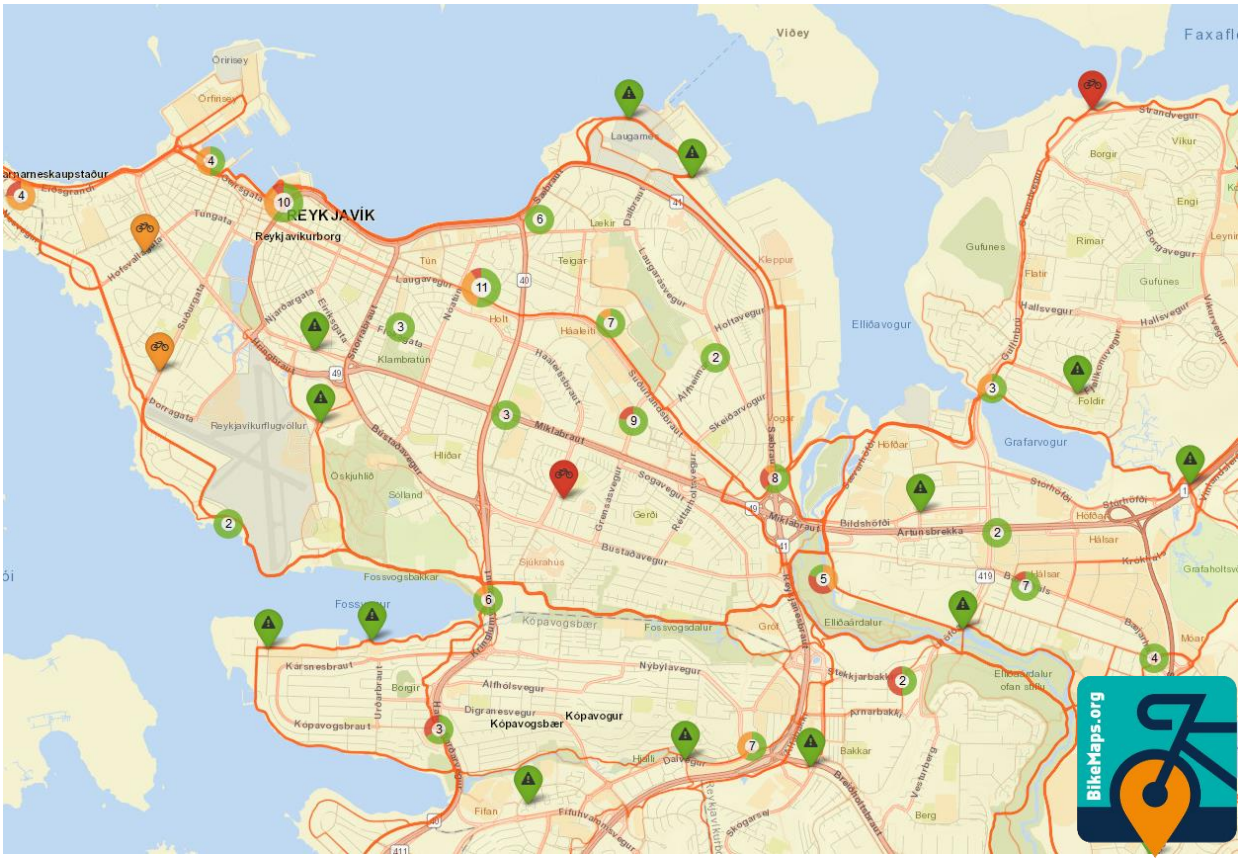
Kortlagning hættulegra staða, hindranir og ótti hjólreiðamanna á höfuðborgarsvæðinu

Beyond accidents: mapping hazards, disincentives and fear for cyclists in Iceland's Capital Area



ReSource International

Beyond accidents: mapping hazards, disincentives and fear for cyclists in Iceland's Capital Area

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Reuse

1 Summary

In this project, citizen cyclists in Iceland's capital area submitted 160 reports of hazards, near-misses and accidents to an online map. These were analysed and recommendations made. The main recommendations are for remediation of blind corners, particular at underpasses; a team to respond to a number of diverse small issues; redesign of several junctions along main cycleways, with detailed illustrations of Hlemmur, Harpa, and Elliðaárósa; information-sharing with street-sweepers removing gravel; and further solicitation of responses from the capital area's cycling community.

2 Introduction

2.1 The project

Cycling is at a turning point in the capital area, and also in Iceland more broadly. In the capital area, municipalities are investing heavily in infrastructure both within and between towns, with the plan to increase from 4,5 to 8% of roads covered by protected bike lanes. Attendance at recreational cycling events such as the Wow Air Cyclathon is increasing. Campaigns to increase commuting cycling are well-established at universities, schools and businesses. The Reykjavík municipal plan envisages an increase from 5,5% of journeys by bicycle to 8% by 2030.

As cycling becomes a greater priority and something better understood, it is natural that the quality of infrastructure should also improve. Likewise, there are often problems with old infrastructure, particularly that initially designed for pedestrians. Until recently, finding these problems and making improvements relied on a good deal of empathy from planners, aided – rarely – by surveys of local users. However, with internet mapping, it is now easy for cyclists to share their perceptions of their own environment.

In this project, we invited cyclists to submit their perceptions of hazards on an online map, and also the places where they had actually had accidents, or come close to it. Their comments are analysed here and some suggestions for specific and general improvements are given.

This project thus gives a valuable insight into cyclists' experience of their environment. Many non-obvious issues were raised, particularly those that might not produce accidents but which can impede or discourage cyclists from making regular journeys. Previous studies of this kind have only had access to official records, which can give access to only a small proportion of serious accidents. In addition, many of the issues raised in this project are ones that are unlikely to be reported to the municipality.

2.2 The role of psychology and fear in cycling

By its nature as an emotion, it is very difficult to study the role of fear as a disincentive in cycling, and so it has taken a back seat to questions of more measurable safety improvements. It is a large barrier to cycling – for example, the UK Department for Transport reported in 2007 that 47% of adults said that "the idea of cycling on busy roads frightens me"[1]. Fear in this many people must mean that it is held regardless of whether people have experienced a serious crash themselves, or know someone else who has. Humans are not rational, especially so as regards safety, so perceptions of specific risks may be as or more important than accident figures, and improvements may not necessarily correlate.

For example, better mirrors and visibility on construction trucks may significantly reduce deaths, but changes little about the actual experience of cycling next to a large, intimidating vehicle. More controversially, many have argued that helmet-wearing serves to brand cycling as a risky activity, and the reduction in people cycling (e.g. c. 15-40% following a ban on riding without helmets in Australia) as a result is not worth the benefits to safety [1]. In considering disincentives to cycling, it is important to consider both measurable and unmeasurable impacts on cyclists.

3 Method

3.1 Platform

We worked in cooperation with bikemaps.org, an existing platform in Canada, founded and operated by academics with an interest in cycling safety. This functions as a map website and a phone app where users can submit details of accidents, near-misses, hazards and thefts (Figure 1). The map also features GPS trace data from the cycle-tracking app Strava, in common use by recreational cyclists and commuters. They have many thousands of accident and hazard reports from across cities in Canada, and have done several academic analyses and reported to municipalities [2], [3].

