roadsafety forall.org

Traffic safety in Cambodia: separation and integration of traffic modes

Consultative document on request of the National Road Safety Committee of the Royal Government of Cambodia

Hans Godthelp & Paul Wesemann

Voorburg, September 2010
Foundation Road safety for all, The Netherlands

Contents

1. Introduction

The Four-Year Report 2006 - 2009 of the Cambodia National Road Safety Committee (ref. 1) shows that the number of traffic fatalities in Cambodia has almost doubled in the last five years. In 2008 an estimated 1638 people were killed and 7200 severely injured. Ref. 1 shortly describes the traffic safety situation in Cambodia.

Traffic characteristics:
- 1.1 million registered vehicles, 20% annual growth
- 79% motorcycles, 13 % cars, 6 % trucks

Fatalities: type of transport:
- 68% motorcycles, 13% pedestrians
- 4 % bicycles, 7% cars

Fatalities: types of collision:
- 35%: motorcycle – 4 wheeler
- 19%: motorcycle - motorcycle

A strong program of traffic safety measures is required and foreseen to prevent a renewed doubling of these figures in the coming years up to 2020. Important measures are about law enforcement (helmet wearing, speeding, drink driving, overloading), driver training and child education. In addition to this set of human behaviour related measures the National Road Safety Committee (NRSC) intends also to view the possibilities of a program of infrastructure improvement .Therefore the NRSC has put forward the question whether and how spatial separation of traffic modes, especially of pedestrians, bicyclists and motorcycles, can be implemented in the Cambodia traffic system. The issue of separation of traffic modes is closely linked with the concept of sustainable safety that has proven to be very effective in western European countries. An important question is whether and how infrastructure innovations based on this concept can be used in the Cambodia case. This document presents some suggestions about this issue .

2. The concept of sustainable safety

In a sustainable safe traffic system potential conflicts are largely avoided through design principles. In the present road transport system many accidents occur because **un**safety is more or less inherently constructed in road and traffic design. On our roads trucks and busses meet motorcycles and biking children on their way to school. The same holds for night time situations, where vulnerable road users may be invisible to motorized vehicles. This mix of traffic participants, with large differences in speed and mass, using the same physical space, makes the traffic system structurally **un**safe. In such a system human errors inevitably will result in high fatality figures.

In a sustainable safe system potential conflicts between participant with large differences in mass, speed and direction, are excluded through design elements. The design of the road network and the roadway characteristics are based on the so-called sustainable safety principles:
1) avoid traffic encounters with high speed and mass differences
2) avoid unpredictable behaviour
3) avoid not intended use of the infrastructure.

Traffic encounters with high speed differences can be avoided through separation of high and low speed traffic, or – the other way around - by homogenizing traffic speeds. The application of roundabouts is an example of effective traffic homogenization. This sort of design elements make the roads more or less ´self explanatory´, and thus prevent unpredictabilities in human behaviour. Structuring the road system in high and low speed road categories, implementing homogenizing design components and separation of vulnerable road users *ultimately forces road users to use the roads in a safe way.*

A sustainably safe road system will allow unexperienced road users to become familiar with the behaviour demanded by different road types, and what to expect from other road users. The roadway environment will be recognisable to the road user thereby enhancing the

predictability of the system as a whole . In the Sustainable Safety vision, we have paraphrased this principle as *continuity* and *consistency* in road design: the layout should support the road user's expectations along the entire route, while all elements of the road design should conform to these expectations. In the ideal case, the road image is so clear for road users that it can be considered as 'self explaining' (e.g. ref 2).

In the western European countries the vision of sustainable safety has resulted in a new philosophy of road categorization. Principally roads are divided in three categories: 1) roads for high speed traffic (through roads), 2) roads for local access to houses, shops, schools (access roads) and 3) roads connecting these two categories (distributor roads). In this system the connection between roads is controlled by intersections with speed homogenization (roundabouts, raised junction) or traffic segregation (traffic lights, priority rules).

A sustainable safe road system will only become effective in combination with a consistent and coherent regime of traffic rules and a clear scheme of vehicle categorization. Priority rules are a nice example. These rules are needed to regulate traffic streams at intersections, whereas design characteristics, e.g. raised junction or roundabout, will harmonize speed.

Vehicle categorization in terms of allowed speed and mass, is needed to implement a road system with separate lanes for cars/trucks/buses, heavy/ light motorcycles, bicyclists and pedestrians or with limited access for certain types of vehicles. Changes in road categorization might also require changes of the vehicle categorization schemes and of the speed limits. New vehicle technology (e.g. ISA) may be used to control speeds on particular road categories.

