

BUILDING AND FINANCING THE TRANSPORT INFRASTRUCTURE OF TOMORROW

THE CASE OF COLOMBIA

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Building and financing the transport infrastructure of tomorrow

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Abstract/Résumé

Recalling the centrality of transport infrastructure in any development strategy and economic recovery and resilience plan, the paper stresses the importance of increasing territorial connectivity in Colombia to sustain future progress. It describes the variety of financing models for transport infrastructure in the country and globally and identifies five key factors that Colombia should take into account when choosing between models in the future.

Le document rappelle le rôle central de l'investissement dans les infrastructures de transport pour toute stratégie de développement et de relance économique, soulignant l'importance de la connectivité territoriale pour la Colombie. Il présente l'évolution des modèles de financement des infrastructures de transport dans le pays et globalement, et identifie les cinq facteurs clés que la Colombie doit prendre en compte dans les choix à venir entre différents modèles.

Foreword

Investing in transport infrastructure is a key component of economic recovery and resilience plans worldwide. The infrastructure gaps between advanced and emerging economies remain significant and risk increasing in light of the ongoing efforts to ramp up investments in transport infrastructure in advanced economies to make it future-proof and sustain economic recovery.

In the context of the Colombia-OECD COVID Recovery Co-operation Project, this document summarises the findings of the meeting of the Investing in Infrastructure for Better Futures Task Force (IITF) hosted by Colombia's National Planning Department and the OECD Development Centre in April 2022, entitled "Building the Future: Infrastructure for Recovery and Transformation – Spotlight on Colombia: What options and contractual arrangements to build and pay for the infrastructure of tomorrow?".

The document emphasises the centrality of enhancing territorial connectivity through transport infrastructure within countries, as a way to support inclusive development. Leveraging on international peer dialogue and OECD best practices, this paper focuses on Colombia and provides recommendations to update infrastructure planning. It clarifies the need to increase financing to bridge transport infrastructure gaps in emerging and developing economies, and calls to choose appropriate financing models, taking the specific objectives of each project into account.

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The authors are grateful to all participants in the IITF Meeting hosted on 26 April 2022 on line by the OECD Development Centre in collaboration with the DNP and the Colombian Delegation to the OECD, entitled “Building the Future: Infrastructure for Recovery and Transformation – Spotlight on Colombia: What options and contractual arrangements to build and pay for the infrastructure of tomorrow?”. In particular, we are grateful to the following participants: Gloria Alonso (Deputy Permanent Representative to the OECD, Colombia), Sandra Angel (Ministry of Transport, Colombia), Juan Benavides (Fedesarrollo, Colombia), Elisa Carbonell (ICEX, Spain), Morteza Farajian (Department of Transportation, United States), Jonathan Bernal Gonzalez (National Planning Department, Colombia), Rafael Hertz (Financiera de Desarrollo Nacional, FDN, Colombia), Akira Kadomoto (Counsellor, Permanent Delegation of Japan to the OECD), German Lleras (Steer Davies Gleave, Colombia), Dejan Makovšek (OECD Directorate for Public Governance), Diego Morales (National Infrastructure Agency, ANI, Colombia), Noriyuki Mori (Ministry of Land, Infrastructure, Transport and Tourism, Japan), Stephen Perkins (International Transport Forum), Mamiko Yokoi-Arai (OECD Directorate for Financial and Enterprise Affairs), Olga Lucía Ramírez (Vice minister of Infrastructure, Ministry of Transport, Colombia) and Laura Pabón (Deputy Director-General, National Planning Department, Colombia).

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Acronyms and abbreviations

1G - 5G	The first - fifth Generation programme
AI	Artificial intelligence
CONPES	Consejo Nacional de Política Económica y Social (National Council for Economic and Social Policy)
COP	The United Nations Climate Change Conference of the Parties
DNP	National Planning Department of Colombia
ESG	Environment, Social and Governance
G7	The Group of Seven
G20	The Group of Twenty
GDP	Gross domestic product
GIS	Geographic Information Systems
IEA	International Energy Agency
IITF	The Investing in Infrastructure for Better Futures Task Force
LCC	Life cycle cost
MLIT	Ministry of Land, Infrastructure, Transport and Tourism of Japan
NDC	National determined contribution
OECD	Organisation for Economic Co-operation and Development
PPPs	Public-private partnerships
RAB	Regulatory Asset Base Model
SDGs	The Sustainable Development Goals
UNCTAD	The United Nations Conference on Trade and Development
UNFCCC	United Nations Framework Convention on Climate Change

Executive summary

Investing in transport infrastructure is a key component of any development strategy and economic recovery and resilience plan. However, despite some progress, the infrastructure needs of developing countries remain significant and are growing. The investment capacities of these countries remain limited, while advanced economies are ramping up investments in infrastructure to make it future-proof and sustain economic recovery.

