

# Africa Infrastructure Country Diagnostic

## Transport

Roads, Railways, Ports, Airports, Urban Transport

***The on-going Study reported here is one of several related to the transport component of the Africa Infrastructure Country Diagnostic (AICD)***

# Objective

- Objective is to measure the transport infrastructure investment requirements for twenty four Sub-Saharan African countries.
- Requirements originally based on what would be needed to increase competitiveness of economy and improve social cohesiveness.
- But changed to achievement of accessibility standards.
- Too many individual investments to even contemplate cost benefit analysis. Method used could be described as a form of cost effectiveness.

# 24 Countries included

1	Benin	13	Malawi
2	BurkinaFaso	14	Mozambique
3	Cameroon	15	<b>Namibia</b>
4	<b>Cape Verde</b>	16	Niger
5	Chad	17	Nigeria
6	DRC	18	Rwanda
7	Cote D'Ivoire	19	Senegal
8	Ethiopia	20	<b>South Africa</b>
9	Ghana	21	Sudan
10	Kenya	22	Tanzania
11	<b>Lesotho</b>	23	Uganda
12	Madagascar	24	Zambia

## Three methods used to measure needs

- **Transport Demand model:** this proved too demanding of data, and would not have provided the location specific investments that are needed to give credibility to the estimates;
- **Regression model:** this gave some implausible results, for example indicating that countries without railways should have them. Since this method also lacked location specificity, such indications were difficult to justify.
- **Accessibility standards method:** this proved feasible, not too demanding of data and gave location specific and credible results

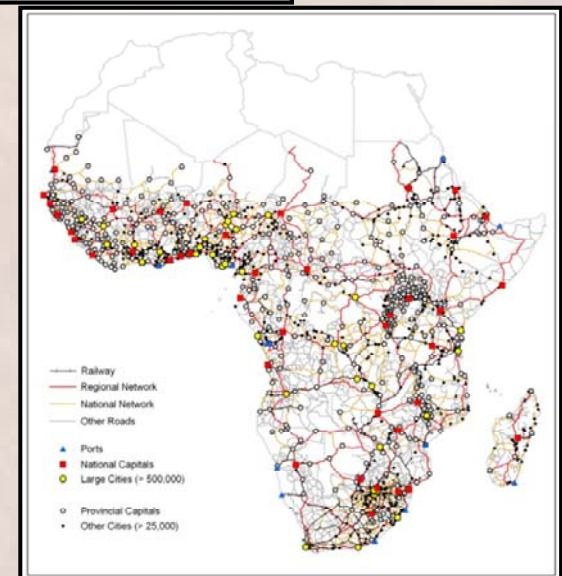
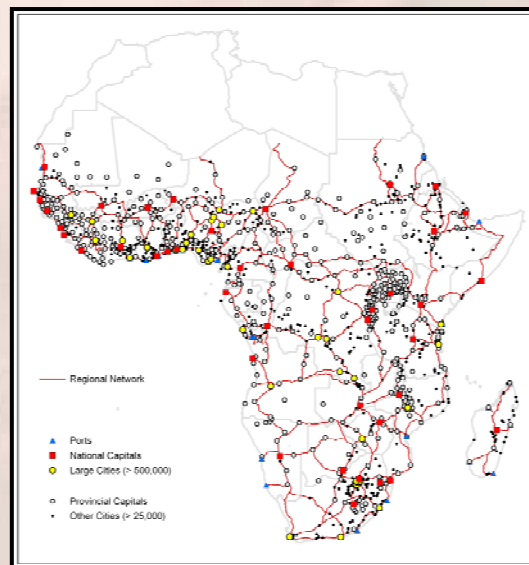
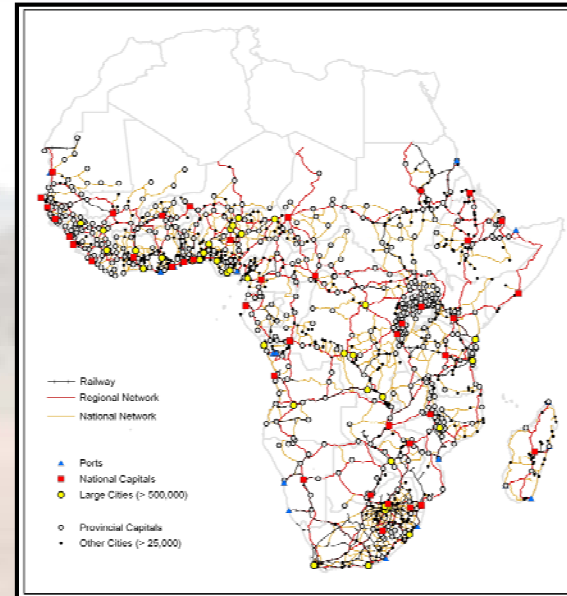
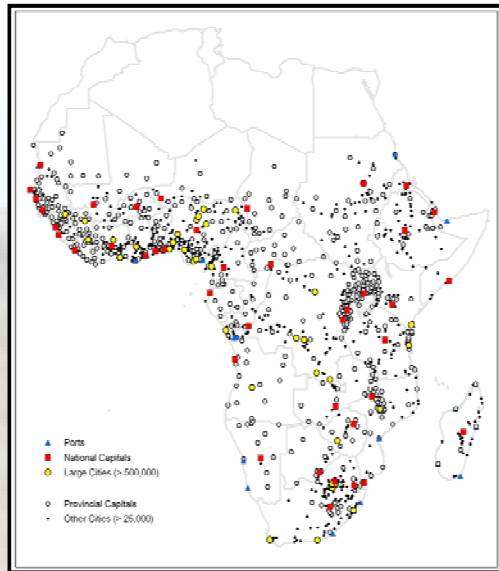
# Accessibility Standards

