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More, Better or Different?

Investing in Paraguay's Roads

LATIN AMERICA AND CARIBBEAN REGION

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ACKNOWLEDGMENTS

This report was developed by Kavita Sethi on the basis of a series of background papers, targeted interviews, and secondary data provided by the Government of Paraguay. The background papers and substantial contributions include those on road network evaluation (paved and unpaved roads) by Rodrigo Archondo-Callao and Atsushi Limi, transport and budget data by Pablo Iribarren Santos and Alex Giron Gordillo and spatial information and analysis by Li Qu and Zhen Liu. The Report relies heavily on roads data provided by the Ministry of Public Works and Communication and budget data from the BOOST Initiative and the Ministry of Finance. The team is grateful for the comments and guidance provided by Jesko S. Hentschel and Juan Gaviria, as well as for comments and helpful suggestions from Carole Megevand, Celia Ortega Sotes, Ruth Gonzalez Illamas, Monica Tambucho and Lincoln Flores. A special thanks is due to the following reviewers for their comments that have helped to improve the document: Vivien Foster, Daniel Benitez and Cecilia Briceno Garmendia.

ABBREVIATIONS / GLOSSARY

DCV	Rural Roads Directorate, Dirección de Caminos Vecinales
DV	Road Directorate, Dirección de Vialidad
Fonacide	Fondo Nacional de Inversión Pública y Desarrollo
MH	Ministry of Finance, Ministerio de Hacienda
MOPC	Ministry of Public Works, Ministerio de Obras Públicas y Comunicaciones
PYG	Guaraní paraguayo
RONET	Road Network Evaluation Tool
Rural Access Indicator (RAI)	is the share of rural population living within 2 kilometers (about 20 – 30 minutes walking time) of an all-season road
All-season road	is a road usable year-round by motorized transport except for occasional interruptions of brief duration due to inclement weather.
Road density by population	is the number of kms of roads per thousand population in a defined geographic or political zone, region or country.
Road density by surface	is the ratio of the length of the country's road network to the country's total land area. Road density may be specified with respect to the entire network which includes all roads in the country or with respect to a subset of the road network such as paved roads or highways.
Sustainable Network	as defined in RONET is the share of the road network in very good, good or fair condition and which requires periodic maintenance works, while roads in poor or very poor condition require rehabilitation works.
Nominal or current values	are derived from market prices without any adjustments for inflation.
Constant or real prices	adjust for the effects of inflation.
Tolls	are direct charges for public services and are retained by the collecting entity.
User charges	(or quasi prices) are indirect charges for infrastructure services that are often levied as fees on proxy transactions. The choice of proxy varies with the type of infrastructure.
Earmarking	refers to the pre-commitment of taxes to support or fully fund prespecified expenditure items. These revenues may be channelled through the general treasury or may be paid directly to a dedicated fund.
First-generation road funds	were established in the 1960s and 1970s as extrabudgetary arrangements through which an earmarked stream of tax revenues was put at the disposal of a road department or agency.
Second-generation road funds	moved away from using earmarked tax revenues in the 1990s. Instead, they are funded by levies or surcharges designated as "user charges" and identified separately from general taxation.

EXECUTIVE SUMMARY



CONTEXT AND FINDINGS

1. Paraguay is a middle-income, landlocked country with a population of about 7 million. The nation is highly dependent on its transport and logistics infrastructure to connect to regional markets and international seaports. Currently, economic growth is reliant on trade of natural resources and agriculture while the country seeks to diversify its economic base. However, there is a significant geographic, economic, and demographic divide that the roads sector needs to bridge. The Eastern Region concentrates 96 percent of the population and hosts most of the soy production while the Western Region is a relatively deserted area with just 290,000 inhabitants in 2017 (4 percent of the total Paraguayan population) and 43 percent of the national livestock production.

2. The existing length of the network, paved and unpaved, is considered sufficient to cater to the vast majority of the population, notwithstanding spatial differences. The national, average road density by surface area of 0.20 km per sq km is on par with Brazil with a density of 0.19 km per sq km, and much higher than Argentina and Bolivia with densities of 0.09 and 0.08 km per sq km respectively. The current paved road network, at the macro-level, serves about 70 percent of the total population. At the departmental level though significant differences are observed in road density values which range from 7 to 70 kilometers (km) of road per 100 km² of land area.

3. In road quality and connectivity, on the other hand, Paraguay trails its neighbors and other middle-income countries. According to the Global Competitiveness Indices, Paraguay is in the bottom third of indexed countries for road connectivity and quality. The country's lowest score relates to the quality of its road infrastructure, where it lags behind neighboring countries Argentina, Brazil, and Bolivia, and where it places among the four poorest performers in the Latin America and the Caribbean (LAC) region. Its performance is also below the upper-middle-income-country average. These competitiveness ratings reflect a need to understand the underlying issues driving quality and poor connectivity and find solutions to improve road infrastructure overall.

4. The government has attempted to address perceptions on quality and connectivity through higher

budget allocations for the road sector. In real terms, road sector spending in 2017 was double the expenditure in 2008 while the share of roads in the overall government budget went from 4.0 percent in 2008 to 5.2 in 2017. Road sector spending as a share of GDP mirrors those of Eastern European countries' in 2009, as these countries attempted to rapidly improve their infrastructure to Western European standards. As a share of GDP, the road sector has received 2 percent or more since 2012, which is well above the regional average, and surpassed only by Bolivia. OECD average expenditures meanwhile are considerably lower at around 1 percent and reflect a more mature stage of infrastructure development.¹

5. The higher road sector budget has been directed to expansion and preservation of the paved roads since 2012 and has, on the whole, allocated sufficient funds for their maintenance as estimated by this Public Expenditure Review. Despite this there has been a slight decline in the overall quality of the network due to over and under funding of roads geographically and by functional classification. The quality of the paved national roads has improved while that of paved secondary roads has deteriorated. The analysis of this PER suggests that to meet the targets of the "paving program", the sector selected low traffic volume roads and "paved" these with thin seals laid over existing cobblestones. These "paved" roads had higher roughness values and poor quality from the very start. The selection process for the paving program appears to have applied socio-economic rather than purely economic criteria and this allowed inclusion of low traffic roads in the program. Both the selection of roads and choice of technology of the program were distorted and yielded an overall decrease in the quality of paved roads. The direct cost of such technical inefficiency is estimated at about US\$160 million for the period 2012-2017.

6. Budget execution is hampered by Institutional inefficiencies and the road sector budget is underspent to the tune of US\$200-400 million annually or 25-35 percent of the annual budget and implies a maintenance deficit which leads to higher rehabilitation costs in the future, at a ratio of 1:3.5. There is considerable volatility in the annual approved and modified budgets, in 2014, for example, the modified budget of US\$818 million was 130 percent higher than the approved budget. Such fluctuations have an adverse impact on the planning, execution and absorption

¹ Source: OECD (2013)

of funds when contracts are lumpy and multi-year as in the case of road works. Poor management of the budget process and works planning are attributed to the institutional “policy environment” which determines what is allocated and what is actually spent. Assuming that about half the amount left on the table is applicable to maintenance activities and given that additional road user costs in Paraguay are US\$3.5 for every dollar of deferred maintenance, a conservative estimate of the cost of institutional inefficiency for the road sector in Paraguay is somewhere between US\$350-700 million annually.

7. The road sector also suffers from a complex, bureaucratic system with inadequate oversight and accountability. Policy formulation and road sector management are both the responsibility of MOPC, responsibilities which are normally separated institutionally to avoid conflict of interest issues. The Ministry of Finance (MOF) should, in principle, assess the efficiency of sector expenditures but there is an almost complete absence of data, mechanisms and tools to track performance and hold MOPC accountable for the quality of spending. Technical staff have very little autonomy, and ministerial and vice-ministerial approvals are required at each step of the procurement and implementation processes. The budget and project execution systems are process-heavy, complex and time consuming – there is low visibility on the location of bottlenecks and the overall result is low execution rates for the sector.

8. One of the main contributions of this PER is the development of physical, financial, and spatial databases and profiles for the road sector that have hitherto been unavailable. There is a major lack of consistent, good quality data on both physical and financial aspects of roads. To set and monitor programs, technicians and policy makers require quality and timely disaggregated data. Reliable planning, prioritizing, and budgeting of sector expenditures require regular surveys of traffic and road conditions, which are not being conducted in the Paraguayan context. There appear to be no mechanisms in place to relate expenditures to physical outcomes or decision tools to support review of budget proposals or evaluate the efficiency of sector expenditures.

9. Budget allocations appear to favor the eastern, southern and central regions², considering the distribution and quality of the road network. The central and eastern regions account for about 48 percent of the total paved road network but received about 65 percent of the total budget allocated to road projects in 2018. By contrast, the rural Chaco region has 14 percent of the paved road network but received only 3.2 percent of the total road-sector budget. Thus, in broad terms there is overinvestment in regions where road conditions are relatively good, i.e. particularly the central and eastern regions, leaving roads in other areas in worse condition with inadequate investment. The actual financial needs of a department must obviously be determined by taking account of its adopted engineering designs, current road conditions, procurement costs and other factors.

10. While preservation of the paved network is the key to continued, reliable access by some 70 percent of the population, there is an enormous, unmet demand for rural road development to address social equity and rural development issues. In rural regions, a few paved roads are spread across a large area and this restricts access to all weather-roads to about 42 percent of the rural inhabitants. Additional access is provided by earth roads with little or no maintenance. While the annual modified budget would suffice to address in full the maintenance needs of rural roads, the budgetary volatility and institutional issues mentioned earlier lead to underfunding of maintenance by about 50 percent. Improving earth roads to provide all-weather access requires a judicious review of the technologies available to improve such roads. The traffic threshold at which paving an unsealed road is economically justified is mainly a function of the unit cost of the paving works, the traffic composition and its expected growth, and the condition of the unsealed road. In a wet environment, an unsealed road deteriorates rapidly due to rainfall. In a dry environment, an unsealed road can remain in passable condition for much longer periods and is a more economical option.

² As of 2018, MOPC groups departments into five regions for budgeting purposes. The departmental composition of regions is shown below.

Chaco	Norte	Este	Centro	Sur
Presidente Hayes	Concepción	Caaguazú	Cordillera	Itapúa
Alto Paraguay	San Pedro	Caazapá	Guairá	Misiones
Boquerón	Amambay	Alto Paraná	Paraguari	Ñeembucú
		Canindeyú	Central	

11. A move toward sustained, universal access, especially in remote areas, therefore remains a challenge that is being addressed but requires further effort.

The country does not have a rural roads policy or a strategy to achieve the SDG goal of universal accessibility at present. The roads sub-sector has been receiving less than 50 percent of its maintenance needs, as RNET model estimates show. Advancing to a universal access goal, that is upgrading roads to a gravel standard, would require an expenditure of about US\$5 billion. A 100 percent access rate for the rural population requires the construction of additional roads to dispersed and remote habitats at an additional, estimated cost of about US\$2 billion. An estimated US\$300 million annually would be needed for maintaining these new and rehabilitated roads.

12. A sustainable long-term revenue source for the road sector is another issue.

Road sector development and maintenance is financed through a complex mechanism involving multiple domestic and external financing sources. The road sector receives funds sourced from taxes and other government revenues; international and domestic credit; and grant funds. While the share of multi-lateral financial institutions (MFIs) has increased over the last decade, sovereign bonds are nowadays the dominant source of capital. There are in turn only a few tolled roads and concessions that rely on user charges, both of which provide a more sustainable source of revenue. The bulk of road sector expenditures are channeled through the Ministry of Public Works (MOPC) and departmental and municipal governments receive some limited budgets for infrastructure.

13. This Road Sector Public Expenditure Report (PER) assesses current practices in the budgeting and expenditure of public resources in the road sector in Paraguay. The Report identifies gaps and potential efficiency gains in the functional and spatial allocation of resources, spending execution, and resource management efficiency. It also considers the adequacy of resources and opportunities for sustainable funding from user charges. Further, the PER looks at ways to rebalance and afford the investment and maintenance needs of rural roads which are a priority to meet the access requirements of approximately 1.8 million beneficiaries.

14. The outcome of this PER is a set of recommendations that address four basic themes:

- Better public management and governance practices,
- Addressing data and capacity issues,

- Striving for universal accessibility in rural areas, and
- Sustainable sources of revenue for the sector.

15. Recommendations on how to improve public management and governance practices address a core set of administrative, organizational, and budgetary issues:

- Experience with road administrations around the world indicates the importance of separating the policy and implementation functions of roads administration. However, the Paraguayan Ministry of Public Works (Ministerio de Obras Públicas y Comunicaciones) is charged with both functions, with no real separation between these two aspects of road administration. Nor are there mechanisms or tools in place to monitor and evaluate sector performance and encourage efficient expenditures. While sector accountability can be enhanced by requiring independent annual audits of all capital and recurrent expenditures and sharing these results in an annual sector report in the short term, clear separation of responsibilities, possibly through an independent road entity, should be a medium term goal.
- The execution process of public investments in Paraguay for road construction, improvement, and maintenance is still highly complex and bureaucratic. While discipline is important to protect the integrity of expenditures, the investment cycle needs to be simplified and optimized. Further, the Ministry of Finance should develop both the tools and technical capacity to review the proposed road network budget and planning, and subsequently confirm that expenditures are aligned to these. The latter can be achieved through ad hoc financial and physical audits of road sector expenditures by the MOF. These changes would strengthen the alignment of annual budgets with the MTEF and help reduce the current underspending by MOPC by anywhere between 25 to 35 percent of the annual budget.
- Project preparation processes and cycles are opaque and show considerable bunching over the calendar year, instead of a manageable, well spaced sequence of preparing and implementing projects. Increasing numbers of complaints from bidders and large numbers of addenda (that seek to clarify contract terms) signal weak document preparation linked to low technical and procurement capacity. These issues can be addressed by requiring MOPC to start preparing specifications and procurement documents as soon as a project enters the

budget process, tracking and oversight of the project preparation cycle, and finally, emphasis on developing and retaining staff skills through regular training.

- In terms of budget allocation, the Government of Paraguay's emphasis on the operation and maintenance of the paved network seems to have led to improvements in road conditions over the past five years and should continue to be the focus of MOPC efforts. At the same time, any funding allocations to upgrading or reconstructing unpaved, secondary and rural roads need to take into account the underinvestment observed in some departments, especially in the poorer rural North and Chaco regions with the lowest levels of road access. It is recommended that standard, asset management tools are applied in the development of the paved roads budget while a transparent, multi-criteria framework is the basis for planning and prioritizing expenditure on unpaved roads. Failure to address the discrepancies in rural access in these regions, combined with their remoteness and difficulties in access to public services and markets, will inevitably perpetuate inequality. A robust data and information system are needed to inform the budget allocation process.

16. Addressing data and capacity issues will integrate evidence-based decision-making with a better-skilled staff.

- A systematic and up-to-date survey of the quality of the paved network, as well as the traffic using it, is necessary for the meaningful application of asset management models and to determine network spending requirements.
- While maintenance expenditure on the paved network appears broadly adequate, there is a concern that the amount, spatial allocation, and type of capital works funded may be inappropriate, especially if expenditure requirements are based on guesswork regarding traffic and road conditions. Conducting a comprehensive survey of the paved road network, developing mechanisms for regular updates of the roads database, and making these data publicly available alongside budget data, are perhaps the best guarantees of improving value for money in the roads sector.
- A functional review of road sector staff and profiles is needed to develop both a staffing and training plan

commensurate with sector responsibilities and planned growth. Budget allocations for capital and recurrent expenditures have increased substantially over the past seven years, challenging MOPC's capacity to manage the annual budget and deliver high-quality works. A functional review can help align staffing needs and skills with the current and future needs of the sector.

17. Striving for universal accessibility in rural areas: a rural roads policy and strategy are necessary to address universal accessibility goals, ensure appropriate technologies, such as gravel roads, for all-weather access, and lessen the cost and time frame for achieving these.

- The rural road network is a vital public resource for the country's more remote areas, despite their lack of economic weight and their dispersed population. A rural roads strategy would be helpful for determining investment priorities based on transparent and objective socioeconomic criteria that are appropriate in a rural context. Thus, it would help improve the efficiency of project selection and public expenditures as well as address inequities in the rural population's access to economic, educational and health facilities.
- Such a strategy should include an objective prioritization framework which is important for systematically allocating limited resources to high-priority roads in a timely manner, while avoiding unnecessary political involvement. The strategy should also address the issue of the resources required to advance the goal of universal access.
- The allocation of the roads budget is disproportionately skewed towards paved roads and a gradual rebalancing of funds towards the rural sector is necessary. It is estimated that about \$62 million are needed annually for maintenance as against the average \$28.0 million (2013-17) currently expended on rural roads. This maintenance gap can be easily covered through, for example, a higher budget execution ratio. The rural access indicator is currently at 42 percent – leaving roughly 60 percent of rural residents without reliable access in the long term has implications for the rural economy, poverty reduction and well-being. A stepped approach to achieving universal access is recommended.

18. Sustainable sources of revenue for the sector: at present, Paraguay's road funding mechanism pools capital from

various sources, relying heavily on donor resources and, more recently, on domestic borrowing. Road user charges provide a more sustainable source of funding since they can be aligned with the maintenance expenditures of the network and channeled through a dedicated fund, if one exists.

- Road funds, managed by independent road boards, are often recommended in situations of insufficient or uncertain budgetary allocations to help avoid deterioration of road assets. However, dedicated funds also reduce fiscal flexibility and may be just as poorly managed as budgetary allocations. Gwilliam et al suggest that there are, in general, two long-term institutional options for reconciling fiscal prudence with asset maintenance: a road agency operating on commercial principles, or a reformed and well-functioning budget process with appropriate checks and balances.
- Paraguay's paved network has been receiving adequate maintenance funds, notwithstanding uncertainty in the budget allocation and transfer process. In this situation, careful consideration of the sector's long-term institutional preferences, together with any need for a provisional road fund, in the form of an active Sistema de Infraestructura Vial del Paraguay (SIVIPAR), is recommended. This consideration should include an assessment of the revenue sources, the structures of user charges, the affordability of proposed user charges (specifically the affordability of tolls and fuel taxes) for lower income populations, and the adequacy of the build-up of revenues toward a sustainable financial model. Appropriate checks and balances in the system to prevent any potential misuse of funds are also necessary.
- The existing system of tolls and concessions to fund the preservation needs of the core network should be expanded. A review of options to increase toll revenues in line with road usage and damage can more fairly distribute the burden of responsibility, with heavier traffic such as semi-trucks covering a great portion of maintenance than light traffic, such as cars and pickup trucks. Concessions are an important source of private funding and management for the road sector, but to expand their use, Paraguay needs to strengthen private sector confidence in the rules and regulations governing concession contracts.

19. The recommendations presented here are realistic and, if implemented together, can bring improvements quickly and efficiently. These steps can advance governance, road sector management skills, better budgeting and expenditures, evidence-based planning for both primary and secondary and rural road networks and achieve the road sector needs of both rural and urban Paraguay.

Disclaimer – This PER report includes a first-ever database of physical and financial data for the roads sector, vetted for coherence and reliability. However, the report needs to be read with the caution that the analysis relies on various sources of incomplete and imperfect network and budget data. The data were obtained either directly from the MOPC, reports and databases developed by consultants to the MOPC, and budget data from BOOST and the MOF. Reconciling data on the size, surface type, and condition of the road network, as well as its budget, has been one of the biggest challenges in the preparation of this study. There is substantial variation in the numbers across different reports, and it is often impossible to reconcile the analysis within a given report or across reports. As such, the present review applies best judgement in finalizing the numbers presented, and these may not always match road and budget data cited elsewhere.

The background consists of a teal color at the bottom and a green color at the top, separated by a white curved line. Another white curved line is positioned above the text.

CHAPTER 1. INTRODUCTION

20. This Public Expenditure Review (PER) of Paraguay's road sector aims to:

- Review the size, composition, and spatial allocation of the flow of funds to the sector;
- Review the structures of governance and the functioning of public institutions;
- Assess the quality of public spending in the sector, including distributional issues and public financial management, and try to link sector spending to outcomes; and,
- Provide recommendations to improve the efficiency, equity, and sustainability of sector expenditures.

21. The PER analysis is conducted within an expenditure choice framework applied to the level and type of expenditures. This analysis of the efficiency of public expenditures on roads is organized principally around allocational issues, both spatial and functional, and the nature of the institutional "policy environment" that determines what is allocated, what is actually spent, and what the outcomes are.

- The functional analysis considers homogenous groupings of roads – primary and secondary roads and rural roads – and addresses the quality of the roads for advancing economic and social requirements.
- The spatial dimension is explored at the departmental (provincial) level to determine if road expenditure allocated to the spatial network is likely to yield the highest economic and social welfare returns (in terms of efficient economic activity, optimized traffic concentration, and connecting the country's population with social resources and markets).
- Technical efficiency and sustainability are considered for each functional group by evaluating: capital expenditures on road rehabilitation and upgrade; current or recurrent expenditures that include wages and salaries, operations and maintenance, and interest payments, among other things; and funding to meet these expenses.

