

Support for Implementing Measures for the South East Core Regional Transport Network Multi Annual Plan (EuropeAid/125783/C/SER/MULTI)

Highway intersections and modern traffic light solutions

by
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Overview about content

1. Network planning issues
2. Design and audit of intersections
3. Traffic signals

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1. Network planning issues

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Choice of intersection

Type of intersection should be chosen from a cost/benefit point of view regarding:

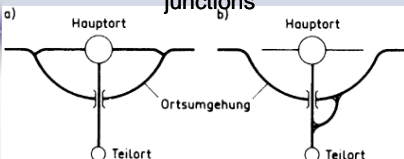
- Technical demands based on reference speed, traffic volumes and traffic composition
 - Level of service
 - Traffic safety
 - Environment
 - Construction- and maintenance- cost
- } Traffic economy

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Is a junction necessary ???

...and minimum distances between junctions



V_k	[km/h]	50	60	70	80	90	100
Knotenpunkte- abstand	[m]	140	170	205	235	270	300

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Focus on safety: Is the planned number of junctions necessary?

The risk of accidents on intersections is much higher than at road sections!

Target for planning of interurban roads:

- Try to reduce the numbers of junctions
- high distance between junctions on arterial roads
- TASK FOR NETWORK DESIGN...

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2. Design and audit of intersections

General design principles for junctions

- perceptibility
- clarity
- understandable
- drivable and walkable
- **Keep in mind the no. of conflict points**

... that means the designer should try to design the intersection as small as possible...

General types of junctions

- Roundabouts
- 3 or 4 leg intersections
- **Intersection with grade separation on Motorways (interchanges)**

Try to use the same type and shape in a road section and network, advantage for the safety (better re-detectability for the driver)

Choice of the intersection type according to capacity

Table 1-1 Capacity based on intersection type

INTERSECTION TYPE	CA _{veh/d} (pcph)
Right-hand priority	1,000 – 1,500
Fixed-priority	5,000 – 12,000
Single-lane roundabout	20,000 – 28,000
Multi-lane roundabout	35,000 – 7 ^a
Signalized intersection	20,000 – 80,000 ^b

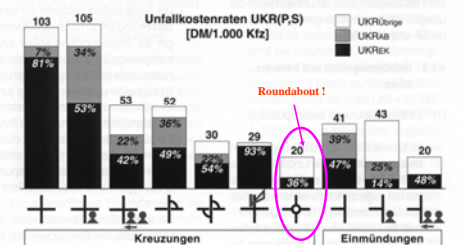
^a Variable between countries; Source: PIARC on the lane assignment.

Intersection audit and design

- Accident research is an evidence for the differences regarding the safety performance of our standard solutions...
- Important information for the auditor and designer

Focus on safety: type of intersection and safety

Safe junctions – comparison of junction-geometries on interurban roads German statistics about the „accident – cost – rates“ source: GDV



Safe type and design of junction?

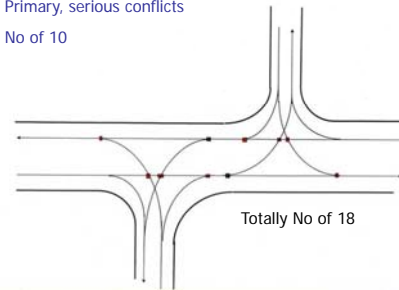
- Harmonisation of the alignment of the road and the type of the junction is needed
- Choice of type but also the details are important
- The number of conflict points is crucial for the safety
- Approach roads: the angle between the main and the approach road should be between 80 and 120 gon (the best is 100 gon)
- The main road should be planned with the best design parameters, for secondary roads often a lower standard is suitable