- Regional: 2-lane paved road to connect all national capitals and cities with more than 250,000 people
- National: 1-lane paved road to connect national and provincial capitals and cities of more than 25,000 people.
- Rural: Achieve Rural Accessibility Standard of at least 50% (current average is about 28%)
- Urban: Maximum walk distance of 0.5km to all-weather road capable of sustaining reliable bus

# GIS Approach

- GIS transport networks and geographical features are available, together with population estimates of cities, towns and smaller communities. Road networks can show type of road, but no yet condition for most countries.
- So GIS based approach is feasible but with some limitations
- This is a new approach to estimating transport infrastructure needs that has not been used before, so it has been a process of trial and error to implement

# GIS Maps



# Scenarios

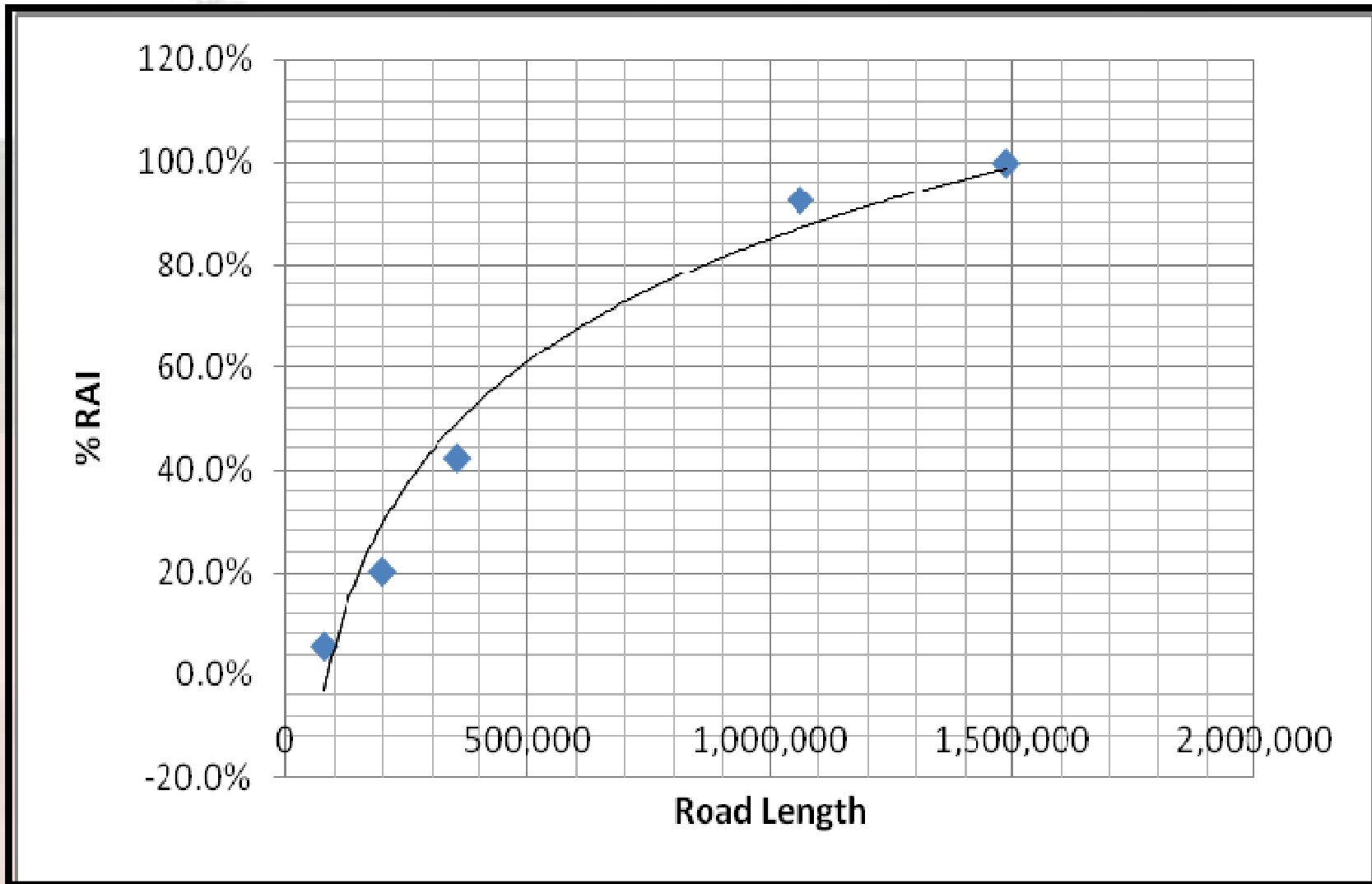
- Two scenarios of Accessibility standards were applied. The first was based on standards applicable to developed and Middle Income developing countries. These standards are referred to the **Basic Scenarios**.
- For most countries implementation is unaffordable so lower accessibility and infrastructure standards were used to create **Pragmatic Scenarios**.
- The Pragmatic Scenarios are only illustrative of what is needed to get investment needs down to an affordable level. Now we can easily assess the cost impact of other packages of investment reduction measures.



# Accessibility and Infrastructure Standards Used

<b>Connectivity</b>	<b>Basic Scenario</b>	<b>Pragmatic Scenario</b>
<b>Regional Network length</b>	Connect all national capitals, all cities of more than 250,000, all major ports with 2-lane paved road	Connect all national capitals, all cities of more than 250,000, all major ports with at least a 1-lane paved road
