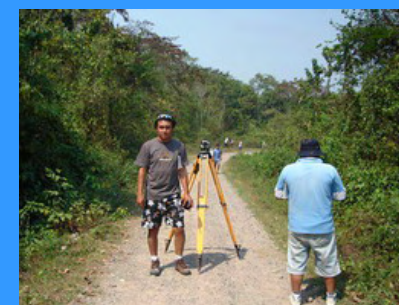




## 206 : Road Notes PERU

An introduction to transport and roads in Peru



**English** language version.

Includes:

- 2 video clips
- 7 topics
- 7 organisations

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**SCHORRELL ANALYSIS**

**ITC Capac Nan**

**Road Notes Series**

**206 - Road Notes PERU**

**Version 1.9**

**July 2006**

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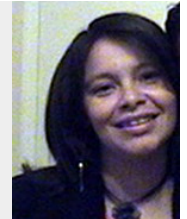
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camineros rurales  
camineros  
Transporte Investigacion  
IFRTD-AL

Organisations in Peru

Camineros Rurales  
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Schorrell Analysis (Germany)

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## **1 INTRODUCTION**

**1.1 Cover Notes**

**1.2 Introduction**



motocarro, driver and passenger (DVA 2006)

### 1.1 Cover Notes

#### Notes

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6. Please email any comments, suggestions or corrections for this review copy to Gregorio Villacorta Alegria [goyotech@yahoo.es](mailto:goyotech@yahoo.es) or Robert Bartlett ([roadnotes@freenet.de](mailto:roadnotes@freenet.de))

#### Version 1.5 18 March 2006

- added more topics, updated photos and layouts

#### Version 1.4 March 2006

- added topic on asphaltic road pavements
- added 2 more organisations

#### Version 1.3 February 2006

- added notes to 3.1 geography
- minor changes to 3.2 indicators
- added 3.3 departments
- section 4 - added notes in ICG
- updated structure, updated table of contents

#### List of changes

##### Version 1.9 / 19.07.2006

- minor changes

##### Version 1.8 23. April 2006

- added acknowledgements, general corrections and editing changes

##### Version 1.7 02. April 2006

- one topic removed, new topic added
- minor changes to text and photos



## 1.2 Introduction



Footbridge over river GVA (2005)

### Purpose of the document on Peru

Highway and traffic engineering are practiced in every country in the world. The contradiction is that all countries have many things in common - even in highway terms -and yet each country also has its own peculiarities and innovative ideas.

For example: Nepal has not only mountains but also, like Germany, low-lying agricultural plains, Peru not only has areas of dense forest but also has snow-covered mountains like Switzerland. All countries have rural areas and busy city shopping streets. And all countries have competent engineers who are interested in sharing their knowledge with others.

Yet countries also have their own peculiarities. In Peru, motocarros are an important form of public transport, as boda-bodas are in some towns in Kenya. Nepal has considerable skills in the design of suspended walkways, Switzerland and Germany in the design of mixed-use streets and "shared space".

The purpose of this document is to give highway engineers from other countries a first introduction to Peru, to describe some of the peculiarities and innovations which Peruvian engineers work with and have developed, and to present organisations and individuals who work in the highway sector who would be willing to exchange ideas with engineers from other countries.

The hope is that this will eventually allow other engineers to benefit from the experience already gained by Peruvian engineers, and so help them find quicker solutions to their own problems.

[Robert Bartlett / Gregorio V. Alegria March 2006](#)

## **2 BACKGROUND NOTES**

**2.1 Geography**

**2.2 Departments**

**2.3 Indicators**



Basic rural road, San Martin Department (GVA 2005)

## 2.1 Geography



### Geography

**Terrain:** Western coastal plains, central highlands (**Sierra**) with the Andean mountains, and the Amazonian jungle (**Selva**) in the East.

**Climate:** The coast presents, in general, a tempered climate, warm in the north, a little colder to the center and south. The rains are almost nonexistent to exception of the north area where strong rains are presented in the months of summer. In some areas of the central and south coast, as the cities of Lima and Arequipa, in the months of winter is common the presence of very delicate rains called *garúa* or *chachani*.

The Andean area or mountain has in general a cold and dry climate, in the north area the rains are more intense.

The Amazon area or jungle has a tropical, hot and humid climate, with presence of torrential rains that are increased in the months of summer.

According to Köppen's international climate classification which establishes 11 main types of climates, Peru possesses 8. The country has one of the most diverse range of climates in the world.

**Administrative divisions:** 25 departments subdivided into provinces and districts.

**Currency.** The official currency in Peru is the Nuevo Sol (S/.), which is divided into 100 centimos.



## 2.3 Departments



Soucre: Peru official promotion site (<http://www.peru.info>)

### Department of San Martin

**The Department of San Martin** is located in North-eastern Peru in the area of the Peruvian Amazon, an extensive area bathed by numerous rivers that form the Huallaga Basin. It is composed of 77 municipalities and 10 Provinces each with its own customs within the general amazonian culture. The Department of San Martin has an approximate total population of 450000.

**Climate:** Warm and humid in average, with a maximum of 38° C. The rainy season is from, Janury to March, and the summer months from June to December.

**Juanjui:** the **capital** of the province, 136 km from the city of Tarapoto. Valley of the Abiseo River that guards the ruins of the Gran Pajaten - a pre-Inca City Fortress not yet available for tourism.

**Tarapoto:** commercial capital of the department located in the valley formed by the Cumbaza and Shilcayo rivers. Its climate in the dry season is warm and dry wtih a maximum temperature of 34°C, in the rainy season it is cooler and more humid allowing a great variety of flora and fauna.

