

Technical note 4

**TYPICAL SAFETY ENGINEERING
PROBLEMS + SOLUTIONS**



**TRACECA Regional Road Safety Project
Safety Engineering Team**

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EU funded road safety project

For

**Armenia, Azerbaijan, Georgia, Kazakhstan, Kyrgyzstan, Moldova,
Tajikistan, Turkmenistan, Ukraine, Uzbekistan**

PREFACE

During visits to each country in relation to road safety audit, black spot management and design issues and after discussion with local engineering experts, the project team on TRACECA Road Safety II project have identified the most common typical safety engineering problems in the region.

These problems were primarily connected with outdated ex-Soviet design standards and norms (SNiP and GOST) which are still in use and their implementation via design, construction and maintenance.

This Technical note presents the most common typical road safety problems and possible solutions in accordance with TRACECA Regional Road Safety Audit Manual. Technical note and can be used as a resource by the road safety engineers in each beneficiary country and visiting experts to improve road safety of the networks.

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Table of Contents:

Introduction	4
A) Road function	5
B) Cross section	6
C) Alignment	7
D) Intersections	8
E) Public and private services; service and rest areas, public transport	9
F) Vulnerable road user needs	10
G) Traffic signing, marking and lighting	11
H) Roadside features and passive safety installations	12
References	13

INTRODUCTION

During TRACECA Road Safety II Project a number of different road safety related activities were undertaken including :

- 3 sub-regional Workshops/Training Courses (WS/TC) "**Training on safety elements of road design, construction and maintenance**", held in Ukraine, Georgia and Kazakhstan,
- 1 regional Workshops/Training Courses (WS/TC) "**Introduction to EU directive on safety in road tunnels**" in Kyrgyzstan,
- 2 sub-regional Workshops/Training Courses (WS/TC) "**Road Safety Audit and Black Spot Management**" in Georgia and Kazakhstan.

Apart from the above capacity building and workshop and training courses a number of additional follow up visits were made to TRACECA countries: specifically to look at and review

- **Safety aspects of design standards**
- **Road safety audit.**

These workshop, training courses and missions were used for road safety engineering capacity building in each of TRACECA countries and for practical training (field visits). During these pilot applications by trainees of the safety audit procedures proposed a number of typical road safety problems were identified. These were mainly related to problems and restrictions in applying modern speed reduction concepts when compliance was required with SNiP and GOST standards. Each of the road safety problems was discussed, described, illustrated with pictures from the field and possible solutions (countermeasures) were proposed.

This document summarises the problems and possible solutions for most frequently occurring problems that typically occur in TRACECA region. Road Safety problems were classified in the following chapters in this document:



- A) Road function
- B) Cross section
- C) Alignment
- D) Intersections
- E) Public and private services
- F) Vulnerable road user needs
- G) Traffic signing, marking and lighting
- H) Roadside features and passive safety installations

A) ROAD FUNCTION

Some of the questions that project team and local experts discussed were:

- Is the road suitable for the role it plays?
- Does it have mixed functions?
- Are speeds limit appropriate?
- Are there any undesirable impacts from adjacent land development?, etc.

Table A.1 Identified problem, illustration and possible solution/s


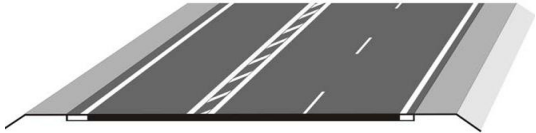
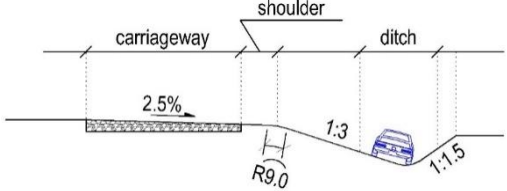
No	Identified problem (short description)	Illustration/s	Possible solution (countermeasure)
1	<p>MIXED ROAD FUNCTION</p> <p>In this case, the role of the road in the road hierarchy becomes confusing for road users While the road is passing through settlements (in the absence of a by-pass) can it keep its geometry unchanged or does something need to be done to encourage speeds more appropriate to a “street” rather than an International/Regional road</p> <p>This, simple planning/ design mistake can create tremendous problems for road safety. Once intense development has been allowed it is very difficult to achieve improvements without major reconstruction of a bypass on a new alignment.</p> <p>In such circumstances, physical measures have to be applied to reduce speeds to an acceptable level while the road is passing through the settlement so it moves from being seen as a rural road to an urban street</p>	 <p style="text-align: center;">TAJ</p> <p style="text-align: center;">AZE</p>	<ul style="list-style-type: none"> - Construction of by-pass - Grade separation of long distance and local traffic - Changing character of road (from mobility to accessibility) – act as a street. The Main task is to “kill” the speed  <p style="text-align: center;">Example:</p> <p>Entering/exit island to/from the built up areas creates a “threshold” effect to show drivers they are “entering” an urban area and that there is a change in character of the road and its function requiring lower speeds</p>

