BORGARLÍNAN

Borgarlínan

Technical Design Basis

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1 Introduction

The Technical Design Basis sets out various design criteria in the form of specific values or a range of values, that are agreed to be implemented for the Borgarlínan project. It is intended that this document gathers specific Borgarlínan Project characteristics and therefore takes precedence over the different countries' guidelines, with the exception that legal requirements of Iceland take precedence above all. Exceptions to the values stated in this document shall be documented throughout the design process.

It is not exhaustive, and it is supplemented by various other documents, such as the architectural/aesthetical requirements for the project, which are outlined in the Overall Design Strategy (Document ID: BL100-ULA-IDA-RP-13001).
The Technical Design Basis has been created to reflect the design ambitions for Borgarlínan. These are set out in the Overall Design Strategy and define the objectives for Borgarlínan.

Both documents form together the basis for designing Borgarlínan. Additions to the design basis may be necessary in order to adapt to the specific context as design of Borgarlínan progresses.. Borgarlínan will mean a significant change to the streetscape throughout the corridor and the fundamental priority driving the design of the BRT will put pedestrians first. The prioritised list of the different modes of transit is as follows:

1. Pedestrians
2. Cyclists / micromobility
3. Borgarlínan
4. Other public transport
5. Cars and other vehicle transport

Emergency service vehicles and freight vehicles have not been shown in the priority list but must be considered in the design.

1.1 Design Criteria

This design criteria included within this guideline covers the following aspects of the design:

- BRT and Street Design
- Drainage Design
- Structure Design
- Lighting Design
- Utility Design
- Architecture
- Landscape Architecture
- Accessibility Design

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1.2 The Conceptual Design

The Borgarlínan Team has produced a conceptual design of Lota 1 in January 2021 which forms the basis of the project. This design basis draws upon the conceptual design of Lota 1 as well as proposes design criteria based on publicly available design standards.

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2 BRT and Street Design Criteria

The below street design criteria will be used as a basis of the design of Borgarlínan.

2.1 Codes, Standards and Guidelines

The following standards will be used as a basis for the design of Borgarlínan. Standards' version may need to be reviewed for subsequent Lotas.

Reference and links	Original Title	Translated Title
1	Veghönnunarreglur - Kafli 01 Grunnatriði (Ísland, 2010)	Road Design Rules - Chapter 01 Basics (Iceland, 2010)
2	Veghönnunarreglur - Kafli 02 Þversnið (Ísland, 2011)	Road Design Rules, Cross Sections (Iceland, 2011)
3	Veghönnunarreglur - Kafli 03 Vegferill (Ísland, 2010)	Road Design Rules - Chapter 03 Road Geometry (Iceland, 2010)
4	Veghönnunarreglur - Kafli 05 undirkafli 4 Vegrið (Ísland, 2010)	Road Design Rules - Chapter 05 Guard Rails (Iceland, 2010)
5	Veghönnunarreglur - Kafli 08 Yfirborðsmerkingar (Ísland, 2019)	Road Design Rules, Road Markings (Iceland, 2019)
6	Reykjavíkurborg og Vegagerðin . Hönnun fyrir alla, algild hönnun utandyra, leiðbeiningar. Reykjavík. (Ísland, 2023)	Accessibility for all (Iceland, 2023)
7	Leidbeiningar Gönguþveranir (Ísland, 2014)	Pedestrian Crossings (Iceland 2014)
8	Hönnunarleiðbeiningar fyrir hjólreiðar (Ísland, 2019)	Design Instructions for Cycling (Iceland, 2019)
9	Reglugerð um umferðarmerki og notkun þeirra nr. 250/2024(Ísland, 2024)	Regulation on traffic signs and their use no. 250/2024 (Iceland, 2024)
10	Handbók um Umferðarmerki - Rammareglur og ýmsar útfærslur (Ísland, 2025)	Regulatory Signage - Framework Rules (Iceland, 2025)
11	Burðarþolshönnun – leiðbeiningar (Ísland, 2013)	Pavement design. Vegagerdin (Iceland 2013)
13	Hönnunarreglur fyrir stoppistöðvar, Strætó (Ísland, 2016)	Stræto Bus Stops (Iceland, 2016)
14	IST/EN 13201-2:2015 Götulýsing	IST/EN 13201-2:2015 Road lighting

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Reference and links	Original Title	Translated Title
15	Veglýsing utan þéttbýlis: Vegagerðin (Ísland, 2015)	Road lighting outside dense areas, Icelandic Road and Coastal Administration (Iceland, 2015).
16	VLD-062 Götu og stígalýsing, Reykjavík (Ísland, 2022)	Lighting of streets and pathways, Reykjavik Municipality (Iceland, 2022)
17	Lýsing gangbrauta og annarra gönguþverana: Reykjavík (Ísland, 2020)	Lighting of zebra crossings and other crossings, Reykjavik Municipality (Iceland, 2020)
18	Stígalýsing – Viðmið á millibil á milli staura fyrir hönnuði: Reykjavík (Ísland, 2019)	Pathways - Reference distance between poles for designers, Reykjavik Municipality (Iceland, 2019).
19	Hönnunarfarartæki í borg, Reykjavík (Ísland, 2021)	Design company in a city, Reykjavik (Iceland, 2021)
20	Ljósvist fyrir Borgarlínu, minnisblað Lisku fyrir Borgarlínuhóp	Lighting plan for Borgarlína, Memo from Liska for the PMO, 29.06 2020.
21	Statens Vegvesen, Håndbok N100 — Veg- og gateutforming. (Norge, 2023)	Road and Street Design, Statens Vegvesen (Norway, 2023)
22	Statens Vegvesen, Plassering og utforming av kollektivfelt, BRT: Løsning for å fremme miljøvennlig transport. (Norge, 2016)	Location and design of public transport & BRT, Statens Vegvesen (Norway, 2016)
23	Vejregler, Vejkryds i byer, Vejdirektoratet (Danmark, 2024)	Road intersections in cities, The Danish Road Directorate (Denmark, 2024)
24	Vejregler, Håndbog – Kollektiv bustrafik og BRT. Vejdirektoratet (Danmark, 2023 / opdateret i august 2024)	Handbook – Public bus traffic and BRT. The Danish Road Directorate – Vejregler (Denmark, 2023 / updated in August 2024)
25	Vejregler, Håndbog – Letbaner i vejkryds. Vejdirektoratet (Danmark, 2016)	Handbook – Light rail at intersections. The Danish Road Directorate – Vejregler (Denmark, 2016)
26	Vejregler, Håndbog – Letbaner på strækninger. Vejdirktoratet (Danmark, 2016)	Handbook - Light rail on stretches. The Danish Road Directorate – Vejregler (Denmark, 2016)
27	Vejregler, Håndbog – Standsningssteder for letbaner. Vejdirektoratet. (Danmark, 2016)	Handbook - Stations for light rail. The Danish Road Directorate – Vejregler (Denmark, 2016)
28	Vejregler, Håndbog - Tracéring i byer. Vejdirktoratet (Danmark, 2024)	Handbook – Geometric design in cities. The Danish Road Directorate – Vejregler (Denmark, 2024)

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Table 2-1 Codes, Standards and Guidelines

Where disparities are evident, design standards shall be applied in the following order of precedence:

1. Icelandic street design standards
2. Norwegian street design standards
3. Danish street design standards
4. Swedish street design standards

To simplify the access to the source codes and standards, links have been added in the first column of the table 2-1. In case of conflict or broken link, the reference to consider is the one described in column "Original title".

2.2 Street Design Criteria

The design of streets, bicycle and pedestrian facilities shall be in accordance with defined speed limits. Much of the Borgarlína design is situated in an urban environment and, as such, the street design criteria set out are appropriate for urban street design. Subsequent design may require rural road design criteria to be adopted.

2.2.1 Design Speed

Street Design Speed

The streets shall be designed using the design speeds defined for each street by each municipality. In Reykjavík, the design speed is in accordance with the traffic speed plan for Reykjavík ("Hámarkshraðaáætlun Reykjavíkur, apríl 2021"). The design speed is equal to the future speed.

The speed shown on signposts will be equal to the design speed. The design speed in intersections will be the same as the adjacent streets. Turning lanes will adopt lower design speeds as appropriate for each location.

A map with future speed limits in Reykjavík can be found online: https://reykjavik.is/fretttir/aukid-umferdaroryggi-i-reykjavik.

Bicycle Path Design Speed

The bicycle paths shall be designed using the design speeds set out in the table below, according to "Hönnunarleiðbeiningar fyrir hjólreiðar" (Iceland, 2019).

Type of path	**Design Speed (km/h)**
Main routes in urban areas	30
Other routes in urban areas	20

Table 2-2 Design speed for bicycle paths

Design speed should be increased by 2 km/h for each % vertical slope, meaning that the design speed increases to 40 km/h when the slope is 5% if the base design speed is 30 km/h when flat. Maximum design speed on bicycle paths is 40 km/h.

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2.2.2 Horizontal Alignment

The horizontal alignment of BRT lanes and car lanes shall be designed in accordance with the design speed of each street. The alignment shall be made from circular curves and straight elements. Clothoids or transition curves are not required due to the low-speed environment of Borgarlínan. Aesthetics should be considered when designing the horizontal and vertical alignment and should follow the principles outlined in Section 7 of Vejregler, Håndbog - Tracéring i byer (Danmark, 2024).

2.2.3 Cross Section

The cross section varies across the geographic sections of the project, and is influenced by traffic modelling requirements, architectural elements, street design requirements, the existing terrain and property boundaries. The street design requirements, such as lane width and width of bicycle paths and pedestrian areas, are provided below. The design shall also incorporate minimum clearances to fixed objects, as described in section 2.2.3.3 (Horizontal Clearances).

Street Lanes

Situation	**Desirabl width (m)***	**Minimum width (m)***
BRT Lanes:		
- 30km/h – 40km/h	3.25	3.00
- 50km/h – 60km/h	3.50	3.25
Traffic lanes:		
- 15km/h – 20km/h		2.50
- 30km/h – 40km/h	3.00	2.75
- 50km/h	3.25	3.00
- 60km/h	3.50	3.25
- 70km/h – 80km/h	3.50	3.50
Parking Lanes including road marking	2.20	2.00
Accessible Parking Lanes including road marking		2.50
Width between kerbs on one-way streets	-	3.50

Table 2-3 Design width for streets

*Lane widths shown are minimum lane widths without adjacent kerbs. Where a kerb is proposed at the edge of a lane, an additional 0.25 m width will be added to the lane width. Where there is a single lane with kerbs on both sides, 0.25 m will be added to each side, resulting in a lane that is 0.5 m wider than the figure shown in the table. Painted edge lines will not be implemented next to kerbs.

The width of street lanes will follow the values in the Table 2-3.

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It is envisaged that, at traffic lanes adjacent to BRT stations, design speeds will be in the range of 30km/h – 40km/h.

All road marking line widths shall be included in the width of each adjacent lane 50/50. Curve widening shall be implemented on lanes where required. Autoturn swept paths shall be used to determine the required widening in these situations.

Sources for the table include Veghönnunarreglur Kafli 02 Þversnið (Iceland, 2011), Håndbok N100 – Veg- og gateutforming (Norway, 2023), Vejregler: Håndbog – Kollektiv bustrafik og BRT (Denmark, 2023 / updated in 2024), Vejregler: Vejkryds I Byer (Denmark, 2024), Tværprofiler i Byer (Denmark, 2024), Håndbog i cykeltrafic (Denmark, 2014).

Bicycle Lanes, Bicycle Paths and Pedestrian Paths.

The most common layout is to have one bike lane going each direction, on each side of the street. However, this may be adapted to the context, depending on local street/urban context or wider bicycle itinerary strategy.

Situation	Desirable width (m)	Minimum width (m)
One-way bicycle lanes	2.00	1.30
One-way bicycle paths	2.50	1.80
One-way shared paths	3.00	3.00
Two-way bicycle paths	3.00	2.50
Two-way shared path (bicycle and pedestrian)	3.50	3.00
Bicycle lane shared with turning traffic lane (additional widening)	Not desirable	1.00
Pedestrian path	2.50	2.00
Clear width past discrete obstacles*	-	1.20

Table 2-4 Design width for bicycle lanes and paths

* Only applies for pedestrian paths.

The figures in the above table are based on Hönnun fyrir alla (Iceland, 2019) and Hönnunarleiðbeiningar fyrir hjólreiðar (Iceland, 2019).

Bicycle lanes are separated from traffic lanes by painted lines, whereas bicycle paths are separated from traffic lanes by a kerb. Bicycle boxes (waiting area for bikes ahead of car stop lines) will not be adopted on the project. For bicycle paths, the width of kerb will not be included in the width of bicycle path to achieve the widths shown in the table.

If a pedestrian path is situated immediately adjacent to a bicycle path and a kerb is placed between the two paths, the width of the kerb will be included in the calculation of the width of the pedestrian path.

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"Clear width past discrete obstacles" means the minimum space that is clear of any fixed objects and that can be used to walk. An example of fixed objects in this scenario could be sign poles, light poles, fixed rubbish bins or fences: clear width is the space needed at that point to traverse past them. This requirement is outlined in Hönnun fyrir alla - algild hönnun utandyra (Iceland, 2023).

Horizontal Clearances

BRT and Traffic Lanes

Horizontal clearance from BRT and traffic lanes to street furniture will be in accordance with the below table.

