A new paradigm for road asset management

WORLD BANK GROUP
Transport

September, 25th 2024

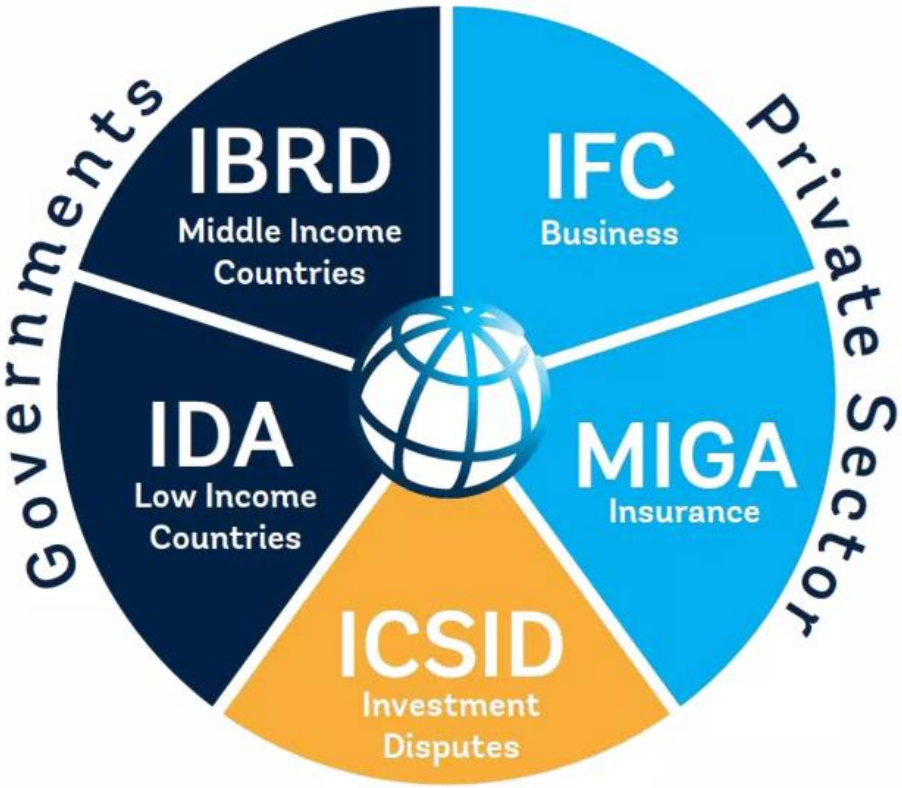
The Presenter: Eric Lancelot

- **Transport Engineer and Transport Economist**
- Joined the World Bank in **2005**
- Held positions as **Transport Specialist** for Latin America and Europe before joining West Africa as **Program Leader** of Infrastructure and Sustainable Development (2015-2019), then **Central America** (2019- 2023)

- **Lead Transport Specialist** at the World Bank Transport Unit of the **Latin American and Caribbean Region;**
- **Global Lead of the Safe and Resilient Infrastructure Knowledge Group** at the World Bank Transport Global Practice;
- Email: elancelot@worldbank.org

The World Bank Group - Who are we?

- **One of the world's largest sources of funding and knowledge for developing countries**
- Its five institutions share a commitment to reducing **poverty,** increasing **shared prosperity**, and promoting **sustainable development**



- **Vision:** to create a world free of poverty on a livable planet
- **Mission:** to end extreme poverty and boost shared prosperity on a livable planet

US$ 73 Bi
Lending in 2023

12,000
Projects

189
Member Countries

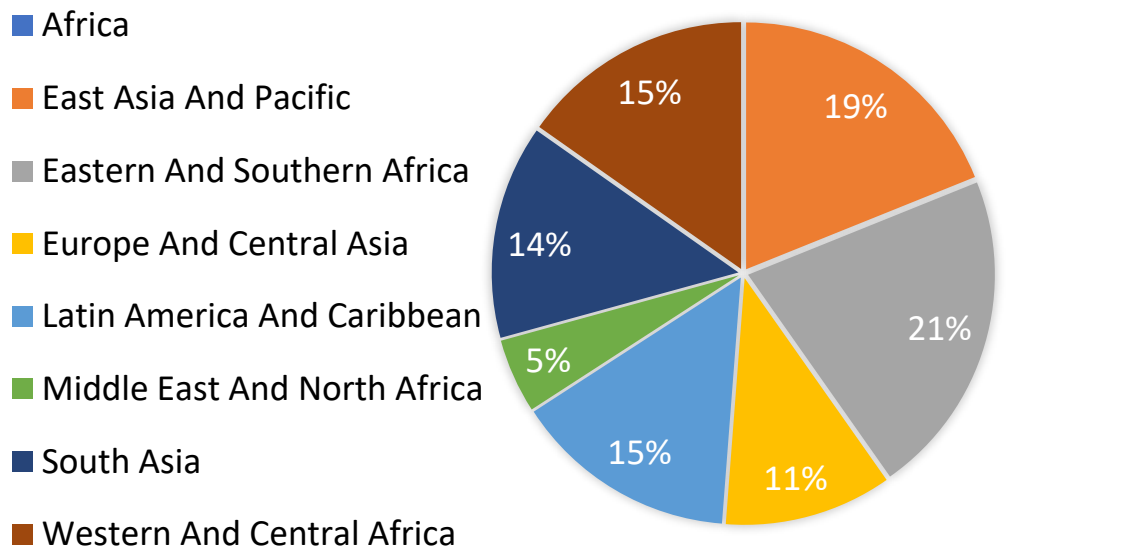
Our Core Values

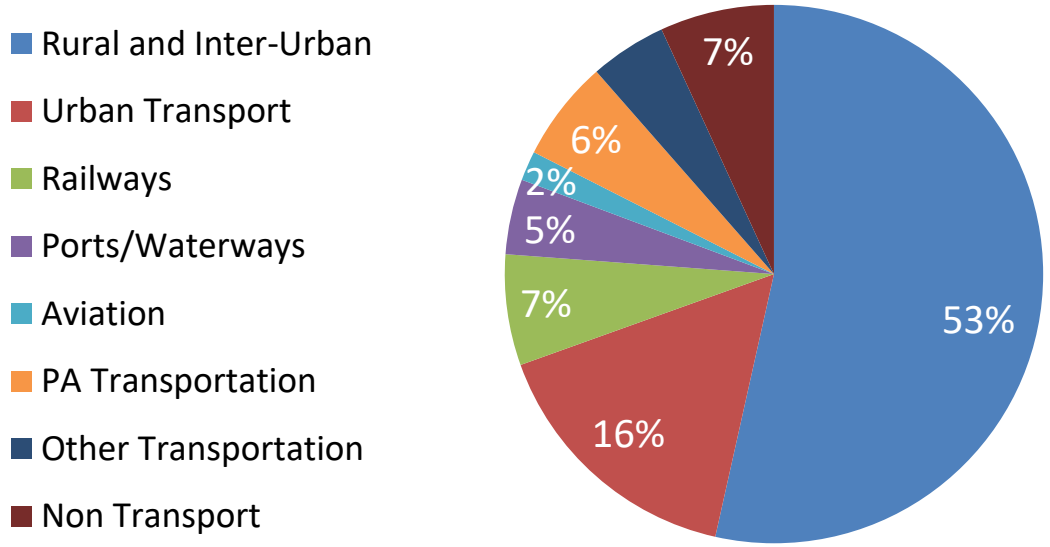
Impact | Integrity | Respect | Teamwork | Innovation

