

Infrastructure Design Standards

Defining cycling infrastructure standards in the Danube region

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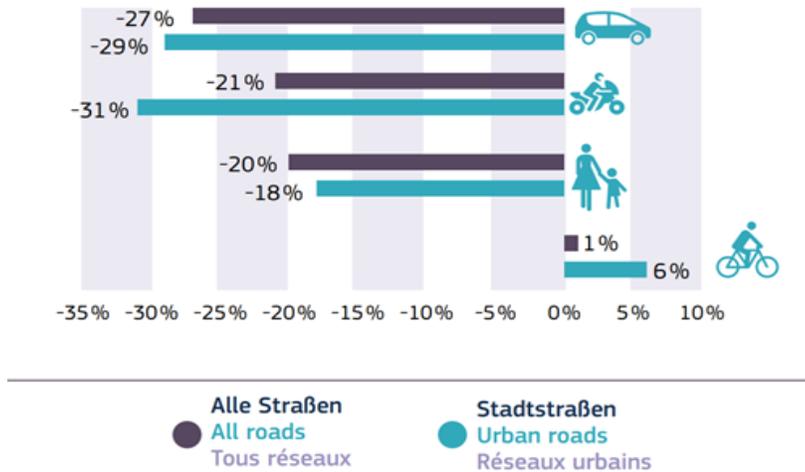


REPUBLIC OF CROATIA
Ministry of the Sea,
Transport and Infrastructure



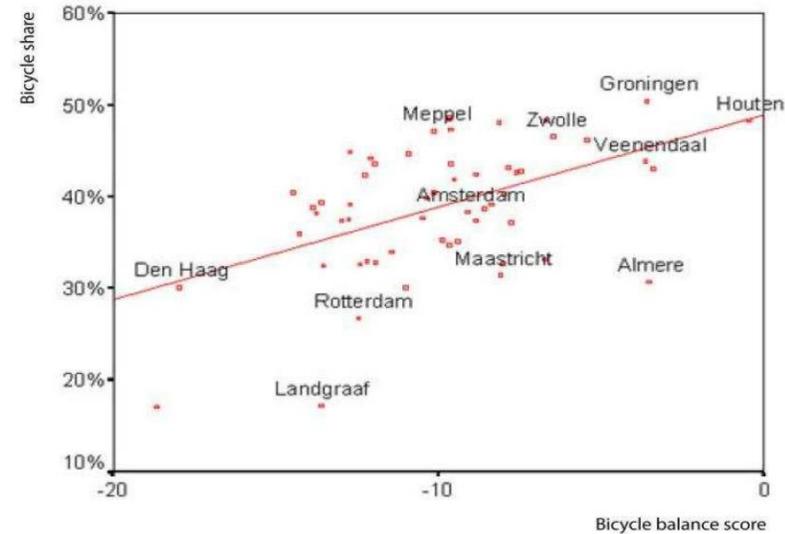
Cycle infrastructure standards

Why do we need it?



- According EU road safety statistics cycling is only decreasing
- fatalities for cyclists, especially in urban areas increased by 6%

Figure 5: Relation bicycle use and quality of cycle infrastructure



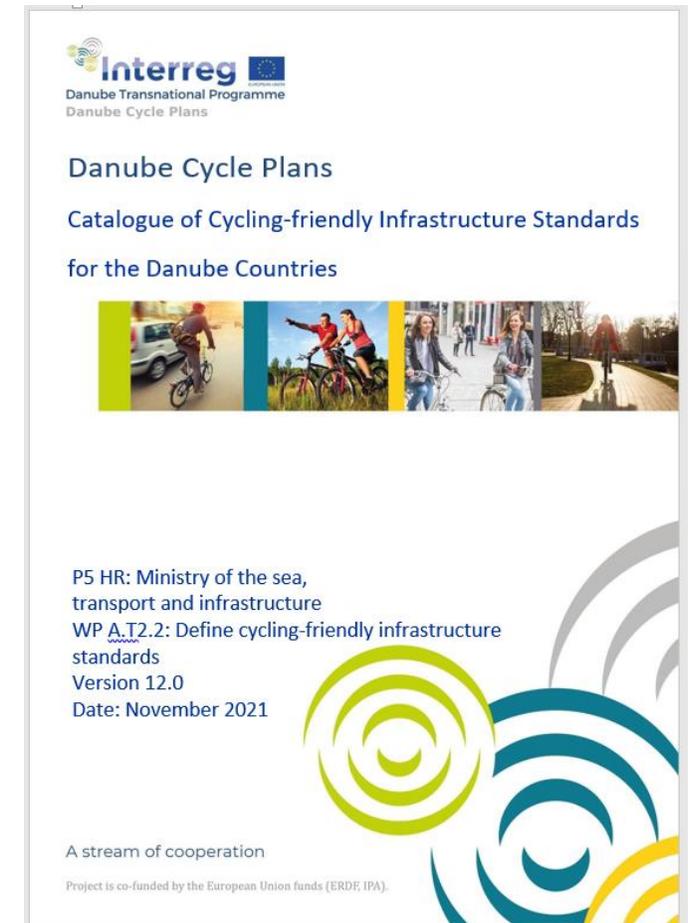
Source: Fietsberaad (NL)