Situation	**Minimum clearance (m)**	**Measurement**
Signs	0.50	Front of kerb to the edge of traffic signs
Traffic signal poles	0.75	Front of kerb to the centre of the pole

Table 2-5 Horizontal clearance

Hazards to traffic lane users are defined as a fixed obstacle that is greater than 0.2 m in height or a downward embankment that is steeper than 1:1.5. The figures in the above table are based on Veghönnunarreglur - Kafli 02 Þversnið (Ísland, 2011). Within the city of Reykjavik, minimum clearance to signs can be 0.30m in accordance with guidelines for placement of traffic signs.

Street lane clearance to hazards will be achieved where possible. Where the minimum clearances stated in the below table cannot be achieved, the project design approach will be:

1. Remove the hazard.
2. Move the hazard to a safe distance from the street edge.
3. Review the street design speed.
4. Place safety barriers if space is available.
5. Seek dispensation from authority if the above cannot be achieved and it makes practical sense.

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The clearances shown in the table below are clearances to hazards in urban areas. For rural areas, appropriate standards shall be adopted.

Design speed (km/h)	**Minimum Clearance (m)**
30 – 40	0*
50	2.00
60 – 70	3.00

Table 2-6 Horizontal clearance - Urban areas

For Lotas that are situated in dense urban areas, it may be impractical to implement safety barriers for hazards within the 30km/h, 40km/h and 50km/h clearance zones. These low-speed situations will be analysed on a case-by-case basis. For situations where the design speed is 50km/h or greater, the clearance is dependent on the number of vehicles. In these situations, Veghönnunarreglur - 02 Þversnið (Iceland, 2011) shall be consulted.

*The minimum clearance to a hazard is 0 m according to Veghönnunarreglur - 02 Þversnið (Iceland, 2011), however for practical purposes the clearances listed in Table 2-5 Horizontal clearance) shall be used for street furniture.

The below items will not be considered hazards:

- Kerbs and BRT platform edges that are less than 0.4 m high
- Poles and bollards mounted with weak links
- Poles and bollards with cross sections that collapse in a flexible manner on impact etc.
- Trees and shrubs with stem diameter of less than 100 mm at a height of 400 mm
- Steel tubes with an outside diameter of less than 76 mm
- Foundations, wells and kerbstones, etc. which ascend less than 0.2 m above ground level.
- Water bodies with a permanent depth of less than 0.25 m

BRT platform shelters need to be assessed as to whether they are hazards depending on their construction, when it is decided.

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Bicycle Paths

Hazards to cyclists are defined as fixed obstacles that are greater than 0.2 m in height. Bicycle path clearance to hazards will be in accordance with the below table and defined as the width from the edge of the path.

Situation	Desirable Clearance (m)	Minimum clearance (m)
Single obstacle (poles, trees, etc.)	1.00	0.50
Continuous obstacle (fence, railing, wall, etc.)	0.65	0.50
Clearance between bicycle paths and parking lane	1.00	0.50

Table 2-7 Horizontal clearance - Bicycle paths

Slopes that are close to bicycle paths will be checked on a case-by-case basis in accordance with Hönnunarleiðbeiningar fyrir hjólreiðar (Iceland, 2019).

2.2.4 Vertical elements

Longitudinal gradient

Where longitudinal gradient can meet the grades set out in the below table, no additional measures need to be applied.

Grades for pedestrian paths should follow those stated in Hönnun fyrir alla - algild hönnun utandyra (Iceland, 2019) and grades for bicycle paths should follow those stated in Hönnunarleiðbeiningar fyrir hjólreiðar (Iceland, 2019).

To ensure safety and operation, if gradients listed in Table 2-15 are exceeded, it will require specific attention related to the design. For example, heated pavement, handrails or resting plateaus can be an option.

Situation	Maximum grade (%)	Desirable grade (%)
BRT Lanes	6%	
Traffic lanes	6%	
Pedestrian path	5%	≤2%*
Bicycle path:	-	≤3%
- Preferred max. 30m length	7%	
- Preferred max. 100m length	5%	
- Unlimited length (>100m)	3%	

Table 2-8 Longitudinal gradient

* According to Hönnun fyrir alla - algild hönnun utandyra (Iceland, 2019) 2% is the desirable maximum where it is known that many pedestrians travel with walkers or in wheelchairs.

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Vertical Geometry

The design approach for the vertical geometry shall be to aim for a simplified alignment with as few as practical geometrical elements. Aesthetics shall be a high priority in coordinating the horizontal and vertical geometries. Design approach hierarchy:

- User safety
- Reuse of existing pavements
- Aesthetic quality

Crossfall

Crossfall will be in accordance with the Table 2-9.

Due to the low speed and urban location of the project, superelevation rotation at curves will generally not be implemented in the redesign of existing streets. Where there exist small radius curves along the BRT route, or where the existing road surface is superelevated, the design may consider superelevating the street lanes. Entirely new sections of street will adhere to superelevation requirements in accordance with Icelandic standards where practical.

Typically, BRT lanes will be designed with two-way (roof-shaped) crossfall. However, alternative crossfalls, including one-way crossfall will be implemented in some locations on BRT and car lanes to match the existing pavement levels, or to enable a smooth connection to the existing terrain at the project boundaries.

A maximum of 5% differential of grade will be adopted for adjacent surfaces with different crossfalls. Vertical curves are preferable in these situations, especially where kerbs are present.

The minimum resulting slope to ensure adequate surface drainage should be 0.5% on traffic lanes and 2.0% on bicycle paths, in accordance with Veghönnunarreglur 03 Vegferill and Hönnunarleiðbeiningar fyrir hjólreiðar (Iceland, 2010).

Situation	**Normal Crossfall (%)**	**Maximum Crossfall (%)**
BRT Lanes	3.0%	4.0%
Traffic lanes	3.0%	4.0%
Bicycle path	2.5%	3.0%*
Pedestrian path	2.0%	2.5%*

Table 2-9 Cross fall

*At intersections and constrained sections, crossfalls of paths may increase to allow the design to tie in vertically to adjacent surfaces.

The values in Table 2-9 Cross fall are referring to general crossfall. Superelevation values may be higher than these figures in some situations.

Where a cross section composes of multiple elements, the maximum slope shall follow the smallest maximum grade of the comprised elements.

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Vertical clearances

Situation	Vertical Clearance, road bridge (m)	Vertical Clearance, footbridge (m)	Vertical Clearance trees / signs over paths (m)	Vertical Clearance, airport* (m)
BRT lanes	5.00	5.20	4.20	4.20
Traffic lanes	5.00	5.20	4.20	4.20
Bicycle path	2.50	2.50	2.20	2.20
Pedestrian path	2.50	2.50	2.20	2.20

Table 2-10 Vertical clearance. Source: Veghönnunarreglur 02 Þversnið (Iceland, 2011)

* Those values shall be checked according to airport obstacle free zone where the alignment is adjacent to airports. It should be verified by relevant airport authorities.

The vertical clearances vary slightly depending on the type of object and lane/path. Minimum vertical clearances will be in accordance with the Table 2-10.

2.2.5 Kerbs

The height of new kerbstones – measured as the free height from top of pavement to top of kerb stones shall typically be in accordance with the Table 2-11 below.

Kerb heights may be adjusted to different heights through the project to better match the existing pavement levels, or to enable a smooth connection to the existing terrain at the project boundaries.

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At BRT platforms, the height and profile of the kerbstones will be in accordance with the platform design, described in Section 7.3 and the Design Manual for Stations (Document ID: BL100-ULA-IDA-RP-01014). The bus stops described in the table below refer to regular bus stops.

Situation	**Preferred kerb height (cm)**		**Kerb width** (cm)**
BRT lanes	10		15
Traffic lanes	10		15
Between bicycle path and pedestrian path*	0-5		25
Special situations:			
-BRT platforms	24		21
-Bus stops (straight)	18		15
-Bus stops (pocket)	15		15
-Pedestrian cross-ings: at pram ramp	2-3		See above
-Emergency vehicle crossings	≤5		See above

Table 2-11 Design of kerbs

* In general no kerb will be provided between the bicycle path and pedestrian path, but some form of separation between path provided, such as tiles of different texture/colour or as minimum a painted line. In some cases there might be an existing kerb between paths or a situation where a kerb is required.

** In reference to the drawing "Kerb Types Street Design Principle" (Document ID: BL100-STR-IDA-JJ-51001), dated 30.03.2023

Painted edge lines will not be used where existing or new kerbs are proposed.

If an existing kerb does not need to be replaced for the purposes of street design or levelling, it should be assessed whether it needs replacing for other purposes or if they can be maintained.

At minor streets with continuous pedestrian paths, kerbs will be lowered for the extent required for the design vehicle. At driveways, kerbs will be lowered for the extent required for a passenger car, a small asphalt ramp constructed on the traffic lane, or a combination of both.

Straight-faced kerbs shall be the standard kerb profile across Borgarlínan, which are suited to a low-speed environment. The profile of kerbs shall be chosen based on the specific situation, for example at driveways, high speed environments or contextual reasons (such as the use of existing basalt kerbstones)

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2.2.6 Intersections

The lane configuration and general layout of intersections is based on principles defined with traffic modelling. This guides the geometrical design of the intersections.

Traffic Islands

Island widths at intersections shall be designed according to the below values.

Island function:	Desirable width: (m)	Minimum width: (m)
Island with signal equipment/signs	≥1.5	1.5
Island acting as a pedestrian refuge	2.5*	2.0

Table 2-12 Traffic islands

* Island widths shall be desirably 3.0 m within the City of Reykjavik.

The width of islands will be calculated as the distance from the edge of the adjacent street lane to the edge of the adjacent street lane (kerb line or road marking, whichever gives the larger island width).

Clearances to signal poles and equipment shall be in accordance with section 2.2.3.3, which may result in islands wider than those stated in Table 2-19 (Traffic islands).

Pedestrian crossings

At BRT platforms, pedestrian crossings may be elevated when crossing traffic lanes and not elevated when crossing BRT lanes. This will be evaluated on a case-by-case basis.

Pedestrian crossing	Desirable width (m)	Minimum width (m)
Signalised traffic intersection	3.0	2.5
Unsignalised pedestrian crossing	3.0	2.5
BRT platform pedestrian crossing	3.0	2.5
Signalised mid-block crossing	3.0	2.5

Table 2-13 Pedestrian crossings. Source: Hönnun fyrir alla - algild hönnun utandyra (Iceland, 2019).

Vehicle Swept Paths

The geometrical intersection layout and tight curves shall be designed using design vehicles and vehicle swept paths.

Each street shall be classified using website information from Borgarvefsjá and other websites for different municipalities. Street classification should be verified by the appropriate authorities.

Table 2-21 (Vehicle swept paths) shall be used to define which design vehicle shall access each street, using the classification system of streets. This table is based on Reykjavik Municipality

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guidelines (Hönnunarfarartæki í borg.pdf). Driving mode of A or B is stated in this table, and follows the definition described in Håndbok N100 — Veg- og gateutforming, Statens Vegvesen (Norway, 2019 – further referred to as "N100"), except for the design speed which shall be 5km/h.

Street Classification	Design Vehicle	Driving Mode
Göngugata (Pedestrian street)	VB	A/B
Vistgata (Shared street)	VB	A/B
Íbuðagata (Residential street)	VB	A/B
Safngata (Collector street)	HB/LV	A/B
Tengibraut (Connecting street)	ÖF/ÖT	A
Stofnbraut (Highway)	ÖF/ÖT	A

Table 2-14 Vehicle swept paths. Source: Hönnunarfarartæki í borg (Reykjavik Municipality)

Schematic diagrams shall be produced for each intersection, showing the design vehicle and driving mode proposed for each movement. BRT, bus routes and intersection functionality are to be considered in deciding which movements are required in each intersection. Some intersections may deviate from the Reykjavik guidelines to use smaller vehicles. These intersections shall be agreed with the PMO.

Vehicle swept paths shall be drawn using AutoTurn software.

a. The Icelandic vehicle library is used to define the vehicle characteristics.
b. A driving speed of 5km/h shall be used.

Intersection geometry should be adjusted (kerb return radii minimised, street marking adjusted, signals adjusted), considering vehicle swept path results and the hierarchy of users. The design vehicle may make use of the median area (when not used for refuge for pedestrians) with its body, but the wheels shall not touch the kerbs/marking. The median needs to be free of any obstacles (such as signs, poles, fences or vegetation). For opposing left turns, a body clearance of 30 cm should be maintained between the opposing vehicles. The buffer zones can intersect as long as they don't intersect the wheels or body of the other vehicle.

Measures for Emergency Driving

The Borgarlínan bus lanes will be used during emergencies by fire trucks, ambulances, police and other emergency vehicles. Intersections shall be designed for these emergency vehicle movements, which can differ from both the buses' and the regular traffic's legal movements in the intersection. At sections with central Borgarlínan lanes with adjacent medians, there shall be designed entrance and exit points at side streets and relevant functions. These points shall be coordinated with the relevant authorities. These entrance and exit points are not to be used by regular traffic but only for emergency vehicles on a call. They shall be designed with lowered and rounded kerbs (5 cm high) and a driveable surface - though not inviting other traffic to intentionally or unintentionally use them to enter the Borgarlínan lanes.