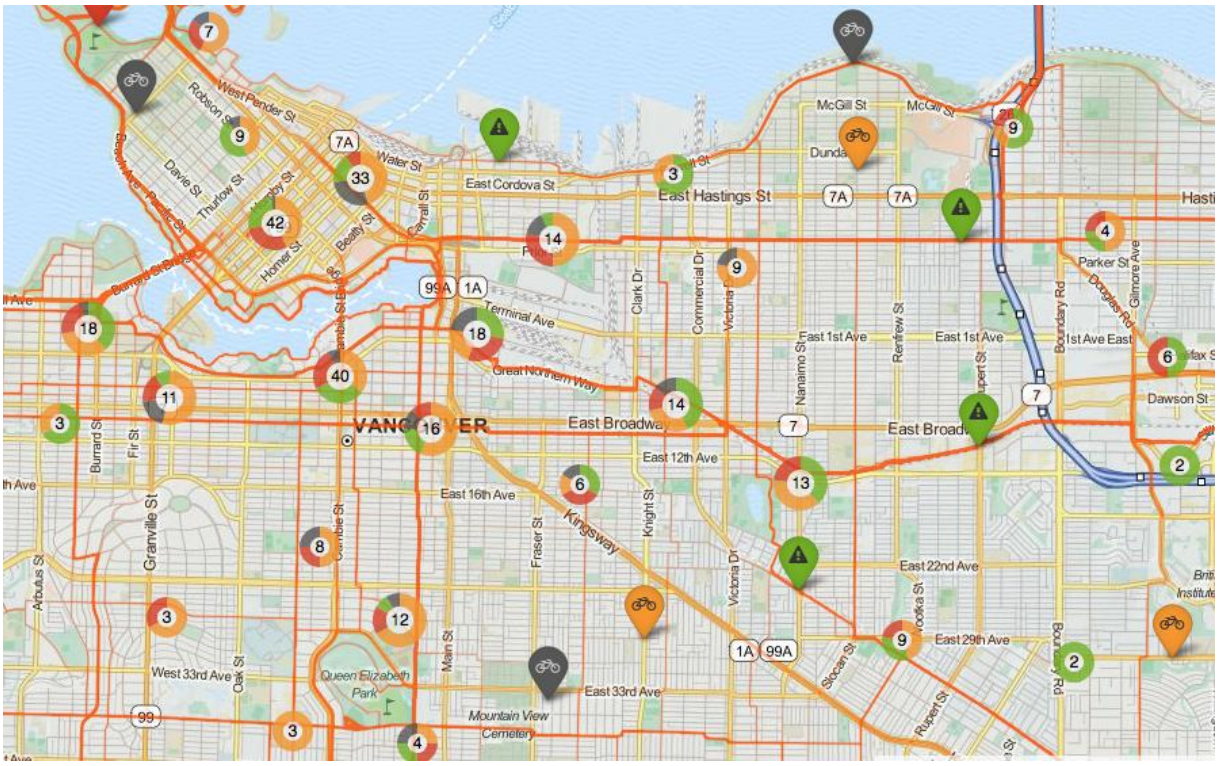

Figure 1 – Bikemaps data from Vancouver. Red marks indicate an accident report; orange a near-miss; green a hazard; and grey are theft reports (not included in this study). Circles are where points are too dense to show clearly at the selected magnification. Orange lines are GPS traces from the cycling app Strava, showing the most common cycling routes. (Bikemaps.org)

Bikemaps.org has several features which make it useful for municipal use. It is possible to easy download data to a spreadsheet for analysis, and it is possible to track a defined area for new submissions, for example allowing those responsible for cycling infrastructure to receive weekly updates of cyclists' experience of Reykjavík's infrastructure. The Bikemaps team are happy to remove

points as they are fixed. In co-operation with their coders, ReSource translated the website, which is available at bikemaps.org/is

3.2 Soliciting responses

ReSource partnered with the Icelandic cycling organization hjolum.is to raise awareness of the project, and they set up a redirect page at hjolum.is/bikemaps to ensure continuity of the project. Leaflets, posters and custom bike seat covers (Figure 2) were distributed at cycling and community events and much effort was made to engage with a number of Facebook interest groups (Figure 3), as our initial assessment was that people in these groups were the most likely to respond.

Figure 2 - Bike seat cover encouraging use of the website (ReSource)

Figure 3 – Example of posting in facebook groups (in this case, Reiðhjólabændur)

3.3 Principles of cycling design

In the analysis, we base our recommendations on widely-accepted principles of good cycling design, primarily from planners in the Netherlands and Denmark.

3.3.1 Principles

1. **Space.** Simply put, cyclists need enough space without risk from pedestrians, other cyclists or cars, and space to maneuver around obstacles, to ride socially and to overtake. This means

different things in different places; in the Netherlands for example, there is no rule on lane width. However, it is understood that most protected paths must allow for a child to ride beside their parent, and for another cyclist to overtake. In practice, this means around two meters in each direction, or wider where traffic is higher. On road lanes, the general minimum is around 1,5m as there is space to avoid obstacles by riding in the road. More space might be given if it passes next to parked cars (not advised).

2. **Smoothness.** Moreso than for cars, cycle lanes must be smooth, although not to the point of being dangerous in rain or ice. Drains and potholes can be fatal for cyclists, and cause significant damage to bikes, and the lack of suspension on most bicycles means that rough roads are a significant disincentive.
3. **Speed maintenance.** For cycling to be efficient and therefore attractive, it must be continuous. Braking and building up momentum again are more difficult for cyclists than other road users, and street design that requires dismounting is a significant inconvenience that is often ignored (Figure 4).

Figure 4 - Speed maintenance is a good thing. (UK street, from StackExchange)

4. **Sight lines.** Cyclists must be able to see the hazards that they face in good time. Bends that are acceptable on walking paths are far too sharp for cycling paths, and as bicycles generally lack rearview mirrors it is dangerous to require any awareness of vehicles behind, such as where a protected cycle lane joins a main road via a „slip lane“.
5. **Homogeneity.** This refers to mass and speed. On the same route, users should be of as similar mass and speed as possible – if cyclists are sharing with cars, cars should be slowed, but this should be avoided entirely. Cyclists should be slowed where they are on the same paths as pedestrians, and shared paths are not a solution for normal cycling.
6. **Information.** Cycle routes should be obvious, particularly at junctions, on long-distance arteries and where they go in non-obvious directions. This can be achieved through coloured asphalt and good signage.

3.4 Surveying

In order to examine points of particular interest and use them to illustrate problems and suggest solutions, we first broke down the number of hazards to select points representative of the major categories, and then examined sites in person and by Google streetview. A longlist was then made of particularly interesting or representative hazards, which was further narrowed to a shortlist based on traffic (as per Strava). Those chosen were then surveyed with photography and in some cases drone video and still imaging, and note was taken of the actions of cyclists in the area at the time of surveying.

4 Results and Discussion

4.1.1 Response types

In Reykjavík, there were 17 reports of accidents, 26 of a near miss, and 117 hazards. This was a higher share of hazards compared to the other categories than is usual for other cities, but this likely is a result of the way the project was advertised. It is also conceivable that there are fewer accidents and near misses in Reykjavík, or that the cyclists that responded are particularly aware of the hazards in their surroundings, or safer than those responding elsewhere.

4.2 Hazards

4.2.1 Overview

An overview of responses can be seen in Figure 5. As regards hazards, it is uncommon for people to submit multiple hazards for the same point. Therefore, analysis of the importance of particular points of interest is based on the Strava data rather than the number of respondents. We can gain some information on the general importance of different kinds of hazard by the frequency of their reporting.

