Drive Slow Go Fast

A new approach to traffic theory with a behaviouristic approach of road design. Used as background material in the Ecocity Quality Support Group Advice to Trnava, Györ and Tampere.

Content

Author

Adriaan Walraad
Albert Jansen

Berlin Amsterdam november 2003

1. A new approach

The concept assessed on the Raab area is known as 'Drive slow go fast'. CROW and SWOV and TNO approved it in the Netherlands[1] in several test situations. In this chapter the concept and its theoretical backgrounds are explained. The concept was developed by Novem and is based on long years research on accicdents, driver behaviour and road design. The concept is assessed in the town of Hilversum and will be assesed in the town of Utrecht. In many other cities, like for example Lyon and Lille in France parts of the concepts are build to calm down traffic.

2. Expectations and driver behaviour

If what a driver expects to see is absent or is present at an unexpected place than the chance of confusion and subsequent error do rise. The design of a self-explaining road corresponds with the expectation that the driver has. The road explains by its design and by the environs how one should behave or what should be expected. The more self explanatory a road desing the more intrinsic safety the road has, and less accidents will happen.

Fig. 1
Do you really expect me there o drive 50 km/h

The function of a road in a network might change over time, or the environs of a road do change. Than the interpretation of the driver of the road might differ from the expected behaviour. As cities grow most radials into the city have this kind of problem. More build up environment, more housing, schools sports and business centres along the road, which profile did not change. So many problems arise. The roads capacity is too low, the roads safety is going down, black spots with many accidents arise, and the road forms a barrier in the city. Our concept can solve these problems to a certain degree in one integrated approach in which shaping the road means shaping speed and integrating the road in the traffic network and urban fabric .

3. Capacity and traffic flow

The undisturbed flow of traffic on a road depends on the relation between the number of cars

[1] CROW is the Commissie Regelgeving Openbare Werken The Dutch Regulation Authority for Public Works; SWOV stands for Stichting Wetenschappelijk Onderzoek Verkeersveiligheid, SWOV is the advisory body of the Dutch Ministry for Transport with respect to traffic safety. TNO-Traffic and Transport is a leading research organisation in the Netherlands.

that actually pass (flow) and the maximum number of cars that can pass (capacity) of the road. The actual flow fluctuates over the day and has a peak in the rush hour. When the flow over a whole day reaches about 80% of the capacity there will be some traffic congestion in the rush hours. A road like the bridege road over the Danube along the plan area easily has a capacity of more than 22.000 cars /day (e.g. up to 40.000 cars/day) when there were no junctions and crossings. So there should be no congestion but there is, how come?

The section with the lowest capacity determines the capacity of a route. Junctions are usually the bottleneck. Most cars have to stop for the traffic lights of a junction. To calculate the number of cars we standardise the number by counting lorries as 2 car-equivalents. The capacity of a junction cannot be calculated in one overall rule. Every green-light group within the junction has its own capacity. The drive-off capacity is the number of cars that can pass when the light has green for one hour. Besides the drive-off capacity the kind of conflict between the several signal-groups influences the capacity of a junction (the number of signal groups which have green at the same time). The junctions are the spots in a route with the lowest capacity. So to increase capacity we have to look at these spots.
To increase the capacity of a junction every direction is given its own separated lane. So by and by a junction takes more space. To give a signal group green the junction should be free so first all other conflicting groups have get red and the cars from all these groups have to leave the junction. This is called the sweeping time. As a junction grows in space and gets bigger, the sweeping time increases, and the capacity of a junction goes down again.
The classical solution of a junction has its limits with respect to traffic flow. Roads and junctions in this type of design become a barrier for the surrounding, noise and air quality are bad. The usability of building stock goes down and prices go down as well.
The capacity of the main roads along the city centre and tha planarea should be enough for the number of cars which want to use it, when traffic can flow smoothly. But the roads now have many traffic lights for safety reasons. So to increase capacity we have to look deeper into traffic safety.

4. Self explaining roads and shaping speed

In urban areas driving speed should be low to avoid casualties in accidents. Pedestrians and other modes like cyclists will use public space and roads.