<b>% of 2-lane roads Road condition</b>	100% 100% Good	Current 100% Good or Regular
<b>National Network length</b>	Connect all cities over 25,000 and all provincial/state capitals with 1-lane paved road	Connect all cities over 25,000 and all provincial/state capitals with at least a 1-lane road with single surface treatment
<b>% of 1-lane roads % of roads in good condition</b>	100% 100% Good	Current 100% Good or Regular
<b>Rural Road type</b>	Reach 75% RAI with roads with at least single surface treatment Single surface treatment	Reach 50% RAI with roads with at least all-weather improved roads with drainage Gravel with drainage
<b>Urban Road type</b>	Maximum walking distance to potential bus route with at least a 1-lane paved road, of 0.5km subject to at least 250m of road per 1,00 urban residents	Maximum walking distance to potential bus route of 1 km, subject to at least 150m of road per 1,000 urban residents
<b>Railways Network length</b>	Axle load of 20 tons where traffic is greater than 5 million net tons per year Current	Axle load of 18 tons where traffic is greater than 5 million net tons per year Current
<b>Airports Runway and terminal condition</b>	At least one 3000m paved runway for each city of 250,000 population and one 1524m runway for each city of 25,000, airport terminal capacity of 20m per peak period passenger 100% Good	At least one 3000m paved runway for each city of 250,000 population and one 1524m runway for each city of 25,000, airport terminal capacity of 10m per passenger 100% Good or Regular
<b>Ports Berth condition</b>	One container berth for each 0.5million TEU, 1 bulk berth for each U\$10 billion of bulk export value 100% Good	One container berth for each 0.5million TEU, one general berth for each 1 million tons of general freight and one bulk berth for each U\$15 billion of bulk export value 100% Good or Regular