22. The economic rationale for public spending in the roads sector rests on the need to overcome market failures and reduce disparities in access to road infrastructure. Government intervention in general is required when there is an underlying market failure to be addressed. The type of failure indicates the form of government intervention

– regulation, financing, oversight, or outright provision (either via government resources or through contracts with private companies), and public-private partnerships (such as toll roads or bridges) when government funds are not sufficient. Roads are a mixed public and private good: rural and uncongested interurban roads are typically nonrival goods since adding another driver does not reduce the value of the road to someone else. Roads are excludable but not always profitable in view of the high upfront costs of roads construction. Roads therefore constitute public goods with a strong rationale for public provision. Access to interurban roads can be managed by tolling (to prevent traffic congestion), and roads can, in principle, be built and operated by the private sector. In Paraguay, some interurban roads are tolled, and there is the possibility to increase the share of such roads in total, although tolls may risk excluding poorer users. The majority of roads, however, will continue to be public goods.

23. This PER is structured as follows:

- Chapter 2 provides some background on the Paraguayan economy, the country's road network (primary, secondary, and tertiary) features and analysis, and an overview of the government institutions responsible for the network;
- Chapter 3 describes how Paraguay budgets and manages its road sector, what the funding sources are, and how efficiently the expenditures are being spent;
- Chapter 4 assesses Paraguay's goals for its road sector, the effectiveness of its budget execution and sustainability of its funding, and its sector monitoring practices; and
- Chapter 5 concludes with the main findings and recommendations.

24. Budget and physical data and information for roads was obtained from government documents and verified through interviews and consultations with sector actors.

Budget data was obtained from BOOST (the World Bank public expenditure database), the Department of Finance in the Ministry of Public Works and Communications, and online data published by the Ministry of Finance. Budget lines were individually examined and assigned to the correct capital or recurrent expenditure category for each functional group. Expenditure estimates were obtained from the Planning Department, Dirección de Vialidad, and the Department for Rural Roads within the Paraguayan Ministry of Public Works (MOPC). The Road Network Evaluation Tools (RONET)

methodology was used to assess road quality. Partial data on the physical characteristics of rural roads was collected from the Planning Department in MOPC and verified in technical workshops. Information for the institutional analysis is for the most part from secondary sources but verified to the extent possible in face-to-face interviews with sector representatives. Data from various sources was cross-checked to avoid double counting. A full review of procurement data is outside the scope of this PER. However, available information was reviewed to understand the impact of the budget cycle on procurement processes and contract prices.

25. Open-source data were used extensively for spatial analysis and to supplement information on the road network. For the spatial analysis, data on population distribution and economic and social centers were downloaded from World Pop, a geospatial demographic website, while rainfall data was obtained from WorldClim.org. All spatial data were processed in ARCGIS³. Poverty and economic data from Anuario Estadístico del Paraguay, 2016, were used to complement expenditure data. The initial findings of the PER were presented and discussed with Government stakeholders at the technical and policy level.

26. One of the main contributions of this PER is the development of physical, financial, and spatial databases and profiles for the road sector that have hitherto been unavailable. The team worked with partial and sometimes unreliable data and advises caution when interpreting some of the results. Data scarcity, however, poses problems well beyond the scope of this review. To set and monitor programs, policy makers require quality and timely disaggregated data. Reliable planning, prioritizing, and budgeting of sector expenditures require regular surveys of traffic and road conditions, which are not being conducted in the Paraguayan context.

³ A Geographic Information System (GIS) for compiling geographic data; creating maps and analyzing mapped information.

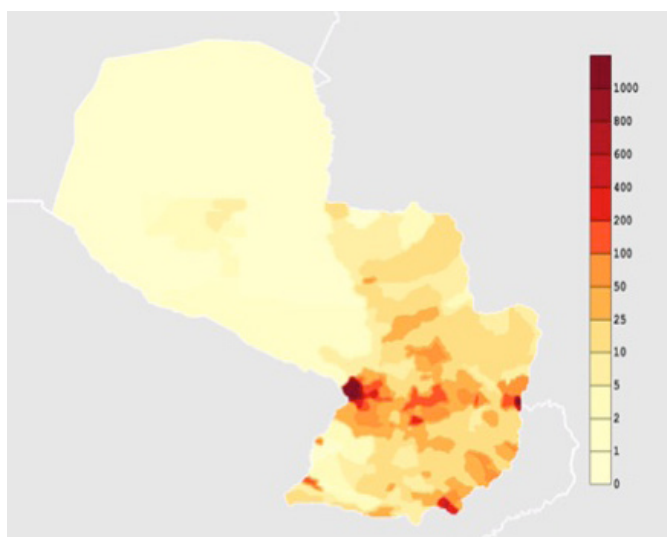
CHAPTER 2. BACKGROUND AND ROAD NETWORK FEATURES



A. PARAGUAY AND ITS TRANSPORT SECTOR

27. Paraguay is a middle-income, landlocked country with a population of 7 million. Currently, economic growth is reliant on trade of natural resources while the country seeks to diversify its economic base. Figure 1 shows that the population is concentrated in the “Oriental” (eastern) half of the country and only 3 percent of the total population resides in the Gran Chaco (or “Occidental”), a semi-arid area to the west, which accounts for 60 percent of the land territory and includes the rural departments of Boquerón, Alto Paraguay, and Presidente Hayes. Around 61 percent of the Paraguayan population is urban, with a just under half living in the capital, Asunción. The urban population is expected to grow at about 1.7 percent per annum over the next five years.

Figure 1: Population Density in Paraguay (2010)



Source: SEDAC 2019

28. The economy has seen solid gross domestic product (GDP) growth, strong poverty reduction, and macroeconomic stability in recent years. GDP grew at 4.7 percent per year on average in the 2004–2016 period, while poverty rates fell by 50 percent⁴ compared with 2003. Paraguay has thus done better than the regional average on both counts. These results are due largely to the exploitation of natural resources for trade and a demographic dividend delivered by an expanding working-age population, supported by

macroeconomic stability. Looking ahead, to meet the aspirations of its population, the country needs to sustain this economic growth and make it more inclusive. For this to happen, Paraguay will have to address structural challenges related to (i) concentration of resources and production, (ii) extent of the informal economy, and (iii) gaps in the delivery of high-quality public services to citizens.

29. Continued economic growth, combined with urban population growth, will place increasing demands on Paraguay's transport, and specifically its road infrastructure. As a landlocked country, Paraguay is highly dependent on its transport and logistics infrastructure to connect to regional markets and international seaports. The road sector is the dominant mode of transport in the country, concentrating nearly 90 percent of freight volume movements. Higher costs of road transport not only hamper the profitability of exports but also that of producers and service providers for the domestic market. In the urban centers, underinvestment in road and transport infrastructure limits access to jobs and services, especially for the poor living in peripheral areas. In both rural and urban areas, poor transport infrastructure adversely affects the well-being of the population in a variety of ways, e.g. higher transport costs impede access to health and education facilities and impact the profitability of agricultural exports from small farms. Moreover, 38 percent of the population lives in rural areas where weak infrastructure links between regions can worsen the impact of shocks such as weather and climate-related events.

30. Paraguay lags behind its neighboring countries in road quality and connectivity. In terms of the quality of transport infrastructure, as measured by the Global Competitiveness Indices, Paraguay needs improvements to catch up with neighbors and the region as a whole (see Table 1). Both road connectivity and low-quality performance place Paraguay in the bottom third of the countries included in the competitiveness indices. The country performs worst in the quality of its road infrastructure, where it lags its neighboring countries, Argentina and Brazil, and even Bolivia, and places it among the four poorest performers in Latin America and the Caribbean (LAC). Its performance is also below the upper-middle-income-country average.

4 Measured at 5.5 US\$ 2011 PPP (Paraguay Systematic Country Diagnostic, June 27, 2018).

Table 1: Paraguay: Quality of Transport Relative to Neighbors

	Paraguay		Argentina		Brazil		Bolivia		UMIC	
	Score	Rank	Score	Rank	Score	Rank	Score	Rank	Score	Rank
Quality of Transport infrastructure	33.8	110	47.2	72	43.5	84	29.3	126	47.26	73
Road Connectivity index	47.3	99	92.6	11	63.7	74	39.8	114	60.3	72
Road Quality index	2.5	129	3.4	93	3.0	112	3.4	98	3.7	80
Efficiency of seaport services	3.4	95	3.7	81	3.1	105	1.9	135	47.6	74

Source: The Global Competitiveness Report, WEF (2018).

Note: Quality, efficiency indices: 1-7 (best) or score 1-100 (best), Rank: 1-135 (worst).

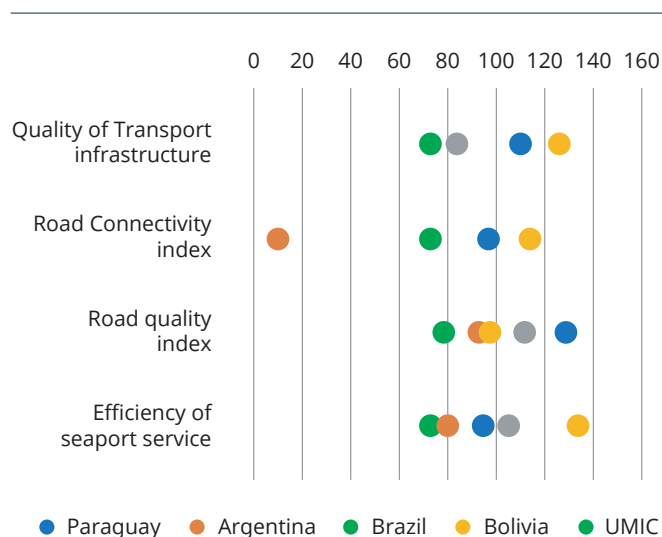
31. The unreliability of the transport infrastructure is also seen as a major constraint by private businesses.

The World Bank’s 2017 Enterprise Survey shows that 27 percent of Paraguay’s businesses perceive transport infrastructure as a “major constraint” to doing business, compared to about 24 percent of firms in the LAC region which see transport as a major obstacle, and about 19 percent worldwide. Geographically, 30 percent of the firms in Asuncion consider transport a major obstacle and 22 percent of those are located in the central region.

32. The business community’s adverse rating of Paraguay’s road quality persists despite quality improvement being a Government policy priority since 2012.

Rapid economic growth between 2004 and 2017 was accompanied by an ambition to improve the quality of the country’s overall infrastructure to enhance the country’s competitiveness, connectivity with neighboring countries, and inclusiveness. These objectives are enshrined in the Plan Nacional de Desarrollo Paraguay 2030⁵, 2014, and the Transport Sector Master Plans of 2012 and 2018.

Figure 2: Quality of transport relative to neighbors (ranking)



Source: The Global Competitiveness Report, WEF (2018).

Note: The higher the rank, the lower the quality: 1-135 (worst)

5 Plan Nacional de Desarrollo (PND, 2014).

B. ROAD NETWORK FEATURES

33. The total length of Paraguay's classified road network was estimated at 80,127 kilometers⁶ in 2018. The country's functional classification of the road network is as follows:

- **Primary or national roads** connect the main cities and provide Paraguay's links to the outside world
- **Secondary or departmental roads** ensure the interconnection of departmental (provincial) capitals as well as the main cities; and
- **Tertiary or rural roads** provide interconnection within departments and links to the outside world for villages and agricultural production centers.

Roads fall under the purview of the Dirección de Vialidad (DV) and the Dirección de Caminos Vecinales, both departments within the Ministry of Public Works. There is a significant additional number of tertiary roads that fall outside of the "official" network, and which are managed in principle by departmental and lower-level authorities. These are at present estimated by MOPC to number about 20,000 km. MOPC is in the process of redefining the classification criteria for national, departmental, and rural road networks. Once the new classification is finalized, it is expected to inform and impact the planning of maintenance and new investments.

34. The 2012 Transport Master Plan (PMT) of the Ministry of Public Works proposed to address quality issues in the road sector primarily by paving more roads and addressing the maintenance needs of the paved network. The Master Plan also proposed improving network connectivity through investment in about 12,000 km of roads (national, departmental, and rural) and mentioned the need for institutional reforms to improve sector performance. While the Plan proposed a paving program, it did not clarify a prioritization framework. The rural subsector in particular received little attention, and no specific strategy for investing in, or managing, rural roads was proposed.

35. The network length in 2018 comprised 4.7 percent national roads, 21.2 percent departmental roads, and 74.1 percent rural roads. Less than 9 percent of the network was paved, with the following breakdown: 91 percent of national roads paved, 23 percent of departmental roads paved, and less than one half percent of rural roads paved. National roads have the highest network utilization (vehicle km/year) at 61 percent, while the utilization of departmental roads is lower at 38 percent. In other words, the road network in 2018 carried around 6,477 million vehicle-kms per year, of which 61 percent travelled on primary roads that represent 4.7 percent of the network length. The average network traffic is estimated at 3,146 vehicles per day, while the average for national roads only is 5,307 vehicles per day.

Table 2: Paraguay's Road Network (in kilometers, 2012 and 2018)

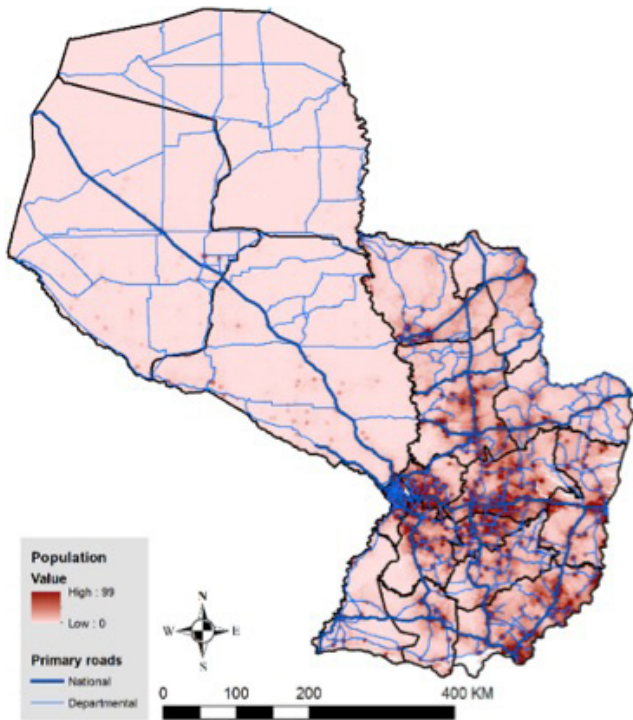
	2012		2018		Responsible authority
	Paved	Unpaved	Paved	Unpaved	
Primary (national)	3018	No data (ND)	3190	304	Vialidad
Secondary (departmental)	2437	ND	3552	11959	Vialidad
Tertiary (rural)		ND	244	60878	Vecinales
Total	5455	ND	6986	73141	

Source: MOPC, Plan Maestro de Transporte, 2018. Paraguay Road Network Strategic Evaluation, RNET, Callao, R. Drafts March 2019.

Note: Paved roads are asphalt-concrete and surface treated roads; cobblestone and gravel roads are not counted as paved roads.

6 Draft Report, Rural Roads Maintenance Needs Evaluation, Archondo-Callao, March 2019. First Draft, GIS Database.

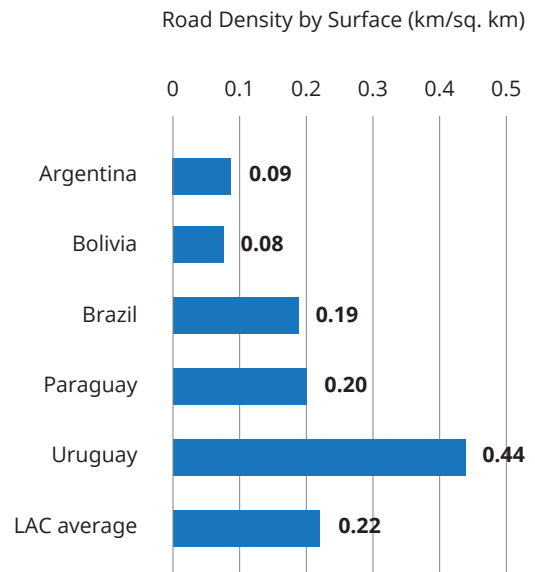
Figure 3: Population and Road Distribution



Source: WorldPop and MOPC.

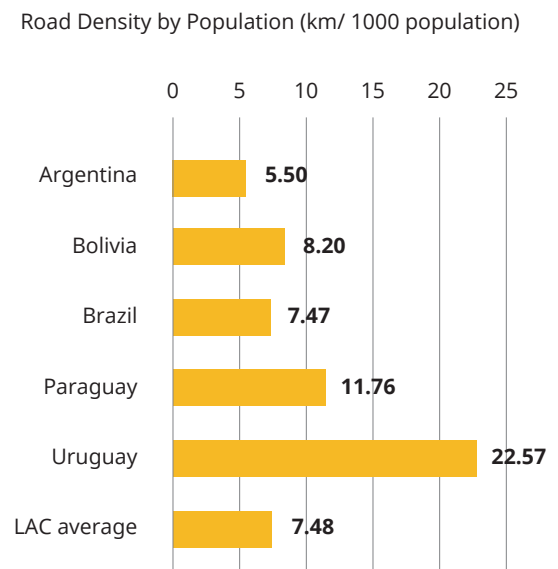
36. According to the latest road statistics, the density of Paraguay's road network by surface area is more or less in line with neighboring countries. Its road density by surface area of 0.20 km per sq km is on par with Brazil with a density of 0.19 km per sq km, and much higher than Argentina and Bolivia with densities of 0.09 and 0.08 km per sq km respectively (see Figure 4). Road density by department ranges between 6 and 68 km per 100 km sq. Road density by population is relatively high at 11.76 kms per 1000 inhabitants and ahead of Argentina, Brazil, and landlocked Bolivia which have population densities of 5.5 kms, 7.5 kms, and 8.2 kms per 1000 inhabitants, respectively (see Figure 5). Paraguay's national averages are, however, skewed by the thinly populated Chaco region which accounts for 3 percent of the population but 61 percent of total land area. If the Chaco region is excluded, the national average road density increases to 0.38 kms per square km of land area, while population coverage decreases to 9 km per 1000 inhabitants.

Figure 4: Road Density by Surface in Paraguay and Comparators



Source: WB staff calculations; data from GIS Roads Database

Figure 5: Road Density by Population in Paraguay and Comparators



Source: World Bank compilation of different data sources, including IRF WRS 2018, 2017, 2016; CIA World Factbook; Infralatam; Dulac, World Bank Open Data.

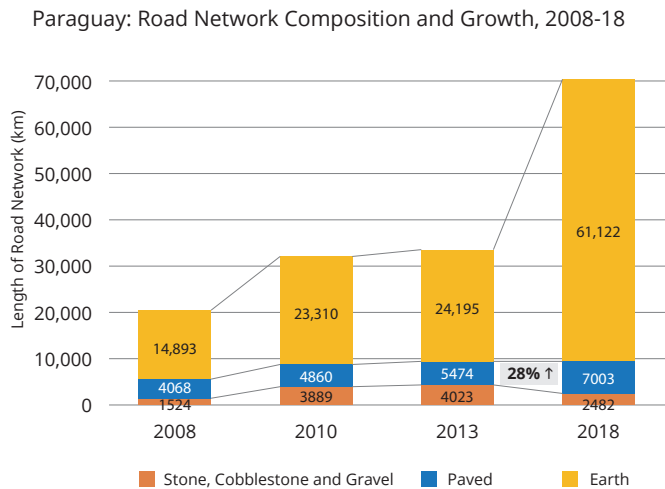
37. Different types of road surfacing are employed on the road network, depending mainly on traffic levels but also on the economic and social significance of the road. Road paving using flexible (surface treatment) or rigid (asphalt concrete) methods are largely employed on the national (primary) roads and the major departmental (secondary) roads. Fewer trafficked roads are being built with stone, cobblestone, gravel or earth. The different properties of surface types result in variations in maintenance requirements and expected life, as well as “ride” quality. A breakdown of the different surface types is shown in Figure 6.

38. The most important development in recent years has been the increase in the length (kms) of paved roads, especially since 2013, which has resulted in a significant change in road reclassification. Paved roads accounted for roughly 20 percent of the network reported for 2013. In 2018, this ratio fell to below 9 percent because several unclassified rural roads and paths became formally “classified” and are now managed by MOPC. Between 2008

and 2018, an additional 2,715 km of roads were paved, or an average of 271.5 km per year. Meanwhile, about 76 percent of the entire 2018 network, and 97 percent of rural roads, are earth roads. Paraguay still lags behind the region in the share of paved roads and, at under 9 percent, the country is behind Brazil, Argentina, and Uruguay (see Figure 7).

