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LA SEGURIDAD VIAL EN EL PERÚ

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Lima, septiembre de 2016

FACULTAD DE INGENIERÍA

Máster en Ingeniería Civil con Mención en Ingeniería Vial



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UNIVERSIDAD DE PIURA
FACULTAD DE INGENIERÍA



“La seguridad vial en el Perú”

Tesis para optar el grado de máster en Ingeniería Civil
con mención en Vial

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A mí querida esposa Abby.

A mis queridos hijos.

A mis queridos padres:

Germán y Olinda.

Prólogo

El Perú como país en pleno desarrollo necesita de una red vial nacional, departamental y local para mejorar su competitividad y economía. Múltiples estudios del *World Economic Fórum* recomiendan que debe invertirse en infraestructura, sobretodo vial.

Esta necesidad vital del país está siendo atendida por diversos gobiernos del Perú. Efectivamente desde hace varios años se viene invirtiendo en vías internacionales, como las interoceánicas; vías nacionales, tanto longitudinales como transversales; vías departamentales y locales. El Perú está por fin conectándose y esto genera mayores actividades económicas sobre todo para gente que siempre estuvo aislada: vivimos un momento importante.

Paralelamente a este *boom* de vialidad, vemos otro boom en la tasa de motorización de todas las ciudades del país, lo cual es perfectamente natural y es el resultado de un crecimiento en los ingresos de todos los peruanos. Además, considerando que los sistemas de transporte público cada vez son más pobres y caóticos, podría parecer lógico pensar que la mejor solución es comprar un vehículo para moverse.

A su vez vemos que los “nuevos carros” cada vez son más fáciles de conducir y sobre todo están diseñados para un mayor confort, que involucra “no sentir la velocidad a la que se está yendo”. También es un fenómeno recurrente que los nuevos compradores son gente joven, que tiene acceso a buenos salarios, y que suele tomar mucho riesgo al conducir. Varios investigadores han estudiado las causas de este comportamiento. Estos dos componentes terminan siendo ingredientes siempre presentes en las colisiones que generan penosas consecuencias.

En este trabajo se analiza el problema de seguridad vial en el Perú y se dibujan posibles programas que contribuirán a empezar a resolver un problema que debe pararse.

Resumen

Se hace un análisis actual del estado de la seguridad vial en el Perú, observando su desarrollo en el tiempo, y comparándola con aquella de Canadá. Se establecen patrones de comportamiento similar que permiten predecir el comportamiento de las fatalidades en nuestro país entre el 2020 al 2025.

Este trabajo presenta una propuesta de programas de seguridad vial que se pueden implementar a nivel local, sin necesidad de esperar a los grandes programas nacionales financiados por grandes organizaciones mundiales. En la experiencia de los autores, estos programas grandilocuentes pueden ser poco efectivos y de largo plazo de aplicación. El Perú no puede esperar en este tema, es necesario tomar acción inmediata.

Además de proponer estos programas se recomienda una serie de pasos fundamentales hacia el establecimiento de una solución más permanente que involucre a varios actores. En particular se sugiere encontrar a un “*champion*”, es decir, una figura que simbolice y actúe a favor de la seguridad vial en el Perú; esta figura, en la experiencia de los autores, suele ser muy atractiva y genera una corriente de opinión y acción favorable hacia la seguridad.

Finalmente se concluye que no todo intento ha sido vano, en efecto hay iniciativas que están funcionando bien en el Perú y esto puede ser muestra de que mejores resultados se pueden conseguir.

Este artículo de investigación fue aceptado y expuesto en acto público en el *22nd Canadian Multidisciplinary Road Safety Conference*, llevado a cabo en Banff, Alberta, entre el 10 y 13 de julio del 2012. También es bueno informar que fue expuesto el miércoles 15 de junio del 2016 ante el pleno de profesores de la facultad de ingeniería de la Universidad de Piura en el marco de nuestros seminarios de investigación.

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Introducción

El presente trabajo nace como respuesta a una situación alarmante que sucede en todo el territorio patrio, es decir el gran número de choques, heridos y fatalidades en las vías de todo el Perú. Es una situación recurrente en todas las ciudades y lamentablemente está creciendo día a día. Además se generan grandes pérdidas humanas y materiales que afectan a las partes involucradas.

En el pasado se han hecho algunos intentos por disminuir estas altas tasas de mortalidad con muy poco éxito. Es importante primero, tomar conciencia del grado de gravedad del problema, y luego tomar acciones que puedan consistir en implementar programas de seguridad vial mucho más efectivos.

