TØI report 1004/2009
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Oslo 2009, 125 pages Norwegian language

Summary:

Design of intersections in Cities

International Recommendations to Secure Environment Friendly Transportation in Cities

Review of international recommendations about how intersections in cities should be designed to secure good conditions for bicycles, pedestrians and public transport shows that the recommendations in Norwegian handbooks in most cases are the same as the foreign recommendations. However, it is possible to prioritise bicycles more in the Norwegian handbooks. In addition, more measures in intersections for especially bicyclists and pedestrians exist that not yet have been tried out in Norway or included in Norwegian handbooks.

Environment friendly transportation in cities

"Environment friendly city transport" is the name of a project by the Norwegian Public Roads Administration that has the objective to improve the knowledge about environment friendly transportation in cities in the administration and in the society in general, and in this way contribute to more environment friendly transportation in cities. Environment friendly transportation includes cycling, walking and public transport.

This report is a part of this project. The objective of this part of the project has been to summarise foreign recommendations about how intersections in cities should be designed to secure good conditions for bicycles, pedestrians and public transport. These recommendations are compared to recommendations in Norwegian handbooks, and suggestions for revision are made.

A total of 59 design manuals for intersections in cities and handbooks about facilities for bicycles, pedestrians and public transport have been examined. The guidelines come from the EU project "HiTrans" and nine countries: Denmark, Sweden, The Netherlands, Belgium, Germany, United Kingdom, USA, Canada and Australia. Additionally there is a chapter about shared space and the effect of this design for bicyclists, pedestrians and busses.

Same demands in Norway as in foreign countries

Comparison of dimensions and demand for areas for bicycles, pedestrians and busses in guidelines from Norway and the included countries, shows that the demands are similar. Thus, it seems unnecessary to revise the Norwegian basis for design of intersections to try to promote cycling, walking and public transport.

Greater priority to bicyclists

It is possible to prioritise different groups of road users by area, route, or time specific priorities. Area specific priorities in Norwegian handbooks for bicyclists, pedestrians and public transport have been discussed.

The report can be ordered from:
Institute of Transport Economics, Gaustadalléen 21, NO 0349 Oslo
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Compared to the reviewed manuals and handbooks, the Norwegian handbooks for pedestrians and public transport have new and detailed recommendations about when to use pedestrian crossings and bus lanes. At present it is therefore probably not necessary to revise these area specific priorities.

The Norwegian bicycle handbook recommend cycle tracks and lanes at higher traffic volume than recommended in handbooks from other countries. It should be considered to reduce these thresholds primarily for cycle lanes to get more cycle lanes rather than mixed traffic because it gives increased subjective safety and passability for bicyclists.

Five new measures for bicycles

A total of 12 measures in intersections in cities that are described to improve the conditions for bicyclists have been reviewed. Table i lists the 12 measures.

Table i. Reviewed measures in city intersections that may contribute to increased bicycle traffic, and measures used in Norway.

Measures recommended in Norway	Measures not recommended in Norway
– Shortened cycle track	– Central approach cycle lane
– Expanded cycle stacking lane	– Cycle lane for right turn in intersection
– Moved stop line for vehicles	– Separate cycle lane for right turn outside intersection
– Coloured cycle lane	
– Cycle lane bent out	– Cycle track bent in
– Mixing of traffic in roundabouts	– Cycle lane for small left turn
– Cycle track in roundabouts	

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Compared to use and recommendation in Norway the measures can be divided into three categories. These are measures where:

1. It is accordance between foreign and Norwegian recommendations
2. Norwegian recommendations are at the forefront
3. Recommendations from included countries are at the forefront.

Seven out of 12 measures are already in use or recommended in Norway. This verifies that the Norwegian recommendations are “right”. These measures should still be used in Norway and if possible the use should be intensified.

The five remaining measures have not been used or are not recommended in the Norwegian handbook. The handbook recommends not to use separate cycle lanes for right turn outside intersection, and pilots with central approach cycle lane have been started. For all five measures it should be examined if they should be included in the handbook.

