

# **Evaluation Design Report:**

## **Niger Roads for Market Access Evaluation**

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# Niger Roads for Market Access Activity Evaluation

## Evaluation Design Report

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### **DISCLAIMER**

*The views and opinions expressed herein are those of the authors and do not necessarily represent those of MCC or any other U.S. Government entity.*

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## LIST OF ACRONYMS

ACC	Accident Costs
AADT	Average Annual Daily Traffic
ADT	Average Daily Traffic
APD	<i>Avant-Projet Détaillé</i>
BB	Benkelman Beam
BDR	<i>Base des Données Routières</i>
CAFER	<i>Caisse Autonome de Financement de l'Entretien Routier</i>
CBA	Cost-Benefit Analysis
CPIA	World Bank Country Policy and Institutional Assessment
CRA	Climate-Resilient Agriculture
CRC	Climate-Resilient Communities
DGER	<i>Direction Générale de l'Entretien Routier</i>
DGR	<i>Direction de Gestion des Réseaux</i>
DGRR	<i>Direction Générale des Routes Rurales</i>
DGGT	<i>Direction Générale des Grands Travaux</i>
ECOWAS	Economic Community of West African States
EDR	Evaluation Design Report
EIRR	Economic Internal Rate of Return
EMC	Evaluation Management Committee
EMP	Evaluation Management Process
ERR	Economic Rate of Return
ESALF	Equivalent Single Axle Load Factor
FIFO	First in- first out
GON	Government of Niger
HDM-4	Highway Development and Management-4
IDG	International Development Group LLC
IM	Investment Memorandum
IMAP	Irrigation and Market Access Project
IPD	Irrigation Perimeter Development
IRB	Institutional Review Board
IRI	International Roughness Index
LTPP	Long-term Pavement Performance
MCA-N	Millennium Challenge Account Niger
MCC	Millennium Challenge Corporation
MOE	Ministry of Equipment
MSMF	Management Services and Market Facilitation
MTC	Manual Traffic Count
NPV	Net Present Value
OPRC	Output- and Performance-based Road Contract
PRAPS	Regional Sahel Pastoralism Support
PSR	Present Serviceability Rating

QA/QC	Quality Assurance Quality Control
RED	Roads Economic Decision
RMA	Road for Market Access
RRS	<i>Route Rurale de Sambera</i>
RTRRMS	Response-type road roughness measuring system
RUC	Road User Cost
SNCCERR	<i>Stratégie Nationale de Conception, Construction et Entretien des Routes Rurales</i>
SSATP	Sub-Saharan Africa Transport Policy Program
TOR	Terms of Reference
TRRL	Transport and Road Research Laboratory
TT	Travel Time
TTS	Travel Time Savings
UEMOA	<i>Union Economique et Monetaire Ouest Africaine</i>
VOC	Vehicle Operating Cost

# **I. INTRODUCTION**

## **I.1 COUNTRY CONTEXT**

The Millennium Challenge Corporation (MCC) and the Government of Niger (GON) signed a five-year, USD 437 million Compact on July 29, 2016, which entered into force on January 26, 2018. The Compact objective is to “increase rural incomes by improving the sustainable productive use of natural resources for agricultural production and improving trade and market access for agricultural products.”<sup>1</sup>

The Compact is composed of two projects: 1) Irrigation and Market Access Project (IMAP) and 2) Climate-Resilient Communities (CRC), subdivided into six activities. There are four activities under the IMAP: 1) Irrigation Perimeter Development (IPD), 2) Management Services and Market Facilitation (MSMF), 3) Roads for Market Access (RMA), and 4) Policy Reform. Under the CRC Project, there are two activities: 1) Climate-Resilient Agriculture (CRA) and 2) Regional Sahel Pastoralism Support (PRAPS).

MCC allocated USD 113 million to the RMA Activity as part of the IMAP. The RMA Activity complements the other activities under the IMAP by reducing trade barriers, improving physical market access through targeted improvements of the road network serving the Dosso-Gaya perimeters, and linking the perimeters to the rest of the country. The sub-activities under the RMA Activity are: 1) rehabilitation and paving of National Road (RN7) from Dosso to Bella II (83 km), 2) rehabilitation and gravel upgrade of RN35 from Margou to Gaya (180 km), and 3) rehabilitation and gravel upgrade of a rural road linking RN35 and RN7 (37 km), referred to as Route Rurale de Sambera (RRS).

## **I.2 OBJECTIVE OF THE REPORT**

On October 1, 2018, MCC issued a contract to International Development Group LLC (IDG) to conduct an Economic Analysis and Independent Evaluation Services in support of the Niger RMA Activity. The evaluation, designed to understand the impact of the RMA Activity on Niger’s economic growth, is mainly threefold: 1) a review of the activity implementation (Evaluation Area 0<sup>2</sup>) to identify any deviations from the original design, 2) an economic analysis (Evaluation Area 1) to understand the costs and benefits of the MCC-funded roads, and 3) performance evaluations of road maintenance, road usage patterns, and transport market structure to complement and enhance knowledge gained through the economic analysis (Evaluation Areas 2, 3, and 4).

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<sup>1</sup> Millennium Challenge Corporation, *Millennium Challenge Compact between the United States of America acting through the Millennium Challenge Corporation and the Republic of Niger acting through the Ministry in charge of Foreign Affairs and Cooperation*, 2016, p.1.

<sup>2</sup> The Statement of Work in the Contract for the Economic Analysis and Independent Evaluation Services in support of the Niger RMA Activity refers to the thematic areas of the evaluation as “Research Areas” and “Research Questions”. This report refers to these terms instead as “Evaluation Areas” and “Evaluation Questions” respectively because the objective of the evaluation is not focused on research but on understanding the effect of MCC’s activity in Niger.



The objective of the Evaluation Design Report (EDR) is to allow MCC to review the following areas:<sup>3</sup>

- Prioritize evaluation questions and outcomes that meet demand from key decision-makers;
- Ensure that the program Objective and all key accountability metrics modeled in the cost-benefit analysis are measured or justification is provided as to why they are not;
- Apply the most rigorous evaluation methodology feasible given project design and implementation rules;
- Clearly define the analysis plan to ensure consensus on outcomes – their definitions and measurement;
- Clearly define sample population and sampling strategy that aligns with project target populations;
- Clearly define exposure period that maps data collection timelines with project start date timelines; and
- Update costs as necessary.

In this report, the team will: i) provide an overview of the Compact and the RMA Activity, ii) present quantitative and qualitative evaluation design for the baseline and the endline of each evaluation question, and iii) summarize administrative issues of the evaluation. The final EDR will incorporate feedback and recommendations from MCC and stakeholders in Niger.

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<sup>3</sup> MCC Independent Evaluations, Evaluation Management Process (EMP) Version: May 2017.

## II. OVERVIEW OF THE COMPACT AND THE INTERVENTION(S) EVALUATED

### 2.1 OVERVIEW OF THE PROJECT AND IMPLEMENTATION PLAN

#### 2.1.1 Original Project Description

The RMA Activity is one of four activities under the IMAP. The RMA Activity includes upgrading the road network serving the Dosso-Gaya irrigation perimeters with the aim of reducing trade barriers and improving physical market access and linking them to the rest of the country.<sup>4</sup>

MCC funding will support construction and non-construction costs for the complete rehabilitation, upgrade and paving of segments of one road and the rehabilitation and gravel upgrade of two roads, as follows:

- Rehabilitation and paving of RN7 from Dosso to Bella II (83 km), linking the southern region of Niger to the rest of the country;
- Rehabilitation and gravel upgrade of RN35 from Margou to Gaya (180 km) directly serving the Dosso-Gaya perimeters; and
- Rehabilitation and gravel upgrade of a rural road that links RN35 and RN7 (37 km)<sup>5</sup>.

IMAP aims to increase crop yields and higher yields are expected to come about as a result of improved productivity from irrigated land through more intensive cultivation (longer growing season), increased land under cultivation, higher propensity to invest in inputs due to reduced risk of flooding (through complementary investments), and cultivation of higher-value crops. The RMA Activity, as part of the IMAP, assumes that savings will be accrued through reducing vehicle operating costs (VOC) (as drivers benefit from reduced maintenance and repair expenditures) and travel time. Additional benefits can be expected to accrue to growers of crops and landowners as farmers take advantage of better access to markets.

#### 2.1.2 Activity Participants

Based on the MCC M&E Plan, the RMA Activity participants and beneficiaries are the same<sup>6</sup>. Discussion on beneficiaries can be found under Section 2.4 below.

#### 2.1.3 Geographical Coverage

The geographic scope of the RMA Activity is limited to the Dosso Department, the southern-most tip of Niger bordering Nigeria and Benin. The three roads (RN7, RN35, and the Sambera rural road) are serving the Dosso-Gaya area. Roads investments and maintenance schemes near the Dosso-Gaya irrigation perimeters are meant to enhance beneficiaries' income by linking increased agricultural production to consumers, improving producers' access to markets as well as reducing associated trade barriers. The three roads to be improved by MCC are shown in **Figure II.1** below:

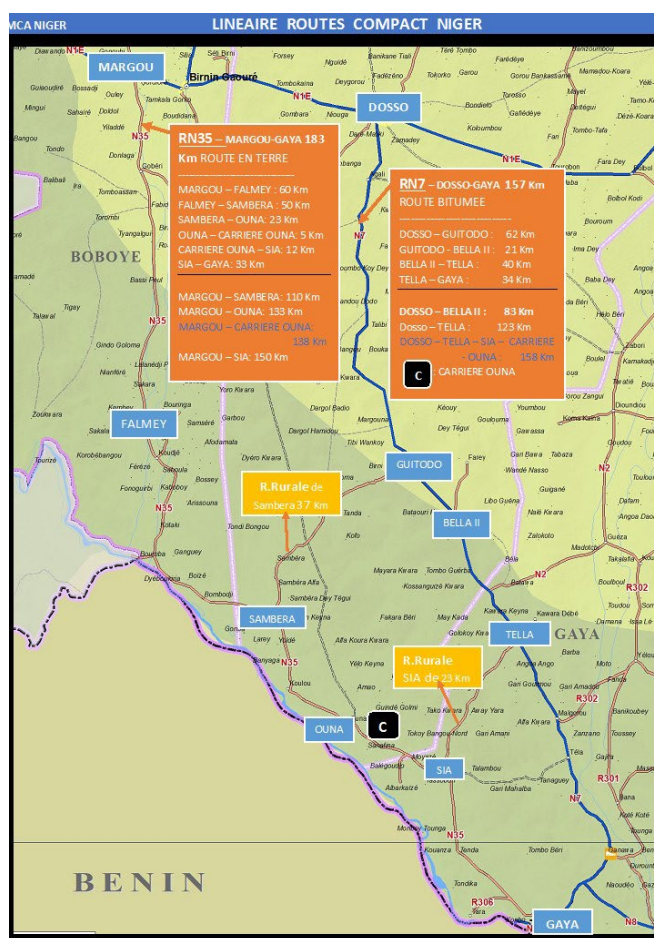
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<sup>4</sup> Millennium Challenge Cooperation, *Monitoring and Evaluation Plan of the Niger Compact between the United States of America, acting through the Millennium Challenge Corporation and the Republic of Niger*, Version 1, March 2018, p.13.

<sup>5</sup> MCC Compact describes the RRS as a rural road linking Ouna-Kouanza and Sia irrigation perimeters with RN35 and RN7. In reality, RRS links RN35 and RN7 directly, as shown in Figure 2.1 below.

<sup>6</sup> MCC, *Monitoring and Evaluation Plan*, p.29.

Figure II.1 Map of RMA Activity Roads<sup>7</sup>



### 2.1.4 Implementation to Date

Since the Compact entered into force in January 2018, Millennium Challenge Account-Niger (MCA-N) has been engaged in preparatory work for the RMA Activity and contracted two firms to draft detailed designs and bidding documents as follows:

- AIC Progetti for RN35 and RRS
- Louis Berger and AGEIM for RN7

As of March 2019, AIC Progetti for RN35 submitted their draft assessment report (Avant-Projet Détaillé, APD) to MCA-N/MCC for review which provides detailed designs, specifications, and cost estimates based on the technical and environmental assessments carried out and validated. Louis Berger submitted the technical and environmental assessments to MCA-N/MCC. Construction on the roads is expected to begin in early 2020.

<sup>7</sup> MCA-Niger website.

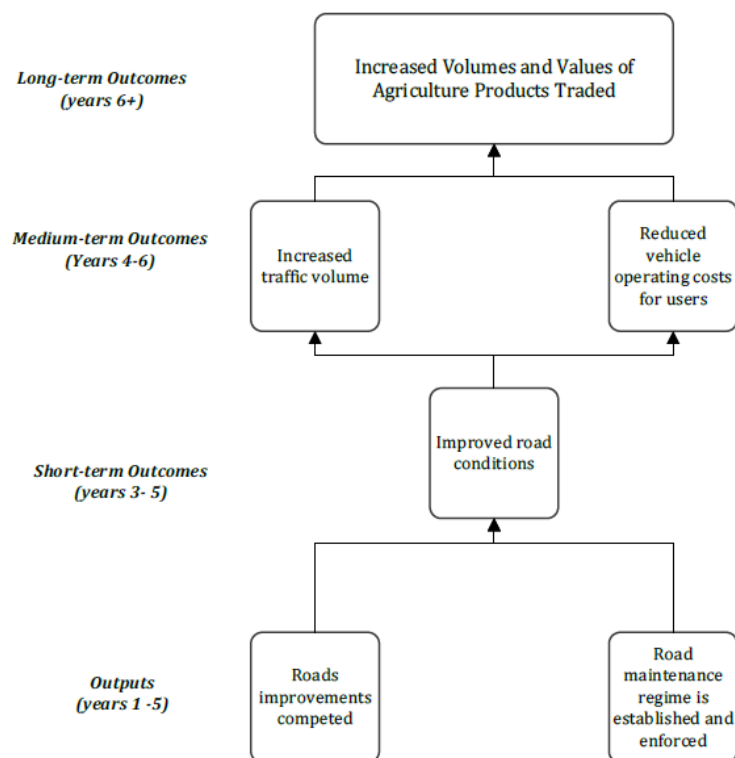
## 2.2 THEORY OF CHANGE

### 2.2.1 MCC Transportation Project Logic

The Compact states that “[b]y investing in roads that are linked to the irrigation perimeters, project beneficiaries will be able to more effectively access inputs, services and markets and sell their increased production.”<sup>8</sup> The ultimate result (or “end state”) is “higher incomes for women and men in rural households and sustainable management of irrigation systems and natural resources.”<sup>9</sup>

Within the IMAP, the RMA Activity aims to facilitate access to markets, thereby increasing trade and the benefits therefrom. However, because the RN7 and RN35 roads connecting the Dosso-Gaya irrigation perimeters with local and international markets are in very bad condition, due to poor maintenance and neglect, they impede access. In response to the problem, the Compact will invest in the rehabilitation of these roads, and the RRS connecting them, along with developing sustainable maintenance regimes. The original program logic included in Version 1 of the M&E Plan is presented below.<sup>10</sup>

**Figure II.2 MCC RMA Activity Program Logic Model**



<sup>8</sup> Millennium Challenge Corporation, *Millennium Challenge Compact between the United States of America acting through the Millennium Challenge Corporation and the Republic of Niger acting through the Ministry in charge of Foreign Affairs and Cooperation*, 2016, p. Annex I-4.

<sup>9</sup> Millennium Challenge Corporation, *Investment Memorandum, Annex B: Project Description Large Scale Irrigation and market Infrastructure Project*, p.1.

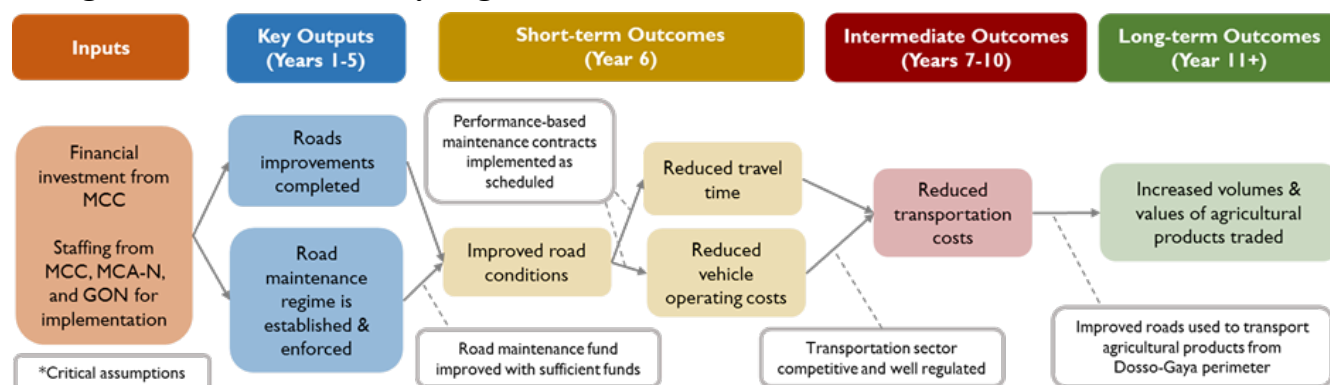
<sup>10</sup> MCC is updating the M&E Plan including the Program Logic Model. While this is not currently available to the evaluation team, the report may be revised in the future to reflect the changes made to MCC’s M&E Plan.

For RN35 and RRS, given the low road usage at present, major impacts are expected to come from changes in traffic patterns as transporters and commuters begin using the roads as alternatives to other routes, or begin exploiting new opportunities which did not exist before the road improvements. The implications of beneficiaries exploiting new opportunities is that not all changes will be fully reflected in lower VOC and time travel costs, but also in decisions to move from low usage to full usage of RN35 and RRS, of markets, and of inputs. It may also induce (or encourage) movement of residents to or away from the irrigation perimeter, as access to other areas of Niger and beyond improves. For RN7, major impact is expected to derive from lowering of transportation cost on the route Cotonou – Niamey. In the medium-long term, the transportation cost should increase the competitive edge of this route as compared to alternative routes from oceanic ports to Niamey.

## 2.2.2 Alternative Theory of Change proposed by Evaluator

The evaluation team modified MCC's RMA Activity logic model by incorporating key inputs, highlighting critical assumptions, and shifting short-term and intermediate outcomes. The revised RMA Activity logic proposed by the evaluation team is depicted in **Figure II.3** below:

**Figure II.3 Revised Activity Logic Model**



A number of key assumptions underpin the theory of change. The following assumptions and theory of change components will be analyzed as part of the evaluation after the baseline data collection has taken place:

- Investment from MCC will lead to improved road conditions and contribute to a stronger road maintenance regime (Evaluation Question 0);
- Improved road conditions will result in reduced VOCs and reduced travel time (Evaluation Question 1);
- Road maintenance fund is improved with sufficient funds (Evaluation Questions 2A, 2B, 2C);
- Performance maintenance contracts are fully implemented as scheduled (Evaluation Question 2A, 2B);
- Transportation sector is competitive and well-regulated, leading to reduced transport costs for agricultural products produced in the MCA-improved irrigation perimeters (Evaluation Question 4);
- More vehicles will use the improved roads to serve farmers' input and marketing needs and access to social and other services (Evaluation Question 3).

Evaluation questions are discussed in further detail below under the Evaluation Design Overview section.

## 2.3 COST-BENEFIT ANALYSIS

MCC updated the ERR of the RMA Activity several times during Compact design. MCC is currently updating the ERR estimates as well. Previously, in the MCC Compact document, the project-level ERR is presented as 17 percent. In Version 1 of the M&E Plan, the estimated ERR is at 20 percent. Based on the initial HDM-4 workspace, RN7 has the highest ERR of 22.4 percent, whereas the ERRs of two gravel roads, RN35 and the RRS, are slightly lower than 12 percent.<sup>11</sup> The initial HDM-4 workspace results, dated January 29, 2019, are presented below in **Figure II.4**.<sup>12</sup> The economic performances are varied for each road and the traffic volume is the main driver of the performances.<sup>13</sup>

**Figure II.4 HDM-4 Workspace Economic Indicators Summary including ERR<sup>14</sup>**

Economic Indicators Summary									
	Present Value of Total Agency Costs (RAC)	Present Value of Agency Capital Costs (CAP )	Increase in Agency Costs (C)	Decrease in User Costs (B)	Net Exogenous Benefits (F)	Net Present Value (NPV = B+E-C)	NPV/Cost Ratio (NPV/RAC)	NPV/Cost Ratio (NPV/CAP)	Internal Rate of Return (IRR)
<b>RN 7</b>									
Do nothing	518.477	0.000	0.000	0 000	0.000	0.000	0.000	0 000	0.000
<b>Option 1</b>	<b>32,516.391</b>	<b>32,259.916</b>	<b>31,997.907</b>	<b>70,387.483</b>	<b>0.000</b>	<b>38,389.576</b>	<b>1.181</b>	<b>1.190</b>	<b>22.4 (2)</b>
Option 2	32,516.391	32,259.916	31,997.907	71,622.746	0.000	39,624.839	1.219	1 228	22.7 (2)
Option 3	32,516.391	32,259.916	31,997.907	71,622.746	0.000	39,624.839	1.219	1 228	22.7 (2)
<b>RN35</b>									
Do nothing	281.875	0.000	0.000	0 000	0.000	0.000	0.000	0 000	0.000
<b>Gravel Option</b>	<b>10,771.597</b>	<b>10,212.586</b>	<b>10,489.726</b>	<b>9,872.700</b>	<b>0.000</b>	<b>-617.026</b>	<b>-0.057</b>	<b>-0.060</b>	<b>11.0 (1)</b>
Paved option	16,219.731	15,290.178	15,937.858	17,139 006	0.000	1,201.149	0.074	0 079	13.0 (1)
<b>RR Sambera</b>									
Do nothing	0.000	0.000	0.000	0 000	0.000	0.000	0.000	0 000	0.000
<b>Option1</b>	<b>2,255.428</b>	<b>1,988.765</b>	<b>2,255.428</b>	<b>2,027.349</b>	<b>0.000</b>	<b>-228.079</b>	<b>-0.101</b>	<b>-0.115</b>	<b>10.0 (1)</b>

Source: MCC Niger HDM-4 Workspace

Based on the team's review of HDM input parameters, the team believes that some input parameters will need to be corrected prior to inputting updated baseline information (details of this will be presented in a separate HDM-4 Level 1 Calibration Report). The updated baseline information will involve, but not limited to:

- Cost of rehabilitation works;
- Existing and projected traffic;
- Maintenance costs
- Prices of vehicles and tires;
- Manpower cost for operation and maintenance of vehicles;

<sup>11</sup> MCC Compact.

<sup>12</sup> MCC is currently updating the ERR estimates. While the updated version is not yet available, the report may be revised to reflect the updated ERR estimates.

<sup>13</sup> This section is based on the HDM-4 workspace from MCC on January 29, 2019.

<sup>14</sup> The options selected by MCC are highlighted in a red box for each road in the figure.



- Value of working and non-working time of passengers.

## **2.4 BENEFICIARY ANALYSIS**

According to MCC's Guidelines for Economic and Beneficiary Analysis, the RMA Activity considers participants/beneficiaries<sup>15</sup> to be all household members living within 5 kilometers on both sides along the roads.<sup>16</sup> The number is estimated by MCC as 447,501.<sup>17</sup>

The cut-off point of 5 km on both sides of roads being rehabilitated has also been used to define beneficiaries in several other MCC road projects, including Nicaragua and Senegal, as well as by the Asian Development Bank in Tajikistan. In other cases, a 2 km cut-off has been used, e.g. for an MCC in Armenia, and ILO in the Philippines. The MCC transport sector project in Malawi did not specify a cut-off point by distance from the roads but refers to estimating the number of people "living along or within the vicinity" of each road project area.

For a World Bank rural access in Nepal, different project zones of influence were defined, based on (walking) distance to the roads, from 10 minutes to as far as 4 or 6 hours, and taking into account whether the terrain is lowlands, hilly, or mountainous. Other studies also take into account natural obstacles, such as rivers and mountains, that would impede access.

To estimate the total number of beneficiaries, the known population density in the region is multiplied by the number of square km in the zone of influence (also referred to as corridor of influence or area of influence).

The selection of cut-off point is stylized, as well as somewhat arbitrary – it assumes persons living 4.9 km will benefit, but those at 5.1 km will not. However, the underlying assumption is that there is a relationship between proximity to the road and benefits is logical.

All of the projects listed above rely on a fairly broad-brush definition of who is a beneficiary. They assume geographic location as the main criterion, i.e. anyone who happens to live within the influence area is automatically a beneficiary. Regardless of what obstacles to access may exist or how far the outer limit is placed, not all persons living in the influence area are expected to be road users. For instance, in the present case, some may use only RN7, some only RN35, some RRS, some all three, and this could vary by distance from the respective roads. Some persons living in the influence area will benefit directly, as road users, some indirectly, as family members or clients of road users, and some not at all.

Defining beneficiaries as those living within 5 kilometers also does not consider as beneficiaries those who use the roads but do not live in the area. Freight transporters, for instance, are expected to benefit from the RMA Activity from the lower cost of transporting goods (as vehicle costs and transportation times decrease), and any subsequent increase in the volume of goods transported that can be attributed to the RMA.

Regardless of how beneficiaries are defined, assessing whether they are affected and by how much

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<sup>15</sup> MCC, *Policy for Monitoring and Evaluation of Compacts and Threshold Programs*, February 2017, DCI-2007-55.4, page 8 defines beneficiary as "an individual who experiences better standards of living as a result of the project, primarily through higher real incomes."

<sup>16</sup> MCC is currently revising its Monitoring and Evaluation Plan (as of August 2019) to update its definition of beneficiaries for the RMA Activity but the document is not yet available to the team.

<sup>17</sup> MCC, *Monitoring and Evaluation Plan*, p.29.

they are affected – especially if they are not direct road users themselves (e.g. sell their produce or purchase inputs from others using the roads) – is beyond the scope of the evaluation. In its “Lessons from MCC’s Investments in Roads,” MCC makes the point that the likelihood that “direct income impacts at the household or business level resulting from road improvements will be relatively small for most individual beneficiaries, even though the aggregate across the potential beneficiaries linked to the road network could be large.” The report goes on to note that “[c]apturing household or business impacts on income that would allow one to validate expected macro-level impacts of road investments would require very large samples and therefore be extremely costly.”<sup>18</sup>

Therefore, the evaluation will define the beneficiaries of RMA Activity as those who use the road, including those transporting goods or passengers on the road, regardless of where they live (within or outside the influence area). This is a narrow, conservative definition, but one which gives high confidence in use and benefit.

The evaluation will focus on estimating who are the direct beneficiaries through the Origin-Destination (O-D) and traffic surveys. While the O-D survey will provide information on the beneficiaries – including whether they live within 2 km or 5 km of the road and the traffic survey will provide numbers of vehicles using the roads. By extrapolating O-D survey data on direct beneficiaries based on traffic counts, the evaluation will be able to arrive at an estimate of direct beneficiaries and information on how and by how much they are benefiting.

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<sup>18</sup> Millennium Challenge Corporation, *Lessons from MCC’s Investments in Roads*, 2017, p. 19.



### **III. EVALUATION DESIGN OVERVIEW**

#### **3.1 EVALUATION AREAS AND QUESTIONS**

The evaluation will address the following evaluation areas:

**Evaluation Area 0** examines whether the RMA Activity was implemented according to plan. The analysis will focus on highlighting any deviations of implementation from the original Compact design to fully understand how the RMA Activity was implemented. Since the Compact is ongoing (2018 – 2023), the evaluation team will monitor the program implementation and document any changes made to the original design.

**Evaluation Area 1** tests the economic viability of MCC-funded roads by conducting a cost-benefit analysis (CBA) to estimate the economic rate of return and net present value (NPV) of the roads. The CBA will employ two models: 1) the Highway Development and Management (HDM)-4 model, an analytical tool used to conduct CBA for roads, and 2) the Roads Economic Decision (RED) model, a tool developed by the Sub-Saharan Africa Transport Policy Program (SSATP) for unpaved roads. Using baseline and endline data, the post-Compact CBA will re-evaluate the validity of the initial assumptions made prior to the Compact. An updated economic rate of return (ERR) of the MCC-funded roads will inform MCC on economic viability of large road infrastructure projects.

**Evaluation Area 2** will evaluate the road maintenance regime within Niger to test the sustainability of improvement in road infrastructure. Examining the political and economic factors shaping road maintenance decisions and practices will improve MCC's assumption on post-Compact maintenance and project-life assumptions about its infrastructure investments. In particular, Evaluation Area 2 will assess whether MCC's investment in improving maintenance practices, including the performance-based road management and maintenance contracts, were effective in improving Niger's maintenance practices.

**Evaluation Area 3** is a study of road users to understand the type of beneficiaries from the RMA Activity. The data collected for Evaluation Area 3 will inform the HDM-4 and RED model. Information such as the cost and duration of the trips and value of the goods being transported will be analyzed. This evaluation area is also intended to understand any change over time in road users and their travel patterns before and after the Activity.

**Evaluation Area 4** is an analysis of the transportation market structure. This evaluation area will analyze transportation market structure, both formal and informal, to understand how cost savings from road improvements have passed on to transport consumers who do not own their own vehicles. The analysis of the formal and informal institutions of the transportation market will inform whether vehicle operating cost savings are passed on to road users who do not own their own vehicle, such as farmers transporting their goods to market and public transportation users.

Below are the key evaluation questions for each evaluation area:

##### **Evaluation Area 0: Project Implementation**

- 0) Was the project implemented according to plan?

##### **Evaluation Area 1: Engineering Analysis and Economic Model**

- 1) What is the economic return – calculated in terms of vehicle operating cost savings and travel time (TT) savings – of the road investment? What factors drove changes to the ERR over time? How could the project have been designed to result in a higher ERR?

#### **Evaluation Area 2: Maintenance**

- 2A) To what extent have the road maintenance reforms been implemented and how has that affected the sustainability of the road investments? To what extent have the roads been maintained, whether through the performance-based road management and maintenance contracts or other mechanisms? Based on this assessment, what set of maintenance assumptions should be used in the economic model to yield the best estimate of the costs and benefits of the road investment?
- 2B) In cases where MCC invested in improving maintenance practices or included a maintenance Conditions Precedent in the Compact (applicable to Niger), what were the effects of those efforts and why?
- 2C) What political and economic factors are shaping road maintenance decisions and practices in Niger? How did this change from before the MCC intervention to after? What evidence is there that MCC facilitated those changes (if relevant)?

#### **Evaluation Area 3: Road Usage Patterns**

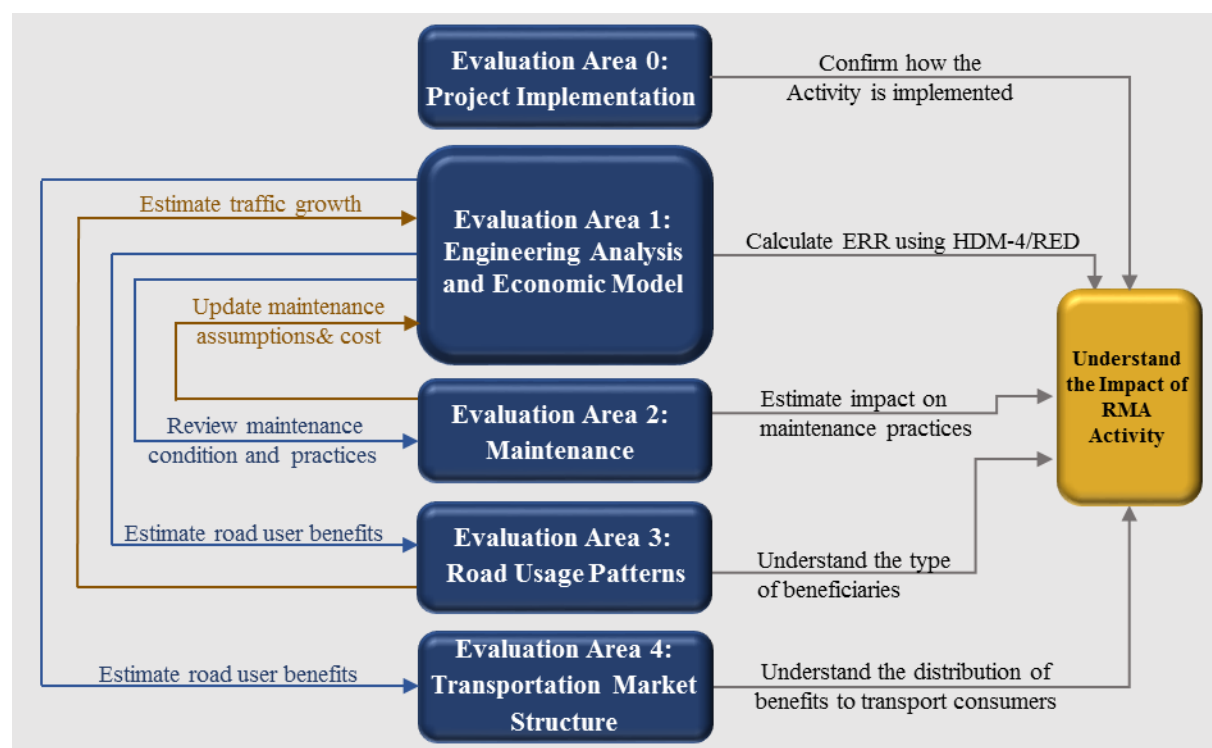
- 3) Have road usage patterns changed, in terms of who is traveling along the improved roads, why, what they are transporting, what they are paying for transport, and how long it takes to move along key routes?