3. Sustainable safety in Cambodia

In the coming 10 years the Cambodia transport infrastructure will develop rapidly. The density of paved roads will grow and so will the network of public transport facilities. Also the number of motorized vehicles, both cars and motorcycles, will rise. The composition of the vehicle fleet might change as well by an increasing share of low speed and non-polluting electric two wheelers. These developments and transport investments make it necessary *and possible* to implement sustainable safe components in the system.

In areas of urbanisation road networks may be (re)designed with the concept of traffic integration or separation in mind. In residential areas, streets and squares should be designed for low speed, ´shared space´ and with ´woonerf´ characteristics. In such urban areas traffic might use low speed access roads and well designed distributor roads. Traffic calming measures on distributor roads may also improve safety in the vicinity of schools, shops and markets. Road pavement programs in urban areas and the construction of new housing estates should not focus on the making of straight streches of concrete roads, which will result in speeding. Instead, road restructuring programs may be used to design residential areas, where low speed vehicles safely meet pedestrians and playing children.

In rural areas roads and intersections should be designed with the concept of separation in mind: high speed traffic should be separated from vulnerable, low speed participants. Road pavement and reconstruction programs can be used to implement this new philosophy. If separation is not possible or desirable motorized traffic should be forced to drive slowly.

Intersections connecting rural and urban areas and between high and low speed roads should either integrate speed (raised intersection, roundabouts) or separate traffic (traffic lights, priority rules).

Speed of motorized traffic is an important characteristic of each road category. Speed limits should depend on the type of conflicts that are possible between the road users on a particular category of road. The advanced Sustainable Safety vision proposes safe speeds for the following situations (ref 3, p 14):
- 30km/h: locations with possible conflicts between cars, motorcycles and vulnerable road users

- 50km/h: intersections with possible side collisions between cars
- 70km/h: roads with possible frontal collisions between cars
- 100km/h: roads with no possibility of side or frontal collisions (only collisions with structures like guard rails)

Safe speeds for motorized two wheelers have not yet been defined.

The sustainable safety philosophy may require changes in the present speed limits and vehicle categorization in Cambodia, particularly regarding motorcycles. A subdivision of the motorcycle category in a high and low speed or mass category might be considered. This will allow a better separation of traffic with high speed/heavy weight and low speed/light weight. However, little knowledge and experience is available on the issue of separation of motorcycles. Therefore no cut and dried solutions can be presented here. We have drafted a preliminary proposal that needs further discussion and research.

Limited access is an important element of a sustainable safe traffic system: vulnerable road users and low speed traffic should not use high speed roads. Large trucks and buses will have limited access to living areas. Walking areas near shops, markets and schools will have limited access for all motorized vehicles.

Spatial planning measures may be needed to facilitate sustainable safety developments. This may require changes of road networks and traffic management in cities and villages, and alongside through roads. Also the use of one-way roads may be helpful. Sufficient parking places are needed to make roads and sidewalks available for traffic and pedestrians. Industrial areas with many heavy transport vehicles should be located in the neighbourhood of national through roads.

Sustainable safety measures, such as the introduction of pedestrian areas, will not only improve safety. In many cases *quality of life* in cities and villages will be positively effected! From this perspective the introduction of electric motorcycles may also be considered.

4. Separation and integration of traffic modes: proposal for discussion

We have drafted a preliminary proposal for the separation and integration of all traffic modes. Most elements are taken from the advanced Sustainable Safety vision (ref 3) apart from the proposed position of motorcycles. We have introduced two categories of motorcycles: low speed/light weight (LL) and high speed/ heavy weight (HH). Except its cubic cylinder capacity and construction (or design-) speed they might differ with respect to speed limit regime, minimum age of driver, driver license and exclusion from access to certain roads or lanes of the road. The Cambodia Traffic Law defines 3 categories of motorcycles but the differences have not been defined as detailed. According to cubic cylinder capacity the categories are up to 49 cc, 50- 125 cc (A1) and over 125 cc (A2). The requirements with regard to age and license of driver are different but no distinction is made in speed limit and all three categories have access to all roads. About 686000 motorcycles A1 and A2 are registered in 2008. No data are available on the number of motorcycles up to 49 cc but they are estimated to be few. One of the future tasks will be to develop a sensible dichotomy (LL/HH) out of these motorized two wheelers.