- The highest barriers for people, preventing them from cycling is the infrastructure
- Share of cycling and the quality of cycling infrastructure are always highly correlated

Danube wide infrastructure standards – comprehensive approach

- The word “standards” used in this Catalogue of standards is used as a common word for all relevant documents.
- Documents covered by analysis:
 - laws
 - regulations
 - technical standards
 - recommendations / guidelines / handbooks
 - collections of examples and information
- Best practises from Danube region and EU

Result is comprehensive document based on the best known practise.



Danube wide infrastructure standards – comprehensive approach

Country	document	facili ty	sign age	parki ng	document type	Issued
AT	[4] RVS - 3.12.13 Road Engineering for bikes	X			technical standard	2014
AT	[5] bicycle parking in Carinthia			X	guideline	2015
BG	[6] BG - Ordinance № RD-02-20-2 transport system urban	X		X	rules	2018
CZ	[10] CZ - TP 179 - road design for cyclists	X	X	X	technical standard	2017
HR	[13] HR - Rules on CYCLING INFRASTRUCTURE	X		X	rules	2016
HR	[14] HR - Rules on traffic signs, signalization and equipment		X		rules	2019
HU	[20] HU - Cycling public road design	X		X	rules	2019
RO	[22] RO - Ordinance no. 195/2002 Road Code		X		rules	2002
RO	[23] RO - LAW no. 250 parking of bicycles in public space			X	law	2020
RO	[25] RO - STAS 10144 2 91 - street design	...			rules	1991
RS	[27] RS - Manual for road design - Bicycle	X		X	handbook	2012
RS	[28] RS - The Rulebook on traffic signals		X		rules	2021
SI	[29] SI - RULES on cycling areas	X		X	rules	2018
SI	[30] SI - Bicycle-friendly infrastructure guidelines	X		X	guiedlines	2017
SI	[31] SI- Rules on traffic signals		X		rules	2019
SK	[33] SK- TP 085 - DESIGN OF CYCLING INFRASTRUCTURE	X	X	X	technical standard	2019

- Romania has no cycling infrastructure standard, just a few sentences in street design rules
- Serbia has a high-quality manual which is not binding
- Best developed countries AT, CZ and SK have „only” non binding technical standards

Danube wide infrastructure standards – aspects covered by analysis

Aspects that are covered:

1. The importance of cycling and quality of cycling infrastructure
2. Planning the cycling infrastructure
3. Types of infrastructure for cycling
4. Selection of appropriate infrastructure depending on the traffic situation
5. Cycle intersections
6. Pedestrians and cycling infrastructure
7. Bridges, tunnels and stairs
8. Bicycle parking
9. Signage
10. Maintenance

Danube wide infrastructure standards

Types of infrastructure for cycling

	AT	BG	CZ	HU	RO	SK	SL	SR
 Cycle tracks	✓	✓	✓	✓	✓	✓	✓	✓
 Cycle and pedestrian tracks	✓	✓	✓	✓	✓	✓	✓	✓
 Greenways / multipurpose path	✗	✗	✗	✓	✗	✗	✓	✗
 Cycle lanes	✓	✓	✓	✓	✓	✓	✓	✓
 Advisory cycle lanes	✓	✗	✓	✓	✓	✓	✓	✗
 Cycle routes	✓	✗	✓	✓	✗	✗	✗	✓
 Contraflow	✓	✗	✓	✓	✗	✓	✓	✗
 Cycle streets	✓	✗	✓	✗	✗	✗	✗	✗
 Mixed-use zones	✓	✗	✓	✗	✗	✗	✓	✗
 Cycle highways	 *	✗	✗	 *	✗	✗	✗	✗

* in progress

Danube wide infrastructure standards

Types of infrastructure for cycling

RECOMMENDATIONS

Harmonize definition of the infrastructure elements with a strong link to UNECE and Vienna Convention for Road Signs and Signals, to make clear the distinction between categories and assure transparency among countries – every category means the same in every country. Share findings of this document with UNECE and propose them to use it for further development of Vienna Convention.

