



Consulting services for national integrated transport master plan study and enhance sector capacity in planning and research & development

TASK 4 – CONSOLIDATED NATIONAL TRANSPORT MASTER PLAN

“SECTOR REPORT 2B – RURAL ROADS”



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ACRONYMS

Abbreviations	Meaning	Abbreviations	Meaning
AA LRT	Addis Ababa Light Rail Transit	FDRE	Federal Democratic Republic of Ethiopia
AACMP	Addis Ababa City Master Plan	FOB	Free on Board
AACRTB	Addis Ababa City Road and Transport Bureau	FTA	Federal Transport Authority
ACTKs	available cargo tonne-kilometres	FTM	Future Transport Model
ADLI	Agricultural Development Led Industrialization	FYP	Five-Year Plan (MoT)
ADPI	Aéroport de Paris International	FUPI	Federal Urban Planning Institute
AfDB	African Development Bank	FX	Foreign exchange
AIM	Aeronautical Information Management	FYP	Five-Years Development
AIS	Aeronautical Information Service	GDP	Gross Domestic Product
BAU	Business-as-usual	GHG	greenhouse gas
BRT	Bus Rapid Transit	GOE	Government of Ethiopia
CA	Current Account	GRSP	Global Road Safety Partnership
CAA	Civil Aviation Authority	GTP	Growth and Transformation Plan
CAGR	Cumulated Average Growth Rate	HGER	Homegrown Economic Reform Programme
CBA	Cost-Benefits Analysis	IATA	International Air Transport Association
CBDS	Capacity- Building for Decentralized Service Delivery)	ICAO	International Civil Aviation Organization
CDE	Chemin de Fer Djibouti-Ethiopien	ICT	Information and communication technology
CoM	Council of Ministers	IHDP	Integrated Housing Development Program
COMESA	Common Market for Eastern and Southern Africa	IMF	International Monetary Fund
CRGE	Climate Resilient Green Economy	IMS	Integrated Management System
CSA	Central Statistical Agency of Ethiopia	ISPS	international Ship and Port Facility
CTKs	cargo tonne-kilometres	ISS Report	Inception and Sector Situation Analysis Report
DRT	Demand responsive transit	IUCN	International Union for the Conservation of Nature
EEAIB	Ethiopian Aircraft Accident Investigation Bureau	IUDP	Integrated Urban Development Plan
EAC	East African Community	JESH	Jiggiga Export Slaughterhouse
EAE	Ethiopian Airports Enterprise	KPI	Key Performance Indicator
EAG	Ethiopian Airlines Group	LAC	Latin America and the Caribbean
EAL	Ethiopian Airlines	LAPSSET	Lamu Port, South Sudan, Ethiopia Transport Corridor
EA-SA	East and Southern African	LIC	Low Income Countries
EBM	Expenditure Budgeting Model	LRT	Light Rail Transit
ECA	Europe and Central Asia	MCA	Multi-Criteria Analysis
ECAA	Ethiopian Civil Aviation Authority	MCBRTA	Multilateral Cross-Border Road Transport Agreement
ECARAS	Ethiopian Civil Aviation Authority Rules And Standards	MDGs	Millennium Development Goals
ECWC	Ethiopian Construction Works Corporation	METEC	Metals and Engineering Corporation)
EDR	Ethio-Djibouti Railways	MMT	Ethiopian Maritime and Transit Services Enterprise
EMAA	Maritime and Logistics	MoF	Ministry of Finance

Abbreviations	Meaning	Abbreviations	Meaning
EMDE	Emerging Markets and Developing Economies	MOFEC	Ministry of Finance and Economic Cooperation
EMTI	Ethiopian Maritime Training Institute	MoT	Ministry of Transport
ENUDP	Ethiopian National Urban Policy	MRO	Maintenance, Repair Operation
EPE	Environmental Policy of Ethiopia	MUDHCo	Ministry of Urban Development and Housing)
ERA	Ethiopian Road Authority	NDCs	Nationally determined contributions
ERC	Ethiopian Railway Corporation	NDP	Neighborhood Development Plan
ERTTP	Ethiopian Rural Travel and Transport Programme	NGO	Non – Governmental Organization
ESL	Ethiopian Shipping Line	NITMP	National Integrated Transport Master Plan
ESLSE	Ethiopian Shipping and Logistic Service Enterprise	NRSP	National Road Safety Policy
ETB	Ethiopian Birr	NRTSC	National Road Safety Council
ETMP	Ethiopia Transport Master Plan	NUDSP	National Urban Development Spatial Plan
ETRE	Ethiopian Toll Roads Enterprise	NUPI	National Urban Planning Institute
EU	European Union to Ethiopia	NVOCC	Non-Vessel Operating Common Carrier
eWTP	electronic world trade platform	O/D	Origin/Destination
FDI.	Foreign Direct investment	RAI	Rural Accessibility Index
		RDMP	Road Development and Maintenance Plan
TTTFP	Tripartite Transport and Transit Facilitation Programme		

1 EXECUTIVE SUMMARY

The objective of this report is to provide an addendum to the Ethiopian National Transport Master Plan with a specific focus on rural accessibility.

While the road sector report focuses on planning the main road network for the country with the use of a macro-simulation model, this report focuses on promoting accessibility for the local communities regardless of the traffic volumes, the number of people served and the economic opportunities involved. Planning for accessibility is first of all considered a matter of equality. For this reason, a different approach is considered where only rural areas and low traffic roads are involved.

While the Master Plan considers a multi-scenario approach for the development of the national transport system, the rural accessibility strategy is assumed to be invariant and a priority for all economic growth scenarios. The reason for this is the crucial role that rural accessibility has in terms of poverty reduction and social inclusion, as well as acting as a promoter for fundamental rights to the rural population such as access to basic services and opportunities for personal and economic development. In addition, as Ethiopia aims at exploiting its agricultural potential, investments in rural accessibility have proven effective in the increase of crop yield and encouragement of agricultural development.

Nonetheless, building and maintaining a network of low volume roads that can hardly finance themselves could generate an unbearable burden for the public finances. Thus, the rationale for the work undertaken is to obtain the maximum benefits with the least financial effort.

The following document provides an overview of the work undertaken by the Consultant in the last months to analyse the present situation, to identify measures and actions at national level and to identify specific actions at regional level.

Initially, the institutional framework is analysed in Chapter 2 with a focus on the agencies that are involved in the planning and management of the rural infrastructure. The work shows the structural differences between the different rural road agencies (RRAs) with a detailed explanation of their duties, budgets and performances.

Then, in Chapter 3 a comparative analysis of the current situation at regional level is presented. An innovative approach that is now World Bank standard (since 2016) is adopted for the calculation of the Rural Accessibility Index (RAI). The initial assessment conducted using ERA's official road GIS database shows that overall Ethiopia ranks low in terms of accessibility compared with other low-middle income African countries.

However, a further investigation of satellite images and databased from secondary sources (World Food Programme) shows that Ethiopia has a much more expanded and interconnected network of rural and community roads. Such discrepancy is investigated by reviewing satellite images and interviewing rural road agencies. The result of such investigation leads to the conclusion that the official database lacks sufficiency as a great part of the rural network is not included.

While it is recognized that the first recommendation for the appropriate development and maintenance of regional networks must be to extensively survey, create and manage such GIS database at local level, a primary work of definition of the existing and ideal size of the network is undertaken in this report to create a framework for the future expansion and development of the network.

In this sense, technology is at the hearth of the work undertaken. The aim of this document is to present an innovative methodology to analyse the current situation in terms of network expansion and population density with the use of satellite imagery and GIS software. The data extracted have the objective of providing a solid basis for the development of an integrated road

management system which will be available for regional agencies to plan regional networks in the next years. The main advantage of using satellite imagery is that rural paths and unclassified roads can be considered in the planning as a basis for the future rehabilitation and expansion of the network. In addition, such system does not only serve as a planning tool for infrastructure, but can be used to show gaps in the presence of basic services in rural areas such as hospitals and schools.

In terms of output, different KPI are used to describe the current situation. The indicators considered in the present situation are:

- population served by the network,
- travel times to markets, and
- travel times to hospitals and schools

The outputs are presented at regional level and show great discrepancy between the different regions. RAI maps show also a great discrepancy between different Woredas within the same region. This is the greatest advantage of using a more expanded database. It should be noted that if only the official database was utilised the difference between some Woredas or Regions would have not been appreciable.

After the present situation analysis, the following Chapter 4 includes guidelines and recommendations at national level that are derived from a thorough review of literature and reports, as well as interviews with the rural agencies. Some of the measures include the structure and responsibility of RRAs, the work and management of contractors, labor conditions and level of mechanization.

Then for each region the existing rural network defined with satellite images is considered for potential upgrade and new links are introduced in areas of low accessibility, especially those with higher population density such as rural villages and towns. The advantage of this methodology is to retain existing links with lower cost of construction. However, because the quality of the existing network is unknown, as a conservative approach the cost of upgrade is considered the same as the cost of construction. In terms of pavement type and quality to be obtained through the program, RED evaluation is used to evaluate different alternatives at regional level. Considering standard traffic parameters and the input from the GIS database in terms of length and population served, in all the regions the surface recommended is gravel roads in fair conditions. The relative costs of the program are defined in terms of upgrade, construction and maintenance to define the funding required for the implementation of each of the regional plans.

Then, in Chapter 5 individual plans for each rural region are presented with the objective to:

- identify the network size to be developed and maintained for the next 30 years
- define the best scenario alternative in terms of road characteristics with the use of RED evaluation model
- identify a regional public transport network which will constitute the backbone of the entire regional public transport system
- present an estimate for the road network's construction, upgrade and maintenance costs in the next 30 years
- present an estimated cost for the public transport solution identified
- Identify benefits of the plan in terms of increased accessibility for the entire region and for the direct accessibility to basic services. This paragraph also identifies gaps in the presence of basic services at regional level.

Regional plans will be a valuable basis for the development of detailed Road Development and Maintenance Plans (RDMP) by the RRAs.

RDMPs at regional level will be defined through the following steps:

- 1) Circulation of the National Transport Masterplan’s GIS database to the RRAs
- 2) Where required, undertake GIS training to the RRAs.
- 3) Rural roads surveys to be performed by the RRAs to inform and expand the existing GIS database. Each road will be classified by average width, surface type, quality, maintenance frequency, traffic volume, average speed, population served, and number of accidents reported.
- 4) After this initial step, the Ministry of Transport will define the yearly budget to be released to each RRA.
- 5) Then, RRAs will use the GIS database to develop yearly RDMPs. Through such instruments RRAs are expected to justify the interventions planned for the year in terms of costs and benefits and report to the Ministry of Transport for signoff.
- 6) Once the works are agreed, the Ministry of Transport will release the funding.
- 7) At the end of each year the RRAs will report on performance and budget spent, so that Ministry of Transport will be able to produce a Yearly Performance Report that will include the budget spent and the performance of all regions. This way, a continuous monitoring of the Masterplan’s implementation will be possible.

While activities 1 to 3 are expected to be finalised in the first part of the plan (year one), it is recommended that the remainder tasks are be undertaken yearly once the regional GIS database is complete with all the information required.

2 INSTITUTIONAL FRAMEWORK

2.1 REGIONAL ROAD INSTITUTIONS AND PUBLIC ENTERPRISES

2.1.1 Introduction

This chapter briefly describes the structure of public intervention in the road sector at the level of the regional states of the FDRE. Public institutions are understood in a broader sense and include both real institutions and public enterprises while the areas of intervention are infrastructures and services. Though Addis Ababa and Dire Dawa have the same constitutional status of regional states, they have been grouped with the urban level administrations, accordingly they are not included in this chapter and are described in the Urban and public transport report.

According to the principles established by the Constitution of the FDRE (Articles 51.9 and 55.2.c), the regional states have full jurisdiction over the road sector that falls within their territory, while in the case of infrastructures or services that connect two or more regional states, the competence goes back to the federal level. Therefore, the institutional organization of the road sector in each regional state is established by the constitution of the state itself or by the regional laws governing the sector.

On the other hand, at least one part of the budget of the regional states, including the one for road infrastructures, comes from financial transfers from the federal budget. In fact, pursuant to Article 62.7 of the Constitution, the subsidies and revenues deriving from joint federal and state tax sources are distributed by the federal government to regional states. The method of assignment is valid for three years and is based on the population and the size of the region / state, the proximity to the federal capital, the status of socio-economic development (the needs of the region / state), aid for generating own revenues (revenues State as a property tax). As a result, even if there is no destination constraint for transfers between the federal and regional level, the institutional role of the federal level maintains great importance.

In general, each regional state has a transport office, linked at the federal level to the MOT and the FTA and a road authority linked to the MOT and the ERA. Beyond this general consideration different ways in structuring the institutional framework of the road sector arises from the analysis: in some cases, both transport bureaus and road authority coexists under the same organizational structure, while in other regions has been established a separation between infrastructure issues (road authority) and administration services (transport bureau).

As far as public companies are concerned, the most important element concerns construction activities, which are active in all regional states and which, together with private companies, contribute to the construction of regional road infrastructures. For these companies, a qualification system is in place which enables them to participate in tenders according to the amount of the work¹.

For these activities it is interesting to note that in some regional states (particularly Amhara, Oromia, SNNPR, Tigray) an intervention model has been adopted by some RRAs. The purpose of this intervention is to decrease the barriers to entry into the road works market through the purchasing of equipment and machineries for road construction by the public authority itself. The authority provides then to rent them to local private companies, allowing the latter to participate in tenders. In this way the public sector: i) takes on the first financial effort and can use the rent

1 All contractors in Ethiopia are subject to national registration and classification which, on the basis of capacity, experience and resources of the contractor, defines the limits of contract value for which the contractor is eligible: Grade 1 >ETB 20M; 2 <ETB 20M; 3 <ETB 15M; 4 <ETB 10M; 5 <ETB 5M; 6 <ETB 2.5M; 7 <ETB 1M; 8 <ETB 0.5M; 9 <ETB 0.25M; 10 <ETB 0.1M.

mainly to the maintenance of the machinery, extending its useful life and, ii) allows small and medium-sized private companies to undertake a development path towards a growth of the private sector.

Recent assessments conducted by the EU² and the PEFA Program³ allow for a picture of the institutional organization of the road sector in each federal state. This picture is described in the following sub chapters.

2.1.2 Afar

The institutional organization of the Afar road sector is based on a single authority (Afar Rural Roads Authority) accountable to the Regional Council, articulated in two areas, Road and Transport. The Figure below depicts the organogram.

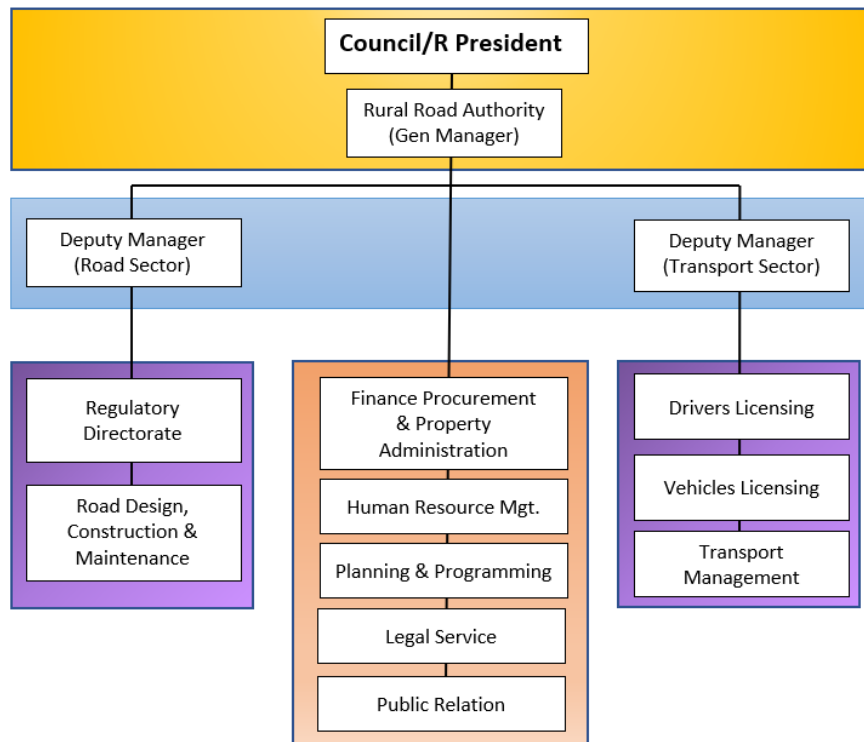
The first area has the task of developing and maintaining roads at regional level, while the second is responsible for the management of the road sector in terms of service authorizations, driving licenses, vehicle authorization, road circulation management.

2 NTU International, Technical Cooperation to Support the Road Sector Development Program for Ethiopia, Institutional Capacity Assessment (ICA) Report, May 2019 and idem, Institutional Organizational Setup and Structure of RRAs Report, March 2020.

3 The Public Expenditure and Financial Accountability (PEFA) program was initiated in 2001 by seven international development partners: The European Commission, International Monetary Fund, World Bank, and the governments of France, Norway, Switzerland, and the United Kingdom. PEFA began as a means to harmonize assessment of PFM across the partner organizations. It subsequently established a standard methodology for PFM diagnostic assessments, the PEFA framework. Since 2001 PEFA has become the acknowledged standard for PFM assessments. The PEFA program provides a framework for assessing and reporting on the strengths and weaknesses of public financial management (PFM) using quantitative indicators to measure performance. PEFA is designed to provide a snapshot of PFM performance at specific points in time using a methodology that can be replicated in successive assessments, giving a summary of changes over time. In Ethiopia PEFA assessments started in 2007 and are currently ongoing. The results have been published in 29 reports, covering national (4) and subnationals (25) levels.

In Ethiopia, PEFA assessments started in 2007 and are currently ongoing. The results were published in 29 public reports, nationally (4) and subnationally (25). The following reports were used for the contents of this chapter: Somali 2020, SNNPR 2020, Amhara 2019, Ethiopia 2019, Oromia 2019, Tigray 2019, Benishangul 2010, Harari 2010, and Ethiopia, Regional Public Financial Management Performance Report 2007.

Figure 1: Afar existing roads organizational structure⁴



The public construction company is the Afar Design and Supervision Works Enterprise (AFDSWE) set up in 2012 as a public company with regulation n. 008/2012 from the National Regional Afar State. The main sectors of intervention are roads, civil works, irrigation engineering, water supply and sanitation.

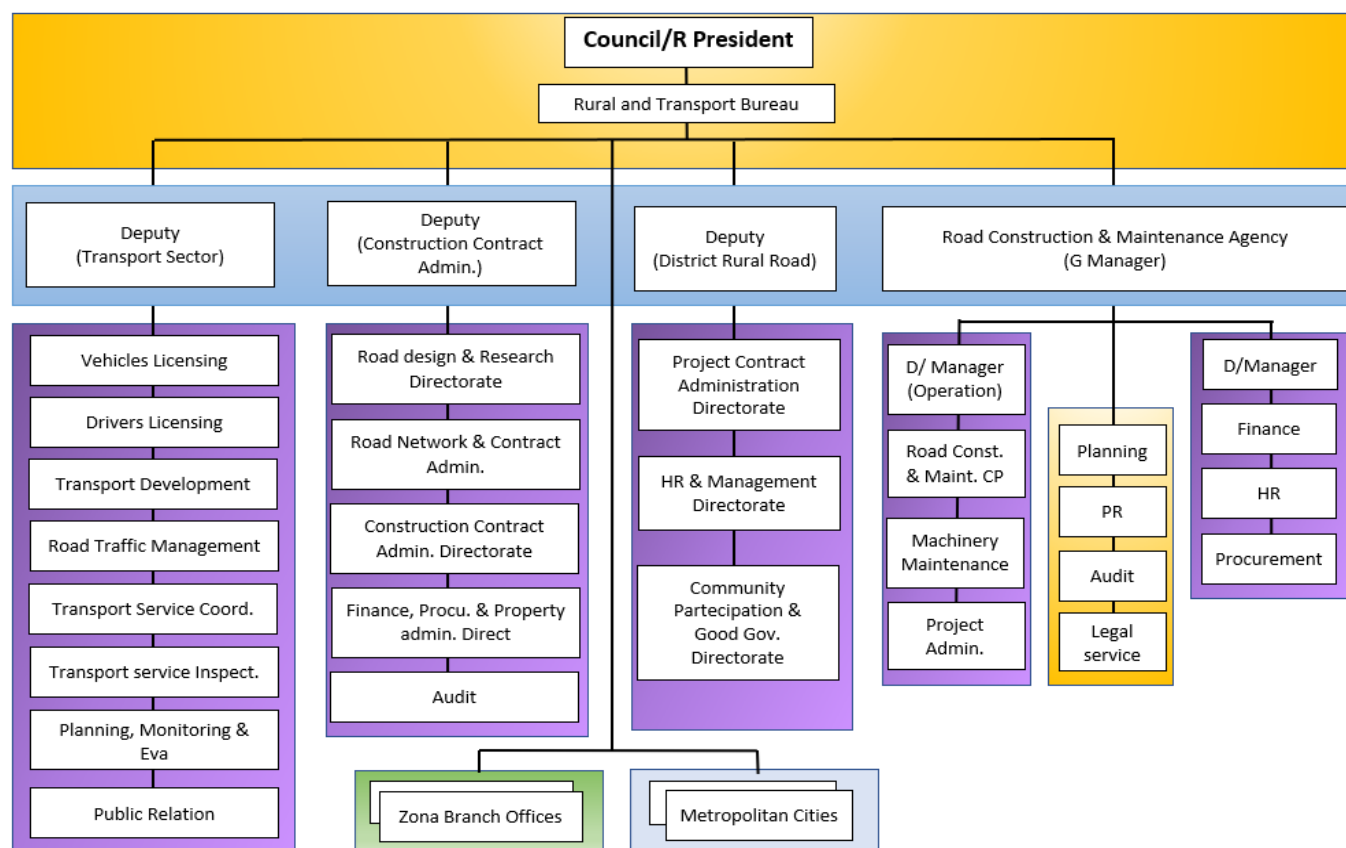
2.1.3 Amhara

The Amhara regional state has road sector's organizational structure based on the Regional Road and Transport Bureau, accountable to the Regional Council. This entity is split into different departments but one of them has a semi-autonomous own force as construction and maintenance agency for the maintenance works. In fact, this Construction and Maintenance Agency is accountable to the Bureau but has its own support structure so that it can run its financial and administrative operation in a relatively independent manner, rather than using the common staff structure of the Road and Transport Bureau.

The other departments of the road and Transport Bureau have different duties such as the road regulatory task (Construction Contract Administration), the transport administration (Transport sector) and the local road development (District Rural Road). The table below describes the organizational structure of the road sector.

⁴ Source: NTU International, Institutional Capacity Assessment (ICA) Report

Figure 2: Amhara existing roads organizational structure⁵



In terms of public budget allocation by functions, the expenditures for transport (considered as allocations for "Trade and transport", "Transport and urban development" and "Rural road") recorded between 11% and 15% of the Amhara public expenditures in the last three Fiscal Years (15/16, 16/17 and 17/18). These items represented the third category of expenditure of the regional state, being Education (31%-34%) and Health (12%-13%) the first and the second one.

As for public enterprises, in Amhara there are 14 public corporations established under the Art. 236 of the Proclamation issued in 2008 as fully state-owned capital and two PPPs. The main activities undertaken are manufacturing (metal works and agro-processing) as well as horticulture, road construction, transport services.

The most important public enterprises are those of road constructions: Amhara Road Works Enterprise and Road and Building Design & Construction Supervision Works Enterprise. These corporations accounted about 54,7% of the total expenditures realised by the Amhara public enterprises in the fiscal year 17/18.

In the following table are reported the basic economic figures of the public enterprises in the road sector.

⁵ Source: NTU International, Institutional Capacity Assessment (ICA) Report

Table 1: Cost and Revenues of Amhara public enterprises in the road sector⁶

Name of Institution	EFY	Revenue	Expenditure	Profit before tax	Tax on profit	Profit after tax
Road and Building Design and construction supervision	2008	136,869,846.00	77,565,723.00	59,304,123.00	17,858,268.00	41,445,855.00
	2009	107,236,960.80	82,640,631.70	24,596,329.10	7,408,545.25	17,187,783.85
	2010	108,050,625.78	89,768,766.72	18,281,859.06	4,581,580.87	13,700,278.19
Road Works Enterprise	2008	94,115,472.28	70,967,677.65	23,147,794.63	6,727,361.33	16,420,433.40
	2009	104,213,559.50	151,131,285.76	(33,698,609.66)	na	(33,698,609.66)
	2010	130,147,203.65	129,661,338.97	485,864.68	na	19,461,578.49)

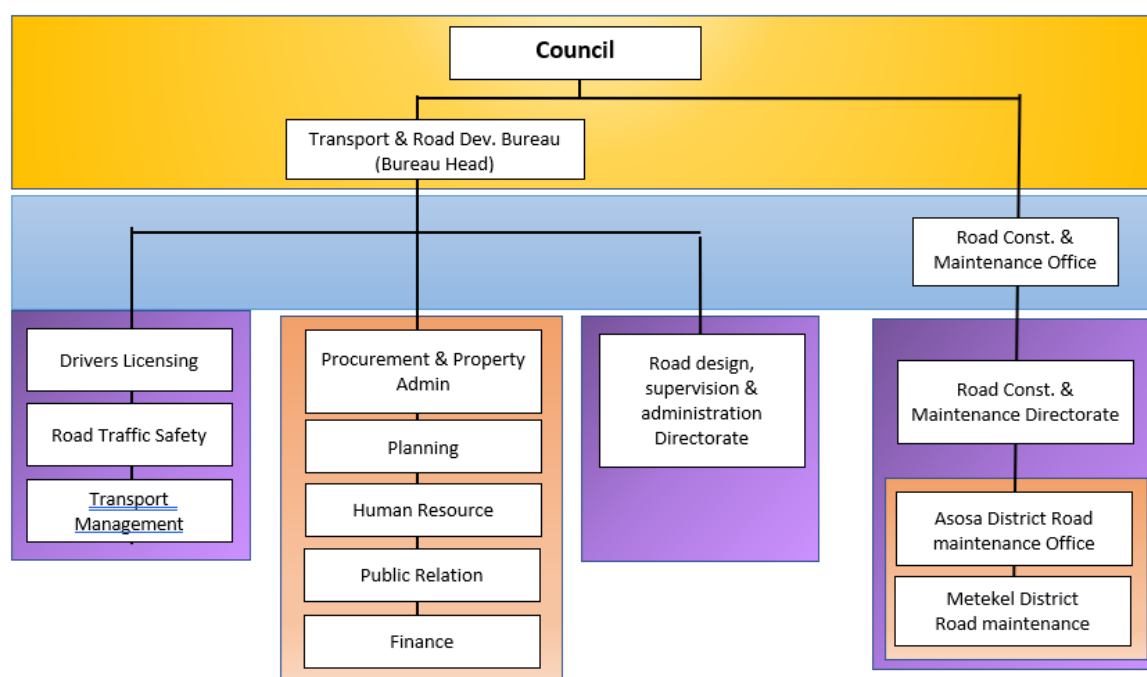
2.1.4 Benishangul-Gumuz

The structure of road sector in the Benishangul-Gumuz regional state is based upon two different bodies: the Transport and Road Development Bureau and the Road Construction and Maintenance Office. This structure has been established in 2018, both the entities are accountable to the President of the Regional State.

The Transport and Road Development Bureau is in divided in two directorates: transport administration (Road traffic safety, driving licensing, traffic management) and road design and administration (Road design, works supervision). The Bureau has also some staff units in charge of transversal tasks (human resources, finance, planning, procurement) supporting both directorates.

The Road Construction and Maintenance Office has two directorate based on geographical differentiation.

Figure 3: Benishangul-Gumuz existing roads organizational structure⁷



⁶ Source: PEFA Program. Performance Assessment Report, Amhara 2019

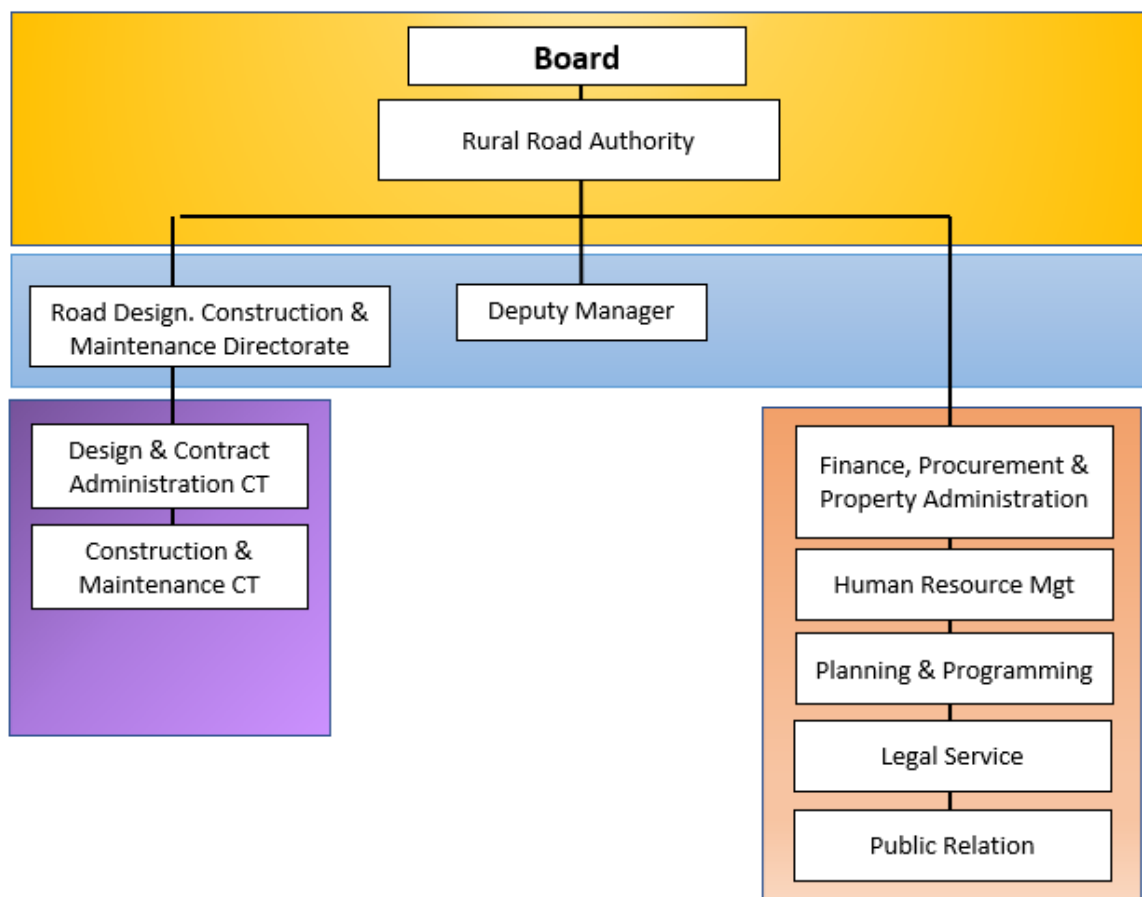
⁷ Source: NTU International, Institutional Capacity Assessment (ICA) Report

2.1.5 Gambella

The structure of road sector in Gambella Regional state is based on two different entities responsible of the different areas of infrastructure and services.

The Rural Road Authority, which is accountable to the Executive Committee of the Council, has two directorates respectively in charge of Design, Construction and Maintenance of roads and of the Road Administration issues (see Figure below).

Figure 4: Gambella Rural Road Authority organizational structure⁸



The Transport and Road Development Bureau has the duty of Transport administration that means vehicles licensing, drivers license, traffic management.