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Traffic Signals

Traffic signal pole locations will be designed as part of the street design scope through the Preliminary Design and Detailed Design phases. Traffic signalling and phasing is completed as part of the Mobility scope and is covered in another document.

2.2.7 Sight Distance

Horizontal Sight Distance

	Design Speed [km/h]										
Slope	**30**	**40**	**50**	**60**	**70**	**80**	**90**	**100**	**110**	**120**	**130**
-10%	22	35	52	74	103	138	176	221	273	333	404
-9%	22	34	51	72	101	134	170	213	262	320	387
-8%	21	34	50	71	98	130	165	206	253	307	371
-7%	21	33	49	69	96	127	160	199	244	296	356
-6%	21	33	48	68	93	123	156	193	236	286	343
-5%	21	32	47	67	91	120	151	187	229	277	331
-4%	21	32	47	66	89	117	147	182	222	268	320
-3%	20	32	46	64	88	115	14.4	177	216	260	310
-2%	20	31	45	63	86	112	140	173	210	252	300
-1%	20	31	45	62	84	110	137	169	205	245	292
0%	20	31	44	61	83	107	134	165	199	239	283
1%	20	30	44	60	81	105	131	161	195	233	276
2%	20	30	43	60	80	103	129	157	190	227	269
3%	20	30	43	59	79	101	126	154	186	22	262
4%	19	30	42	58	77	100	124	151	182	217	256
5%	19	29	42	57	76	98	121	148	178	212	250
6%	19	29	41	57	75	96	119	145	175	207	244
7%	19	29	41	56	74	95	117	143	171	203	239
8%	19	29	41	55	73	93	115	140	168	199	234
9%	19	28	40	55	72	92	113	138	165	195	229
10%	19	28	40	54	71	91	112	135	162	192	225

Table 2-15 Stopping sight distance (Ls) in a vertical curve in urban areas, based on speed limit and slope of the street.

Horizontal sight distance shall be checked in four situations:

- On continuous streets (Stopping sight distance on horizontal curves)
- At T and X intersections
- At driveways
- On bicycle paths:
    - Continuous paths
    - Intersections

The following sections describe the method of horizontal sight distance checks for all four situations. The procedures are based on the Norwegian standard, N100.

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On continuous streets (Stopping sight distance on horizontal curves)

The sight distance on the continuous street (L1) should at minimum be the same as the stopping sight distance (Ls). The Stopping sight distance as defined in the N100 is shown in Table 2-16 below and is dependent on the set speed limit on the street.

Speed limit	**30 km/h**	**40 km/h**	**50 km/h**	**60 km/h**
Stopping sight distance (Ls)	20 m	30 m	45 m	60 m

Table 2-16 Minimum sight distance on continuous streets given in meters.

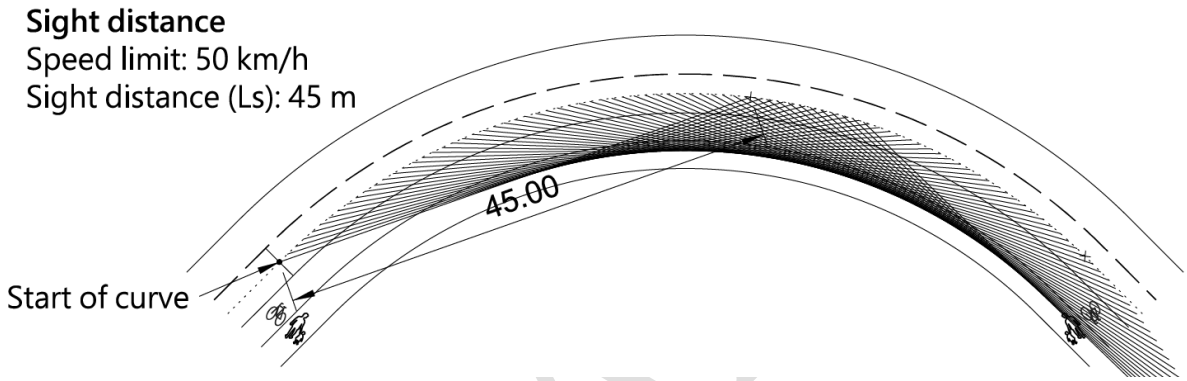


Figure 1: Example of how to draw the sight distance line in a horizontal curve. Source: based on N100.

At T and X intersections

All signalized and unsignalized intersections shall be checked.

Visibility requirements at right-of-way regulated T and X intersections is estimated using a visibility triangle, as shown on Figure 2. The triangle is drawn using the primary street sight distance L1 and secondary street sight distance L2.

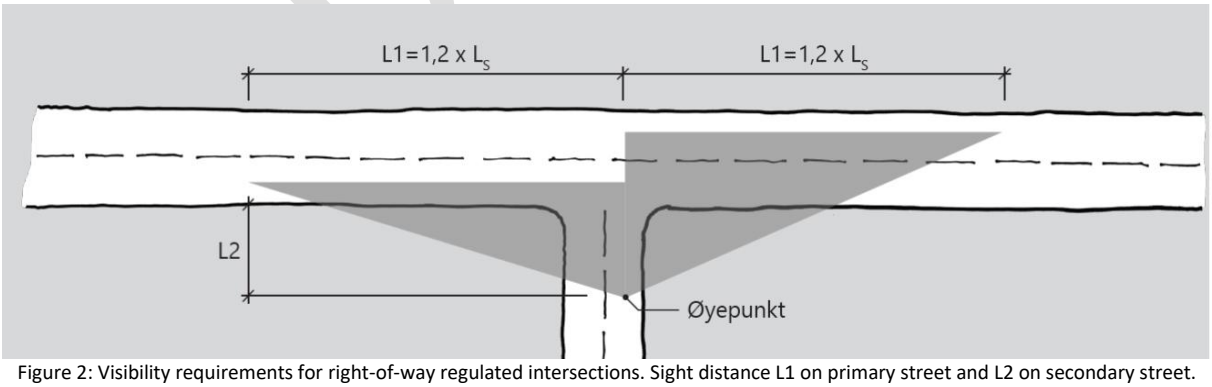


Figure 2: Visibility requirements for right-of-way regulated intersections. Sight distance L1 on primary street and L2 on secondary street. Source: Figure 4.1.1.6—1 in N100

L1 is estimated using: $L_1 = 1{,}2 \times L_S$ where Ls is the stopping sight distance from Table 2-16 above. L1 is measured from the center of the oncoming car lane from the secondary street.

L2 is the sight distance from the primary street onto the secondary street and is defined in Table 2-23. L2 is measured from the back edge of the pedestrian path along the primary street, which is

shown in sketch (a) in Figure 3 below. Where this cannot be achieved, sketch (b) will be checked instead.

Traffic volume on secondary street	Speed limit on primary street [km/h]		
	30 and 40	50 and 60	80 and 90
ÅDT < 100	4 m	6 m	6 m
100 < ÅDT < 500	6 m	6 m	10 m
ÅDT > 500	6 m	10 m	10 m

Table 2-17 Sight distance from the primary street onto the secondary street (L2) based on speed limit and traffic volume.

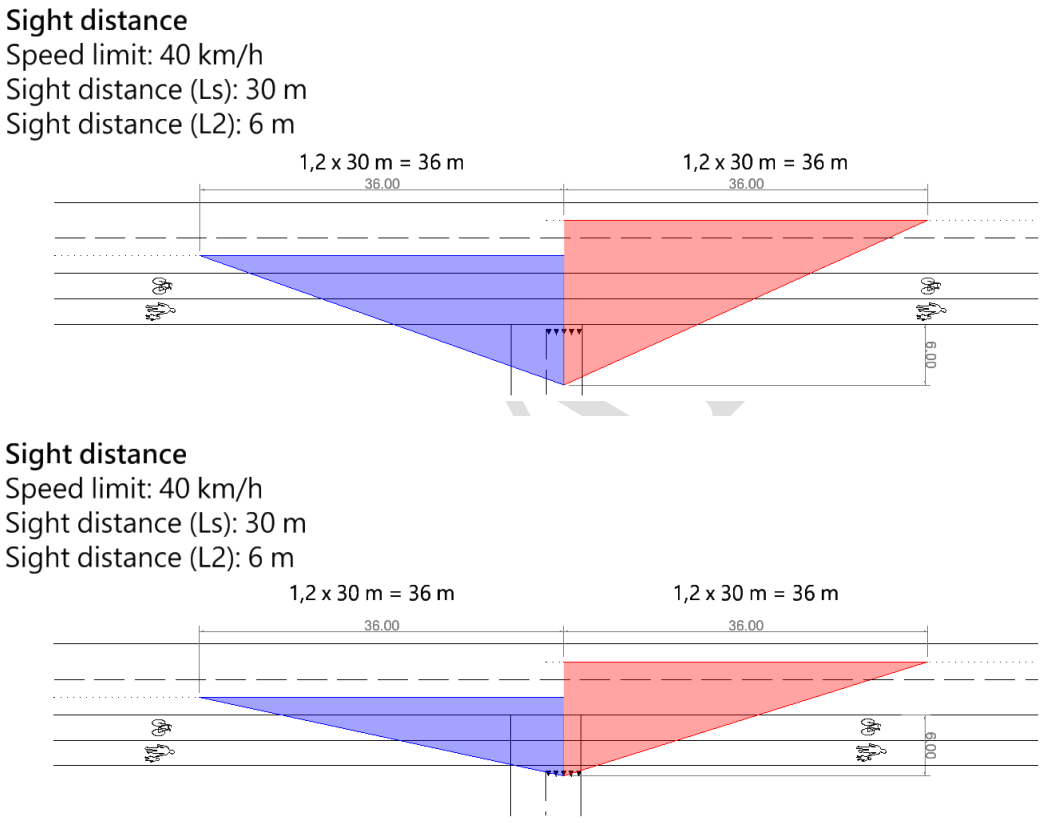


Figure 3: Example of how to draw the sight distance triangle on a right-of-way regulated intersection. On the upper part, (a) shows the sight distance L2 drawn from the edge of the pedestrian path. On the lower part, (b) shows the sight distance L2 drawn from the back edge of the traffic lane. Source: based on N100.

2.2.7.4 At driveways

All intersections where a public street meets a private street (i.e., at driveways) should be checked. Visibility requirements at driveways is estimated using a visibility triangle, as shown on Figure 4. The triangle is drawn using the primary street sight distance L1 and secondary street sight distance L2.

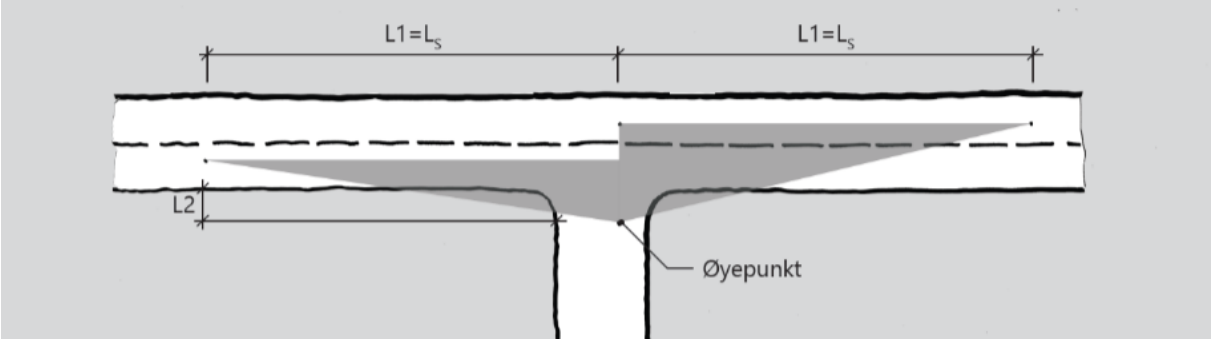


Figure 4: Visibility requirements at driveways. Sight distance L1 on primary street and L2 on secondary street. Source: Figure 4.1.4.2-1 in N100

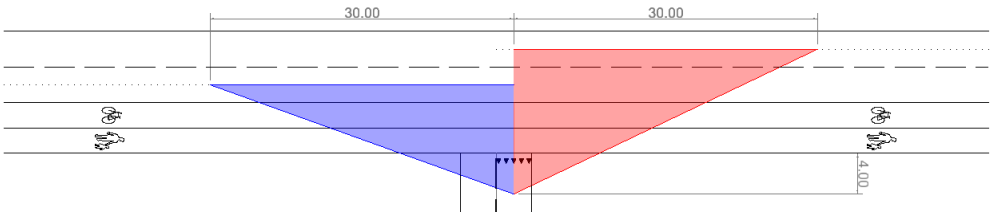
L1 is the same as the stopping sight distance (Ls) from above. L1 is measured from the center of the oncoming car lane from the secondary street.
L2 is the sight distance from the primary street onto the secondary street and is defined in Table 2-18. L2 is measured from the back edge of the pedestrian path along the primary street, as shown in Figure 5 (a). Where this cannot be achieved, sketch (b) will be checked instead.

Traffic volume on secondary street	**Speed limit on primary street [km/h]**			
	30 and 40	**50 and 60**	**80**	**90**
ÅDT < 50	3 m	4 m	4 m	6 m
ÅDT > 50	4 m	6 m	6 m	8 m

Table 2-18 Sight distance from the primary street onto the secondary street (L2) based on speed limit and traffic volume.

