ROLLING HIGHWAY

in the Central Andes Mountain Range

COLOMBIA

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Prologue

"This project would like us to be as soon as possible and not have to wait until 2025 when it starts to operate", a freight forwarder spokesman said at a presentation meeting at the ANDI installations. This strong message clearly indicates the urgency and importance of implementing a rapid, economic, effective and sustainable transport solution to mobilize the load on the Central Mountain Range in the famous and critical Paso de La Línea.

The Project basically consists of the transfer of the trucks by means of a railway platform in the Armenia-Ibagué route, in a total time of 70 minutes, which results in a time saving of between 2 and 3 hours, compared to the duration of the journey of a lorry by road on the same route currently. This surprising reduction of time will trigger great economic benefits: firstly by the decongestion of traffic, then by savings in fuel consumption, lubricants, vehicular deterioration, reduction of accidents and consequently of injuries or deaths. It will also have a huge impact on the mitigation of noise, emission of gases, which will greatly reduce the pollution that so much affects the environment.

The estimated savings per year for an hour of travel, the gasoline used, the risk and the ecological actor are of enormous value: qualitative, in the broad social and quantitative sense, because the economic benefit has a relevant impact of 0.25% In GDP.

All this will result in appreciable improvements in the quality of life of the population, in their comfort and security, reinforcing their identity and belonging to the country, faith in the decision-making capacity of their leaders, important factors for peaceful coexistence among Colombians.

A project of this magnitude is likely to raise the question if the above is a UTOPIA.
At first glance it seems so, since this line of thought was a constant when the initiative of EUROTREN was communicated to England and France below the Channel; The Lötschberg to cross the Alps; The St. Gotthard and others that history recognizes as the great crystallized dreams.
All of them were a UTOPIA come true. UTOPIA, which can also be ours, if in it we put our will and join our efforts.

Now, at the moment of historical changes in national life, it is also the moment to decide and begin the engineering work of the 21st century that will contribute to progress, welfare, economic development and to build the scenarios and conditions for the longed for peace.

Ing. Hernán Otoniel Fernández Ordóñez
Professor, researcher and international consultant

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0. INTRODUCTION

a. Background

Under the framework of Law 1508 dated 2012, about Public Private Partnerships, and its subsequent regulatory decrees, the Project **"Rolling Highway in the Central Range"** was registered in the National Agency of Infrastructure of Colombia (ANI) by the engineering firms UC CONSULT , SAS (Colombia) and ARCS, Estudios y Servicios Técnicos, S.L. (Spain) in September 2013, as a Public Private Partnership Project without public resources.

At the date of this Report, the Initiative is in the Feasibility stage, in accordance with the feasibility statement granted by the National Infrastructure Agency (ANI) in October 2014. The Originator is preparing the technical documents corresponding to the Stage of Feasibility, as well as the financial and legal structuring of the Project.

The Private Initiative aims to reach a concession contract for the design, construction, maintenance and operation of the Project within the framework of the current legislation in Colombia.

b. Purpose and justification of the Project

The Rolling Highway project aims to offer a modern solution of safe and sustainable transport with maximum efficiency, allowing the passage through the Central Andes Mountain Range, between the basins of the rivers Magdalena and Cauca in the central zone of the country, particularly in the Bogotá-Buenaventura axis, where the most important part of freight transit, import and export trade of Colombia takes place. It is a multimodal project, which includes the road and rail modes in an integrative solution that optimizes the service in the Bogotá - Buenaventura logistics corridor.

The proposed solution consists in the implementation of an innovative and efficient railway system for the transhipment of cargo vehicles between the western and eastern edges of the Central Mountain Range,

The Rolling Highway project aims to offer a modern solution, with extensive capabilities and maximum efficiency allowing the passage through the Central Andes Mountain Range, in the central zone of the country

connecting Quindío (Armenia) and Tolima (Ibagué), thus avoiding the passage by the Alto de La Línea (3300 meters above sea level). Trucks and trucktrailers will be transferred on platform wagons that will be integrated into trains moved by electric locomotives. A later chapter of this report describes the characteristics and functionality of this novel transportation system in Latin America.

The current reality, with very serious shortcomings in the functioning of this road, as well as the forecasts of the demands´ development as a consequence of the social and economic progress, support the need to propose new and broader solutions, which contribute at the same time an added value of further benefits in the environmental and social integration of the country. The improvements expected from the execution of a double carriageway between Armenia and Ibagué will be strengthened in its service as a result of the complement that the Rolling Highway proposes by avoiding the transit of trucks by the highway.

The proposed Rolling Highway project has high strategic effects that provides an excellent future scenario for Colombia. It is a project that, due to its breadth and complexity, requires longer deadlines than usual with reference to other projects and, relying on the private initiative that is impelling and promoting it, demands support in the public sphere (National Government, Regional Departments and Municipalities involved) and civil society in general.

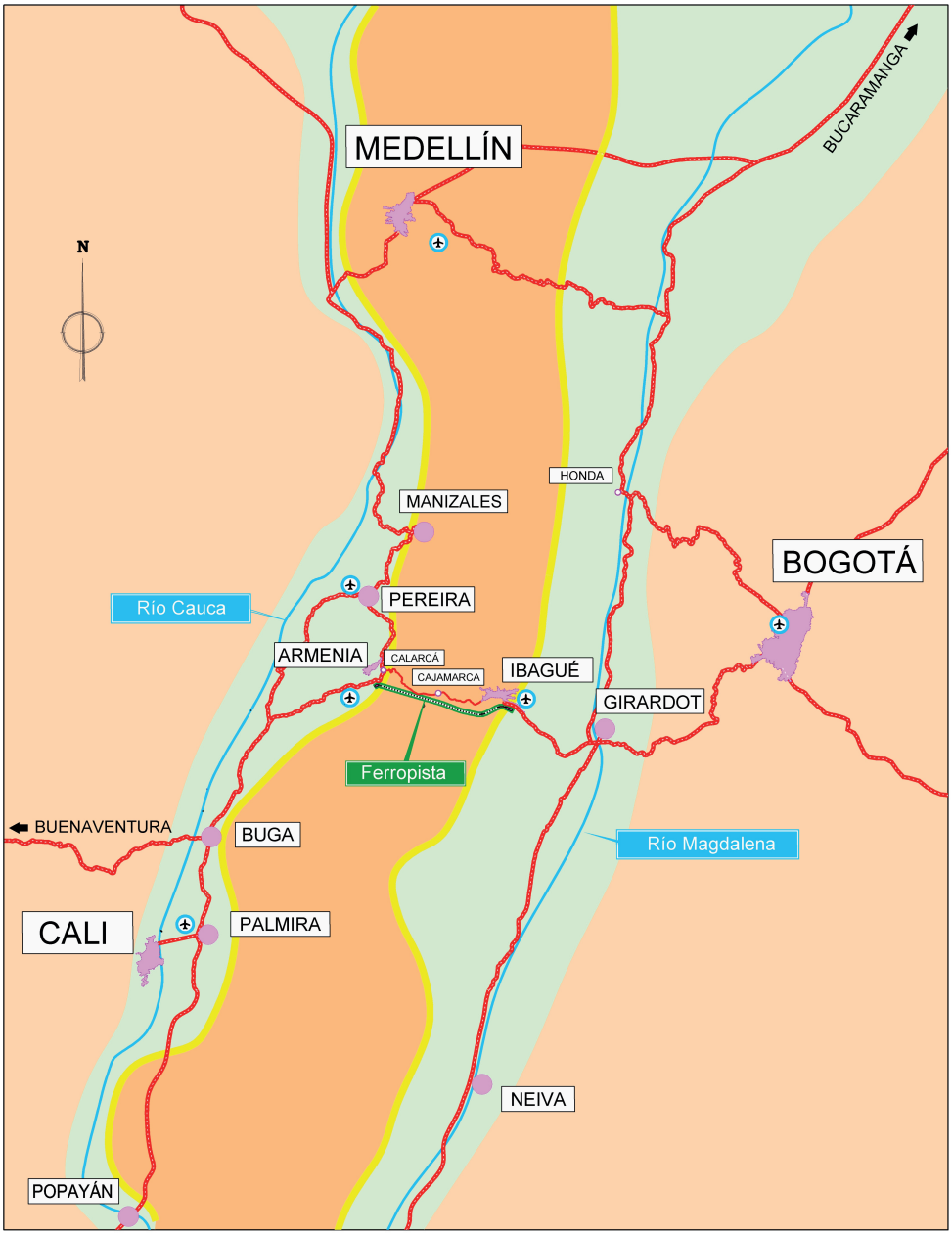


Fig. nº 1: Location of the Project in the Central Mountain Range

b.1. Background

The Central Mountain Range of the Andes is a great barrier that interposes and separates the vast fluvial basins of Magdalena and Cauca, with a width that varies between 50 km and 100 km, the minimum value corresponding precisely to the area where the road between Armenia and Ibagué crosses. This important route now reaches its maximum level in Alto de La Línea, with 3,300 meters a.s.l., while its height in Armenia is 1,450 meters a.s.l., and 950 meters a.s.l. in Ibagué. This route runs through abrupt and unstable slopes of the Range, following over a large part the courses of the Santo Domingo, Coello and Combeima rivers, with a layout of tight curves and steep slopes.

It is known that in precolonial times there was already an Inca Trail that traveled from Peru to the lands of Venezuela, passing through Popayán and surpassing the Central Mountain Range through the Paso del Quindío, coinciding with what is now known as Alto de La Línea. It was a route prepared for walkers, with steps and cobblestones not suitable for mules or horses. During the Viceroyalty it was known as the Road of Carthage, with opening and improvement of roads encouraged by private collaboration through the granting of land, without much success because of the important difficulties to overcome. In these times there were no exchanges between territories, as the population units were self-sufficient. It took between 12 and 30 days to cross the Mountain Range.

Simón Bolívar, as quoted by Jaime Lopera Gutierrez in "The Colonization of Quindío," ordered on January 25, 1830 "the opening of a horseshoe road in the Andes pass, called Quindío, from the city of Carthage to Ibagué", after meeting the difficulties of the route personally, having spent a night in Boquía a few days before, then place of stopover on the trip. Several scientists and writers of the eighteenth and nineteenth centuries referred to this passage of the Mountain Range: Caldas, Humboldt, Codazzi, Faulhaber and Vergara y Velasco.

The Quindío Way is a key part of the colonization process, articulating the West and the East, the Santa Fe Valley and the Pacific Ocean, and the Magdalena and Cauca Valleys.

The navigation on the Magdalena River and the railroad attracted attention on transport routes until the beginning of the 20th century. By 1920 there were already 600 km of paved roads, although not yet connected to each other.- The displacement process of rural populations and their concentration in cities developed in the second half of the last century and increased in recent times, are at the origin of the important demands that upport the transport networks in present-day Colombia, similarly to what happened in other parts of the world.

The reduced participation of the rail transport derives towards the road all the responsibility on the transport of loads, concentrated especially in Paso de la Línea.

b.2. Current reality

The road networks that have been forming throughout history in the wide basins of the Magdalena and the Cauca coincide in the Paso de la Línea as the only link between them that gathers sufficient conditions, since there is no other road passage paved in about 500 km south (Ecuador), while about 200 km north there is only the passage Alto de Las Letras (3,750 m.a.s.l.) on the route to Manizales, which serves a road with very reduced benefits and possibilities.

The road networks that have been forming throughout history in the wide basins of the Magdalena and the Cauca coincide in the Paso de la Línea as the only link between them that gathers sufficient conditions

Fig. nº 2: Location of the Project in the main highway network

The figure below shows these road networks, incorporating the transformations that are achieved with the programs of dual carriageway roads 4G and concessions APP in process of execution.
It follows from the above the total dependence on the communications between the valleys cited with respect to La Línea Pass, which, by linking the cities of Armenia (Quindio) and Ibagué (Tolima), serves the transportation of the whole country as a necessary route in relations West - East and vice versa, as well as between the coast of the Pacific Ocean (Port of Buenaventura) and the central area including the Bogota Capital District and the Department of Cundinamarca.

At the time of writing, the road between Armenia and Ibagué is a single carriageway road of about 7m La Linea with a very sinuous layoutwide, which runs along the slopes of the valleys leading to the Alto deof reduced radios in plant, and with important values of the slopes and ramps, that reach in some point 18%, surpassing in good part of the route 10%, even counting on its continued adaptation to the land. It crosses Cajamarca and flows next to diverse constructions and different uses of the ground and exploitations with direct accesses to the road.

A tunnel of about 8.5 km is under construction, located at approximately 2,500 meters above sea level, planned to redirect traffic in the upward direction towards Calarcá-Armenia once the double carriageway under construction by INVIAS is also completed. Work has also been started on a dual carriageway between Ibagué and Cajamarca through a concession to a private company.

According to the published deadlines, it is expected that in about eight years it will be possible to drive around a dual carriageway in both ways between Calarcá and Ibagué, with a transit route using the new tunnel and the other ascending, as has hitherto, Alto de La Línea. The new road will be used by one transit direction and the current road will support the other. There is not a programmed Cajamarca by-pass, an issue that presents important technical, environmental and social difficulties.

The current travel times on the Armenia - Ibagué route and vice versa are, under normal traffic conditions, of about 4 hours for heavy transport, although from time to time incidents such as crashes, landslides, storms, fogs, etc. lead to a considerable lengthening of the journey time, without any alternative routes of interest. Once operational, and taking into account the limitations that will persist for a fluid and safe circulation, the complete dual carriageway might reduce the times for these vehicles in about 90 minutes, that is, in optimum conditions the trip will last about 2.5 hours, remaining the aforementioned risks, although somewhat smaller.

The current travel times on the Armenia - Ibagué route and vice versa are, under normal traffic conditions, of about 4 hours for heavy transport

According to available traffic data, traffic on the Armenia - Ibagué road is summarized in the following table:

	CARS	BUSES	TRUCKS	TOTAL
ADT	1.368	438	3665	**5471**
%	25%	8%	67%	**100%**

Tabla nº 1: Average daily traffic on the Armenia - Ibagué road (Source: INVIAS, 2011)

The current route, as an important part of the Bogota - Buenaventura axis, is subject to intensities of heavy vehicle use of great importance both in absolute and relative terms, since these types of users have no alternative

It can be observed that the current route, as an important part of the Bogota - Buenaventura axis, is subject to intensities of heavy vehicle use of great importance both in absolute and relative terms, since these types of users have no alternative. It is a route mainly used for long distance travels, except for its use to relate Cajamarca with Ibagué and the Department of Tolima, and vice versa.

The use of medium and long distance transport of people in Colombia is generally by plane, as the land routes do not offer costs and competitive times as a result of their notable technical limitations and the predominance of all kinds of trucks.

c. Scope and objectives of the report

This Report has been prepared by the originators and the technical team supporting them and its main objective is to describe the Project and its main benefits, its outstanding risks and its effects on the country's economy, in addition to showing references of similar succesful works, describing their results. Likewise, the Report reflects the scope and status of ongoing and terminated studies. It is intended to facilitate the knowledge of the project by people and entities of all types involved in its management, both in the public and private spheres.

The first part of the Report is oriented to present the physical reality and economic situation of Colombia, as well as the macro forecasts of the main indicators. Then, the current infrastructure situation as well as the current plans in the country are described.

The second part of the Report includes the presentation of the main technical characteristics of the Rolling Highway Project, its justification and main objectives, and data on demand, operation and miscellaneous costs.

It also describes the current situation of the Initiative.

The third chapter of the Report presents the cases of similar transport systems with large tunnels in the world, together with a summary description of the main effects generated.

The fourth chapter describes the main effects associated with the implementation of the Rolling Highway Project in the Central Range, both economic on users and the general economy, as well as social and environmental.

The fifth section of the Report focuses first on identifying the general risks and uncertainties associated with megaprojects, and then makes an approximation to the main specific risks of the Rolling Highway Project and the necessary measures to minimize and control them.

Finally, **section 6** sets out in the form of conclusions the guidelines considered to guide the management of this important project in the near future.

1. COLOMBIA

Colombia is the third most populated country in Latin America,with almost 48 million inhabitants (DANE, 2015), and is the fourth Latin American economy

1.1. Geography

1.1.1. Physical

The Republic of Colombia is located in the northwestern part of South America. It is the only country in South America with both Atlantic and Pacific coasts. Some islands in the Caribbean and in the Pacific form part of Colombian territory.

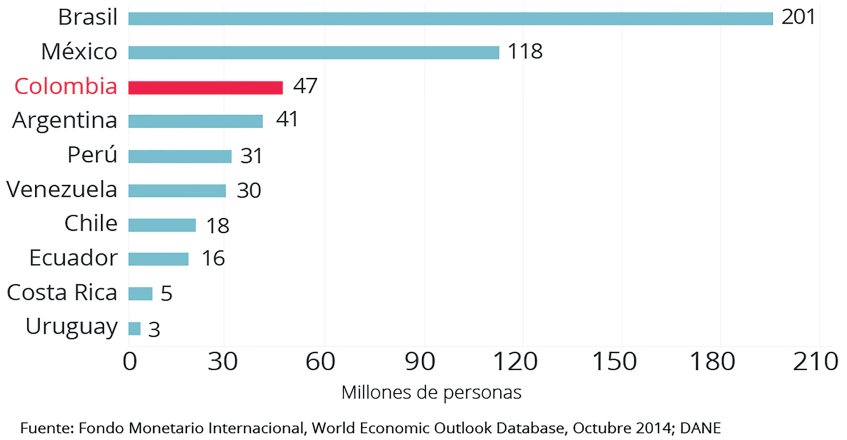
The continental surface of Colombia is 1,141,748 km², being the fourth country of South America in extension. The surface of the country is 2,129,748 km², 54% corresponding to its continental territory and the rest to its maritime extension. It has land borders with Venezuela and Brazil to the East, Peru and Ecuador to the South, and Panama to the Northwest. In terms of maritime boundaries, it borders Panama, Costa Rica, Nicaragua, Honduras, Jamaica, Haiti, the Dominican Republic and Venezuela in the Caribbean Sea, and with Panama, Costa Rica and Ecuador in the Pacific Ocean. Geographically, Colombia presents a very heterogeneous relief. The Andean region, which occupies most of its western sector, is composed of three large branches that cross the territory from North to South: the lower Western Range, which runs parallel to the Pacific coast (Chumbal), Central Range, between the Cauca and Magdalena rivers (Nevados del Huila, 5,750 masl, Nevado del Ruiz and Nevado de Tolima, that exceed 5,200 masl), and the Eastern Range, between the valley of Magdalena and Los Llanos (Sierra Nevada de Cocuy, 5,400 m altitude). At Sierra Nevada de Santa Marta are located the highest peaks of the country: the Christopher Columbus peak and the Bolivar peak, 5.775 m above sea level.

1.1.2. Population

Colombia is the third most populated country in Latin America, with almost 48 million inhabitants (DANE, 2015), and is the fourth Latin American economy, according to the International Monetary Fund (IMF). According to the main indicators, the Colombian economy has managed to maintain some stability despite the current economic crisis in developed countries.

The main conurbations of the country are Bogotá -the Capital District-, Medellín, Cali,Barranquilla and Cartagena, which make up almost 40% of the country's population, with about 19 million inhabitants.

In the area of the triangle formed by the main cities of the country, Bogotá, Medellín and Cali, distanced in a straight line about 300-350 km, it is concentrated 65% of the country population, with more than 30 million inhabitants



Fuente: Fondo Monetario Internacional, World Economic Outlook Database, Octubre 2014; DANE

Fig. nº 3: Population in some Latin American countries. IMF, 2013

In the area of the triangle formed by the main cities of the country, Bogotá, Medellín and Cali, distanced in a straight line about 300-350 km, it is concentrated 65% of the country's population, with more than 30 million inhabitants.

1.1.3. Social

The history of Colombia is generally divided in pre-Columbian times, Spanish discovery and conquest, colony, independence, republican consolidation and twentieth and twenty-first century. Colombia became a state in 1810 from the Viceroyalty of New Granada, a colony of the Spanish Empire that had been founded in 1572. In 1886 it definitively takes its present name, Republic of Colombia. Part of the history of Colombia has a close relationship with the history of Spain until independence and with the stories of Ecuador, Peru, Venezuela, Panama and Latin America in general.

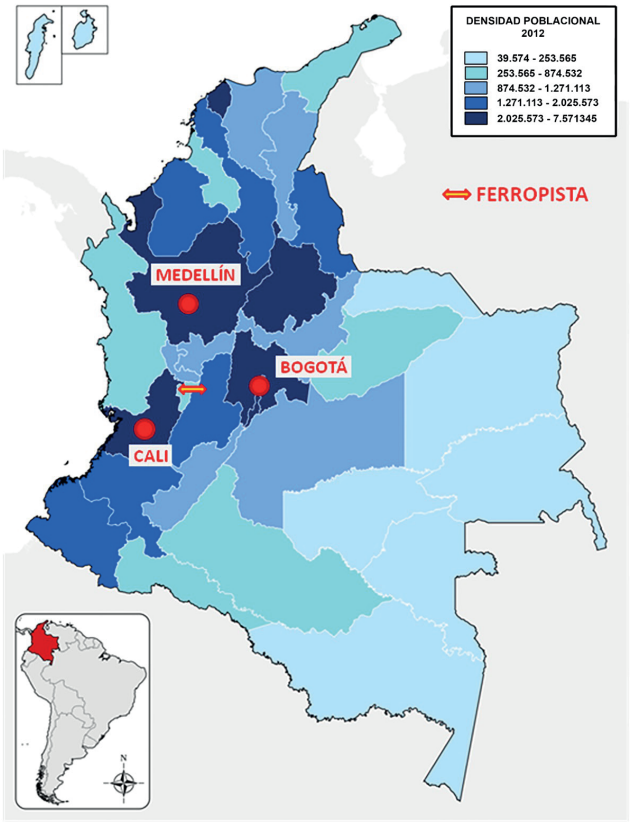


Fig. nº 4: Density of population by departments. Year 2012. Source: DANE

From the 1991 Constitution on, Colombia has been organized in 32 departments and one capital District (Bogota). The departments are formed by the association between municipalities. There are currently 1,120 municipalities including the Capital District and special districts.

According to DANE data, 51.2% of Colombia's population are women and 48.8% are men. Most of the population is in the center (Andean region) and north (Caribbean region) of the country, while in the east and south (Eastern Plains and Amazonia, respectively) there are fairly large areas with only small populations and generally depopulated. The ten eastern lowland departments (approximately 54% of the total area), have less than 3% of the population and a density of less than one person per square kilometer. 60% of the population is concentrated in 7% of the territory, mainly in the Andean Region, the most populated of Colombia.
The movement of rural population to urban areas and emigration outside the country have been significant. The urban population increased from 28% of the total population in 1938, to 75% in 2005; however, in absolute terms the rural population increased from 6 to 10 million in that period.

The indigenous territories in Colombia are created by common agreement between the government and indigenous communities. The indigenous territories in Colombia cover an area of approximately 30,845,231 Ha, and are found mostly in the departments of Amazonas, Cauca, La Guajira, Guaviare and Vaupés, among others. They represent 27% of the total area. They do not affect the Rolling Highway Project.

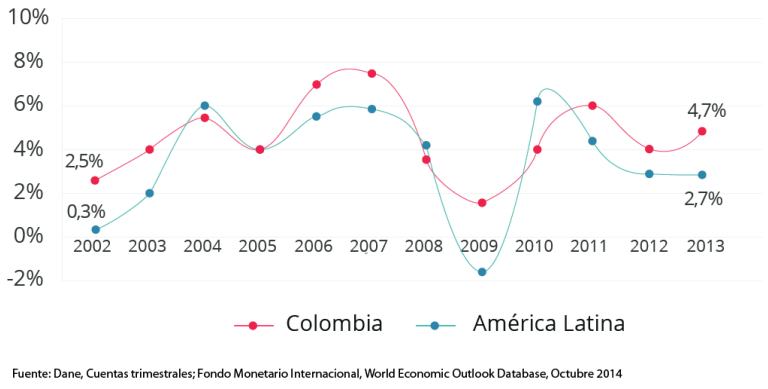
Not all regions of Colombia share the same level of development. The main area of high development corresponds to the Andean region in cities such as Bogotá, Medellín and Cali, which constitute the so-called «Golden Triangle». More than 99.2% of Colombians speak the Spanish language, but also a hundred Amerindian languages are spoken in the country. At present, life expectancy is 74.79 years.