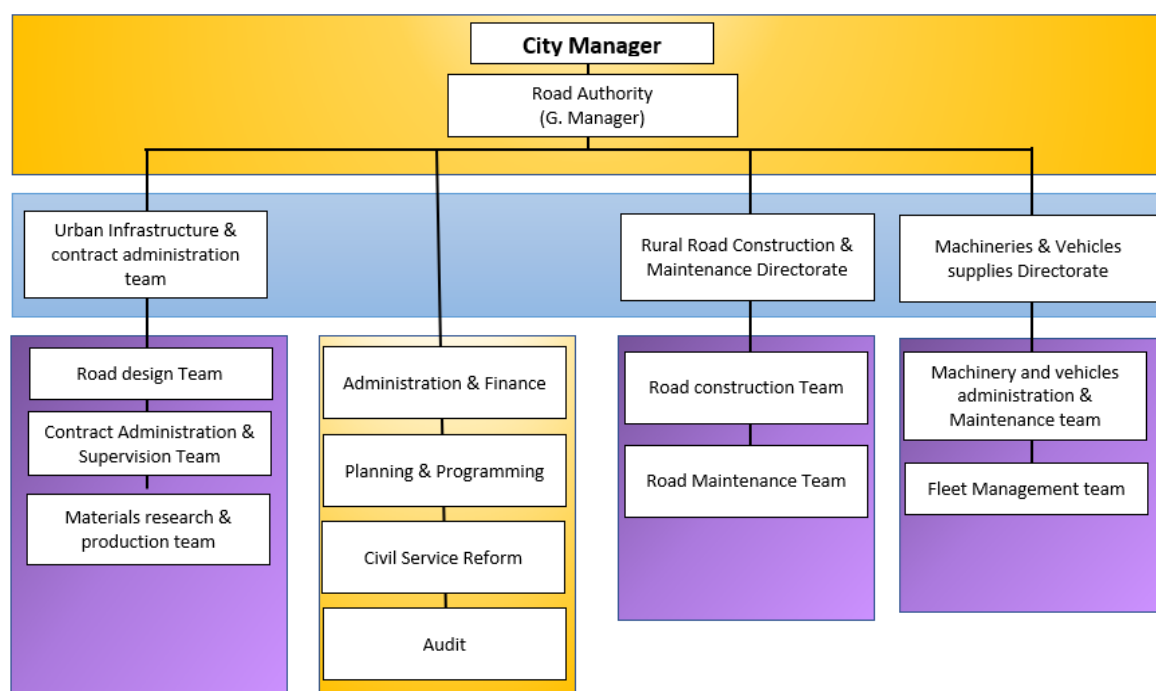
2.1.6 Harari

In Harari the organization of the road sector is based on two different entities responsible of the different areas of infrastructure and services.

In this case the Road Authority is accountable to the City manager (Harar) though the responsibility is at regional scale. The Authority has three directorates and some staff functions. the directorates have the following tasks: Urban Infrastructure and road administration, Rural Road Construction and Maintenance, Machinery and Vehicles (see Figure below).

⁸ Source: NTU International, Institutional Capacity Assessment (ICA) Report

Figure 5: Harari Road Authority organizational structure⁹



The Transport and Road Development Bureau has the duty of Transport administration: vehicles licensing, drivers license, traffic management.

2.1.7 Oromia

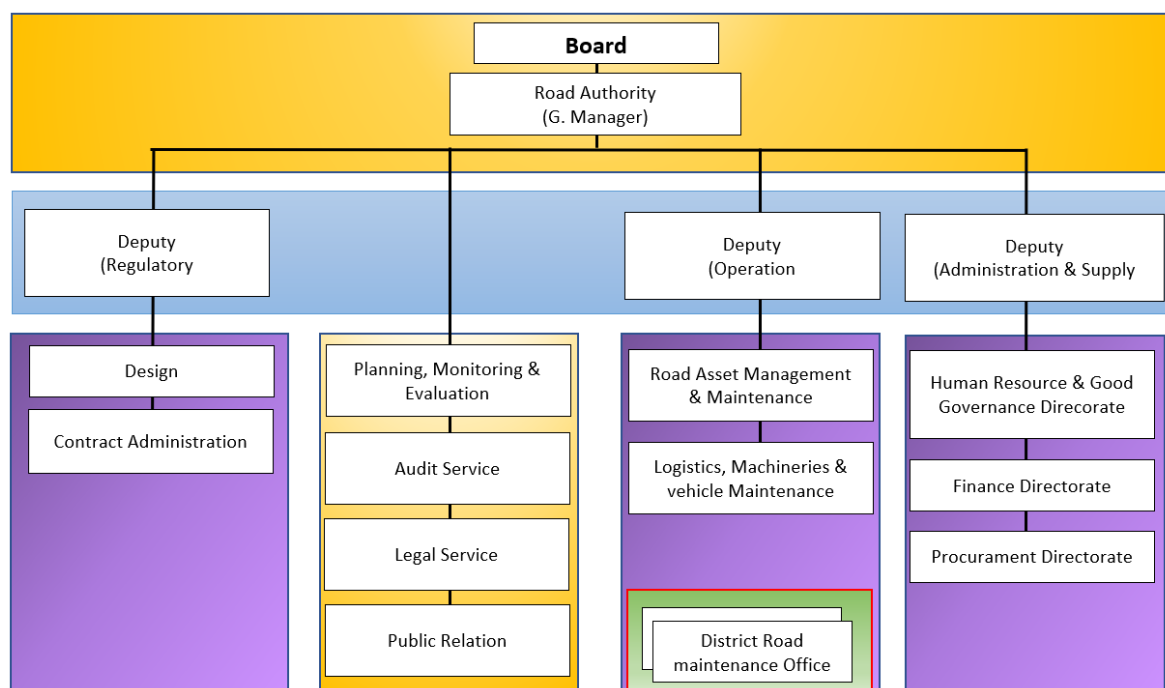
In the Oromia state the organization of the road sector is centered on two entities in charge of infrastructure and services areas.

The Oromia Roads Authority is responsible for regulatory and operational functions of road development and maintenance (see figure below). The mission of the Authority is to carry out road development, create quality road network, administer and ensure sustainability by involving all stakeholders by improve the living standard of the people.

The Authority has a Management Board, accountable to the Council, and has their directorates plus some staff units. The directorates have the following tasks: Design and Contract Administration, Operations (road asset management and vehicles fleet management) and Administration (Human resources, Finance, Procurement). In the figure below is described the structure of the Authority.

⁹ Source: NTU International, Institutional Capacity Assessment (ICA) Report

Figure 6: Oromia Road Authority organizational structure¹⁰



Oromia Transport Authority is the Transport bureau of the Regional State. The main duties are as follows i) to control the provision of transport services in the region, and implement the government's acts on this matter, ii) to conduct registration and technical inspections to motor vehicles registered in the region and issue the concerned directives, iii) to approve trip schedules prepared by transport associations for regional public transport service, iv) to issue competency certifications to enterprises providing vehicles inspection and garage services, v) to follow up and control the enforcement of road transport proclamations, regulations and directives on highways, interurban and woreda connecting roads.

In terms of public budget allocation, the expenditures for transport (considered as allocations for "Trade, transport and investments") accounted about 4% - 6% of the total budget during the period 2015/16 - 2017/18. It is a low value considering the kind of expenditures but it has to be noted that Oromia benefits from all the projects connecting the Ethiopian Capital City with the rest of the country which are financed by the Federal budget.

Coming to public enterprises, there are nine enterprises in the Oromia region totally owned by the regional ownership. They have their own management boards, provide services at market rate and are supervised by the Privatization and Public Enterprises Supervising Authority at Regional state's level. The following table describes revenues and expenditures of regional road enterprises compared with the whole group of public enterprises.

Table 2: Cost and Revenues of Oromia public enterprises in the road sector¹¹

Name of institution	Revenue	Expenditure
Total road enterprises	543.500.000,00	587.700.000,00
Grand total	4.647.090.000,00	2.609.190.000,00
of which total road enterprises	11,7%	22,5%

¹⁰ Source: NTU International, Institutional Capacity Assessment (ICA) Report

¹¹ Source: Consultant's elaboration on PEFA Program. Performance Assessment Report, Oromia 2019

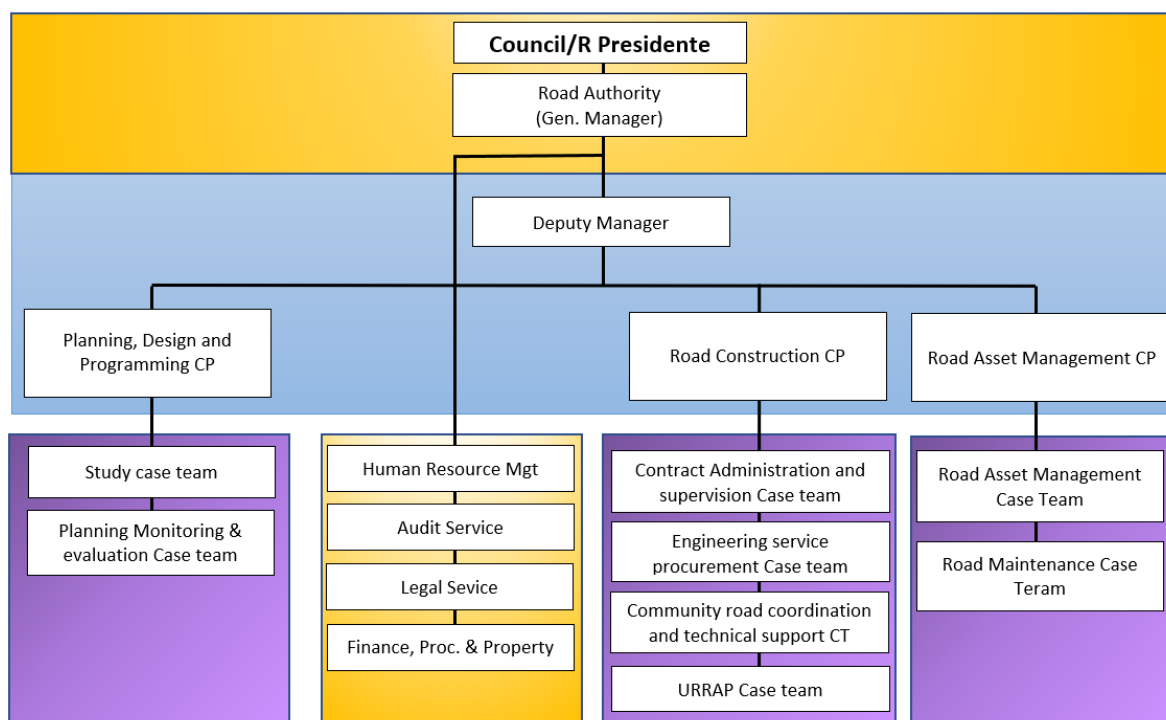
The main road public enterprise is the Oromiya Road Construction and Maintenance Enterprise (ORCE). The company has been established as an autonomous body having a legal personality in proclamation No. 116/2008 issued by National Regional Government. The scope of the ORCE activity is roads construction, water works, buildings, roads maintenance and other construction activities.

2.1.8 Somali

The institutional organization of the road sector in Somali is based on two entities in charge of the different areas of infrastructure and services.

The Road Authority has both regulatory activity and road maintenance task (see figure below). In addition to some staff units, the Authority has two directions for its main functions: road construction - responsible for regulatory and contract management activities - and asset management - responsible for asset maintenance and management problems. The latter direction represents own resources to carry out its task.

Figure 7: Somali Road Authority organizational structure¹²



The Transport and Road Development Bureau is in charge of the administrative duties concerning regional transport: vehicles licensing, driver's license, traffic management.

As for budget expenditures the share assigned to roads can be estimated between 2% and 6%. of the regional budget. Besides to this approximately a further 1%, coming from the federal level and distributed by the Road Fund, must be added¹³.

¹² Source: NTU International, Institutional Capacity Assessment (ICA) Report

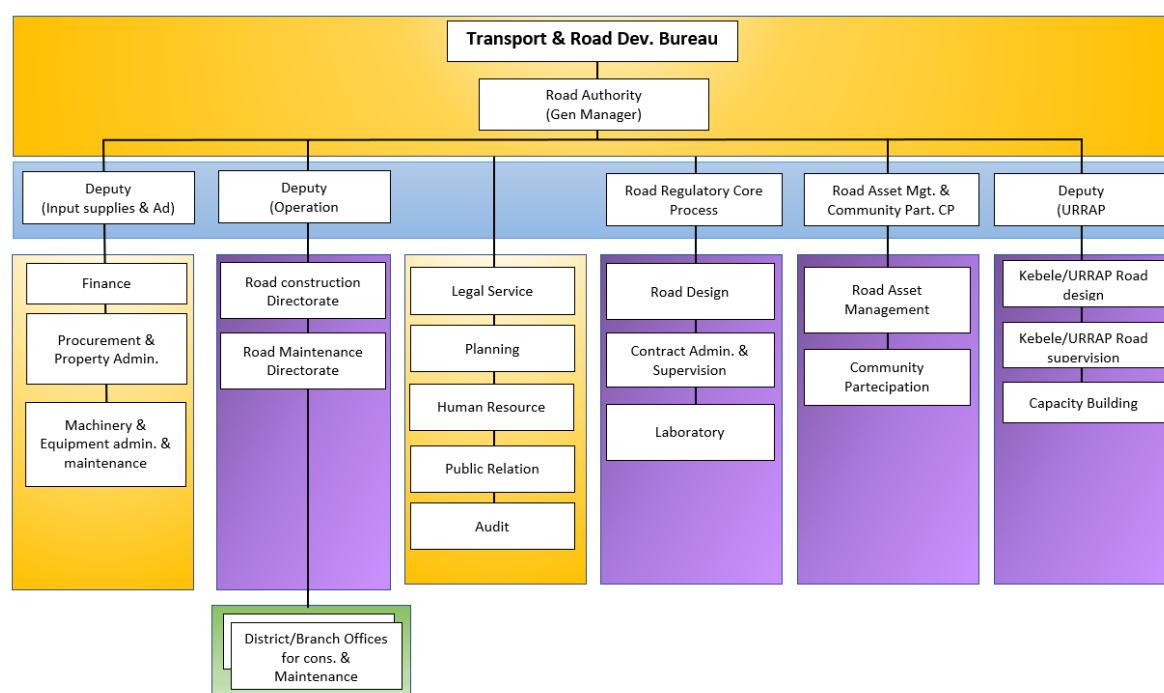
¹³ According to UNICEF, Somali Regional State Budget Brief: 2007/08 - 2015/16, during the period the assignments of resources to road sectors varied between 2% and 6%. The PEFA assessment for Somali RS 2020 reports that the Road Authority "received ETB 25 million in FY2017/2018, ETB 17 million in 2016/2017, and ETB 12 million in 2015/2016. These amounts are less than 1 percent of total government expenditure."

2.1.9 Southern Nations Nationalities And Peoples Region

In Southern Nations, Nationalities and Peoples Region the organisation of the road sector is centered under one entity, the Transport and Road Development Bureau which is accountable to the Council. Within this Bureau there are a Road Authority and a Transport Bureau which are in charge, respectively, of Road development and Transport administration duties.

The organization of the Road Authority is based on three areas and two core departments as follows: Input supplies and administration Area, Road Regulatory Area, Road Asset Management & Community Participation Area, URRAP Department, Operation Department. The latter is in charge of both construction and maintenance operations, to this purpose there are twelve district offices accountable to the regional Operation Department (see figure below).

Figure 8: SNNPR Road Authority organizational structure¹⁴



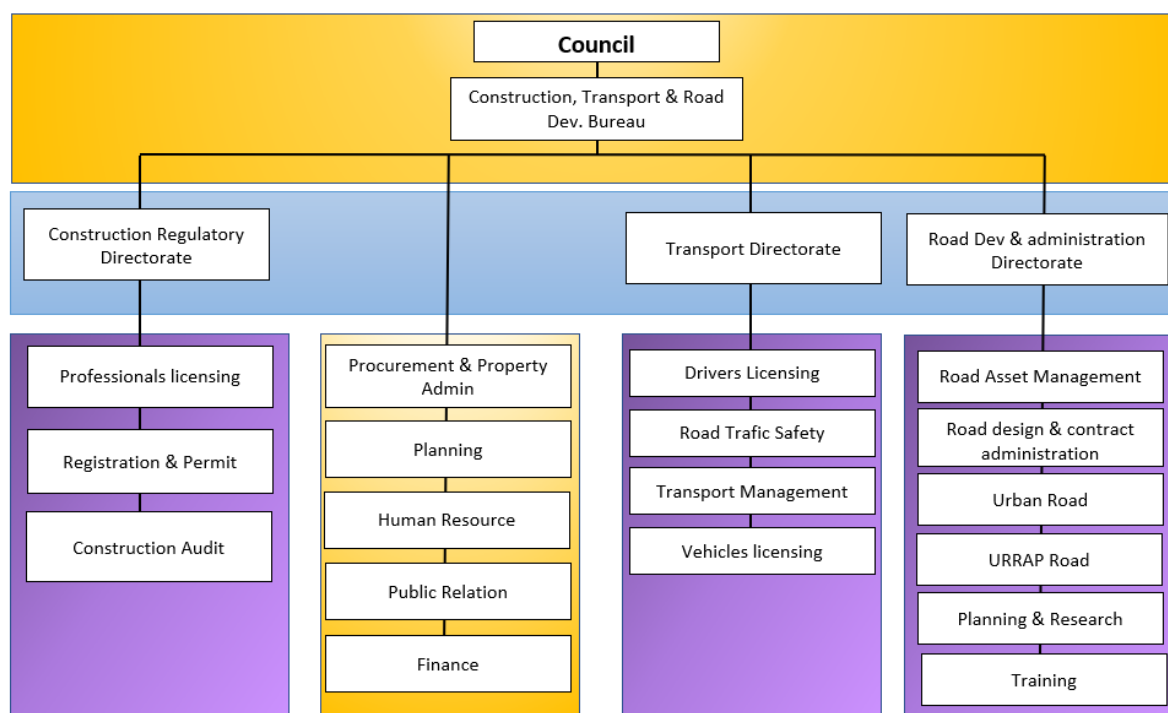
As for public enterprises, there are five corporations owned by the regional state but none of them belong to road sector. Road's construction is carried out by private operators, big public corporations and also the Regional Road Authority.

2.1.10 Tigray

The institutional structure of the road sector in Tigray is based on a single entity accountable to the Council: the Construction, Transport and Development Bureau. This body is divided in three directorates: Construction and Regulatory, Road Development and Administration, Transport, which, in turn are responsible of, respectively, Construction licensing, Permits and Audit; Asset Management, Design and contract administration, Urban and URRAP roads, Planning, Training; Vehicles and drivers licensing, Traffic management, Road safety. The figure below describes the organizational structure of the Construction, Transport and Development Bureau.

¹⁴ Source: NTU International, Institutional Capacity Assessment (ICA) Report

Figure 9: Tigray Construction, Transport and Development Bureau organizational structure¹⁵



There are three public enterprises in Tigray, one of them is focused on road constructions, the Tigray Road Construction Enterprise. In terms of public budget allocation, the share of "Construction and Transport" expenditures varied between 9,3% and 13,2% during the period 2015/16 - 2017/18 (see table below).

Table 3: Actual values of public budget expenditures¹⁶

	2015/2016	2016/2017	2017/2018
Construction and Transport	1,370,124,597.16	1,291,763,637.23	1,515,975,832.87
Total expenditures	10,404,038,256.96	13,878,068,707.00	14,720,370,354.18
%	13.2%	9.3%	10.3%

¹⁵ Source: NTU International, Institutional Capacity Assessment (ICA) Report

¹⁶ Source: Consultant's elaboration on PEFA Program. Performance Assessment Report, Tigray 2019

3 **PRESENT SITUATION ANALYSIS**

3.1 **RAI METHODOLOGY**

The RAI is the standard World Bank indicator for the investigation and comparison of accessibility levels in different countries and regions. The RAI measures the proportion of rural population that lives within 2 km (approximately 20 min walk) of an all-weather road.

The latest RAI methodology was developed in 2016 by the World Bank contractor TRL. Such methodology involves the use of WorldPop data in combination with road data to define the rural population that is at least 2 km away (approximately 20 min walk) from a road that can be used most of the year by a standard vehicle.

After an initial analysis of the road database provided by ERA and a review of other databases from various well-established international organisations, the network repository from the World Food Programme (derived from the processing of satellite imagery) is adopted for planning the rural network. Satellite imagery has the great advantage of showing the complex network of rural paths and unclassified roads that are used and managed by local communities, either to access the neighbouring town or the nearest road, or sometimes just to move cattle between pastures. Although many of these paths are currently unusable by motor vehicles, their existence signifies their relevance to the local communities. This way, accessibility is considered in its broader meaning, rather than reducing its definition to the classified road network only.

The use of such methodology allows to define the network of roads and paths that are existing and require upgrade or rehabilitation, thus taking advantage of the assets that the country already has, rather than just focusing on building new infrastructure from scratch, which is usually more expensive.

3.2 **TRAVEL TIMES METHODOLOGY**

Literature shows that the accessibility level has generally a good correlation with the level of poverty. Thus, providing a good level of accessibility is key to reduce poverty levels in rural areas. The aspects that influence accessibility are many, both social, such as the access to basic services, and economical, such as the access to markets.

Although the RAI is the standard indicator to define a general level of accessibility, it does not provide a measurement of the effective time to reach markets and services. For this reason, mapping travel times is also considered alongside the RAI. In particular, travel times to 20,000 and 100,000 people market from Climafrica 2016 are used in conjunction with the rural population distribution to define the weighted average travel times to markets for the rural population in each Woreda. A similar methodology has recently been adopted by the EU in the calculation of public transport accessibility across Europe (access to mobility services indicator).

Literature shows (Crop Production and Road Connectivity in Sub-Saharan Africa: A Spatial Analysis, World Bank, Sustainable Development Division) that the yield of crops is maximised if crops are produced within four hours travel time from markets, while it decreases considerably if travel times are above such threshold. Therefore, four hours are assumed as an acceptable travel time to markets.

Another indicator is developed to study travel times to hospitals. To do this, iso-distance maps are built using the location of hospitals and the major road network. A distance of 30 km is considered as a threshold. Assuming an average speed of 15 km/hour, people within such distance would be able to reach a hospital within two hours. Such methodology is in line with the one developed by the University of Oxford to study travel times in sub-Saharan Africa (Access to

emergency hospital care provided by the public sector in sub-Saharan Africa in 2015: a geocoded inventory and spatial analysis). It should be noted that the WHO international standard requires nations to provide at least 80% of the population with health services with a maximum travel time of 2 hours. In this case the methodology is used to compare Woredas in terms of access to hospitals.

3.3 DATA SOURCES

The GIS software QGIS is used to collect and analyse multiple data sources derived from the processing of satellite imagery.

The following sources are used for the collection of data:

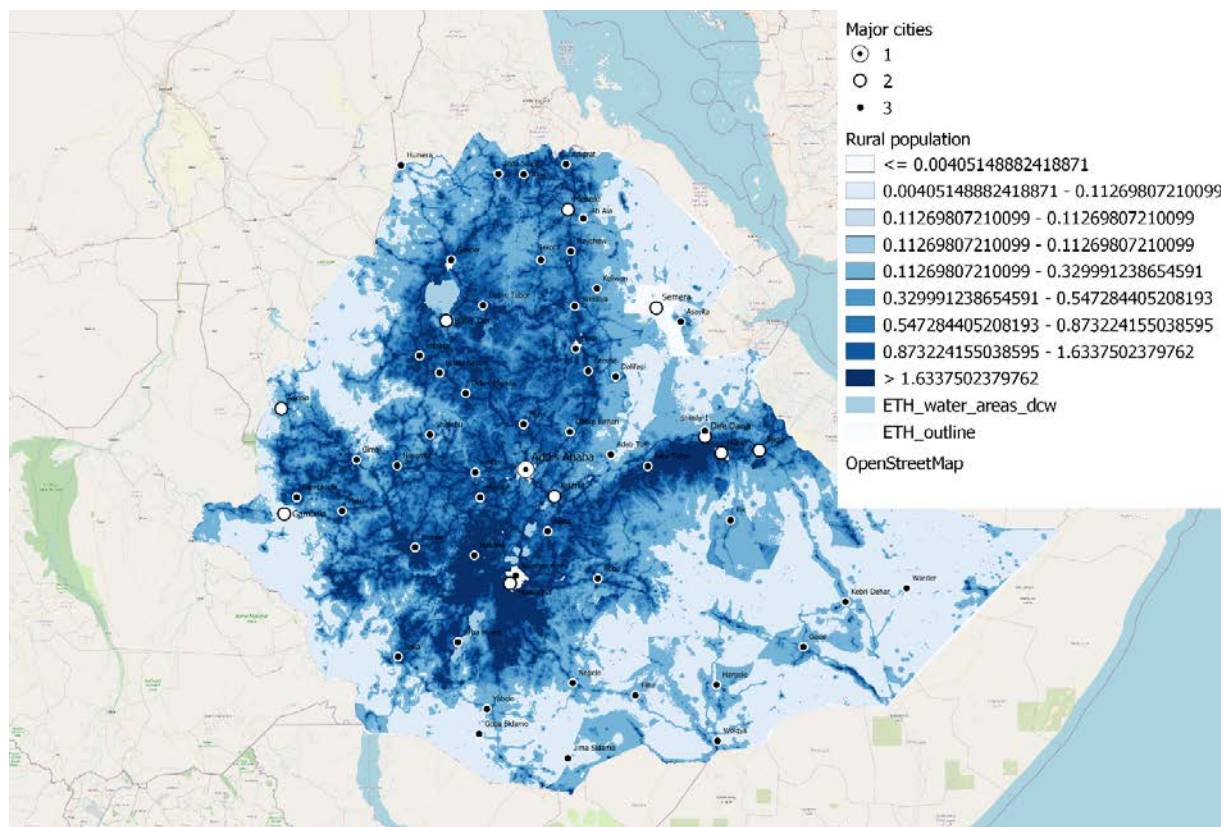
- Worldpop data has been used to define population at 100m grid definition (2020 data)
- Road’s data was obtained from the World Food Programme repository (2019 data)
- Travel times to markets were obtained from HarvestChoice and International Food Policy Research Institute repository

3.4 RESULTS OF THE ANALYSES

3.4.1 Rural population

The rural population of the country is defined by removing the population of the urban Kebeles from the WorldPOP dataset. Google Earth satellite images are used to compare the extensions of urban areas in comparison with the Kebeles administrative boundaries and subtract the population of the urban population from the dataset.

Figure 10: Rural population extracted from WorldPOP – 2020 database



In addition, the entire regions of Addis Ababa, Harari and Dire Dawa are excluded from the analyses as their average density and accessibility levels are very high compared to the rest of the rural population considered.

The rural population considered in the following paragraphs is therefore of 93.8 million people million people, 94% of the WorldPop dataset which shows a country’s population of approximately 100 million people.

3.4.2 Rural accessibility index (RAI)

The Ethiopia 2025 Plan aims at reaching the status of Low Middle income country by 2025. Part of the effort will be targeted at improving the level of rural accessibility for the country.

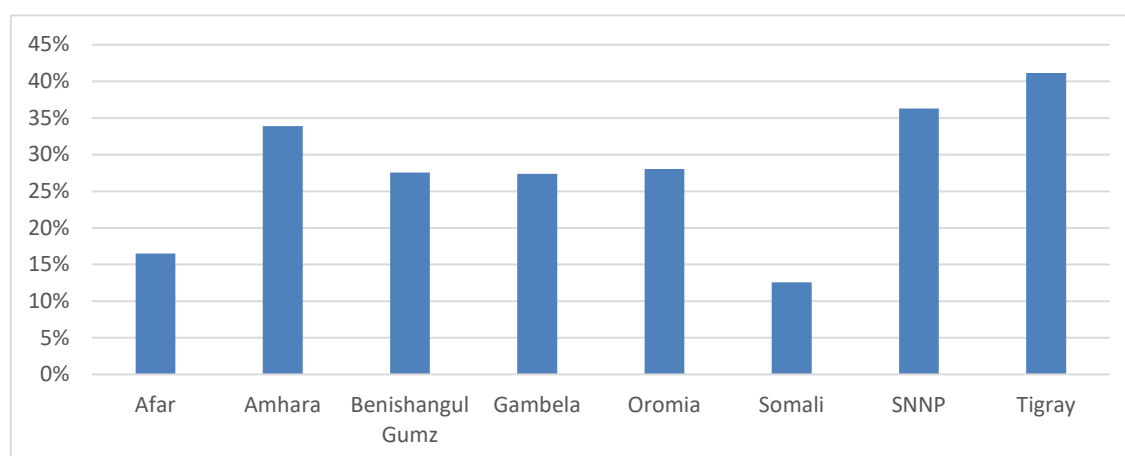
The latest World Bank RAI figures for low middle-income African countries show an average RAI of 42%, with the highest levels of accessibility being reached by Zambia and Zimbabwe both with a RAI of around 65%.

Table 4: RAI for low middle-income African countries¹⁷.

Low middle income countries	RAI
Angola	42%
Benin	32%
Cameroon	20%
Ghana	61%
Kenya	44%
Mauritania	31%
Nigeria - 8 states	37%
Senegal	29%
Tanzania	38%
Zambia	64%
Zimbabwe	65%
Average	42%

The population living within 2 km from an all-weather road with the use of the ERA database is 28 million people. Following the proposed (2016 standard) methodology the RAI for the country is estimated as 0.31. This methodology shows that Ethiopia performs worse than other low-middle income African countries in terms of RAI overall.

Table 5 Calculated RAI with the use of ERA database



A review of the road network with the use of independent databases shows that there are

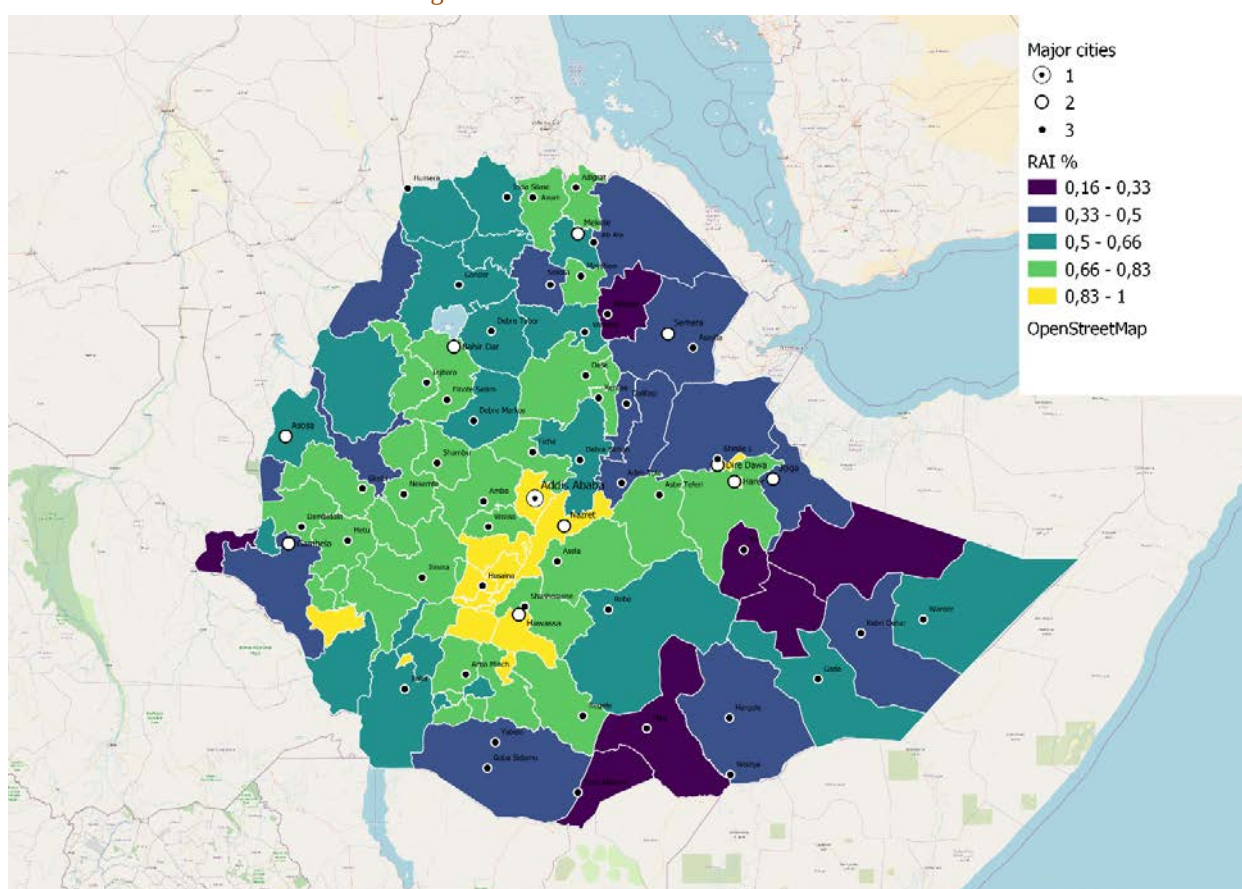
¹⁷ Source: World Bank

numerous links and roads that are be left out from the ERA database. Although many of these roads are likely to be in poor state and cannot be defined as all weather, their presence signifies their importance to the rural communities. In addition, it should be noted that for gravel roads any work of upgrade and rehabilitation is expected to be considerably less expensive than constructing from scratch.

