

Review of road safety projects in Peru

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Evaluation of project proposals establishing a medium and long-term road safety strategy

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Contents of the project: The rapid motorization and enlargement of the road infrastructure in Peru have resulted in rapidly increasing numbers of fatalities, injuries and accidents. The (conservative) estimate of the macro-economic loss due to traffic accidents amounts to 1.6% of the gross national product of Peru, and is on the rise. A National Road Safety Strategy 2000-2004 for Peru is being prepared as part of the Second Transport Rehabilitation Project (TRP-II), which is financed through funding from the World Bank. It involves the implementation of seven selected non-infrastructure projects and one project for infrastructural improvement of road safety. The specification of the projects has been prepared by the National Road Safety Council of Peru (CNSV) with the help of a reviewing expert from the SWOV Institute for Road Safety Research in the Netherlands. The review of SWOV is documented in this summary report for the World Bank and the National Road Safety Council in Peru. It contains a quantitative analysis of road safety improvement in Peru, its feasible achievement, and the review of the eight project proposals for the road safety component of TRP-II.

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Executive summary

Background

The preparation of the National Road Safety Strategy 2000-2004 for Peru is part of the Second Transport Rehabilitation Project (TRP-II), which is financed through funding from the World Bank. The project includes a traffic safety component of US\$10 million for non-infrastructure aspects of road safety and an identical budget for infrastructure improvements, solely dedicated to safety enhancements of the main national road network, including urban stretches.

The rapid motorization and enlargement of the road infrastructure, notwithstanding the relative safety of recently constructed roads, have resulted in rapidly increasing numbers of fatalities, injuries and accidents (an 85% increase in a decade, to more than 3,300 fatalities in 1998 with 1 million motor vehicles, which implies a risk 15 times higher than in the USA and northwest Europe). The (conservative) estimate of the macro-economic loss due to traffic accidents amounts to 1.6% of the gross national product (GNP) of Peru, and is on the rise.

Objective

The objective of the initiative is to establish an effective road safety strategy. It addresses institutional, technical and financial aspects of a comprehensive and effective road safety programme, by providing the National Road Safety Council (Consejo Nacional de Seguridad Vial, CNSV) with a framework for identifying priorities and enabling effective implementation, monitoring, and evaluation of a medium-term road safety strategy. This primarily relates to the TRP-II investments, but should also contribute to a self-financing organization of road safety improvements after 2003. The objectives are quantified in detail in Chapter 1, and are shown to be almost certainly achievable in Chapter 3.

The road safety component of TRP-II will establish a road safety strategy that reduces the number of road fatalities from an expected level of ca. 3,500 in 2000, to 2,900 in 2015. Without this effort, the number would increase to 3,840 fatalities in 2015. Implementation of the road safety strategy will therefore make a total difference of about 7,100 lives saved over the period 2000 to 2015.

Without implementation of the road safety strategy, the annual economic loss due to lack of road safety in Peru would increase to 1.9% of the GNP of Peru. With the implementation of the road safety strategy, these costs will level off below 1.7% in 2001, and reduce thereafter to 1.4% of the Peruvian GNP in 2015. Over these 15 years, the economic return on investment could be at least 12.5%.

The road safety component of TRP-II

The road safety component of TRP-II involves the implementation of seven selected non-infrastructure projects and one project for infrastructure improvement of road safety in Peru. The specification of the projects has been prepared by the CNSV with the help of a reviewing expert from the SWOV Institute for Road Safety Research in the Netherlands. Implementation of the projects will be the responsibility of the CNSV, but

will also involve a variety of organizations and institutions which, depending on the content of the specific project, can be governmental or non-governmental. Seven project proposals concern urgent non-infrastructure aspects of road safety and its institutional organization. These projects are:

- 1) The management, organization and positioning of the CNSV.
- 2) The possibilities for self-financing of further road safety activities.
- 3) Registration of accidents, including the establishment of a database system for statistical analyses, monitoring and evaluation of road safety.
- 4) Road safety surveys and campaigns.
- 5) Road safety education in primary and secondary schools.
- 6) Development of a licensing system.
- 7) Institutional strengthening of police enforcement with respect to road safety, including the provision and use of modern equipment;

For each of these seven projects, investments have been allocated amounting to US\$10 million in total. A similar amount has been allocated to the eighth project proposal:

- 8) Substantial improvement of infrastructural road safety by treatment of black spots or dangerous stretches on the national highways (US\$9 million) and the optimized safety, for demonstration purposes, of a highway between - and through - two small cities (US\$1 million).

Peruvian consultants have been commissioned to produce five of the eight proposals and these have now been finalized. Proposal number six has been postponed, due to prospective ratification of the driving licence law. Project proposal number three, by a consultant from abroad, has been specified in an interim report, which will be finalized after agreement with the Minister of the Interior. An interim report on the last project proposal has just been finalized by the Peruvian consultant commissioned, but the final proposal will still need substantial improvements considered necessary for successful project implementation. This will not cause a delay since the project is to be implemented after May 2000, as part of the renovation works of the TRP-II.

Scope of the review services

Assistance to the Executive Secretariat of the CNSV (SE-CNSV) and the evaluation of project proposals for the road safety component of TRP-II is contracted by a consultant services agreement with SWOV. This agreement, with UPI no. 156062, concerns:

- 1) Assistance in preparing the terms of reference (ToR) for project proposals.
- 2) Evaluation of preliminary specifications in the interim reports of the project proposals, obtained from the consultants commissioned, and assistance in improving the proposals.
- 3) Evaluation of finalized project proposals.

This document contains the review of the eight project proposals, with each review report basically set up according to this scheme.

The review services were based on:

- Familiarization with Peruvian circumstances, discussions with relevant authorities, agencies, and consultants, and discussions with, and assistance to, the SE-CNSV, enabled through visits to Peru and the assistance of a Lima-based expert (Mr. C. Cordero, sub-contracted by SWOV).
- Discussions with the World Bank transport specialist for Latin America.

- Assessment of project effectiveness in view of Peruvian circumstances and internationally available road safety knowledge.
- Assessment of appropriateness and quality of project implementations.
- Assessment of feasibility, costs and benefits of proposal implementations, including feasibility of inter-agency co-ordination and (local, regional, and national) government participation.
- Assistance to the SE-CNSV in:
 - a) optimizing the project designs.
 - b) selecting the most effective implementations to be prepared in the interim and/or final reports.
 - c) co-ordinating project proposals on subjects that can have synergistic multiplier effects on road safety.
 - d) appropriate allocation of funds for the projects within the limits of the total amount available.
 - e) optimizing the national medium and long-term road safety plan.

Review summary

The overall objective for an improved road safety in Peru is based on a quantitative analysis, described in Chapter 1, and its feasible achievement, described in Chapter 3. The review of the project proposals for the road safety component of TRP-II, and their specific objectives, are described in Chapter 2. *Table 1* summarizes these chapters.

Narrative Summary	Key Performance Indicators	Monitoring and evaluation	Critical Assumptions
<i>Sector-related Goal:</i> Improve national health and reduce economic losses due to lack of road safety in Peru.	Planned road safety component of TRP-II complete in 2004, ensuring a long-term road safety strategy that will reduce otherwise expected fatalities and accident costs by 25% in 2015.	Statistical reports from the Police Accident Registration System; Regular inventories of CNSV and MTC; Bank supervision reports.	Relatively high priority for road safety in policies of the Peruvian Government.
<i>Project Objectives:</i> (i) Strengthen policy and institutional capacity of road safety. (ii) Lower the present increase in annual road injuries and fatalities and eventually reduce their absolute level. (iii) Improve road user behaviour and attitudes with respect to road safety. (iv) Improve the safety of the national road infrastructure.	(i) Development of effective road safety organization and an action plan 2000-2005 in 2000. (ii) Reduction of fatality rates from 3.2 per 1,000 motor vehicles in 1998 to at least 2.4 in 2004, and increase the annual reduction of that rate from 4%, currently, to 6% in 2004 and thereafter. (iii) Gradually increase seat belt use (20% higher in 2004), and gradually reduce speeding (7% less in 2004) and driving under the influence of alcohol (18% less in 2004). (iv) Implementation of infrastructural safety improvements at high-risk locations and on short segments of the Pan-American and Central highways in Peru.	(i) Achievement audits for and by the SE-CNSV. (ii) Accident statistics and traffic growth indices (registered motor vehicles, traffic counts at tollbooths by SINMAC). (iii) Annual samples of traffic observations and inventories, serially executed by the SE-CNSV. (iv) Road inventory of MTC, and audits during project period.	(i) Skill/knowledge of key executives. (ii) Reliability and comprehensiveness of injury and fatal accidents registered. (iii) Co-operation of ministries involved {Transport, Interior (police) and Education}. (iv) Skill/knowledge in/of safe road and roadside designs of civil engineers in Peru. <i>Continues on next page</i>

Narrative Summary	Key Performance Indicators	Monitoring and evaluation	Critical Assumptions
<p><i>Project Outputs:</i></p> <p>(1) Reformation of road safety organization.</p> <p>(2) Self-sustained financing for road safety.</p> <p>(3) Enhancement of accident registration.</p> <p>(4) Increased knowledge and public awareness of road safety subjects in Peru.</p> <p>(5) Road safety education in a) primary and secondary schools, and b) professional and academic education.</p> <p>(6) Drivers licensing system.</p> <p>(7) Substantially intensified enforcement on speeding, drinking and driving, and non-use of seat belts.</p> <p>(8) Increased application of modern safety standards in road and roadside design, construction and maintenance by national and local road authorities.</p>	<p>(1) Reformation of road safety organization by mid 2000.</p> <p>(2) Self-financing amounting to US\$4.5 million in 2004.</p> <p>(3) Registration and information system implemented by end 2003.</p> <p>(4) Annual, and periodically intensified, campaigns on speeding, drinking and driving, seat belt use and negligence of pedestrians.</p> <p>(5) Implementation of improved road safety education: - training of 9,000 teachers complete by mid 2003. - teaching of 240,000 pupils in school year 2003/2004. - in 2004, road safety taught at pedagogical schools and in relevant university courses.</p> <p>(6) Introduction in 2002.</p> <p>(7) At least a ten-fold increase in time spent on enforcement by traffic police and the number of fines for speeding, drink-driving, non-use of seat belt and negligence by pedestrians by 2004.</p> <p>(8) Infrastructural safety improvements completed for: a) demonstration project on the Carratera Central by May 2001. b) risky spots and segments on the - Carratera Sur by end 2002. - Carratera Norte by end 2003. - Carratera Central by end 2004.</p>	<p>(1-3) Comparison of achievement levels before and after project phases, based on progress audits of project implementations.</p> <p>(4) Monitoring results of statistics from opinion inventories obtained by the SE-CNSV.</p> <p>(5) Monitoring reports by the SE-CNSV and audits of project achievements.</p> <p>(6) Postponed.</p> <p>(7) Police statistics on time spent on enforcement and on the number of fines in annual police progress reports and in achievement audits by SE-CNSV.</p> <p>(8) Audits and progress reports (based on (iv) above) and evaluations of road safety improvements (based on (ii) above).</p>	<p>(1-2) Support of the MTC for the CNSV and SE-CNSV.</p> <p>(3) Support of Minister of Interior.</p> <p>(4) Support of news media, opinion leaders and MP's for campaign issues.</p> <p>(5) Long-term co-operation with Ministry of Education.</p> <p>(6) Law regulation.</p> <p>(7) Support of Minister of Interior (PNP), management quality in commissariats and proper dedication of traffic police.</p> <p>(8) Co-ordination of transport renovation projects in Peru through funds from IBRD and World Bank (project co-ordination by SINMAC).</p>
<p><i>Project Components:</i></p> <p>Organizational structure</p> <p>Financial structure</p> <p>Accident registration</p> <p>Information campaigns</p> <p>Education</p> <p>Drivers licensing</p> <p>Police enforcement</p> <p>Infrastructural safety</p>	<p><i>Budget Inputs per Project:</i></p> <p>US\$1.55 million</p> <p>US\$0.35 million</p> <p>US\$1.80 million</p> <p>US\$1.50 million</p> <p>US\$1.50 million</p> <p>US\$0.80 million (tentatively).</p> <p>US\$2.50 million</p> <p>US\$ 10.00 million</p>	<p>Progress reports by the CNSV on completed parts of projects; World Bank supervision reports and financial audits of project executions.</p>	<p>Adequate financial administration and control at the institutions managing the projects (including the police).</p>

Table 1. Review summary of objectives, performance indicators, monitoring and evaluation activities, and critical assumptions for the project proposals.

Main conclusions and recommendations

The planned project implementations for the road safety component of TRP-II will almost certainly improve the reduction of the fatality rate from the current reduction of ca. 4% per year, to a reduction of 6% or more per year in 2004 and thereafter. This is concluded in Chapter 3 from the research knowledge on the effectiveness of road safety measures and the

review of these project proposals. The economic return on the planned total investment for road safety is shown to be much higher than 12.5%, even if the project effectiveness should unexpectedly turn out to be only half the level of conservative, research-based estimates on their effectiveness. The feasibility of a substantial road safety improvement by the projects for the road safety component of TRP-II, could be endangered by not attaching a relatively higher political priority to road safety in Peru, and by the apparent lack of professional expertise on road safety for the project implementations.

It is recommended that the SE-CNSV formulates five-year road safety plans, and updates these plans every two or three years, and that it should obtain the approval of the Minister for Transport and CNSV for policy on these plans for the long-term road safety strategy in Peru. The SE-CNSV and the World Bank should look for some twinning arrangement with a foreign road safety organization of outstanding quality, in order to co-operatively enhance the expertise of the SE-CNSV and the effectiveness of its road safety strategy. In order to improve road safety expertise in Peru, the SE-CNSV should also organize seminars on technical and methodological road safety issues for professionals in Peru. Moreover, with respect to the specific projects, it is recommended that the SE-CNSV (1) takes great care of the actual and timely introduction of systems aimed to raise contributions for the self-financing of the CNSV and its road safety projects after 2003; (2) insures that periodically intensified enforcement on drinking and driving, speeding or seat belt use coincides with information campaigns on these subjects in the same period, and (3) acquires experts for statistical analysis and research in order to evaluate road safety development and to produce annual reports on the monitoring and evaluation of the progress of its projects. Last but not least, it is recommended that the SE-CNSV develops and implements, from 2003/2004 onwards, new projects for further intensified enforcement in combination with public information campaigns on seat belt use, drinking and driving, and speeding, as well as new projects for further infrastructural road safety improvement of rural roads and cities, the latter particularly using modern traffic-calming measures and crossing facilities for pedestrians, since these projects have the highest potential for a further substantial improvement of road safety in Peru.