The World Bank Transport portfolio

Total WB Transport portfolio: 164 projects across 77 countries, USD $35bn in commitments

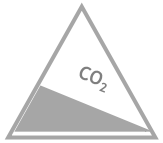
- **Eastern and Southern Africa (21%) and East Asia and Pacific (19%)** are the highest in commitment volume
- Overall, **roads** represent **half** (53%) of our portfolio





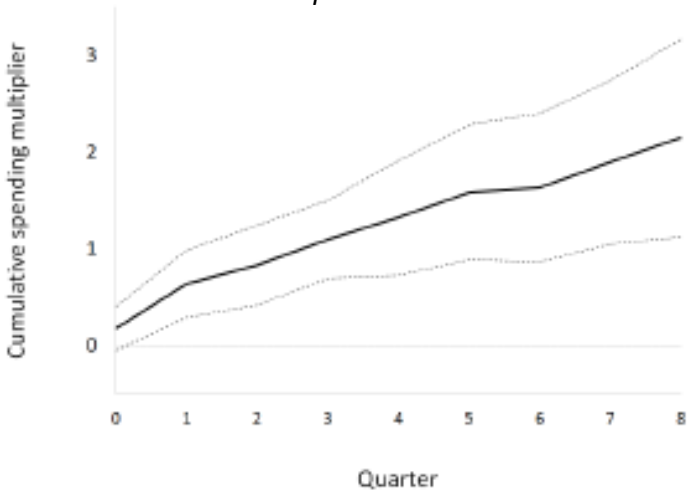
The case for road transport infrastructure

- Fundamental to **inclusion, growth and competitiveness** worldwide
- A **Global Public Goods**: largest immobilized public assets in most countries, generally built cumulatively across generations
- Road transport related activities are significant share of countries' **emissions**
- Road infrastructure are **exposed** to climate hazards and effects of climate change



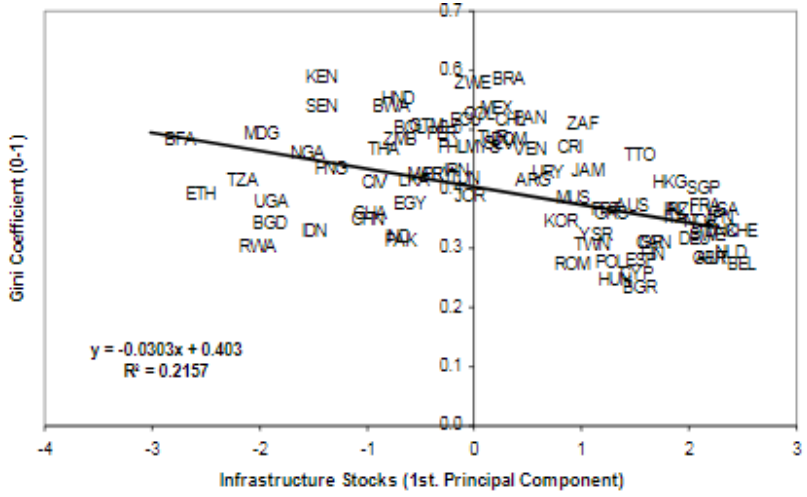
Effect of Public Investment on GDP

Evaluated at low ratio of initial stock of public capital to GDP



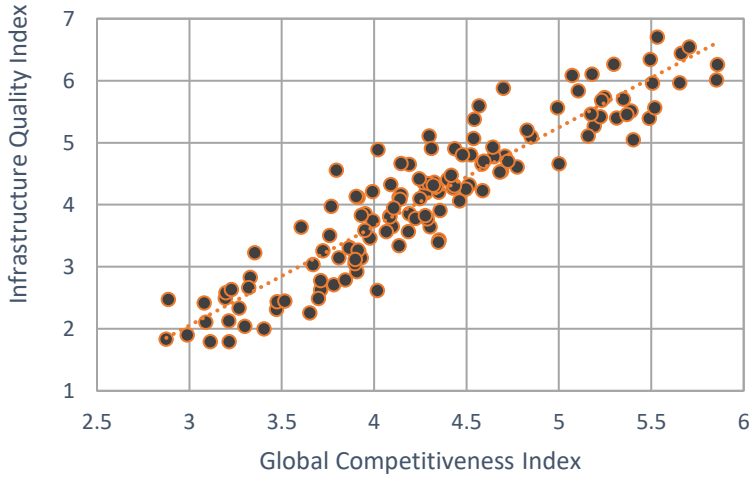
Evidence from European Countries. Evaluated at high, 95th percentile, and low, 5th percentile, initial stock of public capital over GDP ratios. Source: Izquierdo, A. et al. (2019). Is the Public Investment Multiplier Higher in Developing Countries? An Empirical Investigation. NBER

Infrastructure Stock vs Income Inequality



Source: Calderón, C. and L. Servén (2004) "The effects of Infrastructure Development on Growth and Income Distribution"

Infrastructure Quality vs Competitiveness



Source: World Economic Forum (2017). Perception-based infrastructure index

Road Asset – what are we talking about?

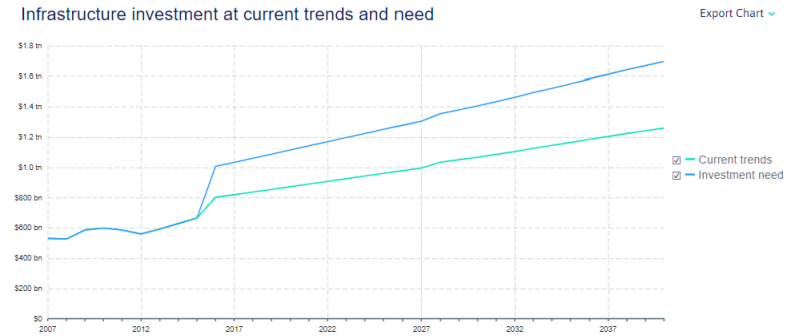
64 M. = 40 M. + 24 M.