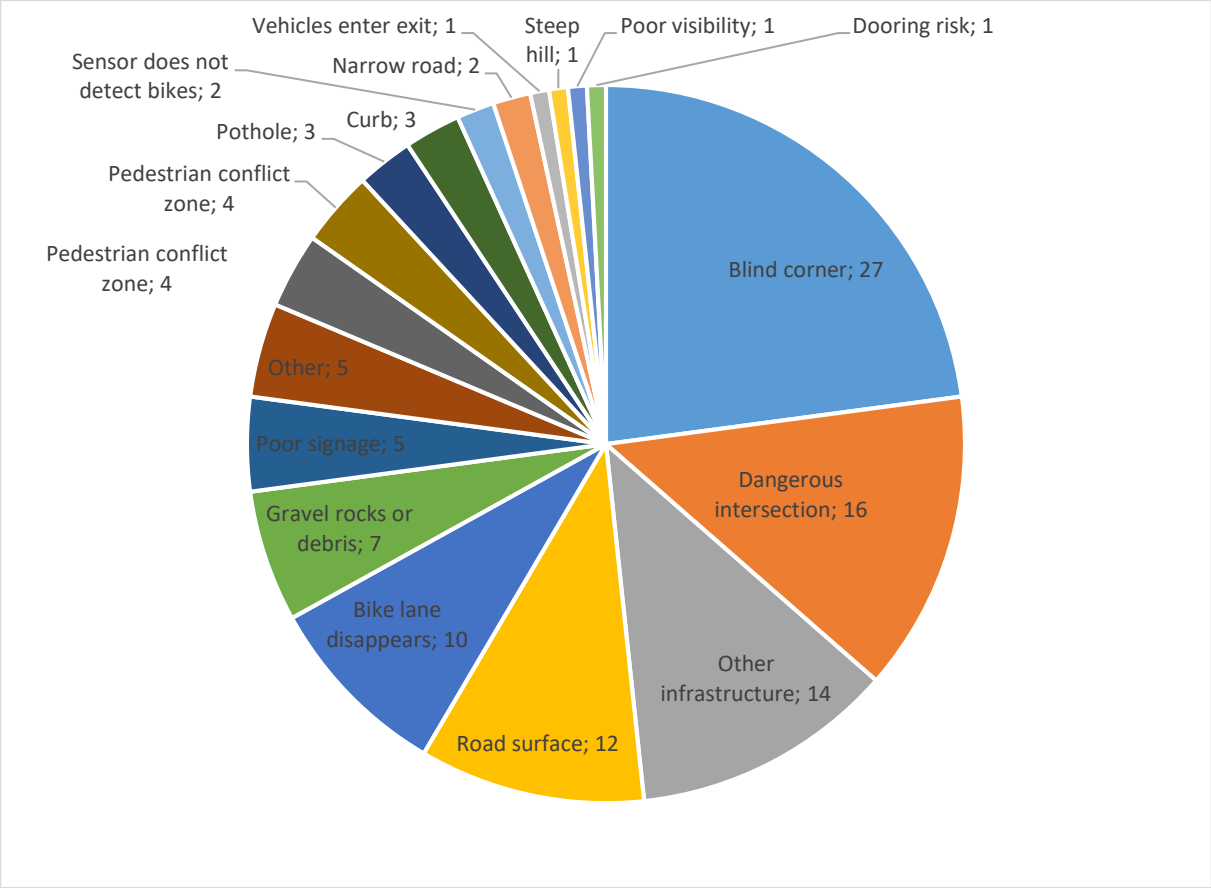

Figure 5 - Hazards, by type (n=117)

4.2.2 Blind Corners

One of the most interesting results from the survey is that cyclists of the capital area have a large problem with blind corners. Almost a quarter of hazards were in this category, and came from diverse respondents. By the comments and by our own surveying, it seems like there are two main categories of blind corners – those that affect the sightlines of car-cyclist interactions, and those that affect the sightlines of cyclist-cyclist or cyclist-pedestrian interactions. By far the most prevalent was the latter category, of which underpasses appear to be the main issue.

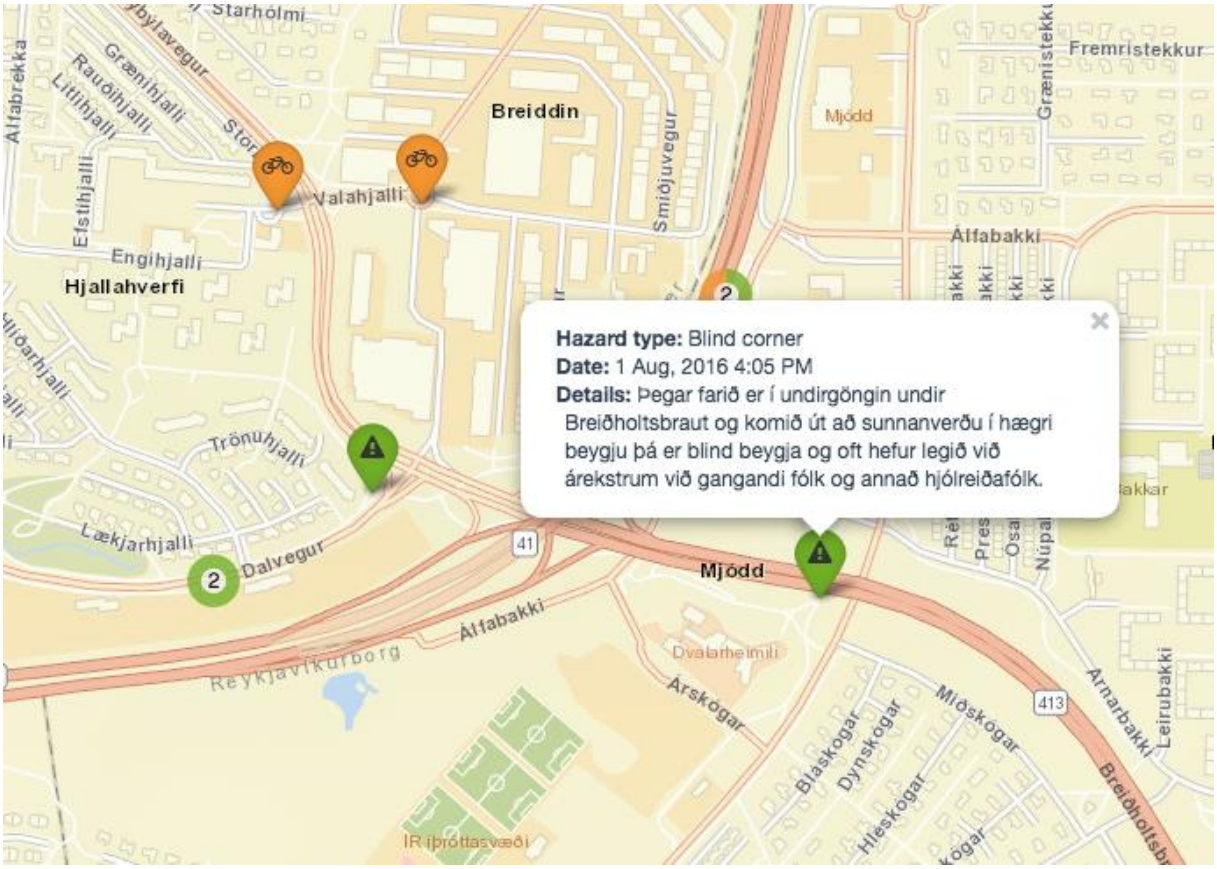

Figure 6 - Typical blind corner submission. Here, the cyclist notes that there is a blind right turn in an underpass where cyclists often collide with each other and pedestrians.(Bikemaps.org)

It seems that the large road system in the capital area, particularly Reykjanesbraut, Breiðholtsbraut, Hafnarfjarðarvegur and the smaller main roads in their vicinity, have been designed with underpasses mainly to facilitate pedestrian access, often with sharp 90º turns (e.g. Figure 7 and Figure 8). Without other traffic, this kind of corner angle would force cyclists to slow to 5km/h or less, something not desirable in itself. Additionally, with other traffic, sightlines that work for pedestrians are inadequate cyclists who have greater speed and less control. There is a particular danger in underpasses, which tend to be at the bottom of a hill and therefore encourage faster speeds and simultaneous braking-avoiding on behalf of cyclists, implying less control.

Figure 7 - Example of blind corner underpass with ReSource drone and operator. This one (on Dalvegur) has no change in elevation. (ReSource)

Figure 8 - Blind corner underpass at Mjódd, with long downhill slope encouraging acceleration and requiring braking (ReSource)

However, only 1 of the 17 personal crashes reported are in underpasses or under bridges despite this being the most "popular" reported hazard, indicating that cyclists are aware of the danger and actively working against it. Of the 43 near misses and accidents reported, only 5 reported conjunction with poor sightlines. Thus, it seems that this is an excellent example of the power of online mapping to show infrastructure that causes stress and discomfort to the users, rather than generating serious accidents.

In a few places, mini "roundabouts" have been constructed to try to alleviate the problem of uncertain traffic priorities on leaving underpasses. These tend to be where sightlines are good and force the slowing of cyclists and create another barrier to avoid. Painted priority marks on the road would be equally effective in persuading cyclists coming from the right in Figure 9 to give way to cyclists on the main path – however, this roundabout has been removed since this picture was taken, perhaps because of the hazard it created

Figure 9 - Cycling roundabout, since removed, in the capital area (http://sett.com/vagablondviews/reasons-6-10).

Underpasses are probably the best way to cross busy roads on the same level – they involve less climbing (c. 3m vs. 7 or 8 for an overpass), if short and designed well can "assist" riders to climb the other side, eliminate the danger from cars and do not involve waiting for traffic lights.

There are four modifications that could immediately benefit the blind corners of the capital area.