Link: <http://www.geocities.com/TheTropics/2087/ingles.html>

## 2.3 Indicators

| INDICATOR                   | PERU         | GERMANY      |
|-----------------------------|--------------|--------------|
| <b>social indicators</b>    |              |              |
| surface area (sq.km.)       | 1.28 million | 0.36 million |
| population                  | 22.0 million |              |
| forests                     | --           |              |
| max. height above sea level | 6678 m       |              |
| min. height above sea level |              |              |
| max. temperature            | +35 °C       |              |
| min. temperature            | -4 °C        |              |
| <b>transport indicators</b> |              |              |
| total road network (km)     | 78,554       |              |
| paved roads (%)             | 13.4%        |              |
| total railway network (km)  | 2,027.4      |              |
| <b>social indicators</b>    |              |              |
| life expectancy             | --           | 78.3         |
| infant mortality rate       | 26.0         | 4.2          |
| GNI per capita (USD)        | 2,360.0      | 30,120.0     |
| % population in rural areas | 27.7%        | --           |
| national poverty rate       | 24,4%        | --           |
|                             | -            |              |
|                             | -            |              |
|                             | -            |              |

## Some additional statistics

- 50% of the rural population live in conditions of extreme poverty. The conditions and extent of the rural road network often contribute to this.

### **3 SUMMARY TABLES**

**3.1 Road network - statistics**

**3.2 Road network by department**



Rio Huallaga (DVA 2006)

## 3.1 Peru road network - statistics

| TYPE OF ROAD AND<br>ROAD SURFACE | LENGTH OF THE ROAD NETWORK (km) |               |               |               |               |               |
|----------------------------------|---------------------------------|---------------|---------------|---------------|---------------|---------------|
|                                  | 1999                            | 2000          | 2001          | 2002          | 2003          | 2004          |
| <b>TOTAL</b>                     | <b>78,127</b>                   | <b>78,213</b> | <b>78,252</b> | <b>78,319</b> | <b>78,397</b> | <b>78,554</b> |
| NATIONAL                         | 16,967                          | 17,053        | 17,091        | 17,158        | 16,857        | 17,095        |
| REGIONAL<br>(departmental)       | 14,251                          | 14,251        | 14,251        | 14,251        | 14,251        | 14,596        |
| LOCAL                            | 46,909                          | 46,909        | 46,909        | 46,910        | 47,289        | 46,864        |
| <b>ASPHALTED</b>                 | <b>10,189</b>                   | <b>10,574</b> | <b>10,745</b> | <b>11,044</b> | <b>10,038</b> | <b>11,074</b> |
| NATIONAL                         | 8,141                           | 8,523         | 8,693         | 8,989         | 7,990         | 8,857         |
| REGIONAL<br>(departmental)       | 1,106                           | 1,106         | 1,105         | 1,105         | 1,106         | 1,240         |
| LOCAL                            | 942                             | 945           | 947           | 950           | 942           | 976           |
| <b>PAVED</b>                     | <b>18,533</b>                   | <b>18,719</b> | <b>18,802</b> | <b>18,947</b> | <b>18,616</b> | <b>17,097</b> |
| NATIONAL                         | 6,640                           | 6,762         | 6,816         | 6,911         | 6,642         | 7,184         |
| REGIONAL<br>(departmental)       | 6,015                           | 6,037         | 6,047         | 6,064         | 6,015         | 5,137         |
| LOCAL                            | 5,878                           | 5,921         | 5,940         | 5,973         | 5,959         | 4,776         |
| <b>SIN AFIRMAR</b>               | <b>13,809</b>                   | <b>13,373</b> | <b>13,179</b> | <b>12,839</b> | <b>13,945</b> | <b>14,028</b> |
| NATIONAL                         | 1,860                           | 1,502         | 1,342         | 1,063         | 1,899         | 912           |
| REGIONAL<br>(departmental)       | 4,291                           | 4,276         | 4,269         | 4,257         | 4,291         | 5,060         |
| LOCAL                            | 7,658                           | 7,596         | 7,568         | 7,519         | 7,755         | 8,055         |
| <b>TROCHA</b>                    | <b>35,596</b>                   | <b>35,548</b> | <b>35,526</b> | <b>35,488</b> | <b>35,797</b> | <b>36,356</b> |
| NATIONAL                         | 326                             | 267           | 241           | 195           | 326           | 141           |
| REGIONAL<br>(departmental)       | 2,839                           | 2,833         | 2,830         | 2,826         | 2,839         | 3,159         |
| LOCAL                            | 32,431                          | 32,448        | 32,455        | 32,468        | 32,632        | 33,056        |

**Notes:** **national network**, formed by the main longitudinal routes (Panamericana, Carretera de la Sierra o Andina and Marginal de la Selva) and the transverse routes, **departmental network**, formed by the roads which constitute the roads within a department, and which link the - main provincial capitals in the department. **local network**, also known as the rural road network, formed by roads which link towns and villages.