Global road network (km) | Paved road network (km) | Unpaved road network (km)

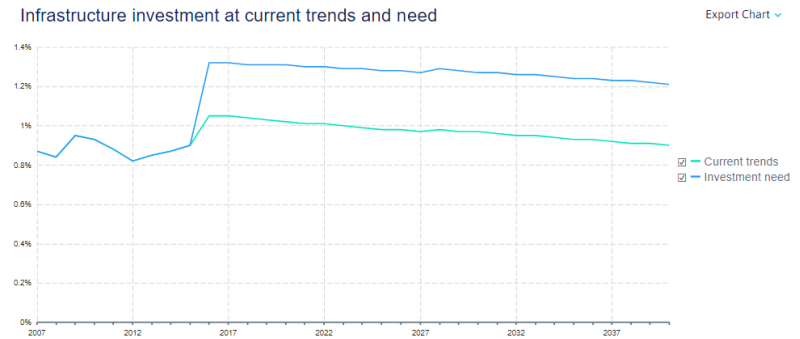
US$ 26 tn. (0.97% GDP) — Investment current trends

US$ 34 tn. (1.27% GDP) — Investment needed

US$ 8 tn. (0.3% GDP) — Investment gap



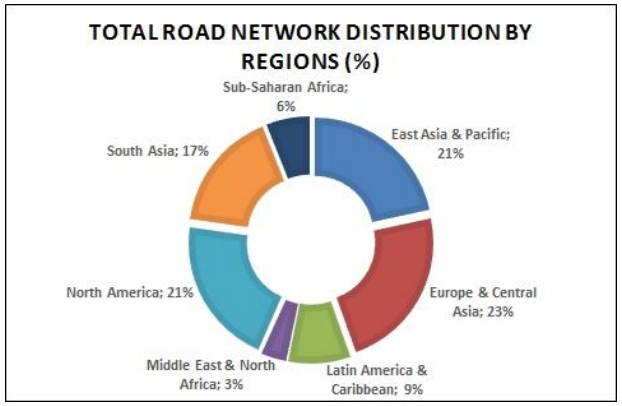
In US$



As a % of GDP

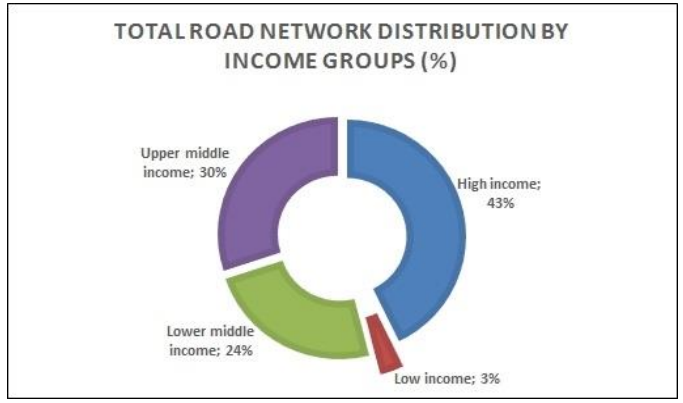
Total forecast road infrastructure investment gap. Source: Global Infrastructure Outlook

Road Asset – where are the road networks?

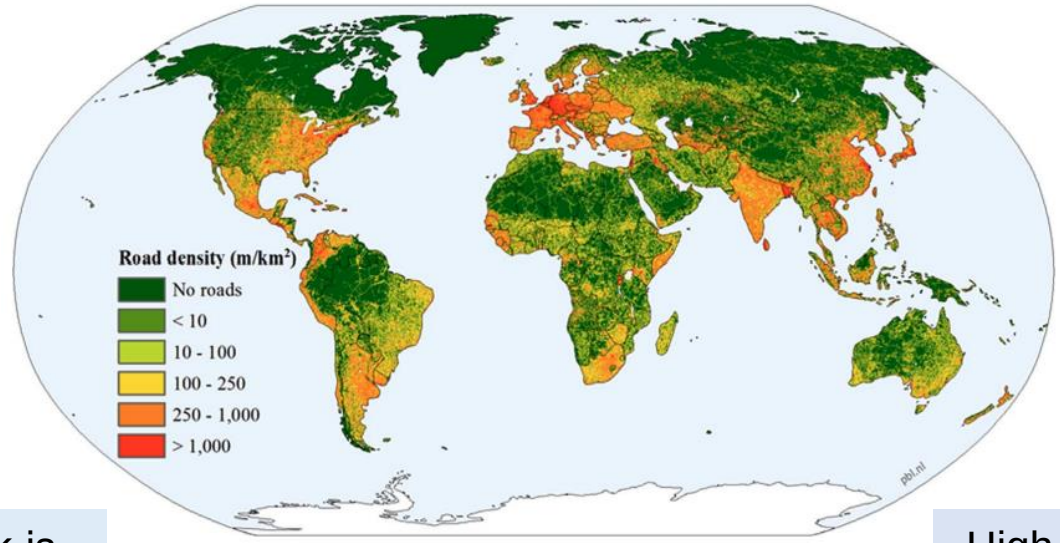


Source: IRF WRS 2018, latest year of available data for countries

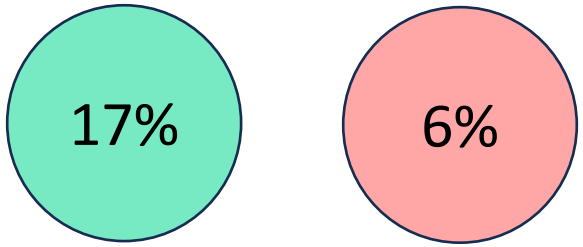
In **Africa, 43% of roads are paved**, of which 30% of all paved roads are in South Africa. This deficit in paved roads has been detrimental to building a modern economy as **80% of goods and 90% of people travel by road** (Center for Global Development)



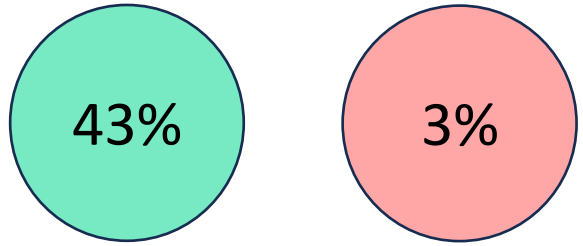
Source: IRF WRS 2018, latest year of available data for countries



Source: Global patterns of current and future road infrastructure. Johan R Meijer et al 2018 Environ. Res. Lett. 13 064006

