

The Republic of Zimbabwe
Ministry of Transport and
Infrastructural

**PREPARATORY SURVEY REPORT
ON THE PROJECT FOR
IMPROVEMENT OF ROAD SECTION
ALONG THE NORTHERN PART OF
THE NORTH-SOUTH CORRIDOR
(PHASE 2)
IN
THE REPUBLIC OF ZIMBABWE**

February 2023

**JAPAN INTERNATIONAL COOPERATION AGENCY
(JICA)**

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PREFACE

Japan International Cooperation Agency (JICA) decided to conduct the preparatory survey on the project for improvement of road section along the northern part of the north-south corridor (phase 2) in the Republic of Zimbabwe and entrust the survey to a joint venture consisting of INGEROSEC Corporation, Eight-Japan Engineering Consultants Inc. and Oriental Consultants Global Co., Ltd..

The survey team held a series of discussions with the officials concerned of the Government of Zimbabwe, and conducted a field investigation from October to November, 2021. As a result of further studies in Japan, the present report was finalized.

I hope that this report will contribute to the promotion of the project and to the enhancement of friendly relations between our two countries.

Finally, I wish to express my sincere appreciation to the officials concerned of the Government of the Republic of Zimbabwe for their close cooperation extended to the survey team.

February, 2023

Akihito SANJO
Director General,
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Summary

1. Overview of the Country

The Republic of Zimbabwe (hereinafter, Zimbabwe) is an inland country located in the southern part of Africa with a total land area of 398,600km² and a population of some 14.65 million (2019, World Bank) and bordered by Mozambique, South Africa, Botswana and Zambia. The season is divided into the dry season from May to October and the rainy season from November to April and annual rainfall varies from 1,000mm or more to 500 to 600mm in semi arid area depending on the area and it is around 800mm in the Survey area. Temperatures are around 25°C in an elevation of 1,000m, which occupies the majority of the national land. In June and July, the temperature difference is extreme as it rises above 30°C during the day, but it drops below 10°C in the morning and evening. In the lowland of Zambezi river basin with an elevation of about 400m, a large temperature rise is seen in the dry season that exceeds 35°C. Since the late 1990s, in Zimbabwe, inflation, unemployment, poverty, etc. continued due to vulnerable governance and failure of economic policy. In addition, due to land reform policies that began in 2000, the productivity of agriculture, which was the country's leading industry, declined and the national economy became extremely poor. In 2008, due to hyper inflation due to excessive issuance of bank notes, the inflation rate exceeded 200 million%, which made the national economy a devastating state. The Government of Zimbabwe (hereinafter, GOZ) tried to get out of economic turmoil by implementing financial reforms such as introducing multiple foreign currency systems (US dollar, South African Rand), central bank reform and budget planning by cash. Through this reform, Zimbabwe could achieve double-digit economic growth from 2010 to 2012, but in 2013 it has fallen to one-digit again. Since the US dollar is distributed in the market, however, the supply of banknotes is small compared to the economic scale, GOZ issued convertible notes (Bond notes) equivalent of US\$10 million from November 2016. The GNI per capita is US\$1,390 (2019, World Bank) and the composition ratio of GDP is 9.2% in the primary industry, 22.9% in the secondary industry and 67.9% in the tertiary industry (2018, UN).

2. Background and outline of the Project

The Government of Zimbabwe aims to achieve an upper-middle income country by 2030, and the National Development Strategy (2021-2025), a five-year plan to accomplish this target, identifies 14 priority areas for implementation. In the area related to infrastructure development, the improvement and maintenance of the country's major transport corridors is identified as a key issue. The North-South Corridor, the subject of this study, is a very important route connecting South Africa to landlocked countries via Zimbabwe and Botswana, which is projected to become the largest corridor in Africa in 2040, with an annual transport volume of over 50 million tonnes. At the request of the Government of Zimbabwe, JICA has improved and widened a 6.5 km mountainous section with many narrow and sharp curves near Chirundu on the border between Zimbabwe and Zambia under the grant assistance project "Northern Section of North-South Corridor Road Improvement Project" ('Phase 1') since 2018. In this project, the road planning,

construction planning and supervision, safety management and other technologies possessed by Japanese companies in mountainous areas were highly evaluated. In view of the importance of the corridor, the Government of Zimbabwe is currently undertaking improvement of the section south of Harare, but the northern mountain section (approximately 141 km) north of the Karoi township, 210 km from Harare, is not being improved by the Government of Zimbabwe due to the high degree of difficulty in designing and constructing the section. However, this section of road has been a major obstacle on the corridor, with heavy trucks travelling at speeds of up to 15 km/h in some parts and frequent traffic accidents, making the improvement of this section of road an urgent priority. To improve these conditions, the 'North-South Corridor Northern Section Road Improvement Project (Phase 2)' (hereafter 'the Project') aims to improve the travelling speed and traffic safety (reduce traffic accident and loss time) in the northern section of the corridor by adding a climbing lane and improving and widening sharp curves which has a complex alignment continuous with the Phase 1 section, thereby contributing to promoting the better utilisation and smooth traffic flow of the corridor. The purpose of this survey is to confirm the necessity and appropriateness of the requested project based on the above, as well as to conduct an appropriate schematic design as grant aid, formulate a project plan and estimate the schematic project cost.

3. Outline of Survey Findings and Project Contents (Outline of the preliminary design, facility plan)

(1) Survey schedule

JICA dispatched the Preparatory Survey Team to Zimbabwe to conduct the field survey from October 1st to November 12th, 2021. The Team engaged in discussions with various government officials in Zimbabwe, conducted field surveys in the Project area, examined the present state of the target section, the state of development progress of its surroundings and other related plans, and confirmed the level of necessity and urgency of upgrading on the requested section. After that, JICA dispatched Survey Team to Zimbabwe for explanation of the draft report from May 23rd to June 3rd, 2022. The Team explained and consulted the contents of the outline design to the relevant institutions of Zimbabwe, and under the understanding of the contents of the design; Minutes of Discussion were concluded with the Zimbabwean side.

(2) Summary of survey results and project description

The 1st field survey was conducted on a 15.5 km section from the suburb of Makuti, 291 km from the capital Harare, to 306.5 km (the edge of the Phase 1 project where road improvement was completed through Japanese grant aid). The survey included a determination using quantitative indicators and a schematic study of the high priority areas that could be addressed with the similar cost as the Phase 1 project. In the 1st domestic work after returning to Japan, the scope of the project was selected from priority, technical and monetary aspects, and the 7.8 km contiguous section between 298.7 and 306.5 km from Harare, which has high continuity with Phase 1 and high priority for improvement, was recommended as the target of the project in a draft preparatory study report. During the 2nd field survey, the draft report was explained to the Zimbabwean side by the survey team and the recommended plan was agreed upon, and the road is to be rehabilitated according to

the specifications shown below.

Table 1 Outline of the Project

Planned item	Unit	Adopted Value		Note
Road Reserve Width	m	31.5 (Lion's Den-Chirundu section, 15.75m bothside from the existing road center)		(Right of way, ROW)
Number of Lane	lane	2		
Width of Lane	m	3.75		SATCC standard and heavy vehicle traffic considered
Climbing Lanes Width	m	3.75		
Shoulder Width	m	2.5		Ditto
Road Cross Fall Gradient	%	2.5		Same for shoulder
Max. Superelevation	%	10		
Max. Vertical Gradient	%	—		Trace existing gradient
Design Speed	Km/hr	60 [40 for partial spots]		
		60km/hr	40km/hr	
Minimum Curve Radius	m	110	50	
Minimum Curve Length	m	150	70	
Omission of Transition Curve	m	1000	500	Omission for Large curvature
Sight distance (Stopping)	m	80	50	
Pavement Type	—	Surface = DBST, Base = Recycled cement/asphalt stabilized base, Subbase = Natural granular material		Main line=2 layers, Shoulder=2 layer
Design life of pavement	Year	15		
Rain Intensity	Year	Major facilities:20years,Others:5years		Drainage facility plan
Ancillary road structures	—	Concrete Kerb, Side ditch, Safety barriers, Traffic sign, Road marking, Delineator, etc.		
Fill slope	—	1:1.5~4.0 (depending on filling height)		
Cut Slope	Rock	1:0.3~0.5 (depending on rock type)		
	Others	1:1.0		

Source : JICA SurveyTeam Note: DBST=Double bituminous surface treatment

4. Project Schedule and Estimated Project Cost

As a result of the above surveys, the length of time required to implement the Project is estimated to be 7 months for implementation detailed design, 5 months for bilateral official procedures, 4 months for tender procedure and 20 months for the construction work (Total 36 months), and the Project cost is estimated as the Zimbabwean portion approximately \$US 690,640 (87 million equivalent-Yen).

5. Project Evaluation

(1) Relevance of the Project

The Government of Zimbabwe aims to become an upper-middle-income country by 2030, and infrastructure development, identified as a priority area for action in the National Development Strategy (2021-2025), highlights the importance of developing and maintaining key transport corridors to facilitate domestic and international trade. The North-South Corridor, which runs from South Africa through Zimbabwe and Botswana to Zambia and the Democratic Republic of Congo, has the largest annual transport volume in the region, mainly mineral exports and imports of essential goods, and it is projected that by 2040 the corridor's transport volume will be the largest

in Africa. However, the mountainous section (about 141 km) of the northern section of the North-South Corridor has many narrow and steep curves and is difficult to design and construct, resulting in a lack of progress in road improvement by the Zimbabwean Government. However, the mountainous section (about 141 km) of the northern section of the North-South Corridor has many narrow and steep curves and is difficult to design and construct, resulting in a lack of progress in road improvement by the Zimbabwean Government. The Project aims to reduce the number of traffic accidents and reduce traffic congestion by constructing a climbing lane and widening sharp curves in a 7.8km section adjacent to the 6.5km section of the Phase 1 project, which was improved through Japanese grant aid, and contribute to the promotion of the utilisation of the corridor. The Project is highly appropriate as it meets Zimbabwe's development challenges and policies and contributes to the economic revitalisation of the Southern African region, including Zimbabwe, through the development of the North-South Corridor.