En el Perú de hoy se habla solamente del problema de inseguridad personal que cada día vivimos, tanto los diarios como nuestra sociedad, reclaman incluso que el presidente de la república tome acciones para resolverlo. Sin embargo, paralelamente al fenómeno anterior olvidamos que hay otra inseguridad que está muy descuidada en el Perú y que es como algo crónico que se desarrolla cada día.

Según la experiencia de los autores muchas ciudades del Perú están pasando de ser ciudades pequeñas a medianas; es decir están experimentando un aumento progresivo del comercio, de los negocios y en general de todas las actividades económicas. Todo este desarrollo conlleva a su vez a una generación de riqueza y por tanto a un aumento del nivel de motorización de estas sociedades; dicho aumento, a su vez, está generando un incremento en las fatalidades que ocurren; todo este análisis se hace en este trabajo.

Desde nuestro punto de vista esta problemática necesita ser permanentemente monitoreada, estudiada, analizada y sobretodo resuelta. Queda claro que el factor humano es clave en todo este problema, pero también es claro que hacen falta medidas en varios campos para controlar el problema. Extensa experiencia canadiense nos puede ayudar a lograrlo.

En resumen, sostenemos que estamos cerca de un punto de inflexión en donde la ciudadanía en general, exigirá a las autoridades tomar medidas que hagan que el problema empiece a disminuir, pero desafortunadamente hasta que esto suceda perderemos todavía muchas vidas.

Este trabajo pretende ser un pequeño aporte a toda esta problemática.

Informe descriptivo

Desde hace unos años el Perú y sus ciudades vienen logrando desarrollos importantes en su infraestructura. Autoridades del nivel central, regional y local están invirtiendo cuantiosas sumas en la construcción de infraestructura vial. El país tiene una muy fuerte inversión en nuevas vías para vehículos motorizados, y paradójicamente ninguna para bicicletas o para peatones. Se están creando ciudades orientadas al carro y no a la persona.

Todo lo anteriormente descrito es importante, pues si se suma la preferencia del vehículo sobre la persona es claro que quien siempre saldrá perdiendo es el peruano de a pie. Este análisis, tan simplista, coincide con los estudios realizados por los autores: son los peatones los que están perdiendo la vida en las ciudades, la mayor cantidad de fatalidades están referidas a ellos.

Sabemos que las carreteras ayudan al desarrollo económico, social y cultural de las ciudades; por ellas transitan millones de personas en todo el país. Debido a que cada vez contamos con mejores vías y con mejores carros en los que muchas veces no “sentimos la velocidad” vemos que estas aumentan inexorablemente y no contamos con un sistema efectivo que ayude a controlarlas, tampoco existe un sistema que efectivamente castigue a los malos conductores.

Estamos viviendo una crisis de la persona que hace lo que quiere en un país con escaso control, tanto a nivel policial como judicial, pero también debemos decir que es un pecado por omisión que la sociedad en general está cometiendo. Pensamos que es necesario un esfuerzo de universidades, organizaciones privadas y gubernamentales y sobretodo medios de comunicación que generen una corriente de opinión que eduque, que hagan reaccionar a los tomadores de decisiones.

Este buen momento por el que pasamos continuará, y seguiremos construyendo más y mejores vías, con más carriles de circulación y más amplias; al mismo tiempo la gente – sobre todo la más joven- tendrá más fácil acceso a comprarse un carro y para ellos será muy difícil evitar no acelerar debido a varias razones y también debido a que su sistema homeostático le informa que está en la plenitud de sus capacidades y habilidades. Todos estos condimentos suelen estar presentes en muchos choques que generan fatalidades, heridos y pérdidas materiales.

Este trabajo analiza la situación peruana en relación con aquella vivida en Canadá y trata de sacar lecciones que podemos aplicar sin pasar por el drama de perder muchas vidas especialmente de gente joven. Tratamos de dar un aporte al análisis serio del problema y sobre todo de posibles soluciones que pensamos podemos implementar incluso a nivel personal.

Road Safety in Peru

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Abstract

Traffic safety is now a major public policy initiative in Peru, particularly for the financial agency behind many of the major new infrastructure projects. The authors have been active in making Peru's roads safer for upwards of 20 years. And more recently, Road Safety Audits for new projects. This paper will outline the status of road safety in Peru and identify its level of implementation relative to that of Canada. Identifying the relative status of road safety in Peru will assist those responsible for policy implementation to understand the elements of road safety policy and the types of projects that they should implement first to improve road safety in Peru.

Certain road safety benefits are already available Peru. For example an effective seat belt wearing program appears to be working quite well. There are other programs that need to be initiated such as road safety audits and pedestrian safety programs. Unique vehicles such as moto-taxis (three wheeled motorcycles used as taxis) and moto-linear (motorcycles used as taxis) present unique problems.