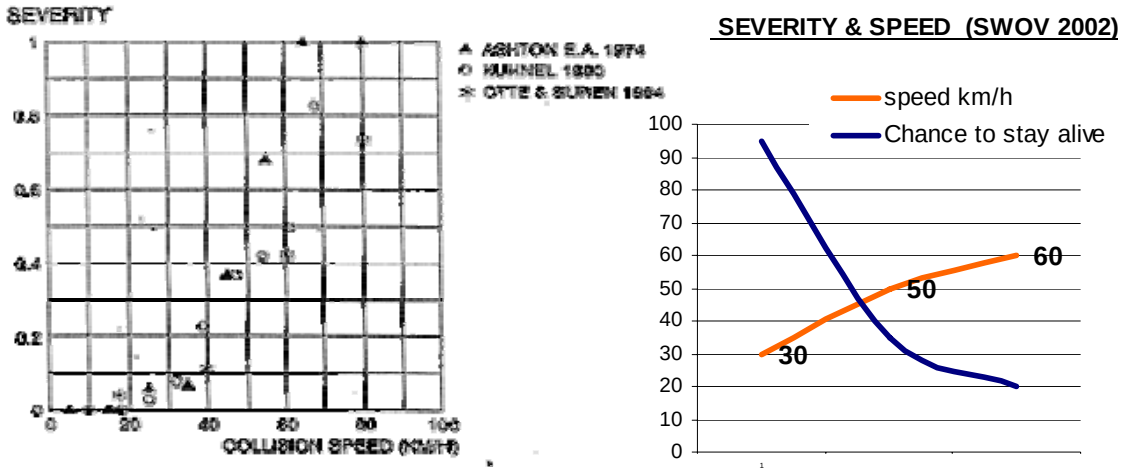


Fig. 2 Collision Speed and Severity

(source 'Veilig, wat heet veilig?' R 2001-28 SWOV Fred Wegman, p65-72

Conflicts between these different traffic participants often end disastrous for the weakest. The chance to stay alive as a pedestrian in a car-accident varies with the speed of the conflicting car. Research of the SWOV shows that the severity of an accident (the chance to die) increases enormously when speed gets higher than 40 km/h. Older studies like Ashton and Kuhnel and Otte &Suren came already in the last century to the same conclusions
So in urban area where there is a high risk of collision with pedestrians, speed policy of traffic should be reconsidered and brought into harmony with the speed of the weakest users in order to increase traffic safety.
The traffic lights along the Mainroads (and most traffic lights in common) are necessary to solve the conflicts between the main traffic flow and crossing or conflicting traffic. When we can solve this safety problem in a different way we might solve the capacity problem as well.

5. Drive slow go fast

By designing the urban roads in such a way that car traffic is urban-friendly the road system will function as a support for sustainable mobility. The redesign is done by the principles of the method: 'driving slow makes you faster'. Where on a wide road with lights cars rush from one light to the other, with top speeds of 60 - 70 km/h and stops for most lights, the characteristics of these roads are: continuous flow of traffic due to absence of traffic lights, separated and small lanes with low driving speeds. Such a road nevertheless has a high capacity due to this special junction design and due to the absence of lights. The main road has priority and traffic can flow smoothly. As cars cannot overtake speed will really be reduced and cars will form trains between which traffic on the side roads can cross. Crossing is easy and safe as it is done lane by lane and due to the slower speed traffic will be self-regulating on basis of eye contact between drivers and participants. Traffic is calmed and so mixed use of the lane for cars and cyclist is possible. Traffic-flow is steady.