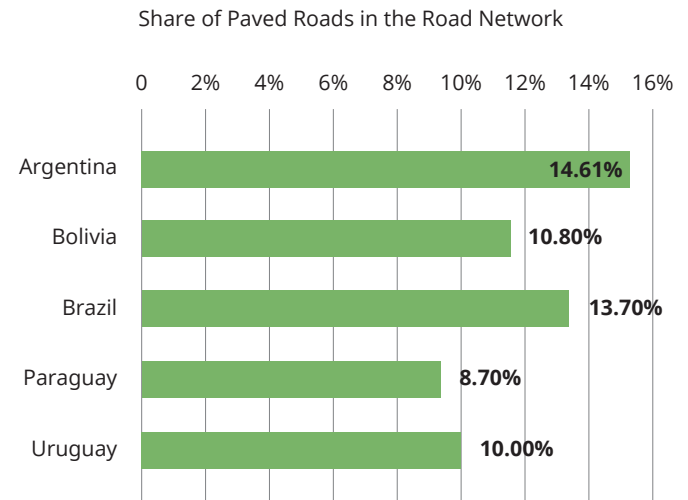
39. The International Roughness Index (IRI) measures road quality and is widely employed to analyze changes in pavement ride quality, over time. On average, during the period 2012–18, the quality of the paved network in Paraguay suffered some deterioration despite an increase in the share of the national budget being directed to the roads sector. Road condition surveys indicate that in 2012, 63 percent of the national paved road network was still in “good” condition, whereas by 2018 this had fallen by 8 percentage points to 55 percent. The network as a whole showed a decline in the share of sustainable⁷ roads of 20 percentage points, from 85 to 65 percent (see Table 3).

Figure 6: Road Network Composition and Growth (km)



Source: MOPC. Note that for 2018 only, an estimate of earth roads outside the administration of the MOPC has been added.

Figure 7: Share of Paved Roads in the Road Network (primary, secondary, and rural networks)



Source: Dirección Nacional Vialidad Sisvial (GIS) (for Argentina) / WB Staff calculations.

⁷ In RONET, roads in very good, good or fair condition constitute the sustainable network and require periodic maintenance works, while roads in poor or very poor condition require rehabilitation works.

Table 3: Paved Road Network Condition (2012 and 2018)

Classification	2012			2018		
	Paved kms	Road Roughness Average IRI	Sustainable Network	Paved kms	Road Roughness Average IRI	Sustainable Network
National	3018	3.0	86%	3395	3.0	77%
Departmental	2437	3.7	85%	4031	4.9	57%
Rural				229	5.8	51%
Total	5455	3.4	85%	7655	4.1	65%

Source: Archondo-Callao, Paraguay Road Network Strategic Evaluation, March 2019. Draft.

40. While there was some change in the performance of the paved national roads, there was a marked decline in the condition of paved roads in the departmental network between 2012 and 2018. From 2012 to 2018, the average roughness of the national network continued at 3.0 IRI while the share of the network in sustainable condition decreased from 86 percent to 77 percent (see Table 3). In contrast, the average roughness of the departmental network increased from 3.7 IRI to 4.9 IRI and the share of roads in sustainable condition decreased from 85 percent to 57 percent over the same period.

41. The fall in the share of sustainable departmental roads appears to be related to the increase in surface-treated (“paved”) roads. Between 2012 and 2018, the length of paved, departmental roads increased from 2,437 km to 4,260 km (this number includes 229 kms of rural,

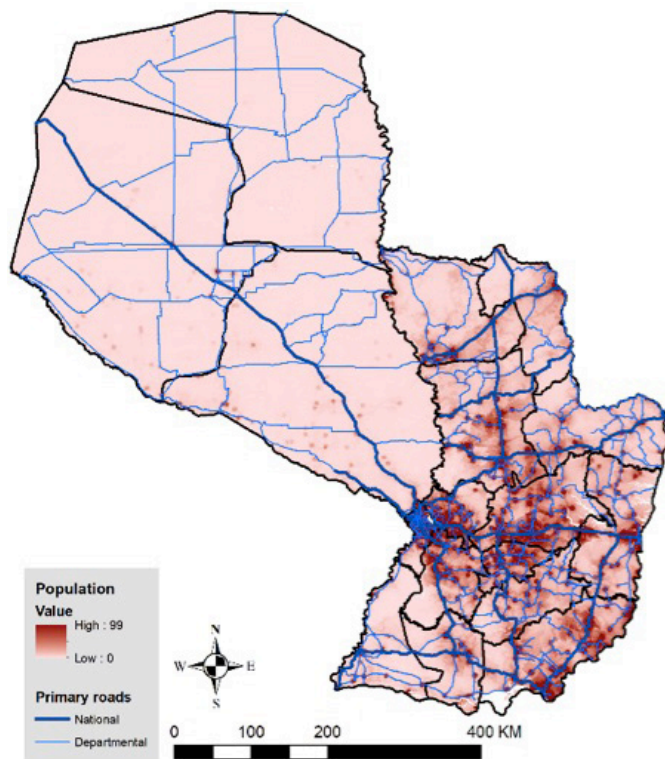
paved roads). This 1,823 km increase consists of largely bituminous surface treated roads, and thus these roads advanced from unpaved to paved status. The deterioration in overall condition appears to be attributable to the length of paved roads added to the network given that the 2012 roads maintained their condition status in 2018. The data does not indicate if these “new” roads deteriorated quickly due to lack of adequate maintenance, or if they started at a high level of roughness due to poor construction standards or moved to poor condition from a combination of both these factors. Surface treatment level of “paving” may be adequate at current levels of traffic where about a third of the paved departmental roads carry less than 1,000 vehicles per day, on average, with many carrying fewer than 400 vehicles per day (definition of a low-volume road)⁸. But these roads will deteriorate quickly as traffic levels increase and quicken the declining condition of these roads.

8 Transportation Research Circular E-C167: The Promise of Rural Roads, Mike Long, Chair, TRB Low Volume Roads Committee.

C. SPATIAL EFFICIENCY: PUBLIC ACCESS TO THE ROAD NETWORK

42. Despite spatial differences, the existing road network is sufficient to cater for the vast majority of the population. It is estimated that the current road network can serve about 90 percent of the total population in terms of current population and road distribution (see Figures 8 and 9). Coverage exceeds 80 percent in most departments, except the Chaco region, where coverage remains about 50 to 65 percent, meaning that around half of the departmental population lives more than 2 km away from the current road network. In other words, even if the entire road network in Chaco were rehabilitated, those people would still be disconnected. While access to all-season roads has a significant impact on household wellbeing, roads bring little benefits in areas without markets to sustain nonagricultural jobs (Rozenberg and Fay, 2019). This may be the case for Chaco with its small, scattered population. Paving rural roads here would not only be expensive but be also unlikely to guarantee connectivity with the rest of the network.

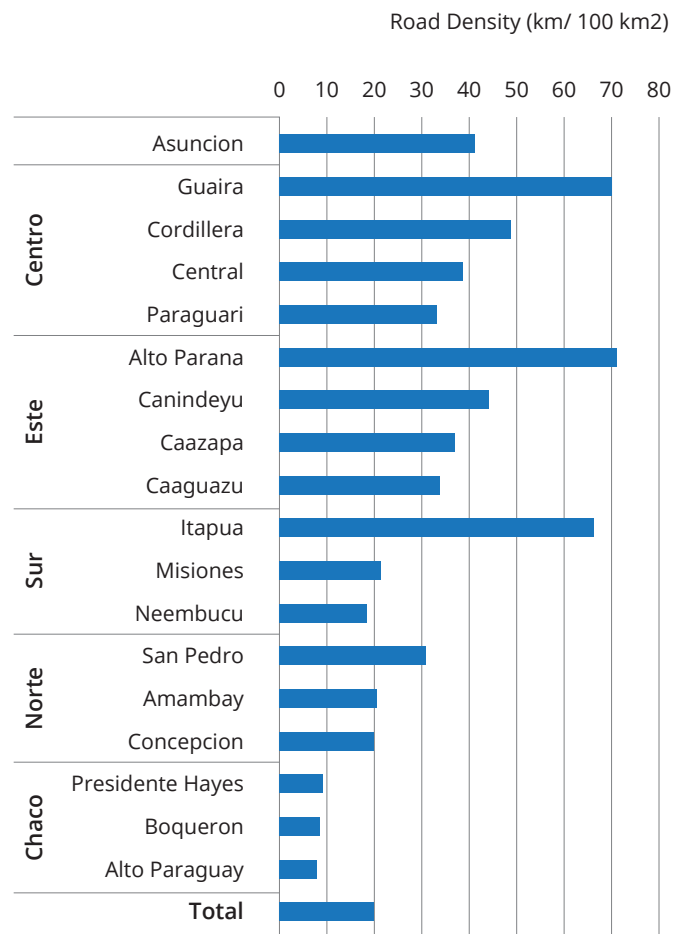
Figure 8: Population and Road Distribution



Source: WorldPop data combined with MOPC roads data.

43. Given the current population and road distribution, an estimated 69 percent of the country's population lives within 2 km of a paved road. This assumes that all paved roads are in good condition and thus transitable (we know this to be optimistic since the paved road network contains roads that are in poor condition). However, the paved road network of Paraguay provides good overall access to 69 percent of Paraguayans. This also indicates that population groups are highly concentrated around paved roads. From a regional standpoint, the central region of the country has the highest rate of access, followed by the eastern and southern regions.

Figure 9: Road Density by Department



Source: WorldPop data combined with MOPC roads data.

44. In Paraguay, rural accessibility is estimated at about 42 percent, meaning that about 60 percent of the rural population, or about 1.8 million rural Paraguayans, are left disconnected from a reliable (paved) road network.

This number is calculated on the assumption that paved roads are all-season (although some of them are in fair or poor condition). In terms of comparison, Paraguay's Rural Access Indicator (RAI) of 42.4 percent falls in the same category as Sub-Saharan African countries, all of which are below 51 percent (Rozenberg and Fay, 2019). Accessibility is particularly limited in the Chaco region, where both population density and road density are low. In Boquerón and Presidente Hayes (departments of the Chaco region), the access rates are estimated at 10.6 percent and 11.7 percent, respectively. By contrast, accessibility is higher in the central, southern, and eastern regions, where about half the rural residents have good access to the paved road network.

45. Access to the road network in rural areas differs significantly across subregions

because of the geographically skewed distribution of paved roads and differences in population and road density. Although systematic data is not available, it is presumed that most of the 60,000 kms of rural roads are in very poor condition. While the majority of the population has access to the paved road network, moving toward universal access, as envisioned in the Sustainable Development Goals, especially in remote areas, remains a challenge. Improving earth roads to provide all-weather access requires a judicious review of the technologies available to improve such roads. The traffic threshold at which paving an unsealed road is economically justified is mainly a function of the unit cost of the paving works, the traffic composition and its expected growth, and the condition of the unsealed road. In a wet environment, an unsealed road deteriorates rapidly due to rainfall. In a dry environment, an unsealed road can remain in passable condition for much longer periods and is a more economical option.

Box 1: The Impact of Rural Roads

Higher Accessibility Means Lower Poverty.

“Lack of access has an impact at the most basic level of living: if there is poor access to health services, people will remain unhealthy; children will die; and any epidemic will be likely to have catastrophic results; if there is poor access to clean water, again health will suffer; if there is poor access to basic information the household will be unaware of ideas and technology that might help them to improve their level of living; and if there is poor access to education, children will probably share in the future the limitations that confront their parents today. If access to markets is difficult, farmers are unlikely to diversify their production to include cash crops, or even to grow net surpluses of subsistence staples. And without such new ideas and opportunities poverty remains an endemic feature of rural life”

(Edmonds 1998).

In a similar vein, the World Bank's 2008 Transport Business Strategy notes that isolation caused by poor transport is often the main impediment to economic progress and poverty reduction.

Data from India, China, Thailand, Uganda and Tanzania, analysed by the International Food Policy Research Institute (IFPRI) shows that public spending on rural roads (especially in economically lagging areas) contributes significantly to lifting people out of poverty. In India, for example, for every 1 million rupees spent on rural roads, 124 poor people could be lifted above the poverty line and *every rupee invested in rural roads generates more than 5 rupees in returns from agricultural production*, the second-largest production growth effect after research and development. Similar results were seen in Thailand and Uganda where the number of poor people declined by 126 and 33, respectively, per million bhat and million shillings made in road investments (Fan et al. 2007). The research concluded that good road networks lower the costs of everything: rural electrification, irrigation, fertilizers, education and health services, agricultural extension services, financial services, output markets, and a host of other goods and services, all of which produce dynamic linkages to new opportunities for migration, investment, and trade.

Cook et al. (2005) likewise show that improvements in rural roads and transport services lead to increased farm incomes and off-farm employment opportunities, improved access to health care, education services and common property resources, as well as improved personal security and community participation. In the case of Thailand, it was seen that as the length of paved roads increases, income levels of rural households rise by 3.5%. This research stressed the importance of time savings for the poor, with road improvements expanding the radius of off-farm employment opportunities accessible to the poor.

Based on empirical evidence from Burkina Faso, Cameroon, and Uganda, Raballand et al. (2010) postulate a rural transport trap based on inadequate rural road infrastructure in low-income countries. Poor road infrastructure leads to insufficient access to services, and in turn to limited economic opportunities and low value-added activities, which decrease the public investment possibilities in road infrastructure (see graphic). This circular trap could be transformed into a virtuous circle by providing connectivity to roads to meet the needs of the rural population.

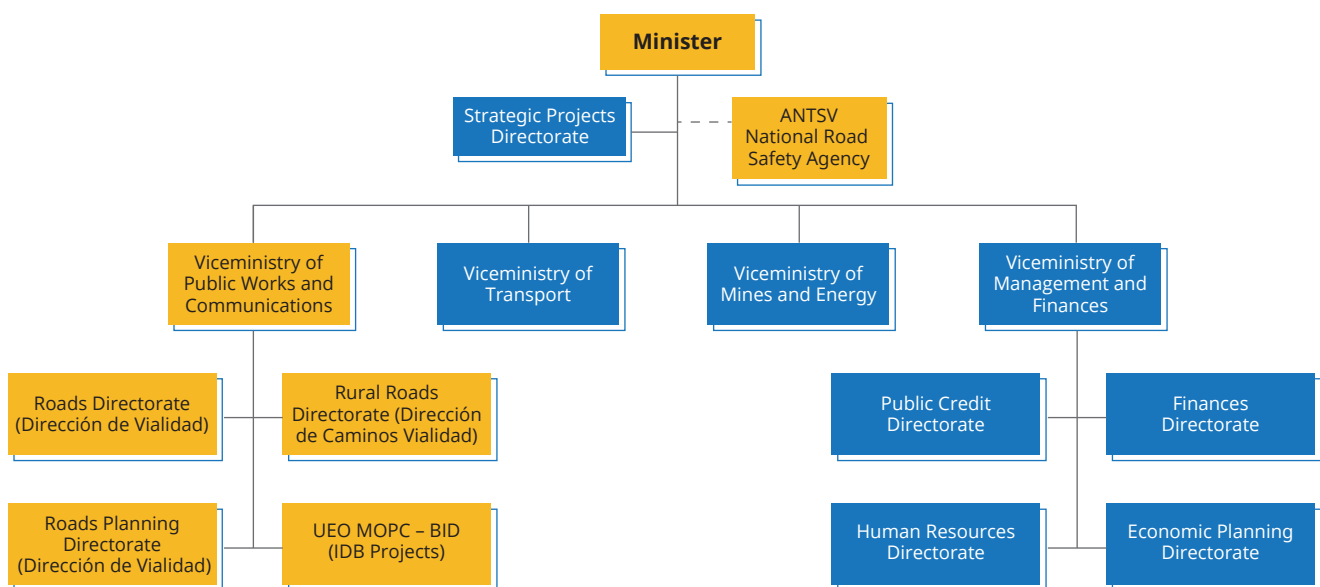
D. INSTITUTIONAL ROLES AND RESPONSIBILITIES

46. The Ministry of Finance (MOF) oversees the formulation and management of the budgetary process, the debt and fiscal policy, and national economic policy. MOF programs, formulates, executes, controls and evaluates the General Budget, which includes the budget of the Ministry of Public Works (MOPC) and its departments. MOPC's overall budget includes the budget for the transport sector, including the budget for roads.

47. Management of the road sector is primarily the responsibility of the MOPC, while departmental and municipal governments play a limited role. The legal framework for the sector is provided by Law 5552/16 which focuses on the classification of the road network and other decrees related to safety, signaling, and other aspects of road transport. The private sector's role is limited to investment and management of toll roads. Despite the approval of a public-private partnership (PPP) law in 2013 (Law No. 5016/2013) " Promoción de la Inversión en Infraestructura Pública y Ampliación y Mejoramiento de los Bienes y Servicios a cargo del Estado," private investments in the sector are stagnant and the country has not yet concluded a PPP operation in the road sector.

48. The MOPC is responsible for policy development, and the management and implementation of all public works and assets related to transport, energy, mines, and national monuments. Of the four vice-ministries within MOPC, the transport sector accounts for two: roads fall under the Vice-Minister for Public Works and Communications, while water, air, and urban transport rest with the Vice-Minister for Transport. Figure 10 shows the organization chart for the MOPC. Unlike in some other regional countries, there is neither a separate ministry for transport nor a decentralized road agency in charge of the execution of capital and maintenance road works. Instead, MOPC manages most of the construction and maintenance works centrally, while using its departmental units for rural roads maintenance. The construction, rehabilitation, and emergency maintenance of national and departmental roads is contracted out. Maintenance of rural roads is by force account, although some share of maintenance is also contracted out.

Figure 10: MOPC Organizational Structure for the Road Sector



Source: MOPC.

49. Within MOPC, all paved roads are the responsibility of the Directorate of Roads (Dirección de Vialidad, DV) while all other roads, irrespective of network type, are administered by the Directorate of Rural Roads (Dirección de Caminos Vecinales, DCV). Development of the road sector works program and the budget are undertaken by the Dirección de Planificación which is also charged with overall sector planning and policy development. Local governments are responsible for rural and departmental roads under the government's decentralization agenda. But, in practice, weak technical capacity and small budgets appear to have limited the role of subnational governments in the sector.

50. Departmental units of the Directorate of Rural Roads carry out maintenance on roads within their jurisdiction. Units receive funds for gas and spare parts for maintenance equipment from DCV. The allocation of the funds among departments is based on historical data from recent years and the amount of the road-maintenance equipment available in each department. Each district then develops a monthly maintenance plan taking into consideration the claims of municipalities, agricultural producers, and the general population. Local authorities may contribute to the prioritization of activities in this monthly maintenance plan.

CONCLUSIONS

51. Paraguay's primary, secondary, and rural road networks are key to its continued economic growth and to the achievement of the country's development goals. The government has to manage two very different networks to move forward: approximately 7,000 km of paved and 12,000 km of unpaved primary and secondary networks that

carry most of Paraguay's economic activities, and more than 60,000 km of unpaved and widely dispersed rural roads. To ensure general mobility of people and goods in the country, the priority for Paraguay should be to maintain the paved road network which comprises most of the national roads and a share of the departmental roads, and provides access for about 70 percent of its population. As the paved network is the main source of reliable access for the majority of the population, it is critical that this network is appropriately maintained to provide continued access.

52. Since 2012 the government has focused on the maintenance of paved roads and expansion of the paved network. The impact on quality has been uneven, with national roads showing improvements while departmental roads indicate a deterioration in quality, with an overall decline in the asset value of the network. Some of the decline in quality may reflect a poor choice of technology in meeting the targets of the paving program, and probably poor oversight of the civil works. The cost of technical inefficiency alone is estimated at about US\$160 million for the five-year period 2012-2017.

53. The rural road network, although less critical from an economic standpoint, is important for social equity and rural development. The spatial distribution of paved roads shows significant disparity across departments which is not corrected by the presence of earth roads. As a result, access to all-season roads is 70 percent universally, but only 42 percent for the rural populations. The Transport Master Plan does not currently include a rural roads policy and strategy. It is important to develop the same and commit to a time frame to meet the SDG goal of universal access. This document should also provide guidance on the prioritization and planning of rural road investments.