Peru, at the municipal level, has started some fairly unique road engineering changes such as "speed humps" just prior to stop signs and pedestrian crossings to make vehicles slow down and improve pedestrian safety.

INTRODUCTION

Globally, road safety has gathered enthusiasm from senior officials in the last forty years. It is now a major United Nations initiative known as the Decade of Road Safety 2011 to 2020.

There are some road safety programs that are operating in Peru. This paper will estimate the current state of road safety in Peru and outline a general program to make it more effective.

The relative comparisons will be with the Canadian road safety experience. Canada and Peru have roughly the same population at 34 million (2009) and 29.6 million (2009) respectively. They are also countries of two lane rural highways. There the similarities end. Canada's road safety is roughly 10th in the world (0.00007 deaths/ capita) while Peru is 66th (0.000215 deaths per capita, World Health Organization (WHO) [1]) or about three times the Canadian rate. Another big difference is in Canada, about 13 percent of the fatalities are pedestrians while in Peru it is 78 percent. Vehicle ownership and use is also very different. In Canada, the vehicle ownership is about 0.68 vehicles per capita while in Peru, the rate is 0.058. But many of the vehicles in Peru are used for some form of public transport.

1. Canada-Peru road safety comparison

The graphical comparison of road safety data between Canada and Peru is given in Figure 1.

There is a fairly stable relationship between; the annual deaths per capita, annual deaths per vehicle and vehicles per capita for most countries. Vehicles per capita estimate a country's level of Motorization. Deaths per capita measure Personal Hazard and deaths per vehicle is a measure of the Traffic Hazard. The diagram to the right, deaths/vehicle vs. vehicle/population is Smeed's law [2].

A three dimension curve may be drawn as a single curve. The curve starts with a high Traffic Hazard at low Motorization and Personal Hazard, increases to a maximum Personal Hazard and then starts to diminish. In most developed (motorized) countries the peak deaths per capita was reached in the early 1970's, in Canada, the peak was 0.00029 deaths per capita.

This is the relationship against which Peru's aggregate road safety data is compared to determine Peru's status relative to Canada.

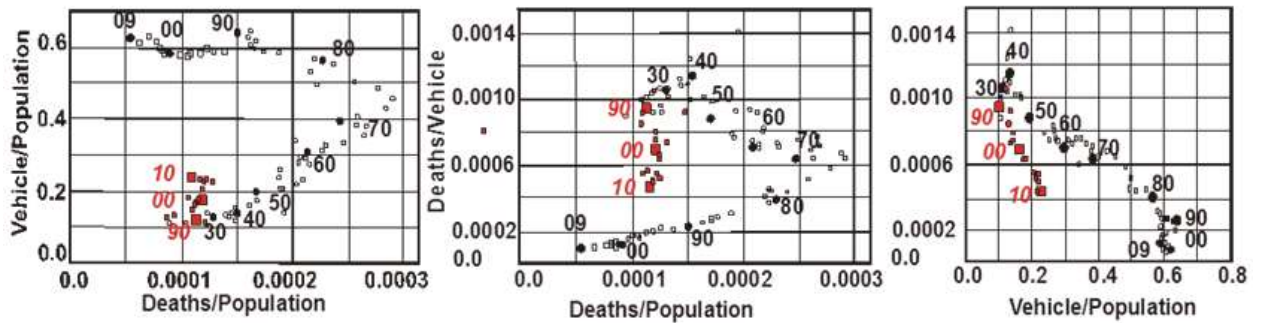


Figure 1 – Traffic road safety measures Canada and Peru

The number of vehicles is used as a measure of exposure. It has been discussed by others that the better measure would be vehicle kilometers but it is more difficult to estimate. The Peruvian data has an adjustment to account for the differing use of vehicles between Canada and Peru. There are many more taxis and small transit (combis) vans in Peru than in Canada. As a rough estimate the authors have used a factor of four (4) to adjust the number of vehicles to reflect the vastly different number of taxis.

The Canadian data is a continuation of trends observed since the 1930's, see Navin et al [3]. The only surprise has been the stabilization of the number of vehicles per population or the vehicle saturation rate starting in about 1990. The vehicle saturation rate seems to have settled to about 0.68 per capita.

Figure 1 illustrates that Peru has different safety characteristics from those in Canada. The road safety experience in Peru over the last 20 years is most similar to that observed in Canada during the 1940's to the 1960's. That implies that the expected number of road deaths in Peru will increase.