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Sight distance
Speed limit: 40 km/h
Sight distance (Ls): 30 m
Sight distance (L2): 4 m



Sight distance
Speed limit: 40 km/h
Sight distance (Ls): 30 m
Sight distance (L2): 4 m

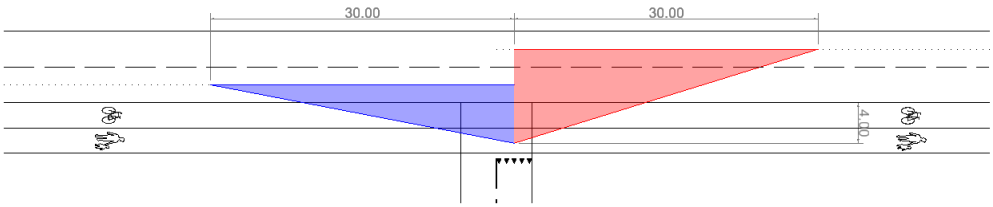


Figure 5: Example of how to draw the sight distance triangle at a driveway. On the upper part, (a) shows the sight distance L2 drawn from the edge of the pedestrian path. On the lower part, (b) shows the sight distance L2 drawn from the back edge of the traffic lane. Source: based on N100.

On bicycle path

Continuous paths

On bicycle paths, the stopping sight distance is dependent on the slope of the path. In Figure 6 below, the different stopping sight distances for bicycle networks in rural and urban areas are given.

For a downwards slope of more than 5% the stopping sight distance for -5% is used. Likewise, for any upwards slope the stopping sight distance of 0% is used.

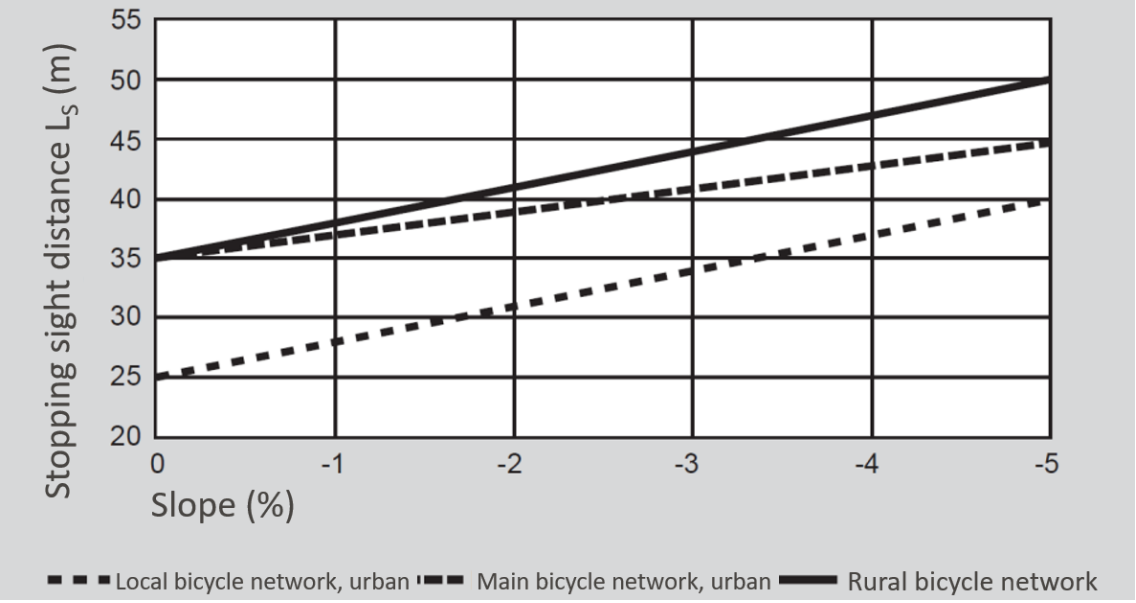


Figure 6: Stopping sight distance (Ls) in m, for bicycle paths. Source: Figure 4.2.1.3-1 (translated) in N100

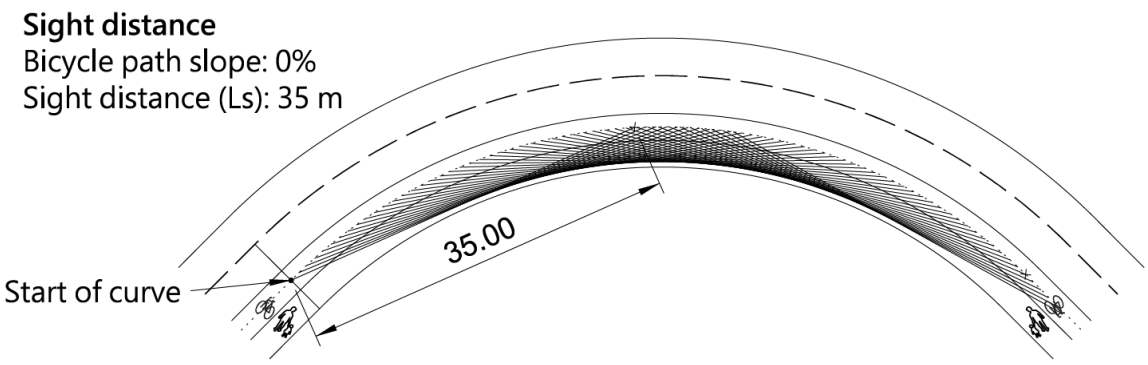


Figure 7: Example of how to draw the sight distance line in a horizontal curve. Source: based on N100

Intersections

All signalized and unsignalized intersections shall be checked.
Visibility requirements at right-of-way regulated intersections is estimated using a visibility triangle, as shown on Figure 8. The triangle is drawn using the bicycle sight distance Ls and a standard of 4 m sight distance from edge of bicycle path. Ls is estimated using Figure 6. A Ls long horizontal line is drawn from the center of the secondary street, along the center of the bicycle path in both directions, and a 4 m vertical line form the edge of the bicycle path, then two visibility triangles should be drawn.

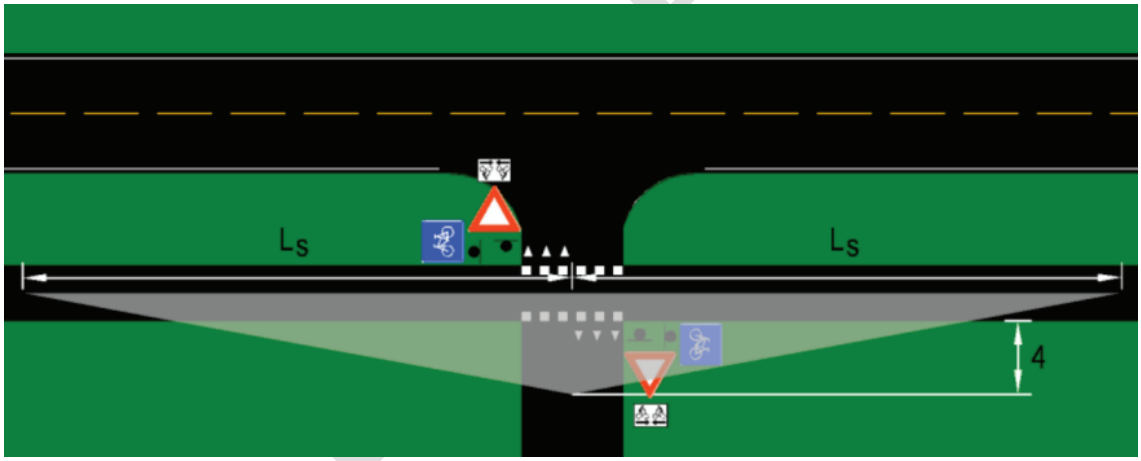


Figure 8: Sight distance on bicycle paths at right-of-way regulated intersections. Source: Figure 4.2.1.3-3 from N100.

On a one-way bicycle path, the sight distance should be checked from both directions, as some cyclist will cycle in the wrong direction.
For a two-way bicycle path, the visibility triangle should be drawn from the center of the bicycle lane on the bicycle path for each travel direction.

Sight distance
Bicycle path slope: 0%
Sight distance (Ls): 35 m

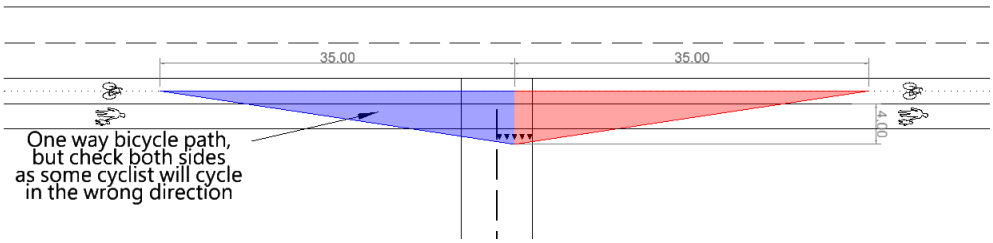


Figure 9: Example of how to draw the sight distance triangle on a right-of-way regulated intersection, with a one-way bicycle path.

Sight distance
Two-way bicycle path slope: 0%
Sight distance (Ls): 35 m

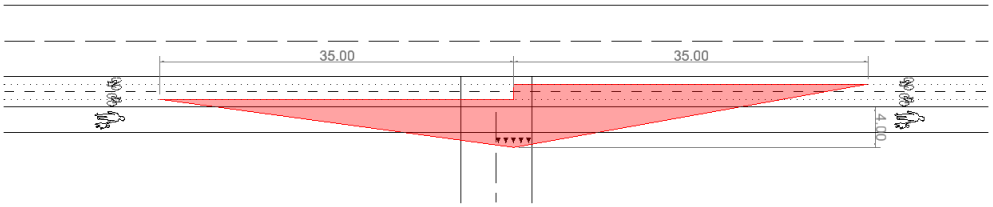


Figure 10: Example of how to draw the sight distance triangle on a right-of-way regulated intersection, with a two-way bicycle path.

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Vertical Sight Distance

Vertical sight distance shall be checked on vertical curves. In general, the sight distance is fulfilled on vertical curves with large radius. However, vertical curves with a small radius need to be checked to see whether the vertical sight distance can be achieved. This is common at intersection approaches.

The following sections describe the method of sight distance on vertical curves. The procedures are based on the Icelandic standard, which utilizes the methods used in the Norwegian handbook V120.

Vertical curves

The vertical sight distance (Lk) should at minimum be the same as the stopping sight distance (Ls). The stopping sight distance as defined in the Icelandic design manual are shown in Table 2-15 and is dependent on the set speed limit on the street, and the slope of the street. Figure 11 shows the principle drawing for vertical sight distance requirements in a curve.

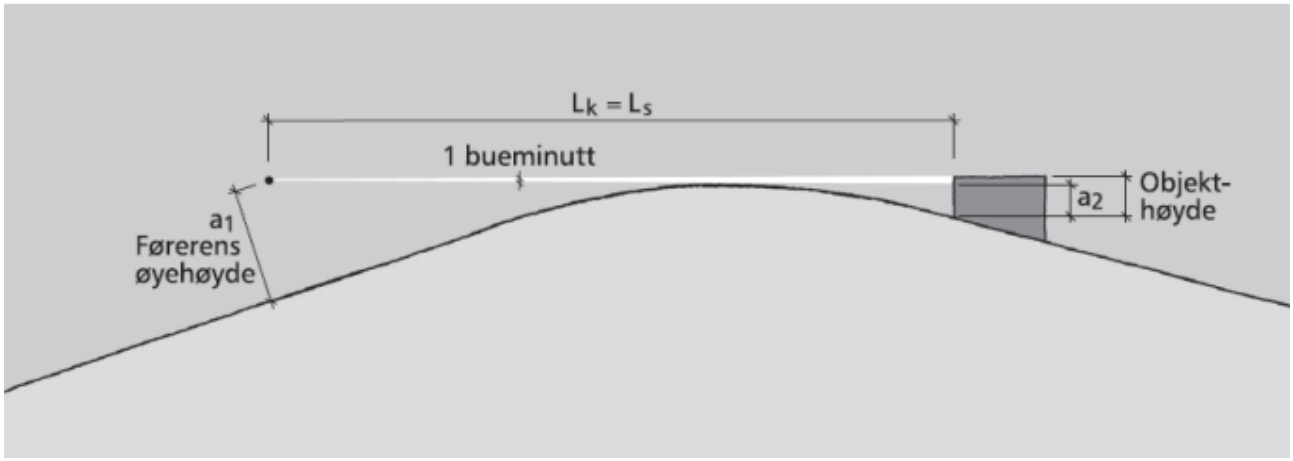


Figure 11: Principle drawing for vertical sight distance requirements in a curve. Source: Figure 3.11 in V120.

The driver's eye height (a1) is set to 1.1 m, drawn perpendicular from the terrain.

The visible surface of obstacle is set in the height a2 from terrain, where a2 is the object height minus 0.1 m:

$$a_2 = object\ height - 0.1\ m$$

In the absence of a specific object, a general object height of 0.2 m shall be used.

The sight distance Lk from the driver's eye to obstacle height should at the least be the same as the stopping sight distance (Ls).

2.2.8 Street Safety Barriers

Due to the urban location of the project, street safety barriers will be avoided where possible. They will be implemented where required to protect street users from streetside hazards. The need for barriers will be in accordance with the clear widths described in section 2.2.3.2 and clearances described in 0.