#### **Evaluation Area 4: Transportation Market Structure**

- 4) How is the transportation market structured and what is the likelihood that VOC savings will be passed on to consumers of transportation services? Did this change from before the MCC intervention to after? If yes, what caused the changes?

Individual evaluation areas are interwoven as outlined in **Figure III.1** below. In advance of evaluating the RMA Activity, the team will investigate how the project was implemented (Evaluation Area 0). With the economic evaluation (Evaluation Area 1) as an instrument to test the activity objective of reduced transport cost, the performance evaluation components (Evaluation Area 2, 3, and 4) inform and provide critical nuances to understand the final ERR of the MCC-funded road infrastructure projects. The five evaluation areas, collectively, will inform MCC on its future project design, monitoring, and implementation of roads project and/or other large infrastructure projects.

**Figure III.1 Integration of Evaluation Areas**



## 3.2 EVALUATION DESIGN OVERVIEW

The evaluation team will collect both baseline and endline data for the evaluation as below:

- Baseline Data Collection: Data collected during the MCC Compact after the road design is completed but before the road rehabilitation work begins on the MCC-funded roads (2019/2020); and
- Endline Data Collection: Data collected three to four years after the completion of the MCC Compact (2026/2027).

For both the baseline and the endline data collection, the evaluation team will work with the APD consultants and other relevant actors to maximize the use of available resources while minimizing new data collection if possible. However, data availability and likelihood of receiving data in the future differ for the baseline and the endline data collection. Therefore, the evaluation design will be discussed separately below for the baseline data and endline data collection. Overall, the evaluation design will include a mix of the following types of data collection methods:

- Data collection (or review of secondary sources) for HDM-4 input data;
- Key information interviews (KIIs); and
- Review of secondary sources.

### 3.2.1 Baseline Data Collection Overview

The evaluation design for the baseline depends on the availability of data from the APD consultants who are contracted to collect some relevant HDM-4 input data on behalf of MCA-N for the design of the road rehabilitation activities. Noting that the APD contracts are not obligated to comply with the data collection required for this evaluation, IDG will review the available data from the APD

consultants and consider adopting the data in lieu of new baseline data collection to be cost-effective. Below Table III.1 presents the updated assumptions on availability of baseline data and the status of receiving the relevant information.

**Table III.1 Availability and assumptions for baseline HDM-4 input data<sup>19</sup>**

Data Collection	RN7	RN35	RRS
<b>Traffic count</b>	Received from Louis Berger; MCA's final approval of the report pending	Received from AIC Progetti; MCA's final approval of the report pending	Received from AIC Progetti; MCA's final approval of the report pending
<b>O-D survey</b>	Received from Louis Berger; MCA's final approval of the report pending	Data received from AIC Progetti is not sufficient	Not available
<b>Axle load survey</b>	Received from Louis Berger; MCA's final approval of the report pending	Received from AIC Progetti; MCA's final approval of the report pending	Data not required
<b>VOC survey</b>	Received HDM-4 workspace from MCC; VOC data need revision and updating	Received HDM-4 workspace from MCC; VOC data need revision and updating	Received HDM-4 workspace from MCC; VOC data need revision and updating
<b>Maintenance cost survey</b>	Received from Louis Berger; MCA's final approval of the report pending	Received from AIC Progetti; MCA's final approval of the report pending	Received from AIC Progetti; MCA's final approval of the report pending
<b>Road geometry and structure study</b>	Received from Louis Berger; MCA's final approval of the report pending	Received from AIC Progetti; MCA's final approval of the report pending	Received from AIC Progetti; MCA's final approval of the report pending
<b>Roughness study</b>	Not available	Not available	Not available
<b>Road condition study (visual road inspection)</b>	Received from Louis Berger; MCA's final approval of the report pending	Data not required	Data not required
<b>Deflection study</b>	Received from Louis Berger; MCA's final approval of the report pending	Data not required	Data not required
<b>Geotechnical study</b>	Received from Louis Berger; MCA's final approval of the report pending	Received from AIC Progetti; MCA's final approval of the report pending	Data not required

Based on the assumptions and review of available data as presented above, **Table III.2** present the evaluation team's summary of baseline data collection required for HDM-4 (Research Area 1).

**Table III.2 Summary of baseline HDM-4 input data collection**

Data Collection	RN7	RN35	RRS
<b>Traffic count</b>	Review and use data collected if appropriate	No data collection required	No data collection required

<sup>19</sup> The table is updated as of the submission date. This table will be updated to reflect the team's review of all existing sources before the final version of the EDR is submitted.

Data Collection	RN7	RN35	RRS
O-D survey	New data collection may be required	New data collection required	New data collection required
Axle load survey	Review and use data collected if appropriate	Review and use data collected if appropriate	Data not required
VOC survey	Update existing data	Update existing data	Update existing data
Maintenance cost survey	Review and use data collected if appropriate	Review and use data collected if appropriate	Review and use data collected if appropriate
Road geometry and structure study	Review and use data collected if appropriate	Review and use data collected if appropriate	Review and use data collected if appropriate
Roughness study	New data collection required	New data collection required	New data collection required
Road condition study (visual road inspection)	Review and use data collected if appropriate	No data collection required	No data collection required
Deflection study	Review and use data collected if appropriate	No data collection required	No data collection required
Geotechnical study	Review and use data collected if appropriate	Review and use data collected if appropriate	No data collection required

### 3.2.2 Endline Data Collection Overview

The MCC Compact in Niger is ongoing and a number of critical variables are still undetermined. In order to maximize the use of available resources while minimizing new data collection, the evaluation team must make some assumptions about the MCC Compact and how it will be implemented. The major assumptions that affect the endline data collection is listed below:

- Availability and reliability of data provided by MCA-N's contractors for RN7, RN35, and RRS;
- Successful implementation of the performance-based maintenance contracts for RN7 and RN35 and the community-based maintenance contract for RRS;
- Availability and reliability of data provided by the maintenance contractor(s);
- Availability of reliable input data for VOCs calculation.

The evaluation team has varying level of confidence in the assumptions listed above. For instance, the evaluation team believes that data provided by MCA-N contractors will most likely be available and reliable because the evaluation team will be involved in the monitoring of Compact implementation under Task 7 of the evaluation. However, it is more difficult to predict whether the maintenance contracts will be successfully implemented.

For the purpose of designing the evaluation, the evaluation team will assume that high-quality data will be available to the team from the MCA-N contractor but not rely on the data from the maintenance contractors in case the maintenance contracts are not successfully implemented. Below **Table III.3** presents the updated assumptions on availability of endline data and the current status of receiving the relevant information.

Input data used by HDM to calculate the VOCs (by vehicle category) are deemed of good quality if obtained from targeted field researches, when such researches are not conducted secondary sources are used, in this case the quality of VOCs lessens but the sensitivity analysis applied to VOCs may provide reliable information on its impact on the ERR.

Prior to starting endline data collection, the table below will be updated.



**Table III.3 Availability and assumptions for endline HDM-4 input data<sup>20</sup>**

Data Collection	RN7	RN35	RRS
Traffic count	Not likely available	Not likely available	Not likely available
O-D survey	Not likely available	Not likely available	Not likely available
Axle load survey	May be available from the maintenance contractor but assumed unavailable	May be available from the maintenance contractor but assumed unavailable	Data not required
VOC survey	Not likely available	Not likely available	Not likely available
Maintenance cost survey	May be available from the maintenance contractor but assumed unavailable	May be available from the maintenance contractor but assumed unavailable	May be available from the community but assumed unavailable
Road geometry and structure study	Expected to be available from MCA-N contractors	Expected to be available from MCA-N contractors	Expected to be available from MCA-N contractors
Roughness study	May be available from the maintenance contractor but assumed unavailable	May be available from the maintenance contractor but assumed unavailable	Not likely available
Road condition study (visual road inspection)	May be available from the maintenance contractor but assumed unavailable	Data not required	Data not required
Deflection study	May be available from the maintenance contractor but assumed unavailable	Data not required	Data not required
Geotechnical study	Expected to be available from MCA-N contractors	Expected to be available from MCA-N contractors	Data not required

Based on the assumptions and review of available data as presented above, **Table III.4** present the evaluation team's summary of baseline data collection required for HDM-4 (Research Area 1).

**Table III.4 Summary of baseline HDM-4 input data collection**

Data Collection	RN7	RN35	RRS
Traffic count	New data collection may be required	New data collection required	New data collection required
O-D survey	New data collection may be required	New data collection required	New data collection required
Axle load survey*	New data collection may be required	New data collection may be required	Data not required
VOC survey	Update existing data	Update existing data	Update existing data
Maintenance cost survey*	New data collection may be required	New data collection may be required	New data collection may be required
Road geometry and structure study	Review and use data collected if appropriate	Review and use data collected if appropriate	Review and use data collected if appropriate
Roughness study*	New data collection required	New data collection required	New data collection required
Road condition study* (visual road inspection)	New data collection required	No data collection required	No data collection required
Deflection study*	New data collection required	No data collection required	No data collection required
Geotechnical study	Review and use data collected if appropriate	Review and use data collected if appropriate	No data collection required

<sup>20</sup> The table is updated as of the submission date. This table will be updated to reflect the team's review of all existing sources before the final version of the EDR is submitted.

*\* Data collection may not be required if the performance-based maintenance contracts are successfully implemented and if reliable data is available to the evaluation team.*

**Table III.5** below summarizes baseline and endline data collection methodology for Evaluation Area 1.

**Table III.5 Summary of Evaluation Design Overview**

Program Logic Result	Indicator	Unit	Definition	Proposed Baseline Data Source (2018/2019)	Proposed Post-Compact Data Source (2026)	Data Quality Controls*
<b>Evaluation Question 0</b>						
Roads improvement completed & Road maintenance regime is established and enforced	Summary of deviations from original Compact design	N/A	N/A	N/A	<b>Secondary Sources</b> <ul style="list-style-type: none"> <li>Review available secondary sources such as the Compact Agreement, Due Diligence reports, and any other documents providing evidence of MCC's Compact design and implementation.</li> </ul> <b>Key Informant Interviews</b> <ul style="list-style-type: none"> <li>Interview key stakeholders involved with the implementation of the RMA Activity to: 1) understand how the project was initially designed, 2) determine how the project was actually implemented, 3) identify any deviations from the original design, and 4) examine the reasons for any changes made.</li> </ul>	<ul style="list-style-type: none"> <li>Information obtained from the secondary sources will be triangulated with information obtained from the key informant interviews.</li> </ul>
<b>Evaluation Question 1</b>						
Reduced vehicle operating cost & Reduced travel time & Improved road conditions	Average Annual Daily Traffic of the MCC-funded road sections	Number	Annualized daily average number of vehicles by type	<b>Secondary Sources</b> <ul style="list-style-type: none"> <li><b>RN7:</b> use Louis Berger traffic count data (2018)</li> <li><b>RN35:</b> use AIC Progetti traffic count data (2018)</li> <li><b>RRS:</b> use AIC Progetti traffic count data (2018)</li> </ul>	<b>Manual Traffic Count survey</b> <ul style="list-style-type: none"> <li>Methodology: US Federal Highway Administration Traffic Monitoring Guide</li> <li>Locations: 6 locations outside urban areas <ul style="list-style-type: none"> <li>2 stations on RN7</li> <li>3 stations on RN35</li> <li>1 station on RRS</li> </ul> </li> <li>Timing: two rounds (June and November 2026)</li> <li>Survey period: <ul style="list-style-type: none"> <li>RN7: 24-hours 4 days</li> <li>RN35: 12-hours 3 days, 24-hours 1 day</li> <li>RRS: 12-hours 4 days</li> </ul> </li> <li>Adjustment: seasonal traffic variation for the two rounds</li> <li>Presentation: graphic representation of traffic counting stations, traffic volume, itinerary diagram</li> </ul>	<ul style="list-style-type: none"> <li>Pilot test to be conducted</li> <li>Double entry of data collected to ensure accurate data entry</li> <li>Data entry using a software with built-in quality checks</li> </ul>
	Vehicle occupancy	Number	Number of average passengers per vehicle	<b>Origin-Destination survey</b> <ul style="list-style-type: none"> <li>Location: 3 locations well outside urban areas <ul style="list-style-type: none"> <li>2 stations on RN7 (same as traffic count stations)</li> <li>1 station on RN1<sup>21</sup></li> </ul> </li> <li>Timing: November 2019</li> <li>Survey period: 2 days-24 hours (Sunday/Monday)</li> <li>Sample rate: 20% of passenger vehicles, 33% of goods vehicles</li> <li>Presentation: graphic representation of O-D stations on aerial imagery and itinerary diagram</li> </ul>	<b>Origin-Destination survey</b> <ul style="list-style-type: none"> <li>Location: 3 locations well outside urban areas <ul style="list-style-type: none"> <li>2 stations on RN7 (same as traffic count stations)</li> <li>1 station on RN1</li> </ul> </li> <li>Timing: two rounds (June<sup>22</sup> and November 2026)</li> <li>Survey period: 2 days-24 hours (Sunday/Monday)</li> <li>Sample rate: 20% of passenger vehicles, 33% of goods vehicles</li> <li>Presentation: graphic representation of O-D stations on aerial imagery and itinerary diagram</li> </ul>	<ul style="list-style-type: none"> <li>Pre-test and pilot test to be conducted</li> <li>Data collected on electronic devices, if possible, to minimize data entry errors</li> <li>Call-back of 10% respondents to verify data collected</li> </ul>
	Trip purpose	Category	Purpose of road users' trip (leisure, business, commute)			
	Cost of travel time	FCFA/h	Cost of travelling based on value of time			
	Equivalent standard axle loads (ESAL) factor	ESAL	Summation of equivalent 18,000 lbs (or 18 kips, or 80 kN) single axle loads used to combine mixed traffic to standard loads	<b>Secondary Sources</b> <ul style="list-style-type: none"> <li><b>RN7:</b> use Louis Berger axle load survey data (2018)</li> <li><b>RN35:</b> use AIC Progetti axle load survey data (2018)</li> <li><b>RRS:</b> use AIC Progetti axle load survey data (2018)</li> </ul>	<b>Axle Load survey</b> <ul style="list-style-type: none"> <li>Methodology:</li> <li>Location: 3 locations <ul style="list-style-type: none"> <li>2 stations on RN7 (as part of the O-D survey)</li> <li>1 station on RN1 (as part of the O-D survey)</li> </ul> </li> <li>Timing: November 2026 as part of the O-D survey</li> <li>Survey period: 2 days-24 hours (Sunday/Monday)</li> <li>Sample rate: 20% of passenger vehicles, 33% of goods vehicles</li> <li>Adjustment: present both 8.2 ton and 13-ton equivalent factor by vehicle class;</li> <li>Analysis: differentiate between domestic and international traffic</li> <li>Presentation: axle weight and heavy weight volume displayed in a tabular format</li> </ul>	<ul style="list-style-type: none"> <li>Pilot test to be conducted</li> <li>Data collected on electronic devices, if possible, to minimize data entry errors</li> <li>Call-back of 10% respondents to verify data collected</li> <li>Weighing pad calibrated</li> </ul>

<sup>21</sup> Conducting the O-D survey on RN1 is important to obtain the baseline origin-destination information relevant for RN35. More information is provided in Section 5.3.3.2.

<sup>22</sup> The exact timing of the O-D survey will be selected after consulting the agronomists of the influence area.



Program Logic Result	Indicator	Unit	Definition	Proposed Baseline Data Source (2018/2019)	Proposed Post-Compact Data Source (2026)	Data Quality Controls*
	Vehicle Operating Cost input parameters	N/A	Cost of crew, fuel, maintenance labor, oil, overhead, (retreaded) tire, vehicle etc.	<b>MCC HDM-4 Workspace</b> <ul style="list-style-type: none"> <li>Update existing HDM-4 inputs used by MCC after verifying the input parameters through interviews</li> <li>Sample: transportation associations, vehicle dealership, GON transportation sector representatives</li> </ul>	<b>Vehicle Operating Cost survey</b> <ul style="list-style-type: none"> <li>Update existing data from the baseline after verifying the input parameters through interviews</li> <li>Sample: transportation associations, vehicle dealership, GON transportation sector representatives</li> <li>Timing: August 2026</li> </ul>	<ul style="list-style-type: none"> <li>Data collected from the interviews will be verified by comparing the responses among the target respondents and also comparing with other secondary resources.</li> </ul>
	Unit maintenance costs	FCFA	Annual routine maintenance per km, patching per m <sup>2</sup> , crack sealing per m, surface treatment per m <sup>2</sup> , bituminous overlay per m <sup>3</sup> etc.	<b>Secondary Sources</b> <ul style="list-style-type: none"> <li><b>RN7:</b> use Louis Berger maintenance cost data (2018/9)</li> <li><b>RN35:</b> use AIC Progetti maintenance cost data (2018/9)</li> <li><b>RRS:</b> use AIC Progetti maintenance cost data (2018/9)</li> </ul>	<b>Maintenance Cost survey</b> <ul style="list-style-type: none"> <li>Update existing data from the baseline after verifying the maintenance costs through interviews (review, verify, and use performance-based/community-based maintenance cost data if available)</li> <li>Sample: maintenance contractors and AMODER</li> </ul>	<ul style="list-style-type: none"> <li>Data collected from the maintenance costs interviews will be compared with international costs to verify the legitimacy of the data collected.</li> </ul>
	Road physical parameters for HDM-4	N/A	Roadway width, geometry, drainage and speed reduction factors etc.	<b>Secondary Sources</b> <ul style="list-style-type: none"> <li><b>RN7:</b> use Louis Berger road geometry and structure data (2018/9)</li> <li><b>RN35:</b> use AIC Progetti road geometry and structure data (2018/9)</li> <li><b>RRS:</b> use AIC Progetti road geometry and structure data (2018/9)</li> </ul>	<b>Secondary Sources</b> <ul style="list-style-type: none"> <li><b>RN7:</b> use data obtained through the works supervision team(s) and the as-built drawings</li> <li><b>RN35:</b> use data obtained through the works supervision team(s) and the as-built drawings</li> <li><b>RRS:</b> use data obtained through the works supervision team(s) and the as-built drawings</li> </ul>	N/A
	Roughness	International Roughness Index (IRI) m/km	Roughness of the road surface in meters of height per kilometer of distance traveled	<b>Road Roughness study</b> <ul style="list-style-type: none"> <li>Equipment: Smartphone apps (Roadroid or RoadLab Pro)</li> <li>Interval: reported every 100-meters</li> <li>Timing: November 2019</li> </ul>	<b>Road Roughness study</b> <ul style="list-style-type: none"> <li><b>RN7: IRI</b> <ul style="list-style-type: none"> <li>Equipment: Bump Integrator or Class 3 or better per ASTM or WB Technical Paper 46</li> <li>Interval: reported every 100-meters of outer wheel path</li> <li>Timing: June 2026</li> <li>Presentation: sub-section the road segments into homogenous or dynamic sections</li> </ul> </li> <li><b>RN35/RRS: PSR</b> <ul style="list-style-type: none"> <li>Methodology: 5-point rating system</li> <li>Interval: reported every 100-meters</li> <li>Timing: June 2026</li> <li>Analysis: PSR converted to IRI</li> <li>Presentation: sub-section the road segments into homogenous or dynamic section</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>IRI - calibrated with six 300-m long calibration sections to provide appropriate precision and bias to the IRI measures using a Class 1 topographical survey method</li> <li>IRI - reference sections will be used to establish calibration equations</li> </ul>
	Road condition parameters for HDM-4	N/A	Area with wide cracking, area with all cracking, area potholed, mean rut depth etc.	<b>Secondary Sources</b> <ul style="list-style-type: none"> <li><b>RN7:</b> use Louis Berger surface distress data (2018/9)</li> <li><b>RN35:</b> data not required for unpaved roads on HDM-4 models</li> <li><b>RRS:</b> data not required for RED analysis</li> </ul>	<b>Road Condition study</b> <ul style="list-style-type: none"> <li><b>RN7:</b> <ul style="list-style-type: none"> <li>Methodology: LTPP following HDM-4 classifications review (verify, and use performance-based maintenance contractor data if available)</li> <li>Sample: 100m per kilometer</li> <li>Timing: June 2026</li> <li>Analysis: maintenance performed; cause of deterioration</li> <li>Presentation: graphical presentation using color categories</li> </ul> </li> <li><b>RN35:</b> data not required for unpaved roads on HDM-4 models</li> <li><b>RRS:</b> data not required for RED analysis</li> </ul>	<ul style="list-style-type: none"> <li>Road condition study verified using a video of the road surface from a video camera mounted on a vehicle</li> <li>Level of maintenance performed cross-checked with existing data on maintenance performed</li> </ul>
	Deflection	mm	Elastic give of a pavement under a wheel load	<b>Secondary Sources</b> <ul style="list-style-type: none"> <li><b>RN7:</b> use Louis Berger deflection data (2018/9)</li> <li><b>RN35:</b> data not required for unpaved roads on HDM-4 models</li> <li><b>RRS:</b> data not required for RED analysis</li> </ul>	<b>Deflection study</b> <ul style="list-style-type: none"> <li><b>RN7:</b> <ul style="list-style-type: none"> <li>Standard: ASTM D 4695 - Standard Guide for General Pavement Deflection Measurements</li> <li>Equipment: Benkelman Beam</li> <li>Sample interval: 200m of outer wheel path</li> <li>Timing: October 2026 after the rainy season</li> <li>Analysis: obtain modulus of every pavement layer and subgrade; obtain pavement layer and determine remaining structural life</li> <li>Adjustment: determine both rainy and dry season deflection</li> <li>Presentation: sub-section the road segments into homogenous or dynamic sections</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>Equipment calibrated using manufacturer recommendations</li> </ul>
	Structural Number (SN)	Number	Index representing the structural strength of pavement			

Program Logic Result	Indicator	Unit	Definition	Proposed Baseline Data Source (2018/2019)	Proposed Post-Compact Data Source (2026)	Data Quality Controls*
					<ul style="list-style-type: none"><li>• <b>RN35:</b> data not required for unpaved roads on HDM-4 models</li><li>• <b>RRS:</b> data not required for RED analysis</li></ul>	
	Adjusted Structural Number	Adjusted Structural Number	Index representing the structural strength of pavement modified for layer depth	<b>Secondary Sources</b> <ul style="list-style-type: none"><li>• <b>RN7:</b> use Louis Berger geotechnical data (2018/9)</li><li>• <b>RN35:</b> use AIC Progetti geotechnical data (2018/9)</li><li>• <b>RRS:</b> data not required for RED analysis</li></ul>	<b>Secondary Sources</b> <ul style="list-style-type: none"><li>• <b>RN7:</b> use data obtained through the works supervision team(s) and the as-built drawings</li><li>• <b>RN35:</b> use data obtained through the works supervision team(s) and the as-built drawings</li><li>• <b>RRS:</b> data not required for RED analysis</li></ul>	<ul style="list-style-type: none"><li>• Monitor the Compact implementation and review the completion reports and as-built drawings</li></ul>
	Subgrade modulus	psi	Index representing rigidity of pavement design			
	Layer thickness	mm	Thickness of base and surface layers			
	California Bearing Ratio (CBR)	%	Strength of non-stabilized cohesive materials			
Evaluation Question 2A						
Assumption: Performance-based maintenance contracts implemented as scheduled & Assumption: Road Maintenance fund improved with sufficient funds	Annual maintenance budget requested	FCFA	Amount of maintenance budget requested for the maintenance of RMA Activity roads	<b>Secondary Sources</b> <ul style="list-style-type: none"><li>• Review of road maintenance budget requested by DGER and DGRR for the maintenance of RMA Activity roads per year between 2013-2017</li></ul>	<b>Secondary Sources</b> <ul style="list-style-type: none"><li>• If performance/community-based maintenance contracts are not successfully implemented, review road maintenance budget requested by DGER and DGRR for the maintenance of RMA Activity roads per year between 2023-2027</li><li>• If performance/community-based maintenance contracts are successfully implemented, review administrative records of the performance/community-based maintenance contracts between 2023-2027</li></ul>	<ul style="list-style-type: none"><li>• Information obtained from the secondary sources will be triangulated with information obtained from the key informant interviews.</li></ul>
	Annual maintenance budget allocated	FCFA	Amount of maintenance budget allocated for the maintenance of RMA Activity roads	<b>Secondary Sources</b> <ul style="list-style-type: none"><li>• Review of road maintenance budget allocated by the MOF and CAFER for the maintenance of RMA Activity roads per year between 2013-2017</li></ul>	<b>Secondary Sources</b> <ul style="list-style-type: none"><li>• If performance/community-based maintenance contracts are not successfully implemented, review road maintenance budget allocated by the MOF and/or CAFER for the maintenance of RMA Activity roads per year between 2023-2026</li><li>• If performance/community-based maintenance contracts are successfully implemented, review administrative records of the performance/community-based maintenance contracts between 2023-2026</li></ul>	<ul style="list-style-type: none"><li>• Information obtained from the secondary sources will be triangulated with information obtained from the key informant interviews.</li></ul>
	Annual maintenance budget spent	FCFA	Amount of maintenance budget spent for the maintenance of RMA Activity roads	<b>Secondary Sources</b> <ul style="list-style-type: none"><li>• Review of road maintenance budget spent by DGER, DGGT, and DGRR for the maintenance of RMA Activity roads per year between 2013-2017</li></ul>	<b>Secondary Sources</b> <ul style="list-style-type: none"><li>• If performance/community-based maintenance contracts are not successfully implemented, review road maintenance budget allocated by DGER, DGGT, and DGRR for the maintenance of RMA Activity roads per year between 2023-2026</li><li>• If performance/community-based maintenance contracts are successfully implemented, review administrative records of the performance/community-based maintenance contracts between 2023-2026</li></ul>	<ul style="list-style-type: none"><li>• Information obtained from the secondary sources will be triangulated with information obtained from the key informant interviews.</li></ul>
	Quality of maintenance performed	N/A	Assessment of emergency and routine maintenance performed on the RMA Activity roads	<b>Secondary Sources</b> <ul style="list-style-type: none"><li>• <b>RN7:</b> use Louis Berger surface distress data (2018/9)</li><li>• <b>RN35:</b> use AIC Progetti surface distress data (2018/9)</li><li>• <b>RRS:</b> use AIC Progetti surface distress data (2018/9)</li></ul>	<b>Road Condition study</b> <ul style="list-style-type: none"><li>• If performance/community-based maintenance contracts are not successfully implemented, use Road Condition survey conducted to answer Evaluation Question 1</li></ul> <b>Secondary Sources</b> <ul style="list-style-type: none"><li>• If performance/community-based maintenance contracts are successfully implemented, review administrative records of the performance/community-based maintenance contracts between 2023-2026</li></ul>	<ul style="list-style-type: none"><li>• Information obtained from the secondary sources will be triangulated with information obtained from the key informant interviews.</li></ul>
	Road maintenance laws, policies, and processes	N/A	N/A	<b>Secondary Sources</b> <ul style="list-style-type: none"><li>• Review available secondary sources including legal documents such as laws and decrees pertaining to road maintenance</li></ul> <b>Key Informant Interviews</b> <ul style="list-style-type: none"><li>• Interview key stakeholders involved with maintenance stakeholders including the DGER, DGGT, DGRR, and relevant donors</li></ul>	<b>Secondary Sources</b> <ul style="list-style-type: none"><li>• Review available secondary sources including legal documents such as laws and decrees pertaining to road maintenance.</li></ul> <b>Key Informant Interviews</b> <ul style="list-style-type: none"><li>• Interview key stakeholders involved with maintenance stakeholders including the DGER, DGGT, DGRR, and relevant donors</li></ul>	<ul style="list-style-type: none"><li>• Information obtained from the secondary sources will be triangulated with information obtained from the key informant interviews.</li></ul>
Evaluation Question 2B						
Road maintenance regime is	Road maintenance laws, policies, and processes	N/A	N/A	<b>Secondary Sources</b>	<b>Secondary Sources</b>	<ul style="list-style-type: none"><li>• Information obtained from the secondary</li></ul>



Program Logic Result	Indicator	Unit	Definition	Proposed Baseline Data Source (2018/2019)	Proposed Post-Compact Data Source (2026)	Data Quality Controls*
established & enforced				<ul style="list-style-type: none"><li>Review available secondary sources including legal documents such as laws and decrees pertaining to road maintenance financing and agencies responsible for implementing road maintenance</li></ul> <b>Key Informant Interviews</b> <ul style="list-style-type: none"><li>Interview key stakeholders involved with maintenance stakeholders including the MOE, DGER, DGGT, DGRR, and relevant donors</li></ul>	<ul style="list-style-type: none"><li>Review available secondary sources including the development and establishment of FER, audit agency, and AMODER to assess the effect of MCC’s investment in improving maintenance practices</li></ul> <b>Key Informant Interviews</b> <ul style="list-style-type: none"><li>Interview key stakeholders involved with maintenance stakeholders including the MOE, FER, AMODER, DGER, DGGT, DGRR, and relevant donors</li></ul>	sources will be triangulated with information obtained from the key informant interviews.
Evaluation Question 2C						
Road maintenance regime is established & enforced	Road maintenance sector key actors and relationship defined	N/A	N/A	<b>Key Informant Interviews</b> <ul style="list-style-type: none"><li>Interview key stakeholders involved with maintenance stakeholders including the MOE, DGER, DGGT, DGRR, and relevant donors</li></ul>	<b>Secondary Sources</b> <ul style="list-style-type: none"><li>Review available secondary sources including legal documents such as laws and decrees pertaining to road maintenance.</li></ul> <b>Key Informant Interviews</b> <ul style="list-style-type: none"><li>Interview key stakeholders involved with maintenance stakeholders including the MOE, FER, AMODER, DGER, DGGT, DGRR, and relevant donors</li></ul>	<ul style="list-style-type: none"><li>Information obtained from the secondary sources will be triangulated with information obtained from the key informant interviews.</li></ul>
	Road maintenance sector implementation capacity assessment	N/A	N/A			
	Constraints/opportunities of reform identified for the road maintenance sector	N/A	N/A			
Evaluation Question 3						
Reduced transportation costs & Assumption: Improved roads used to transport agricultural products from Dosso-Gaya perimeter	Who is travelling on the road	N/A	N/A	<b>Origin-Destination survey</b> <ul style="list-style-type: none"><li>Location: 3 locations well outside urban areas<ul style="list-style-type: none"><li>2 stations on RN7 (same as traffic count stations)</li><li>1 station on RN1</li></ul></li><li>Timing: November 2019</li><li>Survey period: 2 days-24 hours (Sunday/Monday)</li><li>Sample rate: 20% of passenger vehicles, 33% of goods vehicles</li><li>Presentation: graphic representation of O-D stations on aerial imagery and itinerary diagram</li></ul>	<b>Origin-Destination survey</b> <ul style="list-style-type: none"><li>Location: 3 locations well outside urban areas<ul style="list-style-type: none"><li>2 stations on RN7 (same as traffic count stations)</li><li>1 station on RN1</li></ul></li><li>Timing: July and November 2026</li><li>Survey period: 2 days-24 hours (Sunday/Monday)</li><li>Sample rate: 20% of passenger vehicles, 33% of goods vehicles</li><li>Presentation: graphic representation of O-D stations on aerial imagery and itinerary diagram</li></ul>	<ul style="list-style-type: none"><li>Pre-test and pilot test to be conducted</li><li>Data collected on electronic devices, if possible, to minimize data entry errors</li><li>Call-back of 10% respondents to verify data collected</li></ul>
	Why the road users are travelling on the road	N/A	N/A			
	What the road users are transporting	N/A	N/A			
	What the road users are paying for transport	N/A	N/A			
	How long it takes to move along key routes	N/A	N/A			
Evaluation Question 4						
Reduced transportation costs & Assumption: Transportation sector competitive and well regulated	Cost for transporting goods and passengers	N/A	N/A	<b>Key Informant Interviews</b> <ul style="list-style-type: none"><li>Interview key stakeholders involved in transportation sector (transport operators, transport regulators) to estimate the cost for transporting goods and passengers</li></ul>	<b>Key Informant Interviews</b> <ul style="list-style-type: none"><li>Interview key stakeholders involved in transportation sector (transport operators, transport regulators) to estimate the cost for transporting goods and passengers</li></ul>	N/A
	Transportation market laws, policies, and processes	N/A	N/A	<b>Secondary Sources</b> <ul style="list-style-type: none"><li>Review available secondary sources including legal documents such as laws and decrees pertaining to transportation market structure</li></ul> <b>Key Informant Interviews</b> <ul style="list-style-type: none"><li>Interview key stakeholders involved in transportation sector (transport operators, transport regulators) to understand the formal and informal transportation market structure</li></ul>	<b>Secondary Sources</b> <ul style="list-style-type: none"><li>Review available secondary sources including legal documents such as laws and decrees pertaining to transportation market structure</li></ul> <b>Key Informant Interviews</b> <ul style="list-style-type: none"><li>Interview key stakeholders involved in transportation sector (transport operators, transport regulators) to understand the formal and informal transportation market structure</li></ul>	<ul style="list-style-type: none"><li>Interview key stakeholders involved in transportation sector (transport operators, transport regulators) to understand the formal and informal transportation market structure</li></ul>

### 3.3 ALTERNATIVE DATA COLLECTION OPTIONS

It is important to identify alternative data collection options and weigh their costs and benefits. However, it is difficult at this stage to fully determine the estimated impact of alternative endline data collection efforts on the ERR because the baseline data and the availability of secondary sources for the endline data will greatly influence the ERR estimates. In other words, the evaluation team will be able to more accurately estimate the impact of data collection on the ERR estimates when the baseline is collected, and the Compact is fully implemented.