The deaths by year for Canada (1949 to 2009) and Peru (1990 to 2009) are given in Figure 2. The Canadian data starts in 1949 because prior analysis had shown that accounting for the road deaths during WWII and immediately afterwards was difficult. If the Canadian experience is treated as a learning process then it produces the curve noted as "learning", see Navin et al [4] for further explanation. The curve noted as "Safety Pgm" is a regression equation that accounted for most of the observed variation in annual Canadian road deaths until 1990. The regression equation was not applied beyond that year.

The Peruvian data comes from two sources and validated by a third. The road deaths between 1990 and 2000 were reported in a SWOV (The Netherlands) study [5] for the World Bank. The data from 2000 to 2009 was reported by WHO [1]. A study by the Transportation Research Laboratory (TRL) [6] of the UK for the World Bank confirmed the approximate number of road collisions per year in

1996. The TRL study also gave an estimated error range of the reported values of about 50 percent. The error range is shown by the vertical lines on the Peruvian data.

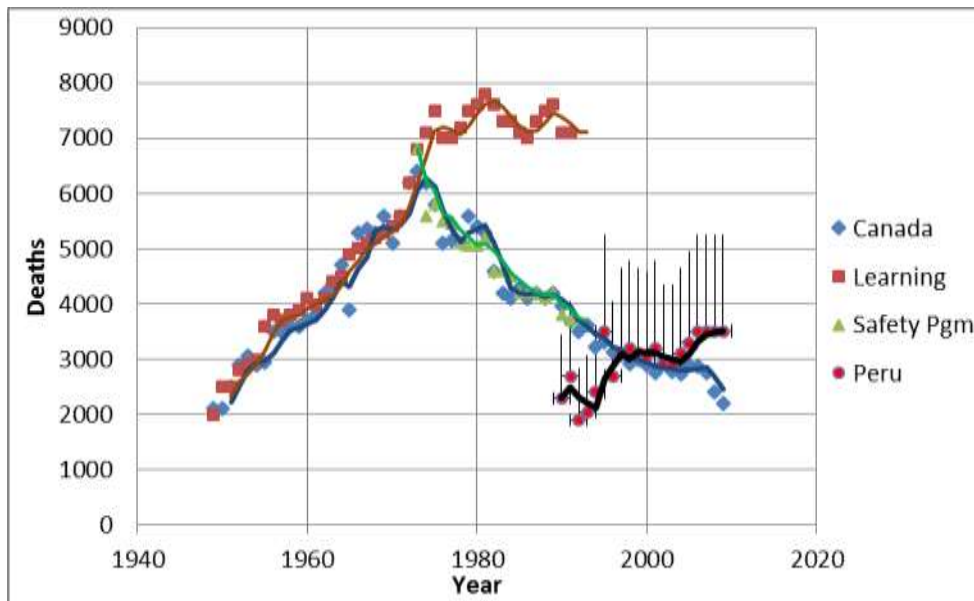


Figure 2 Deaths by year for Canada and Peru

The following analysis assumes that national annual deaths patterns are similar. In this case, it is assumed that Peru will follow the Canadian pattern.

The road deaths in Peru are raising while those in Canada are diminishing, therefore, the Peru experience is similar to that in Canada some time prior to the early 1970's. If Peru follows the Canadian pattern then the peak deaths should occur in about 10 to 15 years, or roughly 2020 to 2025. The peak number of deaths should be less than Canada and range from 4500 to 6000. This assumes that Peru starts to implement a major and sustained road safety program some time in 2012 to 2015.

2. Status of road safety programs in Canada

The influence of Canadian road safety programs is illustrated in Figure 2. The response to the road safety crisis of the 1960's was a significant commitment by all levels of government in Canada to improve road safety. This included improved motor vehicle standards, highway design based on the forgiving highway and many road user programs. University based investigation and research programs were also started in the early 1970's. All these programs had an impact on the road fatalities as shown in Figure 2. The experience was repeated by most developed countries. One of the most effective road safety programs in Canada was the introduction and enforcement of seat belt laws.

The proponents for each program champion their causes but it is usually difficult to get precise benefits for any individual program since so many changes have occurred simultaneously.

The simplest classification of road safety programs is by the Haddon Matrix as shown in Table 1. The examples are a few of the early programs in Canada.