Colombia has prioritised investing in infrastructure to “build back better”. The policy for economic reactivation and sustainable and inclusive growth (CONPES)¹ unveiled in 2021, includes short-term support measures to cushion the effects of the pandemic and sets long-term targets to increase preparedness for future shocks and to invest in more environmentally sustainable and inclusive growth. According to the National Planning Department (DNP) in 2022, the economic recovery plans included 26 transport projects including 13 roads, 5 airports, 5 railways and fluvial infrastructure reaching an estimated value of USD 13 billion.

The Colombian Road and Investment Programme is not only an infrastructure plan; it aims to address social inclusion and national equity across all communities. The plan foresees the building of more than 150 000 km of rural roads, 47 000 km of secondary roads and 16 000 km of primary roads. The uncertainty and risk associated with rural road projects is estimated at 10 times that of primary roads, due among other things to remoteness, geological challenges and lower revenue generation predictability. Connecting rural areas is crucial to ensure social stability and cohesion, especially in a country that underwent a major pacification process in the last decade. Connecting people living in remote areas will not only increase productivity, it will help build a unified country with equal access to opportunities.

To move forward, Colombia is looking to update its financing model for transport infrastructure. In Colombia, road transport infrastructure has attracted considerable private investment since the 1990s, following the approval of Law 80 in 1993, which established the general principles of public contracting. The first generations (1G, 2G and 3G) of private Colombian concessions were launched throughout the 1990s according to those guidelines. Since then, concession contracts and public-private partnerships have been key to attracting private capital to Colombia for the rehabilitation, maintenance, conservation and construction of the different means of transport. Since 2012, the main model used in Colombia for road concessions has been the public-private partnership (PPP). The participation of the private sector in Colombian roads has been considered successful by international standards. By mid-2022, the fourth generation (4G) road infrastructure programme had progressed by nearly 60% and the government launched the first wave of 5G projects as a strategy for post-COVID economic recovery while completing key corridors for Colombia’s foreign trade and to connect the north and south of the country with multimodality services.

Challenges in coming years include increasing public and private investment in infrastructure, finishing the 4G roads, starting the 5G projects including rural roads with poor users and low payment capacity, and

¹ <https://colaboracion.dnp.gov.co/CDT/Conpes/Economicos/4023.pdf>

completing the roads of the 1G projects as the concession terms end in the coming years. The difficulty in quantifying risks is a central challenge for PPPs. Potential risks include exchange rates, natural disasters and the reputational risks for both private companies and public institutions. Alternatives to PPP can deal with several of their shortcomings, including reducing risk pricing under appropriate conditions. One option is the Regulatory Asset Base (RAB) model, under which private or state-owned enterprises act as the infrastructure manager, owning, investing, and operating infrastructure assets. Government capacities are needed to effectively use RAB. An effective economic regulatory institution is critical to ensure regulation and cost supervision. Otherwise, the infrastructure manager has an incentive to behave like a natural monopoly, setting monopoly prices and failing to undertake maintenance.

In going forward, when choosing its transport infrastructure model, Colombia could consider the following five factors:

1. **Be outcome-driven.** Colombia should choose the model most appropriate to its particular circumstances and based on the outcome that it wants to achieve (which transport infrastructure needs to be build and for what?). For example, RAB is less suited to rural roads and small projects, as the model fits best large-scale projects for which it was initially conceived.
2. **Factor in government capabilities, at the national and local level.** Country context and government capacities are paramount. For example, for Colombia to effectively use the RAB model, a regulatory authority would need to be developed and significantly adapted. This process takes time and appropriate resources. Public procurement capacities also need to be quite sophisticated and information and price transparency are critical. Investing in capacity building in project formulation and implementation at the local level is necessary in Colombia. In the United States, for example, the Build America Bureau was set up in 2014 in the US Transportation Department to strengthen the country capacity across the nation to set up viable infrastructure projects; the Bureau implements mechanisms to strengthen project formulation and structuring capacities at the local level, including learning how to partner with universities and consultants for project development.
3. **Maximise community buy-in.** Ensuring positive participation is imperative in a country which expects to build more than 150 000 km in rural roads in coming years. Local communities should be brought to the table early in the process, involved and listened to in an attempt to discern needs and desires. Ensuring community buy-in should be part of the mandate of infrastructure building authorities. The Build America Bureau offers interesting examples of mechanisms for effective stakeholder consultation in infrastructure building.
4. **Consider technology transfer and local industrial development.** Technology transfer is one of the main advantages of foreign investment in infrastructure. Foreign firms can contribute to bring innovations in transport infrastructure but can also, if properly managed, open up opportunities for learning and local innovation. The transport infrastructure authority can play an important role in ensuring that innovative solutions are incorporated into the project, building local capacities. It is important to focus on innovative activities that local people may know how to use with limited or without foreign technical support, as shown by projects implemented by the Ministry of Land, Transport, Infrastructure and Tourism of Japan in developing countries.
5. **Explore innovative and sustainable financing options.** Making transport infrastructure resilient to climate change and acting on climate change mitigation and adaptation is a priority for Colombia. The country could explore innovative financing mechanisms for roads, taking into account climate-change related objectives.

