Rialtas na hÉireann
Government of Ireland

NTA
Údarás Náisiúnta Iompair
National Transport Authority

ACTIVE TRAVEL

Cycle Design Manual

Geometric Requirements

October 2023

Geometric Design

Guiding principles

- A well-designed cycle route alignment will manage speed and be easily understood by cyclists.

- Minimum geometric design criteria for horizontal and vertical alignments provide a comfortable cycle, however where space is available use it to provide a more comfortable and attractive cycle.

- Suitable visibility should be provided to ensure the safety of all users, especially on the approach to roads and crossings.

Design Speed

2023 Rás na mBan
Photo : Lorraine O'Sullivan

Design Speed

- Cycle speeds can vary significantly depending on location, vehicles and user.
- Generally urban cyclists travel between 15 and 25kph, with average free speed in the low to mid 20's.
- Designers should be providing for the everyday cyclists rather then the recreational sports cyclists.

Design Speed

Table 4.1: Recommended Design Speed

Circumstance	Design Speed
Standard design speed for all cycle facilities	30 km/h
On approaches to junctions and obstacles	10 km/h
Downhill gradients >3%	40 km/h
Downhill gradients >5% and longer than 150m	50 km/h

Why is Design Speed Important?

- Design speed defines how fast cyclists can travel along the route section without endangering their safety.
- High design speed means shorter travel times, and therefore increases the competitiveness of cycling.
- Consistent design speed reduces the need of braking and accelerating (comfort).

Design Speed – Changing Cycles

Micro Mobility – Vehicles, Specifications, Requirements and Restrictions

		Technical Specifications					Legal Requirements						Road Type usage					
Vehicle	**Type**	**MPV**	**Max Power (Watts)**	**Max. Speed**	**Pedalling required**	**Max. Weight (Incl. batteries)**	**EU-Type Approval**	**Registration**	**Motor Tax**	**Insurance**	**Protective Equipment**	**Driver's Licence**	**Public Roads**	**Footpath**	**Cycle Lane[1]**	**Bus Lane**	**National Roads**	**Motorways**
E-scooter	Low-power	No	400W	20Km/h	N/A	25kg	N/A	No	No	No	Advised[2]	No	Yes	No	Yes	Yes	Yes	No
	High-power	Yes	> 400W	> 20Km/h	N/A	>25kg	N/A	Not legal for public road use					No	No	No	No	No	No
Bicycle	Any	No	0W	N/A	Yes	N/A	N/A	No	No	No	Advised[2]	No	Yes	No	Yes	Yes	Yes	No
E-bike	Low-power /Pedelec	No	250W	25Km/h	Yes	N/A	N/A	No	No	No	Advised[2]	No	Yes	No	Yes	Yes	Yes	No
E-moped	L1e-A Powered Cycle[3]	Yes	1kW	25km/h	Yes	N/A	Yes[4]	Yes	Yes	Yes	Yes[5]	Yes[6]	Yes	No	No	No	Yes	No
	L1e-B 2-wheel moped	Yes	4kW	45Km/h	Yes	N/A	Yes[4]	Yes	Yes	Yes	Yes[5]	Yes[6]	Yes	No	No	No	Yes	No
Throttle e-moped[7]	*L1e-B Electric or ICE[8]*	*Yes*	*Any*	*Any*	*No*	*Any*	*Yes[4]*	*Yes*	*Yes*	*Yes*	*Yes[5]*	*Yes[6]*	*Yes*	*No*	*No*	*No*	*Yes*	*No*

[1] Cycle Lanes should be used where provided over other road types.

[2] Safety equipment is recommended and strongly advised – Bicycle Helmet and Reflective High-Visibility clothing.

[3] A Powered Cycle is also known as a Speed Pedelec or an S-Pedelec.

[4] Appropriate vehicle EU Category L type approval required - Annex I - Vehicle Classification.

[5] Safety equipment is legally required – Motorcycle helmet. Reflective High-Visibility and protective clothing is recommended and strongly advised.