	Vehicle	Road user	Road environment
Pre-crash	Vehicle Standards Seat Belts use	Drunk Driving Safe School Routes	Forgiving Highways Road safety audits
Crash	Crush, Air Bags	Minimum injury	Forgiving
Post-crash	Fire suppression	Medical help	Minimize impact

Table 1. Haddon Matrix

3. Road safety in Peru

There is an embryonic road safety program in Peru that was initiated in the early 1990's by the World Bank. There was an early 2000 study by Jacobs [6] of TRL that gave a status report. A second study was carried out by Koorstoon of SWOV [5] in 2000 for the World Bank that reviewed road safety in Peru and made recommendations for improvements. The UN General Assembly in 2004 tasked the World Health Organization (WHO) with the responsibility of improving road safety around the world. A recent WHO report in 2007 [1] estimated the error adjusted annual deaths of 6000 from a police reported value of 3510, that is about 70 percent under reporting.

The following is taken from the 2007 WHO [1] report:

Peru has a nationally funded road safety agency known as the National Road Safety Council of Peru (Consejo Nacional de Seguridad Vial, CNSV). There is a national road safety strategy that has measurable targets but there is no funding to achieve these targets.

There are nationally set speed limits that cannot be adjusted lower by local authorities. The maximum urban speed limit is 60 km/h and the usual is 50km/h. Enforcement of speed limits is poor.

There are national drunk-driving laws that are poorly enforced. The BAC limit is 0.5g/dl and there are random breath testing and/or police checks. The police reported road deaths involving alcohol is 11 percent. This is much lower than the

roughly 40 percent in Canada.

There is a national motorcycle helmet law that mandates all riders must wear a helmet. The law is reported by WHO [1] to be poorly enforced. Casual observations by the authors have found that compliance with the law is substantial in the coastal cities but less so in the mountains and jungle areas of the country. Helmet use by the pillion rider is considerably less than the operator.

A success story from Peru is the national seat-belt law. The law applies to all occupants and the reported wearing rate is 85 percent in the front and 25 percent in the rear. This law is well enforced. The authors' casual observations support these findings.

	Vehicle	Road user	Road environment
Pre-crash	Seat Belts law EXCELLENT	Drunk Driving, Helmet law, Child restraint POOR	Forgiving Highways Road safety audits POOR
Crash	Poor to Fair	Unknown	POOR
Post-crash	Unknown	Medical POOR	Unknown

Table 2. Peru's Road Safety Program Performance in 2010

The World Bank and the Andean Bank have been active in promoting road safety in Peru at the national level. Other organizations such as the Center for Disease Control (USA) and IRAP (UK) have been active in helping set up road safety programs in Peru.

In November 2011 there was a major road safety declaration by the mayors of 80 Peruvian cities and municipalities. The main focus of the adopted policies was physical improvements to five locations within the local jurisdiction, reduced speed around schools and involvement of local public transport and educational institutions in road safety programs. They also adopted the target of reducing road deaths by 10 percent within their jurisdictions. This is an interesting development and indicates that there is a very urgent need to improve road safety. This is a "bottom-up" initiative.

Given this cursory review, road safety is at a very early stage of development in Peru. The majority of successful programs have been road improvements at the local level. The dominance of pedestrian deaths suggests that pedestrian safety programs should have top priority.

4. Examples of road safety in Peru

The following are a few examples of road safety on the local roads of Peru. These examples are selected because the majority of road deaths in Peru are pedestrian.

Figure 3 illustrates a typical older mixed residential commercial street in Chiclayo, a small city on the coastal plain about 650km north of Lima. The main industries are agriculture and fishing.

The vehicles parked to the left include a newer midsize automobile and a covered three wheeled device with a motorcycle engine known locally as a mototaxi. There is also a motorcycle, a bicycle (with a passenger), and a wheel barrow.

The pavement has yellow edge markings on the curb of the sidewalk, the street is lighted and there are arrows indicating the direction of traffic. Notice that there is an illegal curb ramp that will interrupt any drainage. There is a dashed lane line that becomes a solid white line towards the intersection. This follows modern practice.

There is also painted speed bump prior to the intersection. The authors were told that the purpose of the speed bump was to slow vehicle going through the intersection for the protection of pedestrians. Observations by the authors confirm their effectiveness in slowing vehicles at the intersection.

The pedestrians use both the sidewalk and the street. It is the authors' experience that the vehicle speed on these streets is low.

The four people on a motorcycle illustrated in Figure 4 are not usually seen in Peru. The majority of motorcycle drivers observed in November 2011 in coastal cities were wearing helmets. Motorcycles used in this fashion are known as motolinear and are the least expensive form of public transport. The cost to ride one in the city of Piura is about 1 sol in comparison of 2 to 3 sol for a mototaxi and 4 sol for a yellow Tico taxi (car to the left in the photo of Figure 4). There are also larger vehicles such as Toyota etc. that are used for taxis. The cost for these is roughly double the cost of a Tico. The cost to purchase the appropriate motorcycle for a motolinear is about \$1000 US and a Daewoo Tico is about \$2000 to \$3000 US. The wage for the average worker in a small coastal city is about 40 sol (\$16.00 US) per day.