For this reason, it is proposed that these roads are included in the calculation of RAI for the purpose of defining disparities between Zones and planning for the upgrade and rehabilitation of roads at local level as well as identifying gaps that require construction of new roads.

With the use of WFP database, the calculated RAI for each Zone is extremely varied (Figure 11), which likely implies strong disparities throughout the country with areas that are better served than others by the road network.

Figure 11: Calculated RAI for all Zones



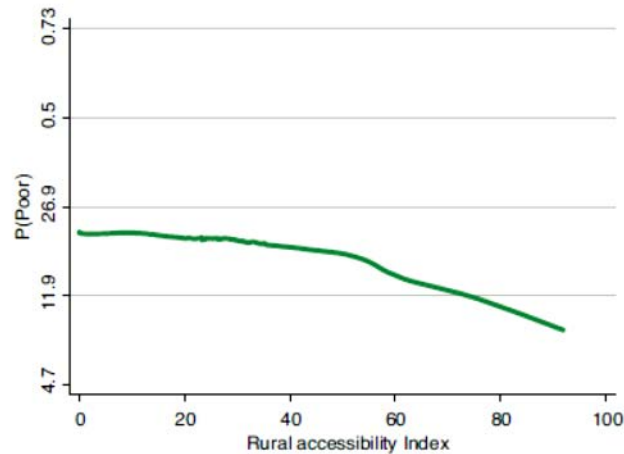
Better connectivity is correlated with lower poverty, thus the more connected the better a place is. In the latest World bank Ethiopia Poverty Assessment 2020¹⁸ it is stated that as the RAI increases, poverty rates decrease, but the strong dent in the poverty only happens when RAI exceeds 50 percent (i.e., when at least half of the population of the woreda lives within 2 km of all-weather road), as shown in Figure 12 below.

¹⁸ <https://openknowledge.worldbank.org/handle/10986/33544>

Figure 12 Poverty rates vs RAI

POVERTY DECREASES AS RURAL CONNECTIVITY INCREASES

Poverty rates by rural accessibility, 2016



Statistics combined with the most recent Ethiopia Household Consumption Expenditure Survey (HCES) and the Welfare Monitoring System (WMS 2016) showed that relative to the rural non-poor, the rural poor live further away from roads, health facilities, and urban centers.

For instance, 57 percent of the poor live more than three kilometres away from an all-weather road, compared to 45 percent of the non-poor, as showed in the Table 4 below. Also, concerning distance to health facilities, 43 percent of the rural poor live more than three kilometres away from the nearest health post, in comparison with the 34 percent of the non-poor.

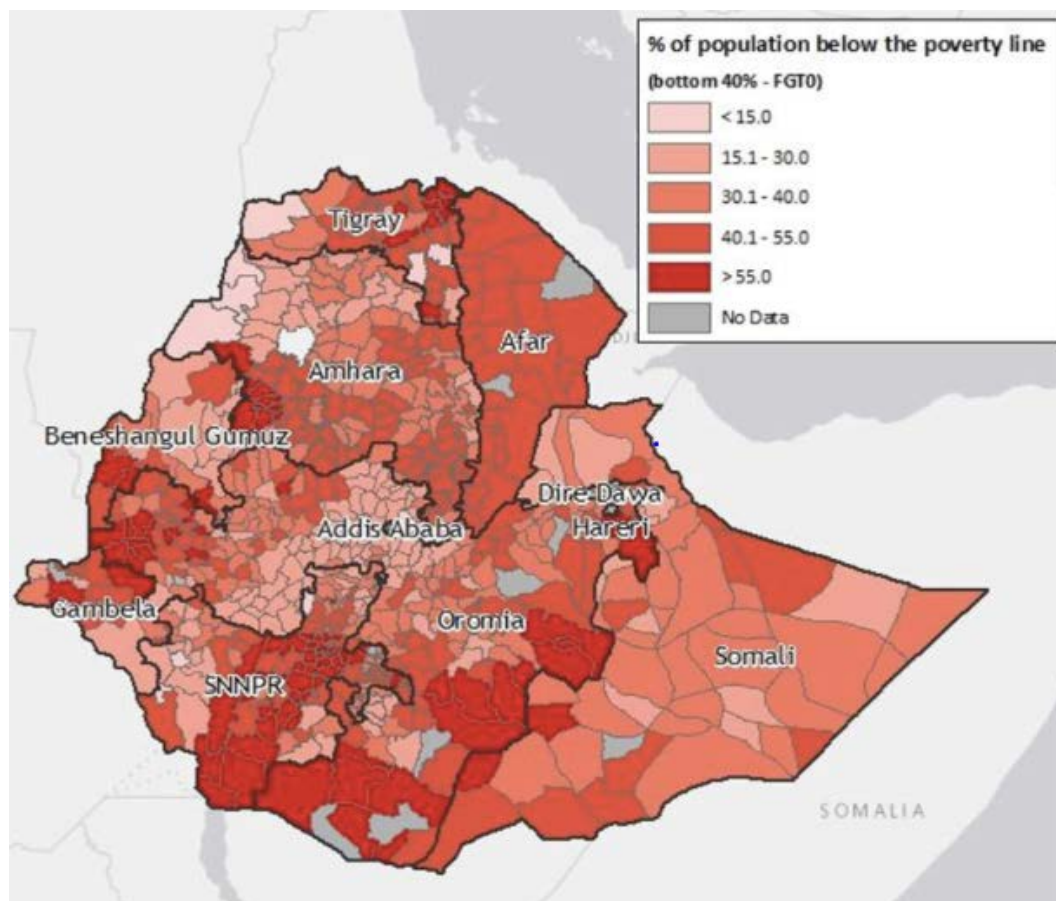
Table 6: Distance to health facility and road connectivity by poverty status in 2016 in rural areas¹⁹

		NON-POOR	POOR
Distance to health facility	% located less than 2 kms	46.3	38.6
	% located between 2 and 3 kms	19.6	18.3
	% located more than 3 kms	34.1	43.1
	Average distance in km	3.4	4.2
Distance to all-weather roads	% located less than 2 kms	43.1	33.2
	% located between 2 and 3 kms	11.5	10.1
	% located more than 3 kms	45.4	56.7

¹⁹ Source: HCES, WMS, 2016

A similar conclusion is reached with the present RAI analysis which shows a good correlation with crop production and poverty indices (Figure 13) thus partly validating the link between RAI and these two indicators.

Figure 13: Population below poverty line by Woreda²⁰



3.4.3 Travel times to markets

According to the 2019 World Food Programme report *Comprehensive Food Security and Vulnerability Analysis*²¹, distance from markets and services is an important determinant of food security and poverty.

Some 70 percent of the rural population in Ethiopia must travel about six hours to reach all weather roads. To make things worse, most of these roads are dry weather roads²². Most Ethiopians still rely on pack animals and carrying loads on their own heads and backs to get goods to market, which limits the mobility of rural people. In fact, only 28.8 percent of the rural population are within 2 km of a market.

The analysis conducted by World Bank suggested that poverty rates increase by 7 percent with every 10 kilometers from a market town²³. Thus, the Ethiopian agricultural output markets are generally characterized by an inadequate transportation network and accessibility is an issue of

²⁰ source: World Bank, 2011

²¹ https://reliefweb.int/sites/reliefweb.int/files/resources/wfp_ethiopia_cfsva_report_june_2019.pdf

²² Wondemu, Kifle Asfaw. (2015). Rural road quality, farm efficiency & income in Ethiopia.

²³ World Bank (2015). Ethiopia Poverty Assessment 2014. Poverty Global Practice African Region

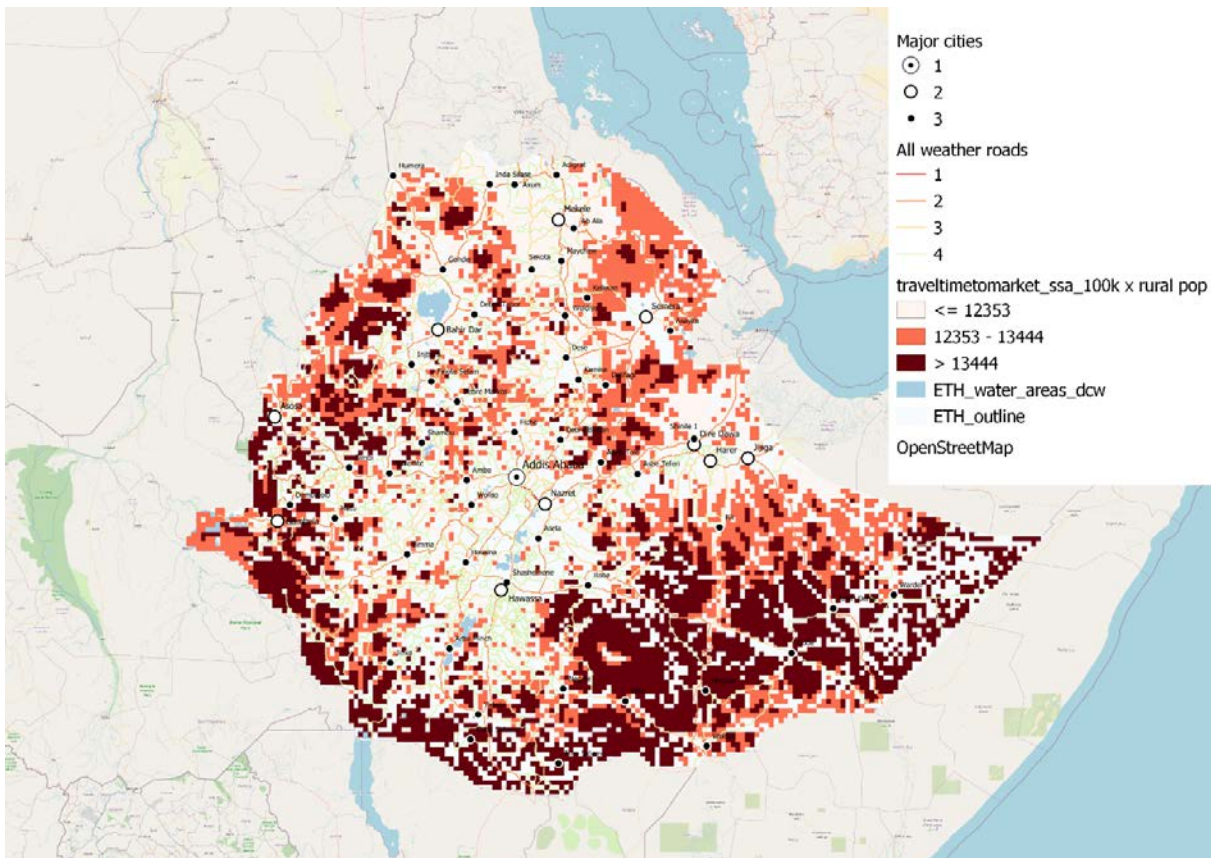
great concern particularly for a great majority of the rural population.

There is a transaction cost for producing and selling surplus food in markets, which may be affected by transportation cost and availability of the necessary infrastructure. This in turn can impact the amount of income that the household generates from its agricultural activities.

In the present analysis, travel times to markets are defined using the ClimAfrica 2016 repository from the International Food Policy Research Institute. The dataset consists of a raster of values showing travel times through a grid covering all sub-Saharan Africa.

Such values are blended with the population distribution to obtain a grid of weighted travel times by population. For this analysis, only the population that is away from all roads has been considered.

Figure 14: Travel times to 100,000 people population market multiplied by population.



Better accessibility obviously has a positive repercussion also in the improvement of the economic conditions and, consequently, in the purchasing power of the more isolated communities. Traditionally rural communities are mostly involved in agricultural activities but there is also a large demand for services that must be satisfied and transportation is crucial.

The Ethiopia Socioeconomic Survey from the Central Statistical Office (CSA) also confirms that the main constraint in rural areas in opening a Non-Farm Enterprise (NFE) relates to Transportation (32 percent), as shown in the Table 7 below.

Table 7: Constraints on opening an NFE²⁴

Constraints on Opening an NFE by Place of Residence, Ethiopia 2018/19, Percent			
	Ethiopia	Urban	Rural
Financial services	32,9	35,1	30,4
Transportation	17,5	5,7	31,6
Markets	13,9	21,5	4,7
Electricity	12,1	9,7	14,9
Technology	1,4	0,6	2,2
Water	1,7	2,2	1,2
Registration and permits	5,7	7,1	4
Safety	1,3	0,2	2,5
Government	2,5	4,7	0
Telecommunication	2	1,7	2,4
Taxation	4,1	5	3
Other	2,5	3,8	0,9
None	2,4	2,7	2

3.4.4 Travel times to hospitals and primary schools

Maternal and perinatal mortality are among the most common causes of death in rural areas. Many studies from around the world highlighted how poor access was a major cause of peri-natal mortality, with an estimated 75% of mortality resulting from inadequate transport to access basic health facilities and/or transport for referrals to hospitals. In particular, the perinatal mortality rate in Ethiopia is one of the highest in sub-Saharan Africa countries (a 2014 study showed a rate of 90 per 1000 birth in a hospital setting, and 40 per 1000 births in community-based settings). The corollary of the problem analyses is that constructing and maintaining rural roads, paths and bridges leads to improved maternal health outcomes and healthier rural communities.

In Ethiopia, seven in 10 women report at least one problem accessing health care for themselves. More than half of women are concerned about getting money for treatment, while half are concerned about the distance to the health facility, as stated in the 2016 Ethiopia Health and Demographic Survey Report²⁵. Distance from health facilities is perceived as a major obstacle in accessing health care particularly in Afar, Oromiya and Benishangul-Gumuz regions. Afar is also the worst-performer region in terms of early childhood mortality.

Moreover, rural roads can greatly influence where schools are built, how many rural boys and girls go to primary and secondary schools and how adequately the schools are staffed. In most countries, rural primary schools are within walking distances of their catchment communities, but secondary schools are more spaced out, requiring much longer average journeys (and perhaps boarding arrangements).

According to the Ethiopia Socio Economic Survey Report for the country as a whole, about 72 percent of primary and 73 percent of secondary students can reach the nearest school in less than 30 minutes (Table 8). Nevertheless, there is a great difference in travel times to schools between urban and rural areas: while only 6 percent of the primary students need more than 30 minutes to reach the nearest school in urban areas, this percentage rise up to 27 in rural areas. The discrepancy is even wider for secondary schools with 7 percent of the students in urban areas travelling more than 30 minutes in comparison with the 45 percent in rural areas.

²⁴ Source: CSA

²⁵ <https://dhsprogram.com/pubs/pdf/FR328/FR328.pdf>

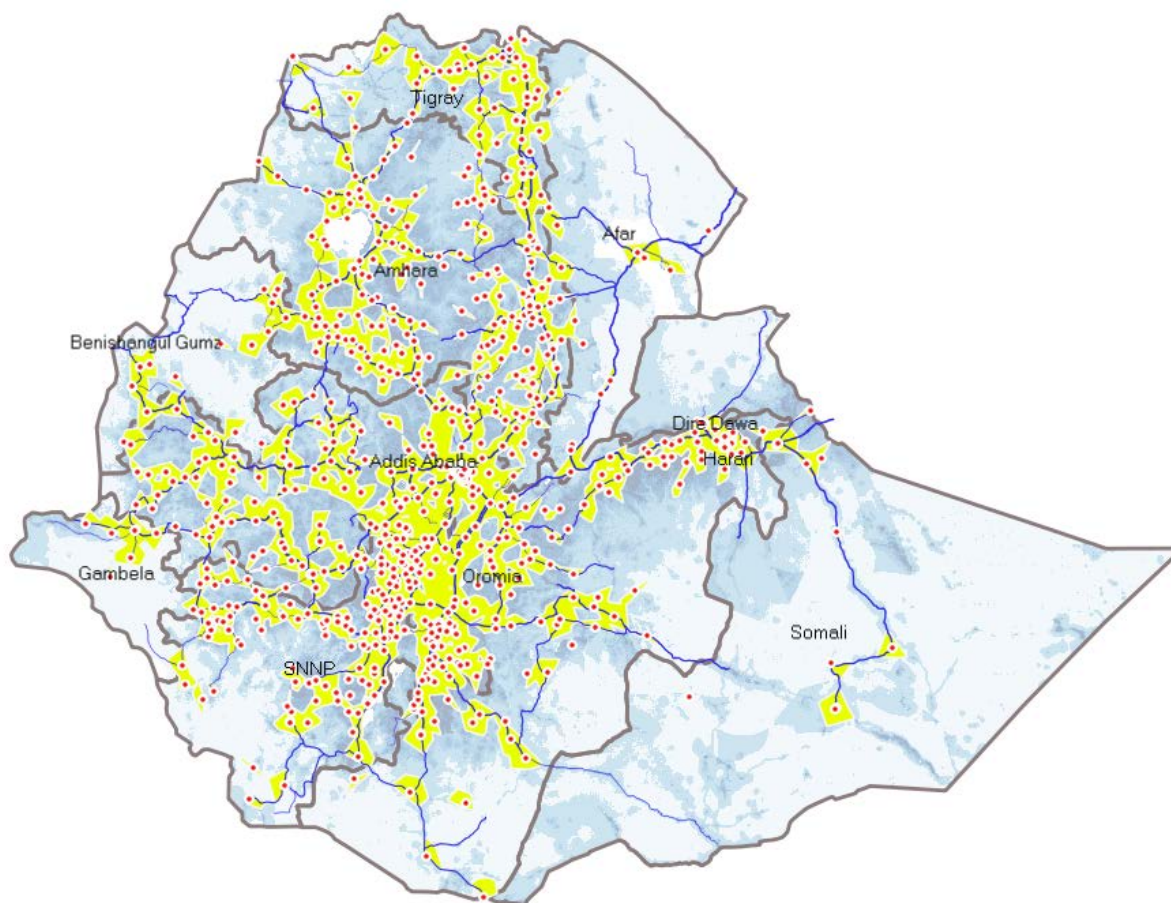
Table 8: Enrolled Students (ages 7-18), Ethiopia, 2018/2019, %²⁶

	Travel times (minutes) to reach the nearest school							
	Primary School				Secondary School			
	0-15	16-30	31-60	61+	0-15	16-30	31-60	61+
Rural	30.4	36.3	27.0	6.4	25.7	20.9	44.9	8.5
Urban	59.6	33.7	6.1	0.6	48.7	42.6	7.3	1.3
Ethiopia	36.8	35.7	22.4	5.1	39.3	33.7	22.7	4.3

In the present analysis, travel times to hospitals are obtained by using the location of hospitals and clinics as well as the major road network. GIS is used to create iso-distance polygons and map distance to hospitals up to 30 km.

Assuming an average speed of 15 km/hour, this would mean a travel time of 2 hours, which is in line with WHO recommendations.

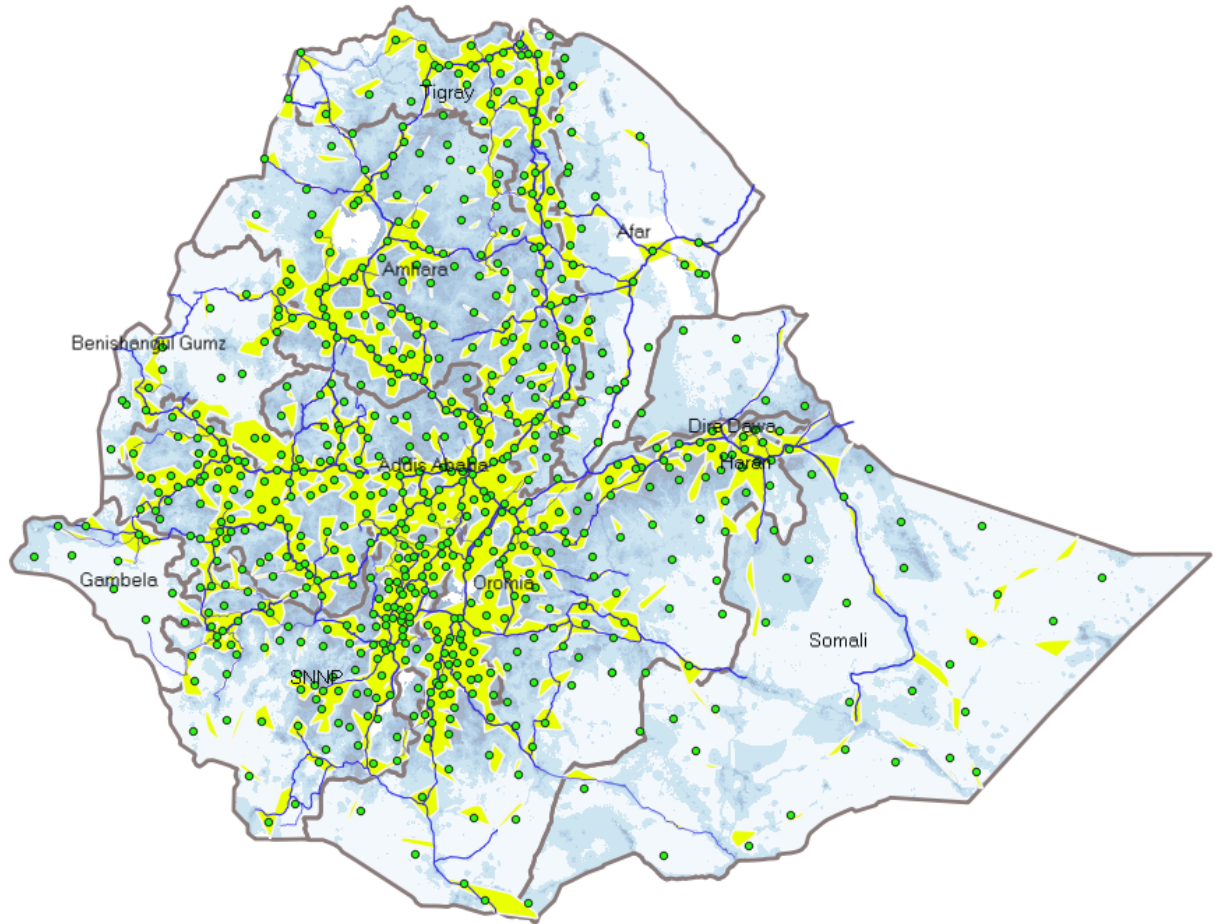
Figure 15: Polygons showing population and travel distances to hospital <30 km.



The population within 30 km from hospitals is then computed for each region to compare the levels of health accessibility. Similarly, the rural population within 30 km from a primary school is extracted for each region.

²⁶ Source: CSA

Figure 16: Polygons showing population and travel distances to primary schools <30 km.



3.4.5 Results at regional level

The Addis Ababa, the Harari Region and the Dire Dawa Region are excluded as their entire population is considered urban, given their high population density.

Results at regional level show a considerable variance in terms of rural population and RAI. Although less populous than others, Afar, Somali, Benishagul Gumz and Gambela show the lowest RAI, considerably below the national average, while other regions have RAI that are near or above average.

Figure 17: Rural population and RAI (ppl) by Region

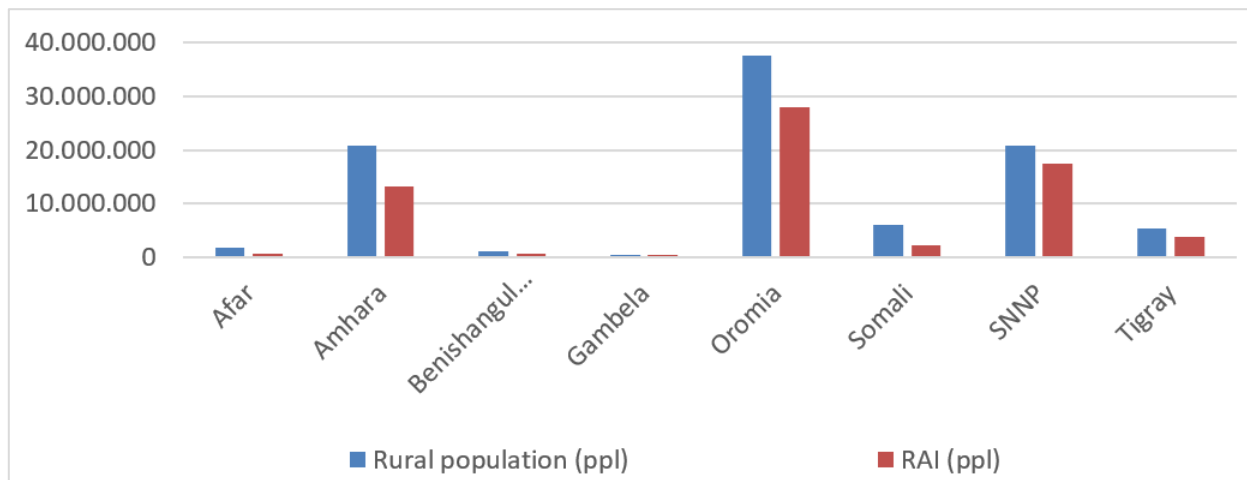
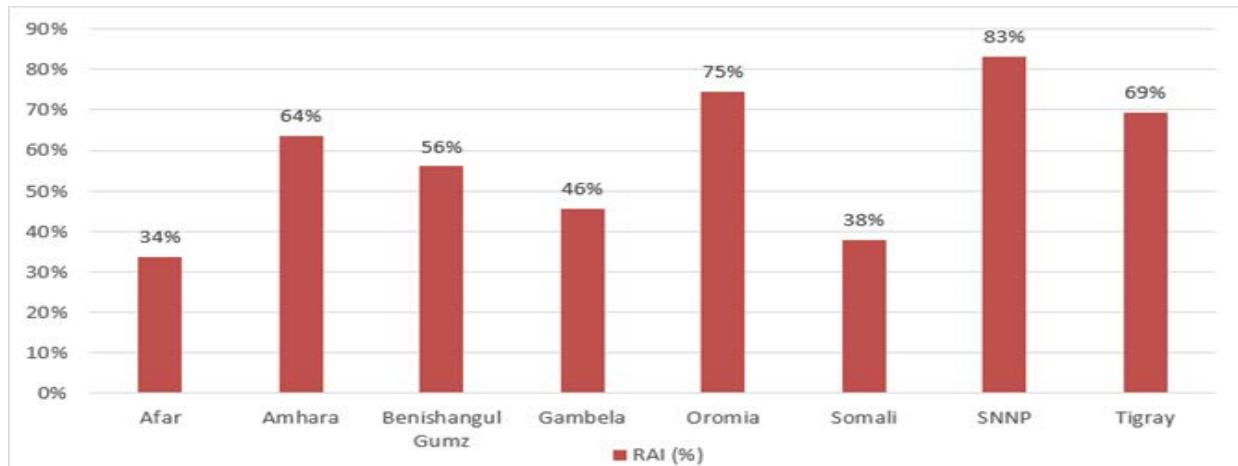
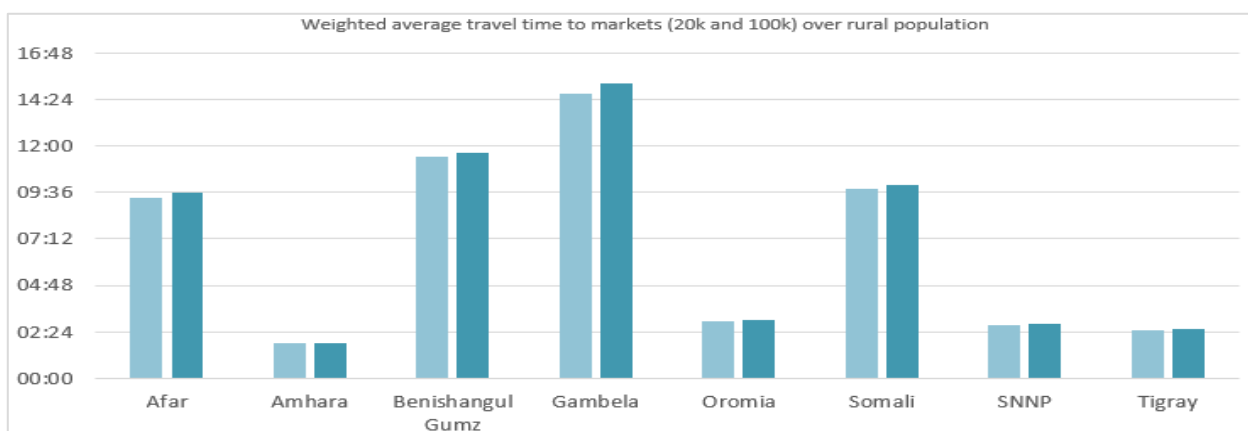


Figure 18: Calculated RAI for each Region (%)



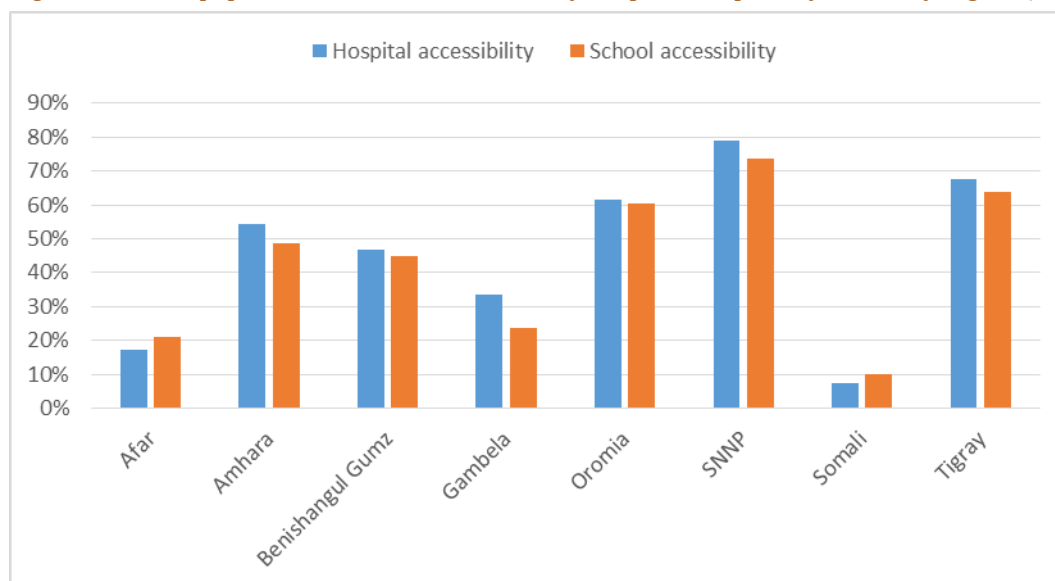
In terms of travel times to markets, Afar, Benishagul Gumz, Gambela and Somali all have travel times to markets above four hours.

Figure 19: Weighted average travel time by population



In terms of hospital and school accessibility, Afar, Benishagul Gumz, Gambela and Somali have less than 50% of their rural population within 2 hours drive from a hospital or primary school.

Figure 20: Rural population within 30 km from any hospital and primary school by region (%).



3.5 CONCLUSIONS

The geospatial analyses undertaken show that the average accessibility in Ethiopia is lower than in other low middle income African countries.

As accessibility is regarded as a key factor in the reduction of poverty and in the increase in crop production, an improvement of accessibility levels should be considered as a matter of priority. This appears to be also the case for Ethiopia as a correlation between RAI and poverty rates is demonstrated. Travel times to schools, hospitals and markets are also considered as they provide a further understanding in factors that constitute accessibility in its broader terms.

The analysis of different databases (including satellite imagery) shows that the country has a wealth of tracks, roads and paths that are not classified in the official ERA databases. Although most of these are likely to be in poor state, it is suggested that their presence is included in the analysis, as they could provide the basis for further upgrades and expansion of the present classified network.

A more detailed analysis at regional and Zone level shows considerable differences in rural accessibility within the Ethiopian regions. For most regions only a few Zones show significantly low performances. For three regions, i.e., Afar, Benishagul Gumz, Gambela and Somali, the levels of accessibility are on average significantly lower than in the rest of the country. However, it should be noted that in some areas the lack of basic services is the driving factor rather than the lack of transport infrastructure.