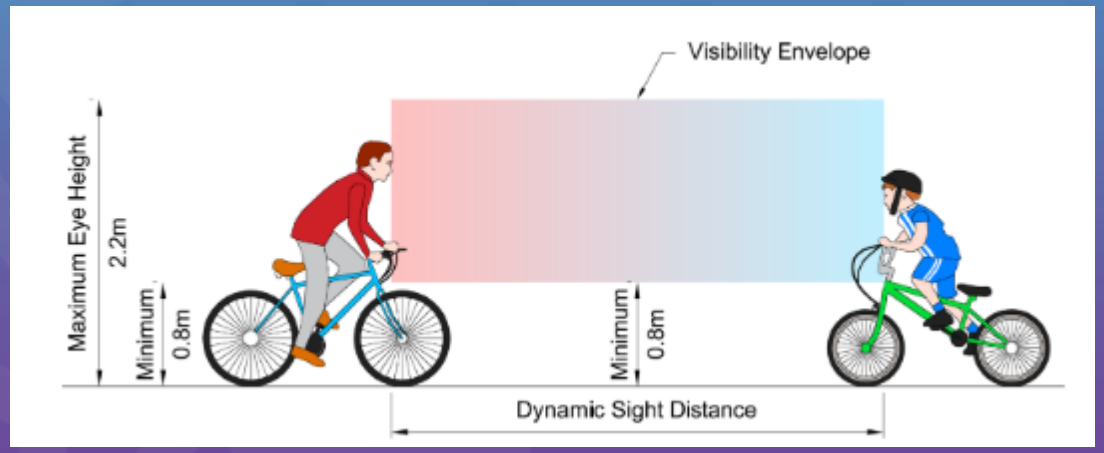
[6] Appropriate Category A Driving Licence is required - Types of driving licence categories in Ireland (rsa.ie).

[7] A power assisted bicycle where power is provided by a conventional mechanical or an electric engine and where a throttle can be used **instead of** pedalling.

[8] ICE means an Internal Combustion Engine.

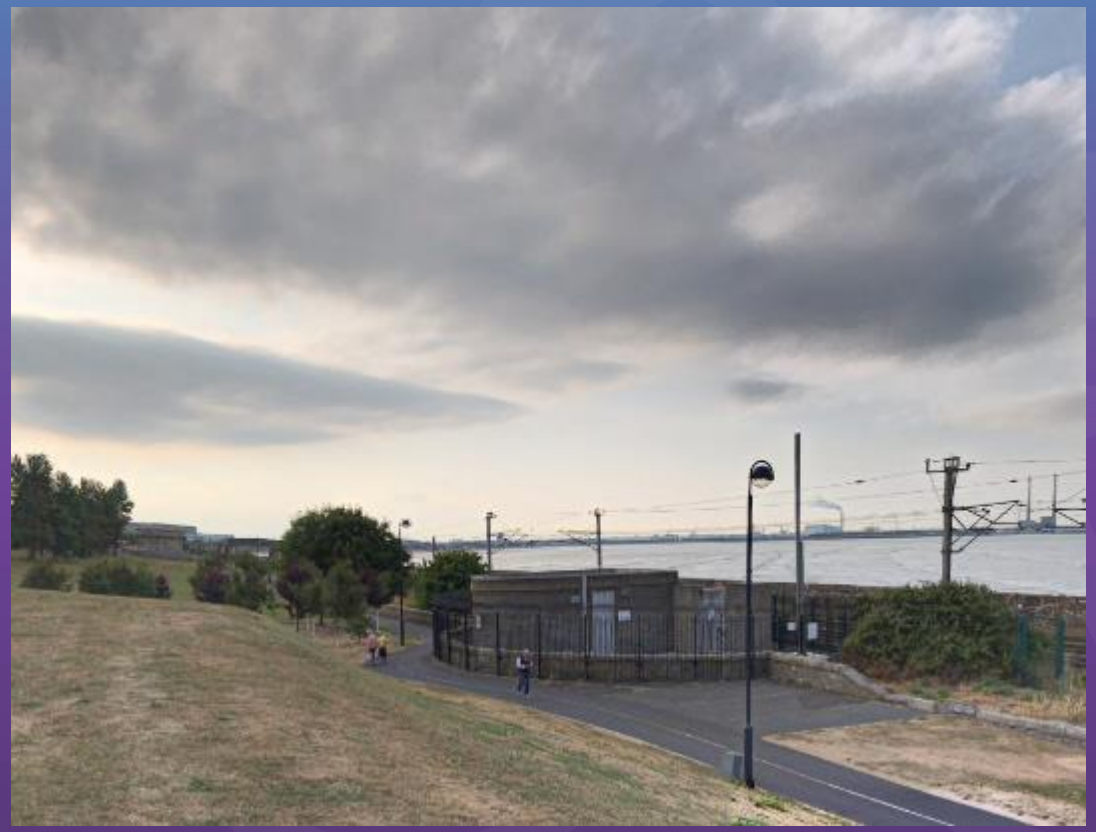
Dynamic Sight Distance

Dynamic Sight Distance Envelope



- The Dynamic Sight Distance is the advance distance a person cycling requires to see ahead so that they can make safe and comfortable progress on their journey.