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List of abbreviations

CNSV	Consejo Nacional de Seguridad Vial (National Road Safety Council, Peru)
DIATEC	Directorate of Technical Affairs
DINSEVI	National Directorate for Road Safety
DIPLAT	the statistical police directorate, residing under the General Planning Directorate
DIPLOCAR	National Road Directorate
DIVIAT	Division of DIATEC for the inspection of fatal accidents
GNP	gross national product
IBRD	International Bank for Reconstruction and Development
MTC	Ministry of Transport, Communications, Housing and Construction
PERT	Proyecto Especial de Rehabilitacion de Transporte
PNP	Peruvian National Police
SE-CNSV	Executive secretariat of the CNSV
SINMAC	Sistema Nacional de Mantenimiento de Carrteras (government agency for road maintenance and construction)
SWOV	Institute for Road Safety Research, the Netherlands
ToR	Terms of Reference
TRP	Transport Rehabilitation Project
UPI	United Press International

Foreword

This review would not have been possible without the kind co-operation and assistance of all persons that were involved in the evaluated road safety projects, either from the consultants, or from the SE-CNSV, SINMAC, Cicloed and the World Bank. However, some persons are to be mentioned by name and especially thanked for their co-operation. Firstly, Carlos Cordero, who became a friend and has been of great help in the work for the review and the understanding of the Peruvian circumstances. Secondly, Mario Duarte and Claudia Adriazola are the two persons of the SE-CNSV who deserve special thanks for their friendly and patient assistance in the time-consuming evaluation of the projects. Last, but not least, special thanks are expressed to Paul Guitink from the World Bank for his trust and friendly co-operation during the review.

1. Introduction on road safety in Peru

In Peru, the rapid growth of motorised traffic and the lack of road safety caused ca.85% increase of road fatalities in a decade (an unstable registered level of ca.1,800 in 1984-1989 and 3,323 in 1998). The motor vehicles grew from ca.0.61 million in 1989 to ca.1.03 million in 1998, or 69% growth in 9 years with an average growth rate of motor vehicles of ca.6% per year. Due to large fluctuations of registered fatalities in some past years the exact development of the fatality rate is problematic, but in average it would mean that the annual fatality rates per amount of motor vehicles are not reduced between 1989 and 1998. If one omits the years with (probably) large under-registrations of road fatalities (compare ca.1,200 in 1989 with ca.2,700 in 1990 and ca.2,900 in 1991 with ca.1,900 in 1992), this picture becomes more positive. The probably more reliable increase in fatalities from ca.2,700 in 1990 to 3,323 in 1998 amounts to 23% increase in these recent 8 years. It implies that the fatality rate per 10,000 motor vehicles reduced from 44.5 to 32.0 in these eight years, an accumulative reduction of that rate by ca.4% per year. Since over-registration of fatalities must be excluded, while newly motorising countries also show exponentially decreasing fatality rates, this 4% annual fatality rate reduction is regarded as a fair estimate for the underlying risk development in Peru.

The growth prognosis of motorised traffic in Peru, assuming a saturation level of one car per two inhabitants, predicts 2.38 million motor vehicles in 2015. Its annual growth rate reduces from ca.6% to ca.4% in 2015, due to the numerical necessity that absolute (not too much increasing) amounts of annual growth become proportionally smaller for increasing, absolute levels. Thus, if the annual reduction percentage of the fatality rate is not increased above the existing ca.4% then the road fatalities in Peru cannot decrease before 2015 and would increase to ca.3,840 in 2015. By the standard methodology the economic costs of road accidents are conservatively estimated (only 12% of the total costs for the value of lost life and disabilities). For 1997 they amount to 1.6% of the gross national product (GNP) in Peru and they would correspondingly increase to nearly 1.9% of the GNP in 2015. The road safety component of the Second Transport Rehabilitation Project, TRP-II, aims to improve this worsening development. Some countries with relatively low, but rapid growing levels of motorisation have been able to develop road safety strategies that achieve annual fatality rate reductions of 6% or more, such as Chili ca.7%, Malaysia ca.6.5% (Koornstra 1995, 1993a), and some countries in Central and Eastern Europe ca.6%. However, the most safe, motorised countries in the world show annual fatality rate reductions of ca.6% or lower. Thus, it will be hard to achieve more than 6% annual reduction of the fatality rate in Peru. Therefore, a feasible objective is to improve the fatality rate reduction from the existing 4% per year to 6% in 2004 and thereafter. What this means for the expected road fatalities is shown in the next figures. *Figure 1* shows the prognosis of motor vehicle growth, based on the generally well fitting, so-called Gomperts trend which describes by its asymmetrically S-shaped curve an almost exponential growth at the start, which is slowly saturating.

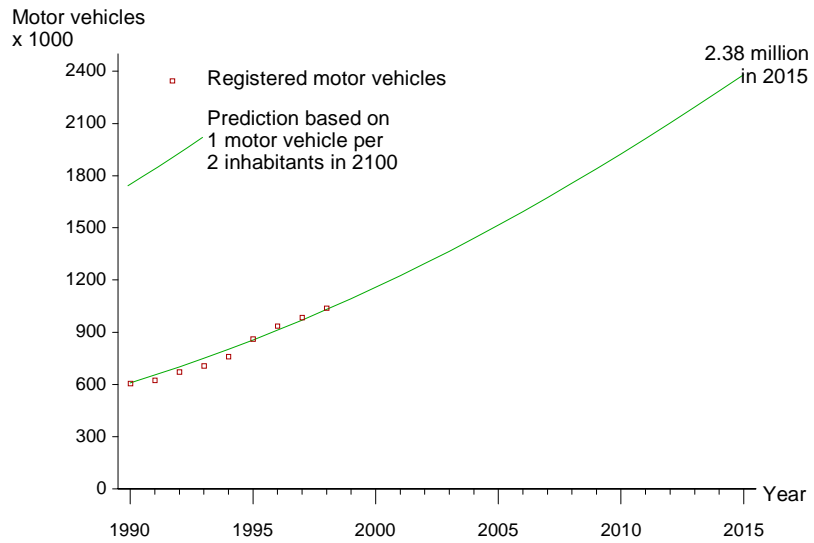


Figure 1. *Fit and prognosis of motor vehicle growth in Peru.*
 $Motor\ vehicles = 13,000.exp[-exp(-0.02359.year + 48.0572)]$

At a saturation level of one motor vehicle per two inhabitants for 26 million Peruvian inhabitants at the time of saturating growth, the Gomperts trend fits the past development fairly well, although economic upsurges or depressions cause (as for other countries) periods of faster and slower growth. For 2015 it predicts 2.38 million motor vehicles. *Figure 2* illustrates two developments of the fatality rate per 1,000 motor vehicles in Peru: one for the existing trend of 4% rate reduction per year and one for the target of a gradually improved rate reduction from 4% in 2000 to 6% per year in 2004 and later.

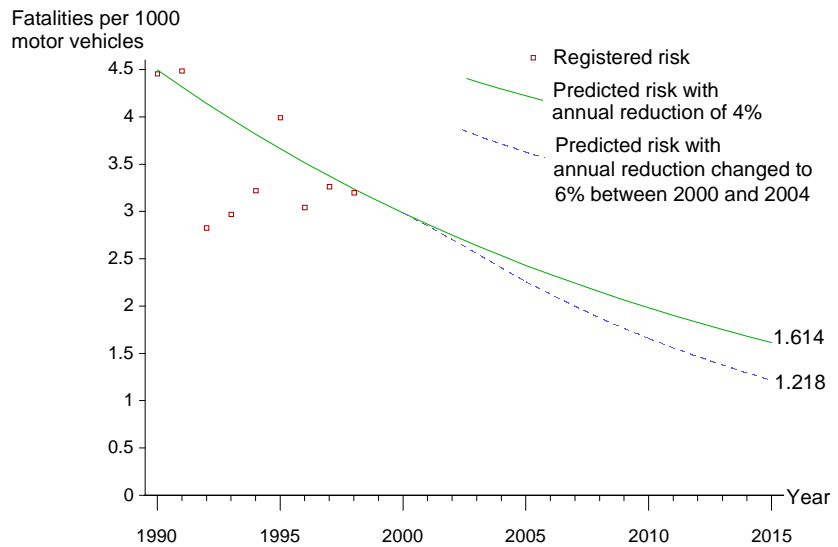


Figure 2. *Predicted developments of the fatality rate in Peru.*
 $Rate = exp(-0.041.year + 83.1)$, after 2003: $Rate = exp(-0.062.year + 83.1)$

By definition, the annually predicted numbers of fatalities can be obtained by multiplication of the annually predicted amount of motor vehicles and the annually predicted fatality rate per amount of motor vehicles. *Figure 3* shows the result of those predictions for the two alternatives of the fatality rate.

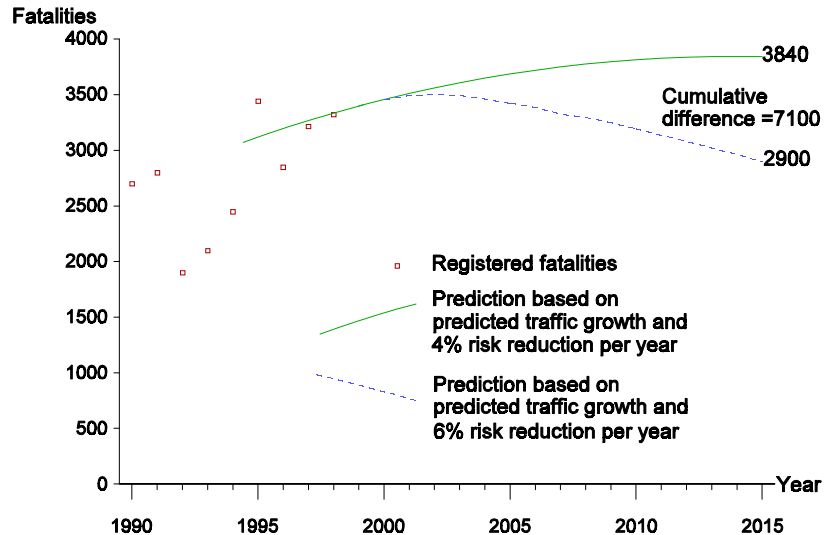


Figure 3. *The predicted developments of road fatalities with and without an improved fatality rate in Peru.*

As can be seen from *Figures 2 and 3*, there are large fluctuations in the annual numbers of registered fatalities in succeeding years. An exponentially decreasing fatality rate and its multiplication by the trend for traffic growth, therefore, cannot well describe the annual fatalities of the past in Peru. However, these large fluctuations of registered road fatalities in succeeding years (even over 50% larger or 40% smaller than the average number) cannot reflect reality, since exponentially reducing fatality rates are usually observed. Thus, one has to assume that the deviating low annual fatality rates are due to under-registration in Peru. Since over-registration is to be excluded, it seems warranted to base the trend for the fatality rate on the relatively high fatality rates only. If this is taken for granted then, as shown in *Figure 2*, the existing annual reduction of the fatality rate in Peru is estimated to be 4%. The traffic growth up to 2015 will be lower than 4% per year. Therefore, if the existing annual fatality rate reduction is not improved, the expected fatalities will increase to 3,840 in 2015.

As discussed before, a target of 6% annual reduction of the fatality rate is feasible in view of results from the effective road safety strategies in some other comparable countries with a low, but rapidly growing motorisation level. The projects of the road safety component in the TRP-II are aimed to establish a more effective road safety strategy in Peru. The objective of the new road safety strategy in Peru that is now being developed by the National Road Safety Council CNSV, therefore, is quantified in *Figure 3* by the alternative with 6% reduction per year of the fatality rate. It is envisaged that the investments for projects in the road safety component of TRP-II by their implementation between mid 2000 and end 2004 will also generate a

reallocation of Peruvian sources and that they together will enhance the annual fatality rate reduction from 4% to 6%. A comparably effective road safety strategy, also after 2004, will further reduce the annual number of road fatalities. In the year 2015, a reduction by ca.25%, from 3,840 to 2,900 fatalities, can then be expected. The cumulative difference between an unchanged and enhanced effectiveness of the road safety strategy will amount to a total of 7,100 lives saved in the period between 2000 and 2015. It is recommended that the CNSV monitors and evaluates the effectiveness of its road safety strategy by comparing the actual and predicted developments, where the latter is based on the achievable 6% annual reduction of the fatality rate.

A positive development in the fatality rate reduction also shows that appropriate investments in road safety can have a rather high return on investments in the long run. The conservatively estimated accident costs for Peru will accordingly reduce to 1.4% of the Peruvian GNP in 2015 by appropriate road safety investments for an enhanced, long-term road safety strategy that establishes 6% annual reduction of the fatality rate, where otherwise these cost will rise to almost 1.9% of the GNP of Peru in the next 15 years (see *Appendix 1*). Over these 15 years, the average macro-economic gain per year is 0.225% of the GNP. It shows that annual road safety investments up to 0.2% of the GNP in Peru can have 12.5% economic return on investment, if these investments achieve a 6% reduction of the fatality rate per year. In Chapter 3 this is shown to be a well achievable objective by less investment than 0.2% of the Peruvian GNP. High percentages of return on road safety investments are also shown to hold for other countries (for example: in the Netherlands, where 9% to 22% return on infrastructural road safety investments is estimated, depending on types of infrastructural measures; Poppe, 1998; SER, 1999). Today 0.2% of the Peruvian GNP means more than US\$100 million. Therefore, it is concluded that:

Appropriate road safety investments up to US\$100 million per year will have a macro-economic return on investment of 12.5% in Peru.

The road safety component of the TRP-II is limited to US\$20 million in four years, but the implementation of its non-infrastructural projects induces also a large reallocation of Peruvian sources (materials and time of schools and police reallocated to road safety), while other parts of the TRP-II also can contribute to improvement of the Peruvian road safety (*remark*: the latter may not always be optimised, because road safety audits are not foreseen for (re)constructed roads in the TRP-II). The total investment for road safety in Peru, generated by the implementation of TRP-II, will not approach US\$100 million per year. Although far less is used in total for the road safety projects, their implementation certainly improves the fatality rate reduction to 6% per year, as will be shown in Chapter 3. Thus, the economic return on investment is much higher than 12.5%, due to the selection and effectiveness optimisation of the projects, discussed in Chapter 2, where also the allocations from the TRP-II funding to the individual road safety projects are specified.

2. Review of project proposals

The first phase of the review concerned the evaluation of the draft terms of reference (ToR) for the projects proposals that were written by the SE-CNVS and the assistance for the optimisation of the final ToR for each project proposal with respect to the requirements that are to be fulfilled by the consultants or organisations to which the studies for the project proposals are to be contracted. The draft ToR for most project proposals needed mainly to be optimised with respect to

- a) the feasibility of proposed project implementation
- b) the expected effectiveness proposed project implementation
- c) the estimated cost-benefit ratio (of proposed road safety measures) or cost-effectiveness (of proposals for institutional strengthening).

Most project proposals concern mainly the institutional strengthening and the development and monitoring of an effective road safety strategy, but some projects relate to the realisations of actual road safety improvements that the contractors have to propose. The contracts for the project proposals are part of the ongoing TRP-I for Peru, which funding will be completed in short time. The project implementations themselves are funded by the road safety component of TRP-II. The selection of contractors was the responsibility of the CNSV in accordance with the procedures of the funding by the World Bank. At the end of March 1999 all project proposals, except the one for a driver licence system, were contracted with private consultants or, where relevant, with appropriate governmental agencies. The project proposal for the driver licence system is postponed, because the Peruvian driver licence law is still to be ratified and then completed by operational regulations from the Ministry of Transport, Communications, Housing and Construction (MTC). As soon as that law is ratified, the project proposal for the driver licence system will be contracted in order to have operational regulations that can be based on results from that project study.

The second and third phases of the review concerned the evaluation of initial, or interim, or draft reports on the project proposals and the assistance to the SE-CNSV and other involved governmental agencies (the Peruvian police and the government agency SINMAC for road maintenance and construction) for the needed improvements of the evaluated interim or draft proposal reports as well as assistance for instructions to the contractors. These phases have been completed in June and mid December of 1999.