- 1) The Project will contribute to strengthen the trunk road network and is expected to benefit not only Zimbabwe but also other Southern African countries using the North-South Corridor.
- 2) The Project will improve the smoothness and safety of the road by alleviating the current traffic congestion and reducing the number of accidents in the target section, which is identified as a priority in the NDS 1.

(2) Effectiveness of the Project

By implementing the Project, the road conditions in the target section will be improved and safe and smooth flow of traffic will be secured. Therefore, it is expected that there will be a great benefit to the residents of the Project area and the users who pass through the logistics trunk route. The expected effects of the Project are shown below.

1) Quantitative effect

- ① The improvement of the target road section will allow slow-speed heavy vehicles (around 20 km/h) to be separated into climbing lanes and other vehicles allowed to pass at speeds of 60/40 km/h, reducing transit time by around 9 minutes.
- ② The number of annual accidents will be reduced from the current 61 to 10.
- ③ The Project will contribute to the safe and smooth passage of approximately 530,000 passengers and 4.45 million tonnes of cargo per year along the section.

Table 2: List of quantitative effects

Source: Survey team

Index name	Base value (Actual value in 2021)	Target value (2028) [3 years after project completion]
Passage time in target section (7.8km) (minutes)	17	8
Number of traffic accidents in target section (7.8km) (incident/year)	61	10
Volume of passengers (thousand person/year)	530	560
Volume of cargo (million ton/year)	4.45	5.01

2) Qualitative effect

- ① Shortening travelling time contributes to reduction of transportation costs.
- ② Traffic safety and smoothness are improved including perspective of drivers.
- ③ Employment of women is facilitated.
- ④ Capacity on traffic safety measures and road maintenance is improved.

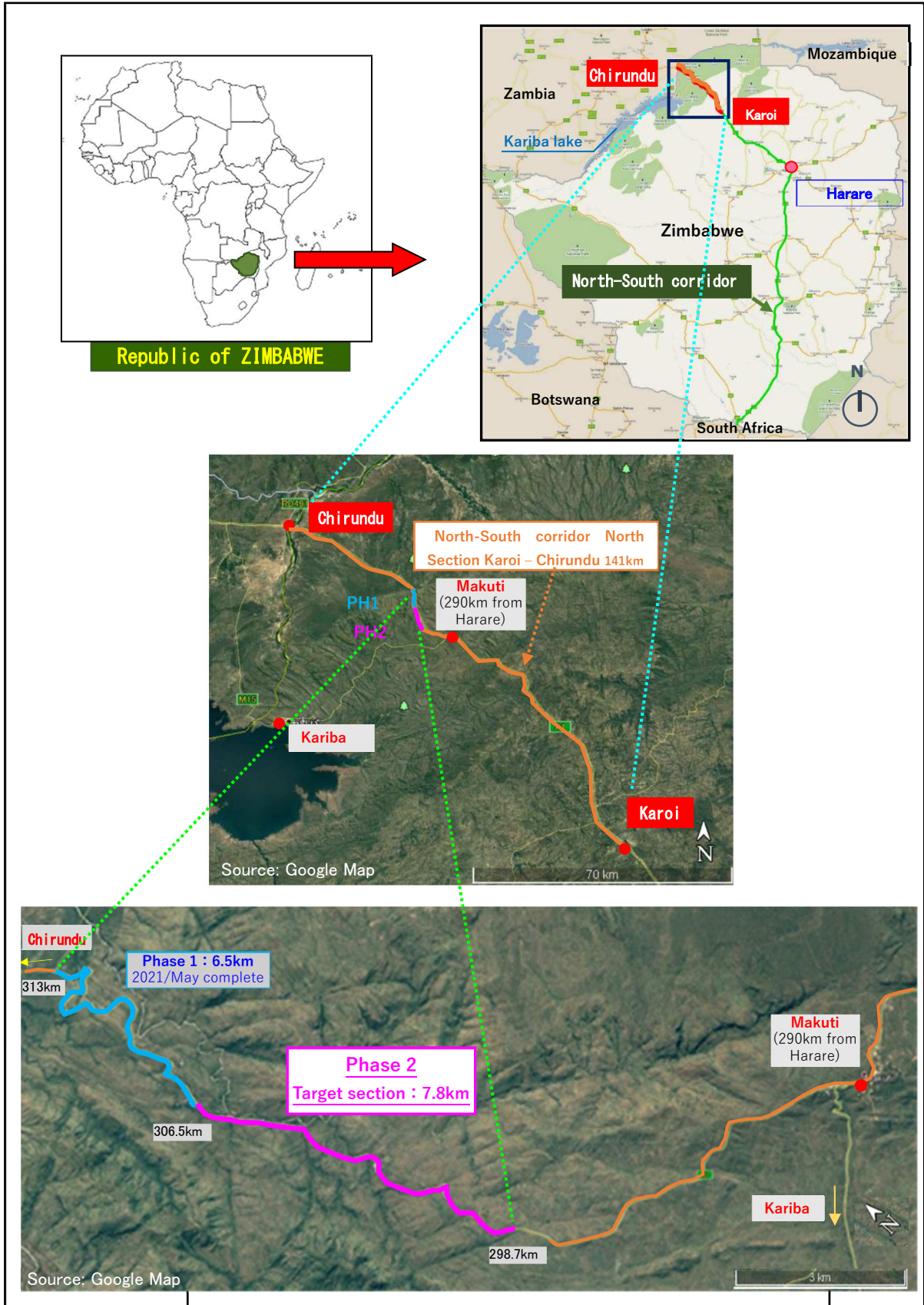
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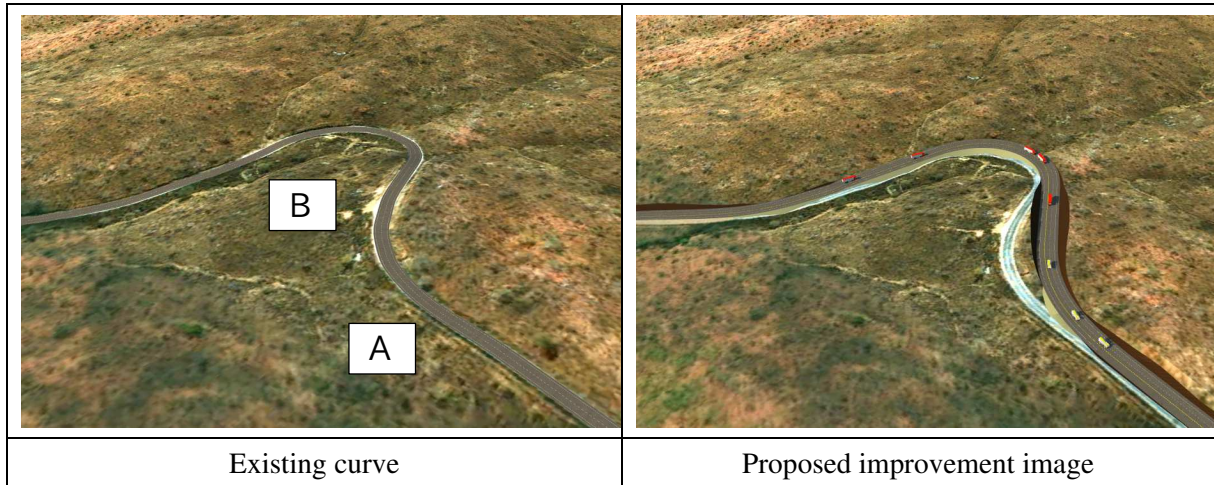


Source: Survey team

LOCATION MAP

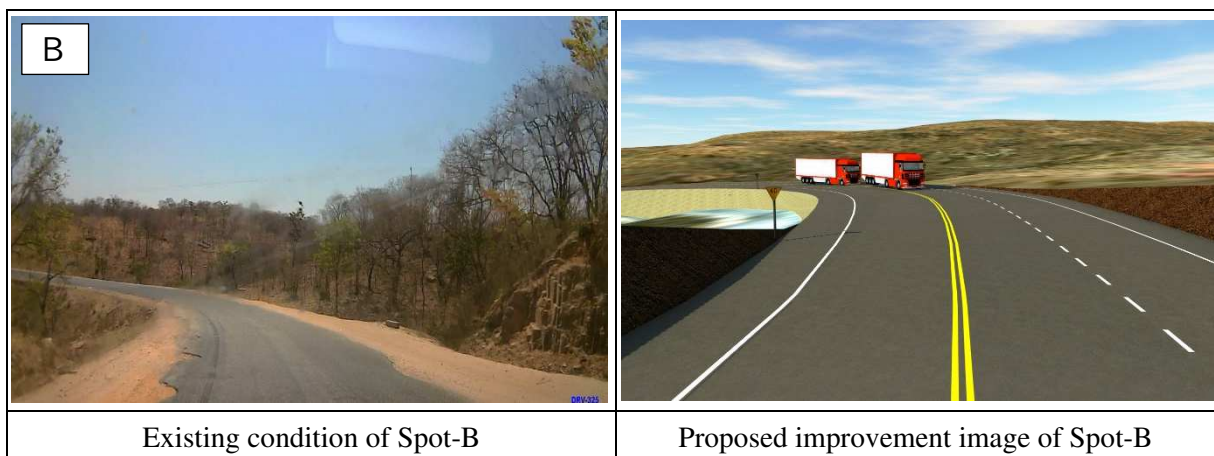
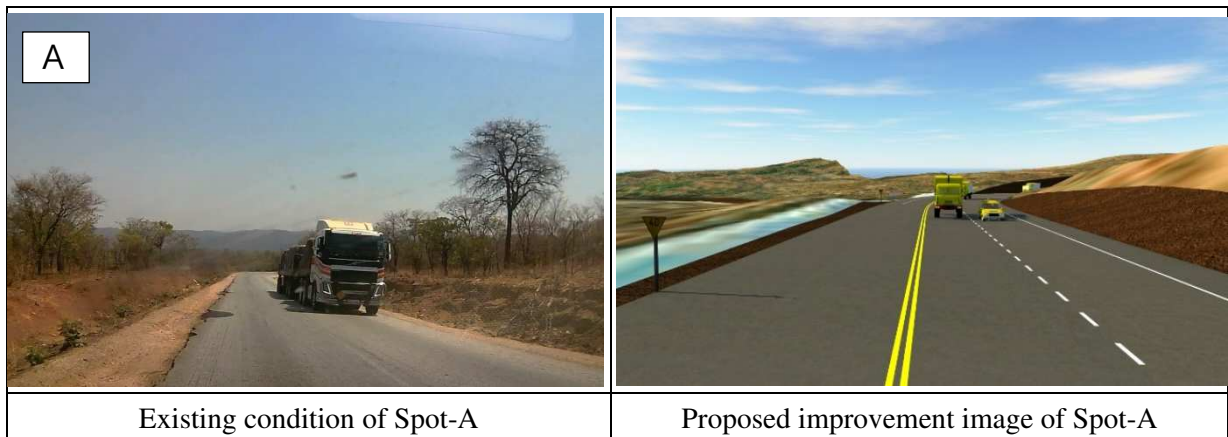
Road Improvement Image of Accident-Prone Spot

The steepest curve at 300.5km point from Harare



Note: Spot-A: Due to poor visibility near the bottom of steep down slope, it is difficult to see beyond the curve.