Pedestrians and bicyclists

- are to be considered as most vulnerable road users. Interactions with high speed motorized traffic should be excluded.
- access of motorized vehicles to footpath, bike path, sidewalks should be forbidden. In malpractice these facilities are often in use for parking, cars, motorcycles and commercial purposes (shops/market). This should be avoided through the availability of regular parking and market places. Access to sidewalks and bike paths may also be prevented through the use of barriers or posts.

- *Through roads:* access is forbidden. Crossings with through roads are split level/roundabout/traffic light.

- *Distributor roads:* separated from motorized traffic. At-grade crossings at junctions and road links. Special crossing design should limit the speed of motorized vehicle at these crossing to max 30km/h.
- *Access roads at residential areas:* separated from motorized traffic in built-up areas. On carriage way outside built-up areas. At-grade crossings at junctions and road links. Special crossing design should limit the speed of motorized vehicle at these crossing to max 30km/h.

Motorcycles Light/Low speed (LL)

- given the number and vulnerability of motorcycles special infrastructure solutions are needed, i.e. so-called motorcycle lanes.

- *Through roads*: separated motorcycle LL lanes *inside built-up areas* on high volume roads. Through the use of one way roads and traffic management, physical space is made available for separate lanes of 1) motorcycle HH/cars/trucks/buses and 2) motorcycles LL l/tuk-tuks. Max speed 30k/h. Separated entrance facilities. Crossings with traffic lights or split-level. Max speed at crossings 30km/h. *Outside built-up areas* motorcycles LL use separated lanes. Max speed 50km/h. Crossings with traffic lights, roundabouts or split level. Max speed at crossings 50km/h.

- *Distributor roads*: separated motorcycle LL lanes *inside built-up areas* on high volume roads. Max speed 30km/h. One-way roads with separated lanes for 1) motorcycle HH/cars/trucks/buses and 2) motorcycles LL/tuk-tuks. Crossings with roundabout or raised junctions for speed homogenization. Max speed at crossings 30km/h. *Outside built-up areas* motorcycles LL use separated lanes or mix with other motorized traffic, dependent on traffic volume . Max speed 50km/h.

- *Access roads at residential areas:* motorcycles LL mix with other motorized traffic both in- and outside built-up areas. Max 30km/h. At-grade crossings with pedestrians and bicyclists, use of raised junctions and roundabouts. Max speed at crossings 30km/h.

Motorcycles Heavy/High speed (HH)/ cars, trucks, buses

- *Through roads*

Within built-up areas:

along the road: separated, max 70 km/h
crossing: roundabout, traffic light, split-level, max 70 km/h

Outside built-up areas:

along the road: separated and physical separation of opposite driving directions, max 100 km/h.
crossing: split-level, traffic light, roundabout, at grade crossing max 50 km/h.

- *Distributor roads*

Within built –up areas:

along the road: separated, max 50 km/h
crossing: roundabout, traffic lights, max 30 km/h

Outside built-up areas

along the road: separated or mix with motorcycles LL dependent on traffic volume, max 70 km/h
crossings: roundabout, traffic lights, max 50 km/h

- *Access roads, residential areas:*

Within built –up areas:

along the road: mix with motorcycles LL, max 30 km/h
crossings: roundabout, raised junction, max 30 km/h

Outside built-up areas

along the road: mix with motorcycles LL, max 50 km/h
crossings: roundabout, raised junction, max 30 km/h

5. Implementation

The implementation of sustainable safety philosophy is a matter of vision and finances. For the Cambodia case the vision has to be developed with the support of local traffic engineers. Regular pavement investment programs and periodical maintenance schemes can be used to provide the money.

Regulating the motorcycle position in the Cambodia sustainable safety approach needs a related vehicle categorisation policy. Particularly a distinction between motorcycle categories heavy/high speed and light/low speed is necessary. Further discussion and research is needed.

A special training for the Cambodia traffic engineers should be developed to support the implementation of sustainable safety in Cambodia traffic policy and engineering manuals.

Handbooks on the concept of sustainable safety and its practical use in European countries are available to support this implementation process, ref. 3, 4, 5 and 6.

Cambodia traffic law should be brought in coherence with the traffic separation and integration scheme as suggested, and its related speed limit schedules and road/vehicle categorization schemes.

6. Conclusions and recommendations

Introduce a system of road categorization based on the sustainable safety philosophy. .

Develop design specifications for road characteristics of each road category for road sections and intersections.

Introduce basic elements of the sustainable safety philosophy: a) low and harmonized speeds on access roads and at intersection connecting access and distributor roads and b) separation of conflicting traffic participants on distributor and through roads.

Adapt the system of traffic rules to the road categorization scheme.

Adapt the vehicle categorization system to the road categorization system, i.e. make a distinction between motorcycle categories heavy/high speed and light weighted/low speed.