2.2.9 Street Traffic Signage and Street Marking

Street Marking

Street marking will be designed in accordance with the Icelandic standards (Veghönnunarreglur – 08 Yfirborðsmerkingar, Iceland, 2019), regulation on traffic signs (Reglugerð um umferðarmerki og notkun þeirra nr.250/2024, Iceland, 2024) and be based on urban street design.

Regulatory street signage

Regulatory street signage will be designed in accordance with the Icelandic standards (Handbók um Umferðarmerki – Rammareglur og ýmsar útfærslur, Iceland, 2025), regulation on traffic signs (Reglugerð um umferðarmerki og notkun þeirra nr.250/2024, Iceland, 2024). and be based on urban street design. BRT-specific regulatory signage is expected to be developed by the Icelandic Road authority as needed.

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Directional street signage

Directional street signage is to be developed by the Municipalities due to the fact that information on the signs is not defined by standards but by municipal knowledge.

2.2.10 Driveways / Private entrances / Parking Lots

Driveways and private entrances will be redesigned at the same width as the existing driveways unless stakeholders provide information for new driveway sizes or changed functionality. A standard driveway layout will be adopted across the project and adapted to meet the appropriate driveway widths.

2.2.11 Regular Bus Stops

Element	Desirable (m)	Minimum (m)
Width of bus bay	3.00	2.70
Length of bus bay	12	-
Deceleration taper length	18*	11
Acceleration taper length	18	7

Table 2-19 Bus stops. Source: Hönnunarreglur fyrir stoppistöðvar Strætó bs, Diagram 3

* Where the design speed is 70km/h or greater the length of the deceleration taper length should be 18-30m.

Regular bus stops are defined as bus stops that are not BRT stations and are existing bus stops that may need to be retained but shifted to accommodate the BRT project. The length of the bus stops is to be retained to ensure that the same regular bus services can be provided after the BRT project is constructed. If they need to be adjusted in the streetscape, they shall be designed according to the following values. The Table 2-19 is based on 12 m buses. Where larger buses or multiple are required to stop, the length of bus bay shall be increased accordingly.

2.2.12 Design for climatic conditions

Climatic conditions will be a consideration of street design as well as the design of pavements.

2.2.12.1 Pavement Heating

In order to increase safety and ensure uninterrupted service by Borgarlínan, it is recommended to consider heated pavement on steep slopes. It is suggested that if the slope of the roadway and paths exceeds 5%, it should be considered separately whether a snow melting system should be installed in the lanes, but if the slope of the asphalt exceeds 6%, heating should be installed in the asphalt.

In Reykjavík, hot geothermal water or return water is generally used to melt ice from streets and sidewalks. For Borgarlínan, we expect that method to be used as well.

The snow melting system will be installed in the bottom asphalt layer. It is possible to mill channels for snow melting pipes in the asphalt. Bitumen will then be used to fill over the pipes to close all voids before the next layer of asphalt is laid. Pipes are led into a box where the control and pumps are placed.

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For tiles or concrete on sidewalks and paths, snow melting system will be placed in sand layer below the surface layer.

Pavement heating is to be implemented to ensure ice does not form on pavement surfaces on specific areas to increase user safety. In severe cold weather conditions, below -10°C, there is a risk that ice will be fored a few millimeters above the surface. In these conditions winter maintenance becomes vitally important and clearing and salting the BRT lanes should be a priority in addition to the pavement heating.

Pavement heating shall be implemented at platforms where users stand or walk, on BRT pavements adjacent to platforms, and on steep slopes where braking or acceleration of BRT vehicles may be impacted by ice creating a slippery surface.

Attention must be paid to surface water, location of drains when implementing pavement heating.

In areas where there is existing heated pavement on sidewalks or paths, it will be relocated under new sidewalks or paths.

2.2.12.2 Snow Clearing

All roadways and paths will be able to carry some sort of snowplows. Areas are not designed to receive snow that is removed from roadways and paths. Either snow will be cleared to side areas or driven away.

In delicate areas as stations, a specialised equipment should be available for snow clearing.

2.3 Pavement Design Criteria

Pavement structure design is outlined in the Pavement Design Reports, for example the Pavement Design Report for Preliminary Design in Lota 1 section 110 (Document ID: BL110-GEO-IDA-RP-00001). Here are the main outlines from the general principles from which the design has been derived. However, in case of conflict between those two documents, please refer to the Pavement Design Report for Preliminary Design in Lota 1.

2.3.1 Introduction

The preliminary pavement design for heavy bus lanes of Borgarlínan was carried out using PMS Objekt, a ME (Mechanistic-Empirical) pavement design software developed by the Swedish Road Administration, Trafikverket. For the roadway with general traffic this preliminary design was carried out following the Icelandic guidelines. Material specifications will be partly gained from Icelandic guidelines, experience and research along with additional information from Norwegian and Swedish guidelines where needed.

2.3.2 Codes and standards

Pavement design guidelines used are:

- By Icelandic Road and Coastal Administration (IRCA)
    - Burðarþolshönnun, leiðbeiningar, LEI-3301, útg. 1 by IRCA
    - Efnisgæðaritið, 31.01.2023.
- By the Swedish Transport Administration, Trafikverket:
    - Trafikverkets infrastrukturregekverk, KRAV med RADSTEXT, TRVINFRA-0024, version 4 Vagoverbyggnad, Overbyggnad vag, Dimensionering och utformning.

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    - ATB Vag 2005, VV Publ 2005:112.
    - TRVR Vag, Trafikverkets tekniska rad vagkonstruktion, TRV 2011:073, TDOK 2011:267.
- By the Norwegian Public Roads Administration, Statens vegvesen:
    - Handbok N200 Vegbygging.
    - Handbok N-V123 Kollektivveiledning.

2.3.3 Design criteria

Climate

PMS Objekt is developed by the Swedish Transport Administration and therefore the climate classification is adjusted for Sweden. For Sweden there are five climate zones with the coldest being zone 5 and the warmest zone 1. Considering average air temperature in Reykjavik from 1991 to 2022 measured by the Icelandic Met Office, temperature is tempered in Reykjavík and moisture content high over the winter and autumn. One of the differences with climate in Sweden and Iceland is the number of frost thaw days, as winters are milder and therefore frost does not penetrate as deep into the pavement and summers colder in Iceland. Here it was decided to use climate zone 3, but the material properties for each season have to be selected and therefore the number of days in each season is crucial but not the selected zone (Table 2-20). Here following is assumed:

- Winter conditions apply for December, January, February, and March when the average temperature is below 2°C, design temperature is assumed to be 1°C on average.
- Frost/thaw and autumn conditions are applicable when average temperatures are between 2 and 8°C, in April, May, October and November, design temperature assumed to be 5°C on average.
- Summer is in June, July, August, and September when average temperatures are over 8°C, design temperature assumed to be 10°C on average.

	Climate zone 3		Reykjavík
Winter	121		121
Defrosting Autumn	45 76	121	121
Summer	123		123

Table 2-20 Days in climate zone 3 in Sweden, compared with the climate in Reykjavík

Design time

The design time of a pavement is the time that the pavement should last for before major renovations or rebuilding is needed. Nevertheless, maintenance will have to be provided throughout the design time, and it is very likely that the wearing course will have to be replaced over the design time. Changes in load, climate etc. will affect the service life of the pavement.
Here a 20-year design time will be used, but strains on subbase and base course will be minimized in the attempt that those layers will have a longer lifetime and that strains on subgrade will be minimum to reduce the likelihood of deformations in the subgrade. This is in line with general practise in Iceland (Chapter 210.1 in Burðarþolshönnun, leiðbeiningar, LEI-3301, útg. 1), Norway (N200, krav 3.1.3), and Sweden (table 5-1 í TRVINFRA-00224).

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Pavement materials

Material	Layer	Stiffness [MPa]			Load factor
		Winter	Summer	Thawing	
HMA 16 mm, 6% SBS	Wearing course	15.000	11.000	12.000	3,0
HMA 16 mm	Binder course	12.000	9.000	10.000	3,0
CMA	Base course	6.000	3.000	5.000	2,5
Cement bound base course	Base course	1500	1500	1500	2,25
Unbound base course, crushed material	Base course	600	600	600	1,35
Unbound subbase material	Subbase	400	400	200	1,35
Fill material	Subgrade	200	200	100	1,0

Table 2-21 Proposed pavement materials

Pavement materials are not only inhomogeneous but also stress dependent and their properties vary with various environmental conditions. In this design three climate conditions are considered, winter, summer, and thawing. Proposed pavement materials and estimated stiffness are listed in Table 2-21. All design stiffnesses assume a well-drained pavement structure, and it is assumed that groundwater table and water will not rise any higher than 30 cm below the bottom of the subbase layer. This will be ensured with proper drainage. It is further assumed that no frost susceptible materials will be present in the top 1,0 meter of the pavement structure.

Traffic volume and traffic load

All traffic numbers are taken from traffic data supplied by PMO, but assumptions have to be made regarding the combination of traffic, traffic increase and occupancy. In this preliminary design following is assumed:

			B-factor	
	Axle Weight [tonne]	Axle type	100%	75%
Van Hool XQC24E 24 m	8 / 13 / 13 / 8	Single	6,5	5,2
Van Hool A18E	8 / 13 / 13	Single	6,1	4,8
VDL Bus & Coach Citea 18 m	8 / 11,5 / 10	Single	3,2	2,6

Table 2-22 Design vehicle being considered, values for 100% and 75% occupancy are shown

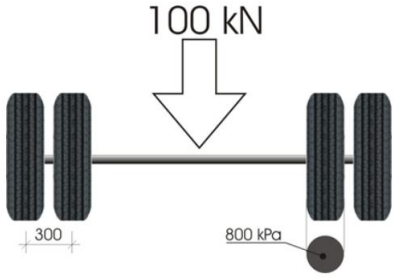


Figure 12: The standard axle (TRVINFRA-00224)

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Stations

Bus stops need to be able to withstand both the static load from a stationary bus as well as the force and heat generated by breaking. The experience, not only in Iceland, is that maintenance for bus stops with asphalt is higher and more frequent than for the streets. The mode of failure is often more related to creep where the load from the bus pushes the asphalt layer downwards causing it to flow away from the loading point forming a noticeable raised elevation on either side of the wheel path, Figure 13. This deformation can be clearly seen in bus stops around the main capital area and is especially noticeable at Hlemmur.

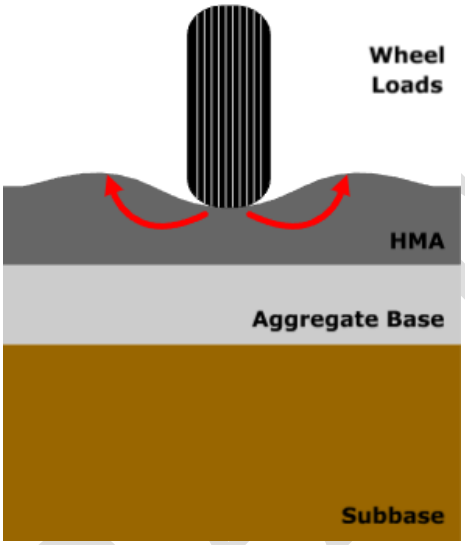


Figure 13: Rutting in pavement due to creep. Source: https://pavementinteractive.org/reference-desk/pavement-management/pavement-distresses/rutting/

It is IDA recommendation to prevent this problem is that all bus stops should have concrete pads. The pads should be the width of the lane or bus stop if it is a separate area and at minimum 20 m long so an 18 m long bus can fully stop on the pad.
For design of bus stops the design vehicle is assumed to be VDL Bus & Coach Citea 18 m with the highest axle value of 11,5 t. The area the load is applied varies with tire configuration as well as tire pressure but according to Eurocode (EN1991-1-1-2002) the area is assumed to be 200x200 mm for heavy vehicles.

2.4 Design bus

Following parameters have been chosen by Betri Samgöngur for the design bus for Borgarlina Lota 1:

Criteria	Parameters
Bus length	18m articulated bus with 3 axles
Bus weight	
- when designing new streets	According to parameters for Van Hool A18E (18m) with an occupancy rate of 75% (see Table 2-22): - Axle weight: 8 / 13 / 13 tons

Criteria	Parameters	
	- Axle type: single - B-factor: 4,8	
- when analysing and re-building existing streets (Lota 1 and other similar Lotas)	According to parameters for VDL Bus & Coach Citea (18m, keeping the Icelandic legislation) with an occupancy rate of 75% (see Table 2-22): - Axle weight: 8 / 11,5 / 10 tons - Axle type: single - B-factor: 2,6	
Platform length	For 18m buses:	For future 24m buses:
- single platform	19.8m	26.1m
- double platform	39.6m	52.2m
Swept paths / manoeuvring in curves	The Icelandic HB 15m bus parameters shall be used for the design as the others analysed buses (the Van Hool, VDL and Icelandic LV - 18m) require smaller turning radii and can accommodate following parameters:	
- turning circle radius, outside vehicle body	26.97m	
- turning circle radius, inside vehicle body (maximum	20.06m	
- turning circle radius, inside vehicle body (opposite starting position)	17.55m	

Table 2-23 Design bus parameters

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3 Drainage Design Criteria

3.1 Introduction

This section describes the requirements of the drainage system that are supplementary to all applicable standards and norms. The drainage system shall be designed in cooperation with the utility companies and municipalities.