The main universities of the country are the National University (public), the University of Antioquia (public), the University of the Andes (private), the Del Valle University (public), and the Pontifical Javerian University (private).

1.2. Economy

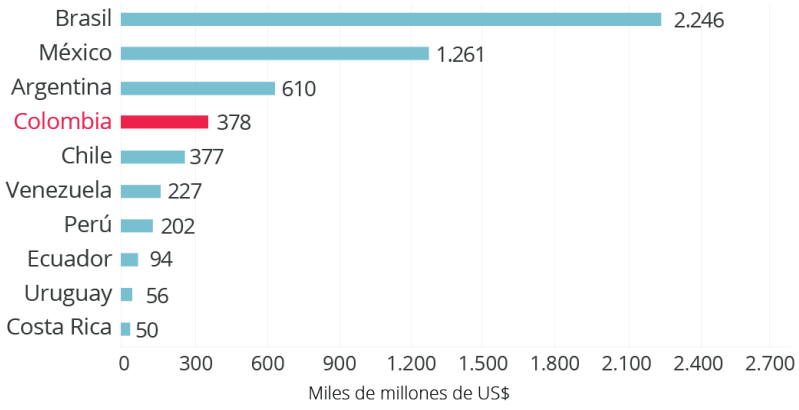
1.2.1. Basic Data

Colombia has been one of the most dynamic countries in Latin America during the last years, showing a vigorous and uninterrupted growth of GDP from 2000 to 2015, although somewhat attenuated in recent years.



Fuente: Dane, Cuentas trimestrales; Fondo Monetario Internacional, World Economic Outlook Database, Octubre 2014

Fig. nº 5: GDP growth rate in Colombia and Latin America. DANE



Fuente: Fondo Monetario Internacional, World Economic Outlook Database. Octubre 2014

Fig. nº 6: GDP of main countries in Latin America (Bill. US $). IMF, 2013

This favorable trend in production has been accompanied by the ending of the armed conflict, a decline in the unemployment rate, the maintenance of moderate inflation rates and an increase in per capita GDP. In this sense, and taking as a reference point the database developed by the World Bank, an average annual increase in GDP close to 4.5% has been registered since 2000, a variation higher than that observed in the whole Latin America and the Caribbean and in the world economy, where it has stood at around 3%. In 2014 and 2015, GDP stood at 4.4% and 3.1%, respectively.

Colombia has been one of the most dynamic countries in Latin America, showing a vigorous and uninterrupted growth of GDP

Per capita GDP in 2014 was 7,928 USD (World Bank), it has been growing since 2000 with variable rates of growth, with annual growth rates from 2010 to 2014 higher than the Latin American average, above other countries like Venezuela, Chile and Peru.

According to the Bank of the Republic data for the year 2015, the unemployment rate stood at 8.9%. Exports grew 38% from 2010 to 2014, from USD 39.7 billion to USD 54.8 billion in that period (according to ProColombia), with growth in foreign direct investment (FDI) in this period From USD 6,430 million in 2010 to USD 16,325 million in 2014.

It is important to note that Colombia managed to reduce its inflation to 2.0% in 2013, bringing it to its lowest level in the last 15 years. This has been a determining factor for foreign investment. In the last two years there have been somewhat higher rates.

Colombia managed to reduce its inflation to 2.0% in 2013

Due to changes linked to globalization, logistics has become a driving force behind trade and industry competitiveness, favoring the emergence of complex systems in this area and giving rise to multimodal transport schemes, depending on the load, time, distance and geography.

Fuente: WEF, (2016) Nota: Puntaje entre 138 países, donde un mayor valor (7) indica mejor calidad de infraestructura

Fig. nº 7: Quality of infrastructure, Colombia and reference countries, 2016 (National Competitiveness Report 2016-2017)

As examples of some infrastructure projects carried out in other countries of the world with significant economic impacts on their respective economies, we can highlight the case of Mexico, whose National Infrastructure Program (PNI) 2014-2018 has an investment of more than 500,000 MUSD, and will have a combined economic impact of approximately 1.5 percentage points of growth in the country's GDP. There are many other projects worldwide with a great economic and social impact on the regions, such as the Eurotunnel under the Channel between the UK and France, the Panama Channel, the system of large tunnels under the Swiss Alps, or the Øresund Bridge between Denmark and Sweden, as will be explained later.

1.2.2. Domestic Trade

According to ANIF´s reports (Transportation, multi-modalism and competitiveness costs in Colombia, 2014), with regard to the mobilization of cargo into Colombia, 73% of the total number of tons transported in the country (220,300 Million tonnes) were moved by road in 2013. It is the highest figure among the different means of transport and has practically tripled the value of the second most used means of transport (railroad reached 26%).

Likewise, there has been an increasing trend in the number of tons transported under this modality of transport, which went from 84 million tons in 2002 to 220 million tons in 2013, reflecting an average annual growth of 8.3%.

73% of the total number of tons transported in the country were moved by road in 2013, reflecting an average annual growth of 8.3%

According to the Ministry of Transport, 46.1% of the load of products moved by road corresponds to products of the manufacturing sector. The second place is reached by agroindustrial products that represent 27% of the goods transported. A lower weighting is achieved by agricultural goods and mining products, with proportions of 17.4% and 9.4%, respectively.

According to ANIF, "although the railroad might offer some competition for the transport of this type of goods, its use is almost exclusively aimed for the transportation of coal, resulting from the lack of railway stock to guarantee access to the main areas of production of the country ".

The lack of railway stock to guarantee access to the main areas of production of the country

1.2.3. Foreign Trade

98.2% of the cargo exported from Colombia is made by sea

According to information available from PROCOLOMBIA, Colombia's foreign trade has the following significant data currently:

- Exports:

• In 2014 exports exceeded USD 54.8 billion (FOB), a decrease of 6.8% over the previous year.
• Non-mining and non-coffee products accounted for 25.7% of exports (USD 14,101 million).
• The sectors with the greatest growth were coffee, confectionery and coal.
• 98.2% of the cargo exported from Colombia is made by sea.

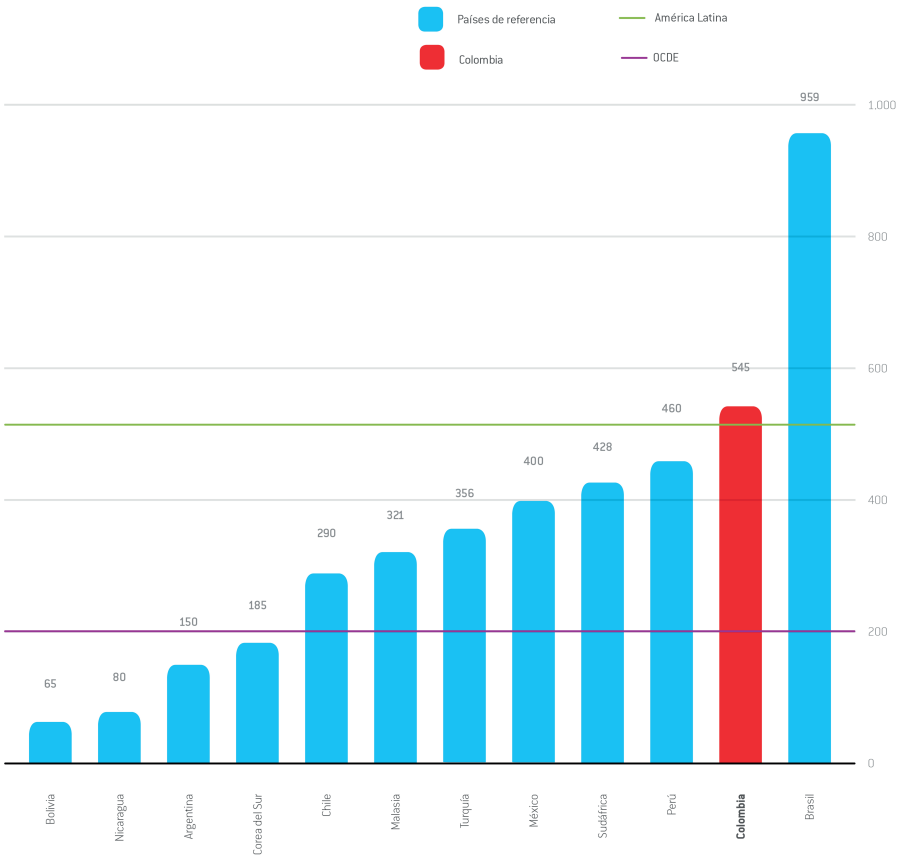
- Imports:

• The level of imports has remained stable in the period 2011 to 2014, with figures around 55,000 Million USD (FOB).

- Exports + Imports through Buenaventura:

The total amount of foreign trade through Buenaventura Port reached 44.4% of the Nation's total

• According to information from the Superintendence of Ports and Transport (Year 2015), 33% of exports were mobilized by the Port Society of Buenaventura in 2014, while if imports are added, the total amount of foreign trade through this Port Reached 44.4%.



Fuente: Doing Business (2016). **Nota:** El costo por cumplimiento fronterizo incluye los costos del cumplimiento de la regulación aduanera y de la regulación relativa a otras inspecciones, así como el costo del manejo en puerto o frontera.

Fig. nº 8: Costs of exporting merchandise (US $ per container). Colombia and countries of reference, 2015 (National Competitiveness Report 2016-2017)

1.2.4. Forecasts

According to data from Euromonitor International, the population of Colombia in the year 2030 will be around 57.2 million inhabitants, which means a 20% increase regarding the population in 2012.

The population of Colombia in the year 2030 will be around 57.2 million inhabitants

The objective of the country, according to the Ministry of Foreign Affairs, is to double per capita income in the next 10 years, and triple it in the next 40 years, which would represent the greatest growth in Latin America thus reaching a place in the Top 30 of the World Economies (The World in 2050, HSBC).

According to information from the Ministry of Commerce, Industry and Tourism, Colombia has currently 10 trade agreements and 3 partial scope agreements allowing the country to have preferential access to more than 45 countries and about 1.5 billion consumers in markets such as the United States, the European Union , Brazil, Mexico, Chile or Peru; and shortly in Costa Rica and Korea, nations with treaties signed already.

The objective of the country is to double per capita income in the next 10 years, and triple it in the next 40 years

Colombia has currently 10 trade agreements and 3 partial scope agreements allowing the country to have preferential access to more than 45 countries and about 1.5 billion consumers

1.3. National Development Plan

The purpose of the National Development Plan (PND) 2014-2018 ***"All for a New Country"*** is to build a Colombia in peace, equitable and educated. In order to achieve the objectives of the PND, 5 strategies have been designed that are transversal to the 3 pillars of peace, equity and education:

1) Strategic Competitiveness and Infrastructure.
2) Social Mobility.
3) Field Transformation.
4) Security, Justice and Democracy for Peacebuil ding.
5) Good government.

According to PND, Strategic Competitiveness and Infrastructure "are necessary to foster economic growth and human development resulting from greater integration and connectivity between the territories and the nation".

Even though the Plan recognizes that in recent years a considerable progress has been made by the country in this area, there is still a large portion of obsolete and maintenance-free infrastructure, which means that Colombia has lagged behind the rest of the American continent, particularly against Latin America.

Strategic Competitiveness and Infrastructure are necessary to foster economic growth and human development (PND Bases)

According to the World Economic Forum Report "The Global Competitiveness Report 2014-2015", Colombia ranks 108 out of 144 in General Quality of Infrastructures, with a rating of 3.4 out of 7 points. In particular, rail mode ranks 102 out of 144 in quality, with a rating of 1.5 points out of 7, and road mode ranks 126 out of 144 in quality, with 2.7 points.

Colombia ranks 108 out of 144 in General Quality of Infrastructures

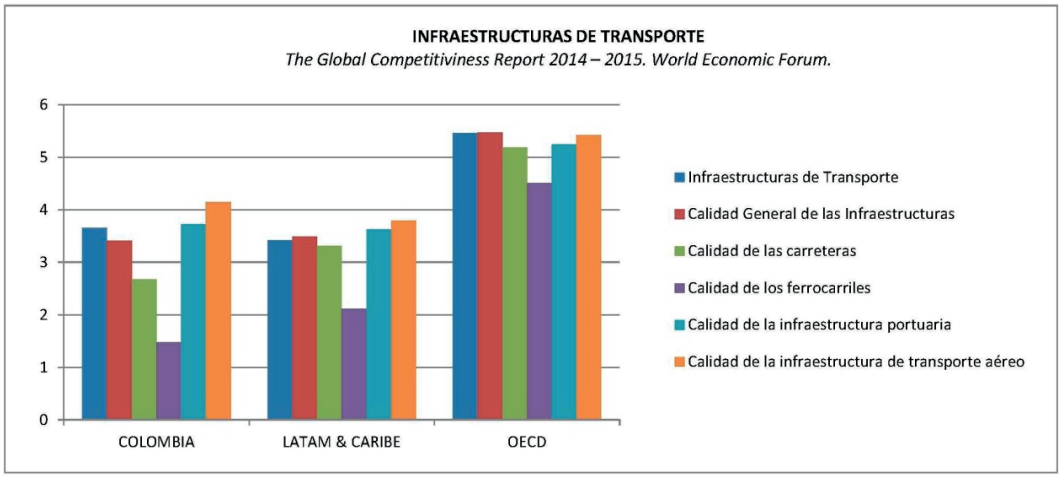


Fig. nº 9: Colombian Economy in the international context. World Economic Forum

In the previous graph is shown the significant gap in the rail and road modes in Colombia, both in relation to the assessment of all transport infrastructures in the country and in relation to the valuation of the railways and roads in the set of Latin America and the Caribbean.

To face this reality, the national government is going to make an infrastructure effort in the coming years, continuing the ambitious fourth generation (4G) concession transport infrastructure program. But it is also necessary to advance in the field of competitiveness with policies that incorporate the articulation of science, innovation and technology system with private enterprise. Thus, the strategy of Competitiveness and Strategic Infrastructure in Colombia is essential to connect with the world economy and enjoy sustained growth, fulfilling its commitments in the aforementioned international agreements.

These Pillars and Transversal Strategies are complemented by an Enveloping Strategy that incorporates the new "Green Growth" environmental concept.

1.3.1. Infrastructure and logistics and transport services for territorial integration

According to the National Development Plan PND 2014-2018

The backlog in logistics and transport infrastructure is one of the main obstacles to Economic development and the consolidation of peace in Colombia (PND)

(Chapter V: Competitiveness and Strategic Infrastructures, page 126), "the backlog in logistics and transport infrastructure has been repeatedly identified as one of the main obstacles to Economic development and the consolidation of peace in Colombia. This delay: 1) generates high costs that make local products more expensive, reducing their competitiveness; 2) slows down regional integration, propping up self-contained regions and wasting the benefits of domestic trade and specialization; 3) stops the growth of the field by increasing the costs of products transportation to the main centers of consumption; And even 4) hinders the presence of the State in many areas of the country through the provision of basic services such as education, health and safety.

One of the main objectives defined in the PND 2014 - 2018 is to provide the infrastructure and services of logistics and transport for territorial integration. This objective has associated different strategies, among which we highlight for its particular interest in the case that concerns us, the strategy of **"Consolidation of strategic multimodal transport corridors"**. According to the PND (p.187), *"it is necessary to give a special impulse to rail, water and air transport, in order to consolidate a multimodal transportation scheme in the country that minimizes costs in the transportation task. The rail mode presents great operational advantages in terms of cost optimization per tonne transported and less environmental impact with respect to the transport of freight by road. In order to take advantage of these advantages and reduce logistical costs, it is necessary to promote economically sustainable railway projects directly related to productive projects that ensure cargo supply. To this end, the sector has established as one of its main objectives to promote private investment in railway infrastructure to recover the corridors with greater potential and guarantee the operation of cargo and passengers".*

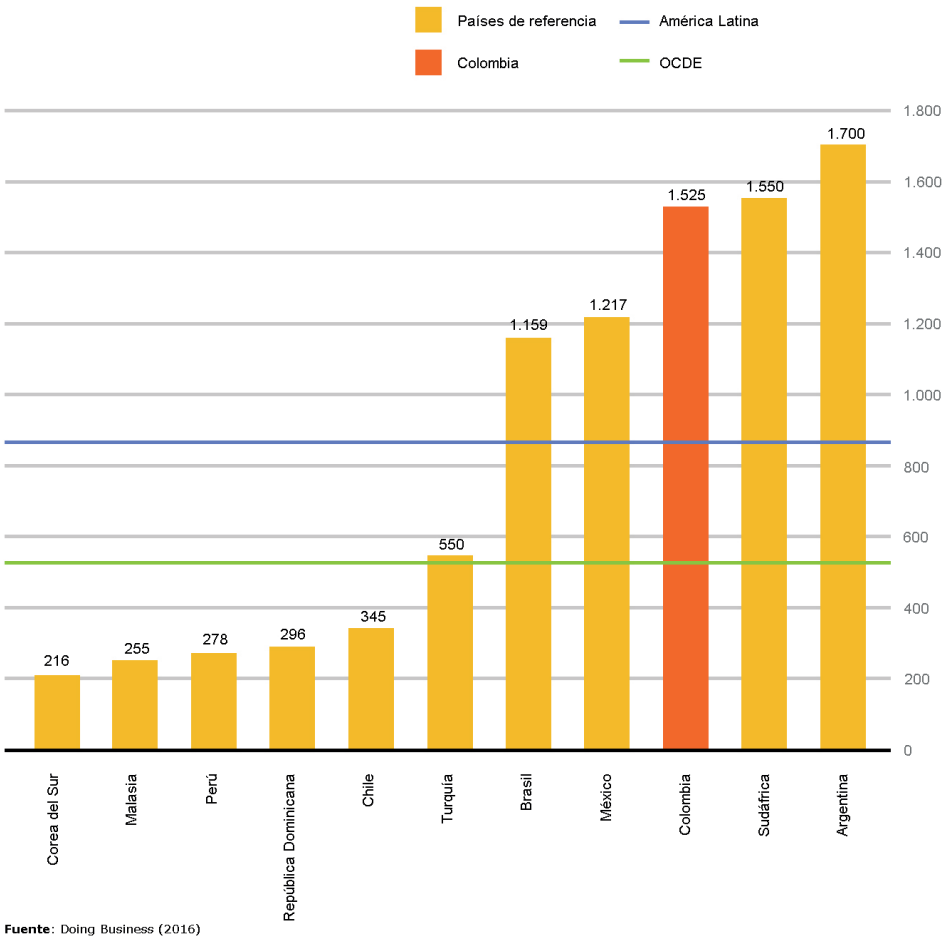


Fig. nº 10: Domestic transportation costs for exporting merchandise (US $ per container). Colombia and countries of reference, 2016 (National Competitiveness Report 2016-2017)

In addition, *"the participation of private capital will be promoted for the development of medium and long-term railway projects, such as (...) La Tebaida-La Dorada rail (central andean tunnel), among others."*

What the PND sets out regarding cargo management in Colombian territory is also of great interest, because as it is well known, almost all cargo is exclusively carried out through road ground transport, so it will be necessary to target actions aimed at the modal integration of infrastructures, *"Combining the recent efforts to make use of the fluvial and rail network for freight transport.*

In line with the promotion of modal neutrality, fluvial and rail projects of public initiative will be structured with schemes of financing and risk assignment similar to road projects, in order to be able to reflect the own efficiencies of each mode".

The PND 2014-2018 establishes the need to coordinate road infrastructure developments with the initiative of river, rail, air and pipeline transportation, and the establishment of logistical platforms and infrastructures complementary to transport *"that guarantee continuity of flows, reduction of time and economic competitiveness of the user supply chains".*

1.3.2. Green Growth

According to the National Development Plan (Chapter X, page 655), greenhouse gas (GHG) emissions from the transportation sector in Colombia correspond to 12% of total emissions, with roadside mode being responsible for 90% (Ideam, 2009, p.25). Therefore, it is important to highlight that the sector has been characterized in the last decade by its tendency to road mode, with a participation of 73% in the national freight transport versus a minimum participation of the rail mode (0.03% not including coal), fluvial mode (1%) and cabotage (0.2%) (Min-Transporte, 2013, page 49). The sector is also characterized by high logistics costs with increases of 60% between 2010 and 2013 (World Bank, 2014).

1.3.3. Multimodal Cargo Transport

Among the objectives set out in Chapter X: Green Growth of the PND (Page 666), the need to move towards sustainable and low carbon growth is established, which requires, among other things, encouraging the transformation of certain productive sectors through more efficient solutions and with lower emissions. These sectors include transport, and in particular, freight transport.

In order to change the course of the situation, *"multimodal freight transport will be increased with a greater share of rail and fluvial transport, in order to reduce logistical and transportation costs, reduce travel times, improve connectivity and competitiveness of the sector, minimize environmental impacts and reduce GHG emissions"*, which will require advancing relevant institutional and regulatory reforms.

The aim is to achieve this through the formulation and implementation of planning instruments such as the Rail Master Plan, which, among other projects, prioritizes the structuring and development of medium and long-term rail projects such as La Tebaida-La Dorada **(central range tunnel)**. The National Competitiveness DP) and in the Central Corridor".

Report 2016-2017 (Private Competitiveness Council) suggests "to define a public policy for multimodal cargo transport, so that the same cargo can travel through a corridor without having to be transported in a single mode" and calls for " allocating sufficient public resources to make the appropriate investments in the current corridors, in particular in the Pacific train (Ferrocarril del Pacífico – F and in the Central Corridor".

Multimodal freight transport will be increased with a greater share of rail and fluvial transport, in order to reduce logistical and transportation costs, reduce travel times, improve connectivity and competitiveness of the sector, minimize environmental impacts and reduce GHG emissions (PND)

1.4. Transports

1.4.1. Existing infrastructures

According to information from the Yearbook of Transportation in Figures 2015, made by the Ministry of Transport, the infrastructure network of Colombia is summarized in the table below:

One of the reasons why Colombia occupies an unfavorable place in terms of road infrastructure is due to the fact that the average cost per container of freight transferred in the country by road has gone from COP 3,841,933 in 2006 to COP 5,270,371 in 2013, implying an increase annual average of 5.4%, which doubles average annual inflation (World Bank)

MODO					TOTAL
VIAL	Red Vial Nacional	Vías Primarias a Cargo de la Nación	Concesionado ANI	10.389 Km	201.736 Km
			No Concesionado INVIAS	8.898 Km	
			Total Vías Primarias	19.287 Km	
		Vías Secundarias Departamentos	Total Vías Secundarias	45.137 Km	
		Vías Terciarias	A cargo de INVIAS	27.577 Km	
			Departamentos	13.959 Km	
			Municipios	100.748 Km	
			Total Vías Terciarias	142.748 Km	
FÉRREO	FÉRREO (en operación)	Red Férrea Nacional		1.493 Km	1.677 Km
		Red Férrea Privada		184 Km	
	FÉRREO (no operativo o inactivo)				1.729 Km
AÉREO	Aeronáutica Civil (Aeropuertos)	Internacionales		11	69
		Nacionales		58	
PORTUARIO	(Puertos)				13
FLUVIAL	Navegable			18.225 Km	24.725 Km
	No navegable			6.500 Km	

Tabla nº 2: Transport Infrastructures Network in Colombia.
Source: Yearbook of Transportation in Figures, 2015. Ministry of Transport

Transport infrastructure is one of the main pillars of competitiveness (OECD, 2013) and is one of the engines of economic growth and social development (Bolbotín, Bonifaz and García, 2012).