Conflict points

Primary, serious conflicts

No of 10



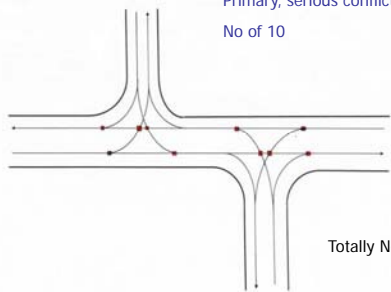
Totally No of 18



Conflict points

Primary, serious conflicts

No of 10



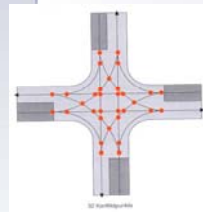
Totally No of 18



Conflict points

Primary, serious conflicts

No of 14



Totally No of 32

Primary, serious conflicts

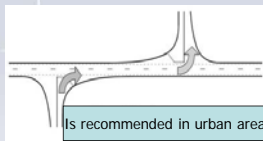
No of 4



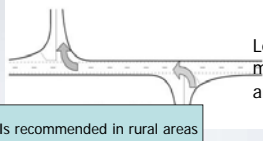
Totally No of 8



Staggered T-junctions, principles



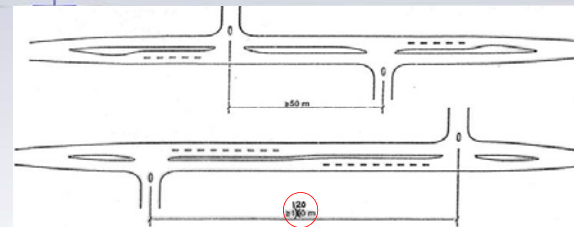
Left turn from the secondary road is the most dangerous manoeuvre in urban areas.




Left turn from the primary road is the most dangerous manoeuvre in rural areas.



Staggered T-junctions



Safety in intersections



Recognizable?

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19 JEE 10

Safety in intersections

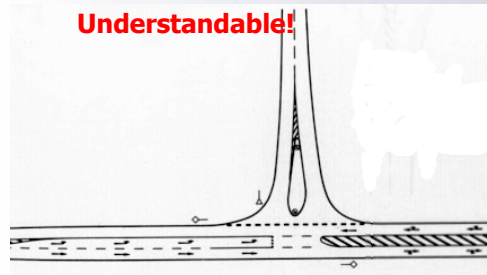


Understandable?

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Safety in intersections



Understandable!

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Safety in intersections

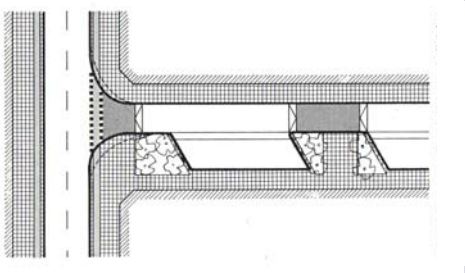


Understandable?

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Safety in intersections



Understandable!

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Safety in intersections



Understandable?

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Safety in intersections



STOP – signage and marking on the secondary road

Understandable!



Safety in intersections



Early enough visible?



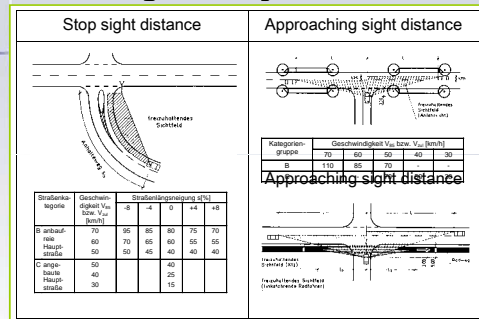
Sight in a junction

The sight-distance depends on:

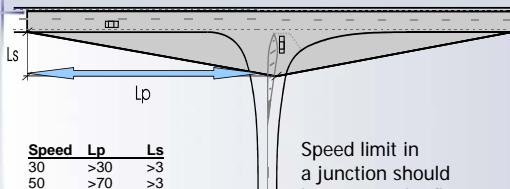
- The regulation in the junction
- How different road-users are separated
- The speed limit in the main road



Sight in a junction



Sight in a junction



Speed	L_p	L_s
30	>30	>3
50	>70	>3
60	>85	>3
70	>110	>3

Speed limit in a junction should be max. 70 km/h in rural areas!!!



Example from a preliminary design



Sight in a junction

freizuhaltendes Sichtfeld

Anliegerweg

Speed	Sh
30	>15
50	>40
60	>60
70	>80

Speed limit in a junction should be max. 70 km/h in rural areas!!!

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Examples of dangerous sight-shadows

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Examples of dangerous sight-shadows

Avoid Y-Junctions – problems:

- Often obstacles in Sight distances
- Look over the shoulder is too difficult
- Very complex situation
- Missing orientation

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Is the junction drivable?

KOROSA, Intersection

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Intersection T - Type

Proposals for safe solutions from Canada for re-alignment the Y into the T - type

Figure I-5 Examples – Intersection re-alignments

L = 20 m minimum

Source: Transportation Association of Canada, 1989

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Example PIARC

Transformation from a Y intersection to a T intersection.