**Source:** Dirección General de Caminos y Ferrocarriles.

**Source:**

Dirección General de Caminos y Ferrocarriles



## Road Notes - PERU

## 206: Road Notes, Peru

### 3.5 Road network by Department

Base data : Dirección General de Caminos y Ferrocarriles and statoids.com

| DEPARTMENT    | TOTAL LENGTH     | ROAD NETWORK (Kms.) |                  |                  |            |            | DENSITY     |         |          |
|---------------|------------------|---------------------|------------------|------------------|------------|------------|-------------|---------|----------|
|               |                  | NATIONAL            | DEPARTAMENTAL    | LOCAL            | POPULATION | AREA       | km/1000 pop | km/area | pop/area |
| <b>Total</b>  | <b>78,554.04</b> | <b>17,094.65</b>    | <b>14,595.75</b> | <b>46,863.64</b> |            |            |             |         |          |
| Amazonas      | 1,651.64         | 651.66              | 391.12           | 608.86           | 336,665    | 39,249     | 4.9         | 42.1    | 8.6      |
| Ancash        | 5,066.96         | 1,320.59            | 1,133.35         | 2,613.02         | 955,023    | 35,826     | 5.3         | 141.4   | 26.7     |
| Apurímac      | 2,923.15         | 559.15              | 544.60           | 1,819.40         | 381,997    | 20,896     | 7.7         | 139.9   | 18.3     |
| Arequipa      | 6,160.46         | 1,028.63            | 1,390.40         | 3,741.43         | 916,806    | 63,334     | 6.7         | 97.3    | 14.5     |
| Ayacucho      | 4,437.93         | 598.90              | 935.02           | 2,904.01         | 492,057    | 43,815     | 9.0         | 101.3   | 11.2     |
| Cajamarca     | 5,602.18         | 1,099.90            | 761.44           | 3,740.84         | 1,259,808  | 33,248     | 4.4         | 168.5   | 37.9     |
| Callao        |                  |                     |                  |                  | 639,729    | 147        | -           | -       | 4,351.9  |
| Cuzco         | 5,483.99         | 804.38              | 1,706.96         | 2,972.65         | 1,028,763  | 71,892     | 5.3         | 76.3    | 14.3     |
| Huancavelica  | 3,596.28         | 412.11              | 736.46           | 2,447.71         | 385,162    | 22,131.00  | 9.3         | 162.5   | 17.4     |
| Huánuco       | 3,067.23         | 854.29              | 368.85           | 1,844.10         | 654,489    | 36,887.00  | 4.7         | 83.2    | 17.7     |
| Ica           | 2,416.54         | 846.94              | 345.40           | 1,224.20         | 565,686    | 21,328.00  | 4.3         | 113.3   | 26.5     |
| Junín         | 6,424.54         | 869.65              | 592.54           | 4,962.35         | 1,035,841  | 44,410.00  | 6.2         | 144.7   | 23.3     |
| La Libertad   | 3,915.73         | 750.27              | 790.25           | 2,375.21         | 1,270,261  | 25,515.00  | 3.1         | 153.5   | 49.8     |
| Lambayeque    | 1,880.40         | 502.30              | 109.40           | 1,268.70         | 920,795    | 14,213.00  | 2.0         | 132.3   | 64.8     |
| Lima          | 4,792.46         | 1,275.79            | 597.76           | 2,918.91         | 5,706,127  | 2,665.00   | 0.8         | 1,798.3 | 2,141.1  |
| Loreto        | 743.50           | 44.15               | 494.40           | 204.95           | 687,282    | 368,852.00 | 1.1         | 2.0     | 1.9      |
| Madre de Dios | 956.76           | 440.73              | 55.50            | 460.53           | 67,008     | 85,183.00  | 14.3        | 11.2    | 0.8      |
| Moquegua      | 1,703.58         | 459.68              | 267.30           | 976.60           | 128,747    | 15,734.00  | 13.2        | 108.3   | 8.2      |
| Pasco         | 2,359.33         | 469.56              | 568.62           | 1,321.15         | 226,295    | 25,320.00  | 10.4        | 93.2    | 8.9      |
| Piura         | 4,268.55         | 858.20              | 583.85           | 2,826.50         | 1,388,264  | 35,891.00  | 3.1         | 118.9   | 38.7     |
| Puno          | 5,375.66         | 1,346.29            | 1,219.57         | 2,809.80         | 1,078,849  | 70,003.00  | 5.0         | 76.8    | 15.4     |
| San Martín    | 2,002.27         | 709.36              | 185.85           | 1,107.06         | 552,387    | 51,253.00  | 3.6         | 39.1    | 10.8     |
| Tacna         | 2,002.87         | 609.56              | 483.30           | 910.01           | 218,353    | 16,076.00  | 9.2         | 124.6   | 13.6     |
| Tumbes        | 902.35           | 198.75              | 333.80           | 369.80           | 155,251    | 4,669.00   | 5.8         | 193.3   | 33.3     |
| Ucayali       | 819.66           | 383.81              | -                | 435.85           | 314,810    | 102,411.00 | 2.6         | 8.0     | 3.1      |

## **4 TOPICS**

- 4.1 Rural roads**
- 4.2 Motocarros**
- 4.3 Inland waterways**
- 4.4 Inca highways**
- 4.5 Use of GIS in Peru**
- 4.6 Transport and socio-economic problems**
- 4.7 Asphaltic pavements - training needs in Peru**



Non-Motorised Transport - freight, by river (DVA 2006)

**4.1 Rural Roads**

Photo: GVA 2006

**Notes**

**Provias Rural** is an organisation within the Peru Ministry of Transport and Communications which has a special focus on improving accessibility for rural populations. It administers technical assistance and international and local funds for this sector, and is a source of technical knowledge on the subject. PR's focus on the rural roads is to use local labour and manual tools rather than civil engineering plant and equipment (an exception is periodic maintenance, which is machine-based).

Provincial and district municipalites set up their own Institutes of rural roads.

As with many rural societies, the types of transport vehicles used is not always the same as that used in urban areas. In rural Peru much use is still made of animal-drawn transport. Often there is little choice, since the less important rural roads can be very narrow.

| FEATURE              | TYPE           | COST                    |
|----------------------|----------------|-------------------------|
| road construction    | --             | --                      |
| road rehabilitation  | mountain areas | USD 15,000 / km         |
|                      | forest areas   | USD 22,000 / km         |
| routine maintenance  | general        | USD 700 / km / year     |
| periodic maintenance | general        | USD 3000 / km / 4 years |

Source:

### 4.2 Motocarros

The author of this note is Gregorio Villacorta Alegría, B.Sc., Perú.



[Video \(click to view\)](#)

Video: G. V. Alegria 2006

**As in all the Selva region**, the motocarros form the principle mode of road transport in Iquitos. One factor for the explosion in numbers of motocarros is the low cost, which means they offer a simple means of transportation for the local population. Thousands of families now depend on motocarros for their income and subsistence, and the zone's economy has become very much dependent on them.

Trip costs for passengers range from 1 sol to 5 sols depending on the length of the journey. Transport by motocarros is similar to the service offered by conventional taxis - they offer a very personalised service, they do not follow a fixed route, the route they choose being related to the destination of the passenger.

Mention should also be made of their "collective" function. Here they carry several passengers along defined routes, mostly following the main highways. Costs per trip are of the order of 0.50 sol per person.

### 4.3 River Transport and Navigable Waterways

The author is Gregorio Villacorta Alegría, B.Sc., [Perú](#).