Spot-B: Wreckage of large vehicles that have been crashed is seen on the side of the road.



Source: Survey team

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Abbreviations

<u>Abbreviation</u>	<u>Official Name</u>
AASHTO	American Standard of State Highway and Transportaion Officials
AfDB	African Development Bank
BS	British Standard
CBR	California Bearing Ration
CMED	Central Mechanical Equipment Department
DBST	Double Bituminous Surface Treatment
DCP	Dynamic Cone Penetration
EIA	Environmental Impact Assessment
E/N	Exchange of Note
EMA	Environment, Management Agency (EMA), MEWC
EMP	Environmental Management Plan
G/A	Grant Agreement
GNI	Gross National Income
GDP	Gross Domestic Product
GNP	Gross National Product
GOZ	Government of Zimbabwe
JICA	Japan International Cooperation Agency
M/D	Minutes of Discussion
MoTID	Ministry of Transport and Infrastructural Development
MoFED	Ministry of Finance and Economic Development
PSIP	Public Sector Investment Programme, MoFED
MEWC	Ministry of Environment, Water and Climate
PWMA	Parks and Wildlife Management Authority, MEWC
RC	Reinforced Concrete
ROW	Right of Way
SADC	Southern African Development Community
SATCC	Southern African Transport and Communications Commission
SBST	Single Bituminous Surface Treatment
ZIMRA	Zimbabwe Revenue Authority

CHAPTER 1
BACKGROUND OF THE PROJECT

Chapter 1 Background of the Project

1-1 Current situation and challenges in the road transport sector

1-1-1 Current situation and challenges

(1) Current status of road administration

The organizations involved in the road administration in the Republic of Zimbabwe (hereinafter referred to as Zimbabwe) are the Ministry of Transport & Infrastructural Development (hereinafter referred to as MoTID) and the Department of Road (hereinafter referred to as DOR) of the MoTID. The client government agency in this project is MoTID and the project implementing agency is DOR. A list of the organizations involved in the implementation of this project is shown below.

Table 1-1: Implementing agencies and relevant authorities of the Project

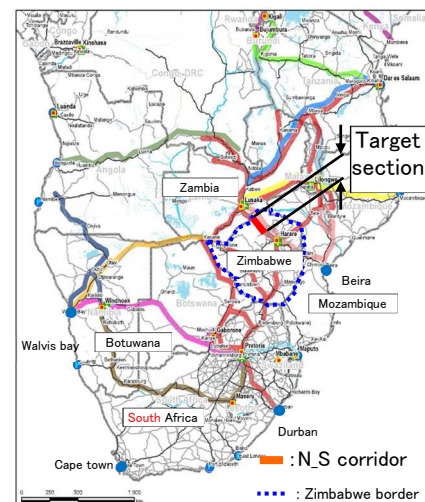
Description	Name of related agency
Supervisory authority	Ministry of Transport & Infrastructural Development (MoTID)
Executing agency	Department of Roads (DOR) of MoTID
Agency of Environment	Ministry of Environment, Water and Climate (MEWC) Environmental Management Authority (EMA) Environmental Planning and Monitoring Unit (EPMU)
Tax & duty	Ministry of Finance and Economic Development (MoFED) Zimbabwe Revenue Authority (ZIMRA)
Public utility	Zimbabwe Electric Supply Authority (ZESA)
Description	Zimbabwe National Water Authority (ZINWA)

Source: Survey team

(2) Road status and issues

1) Status of the road network in Zimbabwe

88,100km, of which only 17,400 km, or about 20%, are paved. In terms of road condition, 21% were in good condition, 38% were passable, and 41% were hindering passage, and it is in a state of great challenge. The major routes of physical distribution in Southern Africa related to Zimbabwe are the North-South route, which runs northward from South Africa to inland countries such as Zimbabwe and Zambia, and the East-West route, which connects from Mozambique to inland countries. The section covered by this survey represents one section north of the capital city of Harare in the North-South route, and is important for the development of not only Zimbabwe but also the region. The road section under this survey is the section passing through a mountainous area with the most curves and undulations in the northern section of the North-South Corridor between Harare and Chirundu, which passes through the capital



Source: Southern Africa infra. Develop. M/P

Fig. 1-1: International corridor

Harare from Beitbridge on the border between South Africa and Zimbabwe and connects to Chirundu on the border with Zambia in the northwest. However, sharp curves have not been improved and uphill lanes have not been installed, which is a major impediment to safe and smooth traffic, and immediate improvement is desired.

1-1-2 Development plans

(1) National development plan

The Government of Zimbabwe (hereinafter referred to as GOZ), in its National Economic Recovery Plan "Zimbabwe Agenda for Sustainable Socio-Economic Transformation, Zim Asset 2013-2018" (hereinafter referred to as ZIM ASSET)" formulated in October 2013, has made the improvement of infrastructure and social facilities (economic infrastructure including roads) one of the four primary areas and has made the improvement of the road environment an important item.

With the completion of the Transitional Stabilisation Programme (TSP), which was implemented from October 2018 to December 2020, a new national development strategy (NATIONAL DEVELOPMENT STRATEGY 1, NDS1) was announced in November 2020 with a new five-year medium-term plan covering the period 2021-2025, for "the achievement of a middle- and high-income society by 2030". In the road sector of the strategy, various measures are being taken to ensure smooth implementation, with the improvement of accessibility and safety as priority issues.

(2) Road sector development plan

Zimbabwe has an urgent need to improve the condition of the country's road network. As for development plans related to the road sector, the African Development Bank (AfDB) conducted a National Transportation Comprehensive Master Plan Study (M/P) from 2015 to 2017 covering road, public transportation, rail, air, pipeline, and inland water transportation. The M/P identified the North-South Corridor as the most important route in Zimbabwe, and recognized the urgent need to address traffic capacity expansion south of Harare and poor alignment areas north of Harare. It is noted that the most serious area north of Harare is near Hell's Gate, 313km from Harare, as well as the section covered by this plan. Regarding the North-South Corridor including the subject section, rehabilitation, improvement, and multi-laning of the current road have been proposed in the M/P study of the northern section of the North-South Corridor by the Development Bank of Southern Africa (DBSA) in 2011 and in the F/S study of the North-South Corridor by the Southern Africa Development Commission (SADC) in 2013.

1-1-3 Socio-economic situation

Since the late 1990s, Zimbabwe has been experiencing inflation, unemployment, poverty, and other problems due to its weak governance and failed economic policies. Furthermore, the land reform policy which began in 2000 led to a decline in productivity in agriculture, which had been the country's main industry, and the national economy severely slumped. In 2008, hyperinflation caused by excessive paper money issuance led to an inflation rate exceeding 200 million percent, devastating the national economy. The government attempted to pull the economy out of the turmoil

by introducing a multiple foreign currency system (US dollar and South African rand), reforming the central bank, and implementing fiscal reforms such as cash-based budgeting. Although these reforms led to double-digit economic growth in 2012, economic growth has slowed again since 2013, and continuous improvement has not been achieved. Although the U.S. dollar circulates domestically, since the supply of banknotes is low relative to the size of the economy, the Zimbabwean government decided to issue \$10 million worth of convertible banknotes (bond notes) beginning in November 2016. Furthermore, in June 2019, the Central Bank of Zimbabwe designated the provisional currency RTGS dollar as the sole legal tender, but also reintroduced the U.S. dollar in March 2020 as a countermeasure to the shortage of banknotes due to inflation.