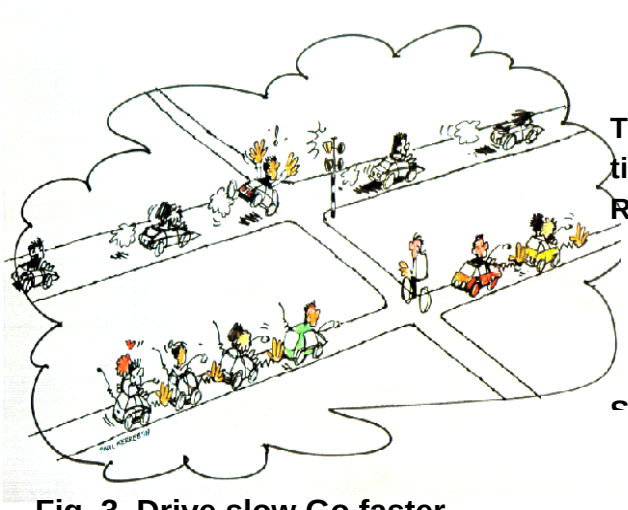


Fig. 3 Drive slow Go faster

6. The effects

As driving speed is low and traffic stops less, energy-use, emissions of CO_2 acidifying SO_x and NO_x are much lower. Noise production will be substantially lower so both air-quality and liveability of the road environs increases, and a better use of building stock is possible. In the case of downsizing or changing a road according to this concept, extra floor space might be build whose financial results will finance (part of) the reconstruction.
This concept is used on many regional roads in the Netherlands. As the road is strongly self-

explanatory actual driving speed was low as expected. Lane-width was restricted by means of rumble-edges and shoulders. Driving over the rumble edge causes discomfort without endangering safety. Monitoring the traffic behaviour showed that accidents went down by 20 % and casualties by even 35 %. So it is possible to shape speed and behaviour with shaping the road.