Following CZ and SK, avoid wherever possible the mixed-use infrastructure where cyclists and pedestrians are separated by the painted line only. Shared cyclists-pedestrians track, if needed, may remain without an elusive separating line. If there is enough space, provide a real separation.

The minimum width of a cycle track or lane should be 2 m for one way (exceptionally 1.5 m*) and 3 m for two-way (exceptionally 2.50*). (* Exceptions apply when there are spatial limits)

The minimum safety distance between the cycle track and the carriageway should be 0.75 m for speeds over 50 km/h and 0.50 m for speeds up to 50 km/h.

If there are parked vehicles, then the minimum safety distance from the parking should be 0.75 m for speeds over 30 km/h and 0.50 m for speeds up to 30 km/h.

The minimum safety distance between the cycle lane and the carriageway should be 0.50 m for speeds over 50 km/h.

If there are parked vehicles, then the minimum safety distance from the parking should be 0.75 m for speeds over 30 km/h and 0.50 m for speeds up to 30 km/h.

The minimum width of the cycle road should be 3 m.

Mixed traffic with pedestrians should be at a minimum width of 2 m.

If there is a parapet between cycling track and motorized traffic lane, request that it is constructed injury-safe - no sharp shapes from the cyclists' side (figures 37 and 38).



Danube wide infrastructure standards

Types of infrastructure for cycling

	AT	BG	CZ	HR	HU	RO	SK	SI	RS	DK	Crow (NL)	Presto	UNECE
Cycle tracks	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green
Cycle lanes	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green
Advisory cycle lanes /sharrows	Green	Red	Green	Red	Green	Green	Green	Green	Red	Green	Green	as one category	no sharrows
Cycle streets	Green	Red	Green	Red	Red	Red	Red	Red	Red	Green	Green	Green	Green
Cycle roads	Yellow	Red	Red	Green	Red	Red	Red	Green	Green	Green	Yellow	Yellow	Yellow
Contraflow	Green	Red	Green	Green	Green	Red	Green	Green	Red	Green	Green	Green	Green
Greenway/multipurpose path	Red	Red	Red	Red	Green	Red	Red	Green	Red	Green	Green	Red	Green
Mixed-use zones	Green	Red	Green	Green	Red	Red	Red	Green	Red	Green	Green	Green	Green
Cycle and pedestrian tracks	Green	Green	Green	Green	Green	Green	Green	Green	Green	not suggested	not suggested	Green	Green
Cycle routes	Green	Red	Green	Green	Green	Red	Red	Red	Green	Green	Green	Green	Green
Cycle highways	Yellow	Red	Red	Red	Yellow	Red	Red	Red	Red	Green	Green	Green	Green

Green = existing

Red = not existing

Yellow = covered partly with other categories

- Recommendation: introduce all categories in all countries in the same way.
- The only „overall green” country is DK

Danube wide infrastructure standards

Selection of appropriate infrastructure depending on the traffic situation

RECOMMENDATIONS

1. Take a common criterion, define minimal strict standard instead of overlapping, and simplify presentation using realistic speed limits in 10 km/h steps. Table 18 shows a “better average” of DCP countries.
2. Defined matrix, agreed among the countries, should be taken as a minimum. Consider stronger criteria in case of significant share of truck traffic (e.g. > 10%), narrow road (e.g. < 3m per lane), bad visibility, general separation of cycling traffic for speeds >70 km/h etc.
3. Separated cycle roads out of the corridor for motorized traffic should not be completely mandatory. An exception of a cycle track along the public road could be accepted as a short section (e.g. up to 3-5 km or up to 20% of the route) in the situation when sticking to the separate routing is much longer or much more expensive.
4. In general avoid cycle lanes in favor of cycle tracks. Space and costs are comparable, and the track gives much more safety and comfort over the lane.
5. Try to influence essential contributors to the cycling infrastructure quality beyond cycling infrastructure standards: respecting the speed limit; implementing of the zones 30 km/h in urban areas.

	speed km/h	30	40	50	60	70	80	90	
v/h	v/d								
50	417	road							
250	2083	road	road	road	road	road	lane	lane	lane
500	4167	road	road	lane	lane	lane	track	track	track
1200	10000	lane	lane	track	track	track	track	track	track
2000	16667	lane	lane	track	track	road	road	road	road
2500	20833	track	track	track	road	road	road	road	road

Speed limit traffic density matrix to define appropriate cycling infrastructure, proposed as DCP standard.