Therefore, the evaluation team will consider data collection options, each one providing incrementally greater level of data collection at the beginning of undertaking Task 8 of the contract “Prepare and Undertake Endline Data Collection” as follows:

- *Option 1:* Includes roughness survey but excludes deflection and road condition study.
- *Option 2:* Includes roughness, road condition, but excludes deflection study.
- *Option 3:* Includes roughness, deflection, but excludes road condition study.
- *Option 4:* Includes roughness, deflection, and road condition study.

The estimated ranges of ERR will be based on the team’s subjective judgment for each option and should not be considered as a rigorous confidence interval. All options will estimate the ERR with varying levels of precision based on the rigor of the data collection methodology. Based on the discussion with MCC, the evaluation team will select the alternative data collection options for Evaluation Area 1 and present the estimated level of precision of the ERR for each option in a table similar to the one below:

**Table III.6 Template Summarizing the Results on Estimated Level of ERR Precisions**

Options	Option 1	Option 2	Option 3	Option 4
	Excludes deflection and road condition study	Excludes deflection study	Excludes road condition study	Includes all studies
Assumptions	• •	• •	• •	N/A
Implications on analysis and interpretation	• •	• •	• •	N/A
Estimated range of ERR	+/- % points	+/- % points	+/- % points	-

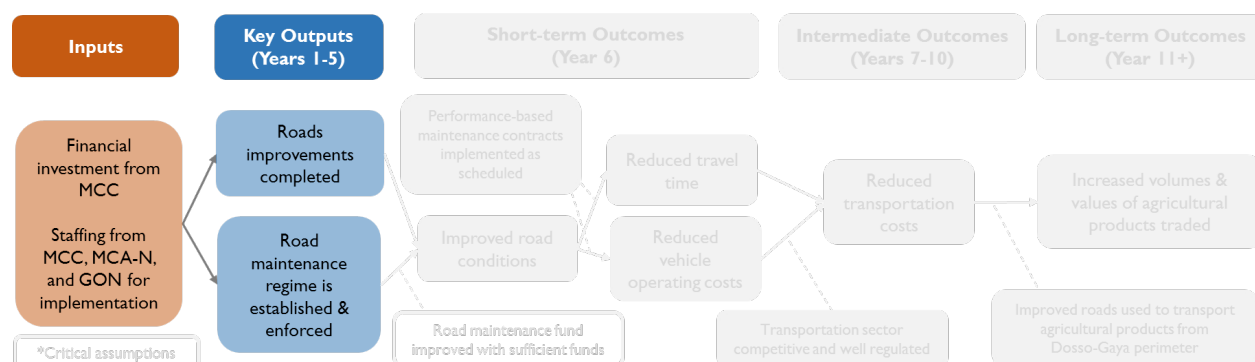
## IV. EVALUATION DESIGN – EVALUATION AREA 0: PROJECT IMPLEMENTATION

### 4.1 EVALUATION QUESTIONS

#### 0) Was the project implemented according to plan?

This evaluation question is aimed at informing the evaluation as a whole. Within the logic model, Evaluation Area 0 examines the contribution of MCC’s investment to the key outputs as shown in **Figure IV.1** below. Evaluation Area 0 will allow the team to understand how the project was implemented and whether any deviations occurred, between original and final design, and between design and the implementation. The information from Evaluation Area 0 will inform the other Evaluation Areas, ensuring that they assess works and activities as implemented, rather than as they were envisaged at baseline.

**Figure IV.1 Activity Logic Model and the Focus of Evaluation Area 0**



First, the team will examine how the MCC Compact was designed and what the intended results and processes were. This helps the team to understand the original plan of the project and whether the design was in alignment with the local conditions and international standards. Second, the evaluation team will monitor the implementation of the RMA Activity to document any deviations from the original design. Since the evaluation will be ongoing during the RMA Activity, the team will collaborate with MCC, MCA-N and its contractors to obtain up-to-date information about implementation progress and issues (e.g. delays, deviations from plans), as relevant to the evaluation. This will allow the team to understand if there are changes in the environment to which MCA-N and MCC may have had to manage and adapt the project implementation. Third, the information obtained to answer the research question will provide the team with a clear foundation to assess other evaluation areas.

In particular, the team will address the following sub-questions:

- How did MCC originally design the project?
- Is the original project design supported with evidence?
- What changes and deviations were made during project implementation?
- What were the rationales for deviating from the original design?
- Are the changes substantiated by evidence?

- How was the MCC project finally implemented?

Based on the information gathered, the team will provide recommendations as relevant to inform future Compact designs.

## 4.2 LITERATURE REVIEW

### 4.2.1 Summary of Existing Evidence (refer to Section 2.1.4)

### 4.2.2 Gaps in Literature

Gaps in literature is not applicable for Evaluation Area 0.

### 4.2.3 Policy Relevance of the Evaluation

Evaluation Area 0 will highlight any pitfalls of road investment project logic and shine light on potential risks that were undermined during the project design phase. Lessons learned from Evaluation Area 0 will be applicable to future road investment project design.

## 4.3 EVALUATION METHODOLOGY

### 4.3.1 General Methodology

Evaluation Area 0 will be answered by key informant interviews (KIIs) and review of secondary sources.

**Table IV.1 Primary Data Collection Summary Table for Evaluation Question 0**

Data collection	Timing	Sample Unit/ Respondent	Sample Size	Relevant Instruments	Exposure Period
KIIs	02/2026 (endline)	MCC/MCA-N staff	2	N/A	N/A

### 4.3.2 Detailed Primary Data Collection Methodology - KIIs

#### 4.3.2.1 Baseline Data Collection

Additional baseline data collection is not relevant for Evaluation Question 0 because the information gathered from the team's first trip to Niger and the document review serves as the baseline.

#### 4.3.2.2 Endline Data Collection

**Description of Methodology:** The team has conducted a number of interviews with key stakeholders during the initial trip to Niger. Throughout the evaluation process, the team will continue to engage with relevant stakeholders to monitor the Compact progress. If deemed necessary, additional interviews will be conducted with MCC/MCA-N for the team to gather information that may be helpful to understand the project implementation and the decision-making process that went into changing the original design.

**Sample Units:** MCC staff and MCA-N staff.

**Target Respondents:** MCC staff and MCA-N staff who can provide information on MCC Niger Compact implementation and the details of the decision-making process.



**Sample Size and Assumptions:** At least two (2) interviews conducted, one with a representative of the MCC and one with a representative of MCA-N.

**Sample Frame:** List of relevant interviewees identified by the evaluation team during Compact implementation and post-Compact.

**Sampling Strategy:** Identify and conduct interviews with the key informant that has the most relevant experience and information about the MCC Compact implementation.

**Instruments/Equipment:** N/A

**Rounds and Timing:** KIIs will be conducted during the endline data collection if needed.

**Location:** Washington D.C., and/or Niamey

**Staffing:** No additional staffing required other than the evaluation team.

**Safety Procedures/Precautions:** N/A

**Data Quality:** The team will conduct KIIs in French and in English whenever possible. KIIs will be conducted by the Evaluation Expert, assisted by the In-Country Coordinator/Survey Manager. While the Evaluation Expert leads the interviews and takes notes, the In-Country Coordinator/Survey Manager will assist the interviews by taking notes that will be used to cross-reference with the notes taken by the Evaluation Expert. The notes will also capture non-verbal information (body language etc.).

**Data Processing:** All KIIs will be audio recorded on digital voice recorders and transcribed by the In-Country Coordinator/Survey Manager and reviewed by the Evaluation Expert as soon as possible after the interview. The In-Country Coordinator/Survey Manager will transcribe the audio recording into French, which will be then translated into English, and corrected by the Evaluation Expert.

**Data Analysis:** The evaluation team will identify areas where the RMA Activity was implemented differently from the original design. The evaluation team will classify, sort, and arrange information gathered to identify trends and examine the relationships in the data. The team will cross-examine information when relevant to help build a body of evidence to support the analysis.

### **4.3.3 Detailed Secondary Data Collection Methodology**

#### **4.3.3.1 Baseline Data Collection**

Additional baseline data collection is not relevant for Evaluation Question 0 because the information gathered from the team's first trip to Niger and the document review serves as the baseline.

#### **4.3.3.2 Endline Data Collection**

**Description of Methodology:** The evaluation team will monitor the Compact implementation and review secondary data on the Activity to address Evaluation Question 0. The team has reviewed the initial design documents provided by the MCC and other stakeholders. IDG will continue to obtain additional secondary data from MCC's contractors and MCA-N and review them to fully understand how the project is implemented. For instance, the contract technical specifications, hand-over documents, and technical inspection reports will be reviewed. Any deviations from the initial Compact design will be noted and discrepancies between available information will be highlighted to be confirmed during the evaluation.

**Data Processing/Analysis:** Based on the secondary and qualitative data collected (details below), the team will evaluate how the RMA Activity was implemented and the changes made during implementation. The team will review the rationale for the initial project design and identify changes made during implementation to assess whether the changes made were well supported with evidence.

## **4.4 CHALLENGES**

### **4.4.1 Limitations of Interpretation of the Results/Risks to the Study Design**

Collaborating with MCA-N and its contractors during Compact implementation is essential for answering Evaluation Question 0. There is a risk that project implementation documents may not be available to the evaluation team due to delay in sharing the documents, loss of records, or unwillingness of the stakeholders to share sensitive information. IDG will discuss with MCA-N the possibility of establishing an information-sharing system with MCA-N and its contractors, to monitor the progress of implementation. In order not to overburden the contractors, the evaluation team will discuss and agree on a list of documents to be transferred to the team from the contractors.



## V. EVALUATION DESIGN – EVALUATION AREA I: ENGINEERING ANALYSIS AND ECONOMIC MODEL

### 5.1 EVALUATION QUESTIONS

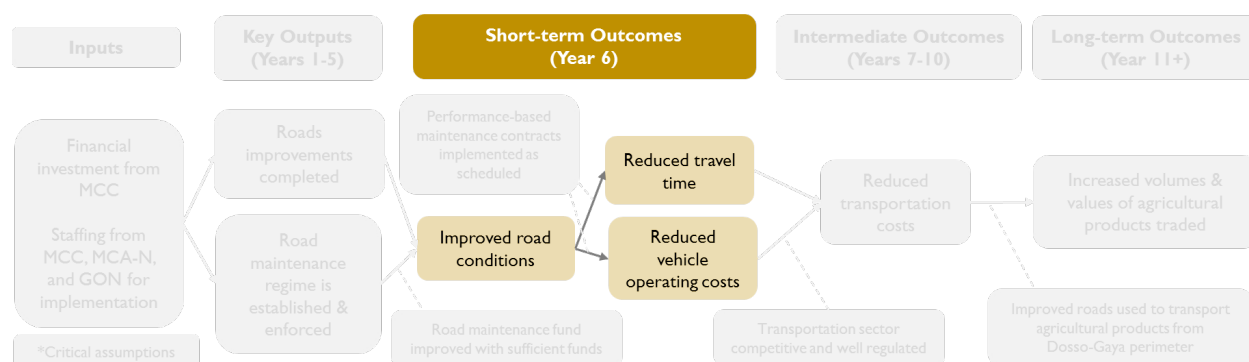
- 1) What is the economic return – calculated in terms of VOC savings and travel time (TT) savings – of the road investment? What factors drove changes to the ERR over time? How could the project have been designed to result in a higher ERR?

An ERR can be assessed by comparing the project capital and recurrent costs (construction costs and expected maintenance costs) versus the benefits of the project road to its users over the intended project life (determined at appraisal stage, usually 20-30 years). The ERR for the evaluation is calculated in terms of VOC savings and TT saving and Evaluation Area 1 will be testing whether the improved road conditions translated into reduced travel time and reduced VOCs as illustrated in the logic model of **Figure V.1**.

Prior to an investment, calculating the ERR helps to decide on competing infrastructure development priorities within the transport sector and across all sectors under consideration. At an evaluation stage, an assessment of the ERR based on actual outcome allows an insight into the original investment decision and provides valuable recommendations for future project design.

The purpose of determining economic return on the RMA Activity is to assess whether the investment resulted in an acceptable rate of return in terms of quantifiable social benefits generated by the project. It also helps to compare the post-Compact ERR with the pre-Compact rate and assess the assumptions made for the investment decisions.

**Figure V.1 Activity Logic Model and the Focus of Evaluation Area 1**



### 5.2 LITERATURE REVIEW

#### 5.2.1 Summary of Existing Evidence

##### 5.2.1.1 Traffic Studies

The evaluation team received historic traffic count data from the Directorate of Network Management (*Direction de Gestion des Réseaux*, DGR) for all roads in Niger, including the Compact roads - RN7, RN35, and RRS. The variables include year collected, count station

location, length of section, total count, average annual daily traffic (AADT), and percentage of heavy trucks (poids lourds).<sup>23</sup>

In addition to the traffic data provided by the Ministry of Equipment (Ministère de l'Équipement, MOE), MCC's Margou-Falmey-Gaya Feasibility Study (2015) provides an insight to the traffic volume on the three roads for 2015. Most recently, MCC's APD contractor for RN35 and RRS, AIC Progetti, conducted a traffic count and an O-D survey in 2018.<sup>24</sup> Additional traffic data and analysis was provided by the Traffic Study prepared by the design consultant Louis Berger. **Table V.1** below presents the available historic traffic volume for each road.

**Table V.1 Historic Traffic Volume for RN7, RN35, and RRS**

Source	Location	Year													
		'01	'04	'05	'06	'07	'09	'10	'11	'12	'13	'14	'15	'17	'18
RN7															
MOE	Dosso-RN7 PK82.8	559	472	493	526	587		786	959	423				522	
	RN7 PK82.8-Benin	1672			594	557		958						533	
MCC Feasibility Study	10km from Dosso (Agali)												875		
MCC AIC Progetti Traffic Report	AADT estimated based on historic data, traffic count on RN35 and O-D on RN 1														765
MCC Louis Berger Traffic Report	3.5 km from Dosso														1,019
RN35															
MOE	Falmey-Margou	60	76				25	36					175		117
	Gaya-Falmey	122	117		42		40	46					630		74
MCC Feasibility Study	Margou-Falmey 6km from Margou												103		
	Gaya-Falmey 10km from Gaya												71		
MCC AIC Progetti Traffic Report	Gaya-Falmey														27
RRS															
MOE	Guitodo-Sambéra	37		0			25	36				130	0		0
MCC Feasibility Study	4km from Guitodo													31	
MCC AIC Progetti Traffic Report	Guitodo-Sambéra														9

The evaluation team's visit to the three roads in December 2018 showed that there was significant traffic on RN7 and while very little was observed on RN35 and RRS, an assessment in line with the AIC Progetti traffic study findings. The evaluation team believes that the main reason contributing to the low traffic volume on RN35 and RRS is the poor road conditions.

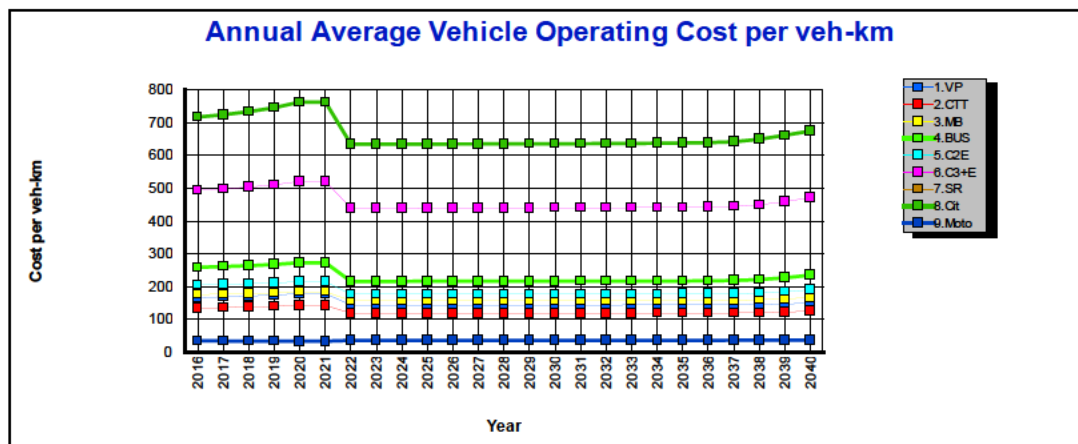
### 5.2.1.2 Vehicle Operating Costs

<sup>23</sup> Synthèse comptage Automatique 30 RN

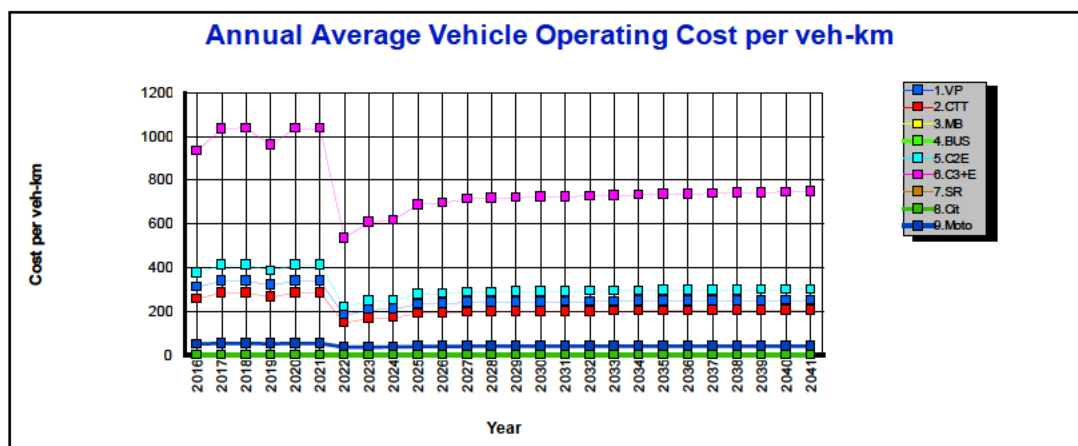
<sup>24</sup> AIC Progetti, Rapport de trafic, *Études d'Avant-Projet Détaillé (APD) et d'Impact Environnemental et Social (EIES) pour les travaux de réhabilitation, de Gestion et d'Entretien par Niveaux de Service (GENIS) de la RN35 et des Travaux d'Aménagement et d'Entretien de la route de Sambéra avec option pour la supervision des travaux de réhabilitation et d'entretien des deux axes*, November 2018.

The annual VOCs estimated from the HDM-4 (updated by MCC) is presented below in **Figure V.2**, **Figure V.3**, and **Figure V.4**. However, it is important to note that these results should be updated after the team validates the HDM-4 input parameters.

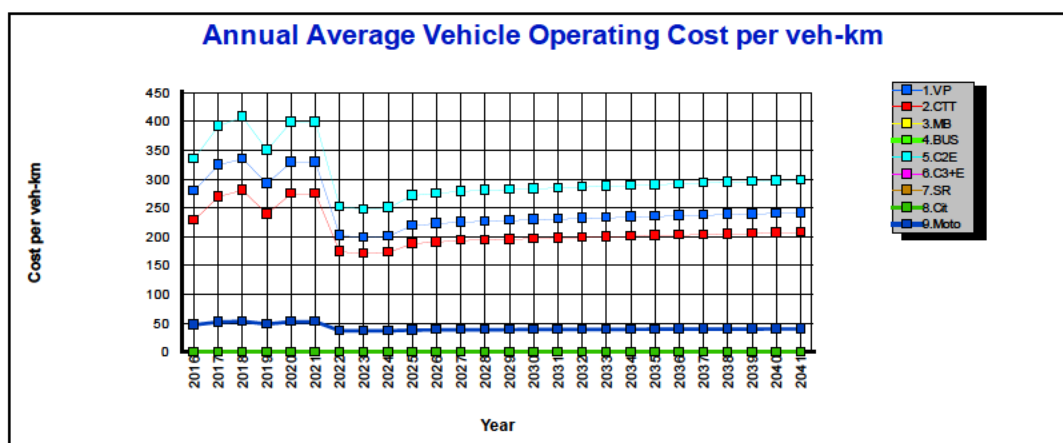
**Figure V.2 RN7 Asphalt Concrete Option Annual VOC derived from HDM-4**



**Figure V.3 RN35 Gravel Option Annual VOC derived from HDM-4**



**Figure V.4 RRS Annual VOC derived from HDM-4**



### **5.2.2 Gaps in Literature**

The economic viability of the RMA Activity roads has been evaluated on various occasions since 2011. These studies have assessed the economic performances of the planned rehabilitation works using the HDM-4. However, the positive results highlighted in these studies are pre-Compact estimates and will need to be updated to reflect updated input data for both the costs and the benefits of the rehabilitation work.

### **5.2.3 Policy Relevance of the Evaluation**

Economic analysis of a public infrastructure investment is critical for assessing whether the benefits accruing to the targeted beneficiaries are higher than the capital and recurrent costs incurred for the construction and maintenance of the infrastructure. The economic return of the planned roads investment based on the evaluation of road users' savings, evaluated in economic prices, is an appropriate tool consistent with the policy of selecting the investments in public infrastructure.

The post-Compact evaluation will identify the changes in the ERR and document the factors driving changes in the ERR for the activity. For instance, if cost overrun is identified as a factor lowering the post-Compact ERR more so than initially anticipated at the project design phase, MCC, and other relevant donors, will need to carefully take into account the risk of cost overrun and its potential mitigation strategies.

In addition, the RMA Activity's investment in improving three roads in the same area is particularly interesting and will show whether MCC's investment in complementary roads will result in the synergic effects thereby optimizing the economic return of the project.

## **5.3 EVALUATION METHODOLOGY**

### **5.3.1 General Methodology**

Economic performance of a project is appraised with NPV and the Internal Rate of Return (IRR) complemented by other derived ratios. The ERR, as calculated by the HDM-4 and RED models, is the discount rate that equalizes the NPV to zero, where NPV is the discounted difference between the benefits accruing to road users generated by the implementation of the Project and the difference of Project costs as compared to the costs of the alternative "without Project."

On the basis of the above indicators (NPV and IRR), two ratios can be calculated. The ratios, being absolute numbers, allow the comparison of road project alternatives that have different costs. The ratios are:

- Ratio Net Present Value/Capital + Recurrent Costs of the Project (NPV/RAC)
- Ratio Net Present Value/Capital Cost of the Project (NPV/CAP)

The above ratios will contribute to the economic evaluation of project roads improvement and eliminate the bias of NPV towards larger project options. However, like the IRR, the ratios give no indication of the size of the costs or benefits involved. NPV and IRR are quantitative results based on all technical-economic inputs (costs and benefits); any change in its inputs would result in the change of the indicator values. Namely, traffic volume and axle loading data are two inputs to the economic calculations that have a major impact on a project's economic performance. Traffic volume is the main driver of road users benefits whereas axle loading is the driver of

maintenance costs. Therefore, an accurate assessment of the current traffic and assumptions for traffic growth is vital to the economic appraisal of a project.

For the evaluation, two different models will be used to calculate the NPV and the IRR for the roads of the RMA Activity. For RN7 and RN35, the HDM-4 model will be adopted using economic prices to estimate the economic internal rate of return (EIRR), whereas the RED model will be used for the RRS.

The traffic volume expected for the three roads after rehabilitation dictated the selection of the evaluation models. According to AIC Progetti's Traffic Report (2018), RN35's AADT is expected to grow from 73 in 2018 to 721 in 2033. For RN7, recent traffic data is not yet available but the traffic survey from 2015 estimates the AADT to be 875 for the traffic flow between Dosso and Bella II.<sup>25</sup> On the other hand, RRS AADT is estimated at 20 in 2018 reaching 54 in 2033. Given the low traffic volume, the RRS will be analyzed using the RED model.

#### **HDM-4**

The HDM-4 model simulates the road condition and resources used for maintenance for each road section per year, as well as the vehicle speeds and physical resources consumed by vehicle operation (fuel, lubricants etc.). After physical quantities involved in construction, road works, and vehicle operation are estimated, user-specified prices and unit costs are applied to determine financial and economic costs. Relative benefits are then calculated for different alternatives, followed by NPV and EIRR computations. The model is then completed using a sensitivity analysis. Risk analysis cannot be conducted with the HDM-4 model so a separate software (e.g. Crystal Ball) will be used.

The HDM-4 model requires a large number of engineering and economic input parameters for each road section undergoing the economic evaluation. The parameters' acquisition will require extensive field investigations and economic research. In the table below are listed the essential data to be acquired.

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<sup>25</sup> AIC Progetti, *Rapport de Traffic, Etudes d'Avant-Projet Détaillé (APD) et d'Impact Environnemental et Social (EIES) pour les travaux de réhabilitation, de Gestion et d'Entretien par Niveaux de Service (GENIS) de la RN35 et des Travaux d'Aménagement et d'Entretien de la route de Sambéra avec option pour la supervision des travaux de réhabilitation et d'entretien des deux axes*, November 2018, p.20.

Figure V.5 HDM-4 Essential Input Parameters

Geometry - Existing Road													
Rise + Fall (m/km)	No. of Rise&Falls (/km)	Horizontal Curvature (deg/km)	Superelevation (%)	Altitude (m)	Sigma adral (m/s)	Speed Limit (km/h)	Speed Enforcement Factor	Drain Type	NMT Friction (XNMT)	Side Friction (XFRI)	MT Friction (XMT)	Length (km)	Width (m)
Condition - Existing Road													
Condition Year	Roughness IRI (m/km)	All Structural Cracking Area (%)	Wide Structural Cracking Area (%)	Thermal Cracking Area (%)	Ravelled Area (%)	Potholes (no./km)	Edge Break (m/km)	Rut Depth (mm)	Texture Depth (mm)	Skid Resistance	Drainage Condition		
Pavement - Existing Road													
Current Surface Thickness (mm)	Previous Thickness (mm)	Last Construction Year	Last Rehabilitation Year	Last Surface Year	Last Preventive Year	Base Thickness (mm)							
Traffic													
Normal Traffic at Survey Year	Normal Traffic Growth Pattern	Generated Traffic	Diverted Traffic										
Rehabilitation Works													
New Road Geometry	New Pavement structure	Financial cost (USD/km)	Economic cost (USD/km)										
Maintenance strategies													
Without Project (itemized rates)	With Project (itemized rates)												

## RED

RED model adopts the consumer surplus approach which measures the benefits to road users and consumers of reduced transport costs. The consumer surplus approach was preferred to the producer surplus approach, since it allows for better judgment of the assumptions made and an improved assessment of the investment alternatives simulated.

The RED model requires a limited number of input data which is appropriate for evaluating rural roads in developing countries where there is limited data availability. The model can be used to evaluate road investments and maintenance, and estimate benefits accruing to motorized road users. Other benefits to motorized road users can be exogenously added. Particular attention is given to the presentation of the results, which highlights all input assumptions and comprehensively integrates them with a sensitivity analysis, switching values analysis and stochastic risk analysis. This allows the evaluation to address the high variability and uncertainty prone to economic analyses of rural roads.

For the RRS, the evaluation team will use the RED model supported by the VOC calculations with the stand-alone module of HDM-4.



**Table V.2 Primary Data Collection Summary Table for Evaluation Question 1**

Data collection	Timing	Sample Unit/ Respondent	Sample Size	Relevant Instruments	Exposure Period
Traffic count	06/2026 11/2026 (endline)	Motorized and non-motorized vehicle on the RMA Activity roads	N/A	Traffic count form	42 months 46 months
O-D survey	11/2019 (baseline)	Motorized vehicle driver on the RMA Activity roads	Depends on the sampling rate (20% for passenger vehicles, 33% for goods vehicles)	O-D survey questionnaire	0 months
O-D survey	06/2026 11/2026 (endline)	Motorized vehicle driver on the RMA Activity roads	Depends on the sampling rate (20% for passenger vehicles, 33% for goods vehicles)	O-D survey questionnaire	42 months 46 months
Axle load survey*	11/2026 (endline)	Heavy vehicle driver on the RMA activity roads	Depends on the sampling rate (20% for passenger vehicles, 33% for goods vehicles)	Axle load survey form	46 months
VOC survey	11/2019 (baseline)	Transport association, vehicle dealership, GON transportation sector	9	VOC survey form	0 months
VOC survey	07/2026 (endline)	Transport association, vehicle dealership, GON transportation sector	9	VOC survey questionnaire	42 months
Maintenance cost survey*	08/2026 (endline)	AMODER or maintenance contractors	4	Maintenance cost survey form	43 months
Roughness study	11/2019 (baseline)	RMA Activity roads	Entire lengths of the RMA Activity roads	Roadroid or RoadLab Pro	0 months
Roughness study*	06/2026 (endline)	RMA Activity roads	Entire lengths of the RMA Activity roads	Class 3 or better equipment (RN7)	41 months
Road Condition study*	06/2026 (endline)	RMA Activity roads	83 (100m/km for RN7)	Road Condition form	41 months
Deflection study*	10/2026 (endline)	RN7	830 (every 200m for RN7 for both wheel paths)	Benkelman Beam	45 months

\* Data collection may not be required if the performance-based maintenance contracts are successfully implemented and if reliable data is available to the evaluation team.

### 5.3.1.1 Selection of Endline Evaluation Timing and Exposure Period

The full economic effects brought about by the project roads rehabilitation, depend substantially on the reduction of Road User Costs (RUC=VOCs+TTS) and the traffic volume composed by normal traffic, generated traffic, and diverted traffic (NT+GT+DT).

To appraise the reduction of RUCs, it is necessary to wait for the stabilization of maintenance strategy and practices and therefrom, the resulting IRI range that can be assumed as average roughness over the roads' service life. A period of 3-4 years (from the coming into service) should

elapse to get a reliable information on the evolution of the pavement roughness, any premature IRI surveys would most likely provide misleading information.

The planned roads rehabilitation will have an impact on traffic volume and in particular of generated traffic (GT) and diverted traffic (DT). Changes in GT and DT bring about structural modifications in traffic patterns of concerned road and take some years to fully evolve.

Generated traffic (GT) of project roads is mainly linked to agriculture and stock raising development in traversed areas that needs some years to take full advantage from roads rehabilitation. Considering the length of agricultural cycles. A period of 3-4 years (from the roads coming into service) is deemed sufficient to fully appraise the GT effects.

The traffic diversion (DT) effect that will affect RN35 and RN7 will also take a certain time to be fully developed. In fact, new and existing routes need to be equipped with various services requested by road users such as mechanical workshops for vehicles repairs, fuel stations, lodging structures and miscellaneous commercial areas. Furthermore, professional transporters (and forwarders) will take some time to stabilize their fares and freights. The evaluation team has assumed that the full stabilization of DT would take 3-4 years.

