provided for traffic use over the dunes surface, it is also essential that fences are constructed immediately next to these surfaces. A gap left between

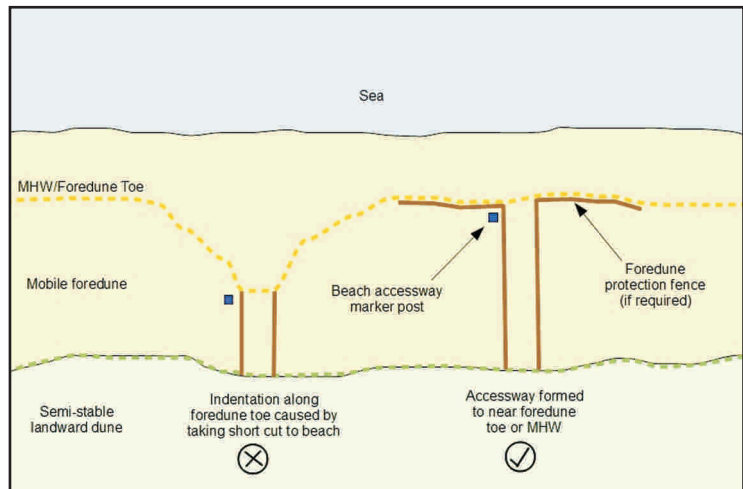


Figure 2: Accessways that end landward of the foredune toe encourage beach users to take short cuts that can lead to localised erosion problems and even the formation of a significant indentation of the natural line of sand binding vegetation along the toe of the foredune (left). Fencing along accessways should therefore be constructed to the toe of the foredune to prevent this damage (right) and may require at least short sections of fencing either side to help clearly demarcate accessway entrances/exits.

the fence and board walk can result in pedestrians selecting these areas to walk and can cause differential scouring as bare sand is blown away by wind.

In high-use areas, it is usually preferable to use a capping rail on fences either side of accessways, particularly along sloping sections. These can be used as handrails to steady pedestrians as they use the accessway. Inevitably, rails along fences will be used for sitting and standing on, so sturdy wooden rails with posts at regular intervals will be essential to reduce injury, as well as for maintenance requirements.



Fencing that splays outward at the toe of this foredune has caused a Y-shaped embayment along the seaward line of sand binding vegetation, even though the sand ladder continues down to near high water mark. Fences should be taken to the edge of the seaward vegetation to prevent beach users taking short cuts.



Ensure fences along accessways are placed immediately adjacent to board walks to prevent beach users creating erosion-prone bare sand tracks either side.



Slope

Construction of accessways with acceptable slopes is a major consideration as a large cross-section of the community will be using them (Soil Conservation Service of NSW, 1990). Accessways should conform to the slope of either the existing dune or the reconstructed dune where dune reshaping of a severely degraded foredune has been required. Flexible board and chain walkways can be constructed on foredune slopes up to 25° (or one vertical unit to three horizontal units) for pedestrians but slopes less than this will be required for regular vehicular traffic, especially in soft sand.

Surface materials

In order to protect accessways from wind erosion and the physical movement of sand downhill by feet or tyres, a protective cover is generally required on high use sites that permits ongoing access and prevents undue erosion (Soil Conservation Service of NSW, 1990). As discussed for unstable foredunes versus more stable landward dunes, different materials may be used for providing a surface for beach traffic, varying from board walks to wood chips or bark. Whatever material is used, it must be flexible so that it does not interfere with the natural dune processes where sand levels fluctuate.

On many high use areas, wooden boards bolted to chains that are flexible have been used successfully on fluctuating surfaces of foredunes, with wood chip or similar materials used on pathways on more landward relatively stable dunes. However, increasingly, due to the cost of installation and the ongoing commitment to maintenance, no surface material is used and bare sand forms the surface of the accessway. This method is particularly suitable to less dynamic dune systems and relatively level situations where sand movement is not likely to occur along the accessway.

Width

Depending on the site and intensity of use, pedestrian access tracks can vary from narrow tracks formed within the vegetation cover or if more formally fenced, to wider accessways that are likely to be more



Boards can be either half round posts or 100 x 50 mm timber bolted to galvanised chain. Half round posts can be placed with round side facing up or down as preferred by the local community.

practical if at least 1.2 m wide to allow two-abreast walking. Wider accessways of at least 2.4 m wide will be required for vehicular access.