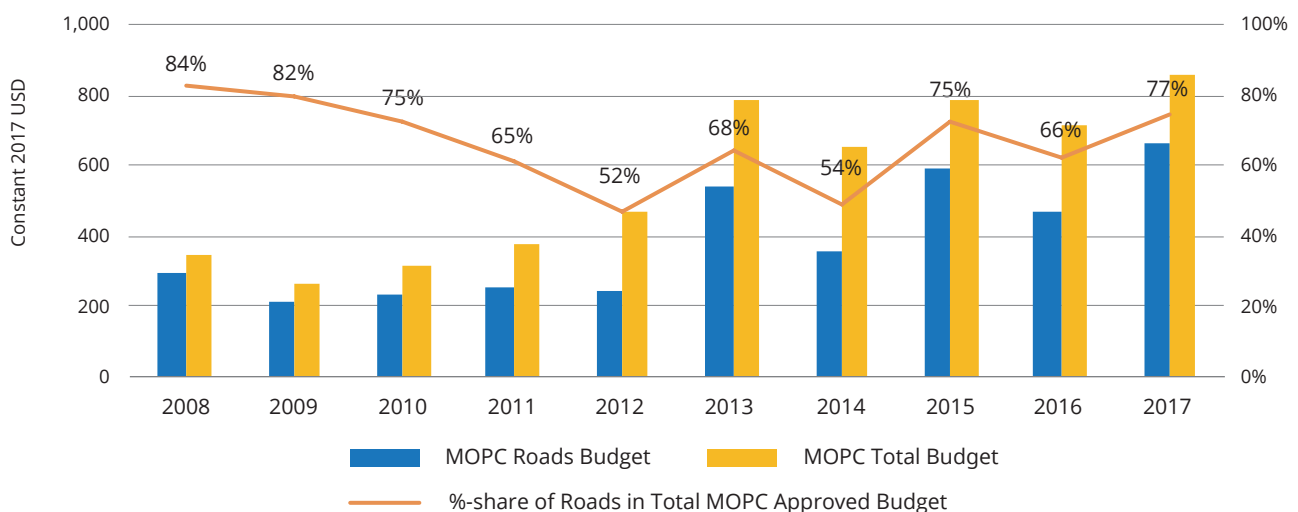
CHAPTER 3. ROAD SECTOR EXPENDITURES, NEEDS AND FUNDING SOURCES

A. BUDGET OVERVIEW

54. The Government of Paraguay has devoted considerable public resources to the road sector over the last decade, notwithstanding fluctuations in MOPC's total and road sector budget (see Figure 11). The MOPC's share in the overall budget increased from 4.8 to 6.8 percent between 2008 and 2017, reflecting the government's focus on the quality and quantity of infrastructure, especially road infrastructure. During this time, MOPC's approved budget averaged about US\$560 million per year, of which about 70% was allocated, on average, to road sector maintenance and development (Figure 11). In real terms, road sector spending in 2017 was double that in 2008. As a share of GDP, the road sector has received 2 percent or more since 2012, which is well above the regional average, and surpassed only by Bolivia (Figure 12) which has been spending an increasing share of GDP (higher than 2 percent), since 2008 on roads. Paraguay's road sector spending as a share of GDP mirrors Eastern European countries' as they attempted to rapidly improve their infrastructure to Western European standards, around 2009. OECD average expenditures meanwhile are considerably lower at around 1 percent and reflect a more mature stage of infrastructure development.⁹

55. Increasing resources to the sector have been accompanied by considerable volatility in the annual approved and modified budgets. Since 2012, year-to-year budgets have seen large fluctuations which tend to undermine effective planning, project selection, and implementation. The reliability of the budget process has been shifting as deviations have fluctuated between 6 and 130 percent (see Figure 13): the 2014 modified budget of US\$818 million was 130 percent higher than the approved budget. In the face of such large fluctuations, planning has been conservative, and budgets consistently have been underspent by 25 to 35 percent. The absence of multi-year budgeting, combined with insufficient institutional capacity, has led to underspent budgets year upon year. The lumpy multi-year nature of road contracts does not allow large sums of money to be absorbed without advance planning.

Figure 11: MOPC Total and Roads Budget, Approved

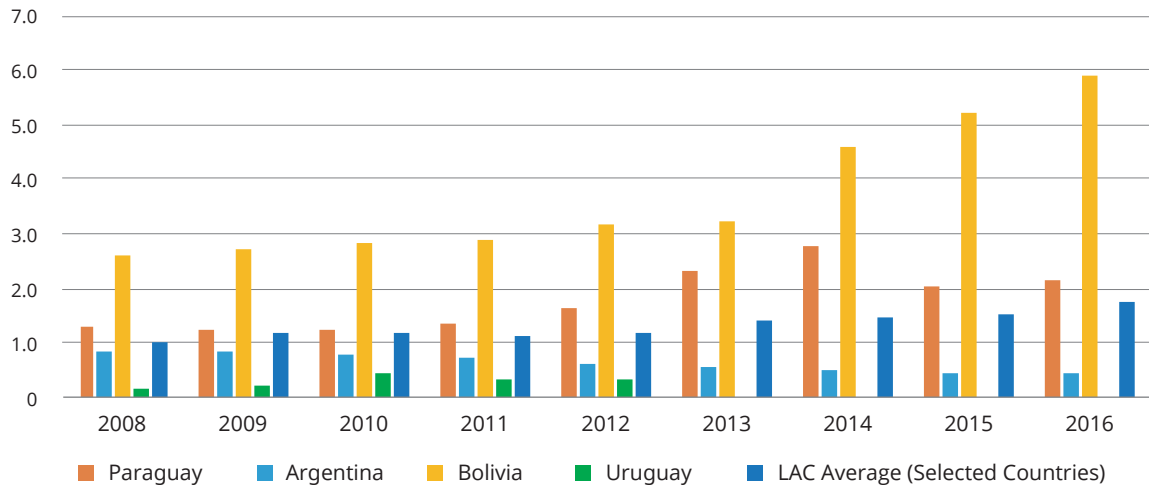


Source: BOOST data (2008-2017)

Note: BOOST data is at a "Program" level

9 Source: OECD (2013)

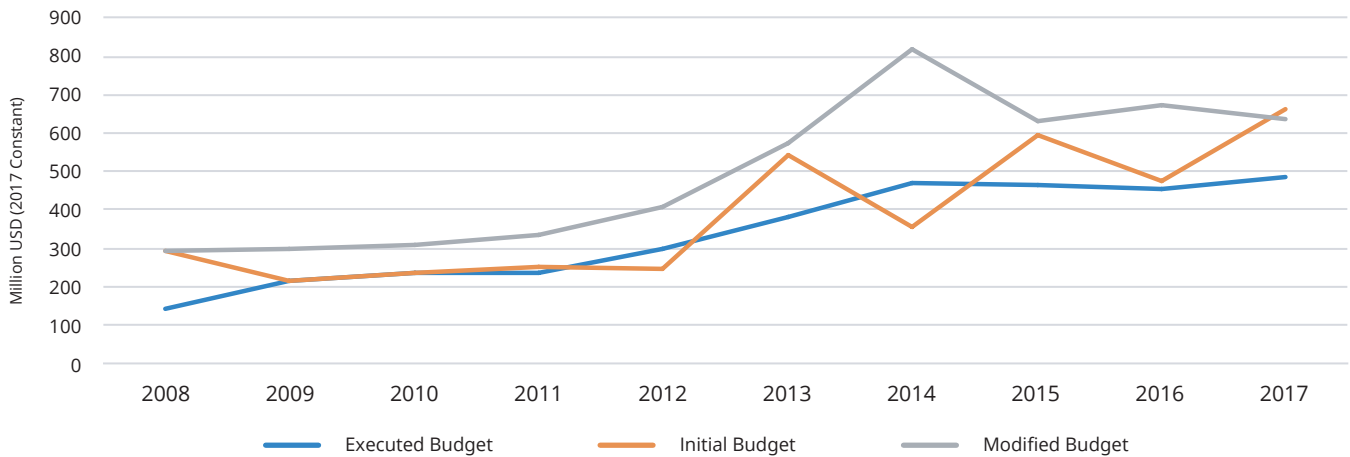
Figure 12: Public Sector Investment in Roads, Select Countries and LAC (% of GDP)



Source: : Infratam, (2019).

Note: LAC Average includes Argentina, Bolivia, Brazil, Chile, Colombia, Costa Rica, Mexico, Paraguay, Peru, and Uruguay.

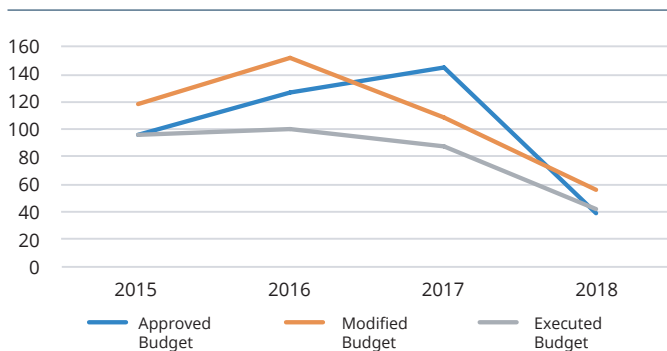
Figure 13: Approved, Modified, and Executed Budget for the Road Sector, 2008-17



Source: : BOOST data (2008-2017)

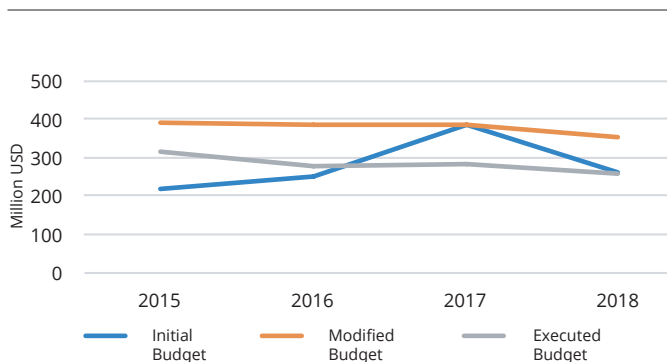
56. Execution ratios for capital and current budgets are low and fluctuating. Between 2015 and 2018 (Figures 14 and 15), execution ratios for the modified budgets for capital and current spending oscillated between 65 and 75 percent. The correlation between the modified budget and executed capital expenditures is low at 0.50. Execution of current expenditure, in contrast, shows a surprisingly high correlation with the modified budget of 0.93, and improving execution rates over time, notwithstanding the decline in absolute amounts allocated for maintenance expenditures.

Figure 14: Approved, Modified, and Executed Budgets for Capital Expenditures on the National and Departmental Network



Source: MOPC Department of Finance data, WB staff calculations.

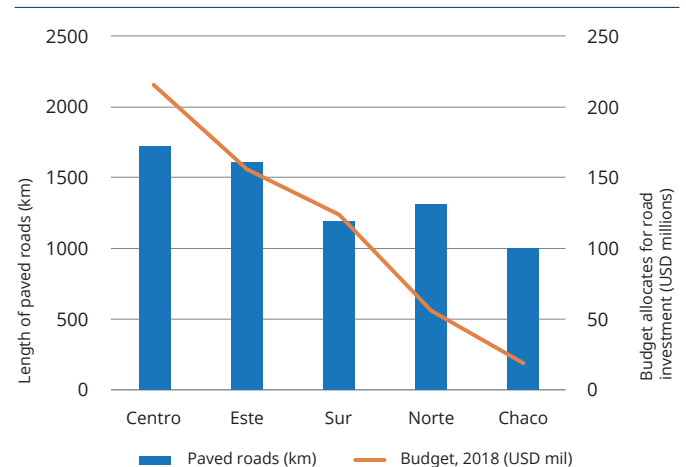
Figure 15: Approved, Modified, and Executed Budgets for Current Expenditures on the National and Departmental Network



Source: MOPC Department of Finance data, WB staff calculations.

57. From a geographic point of view, allocation of the roads budget favors the eastern, southern and central regions, taking into account the distribution and quality of the road network (see Figures 16–18). While the central and eastern regions account for about 48 percent of the total paved road network they received about 65 percent of the total budget allocated to road projects in 2018. By contrast, the Chaco region has 14 percent of the paved road network and received only 3.2 percent of the total road-sector budget. The mismatch becomes even more noticeable when roads in good condition are excluded: due perhaps to the small share of budget, about 25 percent of paved roads in poor or very poor condition are included. In short, the trend appears to be one of overinvestment in regions where road conditions are relatively good (i.e. the central and eastern regions), while roads elsewhere in less favorable condition receive inadequate investment¹⁰. Of course, the actual financial needs of a department must be determined by considering adopted engineering designs, current road conditions, procurement costs and other factors, but the broad trends are clear.

Figure 16: Road Length and 2018 Budget Allocation

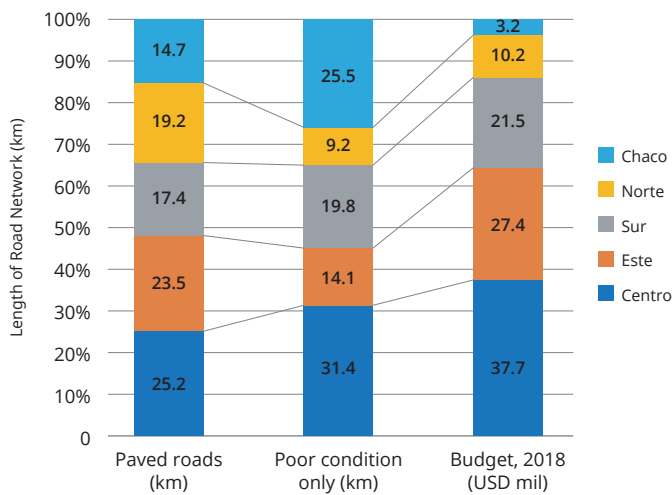


Source: Roads and Expenditure data from MOPC, BOOST.

¹⁰ As of 2018, MOPC groups departments into five regions for budgeting purposes. The departmental composition of regions is shown below.

Chaco	Norte	Este	Centro	Sur
Presidente Hayes	Concepción	Caaguazú	Cordillera	Itapúa
Alto Paraguay	San Pedro	Caazapá	Guairá	Misiones
Boquerón	Amambay	Alto Paraná	Paraguari	Ñeembucú
		Canindeyú	Central	

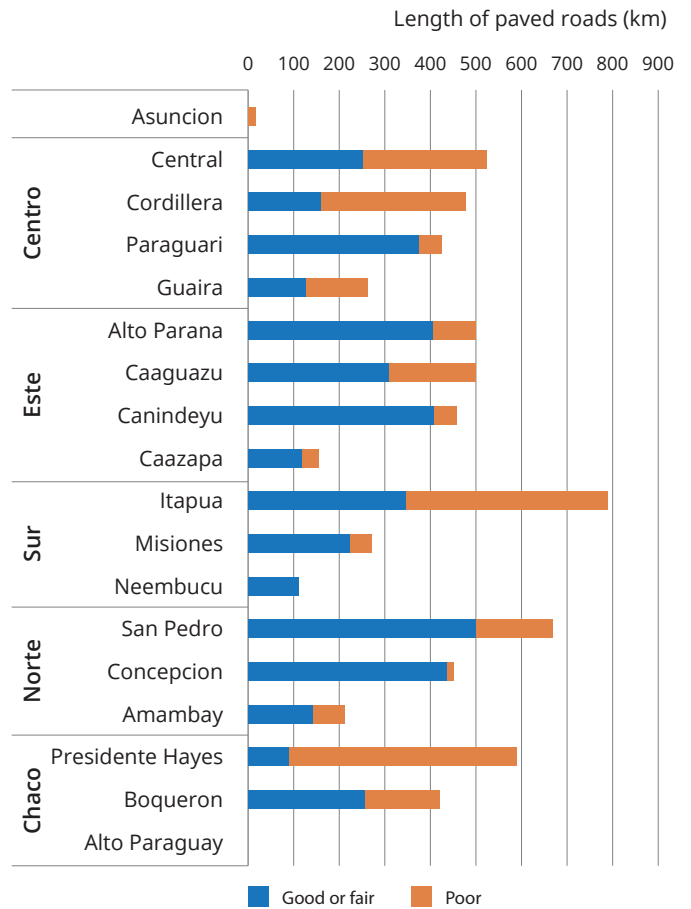
Figure 17: Regional Distribution of Roads and Budget



Source: Roads and Expenditure data from MOPC, BOOST.

58. Although the relatively meager expenditures on the maintenance of unpaved (mainly rural) roads are more evenly allocated across regions than the overall budgeted expenditures (Figure 19), the correlation between the force account expenditures and the length of earth roads was an abysmal 0.38 in 2018, indicating an unexplained regional variation in the allocation of maintenance expenditures. These maintenance expenditures include monetary allocations and expenditures on lubricants, fuels, and spare parts provided to MOPC departmental units responsible for in-house maintenance activities.

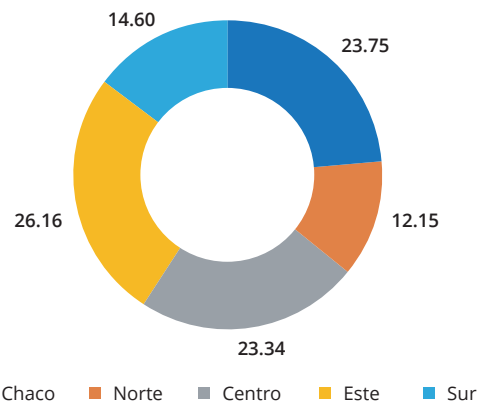
Figure 18: Road Length by Road Condition (Paved roads)



Source: Roads and Expenditure data from MOPC, BOOST.

Figure 19: Regional Shares of Force Account Expenditures for Maintenance

2018 Proxy for Rural Maintenance
Cost of Diesel + Lubricant + Repairs of Rural Roads Directorate



Source: 2018 MOPC Budget

B. REHABILITATION AND MAINTENANCE OF THE ROAD NETWORK – NEEDS VERSUS EXPENDITURES

B1. PAVED NETWORK – NATIONAL AND SECONDARY ROADS

Table 4: Projected Expenditure for the Paved and Unpaved Network (US\$ million)

Classification	2018	2019	2020	2021	2022	2023-2030
Paved	80	220	250	430	300	100 (pa) ¹¹
Unpaved ¹²	36	40	44	48	53	71 ¹³
Total	116	260	294	478	353	

Source: Plan Maestro, Update 2018

Note: Projected expenditures decline after 2022 when all road rehabilitation programs are expected to be completed, including those under the CREMA for Route N.9.

59. The Transport Masterplan of 2012 included a Road Investment Plan (Plan Inversión Vial), which projected the rehabilitation and maintenance expenditures necessary to prevent the deterioration of the existing road network. Based on this objective, and assuming annual traffic growth of 3.4 percent, the Plan estimated average annual expenditures of US\$343 million between 2013-17, and US\$380 million between 2018-22. Although the estimates assumed that there would be no upgrading, 2200 kms of roads were in fact paved between 2013-17. The 2012 Plan, updated in 2018 for the period 2018-30, included a 3000km paving program targeted at departmental roads. For rural roads, the aim is to improve about 500 kms per year to an all-season standard. The updated projections for total expenditures on both paved and unpaved roads are shown in Table 8.

60. As part of the PER, different scenarios of expenditures towards the preservation of paved roads were estimated using the Road Network Evaluation Tools (RONET)¹⁴ methodology developed by the World Bank. Expenditure requirements for a 20-year period were developed for (i) Case 1: the 2012 road network of 5455 kms

(3,018 kms of national roads and 2,437 kms of departmental roads), and (ii) Case 2: the 2018 network of 7426 kms (3,395 km national, 4,031 km departmental, and 229 kms of rural roads). The estimates for the 2012 network were compared with both the originally planned¹⁵ and actual expenditures between 2013-17, while estimates for the 2018 network were compared with the (updated) planned expenditures shown in Table 5.¹⁶ The analysis utilized data on road network conditions, traffic levels and composition in 2012 and 2018 provided by MOPC.

61. For Case 1, in the optimal scenario, defined as expenditure where the present value of total transport costs (the sum of road agency plus road user costs) is minimized, RONET estimated annual expenditures of US\$85 million (maintenance plus rehabilitation) between 2013-17,¹⁷ and US\$81 million subsequently. The annual expenses decrease over time given that the share of total rehabilitation expenditures levels out after the first five years, dropping from 24 to 8 percent as the quality of the network improves. On the other hand, under a “do the minimum” scenario with rehabilitation undertaken only when roads deteriorate to a “very poor” condition, the annual expenditure requirements

11 This is an average. In 2029 and 2030 the figure is expected to be higher as periodic maintenance becomes due on roads where rehabilitation was completed by 2022.

12 This includes all unpaved roads.

13 This is an average. It is assumed that the allocation will need to increase by about US\$4 million per annum to keep pace with the rising maintenance needs of the upgraded rural network.

14 <http://www.ssatp.org/en/page/road-network-evaluation-tools-ronet>.

15 Elaboracion de un Plan Inversión Vial, 2012.

16 See Archondo Callao, April 2019.

17 At an average of US\$15,562 per km per year

Table 5: Total Expenditures on the Paved (National/Urban) Road Network (US\$ million)

	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2008-2017	2013-2017
Investment	84.9	139.7	141.9	138.8	162.0	260.2	289.5	265.1	221.0	242.3	194.5	255.6
Maintenance & Other	24.9	36.5	70.2	82.3	95.7	63.3	79.6	90.8	92.4	75.1	71.1	80.3
Total	109.8	176.2	212.1	221.1	257.7	323.5	369.1	355.9	313.4	317.4	265.6	335.9
Investment share	77.3%	79.3%	66.9%	62.8%	62.9%	80.4%	78.4%	74.5%	70.5%	76.3%	72.9%	76.0%
Maintenance & Other share	22.7%	20.7%	33.1%	37.2%	37.1%	19.6%	21.6%	25.5%	29.5%	23.7%	27.1%	24.0%

Source: BOOST database. Executed Budget. Urban/National (assuming being paved), Road Sector only data.