The following Chapter 4 will present recommendations that should be followed to mitigate some of the issues highlighted at national level in terms of network management, repartition of funds, resources management (including labour conditions), research and guidance, and public transport.

The, the following Chapter 5 will present a plan for each region with the ideal size of the network, the estimated cost to build and maintain such network, as well as the estimated cost of a proposed intercity public transport system.

4 RECOMMENDATIONS

Following the present situation assessment based both on the review of the available documentation and on the analyses undertaken, a few general recommendations are brought forward. These should serve as a guiding policy framework for the next years.

4.1 INNOVATION IN THE NETWORK MANAGEMENT

Innovation is key to develop and maintain the rural network in a cost-effective manner.

In recent years international organisations and researchers have focused their attention on the improvement of geospatial indicators. As innovative data collection methods are more and more utilised, new sources of data are available to use and methodologies to define existing and new indicators are proposed. An example is WorldPop, an independent database that is used to define human settlements and their density. Such database is built with satellite imagery and is validated. In 2016, the World Bank, which is the repository of the Rural Accessibility Index (RAI), has published an updated methodology to help calculate the RAI with the use of geospatial datasets such as WorldPop. Therefore, it is proposed that such innovative methodology is used in the next years by regional agencies to define levels of accessibility and plan investments.

The work undertaken highlights the many advantages of using geospatial analysis for research and communication purposes. It is also recognised that the GIS base tool is indispensable for public organisation to plan and manage infrastructures. It is proposed that an inventory of all Ethiopian rural roads is built and managed directly by RRAs. Such an inventory will contain information on the type of roads, quality of roads, type of terrain, average traffic as well as any reported issue or accident.

It is understood from ERA that the Road Fund is currently undertaking a major work of inventory of federal and rural roads that also includes an assessment of road conditions.

Innovative and relatively inexpensive tools may be introduced by rural agencies to regularly monitor road quality such as drone surveying and road roughness index apps for mobile phones.

Once completed, the RRAs will use such inventory to report to the MOT on achievement of their targets. Such tool may also be used by the regional authorities to request additional funds.

Overall, it will be key that the methodology utilised to build and maintain the RRAs GIS system is consistent with national and international standards (such as those proposed by the Consultant), so that national policy makers will be able to compare and evaluate effectiveness of measures and investments and ultimately act as required to correct deviations from targets.

4.2 REDUCTION OF DISPARITIES

The geographical analysis undertaken in the present situation report shows that some regions have an average level of rural accessibility that is considerably below the national average (Afar, Benishangul Gumz, Gambela, Somali).

This is in line with the 22 years RSDP Assessment which mentions that: *“There are four emerging regions in the country namely Gambella, Benishangul-Gumuz, Afar and Somali. Due to neglect in the past, distribution of main roads in these regions and some pastoral areas of the country is minimal. To bring about balanced development amongst the regions in the country, roads provision should be equitable.”*

It is therefore proposed that efforts are increased in these regions to increase accessibility and reach the national average. This should be considered priority to mitigate regional disparities within the country and promote equality and access to basic services.

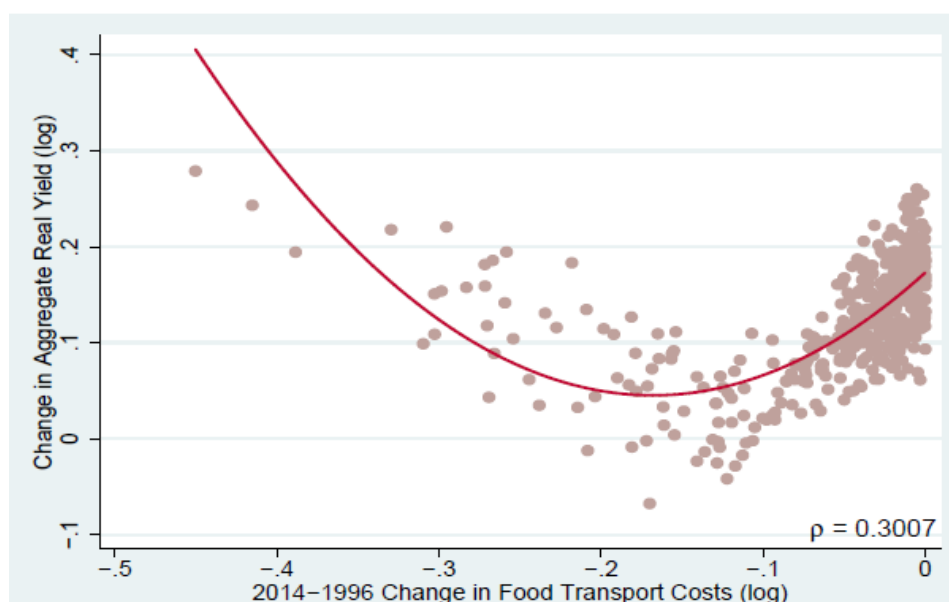
It should be noted that the lack of basic services in some areas is a driving factor for the low level of accessibility. In particular it is noted that large parts of the country are not served by health clinics. In particular in the regions of Afar, Gambela and Somali where more than 50% of the population is farther than 2 hours’ drive from a clinic.

Overall, Afar, Gambela, Benishagul Gumz and Somali are the regions with the lowest average accessibility. For these regions special funding might be required to reduce gaps with other regions.

It is noted that increasing the number of roads may not be sufficient to reduce the gap with other regions. Thus, it is proposed that new facilities such as markets and health clinics are planned to help sustain the rural population of such regions and reduce travel times to basic services.

Literature shows (Figure 20) that reducing travel costs to markets has already had a positive effect in the increase of crop yield in many Woredas between the 1996 and 2014 period. Therefore, it is strongly recommended that special analyses are considered when planning for accessibility. Once again it is important to highlight that the RAI calculation is not sufficient for the purpose of understand the issues of accessibility, especially at local/Woreda level.

Figure 21: Change in aggregate yield vs change in transport cost between years 1996-2014²⁷



At local level, the RAI and travel times to market and hospitals are generally consistent in showing that the most accessible areas are those at the core of the country, while accessibility degrades the farther the areas are from the core. The analysis shows large disparities even within the same regions.

4.3 REFORM RRAS STRUCTURE AND RESPONSIBILITY

It is noted that some RRAs operate differently from others²⁸. The organisational structure and roles for each RRA varies considerably. Although an effort is being made to build capacity and reduce gaps between different agencies, it is recognised that a clear structure and division of roles

²⁷ Spatial Integration, agricultural productivity, and development – Tasso Adamopoulos 2018, International Growth Centre

²⁸ Institutional Capacity Assessment (ICA) Report, May 2019, NTU

is key to maximise governance efficiency and help the MOT coordinate efforts at regional level. Therefore, it is proposed that the responsibilities of the RRAs are standardised.

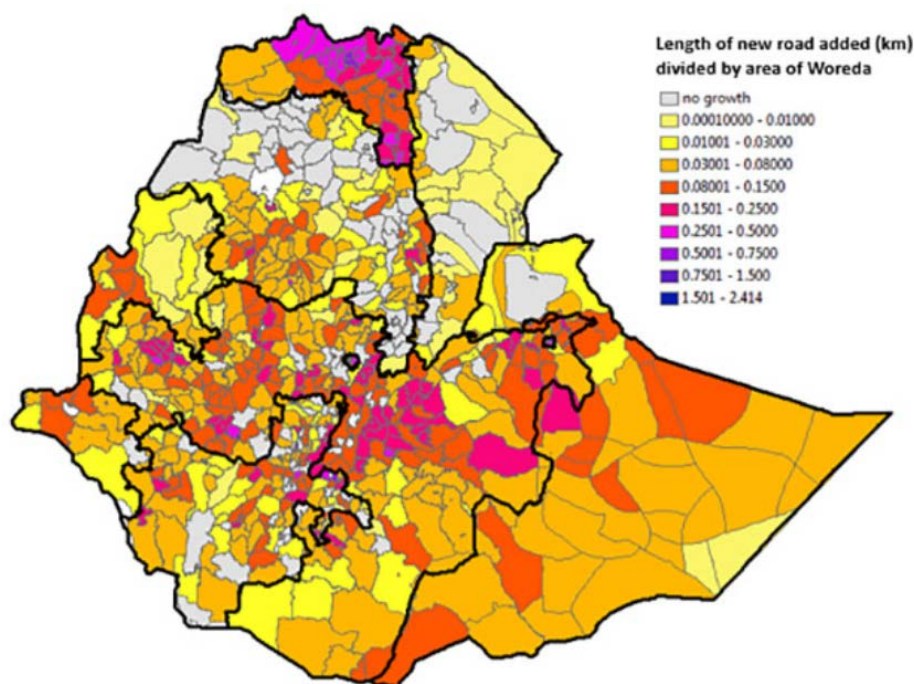
In addition, it is proposed that RRAs responsibilities are limited to:

- Building and maintaining the GIS-based road asset inventory
- Plan construction and maintenance interventions
- Search and obtain funds
- Contract works
- Provide guidance, training and support to contractors
- Audit designs and perform quality surveys
- Provide quarterly reports on advance of works and budget expenditure

4.4 INTRODUCE RRAs KEY PERFORMANCE INDICATORS (KPI)

It is noted that the 5 Years and 10 Years plans consider the works commissioned by the RRAs suggesting that different RRAs have different performances in terms of budget spent and targets achieved.

Figure 22: Changes in road density and length between 2006 and 2016²⁹



For this reason, an agency of experts at the MOT should obtain data from the agencies and compare the work of RRAs with the use of objective KPIs, such as:

- **Budgeted funds vs released funds:** this will show if RRAs are successful at obtaining the funds. As explained earlier release of funds will only be obtained if the yearly RDMP report prepared by the RRAs is signed off by the MOT
- **Network length:** this will show the length of the network managed and construction of new links
- **Proportion of network in good/fair conditions:** this will show if the RRAs are effective in maintaining the network under their remit

²⁹ source: World Bank

- **Road density by Woreda:** This will allow monitoring changes through time and show neglected areas
- **RAI using latest World Bank methodology:** this will show the improvements in rural accessibility index and how they compare with the Masterplan
- **Unit cost of construction and maintenance:** Monitoring unit costs will allow to show gaps in delivery performance

It will be responsibility of RRAs to collect the data required to measure the KPIs and report to the MOT through a yearly RDMP. To do so, adequate support and training of the RRAs should be considered.

It is suggested that such review of the agencies' work is performed by the MOT on a regular basis (i.e. yearly) and that is occasionally delivered through a third party independent consultancy to avoid risk of complacency. Laws should be enforced in case of gross mismanagement or misconduct by RRAs personnel.

4.5 INCREASE RESOURCES AVAILABILITY, LABOUR CONDITIONS AND LEVEL OF MECHANIZATION OF CONTRACTORS

It is noted that the 2007 Masterplan recommended the use of labour-intensive techniques to carry out road construction and maintenance works. As the rural road network expands it is crucial that the productivity is gradually increased to increase the output of works and grant contractors and employees better economic conditions.

As Ethiopia has gone through a period of rapid growth it is also noted that the cost per man/day of work that was considered at the time might not be sufficient to provide adequate pay today or in the years to come. To support this, it is understood that some regions have difficulty sourcing staff to perform road works, namely Somali and Afar, i.e., two of the regions already mentioned for their poor performance in rural accessibility.

In addition, as Ethiopia aims at becoming a middle-income country in the next years, labour intensive works should gradually be substituted with mechanized works.

It is also understood that Ethiopia has successfully started growing its own industry of roadwork machinery, which would benefit from an expansion of the sector.

Therefore, an increase in the use of machinery is recommended to improve work productivity, work conditions and attract employees. This is expected to also allow contractors to build capacity and be able to work both on rural and ERA road network.

Finally, the creation/implementation of workers category associations may be considered to:

- Provide training to unskilled and low skilled workers, including mandatory health and safety training, which has been reported to be sometimes missing
- Certify members and protecting their status as well as protecting them from unfair competition
- Define minimum and maximum hourly pay

4.6 IMPROVE THE BIDDING PROCESS

It is understood that until recently contractors did not have to go through a bidding process³⁰.

It is suggested that a fair bidding system is implemented. It is proposed that the following are considered:

³⁰ Institutional Capacity Assessment (ICA) Report, May 2019, NTU

- The system should consider both price and quality.
- The system should promote competition and allow new contractors to win work as soon as they qualify
- Contracts may be broken down into smaller contracts such as survey, design, construction, maintenance, quality control etc.
- Anti-bribery regulations, processes, control system should be implemented by the MOT using international best practices.

4.7 SIMPLIFY CONSTRUCTION GUIDANCE

Research and development are currently undertaken at different levels. Some RRAs do this as part of their core services³¹.

It is noted that in some regions the number of guidance is high with the risk of overcomplicating regulations. It is proposed that research and development is undertaken only under the supervision and coordination of the universities and the MOT. RRAs should help the development of guidance providing best practices for their local environment.

It is proposed that local and national guidance are merged as far as feasible into a single document to simplify regulations. Research and development should support this work. The final output of this work is to obtain a single document for all Ethiopian rural roads, which should take into account local diversities in terms of climate, geology, materials, terrain and hydrology.

This work should aim at simplifying the work of contractors and auditors. It should also help contractors operate in different regions efficiently.

4.8 DEVELOP A RURAL PUBLIC TRANSPORT SYSTEM

Public transport for rural areas is costly and with limited return of investment. However, in some areas and the weakest parts of the population it can make a real difference in terms of access to basic services such as education and health.

Potential to develop PT strategies at regional level will be presented in the following regional plans with the related cost for implementation.

4.9 DEVELOP TRANSPORT INTERCHANGE NODES

The presence of public transport interchange nodes is key to promote the use of public transport and ensure a smooth transition between different modes of transport. For these reasons, it is recommended that the planning of transport nodes includes the possibility to quickly interchange between transport modes such as urban and rural transport, taxis and cycling, and the private vehicle.

It is suggested that for the success of the interchange system the location is carefully planned to attract and serve the largest number of passengers. Tools that can be used to define the best locations for a transport interchange include spatial planning with GIS software.

However, careful consideration on the impact on the existing traffic should be also given to avoid potential congestion. Traffic impact assessments are sometimes required to mitigate potential issues caused by the increase in traffic. Sometimes these require the adoption of traffic simulation software, mostly microsimulation.

Passenger facilities such as toilets, waiting areas with benches, shelters, timetables, and drinking

³¹ Institutional Capacity Assessment (ICA) Report, May 2019, NTU

fountains are all key to provide an adequate experience. Disabled accessibility should also be considered in the design. Sustainability can be also promoted with the use of solar panels to minimise the operational cost of the building environment.

It should be noted that nowadays the role of transport nodes is rapidly changing from being merely functional to the movement of passengers to become ever more integrated into the urban environment. Thus, transport interchanges become places for business, retail and social life. Ultimately, they can become catalysts for the urban regeneration of entire neighbourhoods. Investment tools can be adopted to create models of mixed-use integrated real estate development. For example, the public agency or company developing the interchange could decide to purchase inexpensive or underutilised land and estates in the surrounding neighbourhood and repay (at least partially) the cost of the intervention with the positive return produced by the regeneration of the neighbourhood and the sale of the developed assets. However, it is key that any urban regeneration considers the specific needs of the existing local community by valorising its heritage and preserving its socio-economical fabric, thus promoting positive change for all the stakeholders involved.

4.10 INCREASE FUNDING

It is reported that the lack of funding is one of the factors that impeded the work of RRAs and the implementation of the URRAP (see 22 years assessment).

The table below shows that Woreda/URRAP roads are the main contributor to the low performance of the latest RSDPs.

Table 9: Performance of RSDPs³²

Program	Federal			Regional			Woreda/URRAP			Overall		
	Plan (km)	Actual (km)	% age	Plan (km)	Actual (km)	% age	Plan (km)	Actual (km)	% age	Plan (km)	Actual (km)	% age
RSDP I	3777	2709	72	5131	6000	117				8908	8709	98
RSDP II	5375	7486	139	2877	4106	143				8252	11589	140
RSDP III	8956	7996	89	5730	4399	77				14686	12395	84
RSDP IV	14782	13633	92	11212	9814	88	71523	62413	87	97,517	85,860	88
RSDP V	12336	11511	93	6600	8036	122	74187	14914	20	93122	34460	37
Total RSDP	45225.5	43332	96	31550	32355	102.6	145710	77327	53	222485.41	153013.13	69

Moreover, where roads have been constructed maintenance has become a heavy burden for regions. It is key that a review of funding is undertaken to outline priorities in the implementation of plans in terms of both construction and maintenance.

As already mentioned, the development of a standardised GIS based tool for road management will help coordinate efforts and direct funding from the government to the regional agencies.

However, it is also recognised that some of the measures identified in this document may require additional funding. The next paragraphs will identify the costs for the implementation of measures and define responsibilities at regional level.

³² Extracted from "Road Sector Development Programme: 22 years assessment".

5 REGIONAL PLANS

5.1 PLANNING APPROACH

The proposed strategy focuses on the improvement of the rural accessibility indicators used to for the investigation of the present situation. These are:

- The regional RAI based on satellite imagery (WorldPop) and WFP road dataset.
- The travel times to markets
- The travel times to hospitals
- Travel times to primary schools

In order to improve such indicators a review of the most isolated areas in each region is conducted. Multiple sources are used to investigate the presence of isolated towns and settlements, such as:

- WorldPop dataset
- Satellite images from Google Earth
- Open Street Map towns and villages

Where clusters of settlements are identified, new roads are considered to connect these populations to the network.

In addition, especially where large areas aren't served by any road, the network density is increased to reduce travel times to major cities and roads.

Ultimately, each plan considers the potential development of a regional public transport network that would aim at serving mainly the rural population.

Such plan considers the development of an intercity bus network that would cover the major regional and inter-regional road network, while it assumes that remote areas would be served by feeder services working on a demand responsive basis (DRT system).

5.2 AFAR

5.2.1 Planned regional road network

Afar is a region with a population of 1,850,940 inhabitants, of which 1,736,809 are considered rural (94% of the total). Currently 65% of the rural population is more than 2 km from any road or path.

The existing road network includes roads managed by ERA, community roads, municipal roads, URRAP roads and unclassified roads. The total existing network size is estimated to be 5,848 km long.

It is proposed that the existing road network is increased in both size and quality. In particular, it is proposed that:

- 2,343 km of new gravel roads are built
- 3,932 km of existing non-ERA roads are rehabilitated/upgraded

The rural network density will be uplifted from 41 km/1,000 sq.km to 66 km/1,000 sq.km which represents an increase of 60%.

The implementation of the plan considers appropriate funding for the regular maintenance of the rural road network.

Figure 23: Planned network

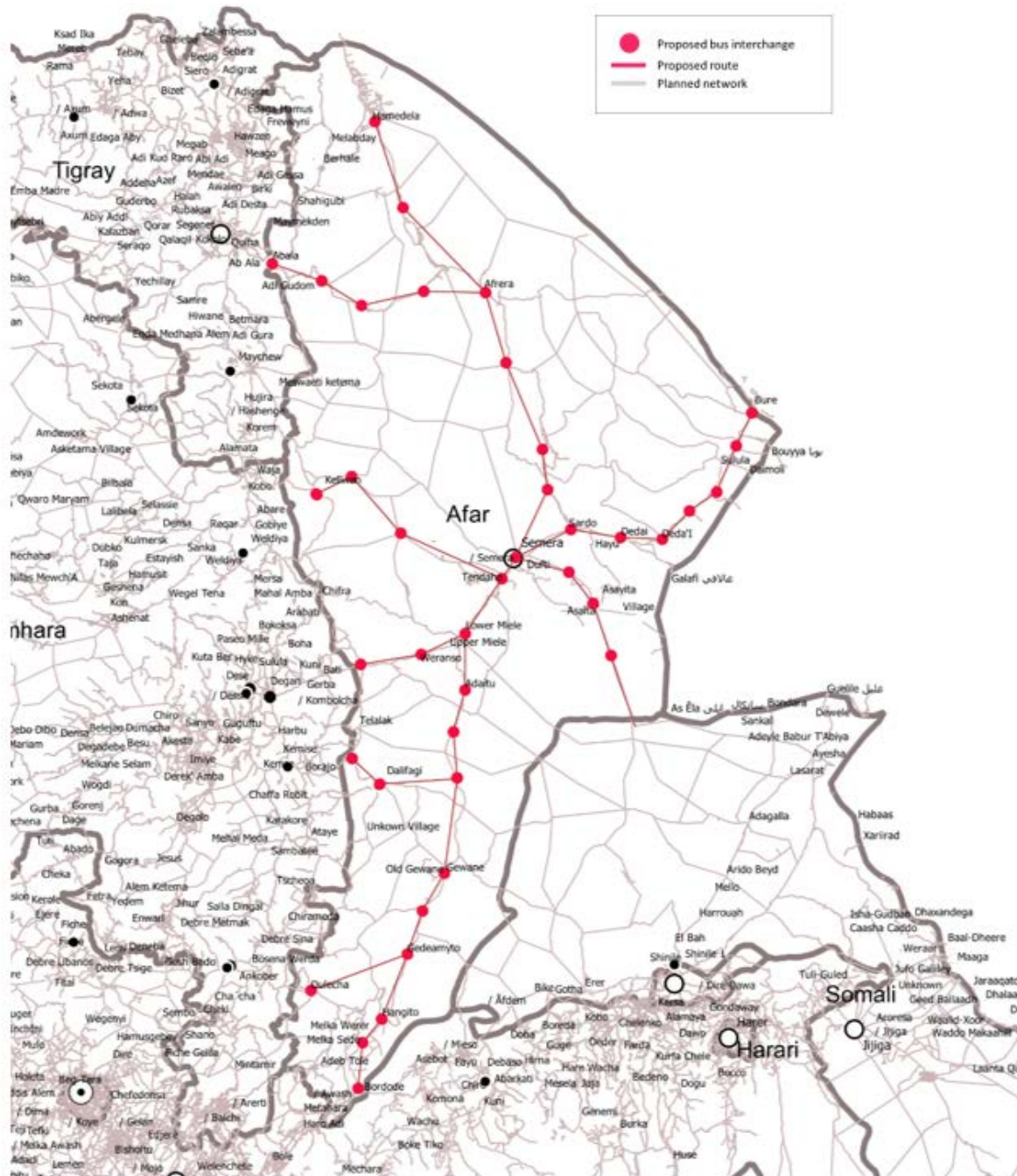


5.2.2 Planned regional public transport

It is proposed that the region is served by intercity coaches with fixed stops and routes. At least two services/day will be provided between the main cities within and outside the region.

The total network length considered is of 1,740 km. Assuming two services/day on all the planned routes in each direction, the services will cover 6,960 km/day.

Figure 24: Proposed intercity network



While intercity services will provide connectivity along the main routes, feeder services will be key to provide accessibility for the most isolated rural communities. It is proposed that such services are provided on a demand responsive basis.

5.2.3 RED model evaluation

A fully costed RED model is used to evaluate cost and benefits for the proposed construction and maintenance road plan. Seven project alternatives are considered for the proposed interventions, ranging from maintaining the current poor network conditions to paving. The options with the

highest net present value are also the costliest. However, the option with the highest internal rate of return is “Alternative 1 - bring to fair conditions” which implies the rehabilitation and regular maintenance of natural ground and gravel roads.

Such option also shows as the one with the highest modified rate of return and net present value per financial investment cost.

As this is the options expected to bring the maximum benefits with the lowest investment, this option is chosen as the preferred option.

Table 10: NPV/FIC ratio - Net Present Value per Financial Investment Costs (ratio)

Alter. 0	Alter. 1	Alter. 2	Alter. 3	Alter. 4	Alter. 5	Alter. 6
0.00	1482.48	891.58	347.36	286.76	238.82	190.88

The following funds would be required to deliver the rural road network plan. The total cost of the plan is estimated as 282,375,000 USD over 30 years.

The construction investment per person is expected to be 43.36 USD/inhabitant, while the maintenance 3.97 USD/inhabitant/year.

Table 11: Estimated costs

Upgrade cost	Build cost	Maintenance cost /year	Investment per inhabitant
\$ 47,184,000	\$ 28,116,000	\$ 6,902,500	\$ 43.36

5.2.4 PT costs

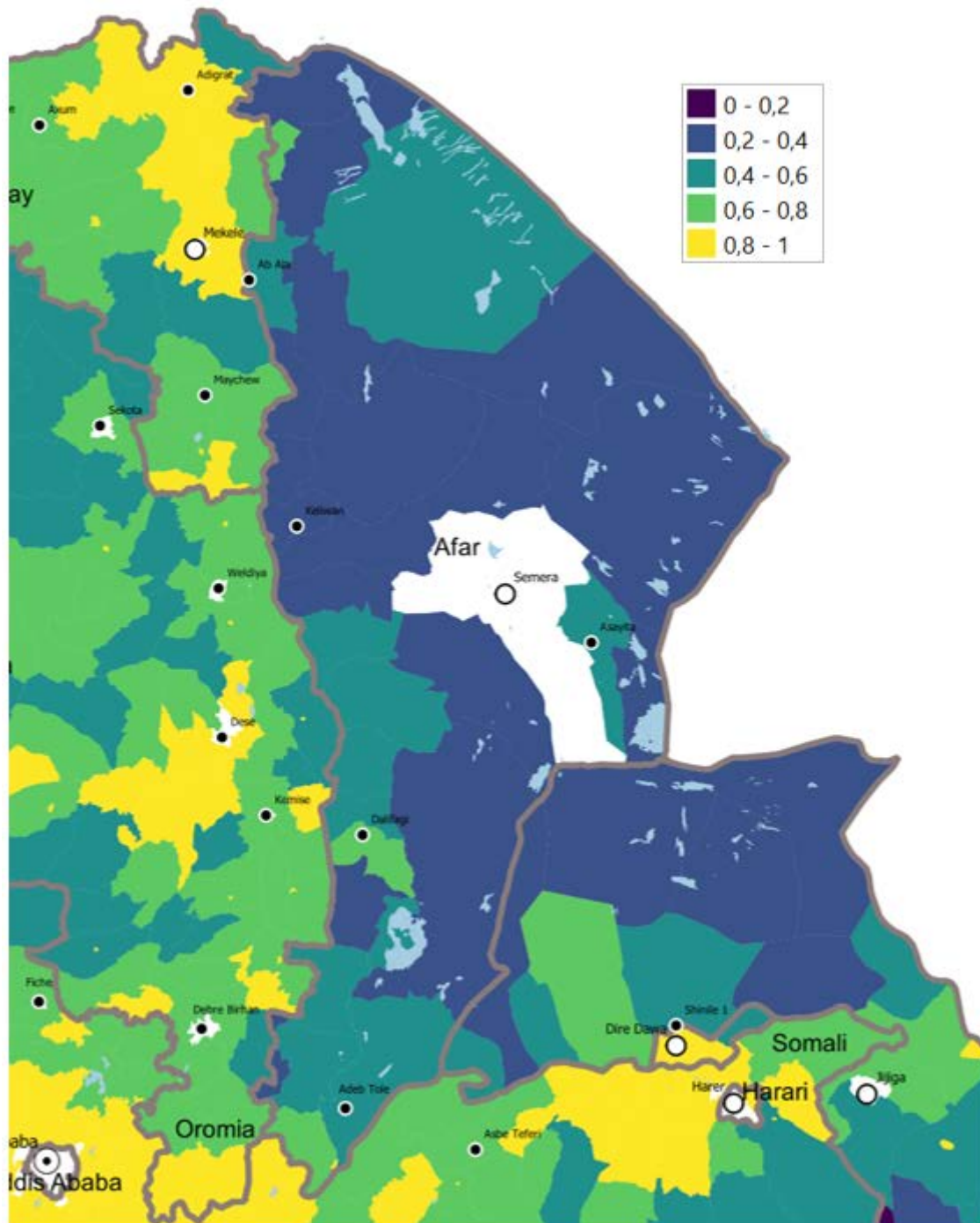
Regarding the intercity buses, it is assumed a cost of 0.2 USD/km. Therefore, the planned intercity system is expected to cost \$ 508,080/ year. Further investments will be required to fund the feeder services.

5.2.5 Benefits

The RAI for the region is expected to increase to 0.44 on average from the previous 0.16.

The plan is expected to provide new connectivity to 159,067 inhabitants within 2 km, while a further 217,645 inhabitants will be within 2 km distance from a rehabilitated road.

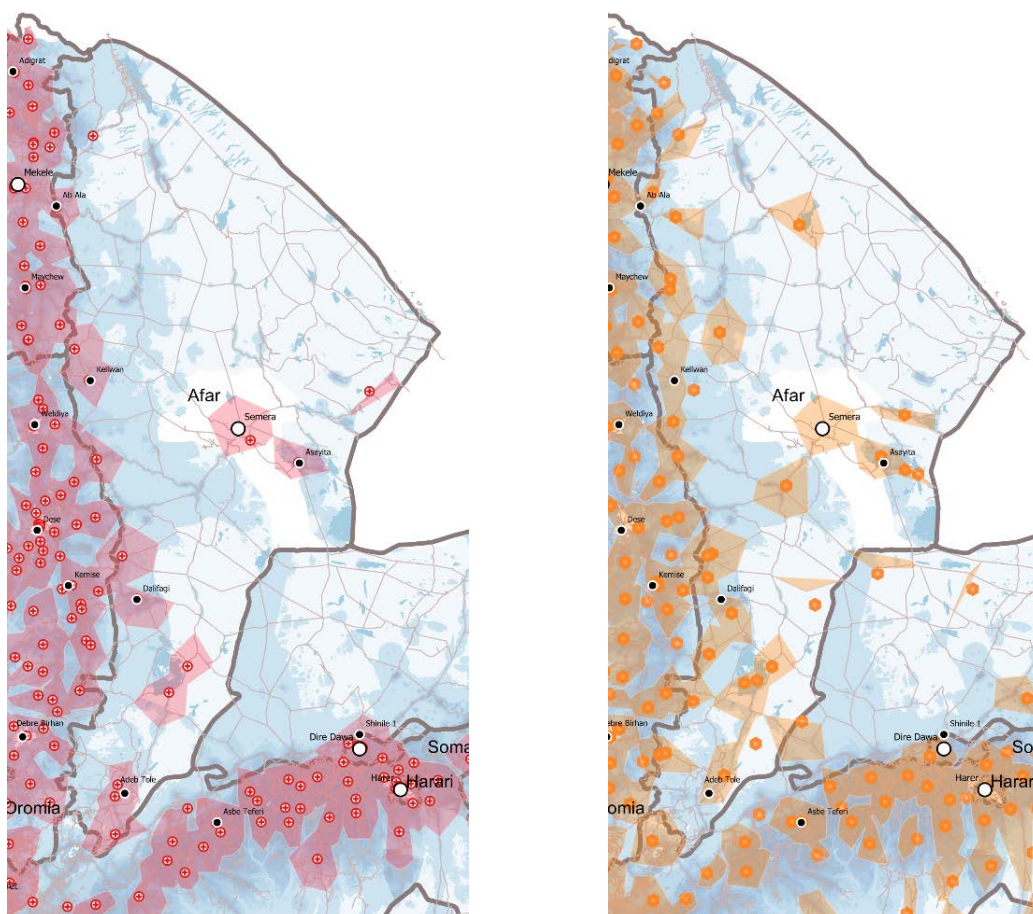
Figure 25: RAI after plan



The planned road network is expected to improve accessibility to both schools and hospitals. It will bring new connectivity to hospitals within two hours to 184,366 rural citizens (61% increase) and new connectivity to schools within two hours to 318,378 rural citizens (87% increase).

However, without an increase in the provision of basic services the accessibility to basic services is expected to remain inadequate. Without such increase the proportion of rural citizen within two hours from a hospital will be 28% and the proportion of those within two hours from a school will be 39%.

Figure 26: Hospitals (left) and schools (right) catchment area.



5.3 AMHARA

5.3.1 Planned regional road network

Amhara is a region with a population of 22,329,370 inhabitants, of which 20,690,200 are considered rural (93% of the total). Currently 34% of the rural population is more than 2 km from any road or path.

The existing road network includes roads managed by ERA, community roads, municipal roads, URRAP roads and unclassified roads. The total existing network size is estimated to be 26,756 km long.

It is proposed that the existing road network is increased in both size and quality. In particular, it is proposed that:

- 3,780 km of new gravel roads are built
- 20,254 km of existing non-ERA roads are rehabilitated/upgraded

The rural network density will be uplifted from 130 km/1,000 sq.km to 154 km/1,000 sq.km which represents an increase of 19%.