1. Enhancing territorial connectivity is pivotal for development

Investing in transport infrastructure is a key component of economic recovery and resilience plans worldwide. However, despite some progress, the infrastructure needs of developing countries remain significant and are growing. The investment capacities of these countries remain limited, while advanced economies are ramping up investments in infrastructure to make it future-proof and sustain economic recovery. After the COVID-19 pandemic, the importance of infrastructure has again come to the fore, and it is now widely recognised that infrastructure needs to support an inclusive and sustainable development. In late June 2022, G7 Leaders launched the Partnership for Global Infrastructure and Investment, a plan to mobilise USD 600 billion in global infrastructure investments by 2027. This will leverage the USD 2 trillion United States domestic infrastructure bill unveiled last year as well as the European Union Global Gateway strategy, a EUR 300 billion plan for worldwide investment in digital; climate and energy; transport; health; and education and research infrastructure. The unfolding geopolitical crisis and rising energy prices are also exacerbating the tensions surrounding infrastructure- building, making it a centrepiece of future global security.

In addition to the direct short-term impact on jobs and resource mobilisation, which make infrastructure spending a traditional component of any economic recovery plan, these major infrastructure initiatives also respond to the pre-pandemic necessities of updating transport infrastructure. These needs are linked to national ambitions of repositioning in the global economic landscape, to meet climate mitigation and adaptation targets, to enable economies to benefit from digitalisation and to ensure inclusiveness.

These will not be easy tasks. Approximately USD 2.6 trillion is required annually until 2030 to meet the Sustainable Development Goals (SDGs) and stay on track to a net-zero emissions by 2050, according to data from the International Monetary Fund (IMF) and the International Energy Agency (IEA) (IEA, 2021; IMF, 2019). This annual sum is equivalent to about 3% of current global GDP. Despite the commendable efforts implemented by many developing economies during and after COVID-19, their economic recovery and resilience plans mobilise fewer resources than advanced economies. Annual road investment in Mexico, for instance, is a tenth of the US, according to OECD data (stats.oecd.org), and investment gaps for developing countries in Africa are much higher.

Colombia has prioritised investing in infrastructure to “build back better”. The policy for economic reactivation and sustainable and inclusive growth (CONPES)² unveiled in 2021, includes short-term support measures to cushion the effects of the pandemic and sets long-term targets to increase preparedness for future shocks and to invest in more environmentally sustainable and inclusive growth, in line with the Agenda 2030. The plan encompasses a public-private partnership programme, the “New Commitment for the Future of Colombia”, leveraging a USD 135 billion stimulus plan approved by the government following COVID-19. It notably aims to foster the uptake of renewable energies, provide employment opportunities via assistance for housing, and deliver income support for the most vulnerable.

² <https://colaboracion.dnp.gov.co/CDT/Conpes/Economicos/4023.pdf>

Infrastructure, and in particular transport infrastructure, plays an important role in national planning and spending in Colombia. According to the National Planning Department (DNP) in 2022 the economic recovery plans included 26 transport projects including 13 roads, 5 airports, 5 railways and fluvial infrastructure reaching an estimated value of USD 13 billion. According to Invest in Colombia, the country will offer investment opportunities until 2035 in roads (worth approximately USD 60 billion), airport expansion projects (USD 5.7 billion), railway infrastructure rehabilitation (USD 3.4 billion), riverine infrastructure (USD 1.6 billion), and ports (USD 433 million) (Colombia Investment Summit 2021). The National Planning Department estimates that these infrastructure projects will contribute to national development by creating an estimated 635 000 new jobs. Efficiency is also expected to increase. For example, the Bogotá-Caribbean Coast corridor is expected to deliver a cost reduction of up to 50%.

The Colombian Road and Investment Programme is not only an infrastructure plan; it aims to address social inclusion and national equity across all communities. The plan foresees the building of more than 150 000 km of rural roads, 47 000 km of secondary roads and 16 000 km of primary roads. The uncertainty and risk associated with rural road projects is estimated at 10 times that of primary roads, due among other things to remoteness, geological challenges and lower revenue generation predictability. Connecting rural areas is crucial to ensure social stability and cohesion, especially for a country like Colombia, which has faced a major pacification process in the last decade. Connecting people living in remote areas will not only increase productivity but will help build a unified country with equal access to opportunities (OECD/UN/UNIDO, 2019).