Figure 3, Intersection in Chiclayo, car, mototaxi, motorcycle, bicycle, wheelbarrow and pedestrians. Speed bump prior to intersection and illegal ramp.

The pedestrians straight ahead in the photo are using a marked crosswalk. Also note that there is a ramp where the two students are, as well as an illegal ramp at the corner. The taxi is a Daewoo Tico. A casual inspection by the authors indicates that Daewoo Ticos would probably not pass any modern North American vehicle standards.



Figure 4, Mototaxi as a “school bus”, Chiclayo, note illegal ramp at curb.

The next photograph, Figure 5 illustrates the incorrect use of a horizontal signal light sequence. The recommended sequence from the Manual of Uniform Traffic Control Devices [7] for the sequence from left to right is red, amber, and green. These traffic signals have green, amber and red. These signals may present a problem to drivers colour blind in the red-green spectrum. In this photograph the motorcycle drivers wear helmets; the passenger does not. The motorcycle with the passenger is probably a motolinear. Also in Figure 5 is a typical roadside monument found in Peru outside the more affluent areas of Lima. The monument is at the base of the pole at the right of the intersection.

Figure 6 shows a signed speed bump on a minor arterial road in advance of an intersection.

The illustrations used for road safety programs demonstrate that there is a bottom up type of road safety beginning to emerge in Peru at the municipal level. The target is to reduce pedestrian collisions by controlling vehicle speed in advance of pedestrian crossing locations. There are also programs to implement modern traffic engineering practices such as pavement markings, warning signs, and street lighting.



**Figure 5, Horizontal Traffic signal wrong,
Note monument at pole to right and motolinear.**



Figure 6, A Signed speed bump before an Intersection, Lima Miraflores.

5. Previously suggested road safety program

There was a major study by SWOV of The Netherlands [5] in 2000 that evaluated a number of recommendations for road safety improvements in Peru.

- 1) The management, organization and positioning of the CNSV.
- 2) Study the self-financing of further road safety activities.
- 3) Registration of accidents; establish a database system for statistical analyses.
- 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.
- 8) Substantial improvement of infrastructure road safety by treatment of black spots or dangerous stretches on the national highways.

These studies all deal with the delivery of road safety programs or the means to achieve road safety. The programs assume that there is an acceptance of the social need and the political will to successfully implement the programs, see Figure 7. The program was not implemented, therefore, the assumption about the political will is probably not correct. There is also the availability of funds..

A very recent proposal by the Andean Development Bank (CAF) to introduce road safety audits and other safety measures to Latin America was given in a

statement by its president in May 2011. The statement is:

"While in CAF we have been working since our inception on infrastructure issues, focusing on the well-being of citizens and respect for the environment, we are pleased to join this UN initiative because road safety is one of the main problems of the sector. Specifically, to address the deficiencies detected in obtaining solid, reliable and up-to-date information on the transport sector and mobility in the region, CAF has been backing the Urban Mobility Observatory (OMU) for Latin America and the Caribbean. This initiative began with an analysis of 15 metropolitan areas in nine countries in the region. We believe it is important for our partner countries to have the necessary infrastructure and mechanisms to guarantee safer road conditions," said CAF President & CEO Enrique García. (Caracas May 11, 2011)

The United Nations resolution encourages all governments to propose realistic targets for reducing traffic deaths and injuries and to take concrete actions to achieve them. The 2011-2020 Decade of Action for Road Safety suggests the following time table for member states.

2011 to 2016	Road Safety Capacity Building
2017 to 2020	Road Safety Capacity Strengthening

All this activity is stimulating interest in road safety in Peru but has yet to be translated into programs that are funded.

6.0 Developing a successful road safety program

Navin and Ho have studied the necessary conditions for a successful project. The major elements that must be satisfied for a project to succeed are shown in Figure 7. Road safety programs usually do not impact the environment.

The demand side are the "ends" of road safety programs. In the case of Peru the demand for improved road safety is a problem that must be solved within Peru by the proponents for road safety. Currently, the social need and political will do not seem to be adequately accepted by either the national authorities or road users. These factors could probably be improved with a national champion of road safety.

The supply deals with the "means" or how to provide road safety. This is a well-developed area usually called capacity building and strengthening which is

encouraged and funded by organizations such as the World Bank and other major international aid agencies.

Peru has the National Road Safety Council of Peru that has the national authority and responsibility for road safety.