B) CROSS SECTION

Some of the questions that project team and local experts discussed were :

- Is the road wide enough for the traffic using it?
- Is the marking sufficient?
- What are the surface conditions?
- Are the shoulders adequate, but not too wide?
- Is the road designed so water does not pool on the surface?,etc.

Table B.1 Identified problem, illustration and possible solution/s


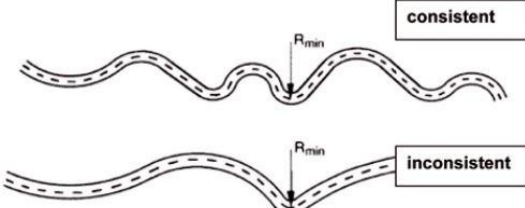

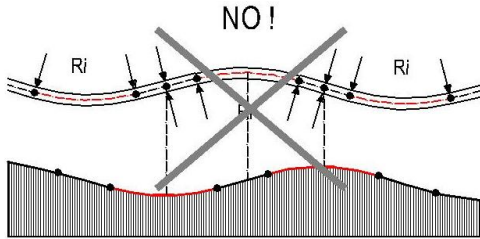
No	Identified problem (short description)	Illustration/s	Possible solution (countermeasure)
1	<p>TYPES (WIDTH) OF THE ROAD</p> <p>Widening lane or carriageway width or widening shoulders up to a certain extent can be beneficial in reducing certain types of accidents, however beyond a certain point this can have negative effects on road safety (as users will start using extended width as a regular lane).</p> <p>Dangerous cross sections of express roads and highways are commonly found in TRACECA region. e.g. a four lane road without a crash barrier can result in very serious head on crashes and two lane roads with excessively wide hard shoulders can sometimes be used as a very narrow four lane road, with disastrous results for road safety</p>	 <p style="text-align: center;">GEO</p> <p style="text-align: center;">KGZ</p>	<ul style="list-style-type: none"> - Reconstruction of cross section  <ul style="list-style-type: none"> - Road improvements (Rehabilitation)  <ul style="list-style-type: none"> - Better signing and marking

C) ALIGNMENT

Some of the questions that project team and local experts discussed were :

- How many horizontal curves are there?
- What about vertical curves?
- Is there consistency of curve design?
- Are sight distances adequate?, etc.