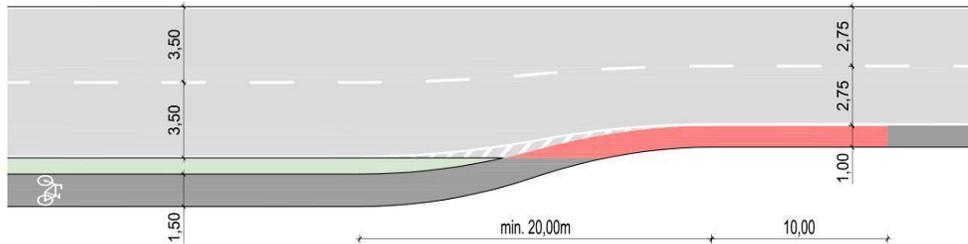
- „Better median value” – almost the same as „ECS Low”
- No continuous lines – speed limits are discrete
- No overlapping – clear definition of minimal standard, you can always make even better

Danube wide infrastructure standards

Cycle intersections

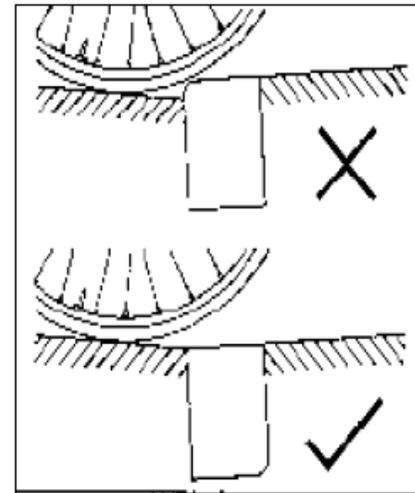
RECOMMENDATIONS - CONTINUITY

In all national standards request a continuity for cycling (example HR): if a specific cycling infrastructure (cycle lane, track etc.) ends, a transition to the mixed-use cycling on the carriageway should be constructed. Continuity request also includes that it is not allowed to interrupt a cycle track and expect pushing or carrying the bicycle over the intersection. Making absurd infrastructure illegal is a good step to fight against it.



RECOMMENDATIONS - CURBS

Accept a common standard for the slope. For the short passages on the intersections, frequently used 5% seems to be good enough and not too complicated for the realization.
 Remove any legal acceptance of any curb (Croatia). If needed (not clear in itself) explicitly define that the curbs are not allowed.

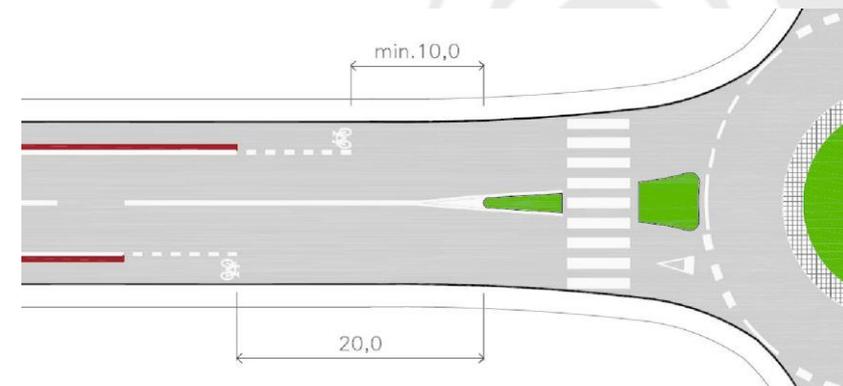
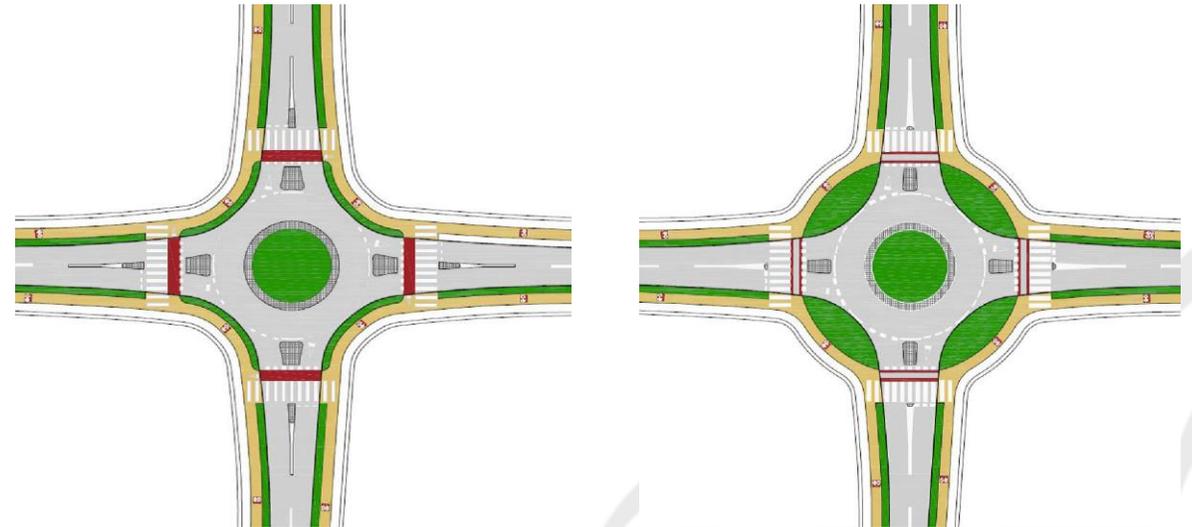