**Video** ([click to view](#))

Video: G. V. Alegria 2006

**The river system in the Amazonas region of Peru** provides more than 6,000 km of navigable waterway. This mode of transport accounts for more than 90% of the movement of goods and passengers in the region, though transport costs are high because there are no permanent, organized transport services. The Amazon river system is the only natural medium which can provide and support the integration, communication and socio-economic development of the riparian and frontier areas.

The costs of river transport is less than compared with other modes. Further, in environmental terms the waterways are the best alternative given that there

are regions of the Amazon forest which are extremely sensitive to the potential environmental impact which would result from the construction of new roads.

The characteristics of river hydraulics are:

- low gradient
- large volumes
- fluctuations in the water level
- transport of considerable amounts of sediment

The above characteristics affect the morphological changes, particularly in July to September when the river is low, and this causes problems of navigation for vessels over 10 feet long.

The drought and the low level of the river lead to deforestation. This in turn damages the hydrographic system. In addition to the cost to the environment, there are economic losses due to the poor port infrastructure

The principle rivers which shape this unique navigable river system are the Río Huallaga, the Río Marañón, the Río Ucayali and the Río Amazonas

The types of vessels which make up the river transport system can be subdivided into those providing passenger transport, goods transport, or mixed (passengers and goods transport).

There is a great lack of port facilities for servicing the vessels and the cargoes they carry. In total the Amazon river system only has 4 port installations, at Iquitos, Yurimaguas, Mazan and Puerto Maldonado.

In order to improve the basic port facilities of the Amazon region in Peru it will be necessary to

- support the integration and socio-economic development of the riparian populations along the navigable river system in such a manner that the Amazon region can be integrated into the economic life of the country.
- Improve basic river transport services in economically deprived areas, supporting commercial businesses, improving the frontier areas and promoting the development of the region to tourism
- supporting the navigable river system as a system for promoting the



### 4.3 River Transport and Navigable Waterways (continued)



Photo: GVA 2006

growth of the farming industry and of commercial products produced by the region, and also the opening of the area to commerce with the Atlantic and Pacific regions of the continent by means of the Amazon river system.

improvement of multi-modal transport in the region

#### **Social benefits:**

Installation of port infrastructure will shape and improve basic services, open up new work opportunities and increase the income of the region's inhabitants, so reducing the level of poverty among the riparian population of the Amazon, which is considered to be the poorest population in Peru. It would also increase security for tourists. It is estimated that the potential benefits would affect around 2 million Peruvian inhabitants of the region.

#### **Economic benefits:**

The economic benefits concern the extension of the agricultural frontier,

### 4.4 The Inca Highways

The text is an excerpt from the detail by Vicente Goyzueta on <http://www.qosqo.com/qosqo/planning.htm>



source: <http://virtualcreations.com.au/trip/>

#### General

The road network in pre-Hispanic Peru was really impressive for its age. It had to allow a fast intercommunication between Qosqo and the entire Tawantinsuyo and vice versa. It was intended to ensure territorial integration, after giving security, rest and supplies for travelers, official suites or the army. It was supposed to allow an efficient production, gathering and redistribution of goods and raise tributary resources. Roads and paths had different categories, functions and characteristics according to their duties and where they were located. In the coast they were just earth roads but raised up above the natural soil. Crossing the deserts there were pegs and even ropes to mark their limits. In rainy and humid regions they were totally paved with cobbles or flagstones. All roads were always planned to give comfort to walking travelers.

#### Road hierarchy

There was a road hierarchy with two important categories: the first category formed by the **Inkañan** (Inka Road) or royal roads that were, for example, the ones that united Qosqo and the four "Suyos", roads known as **Qhapaq Ñan**: principal or rich road. In this same category were the **Hatun Ñan**: big or broad road; they constituted the primary road network that had between 10 to 25 thousand Kms. (6200 to 15500 miles), with a width of from 4 to 8 metres (13 to 26 ft).

The second category was formed by the **Runañan** (peoples' road); these served to provide communication between villages and districts. The road system went over the Tawantinsuyo longitudinally and transversely; all together it reached some 40,000 Kms. (some 25000 miles). This system was constantly supervised by officials following

different hierarchies as the **Qhapaq Ñan Tukuyrikuq**, the **Hatun Ñan Qamayoq** or simply the **Ñan Qamayoq**.

#### Bridges

Something very impressive were also the **Bridges** (Chaka) under the charge of the **Chaka Qamayoq**. Bridges that had to serve crossing rivers and had to be adapted to the site's topography, distance and materials availability. According to their construction procedure bridges can be grouped in trunk, log and stone bridges, suspension bridges and floating bridges.

#### Services

A complete system of different services was found over the vast Inkan road network. It was planned in order to allow integration, safety, supplies and relaxation. A part of this system were the **Chaski**, something like a post crew formed by athletic young relay runners prepared to cover quickly the distance between two **Chaskiwasi** (chaski's house) that had an average of 2.5 Kms. (1.55 miles). Their aim was to carry messages that could be oral or goods with ideographic meanings such as the **Qhipu** (Inkan accounting system consisting in multicolored knotted strings), textiles with **Tokapus** (different symbols framed by squares), some other elements engraved or painted, etc. Moreover, the Chaskis had to carry some other important objects for the Inka and certain noblemen: it is traditionally known that the Inka in Qosqo used to eat fresh fish brought from the coast through this system. This service was uninterrupted all day long, besides being sufficiently quick. These young runners transmitting or passing messages could go over from 15 to 20 kms/hour (from 9.5 to 12.5 miles/h), thence from 360 to 480 Kms. per day

### 4.5 Use of GIS in Peru

The author is Ing. Vladimir García Paz

At the end of the 1980's a few government organisations were equipped with GIS and image processing systems, the aim being to use these new tools primarily in the evaluation of natural resources.

The first GIS system arrived in Peru in 1981. It included a PDP/1144 hardware system with a software packet developed for IRDIC. This system was used to carry out the initial work and constituted the basis for training the first professional staff in Peru in the use of GIS.