According to the *Doing Business report of the World Bank*, one of the reasons why Colombia occupies an unfavorable place in terms of road infrastructure is due to the fact that the average cost per container of freight transferred in the country by road (which is concluded from the average between export and import costs) has gone from COP 3,841,933 in 2006 to COP 5,270,371 in 2013, with a cumulative increase of 37%,

implying an increase annual average of 5.4%, which doubles average annual inflation. This tendency is contrary to the evolution observed in Latin America, whose average cost per container between 2006 and 2013 has been US $ 1,310 (US $ 1,983 in the case of Colombia),

according to ANIF (Economic Commentary of the Day, dated March 5, 2014). In other words, transporting a container by land in Colombia costs 50% more than in any other country in Latin America.

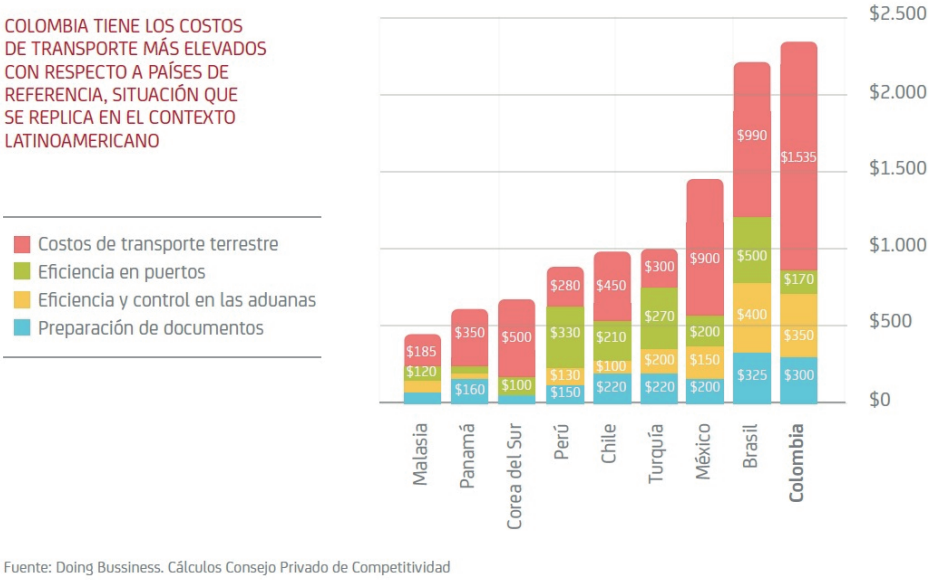


Fig. nº 11: Container Transport costs in the countries of Latin America. Source: PMTI

The new infrastructures have to contribute innovation and maximum economic, social and environmental efficiency. The adequacy of existing means of transport must be accompanied by a better articulation between the different logistic nodes of the country, promoting multimodalism

A new infrastructure provision will not guarantee a more competitive economy by itself. In order to reach this objective, this infrastructure should go through the most important sections of the country, thereby sustaining a relevant part of the trade and boosting productivity, both in terms of time and cost reduction per unit produced.

The new infrastructures, in order to collaborate in the competitiveness of the country, have to contribute innovation and maximum economic, social and environmental efficiency. In this sense, the adequacy of existing means of transport must be accompanied by a better articulation between the different logistic nodes of the country, promoting multimodalism.

According to the study "Costs of Transport, Multimodalism and Competitiveness in Colombia", prepared by ANIF for Cámara Colombiana de la Infraestructura CCI in November 2014, in general terms, the cost of transport affects between 10% and 35% over the operating expenses of the main goods produced in Colombia (oil, coal, flowers, coffee and textiles) compared to international benchmarks of around 6%. This in itself explains the need to move towards a better integration of the different modes of transport and to achieve more efficient transactions, especially in the terrestrial mode.

The infrastructure deficit translates into high logistics costs, equivalent to 23% of GDP.Although historical investments in the transport sector have been relatively low with an average of less than 1% of GDP during the first decade of the twenty-first century, in recent years the national government concentrated its efforts on bringing levels of investment in transportation infrastructure to 3% of GDP before the end of the first half of the current decade. To this end, private sector resources have been linked under the scheme of public private partnerships, among other strategies. This has resulted in a significant infrastructure investment increase: construction sector GDP increased from 6% in 2012 to 9.8% in 2013, consolidating itself as the key driver sector for investment and growth during the year 2013.

The cost of transport affects between 10% and 35% over the operating expenses of the main goods produced in Colombia (oil, coal, flowers, coffee and textiles) compared to international benchmarks of around 6%

1.4.2. Action Plans

Infrastructures are, therefore, one of the main strategic axes for the Colombian economy. The commitment to the construction of new infrastructures, whether in road, rail, sea or air, has been intensifying recently. In this sense, the "Master Plan for Intermodal Transport (PMTI 2015-2035)" is a commitment to organize the country's growth in an efficient and strategic way, through an infrastructure network that connects all regions, prioritizing the Projects that will have the greatest impact on the national economy. Led by the Vice Presidency of the Republic, the PMTI will have an investment of 10.4 BIll. COP $ annually, equivalent to 1.30% of Colombia's GDP in 2015.

"Master Plan for Intermodal Transport (PMTI 2015-2035)"; is a commitment to organize the countrys growth in an efficient and strategic way

During the last decade, the country has made annual investments of 3.2% GDP, with the aim of increasing the multifactorial productivity and the per capita income of citizens.

• Master Plan for Intermodal Transport (PMTI 2015-2035)

Conscious of this lag, and with the aim of placing Colombia in the vanguard of Latin America in the coming years, the Government of the Republic has designed the PMTI 2015-2035, with the following key objectives:

1) Boost foreign trade, reducing costs and transportation times.

2) Promote regional development by improving the quality of networks for accessibility purposes.

3) Integrate the territory, increasing the presence of the State.

The Government of the Republic has designed the PMTI 2015-2035 to:

- *Boost foreign trade.*
- *Promote regional development.*
- *Integrate the territory.*

To this end, two initial goals were defined: to consolidate a list of priority projects to begin their structuring, in order to promote the allocation of resources in the most efficient way possible, and to develop a competitive transport network adapted to the needs of the country until 2035.

The Master Plan for Intermodal Transportation PMTI has been structured by the Government of Colombia "as a strategic vision of the country on infrastructure and transport needs, which ensures economic growth and enhances its participation within the global dynamics",

as explained at the beginning of the presented document. It seeks long-term commitments to correct the current lags in the country and is designed to boost the economy and increase the country's real productivity and its foreign trade, connecting large cities and ports with each other.

The PMTI decides, quite rightly, to use the large national corridors as a unit of analysis, maintaining the coherence of the multimodal efforts at a high level and putting as a high priority task the considerations of connectivity and of transport costs saving.

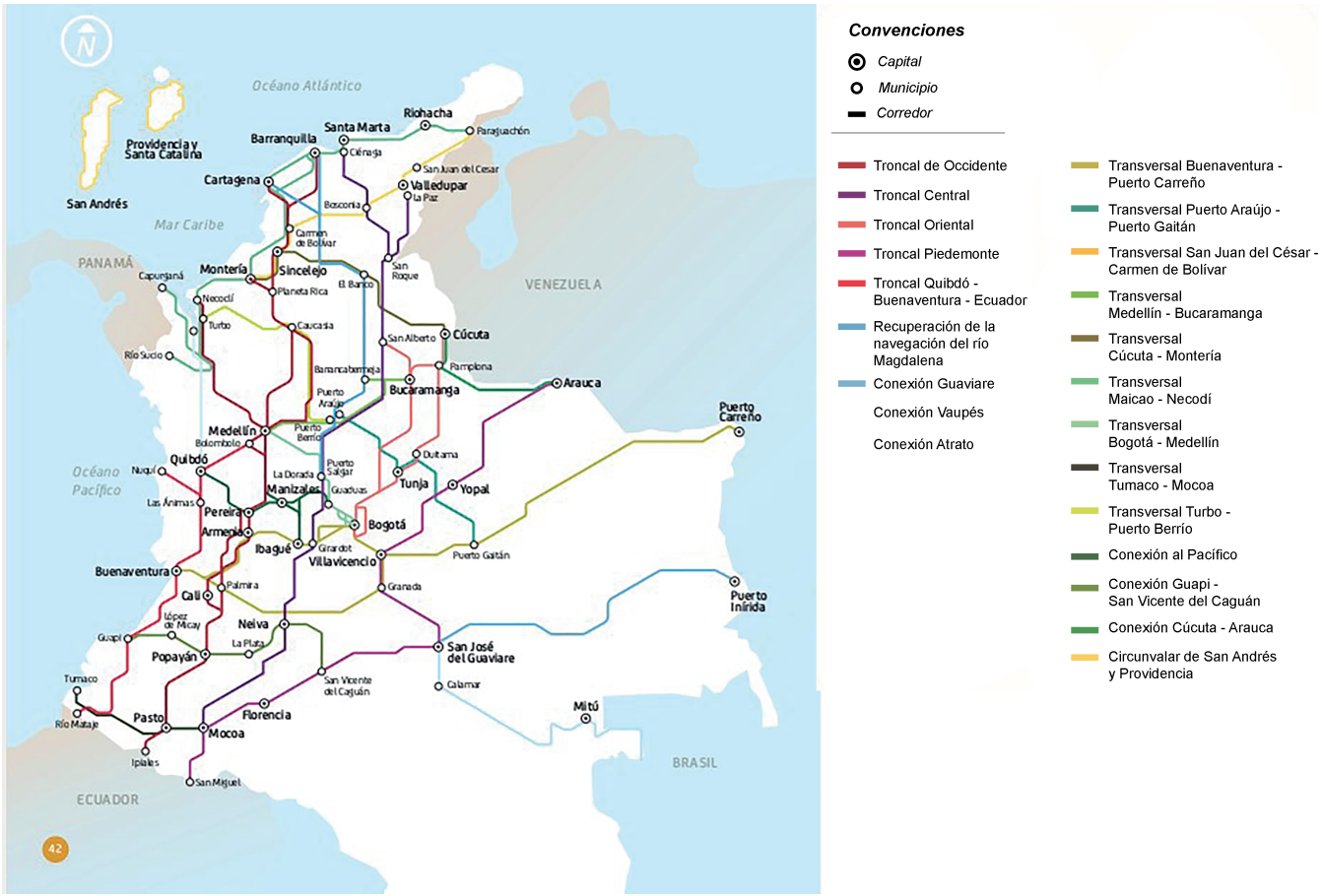


Fig. nº 12: Basic Network (source: PMTI)

The PMTI decides, quite rightly, to use the large national corridors as a unit of analysis, maintaining the coherence of the multimodal efforts at a high level and putting as a high priority task the considerations of connectivity and of transport costs saving

The PMTI document Conclusions, module 1, explicit reference is made to the rail connections between the center and the west of the country and to "the alternative of crossing the Central Range through a tunnel by La Línea". It is also indicated that the PMTI module II will include, among other things, the organization of the logistics management of national corridors and, in particular, the strengthening of the railway as an alternative to the road, ensuring its connectivity and its competitiveness. The section "Plans by mode" indicates that the public sector must support the railway development where demands justify it, accompanying it with institutional measures framed in a transport policy that strengthens and balances the concurrence. We understand that the Rolling Highway Project fully complies these objectives and criteria.

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- Infrastructures for Prosperity

The Government has launched an ambitious infrastructure program in the period 2014-2018, to place the country at the head of Latin America, with well defined objectives:

i. Road Mode: Consolidate the roads and dual carriageways for foreign trade. 4G Program: About 8,000 km, of which 1,300 are dual carriageways. Program divided into three (3) stages or "waves", plus Private Initiative PPP.

ii. Railway Mode: Estimated investment 12.8 Billions of COP $ for an increase of the operation up to 1,283 Km (2014 - 2018).

iii. Port Mode: plans to increase port capacity by 70%, with new terminals (1.8 Billion COP $), expansion of existing ones (1.12 Billion COP $), deepening access channels to ports and other works. Investment> 3 Billion COP $.

iv. Airport Mode: Continuation of El Dorado expansion, and improvements in 17 airports (2015 - 2018). Investment: 3.1 Billion COP $.

v. Inland Waterway Mode: Navigability of the Magdalena River (2014 - 2018). Length: 1,025 Km. Investment 2.5 Billion COP $.

vi. Urban Transportation: Mass Transportation Systems (Bogotá Subway, suburban trains in the metropolitan area of Bogota, etc.) and Public Transportation Systems in the main cities (Transmilenio, SITP, etc.).


connecting
europe
cargo

2. ROLLING HIGHWAY PROJECT

2.1. Project Proposal for a Private Initiative PPP

UC CONSULT SAS and ARCS SL, in Colombia since 2012, has in its team Colombian engineers of the highest qualification and experience, who consider that the Bogota-Buenaventura corridor has deficiencies in its infrastructure offer at this time that justify proposing a solution of breadth and future to its main strangulation, the passage through Alto de La Línea, in the Central Mountain Range. The very important demands on this step today - 1.5 million trucks / year - and its strategic role for economy and social articulation in Colombia, as well as its unavoidable role in the future development of terrestrial communications, highlights the need of a long-range solution that will forever solve this traditional problem of the Colombian nation.

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The enlargements in progress can improve the conditions of the current road, but can not achieve - in terms of quality, economy, efficiency, safety and reliability - the benefits that the Ferropista would bring to the whole traffic in use of the Route 40 between Armenia and Ibagué.

The Originators consider that the time has come to approach this issue with ambition and confidence in the future of the country, as they identify the passage of the Central Mountain Range as a key element in the difficulties that insufficient infrastructures pose to the socioeconomic development of Colombia.

2.1.1. Objectives of the Proposal

2.1.1.1. For the general interests

An innovative and powerful solution for East-West communications and vice versa in the central zone of Colombia is offered,

aimed at helping the entire country, but especially the 30 million people (more than 60% of the total) that inhabit this space, equivalent to 7% of the territory of the Nation. The road through Alto de La Línea is the route that serves, almost exclusively, this main logistics axis, which has an infrastructure of limited benefits today, even when projects are underway to improve it. Many geographical difficulties affect this route, among which the physical barrier of the Andes Central Cordillera stands out, as has been discussed previously.

The Originators consider that the time has come to approach this issue with ambition and confidence in the future of the country, as they identify the passage of the Central Mountain Range as a key element in the difficulties that insufficient infrastructures pose to the socioeconomic development of Colombia

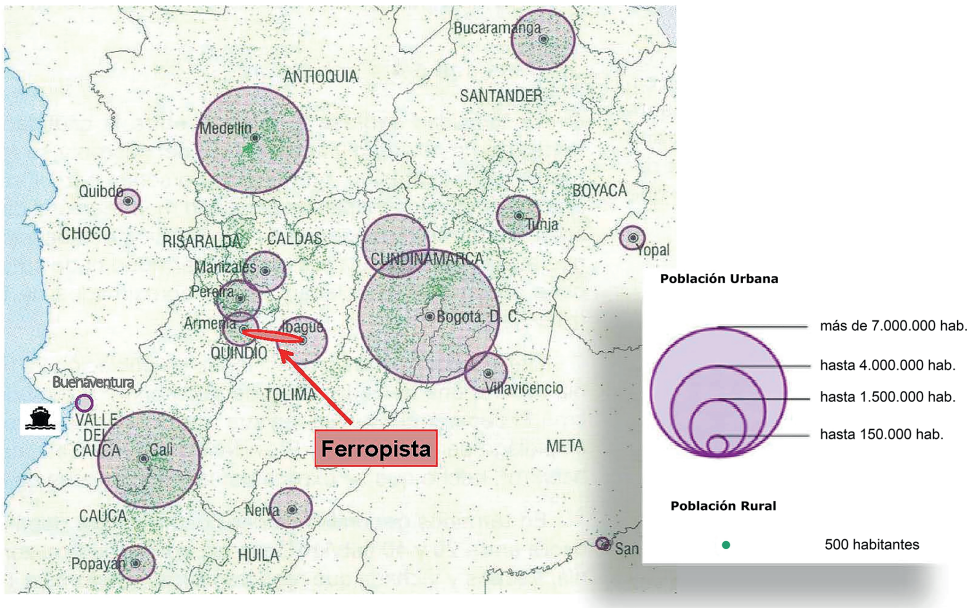


Fig. 13: The Rolling Highway in relation to the population of Colombia. (IGAC)

A solution to improve the continuity of the route between Armenia and Ibagué in the crossing of the Cordillera is proposed, to avoid the rise to high levels of cargo transport that fundamentally help the economy of Colombia, eliminating any environmental negative effects and contributing to social integration and equity

A solution to improve the continuity of the aforementioned route between Armenia and Ibagué in the crossing of the Cordillera is proposed, in order to avoid the rise to high levels of cargo transport that fundamentally help the economy of Colombia, eliminating any environmental negative effects and contributing to social integration and equity. The construction of a base tunnel, analogous to those being implemented to overcome the Central European Alps, should provide a considerable improvement in transport by reducing travel times and costs between Armenia and Ibagué. This way, the Rolling Highway would become a complementary infrastructure of the toll road under construction, specializing each infrastructure in the users to which it can serve in a more efficient and environmentally sustainable way, providing at the same time reliability, safety and versatility to the system of transport through the Cordillera Central.

The chart below shows the evolution of traffic in recent years, and estimated growth for the next, in the road between Armenia and Ibagué. For the period 2011-2016, a similar growth to the period 2000-2011 has been estimated.

Three scenarios have been considered for the evolution of demand: a first scenario in which the trend of the last 20 years is prolonged; a second, which contemplates the start-up of La Linea Tunnel and the dual carriageway so that it will provide traffic induction; and a third scenario, in which, in addition, a higher growth of demand due to a greater growth of the economy of the Nation is considered.

The Rolling Highway would become a complementary infrastructure of the toll road under construction, specializing each infrastructure in the users to which it can serve in a more efficient and environmentally sustainable way

If Colombia's Gross Domestic Product grows at a sustained pace of not less than 2% annually, demand for freight transport is expected to grow by over 3% each year.

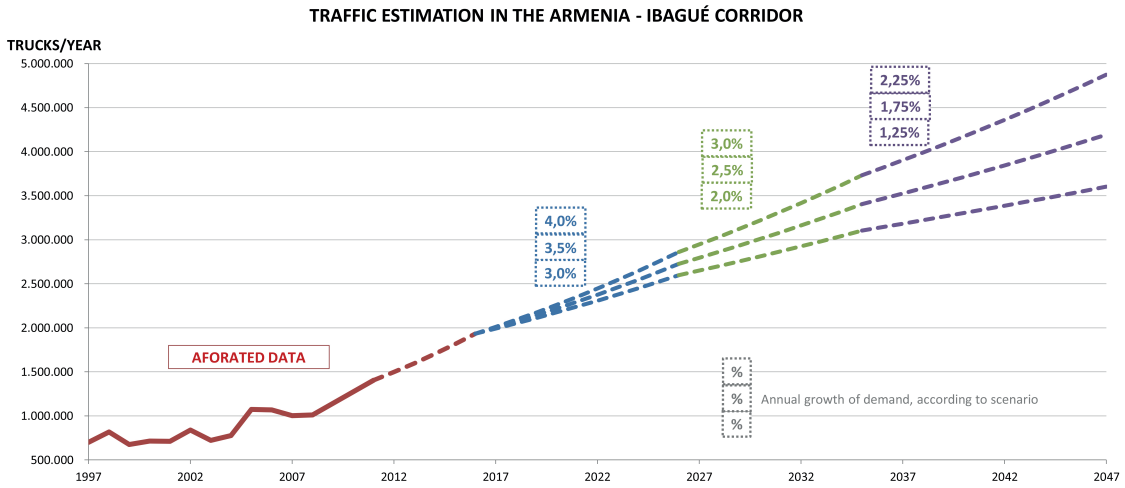


Fig. 14: Estimating the evolution of annual traffic in the Armenia - Ibagué toll road (Data: INVIAS)

The Rolling Highway offers a very important direct improvement for the traffic of heavy vehicles, manifested in reductions of costs and travel times, and, at the same time, it contributes favoring the conditions of use of the toll highway by cars and buses as they would no longer match trucks and trucktrailers.

The solution offered by the project is based primarily on the idea of service to the general public, applying advanced knowledge and technologies of the highest global level

The solution offered by the project is based primarily on the idea of service to the general public, attention to the foreseeable users and the consideration of the people affected, applying advanced knowledge and technologies of the highest global level.

The collaboration of the public sector is very necessary to promote the interest of the public and all types of stakeholders involved, define objectives and create appropriate regulatory frameworks to apply in relations with the private agents. It is necessary to achieve a project that is attractive for the concessionaire between both

The technical solution described below is a consequence of the application of these basic ideas, to which it must be subordinated. The definition of the project in which work is in the Feasibility Phase is based on the development of commitments on the quality of the solution and on the scope of the benefits to be delivered to those who will use it and the country in general.

2.1.1.2 For promoters and funders

The private promoter-initiator generates a solution idea, develops it and structures it as a Private Initiative project within the framework of the legislation that regulates PPP Public-Private Partnerships and intends to operate it - with the incorporation of the necessary investors, sponsors and partners - during the the period of concession necessary for its financing. The collaboration of the public sector, specifically in government entities at different levels of administrative competencies, is very necessary to promote the interest of the public and all types of stakeholders involved, define objectives and create appropriate regulatory frameworks to apply in relations with the private agents. It is necessary to achieve a project that is attractive for the concessionaire between both, it is therefore important to prevail the interests and objectives of the long term, collaborating in the solution of the incidents that can be presented and cooperating in the maximum reduction of the risks, both technical and financial.

2.1.1.3 For the population

The implantation of the Rolling Highway in the Central Andes Mountains will mean to put into operation an innovative railway system with maximum efficiency and sustainability in the heart of Colombia, which will allow, among other objectives:

- Improve **connectivity** in the Bogotá - Buenaventura corridor (520 km), favoring the **accessibility** of Bogota and the center of Colombia to the Pacific, by completely overcoming the physical barrier that the Cordillera Central represents, as a way to boost **competitiveness and productivity** throughout the country, by substantially reducing transportation costs in that corridor.
- To favor substantially the communication between the two major North - South axes of the country, that is, the Cauca river basin and the Eje Cafetero with the Magdalena basin, incorporating an **innovative transport system** without strangulations or traffic jams.
- Promote the connection of the Port of Buenaventura with the ports of the Caribbean - Barranquilla, Santa Marta, Cartagena - and with Venezuela, through the promotion of **multimodalism** through investments in 4th Generation highways and the navigability of the Magdalena River.
- To improve the **conditions of use** of the route to Alto de La Línea, when unloading of trucks and trucktrailers.
- Substantially improve the **quality, reliability and efficiency** of cargo transportation, contributing to the territorial articulation of the Central Region with the Pacific Zone and the Cafetero Hub.
- Collaborate in a powerful way to improve the environment in the area and the fight against **Climate Change**.
- Contribute to **equity** and **social cohesion and integration** in Colombia, favoring relations between communities and populations.
- To create new **industries** and opportunities for specialized training and **educatio**n, thus incorporating the Nation to the greatest **technological advances**.

The following diagram reflects the different movements and relationships that are supported in the Paso de La Línea.