- **Recommendation 1:** Convex mirrors on poles are a cheap and highly effective way of remedying sightlines
- **Recommendation 2:** Painted markings in the approach to underpasses are currently uncommon, and could easily divide space between pedestrians and cyclists

- **Recommendation 3:** Where possible, the earthworks of old underpasses can be modified to give better sightlines, for example by widening either end.
- **Recommendation 4:** Future work should better take into account the effects of trees, fences and noise barriers on cycling.

4.2.3 Dangerous Intersections

The second most-noted category of hazard was, unsurprisingly, intersections. People tended to note that intersections were dangerous, but tended to give few specifics on the problems that they had. However, the most common mentioned issues were that cars ignored cyclists, and that (again) sightlines were bad.

Here, we examine several intersections that seemed particularly troublesome for users and propose solutions.

4.2.3.1 Hlemmur

Four respondents noted problems in the area around Hlemmur, with two complaining about the narrow approach from the East on Laugavegur, one near-miss near the bus station and one general comment about how it is not friendly for bikes to navigate.

The approach to Hlemmur is a commonly-used route in the city, as it is the "missing link" between Suðurlandsbraut/Laugavegur cycleway and Hverfisgata. As noted by two respondents, it is far too narrow for a car to pass, and has roadside metal barriers on one side (Figure 11). The pavement is also too narrow to safely share with pedestrians. Metal barriers are known to be highly dangerous for cyclists, particularly where vehicles may be turning right or attempting to overtake.

Figure 10 – The beginning of the approach to Hlemmur. Note cycle traffic lights on the right despite the lack of an onward cycle path, and the cyclist weaving between waiting pedestrians. (ReSource)

Figure 11 – The approach to Hlemmur from the East. During a few minutes, five cyclists passed here, all on the narrow pavement. (ReSource)

More directly around Hlemmur, from the West cyclists must pass Hlemmur by either cycling on a narrow pavement up Laugavegur, cycling through a dangerous “bus only” street in front of the central Police station, or take a long detour around the back of this building, which loses elevation. From the East, the situation is a little better, but there is still a lack of connectivity with the new bike lanes on Hverfisgata and there are dangerous intersections. If cyclists approach these lanes from the South, they must go to the turn lane in the middle of Snorrabraut, a busy four-lane divided road. Traffic flow seems to be the main barrier to resolving these issues around Hlemmur, but this can be easily resolved.

Figure 12 - Bus routes around Hlemmur (Openstreetmap)

In Figure 13, one proposal can be seen, focusing on traffic flow rather than intersection design – bus traffic is funneled to redirect all traffic from the South and East as in the current plan. This allows the part of Rauðarárstígur on the East of Hlemmur to be closed to vehicles, as well as the area in front of Hlemmur Square Hotel, which would have benefits for the new food hall that is planned inside the old bus station. For completeness, several other bikeways have been added based on the municipal plan for 2010-2030. The only bike lanes currently in this area are on Hverfisgata and further up Laugavegur.

In this design, the one-way street of Laugavegur may then be extended to the junction with Katrínartún, where it widens significantly and becomes a divided dual carriageway. Bríetartún would carry this bus traffic instead, along with the Eastbound vehicle traffic. Laugavegur East of Hlemmur could have a full cycleway similar to that on Suðurlandsbraut in the space freed by removing the Eastbound lane of traffic, and this would connect to the preferred through-route of Hverfisgata with a cycle crossing. The number of crossings any cyclist would make would be reduced to one or two instead of two or three, rather than trying to make the existing junctions work better.

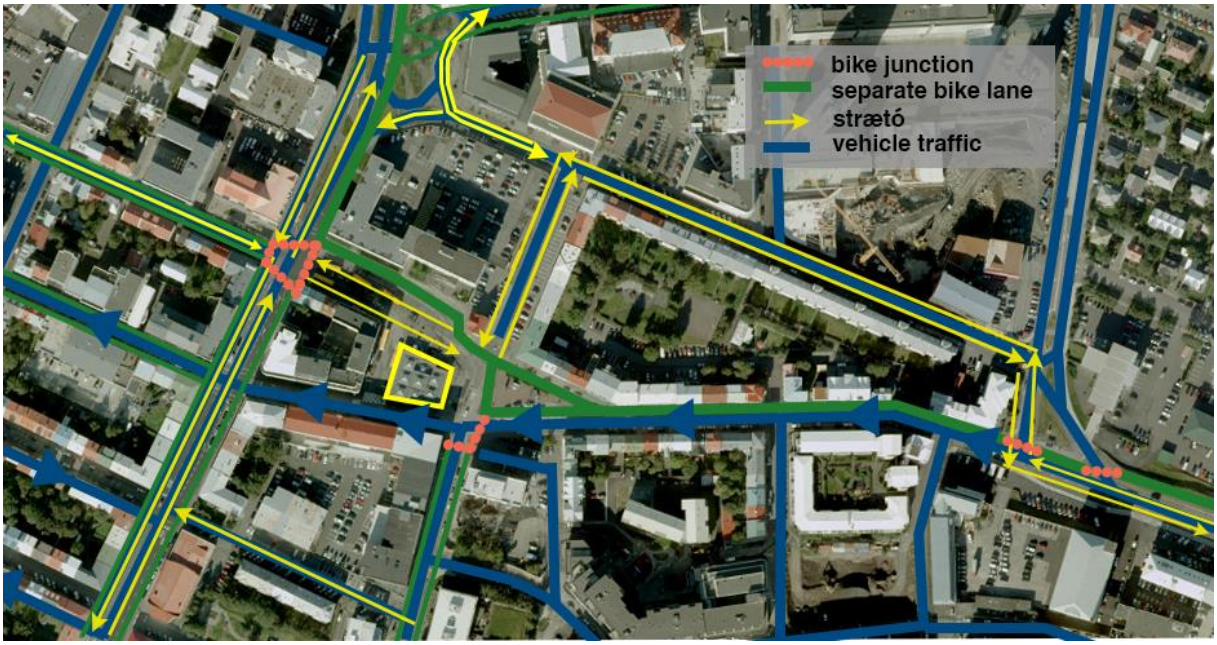

Figure 13 - Proposed traffic flow and cycle lane improvements at Hlemmur (USGS/NASA Landsat/ReSource)

4.2.3.2 Elliðaárvogur

The crossing of Sæbraut on the West side of the new bicycle bridges over Elliðaá was noted as dangerous by three respondents, and one crashed here on the crossing at Duggarvogur (Figure 14)