Note: Mix Categories comprising of both investment and maintenance activities have been converted into the Investment and Maintenance & Other categories, assuming 65% to be Investment and 35% to be Maintenance & Other. Other refers to unidentified expenditures.

are US\$42 million and US\$47 million respectively. These expenditures, however, are insufficient to arrest deterioration of the quality of the network as measured by the IRI (from 3.4 IRI in 2012 to 4.3 IRI in 2017). As expected, the level of service declines as the roads preservation budget declines. By contrast, in the optimal scenario, roads in good and fair condition improve from 66 to 85 percent in 2017, keeping the network with an average roughness of 3.4 IRI over time.

62. The RONET estimates for preservation of the paved network, in the optimal scenario, are about one quarter of the expenditures estimated in the Master Plan. Executed maintenance expenses averaged US\$80 million per year between 2013 and 2017 and are within five percent of the estimates obtained from RONET. It is concluded that maintenance expenditures from 2013 to 2017 were sufficient to cover the preservation needs of the paved network (see Table 6).

63. Case 2: Evaluation of the 2018 network. The 2018 update of the paved network shows an increase of about 40 percent between 2013 and 2017 on the network length. In this period the length of the national roads was unchanged, but the size of the departmental network increased. In terms of condition, the national profile improved while that of departmental roads worsened, on average, from 2013 to 2017. The network IRI does not show much change. Maintenance and rehabilitation expenditures for 2018 and beyond were

reevaluated based on the updated road length, condition and traffic data for 2018. Under the optimal scenario, annual maintenance between 2018-22 is now estimated at US\$132 million (an average of US\$17,198 per km per year) and at US\$116 million subsequently. The respective proportions of expenditure on rehabilitation are 21 percent and 18 percent, due to the need to rehabilitate the new roads added to the network prior to 2018. Under a “do the minimum” scenario, the annual expenditure requirements are US\$50 million and US\$94 million respectively, and the average network roughness increases from 4.1 IRI in 2018 to 5.3 IRI in 2023¹⁸.

64. RONET estimates for maintenance and rehabilitation under Case 2 are about 50 percent less for the first five years than the Masterplan Update, and about 30 percent higher for the later years as the share of rehabilitation spending increases over the years. The US\$85 million budgeted for maintenance in 2018 falls far short of amount indicated for the optimal scenario under RONET. Given that the level of service is a choice variable it may not be necessary to spend the optimal amount, regardless of the fact that lower expenditure on maintenance implies more rapid decline in road conditions and a shorter time horizon before sections of the network require rehabilitation. RONET calculations indicate that every dollar of underfunded maintenance implies a cost of US\$3.5 to the economy.

18 Archondo-Callao, R. March 2019.

Box 2: How Useful Is the Rigid Pavement Law (Given Some Unintended Consequences)?

In 2017, Congress approved Law 5841/2017, which requires the MOPC to allocate a percentage of the funding for roads to “rigid pavements.” An increasing share of the annual budget, 15 percent for the first year, 20 percent for the second year, and 30 percent for the third year, is mandated for expenditure on paved roads. While the objective of the law is to foster the local cement industry, a requirement for purchase of cement would tend to distort the technology selection in the road sector. In its current form, the law simply encourages more paving irrespective of the need for such roads. Applying a thin layer of asphalt on existing cobbled roads may well be the result of this Law. The continued implementation of this law could lead to highly inflated prices as demand for cement increases beyond production capacity, with adverse consequences for the public exchequer.

65. At a global level, the executed budget for the maintenance of paved roads between 2013-17 appears to have been more than adequate (see Table 6). However, the decline over time in the sustainable network of both primary and secondary networks (more pronounced in the case of the latter), raises questions about the planning and quality of maintenance works. The data on road conditions shows that the primary network from 2012 to 2018 retained an average roughness of around 3.0 IRI although the share of roads in very good condition increased from 22 to 43 percent. Primary roads would therefore appear to have received optimal-level maintenance, and possibly higher than was necessary. The length of paved, secondary roads increased substantially from 2012 to 2018¹⁹ (a 65 percent increase) due to paving programs. On the secondary network, the “new” roads appear to be included in the ‘poor’ condition category due to a common approach consisting of applying a thin seal of paving to gravel roads.

66. The ratio of the actual asset value to replacement value is a measure of the quality of the paved network, and both actual and replacement asset values were calculated for the years 2012 and 2018. The decline in this ratio from 89 to 85 percent over the period 2012-18 points to a net depreciation of the asset base, that is a decline in quality over this period. Since the executed expenditures were around the estimated optimal expenditures, the decrease in quality suggests that there is room to improve the efficiency of maintenance expenditures. **By this measure, US\$168 million could have been saved between 2013-17. The difference in the actual road asset value and the value which would have maintained the ratio of actual to maximum value at 89 percent simply by benefiting from technical improvements in the planning and execution of civil works.**

Table 6: Estimated Value of the Road Asset Base

	2012	2018
Paved Roads (in km)	5455	7655
Maximum Value (US\$ mn)	3255	4510
Actual Value (US\$mn)	2888	3846
Actual/Maximum (%)	89%	85%
Actual Asset Value/GDP (%)	10.5%	14%

Source: MOPC and World Bank estimates.

19 In 2012 RONET evaluated 2,437 km of secondary roads, while in 2018 the secondary roads increased to 4,031 km.

B2. UNPAVED NETWORK – RURAL ROADS

67. In general, the benefits of rural roads maintenance are related to their social importance rather than to traffic levels, given that most rural roads are low-volume. For this reason and since there are no traffic-related data for the rural network, rural roads were subdivided based on the population served by them. The population data was obtained from GIS databases, with the network subdivided into three ranges of beneficiary population (Table 8). Population classes were used to allocate all rural roads to three levels of importance: (i) low: serving a population of less than 250 persons (61 percent); (ii) medium: serving a population of between 250 and 1,500 persons (32 percent); and (iii) high: population higher than 1,500 persons (7 percent). This was then used to assign the roads to different maintenance regimes.

68. To estimate the maintenance requirements for the rural network, in addition to traffic levels or, in this case, according to the population served, we need to know the road surface types and climatic conditions. Table 9 shows the distribution of rural roads per surface type. There are 256 km of asphalt concrete roads, 873 km of stone pavement roads, 756 km of gravel and stone pavement roads, and 59,227 km of earth roads. The great majority of the rural roads are earth roads, totaling 97 percent of the rural roads in the inventory. The estimation of the maintenance needs of rural roads in Paraguay focuses on earth roads, on which there is relatively little information regarding their width, condition, and traffic.

69. As for climate, we use rainfall as a proxy, dividing rural roads into areas with three different rainfall levels: (i) a semi-arid climate with rainfall between 30 and 70 millimeters (mm) per month (15 percent); (ii) a semi-humid climate with rainfall between 70 and 130 mm per month (42 percent); and a humid climate with rainfall higher than 130 mm per month (45 percent). (See Appendix A).

Table 7: Importance to Population of Rural Earth Road Network (km)

Department	Earth (High)	Earth (Medium)	Earth (Low)	Total
Alto Paraguay	23	2,124	3,608	3,631
Alto Parana	509	1,005	6,346	9,213
Amambay	31		825	1,927
Asuncion		689		
Boqueron		1,808	3,476	4,166
Caaguazu	518	1,137	803	3,426
Caazapa	191	1,553	1,259	2,598
Canindeyu	111	54	3,555	5,360
Central	64	987	52	338
Concepcion	97	685	1,483	2,684
Cordillera	361	859	606	1,807
Guaira	271	3,123	911	2,123
Itapua	745	638	5,354	9,517
Misiones	91	365	695	1,433
Ñeembucu	25	1,036	894	1,286
Paraguari	278	566	978	2,382
Presidente Hayes	18	2,102	3,308	3,897
San Pedro	560	18,733	2,447	5,332
Total	3,894		36,601	61,122

Source: MOPC and World Bank estimates.

Table 8: Rural Roads Network by Surface Type (km)

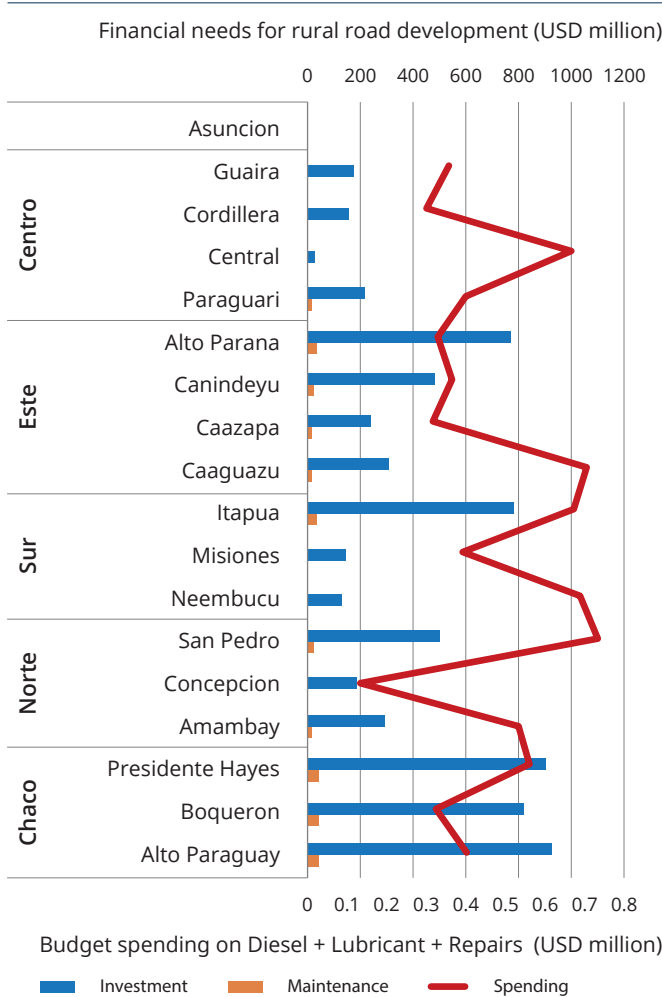
Asphalt Concrete	256
Stone	873
Gravel/Stone	765
Earth	59,227
Total	61,122

Source: 2018 GIS Roads Database.

70. Based on this information, unpaved roads were then assigned to categories based on the level of rainfall and population served, and their maintenance requirements calculated. This enabled us to estimate the minimum requirements for: (i) annual routine maintenance (e.g., cleaning, drainage maintenance, and spot repairs; (ii) annual grading of gravel and earth roads; and (iii) annual periodic maintenance of paved, stone and gravel, and cobblestone roads. The resulting annual needs for routine maintenance are US\$6.0 million for routine maintenance,

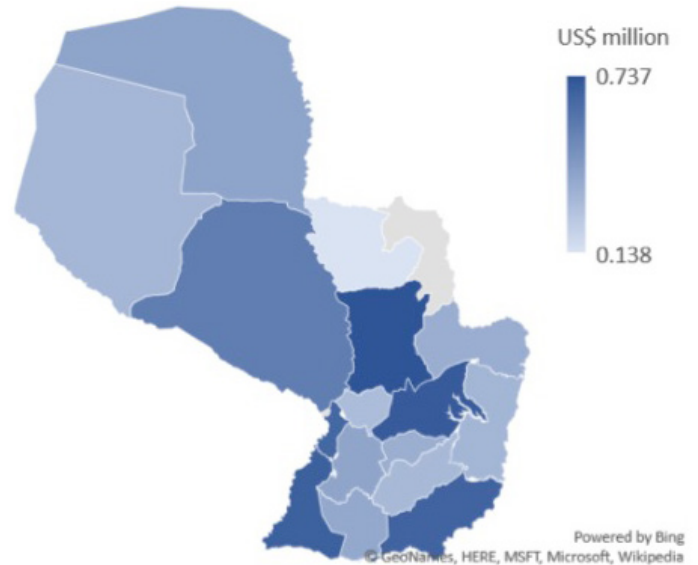
US\$47.4 million for grading and US\$8.20 million for annual periodic maintenance. In sum, an average of US\$61.7 million is needed for the maintenance of rural roads every year (see Appendix B). Figure 20 summarizes the actual expenditures versus estimated needs, by Department. Further details are broken down in Figures 21-23. San Pedro department received the highest allocation, followed by Caaguazu, Neembucu, Itapua, and the Central departments. Whereas the allocation for San Pedro is appropriate, this is not the case for the Chaco region, which has an even greater need for rural road maintenance since there are hardly any paved roads in that region.

Figure 20: Rural Road Capital Needs and Expenditures (actual)



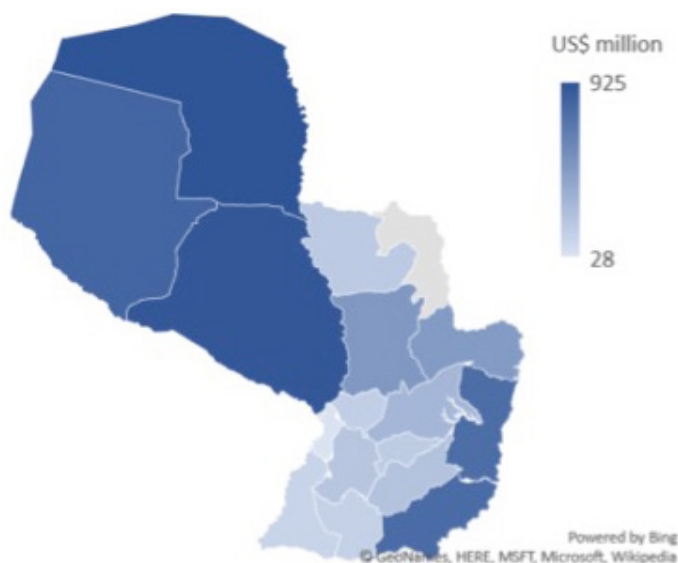
Source: MOPC data

Figure 21: Rural Roads Maintenance by Force Account



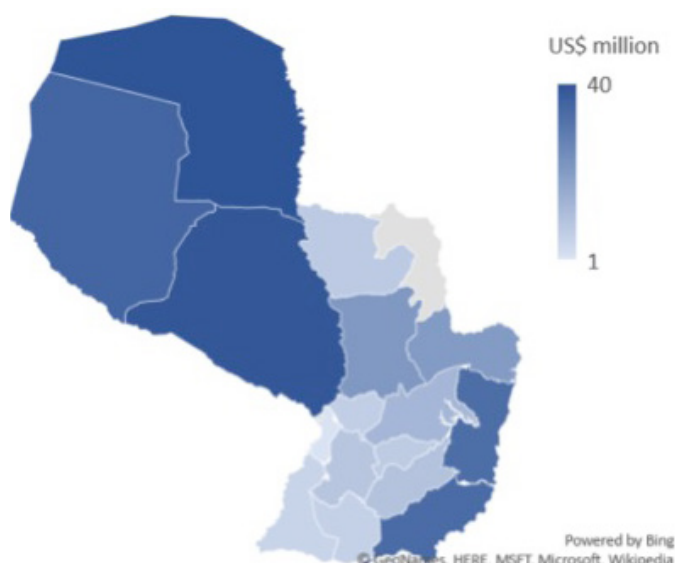
Source: WORLDPOP Database and MOPC GIS data on roads.

Figure 22: Estimated Rural Road Capital Needs



Source: WORLDPOP Database and MOPC GIS data on roads.

Figure 23: Estimated Rural Road Maintenance Needs per Year



Source: WORLDPOP Database and MOPC GIS data on roads.

71. Table 9 below presents the expenditures on the Rural Road Network from 2008 to 2017. The expenditures are shown as (i) Investments including all the improvement and rehabilitation of rural roads (including bridges and culverts); (ii) maintenance and other expenditures. The “other” expenditures category might also include an unknown

share of investments. The average expenditures for maintenance and “other” from 2013 to 2017 were US\$28.3 million per year. This total represents, at best, less than half the required maintenance, and reveals a substantial financing gap for maintaining Paraguay’s rural roads network.

Table 9: Total Expenditures on the Rural (unpaved) Road Network (US\$ million)

	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2008-2017	2013-2017
Investment	30.2	40.5	19.7	10.4	28.5	39.8	80.4	82.9	99.2	117.2	54.9	83.9
Maintenance & Other	0.5	0.7	2.2	6.9	14.8	19.0	20.8	26.6	32.2	42.7	16.6	28.3
Total	30.8	41.2	21.8	17.3	43.3	58.9	101.3	109.5	131.4	159.9	71.5	112.2
Investment share	98.3%	98.2%	90.1%	60.0%	65.8%	67.7%	79.4%	75.7%	75.5%	73.3%	78.4%	74.3%
Maintenance & Other share	1.7%	1.8%	9.9%	40.0%	34.2%	32.3%	20.6%	24.3%	24.5%	26.7%	21.6%	25.7%

Source: BOOST database. Executed Budget. Rural roads (unpaved).

Note: Mix Categories comprising of both investment and maintenance activities have been converted into the Investment and Maintenance & Other categories, assuming 65% to be Investment and 35% to be Maintenance & Other. Other refers to unidentified expenditures.

72. The above calculations for maintenance requirements are premised on preserving the rural network and would not impact the rural access indicator of 42 percent. If, however, the government chooses to go beyond 42 percent, and perhaps target universal accessibility, significant resources would be required, especially if initial reconstruction or improvement investment is envisaged. Capital investment would be needed to (i) rehabilitate the existing rural road network to a maintainable level, and (ii) construct some parts of it as needed. While access to all-season roads presumes paved roads, given the limited traffic levels, rehabilitating from earth to a gravel standard is considered more appropriate in this case. We estimate that a move towards universal access with gravel roads would require about US\$5 billion²⁰, assuming key rural roads are improved.

73. Even after the current network is rehabilitated and upgraded, about 600,000 people would be left without access to an all-season road. As noted in the previous chapter, the roads network provides access to about 90 percent of the total population. To move toward universal accessibility, about 26,000 kms of currently unclassified

roads may need to be reconstructed and formalized. This is estimated to cost a further US\$2 billion. Once reconstructed and rehabilitated, these roads would need maintenance. Assuming that rural roads are reconstructed to gravel standards, about US\$300 million per year would be needed for periodic and routine maintenance.

74. The geographic heterogeneity regarding network size and population distribution is reflected in the financial expenditures needed for universal access in all the regions. The southern region, where the road network is already dense and well-developed, needs to focus resources on rehabilitating the existing road network (Figures 24 and 25). The Chaco region, on the other hand, should consider rationalizing its network by using GIS tools to know the location of hamlets, roads, and facilities prior to committing resources for rehabilitating the existing network and reclassifying unofficial roads. A pragmatic approach to connectivity should be considered, taking into account smaller roads designed for bikes or motorcycles. In the central region, rural road development calls for few financial needs.

Figure 24: Rural Road Access (0 to 1)

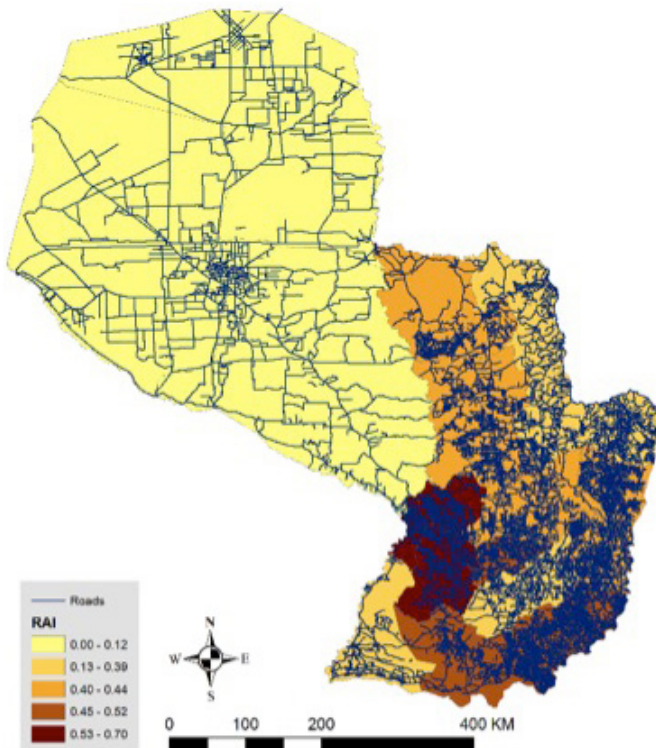
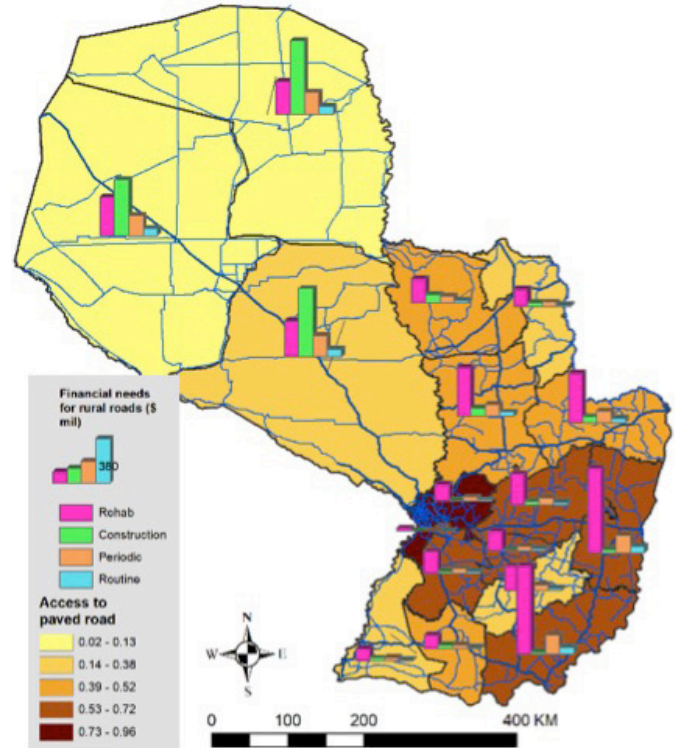


Figure 25: Financial Needs for Rural Road Development



Source: World Bank calculations. Data from Anuario Estadístico del Paraguay, 2016, and MOPC GIS Data.