### 5.3.2 Detailed Primary Data Collection Methodology – Traffic Counts

#### 5.3.2.1 Baseline Data Collection

**Use of Louis Berger traffic count data for RN7:** The evaluation team reviewed the traffic count data from Louis Berger (Rapport de trafic<sup>26</sup>) and concluded that the data is sufficient to substitute new baseline data collection for RN35. The traffic count lasted for seven (7) days. Traffic seasonality factor will be derived from historical traffic data available at DGR's Base des Données Routières (BDR).

**Use of AIC Progetti traffic count data for RN35:** The evaluation team reviewed the traffic count data from AIC Progetti (Rapport de trafic<sup>27</sup>) and concluded that the data is sufficient to substitute new baseline data collection for RN35. The traffic count lasted for four (4) days. Traffic seasonality factor will be derived from historical traffic data available at DGR's BDR.

**Use of AIC Progetti traffic count data for RRS:** The evaluation team reviewed the traffic count data from AIC Progetti (Rapport de trafic<sup>28</sup>) and concluded that the data is sufficient to substitute new baseline data collection for RRS. Similar to the RN35, the traffic count was conducted for four (4) days.

#### 5.3.2.2 Endline Data Collection

**Description of Methodology:** The medium-low volume of traffic on RMA Activity roads does not justify the use of automatic counting (automatic traffic count is only useful when AADT of peak hours exceeds 200 vehicles, which is below the anticipated traffic for the three roads in 2026). For this reason, a MTC will be conducted for the traffic survey of the RMA Activity roads. The need of traffic counting by direction is especially important because traffic flows are expected to

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<sup>26</sup> Louis Berger, Rapport Etude de Trafic RN7, January 2019.

<sup>27</sup> AIC Progetti, Rapport de trafic, *Etudes d'Avant-Projet Détaillé (APD) et d'Impact Environnemental et Social (EIES) pour les travaux de réhabilitation, de Gestion et d'Entretien par Niveaux de Service (GENIS) de la RN35 et des Travaux d'Aménagement et d'Entretien de la route de Sambéra avec option pour la supervision des travaux de réhabilitation et d'entretien des deux axes*, November 2018.

<sup>28</sup> Ibid.



be unbalanced on RN7 and RN35 with northbound traffic carrying heavier loads than traffic in the opposite direction. This information will be required to correct the dimensioning of pavement.

A four (4) day count will be conducted at six (6) stations. Two (2) rounds of MTC will be conducted once in June 2026 and once in November 2026. The MTC will record motorized and non-motorized vehicles observed at the counting station on the roads during the survey period for each direction of flow based on vehicle type.

**Sample Unit:** Motorized and non-motorized vehicle<sup>29</sup> on the RMA Activity roads

**Target Respondents:** N/A

**Sample Size and Assumptions:** Sample size not required because all motorized and non-motorized vehicles on the RMA Activity roads will be observed and recorded.

**Sample Frame:** Sample frame not required because all motorized and non-motorized vehicles on the RMA Activity roads will be observed and recorded.

**Instrument/Equipment:** An A4 or letter size sheet of paper with space for four 15-minute intervals will be used for data collection such that each sheet represents one hour of vehicle movements. At the end of the work shift, completed sheets will be transferred to the supervisor for control and data quality.

**Rounds and Timing:** Traffic volume for the RMA Activity is expected to be influenced by the agricultural calendar particularly during harvesting periods. In addition to the normal traffic linked to other economic and social activities, increased traffic volume is expected from commercialization of agricultural produce generated from the Dosso-Gaya perimeter. AIC Progetti's Traffic Report also states that the traffic count completed in July 2018 may show low traffic because it was conducted outside the main harvest season (start of October until the end of December<sup>30</sup>).

To assess the seasonal variations of traffic patterns, two rounds of traffic counts will be conducted, one during the main harvest season and another during the rainy season (mid-June until the end of September<sup>31</sup>), which also coincides with the agricultural lean season. Therefore, the first round of traffic counts will take place in June 2026 (lean season) and in November 2026 (during the harvest season). If time or budget constraints prevents conducting double traffic counts, IDG will conduct one round of MTC in November 2026.

The duration of MTC will be four (4) days of which three (3) weekdays and one (1) weekend day with the following surveying hours:

- RN7: 24 hours for four (4) consecutive days, the full day survey is suggested by the important share of heavy vehicles traveling in night hours.
- RN35: 12 daytime hours for three (3) days and 24 hours for one (1) weekday.
- RRS: 12 daytime hours for four (4) consecutive days.

**Location:** A total of six (6) counting stations will be located as specified below for each road:

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<sup>29</sup> Bicycles and animal-drawn carts will be counted as "non-motorized vehicles".

<sup>30</sup> Famine Early Warning Systems Network, Niger, <http://fews.net/west-africa/niger>: accessed on January 31, 2019.

<sup>31</sup> Ibid.

- RN7 (Dosso – Bella II): Two (2) stations total and this is sufficient because the traffic pattern along this project road is expected to be homogeneous. Traffic pattern is expected to be homogeneous because the Dosso - Bella II section is not intersected by other trunk roads and the economic activities in its influence area are prevalently agricultural.
  - Location 1: 7 - 10 km from Dosso
  - Location 2: Junction of RN7 with RRS
- RN35 (Margou – Gaya): Three (3) stations total
  - Location 1: 5 - 7 km outside Margou
  - Location 2: Junction of RN35 and RRS (an intermediate station at the junction with RRS will allow the team to check any traffic pattern change between Margou-Sambera junction, and Sambera junction-Gaya)
  - Location 3: 7 - 10 km outside Gaya
- RRS (Guitodo – Sasmbra): One (1) station located at 3-4 km east of Sambera village

**Staffing:** The evaluation team intends to subcontract the traffic count and the team sizes will be determined by the successful bidder based on a competitive procurement process. The evaluation team will allow bidders to consider conducting the traffic counts with teams of three enumerators (one for each direction and one enumerator to support both directions) taking 6 or 8-hour shifts to be cost-effective.

**Safety Procedures/Precautions:** Approximately two to three meters of space is required inward from the carriageway in order to position tables, chairs, and also umbrellas or a tent-like structure for the counters that will provide protection against the sun and rain during data collection. Positioning of the survey location would also need to ensure good visibility in both directions (i.e. road bends or slopes must be avoided). In the evening or other dark times of the day, portable battery powered lamps with suitable back-up batteries, will be placed for the counters. The surveyors will also be provided with yellow reflective jackets. Safety procedures will be in accordance with any guidance provided by Niger's authorities in charge of road control and safety.

**Data Quality:** Quality Assurance/Quality Control (QA/QC) measures will be applied to ensure high quality data collection. The evaluation team will ensure data quality of traffic count forms filled in by counters. Prior to data collection, the subcontractor and the evaluation team will train and pilot the survey to ensure high quality data collection. During data collection, the evaluation team will conduct random checks to ensure the data are recorded correctly and quickly rectify any anomalies. Supervisors will monitor the data collection closely and ensure data accuracy and quality. For a paper form survey, supervisors will ensure the vehicle types are properly categorized in the appropriate columns on the traffic count form. Traffic count stations will have a minimum of two personnel at all times and reserves will be in place in case of unexpected emergencies.

**Data Processing:** If using a paper-form, the data collection firm will be required to use data entry software with built-in quality checks for data entry. If this is not possible, data will be entered from paper forms into pre-designed spreadsheets and will be monitored and randomly checked. The inputted data will be verified by the evaluation team.

**Data Analysis:** The data will be used to estimate AADT for each station. The procedure includes three steps, as described below:

- i) Conversion of daytime counts to full day traffic (denominated Average Daily Traffic, ADT) on the basis of the percentage between daytime and full day counts carried out for

one weekday and one for weekend day. This step is not necessary if the survey is conducted for 24 hours during the entire week of counts.

- ii) Calculation of the week average ADT based on the daily ADT obtained in previous step.
- iii) To obtain the AADT of the road, the season adjustment factor is applied to the average weekly ADT. The value of the season factor depends on the month of the year in which the counts have been made. The season factor provides the monthly fluctuation of traffic as compared to the year average.

### 5.3.3 Detailed Primary Data Collection Methodology – Origin-Destination Survey

#### 5.3.3.1 Baseline Data Collection

**Use of Louis Berger O-D survey data for RN7:** The terms of reference (TOR) issued by MCA-N for the design consultant only requires the firm to conduct an O-D survey of heavy vehicles and an O-D survey is not required for light vehicles transporting goods and/or passengers.<sup>32</sup> Furthermore, the TOR requires the O-D survey to be conducted among a sample of trucks selected for an axle load survey. According to the proposed O-D format in the Louis Berger Inception Report,<sup>33</sup> only the origin and destination of vehicles will be recorded. Other information, including origin and destination of goods and travel time, is not included in the O-D format. The evaluation team believes that the O-D information will not be sufficient to serve as the baseline data of the evaluation.

**Use of AIC Progetti O-D survey data for RN35:** The TOR of RN35 APD does not specify that the firm is required to conduct an O-D survey. AIC Progetti, parallel to its traffic count, for its part, carried out an O-D survey in July 2018 on RN1 between Margou and Dosso. However, the survey was exclusively aimed at assessing the traffic divertible from RN7 to RN35. In addition, data collected from the AIC Progetti O-D survey is too limited to meet the evaluation requirements. For instance, information such as origin and destination of goods and travel time is not included in the report. This is especially problematic because the limited amount of data from the AIC Progetti Traffic Report will limit the evaluation team's ability to fully address Evaluation Question 3.<sup>34</sup>

**Use of AIC Progetti O-D survey data for RRS:** AIC Progetti did not conduct an O-D survey for the RRS.

Overall, the evaluation team believes that available O-D information is not sufficient to serve as the baseline data of the evaluation. Therefore, the team will conduct O-D surveys for the three MCC-funded roads.

**Description of Methodology:** One of the purposes of the O-D survey is to investigate the possibility of traffic deviation to project roads from adjoining roads servicing the same routes.

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<sup>32</sup> Millennium Challenge Account – Niger, *Demande de Propositions: Sélection d'un Consultant pour les études d'Avant Projet Détaillé (APD) et d'Impact Environnemental et Social (EIES) pour les travaux de réhabilitation, de Gestion et d'Entretien par niveaux de service (GENiS) de la RN7 avec option pour la supervision des travaux de réhabilitation et d'entretien GENiS*, December 12, 2017.

<sup>33</sup> Louis Berger, *Rapport de démarrage, études d'Avant Projet Détaillé (APD) et d'Impact Environnemental et Social (EIES) pour les travaux de réhabilitation, de Gestion et d'Entretien par niveaux de service (GENiS) de la RN7 avec option pour la supervision des travaux de réhabilitation et d'entretien GENiS*, October 2018, p.44.

<sup>34</sup> Questions to be addressed by the design firms are different than those to be addressed by IDG.

Traffic deviation is possible from RN7 to RN35, whereas RN7 has no potential deviation from other roads because this road is the shortest route to reach Gaya or the Cotonou port in Benin.

The O-D survey will intercept vehicles at three (3) locations on the RMA Activity roads. Assisted by local police, vehicles will be intercepted at the survey stations and safely directed to the survey areas. An interviewer will follow a structured questionnaire to survey the driver by soliciting responses verbally.

**Sample Unit:** Motorized vehicle on the RMA Activity roads.

**Target Respondent:** Motorized vehicle drivers on the RMA Activity roads.

**Sample Size and Assumptions:** The sample size will depend on the number of motorized vehicle drivers using the RMA Activity roads and the sampling rate. The sampling rate is determined based on traffic data for two groups: vehicles transporting goods, and passenger vehicles. In order to obtain statistically representative samples, their sample size will be adjusted to the respective peak hour traffic of the two vehicle groups. The adjustment to the peak hour is aimed at preventing traffic congestion caused by the O-D survey. A preliminary estimate of the target sample size is as follows:

- Vehicles transporting goods: 33 percent (one in every three vehicles)
- Passengers vehicles: 20 percent (one in every five vehicles)

**Sample Frame:** The sample frame for the O-D survey is motorized vehicle drivers using the road sections where the interview stations are located. Sample frame from another source is not necessary.

**Sampling Strategy:** Vehicle drivers for each vehicle type will be selected randomly based on the sampling rate. Sampling will be done in real time. A traffic counter will be placed at each interview station for each direction to count the traffic by vehicle type. The counter will indicate to the O-D interviewer and the police the vehicle to be intercepted for the interview based on the sampling rate. The counter will track the traffic volume by vehicle type, the number of attempted vehicle interceptions, the number of vehicles successfully intercepted, the number of interviewees interviewed, and those who did not provide consent.

**Instrument/Equipment:** The O-D survey will be conducted following a structured questionnaire. Two versions of the questionnaire will be used, one for vehicles transporting goods and the other for passenger vehicles. The questionnaire for vehicles transporting goods will include questions on socio-economic aspects of the trip in addition to inquiring about their origin and destination (see **Annex III** for an example of the O-D questionnaire).

The questionnaire for cargo vehicles will be composed of six sections listed below:

1. Description of the driver
  - a. Identification [sex, age, nationality] of driver
2. Description of the vehicle
  - a. Based on standard vehicle type categories
3. Description of the trip
  - a. Trip purpose
  - b. Trip regularity/frequency
  - c. Travel times
4. Description of goods' origin and destination

5. Description of goods
6. Cost factors of trip
7. Willingness-to-pay of road users

Questionnaire for passenger vehicles will include a section on fare prices and an optional section on the willingness to pay for the use of the road; the questionnaire sections are listed below:

1. Description of the driver/passengers
  - a. Identification [sex, age, nationality] of driver/passengers
2. Description of the vehicle
3. Description of the trip
  - a. Origin/destination of driver/passengers
  - b. Trip purpose
  - c. Trip regularity/frequency
  - d. Travel times
4. Fare price
5. Willingness-to-pay of road users

When releasing a Request for Proposal to select a data collection firm, the evaluation team will request all bidders to consider using electronic hand-held devices for data collection. The instrument/equipment used may depend on the availability of competent data collection firms in Niger. If the evaluation successfully contracts a firm to use electronic surveying method, hand-held electronic devices, such as tablets or smartphones, will be used to collect data.

**Rounds and Timing:** The O-D survey will be conducted once preferably in November or December 2019 before the road construction begins. O-D survey will be conducted for two (2) days of 24 hours covering representative days of the week (Sunday for weekend and Monday for weekday). As discussed above under the traffic count section, the origin and destination of traffic timing is influenced also by the agricultural calendar. In addition to the normal traffic linked to other economic and social activities, a sizeable traffic linked to commercialization of agricultural produce is expected. To assess the overall origin and destination of traffic, the evaluation team will conduct the O-D survey during the main agricultural season.

**Location:** A total of three (3) O-D stations will be located as specified below for each road:

- RN7 (Dosso – Bella II): Two (2) stations located at the same locations as the traffic count stations (the first station located 7-10 km outside Dosso town and the second at the junction of RN7 with RRS).
- RN35 (Margou – Gaya): One (1) station located on RN 1 located 5km before the junction with RN35.
- RRS (Guitodo – Sambera): No O-D survey due to the current low traffic (see Table 5.1 for more details). An O-D is not representative.

Conducting the O-D survey on RN1 is important to obtain the baseline origin-destination information relevant for RN35. By locating the O-D survey on RN1 after Margou in direction of Dosso, the survey will capture the potential diversion from RN1 to RN35 for Gaya - Niamey traffic that currently use RN1 due to the bad road condition of RN35.

The O-D survey stations will have sufficient space for parking and good visibility of the roads in both directions, avoiding road bends and slopes. Furthermore, stations will be staggered in each



traffic direction to avoid congestion. The location will be selected to avoid potential traffic congestion and road safety risks due to its placement.

**Staffing:** The evaluation team intends to subcontract the O-D survey and the team sizes will be determined by the successful bidder based on a competitive procurement process. All staff shall have proven experience in conducting O-D surveys. The data collection firm shall provide documentation supporting the required experience of its proposed staff. The evaluation team will allow bidders to consider conducting the O-D survey with teams of three interviewers at each location taking 8-hour shifts to be cost-effective.

**Safety Procedures/Precautions:** Safety measures including direct and continuous assistance of road police is critical for the safety of data collection staff. All personnel will be required to wear high-visibility safety vests at all times. The IDG team will develop traffic control plans with the data collection team in accordance with the guidelines from the local police to ensure personnel are safe at each survey station. The traffic plans will provide guidance on the position of the traffic delineators and the percentage of the road that needs to be cordoned off with traffic cones to allow for sufficient space to stop and park the vehicle while the surveyors are at work. The traffic plans will include sketches that provide a visual representation of the survey work area and the space to be reserved/cordoned off. The police, supported by appropriate signage, is expected to assist in intercepting vehicles and directing the surveyed vehicle to the secured survey area. In addition, approximately two to three meters of space will be required inward from the carriageway to position equipment (i.e. tables, chairs, umbrellas and/or tents) that will provide protection against the sun and rain and where surveyors can stow survey materials and/or rest during periods of inactivity.

**Data Quality:** The first layer of quality assurance measure will be the selection of interviewers with proven experience in O-D surveys. The interviewers will also be trained to ask questions in a way that drivers clearly understand the questions and not feel uncomfortable in answering the questions. Other quality assurance measures will include the design of questionnaires that properly tailor to the traffic volume of the RMA Activity roads.

The second layer of quality control will be cross-checks aimed to control the consistency of answers. Depending on the method of data collection (tablet or paper format), the survey process will be monitored by the supervisors to ensure reliable data are obtained and the supervisors will receive the completed questionnaires after the end of the work shift. The evaluation team will also conduct random spot checks to validate the data collection procedure. The evaluation team will also call back 10 percent of randomly selected respondents to ensure the data is recorded correctly.

**Data Processing:** If using a paper form, data will be entered using double entry method, where the data entry operators will enter the data twice to identify mismatches. The mismatches will be corrected based on the original copy of the O-D form. All raw data collected will be entered using data entry software with built-in quality checks for data entry.

**Data Analysis:** O-D data have multiple use. The passenger occupancy and trip purpose data will be used as inputs to the HDM-4. To this end, averages will be calculated by vehicle type. Similarly, the number of hour and kilometers driven per year will be inputs to the HDM-4. Other information, such as passenger fares and trip frequency, will be useful to analyze the socio-economic aspects of the RMA Activity roads improvement.

#### **5.3.3.2 Endline Data Collection**

The methodology for the endline data collection will be the same as described above under the baseline data collection section other than the following sections that differ.

**Rounds and Timing:** The O-D survey will be conducted once in June 2026 and once in November 2026. O-D survey will be conducted for two (2) days of 24 hours covering representative days of the week (Sunday for weekend and Monday for weekday) for each round. As discussed above under the traffic count section, the origin and destination of traffic timing is influenced also by the agricultural calendar. In addition to the normal traffic linked to other economic and social activities, a sizeable traffic linked to commercialization of agricultural produce is expected. To assess the overall origin and destination of traffic, the evaluation team will conduct the O-D survey during the main agricultural season and during the season when agricultural activity is expected to be low.

**Instrument/Equipment:** Additional questions, such as “rationale for choosing the road,” will be added to the baseline O-D questionnaire to address Evaluation Question 3 (see Section 7.2.2 for more information).

Any appropriate adjustments will be made to the endline data collection methodology in case such need arises.

### **5.3.4 Detailed Primary Data Collection Methodology – Axle Load Surveys**

#### **5.3.4.1 Baseline Data Collection**

**Use of Louis Berger axle load data for RN7:** Louis Berger completed an axle load survey for RN7. The evaluation team reviewed the report and has found that the data are suitable for the evaluation as baseline data.

**Use of AIC Progetti axle load data for RN35:** AIC Progetti completed an axle load survey for RN35. The evaluation team reviewed the report and has found that the data are suitable for the evaluation as baseline data.

Axle load data is not required for the RED model for RRS. Therefore, baseline data collection is not required for the RRS.

#### **5.3.4.2 Endline Data Collection**

**Description of Methodology:** Endline axle load data may be available from the performance-based maintenance contractors as it is successfully implemented by MCA-N for RN7 and RN35. If axle load data is not available from the maintenance contractors, the evaluation team will follow the following methodology to conduct an axle load survey. The purpose of an axle load survey is to provide a reliable road loading for the 15-20 years of service. Axle load surveys target heavy vehicles that, if overloaded, may cause premature failures of road pavements. Road loading, alike traffic volume, is prone to seasonal fluctuation. Therefore, axle load surveys carried out over several days cannot be a solid basis to estimate the annual road loading. In order to accurately estimate the seasonal fluctuations, the evaluation team will carry out an analysis of available axle load statistics in addition to conducting an axle load survey. The axle load survey will follow the methodology set out in the TRL Overseas Road Note 40.<sup>35</sup>

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<sup>35</sup> TRL Limited, Overseas Road Note 40, A guide to Axle load surveys and traffic counts for determining traffic loading on pavements, 2004



**Sample Unit:** Heavy vehicle on the RMA Activity roads.

**Target Respondent:** Heavy vehicle drivers on the RMA Activity roads.

**Sample Size and Assumptions:** Similar to the O-D survey, the sample size will depend on the number of heavy vehicle drivers using the RMA Activity roads and the sampling rate. The sampling rate is determined based on traffic data for two groups: vehicles transporting goods, and passenger vehicles. In order to obtain statistically representative samples, their sample size will be adjusted to the respective peak hour traffic of the two vehicle groups. The adjustment to the peak hour is aimed at preventing traffic congestion caused by the axle load survey. The axle load survey, as part of the O-D survey, will follow the same sampling rate as the O-D survey as follows:

- Vehicles transporting goods: 33 percent (one in every three vehicles)
- Passengers vehicles: 20 (one in every five vehicles)

**Sample Frame:** The sample frame for the axle load survey is heavy vehicle drivers using the road sections where the interview stations are located. Sample frame from another source is not necessary.

**Sampling Strategy:** Heavy vehicles will be selected randomly for each vehicle type based on the sampling rate. It is important that empty, partially loaded and fully loaded vehicles are all taken into account. When only fully loaded vehicles are surveyed, this will lead to an overestimation of the average axle loads of certain vehicles. A traffic counter will be placed at each interview station for each direction to count the traffic by vehicle type. The counter will indicate to the axle load interviewer and the police the vehicle to be intercepted for the interview based on the sampling rate. The counter will track the traffic volume by vehicle type, the number of attempted vehicle interceptions, the number of vehicles successfully intercepted, the number of interviewees interviewed, and those who did not provide consent.

**Instrument/Equipment:** The evaluation team will use portable axle weigh pads of adequate capacity (20 tons) for the axle load survey. The data collection firm will present a calibration certificate for the weigh pads issued shortly before the survey. Information from the survey, including the axle load information, will be recorded by the interviewer/technician. When releasing a Request for Proposal to select a data collection firm, the evaluation team will request all bidders to consider using electronic hand-held devices for data collection. The instrument/equipment used may depend on the availability of competent data collection firms in Niger. If the evaluation successfully contracts a firm to use electronic surveying method, hand-held electronic devices, such as tablets or smartphones, will be used to record the data.

**Rounds and Timing:** The axle load survey will be conducted as part of the O-D survey in November 2026.

**Location:** As part of the O-D survey, the axle load survey will be conducted at the same three (3) locations as the O-D survey (see Section 5.2.4 for more the location details).

The axle load survey stations will have sufficient space for parking and good visibility of the roads in both directions, avoiding road bends and slopes. Furthermore, stations will be staggered in each traffic direction to avoid congestion. The location will be selected to avoid potential traffic congestion and road safety risks due to its placement.

**Staffing:** The evaluation team intends to subcontract the axle load survey and the team sizes will be determined by the successful bidder based on a competitive procurement process. All staff shall

have proven experience in conducting axle load surveys. The data collection firm shall provide documentation supporting the required experience of its proposed staff. The evaluation team will allow bidders to consider conducting the axle load survey with an additional two technicians at each location in addition to the O-D team staff taking 8-hour shifts to be cost-effective.

**Safety Procedures/Precautions:** The same safety measures used for the baseline and endline O-D surveys will be applied to the axle load survey.

**Data Quality:** Axle load survey will be carried out as specified in ORN 40 taking all precautions to ensure data quality and minimum disturbance to traffic. Prior to data collection, the subcontractor and the evaluation team will train and pilot the survey to ensure high quality data collection. During data collection, the supervisor will ensure the quality of the data recorded and quickly rectify any anomalies that may be noted. Additional spot checks will be conducted by the evaluation team to verify that weighing procedure is carefully followed and to confirm reasonableness of the results based on visual inspection of the survey procedure and results.

**Data Processing:** To catch and correct data entry errors, double entry method will be used, if using a paper form, where the data entry operators will enter the data twice to identify mismatches. The mismatches will be corrected based on the original copy of the axle load form.

**Data Analysis:** Axle load data collected by the evaluation team will be grouped by vehicle type and respective Equivalent Single Axle Load Factor (ESALF) will be calculated. The data analysis will be carried out as per ORN 40 guideline and ESAL factor will be calculated for standard axles of 8.16 tons and 13 tons.

The evaluation team will also analyze the data from the public axle control station of Gaya in parallel. Though this station is presently out of service, data for all of 2017 are available. Data are associated with O-D references that will enable the selection of trucks directed or coming from RN7. Monthly axle load data will be used to calculate ESALF by vehicle type for each month and this will be applied on the data collected by the evaluation team to estimate the seasonal variation.

### **5.3.5 Detailed Primary Data Collection Methodology – Vehicle Operating Cost Survey**

#### **5.3.5.1 Baseline Data Collection**

**Use of VOC data from MCC HDM-4 model:** The annual VOCs estimated from the HDM-4 (updated by MCC) is available (see Section 5.2.1.3 for more information on existing data). However, it is important to note that the VOC information should be updated after the team validates the HDM-4 input parameters. The evaluation team will review the input parameters used in the HDM-4 and validate them to re-estimate the VOC information for the baseline.

**Description of Methodology:** VOC is a component of the Road User Cost (RUC) in the HDM-4 model that includes also the Travel Time Saving (TTS) and Accident Costs (ACC). RUC, including VOC, is calculated for each year of the analyzed service life by the HDM-4 model on the basis of technical-economic parameters for each vehicle type's representative fleet (see **Annex IV**) for a table of HDM-4 input parameters for RUC calculation). The evaluation team will verify the following input parameters:

- Vehicles market price and conversion in economic prices by interviewing vehicles dealers and Ministry of Finance for conversion factors.
- Fuel, lubricants market price and conversion in economic prices by interviewing Ministry of Finance.

- Salaries and per diems in economic prices by interviewing Ministry of Finance.

**Sample Units:** 1) Transportation association, 2) dealership of new and used vehicles, 3) public organization in charge of taxation of transportation sector.

**Target Respondents:** 1) Transportation association representative, 2) dealer of new and used vehicles, 3) public representatives in charge of taxation of transportation sector.

**Sample Size and Assumptions:** Nine (9) interviews with at least three (3) interviews from each target respondent group will be interviewed.

**Sampling Strategy:** A list will be drafted for each category of target respondents including the details on the size of their operations for the dealerships.

**Instruments/Equipment:** A paper-form listing the VOC areas will be used to guide the interviews and record the data required by the HDM-4 model.

**Rounds and Timing:** The interviews for the VOC survey will be conducted in November 2019 and will last 10 working days.

**Location:** The interviews will be conducted in Niamey.

**Staffing:** The interviews for the VOC survey will be carried out by the In-Country Coordinator/Survey Manager using the form developed by the HDM-4/RED Specialist/Transport Economist. The HDM-4/RED Specialist/Transport Economist will be responsible for the analysis of the data collected and defining the HDM-4 input data for calculation of VOCs.

**Safety Procedures/Precautions:** N/A

**Data Quality:** The relevant HDM-4 input data will be formulated in a preparatory Excel file. The data quality will be verified by crosschecking the responses from the interviews among each target responses and also comparing with any available secondary resources.

**Data Processing:** All interviews will be audio recorded on digital voice recorders and reviewed by the HDM-4/RED Specialist/Transport Economist as soon as possible after the interview. Any anomalies in the interview and the form will be corrected.

**Data Analysis:** The evaluation team will review input parameters to validate the VOCs and RUCs calculated by MCC with HDM-4. Interviews will be completed by the evaluation team to update the market prices and re-assess conversion factors of the market process in economic prices.

#### **5.3.5.2 Endline Data Collection**

The methodology for the endline data collection will be the same as described above under the baseline data collection section other than the following sections that differ.

**Description of Methodology:** All parameters will be updated from the baseline survey, namely economic costs and conversion factors of market prices from the exiting information. This will need additional research and analyses to be implemented with the same procedures above for the baseline.

**Rounds and Timing:** The interviews for the VOC survey will be conducted in August 2026 and will last 10 working days. The analysis of the transportation market structure and the O-D survey (July 2026) will provide the information that will guide the collection of VOC data components.

Alternative proposals for VOC input data collection will be needed according to the distribution of large transport vehicles.

### 5.3.6 Detailed Primary Data Collection Methodology – Maintenance Cost Surveys

#### 5.3.6.1 Baseline Data Collection

**Use of Louis Berger maintenance cost data for RN7:** Louis Berger is asked to design the details of the performance-based maintenance scheme for RN7. In doing so, the design consultant will estimate the maintenance costs for RN7. The evaluation team will also follow the methodology described below to verify whether the data is suitable for the evaluation.

**Use of AIC Progetti maintenance cost data for RN35/RRS:** Similarly, AIC Progetti is asked to design the details of the performance-based maintenance scheme for RN35 and a community-based maintenance system for RRS. In doing so, the design consultant will estimate the maintenance costs for both roads. The evaluation team will also follow the methodology described below to verify whether the data is suitable for the evaluation.

**Description of Methodology:** Updated maintenance unit costs will be drawn from secondary sources with the objective of collecting a wide range of maintenance work items sufficient to test the HDM-4 model alternative maintenance strategies for both paved and gravel roads.

**Data Processing/Analysis:** The Team Leader/Maintenance Expert and the HDM-4/RED Expert/Transport Economist will establish a list of work items to be identified. The unit costs will be critically examined and compared with unit rates for new construction and with international unit rates in order to prepare a set of realistic maintenance budget requirements for Niger and the RMA Activity more specifically. The list of work rates will include but not limited to the items listed in table below:

**Table V.3 Illustrative List of Maintenance Work Items**

Paved Roads		Gravel Roads	
Maintenance work item	Unit rate	Maintenance work item	Unit rate
Overlay of asphaltic concrete (AC) wearing course	USD/km	Spot Re-gravelling	USD/m <sup>3</sup>
Pavement Reconstruction	USD/km	Gravel Resurfacing	USD/m <sup>3</sup>
Heavy patching	USD/m <sup>2</sup>	Erosion Repairs	USD/Km
Edge repair	USD/m <sup>2</sup>	Light Grading (2 blade passes/km)	USD/Km
Crack sealing	USD/m <sup>2</sup>	Hard Grading (4 blade passes/km)	USD/Km
Rejuvenation (wearing course)	USD/m <sup>2</sup>		
Routine pothole patching	USD/m <sup>2</sup>		
Drains & culverts	USD/km		
Shoulders maintenance	USD/Km		
Routine maintenance (Opt. without project)	USD/km		

In case some of the above rates are not found in the national secondary sources, the evaluation team will use data retrieved from international literature, mainly data from Niger's neighboring countries, and adjust it where possible to Niger's conditions.

#### 5.3.6.2 Endline Data Collection

**Description of Methodology:** MCA-N will issue RFPs based on an MCC-adaptation of the World Bank Output- and Performance-based Road Contract (OPRC) bidding documents and select contractors to provide detailed designs for the RN7 and RN35 including the performance-based

maintenance aspect. If MCA-N successfully puts in place performance-based maintenance contractors for the maintenance of RN7 and RN35, the evaluation team will review the maintenance costs incurred by these contractors for the endline data of RN7 and RN35.

Similarly, MCA-N plans to install a community-based maintenance mechanism for RRS. If successful, the evaluation team will obtain the maintenance cost incurred from the communities, the Regional Directorate of Dosso, or the Swiss/Luxemburg development cooperation for the endline data of RN7 and RN35.

However, if the maintenance contracts are not successfully implemented, the evaluation team will conduct a series of interviews to identify the maintenance unit costs for maintenance work items of both paved and gravel roads for the items discussed above.

**Sample Units:** AMODER and maintenance contractors (if relevant).

**Target Respondents:** 1) Representative of the AMODER, and 2) maintenance contractor representatives (if relevant).

**Sample Size and Assumptions:** One (1) interview will be conducted with a representative of the AMODER and at least three (3) interview will be conducted from the maintenance contractors, if relevant.