The last phase of the review covered the overall evaluation of the road safety component of TRP-II, the evaluation of project proposals that are finalised by the contractors and the assistance to the final distribution of the available TRP-II fund for road safety over the individual projects for their implementation in 2000 to 2004. In February 2000 this last phase is completed by this report for the World Bank and the CNSV.

2.1. Organisation and management of the CNSV

The CNSV came into existence in 1996 under TRP-I through funds of the World Bank. The CNSV is an inter-ministerial committee of the Ministers for Transport, for Education, for Interior and for Health, while its Executive Secretariat (SE-CNSV) is positioned within the Ministry of Transport, Communications, Housing and Construction (MTC). The SE-CNSV will have the management responsibility for the projects in the road safety component of TRP-II. This requires a reformation of the SE-CNSV for project management and co-ordination and may also influence the position of the CNSV. The SE-CNSV drafted a ToR for the project proposal on its own reorganisation. It specified mainly the work for the managerial and administrative structure for the project management and for the management within the SE-CNSV as well as the profile of the contractor that is to be selected, the time table and maximum costs for the proposal study.

Evaluation of draft ToR

Several improvements resulted from the evaluation of the draft ToR:

- a) Since the inter-ministerial committee of Ministers, or their high level representatives, has never gathered in the three years of existence of the CNSV, although originally it was envisaged to gather twice a year, it seems that there may be a problem, either with the power of the SE-CNSV to organise such meetings or with positioning of CNSV as such. These subjects were originally not covered by the ToR, nor the requirements for the relationships that the (SE-)CNSV has to develop and maintain with related Peruvian organisations and with road safety organisations abroad and on the international level.
- b) The ToR did originally not require that the consultant has to consider alternatives for proposed structures, nor that the study has to cover the feasibility and political risk of actual implementation.
- c) The ToR concerned also aspects of administrative operations and the provision of hardware and software (the latter needed for statistical analysis and reports) that need not to be part of the paid study, because also found in any relevant handbook.
- d) The requirements for employees' profiles and the task description for SE-CNSV centred on the management of the disciplinary different projects, but did not mention that projects must be co-ordinated with regard to synergetic effects (e.g.: information campaigns and police enforcement on particular road behaviours). Thus, managerial and professional profile requirements for horizontal co-ordination were missing.
- e) The proposal on the number of needed employees of the SE-CNSV and their profiles relate to the proposal on the self-financing of road safety (generally more than 80% of bureau costs of councils are salary costs). Therefore, selection of a suitable contractor for both studies should be preferred and this should be part of the contractor's selection profile.

Assistance for final ToR

The SE-CNSV is assisted in the formulation of suggested ToR-amendments for these five evaluation aspects. Since several Road Safety Councils in other countries are structured as non-governmental bodies of public or semi-public nature it was also formulated (with respect to point a, here

above) that such alternatives and their pros and cons have to be part of the report on this project proposal. The finalised ToR served as basis for the contract with the selected consultant that was, in accordance with the suggestion (above under point e), the same as the one for the proposal on a self-sustained financing structure for road safety in the future.

Evaluation of interim report

The evaluation of the interim report was mainly positive. The evaluation also revealed shortcomings and missing elements, partly due to the intermediate incompleteness of the study for the proposal. It concerns the next points:

- 1) The task description of the SE-CNSV used a conceptual frame for road safety that was judged as in appropriate (seemingly the financial consultant was not familiar with road safety subjects).
- 2) The description of functions and structure of the renewed (SE-)CNSV did not specify the needed organisational aspects and employees' qualities for the outsourcing of projects, nor did it cover organisational matters that concern the documentation of literature, the public relations for the CNSV, and the analyses and monitoring of the statistical data.
- 3) The description of the relations between the SE-CNSV and other relevant governmental agencies (PERT, SINMAC, PNP etc.) was missing. Also, the legal status and the political anchoring of the CNSV and alternatives for these matters were incompletely described.
- 4) The organisation and needed employees were not sufficiently specified in terms of function-related costs. The professional profile of the employees for the tasks of the SE-CNSV was missing, but still rather high salaries (for Peruvian standards) were specified without motivation.
- 5) Several organisational alternatives were discussed, but the pros and cons for the motivation of the preferred alternative were missing.

Assistance for final report

In discussion with the consultant, it turned out that some of the shortcomings and missing elements may have been caused by the consultant's impression that there was a lack of acceptance or a limited willingness to change on the side of the SE-CNSV. Talks with the executive persons of the SE-CNSV and the consultant have clarified this and led on both sides to agreement on the needed improvements of the report of the proposal. Assistance for doing this has been given to the SE-CNSV and to the consultant. The latter was assisted in getting more information on modern road safety concepts and strategies as well as on international comparisons of road safety organisations, also with respect to the required professional and academic qualities for project managers and leading persons of such organisations.

Evaluation of final project proposal

The final report is positively evaluated. It covered all the requirements of the ToR, also with respect to aspects that might have been hardly acceptable for the SE-CNSV. The final report on the project proposal specifies:

- the organisation and functions of an effective road safety council
- the preferred legal and political anchoring of the CNSV as an inter-ministerial body and of the SE-CNSV as a governmental agency in the MTC, based on an explicit weighing of pros and cons of alternatives

- the relationships of the (SE-)CNSV with other governmental and non-governmental institutions or agencies and with private organisations
- how the reorganisation of the SE-CNSV to an optimal effective council can be implemented within half a year
- the foreseen and well-motivated growth of tasks and the corresponding growth of the reorganised SE-CNSV to 15 persons in 2003/04
- the professional profiles of the project managers and leading positions
- the needed equipment for a modern electronic working environment, including those for the downloaded accident database, its analysis and the generation of monitoring reports
- the estimated costs of the SE-CNSV over the years 2000 to 2004, foreseen as part of the costs for this project implementation.

The project proposal describes a financial development of the SE-CNSV over the years 2000 to 2004. The proposal is co-ordinated with the proposal on a self-sustained financing structure for the SE-CNSV and its projects. The total amount of funding from the road safety component of TRP-II for the SE-CNSV is 1.55 million in 2000 to 2004, while after 2002 a gradually increasing funding from Peruvian sources is foreseen.

Comment and critical assumptions

The salaries foreseen for employees of the SE-CNSV are acceptable for international funding institutions, and rather high for comparable state employees in Peru, although really qualified employees in Peru may cost that much. This may cause a problem in case the MTC itself will take over the employees' costs of the SE-CNSV, which is officially considered by the MTC at the last moment in the review process. The critical assumptions on the effectiveness of the reorganised SE-CNSV are that

- a) its council gets more support of the Ministers that constitute the CNSV and that the SE-CNSV itself remains to get the support of MTC
 - b) the professional road safety expertise in the SE-CNSV is improved
 - c) relatively higher priority for road safety is acquired in national policies.
- Whether that priority will become high enough to guarantee a prolonged improvement of the Peruvian level of road safety after the funding by the road safety component of the TRP-II is ceased is still questionable, but that priority will be positively influenced by the foreseen achievements of the projects for the road safety component of the TRP-II and by the quite feasible structure of self-financing, discussed next in section 2.2. It is recommended that the professional expertise in the SE-CNSV becomes enhanced through co-operative 'learning-by-doing' in some twinning arrangement with a qualified, expatriate road safety agency for several coming years (see *Appendix 2*).

2.2. Self-sustainable financing for road safety

From mid 1996 onwards the SE-CNSV is financed by funds from TRP-I. Its costs are US\$1.52 million in total to end 1999. The tasks of the SE-CNSV and the projects for a long-term road safety strategy require a lasting funding, which cannot be covered forever by funds from the World Bank. The aim of the road safety component of TRP-II is to establish a road safety organisation that develops and implements a long-term road safety strategy also after funding through TRP-II is ceased in 2005. Therefore, a project proposal for a self-sustained financing of the SE-CNSV and its projects in the long run is foreseen in the last phase of TRP-I. The SE-CNSV had specified a draft ToR for this proposal. The draft ToR contained requirements for the study of

- a) the costs of the SE-CNSV tasks
- b) the possibilities of obtaining finances for road safety from Peruvian sources related to road transport taxes or charges
- c) the legal and administrative regulations that enable financial contributions to the costs of road safety actions and organisation.

Also the profile of the contractor that is to be selected, the time table and the maximum costs for the study were specified.

Evaluation of draft ToR

The review of the draft ToR revealed that some specifications for the study on the possibilities for the self-sustained financing of the SE-CNSV were rather vaguely formulated, which could lead to interpretation problems if the study report would not be satisfactory. Moreover, some useful aspects for the subject of the ToR were missing, such as:

- an estimation of the costs for road accidents in Peru in order to enable the quantifying of the cost-benefit ratio of investments in road safety
- a comparative study of finance structures for road safety abroad
- the way how new resources can gradually replace financing by the TRP-II
- the possibility of financing the road safety actions and research in the future, additionally to the costs of the SE-CNSV itself.

Assistance for final ToR

It was advised to formulate more precisely that the consultant has to:

- 1) analyse the weaknesses and strengths of the technical and financial operations of existing or envisaged institutional systems with respect to the feasibility of direct or indirect charges on owners or drivers of motor vehicles in order to obtain sustainable resources for the financing of road safety, where at least the following systems must be studied: vehicle registration system, toll systems, systems for transport bills or fines, transport permits, vehicle insurances, vehicle import tax and annual circulation permits.

And to add to the ToR-requirements, the consultant has to:

- 2) estimate the potential amount of resources that possibly can be obtained in the short, medium and long term
- 3) describe how the sustainable finance strategy from Peruvian sources can progressively replace the financial contribution of the World Bank and subsequently can increase resources for the SE-CNSV, its road safety projects, and its research in the future

4) describe, explain and compare the different systems for financing of road safety organisations in several countries around the world, including some in Latin America, and what the feasibility of implementation of these systems may be for Peru

5) investigate the estimation of the costs of road accidents in Peru.

Except the last mentioned point of advice, due to its foreseen impossibility, these matters are included in the final ToR and formed the basis for the contract with the consultant that was selected also for the project proposal described in section 2.1.

Evaluation of interim report

The interim report is discussed extensively with the consultant and the SE-CNSV. Once more, the problems of estimating the road accident costs in Peru as well as its necessity for the economic justification of road safety investments were discussed. The ways to improve the feasibility assessment for implementations of self-sustainable resources and how the risks of obtaining insufficient resources could be minimised were also discussed. Moreover, it was discussed that legal changes for getting parts of charges need to be precisely described and that comparisons with finance structures in countries abroad should be studied more extensively. It was advised to:

- 1) describe the methodology for the estimation of accident costs and to define its estimation as part of the proposed project.
- 2) estimate for the time being the Peruvian accident costs by translating the costs of fatalities, injuries and accidents which are already investigated in Chili. This can be done on the basis of the GNP ratio and by multiplying the Chilean costs with the corresponding registered numbers in Peru.
- 3) include a comparison with the road safety financing in some Latin American or Caribbean countries and in some countries elsewhere.
- 4) use a multi-criteria methodology for the feasibility of implementation for possible finance sources.
- 5) rank the evaluated feasibility and look for possibilities of combining sources that will
 - a) minimise the risk of insufficient resources
 - b) optimise a cumulative resource increase in the long run
 - c) establish a high chance of some resources in the short term.
- 6) describe the implementation aspects in more detail, especially with respect to legal regulations that may be needed.

Assistance for final report

The consultant was provided with some information on the non-governmental finance structure for road safety councils or boards and their projects in Israel and some European countries (including Belgium). The consultant and the SE-CNSV asked for, and were provided with, information on the methodology of estimation of the socio-economic costs of road safety accidents. For the first estimation in Peru, it was advised not to include now the empirical estimation of the cost values for grief and suffering from lost lives, lasting disabilities and hospital treatment by the willingness-to-pay methodology. Also prognosis methods for developments in exposure, risk and road fatalities were explained to the SE-CNSV and to the consultant on request. Apparently the consultant, who had a high quality of expertise on financial and organisational matters, had great interest in enhancing his expertise in road safety. The lack of expertise on road safety

seems to apply to many relevant professionals in Peru (including some areas of expertise within the SE-CNSV). Therefore, in accordance with the transport specialist of the World Bank, it was judged appropriate to spend a small part of the available review time on the professional education of Peruvians with project responsibilities.

Evaluation of final project proposal

The final study report is evaluated as excellent. By the internationally accepted methodology, the consultant included an estimation of the road accident costs in Peru (described in *Appendix 1* of this report). Only the costs for the value of lost life and suffering from disabilities and hospital treatment were not empirically estimated, but their share is held conservatively low. The total estimated costs are amounting to 1.6% of the Peruvian GNP of 1997. The report also contained a prognosis of traffic growth and of the development of road safety in the short run (the latter amounting to more than 3,400 fatalities in 2004, which is somewhat less than predicted in Chapter 1, due to the conservatively low estimate of the expected traffic growth). These two subjects were not specified in the requirements of the ToR for the contact on the project proposal, but were only advised to be included. The specified requirements were nearly all very satisfactory fulfilled by the consultant. Only the comparison with finance structures abroad was a bit superficial, partly due the difficulty of getting official documents on the subject from these countries. The report describes:

- the development and a short-term prognosis of road safety in Peru
- the internationally accepted method for the estimation of the economic social and private costs of road accidents and its tentative, but sound application for Peru on data for 1997
- the tasks of the SE-CNSV foreseen from 2000 to 2005 and its financing by the TRP-II funds and additional Peruvian resources
- the road safety funding in Costa Rica, Columbia, Chili, and Denmark
- twelve different potential sources of finance for road safety, including regulations of charges that do not exist to day
- criteria for selection, the pros and cons, and the prioritisation of suitable sources for the financing of road safety in the future
- four selected sources that contribute by feasible percentages to a self-sustained financing of US\$1 million in 2002 that increases to US\$4.8 million in 2005 and thereafter increases by US\$0.4 million per year:
 - 1) 5% of technical inspection charges, starting in 2002 and contributing US\$0.2 million per year
 - 2) certification by CNSV of driver licence schools, starting in 2002 and contributing US\$0.1 million per year
 - 3) 6% of owner tax for cars up to 5 years old, starting in 2003 with US\$1.3 million that grows by US\$0.3 million per year
 - 4) 3% of the insurance premium for obligatory third party liability, introduced and contributing US\$0.8 million in 2002, amounting to US\$2.5 million in 2004 and growing annually by US\$0.1 million.
- the operational mechanisms of the selected sources, the strategy for a successful implementation of contribution to the financing of road safety and its legal aspects.

The activities foreseen for the implementation of the self-financing projects are modestly estimated to cost US\$0.35 million over the years 2000 to 2003.

Comment and critical assumptions

The implementation of the self-financing project implies, including the foreseen funding by the World Bank and the annual contribution of US\$0.1 million from the Peruvian state itself, that the financing scheme for costs of the SE-CNSV and their road safety projects can be proposed as is shown in *Table 2*.

Source	Years						
	2000	2001	2002	2003	2004	2000-2004	2005-2009
World Bank							
- infrastructural	1.0	2.5	2.5	2.5	1.5	10	0
- non-infrastructural	2.4	3.2	2.8	0.9	0.7	10	0
Self-financed	0.1	0.1	1.1	3.3	4.5	9.1	28.5
Total	3.5	5.8	6.4	6.7	6.7	29.1	28.5

Table 2. Proposal for projected finances, in millions US\$, for road safety in Peru.