The implementation of the plan considers appropriate funding for the regular maintenance of the rural road network.

Figure 27: Planned Road network

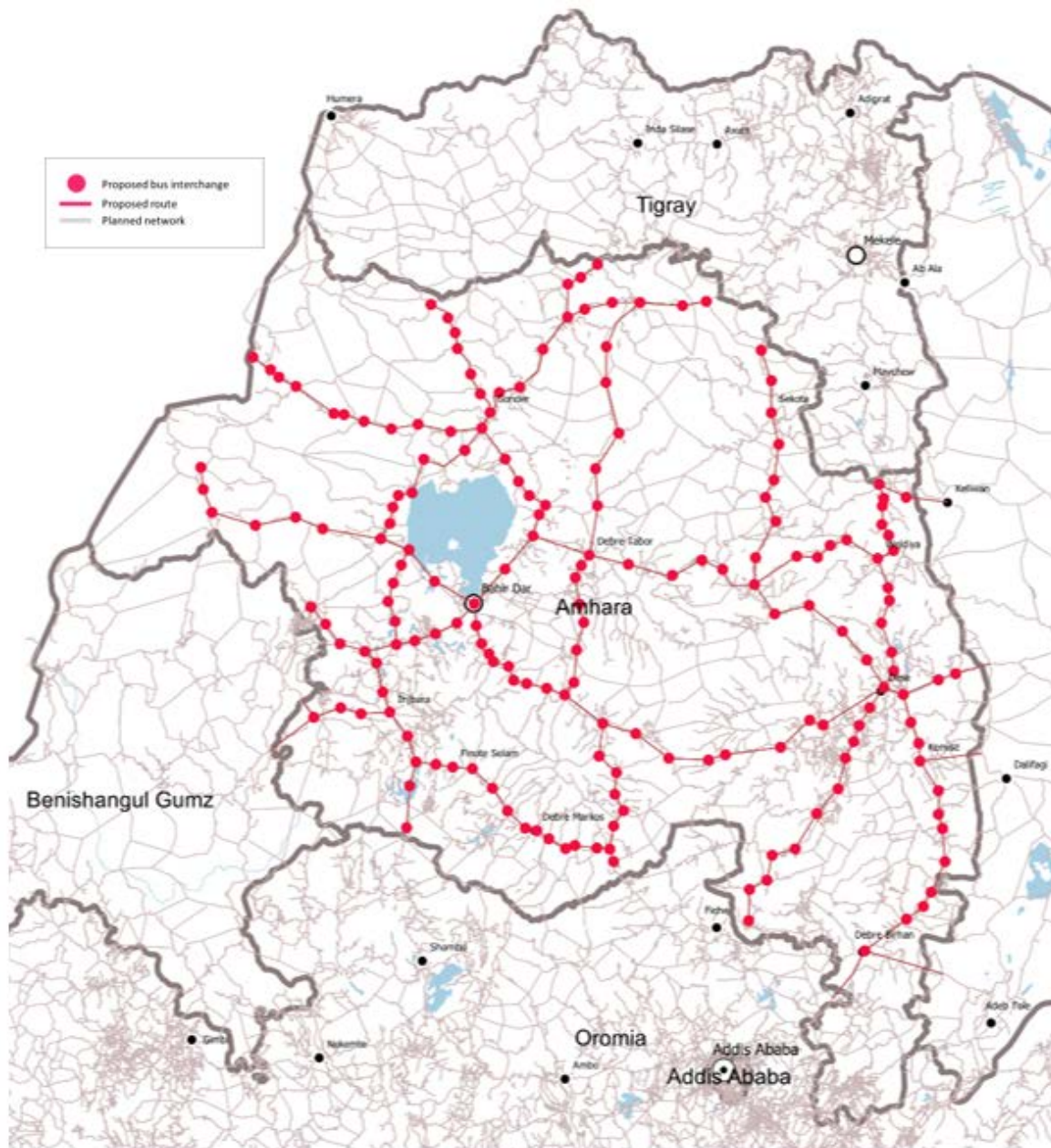


5.3.2 Planned regional public transport

It is proposed that the region is served by intercity coaches with fixed stops and routes. At least two services/day will be provided between the main cities within and outside the region.

The total network length considered is of 3,778 km. Assuming two services/day on all the planned routes in each direction, the services will cover 15,112 km/day.

Figure 28: Proposed intercity network



While intercity services will provide connectivity along the main routes, feeder services will be key to provide accessibility for the most isolated rural communities. It is proposed that such services are provided on a demand responsive basis.

5.3.3 RED model evaluation

A fully costed RED model is used to evaluate cost and benefits for the proposed construction and maintenance road plan. Seven project alternatives are considered for the proposed interventions, ranging from maintaining the current poor network conditions to paving. The options with the highest net present value are also the costliest. However, the option with the highest internal rate of return is “Alternative 1 - bring to fair conditions” which implies the rehabilitation and regular maintenance of natural ground and gravel roads.

Such option also shows as the one with the highest modified rate of return and net present value per financial investment cost.

As this is the options expected to bring the maximum benefits with the lowest investment, this option is chosen as the preferred option.

Table 12: NPV/FIC ratio - Net Present Value per Financial Investment Costs (ratio)

Alter. 0	Alter. 1	Alter. 2	Alter. 3	Alter. 4	Alter. 5	Alter. 6
0.00	12909.84	7615.53	2957.68	2441.07	2034.12	1627.16

The following funds would be required to deliver the rural road network plan. The total cost of the plan is estimated as 1,081,530,000 USD millions over 30 years.

The construction investment per person is expected to be 13.94 USD/inhabitant, while the maintenance 1.28 USD/inhabitant/year.

Table 13: Estimated costs

Upgrade cost	Build cost	Maintenance cost /year	Investment per inhabitant
\$ 243,048,000	\$ 45,360,000	\$ 26,437,400	\$ 13.94

5.3.4 PT costs

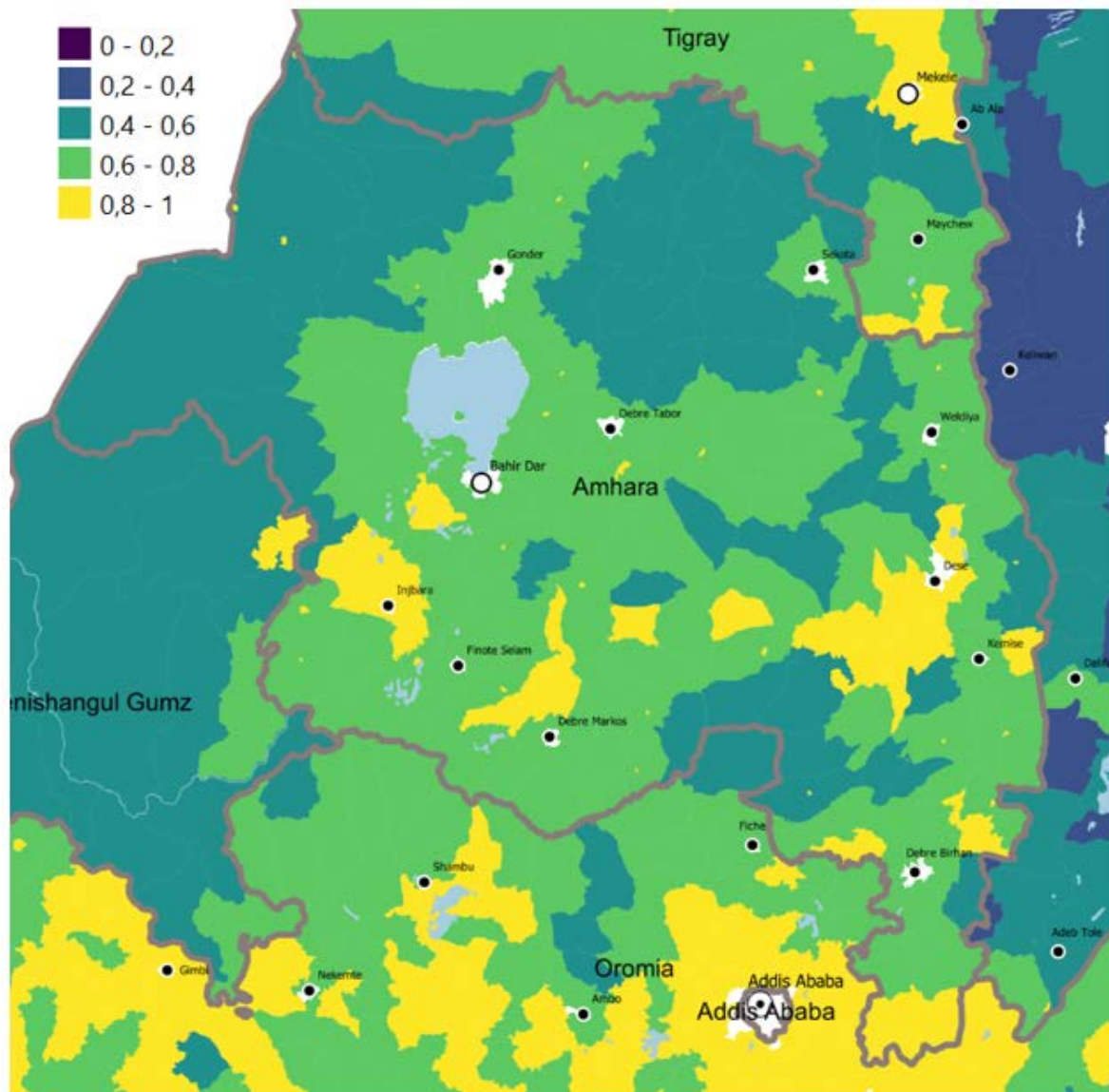
Regarding the intercity buses, it is assumed a cost of 0.2 USD/km. Therefore, the planned intercity system is expected to cost \$1,103,176 / year. Further investments will be required to fund the feeder services.

5.3.5 Benefits

The RAI for the region is expected to increase to 0.69 on average from the previous 0.34.

The plan is expected to provide new connectivity to 647,736 inhabitants within 2 km, while a further 5,059,047 inhabitants will be within 2 km distance from a rehabilitated road.

Figure 29: RAI after plan

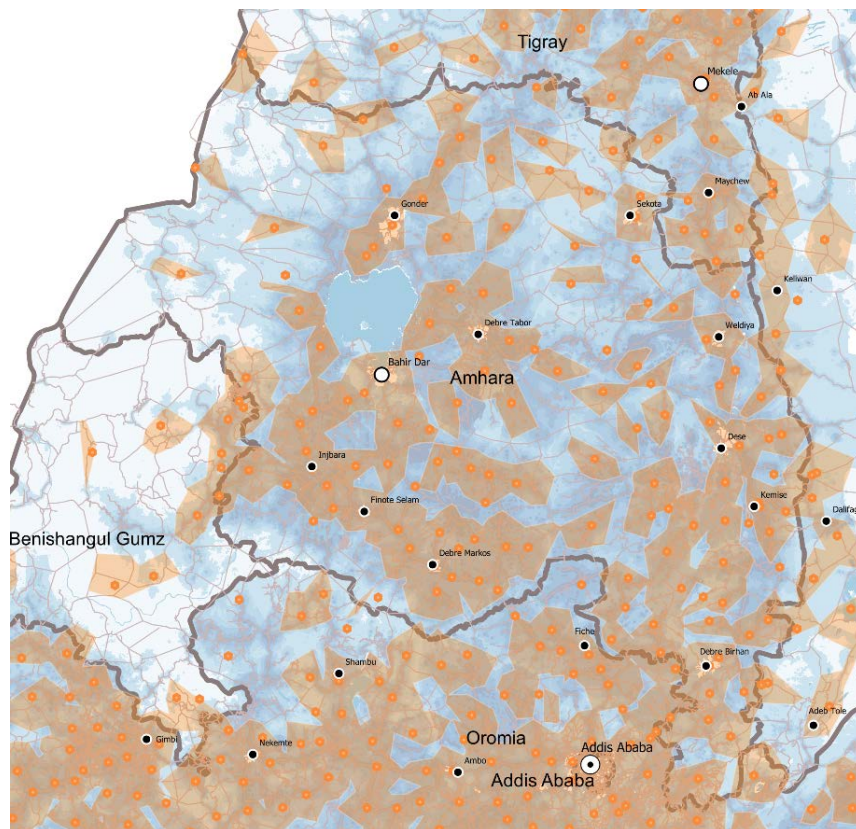
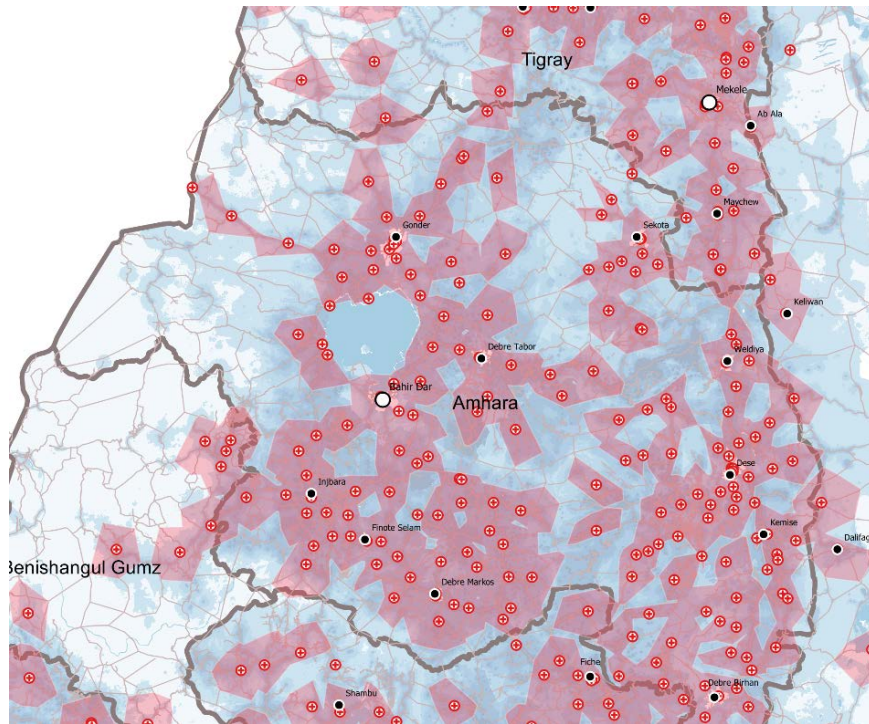


The planned road network is expected to improve accessibility to both schools and hospitals. It will bring new connectivity to hospitals within two hours to 3,966,488 rural citizens (35% increase) and new connectivity to schools within two hours to 3,063,371 rural citizens (31% increase).

The proportion of rural citizen within two hours from a hospital will be 73% and the proportion of those within two hours from a school will be 63%.

It should be noted that in some areas, especially the north-west and north-east of the region, the lack of basic services is the main driver for the poor accessibility to services.

Figure 30: Hospitals (upper) and schools (lower) catchment area.



5.4 BENISHANGUL – GUMZ

5.4.1 Planned regional road network

Benishangul - Gumz is a region with a population of 1,141,341 inhabitants and all its population is considered rural. Currently 42% of the rural population is more than 2 km from any road or path.

The existing road network includes roads managed by ERA, community roads, municipal roads, URRAP roads and unclassified roads. The total existing network size is estimated to be 5,112 km long.

It is proposed that the existing road network is increased in both size and quality. In particular, it is proposed that:

- 1,781 km of new gravel roads are built
- 4,377 km of existing non-ERA roads are rehabilitated/upgraded

The rural network density will be uplifted from 86 km/1,000 sq.km to 122 km/1,000 sq.km which represents an increase of 41%.

The implementation of the plan considers appropriate funding for the regular maintenance of the rural road network.

Figure 31: Planned road network

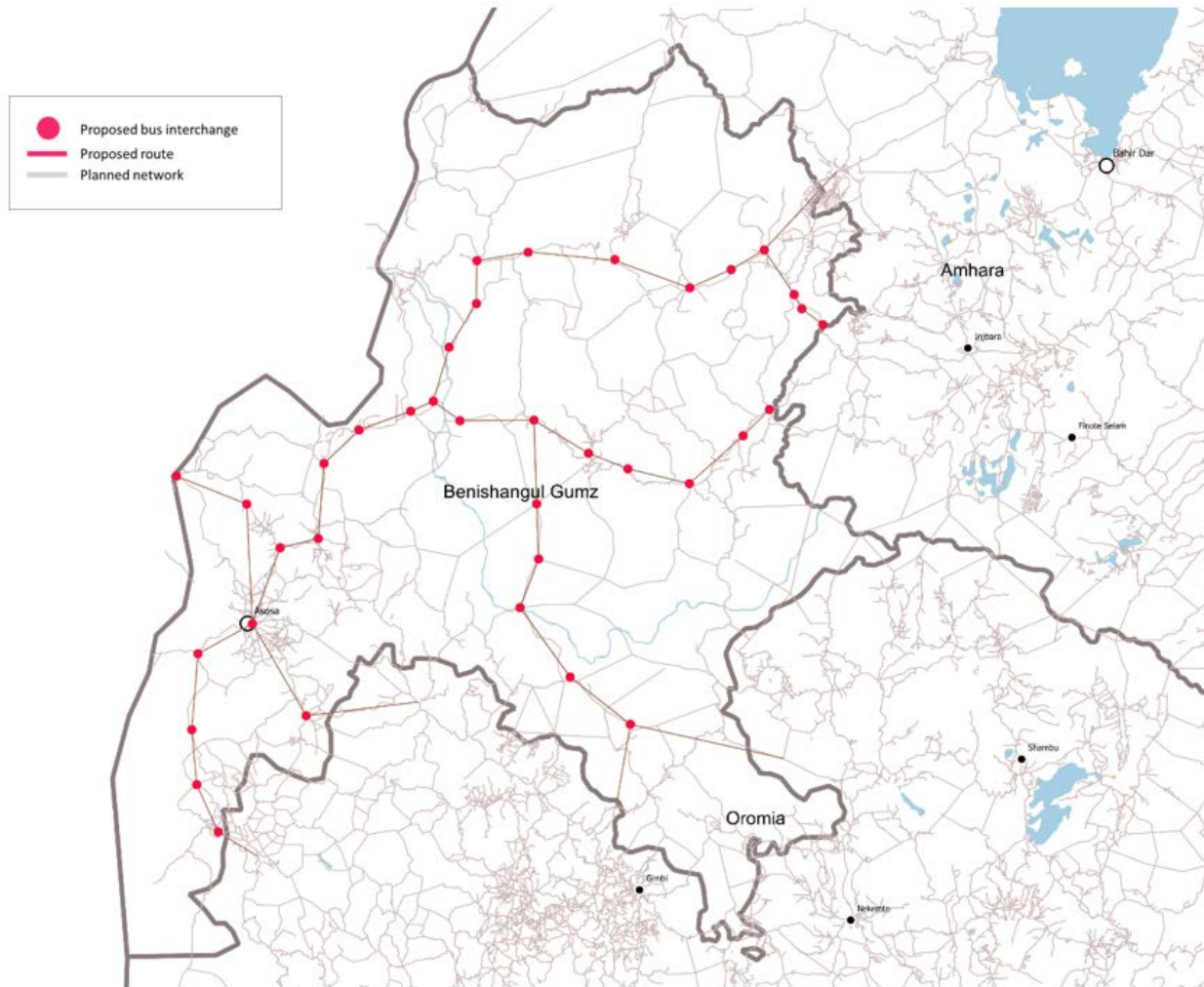


5.4.2 Planned regional public transport

It is proposed that the region is served by intercity coaches with fixed stops and routes. At least two services/day will be provided between the main cities within and outside the region.

The total network length considered is of 1,219 km. Assuming two services/day on all the planned routes in each direction, the services will cover 4,876 km/day.

Figure 32: Proposed intercity network



While intercity services will provide connectivity along the main routes, feeder services will be key to provide accessibility for the most isolated rural communities. It is proposed that such services are provided on a demand responsive basis.

5.4.3 RED model evaluation

A fully costed RED model is used to evaluate cost and benefits for the proposed construction and maintenance road plan. Seven project alternatives are considered for the proposed interventions, ranging from maintaining the current poor network conditions to paving. The options with the highest net present value are also the costliest. However, the option with the highest internal rate of return is “Alternative 1 - bring to fair conditions” which implies the rehabilitation and regular maintenance of natural ground and gravel roads.

Such option also shows as the one with the highest modified rate of return and net present value

per financial investment cost.

As this is the options expected to bring the maximum benefits with the lowest investment, this option is chosen as the preferred option.

Table 14: NPV/FIC ratio - Net Present Value per Financial Investment Costs (ratio)

Alter. 0	Alter. 1	Alter. 2	Alter. 3	Alter. 4	Alter. 5	Alter. 6
0.00	611.49	363.27	139.91	115.53	96.18	76.83

The following funds would be required to deliver the rural road network plan. The total cost of the plan is estimated as 277,110,000 USD over 30 years.

The construction investment per person is expected to be 64.75 USD/inhabitant, while the maintenance 5.82 USD/inhabitant/year.

Table 15: Estimated costs

Upgrade cost	Build cost	Maintenance cost /year	Investment per inhabitant
\$ 52,524,000	\$ 21,372,000	\$ 6,773,800	\$ 64.75

5.4.4 PT costs

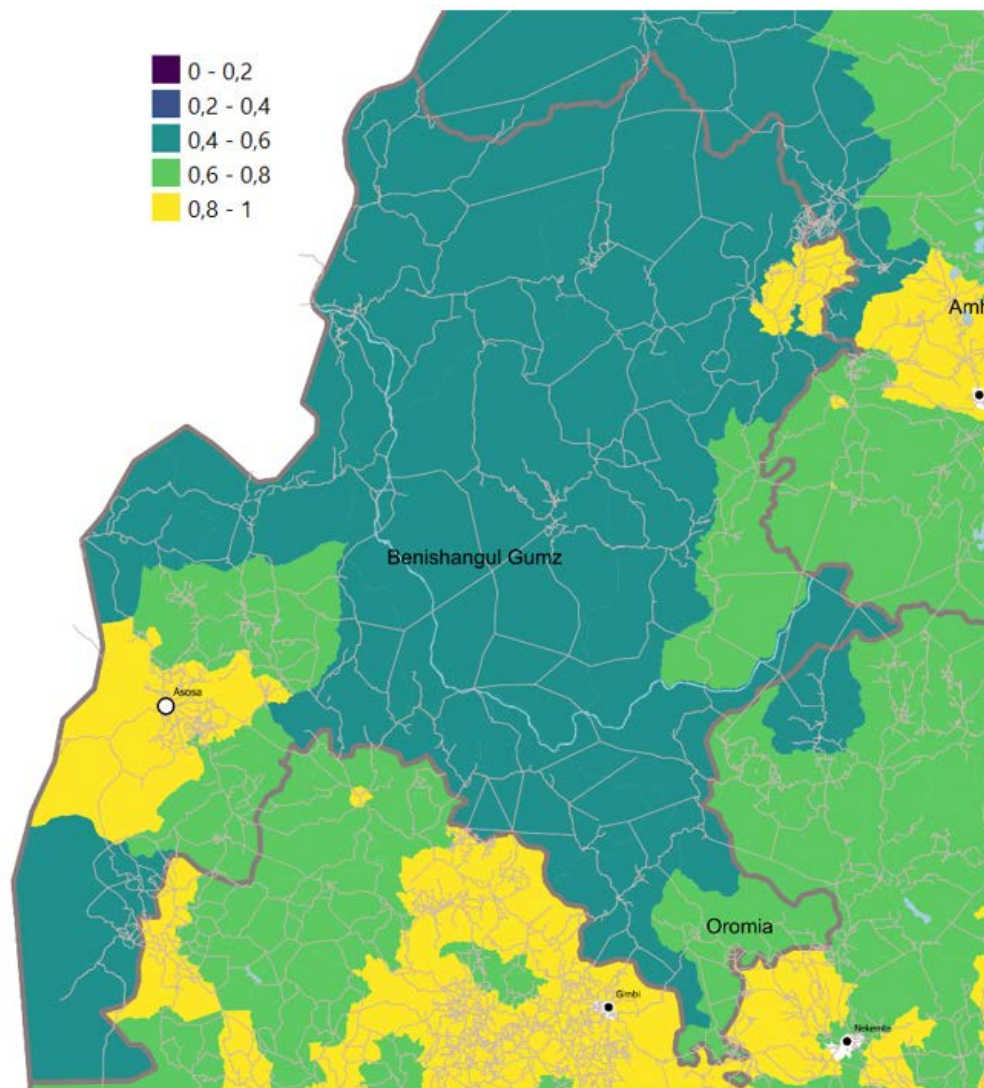
Regarding the intercity buses, it is assumed a cost of 0.2 USD/km. Therefore, the planned intercity system is expected to cost \$ 355,948 / year. Further investments will be required to fund the feeder services.

5.4.5 Benefits

The RAI for the region is expected to increase to 0.63 on average from the previous 0.28.

The plan is expected to provide new connectivity to 63,765 inhabitants within 2 km, while a further 205,338 inhabitants will be within 2 km distance from a rehabilitated road.

Figure 33: RAI after plan

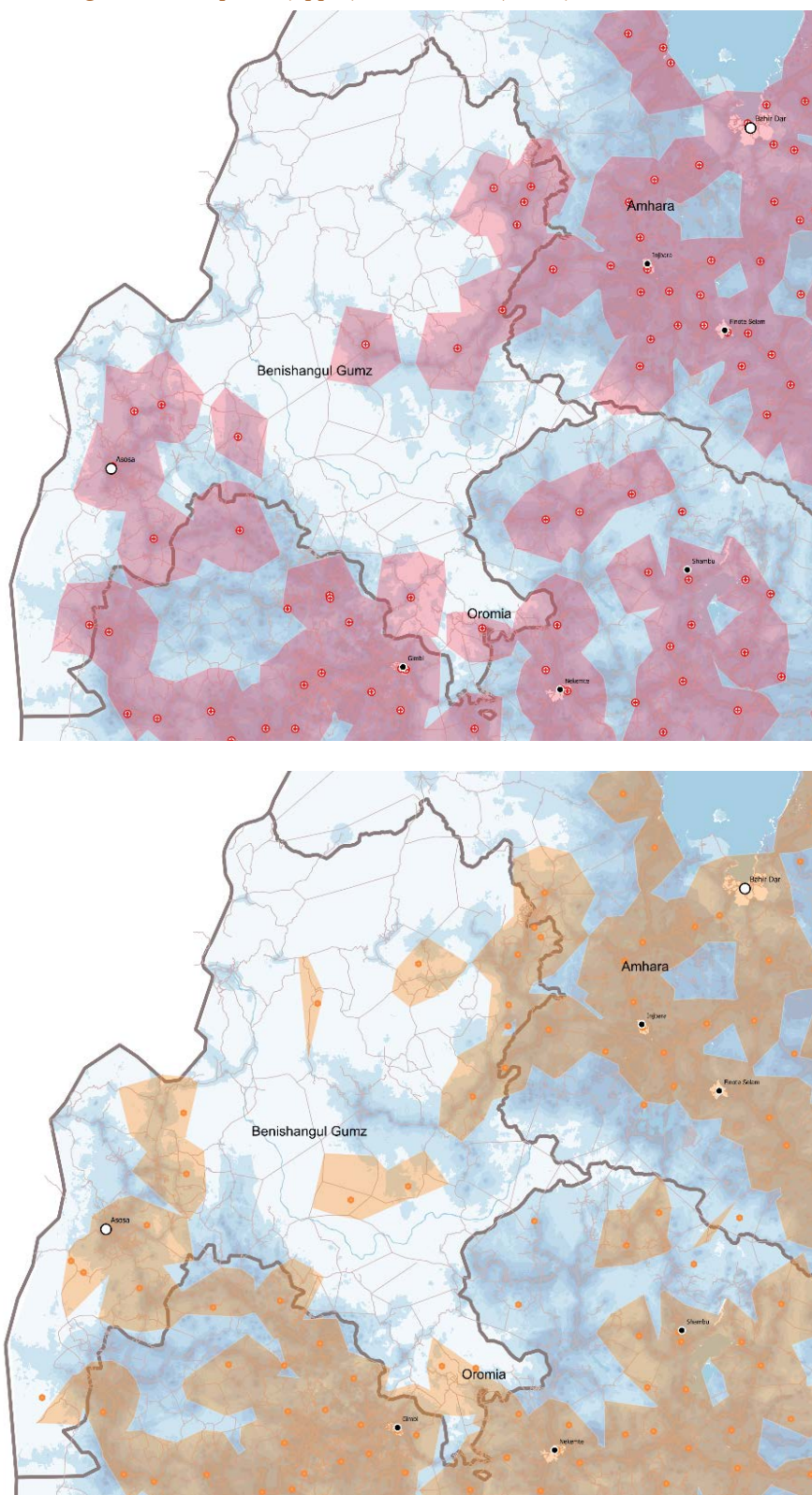


The planned road network is expected to improve accessibility to both schools and hospitals. It will bring new connectivity to hospitals within two hours to 181,296 rural citizens (34% increase) and new connectivity to schools within two hours to 57,636 rural citizens (11% increase).

The proportion of rural citizen within two hours from a hospital will be 63% and the proportion of those within two hours from a school will be 50%.

It should be noted that in some areas, especially the north-east and south-east of the region, the lack of basic services is the main driver for the poor accessibility to services.

Figure 34: Hospitals (upper) and schools (lower) catchment area.



5.5 GAMBELA

5.5.1 Planned regional road network

Gambela is a region with a population of 475,546 inhabitants of which 503,101 are considered rural (87%). Currently 53% of the rural population is more than 2 km from any road or path.

The existing road network includes roads managed by ERA, community roads, municipal roads, URRAP roads and unclassified roads. The total existing network size is estimated to be 2,013 km long.

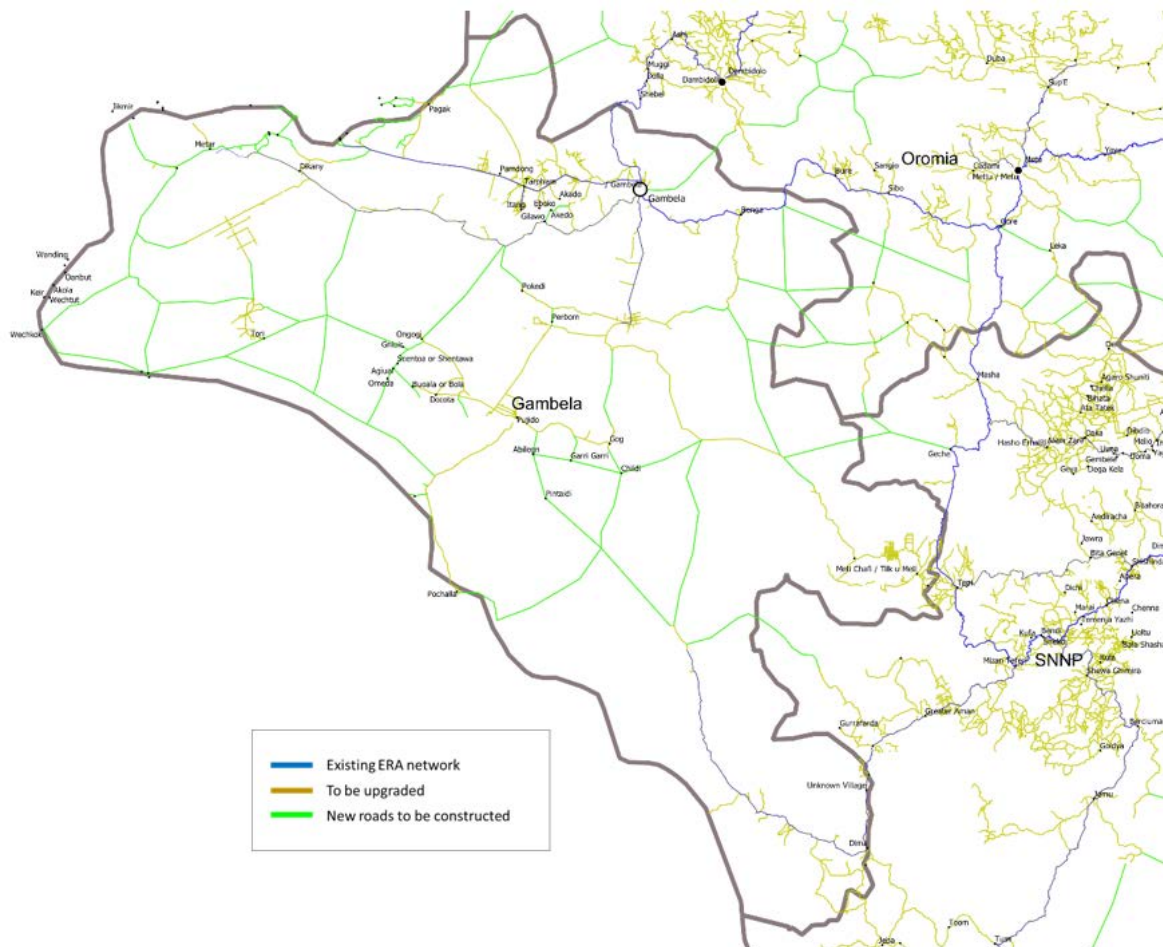
It is proposed that the existing road network is increased in both size and quality. In particular, it is proposed that:

- 1,252 km of new gravel roads are built
- 1,411 km of existing non-ERA roads are rehabilitated/upgraded

The rural network density will be uplifted from 44 km/1,000 sq.km to 84 km/1,000 sq.km which represents an increase of 89%.