**Sampling Strategy:** A list of interviewees will be drafted for each category of target respondents including the details on their operations for the maintenance contractors.

**Instruments/Equipment:** A paper-form listing the maintenance work items will be used to guide the interviews and record the data required by the HDM-4 model.

**Rounds and Timing:** The interviews for the maintenance cost survey will be conducted in November 2019 and will last three (3) working days.

**Location:** The interviews will be conducted in Niamey and other areas of Niger depending on the location of the maintenance contractors.

**Staffing:** The interviews for the maintenance cost survey will be carried out by the Team Leader/Maintenance Expert.

**Safety Procedures/Precautions:** N/A

**Data Quality:** The relevant HDM-4 input data will be formulated in a preparatory Excel file. The data quality will be verified by crosschecking the responses with any available secondary resources. The unit costs will be critically examined and compared with unit rates for new construction and with international unit rates in order to prepare a set of realistic maintenance budget requirements for Niger and the RMA Activity more specifically.

**Data Processing:** All interviews will be audio recorded on digital voice recorders. If there are any discrepancies found in the information, the Team Leader/Maintenance Expert and the HDM-4/RED Specialist/Transport Economist will review the audio recordings to verify and correct the information recorded on the form.

**Data Analysis:** The Team Leader/Maintenance Expert and the HDM-4/RED Expert/Transport Economist will examine and update the cost of maintenance work items. The Team Leader/Maintenance Expert will work with the HDM-4/RED Specialist/Transport Economist to analyze the data collected and define the HDM-4 input data for calculation of maintenance costs.



### **5.3.7 Detailed Primary Data Collection Methodology - Roughness Study**

#### **5.3.7.1 Baseline Data Collection**

**Description of Methodology:** The roughness of the road surface constitutes the smoothness and the frictional properties of the pavement surface. This affects the vehicle's ride quality and in turn the safety and comfort of the road user. In addition, roughness is also related to road users' VOCs. Roughness is usually quantified by international roughness index (IRI), which is the most commonly used roughness measurement on paved roads. For the baseline, the evaluation team will use smartphone apps, such as Roadroid or RoadLab-Pro, to quantify roughness on the three roads.

**Sample Units:** Entire road lengths of RN7, RN35, and RRS.

**Target Respondents:** N/A

**Sample Size and Assumptions:** Vehicular response to travelled surface is a continuous measure and sampling interval is not required. IRI will be calculated and reported for every 100m of the road section. Therefore, a total of 1,660 IRI will be reported for RN7 (830 for each direction), 3,600 for RN35 (1,800 for each direction), and 720 for RRS (370 for each direction).

**Sample Frame:** GPS coordinates of the starting point and the ending point of each road (RN7, RN35, and RRS) is required to establish the starting and ending point of data collection.

**Sampling Strategy:** The entire road sections for the three RMA Activity roads will be surveyed in both directions and IRI will be reported at 100m intervals.

**Instrument/Equipment:** For the baseline, the evaluation team will use smartphone apps, such as Roadroid or RoadLab-Pro, to quantify roughness on the three roads. The smartphone apps will estimate the road roughness based on kinematic and GPS sensors in smartphones.

**Rounds and Timing:** Roughness measurements will take place in November 2019 after the rainy season.

**Location:** RN7, RN35, and RRS.

**Staffing:** The evaluation team will not require additional staffing to collect the baseline IRI data and will time the IRI data collection with other data collection efforts to minimize the logistical preparations required.

**Safety Procedures/Precautions:** IRI is measured at a constant speed and does not require traffic to be diverted. Staffs conducting the survey will remain in the vehicle at all times. Caution signs will be posted at the back of the vehicle or a rotating emergency light on the roof of the vehicle to indicate to other drivers that the survey is in progress and that the vehicle may be proceeding at a slower speed.

**Data Quality:** During data collection, a constant speed (70 – 80km/h) will be maintained within a certain range. The evaluation team will closely monitor the data collection process and verify the information collected to identify any anomalies in the data.

**Data Processing:** Data collected on the smartphone apps will be downloaded to shape or KML files and allow the evaluation team to aggregate the survey in preferred section lengths (100m).

**Data Analysis:** The evaluation team will graphically illustrate the IRI for the entire chainage (kilometers on x-axis, IRI on y-axis) of the three roads. Each road will then be sectioned into homogeneous sections which will also be illustrated in graphical format.



### **5.3.7.2 Endline Data Collection**

#### **RN7**

**Description of Methodology:** For the endline, the evaluation team will use IRI to quantify roughness on RN7 using a Class 3 or better IRI measuring device.

**Sample Units:** Entire road section of RN7.

**Target Respondents:** N/A

**Sample Size and Assumptions:** Vehicular response to travelled surface is a continuous measure and sampling interval is not required. IRI will be calculated and reported for every 100m of the road section. Therefore, a total of 1,660 IRI will be reported for RN7 (830 for each direction).

**Sample Frame:** GPS coordinates of the starting point and the ending point of the improved road section for RN7 is required to establish the starting and ending point of data collection.

**Sampling Strategy:** The entire road sections for RN7 will be surveyed in both directions and IRI will be reported at 100m intervals.

**Instrument/Equipment:** Class 3 or better IRI measuring devices per World Bank Technical Paper 46 will be used on RN7. Class 3 or better IRI measuring devices include Profilometers (which are very expensive and very complex in usage) and response-type road roughness measuring system (RTRRMS), which are less expensive and less complex to use. RTRRMS include Bump Integrators (e.g. CRRI Trailer Bump Integrator, ROMDAS Bump Integrator) and Accelerometer Based System (e.g. ARRB Roughometer).

During the trip to Niger, the DGR indicated that they own a Bump Integrator, which they use to measure the paved network every three years. Other neighboring countries (Benin, Burkina Faso, Nigeria) also own Bump Integrators. The evaluation team will use a Bump Integrator for roughness measurements on RN7.

**Rounds and Timing:** Roughness measurements will take place in June 2026.

**Location:** RN7.

**Staffing:** The evaluation team intends to subcontract the IRI data collection. The team size will be determined by the successful bidder based on a competitive procurement process. The consulting firm may staff the data collection with two staff, one driver, and one technician for IRI. The topographic survey for the calibration will be performed by a survey team of three or four persons.

**Safety Procedures/Precautions:** IRI is measured at a constant speed and does not require traffic to be diverted. Staffs conducting the survey will remain in the vehicle at all times. Caution signs will be posted at the back of the vehicle or a rotating emergency light on the roof of the vehicle to indicate to other drivers that the survey is in progress and that the vehicle may be proceeding at a slower speed.

**Data Quality:** To ensure high-quality data collection, it is essential that the instrument is properly calibrated and regularly checked and that proper testing procedures are followed. Calibration of equipment will adhere to manufacturer recommendations and follow the appropriate ASTM specifications as well as those mentioned in the World Bank Technical Paper No 46. The equipment will be calibrated on three straight reference sections, 500m long each, which are representative of the IRI expected on RN7. Each reference section will have its longitudinal profile

measured on two outer wheel paths using a topographical survey (dipstick or rod and level) method (Class 1). The reference sections will be used to establish a calibration equation (or calibration equations for different measuring speeds, as needed) for the Class 3 road roughness measuring device. During data collection, a constant speed will be maintained within a certain range. The IDG evaluation team will closely monitor the data collection process and conduct random checks to ensure the data is collected correctly and quickly rectify for any anomalies.

**Data Processing:** The average of IRI values obtained using topographical survey will be plotted against the bump counts for each of the test sections. The calibration equation will be then derived by calculating the best fit line for the points. The calibration equation can then be used to convert data from bump counts into IRI units.

**Data Analysis:** The evaluation team will graphically illustrate the IRI for the entire chainage (kilometers on x-axis, IRI on y-axis) of RN7. Each road will then be sectioned into homogeneous sections which will also be illustrated in graphical format.

### RN35 and RRS

**Description of Methodology:** While IRI is the most commonly used roughness measurement on paved roads, it is not appropriate to be used on gravel roads. Therefore, the evaluation team will use the present serviceability rating (PSR) to quantify roughness on RN35 and RRS.

**Sample Units:** Entire road sections of RN35 and RRS.

**Target Respondents:** N/A

**Sample Size and Assumptions:** PSR is a continuous measure and sampling interval is not required but will be reported for every 100m of the road section. Therefore, a total of 3,600 data points for RN35 (1,800 for each direction) and 720 for RRS (370 for each direction) will be reported.

**Sample Frame:** GPS coordinates of the starting point and the ending point of the improved road section for RN35 and RRS is required to establish the starting and ending point of data collection.

**Sampling Strategy:** PSR is a continuous evaluation and it will be reported at 100-meter interval based on a 5-point rating system to obtain the roughness of the roads.

**Instrument/Equipment:** PSR is a ride quality rating that requires a panel of three or four observers to ride in an automobile over the pavements in question in a four-wheel drive vehicle. The panel will rate the roughness between 0 to 5 (0-1 very poor; 1-2 poor; 2-3 fair; 3-4 good; and 4-5 very good). No other equipment is required to estimate PSR for RN35 and RRS.

**Rounds and Timing:** Roughness measurements will take place in June 2026.

**Location:** RN35 and RRS.

**Staffing:** The team size will be determined by the successful bidder based on a competitive procurement process. The PSR will be performed by a panel of three or four technicians from the data collection firm.

**Safety Procedures/Precautions:** PRS is measured at a constant speed and does not require traffic to be diverted. Staffs conducting the survey will remain in the vehicle at all times. Caution signs may be posted at the back of the vehicle or a rotating emergency light on the roof of the vehicle to indicate to other drivers that the survey is in progress and that the vehicle may be proceeding at a slower speed.

**Data Quality:** The evaluation team will ensure that the panel of observers has performed their task with the utmost care and that the roughness results are consistent. The IDG evaluation team will closely monitor the data collection process and conduct random checks to ensure the data is collected correctly and quickly rectify for any anomalies.

**Data Processing:** PSR of each 100m section will be entered using a software with built-in data entry system. The information will be then reviewed by the evaluation team.

**Data Analysis:** The evaluation team will convert PSR to IRI. The evaluation team will graphically illustrate the PSR and the converted IRI for the entire chainage (kilometers on x-axis, PSR or IRI on y-axis) of RN35 and RRS. Each road will then be sectioned into homogeneous sections which will also be illustrated in graphical format.

### **5.3.8 Detailed Primary Data Collection Methodology – Road Condition Study**

#### **5.3.8.1 Baseline Data Collection**

**Use of Louis Berger surface distress data for RN7:** The evaluation team received the road surface distress data of RN7 from Louis Berger as part of its design preparations. The evaluation team reviewed the data to verify its accuracy and determined that the data is suitable for the evaluation.

Surface distress data is not required for the HDM-4 model for unpaved roads (RN35) and the RED analysis for RRS. Therefore, baseline data collection is not required for the RN35 and RRS.

#### **5.3.8.2 Endline Data Collection**

**Description of Methodology:** The purpose of visual road condition survey is to measure, and record defects shown by each of the road sections in a standard and objective manner by walking over the selected inspection lengths. The road condition survey will generally follow the data collection guideline in Appendix A of the Distress Identification Manual for the Long-Term Pavement Performance (LTPP, Fourth Revised Edition) (June 2003). Classification and categorization of distresses will follow a modified methodology to align with the HDM Documentation, Volume 4 – Analytical Framework and Model Description, Part C – Road Deterioration Models.

The distresses to be recorded include:

- **Cracking:** structural (fatigue, wheel track cracking) and transverse (% area): the cracked area is directly measured for surface (alligator) cracking, while for linear (longitudinal and transverse) cracking the area is calculated based on crack length assuming width of distressed area of 0.5m. The cracks are classified as wide (width > 3mm, or spalled cracks) or narrow (width between 1 and 3mm).
- **Potholes** (#/km): the pothole is defined as open cavity in the road surface with at least 150mm in diameter and at least 25mm depth. The average pothole is assumed to have surface of 0.1m<sup>2</sup> and depth of 0.1m. If the pothole is larger, the number of equivalent potholes with area of 0.1m<sup>2</sup> is counted.
- **Rutting** (mm): the average and standard deviation of maximum rut depth in transverse direction under a 2-m straightedge, placed across a wheel path. Rutting should be measured in both wheel-paths in two profiles on the surveyed area at distance of 25 m between them.
- **Edge break** (m<sup>2</sup>/km): the distressed area within 0.5 from the pavement edge.
- **Raveling** (% area): the area with loss of material from wearing surface.

The measurement of surface texture includes:

- Texture depth: qualitatively assessed in 3-level rating, as good, fair, and slippery, based on the HDM-4 default aggregate table for texture depth.
- Skid resistance: qualitatively assessed in 3-level rating, as good, fair, and slippery, based on the HDM-4 default aggregate table for skid resistance.

The overall condition of drainage system:

- Drainage condition: qualitatively assessed in 5-level ratings, as Excellent, Good, Fair, Poor or Very poor, based on AASHTO Guide for Design of Pavement Structures<sup>36</sup> as a function of the permeability of subsurface materials, the crossfall and longitudinal slopes, the drainage distance and the type of drainage structure.

There are a number of potential causes of the above-listed distresses on the project roads, which the evaluation team will investigate while performing the road condition survey. The data obtained from the study will be used in the HDM-4 calibration.

**Sample Units:** 100m full-width road section, which is the inspection length of RN7 to be physically inspected per kilometer.

**Target Respondents:** N/A

**Sample Size and Assumptions:** The evaluation team will sample 100m (full width) per kilometer of RN7, which is equivalent to 10 percent of the full road lengths. The total number of sampled sections will be 83 (one section per kilometer).

**Sample Frame:** GPS coordinates of the starting point and the ending point of the improved road section for RN7 is required to establish the starting and ending point of data collection.

**Sampling Strategy:** The inspection length will begin 500 meters after the start of the road section. The next section will start systematically 950 meters after the end of the previous test section.

**Instruments/Equipment:** The road condition survey is conducted on foot to map the type and extent of the distress and the condition statistics will be summarized for the length of the roads. The list of equipment for the road condition survey will generally follow the example found in Appendix A of the Distress Identification Manual. The road condition survey will be a visual inspection and the surveyors will record the surface distresses, any major maintenance performed, and potential cause of deterioration on a hand-held device or an A4 or letter size sheet of paper.

**Rounds and Timing:** The road condition survey for the endline data collection will be carried out in June 2026.

**Location:** Road condition survey will be conducted on RN7.

**Staffing:** The evaluation team intends to subcontract the road condition data collection and the team sizes will be determined by the successful bidder based on a competitive procurement process. Usually three people will be involved in road condition survey, one technician, one assistant, and a driver.

**Safety Procedures/Precautions:** Personnel conducting the survey will wear safety caps and high-visibility safety vests, and the assistant will act as a flagman to control the traffic. Adequate signs

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<sup>36</sup> AASHTO Guide for Design of Pavement Structures, American Association of State Highway and Transportation Officials, Washington D.C., 1993.

will be placed in the test area as the test progresses. The vehicle used by the staff will follow the investigators to provide protection from the traffic on the lane in which the test is being conducted. Caution signs will be posted at the back of the vehicle or a rotating emergency light on the roof of the vehicle to indicate to other drivers that the survey is in progress and that the vehicle may be proceeding at a slower speed.

**Data Quality:** The survey will be conducted strictly as per the procedures laid out in the Distress Identification Manual. Prior to data collection, the form used to record the distresses will be pre-tested. Data collection staff will be trained, and the survey will be piloted the at a sample road section (at a minimum of 50m). During data collection, the evaluation team will closely monitor the data collection process and conduct random checks to ensure the data is recorded correctly and quickly rectify any anomalies. After data collection, the IDG evaluation team will verify the data collected by comparing the scanned copies of the traffic count forms with the data provided by the consulting firm.

**Data Processing:** Data collection will follow the guidelines in Appendix A of the Distress Identification Manual. The recorded information will be entered using a data entry software with built-in quality check system. The evaluation team will use the information gathered to derive HDM-4 inputs as needed.

**Data Analysis:** The results of the analyzed data will be used in the calibration of the HDM-4 model by comparing the model predictions of pavement deterioration at this point in time and modifying the model parameters as needed. The technician involved in the surface distress will be requested to determine the cause(s) of any pavement distress. Each road will then be sectioned into homogeneous sections which will also be illustrated in graphical format. The road distresses observed will be presented with LTPP distress identification with colors to indicate the severity.

### **5.3.9 Detailed Primary Data Collection Methodology - Deflection Study**

#### **5.3.9.1 Baseline Data Collection**

**Use of Louis Berger deflection data for RN7:** The evaluation team received the deflection data of RN7 from Louis Berger as part of its design preparations. The evaluation team reviewed the data to verify its accuracy and determined that the data is suitable for the evaluation.

Deflection data is not required for the HDM-4 model for unpaved roads (RN35) and the RED analysis for RRS. Therefore, baseline data collection is not required for the RN35 and RRS.

#### **5.3.9.2 Endline Data Collection**

**Description of Methodology:** Pavement surface deflection measurements are the main means of evaluating the integrity of pavement structure. Deflection measurements can be used to determine the thickness of overlay required to increase the life of the road or can be used in back-calculation methods to determine the pavement layer stiffnesses and the subgrade modulus. Deflection measurements are affected by a number of factors including the temperature of the asphalt and the moisture condition of the subgrade.

Measurements will be made at temperatures as close as possible to a reference temperature, and all readings will be corrected to the reference temperature. Tests are also conducted when the pavement is at its weakest condition. Therefore, the deflection study will be conducted at the end of the rainy season in October 2026. The evaluation team will use the deflection data to obtain the modulus of pavement layer and subgrade to determine the remaining structural life of the paved



road RN7. Deflection will be measured on the outer wheel path, in a staggered pattern alternating right and left, according to the NF P 98-200-8 standard,<sup>37</sup> as officially used in Niger.

**Sample Units:** Each location on the RN7 road for measuring deflection.

**Target Respondents:** N/A

**Sample Size and Assumptions:** ASTM (D 4695) standard recommends the following:

- Network Level Testing, tests are performed at 100m - 500m intervals.
- General Project Level Testing, the intervals are 50m – 200m.
- Detailed Project Level Testing, tests are performed at 10m to 100m intervals.

Attachment J.11 states that deflection be performed at 1-kilometer increments. The general project-level testing is the most appropriate for the evaluation and the suggested interval is between 50 and 200m. Assuming static deflection measures, deflection will be measured every 200m on the outer wheel path, in a staggered pattern alternating right and left for RN7. Therefore, the total number of samples will be 830, 415 per direction.

**Sample Frame:** GPS coordinates of the starting point and the ending point of the improved road section for RN7 is required to establish the starting and ending point of data collection.

**Sampling Strategy:** Assuming static deflection measures, the first deflection measurement on the right lane will start 50m after the start of the road section. The first deflection measurement on the left lane will start 150m after the start of the road section. The next measurement will be located systematically 200 meters after the previous location for each lane.

**Instrument/Equipment:** There are broadly three methods for deflection measurements, and hence equipment for deflection measurement:

- **Static deflections:** equipment measures deflection in response to static load (e.g. Benkelman Beam (BB))
- **Steady state deflections:** equipment measures dynamic deflection in response to oscillating load (e.g. Dynaflect, Road Rater)
- **Impact load deflections:** equipment delivers a transient impulse load to the pavement (e.g. Falling Weight Deflectometer (FWD))

The BB apparatus is a convenient, cost effective, and accurate device used for measuring deflection of flexible pavements. This equipment, unlike the others, is available in Niger from the Niger National Laboratory of Public Works (laboratoire national du bâtiment et des travaux publics, LNBTP), and they are familiar with its use.

**Rounds and Timing:** Deflection measurement study will be carried out in October 2026, at the end of the rainy season.<sup>38</sup>

**Location:** Deflection will be measured on the MCC-funded section of RN7.

**Staffing:** The evaluation team intends to subcontract the work to a data collection company with expertise in this type of deflection survey. A data collection team usually consists of at least five

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<sup>37</sup> *Mesure de déflexion de chaussée à la poutre Benkelman*, AFNOR, December 1997.

<sup>38</sup> Sauterey, R., and Autret, P., “*Guide d’auscultation des chaussées souples*”, Eyrolles, 1977.



people: two flagmen to control traffic, the driver of the vehicle, a technician, and an assistant for both type of tests.

**Safety Procedures/Precaution:** For the deflection, traffic will have to be diverted from the section of the lane where the test is being conducted by the use of traffic control devices. These will include the installation of warning signs prior to the start of the survey. These warnings will need to be moved as the survey progresses. Traffic cones shall be used by channeling traffic away from locations where testing is taking place. Caution signs will be posted at the back of the vehicle or a rotating emergency light on the roof of the vehicle to indicate to other drivers that the survey is in progress.

**Data Quality:** To ensure high-quality data collection, it is essential that the instrument is properly calibrated and regularly checked and that proper testing procedures are followed. When carrying out the calibration procedure, recommendations from the equipment manufacturer will be considered. The calibration of BB will follow the procedures described in NF P 98-200-8. For BB, all dial gauges or electronic sensors (LVDTs) used for deflection measurements will be calibrated and the most recent calibration certificates for external calibration (not older than six months) will be provided. In addition, the truck used for deflection measurements will have the appropriate axle loading, tire type, and pressure in accordance with the standard requirements. The evaluation team will also compare the deflection results with previous deflection testing results to identify any discrepancy in data, if any.

**Data Processing:** The deflection raw data will be entered using a data entry software and will include information on test location (route, chainage, lane, distance from the pavement edge), actual axle load used (kN), rebound pavement deflection (0.01mm), date and time of readings, pavement temperature, depth at which the temperature is recorded, and the time of recording. The data collection report will summarize the survey results of the road. Deflection readings will be corrected to the reference temperature.

**Data Analysis:** Deflection measurements will be plotted for the entire road (deflection on y-axis and kilometer on x-axis). This work is usually performed by the deflection subcontractor. From this graphical presentation, homogeneous sections will then be obtained. From the layer thicknesses and deflection data, the Structural Number (SN) will be calculated. For determining the remaining structural life of the road investment, the empirical based procedure includes methods developed by Transport and Road Research Laboratory (TRRL).<sup>39</sup> The TRRL method provides graphs for relation between structural deflection and life for different pavement types. The mechanistic approach is based on soundness analyses of stresses and strength of material used. This approach is more complex but often leads to more consistent results. Therefore, the team will use the mechanistic approach on critical sections with high deflection measurements.

### **5.3.10 Detailed Secondary Data Collection Methodology - Road Geometry and Structure Study**

#### **5.3.10.1 Baseline Data Collection**

**Use of Louis Berger road geometry and structure data for RN7:** The evaluation team received the road geometry and structure data of RN7 from Louis Berger as part of its design preparations.

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<sup>39</sup> Kennedy, C. K. and Lister, N. W. "Prediction of pavement performance and the design of overlays". TRRL Laboratory Report 833. Crowthorne, 1978.

The evaluation team reviewed the data to verify its accuracy and determined that the data is suitable for the evaluation.

**Use of AIC Progetti road geometry and structure data for RN35/RRS:** Similarly, the evaluation team received the road geometry and structure data of RN35 and RRS from AIC Progetti as part of its design preparations. The evaluation team reviewed the data to verify its accuracy and determined whether the data is suitable for the evaluation.

#### **5.3.10.2 Endline Data Collection**

Endline data collection will not be required. The road geometry and structure information will be drawn from the final report of the works supervision team(s) when the road rehabilitations are completed, complemented by the “as-built” drawings.

### **5.3.11 Detailed Secondary Data Collection Methodology - Geotechnical Study**

#### **5.3.11.1 Baseline Data Collection**

**Use of Louis Berger pavement structure data for RN7:** The evaluation team received the pavement structure data of RN7 from Louis Berger as part of its design preparations. The evaluation team reviewed the data to verify its accuracy and determined that the data is suitable for the evaluation.

**Use of AIC Progetti pavement structure data for RN35:** The evaluation team received the pavement structure data of RN35 from AIC Progetti as part of its design preparations. The evaluation team reviewed the data to verify its accuracy and determined that the data is suitable for the evaluation.

Geotechnical data is not required for the RED analysis of RRS. Therefore, baseline data collection is not required for the RRS.

#### **5.3.11.2 Endline Data Collection**

**Use of MCC works supervision data and the as-built drawings:** The evaluation team expects MCC’s road improvement contractors to collect and report on the geotechnical data of RN7, RN35, and RRS respectively throughout the road rehabilitation process in the monthly reports and also the final as-built drawings. The evaluation team will work with MCA-N to monitor the road rehabilitation process and review the data to verify its accuracy and determine whether the data is suitable for the evaluation. If the data is not appropriate for the evaluation, a geotechnical study will be conducted to collect the endline data for RN7 and RN35. Geotechnical data is not required for the RED analysis of RRS. Therefore, endline data collection is not required for the RRS.

### **5.3.12 Analysis Plan**

#### **5.3.12.1 Generated Traffic Estimation**

An important factor in calculating the benefits accruing to project roads users, is the estimate of generated traffic. For RN35, in particular, the road rehabilitation should bring about significant traffic generation.

To estimate generated traffic, different models will be utilized for goods and passengers’ traffic.

First step, common to goods and passenger traffic, is the demarcation of the influence area of each project road. The influence area of RN35 will have variable width depending on the attraction capacity of the competitor road i.e. RN7. In some stretches, the influence area will be narrower

than 5 km due to the proximity of RN7, while in other RN35 stretches, the width of the influence area will be wider than 5km because RN35 is the cheaper option for produce transport to market spots.

After defining the influence areas, the model for generated traffic of goods, namely agriculture produce, will be based on the impact on farm-gate prices induced by the reduction of freights from agri-production areas to main markets. The increased competitiveness of farm-gate prices will likely increase the volume of produce transported to markets. Together with the increase of commercialized agriculture production, there will be also a commensurate increase of agricultural inputs transported from general warehouses to the influence area. Projections of generated traffic will refer to the development of agriculture objectives set out at national level. Data for feeding the model will be of diverse sources, including agricultural statistics at region and department level and targeted interviews of key informants.

The model for the estimate of generated passenger traffic will be based on the assumption that households with more income will increase the number of trips per household. The increase of passenger traffic will be projected on the basis of the growth of the rural population.

#### **5.3.12.2 HDM-4 Analysis**

An economic appraisal of road projects determines how much to invest and what economic returns to expect. The size of the investment is defined by the costs of construction and annual road maintenance. The HDM-4 analysis is used to estimate the economic or engineering viability of road investment projects by considering the following issues:

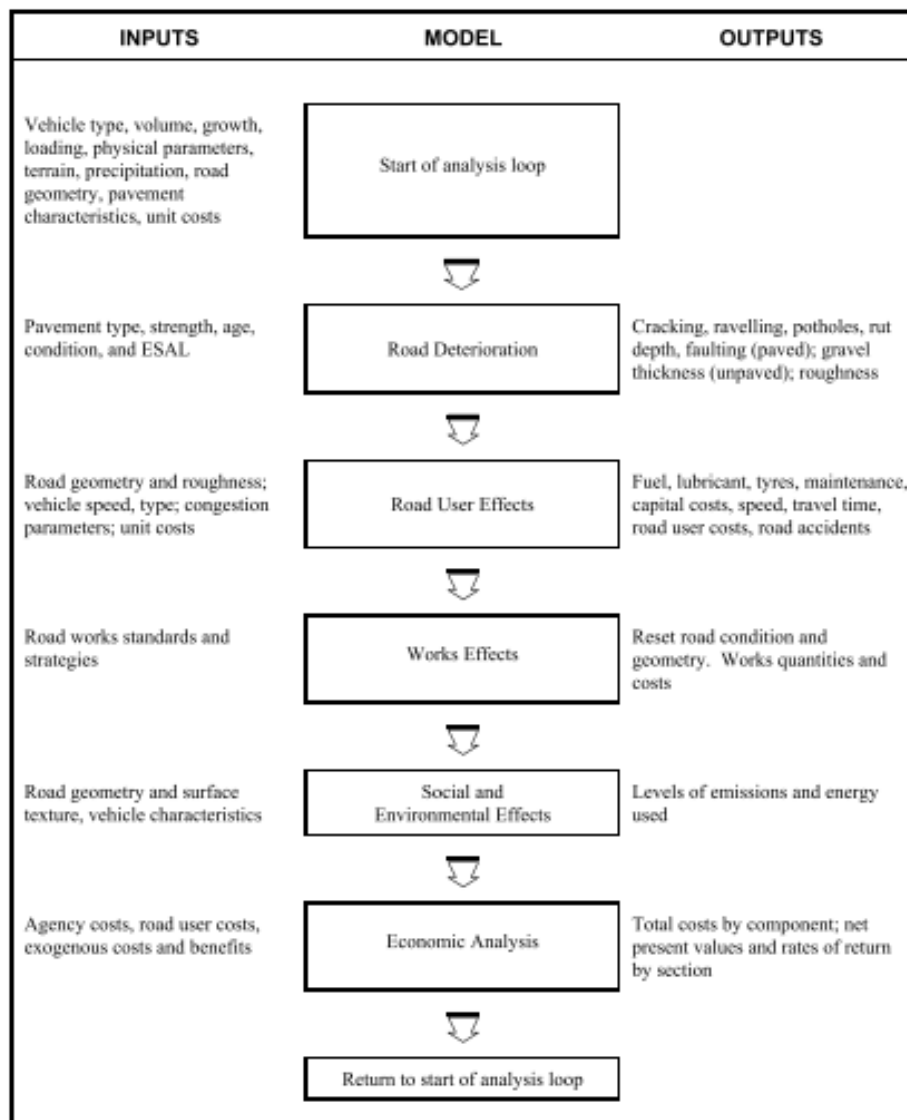
- Pavement surface and structural performance
- Life-cycle predictions of road deterioration, maintenance effects and costs
- Road user costs and benefits
- Economic comparisons of project alternatives

The life-cycle analysis uses sets of costs incurred by the road administration and by the road user. The two sets of costs are added together over time in discounted present values. Costs are determined by first predicting physical quantities of resource consumption and then multiplying these quantities by their unit costs or prices. Economic benefits are then determined by comparing the total cost streams for various maintenance and construction alternatives with a base case (*do nothing* or *do minimum* alternative), usually representing minimal routine maintenance.

The economic returns are mainly in the form of savings in road user costs due to the provision of a better road quality. The cost of construction, road maintenance, and road user costs constitute what is commonly referred to as the total (road) transport cost or the whole life cycle cost.

The following table displays the inputs, HDM-4 model elaborations and model's outputs.

**Figure V.6 Structure of HDM-4 Model**



Source: HDM-4 Manual, vol.2

The economic and technical outputs of the HDM-4 are presented in tables and graphs providing an exhaustive information on the whole evaluation process. The figure below displays a typical output of the economic indicators under the base and sensitivity scenarios.

Figure V.7 Typical Output of the HDM-4 Economic Indicators

H D M - 4 Economic Indicators Summary									
HIGHWAY DEVELOPMENT & MANAGEMENT									
Study Name: <b>Modjo - Awassa Phase 2 new 03- Revised Design 21-3</b>									
Run Date: <b>06-12-2018</b>									
Currency: <b>US Dollar (millions)</b>									
Discount Rate: <b>10.30%</b>									
Sensitivity: Base Sensitivity Scenario									
Alternative	Present Value of Total Agency Costs (RAC)	Present Value of Agency Capital Costs (CAP)	Increase in Agency Costs (C)	Decrease in User Cost (B)	Net Exogenous Benefits (E)	Net Present Value (NPV = B+E-C)	NPV/Cost Ratio (NPV/RAC)	NPV/Cost (NPV/CAP)	Internal Rate of Return IRR %
Without Project	613.438	586.374	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Option 1 - New Expressway	849.419	830.338	235.982	1,240.027	40.957	1,045.003	1.230	1.259	18.5 (1)
Option 2 - New Highway	561.326	540.853	-52.112	1,270.246	61.010	1,383.368	2.464	2.558	26.6 (1)
Option 3 - Full Upgrade Existing Road	505.922	471.899	-107.516	1,212.228	17.579	1,337.323	2.643	2.834	29.4 (2)
Figure in brackets is number of IRR solutions in range -90 to +900									
Sensitivity: Combined traffic reduct.-20% cost increase +20%									
Alternative	Present Value of Total Agency Costs (RAC)	Present Value of Agency Capital Costs (CAP)	Increase in Agency Costs (C)	Decrease in User Cost (B)	Net Exogenous Benefits (E)	Net Present Value (NPV = B+E-C)	NPV/Cost Ratio (NPV/RAC)	NPV/Cost (NPV/CAP)	Internal Rate of Return IRR %
Without Project	576.642	550.694	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Option 1 - New Expressway	849.030	830.338	326.867	328.278	32.766	34.177	0.040	0.041	10.7 (1)
Option 2 - New Highway	559.787	540.396	-20.226	376.771	48.808	445.805	0.796	0.825	17.4 (1)
Option 3 - Full Upgrade Existing Road	502.202	468.181	-89.328	644.511	14.063	747.901	1.489	1.597	23.9 (2)
Figure in brackets is number of IRR solutions in range -90 to +900									

### 5.3.12.3 RED Analysis

The RED model<sup>40</sup> is a customized economic evaluation tool used for decision-making processes for the development and maintenance of low-volume rural roads (LVRs). The World Bank's HDM-4 present a good framework for the economic evaluation of road investments and maintenance but are not particularly customized for LVRs (traffic less than 200 vehicles per day), do not capture all the benefits associated with rural road investments, and require a series of inputs which are impractical to collect for low traffic levels.