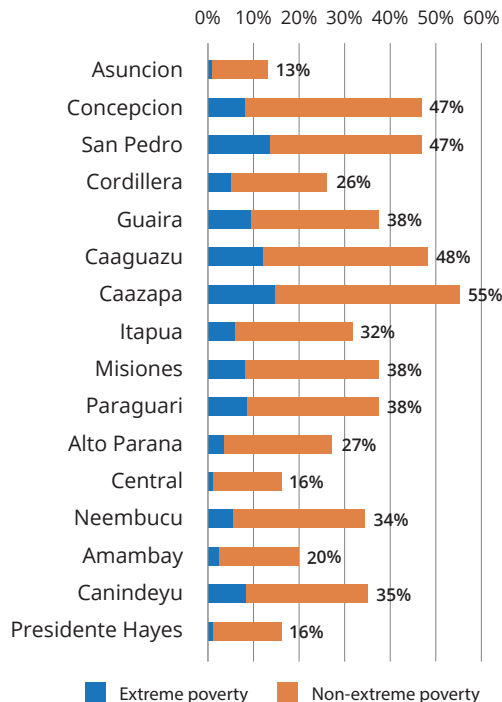
20 Assuming 12,500 kms are upgraded over 20 years at a cost of 400k per km, on average.

C. PRIORITIZATION OF RURAL ROAD INVESTMENTS: AN EXAMPLE

75. While the current rural road network is preserved, some priority roads may need to be rehabilitated and improved. To prioritize rural road investments, a variety of economic and social issues need to be considered. Balancing economic efficiency and social equity, which may not always be compatible, is a difficult task. There is a substantial geographical variation in Paraguay between the Chaco and Oriental (eastern) regions. While in Chaco access rates are low and need improvement, the majority of economic activities and population are concentrated in the Oriental region.

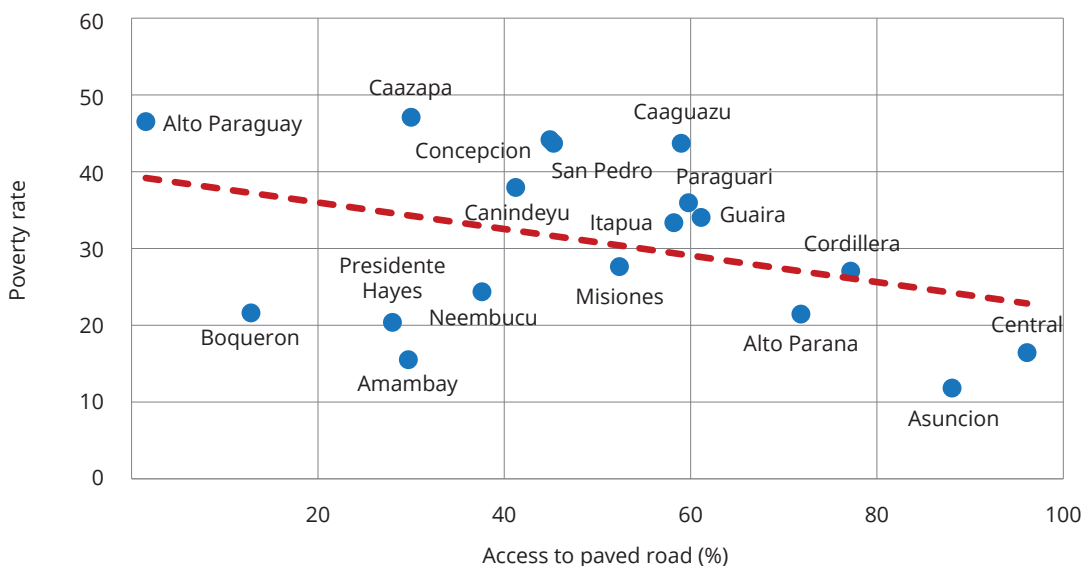
76. Poverty and equity are of concern in terms of road connectivity. The Chaco region has a particularly high poverty rate, while the Central region around the nation's capital is generally much richer than others and concentrates the country's main economic activities. Unsurprisingly, there is a clear correlation (although not causality) between road access and poverty incidence: poor people tend to lack access to the road network (see Figures 26 and 27). While poverty and equity cannot be entirely blamed on the lack of road connectivity (many other constraints exist in those areas) good road accessibility is nevertheless a necessary condition for strong growth.

Figure 26: Poverty Rates by Department



Source: Anuario Estadístico del Paraguay, 2016, and MOPC GIS Data.

Figure 27: Poverty and Road Accessibility



Source: Anuario Estadístico del Paraguay, 2016, and MOPC GIS Data.

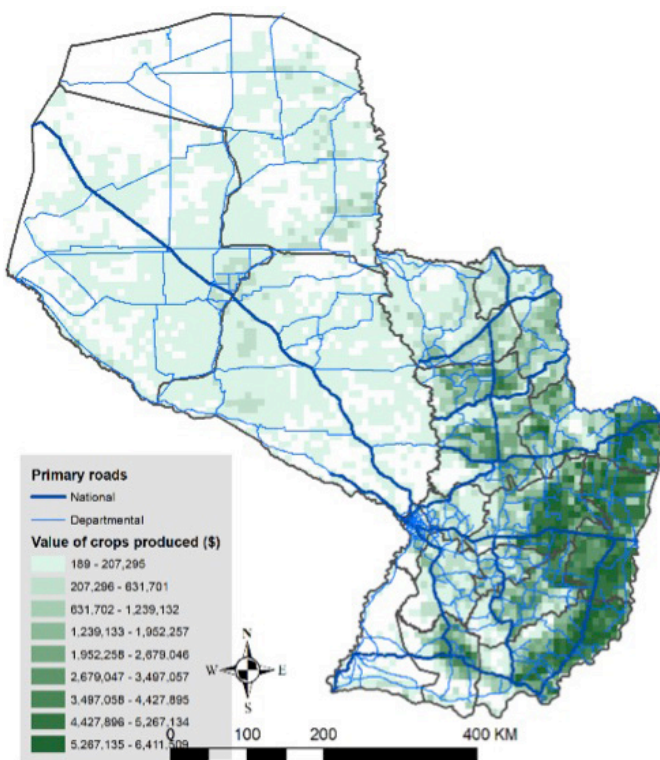
77. From the investment efficiency point of view, the priority should be to focus on underlying economic growth potential. Paraguay has various good economic opportunities, such as in hydropower and agriculture, including livestock-raising. While crop production is focused on the eastern and southern regions of the country, the cattle-raising areas extend to the poorer north and Chaco (see Figures 28 and 29). In order to connect farmers and animal breeders in such areas to the national and regional markets, road connectivity and accessibility are essential.

78. As for access to healthcare and social services, an estimated 58 percent of Paraguay's total population has access to a health facility within 1 hour (according to available open data (Figure 30)).²¹ As in the case of farming, there is substantial regional heterogeneity, with the Chaco lagging behind in terms of access to health facilities. In the Alto Paraguay department, a mere 4.6 percent of the

population has access within one hour. Allowing even 4 hours traveling time, only around 30 percent of the population would be able to access a health facility, reflecting the lack of road network connectivity (see Figures 31 and 32). To improve people's access to healthcare services etc., road accessibility needs to be significantly improved, especially in the rural areas of the north.

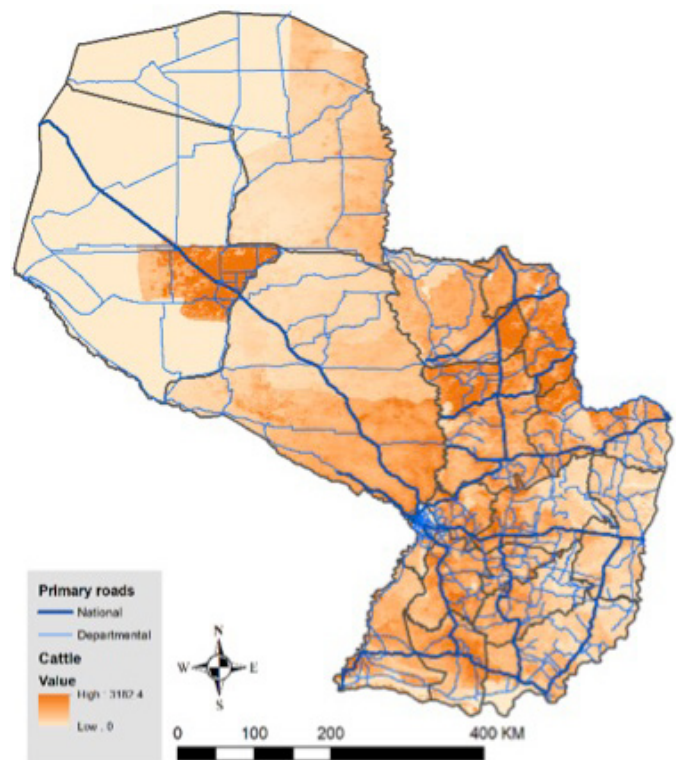
79. Against this background, a possible prioritization framework ("multi-criteria analysis"), could include poverty, road access, economic potential, and social accessibility. More resources need to be allocated to the places where poverty incidence is higher, road accessibility is lower, economic potential is higher, and access to social facilities is more limited. For simplicity, these five criteria are equally weighted here, with different departments prioritized for different reasons.

Figure 28: Distribution of Crop Production Areas



Source: IFPRI SPAM.

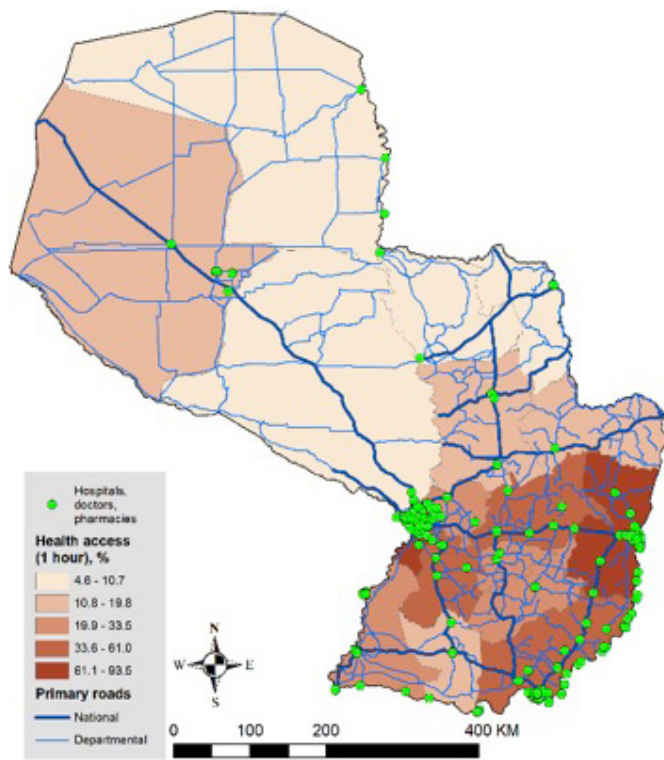
Figure 29: Spatial Distribution of Cattle



Source: Gridded Livestock of the World.

21 The analysis relies on road network data from the Government and open source data, such as OpenStreetMap. Although the latter is not comprehensive or official, the data coverage is considerable. According to the assessment, 935 hospitals, health clinics, and pharmacies are located.

Figure 30: Health Access and Road Accessibility



Source: IFPRI.

80. A sustainable rural road development program needs to be established to meet the existing and substantial demand for rural road development, while balancing a variety of economic and social development objectives. The prioritization framework should be discussed, customized, and agreed with all stakeholders before its formal implementation. The framework will also need to be consistent with the Government's development strategy. Roads for investment could also be selected according to the concept of fixing priorities based on socioeconomic criteria, but including more detailed data on the roads situation. (see Appendix B). The prioritization framework can be updated and revised with newly available data and through program monitoring and evaluation processes. The formula should however be applied systematically in order to avoid a situation where developed rural roads are fragmented and disconnected, thereby defeating the aim of enhancing network accessibility. Rural roads should then be developed to achieve the agreed objectives for the network.

Figure 31: People's Access to Health Care, by Length of Trip and Share of Departmental Population

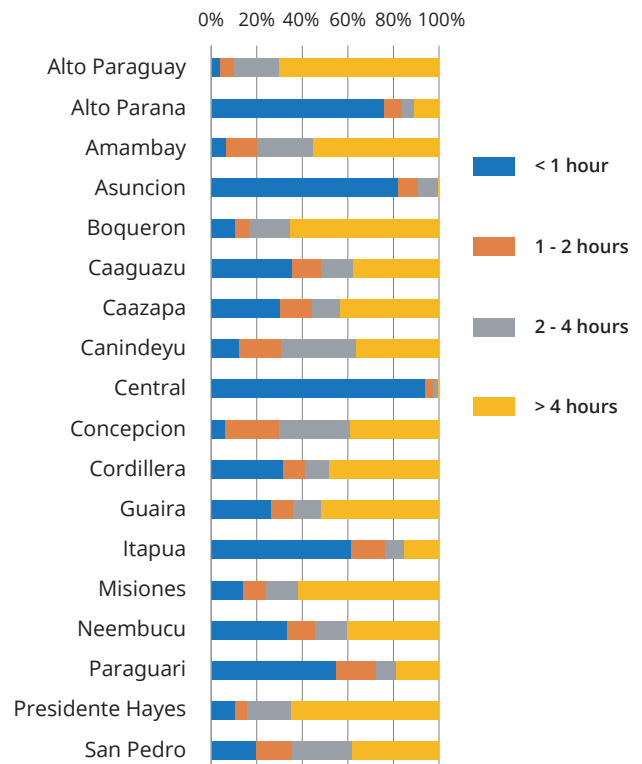
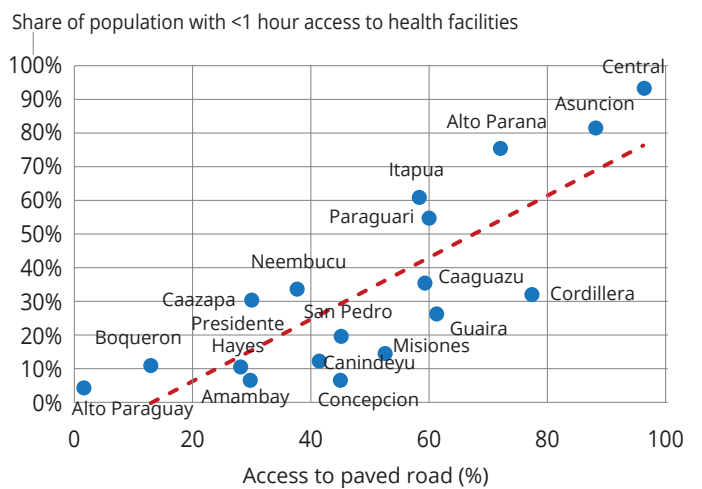


Figure 32: Health Access and Road Accessibility



Source: IFPRI

D. SOURCES OF REVENUES FOR ROADS

81. Road sector development and maintenance is financed through a complex mechanism involving multiple domestic and external financing sources, channeled through the budget. The resources for the road sector consist of central government funds (the central budget), transfers from the National Fund for Public Investment and Development (FONACIDE) to MOPC, and resources from FONPLATA (a multilateral fund set up by Argentina, Bolivia, Brazil, Paraguay and Uruguay), FOCEM (Fondo para la Convergencia Estructural de MERCOSUR) and multilateral or bilateral agencies such as IBRD, IDB, JICA, CAF and the Republic of China. The central budget is administered exclusively by Paraguay's central government, while funding from other sources is also channeled through the central government but administered separately.

82. Road works receive funds from three main sources categorized as Sources 10, 20, and 30. Source 10 includes funding from taxes and other government revenues; Source 20, international and domestic credit; and Source 30 from grant funds (Figure 33). While Source 10 supports mainly administrative expenses and wage costs, it also includes some expenditures for maintenance in the road sector. The other two categories support capital and current expenditures. A given project may receive funding from one or more sources. The MOPC does not summarize allocations across resources, by capital, current and administrative expenses, nor does it compile this breakdown by type of road network.

83. Departmental and municipal governments receive some limited budgets for infrastructure although the bulk of road sector expenditures are channeled through the MOPC. These budgets are all merged and do not allow a disaggregation of the expenditures that correspond to road investments. As for rural road maintenance, municipalities contribute mainly by collaborating with MOPC in the maintenance planning rather than by providing funding. Some municipalities have partnership agreements with MOPC to lead maintenance activities with funding provided mainly by MOPC.

84. Development partners played a major role in Paraguay's road sector investment up to 2012, when sovereign bonds became the main source for development investment. Source 20, composed of multilateral and bilateral funds, and sovereign debt, has been a key supporter of road investment projects since 2008 (Figure 34). Capital investments in the sector have increased substantially since 2012, but while the share of multi-lateral financial institutions (MFIs) has increased in absolute terms, sovereign bonds (part of Source 20, Figure 35) are the dominant source of capital financing in the roads sector. The cost of the capital roads program investment should therefore include the cost of servicing the bonds. Among multilateral donor partners, the Inter-American Development Bank takes the lead in supporting the sector, with Spain as the main bilateral lender.