# Rural Accessibility Index



# The costs of infrastructure investment

We have taken account of four separate categories of investment cost:

- Those of **improving the condition** of existing infrastructure. We used three standards of condition, poor, average and good.
- Those of **upgrading the categories** of existing infrastructure to be compatible with the specifications in the Scenarios. Upgrading refers to changing the technical specification, such as changing a one-lane paved road to a two-lane road, or changing a gravel road to a paved road.
- Those of **expanding infrastructure** networks to satisfy the accessibility standards
- Those of **maintaining** the improved, upgraded and expanded networks to a long term sustainable standard

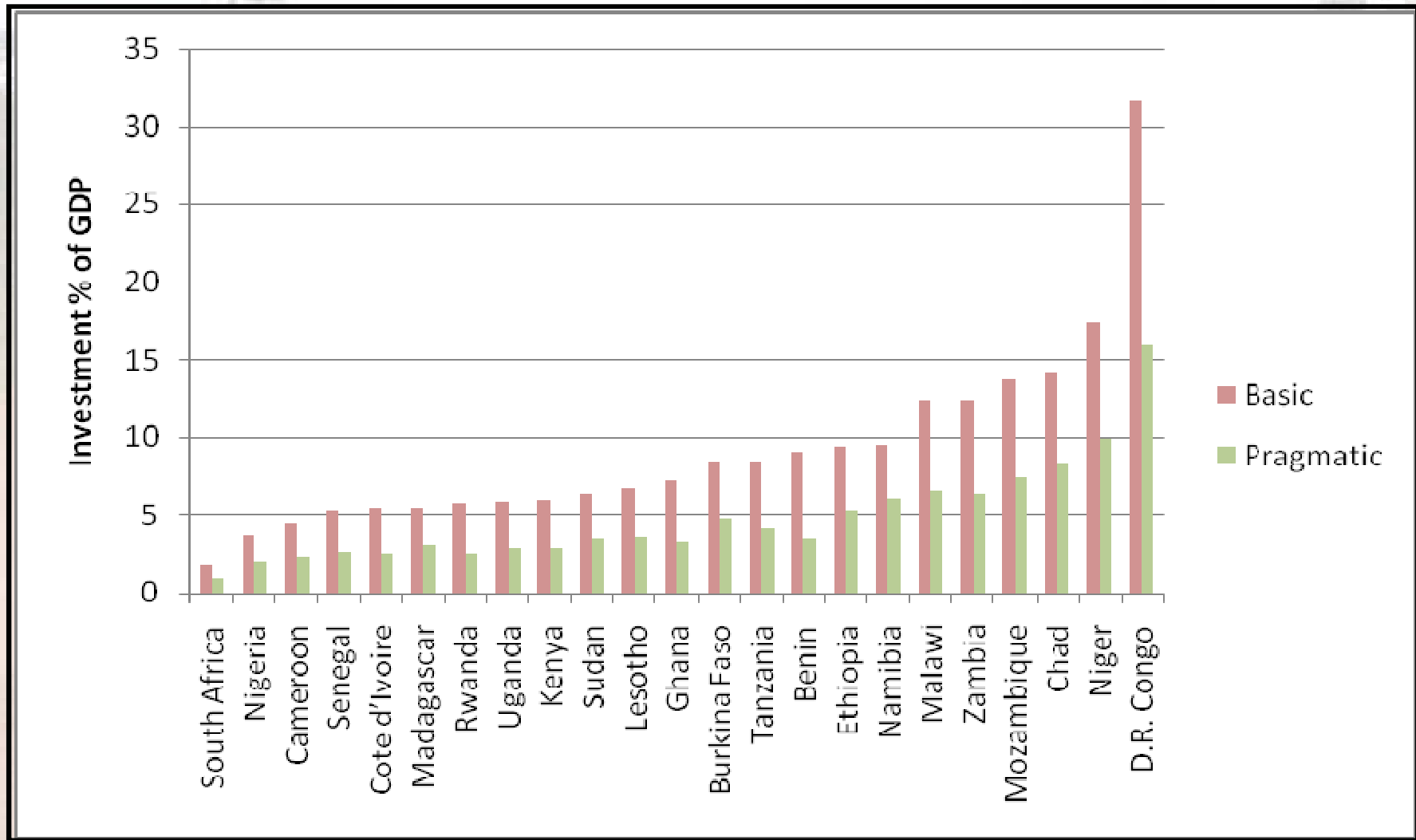
# What is Affordable?