The RED model performs an economic evaluation of road investments and maintenance options customized to the characteristics of low-volume roads such as:

- High uncertainty of the assessment of traffic, road condition, and future maintenance of unpaved roads;
- Periods during a year with disrupted passability;
- Levels of service and corresponding road user costs defined not only through roughness;
- High potential to influence economic development; and
- Beneficiaries other than motorized road users

The model computes benefits accruing to normal, generated, and diverted traffic, as a function of a reduction in vehicle operating and time costs. It also computes safety benefits, and model users can add other benefits (or costs) to the analysis, such as those related to non-motorized traffic,

<sup>40</sup>RED Model prepared by the World Bank for the evaluation of rural roads with a starting traffic volume up to 200 AADT (motorized traffic).

social service delivery and environmental impacts. The model is presented in a series of Excel workbooks that collect all user inputs, present the results in a user-friendly manner and perform sensitivity, switching values and stochastic risk analyses. The evaluation procedure relies upon three modules to be used in sequence, they are:

1. HDM-4 Vehicle Operating Cost Module, this module works out the VOCs using the procedure adopted by HDM-4, VOCs are thereafter automatically copied in the second module.
2. Main Economic Evaluation Module, this module performs the economic evaluation along with the Sensitivity analysis and Switching Values computation. The results of Main Module are automatically copied in the Risk module.
3. Risk Analysis Module, this module performs a classic risk analysis on all performance indicators.

The evaluation team will use the RED model to evaluate road investments and maintenance and estimate benefits accruing to motorized road users to which other benefits can be exogenously added for RRS.

#### **5.3.12.4 Graphic Presentation of Main HDM-4 Data Inputs**

Attachment J.11 requires the evaluator to collect “aerial imagery at a resolution of 5cm or better for the constructed works of each road and overlay the collected data.” However, obtaining aerial imagery is excessive and not cost-justifiable for drafting itinerary diagrams. Therefore, in lieu of aerial photography, the evaluation team will use existing pre-construction images (LIDAR and/or other maps obtained for IMAP) to graphically present the baseline data. For endline data, post-construction satellite imagery at a resolution of 50 cm or better will be obtained for graphically presenting data on images of MCC-funded roads.

The findings of the individual data collection efforts (IRI, traffic counts, deflection, core sampling results, surface distress, and structural analysis) will be overlaid on the satellite image/map for the itinerary diagram. A sample itinerary diagram will be developed for MCC’s review before beginning the work on the itinerary diagrams.

For the purposes of visualizing potential road defects, IDG believes the most cost-effective and practical method is to obtain a GPS-linked video using a vehicle-mounted camera. These videos will be georeferenced and capture the details of the road to visualize the potential defects on the road.

## **5.4 CHALLENGES**

### **5.4.1 Limitations of Interpretation of the Results or Risks to the Study Design**

The evaluation design maximizes the use of available data and data to be collected by MCA-N design consultant to be cost-effective in its data collection. However, this also poses a major risk to the data quality and data availability. First, there is a risk that the data collected by the APD consultants may not be available to the evaluation team in a timely manner, limiting the team’s ability to plan for its baseline data collection accordingly. Delay in design consultant’s data collection and/or MCC’s review of the data collected could potentially prevent the evaluation team from collecting the necessary baseline data before the rehabilitation begins. Second, if the data collected by APD is insufficient to serve as the baseline for the evaluation, the evaluation team



may need to collect baseline data in a short amount of time before the road work starts. Therefore, the evaluation team believes that it is important to be in communication with MCA-N regarding the APD consultants' progress on data collection and their methodologies.

In addition, results of the economic analysis are dependent upon the quality of the data on which it is based. Therefore, satisfactory data collection of each input to the economic model is vital to producing an accurate economic evaluation. Surveys need to be thoroughly carried out in order to obtain representative samples of data which can then be carefully processed and analyzed.

## VI. EVALUATION DESIGN – EVALUATION AREA 2: MAINTENANCE

### 6.1 EVALUATION QUESTIONS

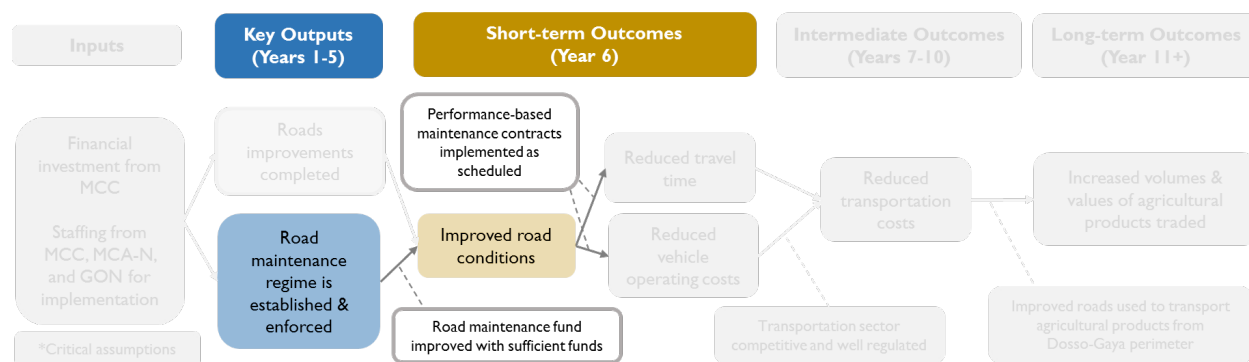
**2A) To what extent have the road maintenance reforms been implemented and how has that affected the sustainability of road investments? To what extent have the roads been maintained, whether through the performance-based road management and maintenance contracts or other mechanisms? Based on this assessment, what set of maintenance assumptions should be used in the economic model estimate to yield the best estimate of the costs and benefits of the roads investment?**

First, it is important to note that the evaluation design for addressing Evaluation Question 2A hinges on the implementation of the performance and community-based maintenance contracts. The evaluation design will need to be updated if the maintenance contracts are not successfully implemented.

The MCC Investment Memorandum (IM), mentions road maintenance as the first key issue of the RMA Activity.<sup>41</sup> The IM stresses that “Even though Niger has a functioning road fund, the fiscal constraints make it possible to only maintain around 30% of the network.” Therefore, road maintenance has received a lot of attention during the formulation of the MCC Compact. The Compact proposes an OPRC-based maintenance setup for the classified roads and a community-based maintenance setup for the rural road.

As shown in **Figure VI.1**, Evaluation Area 2 will be testing 1) if a new road maintenance regime (road maintenance reforms), including an improved road maintenance fund, is established and maintained, 2) if performance-based maintenance contracts are implemented as scheduled, and 3) if MCC facilitated any of those changes.

**Figure VI.1 Activity Logic Model and the Focus of Evaluation Area 2**



Evaluation Question 2A consist of three sub-questions:

**To what extent have the road maintenance reforms been implemented and how has that affected the sustainability of road investments?**

<sup>41</sup> Investment Memorandum, Annex B, page 52.

With a number of development partners assisting the GON on road maintenance, reforms are underway. The decree (in French “*ordonnance*”) modifying the law that created the road fund (FER) and establishing a second-generation road fund, was approved on February 15, 2019. This decree also decided the creation by decrees (in French “*décret*”) of an audit agency (CACER Cellule d’Audit Courant de l’Entretien Routier), and a maintenance executing agency (AMODER Agence de Maîtrise d’Ouvrage Délégué de l’Entretien Routier). The purpose of this evaluation question is to monitor these maintenance reforms and their progress during and after the road rehabilitation to assess how these will affect the roads rehabilitated by MCC. The team will review any changes in legislation, institutions, and funding that impacts future maintenance.

**To what extent have the roads been maintained, whether through the performance-based road management and maintenance contracts or other mechanisms?**

The purpose of the second sub-question is to understand how the MCC-funded roads are maintained after road rehabilitation. As mentioned above, MCC envisions RN7 and RN35 to be maintained through performance-based maintenance contracts and RRS through a community-based maintenance mechanism. Unlike Evaluation Question 2B, which focuses on the effect of MCC’s road maintenance interventions, this sub-question will mainly assess the actual maintenance performed on the roads regardless of the mechanism used.

For the three MCC-funded roads, whether through the performance-based road management and maintenance contracts, community-based maintenance system, or other mechanisms, the analysis will include a descriptive review as well as a technical assessment of the frequency and quality of routine and emergency maintenance practices completed on the roads. This will be done through a review of administrative records and reports of maintenance resources and activities on RN7 and RN35, supplemented by actual field visits to verify or adjust the administrative evidence.

**Based on this assessment, what set of maintenance assumptions should be used in the economic model estimate to yield the best estimate of the costs and benefits of the roads investment?**

The main purpose of this sub-question is to update assumptions about road maintenance practices into the ERR model in Evaluation Question 1 based on the two previous sub-questions. The accuracy of MCC’s maintenance assumptions has not yet been formally tested and assessed. If RN7 and RN35 are maintained through performance-maintenance contracts, the analysis will include review of the maintenance contractor(s) procedures for implementation of routine and emergency maintenance. Since periodic maintenance is not generally required until five or more years after improvement, the evaluation team will evaluate the contractor(s) plans for periodic maintenance on the MCC-funded roads. For the RRS, the analysis will include a review of the community-based maintenance mechanism and financial planning of maintenance and how it compares with the maintenance needs.

**2B) In cases where MCC invested in improving maintenance practices or included a maintenance Conditions Precedent in the Compact (applicable to Niger), what were the effects of those efforts and why?**

MCC has agreed with the government to put in place an OPRC based maintenance setup for the classified roads and a community-based maintenance setup for the rural road. The OPRC contract for the construction of the RN7 and RN35 is expected to include a ten-year maintenance period. It is expected that following this first test of an OPRC maintenance contract in Niger, the GON will

extend this maintenance setup to the whole classified road network of the country. Similarly, it is expected that the successful implementation of a community-based maintenance setup for the RRS will convince the government to apply this maintenance setup to all the rural roads of the country's network.

The purpose of this evaluation question is to understand whether the intended road maintenance activities included in the Compact have been effective in improving road maintenance on the MCC-funded roads and more generally on the whole road network of Niger. If OPRC is established for RN7 and RN35, and a community based maintenance system for the RRS, the evaluation team will assess if the performance-based maintenance contractors maintained the minimum road performance indicators and service level of roads that address the preventative, routine, and periodic maintenance of the RN7 and RN35. For the RRS, the team will examine whether the community maintained the service level of RRS as initially anticipated by MCC. The evaluation team will also identify major policy changes associated with MCC's efforts in improving road maintenance at large and examine whether MCC's investments served as an incentive to improve Niger's overall road maintenance practices.

**2C) What political and economic incentives are shaping road maintenance decisions in Niger? How did this change from before the MCC intervention to after? What evidence is there that MCC facilitated those changes (if relevant)?**

Evaluation question 2C consist of two sub-questions:

**What political and economic incentives are shaping road maintenance decisions in Niger?**

Political economy analysis, in part, seeks to identify the key stakeholders around issues, determine their power and incentives, and comprehend the formal rules and informal norms that determine decision making processes. This will allow the team to assess relative power among stakeholders in road maintenance, and link decisions in this area to variation in the interests and influence of sector stakeholders. In order to do so, the team will identify the main supporters and opponents of allocating sufficient funds for road maintenance in the government and the main drivers of reform in the road sector to date. In addition to public actors, the team will examine whether there are signs that powerful private sector interests are emerging in favor of higher-quality road maintenance.

The evaluation team will examine the extent to which actual processes for road maintenance diverged from the formal ones outlined in Niger's laws and regulations. For example, the team will analyze the current processes for awarding contracts for road maintenance and whether they follow existing rules and regulation. The road maintenance awarding procedures will be examined closely to clarify whether the bids are open, and the assessments are transparent. The team will highlight where the actual processes differ from official ones. Oversight on road maintenance will be also reviewed. The team will compare Niger's regulations and processes (formal and informal) for road maintenance to regional/international standards or best practices.

**How did this change from before the MCC intervention to after? What evidence is there that MCC facilitated those changes (if relevant)?**

The evaluation team will assess the political and economic incentives at the baseline (2019) and the endline (2025 or 2026) to determine whether there were any changes before and after MCC's interventions. Changes in stakeholder interests and drivers of reform will be identified to determine

if MCC facilitated any of the changes through its efforts in establishing performance and community-based maintenance mechanisms in Niger.

## 6.2 LITERATURE REVIEW

### 6.2.1 Summary of Existing Data

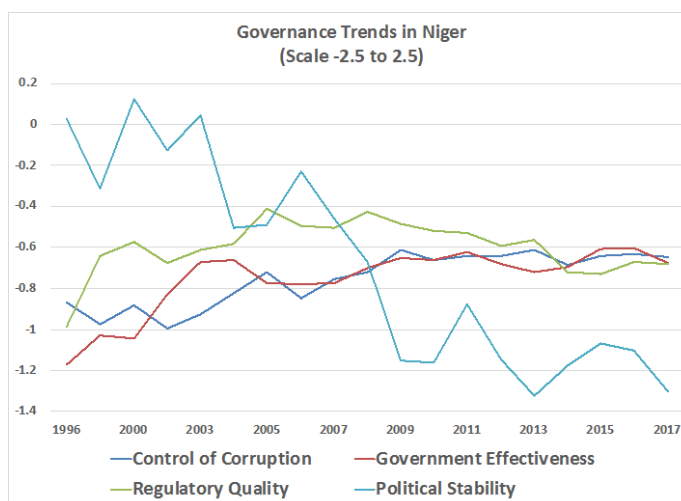
Niger's political environment is not conducive for inclusive development. Its competitive clientelistic political settlement has resulted in high levels of political instability. Such instability in the context of high levels of poverty causes politicians to focus on their short-term self-interest when they have access to state resources and mitigate against development of public goods and services needed for economic transformation. Poor governance in Niger has created and/or exacerbated multiple poverty traps in Niger, including:<sup>42, 43</sup>

- Intergenerational poverty;
- Poor health and education;
- Poor soil quality;
- Gender discrimination; and
- Weather shocks and climate change.

Governance trends in Niger are mixed. The country has made some progress in reducing corruption and improving government effectiveness over the past two decades as shown in **Figure VI.2** below. After making notable progress on improving regulatory quality in the late 1990s and early 2000s, much of those gains have eroded over the past decade. Most troubling is the sharp and continued decline in political stability. Along the same lines, the country currently rates 21 out of 178 countries on the Fragile States Index,<sup>44</sup> about the same as Kenya, Myanmar, and Pakistan.

**Figure VI.2 World Development Indicators Governance Trends in Niger (1996-2017)**

Source: World  
Development Indicators



Niger rates about average for sub-Saharan Africa for a range of the World Bank's Country Policy and Institutional Assessment (CPIA) sub-measures of institutional quality and in the Worldwide

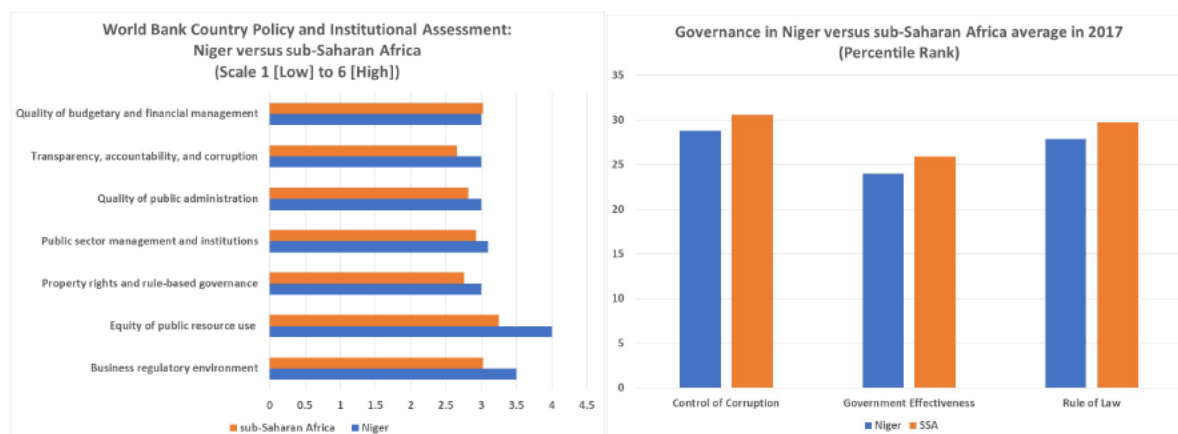
<sup>42</sup> Bertelsmann Stiftung (BTI), *Country Report – Niger*, Gütersloh, 2018.

<sup>43</sup> World Bank Group, *Republic of Niger-Systematic Country Diagnostic*.

<sup>44</sup> The Fund for Peace, *Fragile States index*, 2018.

Governance Indicators measures of Control of Corruption, Government Effectiveness, and Rule of Law. Its most notable weaknesses compared to its regional peers are the CPIA measures of Equity of Public Resource Use, the Business Regulatory Environment, and, to a lesser extent, Transparency, Accountability, and Corruption (see **Figure VI.3** below).

**Figure VI.3 World Bank Worldwide Governance and Development Indicators**

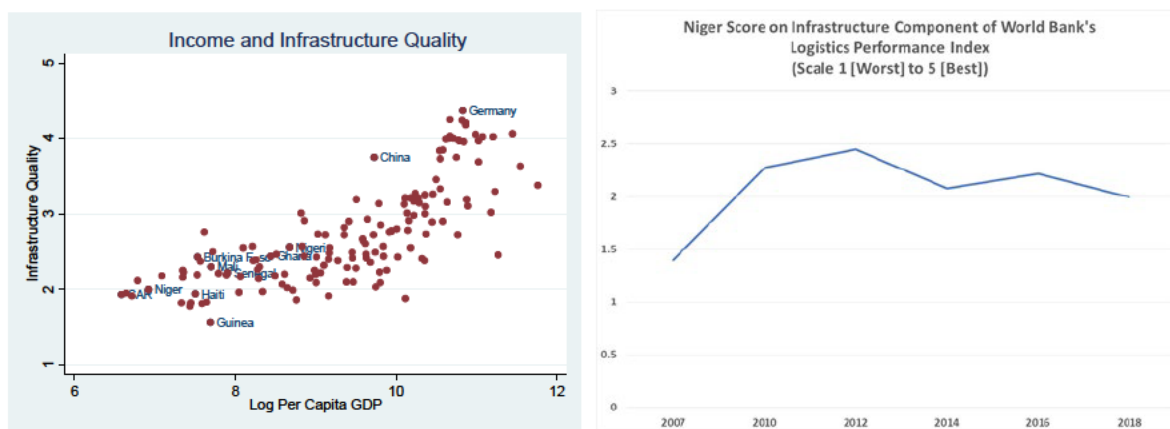


Source: World Bank Worldwide Governance Indicators

Source: World Bank World Development Indicators

While the quality of Niger's infrastructure is about average for its level of development, because it is one of the poorest countries in the world, its infrastructure quality is low and has been deteriorating for the past six years according to the World Bank's Logistics Performance Index (see **Figure VI.4** below).<sup>45</sup>

**Figure VI.4 World Bank Logistics Performance Index**



Source: World Bank Logistics Performance Index and World Development Indicators

Source: World Bank Logistics Performance Index

The European Union and the World Bank have invested in developing roads in Niger. The European Development Fund's 2014-2020 program in Niger is developing rural "road

<sup>45</sup> World Bank Group, *Logistics Performance Index*, 2018.



infrastructure to open up regions at risk of insecurity and conflict.”<sup>46</sup> The World Bank’s 2008-2016 Transport Sector Program Support Project aimed at reducing the backlog of maintenance, improving the quality of the road network, and strengthening key institutions in the road sector, such as its autonomous road fund CAFER (Caisse Autonome de Financement de l’Entretien Routier). The durability of these achievements is unclear, however. According to the Project Results Report:<sup>47</sup>

*Despite the achievements of the project in strengthening the financial and institutional base for road maintenance, the government has shown a chronic lack of commitment to cover the financing gap of the CAFER. The annual government budget always included a provision to increase the resources of the Road Fund; however, due to many pressures on the budget, the allocation when disbursed has always been lower than forecasted, and the releases of funds irregular and in arrears.*

CAFER tolls cover only about one-third of current maintenance budgets and current budgets are not sufficiently large to maintain new and rehabilitated roads. Even if the GON allocated sufficient funds for maintenance, rehabilitated roads may not lead to reductions in transport prices if the transport sector is not competitive and/or if overloading leads to rapid deterioration of road quality. Both have been problematic in Niger in the past, although the GON is making some efforts in controlling overloading over the past few years.<sup>48</sup>

### **Maintenance of Classified Roads**

Responsibility for the maintenance of classified roads lies with the MOE and is shared by the DGER (Direction Générale de l’Entretien Routier – General Directorate for Road Maintenance) and the DGGT (Direction Générale des Grands Travaux). The DGER is in charge of planning all maintenance and of the implementation of routine maintenance and delegates the implementation of periodic maintenance to the DGGT. Since 1999, all maintenance works are implemented by private sector contractors.

For the classified roads, funding is a serious problem and it is estimated that only 30 percent of the required budget is made available according to the IM. For example, the maintenance budget line voted in 2018 was 10 billion FCFA but only 2 billion FCFA was disbursed. The limited funds available are used for short urgent repair works on major issues or when a road is impassable. With the current funding, the GON is unable to fund any routine maintenance. Since there are no funds to do routine and periodic maintenance, the roads deteriorate over the years and need to be rehabilitated. The GON’s definition of periodic maintenance is closer to road rehabilitation.

### **Maintenance of Rural Roads**

Maintenance of rural roads is a shared responsibility between the DGRR (Direction Générale des Routes Rurales) and the local communities. A Strategy for Rural Roads (SNCCERR Stratégie Nationale de Conception, Construction et Entretien des Routes Rurales) has been adopted in 2008. The Strategy states that the local government authorities are the owners of the rural roads, and that the DGRR of the MOE is to provide technical assistance. Funding for maintenance comes from

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<sup>46</sup>[https://ec.europa.eu/europeaid/news-and-events/european-union-stepping-cooperation-niger\\_en](https://ec.europa.eu/europeaid/news-and-events/european-union-stepping-cooperation-niger_en)

<sup>47</sup> World Bank Group, *Project Results Report (PRR)*, IDA-H3780 IDA-52210, Washington, DC, 2016, p.9.

<sup>48</sup> Bove, Abel, Olivier Hartmann, Aiga Stokenberga, Vincent Vesin, and Yaya Yedan, *West and Central Africa Trucking Competitiveness*, Sub-Saharan Africa Transport Policy Program Working Paper 108, Washington, DC, 2018.

different sources: the general budget of the GON, the Road Fund, and the local communities (as financial or physical support).

In practice, rural roads have received assistance from development partners such as the Swiss and Luxemburg development cooperation that have assisted with rural road improvements, rehabilitation, and maintenance. The works are supervised by the Regional Directorates of DGRR, and in the case of the Sambera-Guitodo road, by the Regional Directorate of Dosso. The African Development Bank and the World Bank plans to improve 1,000 km of rural roads in the near future.

Funding of the maintenance of rural roads is also a serious problem: in theory the CAFER (Road Fund) should spend 10 percent of its maintenance budget on rural roads. However, in reality, none is spent on rural roads. The central government allocates a budget each year for rural roads. For example, 1.5 billion FCFA was allocated in 2018 but the actual expenditure was equal to zero. The local communities have very limited resources and many competing needs.

It is reported that the Swiss/Luxemburg donors program had some success in raising funds for roads with small taxes. For instance, they have reportedly a mini-budget for maintenance of rural roads in Gaya.

### **Reorganization of Road Maintenance**

Development partners are assisting the government with the reorganization of road maintenance sector. Three laws on road maintenance are currently being discussed in the parliament.

The first law is "Projet de Loi modifiant et complétant la Loi 2017-37 du 22 Mai 2017 portant création d'un établissement public de financement dénommé 'Fonds d'Entretien Routier' en abrégé 'FER'". This law will modify the previous law to create a second-generation road fund.

The second law is the "Projets de Textes portant création d'une 'Cellule Indépendante d'Audit Courant d'Entretien Routier' auprès du Premier Ministre". This law is to create a special internal audit unit, staffed with 5-6 people, under the Prime Minister's office. Its main task will be to ensure all the intended income accrues effectively to the Road Fund.

The third law is the "loi portant création d'un Etablissement Public à caractère Administratif, dénommé 'Agence de Maitrise d'Ouvrage Déléguée de l'Entretien Routier', en abrégé AMODER." This law will create an executing agency in charge of implementing the road maintenance.

### **Road Condition Database**

A roads database exists at DGR (Direction de la Gestion des Réseaux) within the DGER and was created in 1985 with the assistance of the IDA. The EU provides technical assistance to maintain the DGR database. Initially, DGR used the VIZIROAD software but recently (2010), they shifted to L2R software. The DGR uses a bump integrator on paved roads about every three years with the last measurements made in 2014 by the MOE. Every year a visual inspection and traffic counts are conducted. Both manual and automatic traffic count methods are used. For the automatic counts, a radar is used to distinguish between trucks and smaller vehicles. Recently, they finished a traffic count of RN7 and RN35 (2017), covering all types of vehicles on both roads at two points for RN35 at Margou and Kuka and one point for RN7 at Fara Kela, located 25 km from Dosso. LNBPT measures deflection using a Benkelman Beam with the last measurements made in 2013/14. A copy of the roads database has been provided to the evaluation team.

### 6.2.2 Gaps in Literature

There are very few governance, institutional, and political economy analyses of Niger that address road maintenance in detail. For example, BTI (2018) and World Bank (2017) note that road maintenance is problematic in Niger, but provide little information for the underlying causes, other than poverty and poor governance. Likewise, Bove, et al. (2018) and Dominguez-Torres and Foster (2011) provide useful overviews of Niger's infrastructure and its challenges in this area, but do not delve deeply into governance issues surrounding road maintenance.<sup>49</sup> While Dan Tani (2016) and World Bank (2016) provide useful details about CAFER, similar levels of detail for other aspects of road maintenance, that include planning, budgeting, and oversight, such as Public Investment Management analyses of road maintenance in Niger, do not exist.<sup>50</sup> Finally, the EU provides limited analysis of road maintenance challenges in Niger that inform its project in this area.<sup>51</sup>

### 6.2.3 Policy Relevance of the Evaluation Questions

Evaluation Questions 2A, 2B, and 2C complement each other to provide critical insights to the MCC and other donors working on the road sector or other infrastructure projects. The findings will help inform the critical maintenance assumptions that were often ignored in the past. In addition to examining the effect of MCC on improving its maintenance performance, the findings will also inform the political and economic structures that hinder (or assist) the reforms that many donors are trying to achieve as part of their infrastructure projects.

For Niger, in particular, Evaluation Area 2 findings will provide an updated analysis of GON's road maintenance reforms and clarify the role of MCC (or other donors) in providing incentives to advance those reforms. Overall, the results will contribute to inform the project design of road infrastructure investments for not only MCC but other donors.

## 6.3 EVALUATION METHODOLOGY – EVALUATION QUESTION 2A

### 6.3.1 General Methodology

The team will determine the maintenance needs based on a methodology that combines secondary sources providing information about the constructions designs to establish a concrete case based on local, regional and international standards, and use secondary and primary sources to establish the actual case. This will allow making a comparison between the actual case of road maintenance and the desirable theoretical situation based on the real maintenance needs.

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<sup>49</sup> Dominguez-Torres, Carolina and Vivien Foster. *Niger's Infrastructure: A Continental Perspective*. Washington DC: The World Bank.

<sup>50</sup> Dan Tani, Kabiroou. 2017. *Evolution du Peage Routier au Niger*. Niamey: Republique du Niger  
Ministere de L'equipement

<sup>51</sup> <https://dlca.logcluster.org/display/public/DLCA/2.3+Niger+Road+Network>

**Table VI.1 Primary Data Collection Summary Table for Evaluation Question 2A**

Data collection	Timing	Sample Unit/ Respondent	Sample Size	Relevant Instruments	Exposure Period
KIIs	11/2019 (baseline)	GON maintenance stakeholders	14	KII questionnaire	0 months
KIIs	06/2026 (endline)	GON maintenance stakeholders and maintenance contractors (if relevant)	18	KII questionnaire	41 months

### 6.3.2 Detailed Primary Data Collection Methodology – KIIs

#### 6.3.2.1 Baseline Data Collection

**Description of Methodology:** In addition to reviewing the secondary sources, the team will answer Evaluation Question 2A by developing a detailed set of questions, identifying key stakeholders to interview, and conducting key informant interviews (KIIs). The evaluation team will collect information to triangulate the information available on the secondary sources and to obtain additional information not available from the secondary sources. For instance, the team will ask questions on the decision-making process, such as the selection procedures and criteria for road maintenance and rehabilitation and the process for deciding the maintenance treatment that should be performed.

**Sample Units:** Key stakeholder organizations for road maintenance.

**Target Respondents:** Representatives from key stakeholder organizations for road maintenance.

**Sample Size and Assumptions:** Key stakeholders to be interviewed include relevant officials from the 1) DGER, 2) DGRR including their regional offices, 3) local governments, 4) CAFER, 5) the Ministry of Finance, 6) road maintenance contractors, and 7) donors active in the road sector (e.g., EU, World Bank, Swiss development cooperation, Luxembourg development cooperation, and AfDB). In total, around 14 interviews are expected to be completed.

**Sample Frame:** A list of key stakeholders relevant for the baseline will be drafted by the evaluation team.

**Sampling Strategy:** The interviews will be conducted with unique key informants for each organization and therefore sampling is not required.

**Instrument/Equipment:** The team will conduct semi-structured interviews with a fairly open framework which allow for focused, conversational, two-way communication. Semi-structured interviews ensure that consistent data is collected yet provide opportunities for an individual to offer their perspectives on the relative importance of any factor. The team will ask questions based on the evaluation questions described above and follow-up with relevant inquiries questions to obtain more specific information.

**Rounds and Timing:** The KIIs will be conducted in November 2019 and will coincide with one of the engineering data collection trips and interviews for addressing evaluation questions 2B and 2C to maximize the information gathered during interviews.

**Location:** Niamey or other locations in Niger depending on the interviews.

**Staffing:** The KIIs will be conducted by the evaluation team and no additional staffing is anticipated for this Evaluation area. The Team Leader/Road Maintenance Expert and the Political Economist will lead the data collection procedure to conduct KIIs with key stakeholders in Niger, supported by the In-Country Coordinator.

**Safety Procedures/Precautions:** N/A

**Data Quality:** The team will conduct KIIs in French and in English whenever possible. KIIs will be conducted by the Team Leader/Road Maintenance Expert, assisted by the In-Country Coordinator/Survey Manager. While the Team Leader/Road Maintenance Expert leads the interviews and takes notes, the In-Country Coordinator/Survey Manager will assist the interviews by taking notes that will be used to cross-reference with the notes taken by the Team Leader/Road Maintenance Expert. The notes will also capture non-verbal information (body language etc.).

**Data Processing:** All KIIs will be audio recorded on digital voice recorders and transcribed by the In-Country Coordinator/Survey Manager and reviewed by the Team Leader/Road Maintenance Expert as soon as possible after the interview. The In-Country Coordinator/Survey Manager will transcribe the audio recording into French, which will be then translated into English, and corrected by the Team Leader/Road Maintenance Expert.

**Data Analysis:** Based on the secondary data collected and the KIIs, the team will evaluate the GON's maintenance practices before the start of the construction works. Based on this assessment, the team will also determine the political economic analysis of the section (see section 6.3.3.2 for more information).