Danube wide infrastructure standards

Cycle intersections

RECOMMENDATIONS - ROUNDABOUTS

1. All curve radius for cyclists should be 5 m at least. Below this, the cyclist needs to slow down to 12 km/h and has difficulty maintaining stability. On link bends, 10 m allows for a speed of 20 km/h, 20 m for 30 km/h.
 1. All transitions between different materials should be smooth. The transition from a track to a carriageway should be designed with flush curbs (without any difference in level).
- These two above recommendations are valid for all intersections in general.
1. Cyclists must have precedence over motor vehicles, when those vehicles turn right or left and intersect the cyclist track.
 1. When transitioning from a cycling track to a carriageway, minimum width of lane must be the same as before transition with traffic signalization warning about cyclists on road.
 1. Research regarding the number of vehicles that travel faster than 30 km/h is needed before implementation of roundabouts.



Danube wide infrastructure standards

Cycle intersections

RECOMMENDATIONS -INTERSECTIONS WITH FOUR LEGS

Cycling infrastructure needs to be closer to vehicles regarding to pedestrian crossing.

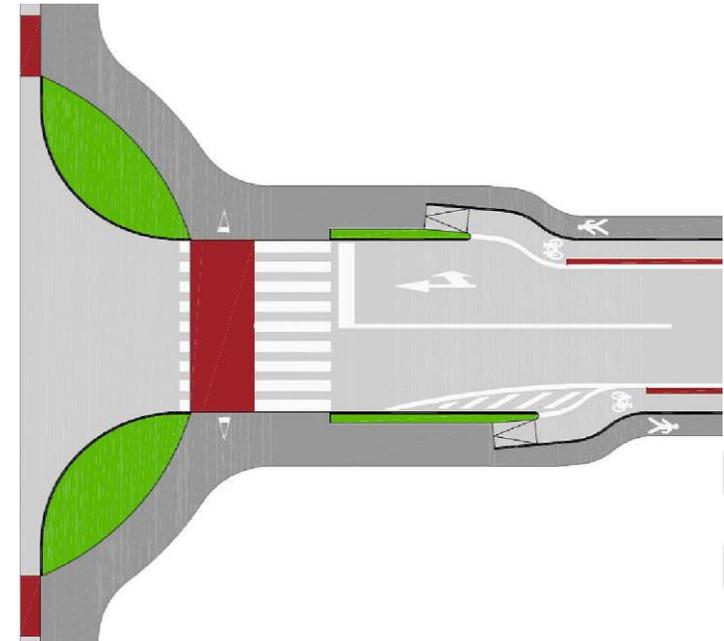
Cyclists must have precedence over motor vehicles, when those vehicles turn right or left and intersect the cyclist track.

It is important to consider the number of cyclists that use cycling infrastructures in the rush hour so that cycling infrastructure can provide good level of service for them.

Passage of the cycle lane over the sidewalk in the area of the intersection need to be at least 20,00 meters before area of intersections and minimum pedestrian-cycling area needs to be at least 2,60 meters (one-way cycling track) or 3,60 meters (for two-way cycling track).