ROUTES BENEFITED BY THE FERROPISTA

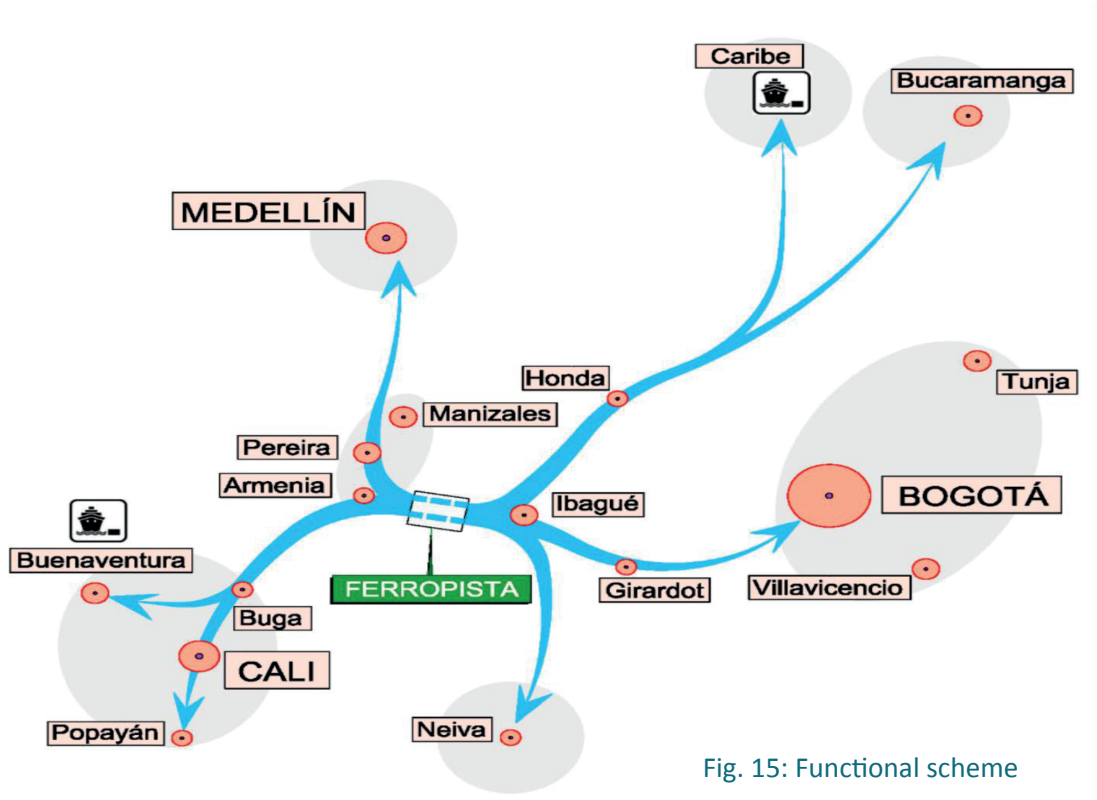


Fig. 15: Functional scheme

2.1.2. Description of the Project

2.1.2.1. Conceptual solution

The Rolling Highway in the Central Andean Range intends to implement an innovative transport system consisting of a rail link connecting the towns of Armenia and Ibagué by constructing a section of railway track of 55 km. of total length, which includes a base tunnel of 44.2 km. of longitude under the Central Range, and transfer stations in the vicinity of Armenia and Ibagué, with their respective accesses and auxiliary facilities.

This modern transport system is designed for the displacement of heavy vehicles (trucks and trucktrailers) on railway platforms (wagons), which are carried by electric traction locomotives, for a fast and efficient communication between one side and another of the Central Mountain Range , offering a solution of maximum quality and efficiency for the continuity of the road network in the valleys of the Cauca and Magdalena rivers. It is a multimodal solution for the main transportation hub in Colombia.

The Rolling Highway in the Central Andean Range intends to implement an innovative transport system consisting of a rail link connecting the towns of Armenia and Ibagué by constructing a section of railway track of 55 km. of total length, which includes a base tunnel of 44.2 km. of longitude under the Central Range

A single tunnel is initially foreseen with a single bidirectional track for most of the length, although some double-tunnel sections and tracks are currently being studied as a by-pass for the crossing of trains inside the main tunnel, also linked to safety solutions in construction and operation

This project will ensure continuity and quality of cargo transportation in the Bogotá - Buenaventura corridor, Colombia 's main foreign trade hub, avoiding the passage of Alto de La Linea, at 3,300 meters above sea level, in comfort conditions , with very high levels of punctuality and road safety.

This project will ensure continuity and quality of cargo transportation in the Bogotá - Buenaventura corridor, avoiding the passage of Alto de La Linea

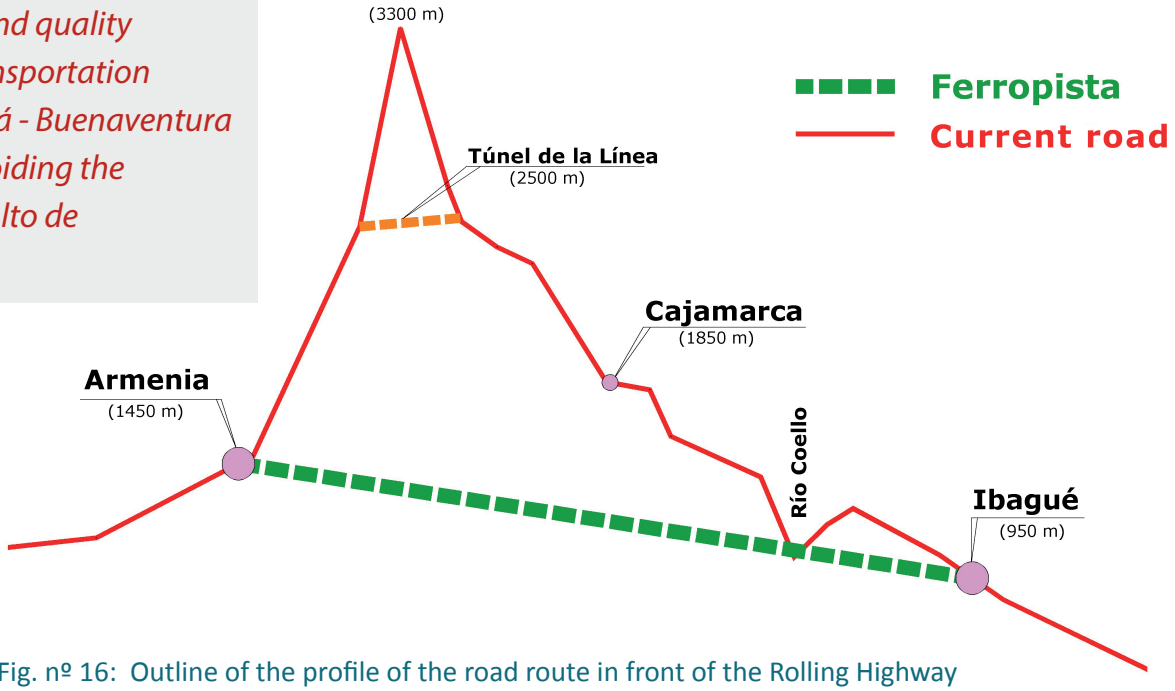


Fig. nº 16: Outline of the profile of the road route in front of the Rolling Highway

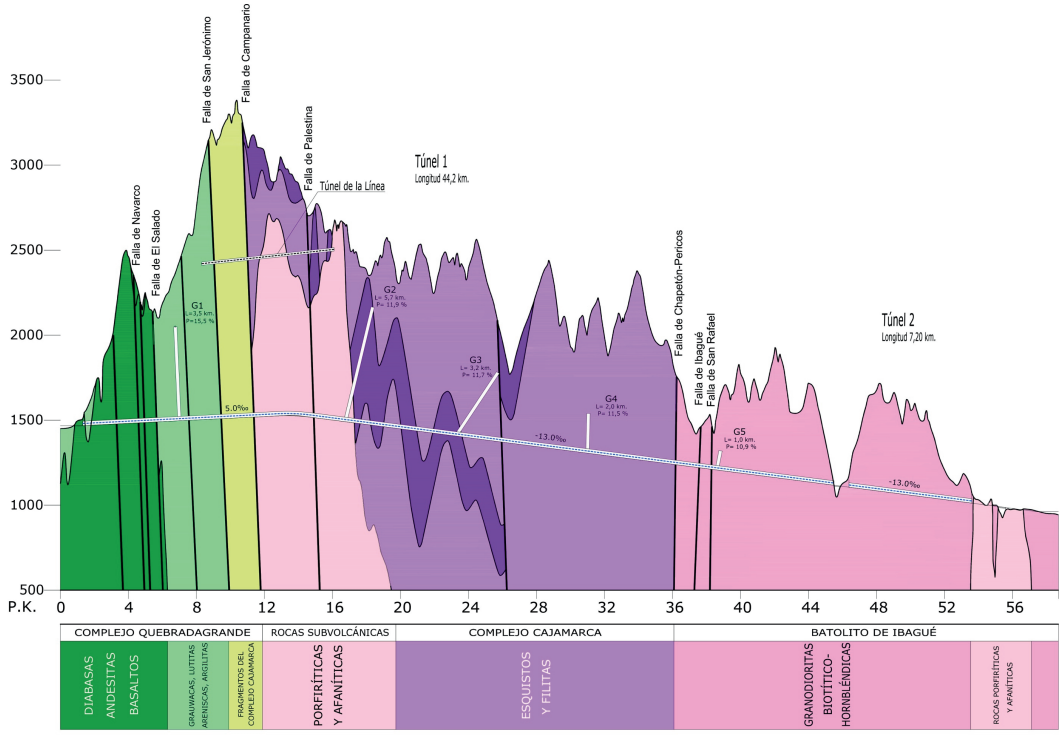


Fig. nº 17: Geological scheme

2.1.2.2. Main conditioner

The Colombian geography has been, as it is usually the case in any other country, a decisive element in the definition and development of the structure of the transport systems. The north-south basic layout of the Andean Mountains, divided into three sectors of the same guideline, together with the historical communication axes that have been based on the two rivers - Cauca and Magdalena - that separate these three mountainous lines have very strongly conditioned their terrestrial communications network. In particular, the central part of the Andean Range, which is the one with the highest heights, has meant a sometimes insurmountable barrier to East-West relations between Colombian populations and territories. As it has been already mentioned, La Linea pass is located in the area of the Central Range of less width and lower heights (3,300 m), so it has long been recognized as the least unfavorable step.

The road network in service identifies and establishes it clearly, and the plans for new roads collaborate in the consolidation of this general scheme.

The abrupt relief in the entire Cordillera, as a consequence of its geological history, is an important element to consider in any terrestrial transport infrastructure project in Colombia. The geology and the different formations that are presented must be taken into account when approaching a great project like the Rolling Highway. We find a geological framework characterized by heterogeneous lithologic entities, with complex structural relationships, with localized tectonic affectations and with remarkable seismic and volcanic activity. The main tunnel will be located in the Quebradagrande and Cajamarca Complex areas as well as in the Batholith of Ibagué, with rock formations of very different problematics, while a second shorter tunnel will also be located in the Batholith of Ibagué.

The heavy rains seasons in the area frequently generate alluviums, landslides and platform detachments on the current roads, apart from the direct disturbing effect for general transit and for their safety.

La Linea pass is located in the area of the Central Range of less width and lower heights. The road network in service identifies and establishes it clearly, and the plans for new roads collaborate in the consolidation of this general scheme

These realities make less recommendable the solutions that should be based on the slopes of the mountains, particularly on the banks of the river Coello, Magdalena basin, which may also be affected by eruptions of the volcano - currently inactive - Cerro Machin, which is at a short distance from the Coello River, towards which its lavas would flow. The seismicity that would be expected from such an eruption would not reach levels that would affect tunnels located inside of the mountain, such as the Rolling Highway.

The hydrographic system in the project area is well developed and subject to significant fluctuations in flow due to heavy rains. Special attention is given to hydrogeology in the ongoing studies, as it might affect moors and crop areas located on the base tunnel cover, and therefore could disturb the drilling and execution of the tunnels. The design of the constructive solutions has to solve these problems in the preconstruction phase.

The Rolling Highway is a complex but approachable project today, as have been other great similar projects described in Chapter 3.

2.1.2.3. Alternatives studied

From the consideration of the demands to be met and the objectives to be achieved, the assessment of the conditions allows to select the most convenient solution among the multiplicity of alternatives available. Once the base typology of the solution is established - iron tracing to optimize costs and times in the passage of the Cordillera Central - diverse ways to meet demands and objectives are available.

The selection of the sites for the two large transhipment stations -of vehicles to trains- is approached with an initial character, since the large size of the stations, the relief - particularly in Quindío (Calarcá) - and the ease of access to them are elements that strongly condition such locations. Several solutions have been considered and, among them, the ones presented here are advanced.

Once the stations have been set, alignments that link them are studied, complying with the parameters that are estimated according to the construction and subsequent operation objectives. The possibility of establishing transversal accesses in reasonable conditions and adequate to their functionality is a factor very taken into account for the designs of alternative layouts, especially of the base tunnel under the Cordillera.

We analyzed up to 15 layouts, with combinations of sections in tunnel and hillside, and with base tunnel of greater or lesser length, we initially selected the solution presented here, at the expense of the results of the most detailed geological and environmental studies in progress.

A geological framework characterized by heterogeneous lithologic entities, with complex structural relationships, with localized tectonic affectations and with remarkable seismic and volcanic activity

2.1.2.4. Project description

The solution that is developed for a first stage of service consists of an infrastructure for the circulation of trains that transport heavy vehicles between stations located in appropriate zones at the basis of the mountain range, in its borders of the west and east. In a later stage the passage of cars and buses would be made possible. These stations are connected by a railway track of about 55 km that will run under the mountains in 95% of its route, with a great base tunnel 44.2 km long and a second tunnel 8 km long in the area closest to Ibagué (Charcorrico). There are also planned two large bridges over the Coello (170 m) and Combeima (380 m) rivers. The highest mountain level above the tunnel is about 1,900 meters and the minimum vertical distance to the tunnel of La Línea in execution is about 1,000 meters, and there is no affectation between the two.

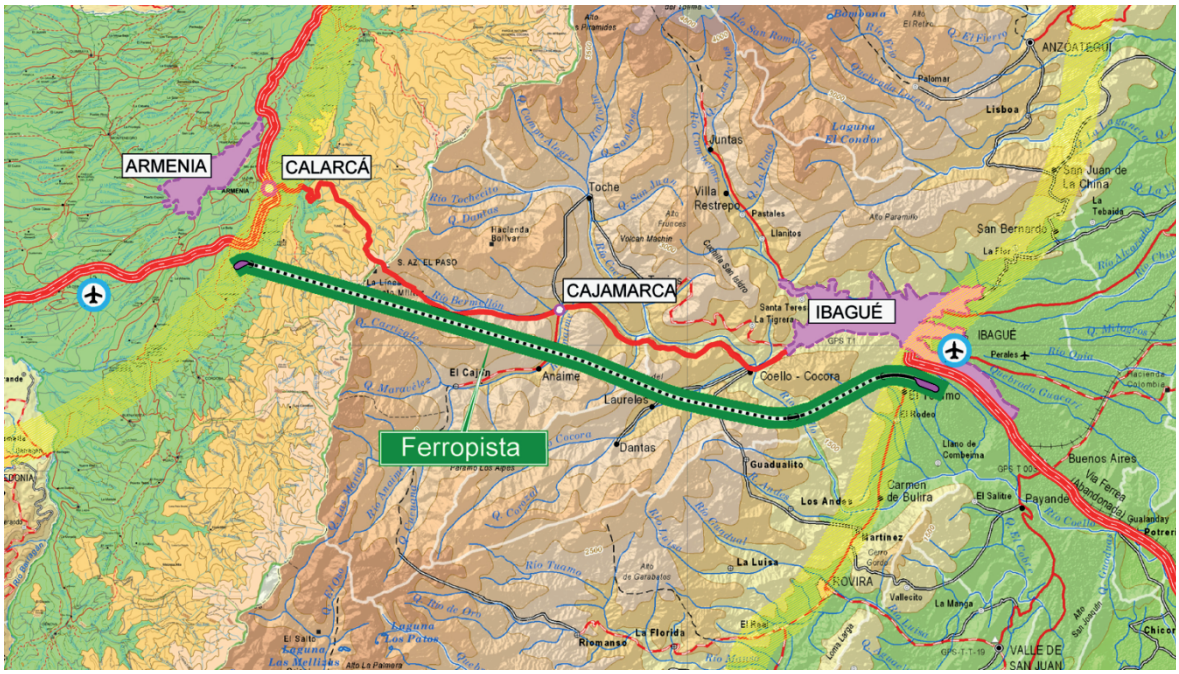


Fig. nº 18: Site of the Rolling Highway

- *Speed: 120 km/h.*
- *UIC international standard track width (1,435 m), on concrete plate.*
- *Electric traction.*
- *Base tunnel for single track: 44.2 + 8 km*
- *Up to five transversal access galleries: 16 km.*
- *Section with double tunnel: 14 km.*
- *Automation and Control Center.*
- *Two large transfer stations.*

The layout is designed so that speeds of at least 120 km / h can be achieved. The levels will have values not surpassing the 1.3%, in consideration of the high load that the trains have to transfer and to the optimization of the energy consumption. The ground geometry in the base tunnel area is adapted to the locations of the transverse access galleries, incorporating two curves in the area of arrival at Ibagué with radiuses 10,000 and 3,000 meters. Lighter trains will be able to travel at higher speeds.

To pay attention to the demands and optimize the solution, the track gauge will be the UIC international standard of 1.435m,

Railway track that will run under the mountains in 95% of its route. The highest mountain level above the tunnel is about 1,900 meters

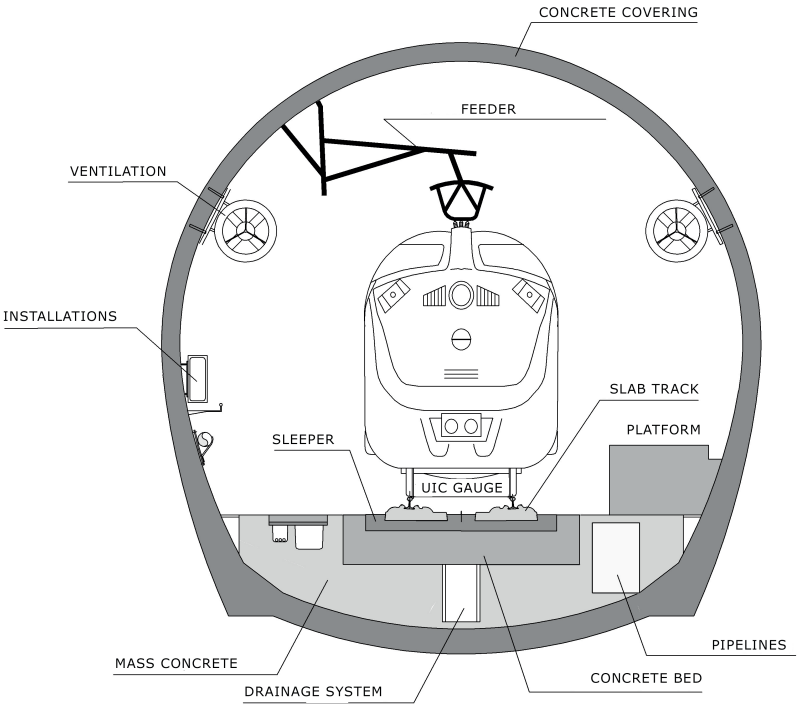


Fig. nº 19: Tunnel section

on concrete plate, without ballast. The intended traction is electric, fed from two power substa-tions to be located at each of the stations at the ends of the railway line.

The section of the base tunnel shall be suitable for single track; It is studied the convenience of running sections with double tunnel to achieve greater capacity and better quality of service (reduction of waiting times for load).

Up to five transverse access galleries are planned to allow the opening of up to ten fronts in the excava-tions, in addition to those for the base tunnel portals.

These galleries, with lengths ranging from 1 km to 5.7 km and slopes of less than 15%, are connected to the main road or other tertiary roads in the area. These accesses also provide the safety conditions during the operation of the system, as well as the execution of a second parallel tunnel without affecting the service in the first.

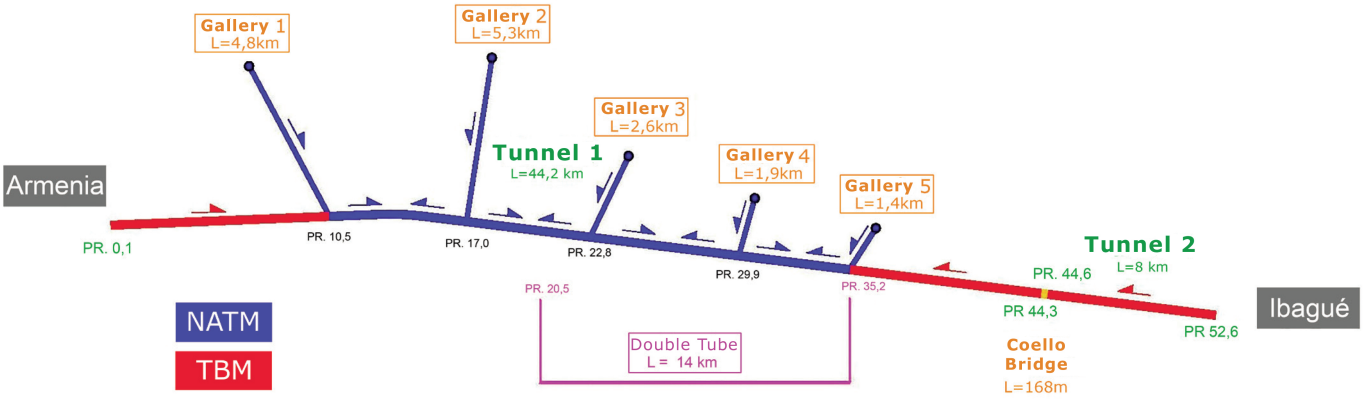


Fig. nº 20: Methods of drilling and provision of access galleries

2.1.2.5. Transhipment Stations

The planned system requires the direct loading and unloading of the trucks on platform-wagons, an operation that will be carried out by the drivers of the trucks themselves, suitably directed by personnel of the operator concessionaire. The access is carried out in a lateral manner by the rear end of the railway composition, to then circulate on the whole of the platforms, which form a continuous surface, until they are positioned one after the other on their respective platform. Discharging is carried out conversely, from the front of the train, also from the side by the first platform. These are maneuvers that come well organized in the waiting spaces, so the time they need is reduced. This form of operation requires slightly longer platform lengths than those of regular trains (about 800m) and that the train arriving at the station, after a U-turn around it, should be positioned geared towards a new journey.

Loading and unloading of the trucks on platform-wagons

The stations are provided with access and security controls, electronic toll payment, hotel services for the carriers, vehicle maintenance services, logistics services, etc. In the Ibagué station, of greater extension, industrial installations will be set up for the manufacture of the railway platforms and for their maintenance and that of the whole system. It is planned to create a free zone that covers all the spaces occupied by the Rolling Highway, which can offer a great diversity of quality logistics services to the transport chain in central Colombia.

2.1.2.6. System operation

Once analyzed the demand for trucks that are expected to use the Ferropista to move between the Cauca river basins and the Magdalena river, it is suggested that the trains should consist of 32/34 platform wagons each, to which a special coach would be added, in which the drivers and assistants of the trucks will make the railway trip. The traction is entrusted to large power locomotives powered by electric power. These trains will reach lengths of about 800m.

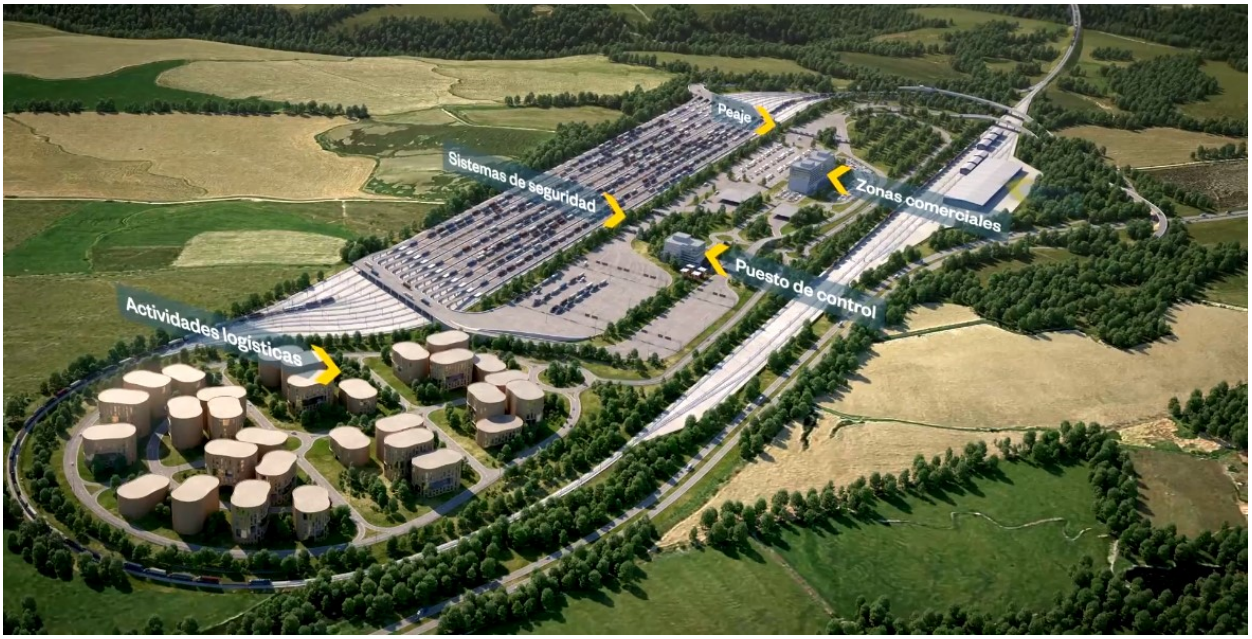


Fig. nº 21: Ibagué station. Basic design

The stations are provided with access and security controls, electronic toll payment, hotel services for the carriers, vehicle maintenance services, logistics services, etc.