From this date the use of GIS spread throughout the country and today GIS can be found in operational use as an indispensable tool for information management. The principle software packages currently in use are: ARC/INFO, ARC/VIEW, IDRISI, ILWIS, INFOCAD, SPAN, PAMAP..

The development of GIS in Peru in the years subsequent to 1980 was initially slow. Few institutions were able to put it to full use, and very often GIS was only used as a means for developing and printing maps. It was only at the end of the 1990's when most NGO's and government organisations began to appreciate the full potential of this valuable instrument.

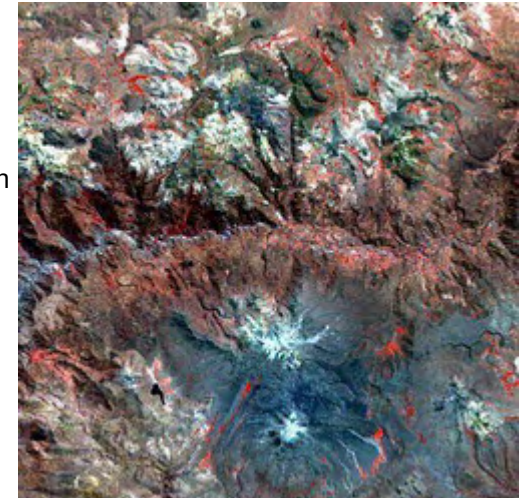
The Ministry of Transport and Communications (MTC), and especially the transport sub-sector, has as one of its objectives the integration of the country through the development of an accessible, safe and efficient highway system, so that persons may travel along a sustainable transport network and also that the network can support the development of productive and social activities in the country.

With this network it is fundamentally important that planners

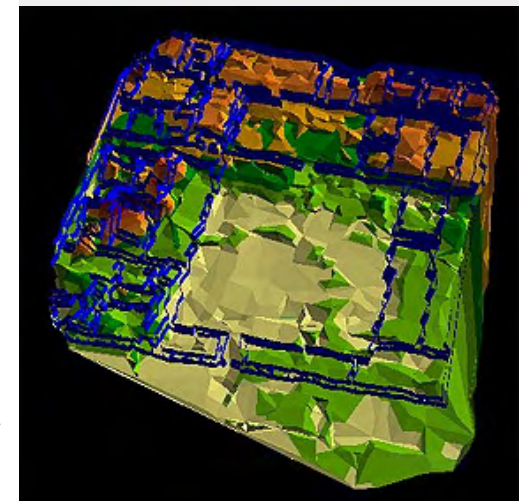
appreciate the geographical space in which transport projects develop (both construction and maintenance projects). It is also important that the planners study the impacts and consequences of such projects, relate them to other projects and monitor the physical condition of the national infrastructure so as to provide a base for planning investment both for their own sector, for any other government organisation, and for public use in general.

For this reason by 1996 one of the institutions which used GIS most fully was the MTC, through its DG Development (formerly ATDM). In a first step the work of GIS (T) was focussed on the development of a sound highways database, making use of such sources as IGN (*Instituto Geográfico Nacional*), INEI (*Instituto Nacional de Estadística e Informática*), and principally in determining the geometry and location of highways and centres of population. The second step consisted in creating a database of the highways - that is, the GIS, should include a description of the characteristics of the highways in the form of codes, the populations which they unite, the pavement materials, condition etc. All this permits activities to be carried out such as project monitoring, project development and implementation, and studying the existing infrastructure, and relating all this to databases maintained in other systems so as to allow the production of different types of multi-disciplinary thematic maps.

In 2001 an important GIS project was implemented, the "Implementation of a GIS to



Colca canyon, Peru showing quality of vegetation (source: Kindernothilfe - [link](#) )



GIS representation of Inca palace, Peru (source: CNR virtual heritage lab - [link](#) )



### 4.5 Use of GIS in Peru

strengthen the study of regional transportation and the design and privatisation of highways". The result of this project allowed GIS T in Peru to include:

- databases: updating of existing databases on MERCOSUR and Peru; updating spatial databases on the areas of all the departments in Peru (national and departmental road networks; centres of population); highway inventory; a mosaic of ortho-rectified Landsat ETM+ satellite images. The latter update was carried out in 2003.
- an applications and user interface: "System for highway project control and emergencies", "System for GIS-based decision-making (GDSS), visualisation of spatial data.

These products provide a flexible tool for project monitoring, one which is automated and which is more precise, and one which is specifically oriented to the needs of the senior management levels of the MTC. For example it has been used since 1998 to maintain a daily register of emergencies which have occurred in the highway infrastructure.

These tools now form a fundamental part of the Multimodal Transport Plan. This is a master plan which complements and integrates the development plans prepared so far, but with a more integrated and sustainable perspective.

The above provides a general overview of the principle activities in the field of GIS in Peru, specifically related to the transport sector. It can be argued that the development of GIS in the MTC places Peru on a level with developed countries in the technology and application of GIS in combination with GPS and remote sensing.

### 4.6 Rural Highways: Constructing A Social Economy

The author is Nadiejda Quintana Vassallo, Economist, and a graduate of the University of Lima, [Perú](#).

Growth of a nation's economy can determine the development of the nation. In this sense, the transport infrastructure is of central importance. Beginning at the start of the last decade, the transport infrastructure in Peru severely deteriorated, so that the country has reached a critical level in terms of fragmentation and difficulty of communication, placing it close to the edge of economic and social collapse. Estimates suggest that only 12% of the national transport network are in good condition.

In this context, between the years 1991 to 1995 an urgent programme of roadworks was carried. The aim was to improve the level of accessibility to the minimum indispensable, and then undertake a programme of rehabilitation work for the commercial intermodal system between the zones of high agricultural importance to provide them with good links with the centres of consumption and to provide connections with the neighbouring countries of South America, in an efficient, modern way essential for the development of Peru. The programme was presented by the DG of Transport of Peru's Ministry of Transport and Communications.