3.2 Codes and Standards

The standards and codes regarding drainage that are valid for this project are the following:

- LAV-501 - Forsendur leiðbeininga um hönnunarrennsli skólps - Útgáfa 14
- LAV-502 - Forsendur leiðbeininga um hönnunarrennsli ofanvatns - Útgáfa 14
- LAV-503 - Leiðbeiningar um hönnunarrennsli skólps og ofanvatns - Útgáfa 15
- LAV-504 - Staðalsnið Fráveitu - Útgáfa 10
- LAV-815 - Hönnunarleiðbeiningar fyrir ráðgjafa - Útgáfa 25.0
- LAV-131 - Öryggi við skurðgröft og gryfjur - Útgáfa 1
- Icelandic IST 68-2003
- Dansk Standard DS 432
- Water plans or climate plans from municipalities
- CIRIA SuDS Manual 2015 – Version 5

3.3 Design Criteria

3.3.1 Road gullies

For collecting the runoff from the streets, gullies are placed in low points. The distance between the road gullies depends on the longitudinal gradient of the street.

- Slope 0 ‰ < s < 1 ‰, distance 15 m
- Slope 1 ‰< s < 2 ‰, distance 17 m
- Slope 2 ‰< s < 3 ‰, distance 19 m
- Slope 3 ‰< s < 4 ‰, distance 22 m
- Slope 4 ‰< s < 5 ‰, distance 25 m
- Slope 5 ‰< s, distance 30 m

All gullies are connected to the main public drainage system through a sand trap. Where the Borgarlínan is located next to a bicycle path, the sand traps used for the Borgarlínan are constructed with a grating to divert runoff from the bicycle path and the sidewalk. New road gullies are placed so that the catchment areas are maximum 400 m^2.

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The exact location of each road gully and the lateral connection to the main drainage system will be designed in the detailed design phase.

3.3.2 Blue Green Solutions (BGS)

Blue Green Solutions (BGS) are implemented in the agreed-upon sections and subsections. At the time of this writing, the following subsections are to be considered for implementation of BGS:

- Section 110.1-110.2
- Section 120.01-120.2 (decision awaits the alignment design)
- Section 130.03
- Section 140.3, 140.5, 140.6, 140.7 (it will be assessed whether there is space for surface solutions)
- Section 150.2-150.3
- Section 160.1-160.4 (decision will be taken at a later stage)
- Section 160.5-160.6

The design criteria for BGS retention have not yet been decided on. For proper design, a rain event has to be agreed upon as well as a potential climate factor.
Where discharge from the BGS is to a sensitive water body, the BGS should be designed to clean the water as much as possible before discharge. All BGS are designed with overflow to the traditional drainage network or other suitable recipients to avoid flooding in the area.
BGS must be designed to accommodate the winter conditions in Iceland. If possible, BGS will be designed to function as potential snow storage during winter.
BGS are designed to make operation and maintenance as easy as possible to avoid the BGS not being operational.
All BGS will be designed with respect to the overall impression of Borgarlínan.

3.3.3 Manholes, chambers and gullies

Load classification for all covers and gratings in terrain shall be D400.

For manholes with sand traps, including road gullies, the volume of the sand trap shall be at least 35 litres for ø315 mm manholes and 70 litres for ø425 mm manholes or bigger.

Inspection chambers, sand traps and gully shall be minimum ø315 mm and shall have a corrugated shaft with flexible joints.

3.3.4 Perforated pipes and gravel

Plastic perforated drainpipes shall be fully slotted double walled pipes for normal draining purposes, or as top slotted drainpipes in case of combined draining and transport purposes.

Drainpipes shall have maximum bends of 30 degrees and a minimum slope of 5‰.

Drainpipes shall be maximum 150 m long, and there shall be a sand trap after maximum 300 m.

Filter gravel around drainpipes shall comply with standard criteria to ensure that drainpipes will not get clogged. There should be 10 cm of gravel over, under and on each side of drainpipes.

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3.4 Specific Designs

3.4.1 Drainage of structures

Drainage of structures/constructions or foundations shall be done with fully slotted pipes and let to a sand trap before connection to the main drainage system.

3.4.2 Drainage of stations

Drainage of stations shall be led to a sand trap before connection to the main drainage system.

3.5 Safety issues

Safety issues have been considered throughout the drainage design process to try to reduce the danger to users as well as operational staff. Attention must be paid to maintenance of Blue Green Solutions and road gullies. Road gullies and Blue Green Solutions are placed to make maintenance as easy as possible for operational staff with minimal impact on Borgarlína traffic.

3.6 Operational issues

All runoff from terrain will be led through a sand trap before discharge to the main drainage system, either in road gully or via a separated sand trap (manhole). This means that there will be a lot of sand traps that will need to be serviced along the Borgarlínan. In the preliminary design, the manholes have been placed to ensure the safest possible servicing of the sand traps. In general, the manholes have been placed with regards to the driving traffic and general infrastructure in the respective areas.

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4 Structural Design Criteria

4.1 Introduction

This section describes the requirements for the design of the structures along the BRT corridor, such as bridges, retaining walls and BRT stations.

4.2 Codes and Standards

The structures will be designed according to the Eurocodes, the Icelandic National Annexes, the Icelandic Building Regulation and the Icelandic Road and Coastal Administration's (IRCA) guidelines on bridge design (*"Reglur um hönnun brúa"*).

Here is a list of some of the Eurocodes:

- ÍST EN 1990:2002 Basis of structural design
- ÍST EN 1991-1-1:2002 Action on structures
- ÍST EN 1991-1-3:2003 Snow load
- ÍST EN 1991-1-4:2005 Wind load
- ÍST EN 1991-2:2003 Traffic loads on bridges
- ÍST EN 1991-5:2003 Thermal actions
- ÍST EN 1992-1-1:2004 Concrete structures
- ÍST EN 1992-2:2005 Concrete bridges
- ÍST EN 1993-1-1:2005 Steel structures
- ÍST EN 1995-1-1:2004 Timber structures
- ÍST EN 1997-1:2004 Geotechnical design
- ÍST EN 1998-1:2004 Design of structures for earthquake resistance
- ÍST EN 1998-2:2005 Design of bridges for earthquake resistance
- ÍST EN 1998-5:2004 Design of retaining structures for earthquake resistance

4.3 Design Criteria

4.3.1 Design Life

A design life of 50 years is recommended for the structures in general, but 100 years for the bridges according to IRCA guidelines.
These recommended values will be used for BRT structures.

4.3.2 Traffic load

The traffic loads on the bridges will be determined according to ÍST EN 1991-2 using load model 1 with adjustment factor a equal to 1,0. The bridges will be designed for general traffic even if they are only intended for BRT buses.

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4.3.3 Snow load

The snow load will be determined according to ÍST EN 1991-1-3 where snow load on the ground is defined as 2,1kN/m^2.

4.3.4 Wind load

The wind load will be determined according to ÍST EN 1991-1-4 depending on the location of the structure and the terrain parameters.

4.3.5 Earthquake load

The earthquake load will be determined according to ÍST EN 1998-1. The seismic zone map in the Icelandic National Annex reveals that the structures along the BRT corridor in Lota 1 are located in seismic areas with 0,1g and 0,15g ground acceleration. According to ÍST EN 1998-2, the bridges belong to importance class II (average importance).

4.3.6 Temperature

Thermal action on long bridges will be determined according to ÍST EN 1991-1-5.

4.3.7 Water level

According to a Verkis report "Deiliskipulag Artunshofda - Svaedi 1 og 2; Breeam - SE03 Flodamat" issued 03.11.2021, the waterlevel around Geirsnef is assumed to be +4.7m.a.s.l. for an event of 200-year flood in Ellidaar together with a 100-year water level in the ocean (+4.0 m.a.s.l.).

4.4 Geotechnical design

The geotechnical design of the structures will be performed according to ÍST EN 1997-1, 1998-5 and the results of the planned geotechnical investigations along the BRT corridor.

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5 Lighting Design Criteria

5.1 Introduction

This section describes the requirements of the street lighting system that are supplementary to all applicable standards and norms.

The street lighting system shall be designed in cooperation with the municipalities and the Icelandic Road and Coastal Administration (IRCA), according to codes and standards.

Connection points will be coordinated with the utility companies.

5.2 Codes and Standards

The standards and codes regarding street lighting that are valid for this project are listed in 2.1 of this report.

5.3 Design Criteria

The general criteria for classification of streets are as follows for Reykjavik Municipality refers to IST/EN 1301-2:2015:

M3: Minor arterial roads and connecting roads in central/commercial city areas

M4: Minor arterial roads and connecting roads in urban/residential areas

C: Conflict areas e.g. crossings and roundabout shall be defined in the next class above the road constriction e.g. C2 class (20 lux) for M3 roads

P1: Streets with dense pedestrian and cycling traffic in central/commercial areas and pedestrian streets. Sidewalks next to arterial roads and collector roads in class M3.

P2: Streets and pathways close to schools and nursing homes.

P3: Streets and pathways for pedestrian and cycling near schools, residential areas, and nursing homes

Icelandic Road and Coastal Administration (IRCA) sets the standards for lighting of Principal arterial roads in urban areas and the general criteria are:

M3: Principal arterial roads and connection roads

C3: Conflict areas e.g. crossings and roundabout

In this project, the design speeds of the streets of Borgarlina are in the range of 30km/h – 40km/h.

Based on the design speeds and codes and standards, the P lighting classes are used in general for classification of Borgarlina and are set as following:

- P1-P3: Pedestrian Paths and Bicycle Lanes and Paths
- P2-P3: Streets for cars and/or mixed traffic.
- P3-P4: Streets for buses only.

Classification will be having to be approved by the Municipalities and the Road authorities (IRCA).

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For the surface reflection characteristic of asphalt, the reflectance coefficients are set to N2: qo = 0,070 and W3: qo = 0,20.

Around the BRT station, the lighting will be designed in collaboration with the landscape architects according to the criteria above.

New street light systems shall be designed so that one of the three phases can be used for smart applications e.g. Wifi, pollution metering, cameras etc.

5.4 Dimming

There are four options for controlling/dimming of lamps.

a) ON/OFF (Contactor in street cabinets either controlled from remote or from in the cabinet)
b) Midnight dimming (Preprogrammed in the lamps)
c) Centralized control (Wireless communication from control gear in cabinet or each lamp with ZHAGA book 18 for instance)
d) Interactive control (Motion sensors, contacts, counters etc.)

The general rule today is option a) but the equipment shall be future ready and new controlling system for Reykjavik Municipality is estimated to be tendered in 2023-2024 up to our current knowledge.

5.5 Other relevant issues

This is a preliminary design and as such, some details are yet to be provided.

Outstanding issues include the following, which are to be included in the detailed design:

- Coordination of detailed position with other disciplines.
- Coordination with lighting of interface projects and at crossings.
- Position of traffic lights, signals, trees and vegetation.
- Changes to existing utilities and new utilities.
- Choice of materials e.g. poles and lamps.

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6 Utility Design Criteria

6.1 Introduction

This section describes the bases of handling existing utilities inside the project boundary of the Borgarlína project.

The utilities cover:

- Sewerage pipes (sewage and rainwater)
- Water supply pipes
- District heating pipes
- Electrical utilities
- Communication cables (copper and fiber)
- Possible third-party utilities.

In order to minimize disruption on Borgarlínan routes, it is assumed that pipes and cables will be kept outside the BRT lanes and, as appropriate, moved under other traffic lanes, bicycle and/or pedestrian paths. Cable pipes will be planned between stations for communication cables, they will be placed outside the BRT lanes.

The plan is to have no utilities placed under stations and platforms except for them servicing the stations. To be able to keep the stations operating during maintains of BUS lanes there will also be preferable to have 40 m utility free zone in each direction from the stations.

It is assumed at this time that this will only be a transfer of existing pipe network and therefore not an actual redesign. In some places it can be assumed that systems are not meeting modern standards. This applies, for instance, to mixed sewerage pipes and laying supply and return pipes for district heating. It is not within the scope of this project to upgrade the existing systems. But utilities could also request to take advantage of the planned earthwork for the Borgarlínan project.

6.2 Codes and Standards

The standards and codes regarding utilities that are valid for this project are the following:

- Sewerage pipes
  - Icelandic IST 68-2003
  - Dansk standard DS430
- Water supply pipes
  - Icelandic IST 67-2013
  - Dansk standard DS439
- District heating pipes
  - Icelandic IST EN 13941-1:2019
  - Icelandic IST EN 253
  - Icelandic IST EN 448
  - Icelandic IST EN 488
  - Icelandic IST EN 489
- Electrical cables
  - Icelandic IST EN 61936-1:2010

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- Icelandic IST EN 50522:2010
- Icelandic IST EN 50160:2010

6.3 Design Criteria

Requirements for surface water design are discussed in section 3.

Type of utility	Min. depth [mm]
District heating	550
Watermains	1200
Sewage/drainage	1200
Electricity	700
Cable pipes	700
Communication cables	550

Table 6-1 Design depths for utilities. Source: LAV-815 "Hönnunarleiðbeiningar fyrir ráðgjafa".