It is planned to create a free zone that covers all the spaces occupied by the Rolling Highway, which can offer a great diversity of quality logistics services to the transport chain in central Colombia

Trains would circulate in both directions by the same route, alternating by centralized control electronically monitored. In periods of time of greater demands the circulation of several successive trains will be arranged, separated from each other about two minutes, in the same direction. The arrangement of twin-track sections, currently under study, will increase the capacity of the system and obtain higher levels of quality, thus reducing waiting times for loading in the two stations. It is estimated that in the first stage of operation, 100/120 trains will be circulating each day, these numbers will increase as demand grows and system capacity is expanded.

The travel time between the stations will be about 30 minutes which means that the integrated travel time with the loading and unloading will be about 70 minutes. The average waiting times for the cargo may be shorter according to arrival time, demand level and capacity offered at any time, and can be estimated at an initial stage in about 15 minutes. During the trip in the Rolling Highway the truck driver has the opportunity to rest and thus comply with the norms that come to establish in the transport of loads in Colombia. At transhipment stations very diverse services might be enjoyed.

In the first stage of operation, 100/120 trains will be circulating each day

The travel time between the stations will be about 30 minutes which means that the integrated travel time with the loading and unloading will be about 70 minutes

Fig. nº 22: Loading and unloading of trucks in Calais (France)

	Annual transit 2011 (Trucks/years)	Estimated Transit 2026 (trucks/year)		
		SCENE		
		1	2	3
C2P AND C2G	579.555	1.005.000	1.055.000	1.107.000
C3 AND C4	211.998	368.000	387.000	406.000
C5	136.465	237.000	248.000	261.000
>C5	475.943	827.000	868.000	910.000
total sum	**1.403.962**	2.437.000	2.558.000	2.684.000

Table 3: Transit volumes by truck category for the year 2026

By truck category and for the year 2026, the volumes of transit would be, for each one of the scenarios of evolution of the demand contemplated, the following:

On these volumes of trucks estimated for the year 2026, two hypotheses are raised in turn:

HYPOTHESIS 1: The Rolling Highway picks up 40% of 2-axle trucks (C2G and C2P) and 80% of other trucks, ie 3 axles or more (C3, C4, C5 and above).

HYPOTHESIS 2: The Rolling Highway picks up 60% of 2-axle trucks (C2G and C2P) and 90% of other trucks, ie 3 axles or more (C3, C4, C5 and above).

The use of the Rolling Highway entails the payment of a toll, estimated at USD 250 in the year of commissioning (2026), and may vary according to the length of each vehicle, and it is planned to offer cheaper temporary subscriptions. The accompanying chart shows the comparison of operational costs, including tolls, between the Ferropista and the Armenia - Ibagué road, with a double carriageway in it.

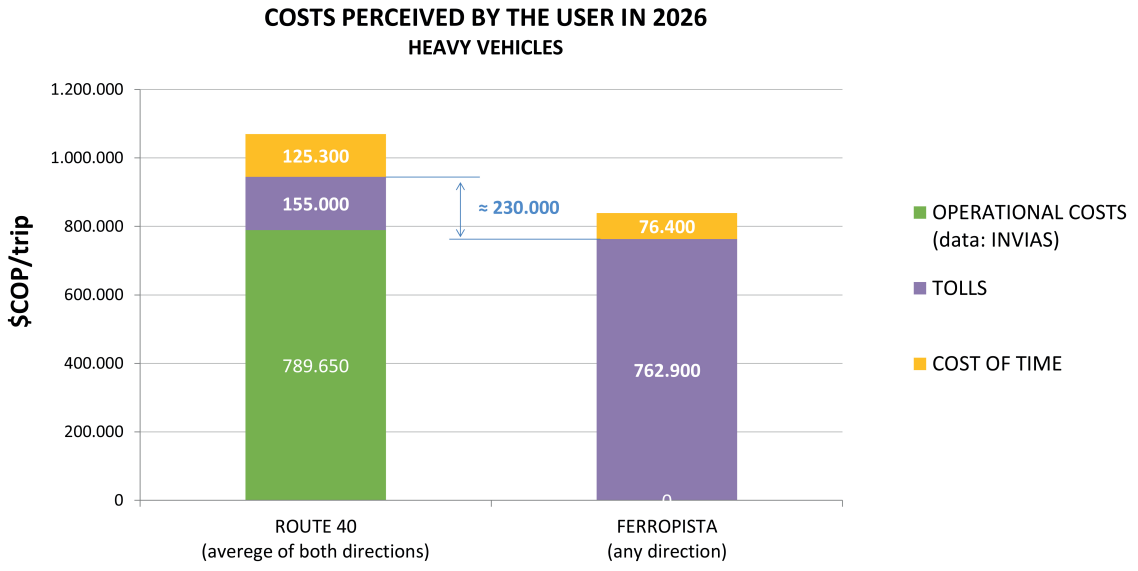


Fig. nº 23: Comparison of Operational Costs, perceived by users in 2026 (Heavy vehicles)

2.1.2.7. Organization of project implementation

The Rolling Highway project is unique and raises many important differential issues for its development, both in the structuring and concession phase and in the construction and subsequent operation phases. Its execution requires the participation of specialized companies experienced in similar works, which are not very numerous in the world, by the way. Based on the knowledge available today derived from these experiences, it is proposed the execution of the base tunnel in a very fractional way, being able to have up to twelve simultaneous fronts of drilling attack, supported in the galleries of transversal access that in our case will present certain comparative facilities with different cases in the world, precisely because it proposes a design of the alignment in plan and profile that considers as a factor of great influence and interest the possibility of having these galleries in favorable technical and economic conditions.
This solution makes it easier to adopt different construction methods according to the quality of the materials to be drilled, significantly helping to reduce the execution times by being able to simultaneously carry out the steps independently and facilitating the exit to the outside of the excavated materials. And as it has already been pointed out in another section of this report, the galleries will provide escape routes in case of emergencies and will allow the execution of enlargements (double tunnel) without disturbing the operation of the initial tunnel.

The execution of the base tunnel is proposed up to twelve simultaneous perforation attack fronts, supported by the transversal access galleries and the end portals

In the Feasibility stage of the project, and based on the information already available on the characteristics of the materials to be drilled,

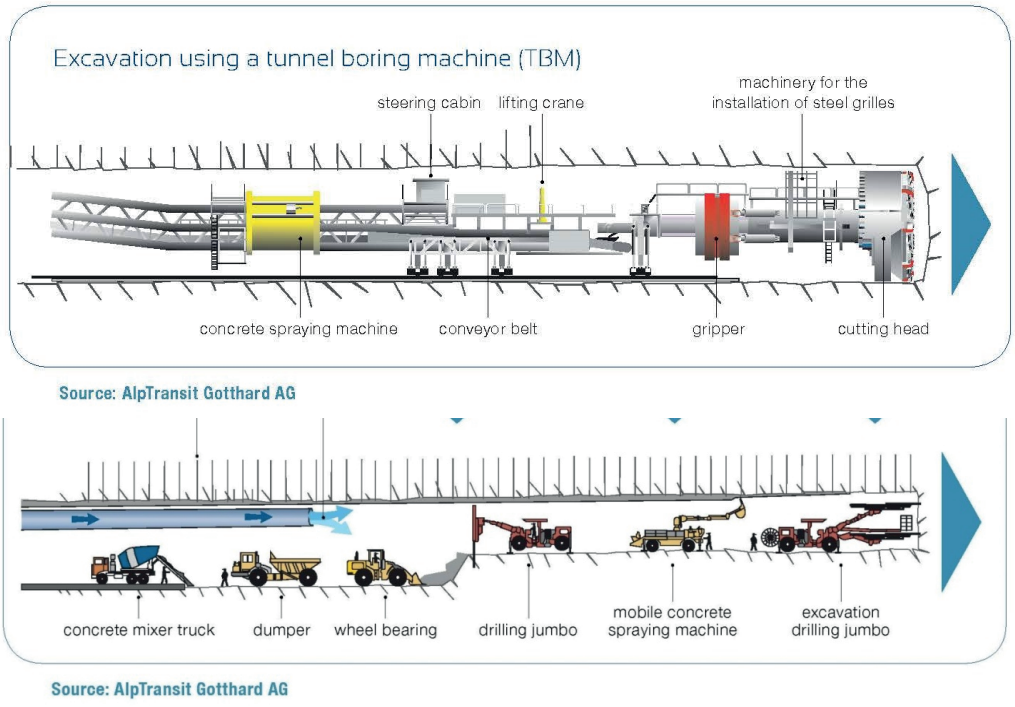


Fig. nº 24: Possible excavation methods to be used in tunnels

it is estimated that 50% of the total length of tunnels (about 28 km) can be drilled and covered by several TBM tunnelling machines, according to the circumstances and constraints of each sub-section. Drilling by these methods is faster, but requires a prior period for the special manufacture of each of such machines. The remaining 25 km are also studied to determine the most suitable methods at each point, either with wall chaser, either with drilling and explosives or even with TBM in some areas.

The construction of the stations is linked to the drilling of the tunnels, since it has to be coordinated with the use of surplus materials in the formation of the large platforms, prior to the construction of platforms. Access to both stations and galleries should be addressed at an early stage of work, with the aim of minimizing disturbances on major roads and nearby towns.

The reduction of the period of construction to the minimum possible is a factor of great importance in a project of the characteristics of the Rolling Highway, since the mobilization of private financial resources has to be very important from the beginning of the works, which requires great efficiency in its management and organization. It is a very significant control factor of risk and cost reduction.

2.1.2.8. Environmental Issues

The environmental aspects associated to the Rolling Highway Project are distinguished in two basic forms:

A) As a **positive foundation** and raison d'être of the project itself, which seeks to eliminate the negative effects of emissions of all kinds of harmful gases and high consumption of fossil fuels by heavy vehicles circulating today between Armenia and Ibagué, which is the main axis of the transportation of cargo in Colombia, as well as reducing at the same time those of other vehicles in the Paso de La Línea.

B) As **negative effects** arising from the implementation process and the operation of the new transport system.

In the first point, it is worth highlighting the enormous advantages that the project contributes, collaborating in the fulfillment by Colombia of the commitments acquired in the Conventions to combat Climate Change COP21. The repercussion of the commissioning of the Rolling Highway in the reduction of emissions of greenhouse gases and other gases harmful to people and nature has been evaluated in an initial and basic way. Several methodologies have been considered: "Manual of the inventory of mobile sources", from the Colombian Ministry of the Environment, and other international reference manuals.

It follows from the application of these assessments that the project will mean a reduction of 83% of the **volume of CO2** emissions in the year 2026, scheduled for commissioning, which is equivalent to about 100,000 tonnes / year.

The reduction of the period of construction to the minimum possible is a factor of great importance in a project of the characteristics of the Rolling Highway. It is a very significant control factor of risk and cost reduction

In the first 30 years of activity, the Rolling Highway will have avoided the **emission of some 5 million tons of CO2,** equivalent to the emissions produced by all modes of transport in Bogota D.C. for a year. Similarly, the effects on the reduction of the consumption of fossil fuels are also very remarkable.

Applying the appropriate methodology, it is anticipated that in the initial year of service the consumption of 24 million gallons of fuel will be avoided, equivalent to 86% of the total that would be consumed between Armenia and Ibagué if there were no Rolling Highway. In the first 30 years of activity, the Ferropista will have avoided the consumption of 1.2 billion gallons of fuel, which is equivalent to 50 million barrels of oil, which at current prices would mean a saving of 2.5 billion US dollars.

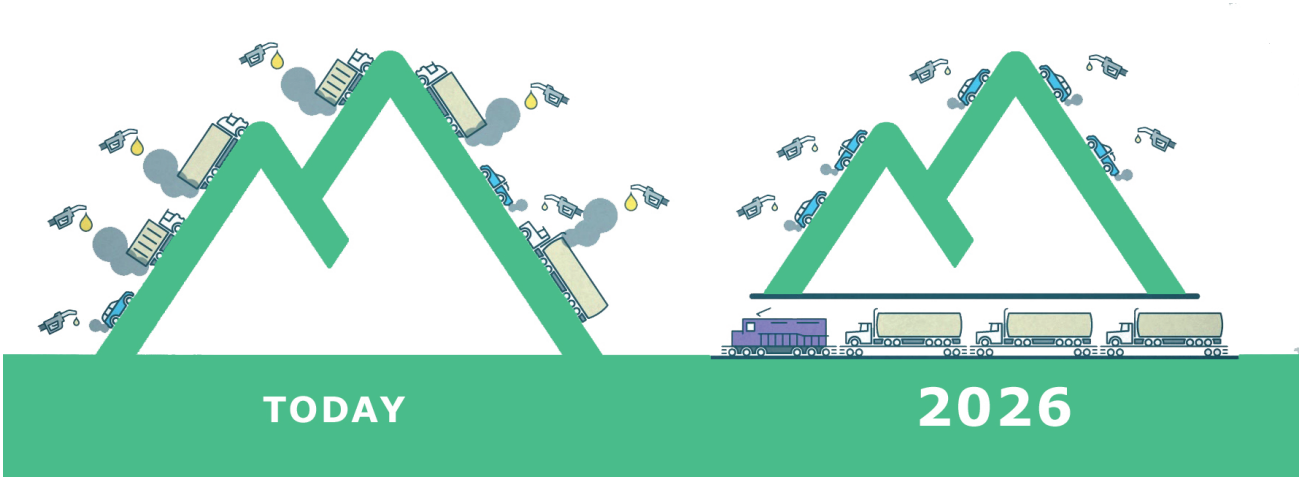


Fig. nº 25: Environmental benefits of the Rolling Highway

The Rolling Highway project completely **eliminates the noise** produced by the trucks in their current route, because 93% of the route will be undergroud and it will absorb all the sounds produced by the railway in which they will be transferred. The outdoor areas of the railway are those of the stations, where speeds will necessarily be reduced and, therefore, the noise emissions will be limited. This is an important contribution for the resident population in the vicinity of the present road, particularly in the crossing of Cajamarca, both in daytime and at night, as well as for the natural values of the spaces crossed, favoring the enjoyment of the landscapes of the zone.

The transfer of the heavy vehicles to the rolling Highway means **the elimination** of the main cause **of congestion** and production of traffic jams in the way. Transit would be safer and more fluid and reliable, creating the conditions so that the crossing trips of the mountain range by the light cars and buses would be more comfortable, practical and attractive and, consequently, increasing in a notorious way, favoring the relations and tourism between the populations on both sides of the Central Mountain Range.

Concerning section (b), impact studies have been carried out on surface and ground **water**, on the **quality of the air** during the works, on the **flora and fauna,** surface and ground **water**, on the **quality of the air** during the works, on the **flora and fauna,** - particularly as derived from the wide spaces that have to be occupied by the two transshipment stations-, for the emissions of harmful gases by the construction and material transport **machinery**, for **the noises** in the execution and other aspects to consider in the process necessary to obtain the environmental license by the National Environmental Licensing Authority ANLA.

The fundamentally subterranean nature of the Rolling Highway project confers to the possible effects certain particularities to take into account in these environmental studies. Those will be mainly related to the areas in which the works surface, where mechanic workshops, materials collections and manufacturing, earthworks, energy supply and other usual elements will be implemented, paying particular attention to the study of groundwater, so that the opening of the base tunnel could affect the Central Forest Reserve and Los Nevados Moorland Complex.

The high volume (about 8 million m3) of rocks and soils that will result from excavations is an aspect of special attention in the environmental studies of the project. It is estimated that 30% of this volume will be reused for the manufacture of the concrete required for tunnel coverings, as well as for the floors and base plates of the railways.

The remainder will be used mostly for the leveling of the two large platforms of the stations, also predicting some dumps for particular circumstances. The economic and technical studies to be carried out in the preconstruction phase will indicate how to organize the transport of these considerable amounts of materials, the routes to be followed in each case and the phases of development of these works, depending on the exit points of these materials, either directly from the tunnel itself or through the cross-access galleries.

Environmental studies also consider the effects of the railway operation of the system, locomotive and wagon maintenance facilities, associated logistics areas, etc.

2.1.2.9. Land Properties

The Rolling Highway project, because of its fundamentally subterranean nature, only needs to occupy land plots for transhipment stations and for short sections (about 3 km) on surface. For the station of Calarcá it is anticipated the necessity to occupy about 50 hectares, fundamentally dedicated today to coffee plantations. The Ibagué station, which is larger due to the location, besides its normal facilities of the industries and general workshops of the railroad, will need to have an area of about 100 hectares of land plots today dedicated to general agriculture

About 8 million m 3 of rocks and soils that will result from excavations. It is estimated that 30% of this volume will be reused for the manufacture of the concrete required for tunnel coverings, as well as for the floors and base plates of the railways. The remainder will be used mostly for the leveling of the two large platforms of the stations

Fig. nº 26: Typical Traffic Jam in La Linea Pass

2.1.2.10. Complementary elements

But it is also a difficult barrier to overtake for service networks such as electricity, telecommunications, water, gas, oil, etc. The Rolling Highway offers a magnificent opportunity to resolve connections of all types between the Cauca and Magdalena river basins. In the Feasibility stage we are developing these possibilities are being considered, both in the technical solutions to be implemented in the base tunnel and in the management and coordination with interested entities and companies.

The construction of the base tunnel planned by the Rolling Highway therefore offers a unique opportunity to enable the connection of a wide range of services:

- Electrical networks
- Fiber optics and communications
- Water supply
- Gas
- Petroleum

In addition to providing a service to the country through networks and services through the tunnel, the infrastructure owner would receive revenues in the form of usage fees, which would favor the economic interest of the Project. The Originator is studying in the Feasibility stage the interest and possibilities that each of these services could contribute to the Project.

The creation of logistical areas and various transport services associated with the two transhipment stations is an element of interest for the proper management of the Bogotá-Buenaventura corridor. Its integration into the tax free zone to be created for the whole Rolling Highway project reinforces its interest and opportunity. The location in the central part of the long-distance itineraries that will make use of the Rolling Highway, solidly endorses and justifies its implementation, which will result in benefits for the cargoes and for the transporters in their way of entry / exit from Colombia to the outside of the country .

The Rolling Highway offers a magnificent opportunity to resolve connections of all types between the Cauca and Magdalena river basins

The creation of logistical areas and various transport services associated with the two transshipment stations is an element of interest for the proper management of the Bogotá-Buenaventura corridor

2.1.2.11. Budgets and costs

Based on construction costs in Colombia and considering data deduced from other studies and projects developed in the world, adapted to the country in its unit prices is available in the stage of Feasibility, in which is the development of the project, a reliable estimate of which can cost the execution of the Ferropista. The following table summarizes the valuations made:

Construction	COP $ Thousand of Mill.	US$ Mill.
Tunnels and auxiliary works	6.300	2.100
Rest of the trace	180	60
Routes, Electrification and Installations	390	130
Transhipment Stations	450	150
Access soads	90	30
Energy Supply	120	40
Environnmental and social costs	240	80
Property Acquisition	60	20
Studies and Advising	300	100
TOTAL	**8.130**	**2.710**

Rolling Stock*	Units	COP$ Thousand of Mill.	US$ Mill.
Locomotives	14	420	140
Wagons - Platform	450	405	135
Car Wagons	14	42	14
TOTAL		**867**	**289**

(* To be operated by leasing or similar).

Table 4: Costs. Construction and Rolling Stock

ANNUAL OPERATION AND MAINTENANCE COSTS					
	Energy	**Personnel**	**Maintenance and Operation**	**Rolling Material***	**TOTAL**
Thousands of Mill. $COP	135	21	75	114	**345**
Mill. US$	45	7	25	38	**115**

Table 5: Operation and Maintenance Costs

Likewise, the costs of the operation have been evaluated: energy, leasing of railway equipment, maintenance of infrastructure, administration and management and other minors.

2.1.2.12. Economic and financial aspects

The economic and financial feasibility of the Project has been assessed by applying a model of similar characteristics to those commonly used in similar cases.

A concession period of 50 years is expected, with an investment distributed in 25% of Equity and 75% of Debt. The Initiative has been raised without the need for public contributions from the Nation.

Taking the planned investment as a baseline data, the estimates of Operation and Maintenance costs and the calculation of revenues, obtained on the basis of demand forecasts and the application of tolls, yields are obtained that, even though they seem initially adequate, do not seem sufficient for a project of the size and complexity of the Rolling Highway.

It is considered necessary to reinforce the Project through support aimed at controlling and compensating the risks that a project such as the rolling Highway entails inexorably.

These institutional supports, among other possible formulas, could be the strengthening of the demand, with actions similar to those applied in other international cases

It is considered necessary to reinforce the Project through support aimed at controlling and compensating the risks that a project such as the rolling Highway entails inexorably

and the assumption of fiscal measures that reduce the burdens for the promoters. In addition, facilitating a long concession period, according to the amortization periods usually considered for this type of projects (of the order of 100 years).

These measures are also necessary to strengthen the economic and financial viability of the Project and to be able to incorporate the necessary investors and financial partners.

2.2. Legal-administrative and social development

The project called ROLLING HIGHWAY IN THE COLOMBIAN CENTRAL RANGE is in compliance with Law 1508 of the year 2012 on Associations Public Private APP and the subsequent Regulatory Decrees 1467 of 2012, 100 of 2013 and 1553 of 2014, that have developed and specified it.

2.2.1. Procedures already carried out

The Colombian company UC CONSULT SAS and the Spanish company URABACONSULT SA (now ARCS SL)

settled in the National Agency of Infrastructure ANI, of the Government of the Republic of Colombia, dated September 27, 2013 and Rad. No. 2013-409-038967-2 a project of private initiative without public resources denominated "Ferropista en la Cordillera Central de Colombia" (Rolling Highway in the Colombian Central Range). On July 2, 2014 and Rad. No. 2014-409-030618-2 filed a supplementary document that developed the initial proposal, also responding to ANI requirements.

On October 16, 2014 (No. 2014-702-019976-1), the National Infrastructure Agency granted the VIABLE Declaration, in accordance with what was legally established for the Prefeasibility stage, identifying the strategic interest of the Project. On October 16, 2015, an extension was granted in the period of presentation of the Feasibility phase.

On October 16, 2014, the National Infrastructure Agency granted the VIABLE Declaration, identifying the strategic interest of the Project

In the period that has elapsed since the initial filing of the file, numerous working meetings have been held in the city of Bogotá with the teams of the aforementioned ANI Agency, developing various aspects of the project being studied for joint analysis. The complexity and uniqueness of the project recommend it to achieve a result that is fully satisfactory to all parties involved.

2.2.2. Current development

UC CONSULT and ARCS are developing the necessary work to present their proposal in the Feasibility Phase within the established deadline, incorporating all those ideas and new solutions that contribute to the exaltation and solidity of the project and to consolidate the trust in it and in its execution.