The institutions charged with improving Peru's ground transport system focussed on projects involving the asphalt highway infrastructure. In our country we identify the main links in this infrastructure as

- the Pan-American Highway,
- the Longitudinal de la Sierra (a road link running N-S parallel to the mountain chain)
- the Marginal de la Selva (a road link running E-W across the forest zone), and
- the main distributors

As is known, the principle characteristic of Peru is that it is an extremely diverse country with different morphological regions. This means that different engineering techniques must be used for highway projects depending whether

they are in the coastal, mountain or forest regions. The difference in the engineering problems is most notable in the low volume rural roads, which have to confront the Andes mountain range in the **Sierra** and the dense forest of the Amazon in the **Selva**.

The development of the highway infrastructure in Peru has been financed by the Interamerican Development Bank, the World Bank, and through cooperation projects with Japan. Projects are presented for evaluation by Peru's SNIP (national system for public expenditure) but the method used results in few projects appearing to be economically viable. Greater emphasis should be given here to the importance of the social evaluation of the projects, because it incorporates the benefits obtained by the users of these roads, such as: the timely access to health centres, a means of communication, education and justice; all these have a positive effect on the human development index (HDI).

In this sense means of transport also are considered as means of communication and form part of the combination of factors which ensure the viability of farming and tourism projects (among other forms of employment generation) and they make an important contribution to the development of the country and to the fight against poverty. In the same way they permit the incorporation of the producing regions with a high level of wealth which has **not been to improve** for the urban centres.

We therefore hope to have indicated the importance of promoting dialogue between research bodies, Internet discussion forums (which cover rural roads, trunk roads and main highways), and other organisations so that we can see what represents the active principle for the local communities and the economically productive units.



Photo: rural children (Source: MTC "Caracterización y Sistema Vial Georeferenciado (Expedientes Técnicos)" page 159 / doc.-005)



### 4.7 ZEE - the missing tool for NMT

The author is Gregorio Villacorta Alegria, a graduate with a degree in Civil Engineering living in San Martin Department.

Peru has been classified as an extremely diverse country because its surface area experiences 95% of the world's range of climates. This diversity particularly applies to the San Martin region, which includes the basin of the River Huallaga, one of the most important basins of the Amazon river system. Its location gives it a series of micro-basins which are presently affected by the phenomenon of migration, leading to deforestation, extinction of the woods and decline in the zone's development. Migration is associated with ease of access which in this case are the rural roads in the high mountain areas, and particularly the roads being built to allow extraction of timber.

IIAP (*Instituto de Investigaciones de la Amazonía Peruana*) is an NGO which is working together with other institutions and with funding from Germany's GTZ is looking into the problem and is developing the *Zonificación Ecológica y Económica* project (ZEE, or ecological and economic zoning project) to provide a tool which will allow project evaluators (for agricultural, road development, forest planning, urban development projects) to develop sustainable schemes which are in harmony with the terrain, based on the characteristic properties of each ZEE.



(DVA 2006)

This tool will allow engineers to assess the environmental and economic impact of a road project. It will also allow users to decide what alternative approaches to use in the construction and maintenance of rural roads. If a road is needed to provide access for the local population then it will have a high environmental impact so that engineers should use other construction methods such as the Green Roads approach Roads (highways constructed using manual labour) presently in use in Nepal (1).

The main problem is accessibility, where evaluators should now be looking at transport from a different point of view – for example routes suitable for mules, a mode of non-motorised transport (NMT) which is more accessible for the rural population, instead of designing for motorised vehicles. Improvements in NMT such as this must be integrated into a multimodal system which should include interfaces with the waterways transport network and the main highway networks.

Universities are beginning to appreciate the importance of sustainable transport and to train their students in the subject. The trend to reduce the overwhelming importance presently given to motorised road transport should be encouraged. Otherwise the sensitive high mountain areas, the topographic, climate and social characteristics will not permit investment in high level roads. Restrictions are also placed by the limited financial resources and engineering problems such as steep gradients and serious problems of drainage. It is also important to begin to study the characteristics of routes for NMT, which should be based on the 'engineering dimensions' of cycle transport, transport by foot, horse-drawn transport, mules etc. rather than on those of motor vehicles.

Kenya's Boda Boda's, are examples to be considered in this context (2). Highways need to become more appropriate to persons rather than to vehicles, and engineers need to change their implicit belief that 'transport equals cars'. The ZEE can be a useful first step in this. It is now up to Peru's engineers to make use of this new tool in future projects in rural areas. To finish with a phrase which hopefully the reader will find stimulating: "An avalanche starts with a single stone" – let young Peruvian engineers be this stone which starts an avalanche.

#### Reference:

(1) GreenRoads in Nepal , GTZ (2) Boda Boda System of Transport , Kenya , Schorrell Analysis (3) MTC Peru, "Transporte fluvial y vías navegables en el Peru"

## **5 ORGANISATIONS**

### **Web Groups**

- camineros rurales
- camineros
- Transporte\_Investigacion
- IFRTD-AL

### **Organisations in Peru**

- ICG - Instituto de la Construcción y Gerencia
- ENEI
- Provias Rural
- Universidad Nacional Mayor de SAN MARCOS
- 



Unsurfaced rural road, San Martin Department (DVA 2006)

## Web Groups

### CAMINEROS RURALES

Grupo formado para tratar sobre temas de caminos de bajo transito , temas que involucran : diseño, mantenimiento , rehabilitación de carreteras de bajo transito y las diferentes materias relacionadas a ellas , con la finalidad de crear una cultura de caminos locales , rurales o vecinales de acuerdo a la terminología usada en nuestros diferentes países e impulsar el desarrollo de nuestros pueblos.

#### Contact

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### CAMINEROS

CAMINEROS en la red es una publicación patrocinada por el Instituto Vialidad y Transparencia para Latinoamérica (VITRAL), asociación privada sin fines de lucro cuyos objetivos están relacionados con la capacitación, promoción profesional, difusión técnica, intercambio tecnológico, investigación y reconocimiento al esfuerzo personal e institucional.

