

Basics of the Road Safety

by

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1. Human factors and errors

2. Twelve basic rules for safer roads

1. Human factors and errors

- 90-95% of all road accidents have **HUMAN ERROR** as a component (Treat, 1977)
BUT
- **Do not blame the driver!**
- Not unsafe driver but unsafe system, we should investigate the traffic system

Human error



Everyone commits
Mistakes – but
should that be
punished with the
death?

Engineering for safer roads

- Modern engineering helps to reduce the results of human mistakes and can reduce the number of accidents!
- Better engineering could help to reduce number and severities of traffic accidents.
- Engineering for safer roads is bringing quick and sustainable wins!
- Road Safety Audits avoid such losses.

2. Twelve basic rules for safer roads

1. Need for Functional classification

- Modern road traffic needs a road network
- Modern network needs a sensitive structure
- Important decision at the start of every investment into the traffic facilities
- Townplanning and regional planning must support the sustainability of investments.

Source: AASHTO

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2. Risks of mixed functions!



- Need of separation of the fast and far traffic from the slow local traffic and
- strict access control

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3. Two different design principles:

3.1. Geometric design for streets

- Most important factors are the shape and size of vehicles and
- Mixed Functions,
- Legal speed is 50 km/h and lower but
- Speed enforcement by design (traffic calming) is necessary!

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...Conclusions

- Narrow lanes (3.25m)
- Small Radii
- No transition curves
- Crossfall but no superelevation
- Separation of non motorized traffic
- Special intersections with pedestrian crossings

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3.2. Dynamic Design for interurban roads

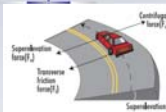
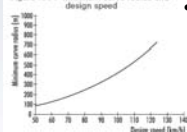


Figure HA-4



- Most important factor is speed
- Legal speed is higher than 50 km/h
- Application along interurban and express roads
- Decisive dynamical formula is :

$$fr + q = v^2/g * r$$

fr = skid resistance
q = cross fall/ super elevation in curves
v = speed, g = gravitation, r = radius

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...Conclusions

- Consistent Alignment with transition curves
- Sufficient superelevation in curves
- Wider lanes (3,25 to 3,75m)
- Longer stopping sight distances
- Stringent separation of slow traffic
- Special intersections
- Harmonize: legal speed – operation speed – design speed

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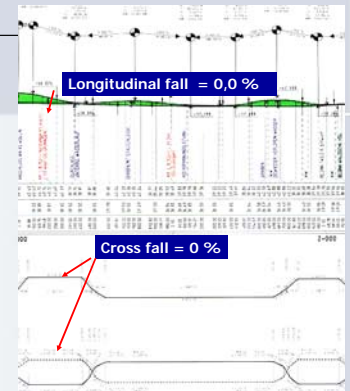


4. Sufficient Road Drainage! (and prevent other natural disasters)

- Aquaplaning risks when speed is higher than 80 km /h
- Drainage of the road surface by a cross fall in straights of 1,5 to 2.5% and
- A safe design for the drainage system beside the carriageway



**Example:
Wrong
superposition
of the horizontal
and vertical
design is
causing
aquaplaning**



5. Assist road users perception!

- Avoid optical illusions
- Avoid delayed and restricted perception
- Avoid Figure-Background-Problems
- Use Multiple codes.



Avoid optical illusions!



Curve in a dip
geradlinige Kurve

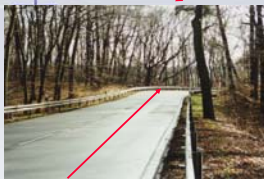


Curve on a crest top
geradlinige Kurve

A curve in a dip seems wider than on a hill top. The result is that road users drive faster in the dip than they should!



Use that knowledge to avoid: Figure-Background-Problems!



Chevron-signs to announce the curve are not detectable.



The perception of the signs is improved by a yellow frame .

Source: Birth 2001 / Wartmann 2002



Use multiple codes - faster reaction to combined signals!



Germany: milled rumble strips



Marked rumble stripes in Vietnam

Drivers have different reaction times:

Faster reaction to audible 150 ms
than to visual signals 200 ms

Faster reaction to combined than to single visual or audible signals!