1-2 Background and overview of Japan grant aid assistance

(1) Background of the Project

The Government of the Republic of Zimbabwe (hereinafter referred to as “Zimbabwe”) aims to achieve an upper-middle income society by 2030 and has identified 14 priority areas in its National Development Strategy (2021-2025), a 5-year plan to achieve the goal. One of the 14 priority areas is infrastructure development, which includes the importance of developing and maintaining key transport corridors to promote domestic and regional trade. The North-South Corridor, which runs from the port of Durban in South Africa through Zimbabwe and Botswana to Zambia and the Democratic Republic of Congo, is the largest transport corridor in the region, with an annual transport volume of over 4 million tonnes (Data Collection Survey on Nacala Corridor integrated Development in Southern Africa, 2018), including export of mineral and import of necessities. The Programme for Infrastructure Development in Africa (PIDA), prepared by the African Union (AU), predicts that by 2040, the corridor will be the largest corridor in Africa with an annual transport volume of over 50 million tonnes. Based on the request of the Government of Zimbabwe, JICA improved and widened 6.5 km narrow and sharply curved mountainous section between Makuti and Chirundu near the border between Zimbabwe and Zambia in 2018 as a grant aid project, “The Project for the Road Improvement of the Northern Part of the North-South Corridor (hereinafter referred to as “Phase 1”)”. The project has received high evaluation for the road design, construction planning and supervision, and safety management technologies possessed by Japanese companies which is necessary to construction work in mountainous areas. Currently, the southern section of the North-South Corridor, south of Harare is being improved by the Government of Zimbabwe, but the northern mountainous section (approximately 141 km), north of the Karoi, 210 km from Harare, is not improved by the Government of Zimbabwe due to the difficulty of design and construction in the mountainous area. This acts as an obstacle, has caused a number of traffic accidents and has made heavy vehicles` speed below 15 km/h. The road in this section is urgently in need of improvement and widening. In “the Project for the Road Improvement of the Northern Part of the North-South Corridor (Phase 2) (hereinafter referred to as “the Project”)”, climbing lanes will be constructed and sharp curves will be widened in the section with a complex alignment that is continuous with the Phase 1 section, in order to improve travelling speed, promoting better

utilization, smooth traffic flow and road safety (reduce traffic accident and loss time). In addition, the Project is expected to further contribute to promoting the use of the corridor and strengthening regional connectivity through synergies with the technical cooperation “project ” The Project for Capacity Development on Smooth Operation of OSBPs on the North-South Transport “Corridor” has been carried out since 2020 and the Phase 1. Therefore, in this survey, the validity of the grant aid for the Project, such as widening the sharp curves in the northern section of the North-South Corridor and installing climbing lanes, was examined and the most appropriate project component and project plan were reviewed.

(2) Project scope

The scope of the survey covers 15.5 km, starting at 306.5 km from Harare (the starting point of Phase 1) and ending at 291 km. Technical studies were carried out on the scope of the installation of a climbing lane, road alignment plan and pavement configuration etc. for the above section, and considering these results, a survey was carried out to determine the scope of the Project.

(3) Project outline

The project aims to improve safety, mainly in terms of traffic accidents, reduce traffic congestion and shorten transit times by constructing a climbing lane and widening the sharp curves in the northern mountainous part of the North-South Corridor, thereby contributing to smooth logistics.

(4) Proposed major road rehabilitation

- To improve the current narrow road and unpaved shoulder to a lane which has width of 3.75m and paved shoulder which has width of 2.5m, as requested by Zimbabwe side
- Adding a climbing lane to steep gradient sections
- Improvement of sharp curves (application of design speed of 60 (40) km and widening of curves)
- Installation of road drainage facilities to ensure the function of the road
- Installation of road ancillary and safety facilities to ensure safe and smooth traffic flow

(5) Government agencies and institutions involved in the survey

The executing agency of the Project and relevant authorities and institutions are listed below.

Table 1-2: Implementing agencies and relevant authorities of the Project

Description	Name of related agency
Supervisory authority	Ministry of Transport & Infrastructural Development (MoTID)
Executing agency	Department of Roads (DOR) of MoTID
Agency of Environment	Ministry of Environment, Water and Climate (MEWC) Environmental Management Authority (EMA) Environmental Planning and Monitoring Unit (EPMU)
Tax & duty	Ministry of Finance and Economic Development (MoFED) Zimbabwe Revenue Authority (ZIMRA)
Public utility authority	Zimbabwe Electric Supply Authority (ZESA) Zimbabwe National Water Authority (ZINWA)

Source: Survey team

1-3 Assistance by Japan

Japan’s assistance to Zimbabwe began in the early 1980s, and in 1999, the Chirundu bridge construction across the border between Zimbabwe and Zambia was implemented as a grant aid project (signed E/N 1999), contributing to improve logistics in both countries. The North-South Corridor, which is the subject of the Project, is included in the five priority corridor area‘ of the ‘Integrated Regional Development with Corridors as’its axis’ set out at the Fifth Tokyo International Conference on African Development (TICAD V), and the opening ceremony for the 6.5 km Phase 1 section was held in May 2021. Furthermore, JICA has dispatched experts to support the One-Stop Border Post (hereinafter referred to as “OSBP”) to expedite customs clearance between Zimbabwe and Zambia, which is expected to have a synergistic effect with the Project. In addition, JICA has dispatched an ODA advisor to MoFED, and the survey team worked with the advisor to address pending issues such as tax exemptions between MoFED and MoTID.

Table 1-3: Assistance by Japan (Transport sector)

Year	Project name	Amount	Remarks
2018	Improvement of road section along the northern part of the north-south corridor	2293	Addition of climbing lanes and improvement of sharp curves for road improvement in mountainous sections.
1998	New bridge over the Zambesi River at Chirundu	3040	Construction of a 400 m long bridge over the border
1996	Road maintenance equipment supply	560	Provision of road maintenance equipment
1993	Local road maintenance project	4480	Rehabilitation of 7 bridges and provision of equipment for local roads

Source: JICA Unit: million yen

1-4 Assistance by other donors

Support for the road sector by other donors has been provided by the Development Bank of Southern Africa (hereinafter referred to as “DBSA”), the Common Market for Eastern and Southern Africa (hereinafter referred to as “COMESA”), the Southern African Development Community (hereinafter referred to as “SADC”) and the African Development Bank (hereinafter referred to as “AfDB”). There is no overlap with the Project.

With regard to the pending road rehabilitation of the southern section of the North-South Corridor, south of Harare, the road rehabilitation plan by the Government of Zimbabwe was confirmed (see related description below).

Table 1-4: Assistance by other donors

Donors	Summary of assistance
DBSA	USD 200 million loan for rehabilitation projects on local roads (Loan)
COMESA	SADC, East African Community (EAC) road rehabilitation (Grant)
DBSA	Master plan (M/P) study for the northern section of the North-South Corridor (Grant, 2011). - Rehabilitation, improvement, multi-laning, etc. by-road section basis between Harare and Chirundu.
SADC	Feasibility study (F/S) of the North-South corridor (2013) - Proposed rehabilitation, multi-laning, etc. of the southern section of the North-South Corridor between Beit bridge and Harare at an estimated cost of approximately 130

	billion yen and the northern section between Harare and Chirundu at approximately 90 billion yen.
AfDB	National Transport M/P study (covering road, public transport, rail, air, pipeline and inland water transport), with traffic forecasts (short term (2017~2020), medium term (2021~2026) and long term (2027~2036)) (2018)

Source: Survey team

Note: The above-mentioned M/P study of the North-South Corridor by DBSA in 2011 proposed rehabilitation, improvement and multi-lane of each road section between Harare and Chirundu. In addition, the F/S study of the North-South Corridor by SADC in 2013 estimated the project cost of the southern section of the North-South Corridor between Beitbridge and Harare on the border with South Africa to be about 130 billion yen, and the northern section between Harare and Chirundu, including the section covered by this study, to be about 90 billion yen. The northern section between Harare and Chirundu, including the section covered by this study, is proposed to be rehabilitated, improved, multi-lane, etc. at an estimated cost of approximately 130 billion yen.

1-5 The Project site and the surrounding situation

1-5-1 Status of related infrastructure

(1) Background of North-South corridor rehabilitation

The North-South Corridor, which runs through Zimbabwe from north to south, is in need of rapid rehabilitation to cope with increased traffic demand and road deterioration after more than 50 years since its construction. For the southern section (between Beit bridge and Harare on the South African border), a groundbreaking ceremony was held in May 2017 as an implementation project of a Public Private Partnership (PPP) by an Austrian contractor and construction started, but it was suspended and is currently being rehabilitated by the Government of Zimbabwe. In the northern section (between Harare and Chirundu near the Zambian border), the Government of Zimbabwe requested Japan's assistance for the improvement of part of the section between Karoi, 210 km west of Harare, and Chirundu, 351 km west of Harare, although there were discussions in 2016 on a Chinese loan project. For the northern section (between Harare and Chirundo on the Zambian border), though there were talks on a loan project by China in 2016, the Government of Zimbabwe requested Japan's assistance for road improvement between Karoi at 210 km and Chirundu at 351 km west of Harare. In 2018, a preparatory survey was conducted by JICA (Phase 1), and road rehabilitation was implemented for 6.5 km between 306.5 km (start point) and 313 km (end point), which included the construction of a climbing lane and improvement of sharp curves. This survey was conducted on the road improvement on the Har're s'de section adjacent to the Phase 1 section, which has the second highest priority for improvement after Phase 1. The survey started in October 2021 to confirm the requests of the Zimbabwe side and the current status of the target section, and to select the scope of improvement and confirm the specifications of the plan.

(2) Current situation and challenges in the road sector

1) National Development Strategy 1 (NDS1, Jan./2021 – Dec./2025)

Transitional Stabilisation Programme (TSP) was implemented by the Government of Zimbabwe between October 2018 and December 2020, and a new National Development Strategy (NDS1)

was launched in November 2020 as a new national plan, a five-year medium-term plan covering the period 2021-2025, with the target of “achieving a middle- and high-income society by 2030”. Seminars on the strategy are currently active by relevant agencies and aims at smooth implementation (MoTID senior management participated in the seminar in the eastern city of Mutare on 18-21 October 2021). In addition, the following targets have been set for the road sector.

1-1) Road transport sector targets NDS1

- (1) Improved road transport services are important for facilitating national, regional and international trade by improving accessibility and facilitating the movement of goods and people.
- (ii) The poor condition of large parts of the road network has a direct and indirect impact on road transport safety: the average number of accidents per year from 2010 to 2017 was 36,105 and the number of people killed in road accidents was 1,836. Total number of accidents increased from 38,620 in 2016 to 42,430 in 2017. Similarly, the number of fatal accidents increased by 1,358 from 2016 to 2017.
- (iii) The goal during the NDS1 period is to achieve high quality and efficient public transport services covering both rural and urban areas. The strategic objective for improving road transport services is to reduce road traffic accidents and fatalities by 25% per annum.
- (iv) The NDS1 sets the following priority targets for improving road transport services.
 - Road authorities install and maintain appropriate road signage on new and existing roads.
 - To install road markings and signs that are resistant to damage and highly visible.
 - To implement traffic management measures, including traffic signage, in line with local standards.
 - To address the remediation of all engineering defects in ‘black spots’.