Four new measures for pedestrians

Six measures for pedestrians have been reviewed. Table ii shows that two of these measures already are used in Norway. The four remaining measures have not been used or are not recommended in Norwegian handbooks. These measures serve as inspiration to more pedestrian friendly design of intersections.

Table ii. Reviewed measures in city intersections that may contribute to increase walking, and measures used in Norway.

Measures recommended in Norway	Measures not recommended in Norway
– Zebra crossing – Traffic island	– Alternative crossing marking – Island at separate lane for right turn – Curb radii – Curb extension

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One new measure for public transport

Table iii lists reviewed measures for public transport. Six measures have been reviewed. With the exception of left turn lane in right side of the road all the measures are already in use in Norway, or described in the Norwegian handbook for public transport. This verifies that the Norwegian recommendations are "right". These measures should still be used in Norway and if possible the use should be intensified.

Table iii. Reviewed measures in city intersections that may contribute to improved condition for public transport, and measures used in Norway.

Measures recommended in Norway	Measures not recommended in Norway
– End of bus lane in intersections – Short bus lanes in intersections – Lock before intersections – Separate bus lane in intersections – Bus stops in intersections	– Left turn lane in right side of the road

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Safety, subjective safety or passability

Measures for bicyclists are normally made to improve either safety, subjective safety or passability for bicyclists. Only few measures have positive effect on all three parameters at the same time. For the five "new" bicycle measures the two measures "central approach cycle lane" and "cycle track bent in" are safety measures that maybe have negative effect on subjective safety. The other measures "Cycle lane for right turn in and outside intersections" and "Cycle lane for small left turn" are passability measures that maybe have negative effect on safety.

Contrary to the measures for bicyclists the measures for pedestrians often have positive effect on all three parameters at the same time.

The objective with measures in intersections for public transport is contrary to measures for cyclists and pedestrians usually not to improve objective and subjective safety, but only to improve passability and maybe accessibility. All the described measures have positive effect on passability.

Shared space has a positive impact

Shared space is an alternative method for designing intersections where they are planned and designed without any or with limited regulations and separation of vehicles, bicycles and pedestrians in time and space.

Table iv summarises foreign experiences with the effect of shared space. Shared spare probably has a positive effect on both safety and passability for vulnerable road users, while subjective safety is impaired at first. Shared space has both negative and positive effects for the passability for busses. Further pilots with shared space in Norway are recommended.

Table iv. Impact of shared space in intersections in cities on passability, safety and subjective safety for bicyclists, pedestrians and public transport.

	Passability	Safety	Subjective safety
Bicycle	(+)	+	(÷)
Pedestrian	+	+	(÷)
Public transport	(+/÷)	0	0

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Greatest potential to promote environment friendly transport

Table v summarises the results of the different comparisons of Norwegian and international recommendations. It seems that the greatest potential to promote environment friendly transportation in cities by revising existing handbooks and implement "new" road measures in intersections, are to focus on bicyclists and partly pedestrians. Bicyclists can be given greater priority, and several untested measures for bicyclists and pedestrians exist. When it comes to public transport most of the described measures are already in use in Norway or described in the Norwegian handbook.

Table v. Summary of the comparison of Norwegian and international recommendations for design of intersections in cities.

	Design basis	Priority of road user groups	Reviewed measures	Already in use	Should be tested
Bicycle	Ok	Should be adjusted	12	7	3-5
Pedestrian	Ok	Ok	6	2	4
Public transport	Ok	Ok	6	5	1
Shared space	-	-	1	(1)	1
Total	-	-	25	14-15	9-11

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Implementation of new designs and measures

This report is primarily thought as a kind of inspiration catalogue that gives inspiration to "new" measures. In total 9-11 measures described should be considered for testing in Norway. Before testing a supplementary literature survey should be performed to verify that the measures actually have a positive impact for the environment friendly groups of road users and to examine it the measures have any overlooked side effects.

The literature study is important, but cannot replace demonstration and evaluation in Norway. The reason for that is that the traffic culture is different in Norway compared to other countries and therefore the impact of the measures may differ from the impact in other countries.