The implementation of the plan considers appropriate funding for the regular maintenance of the rural road network.

Figure 35: Planned road network

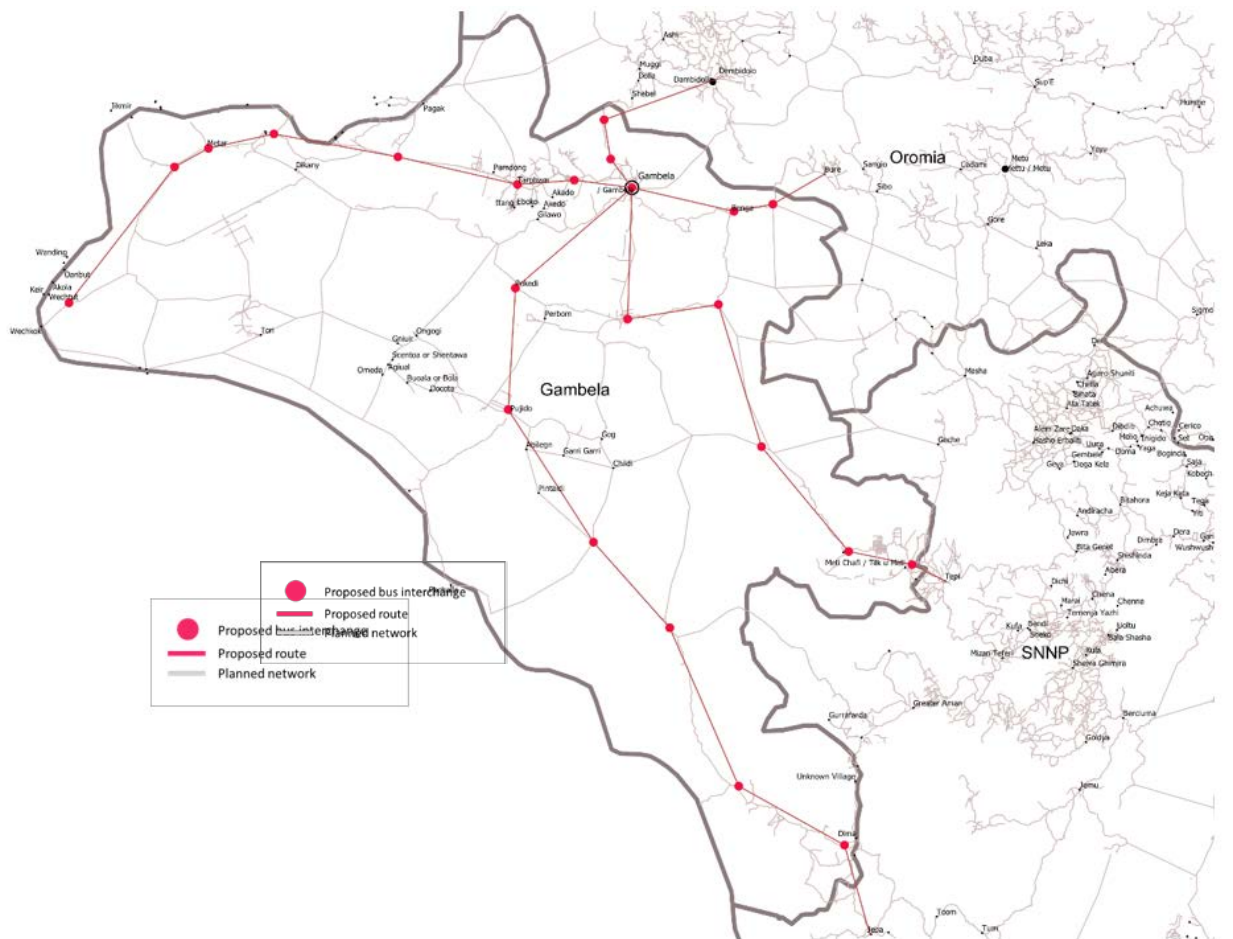


5.5.2 Planned regional public transport

It is proposed that the region is served by intercity coaches with fixed stops and routes. At least two services/day will be provided between the main cities within and outside the region.

The total network length considered is of 764 km. Assuming two services/day on all the planned routes in each direction, the services will cover 3,056 km/day.

Figure 36: Proposed intercity network



While intercity services will provide connectivity along the main routes, feeder services will be key to provide accessibility for the most isolated rural communities. It is proposed that such services are provided on a demand responsive basis.

5.5.3 RED model evaluation

A fully costed RED model is used to evaluate cost and benefits for the proposed construction and maintenance road plan. Seven project alternatives are considered for the proposed interventions, ranging from maintaining the current poor network conditions to paving. The options with the highest net present value are also the costliest. However, the option with the highest internal rate of return is “Alternative 1 - bring to fair conditions” which implies the rehabilitation and regular maintenance of natural ground and gravel roads.

Such option also shows as the one with the highest modified rate of return and net present value per financial investment cost.

As this is the options expected to bring the maximum benefits with the lowest investment, this

option is chosen as the preferred option.

Table 16: NPV/FIC ratio - Net Present Value per Financial Investment Costs (ratio)

Alter. 0	Alter. 1	Alter. 2	Alter. 3	Alter. 4	Alter. 5	Alter. 6
0.00	177.47	150.66	89.08	79.42	67.65	55.30

The following funds would be required to deliver the rural road network plan. The total cost of the plan is estimated as 119,835,000 USD over 30 years.

The construction investment per person is expected to be 63.52 USD/inhabitant, while the maintenance 5.82 USD/inhabitant/year.

Table 17: Estimated costs

Upgrade cost	Build cost	Maintenance cost /year	Investment per inhabitant
\$ 16,932,000	\$ 15,024,000	\$ 2,929,300	\$ 63.52

5.5.4 PT costs

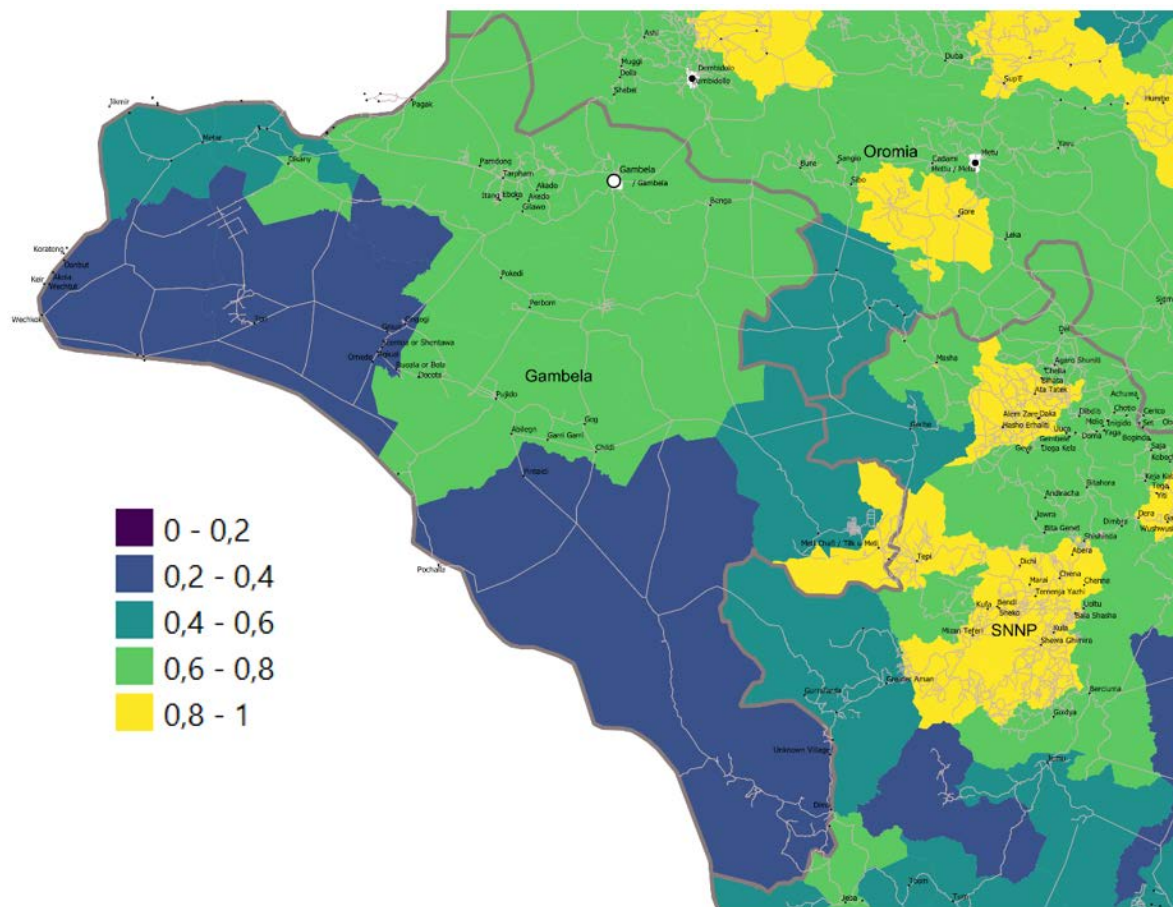
Regarding the intercity buses, it is assumed a cost of 0.2 USD/km. Therefore, the planned intercity system is expected to cost \$223,088 / year. Further investments will be required to fund the feeder services.

5.5.5 Benefits

The RAI for the region is expected to increase to 0.46 on average from the previous 0.27.

The plan is expected to provide new connectivity to 56,061 inhabitants within 2 km, while a further 69,094 inhabitants will be within 2 km distance from a rehabilitated road.

Figure 37: RAI after plan

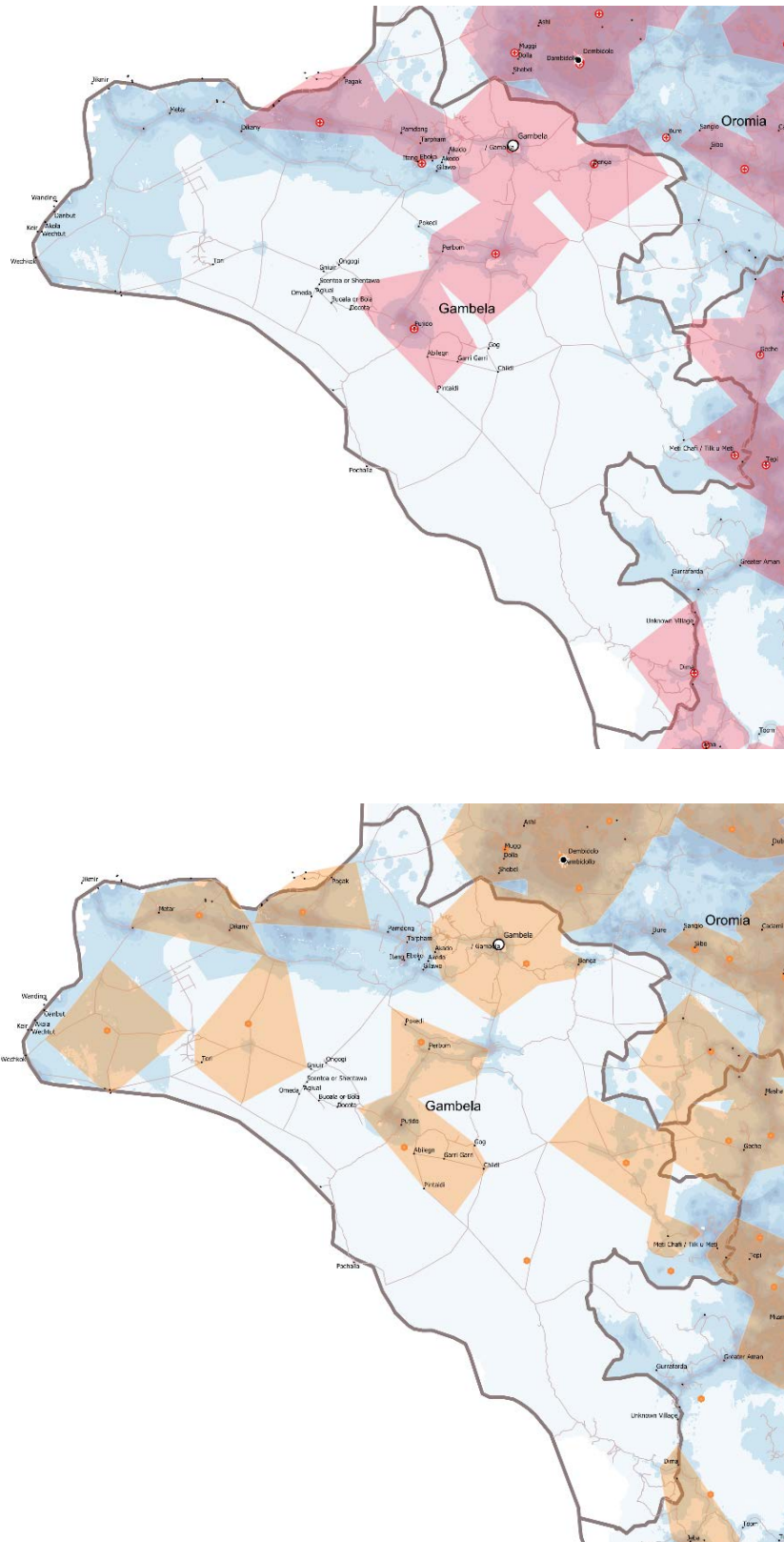


The planned road network is expected to improve accessibility to both schools and hospitals. It will bring new connectivity to hospitals within two hours to 63,475 rural citizens (38% increase) and new connectivity to schools within two hours to 138,170 rural citizens (116% increase).

The proportion of rural citizen within two hours from a hospital will be 46% and the proportion of those within two hours from a school will be 51%.

It should be noted that in some areas, especially the west and south of the region, the lack of basic services is the main driver for the poor accessibility to services.

Figure 38: Hospitals (upper) and schools (lower) catchment area.



5.6 OROMIA

5.6.1 Planned regional road network

Gambela is a region with a population of 39,717,870 inhabitants of which 37,526,961 are considered rural (94%). Currently 22% of the rural population is more than 2 km from any road or path.

The existing road network includes roads managed by ERA, community roads, municipal roads, URRAP roads and unclassified roads. The total existing network size is estimated to be 79,794 km long.

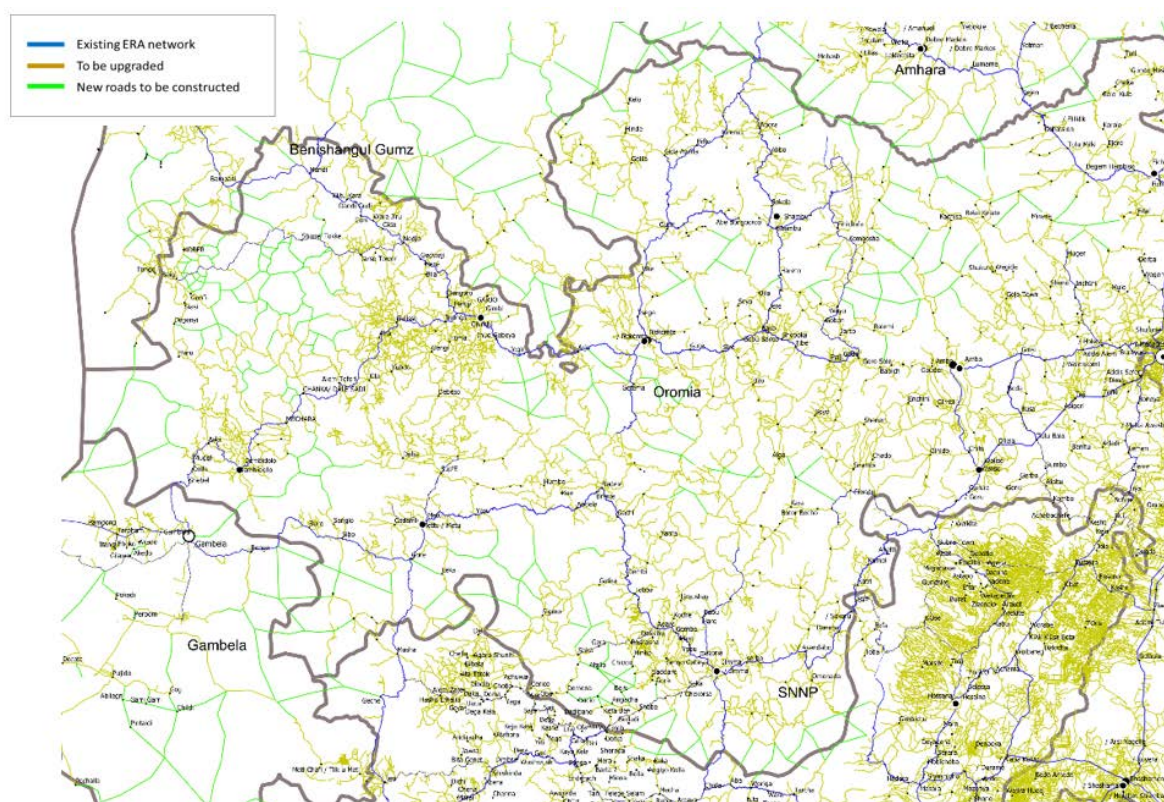
It is proposed that the existing road network is increased in both size and quality. In particular, it is proposed that:

- 5,452 km of new gravel roads are built
- 70,713 km of existing non-ERA roads are rehabilitated/upgraded

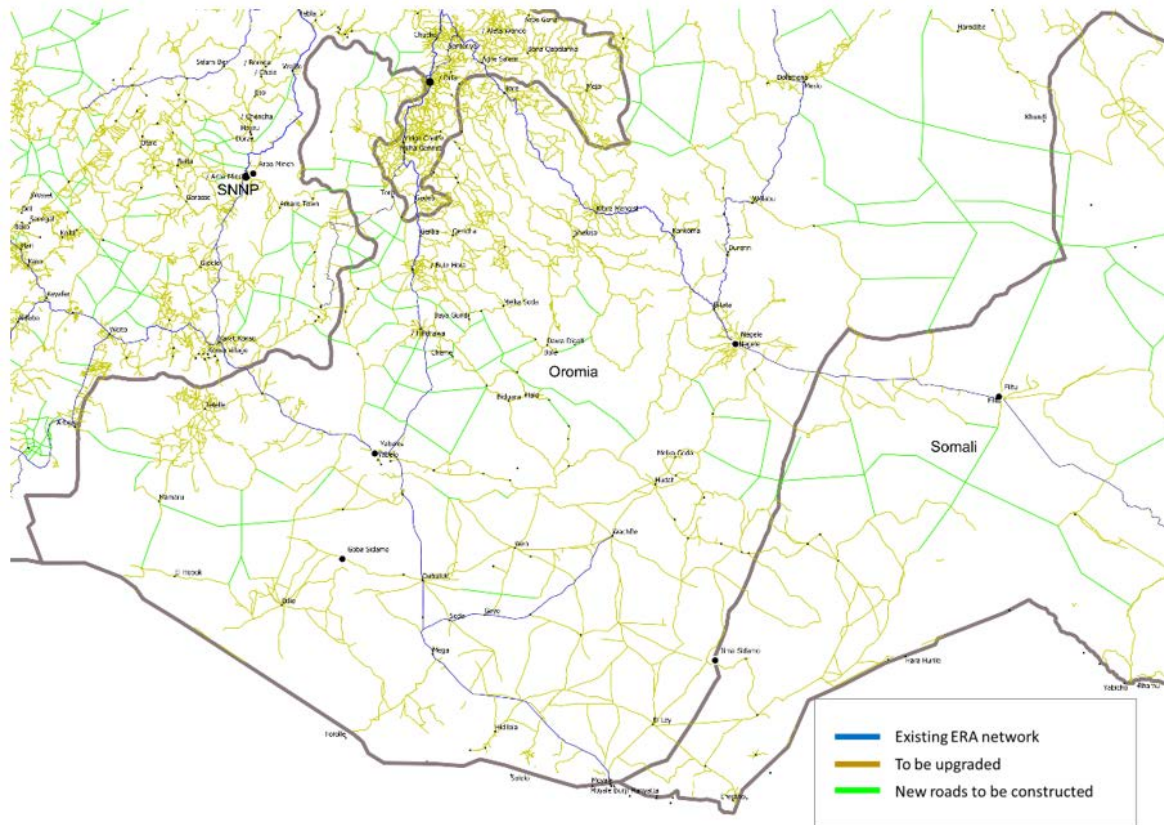
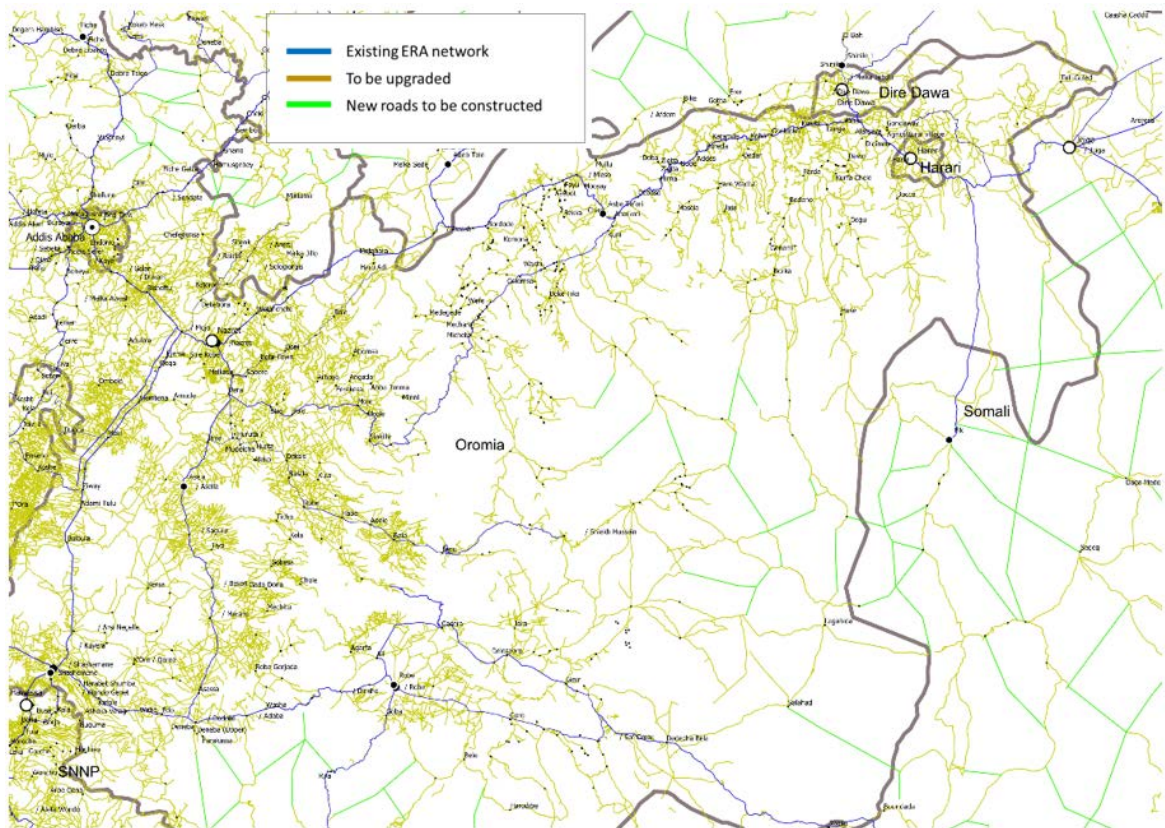
The rural network density will be uplifted from 218 km/1,000 sq.km to 235 km/1,000 sq.km which represents an increase of 8%.

The implementation of the plan considers appropriate funding for the regular maintenance of the rural road network.

Figure 39: Planned road network



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“SECTOR REPORT 2B – RURAL ROADS”

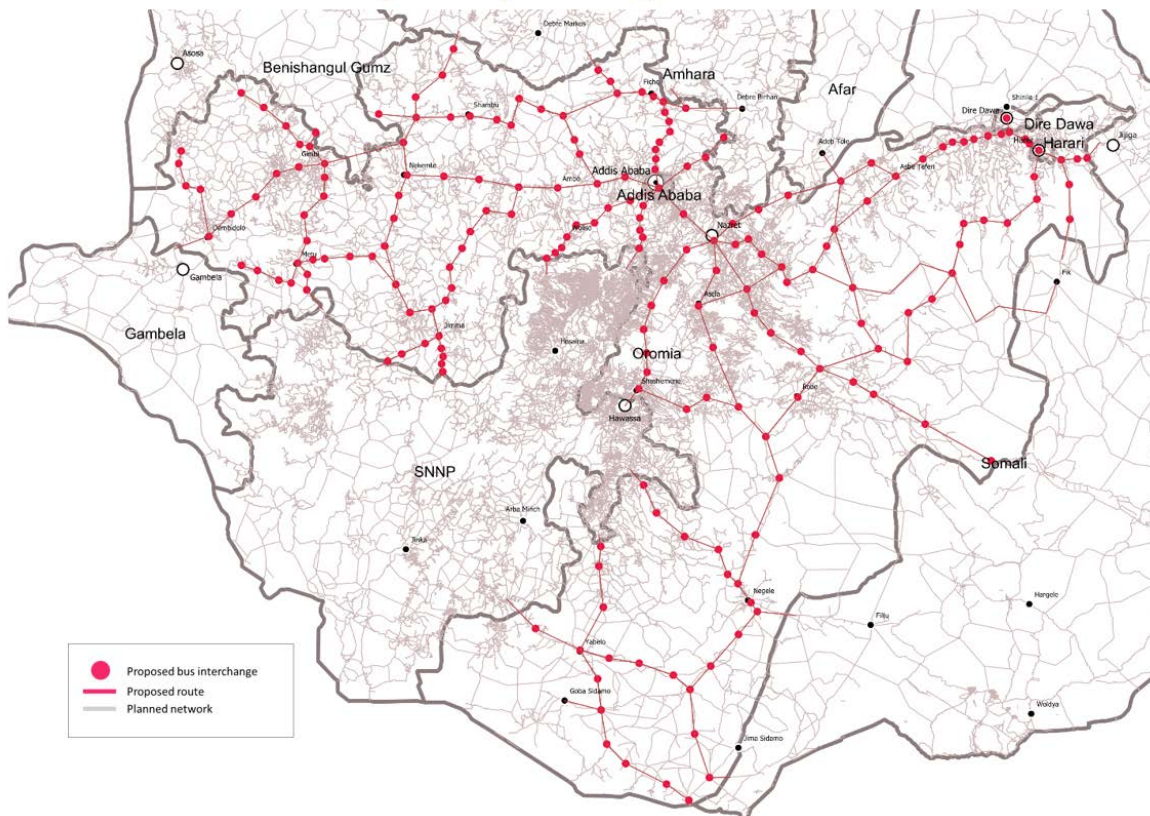


5.6.2 Planned regional public transport

It is proposed that the region is served by intercity coaches with fixed stops and routes. At least two services/day will be provided between the main cities within and outside the region.

The total network length considered is of 7,490 km. Assuming two services/day on all the planned routes in each direction, the services will cover 29,960 km/day.

Figure 40: Proposed intercity network



While intercity services will provide connectivity along the main routes, feeder services will be key to provide accessibility for the most isolated rural communities. It is proposed that such services are provided on a demand responsive basis.

5.6.3 RED model evaluation

A fully costed RED model is used to evaluate cost and benefits for the proposed construction and maintenance road plan. Seven project alternatives are considered for the proposed interventions, ranging from maintaining the current poor network conditions to paving. The options with the highest net present value are also the costliest. However, the option with the highest internal rate of return is “Alternative 1 - bring to fair conditions” which implies the rehabilitation and regular maintenance of natural ground and gravel roads.

Such option also shows as the one with the highest modified rate of return and net present value per financial investment cost.

As this is the options expected to bring the maximum benefits with the lowest investment, this option is chosen as the preferred option.

Table 18: NPV/FIC ratio - Net Present Value per Financial Investment Costs (ratio)

Alter. 0	Alter. 1	Alter. 2	Alter. 3	Alter. 4	Alter. 5	Alter. 6
0.00	1217.65	10600.67	6307.18	5626.05	4802.96	3938.58

The following funds would be required to deliver the rural road network plan. The total cost of the plan is estimated as 3,427,425,000 USD over 30 years.

The construction investment per person is expected to be 24.36 USD/inhabitant, while the maintenance 2.23 USD/inhabitant/year.

Table 19: Estimated costs

Upgrade cost	Build cost	Maintenance cost /year	Investment per inhabitant
\$ 848,556,000	\$ 65,424,000	\$ 83,781,500	\$ 24.36

5.6.4 PT costs

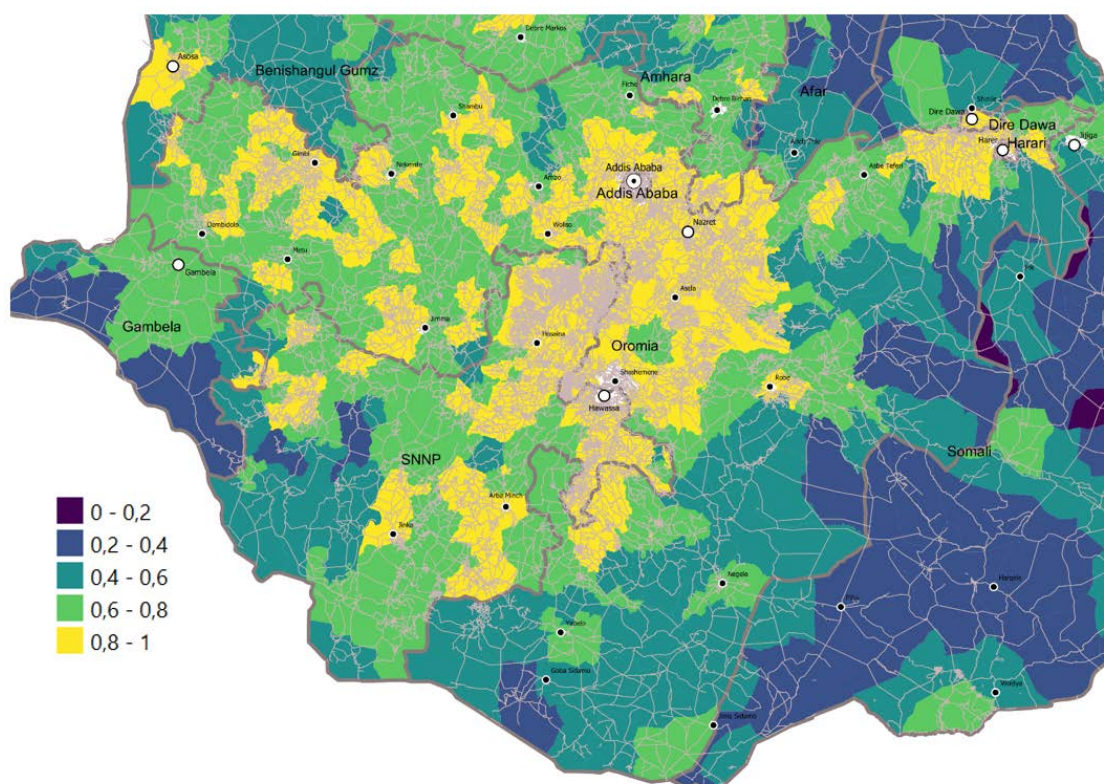
Regarding the intercity buses, it is assumed a cost of 0.2 USD/km. Therefore, the planned intercity system is expected to cost 2,187,080 USD / year. Further investments will be required to fund the feeder services.