Table C.1 Identified problem, illustration and possible solution/s


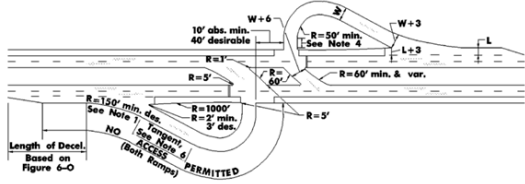
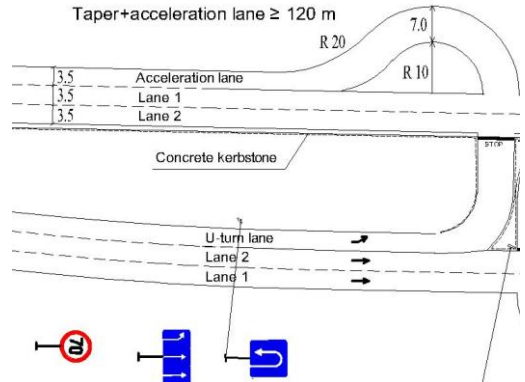
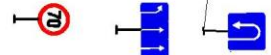
No	Identified problem (short description)	Illustration/s	Possible solution (countermeasure)
1	<p>VERTICAL AND HORIZONTAL CURVES (CONSISTENCY)</p> <p>Poor co-ordination of the horizontal and vertical alignments can result in visual effects which contribute to accidents and are detrimental to the road appearance.</p> <p>Unsafe combinations of horizontal and vertical curves when horizontal and vertical curves of different length occur at the same location can be misinterpreted by a driver and may result in serious accidents</p> <p>Unfortunately these particularly dangerous situations are frequently present on the road networks of TRACECA region. Particular efforts need to be made by designers to avoid such unsafe conditions being created</p>	 <p style="text-align: center;">AZE</p> <p style="text-align: center;">KAZ</p>	<ul style="list-style-type: none"> - Reconstruction of curves <ul style="list-style-type: none">   - Improving sight distance in curves <ul style="list-style-type: none">  - Better signing and marking is needed especially where very tight curves may appear unexpectedly ahead of the driver

D) INTERSECTIONS

Some of the questions that project team and local experts discussed were:

- Is the intersection appropriate for the traffic volumes?
- Are there traffic signals and are they sufficient (e.g. are turning arrows needed)
- Accesses and railway crossings, etc.

Table D.1 Identified problem, illustration and possible solution/s

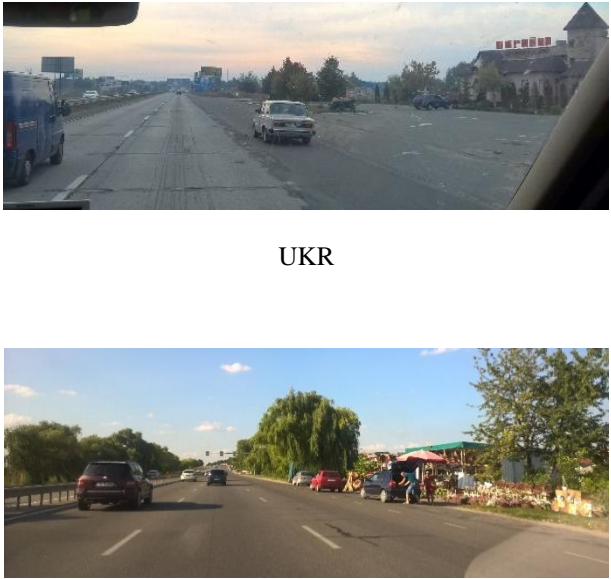
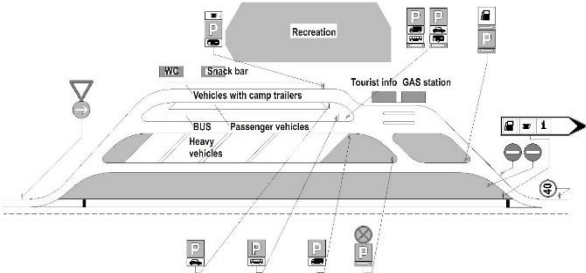
No	Identified problem (short description)	Illustration/s	Possible solution (countermeasure)
1	<p>U-turns</p> <p>The main consideration which governs median openings (U-turns) is minimum turning path (that is, the length of median opening depends upon the width of median and the minimum turning path of the largest vehicle allowed to U turn on that road).</p> <p>Road accidents tend to cluster at median gaps particularly on dual carriageways mainly due to the conflict between the slow manoeuvre of a wide turn and fast approaching vehicles (usually at high speed).</p> <p>In addition, vehicles slowing down in the fast lane to U turn at an unprotected U turn (without a safe area for the turning vehicle to make its turn are often hit in the rear by vehicles travelling fast behind them in that same lane This is a typical and frequent problem in TRACECA countries.</p>	 <p style="text-align: center;">UZB</p> <p style="text-align: center;">KGZ</p>	<p>- Construction of “fly over” U-turns</p>  <p>- Reconstruction of cross section (U-turn)</p>  <p>- U-turn improvements (Rehabilitation)</p> 

E) PUBLIC AND PRIVATE SERVICES; SERVICE AND REST AREAS, PUBLIC TRANSPORT

Some of the questions that project team and local experts discussed were:

- Is there sufficient space and acceleration/deceleration lanes into the Service and Rest Areas?
- How is access controlled to other services such as schools, hospitals, supermarkets, restaurants etc?
- Parking and loading facilities and Public Transport facilities such as tramlines, bus stops and their position relative to traffic lights should also be examined. Are they adequately protected including the needs of their passengers?, etc.