#### **6.3.2.2 Endline Data Collection**

**Description of Methodology:** The methodology for the endline KII will be the same as described above under the baseline data collection section other than the following sections that differ:

**Sample Size and Assumptions:** Key stakeholders to be interviewed include relevant officials from the 1) DGER, 2) DGRR including their regional offices, 3) AMODER (the new Road Agency which should be fully operational by endline data collection), 4) local governments, 5) FER, 6) the Ministry of Finance, 7) performance-based maintenance contractors (if successfully implemented), 8) community maintaining RRS (if successfully implemented), and 9) donors active in the road sector (e.g., EU, World Bank, Swiss development cooperation, Luxembourg development cooperation, and AfDB). In total, around 18 interviews are expected to be completed. However, as roads stakeholders develop, the evaluation team may update the list of specific interviewees to be interviewed.

**Sample Frame:** A list of key stakeholders relevant for the endline will be drafted by the evaluation team.

**Rounds and Timing:** The endline KIIs will be conducted in June 2016 to coincide with one of the engineering data collection trips and interviews for addressing Evaluation Questions 2B and 2C to maximize the information gathered during interviews.

**Data Analysis:** Based on the secondary data collected and the KIIs, the team will evaluate the maintenance completed on RN7, RN35, and RRS. Based on KIIs with RN7 and RN35 maintenance contracts, the evaluation team will determine their plans for performing periodic maintenance on the MCC-funded roads. Upon analyzing the impact of road maintenance reforms, the team will determine the likelihood that MCC's investment on the roads will remain adequately maintained



for the life of the investment. Based on this assessment, the team will also update the maintenance assumptions used in the HDM-4 model.

### **6.3.3 Detailed Secondary Data Collection Methodology**

#### **6.3.3.1 Baseline Data Collection**

**Description of Methodology:** The evaluation team will collect secondary data from various sources to address Evaluation Question 2A. The team will mainly collect the documents from the DGER, the DGRR, the CAFER, private contractors (medium and small-sized) in charge of maintenance, and the Ministry of Finance. The evaluation will attempt to obtain the following documents as available:

- Current laws, regulations, decrees on road maintenance
- Road maintenance policies and processes
- Records of road maintenance budget for classified and rural roads, distinguishing between routine, emergency and periodic maintenance
- Records of road maintenance expenditures for classified and rural roads, distinguishing between routine, emergency and periodic maintenance
- External assessments (by international donors etc.) on Niger's maintenance practices

Upon collecting the secondary sources, the team will examine the current road maintenance practices. This will allow the team to evaluate whether GON's institutional, financial, and technical aspects of the road maintenance sector are adequate in comparison to international standards. The maintenance budgets allocated and the actual expenditures will be reviewed to estimate whether adequate funds have been allotted and used for the routine, emergency, and periodic maintenance.

**Data Processing/Analysis:** When the team is unable to obtain relevant documents in English, the French document (or at least the executive summary or the relevant sections) will be translated for the purpose of the evaluation. Based on the secondary data collected and the qualitative data collected (details below), the team will evaluate current road maintenance practices of Niger.

#### **6.3.3.2 Endline Data Collection**

**Description of Methodology:** Depending on the implementation of maintenance reforms that are currently underway, the evaluation team will collect the documents from the DGER, the DGRR, the newly established FER, the AMODER (the new Road Agency which should be fully operational by endline data collection), performance-based maintenance contractors for RN7 and RN35, and the Ministry of Finance. The evaluation will attempt to obtain the following documents as available:

- Changes in laws, regulations, decrees on road maintenance
- Changes in road maintenance policies and processes
- Records of road maintenance budget for classified and rural roads, distinguishing between routine, emergency and periodic maintenance
- Records of road maintenance expenditures for classified and rural roads, distinguishing between routine, emergency and periodic maintenance
- Administrative records (including performance indicator results) on emergency and routine maintenance on RN7 and RN35 from performance-based contractors
- Administrative records on emergency and routine maintenance on RRS

- External assessments (by international donors etc.) on Niger's maintenance practices

The evaluation team will assess the implementation of road maintenance reforms by comparing the baseline and the endline data. This will allow the team to evaluate whether the reorganization of the sector is adequate in comparison to international standards where possible. The maintenance budgets allocated and the actual expenditures will be reviewed carefully to estimate whether adequate funds have been allotted and used for the routine, emergency, and periodic maintenance through the second-generation road fund.

The team will also review and assess the maintenance performed on MCC-funded roads. Administrative records on all routine and emergency maintenance completed by performance-based contractors for RN7 and RN35 will be reviewed for the adequacy and the quality of maintenance work completed. Assessing the performance indicator results, the team will verify that adequate service level has been maintained by the contractors. For the RRS, the team will identify all community-based maintenance performed on the road and determine the quality of maintenance completed.

**Data Processing/Analysis:** When the team is unable to obtain relevant documents in English, the French document (or at least the executive summary or the relevant sections) will be translated for the purpose of the evaluation. Based on the secondary data collected and the qualitative data collected (details below), the team will evaluate the maintenance works performed on the MCC-funded roads, analyze the impact of road maintenance reforms, and determine what the likelihood is that MCC's investment on the road will remain adequately maintained for the life of the investment. Based on this assessment, the team will also update the maintenance assumptions used in the HDM-4 model.

## **6.4 EVALUATION METHODOLOGY – EVALUATION QUESTION 2B**

### **6.4.1 General Methodology**

The evaluation team will use conduct KIIs and also use secondary data to determine MCC's effect on improving the road maintenance practices in Niger. Data collection for Evaluation Question 2B will overlap with the data collection required for Evaluation Question 2A. Therefore, the KIIs designed to inform Evaluation Question 2A will serve to inform also the Evaluation Question 2B.

### **6.4.2 Detailed Primary Data Collection Methodology – KIIs**

#### **6.4.2.1 Baseline Data Collection**

**Description of Methodology:** KIIs required to answer Evaluation Question 2A for the baseline are inclusive of interviews needed for Evaluation Question 2B. Therefore, no additional KIIs will be conducted for Evaluation Question 2B.

**Data Processing/Analysis:** Based on the KIIs conducted for Evaluation 2A, the team will examine Niger's current maintenance practices to depict a full picture of the pre-Compact situation allowing a comparison to be made after the endline data collection and to determine whether the Compact's activities improved Niger's maintenance practices.

#### **6.4.2.2 Endline Data Collection**

**Description of Methodology:** KIIs required to answer Evaluation Question 2A for the endline are inclusive of interviews needed for Evaluation Question 2B. Therefore, no additional KIIs will be conducted for Evaluation Question 2B.

**Data Processing/Analysis:** Based on the KIIs conducted for Evaluation 2A, the team will assess the effect of MCC's investments in improving maintenance practices. The structured questions will ask the respondents whether MCC's experience implementing performance-based and community-based maintenance influenced the GON's decision to expand (or not expand) similar mechanisms for other roads in Niger.

### **6.4.3 Detailed Secondary Data Collection Methodology**

#### **6.4.3.1 Baseline Data Collection**

**Description of Methodology:** Secondary data sources required to answer Evaluation Question 2A for the baseline are inclusive of documents needed for Evaluation Question 2B. Therefore, no additional secondary documents will be collected for Evaluation Question 2B.

**Data Processing/Analysis:** Based on the secondary data collected for Evaluation 2A, the team will examine Niger's current maintenance practices to depict a full picture of the pre-Compact situation allowing a comparison to be made after the endline data collection and to determine whether the Compact's activities improved Niger's maintenance practices.

#### **6.4.3.2 Endline Data Collection**

**Description of Methodology:** Secondary data sources required to answer Evaluation Question 2A for the endline are inclusive of documents needed for Evaluation Question 2B. Therefore, no additional secondary documents will be collected for Evaluation Question 2B.

**Data Processing/Analysis:** Based on the secondary data collected for Evaluation 2A, the team will examine the implementation of performance-based maintenance contracts for RN7 and RN35 to determine the impact of MCC's investment in Niger's maintenance practices. The evaluation team will assess if the performance-based maintenance contractors maintained the minimum road performance indicators and service level of roads that address the preventative, routine, and periodic maintenance of the RN7 and RN35. For the RRS, the team will examine whether the community maintained the service level of RRS as initially anticipated by MCC. Comparing the analysis with the baseline assessment, the evaluation team will identify any major policy changes associated with MCC's efforts in improving road maintenance at large and examine whether MCC's investments served as an incentive to improve Niger's overall road maintenance practices. In particular, the evaluation team will assess whether the GON extended the performance-based maintenance system to the whole classified road network of the country and the community-based maintenance system to all the rural roads of the country's network.

## **6.5 EVALUATION METHODOLOGY – EVALUATION QUESTION 2C**

### **6.5.1 General Methodology**

The evaluation team will conduct KIIs and also use secondary data to address Evaluation Question 2C. Similar to question 2B, the data collection for Evaluation Question 2C will overlap with the data collection required for Evaluation Question 2A and 2B. Therefore, the KIIs designed to

inform Evaluation Question 2A and 2B will also serve to inform the Evaluation Question 2C. Only a minimum number of additional KIIs will be reviewed for Evaluation Question 2C.

**Table VI.2 Primary Data Collection Summary Table for Evaluation Question 2C**

Data collection	Timing	Sample Unit/ Respondent	Sample Size	Relevant Instruments	Exposure Period
KIIs	11/2019 (baseline)	Transport operators, transport associations	5	KII questionnaire	0 months
KIIs	06/2026 (endline)	Transport operators, transport associations	5	KII questionnaire	41 months

### 6.5.2 Detailed Primary Data Collection Methodology – KIIs

#### 6.5.2.1 Baseline Data Collection

**Description of Methodology:** Building on the secondary document review conducted to answer Evaluation Question 2A and 2B, the evaluation team will conduct KIIs to identify political and economic incentives shaping road maintenance decisions in Niger. Interviews will aim to examine the extent to which actual processes for road maintenance diverged from the formal ones outlined in Niger’s laws and regulations.

**Sample Units:** Transport operator and transport association.

**Target Respondents:** Representatives from transport operators and transport associations.

**Sample Size and Assumptions:** Key stakeholders to be interviewed specifically for Evaluation Question 2C includes 1) transport operators and 2) transport associations.

**Sample Frame:** A list of transport operators and transport associations will be drafted by the In-Country Coordinator/Survey Manager.

**Sampling Strategy:** The interviews will be conducted with randomly selected representatives of each target respondent group based on the size of their operations.

**Instrument/Equipment:** The team will conduct semi-structured interviews, a fairly open framework which allow for focused, conversational, two-way communication. Semi-structured interviews ensure that consistent data is collected yet provide opportunities for an individual to offer their perspectives on the relative importance of any factor. The team will ask questions based on the evaluation questions described above and follow-up with relevant inquiries questions to obtain more specific information to fully understand the political and economic incentives influencing Niger’s actual maintenance practices.

**Rounds and Timing:** The data collection will coincide with those of Evaluation Question 2A and Evaluation Question 2B (November 2019) to maximize the information gathered during interviews.

**Location:** Niamey or other locations in Niger depending on the interviews.

**Staffing:** The KIIs will be conducted by the evaluation team and no additional staffing is anticipated for this Evaluation area. The Team Leader/Road Maintenance Expert and the Political

Economist will lead the data collection procedure to conduct KIIs with key stakeholders in Niger, supported by the In-Country Coordinator.

**Safety Procedures/Precautions:** N/A

**Data Quality:** The team will conduct KIIs in French and in English whenever possible. KIIs will be conducted by the Political Economist, assisted by the In-Country Coordinator/Survey Manager. While the Political Economist leads the interviews and takes notes, the In-Country Coordinator/Survey Manager will assist the interviews by taking notes that will be used to cross-reference with the notes taken by the Political Economist. The notes will also capture non-verbal information (body language etc.).

**Data Processing:** All KIIs will be audio recorded on digital voice recorders and transcribed by the In-Country Coordinator/Survey Manager and reviewed by the Political Economist as soon as possible after the interview. The In-Country Coordinator/Survey Manager will transcribe the audio recording into French, which will be then translated into English, and corrected by the Political Economist.

**Data Analysis:** The team will employ the approach outlined in USAID's 2018 Applied Political Economy Analysis Guide for Practitioners,<sup>52</sup> focusing on foundational factors, rules of the game, the here and now, and dynamics:

1. Foundational Factors: Foundational factors, for the most part, are conditions that affect the overall development environment for road maintenance but can change only slowly if at all, such as geography, resource endowments, and population structure. For Niger, these would include its low population density, high levels of poverty, and difficult climatic conditions. High levels of poverty, for example, limit the capacity of the government to raise domestic revenue for road maintenance. Furthermore, low population density results in higher per capita road maintenance costs compared to countries with higher population densities.
2. Rules of The Game: Rules of the game include formal laws and regulations and less formalized customs and norms that influence the behavior of individuals in the public and private sectors. They define the context in which actors, such as government officials, private sector firms, and civil society organizations, operate. Understanding the relationship between formal and informal institutions is essential for understanding opportunities and obstacles to reform. Is the relationship complementary, substituting, accommodating, or competing? Many projects and programs have foundered by failing to understand the relationship between formal institutions and informal norms.
3. The Here and Now: The here and now is an analysis of how important recent events affect constraints and opportunities for improvements in road maintenance. The key issues and questions on the here and now include:
  - Significant recent events and how they affect rules, norms, and decision-making;
  - The distribution of economic and political power;
  - Stability of the current governing coalition;
  - Dominant ideologies and beliefs and main political parties; and

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<sup>52</sup> USAID. 2018. *Thinking and Working Politically Through Applied Political Economy Analysis*. Washington, DC: USAID.



- Development processes and progress
4. **Dynamics:** Dynamics focus on recent trends (e.g., recent elections, economic shocks) and how they may affect the distribution of political power and/or ability and willingness of the government to implement needed reforms. To the extent possible, dynamics also attempt to explicate potential scenarios (e.g., stable government, early elections, changes in economic conditions) that may impact road maintenance.

#### 6.5.2.2 Endline Data Collection

The methodology for the endline data collection will be the same as described above under the baseline data collection section other than the following sections that differ:

**Rounds and Timing:** The endline KIIs will be conducted in July 2026 to coincide with one of the engineering data collection trips and interviews for addressing Evaluation Questions 2A and 2B to maximize the information gathered during interviews.

## 6.6 CHALLENGES

### 6.6.1 Limitations of Interpretation of the Results or Risks to the Study Design

The interviews conducted by the team may be influenced by response bias. The stakeholders often have a strong incentive to hide their nefarious activities, such as corruption. Similarly, stakeholders may be biased to answer in a certain way for social or political incentives. Consequently, the team is likely to encounter difficulties in probing and understanding these issues, as well as ascertaining the true interests of the people engaged in such activities. For example, determining that a government agency colluded with a private firm to win certain bids requires documentation of their activities. Such evidence is often difficult, if not dangerous, to obtain. Similarly, if not explained fully prior to the interviews, the Niger government staffs may want to provide positive results from the Compact to justify further investments from MCC.

Particularly for the political economy analysis, understanding an issue does not imply that MCC (or any other external partner) can influence it. For example, if tolerance for corruption at high levels of government is part of a country's elite settlement or social polarization has deep historical roots, it will likely prove challenging for external development partners to fully ameliorate these problems. A political economy analysis cannot necessarily provide solutions to weaknesses in governance or resolve political/social tensions in a country.

While political economy analysis can provide insight into decision making processes around key issues in a country, it cannot promise a single, objective account of all problems. In many cases, especially in countries that have deep political or social cleavages, there may not be a single, objective truth to uncover. Rather, there may be multiple versions of the truth by various stakeholders. Political economy analysis can document these competing claims but may not be able to adjudicate them. Even when it can do the latter, that does not mean it is possible to change perceptions among parties to a conflict.

Secondary data sources and KIIs will be essential for answering Evaluation Questions 2A, 2B, and 2C. There is a risk that these documents may not be available to the evaluation team due to delay in locating the documents, loss of past records, or unwillingness of the stakeholders to share sensitive information. Even when the documents are available to the team, the documents may be an inaccurate representation of the actual practice.

An additional risk is gathering accurate information from KIIs that we cannot corroborate with data and/or documents. Interviewees may have biases and/or incentives to skew the information they provide to us. To minimize against these risks, we will interview all relevant institutional and political economy stakeholders for road maintenance in order to validate the information from multiple perspectives.

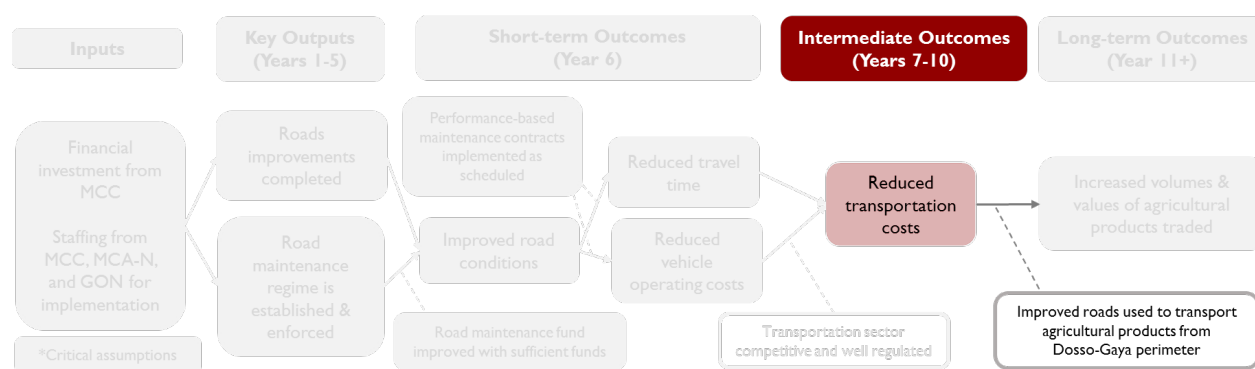
## VII. EVALUATION DESIGN – EVALUATION AREA 3: ROAD USAGE PATTERNS

### 7.1 EVALUATION QUESTIONS

- 3) Have road usage patterns changed, in terms of who is traveling along the improved roads, why, what are they transporting, what they are paying for transport, and how long it takes to move along key routes?

Assuming that road improvements will reduce VOC and time travelled, Evaluation Area 3 will be testing if the improved MCC-funded roads are used to transport agricultural products from Dosso-Gaya perimeter.

Figure VII.1 Activity Logic Model and the Focus of Evaluation Area 3



This evaluation question addresses the impact of the rehabilitation on the road user. This evaluation question will help confirm/validate the identity of the main beneficiaries of the projects (who is travelling on the road, what are they transporting). Moreover, the question addresses why the beneficiaries are travelling, which will be an important input for the HDM-4/RED analysis in Evaluation Area 1 by generating before and after data on road usage. The evaluation will estimate the distribution of benefits by: i) measuring to what extent road users are local (from the irrigation perimeter) vs. thru-traffic; ii) how costs (monetary and time) have changed; iii) changes in the value of freight being transported.

### 7.2 LITERATURE REVIEW

#### 7.2.1 Summary of Existing Evidence

Historic traffic count data from the DGR is available for roads in Niger, including the Compact roads - RN7, RN35 and RRS. The variables include year collected, count station location, length of section, total count, AADT, and percentage of heavy trucks (poids lourds).<sup>53</sup> Data is available on the total length of roads (all types – routes nationales, routes rurales, and pistes sommaires) by province (see Section 5.2.1 for more information on existing traffic data).

<sup>53</sup> Synthèse comptage Automatique 30 RN

### 7.2.2 Gaps in Literature

The academic and empirical literature exploring the effects of infrastructure investments and income growth, productivity and welfare is vast. However, while there is broad agreement that infrastructure is good for growth, there is much less consensus on the effect size and on the contributing factors.<sup>54</sup>

Road rehabilitation is a subset of infrastructure improvements (and within that sector a subset of road construction). Although the case linking rehabilitated roads to improved living standards may seem straightforward, findings on distributive impacts remain ambiguous. While studies of impacts of rural road development have generally found that they can lead to improvements in household income and access to services and markets,<sup>55</sup> strong positive correlations between improvements in roads and improvements in living standards are case-specific. A study on road rehabilitation in the Democratic Republic of Congo even found the effects of road investments on market access for agriculture to be minimal, given the dispersed rural population – which would need feeder roads – and their focus on facilitating transport between mining towns.<sup>56</sup>

The nature and degree of benefits derived from road rehabilitation are often indirect and depend on multiple factors, such as differences between before and after-conditions, land quality in surrounding areas, levels of motorization,<sup>57</sup> strategic location,<sup>58</sup> maintenance, etc. As Nair and Kumar (2006) put it “rural roads are a necessary condition, but not a sufficient condition for rural and overall economic development.”<sup>59</sup>

Because effects are influenced by various existing conditions and investments beyond road infrastructure, distribution of impacts is not necessarily spread evenly. From an equity perspective, much seems to depend on the access to services and markets that the rehabilitated roads provide by poorer populations, although little systemic analysis has been conducted on this issue.<sup>60</sup> Khandker and Koolwal found that rehabilitating rural roads in Bangladesh increased non-agricultural wage employment among target households.<sup>61</sup> On the other hand, a 2002 study found that the benefits of providing better road access to markets in Nepal were not large enough or targeted efficiently enough to greatly reduce poverty and income inequality.<sup>62</sup> Parada finds that even after many years of investments in road rehabilitation by donors, evidence is limited on the

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<sup>54</sup> Calderon, C. & L. Servén. (2014). Infrastructure, Growth, and Inequality: An Overview. World Bank Group. Working Paper 7034.

<sup>55</sup> Iimi, A. et al. (2015). Social and Economic Impacts of Rural Road Improvements in the State of Tocantins, Brazil. Policy Research Working Paper 7249. World Bank Group.

<sup>56</sup> J. Ulimwengu, J. Funes, D. Heady, and L. You, (2009). The Impact of Transport Infrastructure on Agricultural Production and Poverty Reduction in the Democratic Republic of Congo. IFPRI Discussion Paper 944: pp. 1-52

<sup>57</sup> Escobal, Javier and Carmen Ponce. 2002. “The Benefits of Rural Roads: Enhancing Income Opportunities for the Rural Poor.” GRADE Working Paper 40.

<sup>58</sup> Shrestha, S. A. (2012). Access to the North-South roads and farm profits in rural Nepal. Working Paper.

<sup>59</sup> Nair, G. G. & A. Kumar. (2006). Impact of Roads on Rural Agriculture Economy: Evidences [sic] from Tamil Nadu, *Indian Journal of Agricultural Economics* 61(3), July-Sept. 2006, p. 460.

<sup>60</sup> Calderon, C. & L. Servén. (2014). Infrastructure, Growth, and Inequality: An Overview. World Bank Group. Working Paper 7034.

<sup>61</sup> Khandker, S.R., & G.B. Koolwal (2010) “How Infrastructure and Financial Institutions Affect Rural Income and Poverty: Evidence from Bangladesh.” *The Journal of Development Studies* 46(6), 1109-1137.

<sup>62</sup> Jacoby, H. (2000). Access to markets and the benefits of rural roads. *The Economic Journal*, 110(465), 713–737 in Parada, J. (2016). Access to modern markets and the impacts of rural road rehabilitation: Evidence from Nicaragua

heterogeneous distribution of benefits or about how much they reduce transport costs, generate new market activity, and affect input and output prices.<sup>63</sup>

In conclusion, this brief overview of the literature suggests that while the RMA project is likely to boost welfare, the share and the size of the benefits accruing to populations in the influence area cannot be easily estimated. It will be subject in particular to how likely rural residents are to change their usage of the rehabilitated roads in the short- and long-term.

Finally, it is important to bear in mind that the RMA project is not primarily a rural roads story. In the influence area, only one, sparsely traveled rural road (Sambere) is slated for rehabilitation. RN7 and RN35 are national roads and thus used heavily by thru-traffic. Therefore, economic impacts on the influence area is likely to be determined, in part, by what percentage of goods transported along the RN7 and RN35 is local (in origin or destination or both).

The distribution of impacts (within or beyond the influence area) may therefore depend on i) the share of goods being transported (commodities and inputs) having local origin or destination; ii) the concentration vs. openness to competition of the transportation market, which will influence the cost of transporting goods; iii) the degree to which the newly rehabilitated roads have influence on access to markets and services for the local population living nearby; and iv) complementary investments (of which the irrigation perimeter project is one).

### **7.2.3 Policy Relevance of the Evaluation**

O-D surveys and traffic counts are useful for quantifying the effects of investment on road usage and benefits to users. They inform the cost-benefit analysis and rate of return on investment, which will enable us to estimate economic impacts of the RMA Activity, how the benefits are distributed, as well as fiscal impacts (through user fees). By comparing baseline and endline data on usage, volume of goods and passengers transported, changes in traffic patterns, etc., the analysis will indicate whether and to what degree the project reached its goals. The findings will, in turn, help inform the Government of Niger, other countries, and MCC on the wisdom of implementing similar projects. The findings will also point to factors which contributed toward or, conversely, detracted from the desired outcomes.

## **7.3 EVALUATION METHODOLOGY**

### **7.3.1 General Methodology**

The evaluation team will use the data collected under Evaluation Area 1 to inform Evaluation Question 3. Mainly, secondary sources for the baseline, the MTC, and the O-D surveys will be used to inform the evaluation question and no additional primary data will be collected.

### **7.3.2 Detailed Primary Data Collection Methodology – Traffic Count Survey**

#### **7.3.2.1 Baseline Data Collection**

The traffic count will be used to determine the number of road users on the MCC-funded roads and their respective vehicle type before the road rehabilitation begins. Vehicles are classified as: heavy trucks (poids lourds), light vehicles (véhicule léger) and two-wheeled (deux roues)

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<sup>63</sup> Parada, J. (2016). Access to modern markets and the impacts of rural road rehabilitation: Evidence from Nicaragua

A separate data collection is not required to address Evaluation Question 3 because the evaluation team will review the data available from MCA-N design consultants (see Section 5.2.3.1 for more information).

### **7.3.2.2 Endline Data Collection**

By comparing the traffic count information from the design consultants and the new traffic count data from July 2026 and November 2026, the evaluation team will estimate the change in the number of road users and their respective vehicle type. A separate data collection is not required to address Evaluation Question 3 because the evaluation team will conduct a traffic count at the endline as part of Evaluation Area 1 (see Section 5.3.2.2 for more information).

## **7.3.3 Detailed Primary Data Collection – Origin-Destination Survey**

### **7.3.3.1 Baseline Data Collection**

An expanded O-D survey will be used to determine who is travelling along the improved roads, why, what they are transporting, and what they are paying for transport, and how long it takes to move along key routes. In order to determine divertible traffic from other roads, the O-D survey will be conducted on RN 1, where it is possible for road users to use RN7 or RN35 to reach Gaya and beyond. With regard to generated traffic, independent variables include increases in agricultural production and livestock raising. AIC Progetti has estimated the traffic generation linked to the programmed increase of agriculture output, although the calculation is rough and will need to be revised since traffic will not depend on total increases of agriculture output but only on the share sold on markets. Furthermore, AIC Progetti's calculation is missing the traffic volume generated by the supply of agricultural inputs (seeds, fertilizers, pesticides etc.) which are needed to increase the production. The share of inputs (in terms of tonnage) is usually estimated at 15-20 percent of total agricultural output.

A separate data collection is not required to address Evaluation Question 3 because the evaluation team will conduct an O-D survey as part of Evaluation Area 1 (see Section 5.3.3.2 for more information).

### **7.3.3.2 Endline Data Collection**

An expanded O-D survey will be used to determine the changes between the baseline and the endline. The questionnaire will ask road users to comment on who is travelling along the improved roads, why, what they are transporting, and what they are paying for transport, and how long it takes to move along key routes. A separate data collection is not required to address Evaluation Question 3 because the evaluation team will conduct an O-D survey as part of Evaluation Area 1 (see Section 5.2.4.2 for more information). As discussed under Section 5.2.4.2, additional questions will be included in the questionnaire to assess the road users' choices for selecting MCC-funded roads.

## **7.4 CHALLENGES**

### **7.4.1 Limitations of Interpretation of the Results or Risks to the Study Design**

Road user study results are dependent upon the quality of the data. Therefore, the O-D surveys must be a representative sample and the collected data must be carefully processed and analyzed. A potential risk is that sampling may be biased given that the baseline survey of traffic on RN35



and RRS will be extremely sparse. If the sample is very small, it may not be representative of all types of road users, or be difficult to do sub-group analysis by origin and destination.

To be cost-effective in its data collection, the evaluation team will use the traffic count data collected by the MCA-Niger design consultants. However, there is a risk that the data collected by the APD consultants may not be available to the evaluation team in a timely manner, limiting the team's ability to plan for its baseline data collection accordingly. Delay in design consultant's data collection and/or MCC's review of the data collected could potentially prevent the evaluation team from collecting the necessary baseline data before the rehabilitation begins. Also, if the data collected by APD is insufficient to serve as the baseline for the evaluation (not capturing market days for the traffic counts, for example), the evaluation team may need to collect baseline data in a short amount of time before the road work starts. Therefore, the evaluation team believes that it is important to be in communication with MCA-N regarding the APD consultants' progress on data collection and their methodologies.

## VIII. EVALUATION DESIGN – EVALUATION AREA 4: TRANSPORTATION MARKET STRUCTURE

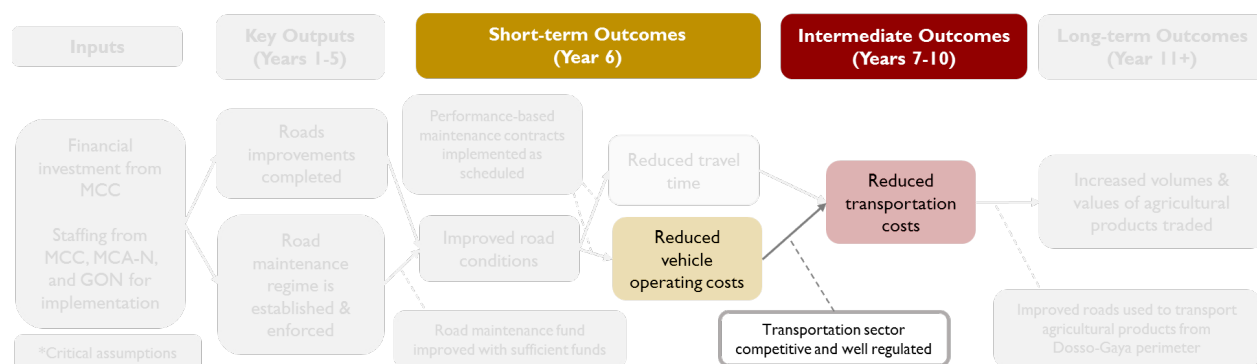
### 8.1 EVALUATION QUESTIONS

- 4) How is the transportation market structured and what is the likelihood that VOC savings will be passed on to consumers of transportation services? Did this change from before the MCC intervention to after? If yes, what caused the changes?

The Compact’s objective is to “increase rural incomes by improving the sustainable productive use of natural resources for agricultural production and improving trade and market access for agricultural products.”<sup>64</sup> The VOC savings may contribute to the increase of rural incomes if transferred to transportation prices that therefore would allow for a commensurate increase of farm-gate prices of agricultural produce.

The transfer on road users of benefits stemming from VOC savings is possible but needs to be assessed in quantitative terms and time taken by transport market for prices’ adjustment. Evaluation Area 4 will be testing whether the reduced vehicle operating costs lead to reduced transportation costs as shown in **Figure VIII.1** below.

**Figure VIII.1 Activity Logic Model and the Focus of Evaluation Area 4**



The evaluation team will evaluate Niger’s transportation market to understand whether the market is competitive and well regulated. Understanding the market structure will allow the team to understand whether the transportation sector is structured to allow the transfer of VOC savings to the transport consumers. Baseline and endline data collection will allow a comparison over time and an analysis of the causes behind the changes.

### 8.2 LITERATURE REVIEW

#### 8.2.1 Summary of Existing Evidence

##### Freight Sharing Rules

<sup>64</sup> Millennium Challenge Corporation, *Millennium Challenge Compact between the United States of America acting through the Millennium Challenge Corporation and the Republic of Niger acting through the Ministry in charge of Foreign Affairs and Cooperation*, 2016, p.1.

The ECOWAS (Economic Community of West African States) Inter-State Road Transportation Convention (No. A/P2/82) allows pairs of member states to conclude bilateral treaties setting quotas of freights passing through a coastal country and destined to a landlocked country. Quotas are specified in terms of percentages of freight assigned to the truckers of each of the two countries. Several such bilateral treaties exist and usually divide imported goods into strategic goods and nonstrategic goods. Strategic goods are completely allocated to the landlocked country. Whereas, two thirds of nonstrategic goods are allocated to the landlocked country and one third to the coastal country.