2) Progress in the rehabilitation of the southern section

The North-South Corridor, which runs through Zimbabwe from north to south, is facing major challenges in terms of road rehabilitation to cope with increasing traffic demand and road deterioration after more than 50 years of construction. Rehabilitation of the southern section is currently being undertaken by the Government of Zimbabwe, starting with high priority sections, covering approximately 20 km per section.

- i) The start date for all construction contracts is November 2019.
- ii) The average construction period for each 20 km section is 6 months with an average cost of USD 1.25 million/km (140 million yen/km).
- iii) The contractors have now completed Phases 1 and 2 and are working on Phase 3a construction section (also 20 km).
- iv) Overall progress is currently around 34%, with the Project completion date yet to be determined.

Table 1-5: Road improvement in the southern section by the Zimbabwe Government

Contractor Name	Length (km)	Remarks
Tensor systems	96	-All five companies share around 20% of the 582 km between Harare and Beit bridge. -5 phases, divided into 2 sections (between Harare-Masving and Masvingo-Beit bridge), 1 section is about 20 Lots, 1 Lot is about 20 km -Road rehabilitate starts with the highest priority spots and proceeds in both directions.
Fossil Contracting	123	
Masimba Construction	125	
Exodus and Company	114	
Bitumen World	124	
Total	582	

Source: Survey team

3) Identification of relevant projects that may affect the project effectiveness of the Plan

3-1) Study on the Zimbabwe and Botswana routes of the North-South Corridor

The road and bridge projects currently underway in Zimbabwe that could have a significant impact on the Project are the road rehabilitation of the southern section mentioned above.

Meanwhile, for the entire North-South Corridor from South Africa to the interior countries, interviews and analysis were conducted with the executing agencies and the OSBP in Chirundu on the potential impact on some of the logistics using the Zimbabwe route covered by the Project, due to changes in the status of the Botswana route in addition to the existing Zimbabwe route, following the opening of the Kazungula bridge at the Botswana-Zambia border in May 2021.

3-2) Current status of the Zimbabwe route

i) At the Beit bridge border facility in southern Zimbabwe (around 1,000 large vehicles per day), the customs clearance fee for trailers has changed from \$100 to \$201, and the less smooth operation of the newly commissioned private collector has caused a 10km traffic jam on the South African side with vehicles waiting to pass. Due to these effects, the trailer congestion at Chirundu OSBP observed during the 2018 Phase 1 survey was not observed during the site visit on 17 October 2021. However, the site visit one week later, traffic congestion of 1-2 km was seen which is similar to that observed during the Phase 1 survey.

ii) Interviews with OSBP manager indicated that the current normal daily traffic volume was 350 vehicles/day in the direction of Zambia and 350 vehicles/day in the direction of South Africa, similar to the daily traffic volume of 700 vehicles/day during the 2018 Phase 1 survey.



Photo: Traffic jam at Beit bridge

iii) Inland traffic is handled through the Zimbabwe-Zambia customs clearance located in Zambia, while procedures in the direction of South Africa are handled through the establishment of a similar function in Zimbabwe, functioning as an OSBP.

3-3) Makuti dry port project

i) Due to difficulties in securing land for the expansion of the existing OSBP facility in Chirundu, the Zimbabwean side is currently in the process of selecting a consultant for the new facility plan to establish a dry port in the Makuti area. The planned facility appears to be intended to handle Zimbabwe's share of traffic in the South Africa direction, but the confirmation needed to the executing agency whether there is any planning consideration for handling vehicles in the Zambian direction.

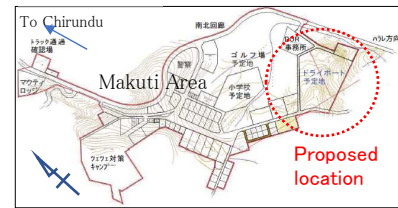


Fig 1-2.: Makuti Dry Port Plan
(Red circled is planned area)

ii) The assumed maximum volume of heavy vehicle traffic of the Project is considered to be the allowable response volume for the OSBP facilities. Therefore, future traffic volumes will need to be considered in light of trends in dry ports and other related facilities.

3-4) Status of the Botswana route

Trailer clearance fees at the Kazungula Bridge have been set at \$100, with collection commencing in May 2021. MoTID and other relevant agencies commented that conversion from the Zimbabwe route is very limited due to the following conditions. In addition, OSBP in Chirundu commented that no concrete changes have been seen since the opening of the Kazunguloute.



Photo: Kazungura Bridge

- i) The Kazungula route is 210 km long.
- ii) The route has no towns or facilities along the route to stop and rest.
- iii) There is no extreme difference in the amount of customs expenditure of around \$100 (around 175 vehicles/day of traffic).

In the Project, the results of the above interviews and the results of the traffic volume survey were verified and calculated traffic flows, etc. to confirm the Project effects.

4) Maintenance status of existing roads

4-1) Status of maintenance of the subject road

DOR carries out maintenance by themselves, using owned machinery. Road maintenance on the target road section is handled by the maintenance branch stationed in Makuti. The branch conducted rehabilitation of pavement in a 10 km section from Makuti to the direction of Harare in March 2021. On the existing road, rehabilitation has been carried out



Photo: Road Maintenance by DOR

relatively frequently and the road surface is relatively well managed for the carriageway section with few potholes. It was also commented during the Phase 1 survey in 2018 that the bituminous materials procured with the support of Japan were effectively used for road maintenance after the rainy season and were very effective. On the other hand, the shoulders of the existing road have been eroded by rainwater to the edge of the carriageway in various places, making it very dangerous

for vehicles to pass each other on these sections. The Zimbabwean side is highly aware of these issues and commented during the survey that they would like to discuss the issues with the survey team and consider measures to address them. Both MoTID and MoFED highly appreciate Japan's past and ongoing cooperation in the road sector, and they requested that cooperation in the road sector should be continued widely in the future.



Photo: Status of erosion

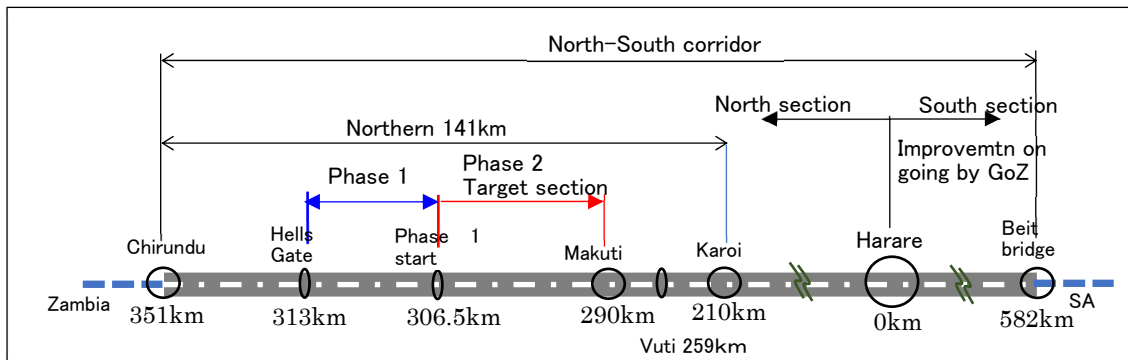
(3) Current status of the subject site

1) Overall situation in the northern section (141 km)

1-1) Overview of the 141 km section and the section covered by this survey

In the northern section of the North-South Corridor (210 km to 351 km from Harare), the target road passes through a section with the following three topographical characteristics, based on the state of the surrounding terrain and elevation.

- I) Length 49 km between Karoi and Vuti (hilly terrain);
- II) Length 54 km between Vuti and Makuti and Hell's Gate (steep terrain); and
- III) Length 38 km between Hell's Gate and Tirund (flat terrain).








Source: Survey team Remarks: 210km= Distance from General Post Office in Harare

Fig. 1-3: Outline of the Target Road Section

The target road section passes through hilly, steep and flat terrain and there are many curved sections within the section. In particular, the steep terrain of the section II ② onwards shown in the Table below has a concentration of continuous curved sections with small curve radii, which account for about 30% of the total number of curved sections. In addition, the alignment is particularly accident-prone where short sections have a series of steep curves, short straights and sharp curves. The following section shows the status of the existing road and the problems and issues identified for each of these three sections through which the subject road passes. The survey covers 15.5 km from the start of Phase 1 of Section II ② (steep terrain) in the direction of Harare.

Table 1-6: Three topographical features and condition of the existing road

Section	Overview	
<p>I . Hilly terrain</p>	<p>Karoi—Vuti section (Length 49km) Roadway: narrow pavement width (6.8 m), dangerous for heavy vehicles to pass each other, scattered damage to pavement edges, narrow spots and curves with insufficient widening. Shoulder: no shoulder or rough unpaved shoulder Alignment: partial sharp bends and gradients, insufficient single-sided gradients Road surface: sags, many repairs on the lower side of one slope. Accidents: 2 accident spots, 1 accident countermeasure (rumble strips)</p>	
<p>II .Steep terrain</p>	<p>Vuti—Makuti—Hells Gate section (54km) <u>① MoTID partially maintained (32km)</u> Roadway: pavement width 6.8-7.0 m, same as above. Shoulder: no shoulder or rough unpaved shoulder Alignment: two dangerous sharp bends Road surface: many repairs on slope lower side and sag. Accidents: 3 accident spots.</p> <p><u>② Existing Road (15.5km)</u> (Note: Target Section) Roadway: pavement width 6.8-7.0 m, same as above. Shoulder: no shoulder or rough unpaved shoulder Alignment: steep gradient sections reduce vehicle speed for heavy vehicles to around 5 km/hr. Problematic sections of alignment with sharp downhill curves. Road surface: many repairs in dents and on the lower side of one gradient, road surface slippage. Accidents: 3 accident spots, 3 accident countermeasures (rumble strips)</p> <p><u>③ Phase 1 section (6.5km)</u> Pavement width, carriageway and shoulder: Zimbabwean standards Alignment: cliff section has a height difference of 400 m in 5 km (many sharp bends and gradients). Design speed 60 km/hr (40 km/hr). Guard rail installed. Road surface: many repair marks on the underside of the road longitudinal section. Slippery road surface conditions in some areas. Accidents: 4 accident spots.</p>	   <p>2021/May complete</p>
<p>III . Flat terrain</p>	<p>Hells Gate—Chirundu section (38km) Pavement width: 9.0 m Roadway: 7 m (DOR standard) Shoulder: paved shoulder (1m+1m, below DOR standard) Alignment: no sharp bends, no steep gradients Road surface: undulating road surface, some repairs across the full width, warmer temperatures Accidents: many tie-burst wrecks, many accidents on straight sections.</p>	

Source: Survey team

Note: SATCC 1997 standard applied at the time of Phase 2 survey start.