Adapt the traffic law in accordance.

Introduce separate lanes for motorcycles LL inside and – dependent on traffic volume - outside built-up areas.

Provide sufficient and separate parking places to prevent the use of sidewalks and bicycle paths/lanes for parking.

Prevent the use for parking of sidewalks and bicycle paths/lanes through the use of barriers and posts.

Develop a special training for the Cambodia traffic engineers to support the implementation of sustainable safety in Cambodia traffic policy and engineering manuals

References

1. Royal Government of Cambodia National Road Safety Committee, Four Year Report 2006 - 2009, Prepared for the First Global Ministerial Conference on Road safety, Moscow, Russian Federation, November 2009.

2. Theeuwes, J. & Godthelp, H., 1995, Self Explaining Roads. Safety Science, 19, p. 217 – 225

3. Wegman, F.C.M. & Aarts, L.A. (eds), 2006. Advancing Sustainable Safety. SWOV Institute for Road Safety Research, Leidschendam, The Netherlands. Download from: www.sustainablesafety.nl

4. DHV Environment and Transportation, September 2005. Sustainable safe road design; a practical manual. Produced for the World Bank and the Dutch Ministry of Transport, Public Works and Water Management. Download from: http://web.worldbank.org/WBSITE/EXTERNAL/COUNTRIES/ECAEXT/EXTECAREGTOPENERGY/0,,contentMDK:20740169~pagePK:34004173~piPK:34003707~theSitePK:511377,00.html

5. CROW, 2009. Road safety manual. Netherlands Information and Technology Platform for Transport, Infrastructure and Public Space, www.crow.nl, Ede, The Netherlands.

6. Dijkstra, A., Janssen, Th. & Wegman, F., 2005. Review of an initial concept of the manual ´Sustainable Safe Road Design´. Report on request of the World Bank. D-2005-2. SWOV Institute for Road Safety Research, Leidschendam, The Netherlands. Download from: http://www.swov.nl

Appendix: Preliminary proposal of road and road user categorization

Pedestrians and bicyclists.
- Access roads, residential areas:
  - Within built –up areas:
    - along the road: separated
    - across the road: at-grade crossing at road links and junctions
  - Outside built-up areas
    - along the road: on carriage way
    - across the road: at-grade crossing at road links and junctions
- Distributor roads
  - Within built –up areas:
    - along the road: separated
    - across the road: at-grade crossing at road links and junctions
  - Outside built-up areas
    - along the road: separated
    - across the road: at-grade crossing at road links and junctions
- Through roads
  - Within built-up areas:
    - along the road: forbidden
    - across the road: split-level crossing
  - Outside built-up areas:
    - along the road: forbidden
    - across the road: split level crossing

Motorcycles Light/Low speed LL
- Access roads, residential areas:
  - Within built –up areas:
    - along the road: mix with other motorized traffic, max 30
    - crossings: roundabout, raised junction?, max 30
  - Outside built-up areas
    - along the road: mix with other motorized traffic, max 30
    - crossings: roundabout, raisedjunction, max 30
- Distributor roads
  - Within built –up areas:
    - along the road: separated, max /30
    - crossing: roundabout, traffic lights, 30
  - Outside built-up areas
    - along the road: separated or mix with other motorized traffic, 50
    - crossings: roundabout, traffic lights, 50
- Through roads
  - Within built-up areas:
    - along the road: separated, max 30
    - crossing: roundabout, traffic light, split-level, max 30
  - Outside built-up areas:
    - along the road: separated , 50
    - crossing: split-level, traffic light, roundabout, max 50

Motorcycles Heavy/High speed HH/cars/trucks/buses
- Access roads, residential areas:
  - Within built –up areas:
    - along the road: mix with motorcycles LL, max 30
    - crossings: roundabout, raised junction, max 30
  - Outside built-up areas
    - along the road: mix with motorcycles LL, max 50
    - crossings: roundabout, raised junction, max 30
- Distributor roads
  - Within built –up areas:
    - along the road: separated, max 50
    - crossing: roundabout, raised junction, traffic lights, max 30
  - Outside built-up areas
    - along the road: separated or mix with motorcycles LL, max 70
    - crossings: roundabout, raised junction, traffic lights, max 50
- Through roads
  - Within built-up areas:
    - along the road: separated, max 70
    - crossing: roundabout, traffic light, split-level, max 70
  - Outside built-up areas:
    - along the road: separated, physical separation of opposite driving direction , max 100
    - crossing: split-level, traffic light, roundabout, at grade crossing max 50