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KOREA

INFRASTRUCTURE IN PERU

MEANS OF TRANSPORTATION AND ITS DEVELOPMENT IN PERU

- In every society, transportation has existed since its inception, both of passengers and of merchandise or military equipment.

- In Peru, the Inca empire developed an impressive road system called Qhapaq Ñan, approximately 5,658 km long, whose starting point was in the city of Cusco, in Huakaypata Square, from where four roads headed for towards each of the four suyu or region in which it was administratively divided. One of the roads went northwest, towards the Chinchaysuyu, and reached the Angasmayo River, in the south of Colombia, on the border with Ecuador. Another of the roads led to the southeast, towards the Collasuyu, and reached the province of Tucumán, in the northwest of Argentina, and, with a deviation, to the Maule River, located more than two hundred and fifty kilometers south of Santiago de Chile. Chile. These two routes formed the Longitudinal Road of the Sierra or Qhapaq Ñan.

- A third road went to the Antisuyu, located to the northeast, in the regions of Amazonian forests, and the fourth road led to the Contisuyu, located to the southwest, and was the route to the current departments of Arequipa, Moquegua and Tacna. This road reached the coast and from there you could go north to Tumbes, following the Longitudinal Way of the Coast.

Qhapaq Ñan

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Later, with the arrival of the Spaniards, the wheel and the means of transport are introduced, before on horseback, they vary with the use of carts pulled by horses or mules. It is from the mid-nineteenth century that there is a significant change with the arrival of the railroad.

Until the year 1,877, 1,500 km of railway lines had been built. Until the year 1,930 railroads were built, it reached more than 4,500 km. After that year no more were built and the decline began with the consequent disappearance of several sections. At present there are 1,720 km.The construction of the central railroad was a great challenge to engineering, since in the 171 km that separates the port of El Callao from Ticlio it had to ascend to 4,818 m.s.n.m. To reach this altitude the train crosses 58 bridges, crosses 69 tunnels, and 6 zigzags.The southern railroad in its route from the port of Mollendo to Arequipa, Juliaca, Puno and Cusco amounts to 4,319 m.s.n.m.

Railways of Peru Network

CENTRAL RAILWAY

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In the decade of the 20s of the twentieth century come to Peru motor vehicles, which create the need to build roads through which circulate safely and in order to unite cities and integrate the various regions of the country.

The first important road built in Peru, the Pan-American, originated in the V International Conference of the American States held in 1923. Subsequently, the First Pan-American Highway Congress was held in the city of Buenos Aires in 1925, mainly referred to to the objective of the execution of the highway, which should unite America, from Alaska, USA, to Buenos Aires, Argentina. In Peru, the highway would run along the entire length of the coast, that is, from Tumbes, in the north, to Tacna in the south.

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The design and execution of the section of the Pan-American Highway corresponding to Peru took place between 1933 and 1939 and culminated in the 50s of the 20th century.

In the decade of the 60s of the last century was conceived and started the construction of the road called Carretera Marginal de la Selva, which runs, from north to south, along the eastern mountain range and integrates the peoples of the jungle high.

The construction of the Marginal Highway meant integrating an area with a great variety of agricultural resources and an enormous tourist potential to the economy of the country.Subsequently, the need to develop the project and then build the Longitudinal Highway of the Sierra was identified. This road links the border with Ecuador with Bolivia.