Revegetation around accessways

Most accessways are usually constructed where there is already an existing track over the dunes to the beach. Continued uncontrolled access, especially in high-use areas, has usually led to degradation of the dune and vegetation cover to the extent that management is eventually required, involving formalising the accessway.

Severely degraded sites may need reshaping but most sites are likely to require planting with native sand dune plants to repair areas either side of the constructed accessway. This will help revegetate areas adjacent to the accessway that have been disturbed by previous uncontrolled usage as well as disturbance created by installation of the accessway.



CONSTRUCTION OPTIONS

Foredunes

Board and chain walkways

Board and chain walkways known as 'sand ladders' are designed to adjust to the changing profile of the foredunes, thereby preventing the lowering of dunes along accessways and the development of blowouts. Ease of access to and from the beach can be improved particularly in soft sand and on foredune slopes.

They are designed to be constructed from the seaward toe of the dune to the crest of the foredune to provide protection and traction for pedestrians. Flat hind dune areas need not have board and chain accessways.

When constructing pedestrian board and chain accessways, ease of use is a priority, including the type of boards used and spacing of boards that best meets beach user requirements (Figure 3).

While narrow spacing of flat boards may allow for more comfortable use by wheeled equipment such as baby buggies, these will require more materials and will be more difficult to keep on the surface as sand levels fluctuate. These options tend to have similar problems to fixed structures on mobile dune systems where they do not allow flexible movement of the dune profile.



Boards at narrow spacing, while necessary for wheeled traffic, will be more difficult to maintain compared to widely spaced board and chain options where boards can be more easily kept on the dune surface as sand accumulates.

Bare sand surface

Increasingly, low maintenance options for accessways over the mobile parts of dunes systems, even for high use areas, are being favoured. These are proving to be particularly successful on relatively sheltered beaches and where there are low foredunes. Careful planning and layout of the seaward ends of accessways may obviate the need to provide alternative walking surfaces such as board and chain structures, which are expensive to install and require constant maintenance.

Guide fencing, signage, alignment of the track exit on to the beach away from prevailing winds, and keeping a narrow track within a good cover of sand binding vegetation are likely to be practical lower-cost options to constructing a major board and chain walkway. However, such bare sand walkways will still require monitoring and where necessary maintenance or even changes in alignment if sand erosion does become a problem.



Accessways with bare sand are proving to be relatively successful especially for relatively sheltered low foredune situations.