The annual distribution of the World Bank funds for the non-infrastructural projects in *Table 2* differs from the proposal by the consultant. Due to the recommended different schedule of the conditional financing for the enforcement projects (see section 2.7) and some delay of signing the TRP-II, now covering the period of mid 2000 to end of 2004, the originally proposed finance amount for 2000 is lowered by ca.50% and redistributed over the years 2001 to 2004. The scheme allows a small growth of the SE-CNSV and additional investments in new road safety projects from 2002 onwards, apart from the US\$20 million for the project funding by the road safety component of TRP-II. After 2004 the annual budget for the SE-CNSV and its road safety projects in the future increases from ca. US\$5 million to US\$6.5 million in 2009, whereby the budget for 2000-2004 almost equals the self-financed budget for 2005-2009.

The critical assumption for the foreseen self-financing concerns the in-time ratification of the necessary law regulations for the retributions from the mentioned charges, premiums or taxes. That ratification presupposes the support of the Peruvian government, especially of the MTC, and also (where necessary) of parliament, but the selection of the feasible sources for the self-financing is largely based on law regulations that are already in preparation or are getting already support from the MTC.

2.3. Accident registration and information system

In the ongoing TRP-I for Peru the necessity of an improved and more detailed registration of accidents by the Peruvian police has already been described (Silcock, 1996), but an implementation of the MAAP-system for accident registration failed. That failure is largely caused by lack of support in the rather complex organisation of the Peruvian police and by some technical aspects concerning the adjustment of the MAAP-format to the daily police work in Peru. Since an accident registration system is indispensable, a renewed project preparation for the implementation of an accident information system, that has to be developed in very close co-operation with the Peruvian police in order to be successful, was started in the last phase of TRP-I.

Experts from the Danish Road Directorate, who were acquainted with the Latin-American road safety through involvements in projects from the IBRD, were asked to orient themselves on the project. In close co-operation with Peruvian police and based on pilot tryouts, the Danish experts adapted the Danish accident registration format and its accident information system to the Peruvian circumstances. This adapted accident registration and information system is abbreviated as the DATAAC-system; it contains an easy coding of manoeuvres of both accident parties and was evaluated as one of the best in Europe. Based on positive prospects for this system in Peru, the CNSV drafted a project proposal in order to contract the Danish Road Directorate for the project proposal. The draft ToR specified that the proposal has to be based on the results of pilot tryouts of the DATAAC-system in five police districts in Lima and five outside Lima as well as on a comparison with the MAAP-system. It also required descriptions of technical system aspects, the needed training, the system management and the technics of the data aggregation from the local police districts into a national information system. The draft ToR also contained the time schedule and costs for the proposal.

Evaluation of draft ToR

The draft ToR needed no much change. It was advised to omit the comparison with the MAAP-system, since the DATAAC-system is superior, and to include an investigation on conditions that enable a successful implementation, which concerns more than training of policemen, while aggregation of local data into a national system is not only a technical, but also an organisational matter.

Assistance for final ToR

The final draft ToR was accordingly formulated by the SE-CNSV without further assistance and subsequently the Danish Road Directorate was contracted for the project proposal on the implementation of the DATAAC-system. Since at the moment the Danish experts represent the only organisation with sufficient expertise on the DATAAC-registration and information system, it will be necessary to contract the Danish Road Directorate also for the project implementation, if the evaluation of the project proposal is positive.

Evaluation of interim report

The interim report shows that the proposal is developed in close co-operation with the Peruvian police. The registration format is user-friendly designed and appreciated by policemen that were trained for use on the accident spot. Through participation in the training of policemen from the commissariats for the pilot tryouts, the training for use of the registration form is evaluated as appropriate and of good quality. The final report is scheduled shortly after the completion of this review report, but the interim report contains already the complete description of the implementation of the road accident information system 'DATAAC' in Peru. Important changes are not foreseen in the final report, unless results on the pilot implementation in the police commissariats outside Lima would cause unexpected adaptations. The pilot implementation was part of the project proposal, developed in co-operation with the police. The interim report needed no further discussion with the Danish experts or the SE-CNSV and is taken as the basis for the evaluation of the project proposal.

Evaluation of project proposal

The project proposal is ambitious, but evaluated as realistically well-planned. Its co-operative project development with the police and the pilot implementations in police commissariats maximise the feasibility of nationwide implementations and reduce the chance of a repeated failure to virtually zero. The project proposal recognises the complex organisational aspects of the Peruvian police. It is directed to all five police divisions of the General Police Directorate that share the responsibility for accident information:

- 1) National Directorate, under which 58 regional districts outside Lima and 42 metropolitan districts of Lima reside, together representing the 1,077 local police commissariats with a traffic unit of 3 to 6 policemen that are responsible for the actual accident registration in their jurisdiction area
- 2) National Road Directorate DIPLOCAR, responsible for police control on the national highways of Peru
- 3) National Directorate for Road Safety DINSEVI, authorised to issue orders within their area of competence and represented in each region
- 4) Directorate of Technical Affairs DIATEC, under which the division for the inspection of fatal accidents DIVIAT, with units in each region, resides
- 5) General Planning Directorate, under which the statistical police directorate DIPLAT resides.

The proposed system for the accident registration is based on the actual gathering of accident data in the 1,077 commissariats of Peru. The accident reporting form is developed in close co-operation with the Peruvian National Police (PNP) and is tested in pilots for several police commissariats. Prior to use of the reporting form a training of all involved traffic policemen is foreseen. In the 58 police regions of Lima and the 42 police regions of the provincial departments a DATAAC system for electronic processing of the registration forms will be installed and delivered as part of the TRP-II project, based on an agreement between MTC (SE-CNSV) and the Minister of Interior (Peruvian police). Such a system consists of a standard PC with network board and laser printer, running under Windows 98, and a web browser for communication. A web server and an Oracle database are to be installed and delivered at DIATEC for the data input from the 100 DATAAC-systems in the country. Copies of the database will be sent to the SE-CNSV, where also a web server and Oracle database are to be installed for

the analysis, monitoring and reporting on the road safety development in Peru. The software of the systems allows the production of general overview reports as well as police accident reports and standard reports for courts. The latter are evaluated as very valuable for the work of the police itself and will promote the actual use of the system by the police. The proposed hardware and software are evaluated as state-of-art technology, user-friendly, easy to maintain at low costs, and robust.

The proposal describes in detail the organisation and management of the implementation, the legal background, the human resources, the training and feedback on quality of registration, the development of manuals and procedures and the reporting form, the installation of hardware and software for the DATAAC-systems and the way how analysis of data from the reporting from in the database at DIATEC and at the SE-CNSV is enabled. All this is positively evaluated, although no specification was given of the necessary control and feedback function of DIATEC with regard to the 100 DATAAC centres in the country, in order to ensure the completeness and data quality of the registration. The implementation is scheduled over three years, in which 5,820 persons will be trained in 1,500 course days, while more than 23,100 manuals will be distributed. The first year covers almost all areas of Lima and Arequipa, whereby more than 70% of all accidents in Peru will be already registered after the first year. The total implementation costs of the project will be ca. US\$1.8 million (ca. US\$0.65 million for hardware and software, system installation, printed forms and manuals, etc., and ca. US\$1.15 million for fees and accommodations of ITC experts, trainers and project management over the three implementation years). The costs are evaluated as appropriate and the whole implementation plan as ambitious, but realistic.

Comment and critical assumptions

The foreseen implementation project will enable a reliable, statistical analysis for monitoring and evaluation of the effects of road safety measures and the overall road safety development in Peru. As such, this project is a prerequisite for any road safety strategy. In view of the likely under-registration of accidents and numbers of fatalities and injuries in the past, it also has to be remarked that its successful implementation may cause the total numbers of registered accidents, injuries and fatalities to increase, due to the expected completeness of registration after three years. The evaluation and monitoring of the Peruvian road safety development of the next years must take this expected artefact into account.

Provided that the Ministers for Transport and Interior affairs, representing respectively the interests of the CNSV and the Peruvian National Police, have signed an agreement that establishes the authoritative basis for the implementation of the accident information system in Peru, its implementation probably will be a success despite the earlier failure for the MAAP-system. Nonetheless, remaining support of the police and the feedback control of the 100 DATAAC centres by DIATEC are the most critical assumption for that envisaged success.

2.4. Road safety survey and information campaigns

The public awareness of the worsening road safety in Peru seems rather low. Attention of media, opinion leaders or politicians for the road safety problem in Peru is rare and can only occasionally be observed. Sufficient knowledge and correct attitudes of road users on safe traffic behaviour are lacking in view of the rather low level of seat belt use, the dangerous car driving that is observable from high frequency of undisciplined lane changes and overtaking manoeuvres, over-speeding and negligence of pedestrians and the existing social acceptance of drinking and driving. Although research seldom shows that information campaigns on road safety have on its own lowered the level and severity of road accidents, it will be evident that the Peruvian traffic culture of unawareness of road safety is not favourable for political priority on road safety and for the establishment of an effective road safety strategy. The raising of the level of public awareness, knowledge and attitudes on road safety, therefore, is more a prerequisite for the improvement of the road safety in Peru than a road safety measure. However, research also has shown that media communication and public information campaigns on particular road behaviour in combination with targeted police enforcement on the same road behaviour can be much more effective in reducing the number and severity of road accidents than police enforcement alone. Therefore, it is justified to include a project on road safety communication and information campaigns in the road safety component of the TRP-II. It will raise the political priority for road safety in Peru and, when combined with markedly increased levels of police enforcement, it also will be an effective road safety measure.

The SE-CNSV has drafted a ToR for a project proposal on the design and implementation of media communications and public information campaigns on road safety. It contained the requirements for:

- a) a social survey on road safety awareness and on the diagnostic information for the present attitudes in many types of dangerous traffic behaviour
- b) a proposal on the design of media communication of the SE-CNSV and of public information campaigns on six road safety topics
- c) a design for the monitoring of possible changes in attitudes and knowledge with regard to road safety
- d) the profile of the contractor, the time table, and the maximum costs for this project proposal.

Evaluation of draft ToR

In the draft ToR, the relation between the information from the social survey and the specification of the content for the road safety campaigns was missing. The survey requirements also concerned information on public knowledge of the CNSV, since at forehand it was clear that such knowledge is presently absent. Also the multitude of attitude topics that have to be addressed by the consultant was not guided by a cost-effective selection of topics with a high road safety potential. In view of the planned monitoring, the requirement of a statistical reporting on the survey results, enabling comparison with later results of monitoring surveys, was missing. Moreover, in the design of the information campaigns no co-ordination with the also planned project on increased levels of police enforcement was specified,

although such links are known to increase the effectiveness of the campaigns. Therefore, it was advised to specify in the ToR that:

- 1) Less survey questions on the image of the CNSV are needed and that every campaign item must always contain a reference to the CNSV, because only this will promote the image of the CNSV.
- 2) Statistics on the survey results must be documented in a way that make them comparable with results from later monitoring surveys.
- 3) The survey must contain questions on experienced enforcement in order to use this information also for monitoring of the enforcement project.
- 4) The content of the information campaigns must be restricted to the topics that have the highest road safety potential.
- 5) The design of the content for the information campaigns must also be based on shortcomings in knowledge and attitudes on these topics that then must be addressed in the survey in order to detect the shortcomings.
- 6) The time planning of the campaign topics must be flexible in order to be able to co-ordinate them with police enforcement on these topics.

Assistance for final ToR

The SE-CNSV was assisted in reformulating the requirements of the ToR with regard to the aspects mentioned above. The final ToR served as basis for the contract with the selected consultant. The study was further discussed with the consultant who was provided with the information on the second European SARTRE survey. It was advised to use also the same questions as in the SARTRE survey to enable comparison with Peruvian survey results.

Evaluation of interim report

The interim report contained part of the results of the survey and specified much of the design for the road safety campaigns. The use of press, billboards, direct mail, radio, and, where possible, television was considered. The media messages are proposed to be based for one part on rational contents and for another part on emotional contents. The evaluation revealed the following topics for improvement of the survey and its better use in the campaigns, which are discussed with the SE-CNSV and the consultant:

- 1) the need to focus the campaigns on the four priority areas of:
 - a) the use of seat belts, because its use is only ca.20%, while a seat belt has ca.40% effectiveness on preventing a fatal accident outcome
 - b) the danger of over-speeding, because a reduction of the mean speed by factor x (e.g. factor 0.9 or 10% reduction) generally causes a reduction factor x^4 (e.g. 0.656 or 34.4% reduction) on fatalities
 - c) the danger of drinking and driving, because the level of alcohol relates exponentially to the number of fatalities, while now probably ca.30% of the fatalities are due to driving under influence of alcohol
 - d) the negligence of pedestrians by car drivers, because the Peruvian road fatalities are almost for 50% pedestrian fatalities (ca. 30% outside and 70% inside built up areas)
- 2) the use of the survey information in social marketing techniques for the design of the campaign contents must be directed to the understanding of correct traffic behaviour (rational) and to the danger of incorrect behaviour (emotional), without the ambivalence of some tentatively proposed types of messages (these can be contra-productive)

- 3) the need of some improvements in the proposed message types and the possibility to investigate the understanding and appreciation of the proposed campaign messages in small samples of road users
- 4) the possibility of using the concept of role identification for the content of campaign messages on pedestrian safety, because every car driver also will be a pedestrian now and then
- 5) the use of information from a stratified survey with respect to detected shortcomings in knowledge and attitudes of specific road user groups in the design of the content of the campaigns for these target groups
- 6) the costs-effectiveness of billboards (evaluated as less cost-effective) and of television (evaluated as too expensive, if no free broadcasting for ideal information is obtained).

Assistance for final report

The consultant and, where appropriate, the SE-CNSV are assisted on the abovementioned matters. Information on the effective, so-called STEP-programme for repeated actions on the accumulative improvement of the seat belt use rate in Canada was provided. On request, also further information on several topics was given to the consultant by e-mail.

Evaluation of final project proposal

The final report is evaluated as excellent. It fulfills all the contract requirements, while many suggested, but not required, aspects are fully explored or used. The reported results of the survey, containing indeed also most questions of the SARTRE questionnaire, are well analysed and fully documented for later use. The report describes the comparison of opinions in Peru with opinions in European countries on the basis of the survey outcomes that are comparable with the SARTRE outcomes. The report on the survey distinguishes the results for target groups of private car owners, professional drivers, non-car drivers (pedestrians), journalists, opinion leaders and politicians with respect to several other categorisations (such as age groups etc.). The reported statistics concern all relevant road safety issues and are a rich source of information for the development of an effective road safety strategy by the CNSV. It will be a valuable source of information for many specific questions that will arise and now it can already be very well used for demonstration of the need for a higher road safety priority in the governmental policies of Peru. The survey information is also used for the design of information campaigns for seat belt use, over-speeding, drinking and driving and negligence of pedestrians. This was also done by using specific information for particular media and target groups (such as: the content of radio messages for risky driver groups or the content of direct mail to journalists, opinion leaders and politicians). The report on the project proposal describes the contents, the methods and implementation requirements for media campaigns of a) press advertisements, b) direct mail, c) billboards, d) video (with use also for television), and e) radio. Also the types of media messages that are most appreciated by the target groups are researched and recommendations on the most effective use of specific media for the respective messages to target groups are given. The objectives, phasing and monitoring of the respective campaigns over the next 4 years and their estimated costs are well described too. In short: it contains all what is needed for an optimal implementation of information campaigns in the next four years.