CAMINEROS en la red es un medio de comunicación independiente, que no hace distinción de raza, ideología, religión, idioma, nacionalidad, edad, nivel de instrucción, condición social o económica. Busca que promover el estrechamiento de vínculos de amistad entre personas relacionadas con el quehacer vial, y sirve de nexo para el intercambio de experiencias y conocimientos.

CAMINEROS en la red se sostiene con el apoyo de sus patrocinadores y la adhesión de sus suscriptores. La suscripción personal a CAMINEROS on line es totalmente gratuita, y para hacerlo sólo se requiere llenar una Solicitud de Suscripción . Hágalo hoy mismo y entérese de los beneficios que se obtienen por estar suscrito a Camineros en la red.

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## Web Groups

### TRANSPORTE INVESTIGACION

Spanish-language web group

Latin America study group on trip generators, by the National University of San Marcos

The principle objective of the University's Institute of Transport Engineering ( IIT ) is to carry out transport studies with a view to helping the socio-economic development of society and to increase the capacity of professional engineers and students in dealing with problems involving transport. The themes covered by the IIT include:

- traffic engineering (traffic control, integrated transport and transit management, highway capacity, road safety, metropolitan congestion studies and intelligent transport systems)
- highway engineering (intelligent transport systems, levels of service)
- transport planning (transport planning and urban development, GIS for transport, strategic transport planning, multi-modal and intermodal planning, highway concessions)
- freight transport (management of freight transport, transport infrastructure, simulation and intelligent transport systems for freight transport, intermodal freight transport terminals)
- public transport (transport financing and regulation, management of transport undertakings)

#### Contact

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### IFRTD-AL Foro Internacional para el Transporte Rural y el Desarrollo, América Latina

Spanish-language web group

IFRTD - the International Forum for Rural Transport Development - there are English-, Spanish- and French-language IFRTD forums.

The Latin America group was set up in 2001 to allow its members to discuss and compare information relating to rural transport and development in the region, using Spanish as the working language. The group presently has more than 120 members. The topics discussed range from transport infrastructure, intermediate transport, road safety, public rural transport services and much more.

An external evaluation found that IFRTD among the most effective and efficient networks that have emerged in the development sector during the nineties. The Forum has shown clear leadership in the establishment of a rural transport agenda for development, instead of simply follow donor or financing trends or the more traditional engineering interests of its members. The IFRTD understands transport as a means and not as an end in itself. Emphasis is put on cross-cutting issues like gender and environment and others are advocated like rural waterways. Information is provided in English, Spanish and French

#### Contact

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| <b>Website</b> | <a href="http://dgroups.org/groups/ifrtdal/index.cfm?CookieTested=TRUE">http://dgroups.org/groups/ifrtdal/index.cfm?CookieTested=TRUE</a> |                 |           |

**IIAP - Instituto de Investigaciones de la Amazonía Peruana /**  
Peruvian Amazon Research Institute

El Instituto de Investigaciones de la Amazonía Peruana (IIAP) es un organismo autónomo de derecho público interno, creado mediante Ley N° 23374, por mandato del artículo 120 de la Constitución Política del Perú de 1979. Tiene jurisdicción en el ámbito geográfico de la cuenca amazónica del Perú, que abarca una extensión aproximada de 760,000 Km<sup>2</sup> equivalente al 60% del territorio nacional. Cuenta con centros especializados de investigación en los siguientes departamentos:

Ucayali (Pucallpa), San Martín (Tarapoto), Amazonas (Amazonas), Huanuco (Tingo María), Madre de Díos (Puerto Maldonado).

**MISIÓN DEL IIAP**

Contribuir a mejorar la calidad de vida de los pueblos amazónicos a través de la investigación dirigida al desarrollo sostenible y la conservación de los recursos naturales de la región amazónica.

**VISIÓN DEL IIAP**

El IIAP es el centro de referencia y consulta sobre el conocimiento científico de la Amazonía, y tiene muy acertada capacidad propositiva de recomendaciones técnicas que facilitan el desarrollo de sus pueblos y uso sostenible y conservación de la biodiversidad en la Amazonía Peruana.

**Contact**

| Name | Position |
|------|----------|
|------|----------|

|       |  |
|-------|--|
| Email |  |
|-------|--|

|         |                                                                                     |
|---------|-------------------------------------------------------------------------------------|
| Website | <a href="http://www.iiap.org.pe/inicio.htm#">http://www.iiap.org.pe/inicio.htm#</a> |
|---------|-------------------------------------------------------------------------------------|





## Rural Waterways

The Waterways & Livelihoods Programme is a programme committed to the development of rural water transport (RWT), not for its own sake but because it has the potential to eliminate poverty and reduce isolation. For many of the poorest people in the world water transport is the only means of mobility and access to basic services. It provides jobs and access to other employment opportunities, and also presents enormous potential for addressing isolation while minimising impacts on the environment.

This web-site gathers international knowledge and research on RWT to provide you with information and networking tools that will support and inform your transport and development initiatives and help you to influence policy making and practice at local, national and international level. For further advice on promoting RWT issues and influencing decision-making click on RWT Advocacy

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## ILO - International Labour Organization

### Mandate

The International Labour Organization is the UN specialized agency which seeks the promotion of social justice and internationally recognized human and labour rights. It was founded in 1919 and is the only surviving major creation of the Treaty of Versailles which brought the League of Nations into being and it became the first specialized agency of the UN in 1946.

The ILO formulates international labour standards in the form of Conventions and Recommendations setting minimum standards of basic labour rights: freedom of association, the right to organize, collective bargaining, abolition of forced labour, equality of opportunity and treatment, and other standards regulating conditions across the entire spectrum of work related issues. It provides technical assistance primarily in the fields of:

- vocational training and vocational rehabilitation;
- employment policy;
- labour administration;
- labour law and industrial relations;
- working conditions;
- management development;
- cooperatives;
- social security;
- labour statistics and occupational safety and health.

The ILO has regional offices for Latin America, including a (Spanish-language) sub-regional office for the Andean countries, which is located in Lima, Peru.