2) Phase 2 sections

The current status of the key indicators of the roads surveyed is presented below.

2-1) Road anment

i) Road cross section

The existing road width of the target section of carriageway is 7m wide which follows 7/10 type (Seven in ten = 3.5m two lanes + 1.5m unpaved shoulders on both sides), which is the old road standard in Zimbabwe. The road width of the Phase 1 section is also shown.

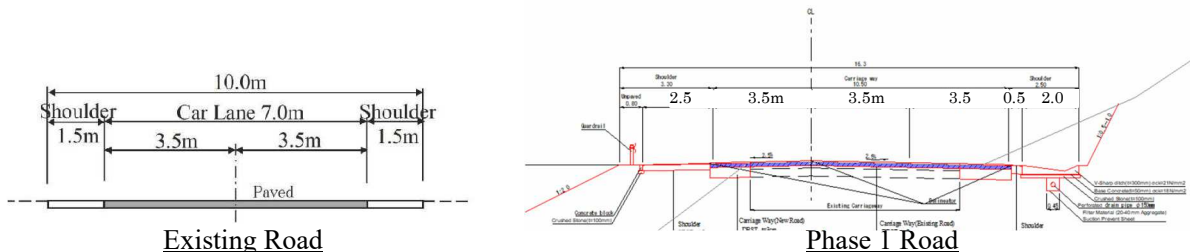


Fig. 1-4: Road width configuration for Zimbabwe Standard 7/10 and Phase 1

The average width of the paved section of the existing road is about 6.9 m. However, sections of the road that are heavily damaged at the edge of the road are a major traffic safety problem because of the constant risk of collisions when large vehicles pass each other.



Photo: Road edge damage

ii) Longitudinal road alignment

On the target section, which passes through mountainous areas, large vehicles forced to drive at low speeds are an obstacle to other vehicles on steep hill sections with uphill gradients of around 6-7%. Cases of accidents due to forced overtaking have been identified during the period of the survey. In the Phase 1 section, a significant improvement was observed by adding a climbing lane to the steep gradient section as an effective countermeasure, but Phase 2 section having a mixture of partial gentle gradients. Therefore, it is important to examine the extent to which effective climbing lanes can be installed.

Flat section Gradient less than 3% Steep road section Difference in height about 500m

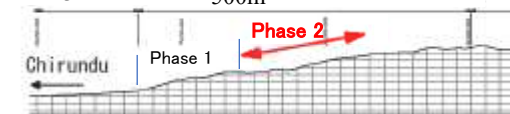


Fig.1-5: Target section vertical alignment

iii) Sight distance

The Southern Africa Transport and Communications Commission (SATCC) standards specify the sight distances to be ensured according to the design speed as follows.

> Design speed 60 km/h = 80m, 80 km/h = 115m

In the Phase 1 survey, the setback width of the cut slope of the curve section was surveyed to check the plane sight distance (braking stop sight distance) and the above criteria. Spots ⑨⑩⑪⑫⑬ did not meet the sight distance at the design speed of 60 km/h, which were identified as problem sections in the Phse 1 survey. Spots ⑩⑪⑫⑬ was improved in the Phase 1, but sight distance was still insufficient in spot spot ⑨.



Photo: Insufficient sight distance spot

Ref.: Min. sight distance (m) of problem sections

⑨	⑩	⑪	⑫	⑬
47.2	120.9	59.5	51.8	42.4

Source: Survey team

Remarks: ⑨ between 300-302.5km, ⑩ 303.5-304.2, ⑪ 305.5-307.2, ⑫ 307.2-307.9, ⑬308.2-312.5

iv) Cut and fill slopes

There are many cut and filled slope of 1m to 5m observed in the target section. In addition, some of the cut slopes have rock outcrops and the weathering conditions are similar to those in the Phase 1 section, with nodules on the outcrop surfaces, and no evidence of large-scale slope failure on any of the slopes. Borehole investigations and other surveys are being carried out to determine the rock type.

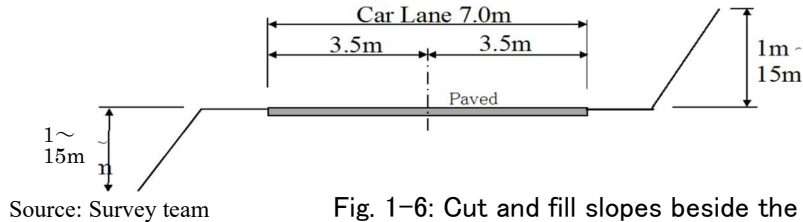


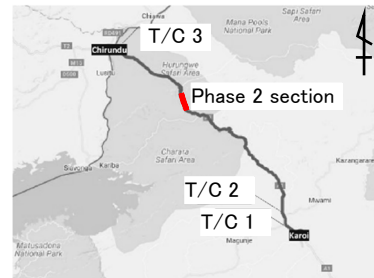
Photo: Existing slopes

Fig. 1-6: Cut and fill slopes beside the current road

3) Traffic volume and traffic condition surveys

3-1) Annual changes in traffic volumes

Traffic volume data from previous years shows relatively large fluctuations in traffic volumes, which may be due to the unstable economy, and therefore, in traffic volume surveys, growth rates should be carefully estimated.



Source: Survey team

Fig. 1-7: Traffic survey location

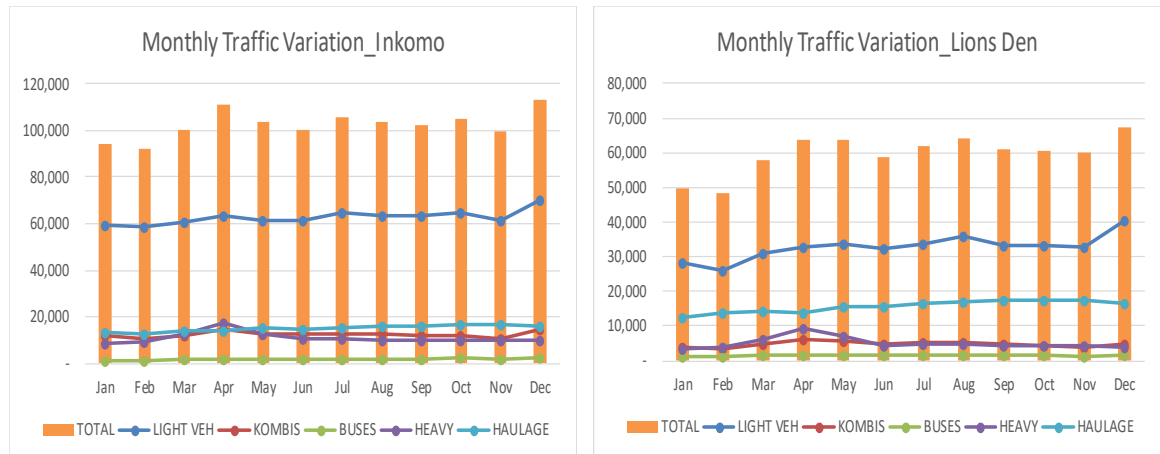
Table 1-7: Yearly changes of traffic volumes

Location	Year	Sedan	Mini bus	Large bus	Track	Trailer	Total (Nos.)	ange
1. Inkomo (40km from Harare)	2013	752,956	147,351	19,509	132,216	180,445	1,232,477	100%
	2015	880,321	87,115	24,331	77,871	139,334	1,208,972	98%
	*2016	835,564	92,296	25,172	84,543	140,289	1,177,864	97%
	Average	822,947	108,921	23,004	98,210	153,356	1,206,438	-
2. Lion's Den (ditto 140km)	2013	393,064	56,761	18,252	61,029	187,685	716,791	100%
	2015	523,757	27,701	19,655	41,435	132,861	745,409	104%
	*2016	499,029	35,994	44,927	54,510	157,243	791,703	106%
	Average	471,950	40,152	27,611	52,325	159,263	751,301	-
Change fro 1 above		57%	37%	120%	53%	104%	62%	-

Source: Survey team *2016 is projected values

3-2) Traffic volume monthly fluctuations

The monthly variation in traffic volume from past data shows similar monthly variations for both Inkomo and Lion's Den, with peaks in April and December during the year and less in January and February. There is also little variation in the other months of the year. November, the month in which the field survey was carried out, is a month when the percentage of annual traffic volume is around 8%, which is almost similar to the annual average.



Source: Survey team

Fig. 1-8: Traffic volume monthly variation

3-3) Road traffic volumes

The survey team arranged traffic volume surveys by the local consultant and carried out. The result is shown below.

- > Survey period: from Monday 1 to Monday 8 November 2021, for eight days.
- > Survey locations: Karoi (T/C1, 2) and Tirund (T/C3)
- > Survey hours: 6:00-18:00 (12 hours), T/C 1 and 2. 6:00-6:00 (24 hrs), T/C 3
- > Type of vehicle surveyed: see table below.