In implementing its transport infrastructure projects, Colombia, as well as most other Latin American countries, will need to meet its National Determined Contribution (NDC), the commitment made by every country to tackling climate change, as agreed at the 26th UN Climate Change Conference of the Parties (COP26) in Glasgow in 2021. Among other things, this includes a commitment to reduce greenhouse gas emissions by 51% in 2030 compared to a baseline scenario, to reduce black carbon by 40% compared to 2014 levels, and to achieve carbon neutrality by 2050. Transport infrastructure will play an important role in achieving the NDC given the carbon intensity of transport, road transport in particular.

The updated transport infrastructure should ensure a reduction in emission levels for people and cargos and be resilient to climate change, for example by ensuring no disruptions during storms. Climate resilient infrastructure will also allow Colombia to pilot and benefit from innovative financing mechanisms such as guarantees to mobilising private sector investment, blended finance facilities for critical state-owned enterprise investments, regional platforms to finance new climate initiatives, and risk sharing to develop local currency finance ecosystems.

The Colombian Road Investment Programme will play an important role in sustaining economic recovery and in ensuring future resilience. Achieving efficiency in planning and implementing the update of transport infrastructure, taking into account the differences of primary and rural roads will be pivotal in a context of limited public spending capacities and growing investment needs.

International good practices offer a number of relevant tools. Mindful of the importance of improving infrastructure, the international community has developed various principles and tools to help countries strengthen their infrastructure planning and implementation capacity, including the G20 Principles on Quality Infrastructure Investment (Box 1). A key issue is also to effectively manage the procurement strategy of major infrastructure projects which involve several key decisions, each of which needs to be made correctly in order to avoid cost overruns and delays and other issues. The OECD has developed an evidence-based tool to inform procurement decisions on major projects, the Support Tool for Effective Procurement Strategies (STEPS) which can be useful for Colombia (Box 2).

Box 1. Tools and principles for ensuring quality infrastructure investment

- OECD's report *Getting Infrastructure Right: A Framework for Better Governance* lays out governance tools to help policy makers improve the management of infrastructure policy, based on 10 dimensions for how governments prioritise, plan, budget, deliver, regulate, and evaluate infrastructure investment (OECD, 2017).
- In 2019 the G20 endorsed the G20 Principles for Quality Infrastructure Investment, under the presidency of Japan. In these Principles, strengthening infrastructure governance is embraced as one of the six principles to promote quality infrastructure investment based on the shared recognition that "sound infrastructure governance over the life cycle of the project is a key factor to ensure long-term cost-effectiveness, accountability, transparency, and integrity of infrastructure investment" (Ministry of Finance of Japan, 2019; OECD, 2020). The G20 Principles are to: 1) maximise the positive impact of infrastructure to achieve sustainable growth and development; 2) raise economic efficiency in view of life-cycle cost; 3) integrate environmental considerations in infrastructure investments; 4) build resilience against natural disasters and other risks; 5) integrate social considerations in infrastructure investments; and 6) strengthen infrastructure governance (Ministry of Finance of Japan, 2019).
- The IMF's Public Investment Management Assessment offers a comprehensive and systemic assessment that allows for comparison of infrastructure governance across countries (IMF, 2015; IMF, 2018).
- The World Bank has developed a framework for assessing public investment management, which helps countries evaluate the strengths and weaknesses of public investment management practices through eight "must-have" features (Rajaram et al., 2010).

Box 2. STEPS: The OECD Support Tool for Effective Procurement Strategies

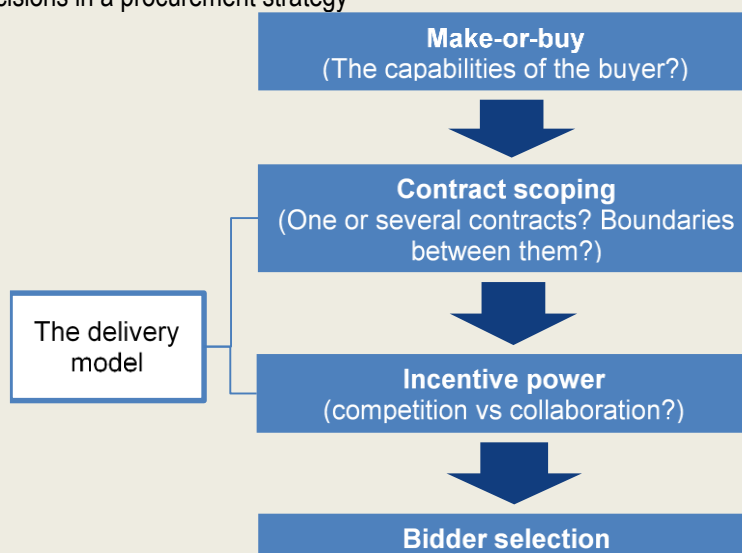
Used in two major road projects in Norway, STEPS can improve the efficiency and effectiveness of public procurement of infrastructure and beyond and can improve value for money in both traditional and privately financed infrastructure projects (OECD, 2021b). It is also an effective tool against bid rigging, the effects of abnormally low bids, and corruption in public procurement. Because the procurement choices of the public sector affect the market structure of the infrastructure supplier market, it could be considered an instrument of implicit market regulation, working against market concentration. STEPS thus supports a range of OECD recommendations and G20 positions on infrastructure governance, private investment in infrastructure, and procurement in general (OECD, 2021b).