When re-laying pipes and cables, guidelines in the document LAV-815, Design guidelines for consultants, "Hönnunarleiðbeiningar fyrir ráðgjafa" (which can be found at the website veitur.is/radgjafar-og-honnudir) is followed in the municipality of Reykjavík and go along with coordination with Míla and Reykjavik Fibre Network. In other municipalities, relevant requirements are used where applicable. Table 6-1 describes the minimum depth for utilities.

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7 Architecture

7.1 Introduction

This chapter describes, in a very overall way, the design criteria for the stations. These aspects are further elaborated in the Stations Design Manual (Document ID: BL100-ULA-IDA-RP-01014)

7.2 Codes and Standards

The station design manual for Borgarlínan is based on recommendations and requirements that follow respectively Icelandic, Norwegian, Danish and Swedish rules.

Iceland:

- Hönnun fyrir alla - Algild hönnun utandyra

Norway:

- Statens vegvesen - Arkitektoniske virkemidler for orientering og veifinning
- Statens vegvesen - Stasjonshåndboken
- Statens vegvesen - Kollektivhåndboka

Denmark:

- Vejdirektoratet - Standsningssteder for letbaner
- Vejdirektoratet - Håndbog for kollektiv bustrafik og BRT
- Vejdirektoratet - Grundlag for udformning af trafikarealer Håndbog

Sweden:

- Trafikverket – Stationsmiljö
- Trafikverket – Stationshandbok
- Trafikverket – Stationshandbok

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7.3 Design Criteria

7.3.1 Overall platform geometry

For accessibility, the Icelandic ‘Hönnun fyrir alla - Algild hönnun utandyra’(2019) has provided the overall guide to the design of the outdoor spaces. The stations design generally adheres to the Norwegian standards as they are more detailed than the Icelandic standards. However, the Danish Handbook for bus and BRT infrastructure (Vejdirektoratet - Håndbog for kollektiv bustrafik og BRT, 2016/updated in 2023) is the handbook that covers BRT more specifically and has provided additional guidelines for the design.

For the platform layout the Norwegian recommendation regarding obstacle free space for wheel-chairs is 1600 mm - *"Universell utforming av veger og gater", statens vegvesen*. The design complies with this recommendation.

The Danish handbook for traffic terminals and the handbook for BRT systems express the same recommendations in many areas. Here the safety zone and the "boarding zone" are expressed as

being within the same geometry. The safety zone expresses the swing a bus can have at start-up while the "boarding zone" expresses a free area for passengers getting on and off the bus. This zone is 600 mm.

In extreme cases, a bus may have a rear end swing of 1300 mm. This affects the overhang of the roof towards the platform edge. These sharp turns mainly relate to bus pockets, which is not currently in the plans for Lota 1.

The total width of the platform is 3500 mm.

7.3.2 Platform kerb height

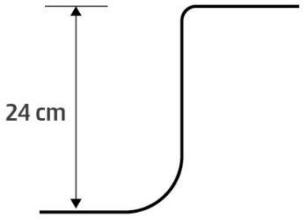


Figure 14: Kerb height

The platform height is 24 cm, due to a combination of the height of existing busses, and new BRT-busses. This gives the biggest flexibility of usage and operations. The kerb will be at the same level as the bus, allowing for level boarding.

7.3.3 Platform functions

A list of suggested functions can be found in the Stations Design Manual (Document ID: BL100-ULA-IDA-RP-01014).

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8 Landscape Architecture

8.1 Introduction

This chapter describes the design criteria for planting including principled cross sections for tree planting and low vegetation. The design criteria seek to ensure good growth conditions. Planting principles for vegetation in general will be developed further in the preliminary Design Phase, this includes principles for open drainage solutions.
Please note that this chapter is established in close coordination with the Overall Design Strategy (Document ID: BL100-ULA-IDA-RP-13001) and the Design Manual for landscape (Document ID: BL100-ULA-IDA-RP-01013).

8.2 Definitions

This section covers:

- Tree plantings
- Low vegetation

8.3 Codes and Standards

The standards and codes regarding landscape architecture that are valid for this project are the following:

Original title	Translated title
Ræktun götutrjáa í þéttbýli og val á tegundum (Icelandic handbook, 2016)	Cultivation of street trees in urban areas and selection of species (Icelandic handbook, 2016)
Statens Vegvesen, Håndbok V271 Vegetasjon i veg og gatemiljø (Danmark, 2016) Byggteknisk forskrift (TEK17)	Statens Vegvesen, Handbook V271 Vegetation in street and urban environment (Denmark, 2016) Building code (TEK17)
Normer og vejledning for anlægsgartnerar-bejde (DK handbook, 2015)	Standards and Guidelines for Landscaping (DK handbook, 2015)
Kvalitetsstandard for planteskoletræer (DK handbook, 2012)	Quality standard for nursery plants (DK handbook, 2012)

Table 8-1 Codes and standards for landscape architecture.

The recommendations regarding landscape architecture are also based on local experience and knowledge from existing tree plantings in Iceland and Denmark.

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8.4 Design Criteria

8.4.1 Width of green verges

Depending on where the planting beds and green verges are placed and what is planted in them, the space required to secure a satisfactory result differs. The following table describes the minimum width for planting beds and green verges. Stated widths include the kerbstone.

Type of planting bed /verge	Min. width [m]	Max. width [m]
Verge with trees between car/BRT lanes	3,0	-
Verge with trees between car/BRT lanes and bicycle/pedestrian paths	2,5	-
Trees/ shrubs in paved areas. Min. Width refers to the open soil around the trunk. This requires structural soil under the surrounding paving.	0,5	-
Verge with low vegetation such as grass, bulbs, perennials, annuals etc.	1	-
Verge with stones and moss	0,5	-

Table 8-2 Width of verges

8.4.2 Tree planting criteria

Traffic safety
In places where a high level of visibility is needed, for example at intersections, the tree trunks should be at least 2.2 m above the pavement. In places where visibility is not important, there is no lower limit to the height of trunks (see section 2.2 for general horizontal and vertical clearances, including a description of vegetation as a hazard). Pruning of trees is necessary to meet the safety clearances in the future.
Trees should be kept outside of sightlines at intersections.

Proximity to utilities and the use of root barriers:
Trees can generally not be placed closer than 2 m from utilities. Exceptions are electrical cables, where trees can be placed 1 m away, and pipes to private properties where trees can be placed 2.5 m away. For pipes larger than 30 cm in diameter, the position of the trees should be determined individually. It is possible to deviate from these distances in certain instances.
Whenever trees are placed in proximity of utilities, a root barrier should be used.

Build-up of planting beds with trees:
The build-up of planting beds depends on the context in which they are to be placed. Load-bearing demands, available space over/under the surface, proximity to utilities, requirements of the plants etc. should all be considered when designing the planting beds.

The root space volume available for each tree is often linked to the future size of that tree.
It is recommended that each tree has an available root space volume of min. 10 m^2 (preferred 15 m^2), a depth of 0.5-0.75 m top soil with loosened sub soil at the bottom of the planting bed. The minimum soil volume requirement can be reduced slightly when two or more trees are sharing a

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planting bed. The root space should be distributed evenly around the tree, to ensure even growth and stability of the tree.

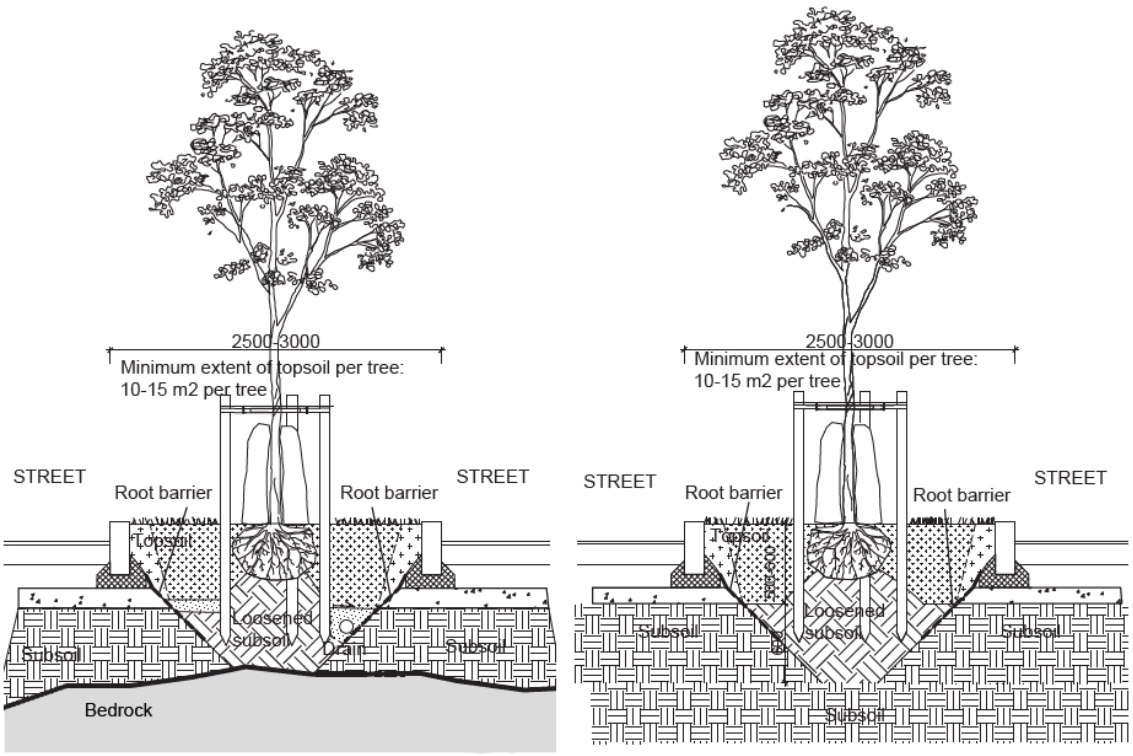
There are two overall types of planting bed build-ups when planting trees:

- *Type 1, Open soil planting beds*
- *Type 2, Paved area planting beds*

Build-up can consist of either structural soil/macadam or a plastic structure.
The types of planting beds can be combined depending on the context. For example, it is possible to have one type of structural soil in one half of the planting bed and open soil in the other half of the planting bed.
The open soil bed is to be used whenever there is room and when there is no load on the surface. The plastic structure and the structural soil/macadam build-up should be used when there is no room for an open soil bed, or when there is a need for load bearing properties, for example if there is a car lane, pedestrian path, or bicycle path on top of the planting bed. The plastic structures can be used under both bicycle lanes and car/BRT lanes with heavy traffic, depending on the type. The structural soil should only be used under bicycle paths and pedestrian paths with no heavy traffic. Where we have trees in a narrow urban context and there is only little room for vegetation, either the structural soil or plastic structure must be used. Here the minimum width for open surface around the tree trunk is 0.5 m (see the Table 8-2 with 'Width of green verges' above). The available root space remains the same in these solutions.

See principle cross sections of the different types of Build-ups below:

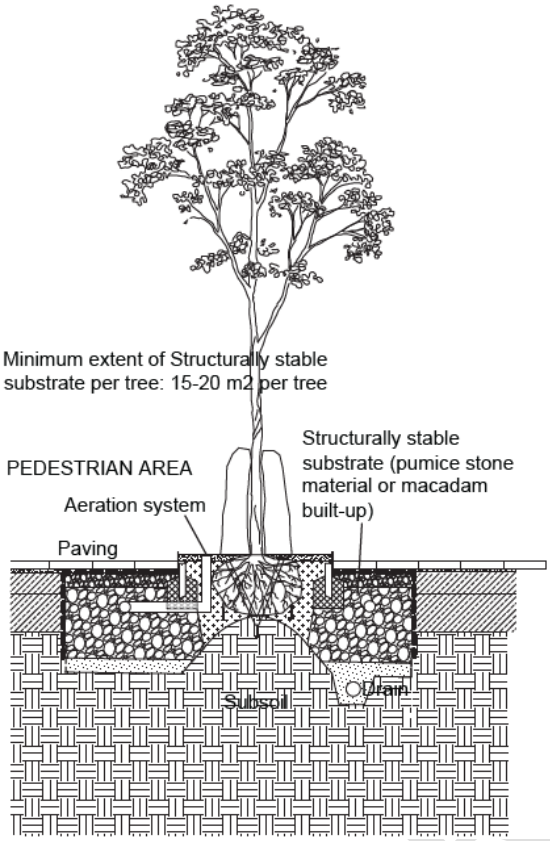
Type 1: Open soil planting beds



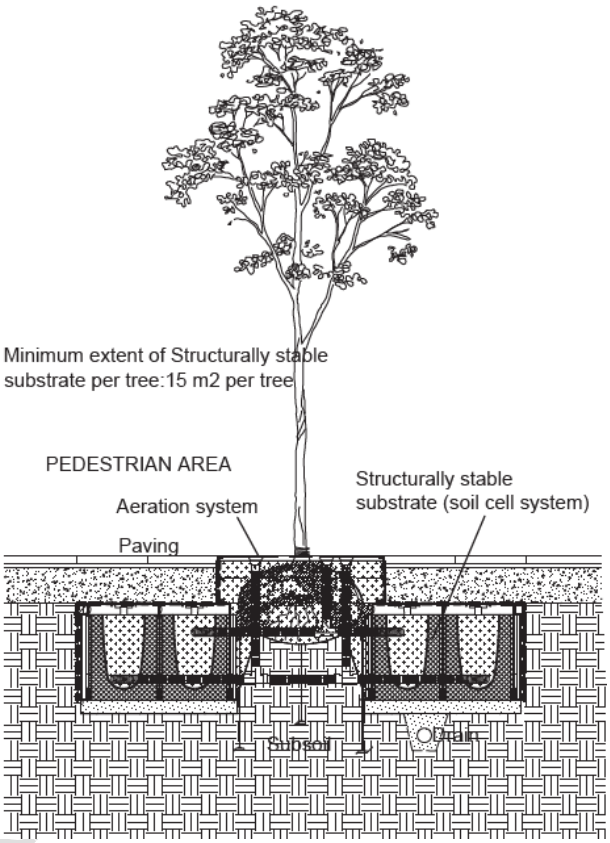
Two principles for planting method in open soil beds in 2.5-3 m green verges. Drain must be installed, if seepage is poor, e.g. when bedrock is close to bottom of plant bed. In case of roots

conflicting with underground services, root barriers have to be used, otherwise it is recommended not to use it.