Source: PIARC

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Focus on safety: Left-turn movement areas

For the safety are left turning lanes are recommended!

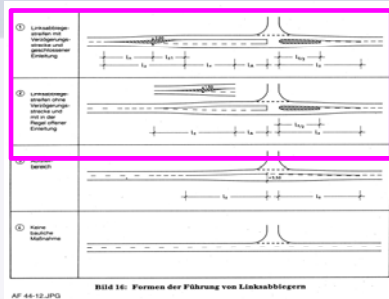


Bild 16: Formen der Führung von Linksabbiegern

Source: German guideline RAS - K1

3. Traffic signals

Traffic signals - Typical audit deficiencies

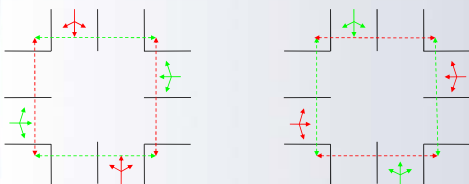
Typical safety problems are identified as:

- Visibility to traffic signals ahead
- Distance between the stop line and pedestrian crossing
- Issues regarding anti skid surface (special solution in UK)
- Left turn problems (...separate signal??)
- Lack of pedestrian facilities or bad solution in detail

Source: TEC - study from UK



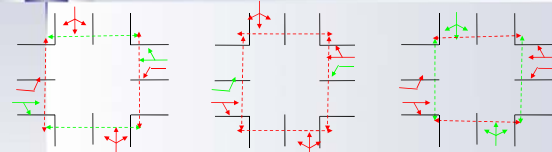
Two phases



Speed ≤ 50 km/h:

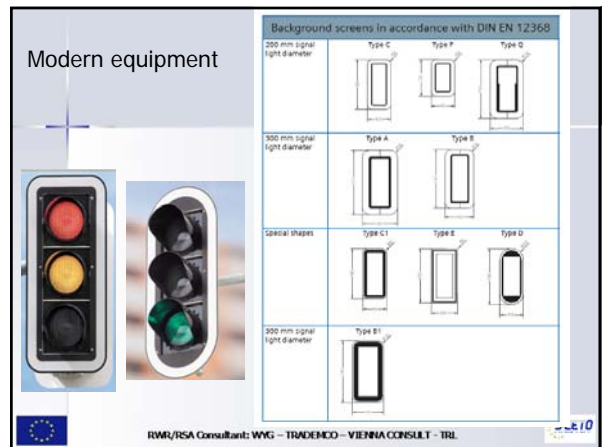
- Usually mixed phases.
- Separate phase can be considered if there are 4 lanes and more than 150 left-turning/h.

Three phases recommended for speed ≥ 70 km/h

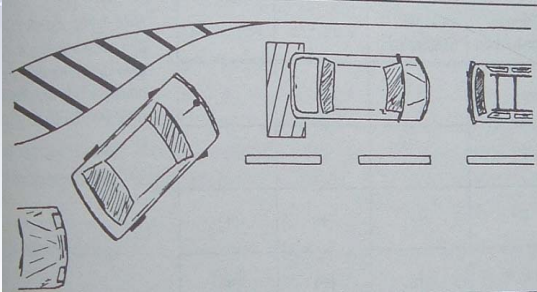


Max. Speed = 70 km/h(not more!!)

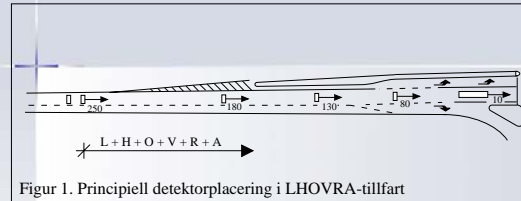
- Separate lane for left-turning with separate phase.
- Suitable for dynamic-regulation (e.g. LHOVRA from Sweden or MOVA from UK).



Example for a task for a detection wire



LHOVRA



Figur 1. Principiell detektorplacering i LHOVRA-tillfart

- L = Prioritation of trucks
- H = Prioritation of main road
- O = Accident reduction
- V = Variable yellow
- R = Red driving control
- A = All red return

Distans	Parallell	Överlappning	Överlappning	Varuslag
H	H	H	H	H
O		O	O	O
V			V	V
R			R	R
A			A	A

Figur 9. Översikt över LHOVRA-tekniken för en tillfart med 50 km/h

Thank you for your attention!
Any Questions?