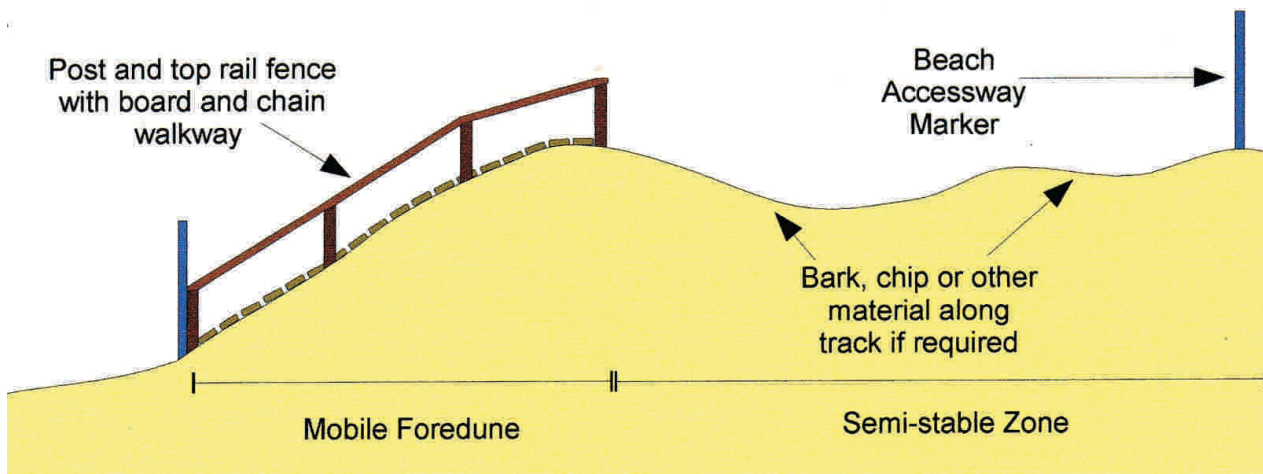
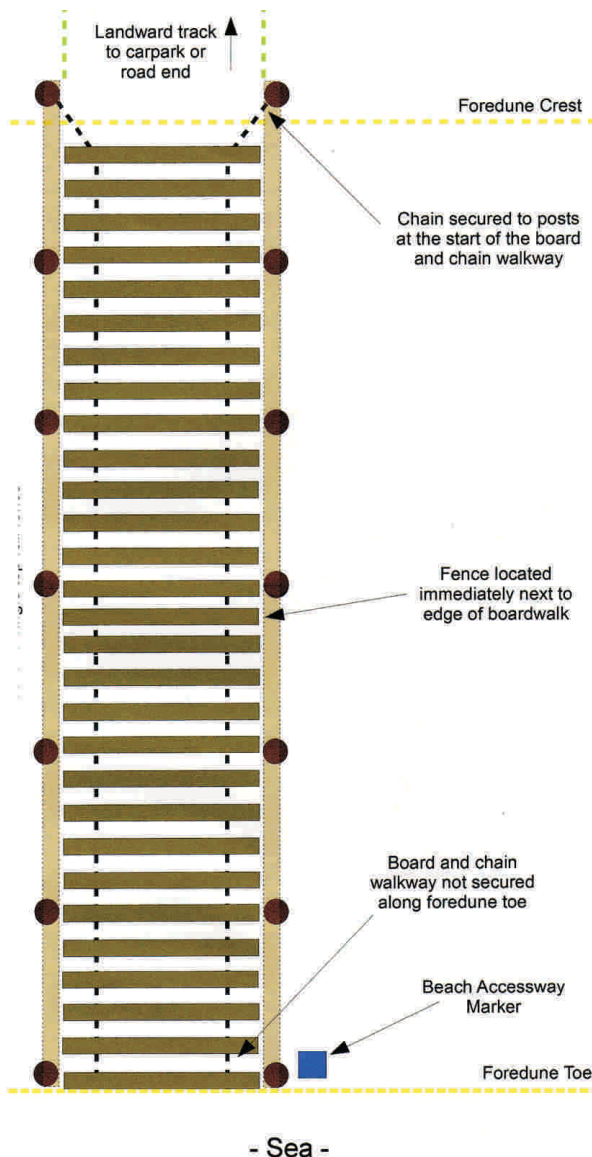


Figure 3: Board and chain walkways are generally only required on the seaward face of the fore-dune in high use areas. They should extend from the fore-dune crest to the toe of the dune at or near high water mark. Landward of the crest, where dunes are likely to be more stable than seaward parts of the fore-dune, a narrow track directly on the dune within dense vegetation is likely to be practical in most situations, although other material such as bark or wood chip can be used on flat sections to define the track. Fencing will be required particularly to guide beach users over seaward parts of the fore-dune and elsewhere where adjacent vegetation is likely to be destroyed. Marker posts at either ends of accessways are effective in identifying formal tracks to and from the beach.



Sand ladders are constructed from timber and chain (Figure 4). The ladder is anchored landward of the dune with no anchorage seaward. This provides for sand movement and creates a 'floating' effect. As provided by Bay of Plenty Coastcare Leaflet No. 8, the method for establishing a board and chain walkway is as follows:

1. Wrap the end of the chain around the top of the anchor post. Attach each chain with at least two staples.
2. Dig out any vegetation in the path of the ladder. Then level off the sand before running out the chain.
3. Bolt the first edged ½ round so it is level across the slope (this is VERY important).
4. Use a 200 mm spacer to get the right spacing for the steps. You may need to increase or decrease the spacing on one side slightly to go around bends on the track.

Figure 4: Board and chain or 'sand ladder' showing the wooden boards used for the tread linked by galvanised chain using galvanised bolts. Half-round posts have been favoured at many sites but 100 x 50 mm planks can be used, provided edges are smoothed to allow easy use with bare feet. Note that the sand ladder is attached to posts at the landward end usually at or near the fore-dune crest while the seaward end is left to 'float' up and down as sand levels fluctuate. Also note that the fences either side should be erected immediately adjacent to board edges to ensure beach users do not walk on sand either side of the boards and thus create erosion problems.



Solid boardwalks and steps

Solid boardwalks or steps are not recommended for the seaward end of accessways as these are highly vulnerable to erosion or exacerbate sand scouring. Beach levels can drop and seaward faces of foredunes can be cut back several metres, even during a single storm, leaving any structures severely undermined or completely destroyed.