The requirements for success may be applied to each part of the Haddon matrix. The authors experience with the Road Improvement Program by the Insurance Corporation of British Columbia suggests that any Peruvian program should start with relatively small projects that have a high probability of success. The smaller projects allow the participants to get to know the system and how to cooperate to achieve success. One of the measures of success is to satisfy the local expectations for safer roads.

6.1 Road Safety Implementation Strategy

Using the successful elements in Figure 7, road safety improvement should focus on two strategies:

- Zero growth in Fatalities by a Target Year (e.g. 2020)
- Capacity building and strengthening for self sufficiency of Peruvian technical and management skills by a Target Year (e.g. 2015).

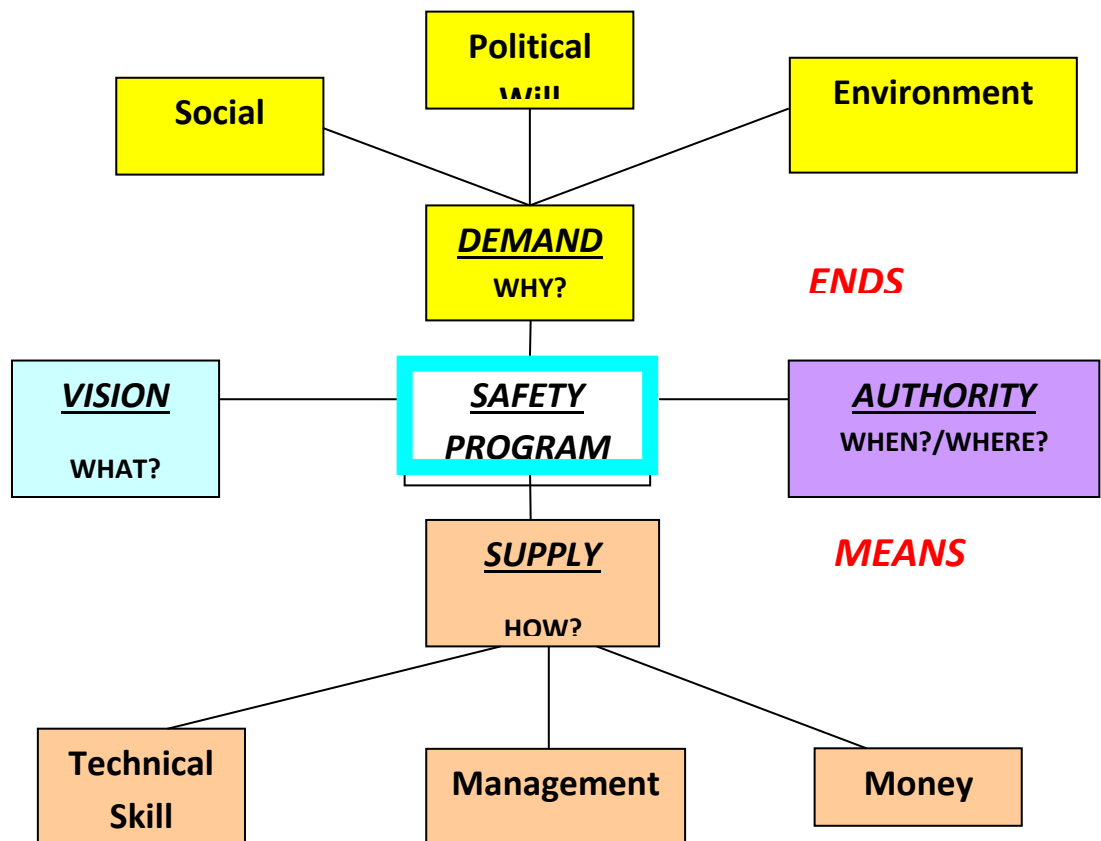


Figure 7. Conditions for a successful road safety program

Zero Growth in Fatality by 2020. This strategy involves the identification and management of three of the four successful project factors: authority, vision, and demand in Figure 7. The proponents for road safety need to find or create national, regional, and local champions to promote road safety to government agencies and the public. This will strengthen the social need and political will for road safety. Second, Government should reconfirm the National Safety Council of Peru authority, mandate, and funding. The champions and the Council identify the demands, communicate the vision to the public, and have the authority and funding to act. Third, there should be, at the start, a few easily implemented road safety improvement programs uniformly and consistently across all regions of Peru. The success of the seat belt program is an example of such a program.

Capacity Building and Strengthening by 2015. This strategy involves the capacity building and strengthening for managerial and technical skills in road safety. The goal is for Peru to be self-sufficient in the supply of these skills by the Target Year. Academic instructions such as the University of Piura can be useful in achieving these objectives.