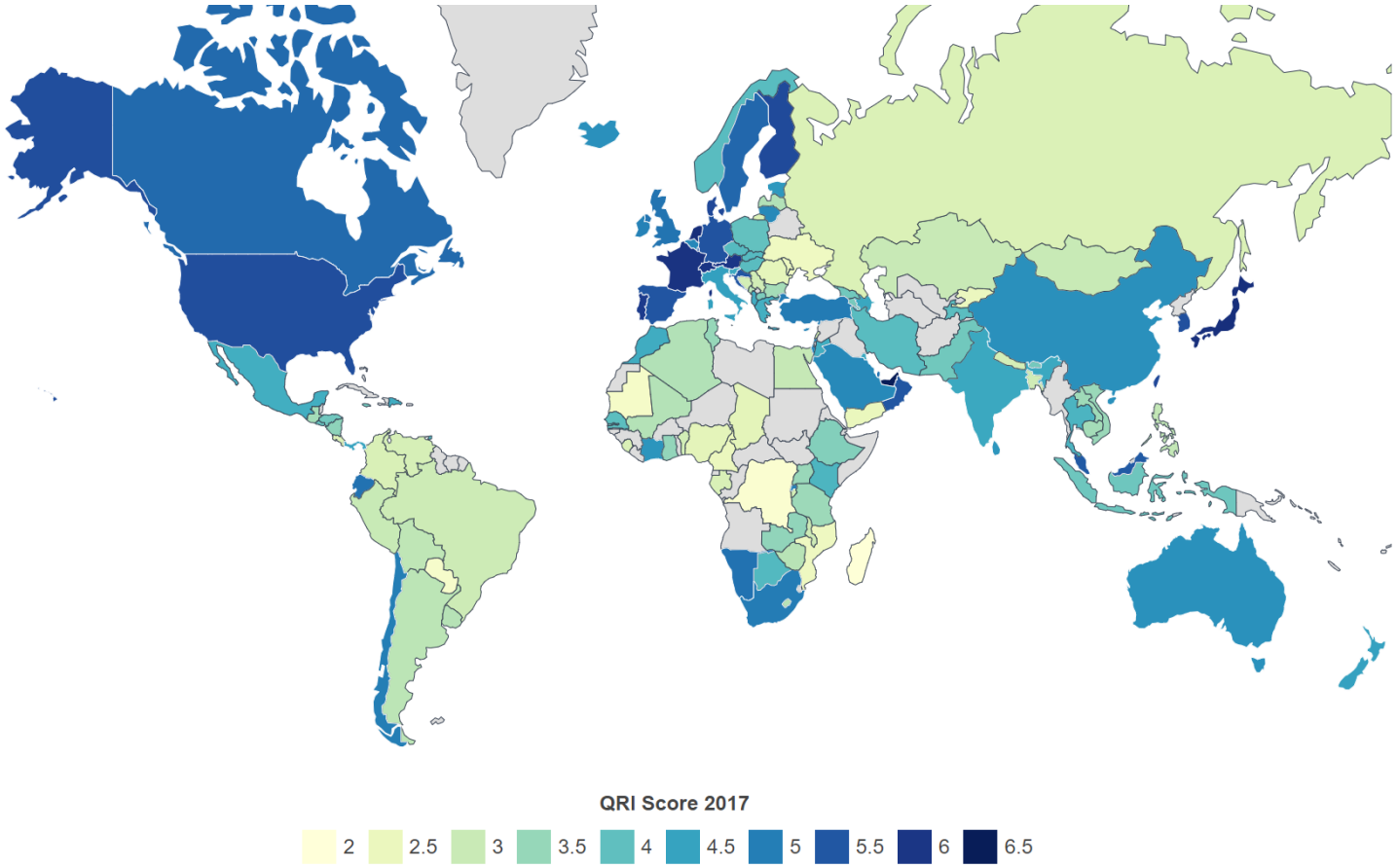


Sub-Saharan Africa's road network is just **6%** while representing **17%** of global land mass



High income countries account for **43%** of global road networks while low-income countries account for only **3%** of them

Road Asset – how good are the roads?

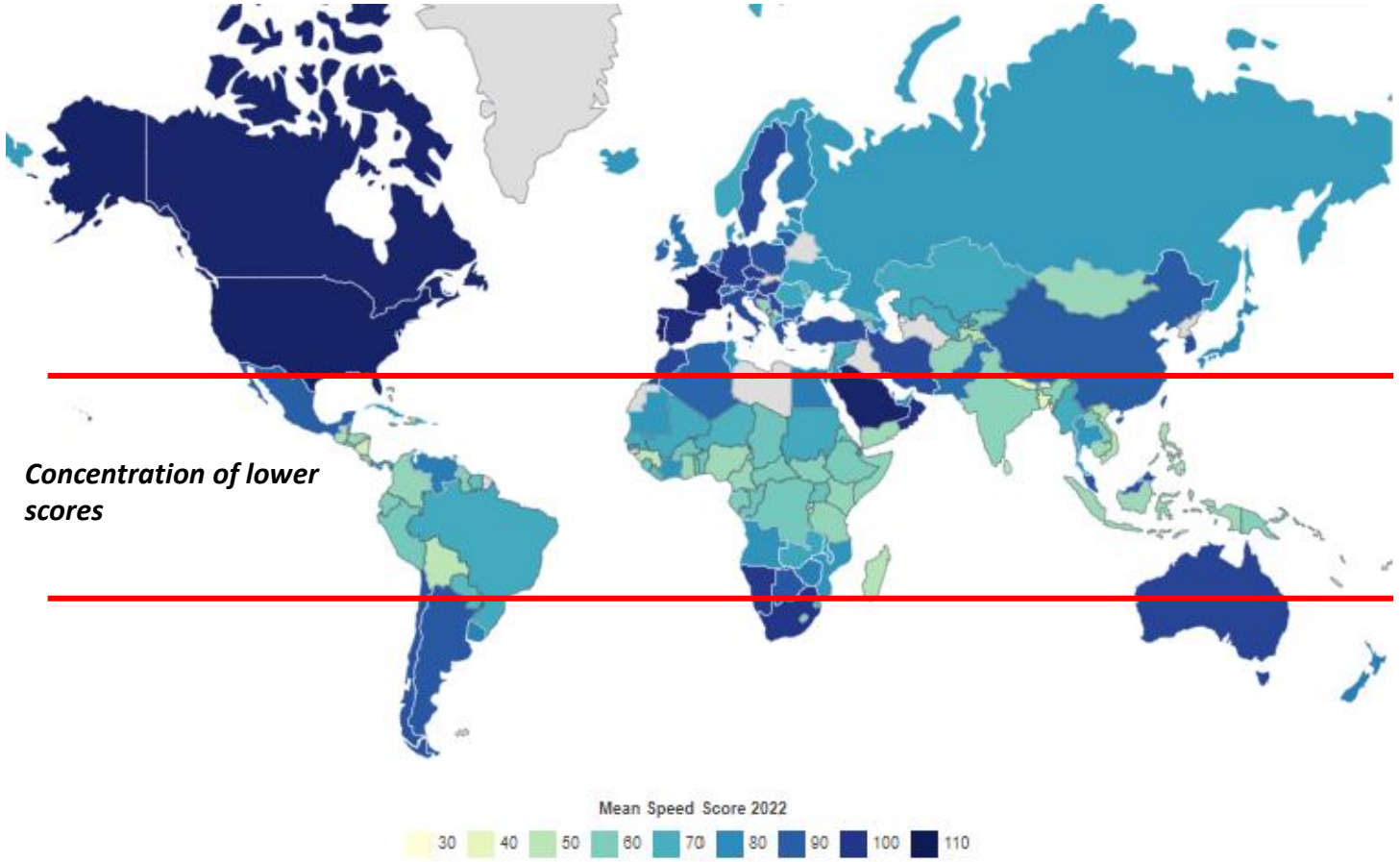


Quality of Road Infrastructure (QRI) score, by the WEF, is currently based on 2019 data from a survey of business leaders in **144 countries**, who were asked to rate the quality of roads on a scale from 1 (underdeveloped) to 7 (extensive and efficient by international standards)