Comment and critical assumptions

The SE-CNSV is advised to use the alarming information from the survey for their long-term road safety strategy (for promotion of priority for road safety, for use in other projects, etc.). The SE-CNSV must also take care of co-ordination between the actions in the enforcement project and the launching of the public campaigns on corresponding topics, which if co-ordinated will have a higher effectiveness. It is recommended that an established public relations agency or a special non-governmental organisation for dissemination of road safety information is contracted, which then would be responsible for the campaigns and the public communications of the CNSV, both under supervision of the SE-CNSV. Also recommended is that the planned monitoring on knowledge and attitude improvements should be contracted to an institute that is independent from the SE-CNSV and from the contractor(s) for the campaigns. In view of the scarcity of financial means, the relative low effectiveness of billboards with relatively high costs, the relative expensiveness of television campaigns, and the high effectiveness of police enforcement in combination with public information campaigns, it is recommended to reduce the tentative allocation of US\$2 million for campaigns in four years to US\$1.5 million, and to reallocate the difference to the corresponding police enforcement projects that are estimated to cost more than tentatively planned. This is preferably achieved by less use of press advertisements and fewer billboards, because they were evaluated as not sufficiently cost-effective, as well as less use of videos, because television campaigns were evaluated to cost too much. Radio campaigns are judged to be very cost-effective, because radio is rather popular in Peru. A lot of social talk between its citizens concerns the topics they hear on the radio. The possibility of obtaining free publicity of journals and television at the time of the launching of campaigns must also be explored and organised by the SE-CNSV or its public relations agency, since such campaigns have raised in that way a lot of free publicity in many countries.

The most critical assumption on the effectiveness of the campaigning is the support of opinion leaders and politicians on the road safety issues that are addressed in the campaigns. Where possible, these persons should express themselves favourably on these topics in the media.

2.5. Education of road safety

Road safety education is already part of the regulations for the Peruvian education law, but it is only taught in one lesson by a policeman in the primary schools. It concerns mainly the meaning of traffic signs and the explanation of traffic rules, without practice or examination. However, children and teenagers are over-represented in the Peruvian statistics of road injuries and fatalities. In Peru, as discussed in section 2.4, the knowledge and attitudes on safe road behaviour are markedly insufficient. Also parents are not able to provide their children with the necessary knowledge and attitudes for safe traffic behaviour. Research in highly motorised countries, where road safety is a substantial part of the school curricula, has seldom shown that more road safety education reduces the road accidents of children and youngsters, unless the school education is accompanied with practical lessons (in the playground and in safe-enough, actual traffic situations) on how to participate safely in traffic. Nonetheless, a certain amount of repeated theoretical and practical road safety education is a prerequisite for safe traffic participation by any mode (walking, cycling, motor riding or car driving). In view of the absence of sufficient road safety education in the schools of Peru it has been decided in TRP-I to prepare a project for the implementation of road safety in the primary and secondary school education, which project implementation will be part of the road safety component of the TRP-II. Together with projects on information campaigns, police enforcement and driver licensing, this project will certainly contribute to the safety of children and teenagers and in the long run to a higher priority for road safety in Peru.

The preparation of the educational project is covered in the last phase of the TRP-I. The SE-CNSV drafted the ToR for a proposal on the implementation of the educational project under TRP-II. The ToR described, besides the requirements on the profile of the consultant, the time schedule, and the maximum costs for the proposal study, that the general project objective concerns the promotion of the educational development of knowledge, values, and attitudes on road safety of children and teenagers. According to the ToR, the proposal must review and propose improvements of:

- a) the road safety education in primary and secondary schools
- b) the training of school teachers and the policemen that visit schools
- c) the production and use of materials for road safety education
- d) the promotion of road safety education in organisations that are related to the educational institutions, such as school committees, parent committees, school and student clubs and the school for parents organisation.

Furthermore, the proposal must design a monitoring of results and estimate the cost for the project.

Evaluation of the ToR

The draft ToR described fairly well what is needed for the proposal study. Nonetheless, some aspects could be optimised, while the important sector of pedagogical education of new school teachers and the professional education of students in universities (social and behavioural scientists) and polytechnic schools (vehicle and civil engineers) were only implicitly

mentioned. It was advised to formulate more specifically, or in addition, the requirements that:

- 1) In the educational project special attention must be given to safe road behaviour in built-up areas, because there relatively higher risk and more traffic-conflict exposure are observed for children and teenagers.
- 2) The proposed designs of improved curricula on road safety must specify the practical and theoretical contents for the successive age-dependent types of traffic participation and levels of comprehension of children in kindergarten and primary schools and teenagers in secondary schools.
- 3) The study must contain also a feasible proposal for the pedagogical education of new school teachers on the subject of road safety.
- 4) The study must contain a feasible proposal for the inclusion of road safety as a course in the relevant curricula of the professional higher education (universities and polytechnics).

Assistance for final ToR

The SE-CNSV formulated accordingly the final ToR and selected a Peruvian consultant. The tasks for the study were further discussed and explained to the consultant, who was instructed to investigate the feasibility of his proposals for improved or newly introduced curricula and to cover not only paper-and-pencil education, but to pay also attention to practical exercises and feedback on safer road behaviour by the participation of children in simulated and safe-enough, actual traffic situations.

Evaluation of interim report(s)

The intermediate project report contained interesting proposals for the sub-tasks that were specified in the ToR, especially those for the promotion of road safety education in organisations that are related to the schools. However, the evaluation also revealed serious imperfections in the proposed designs of the school curricula and potential obstacles for their successful implementation. It concerned the following shortcomings:

- 1) A major divergence from the traditional education in Peruvian schools is implicitly proposed. Although it was advised to pay also attention to practical education of road safety, the idealistic ambition of the consultant to modernise the relatively authoritarian way of knowledge teaching in Peru, by the proposed kind of interactive teaching in the design of the lessons in road safety, will become an obstacle for the actual implementation of the proposed road safety curricula, because they will probably not be appreciated by the teachers of today in most Peruvian schools.
- 2) The proposed design of the lessons did not contain a modular segmentation that allows for choices and adaptations by the teachers, which generally will not encourage teachers to use the proposed curricula and materials in their education.
- 3) Differentiation of the educational contents with respect to age-dependent types of traffic participation and levels of comprehension in kindergarten and primary and secondary schools was largely missing.
- 4) Practice of what is learned in the school classroom and feedback on potential dangerous behaviour in traffic-like environments outside the class room or in safe-enough environments in actual traffic was not included in the proposed design;
- 5) The feasibility of road safety as a subject in the higher education of teachers and academic professionals was not sufficiently addressed.

- 6) The proposal of the consultant contained an estimation of the costs that apparently were based on the financing of the creation of an institution for supervision and implementation of the educational project, independent from the SE-CNSV, while the project implementation must be based on an agreement between the Ministry of Education and the CNSV, on supervision by the SE-CNSV and on a contract with an existing institute or organisation for the project implementation.

Assistance for final report

The shortcomings mentioned were extensively discussed with the SE-CNSV and the consultant. The consultant was also advised to take advantage of the achievements on road safety education in other Latin American countries and to look for already developed Spanish curricula and materials that could be used in Peru too (for example: Kindergarten and primary school programmes in Columbia). After elaborate explanations and suggestions on how the study has to be improved, the consultant reluctantly agreed to improve his report on all the discussed subjects, but there remained doubts whether he was able to do this on his own. It was decided, in agreement with the consultant, that assistance for the final report will be given by a qualified Peruvian expert with international experience in road safety education.

Evaluation of final report

The final report was judged to be satisfactory after (partly) revising an initially delivered final report on several organisational aspects that were discussed with the SE-CNSV and the consultant. The study report contains satisfactory proposals for the contents of curricula and the educational materials that have to be developed and for monitoring and evaluation of the project, as well as more or less acceptable proposals for the project management and organisational aspects. However, the feasibility of successful implementation is hardly investigated, and the actual application of the planned curricula and materials in the education may remain questionable. The project proposal describes a phased implementation over the school years 2000/2001 to 2003/ 2004 in selected urban areas of Arequipa, Cuzco, Lima and Trujillo, which areas contain 90% of all Peruvian registered road accidents. The following expected main results are specified:

- 1) 9,000 teachers are trained in the improved education of road safety.
- 2) 180 policemen are trained for assistance in education of road safety.
- 3) Improved road safety education is part of the curricula of 238 Kindergarten, 342 primary schools and 170 secondary schools.
- 4) 243,500 pupils will be educated annually in road safety.
- 5) In 80 pedagogical higher education centres road safety is part of the professional training of new teachers.
- 6) Specialists will teach road safety in 70 education centres for parents.
- 7) The proposed curricula and their educational materials (documents, videos and software) for the improved education of road safety are developed, distributed and used.
- 8) Indicators and methods for monitoring and evaluation of implementation progress are developed and used accordingly.

The revised proposal describes the supervision of the project implementation by the SE-CNSV as based on a proposed agreement between the Minister of Education and the Minister of Transport on behalf of the CNSV. The co-ordination and actual project implementations are planned to be in

the hands of one central organisation that has to be contracted. The total costs are estimated to amount in total to ca. US\$1.5 million with 32% for training, 27% for implementation costs of the contractor's organisation, 24% for the development of curricula and materials and the rest for a diversity of operational activities and for monitoring and evaluation. The total costs are evaluated as reasonable, but the specification and the 27% share of costs for the contractor's organisation as questionable (the latter is not the case according to the SE-CNSV, which has more insight the Peruvian education culture).

Comment and critical assumptions

Experiences in other countries show that changes in education and introductions of curricula for road safety are hard to achieve, if not implemented in close co-operation with the relevant educational sector. Although the planned implementation shows desirable results, the feasibility of the planned implementation remains somewhat questionable. Moreover, the proposal of a contractor with a centralised, relatively large and relatively expensive organisation for co-ordination and implementation of the whole project, although under supervision of the SE-CNSV, can be regarded as risky as well as peculiar in view of its specified costs. For the Peruvian education culture it may be the right way of project implementation, but the SE-CNSV is advised to consider carefully a suggested alternative. In this alternative, a qualified consultant will be contracted as main contractor for the project management and co-ordination of specialised subcontractors (contracted by the main contractor) for the separate implementations of proposed project parts for different educational levels and sectors, where the subcontractors then can work in a much closer co-operation with the respective education sectors. This alternative may have a higher feasibility of successful implementation of the project proposal. The choice between the alternatives is left to the SE-CNSV.

The main critical assumption, apart from the feasibility of successful implementation, is that the initially obtained support from the Minister of Education becomes materialised by the signing of the proposed agreement and that this support is maintained in the long run, because this support of the Minister of Education will be instrumental in obtaining sufficient co-operation of the involved education sectors.

2.6. Driver licensing system

In Peru, currently a license is still only required for professional drivers of busses and freight vehicles, but it can easily be obtained without actual training in safe driving and its examination. In the TRP-I the preparation of a project on the implementation of a system for the licensing of all drivers after training by driver licence schools and examination is foreseen. The MTC was preparing in 1998/1999 a law for the obligation that all motor vehicle drivers must acquire a driver licence by training and examination. The SE-CNSV drafted a ToR for the proposal on the specification of a driver-license system and its later implementation in Peru as part of the road safety component of the TRP-II. The draft ToR contained requirements for:

- a study on driver licence systems that are used abroad
- a proposal for a system of driver licensing in Peru
- recommendations on the national organisation and the local institutions for the driver licensing in Peru
- recommendations on the criteria for certification of the driver license
- recommendations on technical and legal aspects of a driver licence system
- recommendations on enforcement and demerit withdrawal of driver licences.

The ToR also described the profile of the consultant, the time schedule and the maximum costs for the study of the project proposal.

Evaluation of draft ToR

The draft ToR was evaluated as not fully appropriate. It contained some hardly relevant requirements, while useful requirements were missing. The following aspects for improvement of the ToR were discussed with the SE-CNSV:

- a) It was made clear that the certificate of the driver licence and the obligation to have it with you while driving must enable its police enforcement. However, the enforcement and a demerit point system for its withdrawal have nothing to do with a system of training, examination and certification for a driver license. It was advised to omit the requirements on the enforcement of the driver license and, if it is given a high priority, to include it in the project for police enforcement in a later stage after the driver licence system is successfully implemented.
- b) The requirements for the study of foreign systems for driver licencing did not specify that weaknesses and strengths of these systems with respect to a possible implementation in Peru are to be described. It only asked a recommendation on which system should be chosen for Peru.
- c) Examination criteria for the driver capabilities of the licensed driver were required, but the training and examination of instructors and quality criteria for the certification of driver license schools and their performance inspection were not addressed.
- d) The development of training materials for the Peruvian driver license schools or adjustment of such materials from abroad also was missing.

Assistance for final ToR

The SE-CNSV was assisted in the reformulation of the ToR according to the mentioned aspects above. It was estimated that the whole project implementation, including the developed and distributed training materials,

may cost about US\$0.8 million, but much more if it would include driver licence enforcement and a demerit point system for licence withdrawal. It was further discussed that retributions to SE-CNSV from the charges for the driver licensing, or more likely from the fees for a certification of the schools for driver training and licensing by the SE-CNSV, could be used for the financing of new road safety projects and the SE-CNSV, which latter option became a part of the proposed self-sustained financing for the SE-CNSV (see section 2.2).

Postponement of the project

The project proposal was to be contracted to a consultant on the basis of the final ToR, but the preparations for the foreseen driver license law by the MTC and Minister of Justice were not finalised and still await ratification. On the one hand it was decided to postpone the contract for the proposal and to wait for the ratified content of the driver licence law, because it might influence the work for the project proposal. On the other hand, the law needs to be complemented by regulations in which the technical and operational details of the driver licensing are specified. Since this is aimed to be based on the project proposal, the project proposal must be contracted as soon as the driver licence law is ratified, in order to contribute to the specifications of the regulations for the law. Moreover, the implementation of the project for the driver license system is envisaged to take about two years. It is envisaged that the driver license law will be ratified in 2000 and that the system can be operational in 2002, which is in line with the projected financial retributions from the foreseen certification of driver licence schools by the SE-CNSV (as was described in the project proposal for the self-sustained financing of the SE-CNSV). As a consequence of the postponed proposal, the evaluation of the study for this project is not a part of the review.

2.7. Strengthening of police enforcement

Due to the vanishing needs to defend the Peruvian border with Ecuador (which has been in war with Peru) and to combat the revolutionary organisation in Peru (which has been a real threat for the Peruvian state), the political climate allowed a gradual shift from semi-military tasks to the usual protection and prevention tasks of the police. Partly also due to these changed circumstances, Peru had a rapid economic growth in the last decade. Its GNP per capita of ca. US\$3,000 in 1998 ranks Peru amongst the developing countries as one of the most developed countries. As discussed in Chapter 1, this growth is accompanied with rapid motorisation and caused an almost as rapid increase in road fatalities and injuries. Moreover, inhabitants of a country can only gradually adapt to a rapid increasing complexity of motorised traffic. Therefore, the development of safe behaviour for traffic participation is lagging behind in Peru. The use of seat belts is low, over-speeding is a common phenomenon, drinking and driving is socially accepted (alcohol even is misbelieved to increase the driver's alertness). However, the concerns are more about traffic flow than about road safety or the omnipresent negligence towards pedestrians. Although today the police gives more attention to traffic enforcement, there still is no enforcement on the use of seat belts and only occasionally controls are held on over-speeding and on drink-driving (only 458 drivers involved in accidents received a conviction or fine for drink-driving in 1998). Willingness to intensify the enforcement is present, but modern control equipment for speed and alcohol measurements and institutional strength for efficient enforcement are lacking. Intensified enforcement by state-of-the-art technical equipment is most needed, because research shows that intensified enforcement can contribute substantially to improvement of road safety, especially when combined with information campaigns. However, since the enforcement level in Peru is very low, it requires a manifold intensified level in order to be effective, which is further discussed in Chapter 3.