Dynamic Sight Distance



Original Alignment

Revised Alignment

Horizontal Alignment

- A cyclist should be able to negotiate curves at design speed while keeping stable position in relation to the edge of the rideable surface.
- For most links the designer should be providing a desirable radii of 25m

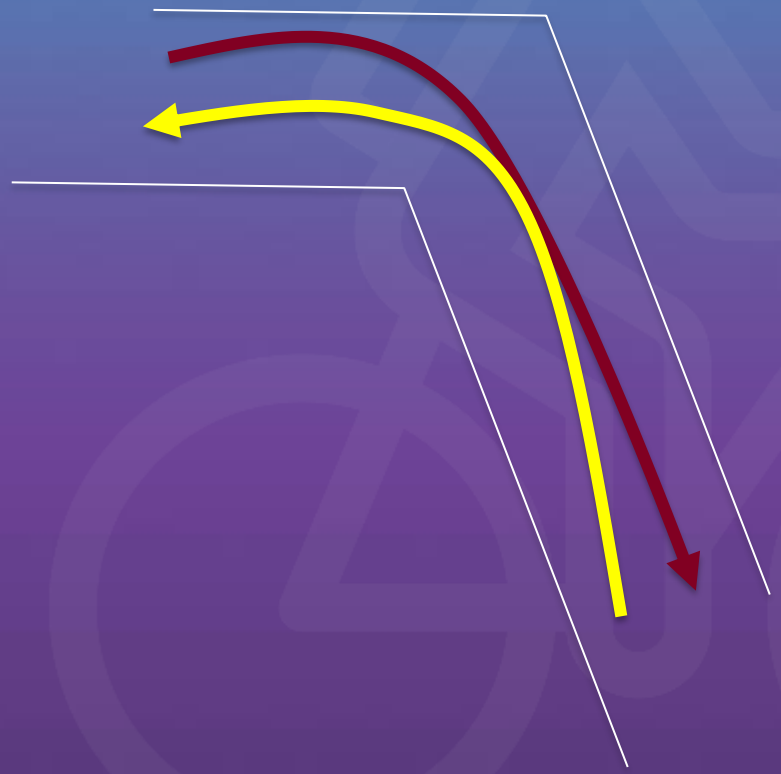
Table 4.7: Desirable Minimum Horizontal Radii.

Design speed (km/h)	Desirable Minimum Horizontal Radius
10	4 m
20	15 m
30	25 m
40	40 m
50	94 m

Horizontal Alignment – as a speed reduction devise

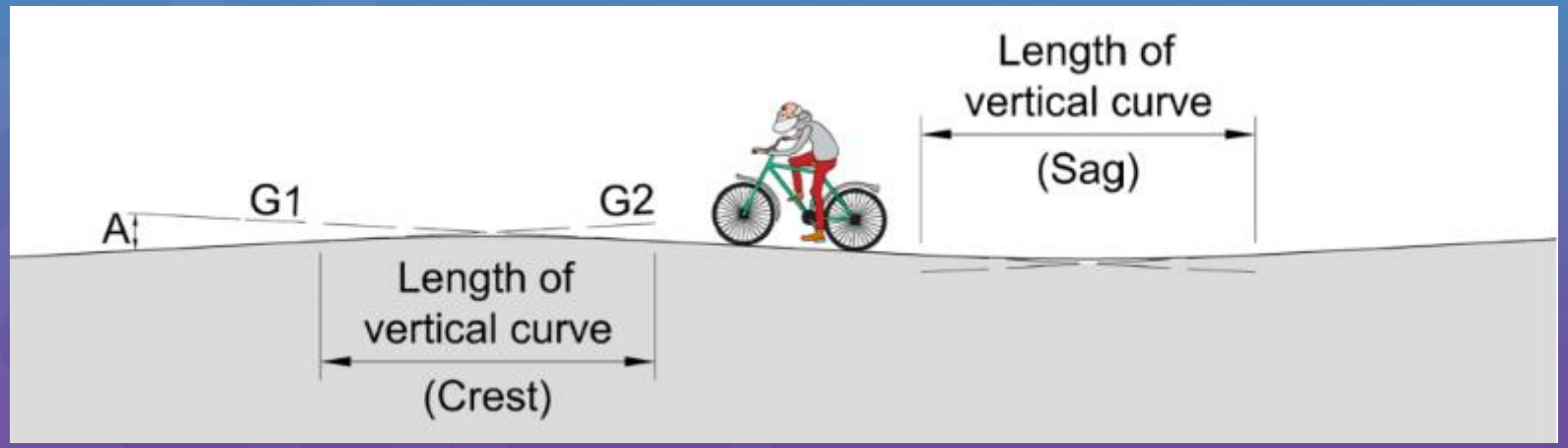
- The provision of physical measures to control user speeds, such as speed humps and rumble strips, should be avoided. These features negatively impact on the attractiveness of a cycle route and can make it inaccessible to some users.
- Where it is necessary to encourage slower speeds on approach to a hazard, the preference is to introduce a change in horizontal alignment that will require users to slow down.
- This must be clearly legible/ visible on approach so cyclists have time to adjust there speeds.