Country	Roads Quality Index (QRI), WEF, 2019	QRI Score 2017	QRI Score 2015	Mean Speed Score 2022
Search... (165)	Min / Max	Min / Max	Min / Max	Min / Max
Singapore	6.45	6.28	6.05	
Switzerland	6.36	6.02	6	87
Netherlands	6.18	6.14	6.14	87
Hong Kong	6.06	6.16	6.04	
Portugal	6.05	5.91	6.34	106
Japan	6.02	6.12	5.92	81
France	5.96	6.05	6.17	105
Oman	5.96	5.51	6.01	102
United Arab Emirates	5.92	6.5	6.61	80
Austria	5.89	5.99	6.27	96
United States	5.87	5.61	5.69	107
South Korea	5.73	5.59	5.6	93
Spain	5.63	5.52	5.91	103
Qatar	5.6	5.14	5.03	82
Sweden	5.57	5.29	5.5	94
Denmark	5.55	5.71	5.43	78
Croatia	5.49	5.51	5.62	98
Taiwan	5.48	5.7	5.89	91
Germany	5.46	5.55	5.88	97
Malaysia	5.45	5.46	5.59	92

Top 20 countries by QRI in 2019

Road Asset – how well do roads connect?



Mean Speed Score (MSS), used by the IMF with the latest data of 2022, is a measure of cross-country road quality based on the travel time between large cities according to Google Maps. MS score correlates closely with the World Bank's Rural Access Index and the WEF's Quality of Road Infrastructure score

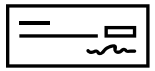
Country	Roads Quality Index (QRI), WEF, 2019		QRI Score 2017		QRI Score 2015		Mean Speed Score 2022	
Search... (165)	Min	Max	Min	Max	Min	Max	Min	Max
United States	5.87		5.61		5.69		107	
Canada	5.21		5.25		5.34		106	
Saudi Arabia	4.97		4.87		5.27		106	
Portugal	6.05		5.91		6.34		106	
France	5.96		6.05		6.17		105	
Spain	5.63		5.52		5.91		103	
Oman	5.96		5.51		6.01		102	
South Africa	4.27		5.03		4.93		100	
Namibia	5.09		5.15		5.2		99	
Czech Republic	3.95		4.1		3.7		98	
Croatia	5.49		5.51		5.62		98	
Germany	5.46		5.55		5.88		97	
Australia	4.77		4.76		4.75		96	
Hungary	3.89		4.06		4.25		96	
Austria	5.89		5.99		6.27		96	
Italy	4.39		4.55		4.26		95	
Morocco	4.48		4.36		4.46		95	
Iran	3.91		4.07		4.09		94	
Sweden	5.57		5.29		5.5		94	
Serbia	3.43		2.91		2.93		94	

Top 20 countries by MSS in 2022

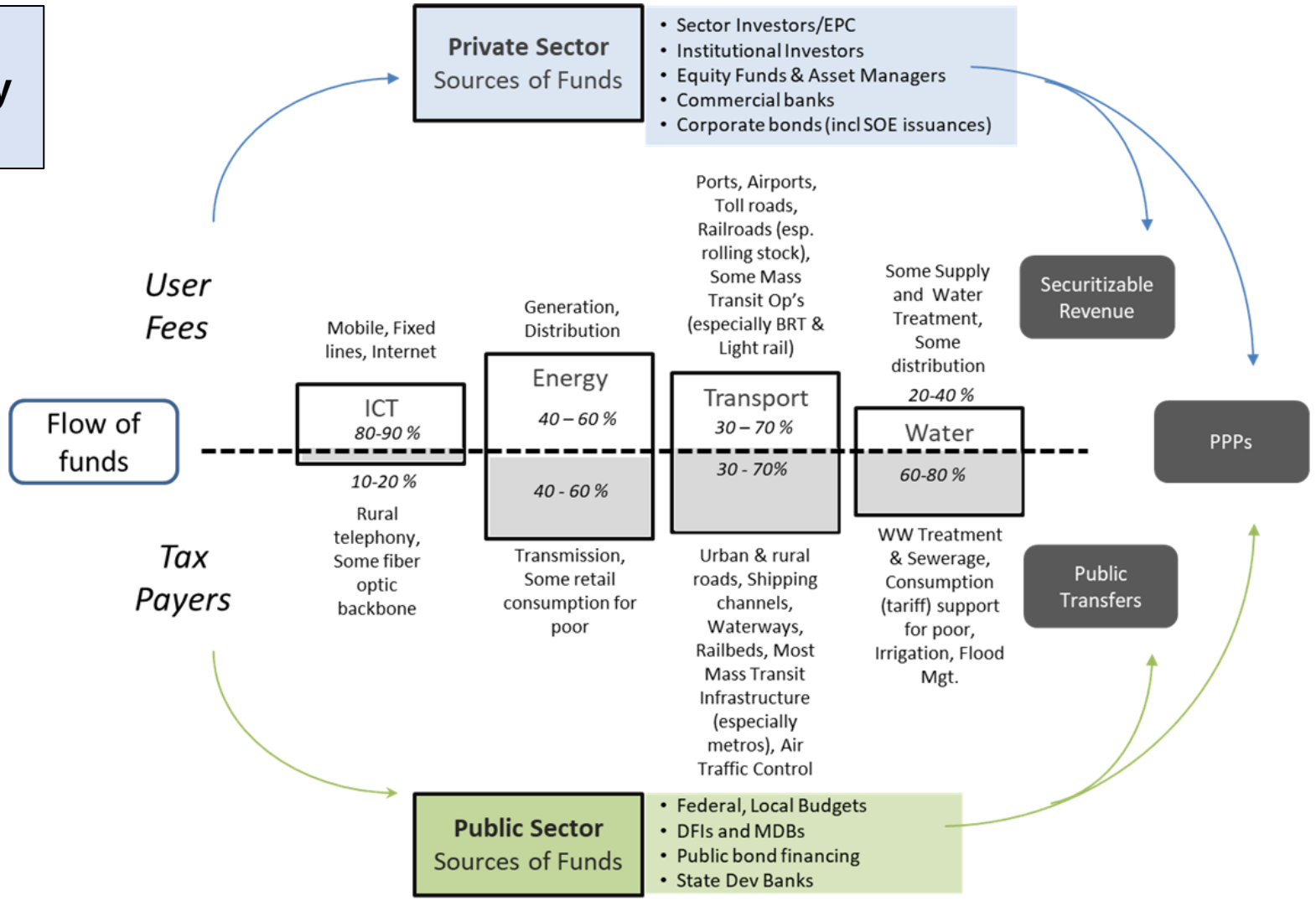
The potential for self sustained toll roads … myth and reality