In view of the potential effectiveness of intensified enforcement and the actual situation in Peru, it was rightfully decided in the TRP-I to prepare a project on the strengthening of the police enforcement, which project then is to be implemented by the funding of the TRP-II. The SE-CNSV drafted the ToR for this project proposal. It mainly required, besides the time schedule and maximum costs for the study, that the study has to propose in agreement with the police a plan for a substantially improved enforcement level that is enabled by incentives of sufficient deliveries of enforcement equipment to the police.

Evaluation of draft ToR

The requirements for the proposal had to be improved in order to expect a project implementation that effectively can contribute to the improvement of road safety. Some types of effective enforcement, the conditions for equipment delivery, the base level and methods for monitoring and evaluation were insufficiently or not specified. It was advised that the study must contain:

- 1) a diagnosis of the present level of enforcement on speed and drinking and driving by describing the management of the police enforcement and the time spent on enforcement on these two types of violations

- 2) a design for the strategy on the increased use of seat belts (now fully absent, but belt use reduces 40% of the fatal outcomes of accidents)
- 3) the description of performance indicators that allow the measurement of the effects from the project implementation
- 4) a strategy for intensified enforcement sustained by incentives in the form of the delivery of modern enforcement equipment to the traffic police in the districts, conditional to the initial agreement and later progress on substantially intensified enforcement
- 5) an implementation plan that optimises the efficiency and operational procedures of the enforcement by improved enforcement management and use of conditionally delivered equipment in each police district.

Assistance for final ToR

The formulation of the final ToR by the SE-CNSV was in accordance with the suggested improvements. The SE-CNSV and other involved persons were assisted in understanding the effects from an intensified enforcement by explanation of the inverted S-shaped relationship between intensity and effectiveness of enforcement. This will be illustrated and further discussed in Chapter 3. The importance of seat belt wearing, also in urban areas, was also discussed and its effectiveness clarified (this is also illustrated and further discussed in Chapter 3).

The SE-CNSV contracted a Peruvian consultant who works with the relevant road safety organisation DINSEVI of the police. The objective of the project was discussed with the commanding General and other high officers of the Peruvian National Police in order to guarantee police co-operation. The proposal was extensively discussed with the consultant to ensure that the proposal will describe an implementation that actually increases the time spent on enforcement and the number of fines, which especially has to be achieved on not wearing a seat belt, drinking and driving and over-speeding as the potentially most effective topics, addressed also by the information campaigns.

Evaluation of interim report

There was no written interim report delivered, but the consultant presented the parts that should be ready in the interim phase. The sheet presentation of these interim results served as basis for the interim evaluation. That evaluation revealed that the consultant and SE-CNSV needed further explanation on the topics that are to be specified by the consultant. It concerned mainly:

- 1) the formulation of a proposal for a general agreement between the Minister for Transport (on behalf of the CNSV) and the Minister of Interior (on behalf of the PNP) on the implementing of intensified enforcement, enabled by delivery of modern control equipment
- 2) the specification of an operational management agreement with the regional police districts on a manifold intensified enforcement level
- 3) the specification that an initial delivery of control equipment only can be acquired by a police district on the basis of an agreed, quantified initial plan on markedly intensified enforcement
- 4) the specification that additional deliveries of control equipment in the following three years will be conditional on satisfactory increased enforcement results in the first year and on plans for further raised levels of enforcement that both have to be quantified in terms of time spent on enforcement and numbers of fines.

Assistance for final report

This precise specification of requirements for the proposal of the project implementation was needed, because the implementation requirements apparently were not well understood by the consultant or initially not seen as important enough by the involved officers from the road safety division DINSEVI. It was suggested to the consultant that quantified plans for manifold increased enforcement on speed and drink-driving could be illustratively operationalised for the Lima-based police districts that are already co-operating in the pilot tryouts of the accident registration system and that this should be part of the final proposal report. It was further discussed that it was not intended to finance other matters by the project than the additional costs for project management and for the needed control equipment. In contrast to the initial expectations, control vehicles, office equipment and other manpower costs had to come from reallocation of resources within the police, since no more than US\$2 million was initially available for project implementation.

Evaluation of final report

The final proposal report is evaluated as satisfactory. First, it describes the relevant organisations that are in charge of the police control of traffic and road safety. On the central level the national directorate for road safety DINSEVI can issue orders to the police districts and the national road directorate DIPLOCAR is responsible for police control on the national highways of Peru. The traffic police in the police districts of Lima and the regional districts outside Lima are responsible for traffic enforcement on their district roads. Second, the legal and organisational aspects of the enforcement, as well as the factors that limit the efficiency and intensity of the present enforcement activities (working conditions, lack of training, lack of modern equipment and insufficient administrative data processing) and the main statistical characteristics of fatal accidents (mainly in urban areas) are described. Third, the report discusses some research on the relationships of speed and amount of blood alcohol with the occurrence of fatal accidents as well as describes the existing Peruvian speed limits (30 km/h in school zones, 35 km/h in shopping areas, 55 km/h in residential areas and 100 km/h on rural highways with 80 km/h for passenger busses) and the legal limit of blood alcohol in Peru (0.7‰ for private and 0.5 ‰ for professional drivers). Furthermore, the report describes the control, sanction, and prevention function of enforcement tasks and the way they are organised in Peru. These preliminary aspects are evaluated as rather well documented.

After these preliminary expositions, the goal of the project is more specifically formulated and summarised as: reduction of over-speeding and alcohol-related accidents by increased levels of enforcement and public campaigns on these topics, and the reduction of the severity of accident outcomes by increasing the use of seat belts (the latter not explicitly stated to be raised by enforcement). The needed equipment, training and other actions are specified (with technical annexes for the equipment delivery), while also the possible administrative, financial and criminal sanctions are listed. The feasibility of actual application of these matters is not actually studied. Only critical factors and risks of failure for the project implementation are listed. However, for the feasibility of success the list on dangers of failure risks is informative:

- insufficient political support
- resistance in sectors of state employees against project components
- too many job rotations or too much organisational change in the police
- insufficient financial means for the information and training of local traffic police, due to the allocation of project finances by central government levels
- insufficient efforts in police directorates for continuation of the four-year implementation process for this prevention task of the police
- insufficient project collaboration of executives in the national police
- possibilities that the CNSV will not keep its influential position.

Lastly, the operational plan for the project implementation is described for the project years of mid 2000 to mid 2003, but hardly thereafter. It is planned to cover 40% of the main roads in police districts of Lima and Callao in 2001, increasing to 70% of the roads in these areas and additionally 50% of the rural paved roads in 2002 and further increasing to 85% of the main roads in Lima and Callao in 2003, while further coverage of rural roads is not discussed. The data that are necessary for the evaluation of the project and the conditional delivery of equipment are described, after a required revision of the initial description. They are specified quantitatively for the five pilot districts in Lima, where gathered data for the base level of enforcement in 1999 and projected data for the planned levels of intensified enforcement in the following years are used for illustration of the project implementation. These data show that manifold increased levels of enforcement on over-speeding and driving under influence of alcohol are feasible (up to twelve times more), but mainly because of the low existing levels in 1999.

The report also contains the proposal for an agreement between the Ministers for Transport and Interior as well as proposals for an operational management agreement with the police districts and for contracts on delivery of equipment for measurements on driver speed and amount of driver alcohol. The total project costs are estimated to amount to US\$5.6 million, but contain also costs that have to come from reallocation in the police expenses for control vehicles and manpower time for the project. The actual budget for the needed control equipment can reasonably be limited to about US\$2 million, while for the project management and evaluation an additional US\$0.5 million is needed in the period to end 2004, which US\$2.5 million is evaluated as appropriate for the funding by the road safety component of the TRP-II.

Comment and critical assumptions

The final proposal report on the operational aspects of the project implementation is evaluated as acceptable, but *it needs to be complemented by operational management agreements with the involved police districts* on the conditions and progress evaluation of the local project implementation, in order to guarantee that the funding conditions for the delivery of control equipment are fulfilled. Before project implementation in the police districts, it must become clearly agreed that the same data as the illustratively gathered data for the five Lima-based police districts, specifying the present level and the planned intensified levels of enforcement, are also needed for every police district that participates in the project. Also the enforcement on seat belt use needs to be described and agreed more explicitly before project implementation. The to-be-agreed instruction for the traffic police should be that every car, once stopped for whatever reason, must also be

controlled on seat belt use and that, if car occupants are not using their seat belts, this must be enforced by fines. These matters were well understood and accepted by the police representative of the road safety directorate DINSEVI, but it remains doubtful whether they will be explicitly enough described as an agreed condition for the local project implementations and deliveries of the needed control equipment. It evidently is not the management culture of the Peruvian police to get such quantitative reporting obligations and operational constraints on their work, and this certainly not from outside the police. In view of these circumstances, the SE-CNSV is advised to use all kinds of opportunities that can contribute to commitment within the police organisations and districts.

It must be recognised that this project is the most crucial one of all the projects in the road safety component of TRP-II. This is also the reason for the advised final amount of project funding, which is increased by US\$0.5 million above the initially allocated US\$2 million. This was enabled by the reduced final allocation to the project funding for information campaigns. Without success of the enforcement project the formulated objective of improving the annual reduction of the fatality rate from presently 4% to 6% in 2004 will not be achieved, while then also the educational project and the project on information campaigns will become both less effective.

As the above cited list of dangers for an unsuccessful implementation indicates, it is not yet guaranteed that a substantially increased level of enforcement will be achieved by the project. Firstly and most critically, a signed agreement between the Ministers for Transport and Interior is needed. Secondly, after this is signed, commitment to the project implementation, which seems present in the road safety directorate DINSEVI, must be broader obtained within the police districts by operational management agreements, and if necessary even by directive orders from the highest level in the PNP to the involved lower levels within the police. The SE-CNSV is advised to follow the project closely and to take action via the committee of Ministers for the CNSV, if such turns out to be necessary.

2.8. Infrastructural road safety improvements

In the last phase of the TRP-I it also was foreseen to prepare a project for the infrastructural road safety improvements on risky spots or short segments of the national highways of Peru. The SE-CNSV and the governmental agency for the maintenance of the paved road network (SINMAC: Sistema Nacional de Mantenimiento de Carrateras) were in charge of the formulation of the ToR for the proposal of the project implementation that will be part of the funding by the road safety component of the TRP-II. Its funding by that component of the TRP-II is already specified to be US\$10 million. The explicit objective of the project is to improve the road safety by infrastructural measures on high risk spots and stretches (black spots and dangerous segments) of the three national highways (Carratera Sur, Norte and Central).

Assistance for the ToR

There was no draft ToR available for evaluation in the first phase of the review service, but the requirements in the ToR were discussed with the SE-CNSV and representatives of SINMAC. It was made clear that the project on the infrastructural road safety improvement should not concern the maintenance of highway parts that are in bad condition, but it should concern the selection of road spots and stretches with high accident, injury and fatality risks that can be reduced by physical road and road side improvements. The ToR for the study, therefore must explicitly require that the project proposal has to describe how that selection for road safety improvements will take place. In view of the total length of the three highways it was further discussed that the limited amount of US\$10 million for the project requires that proposed infrastructural prevention measures on selected black spots or dangerous segments must optimise the ratio of their costs and expected safety benefits and that the project proposal has to specify how this optimisation will be achieved.

Moreover, it was discussed with SE-CNSV and SINMAC that such selectively improved black spots and dangerous segments will not guarantee that a road will become modified in the manner that would be required for state-of-the-art road safety of a whole road. In order to demonstrate at least for a longer part of a road what state-of-the-art safety of roads means, it was advised to select also one dangerous road part of 10 to 20 km length and to use about US\$1 million for its state-of-the-art safety improvement. This was advised, because in other countries such demonstration projects have been very effective in raising the priority for infrastructural road safety. It would require that the demonstration project is completed first and then showed to the Minister of MTC, road authorities, politicians and press as a demonstration on what is achievable by application of state-of-the-art infrastructure safety. The SE-CNSV, in accordance with the transport specialist for Latin America from the World Bank, agreed to include such a show case as a sub-project in the project and to allocate US\$1 million for it, within the US\$10 million for the project. After these discussions, without an evaluated draft text, the SE-CNSV and SINMAC formulated the ToR for the project proposal and contracted a Peruvian engineer consultant on the basis of that ToR. The consultant is required:

- a) to concentrate on the identification of spots where many road accidents occur (identification of black spots and dangerous segments), in order to prevent them by infrastructural means that are to be proposed
- b) to define the black spots and dangerous segments by statistical accident information on these locations and other existing relevant information
- c) to identify on the basis of the obtained information stretches or segments for project actions that improve their infrastructural road safety
- d) to select a demonstration stretch for a project of US\$1 million on the basis of the road accidents and fatalities, where the selected demonstration stretch has to be rehabilitated by all means that have been shown to reduce effectively accidents in other countries
- e) to formulate a project plan of infrastructural measures that improves the road safety on the Panamerican and the Central highways by prioritised project actions, based on the selection criteria for their priority, and for the first two years an operational plan for the project implementation, where the first two years must include the demonstration stretch. The selected spots or segments must not be contained in the other road rehabilitation projects of SINMAC or the TRPs.

The ToR required that the consultant delivers:

- 1) an initial report on the global analysis for the situation of the studied roads with respect to their road safety and the adopted actions for co-ordination with other parties, such as the police, where the initial report also has to justify the selection of the demonstration stretch
- 2) an interim report that must contain the statistical data of accidents, provided by the national police, that occur on the locations of the roads that have to be studied and the preliminary design of the measures that are to be identified in the four-year project of US\$10 million for the infrastructural safety improvements as well as the operational plan for the first two project years, including the demonstration project
- 3) a final report on the technical works in the first two years and on the complete information that specifies the selection and priority for all works that are to be scheduled in a time table for the whole project.

Here the requirements on the reporting, as well as on the selection of locations and the infrastructural measures are rather precisely translated, because in the sequel of this section it will turn out that the consultant did not understand or was not able to fulfill the requirements for the selection of the black spots or short segments and for the corresponding prevention prioritisation of infrastructural road safety measures (optimising their cost-benefit ratio). Although the selection and cost-benefit methodologies were earlier discussed more precisely with the SE-CNSV and SINMAC than later were formulated in the ToR, their descriptions were clear enough to cause no misunderstanding on the side of the consultant for the project proposal. (These descriptions were: a) define the black spots and dangerous segments by statistical accident information, b) identify on the basis of the obtained information stretches or segments for project actions that improve their infra-structural road safety, and c) formulate a project plan of infrastructural measures that improve road safety [...] by prioritised project actions based on the selection criteria for their priority.)