While solid boardwalks are favoured by beach users with prams or wheelchairs, expectations of providing these structures over mobile foredunes are unrealistic. Nevertheless, boardwalks or low steps are found on relatively sheltered beaches and low foredunes.

Solid wooden structures, whether elevated boardwalks, viewing platforms, seats or steps, are best sited on the semi-stable landward zones.

Semi-stable dunes

Providing alternative surface material to loose sand is not necessary on most semi-stable landward dunes (Figure 5). Narrow sand tracks within a dense cover of vegetation are often a practical option.

Fine bark, wood chips, metal or other similarly locally sourced material can be used on flat areas to help delineate the track on more stable parts of the dune system. Such material is also likely to be less susceptible to wind erosion than leaving a bare sand surface in exposed areas, especially where adjacent vegetation cover is sparse.

Choosing materials that maintain or enhance the natural aesthetics of the



Solid wooden structures are only suitable for erecting on the more stable well vegetated landward parts of dune systems to provide access. However, ultimately most will become undermined, damaged or completely destroyed by wave action during high seas or major storms.

location, are comfortable to walk on with bare feet, last reasonably well, are cost effective to source and can be provided locally are likely to be acceptable to beach users and the local community.

Rigid materials such as asphalt, compacted clay and metal, or concrete should not be used on any parts of the dune systems where they can be buried by wind blown sand, have the potential to focus wind or waves that could exacerbate erosion, or where such materials can be undermined and damaged by wind and waves.

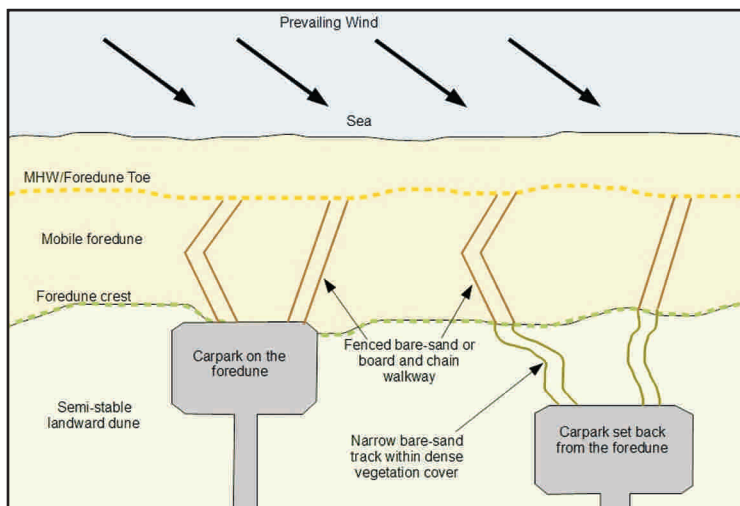


Figure 5: Length of accessways will vary depending on proximity of carparks and road ends to the beach. Where carparks occur on or near the foredune, the short accessways over the foredune can comprise fenced angled tracks (left). Where carparks are located landward, accessways can be via a significant length of track over undulating semi-stable landward dunes. A narrow bare-sand track within dense vegetation that may or may not require fencing is likely to be most practical leading to a fenced angled portion of track over the seaward face of the foredune (right).



MONITORING AND MAINTENANCE

It is important that all accessways be regularly maintained so that they continue to function correctly and they do not become a hazard to public safety. Board and chain accessways with broken, splintered or undermined boards require urgent repair as they can cause severe injury to pedestrians and damage to vehicles. There may be a need to temporarily close public access to board and chain walks or other wooden access structures in the interests of public safety if they are undermined by wave or wind erosion.

In areas where sand is accumulating, board and chain walkways require lifting so that the boards continue to remain on the sand surface. If this is not done regularly, the boards become so deeply buried that recovery without disturbing adjacent vegetation is extremely difficult and time consuming. In some situations, deeply buried boarded accessways cannot be easily recovered, thereby requiring complete replacement of the structure (Soil Conservation Service of NSW, 1990).

ACCESSWAY SIGNS

Simple signs or posts at both beach and landward ends of each accessway will encourage beach users to use formal access routes across dune systems. These can be as basic as a painted treated wooden post up to two metres tall erected on the back of dunes at carparks or road ends with a small sign indicating beach access. Similarly, an easily identifiable post at the toe of the foredune clearly identifies access points back to landward facilities.