Horizontal Alignment



- Lack of curves, or insufficient curve radii, can cause head-on collisions, or single-vehicle accidents.

Vertical Alignment - Curves

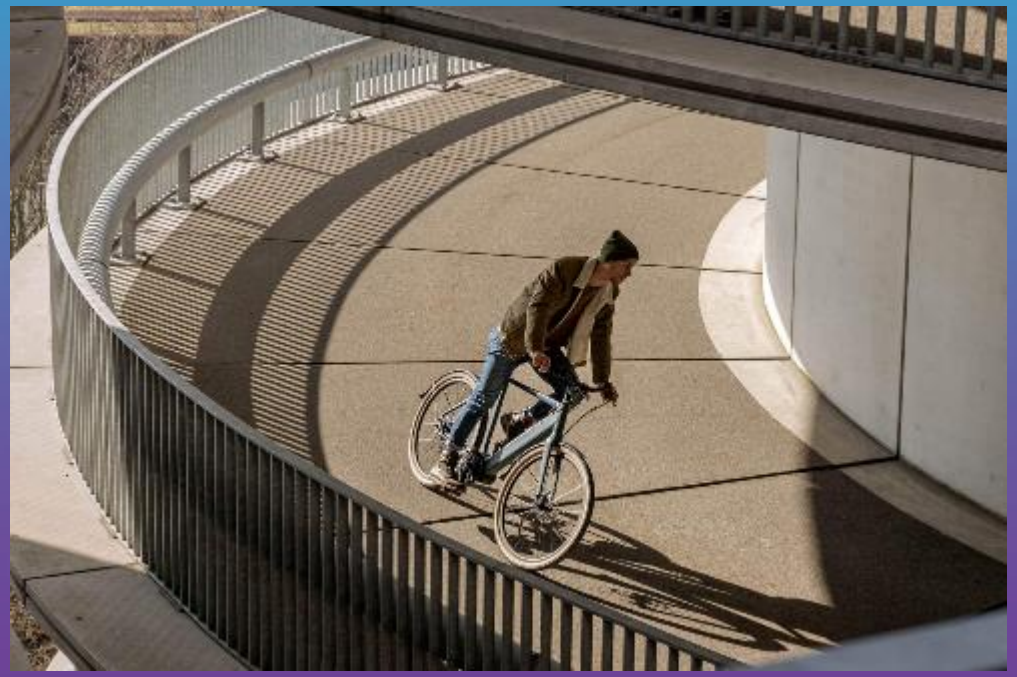


- Crest curves affect forward visibility and their values are therefore determined on that basis (SSD in particular).
- Sag values generally do not affect visibility and are therefore based on comfort.

Vertical Alignment - Curves

Vertical Alignment - Gradients

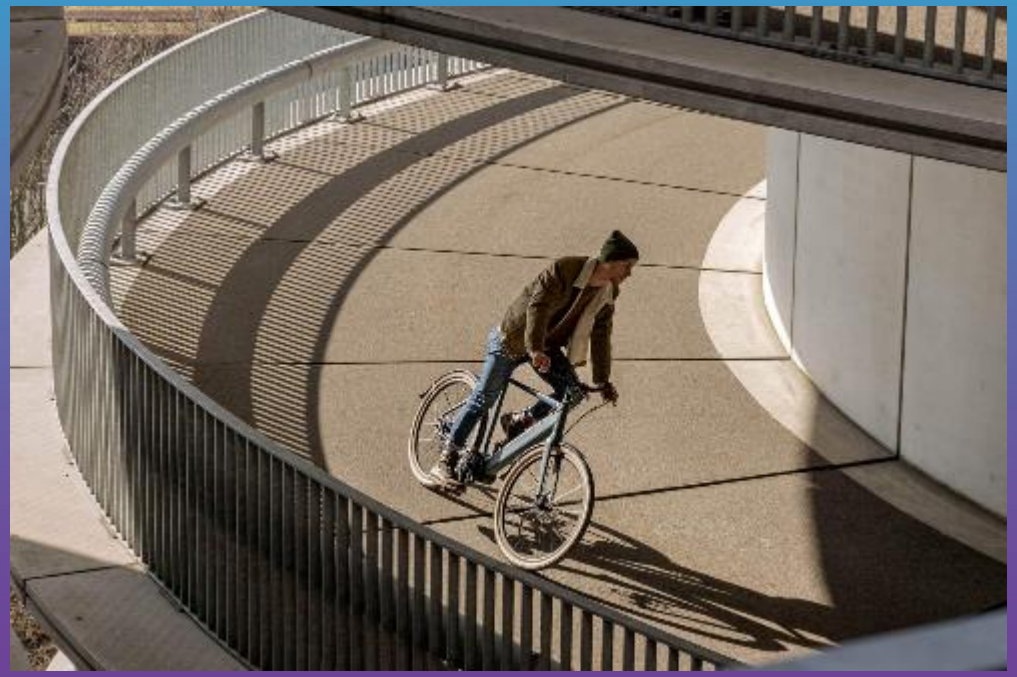
- Cycle tracks should be usable by cyclists with different levels of fitness and skill and on different types of cycles.
- Not all cyclists are sporty, not all cycles have a wide range of gears or power assistance, therefore not everyone is able to climb steep hills.
- Downhills might seem easier, but with steep gradients result in higher speeds and much longer braking distance (gravity is counteracting the braking power).