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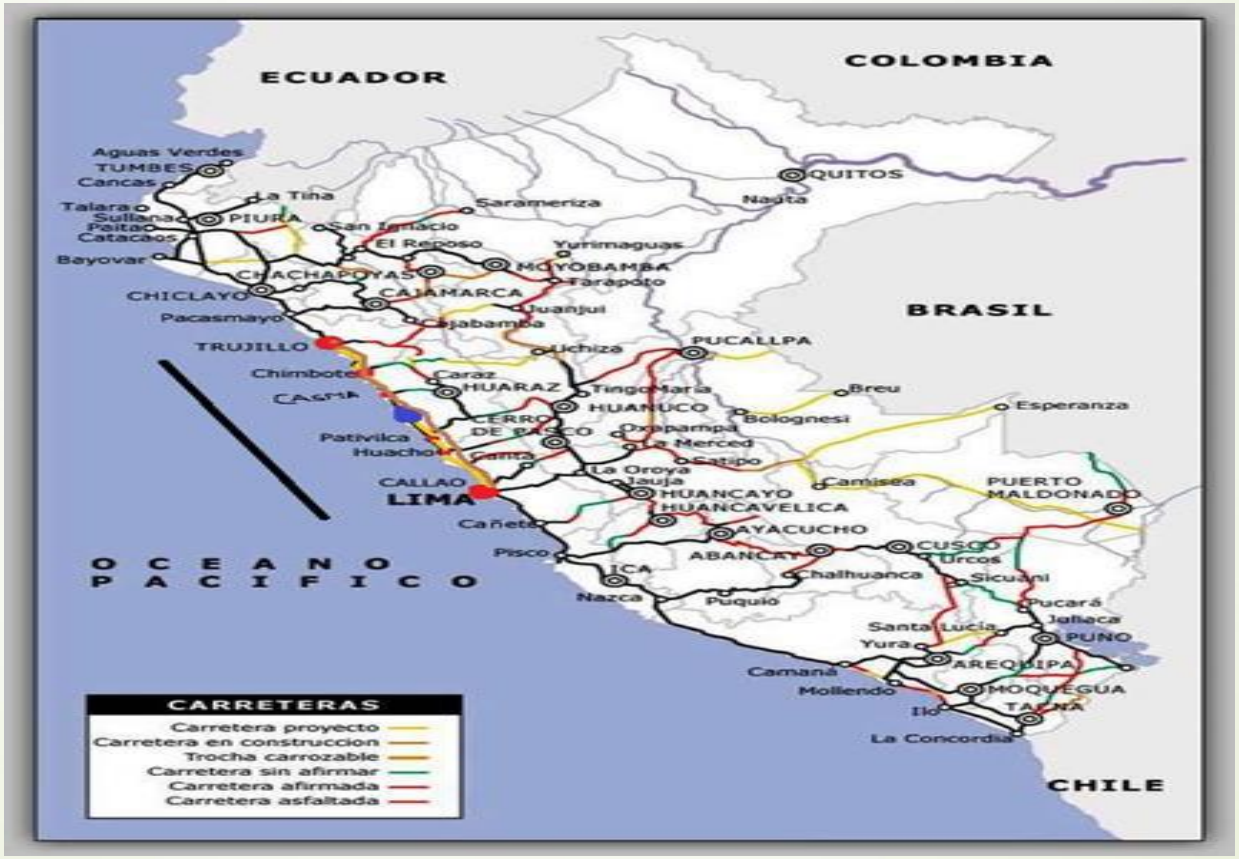
Then the project was developed and built the so-called Interoceanic Highway, which communicates with Brazil in the southern part of the country. This road is transversal, that is, it starts on the coast, crosses the mountain range and continues through the jungle.

Road Network of Peru



Billinghurst Bridge, in Puerto Maldonado, Madre de Dios.

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Peru is a country located on the western coast of South America, on the shores of the Pacific Ocean. It has an extensive literal of more than 3,000 km in length, along which there are several ports. The main ones are: El Callao, Paita, Salaverry, Chimbote, San Martin, Matarani and Ilo.

Puerto El Callao

Also, the great rivers of the Amazon rainforest are navigable and have ports and jetties. The main ports are: Iquitos, on the banks of the Amazon River; Yurimaguas, on the banks of the Huallaga River; Pucallpa, on the banks of the Ucayali River and Puerto Maldonado, on the banks of the Madre de Dios River.

PUERTO DE IQUITOS

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In the south of Peru Lake Titicaca is located, whose sovereignty Bolivia and Peru share. It is located at 3,812 masl, and is the highest navigable lake in the world. On the shore is the city and port of Puno that serves the ships that carry out cabotage with Peruvian and Bolivian ports, as well as tourism ships and smaller vessels.

Puerto de Puno, on Lake Titicaca

PRINCIPALES PUERTOS DEL PERÚ

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The first flight in Peru was made on April 13, 1911. From that date, given the importance of being able to travel to places that were extremely difficult to reach because there were no roads, a new stage began with the incorporation of the new means of transport.

In the following years, aerodromes and airports were built due to the demand originated by the constitution of several airlines in the country and the integration to the international air circuit.

Peru is a country whose territory is varied, which can be divided into three regions: the coast, narrow strip on the shores of the Pacific Ocean; the mountain, conformed by the mountain range of The $ andes, that runs parallel to the coast and reaches peaks of more than 6,700 meters of height, region in which an important percentage of the population lives and exist cities located between 2,000 and 4,000 m.s.n.m .; and the Amazon rainforest, which represents more than half the size of the country.

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This geographic diversity of the country explains that there are airports located by the sea, such as Ilo at 10 m.s.m., or at a considerable altitude, whose best example is Juliaca at 4,140 m.s.n.m

Ilo Airport, Moquegua10 m.s.n.m

Juliaca Airport, Puno
4,140 m.s.n.m.

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The infrastructure covers a set of engineering structures, equipment and long-life facilities, which constitute the basis on which the provision of services for the productive sectors and households takes place.

There are four types of infrastructure:

a) Economic infrastructure:
Transport
Energy
Telecommunications

b) Social infrastructure:
Dams and irrigation channels
Drinking water and sewerage systems
Education
Health

c) Infrastructure of: Environment and Recreation and recreation

d) Infrastructure linked to Information and Knowledge

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In Peru there are three very marked geographical areas.