6.2. Road Safety Program Framework

The road safety program framework should focus on the following:

- Road Users: drivers, pedestrians, and cyclists;
- Roads: safe design, geometry, high crash locations; and
- Vehicles: road worthiness, standards.

Peru is a vast country with different terrains and traffic conditions. One of the first tasks is to gather sufficient data and information on crashes to formulate reasonable programs to achieve the goal of Zero Growth in Traffic Fatalities. The emphasis should be on adequate data to develop a program that is achievable. The data collection should not be viewed as an end in itself.

While the data collection plans are being developed, an initial road safety framework should be established based on Short Term Countermeasures. Simultaneously, a long term road safety countermeasure program can be established.

Short Term Countermeasures. A road safety team of experts can meet with Peruvian road and enforcement agencies to identify high crash locations and locations where pedestrians are most vulnerable. Short term countermeasures could be designed and deployed. These countermeasures should be low cost and quickly implementable for local authorities. Current road safety countermeasures, such as speed humps at intersections can be considered. These will demonstrate to the public that road safety is a serious business and that there is a national and local commitment to make roads safer. By keeping the projects fairly simple, it is also possible to work through jurisdictional issues and other managerial problems at a scale that is easily managed.

Long Term Countermeasure Framework. With the support of improved data and operational experience, a long term countermeasure framework can be established. The framework could include:

- Public road safety campaigns aimed at drivers and pedestrians;
- Education of drivers;
- Improved vehicle safety requiring inspections;
- Improved road geometry, signing and speed control;
- Established evaluation guidelines so countermeasure and program effectiveness can be measured;
- Establish a road safety “culture” in road agencies, highway design and maintenance professionals, government departments, traffic management

agencies, road enforcement agencies. This is the 3'E doctrine; Education, Engineering and Enforcement; and

- On-going review and update of road safety improvement programs.

The strategy recommended is to act immediately while the Road Safety Champion and the National Safety Council are developing the program. The early winners, that is, successful projects will also encourage agencies' buying into the program.

CONCLUSIONS

Annual Peruvian road deaths are increasing. A comparison with the Canadian experience indicates that Peru peak deaths should occur in 10 to 15 years. The road safety outcome for Peru does not have to follow this path.

To reduce the number of road deaths in Peru requires some fundamental changes in the road safety system. The first step must be the recognition that road safety in Peru is a problem and that there are solutions. The second step is to have a national champion for road safety. The third step is to initiate a Peruvian based road safety capacity building and strengthening program.

The first step is fairly easily recognized by the available statistics. While the statistics have a very large marginal error, somewhere in the order of 50 to 70 percent estimated under reporting, the message is loud and clear; Peru has dangerous roads. Between 3500 and 6000 people are killed annually on the roads. The number will increase to 4500 or 7000 by the year 2020 if nothing is done to stem the tide. At the municipal level this step has been taken by the announcement by the mayors in November 2011. There needs to be a similar step taken at the national level.

The second step is to find a champion for road safety at the national level. The champion should have national recognition and an efficient means of communication across the nation. One of the usual champions in the early days of road safety in Canada was the Canadian Automobile Association and their provincial counterparts. In Peru, since about 80 to 90 percent of the population is Catholic, the Church through the Cardinal in Lima, could be the road safety champion. The role of the champion is to help define the problem and to help marshal the national and local resources to solve the road safety problem.

The third step is capacity building and strengthening. The world's knowledge of what has to be done to improve road safety has increased greatly since the early 1970's. Road safety capacity building has been carried out by the developed countries through agencies such as the World Bank, WHO, CDC and charities such as iRAP, International Road Federation for many years. To initiate the capacity building, a university such as the University of Piura can take on the task in their Masters of Infrastructure Program.

In Peru there are existing road safety programs that are working quite well. The most obvious to the visitor is the national seat belt program. Almost all taxi drivers and front seat passengers use their seat belts. There are other programs that seem to have grass roots support. One such problem is vehicle speed at pedestrian crossings on arterial roads. The informal program observed by the authors is to use speed bumps prior to what are probably problem intersections and pedestrian crossings. Road safety capacity building would add to the repertoire of suitable solutions.

Peru needs to organize its road safety programs by adopting a few achievable goals such as Zero Growth in road deaths by 2020, for example. Peru then needs to initiate short term countermeasures that are relatively small projects and programs that are easily achieved to sort out jurisdictional and management difficulties.

Road safety has arrived in Peru, it is now simply a matter of time and resources to get it implemented.

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