Evaluation of initial report

The initial report contained information on the serious accidents from January to June 1998, aggregated to total numbers for rather long stretches of the North, South and Central highways, as well as on the terrain

characteristic of these long stretches and their maintenance condition, their approximately estimated traffic volumes and their evaluated demonstration suitability. A multi-criteria analysis was used for these aspects in order to determine the selection of the demonstration stretch. It was proposed to locate the demonstration stretch on the Central highway between 40 and 100 km from Lima. This initial report was evaluated as satisfactory, while it was discussed to locate the demonstration stretch there where it includes urban segments of the selected highway part. It led to the conclusion that ca.16 km Central highway between and including Matucana and San Mateo will be the demonstration stretch. The SE-CNSV was advised to mobilise the political interest for the demonstration project. No further discussion with or assistance to the consultant seemed necessary, because the initial report fulfilled satisfactorily its requirements.

Evaluation of interim report

The interim report contained the information on accidents, injuries and fatalities that occurred on registered locations of the Panamerican and Central highways from January to June 1999. They are aggregated to total numbers for 10 km stretches and those stretches with the highest accident numbers were selected as the dangerous segments for the project. The local road and roadside characteristics for each selected 10 km stretch were described; for the demonstration stretch they were described in more detail. No short dangerous segments, nor black spots were identified, while also no specification of the infrastructural road safety measures that can prevent the accidents that occur on the selected stretches of 10 km length was given. Only technical descriptions of some measures are presented in the interim report, however without clues where and why to apply them. Only for the demonstration stretch the infrastructural improvement measures are specified, but also there without a prevention relationship between accidents and measures that justify the proposed measures. Obviously without the study of prevention relationships between the local accident occurrences and local road improvements, the interim report could not contain the required prioritisation of the project actions, which only can be based on a comparison of costs for the measures and benefits for the expected prevention of accidents by the specific measures. The costs of the infrastructural improvements were estimated, but only on the basis of the usual, safety-related maintenance costs per kilometre road length, differentiated for flat or hilly or mountainous roads. These global costs per kilometre and the available US\$10 million determined how many 10 km stretches with the higher accident numbers could be selected. For reasons of road continuity, the selected 10 km stretches are shortened or lengthened and combined to stretches ranging from 7 to 37 km length. These stretches are proposed to be improved by the safety-related maintenance that by their global costs amount to US\$2.61 million for 117 km on the mainly flat Carratera Norte, US\$3.24 million for 130 km on the more hilly Carratera Sur and US\$4.15 for 103 km on the mainly mountainous Carratera Central. The latter includes the demonstration stretch at the same costs per kilometre as other hilly or mountainous stretches.

The intermediate report was somewhat delayed, but the consultant misbelieved that no much additional work was needed for an in-time delivery of the final report. However, in view of the ToR requirements and the general understanding of professionals on what selections and

treatments of black spots and dangerous segments mean, this interim report was totally insufficient. For the initial report the consultant was not required to use more precise location information on accidents and their infrastructural prevention measures, nor at that stage to prioritise the infrastructural measures by the use of the cost-benefit methodology. The satisfactory evaluation for the selection of the demonstration stretch might have contributed to the expectation that selection of large segments of 7 to 37 km length would suffice. It indeed can be sufficient for the detection of generic road improvements that will prevent commonly occurring types of accidents, but it is insufficient for the detection of locally needed accident-prevention measures. The latter requires a selection of black spots and dangerous segments and their prioritised improvements by infrastructural road safety measures, which were required explicitly for the intermediate and final report. Moreover, the stretch selections were based on a half year period of accident frequencies. This yields highly unreliable selections, where any engineer book on the subject recommends a period of three years for a reliable selection of black spots. Together with the absence of prevention relationships between local infrastructural measures and accidents, the proposed project actions will only achieve a fraction of the road safety improvement that is achievable by US\$10 million for the project. Due to this evaluation, the SE-CNSV required an improved interim report.

Assistance for revision

In discussions with the consultant and the SE-CNSV, as well as with representatives from SINMAC and the World Bank, the shortcomings of the interim report were extensively explained. It revealed that the consultant, who actually is even the most qualified consultant in Peru, did not have the needed experience and knowledge for the required improvements of the interim report. This seems to hold as well for other professionals in Peru, including engineers of SINMAC and the SE-CNSV. Therefore, the consultant and others involved were assisted in the understanding of the application of the required selection and cost-benefit methodologies. After several sessions of instructive explanations the consultant provided a more or less satisfactory outline of the basic elements for the methodologies that must be used for proposed implementation in the final report and agreed that the interim report needed revision.

Due to the additional delay that the evaluation and the explanations on the shortcomings caused and the further delay that is to be expected for an acceptably improved interim report, it was considered by the SE-CNSV in accordance with the transport specialist from the World Bank not to require a full revised interim report, but to require a sufficient description of the methodologies that will be used for the implementation of the final report, which description has to be delivered as addendum to the interim report. The delivery of the addendum and the not foreseen, but still originally required, additional work for the consultant on the final report, not only delays the acceptance of the interim report by some weeks, but also delays the delivery of the final report by several months. Since a delivery of the final report was only needed before the signing of TRP-II, foreseen before mid 2000, it was possible to accept this. However, it presupposes that the addendum would satisfactorily describe the methodology and that the described implementation in the final report would be based the correct application of that methodology, including the cost-benefit justification of

the prioritised, infrastructural road safety measures for the whole project. It was advised to proceed in this manner, provided that two conditions will be fulfilled.

The *first condition* concerns the effectiveness optimisation of the demonstration sub-project, because the demonstration project will be the most sensitive part of the whole project. Further information on the location and possible causes of all accidents on the demonstration stretch in the years 1997-1999 needs to be gathered and researched on the basis of the original police documents and the inspection of the road locations of the accidents in order to define more reliably the needed infrastructural measures for their prevention or for the protection of involved road users. Occurrences of fatal accidents on the demonstration stretch shortly after the publicity for its safety-optimised rehabilitation would be disastrous for the needed priority on infrastructural road safety improvements, which will be minimised by this additional condition.

For the other safety improvements on black spots and dangerous segments of the highways, the registered accident data and existing documents on road and roadside characteristics are judged to be sufficient for their use in the required application of the selection and cost-benefit methodologies. However, in view of the apparent lack of expertise on the application of these methodologies, that are nowadays standard and used everywhere else, the *second condition* concerned the actual training of the involved professionals for the project formulation and implementation in the use of these methodologies that require the mastering of a geographic information system and the research software for the combined analysis of accident and road data. This second additional condition is advised in order to guarantee that the implementation of the project will indeed maximise the achievable prevention of accidents, injuries and fatalities by the remaining US\$9 million for infrastructural improvements.

The SE-CNSV in accordance with the transport specialist for Latin America from the World Bank decided to require that the consultant has to integrate the description of the methodology for the selection of black spots and dangerous segments on the basis of three year accident data, as well as the description of the cost-benefit methodology for the selection of the infrastructural road safety measures in the final report that has to base the project implementations on their application. They also sustained the advised conditions in order to guarantee the needed quality of the final report. The consultant agreed reluctantly, while the additional work for the conditions has been or will be contracted soon to already co-operating Peruvian and foreign consultants.

Final project evaluation

In the end, the consultant produced the required description of the methodologies. It contained all the ingredients for their application in the final report. The revised interim report could be evaluated as acceptable just before the finalising of this review report. Nonetheless, the actual application of the methodologies in the proposed project implementation still is to be evaluated. However, the agreed participation of the consultant in the training for the use of the methodologies, which will be based on the actual application to a larger part of the Carratera Central that includes the

demonstration stretch, is judged as sufficient guarantee for a positive evaluation.

On the very last moment in the last phase of the review services it turned out that the IBRD is planning a reconstruction of the road segment through the city of San Mateo (preferably constructing a bypass around the city), which segment is part of the demonstration stretch. Because its reconstruction is planned in 2003, it was decided to shorten the demonstration stretch to the point where the reconstruction of the segment in San Mateo will begin. It is advised to the SE-CNSV to investigate whether, after the type of reconstruction is decided, additional infrastructural measures in that city (pedestrian sidewalks and crossing facilities or/and traffic calming measures) are needed.

Comment and critical assumptions

The evaluation and the discussions with engineers from the consultant, the SE-CNSV and SINMAC clearly showed that state-of-the-art knowledge of professionals on the methodologies and the design of effective measures for infrastructural road safety improvements is largely lacking in Peru. It is advised to the SE-CNSV to organise courses for the professional road safety education of engineers. The World Bank is advised to evaluate by road safety audits the planned road rehabilitation projects that are funded by the bank in Peru, because the actual implementation of these infrastructure works by Peruvian firms probably often will neglect the road safety aspects, due to their apparent lack of updated know-how on safe road design and rehabilitation. In view of the lack of co-ordination between infrastructural works in the case of the demonstration project, SINMAC is advised to co-ordinate timely the project with other infrastructural works that will interact with its implementation.

3. The long-term road safety strategy in Peru

The eight projects described in Chapter 2 and envisaged projects from the proposed self-financing for road safety, are an excellent basis for the long-term road safety strategy of the SE-CNSV. The SE-CNSV is advised to

- 1) write a policy document on a five-year strategy for the improvement of the Peruvian road safety
- 2) update these Five-Year Plans every two or three years
- 3) have these policy documents approved by the Minister for Transport and the steering committee of Ministers for the CNSV.

The first policy document should contain a general description of the road safety in Peru, the economic and human need for its improvement, the achievable objective for that improvement (for which Chapter 1 could be used) and the actually planned projects for the realisation of the objective. That realisation should be based on the eight described projects and on new projects that can be financed by the self-sustained sources in later years. The realisation expectancy of the objective that was formulated in Chapter 1 can be quantified by the well-known effects for some types of road safety projects. The two projects with effects that can be quite reliably quantified are the enforcement project and the infrastructural project. These two topics are also the most promising topics for projects in the future, although other projects sustain and multiply their effects, notably road safety education and information campaigns.

The expected project effects of infrastructural road safety improvements can be quantified as follows. These improvements concern black spots and dangerous segments on the originally selected stretches that, together with the demonstration stretch, amount to a total road length of 350 km. The selected stretches have an annual average of 0.72 fatalities per kilometre. On the less dangerous, not-selected stretches occur an average of 0.14 fatalities per kilometre. The appropriate road safety measures on the black spots and dangerous segments of the originally selected stretches could establish a safety that is equal to the safety on the not-selected stretches. The project would then reduce the annually expected fatalities of $350 \times 0.72 = 252$ to $350 \times 0.14 = 49$ fatalities per year. This 80% fatality reduction is not fully achievable, not only because the traffic volumes are somewhat less on the more remote, not selected stretches, but also because of more urban segments on the selected stretches and the so-called 'regression to mean' for the selection effect of the difference between selected and not-selected stretches. Meta-analysis research (Elvik et al., 1997) shows that infrastructural improvements in highly motorised countries have an average reduction effect of 30%. Since their effectiveness on the more risky highways of Peru will be much higher, about 50% fatality reduction is a fair estimate of the achievable project effectiveness. It means the saving ca.125 fatalities per year, which together with the expected saving of injuries and accident damages that go along with the fatalities, reduces the annual macro-economic loss due to road accidents by ca. US\$40 million, provided that the project of US\$10 million realises the achievable safety improvement.

The effectiveness of the enforcement project depends on the existing enforcement level and its intensification, which will be explained by *Figure 4*.

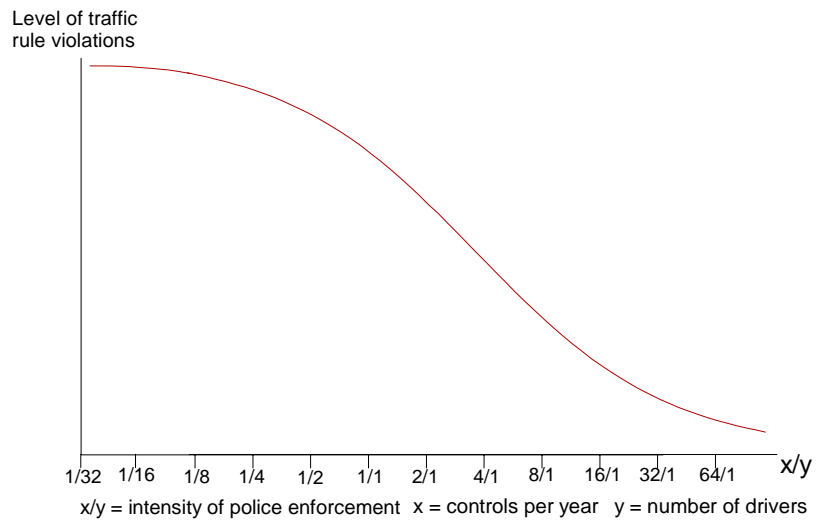


Figure 4. *The relationship between intensity and effectiveness of police enforcement.*

Figure 4 shows that an eight times increase in enforcement intensity, from 1 control per 32 drivers per year to 1 control per 4 drivers per year, is hardly effective, however, it also shows that a further eight times increase in intensity from 1 control per 4 drivers per year to 2 controls per driver per year is very effective. This reflected S-shaped relation theoretically holds for all kinds of traffic violations, but the intensity scale will differ per type of violation. Empirical research (Koonstra, 1993b) indicates that the pictured relationship describes the effectiveness of enforcement on drinking and driving rather well, while for speed enforcement the intensity values in the figure must be doubled in order to describe approximately the research result. Since the level of enforcement in Peru is rather low (probably lower than 1/8 for drink-driving and 1/16 for speed), a manifold increased enforcement level (probably more than tenfold) is needed in order to reduce the level of alcohol violations by ca.25% and the speed violations by ca.10%. The enforcement project plans to intensify the enforcement ten to twelve times between 2000 and 2004 on 85% on the main roads in Lima and Callao and on 50% of the rural roads in the rest of Peru, representing about 70% of the traffic. In order not to overestimate the effects, the enforcement project is estimated to reduce alcohol violations by 25% of 70% or by ca.18% and speed violations by 10% of 70% or by ca.7%.

Since 30% or more of the fatalities are due to drinking and driving in Peru, it is estimated that the intensified control on drink-driving reduces the number of fatalities by 18% of 30% or by ca.5.5% of the otherwise expected total in 2004. The share of fatalities that are due to over-speeding is generally more than 50%, but also other causes always contribute simultaneously to over-speeding accidents. The reduction by intensified enforcement on over-speeding that can be achieved, therefore, would contribute to no more than 50% of 7% or less than 3.5% reduction of the otherwise expected fatalities in 2004. Correcting for other causes that

contribute to over-speeding accidents, ca.2% reduction on fatalities could be a realistic estimate for the effect of intensified enforcement on over-speeding. In Peru the police have registered only 22% of the accidents in 1998 to be due to over-speeding, while here the expected 7% reduction of over-speeding would apply to these accidents. This would then mean 1.5% reduction of all accidents by the enforcement on over-speeding, but over-speeding will be a causal factor in more fatal accidents than in the 22% of the accidents that are registered as over-speeding accidents by the police. Thus, the estimate of 2% fatality reduction in 2004 is indeed a fair estimate for the effect of intensified enforcement on over-speeding in Peru.

The enforcement project is also aimed at the enforcement of the use of seat belts and together with the public information campaigns it certainly can contribute to a raised level of seat belt use in Peru. Repeated co-ordinated actions on police enforcement and campaigns for seat belt use over many years have shown in other countries increases of seat belt use from rather low levels to 90% seat belt use (Koornstra, 1993b). The estimated level of about 20% use of seat belts that exist in Peru today can be raised markedly by enforcement and public campaigns, but a rise to the 60% seat belt use of the average country in Southern Europe would be an enormous achievement for the relatively short period to 2004. Probably an achieved level of 40% use of seat belts in 2004 is more realistic. The effectiveness of seat belts in relation to the collision speed is illustrated by *Figure 5*.