Due to the technical importance of the works to be carried out, due to the scope of the objectives that are intended to be achieved with its commissioning and due to the high scope of the expected effects of its execution, the arduous task to fulfill that objective is noted. In this sense, it should be noted that in the similar projects analyzed in chapter 3 of this Report, the period of legal and economic-financial planning studies has always been much higher than those applied in other projects. It is the firm intention of the initiating companies of the project to continue collaborating in its complete and correct development, which should culminate in a concession contract for the design, construction, operation and maintenance of the proposed infrastructure.

The work in progress is not only aimed at fulfilling the requirements of the applicable legislation, but is also about providing potential partners and investors with additional information and analysis that allow them to adequately evaluate their proposals and solutions and thus to adequately base their timely decisions, minimizing risks and uncertainties

An essential part of these tasks is the presentation of the project to private companies - Colombian and foreign -, including the most important companies in the world related to these activities, which have shown interest in studying and getting involved in the project, responding to their questionings and operating In a very active way to publicize the project and generate interest and confidence. It has also been presented to various representatives of the Governments of Colombia and Spain and the European Union. In this sense, more than 30 meetings have been held with potential partners of top level. It has also been presented to the Latin American Development Bank (CAF) in Bogotá and Madrid, the Inter-American Development Bank (IDB) in Washington, the International Finance Corporation (IFC) in Bogota and the European Investment Bank (EIB) in Luxembourg.

The project has been very well received in all cases, highlighting some of the people interviewed the interest of establishing some form of collaboration of the National Government, supporting the project and the development of the works of structuring in Feasibility Phase, in order to bring the project to a level of development that would make it more attractive to investors and private managers.

The work in progress is not only aimed at fulfilling the requirements of the applicable legislation, but also, in view of the particularities of the project, it is also about providing potential partners and investors with additional information and analysis that allow them to adequately evaluate their proposals and solutions and thus to adequately base their timely decisions, minimizing risks and uncertainties.

Consequently the project has been submited to:

- INVÍAS, National Institute of Roads
- FDN, National Development Fund
- DNP, National Department of Planning
- ANLA, National Environmental Licensing Authority
- FEDESARROLLO, Foundation for Higher Education and Development
- ANDI, the National Association of Colombian Industry
- SCI, Colombian Society of Engineers
- ACIEM, Colombian Association of Engineers
- SAI, Antioquia Engineering Company
- CCI, Colombian Chamber of Infrastructure
  CPC, Private Competitiveness Council
  Hispanic-Colombian Chamber of Commerce
  CG / LA Infrastructure, and others.

2.2.3. Socialization and information

The promoting societies of the project have understood since they began the studies and management of the Rolling Highway Project that it is essential to connect with the administrative departments and with the social groups that have or may have some kind of relationship with the Project itself or with its services and effects.

Through these social and business entities the project has been presented in Medellín, Cali and Cartagena, as well as in Bogotá on several occasions. It has been therefore debated with businessmen, engineers, transporters, financiers and other members of Colombian civil society, since it is of great interest and attention the participation and the dialogue with the very diverse people interested and affected by it. We continue with activities in this line.

3. ANALOGUE CASES IN THE WORLD

We present here some data on large tunnel projects for passenger and freight transport routes that overcome important geographical obstacles, either mountain masses of importance or maritime spaces, which in both cases represent serious discontinuities for land routes, railway or road.

Each case and situation usually has different characteristics and conditions, both in terms of the demands and services to be served and the technical difficulties to be overcome. Our Rolling Highway project is focused, in a very unique way, on offering a solution of multimodal type and of high interest for the users and for the society to the continuity of a motorway - the route Armenia - Ibagué - when it faces the mountainous massif that supposes the Central Mountain Range of the Colombian Andes. The following cases coincide with the Rolling Highway in the basic concept: they provide a solution to the continuity of terrestrial communications, in conditions of economic efficiency and environmental quality. They differ in the characteristics of the users and, logically, in the concretion of the technical aspects of the solutions.

The following cases coincide with the Rolling Highway in the basic concept: they provide a solution to the continuity of terrestrial communications, in conditions of economic efficiency and environmental quality

It is noteworthy that, although the environmental aspects were also taken into account when promoting and developing these solutions, there are many more arguments today to base them on such reasons, especially in what is now known about Climate Change and what has been agreed at various international conferences on this subject (COP 21).

3.1. Eurotunnel (France-United Kingdom)

Under this denomination the fixed link under the sea (Channel of La Mancha) between the United Kingdom and France is presented. At the time various alternatives were considered to connect these two large countries, especially bridges and tunnels, previously connected only by ferries between different points of the respective coasts, which carried people, all types of vehicles and even full and loaded railway trains. The Eurotunnel project consists of a double tunnel, plus a smaller service gallery linking the towns of Folkestone on the island of Great Britain and Coquelles in France. There are no galleries for intermediate access. Due to their great length, the main tunnels serve as support for railways, one in each of them, which provide the following two main functions:

a) Link without any interruption the rail networks of Great Britain and the European continent through France, making it possible for passenger trains and normal freight trains to travel between such networks. With the recent completion of the High Speed Line from London, services have been implemented through the Eurotunnel between Paris and Brussels, and other major European capitals that compete with the aircraft.

b) Allow the passage of the English Channel to the vehicles that circulate through the road networks of the territories already mentioned, completely surpassing the discontinuity that the maritime zone supposes by means of a multimodal solution shuttle system very agile and efficient. The service of some of the ferries that previously operated between the continent and the island is maintained. Overall, Eurotunnel is capturing about 50% of the demand for freight transport. These services compete in price, travel time and reliability (meteorological contingencies in ferries).

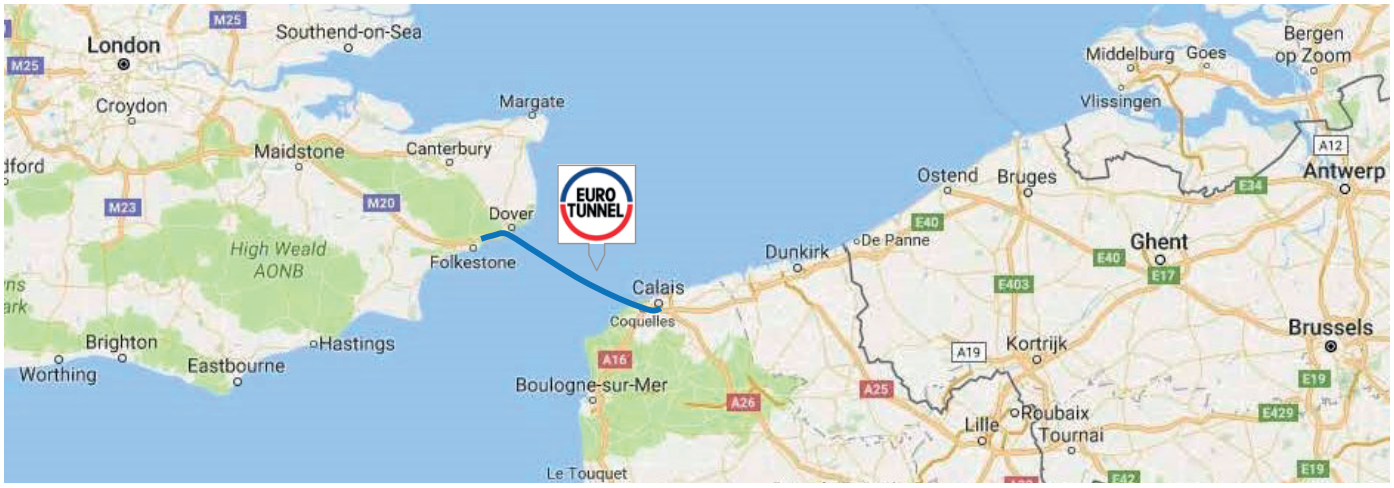


Fig. nº 27: Location of Eurotunnel

Its main specifications are:

- under the seabed, 50 m deep.
- The maximum slope of the alignment is 13‰.
- Maximum speed of the trains in the tunnels: 140 km / h.
- Integrated travel time (includes customs controls, tolls and transfers): 90 minutes.
- About 300 trains / day are circulating on average, about 120 of these are loaded with trucks.
- 15 trains that can load up to 32 trucks, with 745m of total length.
- Truck service is available to meet the demands, up to a train every 10 minutes.
- It has reached the movement of 6800 trucks on December 16, 2015.
- The demand rate grows the double than the economy in the zone does.
- Revenues: direct rates for cars and trucks and tolls to railway companies.
- Rates for large trucks vary between $ 260 and $ 310 per trip.
- Revenues from trucks account for more than 40% of the total Eurotunnel.
- It has two large transfer stations and services to the users.
- Fully automated access roads to Eurotunel.
- In 2015, more than 1.5 million trucks have used it.
- 2 million trucks are expected in 2020.
- The tunnels were drilled in about three years, with several TBM machines.
- From the beginning, about seven years of construction. It entered into service on December 22, 1994.
- Approximately 14,000 people were invol ved in the construction phase.
- In the operation of the service work almost 4000 people, in France as in the United Kingdom.
- The electricity networks of the two coun tries have been connected through Euro tunnel.

At the outset, this project was affected by a number of vicissitudes as a result of the insufficiency of the studies that had been carried out and a significant increase in the security requirements for travelers, which made it necessary to review the concession period and conditions of financing. The delays in commissioning the London-Folkestone high-speed railway (outside the Eurotunnel contract) also damaged the financial equilibrium of the Eurotunnel and had to be compensated.

3.2. Passes between Italy and Switzerland

On September 27, 1992, the Swiss people passed a referendum on the new Alpine Rail Crossings (NRLA: New Rail Link through the Alps) through the Alp Transit project, which seeks to resolve the continuity of the major transport axis North- South in Europe through Switzerland, aimed at achieving efficient and efficient transport systems that meet the requirements of environmental protection and guarantee durable mobility.

In 1994, the transfer of freight to railways was also approved. In 2001, the application of a tax burden (RPLP: Redevance sur le traffic des Poids Lourds liée aux Prestations)
was started on the transport of loads in road mode, to promote a greater use of the iron way. This rate is applied according to vehicle and level of utilization (km traveled in Switzerland).

The new railways have required the execution of several large tunnels under the Alps, integrated in the Trans-European Transport Network (TEN), with equal gauge and electric traction. They were assumed by the Swiss Federal Government and financed with exclusively public funds obtained by new taxation.

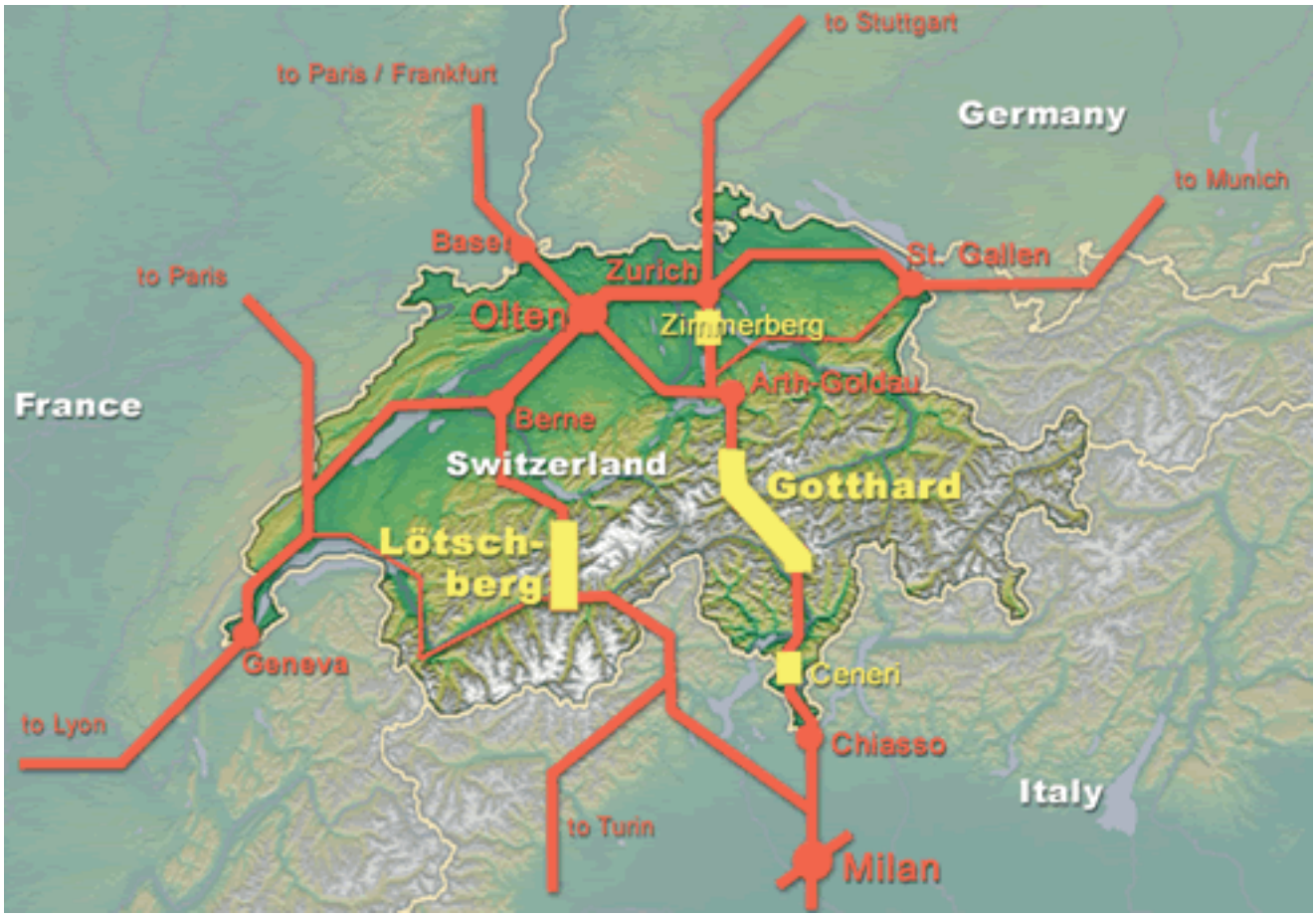
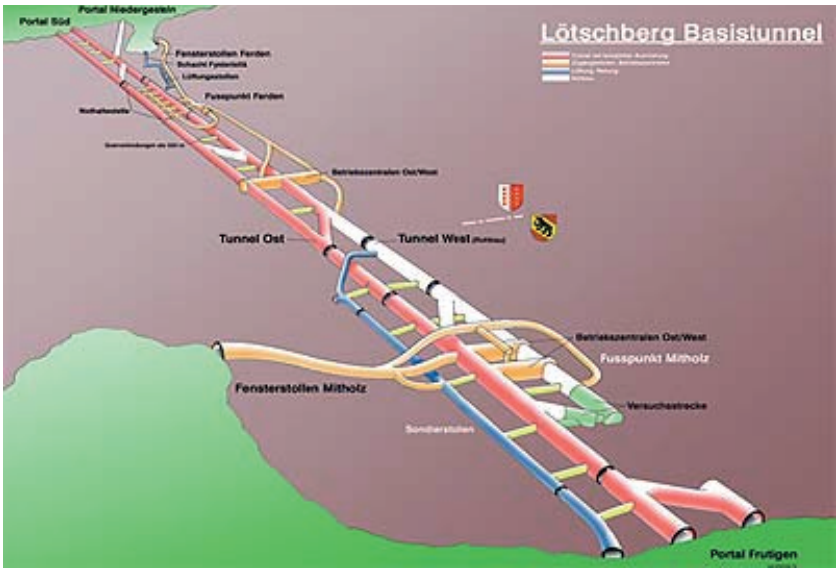


Fig. nº 28: Main transportation routes in Switzerland



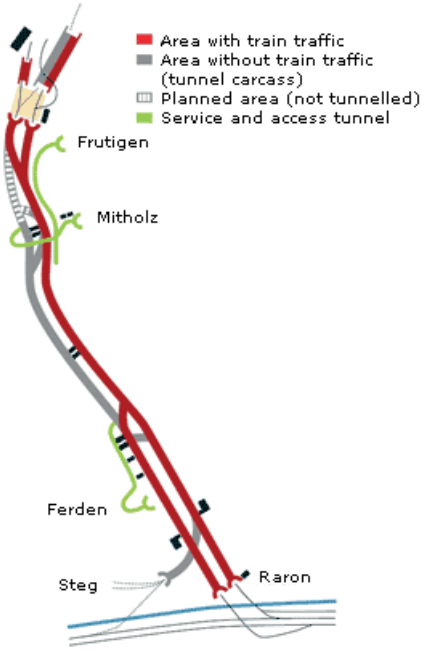


Fig. nº 29: Lötschberg base tunnel scheme.
Source: NRLA Alptransit

The two most noteworthy are described succinctly, which are key to the system and to the main routes:

- Lötschberg base tunnel.

- It has been built at a lower level (about 500 m) than the previous one of 1913 - 14.6 km in length and single tube for double track - which remains in service, although with lower performance in terms of speed and capacity.

- Main tunnel length: 34.6 km; it has three transverse galleries.

- It is used by 120 trains of all types and func tions every day approximately, on average. The speed of circulation can reach 220 km / h.

- The mountain reaches 2000 m above the tunnel.

- The maximum slope of the track is 1,3%.

- It has been in service since 16 June 2007. The second tunnel has not been continued.

- it has facilities and equipment at the highest level, and very broad forecasts.

- The investment made was about US $ 4.2 billion.

- St. Gotthard base tunnel.

· Opened in June 2016, it will be put into service next December. It is situated at a height about 600 m lower than that of the current railway line, and to the East.

· A nearby highway, with a road tunnel (from 1980, and only a dual carriageway) of about 17 km, with heavy traffic and saturated routes. In October of 2001 there was a very serious accident inside this tunnel, with a great fire, and with more than 100 fatalities. Since then, strong restrictions on the passage of trucks through this road tunnel have been established.

· Two tubes for one way each. Four transverse galleries for construction.

· Drilling began in 2003: 80% by TBM and 20% by explosives.

· Main tunnel length: 57 km. It is now the longest in the world.

· 151.8 km of the set of tunnels and access galleries.

· Two intermediate stations of security inside the Mountain range of the Alps.

· The mountain reaches 2300 m above the tunnel.

· The layout in plant will allow the circulation of European High Speed trains.

· It is foreseen the passage of 250 trains / day: conventional travelers, high speed and load.

· The maximum slope of the route is 0.676%.

· Minimum inner diameter 8.83 m.

· The speed can reach 250 km / h. (Passenger trains).

· The investment made was about US $ 10700 million.

· About 2,500 people have worked on it.

· 1.14 million trucks pass through the whole of the four Swiss alpine passes during the year. On the other hand, 60% of the total load passes through St. Gotthard (road and rail). The full operation of the transfer of cargo to the railway mode is subordinated to the termination of all new infrastructure projects.

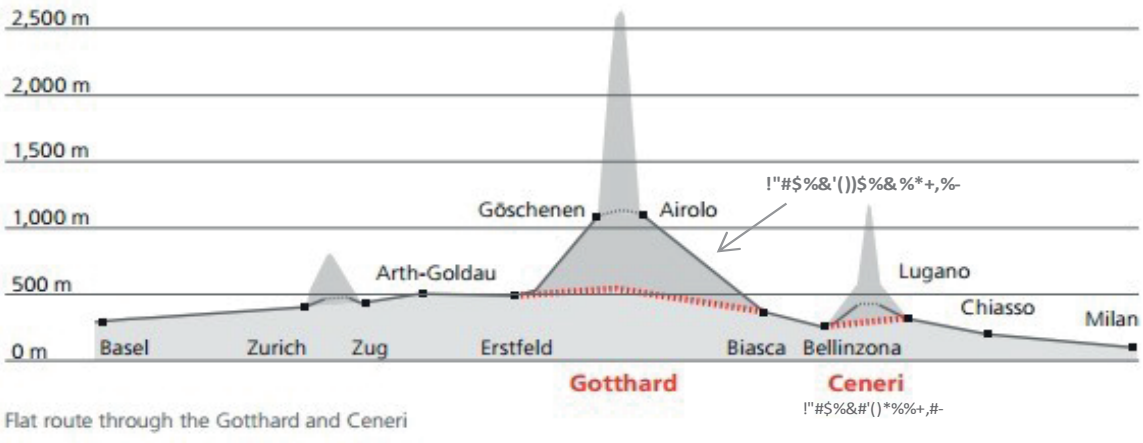


Fig. nº 30: Schematic of the longitudinal profile of the base tunnels of St. Gotthard and Ceneri (Switzerland-Italy). Source: NRLA Alptransit

3.3. Brenner Pass (Austria – Italy)

· It is located on a historical road crossing the Alps, between Austria and Italy. This step now serves the transport route linking the countries of Scandinavia with the Mediterranean ports (SCAN-MED Corridor), through Germany. A high-quality and high-capacity motorway, which was built in 1974, co-exists with a railway line that entered service in 1867, reaching both infrastructures the 1371 elevation, which is the lowest of all alpine passes. The current rail line has ramps up to 2.6%, which limit the loading and speed of trains. The aim is to transfer cargo to the railroad to be more efficient and to meet environmental objectives.

· 40% of all the loads that cross through the Alps pass by Brenner. Two thirds of these now circulate in trucks and a third in rail. In 2014, 1.4 million trucks were transported through Brenner, mostly by road.

· The Brenner base tunnel project is a top priority for the European Union, which contributes 40% of its funding. It will link Germany and the countries of Scandinavia with the ports of the Mediterranean. It is managed by a business association (BBT SE) of the governments of Italy and Austria, which is 50% held by these.

- Its main characteristics are:

- Double tunnel, each for one way, gallery of services and four lateral accesses.

- Three interspaces for possible emergency stops.

- Lengths: base tunnel: 55 km. (2nd longest in the world); Total project: 64km.

- Total length of tunnels, accesses and galleries: 230 km.

- Heights in which it is implanted: 600-800m (about 600m lower than the current line).

- Maximum slope in the main tunnel: 0.67%.

- Expected running speeds: 250 km / h for passengers and 120 km / h for loads.

- The base tunnels are drilled: 70% with TBM, and 30% with explosives (depending on rocks).

- It is expected to enter into service in 2026, with a cost of 8.5 billion euros.

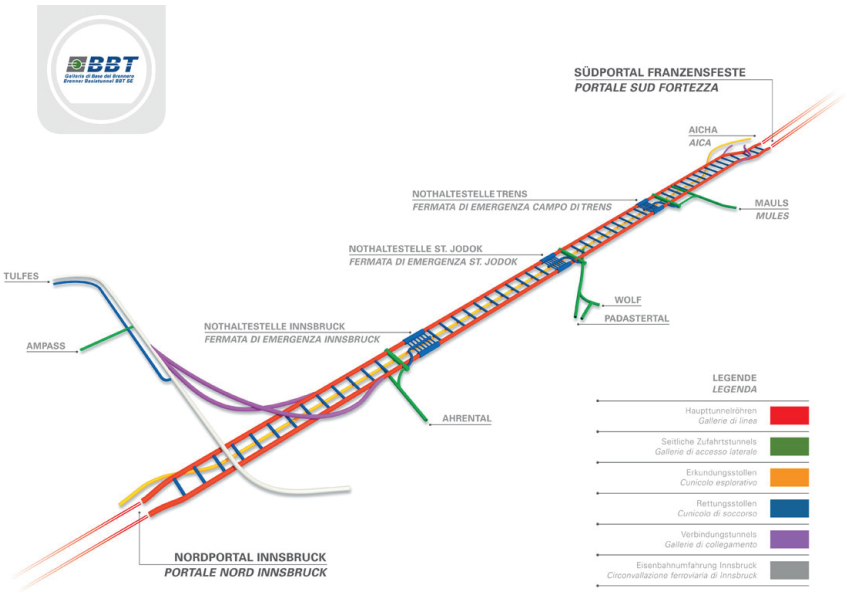


Fig. nº 31: Schematic of the new Brenner tunnel (under construction). Source: BBT-SE

3.4. Seikan Tunnel (Japan)

· This great tunnel was built underwater to link the islands Honshu and Hokkaido.

· Its objective is to connect the railroads of the great Japanese islands, in the north of the country.

· It is located in an area of seismic importance.

· Its length is 53.85 km, 23.3 of which under the seabed (up to 140 m).