Table 1-8: The result of Traffic Survey

Date		Ordinary car		Bus		Truck		Trailer			Daily traffic
		Sedan	Taxi	Mini bus	Large bus	2 Axle	3 Axle	4 Axle	5 Axle	6 Axle~	
2021/11/1	Mon.	225	1	24	21	31	14	5	14	488	823
2021/11/2	Tue.	253	1	22	25	36	16	7	3	533	896
2021/11/3	Wed.	237	2	21	21	24	20	10	3	541	879
2021/11/4	Thr.	178	0	25	8	22	14	5	2	334	588
2021/11/5	Fri.	56	0	2	7	2	6	3	0	75	151
2021/11/6	Sat.	271	1	27	24	25	16	13	5	469	851
2021/11/7	Sun.	226	1	11	18	20	20	11	3	535	845
2021/11/8	Mon.	210	1	26	17	23	23	14	6	511	831
Remarks	8 days	1,656	7	158	141	183	129	68	36	3,486	5,864
	6 days	1,422	7	131	126	159	109	60	34	3,077	5,125
	Average (Nos.)	237	1	22	21	27	18	10	6	513	855
	Share	28%	0%	3%	2%	3%	2%	1%	1%	60%	↑ Design traffic
	Share	28%		5%		5%		62%			
	Day/Night	33%	29%	37%	47%	28%	19%	25%	6%	28%	

Source: survey team Note: 72% heavy vehicle mixing rate, outliers on 4 an Nov.

i) Results of traffic volume survey

The survey identified the following four points

- ① Traffic volumes have increased slightly.
- ② Heavy vehicles have decreased slightly.
- ③ Possibility of impact due Beit bridge border crossing problems
- ④ There is a shift towards larger transport vehicles.

Taking into account monthly fluctuations, the average daily traffic volume (ADT) at the traffic survey sites was estimated using the following formula.

[T/C 1 &2]	[T/C 3]
$ADT_n = Q_n \times 1.2 / (7/30) / 8\% / 365$	$ADT_3 = Q_3 / (7/30) / 8\% / 365$
Where	Where
ADT _n : ADT of location “n”	ADT ₃ : ADT of location 3
Q _n : Weekly traffic at “n”	Q ₃ : Weekly traffic at 3

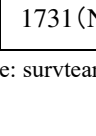
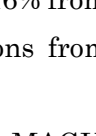
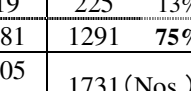

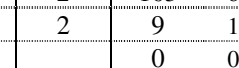

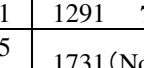
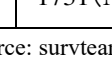
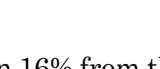


Classification			Vehicle	Example
HV	Type	Class		
1-4	T/3	1	Passenger cars	
		2	Taxi	
	T/4	3	Large Bus	
		4	Mini bus, Coaches	
M/3	M/3	5	Single Unit Truck, 2 Axle	
		6	Single Unit Truck, 3 Axle	
M/3	M/3	7	Trailer, 4 Axle	
		8	Trailer, 5 Axle	
		9	Trailer, 6 Axle and more	
		10	Motor Cycles & Scooters	
		11	Bicycles, Non-motorized vehicle	
		12	Pedestrian	

Fig..1-9: Vehicle categories

Source: MoTID

ii) The result of Origin Destination (OD) survey

In conjunction with the above traffic volume survey, a roadside OD survey was conducted at one location each in Karoi and Chirundu. As in Phase 1, approximately 1,700 vehicles (38% is passenger cars, 10% is buses and 52% is trucks and trailers.) were interviewed in the survey. A summary of the results is shown below.



Photo: OD survey

Table 1-9: Result of OD survey

Description		Destination							Total		
		Congo Democ.	Malawi	Mozambique	South Africa	other	Zambia	Zimbabwe			
Origin	Congo Democ.				38				38	2%	
	Marawi								0	0%	
	Mozambique	33					31	1	65	4%	
	South Africa	39					62	2	103	6%	
	Tanzania				7			2	9	1%	
	Other								0	0%	
	Zambia			61	45				119	225	13%
	Zimbabwe	5					105	1181	1291	75%	
Total	77	0	61	90	0	198	1305	1731 (Nos.)			
	4%	-	4%	5%	-	11%	75%				

Source: survteam.

【Summary of results】

- a) Domestic logistics in Zimbabwe account for 75%, and have increased in 16% from that of Phase 1 (impact of agricultural harvesting and mineral calculations from five neighbouring locations).
- b) The above mentioned five neighbouring locations are MOYA, MAGUNJE,

ELEPHANT WALK, GOODHOPE and VUTI, scattered within approximately 30-40 km of Karoi.

- c) Destinations decreased by 4-8% in Zambia, South Africa and Mozambique, and departures decreased by 7-10% from South Africa and Mozambique.
- d) It is guessed that the variation in c) above is the result of impact of economic stagnation due to the impact of the COVID-19 epidemic and the temporary stagnation of the South African-Zimbabwean border crossing.



Source: survey team Fig. 1-10: Factors contributing to increased domestic logistics in Zimbabwe (Increased of traffic volume in agricultural products and mining from neighbouring area was identified.)

3-4) Axle weight survey

Zimbabwe Act No. 129-2015 (Statutory Instrument 129 of 2015: Road Traffic (Construction, Equipment and Use) Regulations,2015) shows the standard dimensions of the vehicles permitted to pass, as well as the loaded gross vehicle weight and the maximum axle weight limit. The following table shows the regulatory values for Zimbabwe and neighbouring countries.

Table 1-10: Comparison of axle weight regulations

Country	front	single	2 axles	3 axles	Combined
Zimbabwe	-	8 000 kg	18 000 kg	24 000 kg	56 000 kg
South Africa	7 700 kg	8 000 kg	16 000 kg	24 000 kg	56 000 kg
Botswana	7 700 kg	8 200 kg	16 000 kg	24 600 kg	50 200 kg
Malawi	7 700 kg	8 200 kg	16 400 kg	24 600 kg	55 000 kg
Mozambique	7 700 kg	10 000 kg	16 000 kg	22 000 kg	38 000 kg
Tanzania	7 700 kg	10 000 kg	18 000 kg	24 000 kg	52 000 kg

Source: survey team

An axle-weight survey was carried out at Chirundu, to establish the Vehicle Equivalent Factor (VEF) of 8.16 tone to be used in pavement design and to examine the actual overloading situation. Since an overloaded vehicles are allowed without unload of the excess weight and the vehicles pass after payment of the fee in Zimbabwe, the pavement design was examined in light of these current conditions.

Table -1-11: Results of axial weight measurements

Description	Bus	Truck		Trailer				Total
		2 Axle	3 Axle	4 Axle	5 Axle	6 Axle	7 Axle more	
Surveyed	0	0	0	1	3	106	29	139 (Nos.)
	0%	0%	0%	1%	2%	76%	21%	100%

Weight (t)	-	-	-	45.7	47.4	46.0	50.1	↓ Value applied
VEF	-	-	-	21.1	10.6	6.4	4.2	6.19

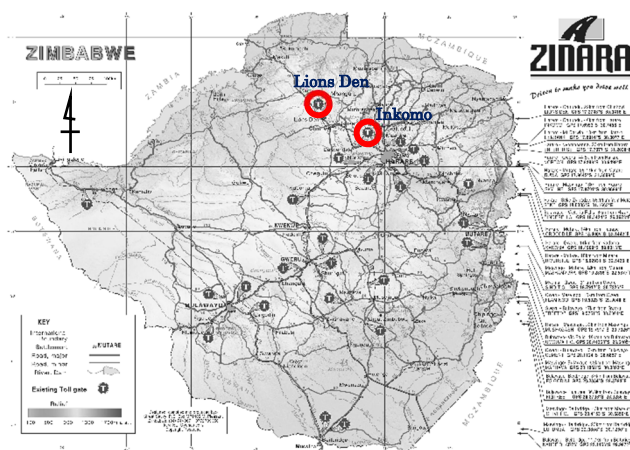
Source: survey team Note: VEF = Vehicle Equivalent Factor (VEF), weight = average weight per vehicle.

Two (1.4%) out of 139 vehicles were identified as overloaded.

> Survey period: -1 (Mon) - 6 (Sat) November 2021, 6:00-18:00 (12 hours).

3-5) Road toll booths

Since the 1990s, Zimbabwe has set up toll booths in major cities on trunk roads to collect road tolls. Revenue from tolls is one of the main sources of revenue, accounting for 21% of the Road Fund. The 36 toll stations located across the country are operated by the Zimbabwe National Roads Administration (ZINARA). Along the northern section, there are toll booths at Inkomo, at 40 km and Lions' Den, at 140 km from Harare.



Source: ZINARA

Fig. 1-11: Location of Toll Booths

3-6) Cross-border traffic

The border between Zimbabwe and Zambia, Chirundu, was the earliest border crossing point in Africa, which has adopted the OSBP system. Currently, cross-border logistics traffic through Chirundu is about 700 vehicles/day. The annual variation peaks between August and October, with little variation in the other months.



Photo: Chirundu OSBP

3-7) Travel speedveys

i) Heavy vehicle tracking results

Tracking of heavy vehicles in the survey section was carried out in order to study the sections where climbing lanes were installed. There were some differences in the result between that of the survey of Phase 1 (extremely slow vehicle observed) and this survey but significant decrease in speed less than 40km/hr was observed in both surveys in the 300-303 km section and the section was identified that a climbing lane should be added.