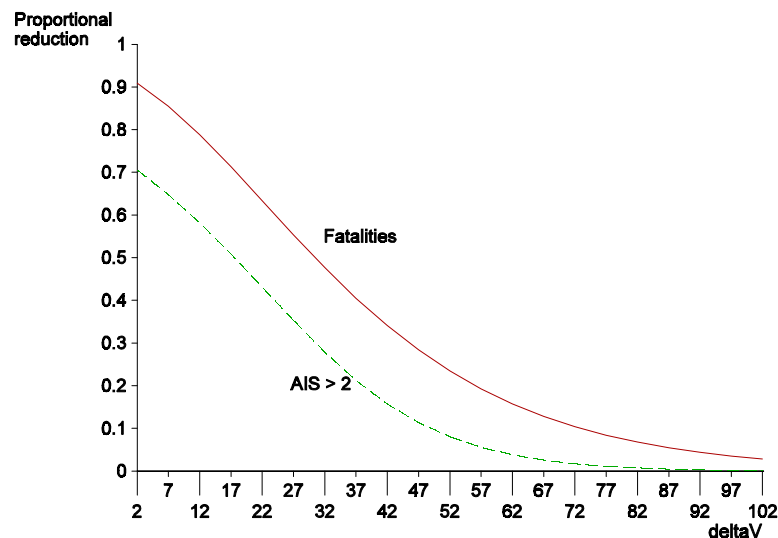


Figure 5. Proportional reduction factor in fatalities or serious injuries (AIS>2), of belted drivers as compared to unbelted drivers, in crashes with different collision speeds (delta V in miles per hour).

In *Figure 5* (Koornstra, 1994) delta-V relates to the collision speed in miles per hour. The figure shows that the effectiveness of belt wearing is the larger the smaller the collision speed is. Since the average road fatality occurs at a collision speed of ca.35 miles/h (ca. 57 km/h), and the average serious injury (AIS > 2) at about ca.25 miles/h (ca.40 km/h), the average prevention effect of seat belt use is about 40% (Evans, 1991). Accidents

with serious injuries are more often observed on urban roads, while rural roads or express-roads and motorways have relatively more fatalities. This also illustrates how important the use of seat belts is in urban areas, which seems not to be understood by the Peruvian driver, nor by the police who currently does not control its use in Peru. Assuming an increase from 20% to 40% use of seat belts by the enforcement and campaign projects, it amounts to 20% increase for 40% effectiveness or to 8% less fatalities or serious injuries of the otherwise expected numbers in 2004.

The estimated proportional effects on fatalities of the intensified enforcement and information campaigns on drink-driving, over-speeding and non-use of seat belts cannot be independently combined, because many fatal accidents are characterised by combinations of these violations. The maximum effect of their combined effects is computed by the product rule for independent reduction proportions, that for the effects of 5.5% (on drink-driving), 2% (on over-speeding) and 8% (on seat belts) is defined by $0.945 \times 0.98 \times 0.92 = 0.852$. Thus, ca.15% reduction, if no dependence between these violations is present. However, there is much dependence between these violations (for example: young drivers often violate rules by drink-driving, over-speeding and no use of seat belts simultaneously). The covariance of these violations is not known for Peru, but can safely be estimated to approach 50%, where almost 50% reduction must be expected on the maximum effect of the intensified enforcement in combination with information campaigns. In conclusion, it defines that the expected total reduction of fatalities from the intensified enforcement and information campaign projects will be ca.7.5% reduction of the otherwise expected fatalities in 2004.

Since the otherwise expected fatalities in 2004 are estimated in Chapter 1 to be 3,650, it amounts to almost 275 fatalities less in 2004 by the estimated effectiveness for the projects on enforcement and information campaigns. About half the effect is due to the higher seat belt use, while seat belts do not prevent damage-only accidents. The costs for damage-only accidents are 36% of the total costs for all accidents (see *Appendix 1*), where the expected reduction of the macro-economic loss due to road accidents by the enforcement and information campaign projects will be 82% of 7.5% or just more than 6% in 2004. Since in 2004 the macro-economic costs would otherwise be US\$1.18 billion, the saving is ca. US\$70 million per year, while the investments for the projects on information campaigns and intensified enforcement from the funding by TRP-II are together US\$4 million. However, the police has additionally to (re)allocate every year an increasing amount of their manpower and other resources to the enforcement project, while also the costs for SE-CNSV and for other projects (for example: for the accident registration and information system) are partially also necessary for the effect of the enforcement project.

Combining the expected 125 fatalities from the infrastructure project and the expected 275 fatalities from the enforcement and campaign projects, it means ca.400 saved fatalities that otherwise would have occurred in 2004 and ca.1.000 fatalities less in 2000 to 2004 than otherwise occur. This reduction effect is more than needed for a accumulative reduction of the fatality rate from 4% to 6% per year. Even if the projects would be half as effective as estimated, it still would be enough to realise that objective. The

formulated objective for the road safety component of TRP-II of changing the annual reduction of the fatality rate from 4% to 6% is thus very realistic, provided that the projects achieve at least half the effects that are estimated in a realistically conservative and research-based way. It are indeed the enforcement and infrastructural projects that have raised the most doubts about whether their implementations will achieve the achievable effects. As discussed in sections 2.7 and 2.8, each project implementation is still not fully guaranteed to be as effective as possible, unless additional implementation conditions are satisfied. The above effectiveness estimates, therefore, could turn out to be too high, although they can be hardly lower than half of the estimated levels. Nonetheless, even half the estimated effectiveness would imply that the macro-economic loss due to road accidents is reduced by 5.5% of US\$1.18 billion or by ca. US\$58.6 million in 2004. From 2000 to 2004, half the achievable effectiveness still means in average an economic loss saving of ca. US\$28 million per year, while the investment from the road safety component of TRP-II are US\$20 million or US\$4 million per year. Although the amount of additional investments from Peruvian sources, generated by the project implementations, is not known, it will be far less than US\$20 million per year. Thus, it almost certainly guarantees a much higher economic return on investment than the 12.5% that is estimated for annual road safety investments of US\$100 million in Chapter 1.

The above exposition also indicates that the new road safety projects of the SE-CNSV from 2003 onwards must concentrate on the further improvement of road safety by more infrastructural measures (especially in urban areas much can be achieved by modern traffic calming measures and crossing facilities for pedestrians, see: Elvik et al., 1997) and by further intensified police enforcement on the same topics in combination with public information campaigns. The latter can contribute to more than 50% less drink-driving when combined with a limit of 0.5 ‰ blood alcohol content and to more than 90% use of seat belts, because intensified enforcement and public information campaigns were able to achieve this in other countries (Koorstra 1993b). Moreover, combinations of modern infrastructure measures for speed reduction, police enforcement on over-speeding, and the lowering of speed limits (in shopping, school and residential living areas to 30 km/h, on other urban roads and minor rural roads to 50 km/h, on main rural roads to 80 km/h and on express-roads to 100 km/h) can also immensely contribute to the improvement of road safety in the future (Koorstra, 1992), also in Peru. The SE-CNSV is advised to investigate whether it is possible to initiate and finance further road safety projects on these topics. Their Five-Year Plans can thus be updated for the recommended policy documents on the long-term road safety strategy in Peru.

4. Main conclusions and recommendations

Main conclusions

- The planned project implementations for the road safety component of TRP-II will almost certainly improve the annual fatality rate reduction from the existing ca.4% to 6% or more per year in 2004 and thereafter.
- The economic return on the road safety investments will be much higher than 12.5%, even if their effectiveness would unexpectedly turn out to be only half the level of their conservative, research-based estimates of effectiveness.
- The potential effectiveness for road safety improvement in Peru is the highest for the infrastructural road safety project and the combined projects on intensified enforcement and public information campaigns.
- The effectiveness of the other 5 projects is hard to quantify, but these projects are prerequisites for any road safety strategy and contribute indirectly to more road safety.
- The positive feasibility of a substantial road safety improvement in Peru is endangered by the risk not to obtain a relatively higher political priority for road safety and by the apparent lack of professional expertise on road safety.

Main recommendations

- The SE-CNSV has to formulate Five-Year road safety plans, has to update these plans every two or three years, and has to obtain the approval of the Minister for Transport and CNSV on the planned long-term road safety strategy.
- The SE-CNSV and the World Bank should look for some twinning arrangement with a foreign road safety organisation of outstanding quality, in order to enhance in co-operation the expertise of the SE-CNSV and the effectiveness of their road safety projects.
- The SE-CNSV should organise seminars on technical and methodological topics for professionals in order to improve their road safety expertise.
- The SE-CNSV has to take great care in the actual and in-time introduction of systems (vehicle inspection, certification of driver schools and third party liability insurance) with planned retributions for the self-financing of the CNSV and its road safety projects after 2003.
- The SE-CNSV should organise periodically intensified enforcement on seat belt use, drinking and driving or over-speeding that are co-ordinated with information campaigns on these topics in the same period.
- The SE-CNSV should acquire experts for statistical analysis and research in order to evaluate the road safety development by analyses of the accident database, to be able to do or commission research for new road safety projects in the future and to write annual reports on the monitoring and evaluation of the progress on their projects.
- From 2003 onwards, the SE-CNSV should develop and implement
 - a) new projects for further intensified enforcement in combination with information campaigns on seat belt use, drinking and driving and over-speeding, and
 - b) new projects on infrastructural road safety improvements on rural roads and in cities, the latter especially also by modern traffic calming measures and crossing facilities for pedestrians.

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Appendix 1

Socio-economic loss in Peru due to accidents

Table 3 shows the estimated costs that are caused by traffic accidents in Peru, in 1997. Most cost types are empirically investigated, but the personal cost types per unit and the total subjective costs for suffering of serious injuries and for the value of life for fatalities are estimated by reasonably low proportions of total other costs. In the EU, the subjective costs are about 25% of the total costs (ETSC, 1997), thus the 12.5% for Peru is indeed a rather low estimate. Due to the absence of an obliged insurance for third party liability, also the personal cost are a fair estimate.

Type of costs	Social costs per unit (US\$)	Private costs per unit (US\$)	Total social costs (million US\$)	Total private costs (million US\$)	TOTAL (million US\$)
Vehicle	316	5,147	35	567	611
Reparation	-	5,147	-	567	576
Police/Administrative	316	-	35	-	35
Injury	703	4,823	20	133	153
Production loss	387	-	11	-	11
Medical	-	706	-	19	19
Police/Administrative	316	-	9	-	9
Personal	-	4,117	-	113	113
Fatality	38,074	9,224	151	-	151
Production loss	37,758	-	121	-	121
Medical	-	706	2	-	2
Police/Administrative	316	-	1	-	1
Personal	-	8,518	27	-	27
Subjective			124	-	124
Total			330	709	1,039

Table 3. *Estimated costs caused by accidents in Peru in 1997 (adapted from the proposal report of the consultant in the self-sustainable financing project, see section 2.2).*

The GNP of Peru in 1997 amounts to US\$65,320 million, thus the socio-economic loss of accidents are 1,6% of the Peruvian GNP. It relates to the 3,216 fatalities, about 27,500 injured and about 81,000 accidents that are registered in 1997. Related to the expected maximum number of fatalities of 3,840 in 2015, that would occur without an effectively enhanced road safety strategy (see Chapter 1), and assuming that the proportional increase of fatalities relate to the same proportional increase of the economic loss as fraction of the GNP in 2015, it implies that the economic loss would increase to about 1,9% of the GNP. Due to the foreseen implementation of an enhanced road safety strategy by the project for the road safety component of TRP-II, the number of fatalities will level off to an maximum of 3,500 in 2001 and is expected to decrease to 2,900 in 2015 (see Chapter 1). This means, under the same assumption, that the socio-economic loss will first level off to 1.7% of the GNP, and then reduce to 1.4% of the GNP in 2015. Over these 15 years, this means an accumulative reduction of 0.225% per year. Hence an annual investment of 0.2% of the GNP in the enhanced road safety strategy can have the 12.5% economic return rate that is required by the World Bank. Since much less is annually invested for

the enhanced road safety strategy, that is expected to achieve more reduction in fatalities than is assumed above (see Chapter 3), the economic return rate on the planned road safety investments is much higher than the required 12.5%.

Appendix 2 **Proposal for twinning arrangement with CNSV**

An effective road safety strategy for Peru requires that the SE-CNSV is equipped with professional expertise in each relevant discipline of road safety. As has been noticed several times in this review report, the SE-CNSV - and the more so other relevant governmental organisations - do not have the required expertise and know-how for planning and effectively implementing an enhanced road safety strategy. The professional and academic educational institutes in Peru cannot yet provide the expertise needed. Therefore, it is recommended that the professional expertise of the SE-CNSV is enhanced through a co-operative 'learning-by-doing' in a twinning arrangement with a qualified road safety organisation or consultant abroad for several coming years. The foreign organisation or consultant should have a multi-disciplinary scientific research and policy orientation. Organisations that cover the wide range of road safety disciplines can be found in North America (some contractors for TRB projects and Transport Canada), and in Finland (VTT), France (INRETS), Great-Britain (TRL), the Netherlands (SWOV), Norway (TØI) and in Sweden (VTI), while only a few qualified consultants in the USA or EU cover the whole range of disciplines for road safety. The needed improvement of disciplinary expertise in the SE-CNSV and the learning-by-doing assistance from the foreign twinning partner concern:

- statistical research and analysis methodologies of accident data
- modern engineering research and know-how on infrastructural road safety
- research and application know-how on road safety education
- behavioural research and scientific know-how on road behaviour and enforcement
- communication research and social psychology of information campaigns
- sociological and political research and scientific know-how on road safety policies.

The SE-CNSV must employ at least one, and preferably more, academic Peruvians in these fields, which employees then need to be assisted in their work by regular visits of the consultant or experts from the foreign partner that is selected for the twinning arrangement. Additionally, some Peruvian employees should work abroad for several months with the consultant or experts from the foreign twinning partner, either on an exchange basis or otherwise. The purpose of such a twinning arrangement is to establish a good working relationship for several years between the SE-CNSV and the selected foreign partner. The foreign partner has to take responsibility for the quality enhancement of the work by the Peruvian employees in the SE-CNSV, or preferably also in a broader way, by some teaching of more involved Peruvian professionals. The advantage of such a long-term twinning arrangement, that covers the whole range of road safety subjects, is also that the assisting foreign partner becomes acquainted with the Peruvian road safety circumstances, research needs and project difficulties. Such will be very beneficial for the quality and effectiveness of the road safety improvement in Peru and will avoid additional costs of efforts for assistance on different subjects by different partners.

The proposed twinning arrangement requires a contracted commitment of the foreign partner and the SE-CNSV. The annual costs for such a twinning arrangement will depend on the intensity of the co-operation, but without sufficient intensity the purpose will not be achieved. Therefore, a selected consultant or organisation should be invited to submit a proposal for a rather intensive co-operation in the twinning arrangement. The annual costs can be estimated, based on several visits of a foreign consultant or the experts for two weeks to Peru, and on visits for some months of Peruvians to the foreign partner in the USA or Europe. About US\$15,000 for travelling and hotel costs, and US\$60,000 for time spent by the foreign consultant or experts, as well as living costs of Peruvians abroad, are then a fair estimation of the budget needed. This is judged to be cost-effective, since other feasible ways of expertise enhancement will probably cost more, and achieve less.