### **Queuing Systems**

The quota system may operate in a port to allocate freight by country of truck registration. A type of queuing system may be used to allocate freight to trucks registered to each country. Transporters' associations (not shippers' councils) implement these queuing systems in the ports. The associations register each truck upon arrival and supervise its loading according to a first in-first out (FIFO or *tour de rôle*) rule whereby each driver registers with his/her transport association on arrival, joins the back of the queue, and waits his/her turn.

### **Third Country Rule, Cabotage, and Backhaul Regulations**

Third-country transport is when a trucker from a third country transports freight between two other countries. Cabotage is when a trucker from another country picks up and transports freight to domestic destinations. To protect the domestic trucking industry, some regulations limit which truckers shippers can be used. Although these regulations could be changed in the context of bilateral or multilateral treaties, the norm in West Africa is for third country trucking and cabotage to be banned (e.g., zero quota). This protectionist allocation of freight lowers the average efficiency of north-south road haulage along that corridor.

### **Axle Load Limits**

To limit road damage, Union Economique et Monetaire Ouest Africaine (UEMOA) issued an axle-load control directive that sets a limit of 11.5 tons/axle.<sup>65</sup> Niger had introduced in 2010 more complete controls. However, the regional harmonization process is not yet completed.

### **Border Crossings**

Duplication of procedures and paperwork at border crossings, and their different operating hours, contribute to transit delays. To improve border crossing efficiency, and building on the recommendations of WCO SAFE Framework, ECOWAS and UEMOA are establishing one-stop border posts.

### **Roadblocks and Checkpoints**

All major international corridors in West Africa have roadblocks where formal and informal payments are collected, causing delays and raising transit costs. While a relatively small percentage (5 percent on average) of total transport costs and times, they add up and reduce the competitiveness of West African businesses

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<sup>65</sup> Règlement n°14/2005/cm/UEMOA relatif à l'harmonisation des normes et des procédures du contrôle du gabarit, du poids, et de la charge à l'essieu des véhicules lourds de transport de marchandises dans les états membres de l'Union Economique Et Monetaire Ouest Africaine (UEMOA)

## **Transit Agreements**

To facilitate transit, the UEMOA TRIE agreement allows goods to be transported by road with all customs-enforced duties, taxes, and restrictions suspended under cover of a single document—the State Road Transit Declaration, or Le Carnet TRIE—without requiring unloading.

## **Road Transport Pricing**

Transport prices are determined in a variety of ways, most common are:

- Where there is no allocation of freight, the free market can determine a price, usually with respect to an indicative price used by trucking associations.
- Shippers in niche markets and freight forwarders for imports with direct bills of lading can arrange contracts with truckers, usually through a bidding process to determine the lowest price. This applies primarily to larger truckers in the formal sector and to markets where there is more competition among trucking companies.
- For imports without a direct bill of lading, indicative prices are fixed by collective bargaining between importers and transporters represented by their respective associations.
- Where control of freight allocation is strict, such as in corridors serving Niger, pressure from a coalition of transporters and shippers drives up prices.
- Cartel actions by landlocked country's truckers and trucking associations make prices for shipping strategic goods higher.

## **Transport Market**

Information on Nigerien transport market structure is not readily available. Some analyses have been made at the West African regional level that include information on Niger among others. Two studies are worth citing including: a report “Impact of Road Transport Industry Liberalization in West Africa”<sup>66</sup> prepared for USAID, and a World Bank report “Transport Prices and Costs in Africa”.<sup>67</sup>

Niger's transport market is composed of two separate structures: the goods transport and the passengers transport. The goods' transport market is divided in two sub-sectors: the professional transporters and the medium/small informal transporters. Professional transporters offer long-haul national and international services. Large size cargoes which require heavy trucks for transport or “groupage” (freight bundling) is also practiced. Transportation demand in rural areas is serviced less due to smaller size of cargoes on average. The willingness for all parties to overload trucks to maximize profits does not favor containers, because their fixed maximum capacity prevents overloading. As a result, containerization rates remain low.

Professional transporters in Niger are well organized in accredited associations. These associations communicate issues related to roads' condition and controls to relevant authorities, as well as recommendations on how to improve their services. From the evaluation team's first trip to Niger, transporters provided the average fare for long-haul transportation (40-50 FCFA per t.km). A detailed breakdown of trucks' operation costs has been requested along with statistics on transported tonnages.

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<sup>66</sup> USAID, Nathan Associates, *Impact of Road Transport Industry Liberalization in West Africa*, 2012.

<sup>67</sup> World Bank, *Transport Prices and Costs in Africa*, 2009.

Competition is improving and a telematic transportation services exchange is being organized, which is aimed at improving the transportation market's efficiency.

Information on the sub-sector of medium-small informal goods' transporters is also limited. This is not surprising given that the sub-sector is fragmented and is not grouped in accredited associations. Services offered meet rural demands and take advantage of the latent potential of agriculture and livestock raising. However, the activity of this sub-sector is constrained by the bad conditions of rural roads.

### **Passenger Transport Market**

The passenger transport market is divided in two sub-sectors: the professional transporters offering scheduled services through large buses, and informal transporters providing unscheduled services to rural and urban destinations. Professional passenger transporters are organized in an association which discusses the legal and economic aspects of the sub-sector with its relevant authorities. In addition, the president of passenger transportation association provided information on current fares, which is to be confirmed by the evaluation team. The informal passenger transport sub sector is unorganized, and information is limited on its structural and economic aspects.

#### **8.2.2 Gaps in Literature**

There are several analyses of the transportation market in Niger and West Africa. Among them, the World Bank report, *Le prix et le coût du transport en Afrique*<sup>68</sup>, is the most documented analysis and provides a comprehensive discussion and quantitative analyses on the various factors determining the poor performance of the sector. The report highlights that the following three constraints put at risk the economic efficiency of the transportation markets: 1) quota systems, 2) the market cartels, and 3) bad condition of roads. More recent analyses have led to substantially similar conclusions (USAID, Nathan Associates, Impact of Road Transport Industry Liberalization in West Africa, 2012.)

However, there is limited evidence to understand how the improvement in road condition will impact the transportation costs in light of the transportation market structure. For instance, the USAID report empirically examines the reduction in transport costs when there are reforms in axle load controls, elimination of quotas, queuing, and the ban on freight transport in one country by truckers from another country, subsidies for truck fleet modernization, and major reductions in en route checkpoints and border transit times. However, the reduction in transportation costs resulting from improvement in road condition is not examined in the literature.

#### **8.2.3 Policy Relevance of the Evaluation Question**

Findings from Evaluation Question 4 will provide nuanced assessment of who actually benefits from road infrastructure improvements and how. While it is easy to assume that the reduction in VOC will increase income for vehicle owners, the findings for this question will address how the transport service consumers benefit from the road improvements. This is especially important for countries where vehicle ownership is lower and where transportation of goods is a major usage of road infrastructure.

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<sup>68</sup> World Bank, Supee Teravaninthorn et Gaël Raballand, *Le prix et le coût du transport en Afrique*, 2009.

## 8.3 EVALUATION DESIGN

### 8.3.1 General Methodology

The evaluation team will analyze the transportation market structure and the formal and informal institutions that regulate and govern the transportation market. To answer Evaluation Question 4, the evaluation team will:

- analyze the regulatory framework of the sector and will assess the gap between enacted and actually enforced regulations;
- analyze the structure and composition of transportation cost;
- identify the modalities of pricing of transportation services.

The above analyses will be based on available secondary sources complemented by KIIs to acquire updated information on the following:

- Industry structure, types of operators, average vehicle fleet, number of vehicles owned;
- Transportation service prices;
- Operating practices;
- Regulatory policies and actual enforcement of regulations.

**Table VIII.1 Primary Data Collection Summary Table for Evaluation Question 4**

Data collection	Timing	Sample Unit/ Respondent	Sample Size	Relevant Instruments	Exposure Period
KIIs	11/2019 (baseline)	transporter associations, public transport associations, goods transporters, and relevant officials from the MOE	12	KII questionnaire	0 months
KIIs	06/2026 (endline)	transporter associations, public transport associations, goods transporters, and relevant officials from the MOE	12	KII questionnaire	41 months

### 8.3.2 Detailed Primary Data Collection Methodology – KIIs

#### 8.3.2.1 Baseline Data Collection

**Description of Methodology:** The evaluation team will analyze the transportation market structure and the formal and informal institutions that regulate and govern the transportation market. To close the information gap on the current and future condition of formal and informal transporters, the evaluation will conduct KIIs and determine the structure and economics of the transport sector and the following details:

- Industry structure, types of operators, average vehicle fleet, number of vehicles owned
- Operating practices such as:
  - Cultural factors affecting the service providers and users
  - Acquisition of modern vehicles



- Maintenance of vehicles
- Overloading
- Informal payments
- Regulatory policies and enforcement such as:
  - Freight sharing rules
  - Queuing systems
  - Third country rule, cabotage, and backhaul regulations
  - Axle load limits
  - Border crossings
  - Roadblocks and checkpoints
  - Transit agreements
  - Domestic transport regulations

**Sample Units:** Key stakeholder organizations in transportation market.

**Target Respondents:** Representatives from key stakeholder organizations in transportation market.

**Sample Size and Assumptions:** Key stakeholders to be interviewed include 1) transporter associations, 2) public transport associations, 3) relevant officials from the MOE that regulate the sector, and 4) goods transporters. In total, around 12 interviews are expected to be completed with three (3) interviews per target respondent group.

**Sample Frame:** A list of key stakeholders relevant for the baseline will be drafted by the evaluation team. For the goods transporters, the evaluation team will compile a list of transporters that operate (or have the potential to operate) using the RMA Activity roads.

**Sampling Strategy:** A number of interviews will be conducted with unique key informants for each organization and therefore sampling is not required. For the goods transporters, the representatives will be selected based on the location and the size of their operations.

**Instruments/Equipment:** The team will conduct semi-structured interviews with a fairly open framework which allow for focused, conversational, two-way communication. Semi-structured interviews ensure that consistent data is collected yet provide opportunities for an individual to offer their perspectives on the relative importance of any factor. The team will ask questions based on the evaluation questions described above and follow-up with relevant inquiries questions to obtain more specific information.

**Rounds and Timing:** The KIIs will be conducted in November 2019 and coincide with one of the engineering data collection trips to maximize the information gathered during interviews.

**Location:** Niamey, Gaya, or other locations in Niger depending on the interviews.

**Staffing:** The KIIs will be conducted by the evaluation team and no additional staffing is anticipated for this Evaluation area. The Transport Economist/HDM-4/RED Specialist, and the Political Economist will lead the data collection procedure to conduct KIIs with key stakeholders in Niger, supported by the In-Country Coordinator.

**Safety Procedures/Precautions:** N/A

**Data Quality:** The team will conduct KIIs in French and in English whenever possible. KIIs will be conducted by the HDM-4/RED Specialist/Transport Economist, assisted by the In-Country Coordinator/Survey Manager. While the HDM-4/RED Specialist/Transport Economist leads the

interviews and takes notes, the In-Country Coordinator/Survey Manager will assist the interviews by taking notes that will be used to cross-reference with the notes taken by the HDM-4/RED Specialist/Transport Economist. The notes will also capture non-verbal information (body language etc.).

**Data Processing:** All KIIs will be audio recorded on digital voice recorders and transcribed by the In-Country Coordinator/Survey Manager and reviewed by the HDM-4/RED Specialist/Transport Economist as soon as possible after the interview. The In-Country Coordinator/Survey Manager will transcribe the audio recording into French, which will be then translated into English, and corrected by the HDM-4/RED Specialist/Transport Economist.

**Data Analysis:** The evaluation team will analyze how the market is structured and assess the likelihood that VOC savings will be passed on to consumers of transport services. The evaluation team will classify, sort, and arrange information gathered to identify trends and examine the relationships in the data. The team will cross-examine information when relevant to help build a body of evidence to support the baseline analysis.

#### **8.3.2.2 Endline Data Collection**

The methodology for the endline data collection will be the same as described above under the baseline data collection section other than the following sections that differ:

**Rounds and Timing:** The endline KIIs will be conducted in June 2026 to coincide with one of the engineering data collection trips to maximize the information gathered during interviews.

### **8.4 CHALLENGES**

#### **8.4.1 Limitations of Interpretation of the Results or Risks to the Study Design**

The proposed methodology for Evaluation Area 4 comes with the following limitations. First, there is a risk that the interviewees will not provide accurate information; for example:

- The interviewee may provide information they believe the interviewer wants to hear, rather than more accurate information they believe is not desired;
- The interviewer may withhold, or even provide misleading information, to protect sensitive or proprietary information; and
- The interviewee may not trust the intentions of the Evaluation Team.

Second, understanding an issue does not imply that MCC (or any other development partner) can influence it. External development partners may face severe limits in being able to ameliorate problems in transport market.

## **IX. ADMINISTRATIVE**

### **9.1 SUMMARY OF IRB REQUIREMENTS AND CLEARANCES**

The Evaluation Team will prepare and submit an Institutional Review Board (IRB) application to an IRB registered with the Office for Human Research Protections with the US Department of Health and Human Services for approval of the research and data collection plan. If there are no registered IRBs in Niger, the team will submit the application to an IRB in the US. The team anticipates only minimal psychosocial stress and related risks for the research participants.

The application materials for IRB will include four sets of documents: 1) a copy of the Design Report, 2) a copy of survey protocol, 3) copies of all data collection instruments that will be used for the survey, and 4) a completed IRB application form summarizing protection of participant's rights and data safety. All materials will be translated into French and verified through back-translation before submission and the interviews of road users will be conducted in French or English.

The selection of the participants to surveys on the road will respect the principle of equity since participants will be randomly selected among the road users on MCC-funded road segments. All survey and interview procedures will be based on the principles of voluntary participation and informed consent. Prior to participating in the survey, respondents will be given sufficient information on the objective of the survey and the use of the data collected to decide whether they wish to participate in the survey. The informed consent statement will closely follow the guidelines provided by MCC.

### **9.2 APPROVAL FROM LOCAL AUTHORITIES**

For the collection of field data, the evaluation team will contact the necessary authorities early and work closely to ensure their timely cooperation. The team, with assistance from data collection firms, will acquire official approval for data collection from the police, weight station authorities, and toll stations.

### **9.3 DATA PROTECTION, ACCESS, AND DOCUMENTATION**

The study will ensure that the confidentiality of information obtained from or about human participants is maintained. The evaluation team will ensure that the raw datasets are cleaned and de-identified closely following MCC's guidelines for public use of data. The obtained data will be stored in a secured server with limited access to key project personnel who signed the non-disclosure agreement.

The evaluation team will provide both a raw, non-de-identified dataset and a clean, de-identified dataset to MCC for public and internal use. The public-use dataset will be free of personal or geographic identifiers that would permit identification of individual respondents. Any additional variables with risk of divulging identity of individual subjects will be removed. In order to facilitate access to and usability of data, all datasets delivered to MCC will be accompanied with completed documentation in the form of standardized metadata.

## 9.4 DISSEMINATION PLAN

The Baseline Report will be submitted to MCC, along with a briefing note and presentation materials, in 2020. The Endline Report will be submitted in 2027 with the final independent CBA model. The evaluation team will also submit the final datasets (a raw dataset and a de-identified dataset) and the analysis files. Feedback from MCC and local stakeholders will be incorporated to produce the final baseline and endline reports. Upon review by the Evaluation Management Committee (EMC), the evaluation team will present the results of the baseline and the endline in Niger and Washington DC. The evaluation team will deliver the entire contents of the project library in good order properly indexed and marked in both digital and paper copy to MCC.

## 9.5 EVALUATION TEAM ROLES AND RESPONSIBILITIES

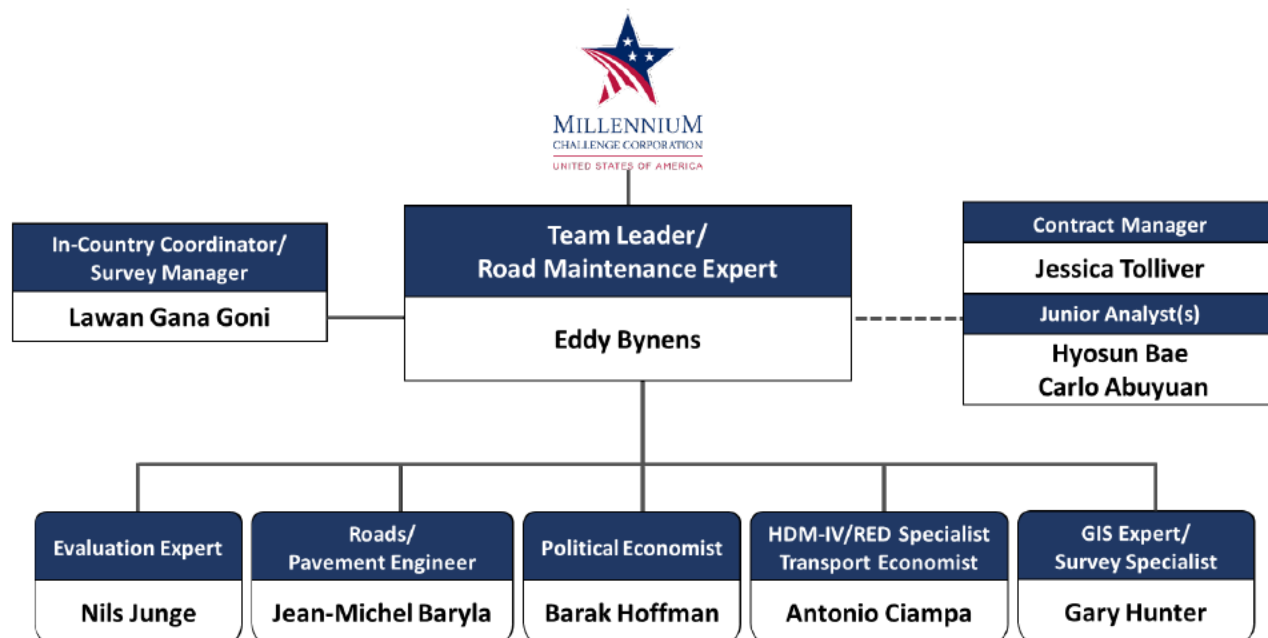
The evaluation team has five key personnel that work closely together for evaluation. The table below presents each of the key personnel on the Evaluation Team and their responsibilities. The support team will provide technical and administrative capacity to carry out the project activities and achieve MCC's goal and objectives. The diagram (Figure 9.1) below shows the organizational chart of the complete evaluation team.

**Table IX.1 Evaluation Team and Responsibilities**

Name	Position	Responsibility
Eddy Bynens	Team Leader/Road Maintenance Expert	<ul style="list-style-type: none"> <li>• Evaluation Coordination and Quality Control</li> <li>• Technical lead for the evaluation of Evaluation Area 2 on road maintenance</li> </ul>
Antonio Ciampa	HDM-IV/RED Specialist/ Transport Economist	<ul style="list-style-type: none"> <li>• Technical lead for Evaluation of Evaluation Area 1: Engineering Analysis and Economic Model</li> <li>• Technical lead for the evaluation of Evaluation Area 4: Transportation Market Structure</li> <li>• Technical support for the evaluation of Evaluation Area 3: Road Usage Patterns</li> <li>• Technical support for the evaluation of Evaluation Area 2: Maintenance</li> </ul>
Jean-Michel Baryla	Roads/Pavement Engineer	<ul style="list-style-type: none"> <li>• Technical support for the evaluation of Evaluation Area 1: Engineering Analysis and Economic Model, especially for the roughness study, the road condition survey, the deflection measurement study, and the geotechnical study</li> <li>• Technical support for the evaluation of Evaluation Area 2: Maintenance, especially for assisting the analysis of road maintenance quality</li> </ul>
Nils Junge	Evaluation Expert	<ul style="list-style-type: none"> <li>• Technical lead for the evaluation of Evaluation Area 3: Road Usage Patterns</li> <li>• Technical support for Evaluation of Evaluation Area 4: Transportation Market Structure</li> </ul>
Barak Hoffman	Political Economist	<ul style="list-style-type: none"> <li>• Technical support for the valuation of Evaluation Area 2: Maintenance</li> </ul>

Name	Position	Responsibility
Goni Lawan Gana	In-Country Coordinator	<ul style="list-style-type: none"> <li>Assist the team to arrange meetings with different stakeholders and facilitate the data collection procedures</li> </ul>

**Figure IX.1 Evaluation Team Organization Chart**



## 9.6 EVALUATION TIMELINE & REPORTING SCHEDULE

**Table IX.2 Summary of Evaluation Timeline and Reporting Schedule**

Name of Round	Data Collection	Data Cleaning & Analysis	First Draft Report Expected	Final Draft Report Expected
<i>Baseline</i>	<i>November 2019</i>	<i>December 2019 – January 2020</i>	<i>February 2020</i>	<i>April 2020</i>
<i>Endline</i>	<i>February 2026 – November 2026</i>	<i>December 2026 – February 2027</i>	<i>March 2027</i>	<i>July 2027</i>

The work plan for the evaluation is outlined in **Annex II**. The plan accounts for each of the major deliverables along with the expected timeline of the evaluation.

## ANNEX I: REFERENCES

- AASHTO Guide for Design of Pavement Structures, American Association of State Highway and Transportation Officials, Washington D.C., 1993.
- AFNOR, *Mesure de déflexion de chaussée à la poutre Benkelman*, December 1997.
- AIC Progetti, *Rapport de Traffic, Etudes d'Avant-Projet Détaillé (APD) et d'Impact Environnemental et Social (EIES) pour les travaux de réhabilitation, de Gestion et d'Entretien par Niveaux de Service (GENIS) de la RN35 et des Travaux d'Aménagement et d'Entretien de la route de Sambéra avec option pour la supervision des travaux de réhabilitation et d'entretien des deux axes*, November 2018.
- Alevy, Jonathan E, *Impacts of the MCC Transportation Project in Nicaragua*, The Millennium Challenge Corporation, September 2014.
- Bertelsmann Stiftung, *Country Report – Niger*, Gütersloh, 2018.
- Bove, Abel, Olivier Hartmann, Aiga Stokenberga, Vincent Vesin, and Yaya Yedan, *West and Central Africa Trucking Competitiveness*, Sub-Saharan Africa Transport Policy Program Working Paper 108, Washington, DC, 2018.
- CETE de l'Ouest, *Route Inter-Etat N°7 de Kandi à Banikoara au Bénin - Auscultation de chaussée par méthode Radar*, Case No. 17855, Saint-Brieuc, February 2010.
- Donnges, Chris, Martha España, and Nori Palarca. “Philippines Infrastructure for Rural Productivity Enhancement: Tools for Identifying Rural Infrastructure Investment Priorities,” Rural Accessibility Technical Paper (RATP) Series No. 14. International Labour Organization, 2006.
- Estache, Antonio, A survey of impact evaluations of infrastructure projects, programs and policies. ECARES working paper 2010-005.
- European Union, *Devis Estimatif et Quantitatif, Etudes d'Avant Projet Détaillé (APD) pour la réhabilitation du tronçon de la route Dosso-Bella (II) dans la République du Niger (82.5Km)*, ARUP-OVE, March 2012.
- European Union, *Etude d'impact environnemental et social pour la réhabilitation du tronçon de la route Dosso-Bella (II) dans la République du Niger (82.5Km)*, ARUP-OVE, March 2012.
- European Union, News and Events, June 21, 2018, [https://ec.europa.eu/europeaid/news-and-events/european-union-stepping-cooperation-niger\\_en](https://ec.europa.eu/europeaid/news-and-events/european-union-stepping-cooperation-niger_en): accessed on January 31, 2019.
- Famine Early Warning Systems Network, Niger, <http://fews.net/west-africa/niger>: accessed on January 31, 2019.
- Gajewski, Gregory R., “Community-based Rural Road Maintenance Project: Baseline Survey and Poverty Impact Assessment Report.” JFPR Grant No. 9078-TAJ. Asian Development Bank, April 2007.
- International Development Group, “Evaluation Design Report: Economic Analysis and Evaluation Services of the North-South Road Project in Mongolia.” The Millennium Challenge Corporation, May 2019.



Impaq, Evaluation Design Report Impact of the Roads Project Sénégal, The Millennium Challenge Corporation, 2012.

Kennedy, C. K. and Lister, N. W., *Prediction of pavement performance and the design of overlays*, TRRL Laboratory Report 833, Crowthorne, 1978.

Louis Berger, *Rapport de démarrage, études d'Avant Projet Détaillé (APD) et d'Impact Environnemental et Social (EIES) pour les travaux de réhabilitation, de Gestion et d'Entretien par niveaux de service (GENiS) de la RN7 avec option pour la supervision des travaux de réhabilitation et d'entretien GENiS*, October 2018.

Mathematica Policy Research. "Evaluation of a Rural Road Rehabilitation Project in Armenia." The Millennium Challenge Corporation, March 2015.

MCC Independent Evaluations, Evaluation Management Process (EMP) Version: May 2017.

Millennium Challenge Account - Niger, *Demande de Propositions: Sélection d'un Consultant pour les études d'Avant Projet Détaillé (APD) et d'Impact Environnemental et Social (EIES) pour les travaux de réhabilitation, de Gestion et d'Entretien par niveaux de service (GENiS) de la RN7 avec option pour la supervision des travaux de réhabilitation et d'entretien GENiS*, December 12, 2017.

Millennium Challenge Account - Niger, <http://ucpmc.ne/>: accessed January 31, 2019.

Millennium Challenge Corporation, *Compact Development Guidance*, 2017.

Millennium Challenge Corporation, *Malawi Compact Program Development (2011–2016): Project Concept Paper for the Transport Sector: Promoting Economic Growth and Poverty Reduction through Addressing Transport Infrastructure Constraints in Malawi*, 2011.

Millennium Challenge Corporation, *Independent Engineering Services – Niger Implementation Oversight of Infrastructure Components*, Norda Stelo, March 2016.

Millennium Challenge Corporation, *Investment Memorandum, Annex B: Project Description Large Scale Irrigation and market Infrastructure Project*.

Millennium Challenge Corporation, *Lessons from MCC's Investments in Roads*, 2017.

Millennium Challenge Corporation, *Millennium Challenge Compact between the United States of America acting through the Millennium Challenge Corporation and the Republic of Niger acting through the Ministry in charge of Foreign Affairs and Cooperation*, 2016.

Millennium Challenge Cooperation, *Monitoring and Evaluation Plan of the Niger Compact between the United States of America, acting through the Millennium Challenge Corporation and the Republic of Niger*, Version 1, March 2018.

Millennium Challenge Cooperation, *Policy for Monitoring and Evaluation of Compacts and Threshold Programs*, DCI-2007-55.4, February 2017.

Sauterey, R., and Autret, P., *Guide d'auscultation des chaussées souples*, Eyrolles, 1977.

The Fund for Peace, *Fragile States Index*, 2018.

TRL Limited, Overseas Road Note 40, *A guide to axle load surveys and traffic counts for determining traffic loading on pavements*, 2004

UEMOA, *Règlement n°14/2005/cm/UEMOA relatif a l'harmonisation des normes et des procédures du contrôle du gabarit, du poids, et de la charge a l'essieu des véhicules lourds de transport de marchandises dans les états membres de l'Union Economique Et Monétaire Ouest Africaine.*

USAID, Nathan Associates, *Impact of Road Transport Industry Liberalization in West Africa*, 2012.

USAID, *Thinking and Working Politically Through Applied Political Economy Analysis*, Washington, DC, 2018.

World Bank Group, *Logistics Performance Index*, 2018.

World Bank Group, *Project Results Report (PRR)*, IDA-H3780 IDA-52210, Washington, DC, 2016.

World Bank Group, *Republic of Niger-Systematic Country Diagnostic*, 2017.

World Bank, *Transport Prices and Costs in Africa*, 2009.

World Bank, *Revised Environmental and Social Management Framework (ESMF): Nepal Rural Access Improvement and Decentralization Project (RAIDP)*, September 2009.

## ANNEX II: EVALUATION WORK PLAN

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## ANNEX III: EXAMPLE OF O-D QUESTIONNAIRE

### Sample Questionnaire for vehicles transporting goods

A.	DESCRIPTION OF THE VEHICLE
A.1	Type or Make
A.2	Number of axles
A.3	Number of Tires
A.4	Total capacity of the vehicle in tons
A.5	Fuel type, Diesel (D) Petrol (P)
A.6	Kilometers driven per year
A.7	Hours driven per year
B	DESCRIPTION OF THE TRIP
B.1	Origin of the trip (ZONE xx)
B.2	Destination of the trip (ZONE yy)
B.3	Expected date and hour of the arrival
B.4	If breaking the journey, date and hour of the last stop
B.5	Time spent in stops from the beginning of the trip
B.5.1	Stop due to 'normal' factors
B.5.2	Stop due to abnormal infrastructure conditions
B.5.3	Stop due to other factors
C	DESCRIPTION OF GOODS ORIGIN AND DESTINATION
C.1	Origin of goods
C.2	Final destination of the goods
C.3	Are the goods owned by the owner of the vehicle?
D	DESCRIPTION OF GOODS
D.1	Are goods parked in containers?
D.2	Quantity/amount in tons
D.3	Single commodity (1) or mixed (2)
D.3.1	- Product 1: type
D.3.2	- Volume of product 1 as %
D.3.3	- Product 2: type
D.3.4	- Volume of product 2 as %
D.3.5	- Other Products
D.4	Cargo as % of payload capacity
E	COST FACTORS
E.1	How much fuel consumed from beginning of the trip in litres
E.2	Number of tires changed from the beginning of the trip
F	WILLINGNESS-TO-PAY OF ROAD USERS (optional section)
F.1	Ownership of the vehicle (Yes/Not)
F.2	Is the payment of a toll to use the improved road an equitable principle?
F.3	Are you available to share with the Road Agency part of the benefits generated by use of improved road

F.4	Tolls would range between XX FCFA and YY FCFA, do you believe this range acceptable?
F.5	What amount do you think is fair?

**Sample Questionnaire for vehicles transporting passengers**

A.	DESCRIPTION OF THE VEHICLE AND TRIP
A.1	Vehicle Type
A.2	Fuel type, Diesel (D) Petrol (P)
A.3	Number of Passengers
A.4	Vehicle Trip Origin
A.5	Vehicle Trip Destination
A.6	Vehicle Trip Purpose
A.7	Vehicle Trip Frequency
A.8	Passenger occupancy rate %
E	FARE PRICE
E.1	How much is the fare per passenger?
E.1.1	- length of the trip in km
E.1.2	- amount paid in FCFA
F	WILLINGNESS-TO-PAY OF ROAD USERS <i>(optional section)</i>
F.1	Ownership of the vehicle (Yes/Not)
F.2	Is the payment of a toll to use the improved road an equitable principle?
F.3	Are you available to share with the Road Agency part of the benefits generated by use of improved road
F.4	Tolls would range between XX FCFA and YY FCFA, do you believe this range acceptable?
F.5	What amount do you think is fair?

## ANNEX IV: HDM-4 INPUT PARAMETERS FOR RUC CALCULATION

Input parameters for RUC calculation	Vehicle type			
	Type 1	Type 2	Type .....	Type n
<b>Basic characteristics of vehicles' fleet</b>				
Gross vehicle weight - ton				
ESALF <sup>69</sup> per vehicle (exponent 4.5)				
PCSE (Passenger Car Space Equivalent)				
Number of axles				
Number of tires				
Number of passengers				
<b>Vehicle utilization data</b>				
Service life - year				
Hours driven per year				
Km driven per year				
Depreciation method				
Annual interest rate %				
<b>Economic prices<sup>70</sup></b>				
New vehicle price (USD)				
New tire price (USD)				
Maintenance labour (USD/hr)				
Crew cost (USD/crew-hour)				
Passenger working time (USD/pax-hr)				
Pass. non-working time (USD/pax-hr)				
Cargo time (USD/veh-hr)				
Gas/petrol price (USD/lt)				
Diesel price (USD/lt)				
Lubricants price (USD/lt)				
Accident rate <sup>71</sup>				
Average of cost by type of accident (USD/acc.)				

<sup>69</sup> ESALF: Equivalent Standard Axle Loading Factor

<sup>70</sup> The determination of economic prices implies an adequate local research to establish the conversion factors of market prices.

<sup>71</sup> Accident rate expressed in number of accidents per 100 million of veh-km

## **ANNEX V: STAKEHOLDER COMMENTS AND EVALUATOR RESPONSES**

Stakeholder comments and evaluator responses are removed from the external version of the EDR.

## **ANNEX VI: EVALUATION BUDGET**

Evaluation Budget is removed from the external version of the EDR.