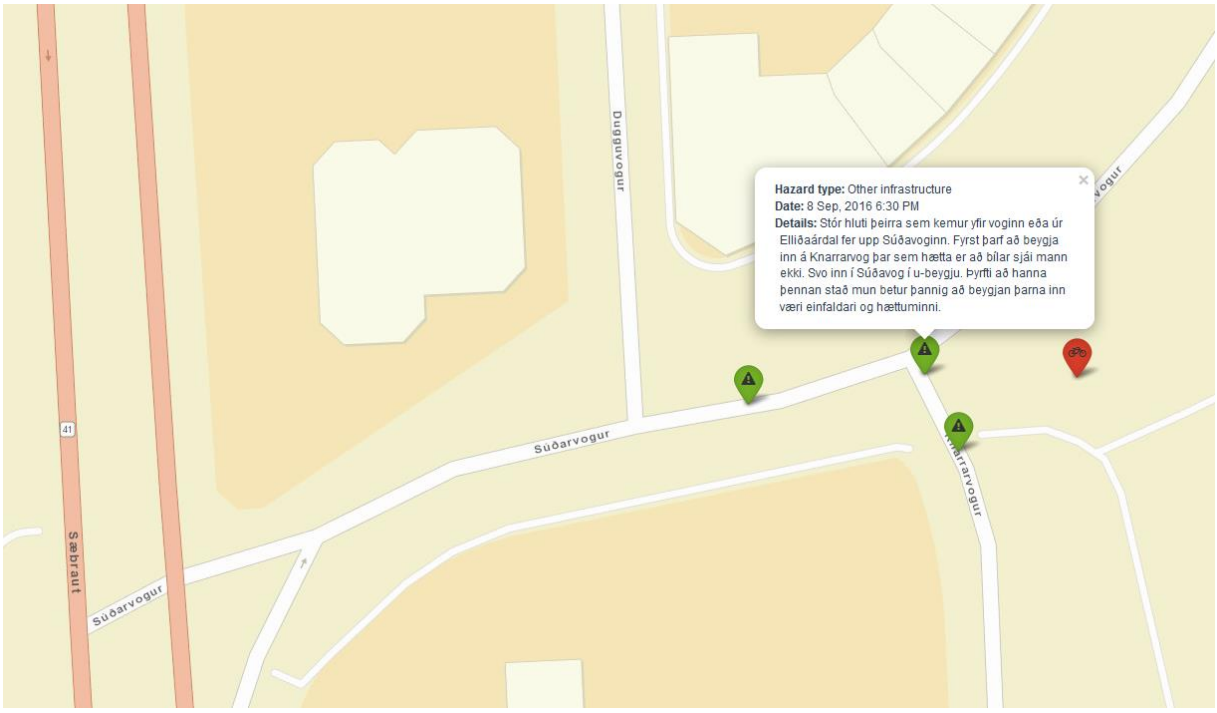

Figure 14 - Bikemaps.org comments on the Suðarvogur junctions. This commenter says that there is a lot of cycle traffic but cars on Knarravogur do not see that, then that the angle across Suðarvogur is bad, and then that it needs redesigned. Strava data not visible at this magnification. (Bikemaps.org)

Here, there are four junctions in the space of less than 100m, three of which are dangerous. From the West, the first (seen in Figure 15) is controlled by traffic lights and is unproblematic for safety, though

it does not have an independent control for bikes or pedestrians and wait times are often long. There, the bike lane goes steeply downhill and crosses a side street with priority, crosses Suðarvogur at a right-hand turn with priority to cars, and then crosses another side street with priority to the bike lane. On Knarrarvogur cars are unprepared for cyclists to be coming from the East, and on both cycling-priority junctions cars must straddle the bike lane before turning. It is far from ideal to have such similar constructions for different vehicle priorities in a whole city, never mind within a few meters of each other. In addition, cyclists from the parkland in the East are suddenly thrust into busy roads, which can be disorientating and something that car drivers on Knarrarvogur do not look for. Lastly, the whole junction takes considerable time to navigate at slow speeds.

Figure 15 - Cycling junction at Sæbraut. Four road crossings can be seen. (ReSource)

There is a relatively easy way to improve the junction here – to move the crossing to the South side of Suðarvogur avoids two crossings entirely, and may even improve vehicle traffic flow (Figure 16).

Figure 16 - Map of current bike lane situation (blue and red) at the west side of Elliðaárvogur, and proposed modification (green). (Openstreetmap)

Car traffic out of Suðarvogur to Sæbraut could thus turn right without a signal. The crossing of Sæbraut should also span the right-turn lane into Suðarvogur. The crossing of Suðarvogur should remain in order to provide access to the North for cyclists, but this would now be a low-traffic crossing.

Additionally, at Knarravogur, extra precautions should be made for cars coming onto and from Suðarvogur. The intersection is currently raised, but as this is a parking lot with good exit visibility, it is quite possible to have a stop sign for cars before the cycle crossing in addition to signs about bicycles on both sides. Visibility could be improved further through the use of coloured red asphalt to pave the bike lane – this is common in the Netherlands and Denmark, and unlike road paint is totally impervious to studded tyre wear and poses no slipping hazard for cyclists. In general, it is good (and current practice in most places in the Netherlands) to make crossings of roads cycle-priority, except where there are lights – in other words, the same system that currently exists for pedestrians.

Figure 17 - Knarravogur crossing currently. Improved by a stop sign and on both sides a warning about bicycles crossing. The bike lane could also be or paved in red asphalt. (Google Streetview)

4.2.4 Other infrastructure

The third most-used category of hazard was the “other infrastructure” category. Some entries were miscategorised into this category, but the majority of others were to report nonsensical obstructions in the bike lane.

The best example of this is outside the front of Harpa, which cyclists might be forgiven for thinking had been designed as an obstacle course. The main seafront cycle path from East to West is unmarked on a busy pavement on the approach to Harpa where many tourists are moving unpredictably. It then passes through a busy pedestrian square outside the front of Harpa, which is surrounded by concrete blocks and often has bus traffic. Near the East end of this, there is a glass fence around a stairwell that is difficult to see at night or in some lights. The most dangerous of all is an unmarked water trench that bisects the bicycle path with a narrow, slippery metal bridge across it. In order to stop cyclists falling into the trench, concrete blocks have been arranged in front of it, but if there are pedestrians crossing the bridge then cyclists may attempt to pass between the blocks to avoid them.

Figure 18 - Elevation from front of Harpa. Note concrete bollards, lack of marking, poor-visibility glass and badly-indicated water trench (ReSource)

This was the only hazard in the capital area to receive multiple specific mentions – three people marked it, two of which had accidents here (although these were submitted to the wrong category). Here are the comments:

1. *„A trench in front of Harpa is extremely dangerous as in various conditions it is very hard to see. I ran into this as I was avoiding a group of tourists in front of Harpa. My bike literally went 180 degrees and I fell on outstretched hands. Very lucky not to sustain serious injury.“*
2. *„A trench in front of Harpa is not visible enough. Luckily I only ended up with a flat tire.“*
3. *„Poorly visible water trench in the middle of Harpa square.“*

There are quite a number of ways to make the front of Harpa friendly to through-cyclists. However, due to its status as one of Reykjavík's foremost landmarks and cultural centers, it is important to be sensitive to both the aesthetic environment and the experience of people observing and travelling to the building.

First, it seems quite possible to remove entirely car access to the front concourse (Figure 19). The road along the eastern side must remain at least for deliveries, but the car parking could easily be shifted into the underground parking garage, with this space used instead for a taxi rank. There is another taxi rank and adequate drop-off space for buses in the local neighborhood and also on the road on the North of the parking garage entrance. This would allow the removal of all traffic and concrete blocks in front of Harpa, with the effect of improving both safety and the pleasantness of the environment.

Due to the fact that there is heavy traffic of pedestrians at right angles to cyclists, and many people behaving unpredictably (e.g stopping, taking pictures, waiting for others, talking on the phone) it is probably best to mark bike lines rather than have a “shared use” square. In order to do so, it is

sensible to cross pedestrian flows at as few points as possible, with good sightlines. The proposed route is shown in Figure 19.

Figure 19 – Proposed path of bike lane, with pedestrianised concourse and parking converted to taxi rank (USGS/NASA Landsat/ReSource)

The proposed route from West to East stays clear of bus traffic returning to Sæbraut and passes close to the end of the footbridges in order to cross the flow of pedestrians at the narrowest points, where people tend to be moving. A new bridge over the hazardous trench would be cycle-only and non-slip. Currently, the space used by the bike lane seems to be a low traffic area in the context of the concourse.

When ReSource was surveying the area, many cyclists were observed passing the pedestrian bridges (Figure 20). They are a natural connection from the city to the seafront cycleway, yet they create pedestrian-cyclist conflicts. We propose marking the central bridge and modifying the smooth wood surface to something with more friction if possible, preserving the other two bridges for pedestrian or mixed use traffic. Local cycle traffic currently uses this bridge the most indicating that it is the most useful, and it is also the only one wide enough for a two-way cycle lane and pedestrian access.

Due to the high traffic, it is recommended that new bike lanes be in keeping with the environment, but also very clear – perhaps a unique colour of cobblestones, with markings. To the East a cycleroute is marked with rainbow paint. This aids with route-navigation for people unfamiliar with the way, but does little to avoid conflicts with pedestrians. It works in that context as traffic is low by comparison to Harpa.