Type 2: Paved area planting beds



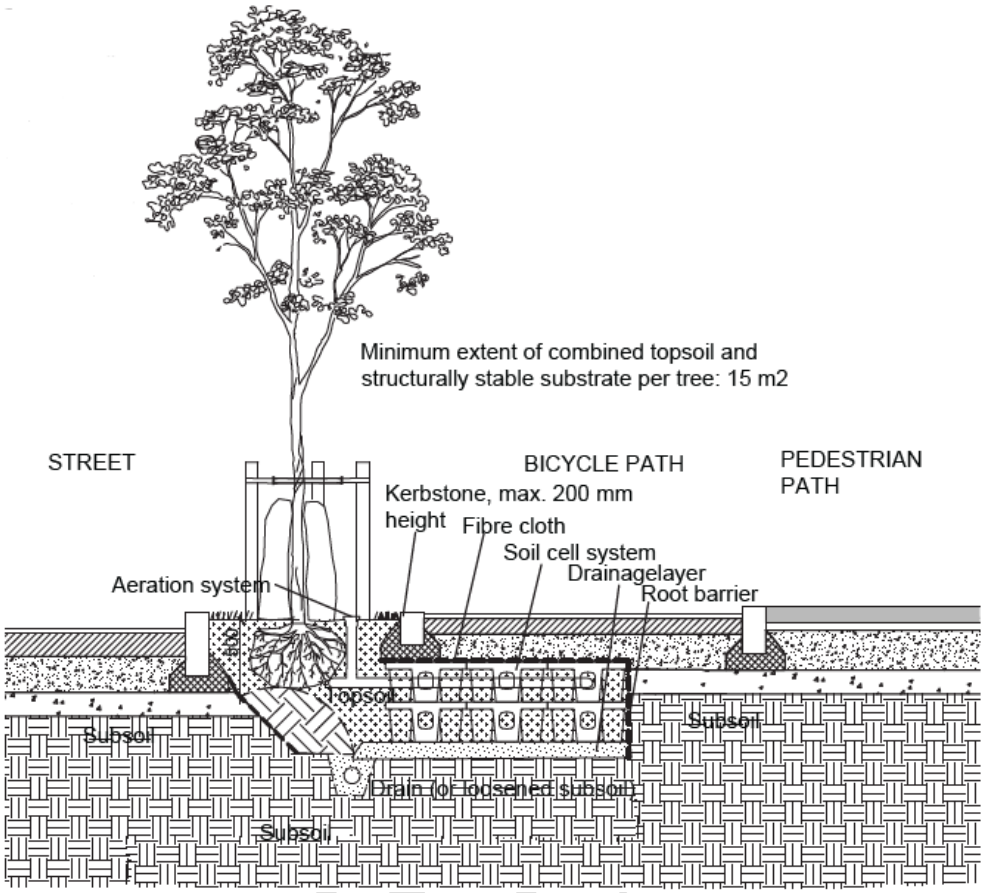
Principle for planting in a paved area with a structural soil/macadam build-up



Principle for planting in a paved area with a plastic cell structure

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Hybrid planting bed example: open soil planting bed mixed with structural build-up under paving:



Principle for planting in a 1.5 m wide open soil planting bed with structural build-up under the bicycle path

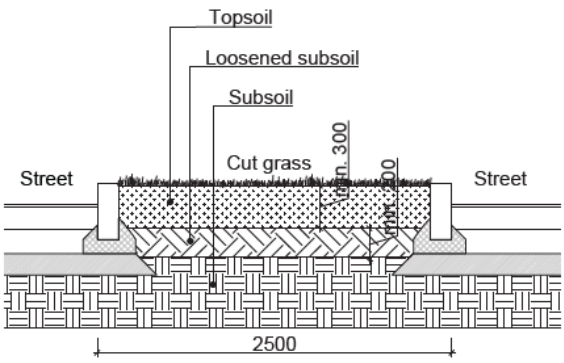
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8.4.3 *Low vegetation criteria*

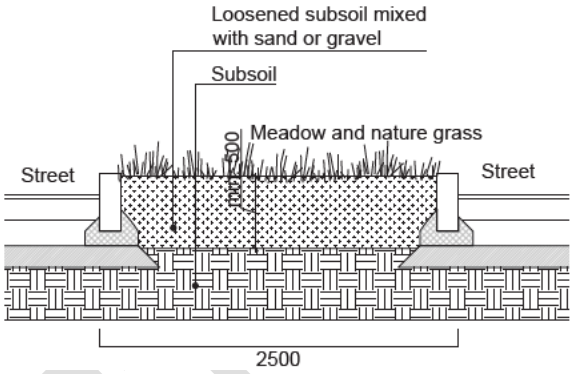
Build-up of planting beds with low vegetation

As with the planting beds for trees it is also important to ensure correct build-up of planting beds for low vegetation. See principle cross sections of different types of build-ups below:

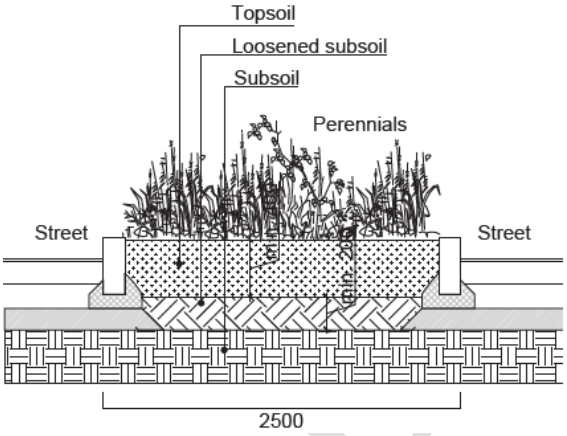
Type 1: Cut grass/turf



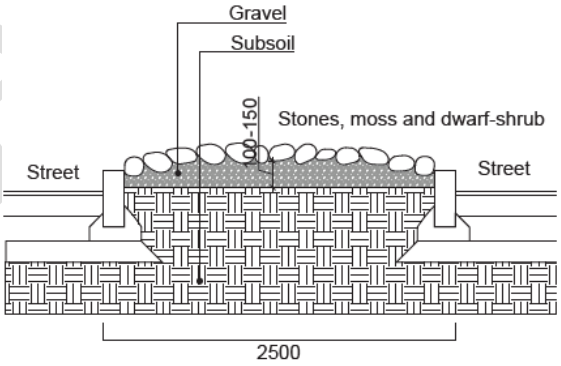
Type 2: Meadow and nature grass



Type 3: varied perennials and bulbs



Type 4: Stones with mosses and dwarf-shrubs



8.4.4 Selection of plant species

It is important to choose species that are hardy and adapted to the Icelandic climate to ensure the proper and intended characteristics and growth of the planting. It is also important to choose species which require less maintenance, can be pruned, and do not carry many allergens.

Most trees planted should be of species that are tried and tested with success in the Capital region of Iceland. In some selected areas new tree species that are currently used in other countries with similar climates could be introduced. It is important to never introduce invasive species.

9 Accessibility Design Criteria

9.1 Introduction

Accessibility covers the topic of designing for all people in society so that they have equal access to public infrastructure. Guidance for wheelchair users, prams and vision-impaired people will be provided in accordance with the standards within the project limits.

9.2 Codes and Standards

The following standards will be used as a basis for the design of accessibility aspects of Borgarlínan:

Links	Original Title	Translated Title
1	Veghönnunarreglur - 02 Þversnið (Ísland, 2011)	Road Design Rules, Cross Sections (Iceland, 2011)
2	Veghönnunarreglur - 08 Yfirborðsmerkingar (Ísland, 2019)	Road Design Rules, Road Markings (Iceland, 2019)
3	Reykjavíkurborg og Vegagerðin . Hönnun fyrir alla, algild hönnun utandyra, leiðbeiningar. Reykjavík. (Ísland, 2019)	Accessibility for all (Iceland, 2019)
4	Leidbeiningar Gönguþveranir (Ísland, 2014)	Pedestrian Crossings (Iceland 2014)
5	VSÓ Ráðgjöf . Borgarlína og umferðaröryggi, rannsóknarverkefni. (Ísland, 2019)	Borgarlínan and Traffic Safety - Research project (Iceland, 2019)
6	Hönnunarreglur fyrir stoppistöðvar, Strætó (Ísland, 2016)	Stræto Bus Stops (Iceland, 2016)
7	Håndbok N100 — Veg- og gateutforming. Statens Vegvesen (Norge, 2019)	Road and Street Design (Norway, 2019)
8	Statens Vegvesen Plassering og utforming av kollektivfelt, BRT: Løsning for å fremme miljøvennlig transport. (Norge, 2016)	Location and design of public transport & BRT (Norway, 2016)
9	Vejregler, Vejkryds i byer, Vejdirektoratet (Danmark, 2018)	Road intersections in cities (Denmark, 2018)
10	Vejregler (2016a). Håndbog – Kollektiv bustrafik og BRT. Vejdirektoratet (Danmark, 2016 / opdateret i august 2023)	Handbook - Public bus traffic and BRT. The Danish Road Directorate – Vejregler (Denmark, 2016 / updated in august 2023)
11	Vejregler - Håndbog - Tracéring i byer. Vejdirktoratet (Danmark, 2016)	Handbook – Geometric design in cities. The Danish Road Directorate – Vejregler (Denmark, 2016)

Table 9-1 Codes and standards for accessibility

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Where disparities are evident, design standards shall be applied in the following order of precedence:

- Icelandic street design standards
- Norwegian street design standards
- Danish street design standards
- Swedish street design standards

9.3 Design Criteria

9.3.1 General Criteria

Design for vision-impaired users

Guidance along pedestrian paths and towards signalised intersection crossings will be provided using guiding lines in the form of:

- tactile changes in surface material,
- natural edges such as a building façade,
- tactile indicators, or
- guiding fences or handrails.

Street furniture shall be placed at least 0.5 m from guiding lines.

Guiding lines leading to pedestrian crossings will be placed parallel to the crossing. The vision-impaired will not be led with guiding lines to an unmarked pedestrian crossing.

Standards for "Hönnun fyrir alla - algild hönnun utandyra" (Iceland, 2019) will be followed and the Technical Design Basis will be updated as new information emerge and follow the development of the standards in the future.

Design for mobility-impaired users and perambulators

Gradients and crossfalls of pedestrian areas will be designed in accordance with the accessibility standards. Values for both crossfall and longitudinal grade of paths can be found in section 2.2.3 & 2.2.4 respectively.

Kerbs at pedestrian crossings will be lowered to have a height of 2 cm, as described in section 2.2.5. The lowering shall generally take place over 1.5 m – 2.0 m. The grade of the lowered path leading to the lowered kerb shall not be greater than 1:12 (cf. Hönnun fyrir alla - algild hönnun utandyra, Iceland, 2019). Pedestrian crossing widths will be in accordance with section 2.2.6.2.

Kerbs at bus stops will be raised or lowered in accordance with 2.2.5.

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9.3.2 Platforms Criteria

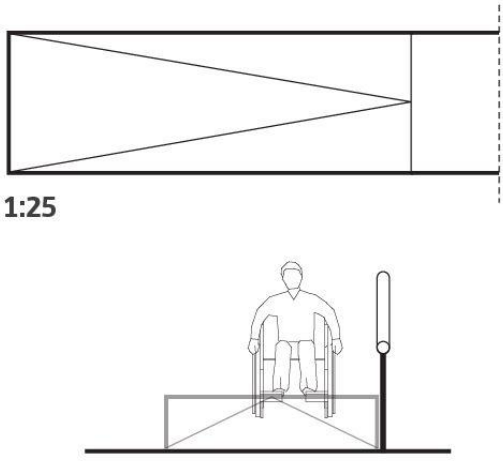


Figure 15: Slope of ramps

The inclination for ramps affects various design options. It's recommended to use a lower inclination, as this simplifies the ramp and lowers the need for extra security and accessibility measures. The length of the ramp will be adjusted depending on the slope of the street.

The longitudinal grade and crossfall of platforms shall be in accordance with the below table.

Platform	**Desirable grade**	**Maximum grade**
Longitudinal direction	1.0%	3.0%
Cross fall	1.5%	2.5%

Table 9-2 Longitudinal grade and cross fall for platforms

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