STEPS (Figure 1) calls for decisions to be executed in order to ensure a large enough number of bidders and to allow bidders to allocate the correct level of risk to each project on its merits, rather than applying a one-size-fits-all approach. Many existing approaches for informing procurement strategy rely on subjective judgement or do not cover the complete scope of the procurement strategy. STEPS is the first method available to help inform these decisions in an evidence-based way. It is thus an advance on previous methods. An effective application of STEPS can substantially reduce the cost of

infrastructure without increasing conflict between supplier and contractor or reducing innovation potential.

Figure 1. The Support Tool for Effective Procurement Strategies (STEPS)

The sequence of decisions in a procurement strategy



Source: OECD (2021a), "OECD Implementation Handbook for Quality Infrastructure Investment", <https://www.oecd.org/finance/OECD-Implementation-Handbook-for-Quality-Infrastructure-Investment-EN.pdf>.

STEPS can be applied to any product or service that requires customisation and cannot be bought off the shelf, such as infrastructure, defence projects or industrial plants. It is intended for application after the project appraisal phase is complete and before any procurement related activities begin, including market engagement. Its application requires that at least an outline design of the project be available. It is most effective when an initial detailed risk analysis is made beforehand, something that is part of standard project risk management and should be done regardless.

2. Colombia is looking to update its transport infrastructure financing model

During most of the 20th century, infrastructure investment around the world relied on governments using tax revenues to finance design and construction, operation and maintenance. Although design and construction could be procured through competitive tenders from private firms, the traditional model relied on government investment, ownership and operation after the completion of construction.

During the 1990s, in line with the emergence of the Washington Consensus and privatisations, and as well as a response to limited public funding capacities, several countries in Latin America and elsewhere started to increase private sector involvement in the financing, delivery and operation of infrastructure (IDB, 2020). This was a response to the primary challenge of the traditional model – the limits on government finance. A large variety of public-private arrangements for infrastructure provision ensued, including private fees or taxes, private financing versus public financing and public ownership with private operation and management.

In Colombia, road transport infrastructure has attracted considerable private investment since the 1990s, following the approval of Law 80 in 1993, which established the general principles of public contracting. The first generations (1G, 2G and 3G) of private Colombian concessions were launched throughout the 1990s according to those guidelines. Since then, concession contracts and public-private partnerships have been key to attracting private capital to Colombia for the rehabilitation, maintenance, conservation and construction of the different means of transport. Although Colombia introduced some modifications in concession regulations to limit the transfer of risks between the public sector and the concessionaire, the participation of the private sector in Colombian roads has been considered successful by international standards.

Since 2012, the main model used in Colombia for road concessions has been the public-private partnership (PPP). These contracts commonly take the form of design-build-finance-maintain-operate. The contract gives the successful private consortium responsibility for all aspects of project construction, financing, delivery and operation, for periods often spanning decades. The contract sets out how the consortium receives revenue: either from the government in the form of periodic payments, and/or direct from users.

The Government launched the first wave of 5G projects as a strategy for post-COVID economic recovery while completing key corridors for Colombia's foreign trade and to connect the north and south of the country with multimodality services. By mid-2022, the fourth generation (4G) road infrastructure programme had progressed by nearly 60%. Challenges for the authorities in coming years include finishing the 4G roads, starting the 5G projects including rural roads with poor users and low payment capacity, and completing the roads of the 1G projects as the concession terms end in the coming years.

In addition to increasing public funding for infrastructure, it is important to mobilise private investment. Attracting private capital to infrastructure can be challenging because capital expenditure is high, costs are significant and life cycles long (ITF, 2018a). Moreover, infrastructure investment is complex and can involve risks which only become clear over the lifetime of the asset (OECD, 2021b). The difficulty in quantifying risk is a central challenge for PPPs. Potential risks include exchange rates, natural disasters

and the reputational risks for both private companies and public institutions. It is generally accepted that transferring risk to a risk-averse private party will incur a premium, with the size of such premium depending on the level of risk aversion and the degree of competition. The availability of information is also key. The heterogeneity of contracts and project scopes means that the pricing performance history that could enable quantification of risks has not always been available to bidders or governments. Asset diversification is also difficult when risks cannot be clearly identified, because market actors are unable to identify assets with imperfectly correlated returns. This can discourage bidders or cause them to levy excessive premiums, inflating overall project costs (IMF and World Bank, 2019).