- Affordability is considered as related to total GDP. Given that most investment is by public sector, Public Sector Revenues could also be used, but these are unstable as a long term measure. Other studies have used investment cost as a % of GDP as the affordability parameter, so we have done the same.
- The average result for the Basic Scenario was 5% of GDP, but with wide variations, from a maximum of 31.7% for DRC to a minimum of 1.8% for South Africa
- For the Pragmatic Scenario the target was 3% of GDP, although few developing countries have sustained more than this for any length of time. The average result was 2.6%, with a maximum of 16% for DRC and a minimum of 0.9% for South Africa.

# Indicative Results

- In the following slides we show some of the outputs of the analysis for the Basic Scenario. Similar results are available for the Pragmatic Scenario.
- The first slides gives an idea of the quantities of infrastructure that are needed to achieve the objectives of the Basic Scenario, and the next summarizes the total investment costs for all the countries
- The next slide provides a summary of the investment costs, by mode and by type of cost, and the two after that the detailed cost by country by mode and cost source respectively

# Investment by % of GDP



# Interpretation of results

- We have only had the detailed results by country for a short time, so we have not progressed far in interpreting them.
- Our first action has been to arrange the countries in four groups according to the % of GDP they need to spend on transport infrastructure for the Basic Scenario;
- We then assessed the affordability of those investments, and the extent to which the Pragmatic Scenario indicates what is possible for those countries where the Basic Scenario is unaffordable ;
- This is still a work in progress, with the analysis still being verified. But we feel that now is perhaps a good time to get ideas as to how best to use the powerful tools that we have developed

# Countries by Group

	Country	Basic as % of GDP	Pragmatic as % of GDP
Group One	South Africa	1.8	0.9
	Nigeria	3.7	2.0
	Cameroon	4.4	2.3
Group Two	Senegal	5.2	2.7
	Cote d'Ivoire	5.4	2.5
	Madagascar	5.5	3.1
	Rwanda	5.8	2.6
	Uganda	5.9	2.9
	Kenya	6.0	2.9
Group Three	Sudan	6.4	3.5
	Lesotho	6.7	3.6
	Ghana	7.2	3.3
	Burkina Faso	8.4	4.7
	Tanzania	8.4	4.1
	Benin	9.1	3.5
	Ethiopia	9.4	5.2
	Namibia	9.5	6.1
Group Four	Malawi	12.4	6.6
	Zambia	12.4	6.4
	Mozambique	13.7	7.4
	Chad	14.2	8.3
	Niger	17.4	9.9
	D.R. Congo	31.7	16.0



# First two Groups of Countries

- In the first group are three countries whose transport investment needs amount to less than 4.5% of GDP - **South Africa, Nigeria and Cameroon**. These are the only countries that could achieve all the accessibility objectives of the Basic Scenario with infrastructure comparable with best international standards, without compromising expenditure in other economic sectors.
- These are followed by a second group of six countries - **Senegal, Cote d'Ivoire, Madagascar, Rwanda, Uganda and Kenya** - where transport investment in the Basic Scenario would cost between 4.5% and 6% of GDP, and so would have to make only marginal compromises on the standards of infrastructure, and not on the achieving the objectives of accessibility, to bring their costs to an affordable level.