In the area of intersections minimum cyclist infrastructure needs to be harmonized with cyclist number in rush hour to satisfy a good level of service.

Optionally, cycling infrastructure can be at least 2,00 meters away from the edge of the lane for motorized vehicles (if visibility is poor or insufficient).



Danube wide infrastructure standards

Bridges, tunnels and stairs

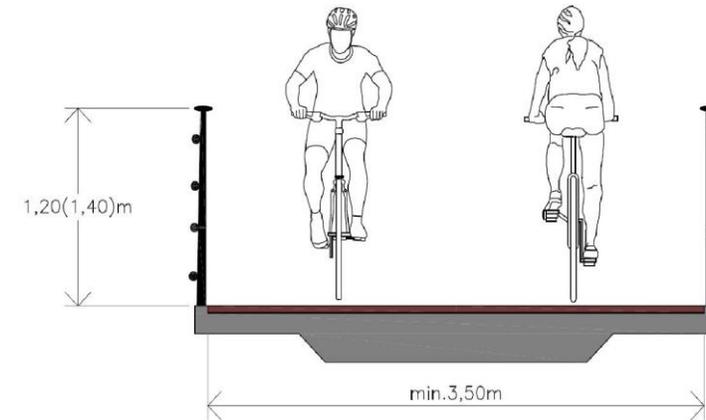
RECOMMENDATIONS - BRIDGES

Use sufficiently comfortable dimensions. The bridge should be at least 3.5 m wide (3 m for cycling if there is additional separate footpath), or the same as the approaching cycle track. The incline should be at most 1:20.

Provide at least 4.5 m headroom.

Provide a handrail or parapet, of at least 1.2 m high.

When space is lacking, a phased ramp can be considered.



Minimum permissible profile of a two-way cycle area on an overpass / bridge in Slovenia.

Danube wide infrastructure standards

Bridges, tunnels and stairs

RECOMMENDATIONS - TUNNELS

Keep cyclists at ground level preferably. If this is not possible, raise the carriageway level app. 2 m to decrease the depth of the tunnel. This also avoids groundwater problems.

Use sufficiently comfortable dimensions. The tunnel should be at least 2.5 m high and 3.5 m wide (3 m is there is a footpath), the same as the approaching cycle path. The gradient should be at most 1:20.

Keep the approach to entrances open and unobstructed. Avoid high vegetation, corners or anything that obstructs the view and create opportunities for concealment.

Make the exit visible upon entering the tunnel. Provide a straight path and avoid all bends and corners. This increases riding comfort and allows the cyclist to keep up speed with a good view on approaching cyclists. This also opens up space and improves social safety.

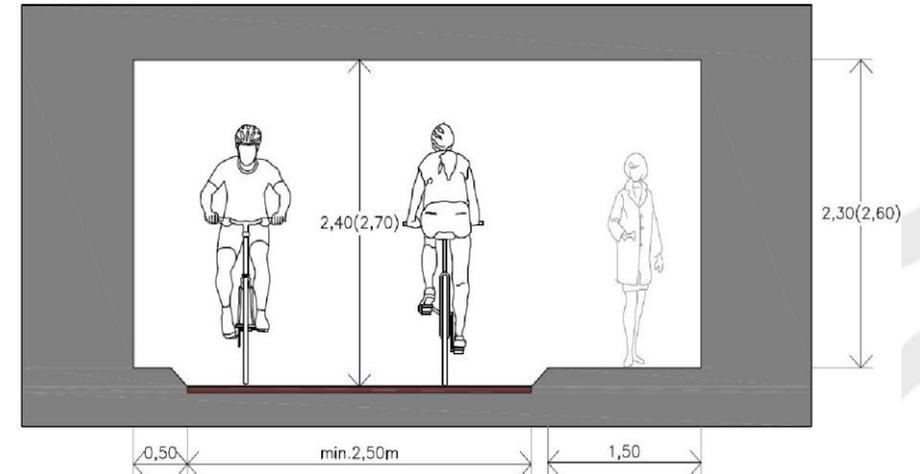
Make sure walls recede towards the top, to create a feeling of open space. Avoid straight vertical walls.

Create daylight gaps in the tunnel roof. Separating the traffic lanes makes it possible to create a daylight gap for the tunnel in between. The central traffic island of a roundabout should be opened up when a cycling tunnel passes below.

Put-in high-quality and vandal-proof lighting, preferably lights sunk into ceiling or walls. Faces NEED to be clearly recognizable.