PPP features such as bundled contracts, long contract periods, multiple numbers of stakeholders, the determination of specifications, technical requirements and financial structure arrangements make the PPP procurement process particularly complex. A critical requirement for PPP models is that investors and suppliers accurately price risks associated with the project. In any context this is difficult, but it is particularly so in Colombia due to the dispersed nature of the country and the infrastructure requirements in isolated rural areas. Efficient risk pricing is crucial as it affects overall costs, freeing up funds for use elsewhere. Exploring options to reduce risk pricing is a priority for Colombia.

Insufficient bid offers may indicate that investment is premature, for instance because of too many uncertainties over construction costs or difficulties in determining toll revenues. The most common response is to wait for more information, attracting more bidders in order to increase competition although this delays the project. Competition authorities may also be able to improve competition during the auction process to ensure that concessions attract enough investors and to prevent collusion. They can ensure transparency, so that bidders know and understand the processes by which contracts are awarded, implying that the award criteria are clearly and objectively defined and that award process records are easily accessible. A competition authority may also improve outcomes by using discretionary powers to exclude dubious providers *ex ante* and/or punish opportunistic suppliers *ex post*.

Inadequate maintenance increases lifetime costs while also reducing benefits. Preventative strategic maintenance is an efficient way to reduce the overall cost of a road, as it is more cost effective than allowing quality to degrade until major rehabilitation work is needed. Strategic preventative maintenance encourages predictable and regular maintenance works, resulting in improved asset quality and reduced long-term rehabilitation and reconstruction costs. Digital technologies can play an important role in this respect as the experience of the Ministry of Land, Infrastructure, Transport and Tourism of Japan shows (Box 3).

The user-fee PPP model bundles construction and ongoing maintenance into a single contract that gives the company the right to receive user fees. This model incentivises the private company to build the asset to a high quality upfront, reducing the need for maintenance and resulting in a lower whole of life cost of the asset. The private party then faces a strong incentive to carry out adequate maintenance because its revenue depends on user fees. The operator has an incentive to make sure the asset meets performance requirements and attracts users. However, the incentives for good maintenance may be limited in some critical circumstances. For example if the contractor does not have much equity in the project, it may walk away rather than spend on costly maintenance. Towards the end of the contract, there is no incentive for investment when the contractor knows it will not reap the benefits. Well-designed contracts require specific clauses for maintenance on the final phase of the concession. Well-designed PPPs must also ensure that government, and therefore taxpayers, do not bear too much of the overall risk, leaving the private contractor to make excess profits at the expense of users and the public.

Transportation authorities face a growing backlog of road repair, maintenance and reconstruction needs on many key sections of the road system. Most sections often serve high traffic levels and cannot be shut down for rehabilitation or reconstruction without causing major disruptions for road users and adjoining communities. Innovations in construction, materials, equipment, and construction traffic management can

help reduce the need to close highways for extended periods of time, thereby avoiding inconvenience and delays for road users, major community disruption, and economic loss.

Box 3. Using cutting edge technologies for strategic preventative maintenance: The experience of Japan

In Japan, the Ministry of Land, Infrastructure, Transport and Tourism (MLIT), in charge of national land planning, infrastructure development, maintenance, and international co-operation in infrastructure development and disaster countermeasures, is aiming to increase the life of infrastructure by focusing on preventative maintenance and harnessing cutting edge technologies, as included in the Action Plan for Life Extension, launched in 2014 by MLIT to respond to pressing issues of aging infrastructure in Japan.

Preventative maintenance consists of the strategic use of actions towards infrastructure improvement and maintenance before deterioration leads to failure, avoiding or delaying the massive use of resources and machinery involved in its reconstruction. Extending the project life cycle is not only cost-efficient, but also minimises fatalities and injuries caused by failures and their social and environmental impact. It is estimated that “preventative maintenance”, instead of “reactive maintenance”, could reduce the estimated costs of infrastructure (e.g. transport and dams) by approximately 30% over the next 30 years (MLIT, 2018). To do so, infrastructure projects managed by MLIT make improvements at regular periods before the emergence of failures or accidents to prolong the life of a structure. For instance, the Tokyo Gate Bridge, which entered service in 2012, employs about 50 fiber-optic sensors that are resilient against dust and thunderbolt to produce approximately 2 800 data points per second, with a view to monitoring the conditions of the bridge and the early detection of failures. This has led to higher efficiency and lower cost of monitoring (MLIT, n.d. a).