User fees cover 20-25% of infrastructure funding. **Above 50% may not be not realistic**

- **Some infrastructure sectors have high capacity to be funded** with user fees and attract the private sector; **others** with high social benefits and externalities **do not**



- **Infrastructure investment is cyclical** in many countries, but it is needed for economic growth and job generation



Road asset Management

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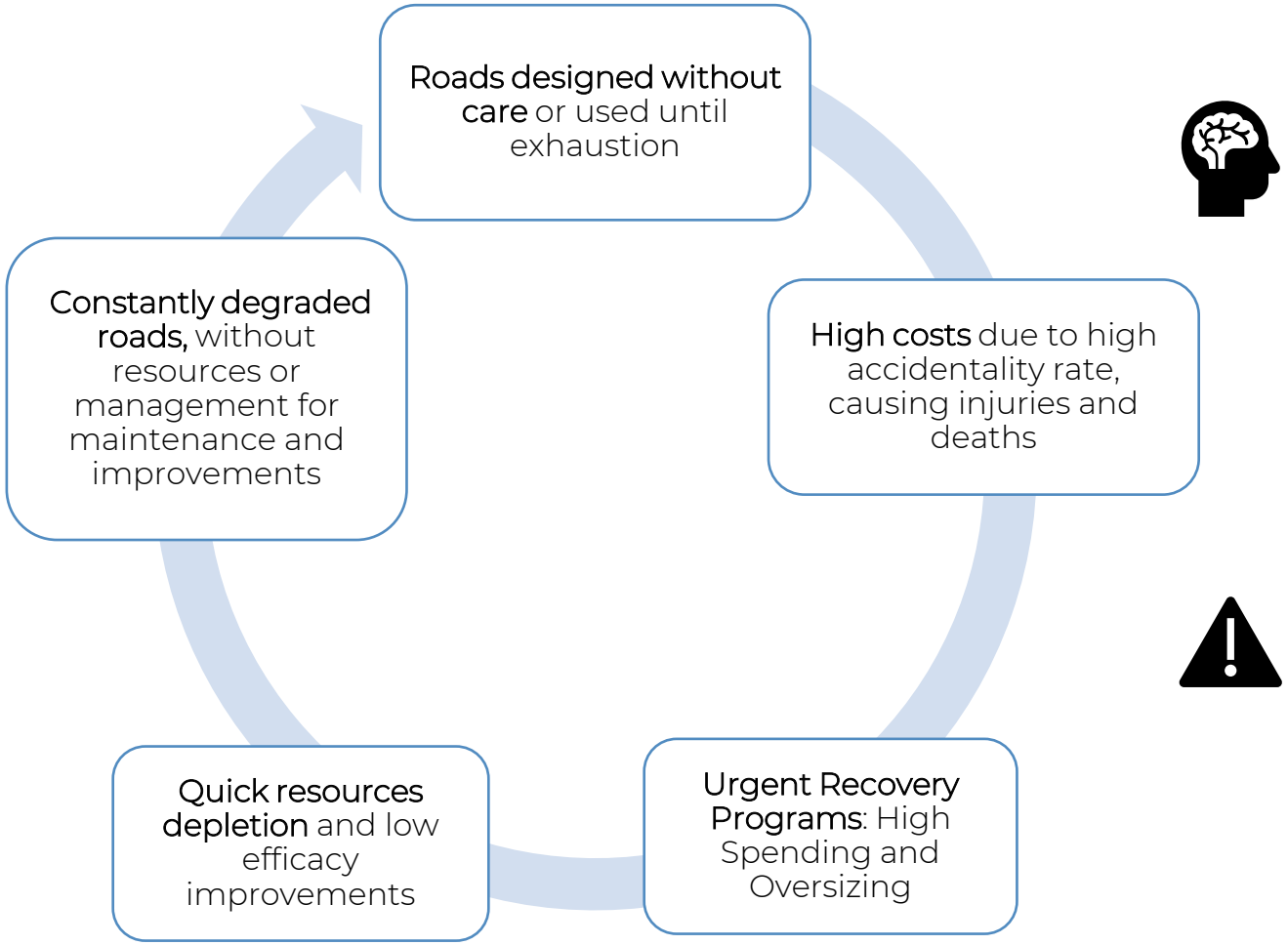
Why is it important?

While large investment programs are welcome, the focus should be on finding sustainable and consistent strategies for road maintenance over the long term



Breaking the vicious circle

- **Rethink the approach** to road asset management:
  - ❑ **long-term consistency** of management policies
  - ❑ greater **transfer of responsibility** to the private sector

=> Absolute priority on maintaining infrastructure and establishing sustainable financing mechanisms on one side and improving the efficiency of **public spending** on the other side, thus achieving greater **fiscal efficiencies** for governments

Road Asset Management – opportunities and impacts

Improving road infrastructure management can have **significant impacts** on:

1. **Inclusion** – improving **access** to services, jobs and markets, and **connecting** people

2. **Growth & Competitiveness** – reducing the **cost of operation of vehicles, logistics costs** and **time lost** in transport, increasing **national competitiveness**

3. **Countries' Fiscal** – improving **efficiency** of expenditures in the sector (20-50%), usually a **high** share of the nations' budgets **spending**

4. **Private Capital Mobilization** – contributing to further optimize countries' fiscal: **with tolls**, less is required from tax-payers; **without tolls**, private capital can bridge the financing needs

5. **Climate Change** – improving **resilience** and reducing **emissions**, as roads are on the front line of climate related disasters

6. **Road Safety** – **1.3 million deaths yearly** on the roads, up to **5% of GDP lost** in traffic accidents. Improved road can improve road safety

Road maintenance – three levels of fiscal impacts

No maintenance:
➔ Amplified road infrastructure deteriorations
➔ Exponential costs of works

No maintenance:
➔ Accelerated road infrastructure deterioration
➔ Increase frequency of rehabilitation/reconstruction programs

No maintenance: a fact embedded in the psyche of road engineers
➔ overdimensioning of solutions
➔ costly (budget inefficiencies)