Table E.1 Identified problem, illustration and possible solution/s


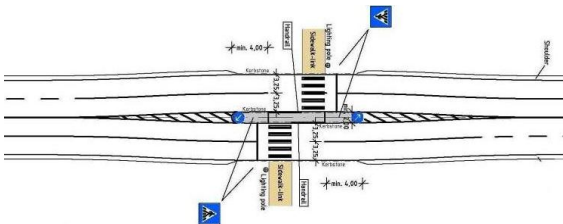
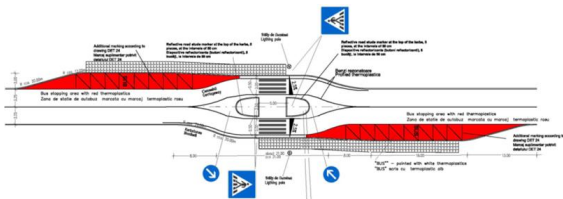
No	Identified problem (short description)	Illustration/s	Possible solution (countermeasure)
1	<p>SERVICES ALONG ROADSIDE</p> <p>Roadside facilities (rest places and petrol stations) are necessary to serve the long distance traffic between regions and towns (villages). Drivers need to rest at least once every 2-3 hours in order to maintain their concentration when driving.</p> <p>In TRACECA Region there are a lot of examples where rest areas are invaded / encroached on by unauthorized selling activities and there are often similar roadside commercial activities that can increase danger because of huge speed difference between vehicles suddenly slowing down or entering the traffic stream and following vehicles on the roads</p> <p>This mixture of parked vehicles, different categories of road users , unprotected pedestrians and high speed roads , traffic passing at high speed within a few feet of pedestrians is extremely dangerous and is found on roads throughout the region</p>	 <p>UKR</p> <p>MDA</p>	<ul style="list-style-type: none"> - Improving of entrance/exit to services along roadside  <ul style="list-style-type: none"> - Improving of parking areas - Improving of signing and marking of services along the roadside <p>Relocating roadside commercial activities to designated laybys or off road areas where vehicles can stop safely to buy goods can reduce crashes but this requires strict enforcement of roadside activity to deter roadside commercial activities resuming or new sellers starting to seek customers at the road side</p>

F) VULNERABLE ROAD USER NEEDS

Some of the questions that project team and local experts discussed were:

- Have the needs of pedestrians, cyclists and scooter/moped or motorbike riders been taken into account, etc.

Table F.1 Identified problem, illustration and possible solution/s


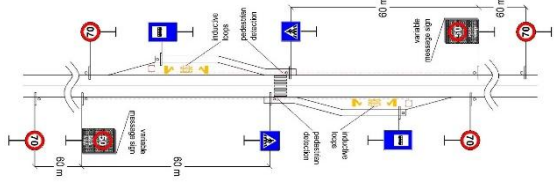
No	Identified problem (short description)	Illustration/s	Possible solution (countermeasure)
1	<p>PEDESTRIAN CROSSINGS</p> <p>With the exception of roundabouts where speeds are low, pedestrian crossings should not be placed at grade on major roads</p> <p>At-grade pedestrian crossings should be forbidden on dual carriageways and where roads have with multiple lanes in each direction unless pedestrian traffic signals are provided to give them a chance to cross safely</p> <p>Where feasible/ affordable , crossings on major roads should be provided as underpasses or overbridges with ramps, rather than stairs to make them accessible to all. Any other solution significantly increases risks of accidents with pedestrians</p> <p>Even though contrary to good practice in design standards around the world (including SNIp and GOSTstandards) there are frequent examples in TRACECA region where at grade pedestrian crossings have been provided on major multi lane international roads with very fast traffic – many funded by development banks .</p>	 <p style="text-align: center;">ARM</p> <p style="text-align: center;">TAJ</p>	<ul style="list-style-type: none"> - Separated pedestrian crossings - Narrowing of road and usage of refuge islands to guide and protect pedestrians  <ul style="list-style-type: none"> - Connecting pedestrian paths (walking routes) - Pedestrian crossings placed behind BUS Stops  <ul style="list-style-type: none"> - Where such major roads are passing through settlements raised pedestrian crossings can be used to make pedestrians more visible and to reduce traffic speeds at the crossing