The coast, very narrow, arid strip, except the valleys that have permanent water.

The mountain range, which grows in the Andes mountain range and whose height varies between 1,000 and 6,800 m.s. In this region are the vast majority of mines and engineering challenges for the design and construction of communication routes are huge, so that changes in altitude vary from sea level to 4,818 m.s.n.m. in 140 km of road or rail.

The Amazon rainforest, which covers more than half of the country's territorial extension, a sparsely populated region with scarce roads. The plentiful rivers are the means of transporting people and cargo. In this region are the oil and gas fields.

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It is these geographical conditions, as well as others of a different nature, that cause the infrastructure deficit in the country to be significant,

The following table gives us an overview of the infrastructure gap.

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Infrastructure Gap in Peru
2016-2025 (10 years)
Source: National Infrastructure Plan 2016-2015 University of the Pacific-AFIN

RUBRO	Millones de US$ del año 2015
AGUA Y SANEAMIENTO	
- Agua Potable (cobertura 85%)	2,629
-Saneamiento (cobertura 70%)	9,623
TELECOMUNICACIONES	
-Telefonía móvil	6,884
-Banda Ancha	20,151
TRANSPORTE	
- Carreteras (pavimentadas 24355)	31,850
- Ferrocarriles	16,983
- Aeropuertos	2,378
- Puertos	6,287
ENERGIA	30,775
SALUD	18,944
EDUCACIÓN	4,568
HIDRÁULICO	8,477
TOTAL US$	159,549

Source: National Infrastructure Plan 2016-2015
University of the Pacific-AFIN

The programmed investments only cover 41% of this gap.
Peru in 2017 had a relatively low percentage of public debt with respect to GDP, of 26%, that is, it had enough ceiling to borrow from public works.
Peru is ranked 112 worldwide with respect to the quality of infrastructure (WEF).

To close the gap in the 2016-25 period, infrastructure investments of over 8% of GDP are needed.

The gap estimated by the Universidad del Pacífico of US $ 159,549 million would have to be added the reference to housing that must be addressed by the private sector with a clear policy of the state of financing on demand. The current deficit is of 1,000,000 houses considering the qualitative and quantitative deficit, plus the necessary one due to the demographic growth of the population, which originates that in 50 years the need to build will be approximately 75,000 houses per year at an average cost of US $ 22,000 / housing, that is, an investment per year of US $ 1,600 million.

If we add to this the need to improve the transport infrastructure of Lima and the main cities of the country that reach a population of more than 500,000 inhabitants, 8 according to the INEI, investments that can reach 30,000 million US $ in 10 years will be necessary. years. We would be considering 4 additional lines of the Lima metro 8 light mass transport infrastructures for 8 cities in the country with a population of more than 500,000 inhabitants. All this makes the investment need to be of the order of US $ 20,000 million per year.

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Maintaining this rate of investment in the next 50 years would mean an investment of US $ 1,000,000 million that would endow Peru with a first world infrastructure: 100% water and sanitation coverage, internet for the entire population, the Pan-American highway, Along the whole coast, from Tumbes to Tacna, it would be a highway as well as the central highway, which gives access to the mountains and jungle. US $ 250,000 million would be invested in educational infrastructure and US $ 100,000 million in health.

It is important to highlight that there are fields in civil engineering in which there has been no greater activity in recent years. An example of this is the design and construction of new railroads.

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However, this year the Ministry of Transport and Communications has convened four (4) Pre-Investment Studies at the Profile level:

Description	Length (Km)	Term (days)
1) Lima - Barranca	200	180
2) Lima - Ica	324	180
3) Lima - Chosica	41	185
4) Marcona - Andahuaylas	570	365
Total	1,135	

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The fourth railway line would start in the port of San Juan, in Marcona, Ica, (south of Lima) and would go east, ascend the Andes mountain range to reach the city of Andahuaylas, Apurimac at 2,926 m.s.n.m. In the route, the railway line would reach levels close to 4,200 m.s.n.m.

The budgets for studies at the profile level of the four (4) railroads are the following:

	Soles (S /.)	US $
1)	29'709,607	9'141,418
2)	37'466,313	11'528,096
3)	7'829,342	2'409,028
4)	32'028,827	9'855,024

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ECLAC estimates for Latin America and the Caribbean that it would be necessary to annually invest 5.2% of the regional GDP (170,000 million US $) to respond to the needs that will arise from companies and final consumers in the region until 2020, while that if what is wanted is to reach the levels of infrastructure per capita of a group of Southeast Asian countries it would be necessary to invest annually 7.9% of GDP (US $ 260,000 MM).According to the United Nations, in a June 2017 report, the world population in millions would vary from 7600 in 2017 to 8600 in 2030, 9800 in 2050 and 11200 * in 2100.