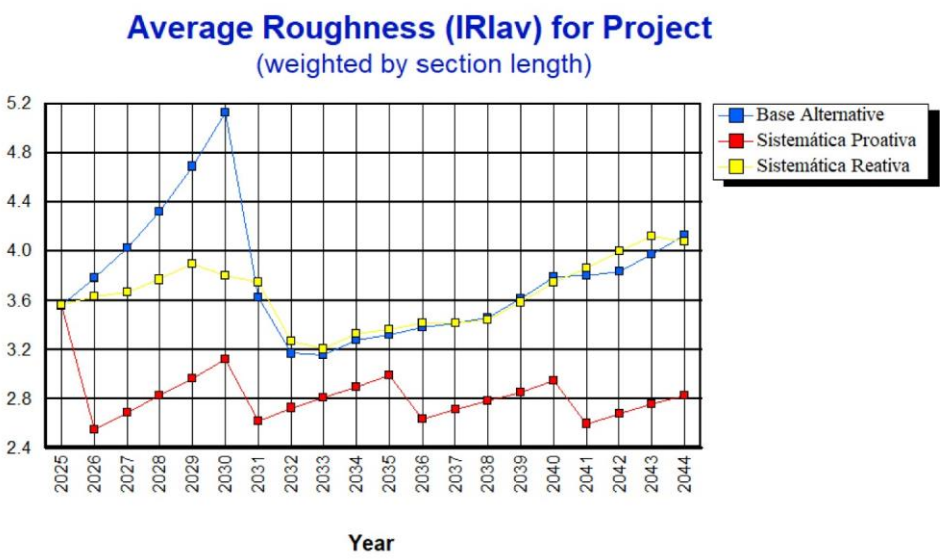
➔ **Good maintenance practices contribute to lower substantially the overall cost of managing the road network on a life cycle basis**

Besides fiscal benefits, a competitiveness agenda

Fiscal

Road Agency Costs

20-30%



Competitiveness agenda

70-80%

Road User Costs

Vehicle Operating Costs and Logistic Costs

Countries' competitiveness

For **1 USD invested**, the **benefits** for the users are **4 USD**

Paved road networks

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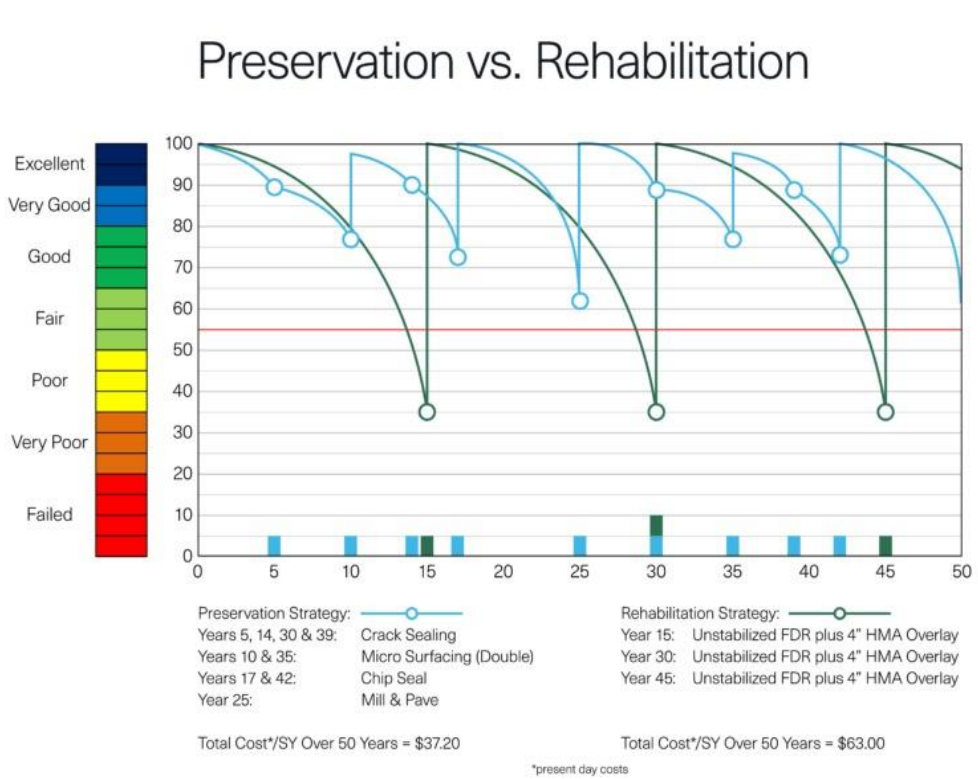
The case for CREMA

Long-term Rehabilitation and Maintenance Contracts (CREMA) have proved to be a relevant solution

- **History**: introduced in LAC in 1997 in Argentina then Brazil in 1999, other countries since then
- **In depth experience:** various generations, progressively more delegation of day-to-day management to the private sector e.g. towards CREMA-Design, Build & Maintain (8-10 years) / CREMA-PPP (15-25 years)
- **Longer term commitments of public and private (paid upon performance)**: Consistency of road asset management, payments based on performance
- **Incentives to less costly proactive management**: avoid deteriorations before they occur, lower road asset management over life cycle, improve roads conditions consistently for reduced logistics costs
- **Road safety and resilient infrastructure**: Improve road safety, Reduce climatic vulnerability and GHG emissions, targeted actions for more safer and more resilience



Comparison between road preservation and rehabilitation strategies over 50 years

Source: Henning et al. (2016)

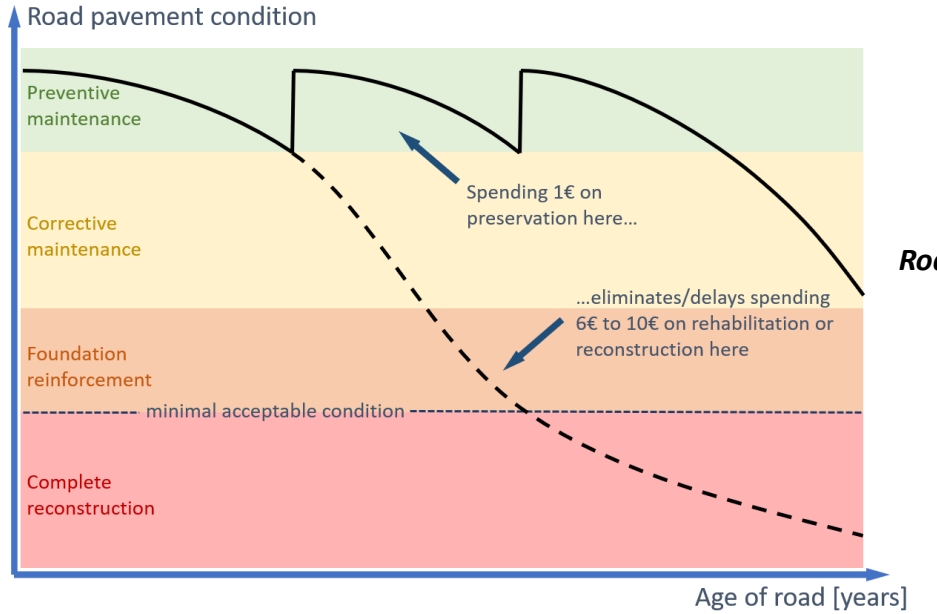
CREMA – brings efficiency in the management of road infrastructures

Comparing CREMA vs. Traditional road asset management: 20% savings on average on 5 years, 40% on 10 years

Country	Reported Savings against Conventional Unit Price Contracts
Australia	10%–40%
Brazil	15%–35%
Canada	About 20%
Estonia	20%–40%
Finland	18%
The Netherlands	30%-40%
New Zealand	15%-38%
United States	10%–15%