G) TRAFFIC SIGNING, MARKING AND LIGHTING

Some of the questions that project team and local experts discussed were:

- Is the signing and marking appropriate and clear?
- Is lighting adequate or is more lighting needed ?, etc.

Table G.1 Identified problem, illustration and possible solution/s


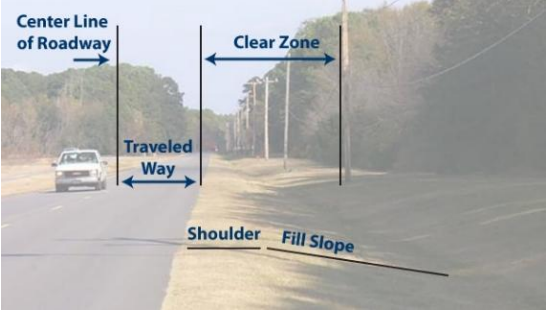
No	Identified problem (short description)	Illustration/s	Possible solution (countermeasure)
1	<p>SIGNING AND MARKING</p> <p>At road sections visited in TRACECA Region, it is common practice that the signs are either missing (even at dangerous locations), not properly positioned, without adequate reflectivity for night time conspicuity, non-standardized or even not compliant with UN conventions to which all countries have assented.</p> <p>Although most of TRACECA countries have their own national standards for road marking, many of the roads do not have good markings (without reflectivity or partially worn or missing altogether). This is partly due to the fact that road marking paint available locally often tends to be of poor quality whilst imported road marking paint is often too considered too expensive. (even though it lasts much longer and whole life costs are often cheaper)</p>	 <p style="text-align: center;">KGZ</p>	<ul style="list-style-type: none"> - Usage of high class of reflectivity materials for traffic signs/markings - Variable message signs (VMS) usage  <p style="text-align: center;">Example: Usage of VMS for speed limit in accordance with BUS stop detection and pedestrian crossing detection</p> <ul style="list-style-type: none"> - Maintenance of traffic signs/markings

H) ROADSIDE FEATURES AND PASSIVE SAFETY INSTALLATIONS

Some of the questions that project team and local experts discussed were:

- What structures, steep slopes and embankments, plantings, trees and other obstacles are too near the roadside and that could pose a problem?
- Are there open windows in the passive safety system and/or is it an obstacle itself?, etc.

Table H.1 Identified problem, illustration and possible solution/s

No	Identified problem (short description)	Illustration/s	Possible solution (countermeasure)
1	<p>ROADSIDE OBSTACLES</p> <p>Great care should be taken concerning the positioning of roadside features which may either obstruct visibility, lead to accidents or increase accident severity. Where obstructions cannot be removed but could contribute to hazardous situations, consideration should be given to their replacement with equipment designed to collapse on impact, re-alignment of the road, or the introduction of barriers to protect and prevent collision directly with such obstacle.</p> <p>Once a road is completed, care must be taken to ensure that obstacles are not introduced by other institutions subsequently, such as telephone or electricity authorities. Vegetation should be trimmed regularly and planning controls should be enforced.</p>	 <p style="text-align: center;">ARM</p> <p style="text-align: center;">GEO</p>	<ul style="list-style-type: none"> - Removing roadside objects from road clear zone  <ul style="list-style-type: none"> - Relocation of hard roadside - Alter to reduce severity or protect roadside hazards objects - Protect hazard objects (using of guardrail systems)

REFERENCES AND FURTHER READING

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