Vertical Alignment - Gradients

Table 4.10: Recommended gradients for cycle facilities.

Parameter	Gradient
Desirable minimum	0.5%
Desirable maximum	3%
Absolute maximum	5%



Dafne Schippers bridge, **The Netherlands**

Nigtevecht bicycle bridge, The Netherlands

M8 Sighthill bridge, Glasgow

Vertical Alignment - Gradients

- Tight curves or crossings without priority for cyclists on the ramp, or shortly after the bottom of the ramp should be avoided for the following reasons:
  - Cyclists going downhill have less time to react and require significantly longer distances to stop or reduce speed;
  - Braking might be a safety hazard, or not feasible at all, in adverse weather conditions.
  - Braking, necessary to stop or reduce speed on downhill, is not efficient and a waste of a cyclists energy.

Cycle Highway Manual, Interreg

Vertical Alignment - Gradients

- Cyclists should not need to dismount (or put foot on the ground) to negotiate corners on ramps……not all cyclists can dismount with ease.
- If tracks are shared with pedestrians the gradient must be in line with accessibility requirements so as its usable by wheelchair users. This will require rest places at regular intervals which will lengthen the ramp.

Clearances - Headroom

- Cyclists passing through tunnels or under signs need clearance so as they do not collide with a solid object.

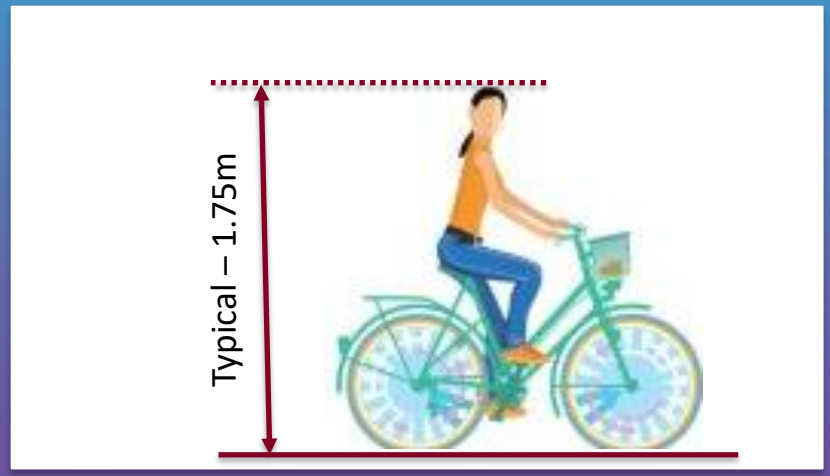


Table 4.12: Recommended headroom clearance.

Parameter	Headroom clearance
Desirable minimum	2.7 m
Absolute minimum	2.4 m
Absolute minimum (existing structures)	2.2 m

Cycle Highway Manual, Interreg


CLARENDON
72

Clearances – entry restriction

- Ideally no bollards or signs should be provided within a cycle track as they can be a hazard to cyclists particularly in poor weather and darkness.
- Where vehicles need to be prevented from accessing a cycle track bollards can be used as long as there is a clearance of 1.5m between upstands.
- These bollards must be in a contrasting colour, have associated markings and reflective banding.

Thank you for your attention

Email feedback: cyclemanual@nationaltransport.ie

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TRA

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