Reported savings of PBC vs conventional unit price contracts

Source: Guide to performance-based Road maintenance contracts. CAREC/ADB



Road pavement condition over time based on maintenance type

Source: Roads AI

- Rehabilitation works solutions are optimized
- Their implantation is thinly customized
- Proactive maintenance is key

Now let's do it at scale – a paradigm shift in the management of the road infrastructure

Premises for success

Capacity building for both private and public stakeholders

Consistency and commitment to long-term financing and contractual obligations by the Public Authorities

How to reach the paradigm shift

- Positive and **committed** stakeholders
- **Gradual** approach (pilot projects)
- Effective **supervision and performance measurement**
- **Corruption–free** and **transparent** procurement
- **Knowledge agenda**, standards and guidelines
- Inter-jurisdictional **coordination**

Performance-Based Contracts – Benefits for stakeholders

Road agencies		Road users	Private sector
Improve the quality of road maintenance	Budget predictability	Operating costs savings	Business growth
Limits the risks of cost overruns	Reduction of staff's workload lower risk of fraud	Better road conditions, safety and inclusion	Potential for increased margins
Cost savings and greater efficiency of public spending	Adoption of cutting-edge technologies	Time savings and competitiveness	Workload consistency over longer periods

Performance-Based Contracts – Contract timeline and remuneration

8-10 years (CREMA-DBM) or 15-25 years (CREMA-PPP)

Design and Construction / Rehabilitation phase

Operation & Maintenance phase

Proportional payments based on works execution on measurable outputs (**milestones**)

- **Periodic lump-sum payments** to cover all the maintenance and management services provided by the Contractor, having achieved a specified and agreed **Level of Service** (minus potential penalties if not)
- **Deferred payments** from the works phase may occur
- **Unforeseen or Emergency Works** are defined in the Contract and remunerated separately

The example of Brazil

Follow the lead

History of the CREMA approach in Brazil: Partnership between the Federal Government and the World Bank – progressive abandonment in 2014

1st generation of CREMA (99-2010):

1990s

- Pavements at the **end of their useful life**
- **Slow and disorganized administrations**
- **Uncommitted companies** with no management capacity

Introduction of CREMA contracts (1999)

- Reduction of **bureaucracy**
- Transparent **delegation of responsibilities**
- **Performance-based contracts;** sector optimization

55% of the DNIT federal network on CREMA

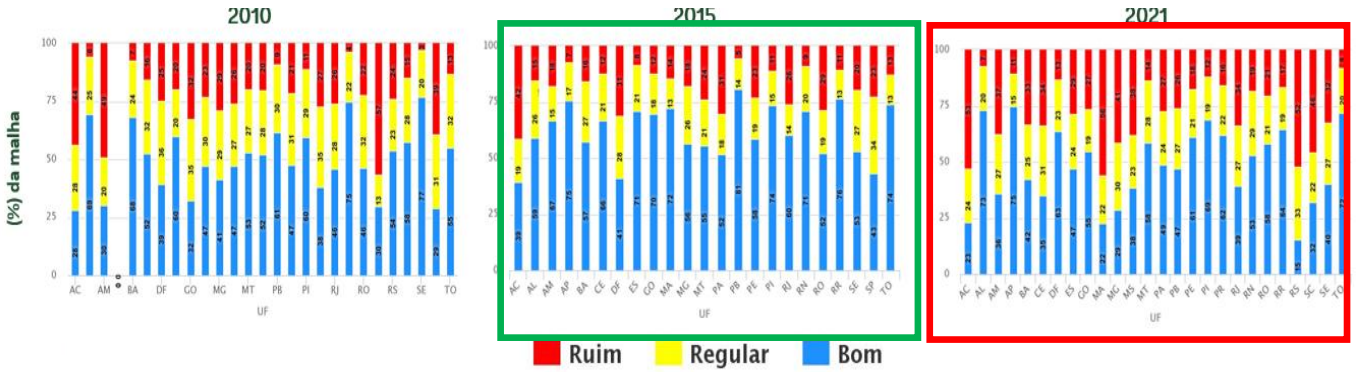
- **20 – 25% reduction** in total project costs
- **Standardization** of projects and tenders

2nd generation of CREMA (2010-2015):

2010-2015

- Lack of consistency in implementation::
  - **Oversizing** of solutions
  - Launching of the program in phases: progressive **distortion of the model** that led to its **abandonment** between 2014 and 2016
- **Limitation of contract duration** to 5 years
- New climate, environmental and safety challenges

Impact on the road network after abandonment of maintenance with CREMA



Source: World Bank based on DNIT data

Brasil Pro-Rodovias: Proactive, Safe and Resilient Road Asset Management Program in Brazil – 12 States and DNIT (National Department of Land Infrastructure)

Objective: improve the management of road infrastructure through greater delegation to the private sector

Scope: 30% of the territory and +**36% of the country's population** (74 million inhabitants), mainly from regions that suffer from a **low human development index**

4 components

1. **Proactive maintenance** with CREMA model over long term (8–25 years) using Performance Based Contracting
2. **Institutional strengthening**
3. **Improvement of selected state roads** and unpaved municipal roads and transportation infrastructure
4. **Project management**

Expected benefits

- Increased **institutional capacity**
- Reductions in **fiscal costs**
- Increased **road safety and road resilience** to climate-related disasters
- **Reduced costs** vs. traditional contracts

Brasil Pro-Rodovias: Proactive, Safe and Resilient Road Asset Management Program in Brazil – Projects in preparation and under discussion

External Financing Committee (COFIEX) or in discussion

In preparation

- DNIT – 12 states (right map) – 700 M
- Bahia (Phase 1) – 150 M
- Espirito Santo (Phase 2) – 162 M
- Santa Catarina (Phase 3) – 300 M
- Mato Grosso do Sul (Phase 4) – 200 M
- Piauí (Phase 5) – 150 M
- Rio Grande do Norte (in preparation) – 180 M
- Tocantins (COFIEX) – 120 M
- Paraíba (in discussion)
- Pernambuco (discussion)
- Goiás (COFIEX - pending Tax Recovery Regime, RRF) – 161 M
- Rio Grande do Sul (pending RRF) – catastrophe response
- Minas Gerais (pending RRF)

Selected States Pro-Nordeste
*only northern MG

Unpaved roads asset Management
What is the approach?
What is the roadmap?

The gap between developed and developing countries

Some Ratios:

•**Developed Markets:** the paved-to-unpaved ratio is typically around **4:1 (80%)** or higher (4 paved kilometers for every unpaved kilometer)

•**Emerging Markets:** can be as low as **1:4** (**20%**) or even lower in some regions

- CREMA, a solution for **the paved road network**
- What is the approach for **unpaved road** asset management?

64 M. = 40 M. + 24 M.

Global road network (km) | Paved road network (km) | Unpaved road network (km)

Thank You!

Questions & Answers