5.6.5 Benefits

The RAI for the region is expected to increase to 0.80 on average from the previous 0.28.

The plan is expected to provide new connectivity to 838,882 inhabitants within 2 km, while a further 11,251,058 inhabitants will be within 2 km distance from a rehabilitated road.

Figure 41: RAI after plan

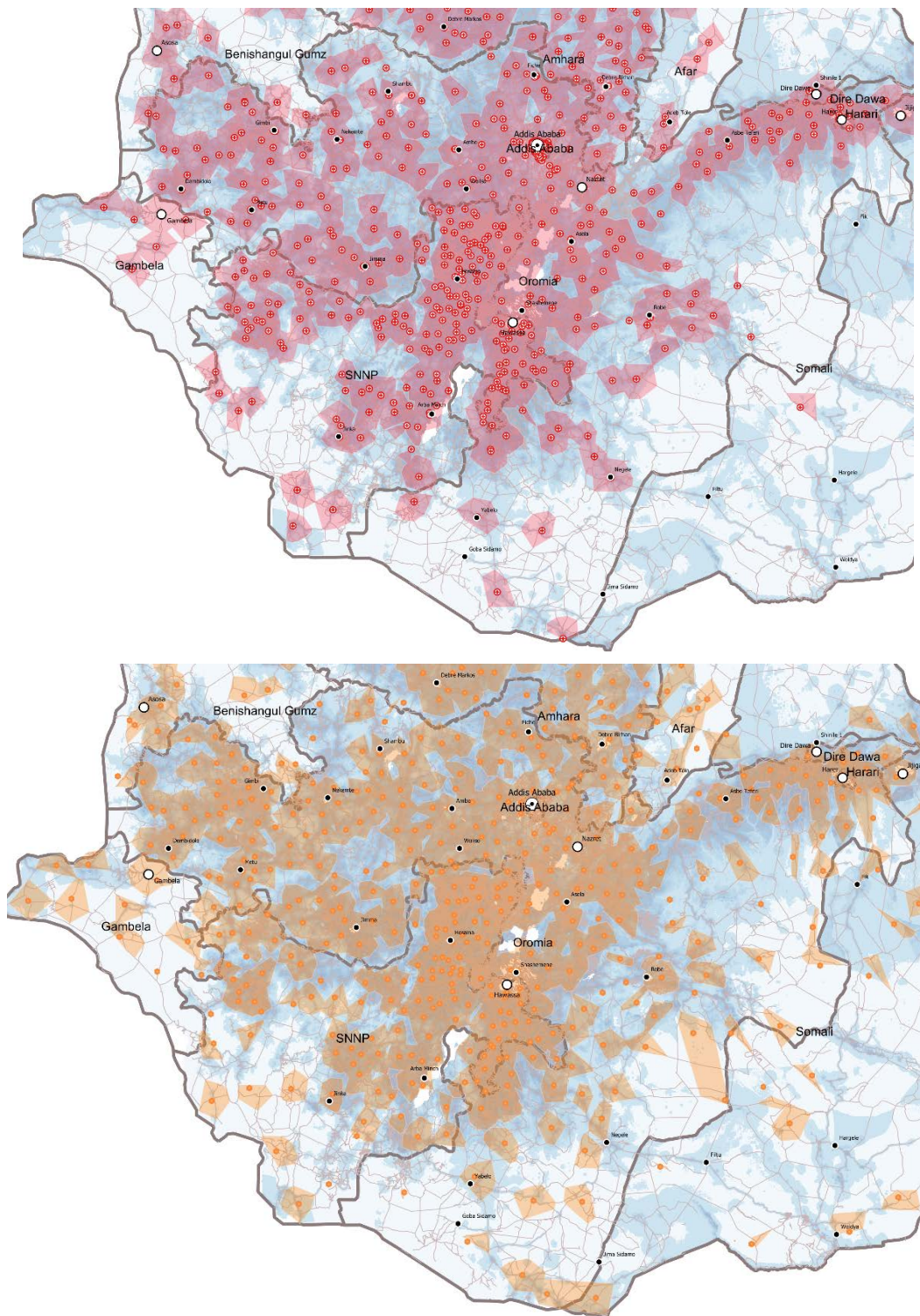


The planned road network is expected to improve accessibility to both schools and hospitals. It will bring new connectivity to hospitals within two hours to 5,211,331 rural citizens (23% increase) and new connectivity to schools within two hours to 5,758,864 rural citizens (25% increase).

The proportion of rural citizen within two hours from a hospital will be 76% and the proportion of those within two hours from a school will also be 76%.

It should be noted that in some areas, especially the east and south of the region, the lack of basic services is the main driver for the poor accessibility to services.

Figure 42: Hospitals (upper) and schools (lower) catchment area.



5.7 SOMALI

5.7.1 Planned regional road network

Somali is a region with a population of 6,243,941 inhabitants of which 6,002,602 are considered rural (96%). Currently 60% of the rural population is more than 2 km away from any road or path.

The existing road network includes roads managed by ERA, community roads, municipal roads, URRAP roads and unclassified roads. The total existing network size is estimated to be 27,209 km long.

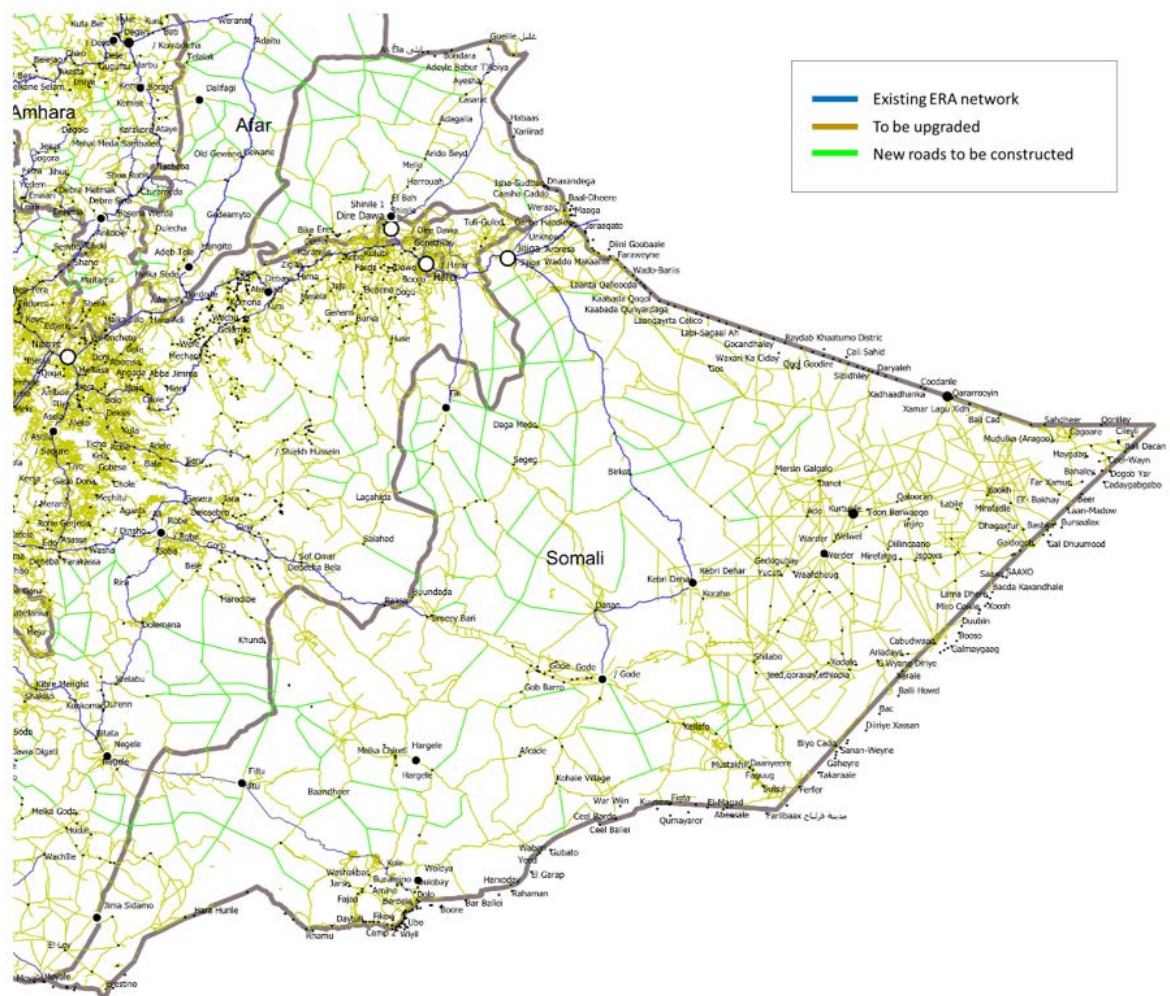
It is proposed that the existing road network is increased in both size and quality. In particular, it is proposed that:

- 4,392 km of new gravel roads are built
- 22,617 km of existing non-ERA roads are rehabilitated/upgraded

The rural network density will be uplifted from 72 km/1,000 sq.km to 86 km/1,000 sq.km which represents an increase of 19%.

The implementation of the plan considers appropriate funding for the regular maintenance of the rural road network.

Figure 43: Planned road network

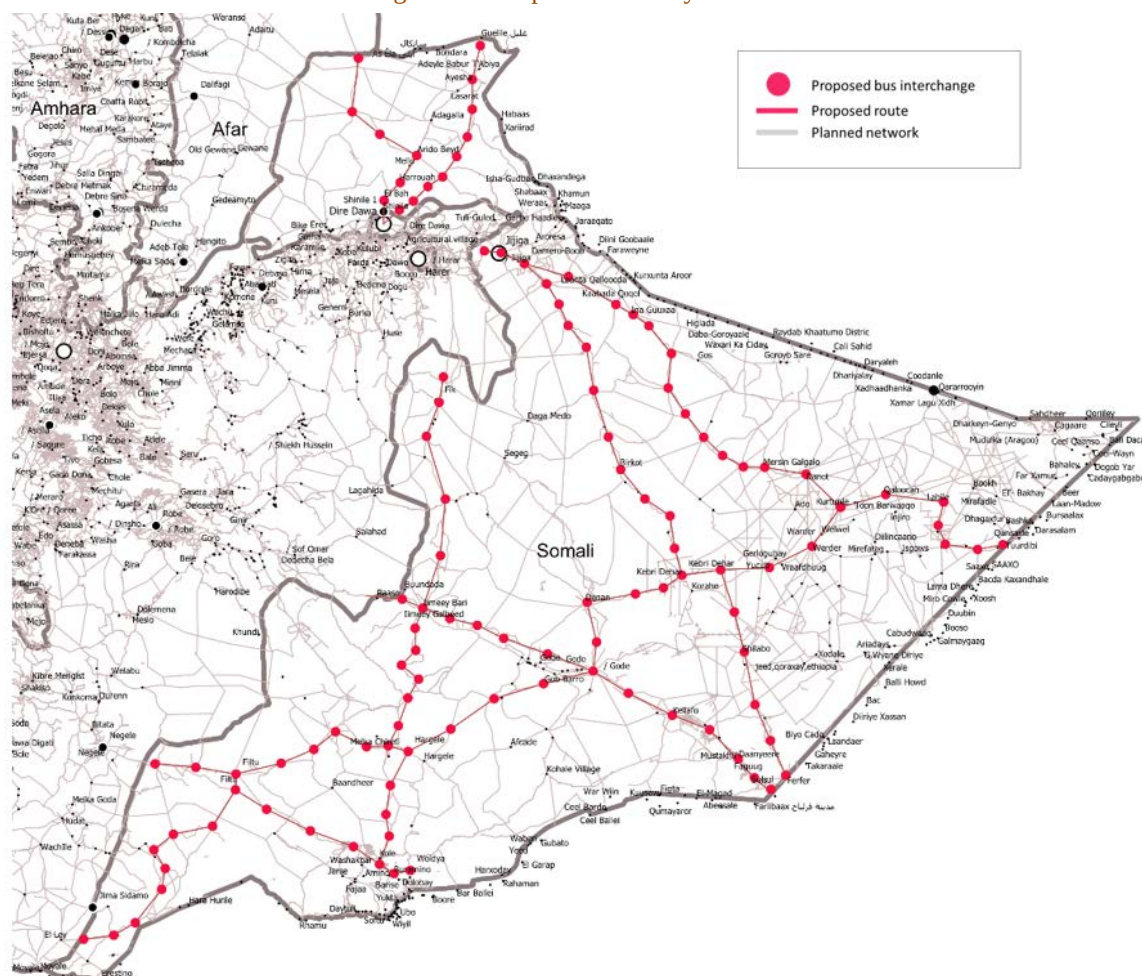


5.7.2 Planned regional public transport

It is proposed that the region is served by intercity coaches with fixed stops and routes. At least two services/day will be provided between the main cities within and outside the region.

The total network length considered is of 3,718 km. Assuming two services/day on all the planned routes in each direction, the services will cover 14,872 km/day.

Figure 44: Proposed intercity network



While intercity services will provide connectivity along the main routes, feeder services will be key to provide accessibility for the most isolated rural communities. It is proposed that such services are provided on a demand responsive basis.

5.7.3 RED model evaluation

A fully costed RED model is used to evaluate cost and benefits for the proposed construction and maintenance road plan. Seven project alternatives are considered for the proposed interventions, ranging from maintaining the current poor network conditions to paving. The options with the highest net present value are also the costliest. However, the option with the highest internal rate of return is “Alternative 1 - bring to fair conditions” which implies the rehabilitation and regular maintenance of natural ground and gravel roads.

Such option also shows as the one with the highest modified rate of return and net present value per financial investment cost.

As this is the options expected to bring the maximum benefits with the lowest investment, this options is chosen as the preferred option.

Table 20: NPV/FIC ratio - Net Present Value per Financial Investment Costs (ratio)

Alter. 0	Alter. 1	Alter. 2	Alter. 3	Alter. 4	Alter. 5	Alter. 6
0.00	2979.03	1770.69	682.36	563.73	469.69	375.65

The following funds would be required to deliver the rural road network plan. The total cost of the plan is estimated as 1,215,405,000 USD over 30 years.

The construction investment per person is expected to be 53.99 USD/inhabitant, while the maintenance 4.95 USD/inhabitant/year.

Table 21: Estimated costs

Upgrade cost	Build cost	Maintenance cost /year	Investment per inhabitant
\$ 271,404,000	\$ 52,704,000	\$ 29,709,900	\$ 53.99

5.7.4 PT costs

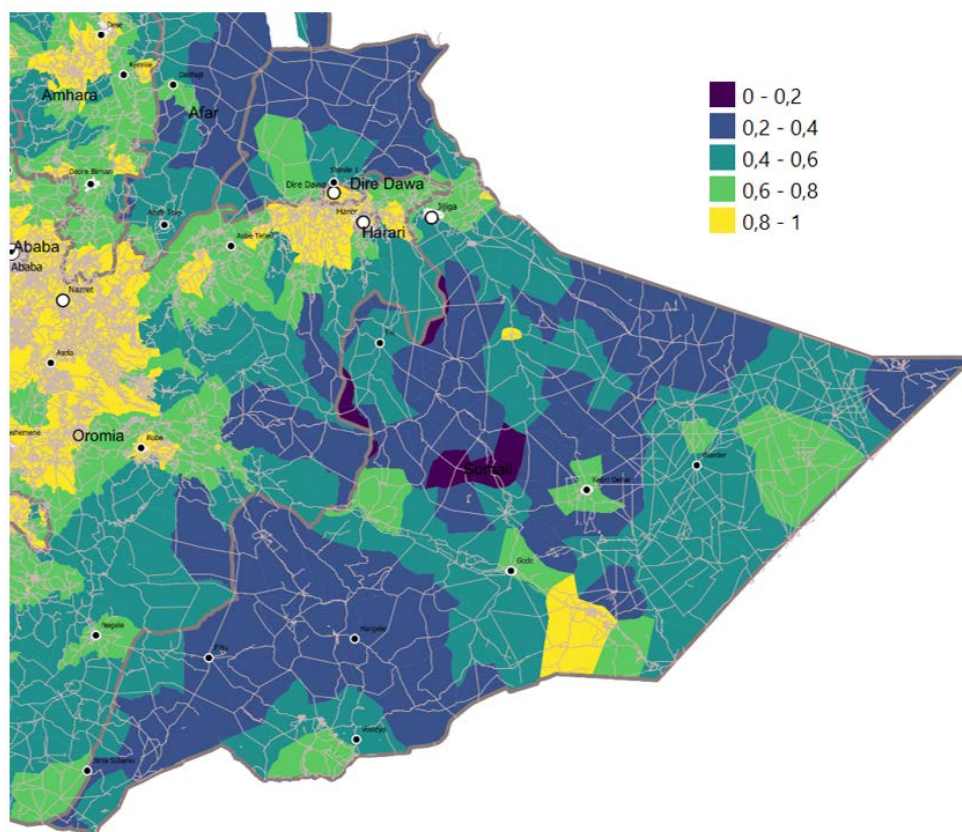
Regarding the intercity buses, it is assumed a cost of 0.2 USD/km. Therefore, the planned intercity system is expected to cost \$21,713,120 / 20 years. Further investments will be required to fund the feeder services.

5.7.5 Benefits

The RAI for the region is expected to increase to 0.46 on average from the previous 0.13.

The plan is expected to provide new connectivity to 335,601 inhabitants within 2 km, while a further 1,414,002 inhabitants will be within 2 km distance from a rehabilitated road.

Figure 45: RAI after plan

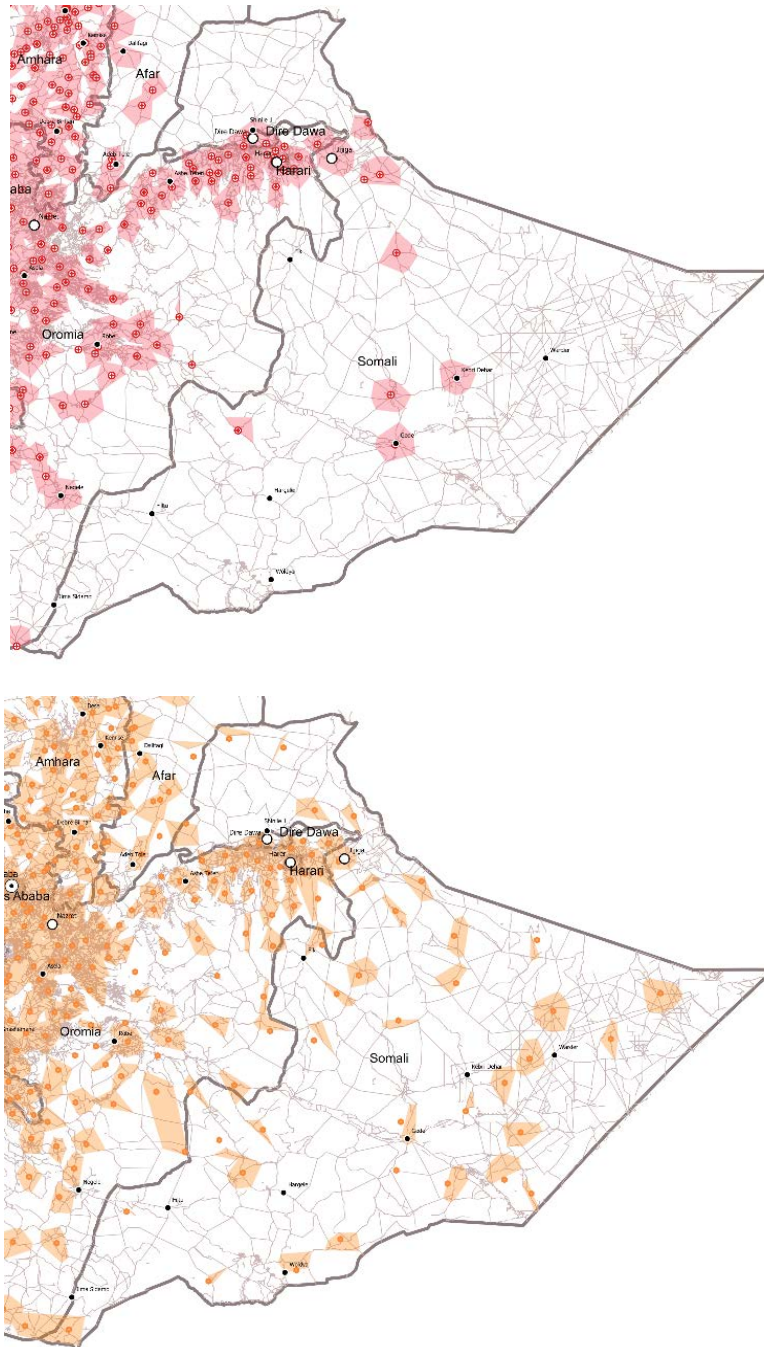


The planned road network is expected to improve accessibility to both schools and hospitals. It will bring new connectivity to hospitals within two hours to 330,995 rural citizens (76% increase) and new connectivity to schools within two hours to 258,966 rural citizens (42% increase).

The proportion of rural citizen within two hours from a hospital will be 13% and the proportion of those within two hours from a school will be 15%.

In most of the region the lack of basic services is expected to remain the main driver for the poor accessibility to services.

Figure 46: Hospitals (upper) and schools (lower) catchment area.



5.8 SNNP

5.8.1 Planned regional road network

SNNP is a region with a population of 21,631,688 inhabitants of which 20,826,044 are considered rural (96%). Currently 14% of the rural population is more than 2 km from any road or path.

The existing road network includes roads managed by ERA, community roads, municipal roads, URRAP roads and unclassified roads. The total existing network size is estimated to be 37,478 km long.

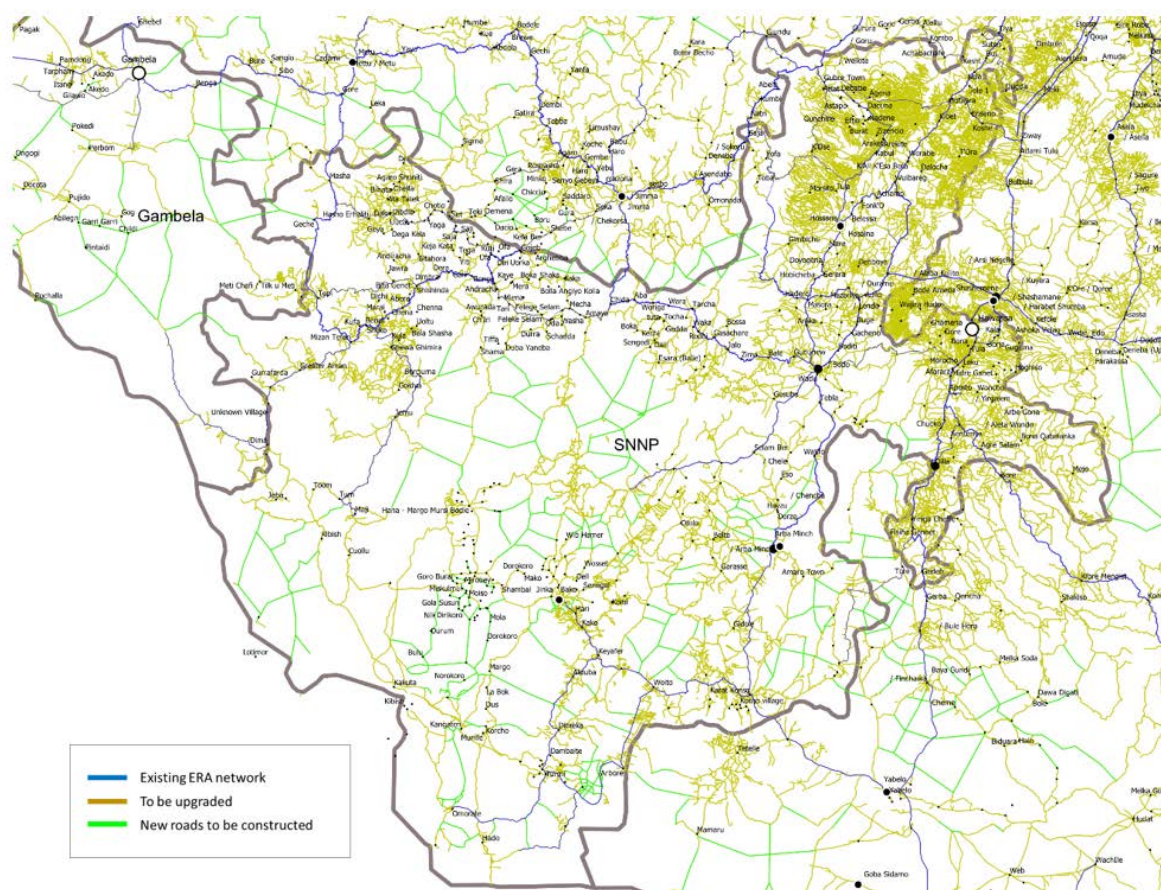
It is proposed that the existing road network is increased in both size and quality. In particular, it is proposed that:

- 2,731 km of new gravel roads are built
- 34,892 km of existing non-ERA roads are rehabilitated/upgraded

The rural network density will be uplifted from 319 km/1,000 sq.km to 344 km/1,000 sq.km which represents an increase of 8%.

The implementation of the plan considers appropriate funding for the regular maintenance of the rural road network.

Figure 47: Planned road network

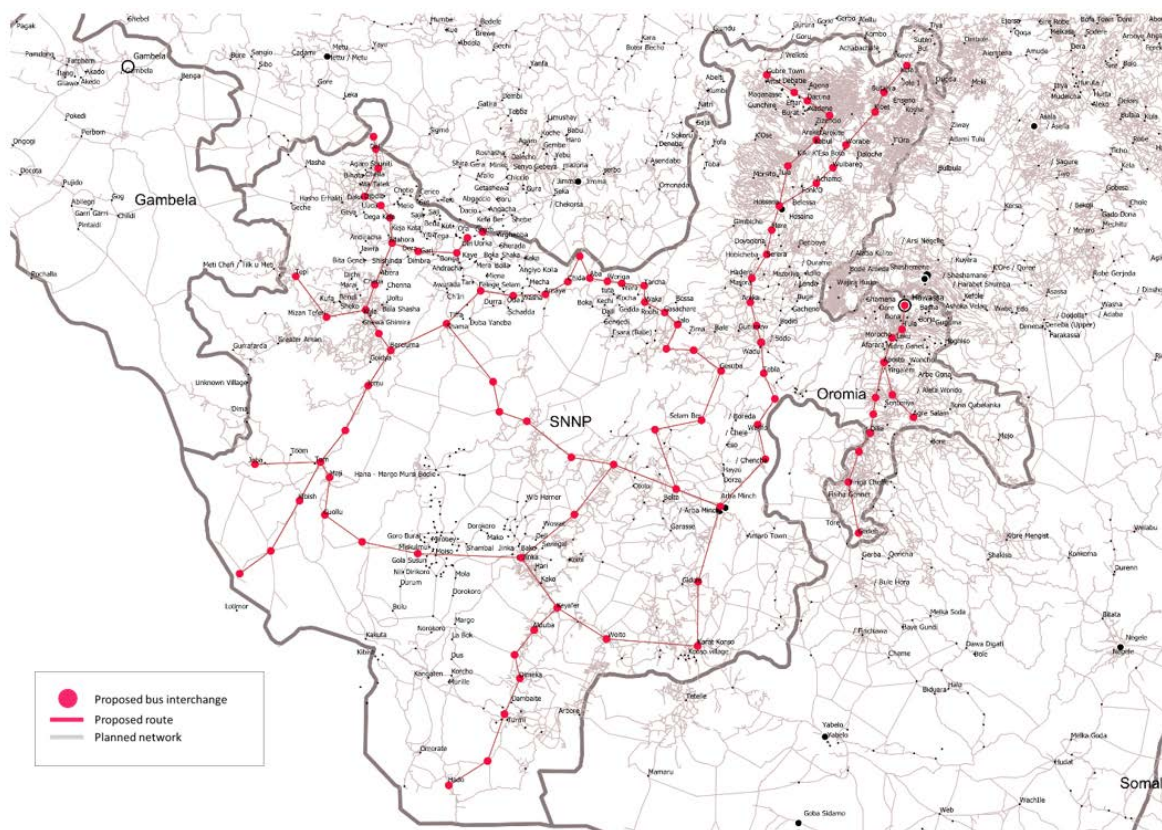


5.8.2 Planned regional public transport

It is proposed that the region is served by intercity coaches with fixed stops and routes. At least two services/day will be provided between the main cities within and outside the region.

The total network length considered is of 2,521 km. Assuming two services/day on all the planned routes in each direction, the services will cover 10,084 km/day.

Figure 48: Proposed intercity network



While intercity services will provide connectivity along the main routes, feeder services will be key to provide accessibility for the most isolated rural communities. It is proposed that such services are provided on a demand responsive basis.

5.8.3 RED model evaluation

A fully costed RED model is used to evaluate cost and benefits for the proposed construction and maintenance road plan. Seven project alternatives are considered for the proposed interventions, ranging from maintaining the current poor network conditions to paving. The options with the highest net present value are also the costliest. However, the option with the highest internal rate of return is “Alternative 1 - bring to fair conditions” which implies the rehabilitation and regular maintenance of natural ground and gravel roads.

Such option also shows as the one with the highest modified rate of return and net present value per financial investment cost.

As this is the options expected to bring the maximum benefits with the lowest investment, this option is chosen as the preferred option.

Table 22: NPV/FIC ratio - Net Present Value per Financial Investment Costs (ratio)

Alter. 0	Alter. 1	Alter. 2	Alter. 3	Alter. 4	Alter. 5	Alter. 6
0.00	18632.62	11209.88	4377.19	3614.65	3012.06	2409.46

The following funds would be required to deliver the rural road network plan. The total cost of the plan is estimated as 1,693,035,000 USD over 30 years.

The construction investment per person is expected to be 21.68 USD/inhabitant, while the maintenance 1.99 USD/inhabitant/year.

Table 23: Estimated costs

Upgrade cost	Build cost	Maintenance cost /year	Investment per inhabitant
\$ 418,704,000	\$ 32,772,000	\$ 41,385,300	\$ 21.68

5.8.4 PT costs

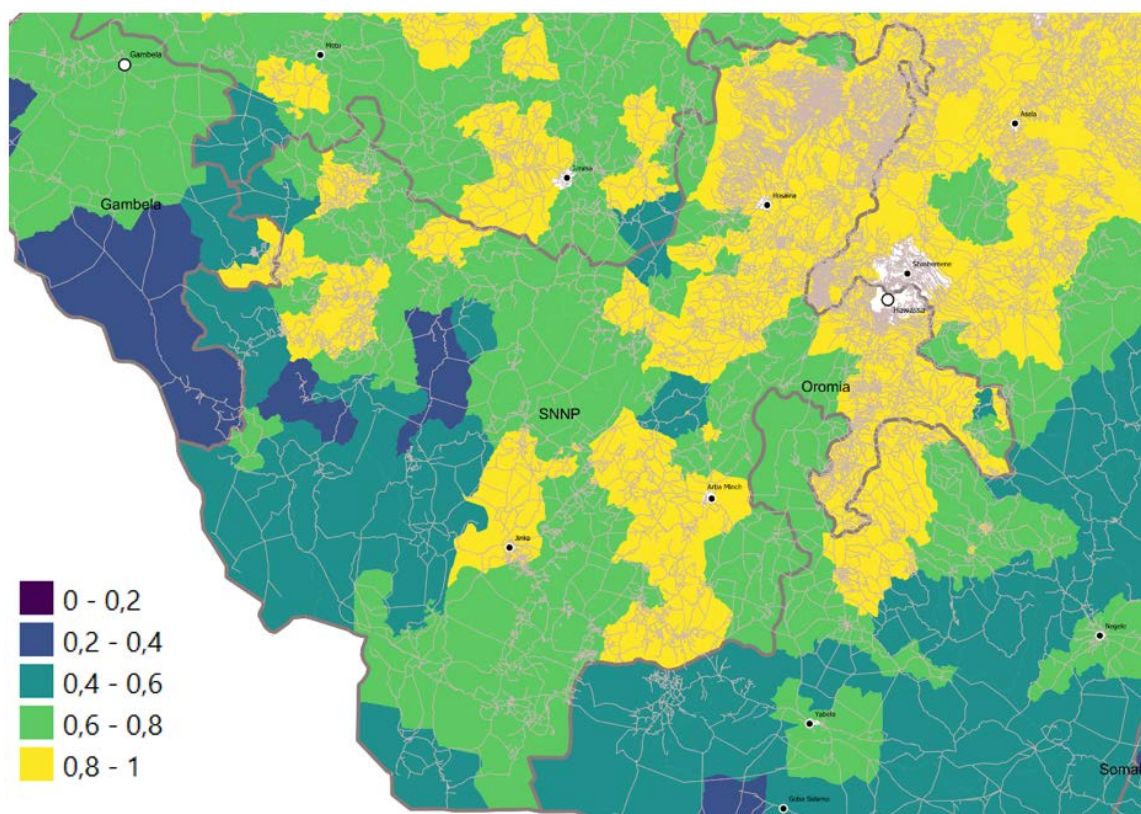
Regarding the intercity buses, it is assumed a cost of 0.2 USD/km. Therefore, the planned intercity system is expected to cost \$ 736,132 / year. Further investments will be required to fund the feeder services.