· It descends to 240 m below sea level.

· It was drilled by conventional and explosive methods.

· Main tunnel and service gallery.

· Two 1,067 mm wide tracks in the same tunnel.

· It was put into service in March 1988. About 50 trains circulate daily.

· It has two emergency stations, one on each island.

· From 2016 bullet trains will circulate with limited speed, for aerodynamic reasons at the crossing of trains, at 140 km / h.

· For this, a third lane is being installed with international width.

· CAPEX was USD 3.6 billion.

· As it is located on a very long distance route, it has not provided advantages for the transport of people with respect to the airplane, at least until now. High Speed (Shinkansen trains) can change the situation. Freight trains also circulate.

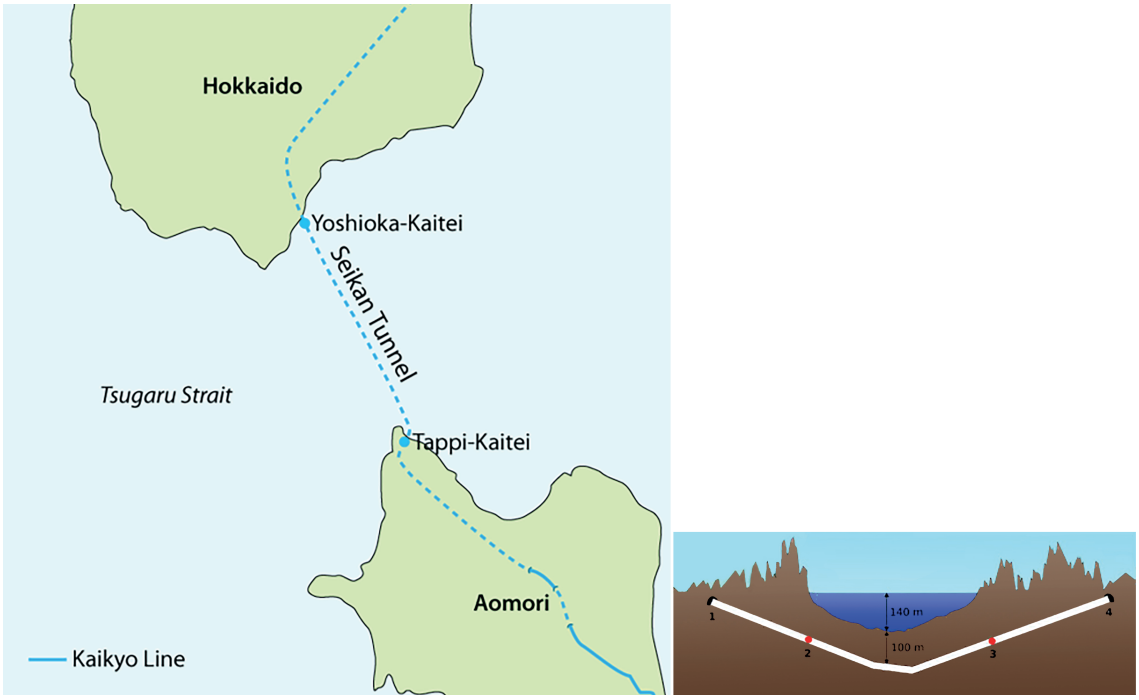


Fig. nº 32: Schemes of Seikan Tunnel (Japan)

3.5. Large Spanish tunnels

In the development of the new rail network for High-Speed that has been running in Spain for almost thirty years, numerous important tunnels have been built, in conditions and terrains of great diversity and difficulty.

We refer next to the two cases of greater significance by their length:

- Guadarrama Tunnel.

- It serves the railway line that leaves from Madrid towards the North of Spain, towards Segovia.

- It crosses the granite massif of the mountain range, of great consistency and hardness.

- Only high-speed passenger trains circulate.

- It has double tube for single track, and lateral accesses were not built.

- An emergency room has been run in the central area of the tunnel.

- It is 28.4 km long. It is set in heights between 1,000 and 1,200 meters.

- The mountain reaches almost 1,000 meters above the tunnel.

- The maximum slope of the track is 1.5%. The diameter of the useful section is 8.5m.

- Four specially designed TBM double-shield tunneling machines were used.

- These machines were placing the concrete coating (0.30m) during the drilling.

- The average advance was 16 m / day, and 1000 m in one month. They were drilled in 32 months.

- 30% of the excavation materials were used to prefabricate this concrete coating.

- The budget was 1,250 million euros. It entered into service at the end of 2007.

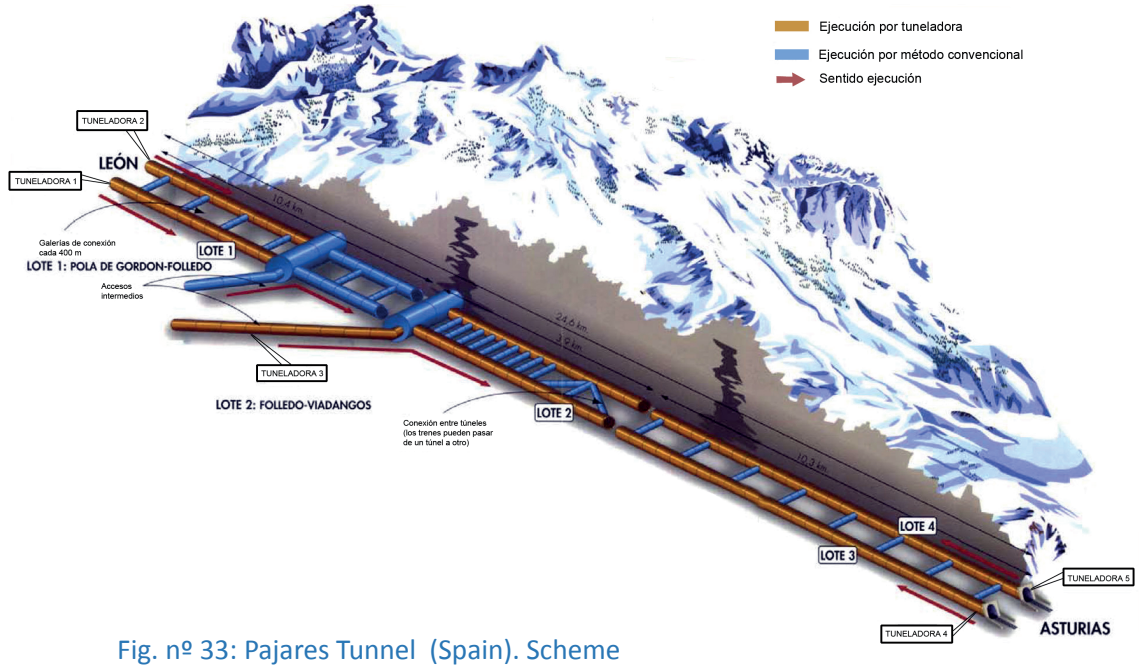


Fig. nº 33: Pajares Tunnel (Spain). Scheme

- Pajares Tunnel.

- It is integrated in a route variant (50 km) of the railroad linking León and Oviedo.

- It has two tunnels for single track and lateral access. Inside diameter: 8.5m.

- The maximum slope is 1.68%.

- The main tunnel has a length of 24.6 km. It is under advanced construction.

- The mountain range reaches up to 1,000 meters above the tunnel.

- The geology of the crossed mountains is very complex, with important aquifers.

- The execution has been divided into four lots, which has complicated the construction.

- Execution with TBM: 55%. The rest was executed with conventional procedures: explosives, etc.

- The maximum speed may be 250 km / h.

- Trains are expected to run for freight and for passengers.

3.6. Projects Contrast

We point out the following elements of general coincidence in the indicated cases:

· In general, they are integrated into impor tant nets and transport networks.

· All (except Seikan) are single-track tunnels, standard width (1,435 mm) and plate-rail (lanes without ballast, over concrete).

· All are served with electric traction.

· All are planned for various services: passengers and cargo.

Recently made tunnels base the decision of its execution on environmental and transport policy factors in the countries involved

- The sections are very similar, with minimum diameter tubes of 8.5 meters.
The slopes, except in Pajares, do not exceed 1.3%.

· Where possible, lateral access galleries have been constructed.

· The speed of the load trains is 120/140 km / h.

· Excavations executed with TBM where possible; the rest was executed using explosives.

· Waterproofing and drainage have been studied in great detail in all cases.

· In all cases, great attention has been given to environmental effects.

All of the Alps Passes have an alternative parallel highway

The Rolling Highway Project in the Central Cordillera of Colombia coincides with all these elements in its basic formulations, in the Feasibility Phase in which it is, although it is considered as an autonomous project in a first stage of its development, susceptible of being integrated in the future in a rail network. Colombian dependence of both internal and external trade on the Alto de La Línea Pass, between Armenia and Ibagué, represents a very special case in the world, with notable conceptual and technical coincidences and differences with the similar cases that have been presented.

The current traffic demands for truckloads on La Linea route is similar to the setof four steps between Switzerland and Italy and slightly lower than those of the Brennero pass between Austria and Italy

Recently made tunnels, in particular those of the Alps, base the decision of its execution on environmental and transport policy factors in the countries involved. The Paris Conference on Climate Change (COP 21) outcome reinforce these arguments in a very remarkable way. The current traffic demands for truckloads on La Linea route is similar to the set of four steps between Switzerland and Italy and slightly lower than those of the Brennero pass between Austria and Italy. All of the Alps Passes have an alternative parallel highway.

The Rolling Highway Project will have a tunnel of 44 km that is called to be the 5th longest in the world and first in America

The Rolling Highway Project will have a tunnel of 44 km that is called to be the 5th longest in the world among those destined to the transport of people and loads.

In its initial concept will be the first one destined to loads only, based on economic and environmental reasons. The Alpine projects are derived from the definition of future strategies for transport and the environment in the whole of Europe; The Rolling Highway Project will meet already existing demands and needs (cargo transport economy) and, at the same time, will be in tune with future European and global strategies. The Rolling Highway Project contributes to important improvements to the social integration in Colombia in a unique way.

All projects have been considered at the time as of great strategic sense by the States involved and, consequently, qualified as of high public interest

Sufficient knowledge of the geology of the terrain to be traversed is always an essential element for the success of these large underground projects. Sufficient and safe demands are essential for its financing and operation.

All projects have been considered at the time as of great strategic sense by the States involved and, consequently, qualified as of high public interest.

4. EFFECTS

Construction, maintenance and operation during the concession period of a mega-project such as the Rolling Highway in the Mountain Central Range leads to the emergence of important economic, social and environmental benefits, not only in the immediate area of influence of the Project, but throughout the Central Region of Colombia, with some of these effects extending to the country as a whole.
The main economic, social and environmental benefits that are expected are summarized below, concluding this chapter with a summary of the advantages of any kind that the project has to offer.

Construction, maintenance and operation during the concession period of a mega-project such as the Rolling Highway in the Mountain Central Range leads to the emergence of important economic, social and environmental benefits, not only in the immediate area of influence of the Project, but throughout the Central Region of Colombia, with some of these effects extending to the country as a whole

4.1. Economic

The main economic advantages of the Rolling Highway are laid down in the report "Economic Effects of the Rolling Highway Project in the Central Mountain Range", prepared by Analistas Económicos de Andalucía (Unicaja Bank - Spain) in collaboration with the National Association of Entrepreneurs of Colombia (ANDI) in May 2015.

This report details and justifies, based on methodologies of application in the European Union, the economic benefits of the project in two main levels:

- *Benefits for users*
- *Benefits for Colombia*

4.1.1. Benefits for users

The Rolling Highway Project in the Central Mountain Range will bring substantial benefits to the main users of the system, who will be the originators and cargo transporters, in the form of savings in operational costs and reduction of travel times.
In the year of commissioning, it is estimated that the following effects would be obtained (updated with the exchange rate in January 2016):

- In case of driving on the road - considering a complete dual carriageway between Armenia and Ibagué - a heavy vehicle as a trucktrailer of 5 or more axles will have a cost per route of about 1,165,000 COP $, between consumption and maintenance, tolls and operation time.

- By using the Rolling Highway, a truck trailer would pay a toll of COP $ 843,500 , without other additional expenses, obtaining a net **saving in the order of COP $ 321,500 per route.**

- Each heavy vehicle passing through La Linea **would save around 400 hours a year, which could increase its productivity by 14%.**

- **In the first year of service, the savings for the cargo transport sector would reach a total of COP $ 553.3 billion.**

- Vehicles will **reduce their travel time** by 2 hours and 30 minutes at La Linea pass compared to the current average time, and 1 hour and 15 minutes once the road between Armenia and Ibagué has double carriageway.

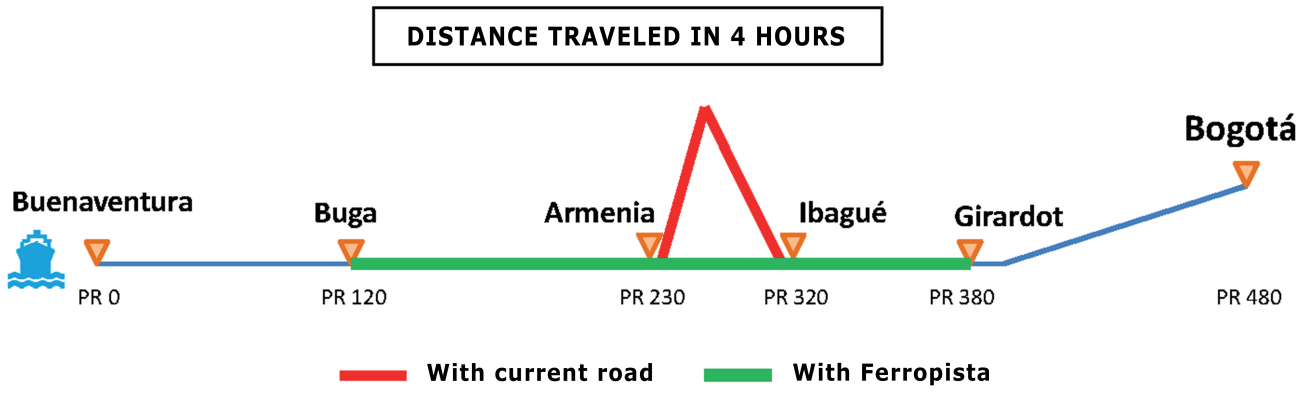


Fig. nº 34: Increase of the distance covered in 4 hours

4.1.2. Benefits for Colombia

The benefits to the country generated by the Rolling Highway will appear in the form of direct tax receipts, savings of externalities (external costs), and other effects that will occur on the nearest road network. According to the aforementioned Report, the commissioning of the Rolling Highway will produce direct tax collections of:

- COP $ 2.5 billion for the initial investment

- COP $ 5.2 billion for the operation and services of the Project (first 30 years).

- COP $ 18.9 billion in the form of tax concessions from the concessionaire company (first 30 years).

These **tax collections** amount to a total of COP $ 26.7 billion in the first 30 years of operation.

Furthermore, it is estimated an **overall profit** of COP $55.7 billions in 30 years for avoided externalities, improvement of the service in Route 40, traffic induction in the road net and for investments avoided:

- A saving of COP $25.93 billion in external costs, i.e. costs associated with vehicular congestion, pollution, accidents, and others, evaluated according to the methodology of the European Commission's Handbook of External Cost.

- The improvement of the service on the alternative road (La Línea Pass) is valued at COP $11.1 billion as a result of the increase in the collection of existing and planned tolls, derived from the induction generated by the reduction of travel times and the increased road safety.

- The effects of the traffic influx on the road net will mean an economic benefit of COP $ 10.0 billion.

- An investment of COP $ 4.3 billion in the current highway will be avoided, since it would not be necessary to construct a second road tunnel above 2,600 meters.

Therefore, adding the benefits by direct tax collections and the general economic benefits in the period of concession, it is estimated at **COP $ 82.5 billion the economic benefit generated for the country in the first 30 years of operation.** And this without the contribution of public funds.

Other economic benefits generated as a result of the construction and operation of the system will be:

- **Expected growth in foreign trade: 3.3%** (initial year)

- Foreign trade **growth in Puerto de Buenaventura: 39%** (initial year)

- **Jobs during the construction phase: 20,000**

- **Permanent jobs during the operation: 2,000**

Considering all the economic benefits presented, it is estimated that the construction and operation of the Project will have an economic **impact on the GDP of Colombia of about 0.25%.**

4.2. Social

The Rolling Highway Project is a complementary element of the road, that allows the functional specialization of each transport system

The Rolling Highway Project is focused on providing very diverse and important services to the population, contributing to avoid, as far as possible, the inconveniences and problems represented by the Andes range in relations of all types among Colombians, as well as for foreign trade from the country. As already mentioned, this is a project that, in a first stage of service, will allow the majority of heavy goods traffic to stop circulating by the route between Ibagué and Armenia (Calarcá), thus freeing up the highway of an important load that hinders and disturbs the transit of the remaining vehicles: cars and buses. It is conceived, therefore, as a complementary element of the road, that allows the functional specialization of each transport system, which has to result in economy, efficiency and environmental sustainability in the main axis of the terrestrial communications of Colombia.

Achieving such economic results will make possible other public investments for the benefit of the population

The previous section has shown in an abbreviated way the contributions of extraordinary importance for the country and its population that in economic terms implies the execution of the Rolling Highway project, which implies at the same time social benefits out of the ordinary. Achieving such economic results will make possible other public investments for the benefit of the population, while avoiding overcharging and inefficiency.

A great contribution to the integration between different populations that are now widely separated

The project will facilitate relations between the populations that settle in the basins of the Magdalena and Cauca rivers by creating more favorable conditions for general mobility: shorter travel times for trucks and also for cars and buses, increased safety for all, reliability and guarantees in general trips, etc. This will materialize in more and better solutions for the access of all the population in the central zone of Colombia to health, culture, education, commerce, tourism, etc. encouraging equity and equal opportunities.

More and better solutions for the access of all the population in the central zone of Colombia to health, culture, education, commerce, tourism, etc. encouraging equity and equal opportunities

But, especially, the Rolling Highway project has to make a great contribution to the integration between different populations that are now widely separated, making possible relations unthinkable today due to their technical difficulty and their economic cost, time consumption and risks. All this will result in appreciable improvements in the quality of life of the population, in their comfort and safety, while at the same time reinforcing the sense of peaceful coexistence among Colombians.

Shorter travel times for trucks and also for cars and buses, increased safety for all, reliability and guarantees in general trips

The almost complete suppression of truck traffic on Route 40 and the improvement that this implies in the circulation of the other types of vehicles by it will be a great benefit for the populations resident in the vicinity of the aforementioned route, as a consequence of the reduction of noise levels and harmful gas emissions, and especially for the inhabitants of Cajamarca, a city that is crossed by this road and for which it is very difficult to execute a by-pass route.

Fig. nº 35: Cajamarca crossing

Appreciable improvements in the quality of life of the population, in their comfort and safety, while at the same time reinforcing the sense of peaceful coexistence among Colombians

The very unique nature of the Rolling Highway entails the development in Colombia of a set of new technologies already applied in other advanced countries, creating very important opportunities for innovation, training of technical experts, and the implantation of new industries to produce the equipments and technical means needed for the execution and operation of the project. Large tunnel drilling systems, high-performance railways, railway material for the transportation of trucks and electronic control systems are some of the main sectors in which new activities can be developed.

Great benefit for the populations resident in the vicinity of the aforementioned route and especially for the inhabitants of Cajamarca

It is estimated that up to 20,000 people can be employed during the different phases of the Rolling Highway project and in the production of materials and auxiliary resources. The operation and maintenance will involve the creation of some 2,000 stable jobs. All these people will have to be properly formed, for which it is expected to establish agreements of collaboration with the corresponding specialized entities.

The development in Colombia of new technologies, creating opportunities for innovation, training of technical experts, and the implantation of new industries

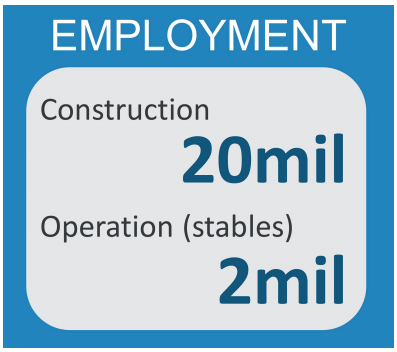


Fig. nº 36: Job Creation

4.3. Environmental benefits

The Rolling Highway project was born not only from objectives of efficiency and economy in the transport of loads in the central zone of Colombia, but also from the consideration of the fight against the climatic change, an essential task in the present times. The emissions of greenhouse gases generated by the vehicles circulating between Armenia and Ibagué are an important element in this environmental problem, both because of the high volume of traffic in cars and trucks, and because of the polluting emissions that the powerful engines of the latter emit to the atmosphere when having to ascend more than 2000 m high. The development prospects of the country have to mean high growth in traffic on this vital route to Colombia's foreign and domestic trade, which will certainly lead to a significant increase in harmful gas emissions if measures to avoid it are not taken.

The Rolling Highway project, in a similar way to what countries like Switzerland were raised more than two decades ago, comes to contribute in a powerful way to overcome this situation, collaborating at the same time in the contribution of Colombia to the objectives of COP21.

The Rolling Highway project comes to collaborate in the contribution of Colombia to COP21

Initial estimates of the volumes of greenhouse **gas emissions and fuel consumption** that can be avoided once the Rolling Highway project is implemented are as follows: By avoiding the passing of trucks and trucktrailers through the current road, the Rolling Highway project entails an important reduction of affections by **noises and by intrusion landscape** in natural spaces and in inhabited zones nearby. In particular, it is important to improve the Cajamarca crossing, which could become a road without trucks, avoiding the urban fracture and the barrier effect that these heavy vehicles cause on the road. Any different by-pass route to avoid this long journey (about 2 km) would have great technical and social difficulties and would entail high costs of studies and designs, construction and operation and maintenance. The Rolling Highway is therefore a very valuable contribution to the life of the population of Cajamarca and other towns, as well as to its valuable environment.

All these external effects of the transport are usually evaluated and assigned to agents to which corresponds to resolve them, for which there exist various procedures. The Rolling Highway would help to create not only more efficient and durable environmental conditions, but to offer a quality alternative to avoid such externalities and costs.

Within the framework of the legislation and regulations applicable in Colombia, the Rolling Highway project also examines how many negative effects can the execution of these large works bring, both during its execution and during its operation along the concession period.In this sense a route is being designed for the main tunnel that allows a fractional but simultaneous execution through transverse accesses that make it possible

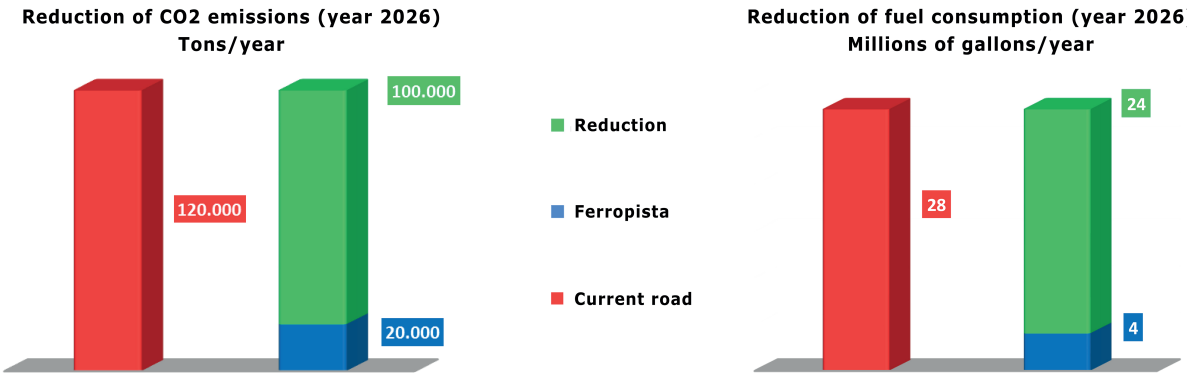


Fig. nº 37: Reduction of CO2 emissions and fuel consumption due to the Rolling Highway

to divide the volumes of rocks and lands to be transported, to reduce the distances of the transports and to facilitate the location of stockpiles and dumps, which will result in less environmental damage.It is expected that 30% of the excavated materials will be reused for concrete, and much of the remaining volume will be applied to the leveling of the large stations needed, provided that the transfer of materials does not generate other environmental problems. Adequate solutions will be provided in ongoing studies.