Japan is reaping the benefits of advanced technologies in preventative maintenance. For example, some MLIT-managed projects use monitoring technologies that replace the use of inspection cars and rope access methods for drones, infrared cameras, and deformation detection systems, which constitute more efficient, effective and safer maintenance techniques. For instance, Hanshin Expressway, connecting between Osaka-city and Kobe-city as well as its surrounding areas, is regularly monitored with infrared cameras that detect cracks in metals beneath the pavements at early stage without removing the pavements. After detecting abnormalities, a flaw detector using electromagnetic induction identifies specific points of detection, and ultrasound phased array examinations confirm cracks in metals beneath the pavement (MLIT, n.d. b). MLIT is also proactive in the development and diffusion of new relevant technologies in partnership with the private sector and other government stakeholders and academia. MLIT, for example, co-operates with the Advanced Construction Technology Center established as a non-profit under the guidance of MLIT to conduct R&D and assessments of new technologies, disseminate knowledge and act as an interface between stakeholders.

Source: Presentation at the IITF meeting on “Building the Future: Infrastructure for Recovery and Transformation – Spotlight on Colombia: What options and contractual arrangements to build and pay for the infrastructure of tomorrow?” organised on line by the OECD Development Centre and the National Planning Department of Colombia on 26th April 2022 and additional research.

Alternatives to PPP can deal with several of their shortcomings, including reducing risk pricing under appropriate conditions. One option is the Regulatory Asset Base (RAB) model, under which private or state-owned enterprises act as the infrastructure manager, owning, investing, and operating infrastructure assets. A key feature of the RAB model is that to perform effectively it needs a regulatory agency. The

infrastructure manager receives user fees and/or public payments to fund its operations and recoup investment costs. The main advantage is considered to be the pooling of assets, which spreads risk across a large number of roads and smooths the flow of user fees. It also creates a recognised asset class, greatly increasing the number and variety of potential investors. Project value is also clearer, reducing the need to build in an excessive risk premium, something which is important in Colombia. A main feature of this model is that the economic regulator should maintain the financial capital values, but at the same time consider realistic replacement value for old assets (Makovšek and Veryard, 2016).

Government capacities are needed to effectively use RAB. An effective economic regulatory institution is critical, ensuring reregulation and cost supervision, and ensuring that prices are set competitively. Otherwise the infrastructure manager has an incentive to behave like a natural monopoly, setting monopoly prices and failing to undertake maintenance. Regulatory institutions take time to build and may be difficult in Colombia. An effective regulatory institution could, for example, be prepared to cancel award of concessions due to insufficient competition, something which can work well in a competitive market, such as port container terminals. If, however, the number of bids is limited because potential bidders have stretched balance sheets, then postponing the concession may be inappropriate.

If it considers the RAB model, Colombia may wish to evaluate its efficiency relative to PPP models by undertaking and comparing a RAB pilot project with its PPP equivalent. PPP models ending their concession terms in the coming years are a good option for experimenting with new alternatives because the cost implications are lower and the consequences of any changes have fewer repercussions.

3. Updating Colombia's transport infrastructure model: 5 factors to take into account

The OECD (2015) identifies the factors required to support public investment in infrastructure including institutional capacity, public procedures, institutions and tools and calls for the development of a coherent and integrated framework for infrastructure planning. In going forward, the OECD three-step process is useful in streamlining options based on sectoral, country and project criteria:

- Set a preferred sectoral approach by assessing reform objectives and the characteristics of the sector.
- Assess country circumstances that may impact the sector, such as government and private sector capacities and the enabling legal environment.
- Choose a delivery model based on the project characteristics and overall approach.

In particular, when choosing the transport infrastructure building model Colombia could pay particular attention to the following factors:

1. **Be outcome-driven.** Choose the model that best fits the ultimate goals of the project. Colombia should choose the model most appropriate to its particular circumstances and based on the outcome that it wants to achieve [which transport infrastructure needs to be built and for what?]. For example, RAB is less suited to rural roads and small projects, as the model fits best large-scale projects for which it was initially conceived.
2. **Factor in government capabilities, at the national and local level.** Country context and government capacities are paramount. For example, for Colombia to effectively use the RAB model a regulatory authority would need to be developed and significantly adapted. This process takes time and appropriate resources. The country could start with a pilot approach, comparing a RAB project with a PPP model and assessing the relative efficiency of the two approaches. Public procurement capacities also need to be quite sophisticated and information and price transparency are critical. Solid metrics are important in making objective performance assessments, improving the application of incentives in the contract. Strengthening capacities at the local level is also highly important for Colombia especially in the case of transport infrastructure. Investing in capacity building in project formulation and implementation at the local level is necessary. In the United States, for example, the Build America Bureau was set up in 2014 in the US Transportation Department to strengthen the country capacity across the nation to set up viable infrastructure projects; the Bureau implements mechanisms to strengthen project formulation and structuring capacities at the local level, including learning how to partner with universities and consultants for project development (Box 4).
3. **Maximise community buy-in.** Ensuring positive participation is imperative in a country which expects to build more than 150 000 km in rural roads in coming years. Local communities should be brought to the table early in the process, involved and listened to in an attempt to discern needs

and desires. Ensuring community buy-in should be part of the mandate of infrastructure building authorities. The Build America Bureau offers interesting examples of mechanisms for effective stakeholder consultation in infrastructure building.