Figure 33: Funding Sources for the Road Sector

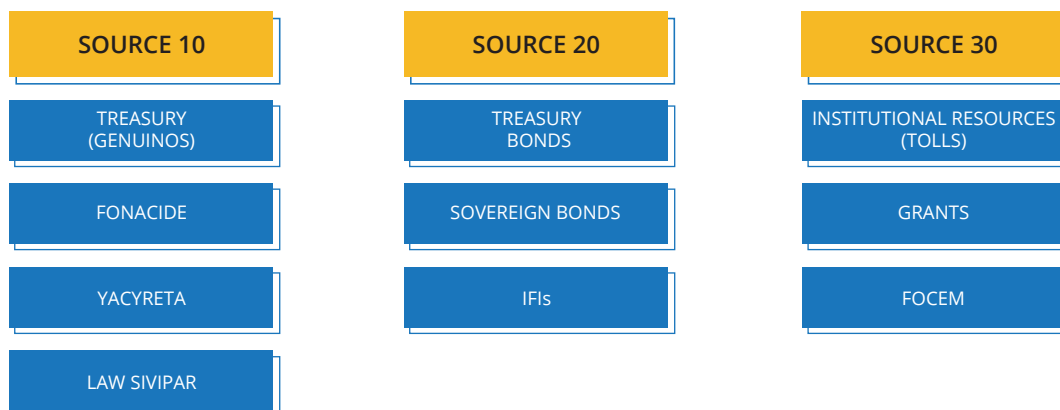
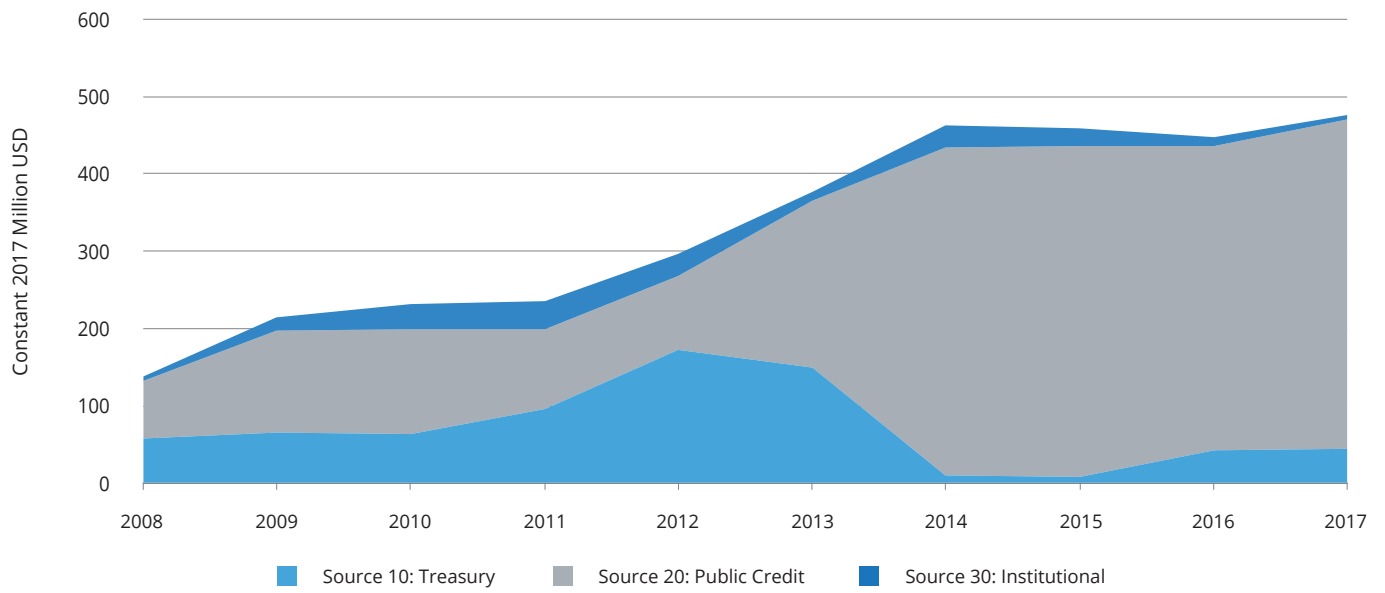
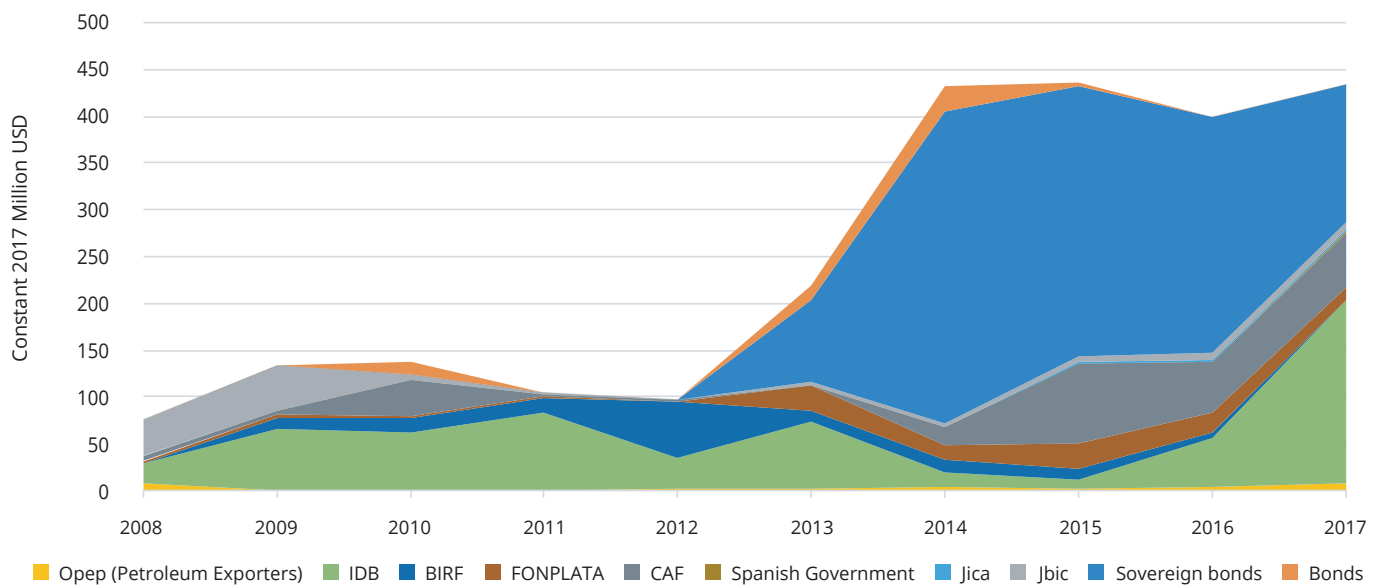


Figure 34: Capital (Committed) Budget for the Road Sector by Type of Source



Source: BOOST database

Figure 35: Source 20 Capital Road Sector Executed Budget by Subtype of Source



Source: BOOST database

85. MOPC expenditures through the budget are funded by a variety of domestic and external resources. Toll revenue is also raised on traffic using part of the primary and secondary network. External sources of funding are predominantly from multilateral official sources, amounting to about 85 to 90 percent of total funding. Of this amount, around one-half to two-thirds has typically been provided by the International Bank for Reconstruction and Development and the Inter-American Development Bank. On the bilateral side, the principal sources of assistance are from Spain, Taiwan, and Japan.

86. Funding from external sources has typically been higher than from domestic sources, but this trend started to change from 2013 onwards. There have been some major shifts in recent years away from dedicated line item funds and toward bond issuance. Much of this funding has been focused on works. Direct treasury funding has continued, but is smaller in relation to the above-mentioned sources. Such funding is likely to be directed toward MOPC operational costs.

87. Reliance on external funding sources is not a viable long-term strategy for the upkeep of the road network. User-based charges offer a more sustainable, long-term solution. The country already has an infrastructure fund, the Sistema de Infraestructura Vial del Paraguay (SIVIPAR), created in 2003. This was designed to have the following revenue sources: (i) 10 percent of the Itaipú and Yacyretá tolls; (ii) 50 percent of the “patente fiscal annual” tax; (iii) 10 percent of the fuel tax; and (iv) 40 percent of the vehicle import tax. Although approved in 2003, the law has not been implemented due to the lack of a regulatory decree, and the SIVIPAR fund was never set up. The government is in the process of reviewing the law with a view to either implementing or scrapping it. Road funds tend to reduce fiscal flexibility and are often resisted by the Ministry of Finance even though they could, in certain circumstances, improve asset maintenance. Box 2 below offers some thoughts on road funds as an interim step and the features of an effective road fund.

Box 3: Road Funds as an Interim Step

Gwilliam and Shalizi (1999) argue that insufficient or uncertain budgetary allocations to road maintenance result in road deterioration that significantly increases production and transport costs in many countries. To avoid this problem, road professionals advocate the establishment of dedicated road funds managed by independent road boards consisting of user representatives. The road boards would have the power to determine both the level of charges for road use and the level of expenditure on road maintenance. By contrast, macroeconomists and public finance specialists tend to resist the establishment of dedicated road funds, arguing that road funds reduce fiscal flexibility, do not adequately address problems associated with the provision of public goods or the internalization of externalities, and are often not well managed.

In general, there are two long-term institutional options for reconciling fiscal prudence with asset maintenance: a road agency that is operated commercially (subject to the normal oversight accorded to privatized monopolies), or a reformed and well-functioning budget process. Gwilliam et al take the view that road funds must be viewed as a provisional, case-specific intermediate step toward one of these long-term solutions.

If a country decides to proceed with an interim Road Fund, it should seek to address the following conditions. First, the Road Fund's expenditure responsibilities should be limited to maintenance in order to correct a systematic bias against maintenance, despite the link between investment and maintenance. Second, the Fund's revenues should come only from direct charges on road users, except in the case of fuel surcharges (which need to be separated from general taxes in agreement with the treasury). Where feasible, weight-distance charges should be introduced for trucks. Third, the Road Fund should have professional management under the direction of a user-representative board and be subject to strict oversight and auditing arrangements by third parties. Fourth, the Road Fund requires explicit transition arrangements as it moves toward a long-term solution.

88. Paraguay has a history of tolling on some of its primary roads. The importance of tolling as a means of managing traffic and generating revenue has expanded since the completion in the early 2000s of a major toll modernization program. This expanded the number of toll stations to 13 and the length of road covered to 1,842.5 km. New technology was introduced through this program to automate and improve secure revenue collection. Furthermore, a new tariff structure was introduced in June 2014. In June 2016 a policy was introduced to charge vehicles traveling in both directions. However, toll charges remain on the low side for five different vehicle classes ranging from US\$2 equivalent to US\$8 equivalent. In 2017, the revenue generated from 29.5 million journeys was equivalent to US\$12.2 million. A high-level comparison of tolls, in US cents per km, shows Paraguay at the lower end of the range at 0.033, compared with Uruguay at 0.061 or Brazil at 0.059 though this may reflect to some extent Paraguay's lower GDP per capita (less than half of Uruguay and sixty-five percent of Brazil). Revenue collection can be improved through modifications of the tariff structure to better align tariffs with the differential impacts of heavier freight transport versus lighter passenger vehicles on roads. Revenues are fairly distributed in this way and should help the country to progress towards achieving the levels of upkeep required by the core road network.

89. Aside from tolls, weight-distance charges have little conflict with fiscal objectives. Road use generates several externalities, of which road damage—requiring maintenance—is only one. A surcharge on fuel use provides a reasonable proxy for the road damage externality caused by automobiles and implies a modest tax on gasoline. Fuel use, however, is not as good a proxy for road damage by trucks, which account for the bulk of road damage. The impact of a heavy truck is 10,000 times as great as that of a medium auto (Newbery 1987). It also varies nonlinearly with axle weight. MOPC could collect a weight-distance charge from truckers and channel the revenue towards maintenance activities, with or without a road fund, taking care to manage administration costs and vulnerabilities to evasion.

A weight-distance toll on trucks would also avoid penalizing low-income users of tolled roads. Indeed, it is possible to design a toll system including, for example, discounted passes to local traffic as a way of addressing issues of equity with respect to the poor.

90. Fuel taxes do not appear to be availed to their full potential. The price of a liter of fuel in Paraguay is US\$1.04 compared to the world average of US\$1.11, and lower than in neighboring countries such as Brazil and Uruguay where the unit price is US\$ 1.09 and US\$ 1.47²², respectively. It is noted that in 2017 revenues from fuel taxes amounted to a total of US\$3.5 million, considerably lower than toll revenues and suggesting room for a review and increase of such taxes. While fuel taxes are a workable proxy for road usage and externalities such as air pollution, they are not appropriate for other externalities like congestion (which varies by time and location) or safety. Given the multiple claims on the surcharge, the allocation of revenues generated by the surcharge should be calibrated rather than being directed entirely to road administration.

91. In addition to these tolls, revenue is also generated on concessioned roads managed by Rutas del Este (Route No.2) and Tapa Pora (Route No. 7), covering 163.5 km and 502 km respectively. The Tapé Pora concession has its own tariff schedule, varying by location and number of lanes from a low tariff of US\$2 equivalent to a high of US\$20 equivalent. Revenue generation from Tapé Pora appears to be significantly higher than that of any other tolled section of the network, generating revenue in 2017 of US\$50 million equivalent (about double the 2013 take), from 6.6 million journeys. It is worth noting that road concessions in Paraguay are still at an early stage and expansion of such contracts depends on the extent to which confidence in the regulations governing private contracts increases. As revenue increases to meet core network maintenance and other requirements, public resources should be freed up to focus more on supporting the rural network, for which similar user-fee-based concessions are not feasible.

22 https://www.globalpetrolprices.com/Paraguay/gasoline_prices/

CONCLUSIONS

92. Despite considerable volatility, the road sector budget has expanded substantially since 2012. Budget volatility is seen in budget allocations across years and in the intra-year changes reflected in the approved, modified and executed budgets. The uncertainty of the annual final budget undermines effective planning, project selection and implementation. The absence of multi-year budgeting, combined with insufficient technical and managerial capacity, has led to consistent underspending of the sector budget, ranging between 25 and 35 percent. When budgets are not executed in the way they were promised, there is generally less confidence that the government is able to manage public finances effectively. Given that underspending could also mean off-budget spending, there is a declining confidence in institutions and budget credibility.

93. Underspending, as well as overruns, is generally related to insufficiencies in budget preparation and program preparation at MOPC and MOF. Development expenditures are difficult to plan accurately, but adequate flexibility to reallocate funds from projects that are delayed to projects that are proceeding well could allow satisfactory implementation of the overall expenditure program. MOPC does not currently appear to have the flexibility to make such changes. It is possible that cash-flow budgeting is a means for the MOF to manage a development budget that it has not prepared and may explain the low execution rates which undermine budget credibility. When analyzing budget execution, it is important to consider both the risks of disruptive repetitive budgeting and the requirements for cash control and compliance.

94. We find that the road sector budget is underspent to the tune of US\$200-400 million annually. These inefficiencies may be attributed to the institutional “policy environment” which determines what is allocated and what is actually spent. Assuming that about half the amount left on the table was applicable to maintenance activities, the cost of institutional inefficiency for the road sector in Paraguay is roughly between US\$350-700 million every year. Furthermore, the annual, modified budget of the sector is more than sufficient to address the maintenance needs of rural roads that are currently underfunded by about 50 percent.

95. In terms of budget allocation, the Government's emphasis on the operations and maintenance of the paved network seems to have improved road conditions over the past five years. Paved roads should continue to be the focus of the maintenance policy. However, any allocation of funding to the upgrade or reconstruction of secondary and rural roads needs to take into account the underinvestment experienced by some provinces, especially in the poorer north and Chaco regions with the lowest levels of rural access. Failure to address the discrepancies in rural access in these regions, combined with their remoteness and difficulties in access to public services and markets, will inevitably perpetuate inequality.

96. Rural access is currently estimated at about 42 percent, far below the SDG goal of universal access. It is estimated that a move to universal access with gravel roads would require about US\$5 billion²³, assuming all rural roads are improved. To reach the 60,000 people who currently do not live within 2 kms of even a rural road would require another approximately US\$ 2 billion.

97. The MOPC can enhance the value of the Transport Master Plan of 2018, and its road sector strategy and investment plan, by retaining the results of the asset management modelling exercise. Asset management models, using economic analysis, have been applied for assessment of the paved road network and strategic planning of road investments, but the extent to which model recommendations have been carried forward is not clear. The results of the modelling exercise have been modified with the application of socioeconomic criteria prior to finalizing the paving program. When the returns to investment are so distorted, decisions to invest or not to invest, or what scale of investment to pursue, are also adversely affected. Changes to the modelling results are likely to have substantially reduced the allocative and spatial efficiency with which public resources are expended irrespective of any budget constraints. Disregarding the results of the asset management system has also had an important, adverse impact on the technical efficiency of expenditures.

²³ For simplicity, rehabilitation costs are assumed to be US\$80,000 per km. Periodic and routine maintenance costs are also assumed to be US\$10,000 for every 6 years and US\$1,800 per km for every year.

98. It is recommended that annual budget requests be aligned with the Medium-term Expenditure Framework (MTEF) and demand better preparation of technical and procurement documents. Currently, the link between the MTEF and annual budgets is tenuous at best and does not allow the linkages between expenditures and longer-term outcomes to be traced. Furthermore, project preparation processes and cycles are opaque and show considerable bunching over the calendar year. Increasing numbers of complaints from bidders and a large number of addenda in contracts signal weak document preparation linked to low technical and procurement capacity and efficiency. These issues can be addressed by requiring MOPC to start preparing specifications and procurement documents as soon as a project enters the budget process.



CHAPTER 4. GOVERNMENT ROAD SECTOR
PRACTICES AND MANAGEMENT (FUNDING,
PROCUREMENT, BUDGET EXECUTION)

A. OVERVIEW OF PRACTICES

99. The Government recognizes the significance of an adequate and efficient transport sector and has accorded priority to infrastructure spending for the sector since 2012. Public expenditures on transport in Paraguay increased from 1.04 percent of GDP in 2010 to about 2 percent in recent years, which is much higher than spending by other countries in the region. For example, Argentina allocated an average of 0.58 percent of GDP to road transport,

Uruguay 0.33 percent, and Brazil 0.12 percent in 2017, while Bolivia allocated 2.87 percent. Although the overall sector budget appears sufficient for road preservation needs, planning and utilization of the available resources leave room for improvements. There are potential inefficiencies in road maintenance expenditures in the paved road network and financial requirements to achieve universal access in rural and remote areas.

B. MANAGEMENT SHORTCOMINGS: WEAK PLANNING AND LOW EXPENDITURE EFFICIENCY

100. The unpredictability of budget approvals contributes to significant spending inefficiencies. The substantial budget revisions from the initial allocations provide incentives to divide projects into smaller entities and to prioritize shovel-ready over higher-priority investments. For larger, multiyear projects, funding unpredictability can lead to implementation delays and higher costs, both in terms of capital costs (since delays increase the construction costs), and in terms of recurrent costs, since the supervision and implementation support budgets that represent a significant part of total recurrent costs also increase. Budget unpredictability also weakens the project prioritization process by reducing the time for implementing projects within a given year, since budget modifications are only approved in mid-year, thus creating an incentive to allocate money disproportionately to shovel-ready, potentially low-impact projects.

101. The same unpredictability highlights inefficiencies in the central government's budget processes and contributes to low budget execution ratios. The complexity of the budget approval process has a bearing on the predictability of the road sector budget. The budget classification system does not facilitate the budgeting and monitoring of expenditures by programs, apart from those funded by development partners, and it is difficult to monitor spending

allocated to a program and establish a link with longer-term, strategic objectives. Detailed data broken down by function are also in short supply. Poor expenditure reporting practices signal uncertainty over total spending in the sector, and further complicates planning development of the sector. According to the MOPC, streamlining the budget preparation and approval process, together with better record-keeping, could be important ways to improve the reliability and efficiency of spending in the roads sector.

102. The Fiscal Responsibility Law No. 5098 mandates the preparation of multiyear plans and budgets but it does not appear to be effectively utilized. It is unclear whether multiyear budgeting is applied at all, since both MOPC and the Ministry of Finance have confirmed that annual budgets are based mostly, although not entirely, on historical data.

103. The Transport Sector Master Plan, with a detailed investment plan for the medium and long term, requires significant strengthening to provide a strategic direction to the sector.²⁴ For the road sector, the 2018 update of the Plan could be improved by emphasizing the importance of a transparently derived, prioritized investment and maintenance program. It would also be enhanced by giving more attention to (i) ensuring adequate maintenance to minimize

²⁴ A master plan provides a predictable and disciplined framework for multi-year budgeting which can ease the process of year-to-year budgeting, keeping a country's overall development objectives in mind. Typically, such a plan sets out institutional priorities, and provides demand forecasts for the different modes under various economic growth scenarios, with alternative investment strategies. Typical sections in such a plan can include a situational analysis along with a gap analysis, a strategic framework, and an actual implementation plan to meet the objectives identified.

total road user costs and improve road safety; and (ii) ensuring the sustainability of road programs by prioritizing investments in line with available resources, while expanding the toll-road network and introducing user charges to increase revenue sustainability. The lack of a well-defined and articulated master plan means that there is no systematic framework for budget allocations for network development and maintenance.

104. Budget execution can be improved by delegating greater responsibilities to MOPC technical departments. The MOPC Roads Department is responsible for most investment and maintenance projects. It comprises functional divisions (execution and conservation) and some units according to funding source – JICA, CAF, FONPLATA, GMANS, FOCEM. The implementation unit for World Bank projects is separate from Vialidad and has considerably more autonomy than those within it. Technical staff have very little autonomy, and ministerial and vice-ministerial approvals are required at each step of the procurement and implementation processes. This creates serious bottlenecks and impacts overall execution rates, exacerbating an already poor situation with respect to MOPC's technical capacity.

105. A further issue to be addressed is the strength or weakness of a country's institutional system. In a best-case scenario, politicians and policy makers negotiate the prioritization of particular investments, while quasi-independent or independent regulatory institutions may contribute with checks and balances. However, the results of such a process can be distorted by rent-seeking behavior.²⁵ It is important to understand the political, economic, and social processes that promote or block pro-poor investments, and the role of oversight, rules, and regulations that permit more effective and politically feasible investments.

106. Experience with road administrations around the world indicates the importance of separating policy and implementation functions. As we have seen in Chapter 2, MOPC has responsibility for both functions - policy formulation and its implementation, and there is no meaningful separation between the two. There is also an almost complete absence of mechanisms and tools to track performance and hold MOPC accountable for the same.

107. Accountability mechanisms are needed in order to promote technical efficiency. An MTEF is the institutional mechanism that allows sector ministries to allocate resources in line with their strategic priorities and within the aggregate resource envelope presented by the Ministry of Finance. It helps to address information asymmetry between central and sector ministries: sectors have better information for making disaggregated expenditure allocations than Ministry of Finance. For this approach to produce the desired results, line ministries need to have incentives to use resources in a technically efficient manner. In other words, they must be held accountable for the allocation and use of budgeted resources. Accountability mechanisms include inter alia financial accountability and audits, value for money audits, ex post evaluations, and annual reports.