The Cajamarca crossing could become a road without trucks, avoiding the urban fracture and the barrier effect

In the geology chapter, special attention is given to **hydrogeology** issues, which might damage to the populations of the area in case these problems were not adequately addressed. To this end, the complete waterproofing of the tunnel and the simultaneous execution of its inner lining with the drilling and excavation are foreseen. It also anticipates the treatment of wastewater in the construction of the tunnel prior to delivery to the natural channels.

During implementation, measures will also be taken to protect the **quality of air** in the works area.

Special attention is given to hydrogeology issues

A set of compensatory measures are studied, such as the creation of forests and landscape integration of the works: tunnel portals and stations, especially.

As a general basic criterion, and following the experiences of other large projects, it is intended to apply a methodology that establishes clear and well formulated objectives and that values correctly the results obtained.

The complete waterproofing of the tunnel, the simultaneous execution of its inner lining and the treatment of wastewater in the construction are foreseen

4.4. Global benefits

The Rolling Highway project represents an innovative and unique solution for a one-of-a-kind issue. The conditions imposed by the geography and the consolidated structure of the road networks in the central area of Colombia are the basis of the idea, which incorporates the knowledge of today's technology world-wide. The economy of transport, in general, the new post-conflict scenarios that open for Colombia with Peace, and the demands imposed by climate change, are the three pillars that support the arguments in favor of the project. The most significant aspects are outlined below:

The Rolling Highway project represents an innovative and unique solution for a one-of- a-kind issue

- Operational **costs:** improved, and adequately socialized and explained to users, which are of great importance, as shown in Fig. 23.
- Very favorable effects on the **environment**: emissions of noxious gases, noises, landscape, fracture effect, etc.
- It contributes to combat **Climate Change,** greatly reducing greenhouse gases and fossil fuel consumption: it facilitates Colombia's compliance with the commitments of the international agreement COP21.
- It facilitates relationships between the **popu lations** in the Departments of the central zone of Colombia, collaborating to the equity and the social integration.

- It provides **security and reliability** to cargo transport services, thus contributing to domestic and foreign trade in Colombia: it is not affected by technical incidents on the roads or by meteorological issues.
- By significantly reducing travel **times** in a safe way, conditions are created to improve productivity, competitiveness and efficiency in the transportation sector in Colombia.
- Better conditions of use and service on the **road** through the Alto and La Linea tunnel are generated, which can be intended for almost exclusively car and bus use: security and economy.
- It provides an improvement in the working conditions of **truck drivers:** integral services in logistics areas, rest during the train jour ney, comfort and safety, etc.
- Conditions are avoided in **urban areas:** Cajamarca (crossing), Calarcá and Ibagué.
- About **20,000 jobs** will be created during construction and about **2,000** during the operation and maintenance.
- New **industries** will be installed, **technologies** of world-class will be incorporated and the formation of new professions of future in Colombia will be **developed**.

The economy of transport, the new post-conflict scenarios that open for Colombia with Peace, and the demands imposed by climate change, are the three pillars that support the arguments in favor of the project

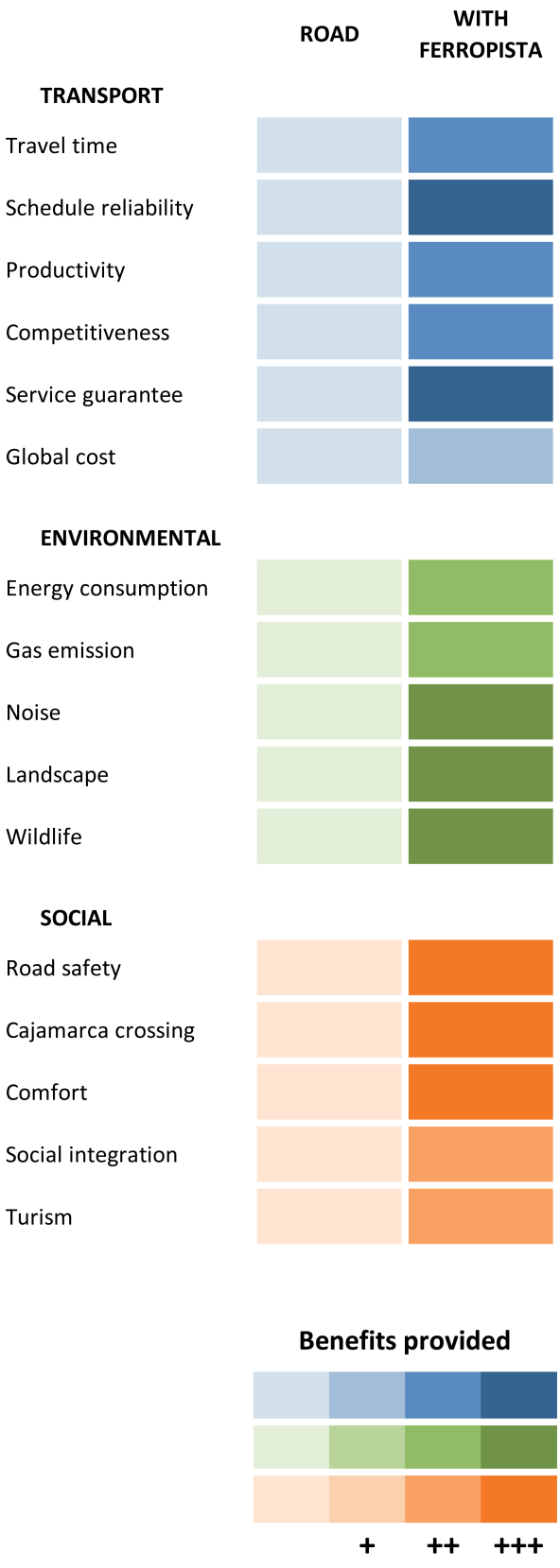


Fig. nº 38: Effects on freight transport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5. RISKS

5.1. Introduction

The analysis and ongoing studies regarding the scope of uncertainties and risks involved in the implementation of the Rolling Highway Project in the Central Range of Colombia are summarized here.

From an initial perspective, the perception of risk in infrastructure projects increases the costs and difficulty of organizing and sustaining the necessary political support, which, in turn, increases the risk assessment. This particularly occurs in situations of contained global growth.

Risks can not be completely eliminated, but their negative impacts can be controlled and reduced through good analysis and proper allocation to those who are best trained to manage them

Risks can not be completely eliminated, but their negative impacts can be controlled and reduced through good analysis and proper allocation to those who are best trained to manage them. Through the ingenuity, creativity and innovation provided by private developers, especially in the planning and design phases, the necessary conditions are created to control and mitigate the main part of the risks.

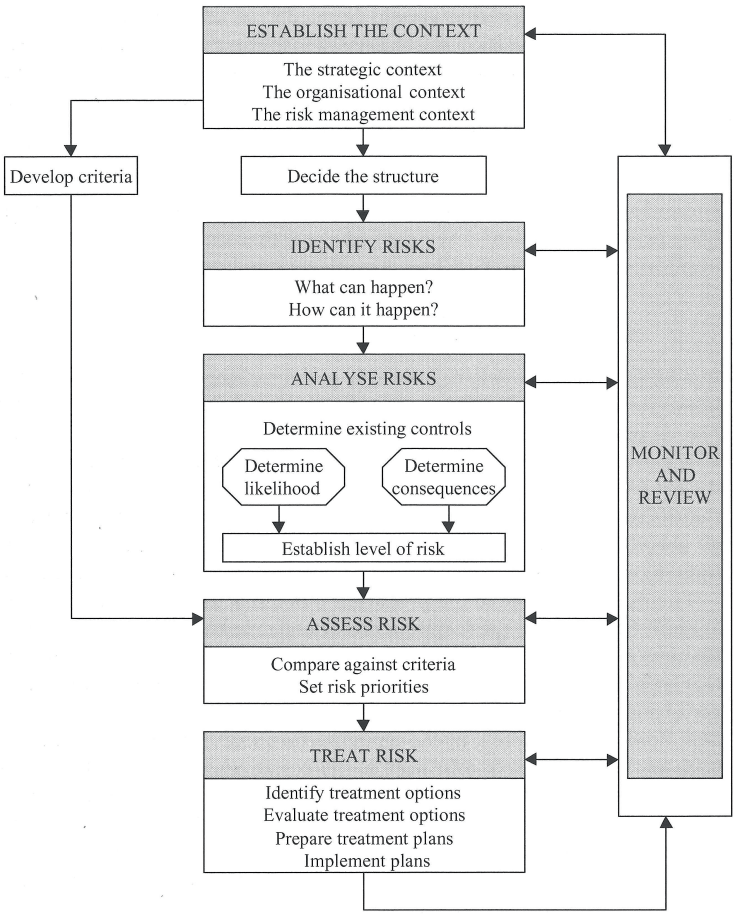

Fig. nº 39: Methodology for risk management (Megaprojects and Risk, Bent Flyvbjerg, Cambridge)

5.2. Identification of risks and uncertainties

We can not assume the idea, frequent in many projects, that "everything will run as planned", which may be too optimistic and lacking in realism. Instead we propose the analysis of the "most likely development" in the Feasibility study of the project (currently ongoing), thus identifying the most foreseeable risks and areas of the project with the highest risks, in order to know and control them well and reduce them when possible, and also establishing limit values for costs and conditions that may result in the incorporation of adjustments in the project when needed. In this way we aim to achieve a more robust and viable project. As part of the Feasibility study we will incorporate a risk management plan in order to reduce costs and impacts.

The main causes of financial risk in large-scale transport projects, such as the Rolling Highway, are:

- **Construction overcosts**, induced by different causes.
- Increases in **financial costs**: interest rates, exchan ge rates, etc.
- **Lower income than expected:** by transit or / and tariffs.

  Delays in commissioning, for delays with different causes.
- Higher **operational costs.**

5.3. Risks and uncertainties associated to the Rolling Highway Project

The Rolling Highway in the Andes Central Range of Colombia is a project of great magnitude and scope, both in its technical aspects and in its economic and social effects, already exposed in this Report. It is an absolutely singular and unique project in the Ameri-can continent, with only some similar precedents in a few European and Asian cases. As already stated, the first stage is exclusively aimed at providing continuity, in the best efficiency and safety condi-tions, to the heavy transport that circulates between Ibague and Armenia, leaving the future open to the development of solutions that allow all types of vehicles and users, depending on the actual demands that are presented. It is therefore a project created to meet the requirements of real demands and objectives, and not supported by forecasts of future developments that would be unconfirmed today; At the same time, various scenarios of social and economic evolution in Colombia are considered, particularly in its central area, that would have a great influence on the future of the project. The impact that the project itself should have in such evolution is also undeniable.

Due to its magnitude in the volume of investment, any deviation from what is expected must have economic and financial importance. We present below the vision about the risks and uncertainties that affect the project to the current level of knowle-dge, and in the absence of the remaining studies that we are developing in the Feasibility phase:

It is a project created to meet the requirements of real demands and objectives, and not supported by forecasts of future developments that would be unconfirmed today

5.3.1. Design and construction

The Feasibility Study is addressed analyzing the different constraints known so far to define a basic design that solves such circumstances in the most rational and efficient possible way. The consideration of the processes and constructive solutions that may be required depending on the characteristics of the land and the geography of the area involved are incorporated from the beginning of the design. The aim is to achieve a safe and viable solution, in which the forecasts are confirmed later in reality. The advanced technological means that the nature of the project requires are used.

The consideration of the processes and constructive solutions that may be required depending on the characteristics of the land and the geography of the area involved are incorporated from the beginning of the design

Based on the experiences of the large tunnels in the Alps, it is proposed to open up to five cross galleries in the main tunnel, both for access in the construction phase and as escape routes in emergencies on the operation phase and, in later expansions, to enable the construction of a new tunnel without affecting the use of the initial Rolling Highway. This basic design solution provides an important element of security and guarantee in the construction processes, since it allows a flexible adaptation of such procedures to the real conditions that the lands have, beyond what has came to know and solve from ongoing geological and geotechnical studies. A geological study of the terrain is undertaken to advance the knowledge of its characteristics, having started with the compilation of the reports and data available in this respect, in particular on the Alto de la Línea tunnel in advanced execution.
With all this it is expected to reach a level of knowledge that, although it may not be absolutely accurate at this stage, should be sufficient to evaluate the basic costs of construction and delimit and estimate the costs that may arise.

5.3.2. Completion Time

Building processes can lead to delays in the completion of works, which would result in delays in the entry into service and in the generation of income. It is therefore of great importance to ensure that the forecasts made in the program of implementation are met, both regarding the execution of the works themselves, as the necessary coordination provisioning the different technological equipment needed for the Rolling Highway Project: railway material, rails, catenaries, power supply, signaling and safety installations, electronic equipment, transfer stations, road access, etc. It is also of great importance to ensure compliance with intermediate deadlines by all parties involved: government, environmental, local, social, etc. The training of the personnel that will be operating the Rolling Highway is also a subject of great importance and social reach, which requires a precise coordination with the other activities.

It is of great importance to ensure compliance with intermediate deadlinesby all parties involved: government, environmental, local, social, etc.

5.3.3. Demands and incomes

A project such as the Rolling Highway needs to have guaranteed its income with sufficient reliability. In application of the idea that each risk must be managed by the public or private party who can face it in better conditions, we understand, by starting this project as PPP, that the private sector is more qualified to handle and mitigate it within the framework advocated here. There are four basic elements that can influence this important chapter:

- Guarantee of traffic transfer, with secured capture of 90% of heavy vehicles.
- Lack of new competing solutions
- Evolution of the country's economy
- Maintenance of tariffs appropriate to the econo mic viability of the project

An adequate evaluation of the externalities present in the current and future situation provides a clear basis for these necessary policies on transport management and promoting multimodalism

The transfer of truck traffic can be assured both by the level of the usage rates, and by the consideration by the Government of Colombia, similar to what already happens in Alpine crossings, of the convenience of routing traffic of users towards these railway solutions, both for environmental reasons (especially the fight against climate change) and for powerful economic efficiency, as well as for making a notable improvement to the conditions of use of the route by Alto de la Línea, which is expected to be affected by the significant growth of mobility in the area. An adequate evaluation of the externalities present in the current and future situation provides a clear basis for these necessary policies on transport management and promoting multimodalism.

In the concession period, it seems neither viable nor reasonable the building of new solutions that would compete with the Rolling Highway in its role as an articulating axis in East-West communications in the central Colombian zone, and it is foreseeable that the road Ibagué-Armenia will remain the main support for these functions and services.

Colombia's economy is reasonably evolving, as an emerging country that is called to play a major role in the American continent as an articulator of the Center / North with the South. The issue does not affect this project differently than any other in the country, so consideration of this type of risk has already been well studied.

The fees for the use of the Rolling Highway are an essential element in the balance of the concession contract. Adequate income must be guaranteed to secure financing, with the necessary stability guarantees. It is also related to exchange rates and financing solutions.

Adequate income must be guaranteed to secure financing, with the necessary stability guarantees

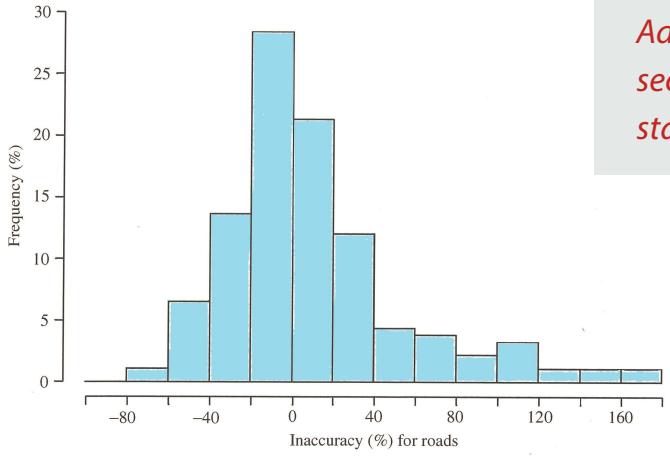

Fig. nº 40: Inaccuracy of planned transit in 183 road projects. The inaccuracy is measured as the difference of the actual traffic, in percentage of the predicted traffic. (Megaprojects and Risk, Bent Flyvbjerg, Cambridge)

5.3.4. Design and construction

Different types of risks and uncertainties that can involve the Rolling Highway Project are considered, such as those derived from ambiguities and environmental complexities, which will be controlled in the course of the corresponding studies. Those related to various affected: communities, transporters, cargo operators, etc. will be minimized through transparent information and the participation of such actors and civil society in general in the overall project process. And those that could be derived from political reasons will be framed in the concession contract.

5.4. Comparison with similar cases in the world

The risks and uncertainties that have affected several major projects in the world are conditions derived from their very special circumstances. Several known studies have analyzed the events occurred in major highway projects in the world. It is a generalized issue that costs tend to increase and that demands are often overestimated - particularly in the case of rail projects as opposed to road projects -. At this point it should be noted that the Rolling Highway Project, despite its strong technical solution, is a project to improve the continuity and service of the road network of Colombia, thus linked to the expectations of demands from this network. The deviations in the large projects

By way of significant examples: Modifications to the required safety conditions and changes in general socio-economic scenarios were of great importance in increasing construction costs and in the lower initial demands on the Eurotunnel between England and France.

In the Øresund pass between Denmark and Sweden, construction cost increases were triggered by new technical requirements in the accesses to Copenhagen and initial demands reached levels somewhat lower than expected but sufficient.

The deviations in the major road projects of the world have not incurred important costs and demands in most cases. Greater deviations have been detected in the iron projects, especially affected by demands that are significantly lower than expected. In the large alpine tunnels, the unforeseen events have been solved within the established financial framework, without unbalancing the projects, within the framework of the transfer policy already exposed. Other large links with tunnels and bridges have had more significant deviations.

There are also notable examples of good fit of the realities to the initial estimates. The majority of these great projects have been of public management and promotion, without private participation. A significant exception is the Eurotunnel, of private equity company promotion, management and operation.

The Rolling Highway Project, despite its strong technical solution, is a project to improve the continuity and service of the road network of Colombia, thus l inked to the expectations of demands from this network

5.5. Management and compensation

Risks and uncertainties are inherent to large projects and it is necessary to perceive them as opportunities to create new solutions and to redesign them. As part of the Feasibility study, we developed a risk management plan considering the worst scenarios, in order to identify how it should be managed and by whom, without looking for improper transfers that may impact on the project and damage it. This has to be taken into account, particularly in the formulation of both the concession contract with the Government of Colombia and in all types of contractual relations with collaborators and contractors.

Risks and uncertainties are inherent to large projects and it is necessary to perceive them as opportunities to create new solutions and to redesign them

Public-private partnership must be authentic and complete, as it is crucial to the success of the project. A megaproject like the rolling Highway has its great share of complexities and results in enormous positive effects for the country. Because of its nature, a PPP project has to be essentially hybrid and not only private. The question is how such collaboration should be articulated in this special case.

Public-private partnership must be authentic and complete, as it is crucial to the success of the project. A megaproject like the rolling Highway has its great share of complexities and results in enormous positive effects for the country. Because of its nature, a PPP project has to be essentially hybrid and not only private. The question is how such collaboration should be articulated in this special case

The participation of the beneficiaries and affected by the project from the initial stages is of special importance. We work to get the information to all stakeholders, gathering their proposals to improve the project and to avoid damages. We study procedures to compensate the financial consequences of incidences in the execution, delimiting their scope and defining procedures of action.

To mobilize funders, it is necessary to provide safe and reliable project conditions, controlling risks and uncertainties and trying to spread the risk of investment among various parties. It is necessary to ensure the inflation adjustment of toll rates and of various services to be provided, as well as to establish monetarization mechanisms for tariffs and total revenues. And in a competitive market, it is necessary to offer high rates of internal profitability of the project.

To mobilize funders, it is necessary to provide safe and reliable project conditions, controlling risks and uncertainties and trying to spread the risk of investment among various parties

To this end, it is necessary to create the required conditions for a better development and scope of ongoing Feasibility studies, while consolidating the support of the Government of Colombia and the institutions and corporations involved in the project. In this way, the approximation and incorporation of sufficient and appropriate investors to its strategic importance will be facilitated.

Conclusions

A brief presentation of the project ROLLING HIGHWAY IN THE CENTRAL MOUNTAIN RANGE OF COLOMBIA has been showed above, with its foundations, effects and risks, the status of the work on the current Feasibility Phase, and its comparative relations-hip with other analogous projects executed in the world during the last decades.

Both the companies that promote this Project and the technical team that supports its structuring and development, consider implanting it an absolutely unique solution for the main logistics corridor of the country, a solution of exceptional strategic importance for Colombia and Latin America. It is one of a kind, with unique and very special conditionings, and means a proposal that follows in a complete and faithful way the guidelines of COP 21 (Climate Change), providing innovation and technologi-cal development, and the application in the American continent - Colombia - of techniques successfully used in other places. As a privately owned PPP project, its very special characteristics offer an opportunity to propose innovative management formulas, based on sharing objectives and results between the private and the public that help to develop a real common project, beyond the economic contributions from the public. We work to provide it with financial solutions that guarantee its fulfillment in any circumstance, supported by the confidence generated by Colombia's accredi-ted capacity to finance ambitious infrastructure projects.

The basic orientation of the Rolling Highway Project towards multimodality as a more efficient and durable form of freight transport is a contribution that would have to be valued as a decisive factor of institutional and general support of the society. It also involves the development and fulfillment of the guidelines that are deduced from the National Plans of Development and Transport Master, since it will collaborate in making Colombia a more competitive country. The contribution that it assumes to better integration of populations and territories of Colombia, by "eliminating" the Central Mountain Range of the Andes as an almost insuperable barrier so far, adds in the present conjuncture of the country an element of remarkable reinforcement in such valuations and decisions.

The inclusion of the Rolling Highway in the list of projects "selected" as of interest in the Master Plan of Intermodal Transport (PMTI), as well as in the "Colombia Portfo-lio" for the Green Climate Fund (FVC), are considered as necessary steps so that the management of this Project can continue advancing in international areas.

Support should be mainly oriented in contributing to the control and compensation of the risks that a project like the Rolling Highway inexorably entails. Two broad areas for the study and analysis of the forms that these institutional supports can cover are the strengthening of the demand with actions of the type applied in Switzerland and other European countries and the participation in the costs of the risks through fiscal measures that do not involve Contribution of public funds but reduction of charges for promoters and operators. A long concession period, accor-ding to the amortization periods usually considered for this type of projects, is also necessary to be able to incorporate the required financing.

We are facing a project that will be historic for Colombia, because there will be a before and after its execution, socially, economically and environmentally.

To the justifications provided, it is important to add the sense of opportunity that is now presented, both because of the special financial channels that are being deve-loped internationally for projects that combine the environmental with the produc-tive, as well as the ongoing support flows in the phase of peaceful coexistence that Colombia is entering. The great future that is glimpsed for the development of the country certainly favors the financing of projects of the scope and dimension of the Rolling Highway.

It is a necessary and feasible project now.

September 2016

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2	Adapting Transport Policy to Climate Chage.	OECD. International Transport Forum.	2015
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This *Rolling Highway* is called to collaborate in a very important way in the advance of Colombia towards a more developed and fairer country, according to its National Development Plan. It is a project of a new infrastructure that has to contribute efficiency to the transport, improvement of the environment and social integration.

In the legal framework in force in Colombia, it is proposed as a private initiative APP project. The companies promoting the project have prepared this report to present the progress of studies and activities in progress and to provide information on their particular characteristics, expected effects and contrast with other similar projects.

It is intended that this publication be useful for those interested in the execution of the project and involved in its development, so that a broad and well-founded criteria can be formed. It is considered that information and participation of the population in general and of economic and social agents, in particular, are key to the success of the Project.