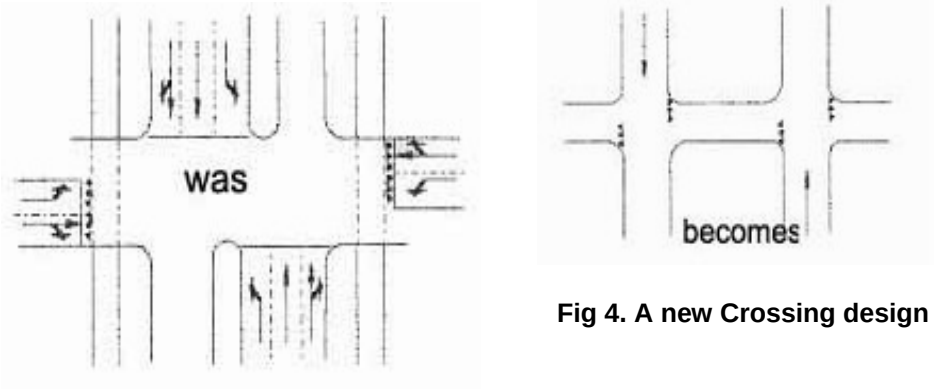


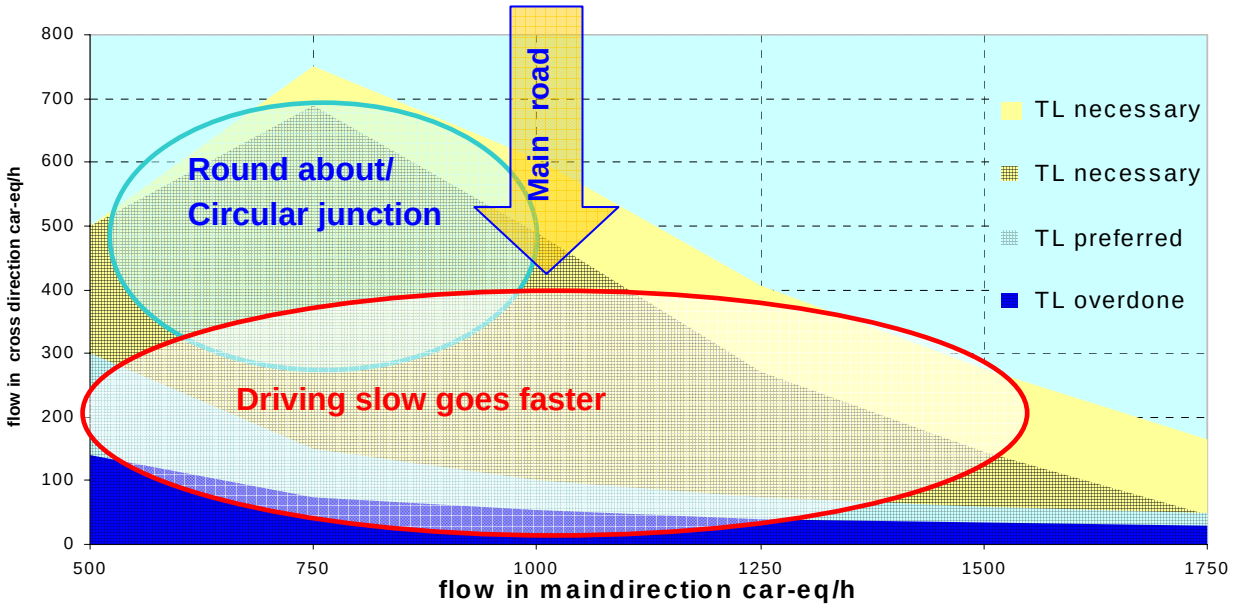
Fig 4. A new Crossing design

This concept can be used to design the main-collector roads and radials in cities and still keep up with the EU-regulations for air-quality. This road and junction concept takes less space for traffic- infrastructure so more space can be used for urban functions.

7. Junction design and traffic lights

In classical traffic engineering theory traffic lights guarantee safety but as we have seen by increasing flow the space consumption and the number of accidents increases as well as the barrier function. When we look deeper into this aspect we found that depending on the combination of the flow of the main road and the flow of the secondary road traffic lights are advisable or needed. This is represented in a graph fig. 5. [2]

FIG 5 junction flow and traffic lights



When the flow of the secondary road is lower than 400 cars per hour (equals 8.000 cars in

[2] Source Ir. H. Tromp, Goudappel Coffeng Traffic Engineers Deventer Netherlands

both directions per day) the solution with separated lanes on a junction is a possible alternative for traffic lights. When the flow of the secondary road increases a roundabout might be better. The separation of the lanes can be small but should at all times be physical as overtaking should not be possible. On the spot where a U-turn is planned, the width should be at least 10,5 m but with 16,5 m even trucks and big lorries can use the U-turn. Fig. 6,7 and 8 show examples of junctions.

8. Identity and tailor made design

The middle verge of the road can be used to give the road its identity. Trees, pedestrian lanes, paper selling kiosks, banks can be in the middle responding to the urban environs. So the driver will experience the atmosphere and feel the difference between a more historic part and a new development part of the route. The CROW did give some design examples for crossings with a middle verge, u-turns and roundabouts. Decisions on the design of a road and its crossings should be taken in a design process where traffic engineers cooperate with the urban planners. Such a design session starts with analyses of the functions in the city and the flows of goods and persons that come with the allocation of the functions. Than the transport network (with all modes) is analysed on its transport functions given the structure of functions and with respect to the chances for allocation of functions. Accessibility means a maximum flow of goods and people by the least use of resources. When the functioning of both systems is clear to everybody design of a road and its sections is taken at hand. In this process the roads urban environs are taken into account when designing the road, the crossings and the middle verge. For every section tailor made solutions may be found and a close cooperation with fire department, police etc is necessary as well to make a rescue plan. These constructions serve the traffic calming and fit well in the '*drive slow go*

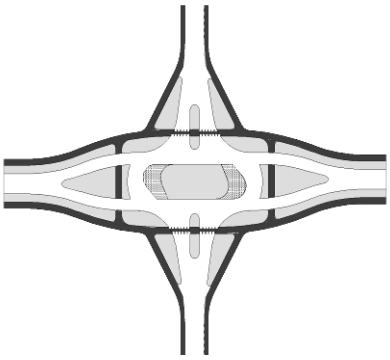


Fig 6 Junction with a middle verge

The middle verge in a junction can be used for parking. The black lines are the free bike lanes. Picture example Utrecht (Netherlands)