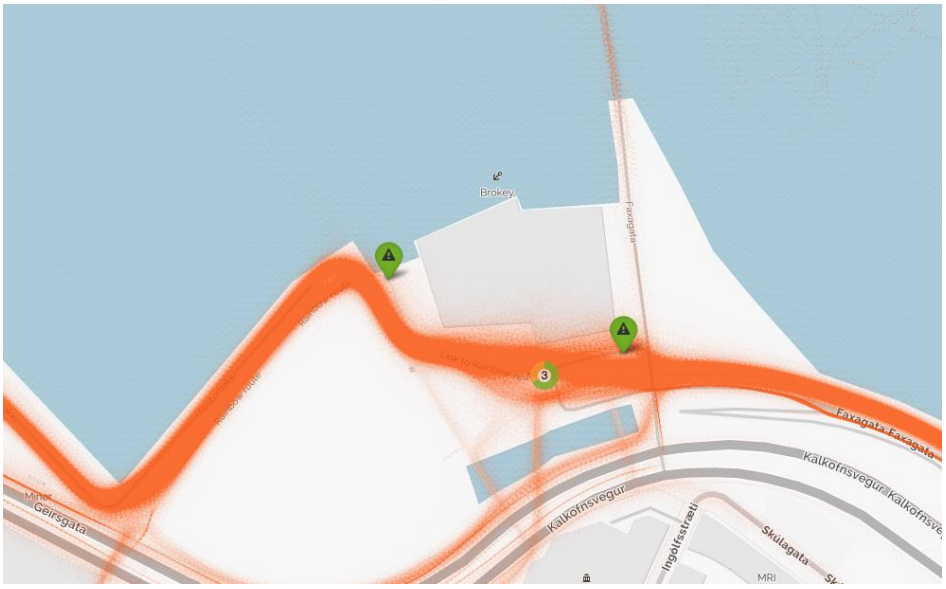

Figure 20 - Strava data shows current bridge usage and chaotic situation in the conourse in front of Harpa. It is likely that much of the traffic to the South of the land immediately adjoining Harpa to the West is by users unaware of the more common route along the docks. (Bikemaps.org)

4.2.5 Road Surfacing, Potholes and "Other"

Road surfaces and potholes are, it seems, of at least as much concern to cyclists as to drivers, and sometimes more-so. Together, there were 15 submissions about potholes and road surfacing, and six in the "other" category. Road surfacing took in issues about kerbs lacking ramps, bumps in the cyclepath causing distracted users, slippery bridge surfaces and even complaints about main roads with ruts in them. Although cyclists do not tend to travel on such roads, they often cross them - in the words of one user, "crossing Kringlumýrabraut is like riding on a washboard".

The other category was almost entirely devote to issues of water on the path. There are a few reasons why this is undesirable – first, as noted by many, cyclists tend to avoid the puddles, particularly if they are at stopping points, and so come into conflict with other road users. Second, there is a particular hazard in autumn, winter and spring as there is a good chance of such puddles freezing and forming black ice. Due to the number of freeze/thaw cycles in Iceland, amongst the highest in the world, this is a particular danger here. Third is that cycling is plainly much less attractive for most people when clothes get wet. Water was noted as particularly likely to form in underpasses (e.,g. Figure 21).

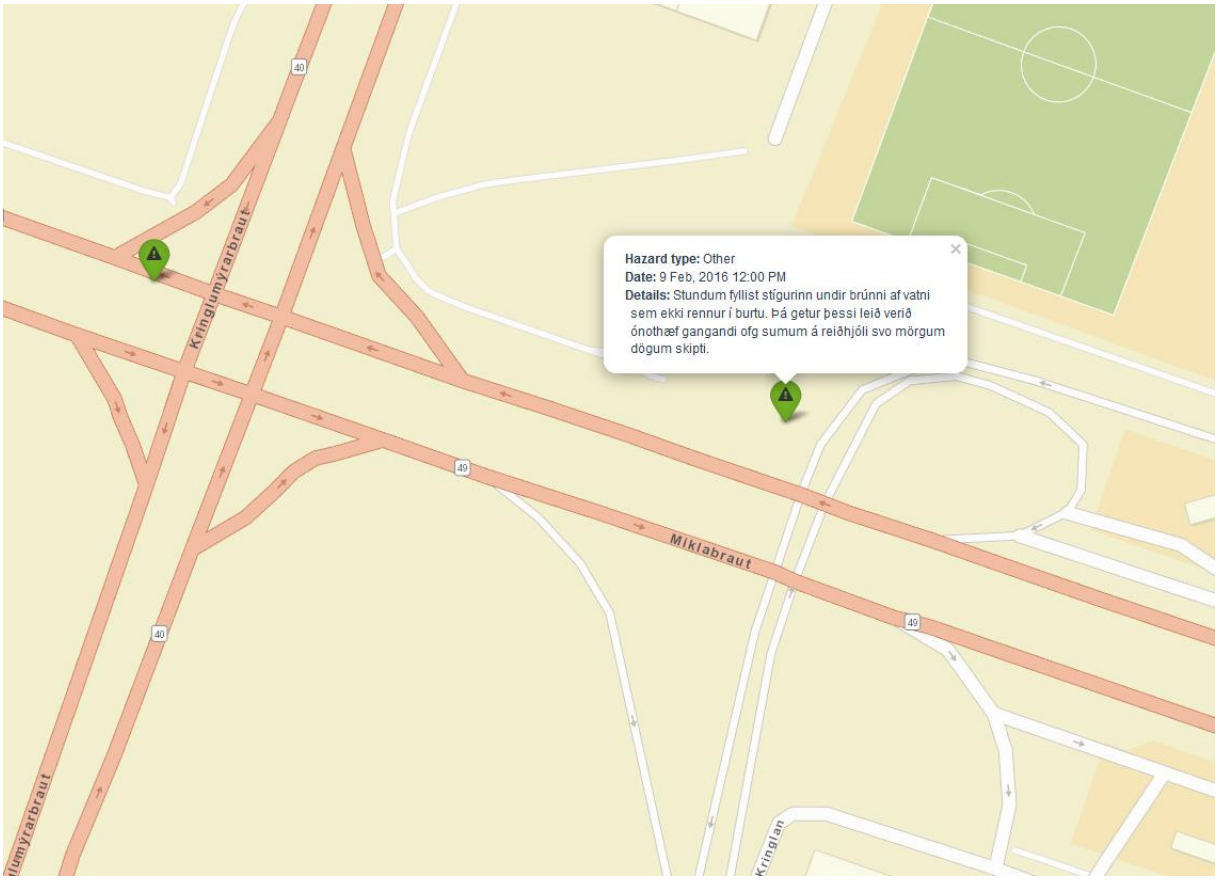

Figure 21 – the underpass under Miklabraut fills with water sometimes, making it unusable for many days at a time. Strava data not visible at this magnification.(Bikemaps.org)

It was also possible to see some room for improvement in Strava data, e.g. Figure 22. For example, "shortcutting" as in this instance indicates that the cyclepath should be improved or the shortcut formalised as a path itself.

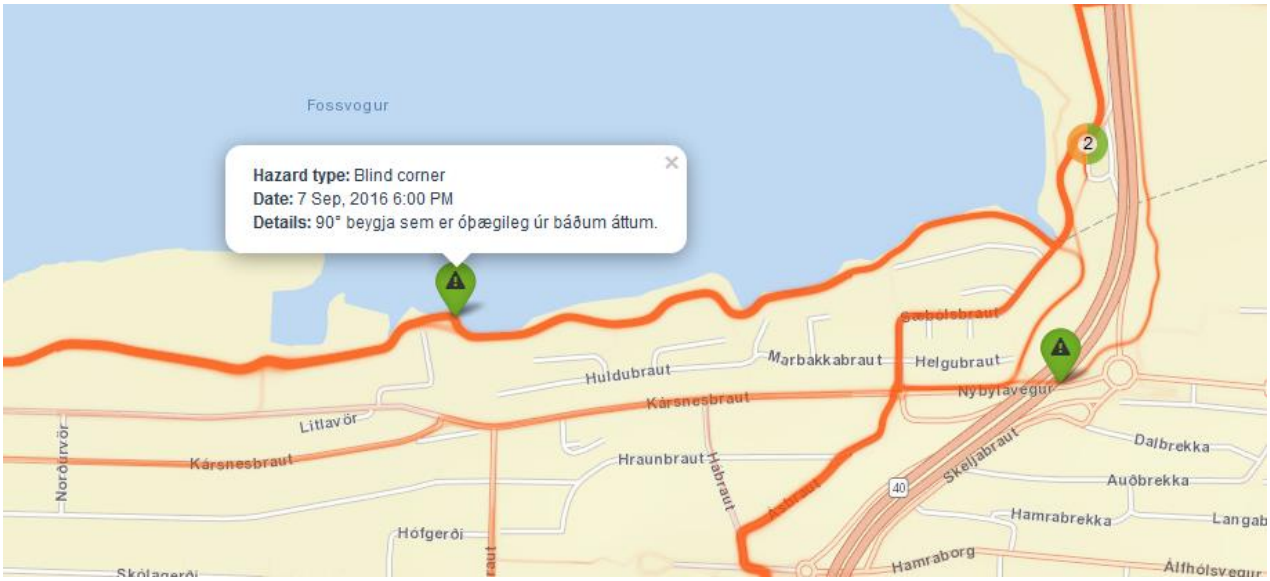

Figure 22 – Shortcutting in North Kópavogur to avoid a blind corner (Bikemaps.org)

These kinds of hazards tend to be quite specific and easily remediable. Kerbs can be ramped, potholes can be filled, underpasses can be drained and surfaces can be improved to shed water or give better traction. The solution to these is usually local to the problem, and may just require a couple of days of time for someone to examine it, plan and enact a permanent solution. It would surely be of significant benefit to the cycling community of the capital area to have these "low-hanging fruits" for infrastructure improvement acted on in a reactive way by the municipality. In addition, the experience of the people involved in this kind of rapid response could much better inform long-term junction and infrastructure design based on the actual problems faced by Iceland's cyclists.