When co-used with pedestrians, provide a separate pedestrian footway on one side (1 m minimum).

Provide multiple approaches when useful. Cyclist may approach from different directions. Stairs with a cycle channel allow cyclists to interchange with the road above.



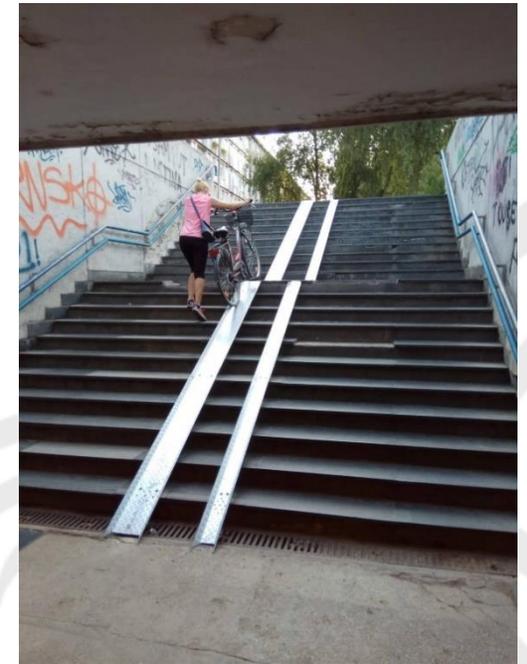
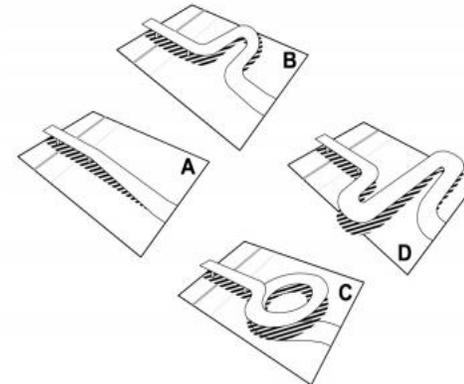
Minimum permissible profile of a two-way cycle area in an underpass /tunnel with demarcated areas in Slovenia.

Danube wide infrastructure standards

Bridges, tunnels and stairs

RECOMMENDATIONS – ACCESS TO TUNNELS/BRIDGES & STAIRS
Put in channels on both sides of the stairs.
Construct channels out of concrete preferably. On existing stairs, metal channels can be installed, using the same quality criteria.
The channel incline should be no more than 25% for comfort.
The channel should be at 0.08 m to 0.12 m wide, and at a distance of 0.03m to 0.05m from the side of the stairs.
Set the handrail close to the wall, to avoid contact with the handlebars.
Make the top level with the top stair for easy entering and exiting. Mechanical devices such as lifts or escalators can provide assistance. However, many users are not comfortable with these solutions. They can therefore only be recommended as an additional solution, not as the only option to scale a difference in height.

Individual types of ramps.