4. **Consider technology transfer and local industrial development.** Technology transfer is one of the main advantages of foreign investment in infrastructure. Foreign firms can contribute to bring innovations in transport infrastructure but can also, if properly managed, open up opportunities for learning and local innovation, as well as for building local capacities for strategic preventative maintenance. The use of innovative digital technologies in infrastructure projects could help transport infrastructure not only to be built in a forward-looking way, but also to make maintenance more effective and to increase local technical and innovation capacities. The transport infrastructure authority can play an important role in ensuring that innovative solutions are incorporated into the project, building local capacities. It is important to focus on innovative activities that local people may know how to use with limited or without foreign technical support.
5. **Explore innovative and sustainable financing options.** Colombia could explore innovative financing mechanisms for roads, taking into account climate-change related objectives and bearing in mind the carbon-intensity of road infrastructure, as well as exploring innovative financing for transport infrastructure that enhances social cohesion (Box 5). Matching transport infrastructure needs with climate change mitigation and adaptation needs could allow countries to tap into new financing sources. For example the Green Climate Fund under the UN Framework Convention on Climate Change (UNFCCC) offers USD 50 billion over 2020-25. Making transport infrastructure resilient to climate change and acting on climate change mitigation and adaptation is a priority for the country. Access to financing should be enhanced to allow the country to meet its sustainability objectives. Another possibility is a new impact finance tool modelled on green finance, the Road Safety Bond. The first such issuance was a Georgian lari 31 million (USD 11.2 million) two-year Sustainable Development Bond issued by the World Bank in December 2021.³ Colombia could also consider exploring innovative financing mechanisms such as those implemented by the Build America Bureau to attract financing at the local level bundling together projects of small territorial entities for infrastructure maintenance and operation.

Box 4. Fostering infrastructure building across a whole nation: The Build America Bureau

Build America Bureau, launched in 2014 by the US Department of Transportation, aims to support viable, shovel-ready infrastructure projects, bringing together a range of stakeholders with an emphasis on stakeholder engagement.

In its support for transportation infrastructure development, Build America Bureau helps speed up access to various loan and grant programmes and make them more transparent. It also provides technical assistance and best practices in project planning, financing, delivery, and monitoring. The Bureau brings communities to the table early in the process, involves them and listens to them in an attempt to understand community needs and desires and balances them with national objectives.

The Bureau has an approximately USD 110 billion lending capacity. It made approximately USD 12 billion in loans in 2021. Loans are of long duration, low-cost and flexible, with the option of an initial payment holiday of five years after project completion.

³ <https://www.worldbank.org/en/news/press-release/2021/12/20/world-bank-issues-sustainable-development-bonds-while-raising-awareness-for-the-importance-of-road-safety-in-developing->

The Bureau works closely and co-ordinates with states, municipalities, and other project sponsors that wish to use federal transportation expertise; apply for federal transportation credit programmes; and explore ways to access private capital in public-private partnerships. Build America Bureau aims to create more eligible projects via educational outreach and technical assistance to potential borrowers in using various programmes, helping them fill market gaps by leveraging local and private co-investment. The Bureau also aims to diversify the range of eligible projects by geography, size and type to ensure an equitable distribution of benefits.

Source: Official information from www.transportation.gov/buildamerica/about.

Box 5. Financing for sustainable transport infrastructure: Lessons from the OECD

- Infrastructure projects are long-term, with sometimes changing ownership and uncertain revenue streams. Investors have a natural home bias when deciding on investment. This can become even more complicated when taking into account the need to ensure that infrastructure projects adhere to sustainable infrastructure standards which have uncertain cost implications.
- The OECD analysis on sustainable finance and infrastructure initiatives makes clear that while climate mitigation measures are relatively well covered, too few measures exist to address climate adaptation and resilience. For the transport sector, climate-related problems are a real concern. Adaptation and resilience are key areas that require careful consideration. Retrofitting transport networks to adapt to climate change and improving resiliency against disasters are important.
- A careful consideration of the development of road networks needs to be undertaken versus other forms of transportation, taking into account the accompanying fossil fuel that may be used, as well as local pollution and congestion.
- Balancing the need for roads and building over existing structures, and nature-based solutions should be an important approach to resiliency in all countries.

Source: OECD (forthcoming), The Landscape of Sustainable Infrastructure: Convergence of Standards and Data.

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