²⁵ Rent-seeking behavior occurs in situations in which some interest groups manage to capture key state institutions or processes and pursue their particular interests rather than those of society as a whole.

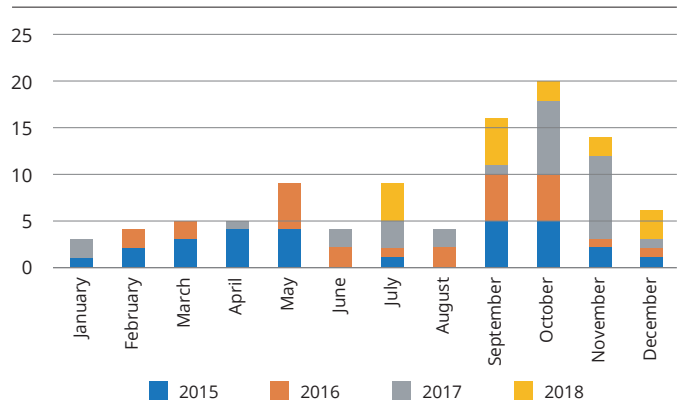
C. PROCUREMENT AND VALUE FOR MONEY IN PUBLIC EXPENDITURES

108. The Dirección Nacional de Contrataciones Públicas (DNCP) has pioneered the adoption of open-contracting data standards for procurement in all sectors, including the transport sector. But procurement still remains highly inefficient. Law 2051/03 and its regulations establish the functions and roles of all the units involved in procurement and is implemented by DNCP. All the entities, including the MOPC, have a Unidad Operativa de Contratación (UOC) responsible for ensuring compliance with the UOC procurement procedures and requirements. UOC also coordinates the finalization of bidding documents and their approval by the DNCP. Despite the country's commitment to open contracting data standards, public procurement in Paraguay experiences low levels of competition for government contracts, procurement bunching, and poor contract preparation, which generates successive complaints – all of which point to the need to make value for money improvements in public contracting, including the need to boost low staff capacities in the MOPC and sector ministries.²⁶

109. Bunching of bidding processes (see Figures 36 and 37) and a high number of addendas per contract (Figure 38) indicate weak technical capacity within MOPC for bid preparation and process management. There are no restrictions on when a procurement process is launched, and DNCP allows publication of bid documents prior to budget approval. A more even flow of new procurement starts would allow better preparation of technical documents, and fewer addenda as a result. These enhancements could be achieved through improved work planning and monitoring within MOPC.

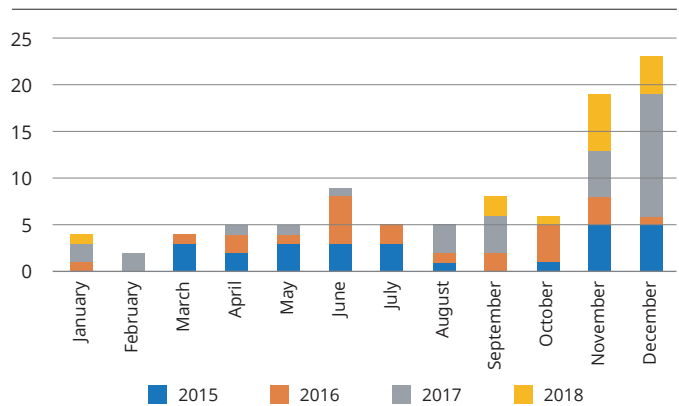
110. Regression analysis was undertaken to test the impact of seasonality on the contract award price. The data tested did not show any significant impact: the award price correlates with the estimated price and the number of bidders. Competition measured by the number of bids was found to be higher for smaller contracts rather than for higher-value ones. As final costs per kilometer of works relate to the level of deterioration of project roads, a shorter project cycle from identification to implementation is expected to yield lower costs per kilometer for maintenance and development.

Figure 36: Number of Bids Invited, by month, 2015-18



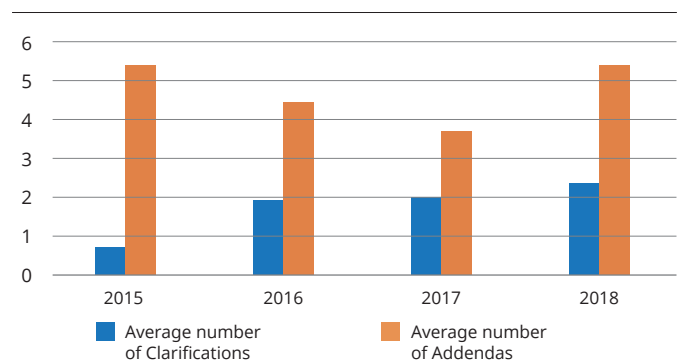
Source: Dirección Nacional de Contrataciones Públicas, 2019

Figure 37: Number of Bid Invitations Closed, by month, 2015-18



Source: Dirección Nacional de Contrataciones Públicas, 2019

Figure 38: Average number of Clarifications and Addendas, 2015-18



Source: Dirección Nacional de Contrataciones Públicas, 2019

26 World Bank. 2018

111. MOPC's capacity for planning and management of the road sector is likely constrained by the 25 percent staff reduction between 2013 and 2018, possibly implemented to counter overemployment at the Ministry. In 2017-2018, MOPC employed a total of 110 engineers of all disciplines (water, civil, etc.), and has recently hired and trained an additional 115 engineers. DCV currently employs 900 staff, DV has 330, UEP has 80, and DPV 14 staff. A staffing and salary review, followed by the implementation of recommendations for staffing and training, would go a long way to resolving capacity issues at MOPC.

CONCLUSIONS

112. It is recommended that annual budget requests be aligned with the Medium-term Expenditure Framework (MTEF) and that technical and procurement documents should be better prepared. Currently, the link between the MTEF and annual budgets is at best tenuous and does not allow the linkages between expenditures and longer-term outcomes to be traced. Furthermore, project preparation processes and cycles are opaque and show considerable bunching over the calendar year. Increasing numbers of complaints from bidders and a large number of addenda in contracts signal weak document preparation linked to low technical and procurement capacity and efficiency. These issues can be addressed by requiring MOPC to start preparing specifications and procurement documents as soon as a project enters the budget process.

113. The Paraguayan context requires particular emphasis on reforms that promote transparency and accountability since there is no separation between policy development and road sector management – both functions being housed in MOPC. There are practically no mechanisms or tools in place to monitor and evaluate road sector performance and encourage efficient expenditure, either by the Ministry of Finance or another autonomous or semi-autonomous entity. An important first step towards accountability is for MOPC to commission and publish annual, audited reports on the income and expenditures of the road sector, to be followed by audits of physical progress and quality in subsequent years.

114. It is recommended that the MOF simultaneously introduce ad hoc financial and physical audits of road sector expenditures to help improve discipline and increase value for money in the sector. The execution of public investments in Paraguay is still highly complex and bureaucratic. While several of the process steps are important to protect the quality of expenditures, a major overhaul of the investment cycle would help to simplify and optimize execution. Given that monitoring of public expenditures is the MOF's responsibility, it is imperative that the MOF develops both the tools and technical capacity to review the budget proposed by the MOPC, and subsequently confirm that expenditures conform to the agreed budget.

115. A functional review of MOPC's staffing aimed at identifying the number and profile of staff needed for optimal performance is strongly recommended. Many of the changes entailed by the recommendations above require an appropriate size and skills mix of the technical staff at MOPC. A functional review indicating gaps and a prioritized staffing plan should be undertaken as a priority next step to enhance sector efficiency.



CHAPTER 5. FINDINGS AND
RECOMMENDATIONS

116. This PER presents several findings and recommendations to advance the management and administration of Paraguay's roads sector in ways that tangibly improve the network while strengthening government capacity and sustainable budgeting. These are organized under four main themes:

- Better budget management and governance practices;
- Addressing data and capacity issues;
- Striving for universal accessibility in rural areas; *and*
- Sustainable sources of revenue for the sector.

A. BETTER BUDGET MANAGEMENT AND GOVERNANCE PRACTICES

117. While there is no blueprint for enhancing public sector efficiency, experience with road administrations around the world reveals the importance of separating policy and implementation functions of road administration. Experience also shows that, for public sector agencies “transparency and clear disclosure policies, and a clear mechanism for evaluating performance, are associated with high levels of performance, with performance orientation and professional management being the most important contributors.”²⁷ The Ministry of Public Works, however, is charged with both road administration policy and implementation functions. Furthermore, Paraguay has virtually no mechanisms or tools in place to monitor and evaluate road sector performance, and to encourage efficient expenditure by the Ministry of Finance or any other autonomous or semi-autonomous entity.

118. An important first step in this direction is for MOPC to publish annual, audited reports on the income and expenditures of the road sector, followed by physical progress and quality audits in subsequent years. The Paraguayan context requires particular emphasis to be placed on reforms that promote transparency and accountability, since policy development is not separate from road sector management. Paraguay needs to consider long term institutional options for reconciling fiscal prudence with asset maintenance (an independent road entity with implementation responsibility or a well-functioning budget process). Meanwhile, sector accountability could be enhanced by introducing independent annual audits of all capital and recurrent expenditures and sharing these results in a transparent manner.

119. It is recommended that the MOF simultaneously introduces ad hoc financial and physical audits of road sector expenditures to help improve financial discipline and to increase value for money in the sector. The execution of public investments in Paraguay is still highly complex and bureaucratic. While several of the process steps are important to protect expenditure quality, a major overhaul of the investment cycle would help simplify and optimize execution. Given that public expenditure monitoring is an MOF responsibility, it is crucial for this ministry to develop the tools and technical capacity to review the budget proposed by the MOPC, and subsequently confirm that expenditures correspond to the agreed budget.

120. The MOPC can enhance the value of the Transport Master Plan of 2018, and its road sector strategy and investment plan, by upholding the results of the asset management modelling exercise. Asset management models using economic analysis have been applied for assessing the paved road network and for strategic planning of road investments, but it is not clear to what extent the model recommendations have been carried forward. The results of the modelling exercise have been modified with the application of socioeconomic criteria prior to finalizing the paving program. When the returns on investment are so distorted, decisions to invest or not to invest, or what scale of investment to pursue, are also adversely affected. Changes to the modelling results are likely to have substantially reduced the allocative and spatial efficiency with which public resources are expended, irrespective of any budget constraints. Setting aside results of the asset management system also have an important, adverse impact on the technical efficiency of expenditures.

121. It is recommended that annual budget requests be aligned with the Medium-term Expenditure Framework (MTEF) and that the preparation of technical and procurement documents be improved. Currently, the link between the MTEF and annual budgets is at best tenuous and does not allow the linkages between expenditures and longer-term outcomes to be traced. Furthermore, project preparation processes and cycles are opaque and show considerable bunching over the calendar year. Large amounts of addenda and increasing complaints from bidders signal weak document preparation and low technical and procurement capacity and efficiency. These issues can be addressed by requiring MOPC to start preparing specifications and procurement documents as soon as a project enters the budget process.

122. In terms of budget allocation, the Government's emphasis on the operations and maintenance of the paved network seems to have led to improvements in road conditions over the past five years, and should continue to be the focus. At the same time, funding allocations to the upgrading or reconstruction of secondary and rural roads need to consider the underinvestment experienced in certain provinces, especially in the poorer rural north and Chaco regions which have the lowest levels of accessibility. Failure to adequately address issues of rural access to public services and markets in these regions will inevitably perpetuate inequality.

B. ADDRESSING DATA AND CAPACITY ISSUES

123. A systematic, up-to-date survey of the quality of the paved network, as well as of the amount of traffic on it, is necessary for the meaningful application of asset management models and for determining network spending requirements. While maintenance spending for the paved network appears to be broadly adequate, there is concern that the amount, spatial allocation, and type of capital works funded may be inappropriate, especially if expenditure requirements are based on guesswork as opposed to hard data regarding traffic and road conditions. Conducting a comprehensive survey of the paved road network, developing mechanisms for regular updates of the roads database, and making this data publicly available alongside budget data, are perhaps the best means of improving value for money in the roads sector.

124. A functional review of road sector staff and profiles is needed in order to develop a staffing and training plan commensurate with sector responsibilities and planned growth. Budget allocations for capital and recurrent expenditures have increased substantially over the past seven years, challenging MOPC capacity to manage the annual budget and deliver high-quality works. Vialidad, the department for roads (primary and secondary), has seen a substantial increase in its investment budget, while staff levels were reduced by about 25 percent in 2013–18. While greater staff productivity can legitimately be expected, there is a significant risk that the sector's maximum absorptive capacity (given numbers of personnel, skill levels, responsibilities, and work plans) has been reached. A functional review could help bring staffing needs and skills into line with the future needs of the sector.

C. STRIVING FOR UNIVERSAL ACCESS IN RURAL AREAS

125. Develop a rural roads policy and strategy that address universal accessibility goals, appropriate technologies for all-weather access, and the cost and time frame required to achieve the strategic goals. The current lack of a roads subsector strategy results in fragmented efforts and uncoordinated construction are unlikely to enhance rural connectivity and could worsen regional inequities. While about 70 percent of the general population of the country live within 2 kilometers of a paved road, only 42 percent of the rural population has such access. A sustainable rural road development program is needed to meet the huge demand for rural road connectivity. Developing a rural roads policy in consultation with relevant stakeholders – the MOPC and across key sectors (health, education, agriculture) – would also go a long way to support achievement of the National Development Plan 2030. The policy should include guidance on the methodology for prioritizing rural

roads, including multicriteria analysis and identification of funding sources for the development and maintenance of the existing and upgraded network.

126. The rural roads strategy should guide the prioritization and planning of rural roads investments for the next five to ten years. The rural road network remains a vital public resource for the country, despite the poorer rural areas' dispersed population and lack of economic weight. A rural roads strategy would help to determine investment priorities based on transparent and objective socioeconomic criteria that are appropriate in a rural context. This strategy would help improve the efficiency of project selection and public expenditures, as well as address current inequities in rural people's access to economic, educational, and health facilities.

D. SUSTAINABLE SOURCES OF REVENUE FOR THE SECTOR

127. At present, Paraguay's road funding mechanism is to pool capital from various sources, relying heavily on donor resources and more recently on domestic borrowing. In the longer term, road user charges provide a more sustainable source of funding since these can be aligned with the maintenance requirements of the network, especially if they are channeled through a road fund. Paraguay has an infrastructure fund law, the SIVIPAR law adopted in 2003, which theoretically functions as a road fund to collect road user charges to defray the costs of upkeeping the road network. However, SIVIPAR has not yet been regulated or implemented.

the two institutional options for the road sector. Paraguay's paved network has been receiving adequate maintenance funds regardless of the uncertainty in the budget allocation and transfer process. In this situation, a careful review of the sector's long-term institutional options and preferences, including the need for a provisional road fund in the form of an active SIVIPAR, is recommended as a way forward. This review should also include an assessment of the sources of revenues, the structures of user charges, the affordability of proposed user charges (specifically tolls and fuel taxes), and adequacy of the build-up of revenues toward a sustainable financial model.

128. Road funds, managed by independent road boards, are often recommended in situations of insufficient or uncertain budgetary allocations to help avoid deterioration of road assets. However dedicated funds also reduce fiscal flexibility and may be just as poorly managed as budgetary allocations. In general, there are two long-term institutional options for reconciling fiscal prudence with asset maintenance: a road agency that is operated commercially, or a reformed and well-functioning budget process with adequate checks and balances. A well-designed road fund is an interim measure while the country moves towards one of

129. Expanding the use of tolls and concessions to fund maintenance of the core network is recommended. Tolls offer a reliable source of funding to meet road upkeep costs. An increase in tolls to pay for road upkeep and damage needs to ensure a fair distribution of charges between heavier vehicles such as semi-trucks and lighter traffic, such as cars and pickup trucks. Finally, while road concessions are also an important source of private funding and management for the road sector, and could be expanded, Paraguay first needs to boost the confidence of the private sector in the rules and regulations governing concession contracts.

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APPENDIX A. RURAL ROAD NETWORK DISTRIBUTION BY CLIMATE ZONE

Table 11: Network Distribution by Climate Zone

Department	Semi-Arid (30-70)	Semi-Humid (70-130)	Humid (130-220)	Total
Alto Paraguay	3,020	611		3,631
Alto Parana	17	303	8,893	9,213
Amambay		709	1,218	1,927
Asuncion				
Boqueron	4,013	152		4,166
Caaguazu	53	1,629	1,744	3,426
Caazapa	29	1,305	1,265	2,598
Canindeyu	45	1,300	4,015	5,360
Central		316	21	338
Concepcion	22	2,595	68	2,684
Cordillera	6	1,739	62	1,807
Guaira		883	1,240	2,123
Itapua	14	2,510	6,993	9,517
Misiones		1,104	329	1,433
Ñeembucu		1,221	65	1,286
Paraguari		2,337	45	2,382
Presidente Hayes	1,773	1,741	383	3,897
San Pedro		5,258	74	5,332
Total	8,992	25,715	26,415	61,122

APPENDIX B. TOTAL COSTS OF RURAL ROAD MAINTENANCE

Table 12: Maintenance Total (US\$ million per year)

Department	Asphalt	Stone	Gravel/ Stone	Earth (High)	Earth (Average)	Earth(Low)	Total
Alto Paraguay	0.00	0.00	0.00	0.02	0.00	1.62	1.65
Alto Parana	0.01	0.61	0.75	0.88	1.91	2.86	7.03
Amambay	0.00	0.02	0.35	0.05	0.90	0.37	1.70
Asuncion	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Boqueron	0.00	0.00	0.00	0.00	0.34	1.56	1.91
Caaguazu	0.04	0.96	0.66	0.79	1.62	0.36	4.44
Caazapa	0.00	0.06	0.00	0.27	1.01	0.57	1.91
Canindeyu	0.22	0.00	0.62	0.17	1.40	1.60	4.00
Central	0.57	0.52	0.00	0.09	0.05	0.02	1.25
Concepcion	0.09	0.00	0.49	0.13	0.89	0.67	2.26
Cordillera	0.42	0.49	0.06	0.49	0.62	0.27	2.35
Guaira	0.00	0.39	0.09	0.43	0.77	0.41	2.08
Itapua	0.43	1.19	0.26	1.21	2.81	2.41	8.30
Misiones	0.00	0.05	0.00	0.14	0.57	0.31	1.07
Ñeembucu	0.01	0.00	0.00	0.03	0.33	0.40	0.78
Paraguari	0.00	0.51	0.00	0.37	0.93	0.44	2.26
Presidente Hayes	0.00	0.03	0.00	0.02	0.42	1.49	1.96
San Pedro	0.22	0.29	0.66	0.76	1.89	1.10	4.93
Total	2.02	5.12	3.94	5.85	16.48	16.47	49.87

Source: WB staff calculations.

APPENDIX C. MULTI-CRITERIA ANALYSIS TO IDENTIFY RURAL ROAD PRIORITY AREAS

Table 12: Maintenance Total (US\$ million per year)

Weight (%)		20	20	20	20	20	100	
Criteria		Economic Development		Poverty	Road Access	Access to health	Overall score	
Department	Region	Land Under Cultivation (hectares)	Number Cattle (thousands)	Total Poor Population (%)	Paved Road Access (%)	Share of Population with <1 hr (%)	Overall Index (Index)	Overall Rank (no)
Alto Paraguay	Chaco	415	1,565	46.5	1.6	4.6	53	3
Alto Parana	Oriental	7,314	210	21.4	71.9	75.7	45	8
Amambay	Oriental	2,715	991	15.2	29.8	6.7	31	15
Asuncion	Oriental	0	0	11.6	88.1	81.7	19	18
Boqueron	Chaco	814	1,877	21.5	12.9	11.0	42	10
Caaguazu	Oriental	7,419	553	43.7	59.1	35.7	54	2
Caazapa	Oriental	2,646	343	47.0	30.0	30.6	49	5
Canindeyu	Oriental	5,643	737	38.0	41.2	12.3	47	7
Central	Oriental	3,450	64	16.2	96.1	93.5	31	14
Concepcion	Oriental	3,959	1,210	44.0	45.0	6.3	48	6
Cordillera	Oriental	3,003	255	26.9	77.2	32.1	28	17
Guaira	Oriental	1,968	157	33.9	61.1	26.5	31	16
Itapua	Oriental	8,714	453	33.2	58.3	61.0	57	1
Misiones	Oriental	3,121	508	27.5	52.4	14.7	32	13
Ñeembucu	Oriental	2,124	607	24.2	37.7	33.5	36	12
Paraguari	Oriental	2,029	475	35.8	59.8	55.0	41	11
Presidente Hayes	Chaco	1,599	2,497	20.0	28.1	10.7	44	9
San Pedro	Oriental	3,113	1,355	43.6	45.1	19.8	50	4