5.8.5 Benefits

The RAI for the region is expected to increase to 0.88 on average from the previous 0.36.

The plan is expected to provide new connectivity to 418,286 inhabitants within 2 km, while a further 6,546,490 inhabitants will be within 2 km distance from a rehabilitated road.

Figure 49: RAI after plan

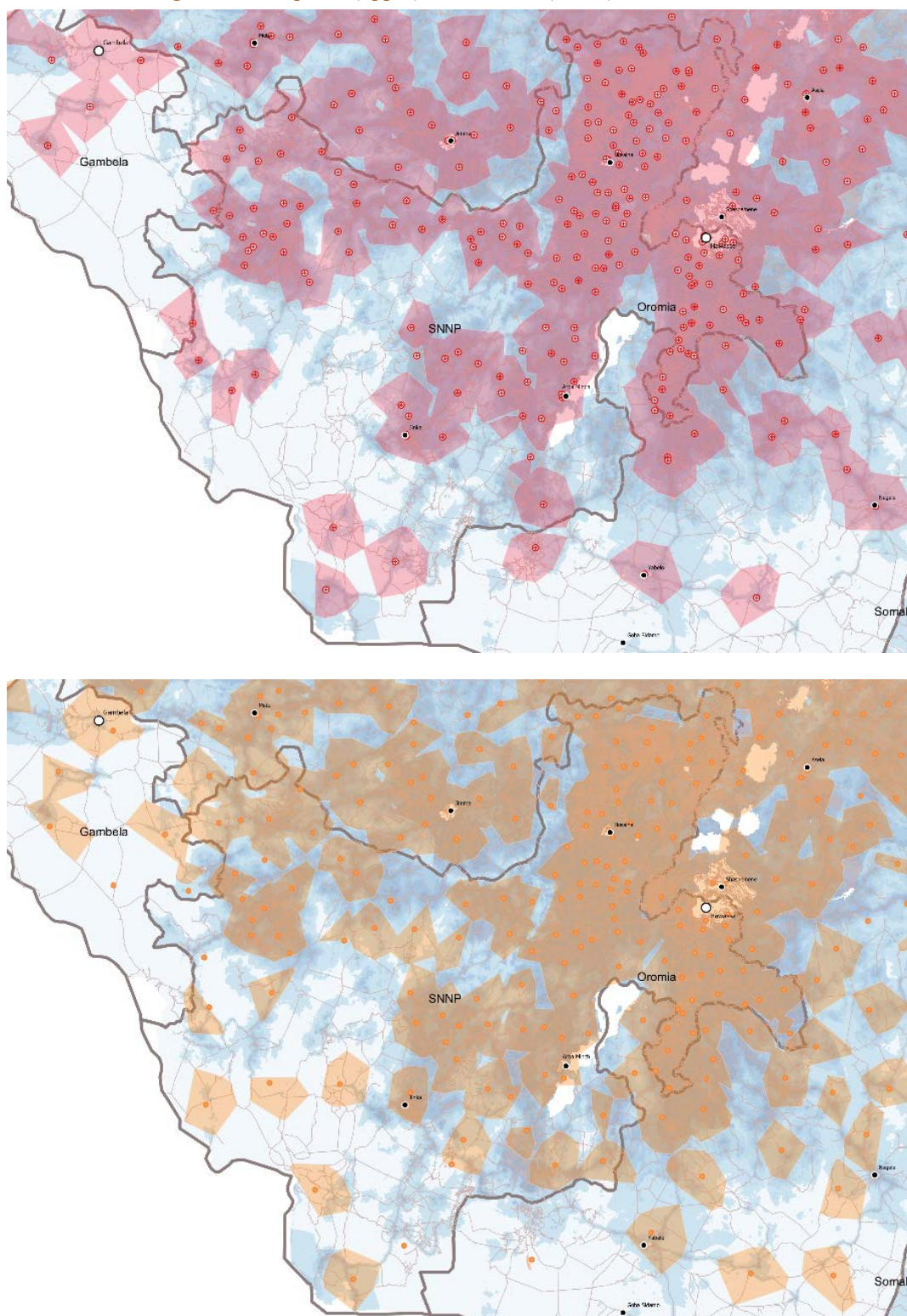


The planned road network is expected to improve accessibility to both schools and hospitals. It will bring new connectivity to hospitals within two hours to 2,447,313 rural citizens (15% increase) and new connectivity to schools within two hours to 2,928,202 rural citizens (19% increase).

The proportion of rural citizen within two hours from a hospital will be 90% and the proportion of those within two hours from a school will be 74%.

It should be noted that in some areas, especially the south-west of the region, the lack of basic services is the main driver for the poor accessibility to services.

Figure 50: Hospitals (upper) and schools (lower) catchment area.



5.9 TIGRAY

5.9.1 Planned regional road network

SNNP is a region with a population of 5,910,998 inhabitants of which 5,395,328 are considered rural (91%). Currently 29% of the rural population is more than 2 km from any road or path.

The existing road network includes roads managed by ERA, community roads, municipal roads, URRAP roads and unclassified roads. The total existing network size is estimated to be 10,297 km long.

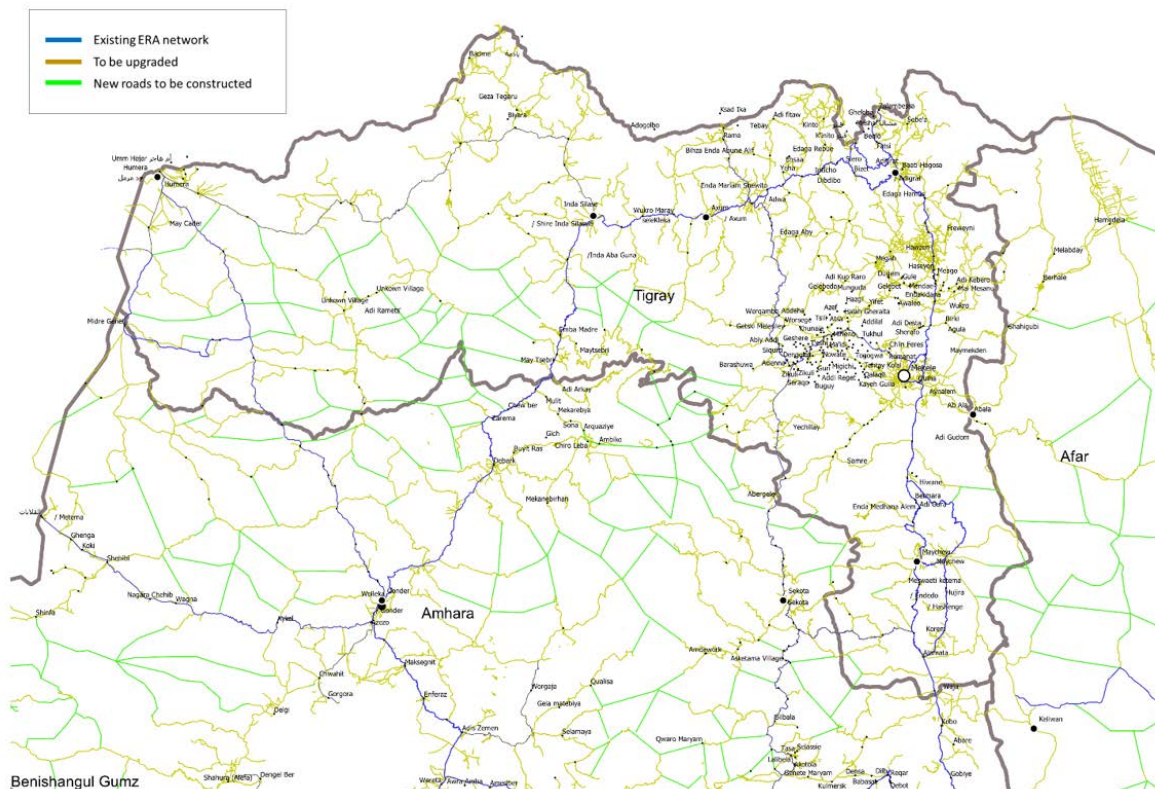
It is proposed that the existing road network is increased in both size and quality. In particular, it is proposed that:

- 957 km of new gravel roads are built
- 7,709 km of existing non-ERA roads are rehabilitated/upgraded

The rural network density will be uplifted from 146 km/1,000 sq.km to 164 km/1,000 sq.km which represents an increase of 12%.

The implementation of the plan considers appropriate funding for the regular maintenance of the rural road network.

Figure 51: Planned road network

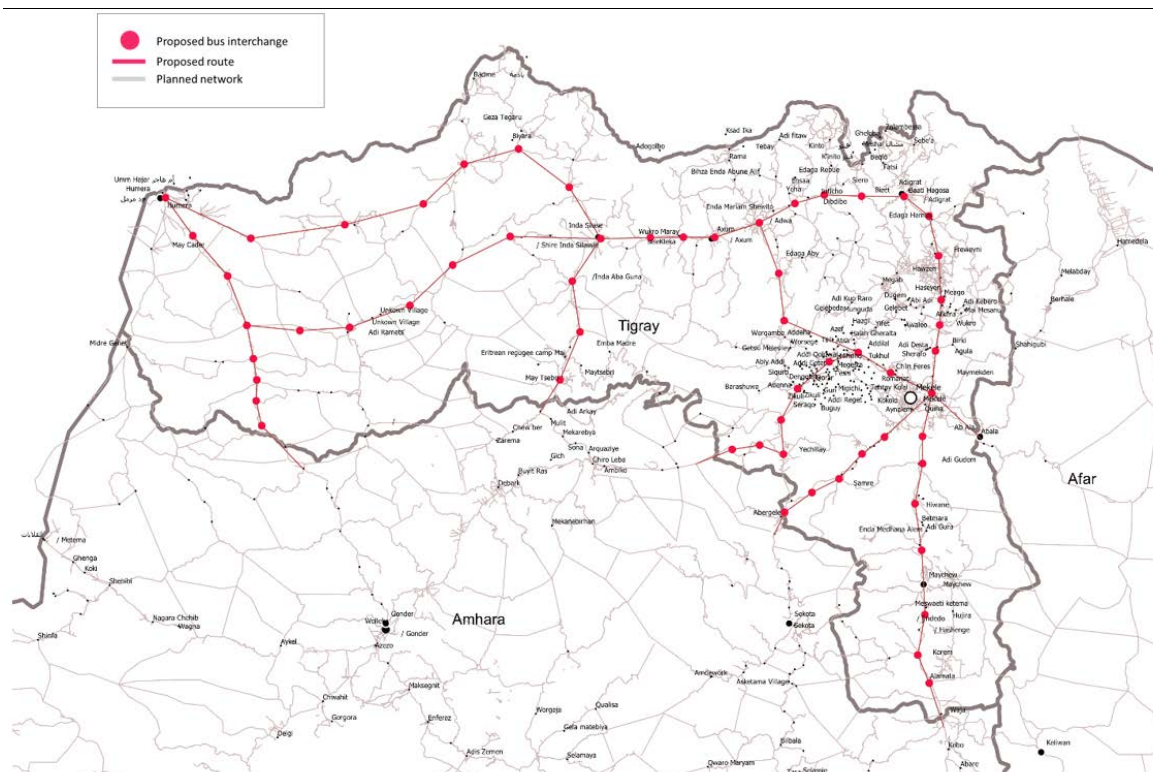


5.9.2 Planned regional public transport

It is proposed that the region is served by intercity coaches with fixed stops and routes. At least two services/day will be provided between the main cities within and outside the region.

The total network length considered is of 1,395 km. Assuming two services/day on all the planned routes in each direction, the services will cover 5,580 km/day.

Figure 52: Proposed intercity network



While intercity services will provide connectivity along the main routes, feeder services will be key to provide accessibility for the most isolated rural communities. It is proposed that such services are provided on a demand responsive basis.

5.9.3 RED model evaluation

A fully costed RED model is used to evaluate cost and benefits for the proposed construction and maintenance road plan. Seven project alternatives are considered for the proposed interventions, ranging from maintaining the current poor network conditions to paving. The options with the highest net present value are also the costliest. However, the option with the highest internal rate of return is “Alternative 1 - bring to fair conditions” which implies the rehabilitation and regular maintenance of natural ground and gravel roads.

Such option also shows as the one with the highest modified rate of return and net present value per financial investment cost.

As this is the options expected to bring the maximum benefits with the lowest investment, this option is chosen as the preferred option.

Table 24: NPV/FIC ratio - Net Present Value per Financial Investment Costs (ratio)

Alter. 0	Alter. 1	Alter. 2	Alter. 3	Alter. 4	Alter. 5	Alter. 6
0.00	3980.12	2365.70	917.44	757.78	631.36	504.94

The following funds would be required to deliver the rural road network plan. The total cost of the plan is estimated as 389,970,000 USD over 30 years.

The construction investment per person is expected to be 19.27 USD/inhabitant, while the maintenance 1.77 USD/inhabitant/year.

Table 25: Estimated costs

Upgrade cost	Build cost	Maintenance cost /year	Investment per inhabitant
\$ 92,508,000	\$ 11,484,000	\$ 9,532,600	\$ 19.27

5.9.4 PT costs

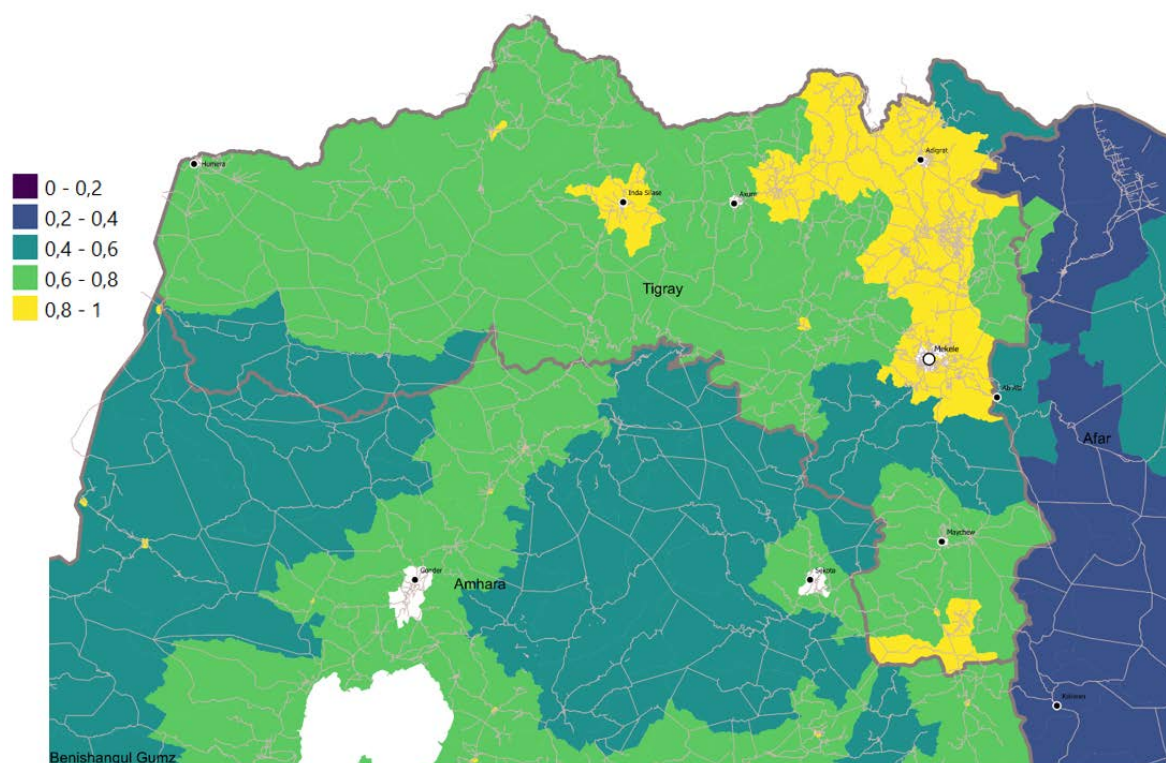
Regarding the intercity buses, it is assumed a cost of 0.2 USD/km. Therefore, the planned intercity system is expected to cost \$ 407,340 / year. Further investments will be required to fund the feeder services.

5.9.5 Benefits

The RAI for the region is expected to increase to 0.73 on average from the previous 0.41.

The plan is expected to provide new connectivity to 116,632 inhabitants within 2 km, while a further 924,901 inhabitants will be within 2 km distance from a rehabilitated road.

Figure 53: RAI after plan

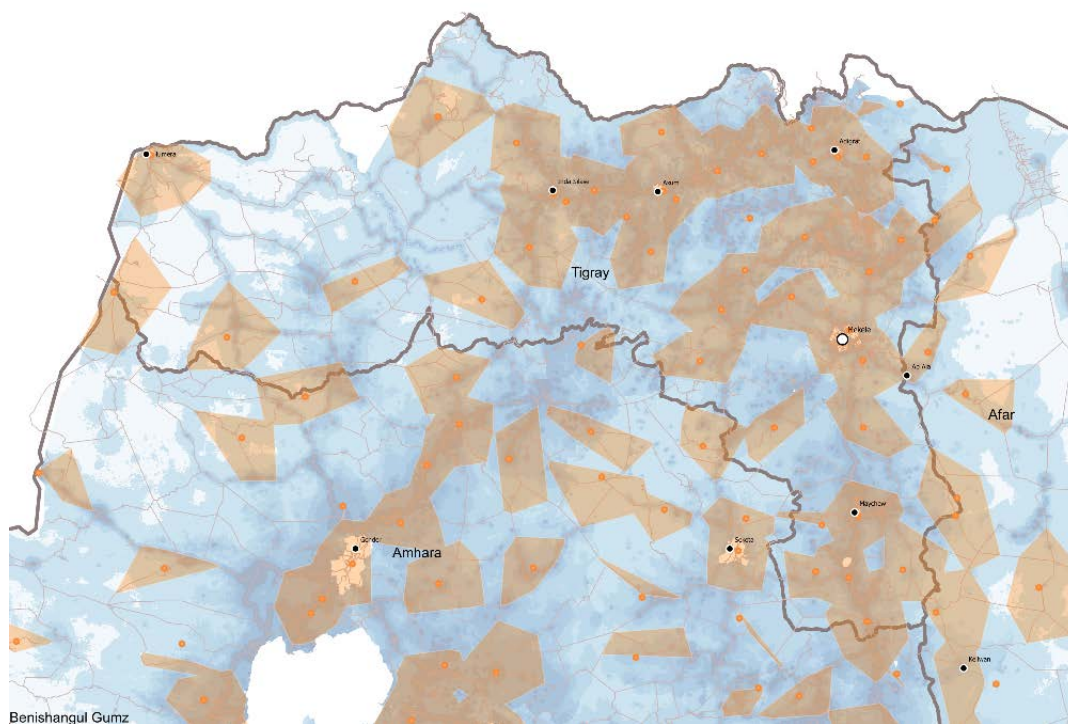
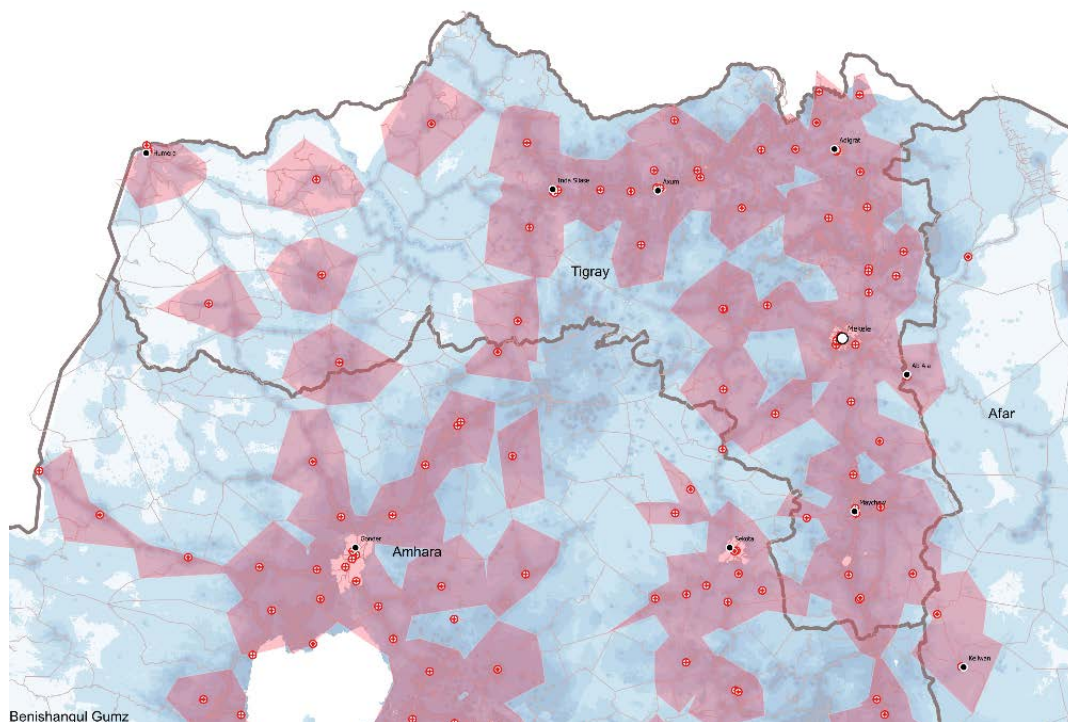


The planned road network is expected to improve accessibility to both schools and hospitals. It will bring new connectivity to hospitals within two hours to 517,552 rural citizens (14% increase) and new connectivity to schools within two hours to 261,191 rural citizens (8% increase).

The proportion of rural citizen within two hours from a hospital will be 77% and the proportion of those within two hours from a school will be 69%.

It should be noted that in some areas, especially the west of the region, the lack of basic services is the main driver for the poor accessibility to services.

Figure 54: Hospitals (upper) and schools (lower) catchment area.



6 CONCLUSIONS

The sector report has the aim of serving as a guidance for the improvement of rural accessibility in the next 30 years.

The methodology considers the right of all citizens to socio-economical inclusion, which can only be guaranteed with appropriate infrastructure.

In many contexts, including the case of Ethiopia, an increase in rural accessibility has proven effective both in reducing poverty and boosting agricultural production. Thus, it should be considered a priority for all economic growth scenarios.

It is recognised that the country’s rural network is not just made of its classified road network, but a rather complex network of unclassified roads and paths that have been used and managed by local communities for years, either to access the neighbouring town or the nearest road, or sometimes just to move cattle between pastures. Although many of these paths are currently unusable by motor vehicles, their existence signifies their relevance for the local communities. Therefore, it is proposed that accessibility is considered in its broader meaning, rather than reducing its definition to the classified road network. To do this, the present situation analysis considers the use of satellite imagery to identify rural population densities and infrastructure.

In order to study the present situation, gaps in terms of population served by the network and time required to reach basic socioeconomic activities such as markets, hospitals and schools are identified.

The analysis shows that some regions have networks that are considerably more expanded than others. It also highlights that in some areas that are poorly served by basic services, an increase in road density is not expected to be sufficient to improve accessibility.

Overall, it seems clear that the past plans of rural roads network expansion have been successful in building a key asset for the country’s development.

On the other hand, recent assessments show that the bulk of natural ground and gravel roads built in the last decades is now mostly in poor conditions due to insufficient maintenance.

For the next years the plan envisages that the country takes advantage of its assets by rehabilitating and properly maintaining the rural road network rather than pushing on its expansion.

To do so, it is suggested that a GIS based road inventory system is built and managed at regional level. Such repository will be the key planning tool for regional agencies to prioritise projects and obtain funding.

The gradual standardisation in the structure, responsibility and processes of regional road agencies is also envisaged to minimise further disparities in the construction and management of the regional road networks. In addition, the use of KPIs to measure the agencies performances should be considered.

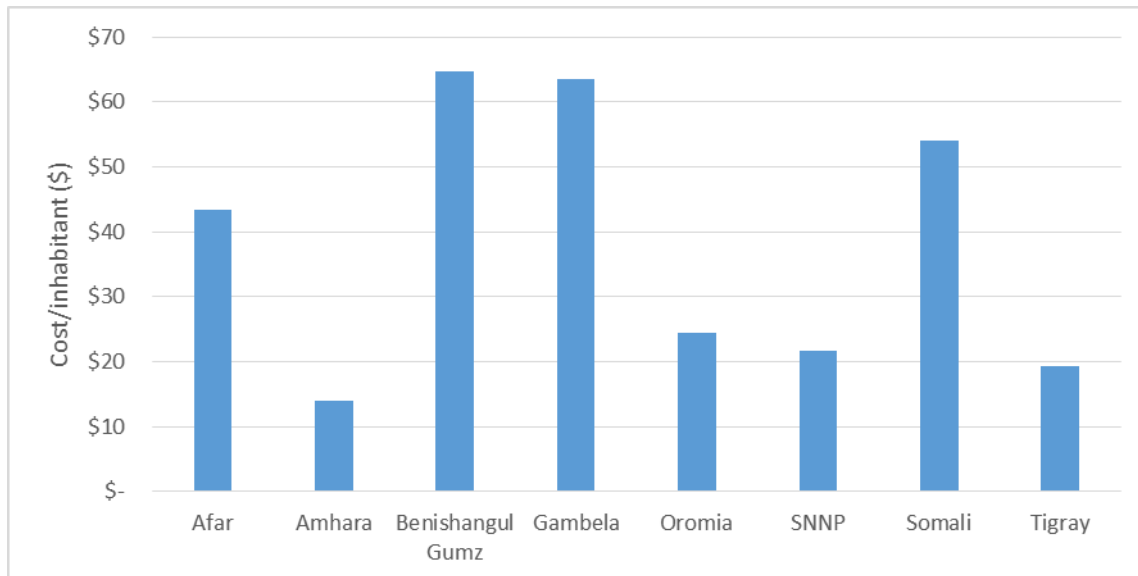
Properly maintenance of the network will also require an increase in funding. However, in the longer term the cost of regular maintenance is expected to be considerably lower than the cost of rebuild/rehabilitation if the roads are not properly maintained.

The RED model is used to demonstrate the advantage of bringing roads to fair conditions and applying regular maintenance compared with other construction alternatives, including the construction of paved roads. Given the low traffic volumes, the plan considers the adoption of gravel roads to optimise the net present value in relation to construction costs.

In addition, the plan assumes that the cost for the rehabilitation of a rural path would be the same as to build a new road section, which is generally expected to prove as a conservative and cost-saving assumption.

The plan aims to address regional disparities by increasing the spending in those regions that have been neglected in the past. Figure 54 shows that as a result of the plan the investment per inhabitant will be significantly higher for those regions that are the least accessible.

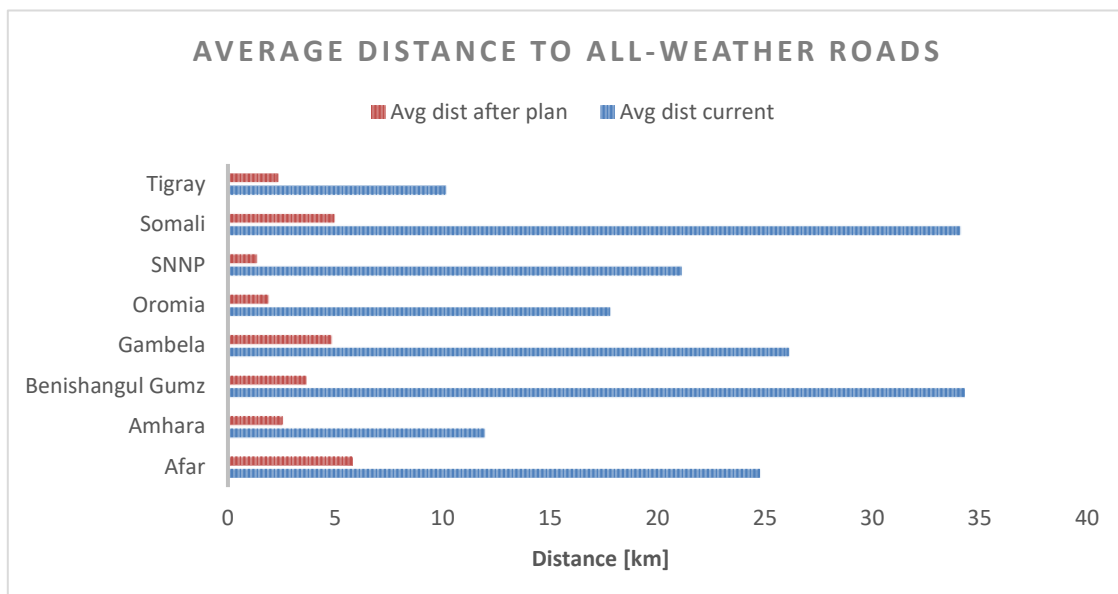
Figure 55: Investment per inhabitant by region



The total cost of financing the rural roads plan in the next 30 years is estimated as 8.48 billion USD. Such investment should be sufficient to grant the country with a non-ERA network of 217,000 km of gravel roads in fair conditions, which is consistent with the existing network development plans (10 years plan).

As shown in Figure 46 the average distance to all weather roads after the plan will be considerably reduced for all regions.

Figure 56: Average distance to all weather roads measured before and after the plan.



The development of a public transport system is also considered at regional level to both provide accessibility and promote sustainable transport. For each region it is considered that both regular services and DRT services will be required. While intercity buses will provide regular services between cities along main regional corridors, DRT services will be used as feeder services for local communities to reach villages or transport interchanges.

The plan proposes the regional intercity lines and interchanges required to serve the population, with its associated costs.

Finally, the benefit to the population in terms of increased in accessibility and travel times to hospitals and schools are presented, showing the areas where an increase in the provision of basic services is also required.

An overview of the funding required to finance the plan is provided below:

	Upgrade cost (\$)	Build cost (\$)	Maint cost/year (\$)	Tot cost (\$)	
				2042	2052
Afar	47,184,000	28,116,000	6,902,500	213,350,000	282,375,000
Amhara	243,048,000	45,360,000	26,437,400	817,156,000	1,081,530,000
Benishangul Gumz	52,524,000	21,372,000	6,773,800	209,372,000	277,110,000
Gambela	16,932,000	15,024,000	2,929,300	90,542,000	119,835,000
Oromia	848,556,000	65,424,000	83,781,500	2,589,610,000	3,427,425,000
SNNP	418,704,000	32,772,000	41,385,300	1,279,182,000	1,693,035,000
Somali	271,404,000	52,704,000	29,709,900	918,306,000	1,215,405,000
Tigray	92,508,000	11,484,000	9,532,600	294,644,000	389,970,000
Total	1,990,860,000	272,256,000	207,452,300	6,412,162,000	8,486,685,000

	Intercity cost/year (\$)	Intercity cost (\$)	
		2042	2052
Afar	508,080	10,161,600	15,242,400
Amhara	1,103,176	22,063,520	33,095,280
Benishangul Gumz	355,948	7,118,960	10,678,440
Gambela	223,088	4,461,760	6,692,640
Oromia	2,187,080	43,741,600	65,612,400
SNNP	736,132	14,722,640	22,083,960
Somali	1,085,656	21,713,120	32,569,680
Tigray	407,340	8,146,800	12,220,200
Total	6,606,500	132,130,000	198,195,000