- **Recommendation 1:** The capital area municipalities allocate some of their roads budgets to making a small quick-response team who work to improve city infrastructure through consultation and tools like bikemaps.org.
- **Recommendation 2:** The capital area municipalities actively solicit information from cyclists using bikemaps.org

4.2.6 Bike Lane Disappears

The last category of hazard worth special mention is "Bike Lane Disappears". There are usually two reasons why a bike line "disappears" according to our responses and surveying – lack of improved road beyond that area or an unimaginative approach to planning an intersection. Three roundabouts on Borgartún are typical of the second type (Figure 23, Figure 24). These have three bad features – one, cyclists are in particular danger at roundabouts, and extra care should be taken to separate them from such. Second, re-entry into a road is a danger point in any situation, and should not be combined with merging into traffic, particularly at a junction where drivers are distracted by braking and by other cars. The distance allowed here for merging is c. 4m, is also inadequate. Third, re-entry into the road at a less-than 90° angle creates the need for the cyclist to look over their shoulder (as well as scan the roundabout) – this is something to be avoided in all designs, as this is not a good sightline even for aware, able-bodied adults.

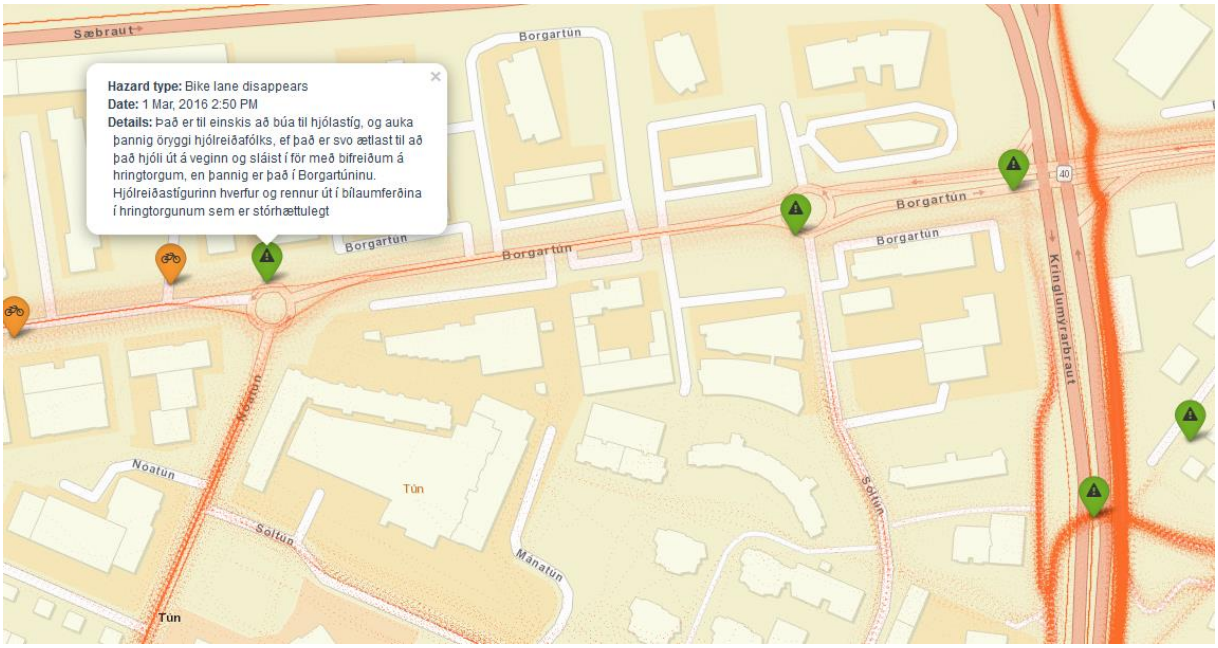

Figure 23 Borgartún – the commenter notes that there is little point in protecting bikes on a bike lane only to have them re-enter the road at dangerous roundabouts. (Bikemaps.org)

Figure 24 - Entry to roundabout on Borgartún. Attractive, but dangerous. (ReSource)

It is possible to use best practice in intersection design from the Netherlands in particular, and to some extent Denmark, in order to design new infrastructure, particularly where space is not a major issue (e.g. at Borgartún). For an example of an existing safe design on a well-trafficked intersection, see Figure 25.