Peru's GDP for 2016 was US $ 195,140 million (0.26% of world GDP) and ranked 49 out of 190 countries according to the International Monetary Fund.

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The GDP growth rate of Peru in 2016 was 3.9%, however, in 2014 and 2015 the rate was 2.4 and 3.3%, which can be satisfactory for a country that has already reached the level of developed country, without However, it is not enough for present-day Peru, which registers 20.7% of the population in poverty in 2016 and 3.8% in extreme poverty. In the 2014-2016 period, the global GDP was 3.4, 3.2 and 3.1%. Latin America went from growing 0.9% in 2014 to -0.5% in 2015 and -1.1% in 2016. Peru should not grow less than 4% annually.By 2018 Peru's per capita GDP will be of the order of US $ 15,000, which is 62.5% of the US $ 24,000 minimum amount to be considered as a first world country.

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According to ECLAC, the infrastructure stock compared to 2005 in Latin America and East Asia is:

Sector	Unidad	América Latina y El Caribe	Este de Asia	Diferencia
Capacidad de Generación Eléctrica	Mw cada 1000 hab	0.47	1.32	0.84
Telefonía Fija	Líneas cada 1000 hab.	181	400	219
Telefonía Móvil	Líneas cada 1000 hab.	446	835	389
Internet Fija de banda ancha	Suscriptores cada 1000 hab.	15	205	189
Caminos Pavimentados	Km. cada 1000 hab.	0.92	1.86	0.94
Vías Férreas	Km. cada 1000 hab.	0.22	0.06	-0.16
Agua	Porcentaje de la población	92	100	0.07
Saneamiento	Porcentaje de la población	78	97	0.19

Source: ECLAC Daniel Perrotti. Ricardo Sánchez (July 2011)

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Modalities of execution of public works in Peru: APPs, OXI, conventional modality of public works and the role of Peruvian engineering and consultancy.

Public works (preferably in the Western world, including Peru) were carried out until the 1980s by the conventional modality, that is, the state hired private consulting firms for engineering through public tenders for the preparation of definitive studies. of engineering or technical files of execution of work and then on the basis of those files tendered the execution of the work, among private contractors, entrusting the supervision of the same to private consulting engineering companies.

However, since the 1990s, the public works execution modality has been developed through public-private partnerships (PPPs), which means concessioning the execution, financing, operation and maintenance of public works.

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Another form of execution of public works that has been developed in recent years in Peru is that of works for taxes (OXI), which consists of a private company with a charge to the taxes that it has to pay to the contracting State, in coordination with the State, the execution of a public work.

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Which modality is more convenient to execute a public work in Peru? The conventional one, via APPs (concession) or via OXI.

To answer that question it is convenient to analyze some concepts related to public works, such as the maintenance of public works, the level of investment and the financing of the work

On maintenance: The states have proven over many years not to be efficient or timely in the maintenance of public works. The maintenance of a public work is not "attractive for politicians" there is no first stone, no inauguration; For this reason, sufficient budgets are not allocated for its maintenance, with the serious consequences for the existing infrastructure that deteriorates rapidly and its maintenance or rehabilitation is more expensive. The private sector has shown better performance in the maintenance of public works subject to the control of service levels under regulatory and control bodies.

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Regarding the financing of the investment necessary to execute the infrastructures, it is necessary to recognize that in many cases the states can not finance in the short term the execution of all the necessary public works, mainly megaprojects for the large investments that they require and in that case, it may be convenient to resort to private investment via PPPs or concessions.

The public works executed conventionally and with adequate private supervision and economic control by the Comptroller General of the Republic is the most advisable and the one that has given better results in recent years in Peru, especially in the case of investment works moderate For this, it is important to tender the works with good final projects that include the study of the risks, their identification and assignment.

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In the case of mega-projects that mean large investments and in line with the experiences in Peru over the last 10 years, I believe that the solution via PPPs would be more convenient, preferably through self-financed concessions, that is, when the cost of the service pays the investment and its maintenance. If the project is co-financed, the state should adequately evaluate the investment and financing to avoid incurring higher costs.In this case, the tenders of the concessions should be convened with technical files at the level of study or final project that includes a risk analysis that identifies, quantifies and assigns responsibility and does not bid only with feasibility studies.

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The Peruvian engineering and consultancy will have a very big challenge to face this investment of US $ 1'000,000 million to be executed in the next 50 years, to endow the country with a first world infrastructure; In addition, Peruvian engineering and consultancy companies will face the challenge of being the major designers and executors of this great investment, after that and with that great experience they will also have the challenge to internationalize, as in their time they did engineering companies from USA, Spain and other European countries. All this will be facilitated with the exponential development of the technology that we will have to master and apply.