# Second two Groups of Countries

- The next group of eight countries – **Sudan, Lesotho, Ghana, Burkina Faso, Tanzania, Benin, Ethiopia and Namibia** - would require an investment of between 6% and 10% of GDP to meet the Basic scenario objectives and standards. For these countries to bring their investment cost down to about 4% of GDP they will need to reduce the accessibility objectives as well as the investment standards.
- The final group of six countries – **Malawi, Zambia, Mozambique, Chad, Niger, and the Democratic Republic of Congo** - would require more than 10% of GDP to reach the Basic Scenario objectives and standards. It will be very difficult to compromise on the accessibility objectives and infrastructure standards sufficiently to bring the investment costs down to a feasible level. It will be necessary to rethink their strategic objectives and priorities for their transport sector and adopt a different approach to that implied in the Basic scenarios.

# Impact of Pragmatic Scenario

- For fourteen of the countries – all those in the first two groups and half of those in the third group - the investment cost of the Pragmatic Scenario is below 4% of GDP and therefore the accessibility objectives are achievable but with some compromises, on the objectives themselves but more particularly on the infrastructure standards.
- There remain nine countries for which more dramatic measures would be needed to achieve this level of investment. Of these nine, six are the same countries that are in the last group for the Basic scenario.
- The other three – Burkina Faso, Ethiopia and Namibia – need to be added to those that need to reconsider their transport objectives as the compromises indicated by the Pragmatic scenario would not be enough to make the investment cost feasible.
- *Note: we have not included Cape Verde in the Table as its analysis needs some revision. It will probably fall into Group Two*

# Some Questions

- How do we check that the Objectives and Infrastructure standards in the Basic Scenario are comparable with what the Governments are thinking?
- How do we confirm that the Pragmatic Scenarios represent the sort of compromises that are acceptable?
- How important is the Rural Accessibility Index in the strategies of our Governments?
- How do we adjust the Unit costs for country variations?
- What can we do when even the Pragmatic Scenario is unaffordable?

# Investment: Pragmatic Scenario

	All 24 countries	Lower Middle Income countries	Low Income countries
<b>Total Investment</b>	<b>U\$170b</b>	<b>U\$31b</b>	<b>U\$139</b>
<b>Investment as % of GDP</b>	<b>2.6%</b>	<b>1.0%</b>	<b>4.1%</b>
<b>Improve condition</b>	<b>7.6%</b>	<b>10.5%</b>	<b>6.9%</b>
<b>Upgrade categories</b>	<b>9.9%</b>	<b>8.1%</b>	<b>10.3%</b>
<b>Expand capacity</b>	<b>16.3%</b>	<b>2.2%</b>	<b>19.4%</b>
<b>Subsequent maintenance</b>	<b>66.2%</b>	<b>79.2%</b>	<b>63.4%</b>
<b>Total</b>	<b>100.0%</b>	<b>100.0%</b>	<b>100.0%</b>
<b>Regional Connectivity roads</b>	<b>9.9%</b>	<b>7.2%</b>	<b>10.5%</b>
<b>National Connectivity roads</b>	<b>17.1%</b>	<b>22.9%</b>	<b>15.9%</b>
<b>Rural roads</b>	<b>41.4%</b>	<b>34.4%</b>	<b>42.9%</b>
<b>Urban roads</b>	<b>15.4%</b>	<b>5.7%</b>	<b>17.5%</b>
<b>Railways</b>	<b>11.5%</b>	<b>13.1%</b>	<b>11.2%</b>
<b>Airports</b>	<b>2.7%</b>	<b>9.2%</b>	<b>1.2%</b>
<b>Ports</b>	<b>2.1%</b>	<b>7.6%</b>	<b>0.9%</b>
<b>Total</b>	<b>100.0%</b>	<b>100.0%</b>	<b>100.0%</b>

# More Information

- For more information, or if you have any suggestions for improving or changing the analysis, or for better interpreting the results, please contact:
- Vivien Foster, [vfoster@worldbank.org](mailto:vfoster@worldbank.org) or
- Robin Carruthers, [rcarruthers@worldbank.org](mailto:rcarruthers@worldbank.org)
- The final report should be ready by the end of 2008

# Country Visits

- Robin Carruthers to visit eight landlocked and neighboring transit countries over the next three months
- Intends to meet with Ministers and Secretaries of Transport to inform and discuss related issues

A photograph of a dirt road winding through a hazy, mountainous landscape. The road is reddish-brown and leads towards distant, misty hills. There are trees and utility poles on either side of the road. The sky is overcast and grey.

**Thank You!**