Give unmistakable orientation for different types, functions and speeds...

Motor way ≥ 120 km/h

Express way 100 km/h

Highway 80 km/h

Community connection 60km/h

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...and for the right of way at intersections

Figure 1-5 Examples – Intersection re-alignments

Source: Transportation Association of Canada, 1999

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7. Never mislead the driver!
But give clear orientation for changes in direction and speed

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Misguidance....can cause errors

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Sufficient signing

- Sign size depend on
- the operation speed
- Directional signing
- with clear information and sufficient repetition

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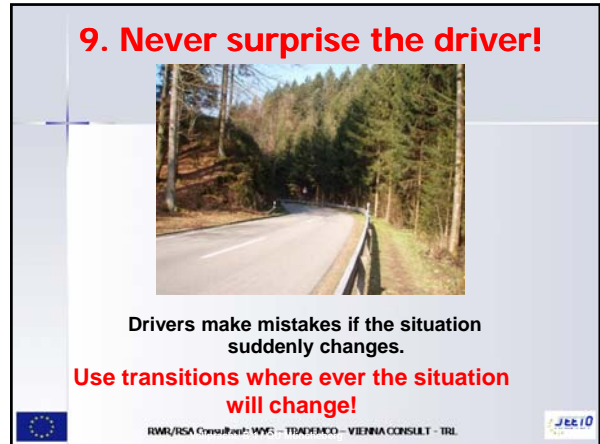
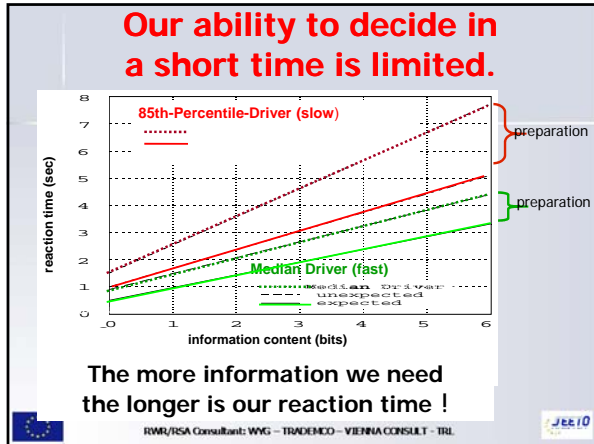
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8: Don't overload Road Users

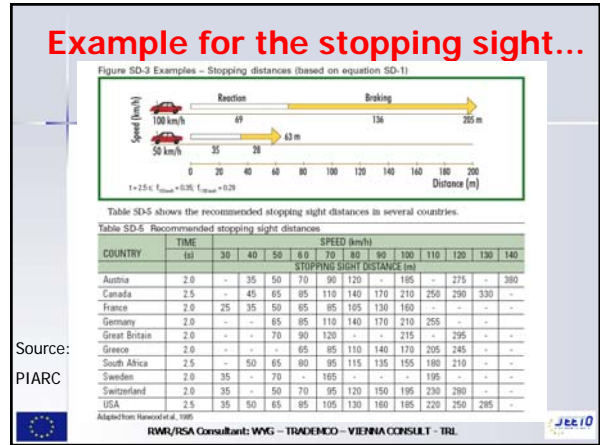
Source: Hacker 1984

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- ### 10. Give enough sight distances for:
- View on the road course for orientation
 - Stopping and overtaking
 - Visibility at night
 - Visibility on dangerous road sections, intersections, pedestrian crossings and so on
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- ### 11. Take into consideration the interrelation between the choice of speed and design features
- Pay attention to:**
- The interrelation between speed and the point of fixation
 - The influence of the surrounding, width of the carriageway and so on
 - Mistakes by estimation of speed and distance
- ...and use it for enforcement by road design and for traffic calming
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12. Provide an error forgiving road side!



- It is possible to adapt the road transport system to the physics of the vehicles and the nature of the users. But human errors are not totally avoidable.
- We need an error forgiving road side!

• Roadside obstacles and steep slopes don't!



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They should be totally avoided or...



Example of smooth roadside area design in cutting slope (from Sweden)

Example of energy absorbing crash cushion (from Germany)



...well protected



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**THANK YOU
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