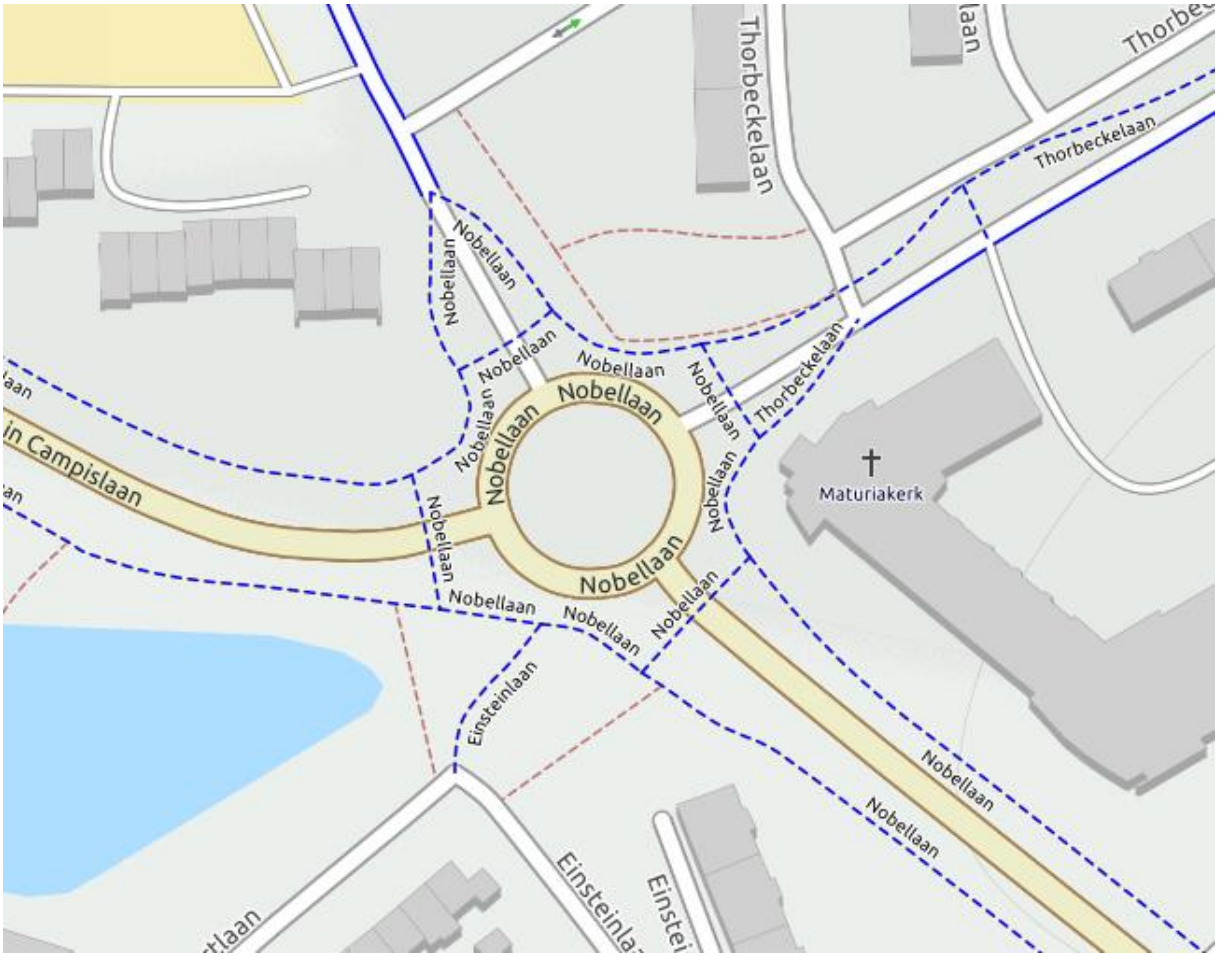

Figure 25 - Safe roundabout design, from Assen, Netherlands. Blue dashed lines are protected bike paths; solid lines are lanes. Cyclists do not have priority at crossings. The cycle path doubles at the roundabout to allow cyclists to go clockwise or anticlockwise. Note 90° crossings of the roads. (Openstreetmap)

The junction above is a good example of evidence-based policy. A national study showed that roundabouts in general gave a rediction in cycling casualties of 60% over crossroads. Roundabouts with protected cycle paths had significantly lower casualties than those merely with lanes, which were roughly the same as not having a lane at all. However this only applied to roundabouts where cyclists had no priority (87% fewer casualties than crossroads). At roundabouts with protected lanes where the cyclists had priority, casualities were only 11% lower than crossroads, i.e. worse than just having a shared roundabout [4].

Figure 26 - Example of a convenient but dangerous design for cyclists, again from the Netherlands (source unknown). Lack of cycle awareness in Iceland is likely to make this design more dangerous.

Recommendation 1: Attention should be given to the end of bike lanes, and new junctions designed with these points in particular focus.

Recommendation 2: Public safety data from the Netherlands in particular should be used to make evidence-based design of different junctions.

4.3 Accidents and Near Misses

Although there were 43 accidents and near misses reported, in the analysis we determined that these were mostly less useful in making infrastructure improvements than self-reported hazards. This is an interesting point in itself, and points to the usefulness of this kind of dataset over public health and police datasets. However, there are some points that can be drawn from both.

4.3.1 Careless driving, right turns and roundabouts

20 of 26 near misses and 10 of the 17 accidents reported involved a motor vehicle. The two main causes seemed to be problematic right turns and roundabouts. One cyclist reported cycling less after their accident, and one stopped cycling entirely, but the rest of respondents said that their attitudes were unchanged or that they intended to take more care in future.

As noted in 4.2.6, it is generally unsafe to have cyclists sharing the carriageway on roundabouts (either with a lane or on the open road) and this should be avoided. Some of the near-misses

mentioned cars attempting to overtake on the entrance to roundabouts or on the roundabout itself, not using indicators, or even trying to pass in the right-hand lane.

On the subject of right turns at crossings – the norm in the capital area is to have a cycle/pedestrian crossing which also allows a green light for cars that are turning. This system relies entirely on the spatial awareness and patience of the driver, and can lead to a serious accident if this lapses. It is also not common in many other countries, and many tourists may understand a green light as a signal that they have the right of the way. In addition, this is a pedestrian-focused design and is much more dangerous for cyclists, for a simple reason – speed. Except on busy streets, the norm is that pedestrians gather on one side of the junction and then cross, with few or no pedestrians crossing long after the light has turned green. However, there is much more time for cyclists to enter the crossing "late" due to their speed, at which point a car may be already trying to cross it.

Recommendation 1: Shared use of roundabouts is avoided in future construction and addressed in current intersections through separated bike lanes or slowing of traffic.

Recommendation 2: Crossings with lights on common cycle routes are timed so that cyclists are not crossing live traffic streams.

4.4 What wasn't there

There are several heartening conclusions from the *absence* of some kinds of submissions in this project. For one, around three quarters of reports were for hazards, as opposed to actual falls or crashes. This compares to 40-50% in other countries. However, this may point to a smaller sample pool and/or a difference in emphasis to similar Bikemaps.org projects in Canada, and also a different kind of respondent, e.g. regular riders who notice their environment more, vs. convenience cyclists.

4.4.1 "Dooring"

In particular, one item was noticeably absent - so-called "dooring", where a parked car driver opens their door onto a cyclist (Figure 27). There is only one note for this in the whole city – in the middle of Reykjavík on Lækjargata where it caused a broken elbow – whereas it is relatively common in other cities. This may be partly a result of the tendency of cyclists to cycle on the pavement when not on quiet streets, but also indicates that cyclists are not put at great risk by badly-designed bike lanes, such as is common in the USA and UK. Instead, most of the capital area's bike lanes (where they exist) appear to follow the Dutch model of protecting lanes where possible, and shared streets are marked with "sharrows" on the road instead of trying to separate cyclists and vehicles in a strict pattern.

Recommendation 1: No future bike lanes should be painted on the side of roads where parked cars may open their doors. Instead, greater redesign of the street should be prioritized, and where this is not (yet) possible, road markings can be used to encourage drivers to be tolerant of cyclists "taking the lane".

Figure 27 - Cyclists' graffiti in Nottingham, UK. The cyclists on this bike lane are at risk from the doors of drivers of cars. (road.cc)

4.4.2 Snow, Ice and Gravel

The current system of clearing cycle lanes in winter appears to be working adequately, as there were very few reports of snow or ice buildup, although this may be a result of peak survey response time. There were five reports of gravel hazards, yet this is small compared to a city's worth of gritting efforts, so cleanups and sweeping must also be having an effect. However, this kind of citizen data may be particularly useful for finding the spots that have been missed and optimizing the work of municipalities.

Recommendation 1: Municipalities use citizen-submitted data to improve gravel removal in troublespots.

5 Conclusion and Recommendations

This project has demonstrated that citizen reports of cycling hazards give a level of useful detail that is hard to find elsewhere, and that it is possible for municipalities to quickly and cheaply improve cycling infrastructure by fixing basic problems. Based on the current dataset, we can recommend that as immediate actions, the city's municipalities should:

- Examine all reports of blind corners, and install mirrored poles and signage and plan reconstruction where feasible

- Make a small quick-response team to fix small problems such as kerbs, bad drainage, potholes, obstacles in the bike lane etc.
- Mark all improvements with a temporary signpost bearing the bikemaps.org logo and thus encourage cyclists to use bikemaps.org to submit more citizen reports
- Feedback to street sweepers about places where gravel removal should be given more attention

In the medium term, we recommend that:

- Infrastructure redesign takes account of the reports around these intersections in a similar process to our proposals at Hlemmur, Harpa and Elliðaárósa
- Funding is given to cycling advocate groups to promote the use of bikemaps.org amongst their members
- An analysis and feedback system is enacted to make sure that citizen-submitted data is compiled, analysed and acted upon, and that this is well-communicated.

In the long term, we recommend that:

- New infrastructure is planned on the evidence of what does not work in Reykjavík, and more broadly from countries such as the Netherlands where a large body of evidence exists already
- Some streets are designed with cycle lanes and paths as the priority element
- Traffic flows at key parts of the city center (e.g. Hlemmur) are altered in line with what is safest and most efficient for cyclists, buses and pedestrians
- Emotional responses of cyclists are given attention, and that infrastructure designs that may not produce many accidents but do produce significant stress (such as blind underpasses) are avoided such that cycling is attractive and enjoyable, as well as safe.

If municipalities enact these measure, particular better planning, rapid response teams and communication of their response to cyclists, we see the potential for many side benefits. It is a good thing for the citizenry of a city to feel engaged and involved in the planning process, and this is one of the most efficient means for cyclists to have a voice. In addition, these changes have the potential to not only make cycling safer and also more pleasant, but also to save significant amounts of money through targeting interventions to the most-requested and most-trafficked areas first. If this makes more people cycle, then the benefits for society's wider health are likely to be many times the investment.

6 References

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