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## EDITORS

### Instituto de Transportes y Caminos " Capac Ñan" (PERU)

- Is a private non-government association, with an academic, educational, scientific and executive character, and has the task of supporting the social, economic and cultural development of Peru.

The social objective of the Association is:

TO INVESTIGATE. EDUCATE, ASSESS AND EXECUTE ACTIONS RELATED TO RURAL AND MARGINAL URBAN TRANSPORT SYSTEMS, in order to contribute to human development within the framework of sustainable development.

The social objective will be developed by means of the following specific objectives:

Investigate rural and marginal urban transport systems and their impacts on the social, economic and cultural life of the communities .

- Offer technical support to and to educate and enable participants in rural and marginal urban transport systems
- Assist the local communities and authorities in the participation and formulation of policies for rural and marginal urban transport.
- Participate in the formulation of standards, projects and the execution of public works in order to reinvest the profits in the investigation and education to the benefit of the end users within the framework of sustainable development.

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### SCHORRELL ANALYSIS (GERMANY)

- is a company involved in the provision of engineering services, and also active in research and in the electronic publishing of technical information.

The aims include

- exchanging skills and knowledge with others
- applying skills and knowledge to real world problems

Activities include editing and publishing technical papers

- on and from developing countries with the aim of providing insight for more developed societies
- on and from developed societies with the aim of making information on new approaches and projects more accessible to developing countries

Generally speaking the documents are in PDF format, often with embedded multimedia. There are presently three main types of document:

- short articles (ca. 500 words) grouped together by country (e.g. the "roadnotes" series of documents)
- longer articles (ca. 1500 words) on a specific topic
- detailed technical documents on specific aspects with comparative information from several countries (e.g. the "comparative geometrics" series on highway engineering)

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## 6 ANNEXES

- A1. Relevant Publications from Peru
- A2. Acknowledgements
- A3. Relevant Weblinks
- A4. Schorrell Analysis—Current publications



Young engineers of the future (DVA 2006)

**A1. Relevant Publications from Peru**
**Documents**

| No. | Title                                                                 | Author                                                                            | Year | Publisher | format | available |     | Own      |
|-----|-----------------------------------------------------------------------|-----------------------------------------------------------------------------------|------|-----------|--------|-----------|-----|----------|
| 1   | Manual de Diseño Geométrico de Carreteras (DG-2001)                   | various                                                                           | 2001 | MTC Peru  | z.pdf  | yes       | 783 | peru-007 |
| 2   | Especificaciones Técnicas Generales para Carreteras                   | various                                                                           | 2000 | MTC Peru  | z.pdf  | yes       | 784 | peru-008 |
| 3   | Manual de Dispositivos de Tránsito Automotor para Calles y Carreteras | various                                                                           | 2000 | MTC Peru  | z.pdf  | yes       | 785 | peru-009 |
| 4   | Caracterización y Sistema Vial Georeferenciado (Expedientes Técnicos) | .Provincia de Yauyos -<br>Instituto Vial Provincial, MTC -<br>PROVÍAS RURAL - GPP |      | MTC Peru  |        | yes       | 781 | peru-005 |
| 5   | Transporte fluvial y vías navegables en el Peru                       | , Dirección General de<br>Transporte Acuatico                                     | --   | MTC       | --     | --        | --  | --       |

## A2. Acknowledgements

| page    | company                                                                                            | website/ contact                                                                                                                                                                                   |
|---------|----------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 8       | Geography etc. (text)                                                                              | <ul style="list-style-type: none"> <li>• <a href="http://bruceperu.com/">http://bruceperu.com/</a></li> <li>• <a href="http://www.peru.info/peru.asp">http://www.peru.info/peru.asp</a></li> </ul> |
| 8       | Map (text)                                                                                         | <ul style="list-style-type: none"> <li>• MS Encarta</li> </ul>                                                                                                                                     |
| 9       | Departments: San Martin                                                                            | <ul style="list-style-type: none"> <li>•</li> </ul>                                                                                                                                                |
| 13      | <a href="#">Dirección General de Caminos y Ferrocarriles</a>                                       | <ul style="list-style-type: none"> <li>•</li> </ul>                                                                                                                                                |
| 13      | additional information : Statoids.com                                                              | <ul style="list-style-type: none"> <li>• <a href="http://www.statoids.com/upe.html">http://www.statoids.com/upe.html</a></li> </ul>                                                                |
| general | Dr. Victor Arevalo Lay of Peru, for initial help with information on rural roads                   |                                                                                                                                                                                                    |
| general | Ing. Sergio Aviles Cordova of Peru, for help with information of maps and materials on rural roads |                                                                                                                                                                                                    |

Thanks to the above for permission to use material from them.



**A3. Relevant Weblinks**

| name         | description                                                                                                                                                                                                                                                                                                      | website                                                                               |
|--------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|
| VITRAL       | VITRAL es una pagina web dedicada al estudio de la vialidad, el transito y el transporte en Lima Metropolitana.                                                                                                                                                                                                  | <a href="http://www.vitral.4t.com">http://www.vitral.4t.com</a>                       |
| Bruce Perú   | Hay demasiados ahora como para ayudar a cada uno de ellos. Sabiendo que se encuentran ahí afuera y que su sufrimiento nos obliga a hacer algo, aunque sea un poquito para poder aliviarlos. Como podríamos enfrentarnos a nosotros mismos en la hora de nuestra muerte, confesando que no hicimos nada por ellos | <a href="http://bruceperu.com/">http://bruceperu.com/</a>                             |
| Peru tourism |                                                                                                                                                                                                                                                                                                                  | <a href="http://www.peru.info/perueng.asp">http://www.peru.info/perueng.asp</a>       |
| QOSQO        | Detailed website on Qosqo and Machu Picchu, by Vincente Goyzueta                                                                                                                                                                                                                                                 | <a href="http://www.qosqo.com/qosqo/coca.htm">http://www.qosqo.com/qosqo/coca.htm</a> |

**A4. Schorrell Analysis—Current publications****100 series—starter documents**

- 102 road hierarchy
- 103 road classification
- 104 the value of pcu's

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