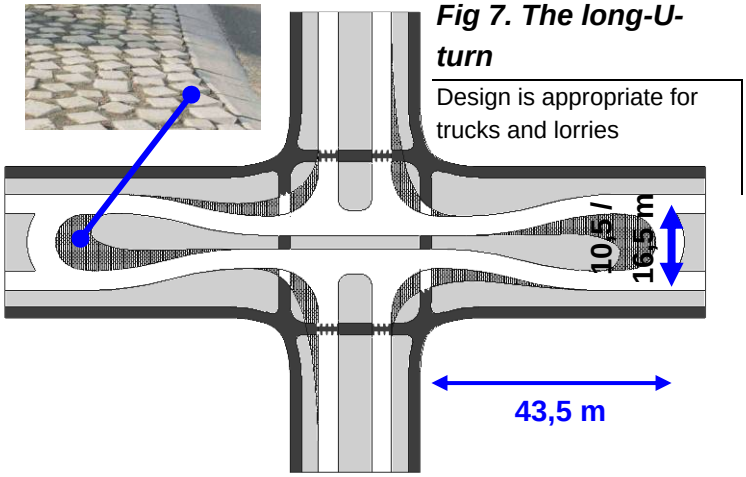


Fig 7. The long-U-turn

Design is appropriate for trucks and lorries

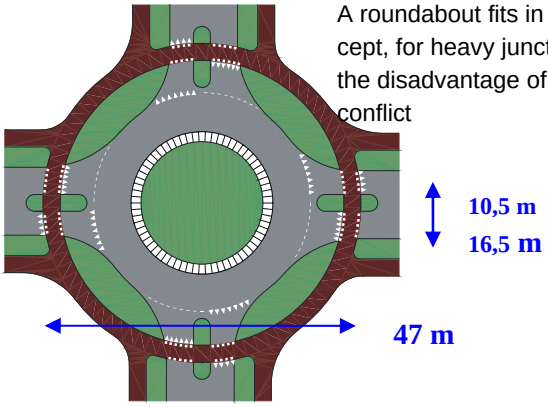


Fig. 8 The roundabout
A roundabout fits in the concept, for heavy junctions. It has the disadvantage of Virtual conflict

fast' concept. Roundabouts do fit in it as well but should only be used on very heavy junctions as they have some disadvantages.

9. Traffic lights no more

To get a steady flow traffic lights are abandoned as far as safety is concerned. The traffic safety is solved with other means, e.g lower speed and eye contact. In our concept traffic lights might be needed for regulation purposes. First there may be a lack of train building of cars when flow on the main-line increases. In such cases a traffic light for regulation of the flow and capacity reasons is an adequate answer. Such can also be adequate when one than more junctions are to be regulated in one time by this principle. Within the framework of this small theory we cannot work this out further in detail. The consequence of these aspects is that never a standerd but always tailormade solutions have to be found.

10. Sustainable transport

This *'drive slow go fast'* concept serves the development towards sustainable transport. Sustainable transport starts with spatial planning i.e. to bring functions together in such a way that no or very less transport is needed. What is left should be possible to do by walking or longer distances by public transport. For dispersed functions and special functions one will need the use of a car. Cars can be used collectively (car sharing) or publicly (taxi's) and do not to be one's property. Modal choice is based on speed, cost, comfort and convenience. The layout of the city and its boroughs influences this modal choice by aiming for optimum location of functions. Urban design and traffic design must be coordinated or even combined to get the optimum out of the function mix (mixed use of space) and mobility mix (mix use of modes) It needs a comprehensive traffic network design in which the networks for pedestrians and cyclist get an equal important role and attention in the design process as the car-networks. The pedestrian and cyclist networks influence strongly the quality (and price) of the urban environment. The urban environment and the comprehensive traffic network design will complete one another and bring synergy with respect to intensive use of space and the lowest use of non-refundable resources (space and fuels). The urban environment and the traffic network together set the conditions for sustainable behaviour. Traffic is like water, as water always runs down, taking the easiest way so people and drivers do. They use the easiest mode when available and the easiest route.
As a result, of our approach for short trips a shift towards the modes walking and cycling, is expected and for the longer trips a swift to public transport. [3].

[3] See also 'Local Transport Performance' a comprehensive design approach to be found on the Ecocity website www.ecocityprojects.net