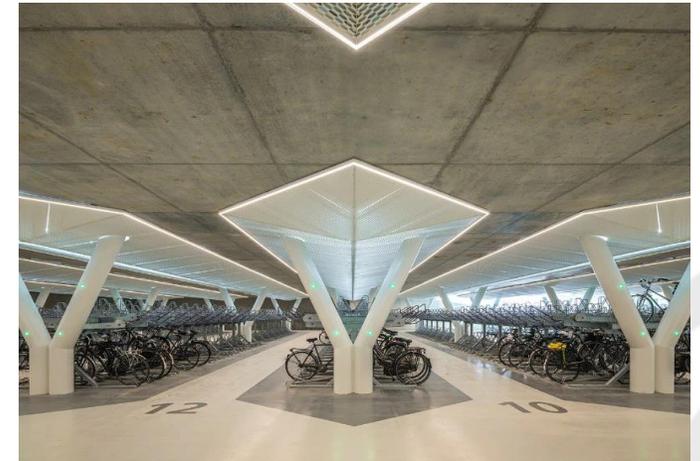


Stairs with a bicycle channel

Danube wide infrastructure standards

Bicycle parking

RECOMMENDATIONS	
1.	Outside parking should be well-lit and in a visible location.
1.	Closing the gap between planning and implementation phase, especially regarding capacities of bicycle parking in long-term and daily parking in front of public building and transport nodes.
1.	Parking should be accessible from the cycling infrastructure.
1.	Short-term parking should be located directly at the destination.
1.	Consider using pavement extensions for bicycle parking in areas using traffic-calming.
1.	Designs should be functional and simple, and where street furniture has been specially designed, the design of bicycle parking should be considered to ensure its integration visually.
1.	Depending on the duration of bicycle parking, differing levels of quality/provision may be applied, from freestanding or simple bicycle racks to more complex solutions.
1.	Bicycle parking facilities need to be easy to use, which includes having a convenient location and being easy to access. Movement within the facility with a bicycle must be easy and obstacle-free. The racks themselves must be easy to use, particularly second tier racks that need to be raised.
1.	For large facilities, consideration could be given to installing a bicycle parking monitoring system, to help users identify where there are free racks within the facility.
1.	One of the important elements of managing a large bicycle parking facility or ensuring that the bicycle parking facilities within a city are used efficiently is to remove abandoned bicycle frames or wheels. If a parking facility has a bicycle parking monitoring system, this can be used to identify which bicycles have been left too long in the parking facility. In the Netherlands, dated stickers are placed on bicycles that appear to have been abandoned, during regular inspections. If the bicycle does not move after three weeks, it is then removed and kept in a storage facility for three months.



Danube wide infrastructure standards

Signage

RECOMMENDATIONS

- Supporting the recommendation to avoid combined cyclists and pedestrian light (section 7.3.) this sign could be removed from the legislations in the countries where present.
- Introducing Slovakian example with additional arrows and yellow color, might be useful also in other countries.

- Complete harmonization is not realistic objective, but signs are overall intuitive and clear, despite its difference
- Realistic recommendations
 - Introduce missing signs in the DCP countries to support introduction of appropriate new infrastructure to be introduced
 - Encourage using of additional panels that are already existing in legislation (arrows, bike pictograms etc.) by giving examples in the national signage legislation to provide additional information for safety and comfort
 - Promote equality of cycling traffic by integrating cycling signage in the common signs – e.g. combine a bike route logo with the road logos in the signposting boards

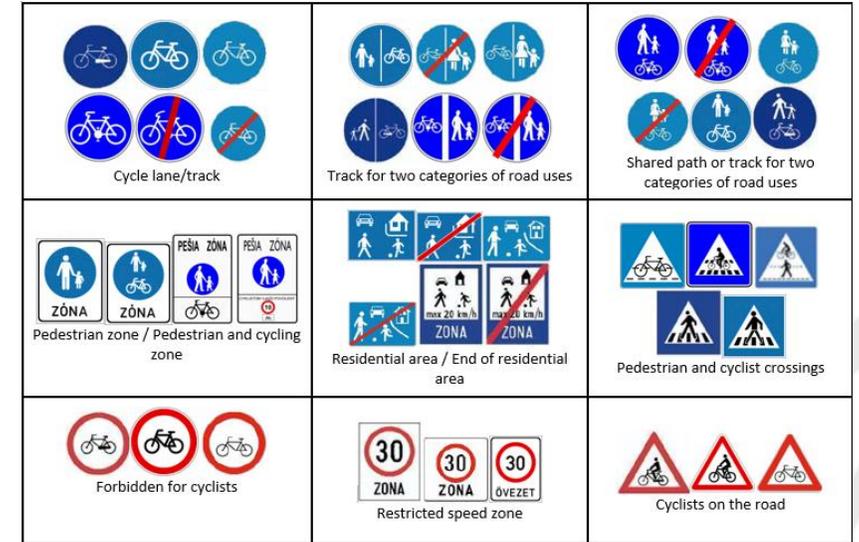


Figure 98. Certain deviations in the appearance of vertical signs in Hungary, Romania, Slovakia and Croatia.



Danube wide infrastructure standards - additional consideration

	AT	BG	CZ	HR	HU	RO	RS	SI	SK
not defined		X		X					
few cases								X	X
sporadically			X				X		
consistently	X				X	X			

- Not in the scope of infrastructure standard but important – 30 km/h zones
- Recent example – new traffic safety law in Croatia – proposal to make 30 km/h zones common and easy to implement is declined

Danube wide infrastructure standards

Key findings:

- In most of the countries a high-quality standard, aiming to improve the infrastructure
- In many countries standards are rather a wish or a plan than respecting the reality
- Differences in obligations to follow the standard (law, rules, standard, recommendation) but it is not highly correlated with the realized quality
 - e.g. CZ, SK, AT only technical standard but best realization in the region
- Some topics quite similar, some quite different

Thank you for your attention!



Contact



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