Over long stretches of sandy coastline that have multiple entry points, some councils have numbers or adjacent street names routed on posts allowing beach walkers to identify accessways quickly. Keeping accessway signage basic and low cost reduces losses to vandalism. Posts at the seaward end can be easily lifted as the dune increases in height or

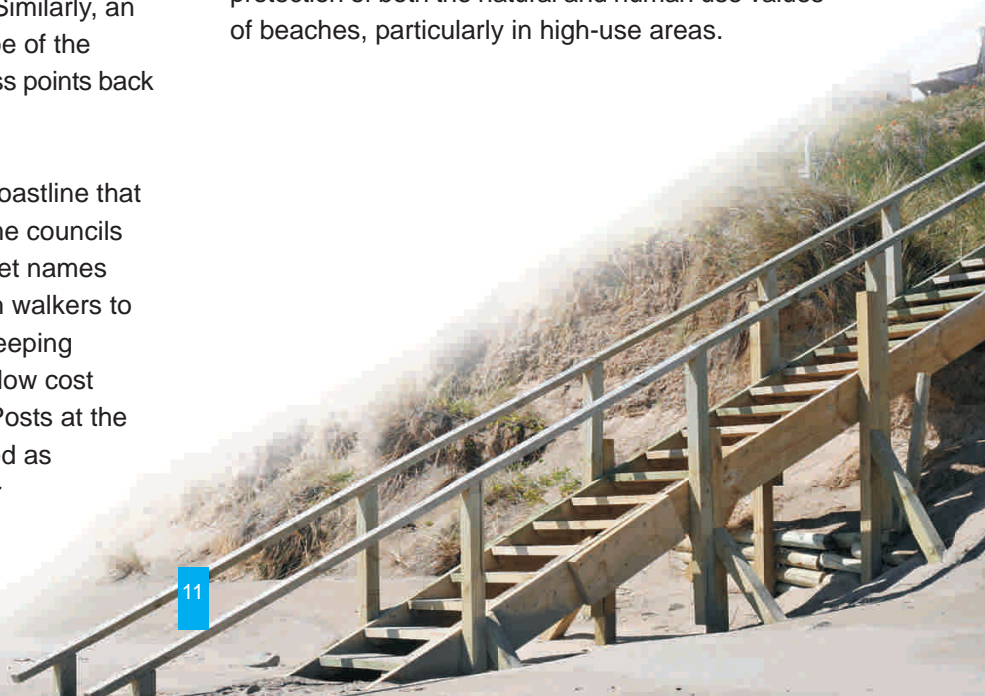
can be moved if the toe of the foredune becomes eroded landward or moves seaward.

EFFECTS OF CLIMATE CHANGE

Over the next few decades, climate change effects including sea level rise have the potential to considerably exacerbate hazard risk to coastal communities. The sea level has risen by 10-15 cm over the last century and projections are for this trend to continue and to accelerate for centuries, with potential for a relative sea level rise of 50-80 cm by 2100 (Ministry for the Environment, 2008). There will be more frequent and more serious flooding of low-lying coastal margins by extreme tides, storm surge and wave effects.

The potential for coastal erosion and flooding to be considerably accentuated by climate change effects further emphasizes the importance of restoring and maintaining wide natural dune buffers along the seaward margin of coastal development (Ministry for the Environment, 2001). It is therefore essential that a good cover of appropriate native sand binding vegetation is maintained on foredunes to ensure natural dune building and repair after storms or high seas (Dahm et al., 2005).

With increasing development and usage of beaches, dunes inevitably become severely degraded and it is uncontrolled access that is one of the major causes of this degradation. Management of well-used beaches including establishment and maintenance of formalised accessways is therefore critical in the protection of both the natural and human use values of beaches, particularly in high-use areas.





MAINTAINING ACCESS – AN EXERCISE IN FUTILITY!!!

Storms or high seas that result in significant erosion of the foredune can create major challenges for maintaining access, particularly where coastal dunes may be retreating landward naturally or where development is too close to the sea. If permanent shoreline retreat is not occurring and there is a well-managed dune of native sand binding vegetation, natural dune repair is likely to occur over several months or more between storm events. This should result in the return of sand to the beach, the build up of an incipient dune at or near high water mark, and a gentler sloping foredune.

Where this does not occur, there are no practical options for maintaining accessways over steep foredunes where there is likely to be continued erosion and significant changes in the dune profile from further wave action or from wind. Alternative accessways either end of the most dynamic sections of erosion-prone foredunes is likely to be the only option in the short to medium term.

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