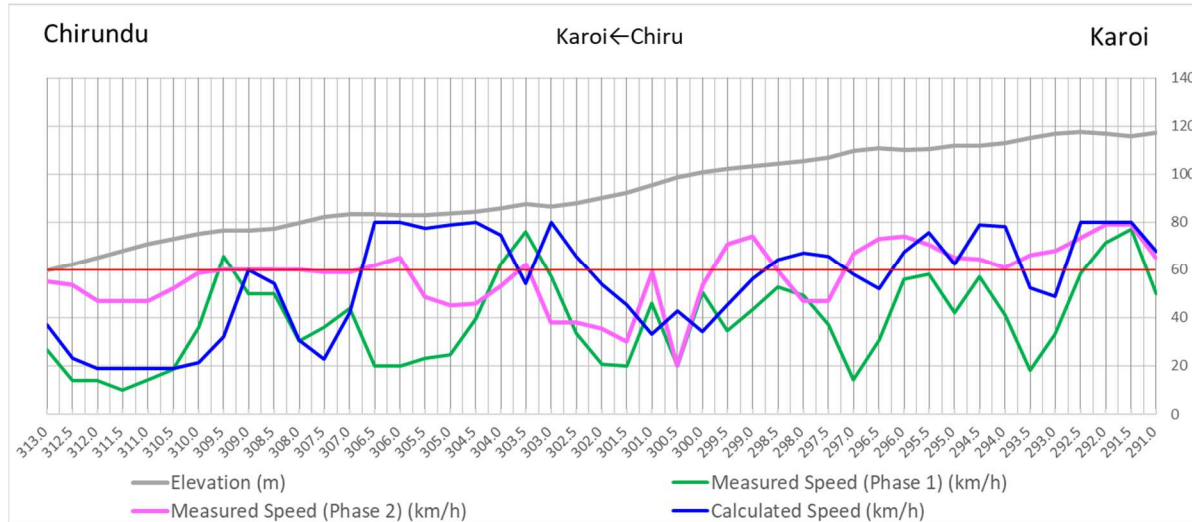


Photo: Speed Tracking survey

- The average speed in the Phase 1 section where the climbing lane was added increased significantly and the bottleneck was eliminated (increasing the economic benefit in logistics).
- The improvement of road conditions in the Phase 1 section has benefited about 1km of the adjacent Phase 2 section, which has seen an increase in transit speed.

- After 6.8 km from the start of Phase 1 in the direction of Harare, the speeds measured in this survey are higher than the results of the Phase 1 survey.

Based on the above measurement results and the longitudinal gradient, speed calculations were carried out to determine the section where an uphill lane needs to be installed.



Source: survey team

Fig. 1-12: Result of Speed Tracking Survey

ii) 6 sections where climbing lanes need or do not need

As a result of the above study, it was confirmed that the target section can be divided into the following 6 sections where consideration of a climbing lane is necessary or unnecessary (see 2-1 (3) 7) for details).

Table 1-12: Confirmed 6 sections according to existing large vehicle speed and road gradient

Section	Location	Length	Longitudinal profile
1	306.5~302.7	3.8 km	Partially steep sections with sections that are not long
2	302.7~298.7	4.0 km	4-6% gradient sections are remarkable (speed reductions are observed), climbing lane required
3	298.7~296.1	2.6 km	1.5 km of gentle gradient section adjacent to Section 2, followed by a 4-6% gradient section; additional climbing lane desirable
4	296.1~294.4	1.7 km	Relatively gentle gradient sections
5	294.4~292.1	2.3 km	4-6% gradient section are remarkable (speed reduction observed), climbing lane required
6	292.1~291.0	1.1 km	Relatively gentle gradient sections

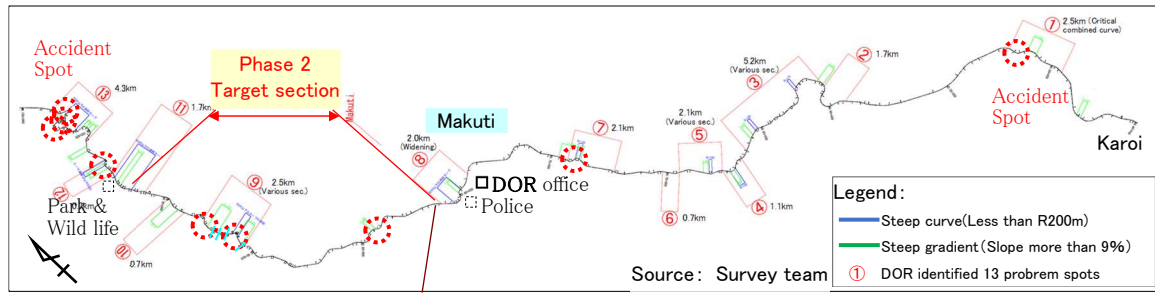
Source: survey team

3-8) Road safetssues

i) Accident spots within the 141km section

Interviews were conducted with local police stations, DOR provincial offices, safari area officers and others to ascertain the actual number of road traffic accidents, the locations and circumstances of the accidents that have occurred in the targeted section, and the following 10 accident hotspots were identified in the target section (spots 11-13 were improved by Phase 1). In these sections, the

road surface still shows signs of accidents, such as brake marks, scattered window glass on the shoulder and wreckage of vehicles involved in accidents.



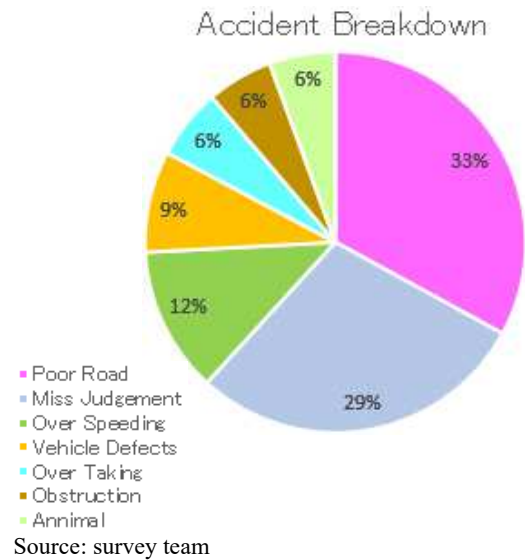
Source: survey team Fig. 1-13: High accident frequency spots within the northern section

ii) Road accidents in Phase 2 sections (results of interviews with police)

Interviews with police regarding accident information were conducted in Makuti, which has jurisdiction over the target road section.

Table 1-13: Accident between 290-306.5 km (number and type of accidents 2016-2020)

Cause of Accident							
Detail	2016	2017	2018	2019	2020	Total	Share
Vehicle Defects	5	3	4	7	4	23	9%
Over Speeding	9	7	1	9	7	33	12%
Over Taking	4	1	2	5	4	16	6%
Poor Road	22	14	10	25	17	88	33%
Miss Judgement	19	7	17	12	22	77	29%
Traffic Sign	0	0	0	0	0	0	0%
Obstruction	2	1	5	4	3	15	6%
Animal	3	2	3	3	4	15	6%
Total Nos.	64	35	42	65	61	267	
Vehicle Type							
Bus	1	1	2	1	0	5	2%
Trailer	42	29	20	38	48	177	66%
Others	21	5	20	26	13	85	32%
Monthly							
Month	2016	2017	2018	2019	2020	合計	割合
Jan.	6	7	4	8	10	35	13%
Feb.	6	4	5	10	2	27	10%
Mar.	11	3	4	7	5	30	11%
Apr.	7	4	1	4	2	18	7%
May	2	1	1	5	3	12	4%
Jun.	2	2	3	3	5	15	6%
Jul.	2	2	2	2	7	15	6%
Aug.	9	1	1	2	6	19	7%
Sep.	4	2	7	6	5	24	9%
Oct.	2	5	3	3	5	18	7%
Nov.	5	3	4	9	9	30	11%
Dec.	8	1	7	6	2	24	9%
Annual Accident	64	35	42	65	61	267	100%



【Observations】

a) Analysis of the above causes of accidents confirms the following points

- > Many accidents occur during the rainy season from November to April → Road surface conditions are not good.
- > The most frequent cause of accidents is poor road conditions and the second 2 is misjudgement, which account for approximately 60% of all accidents.
(Rehabilitation of the current road is expected to have a significant effect on accident prevention).
- > Approximately 20% of accidents are caused by overspeeding and overtaking.
- > The number of accidents involving large vehicle is high, but the causes of vehicle breakdowns are not so common (9%).
- > A few respondents said regarding to the road signs → they do not even notice road signs.

b) From the above points, effective accident countermeasures could include the following

- > Improvement of road alignment and road surface conditions is necessary.
- > Appropriate placement of road safety facilities to reduce the number of misjudged accidents.

iii) Current state of accident spots in the survey section

MoTID has installed rumble strips in the downhill lanes at 300.1 km, 301.3 km and 301.8 km to alert drivers to slow down, but there are many cases where passing vehicles avoid the oncoming lane, so effective measures need to be considered. In addition, at km 292 (point 3 in the figure below), there is an extremely dangerous combination of longitudinal and flat alignment



Photo: Rumble strip

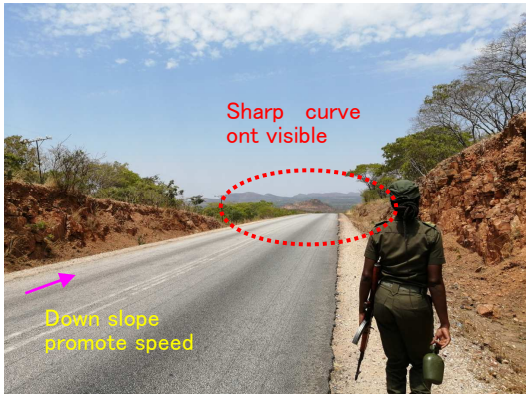
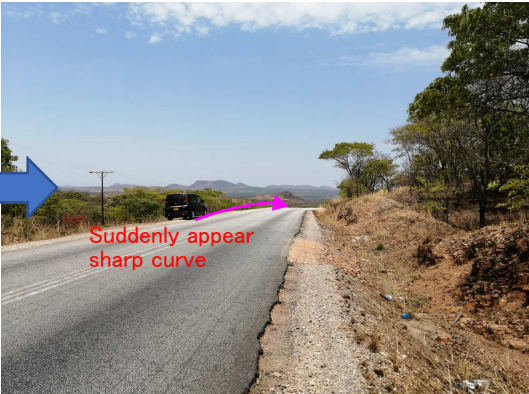


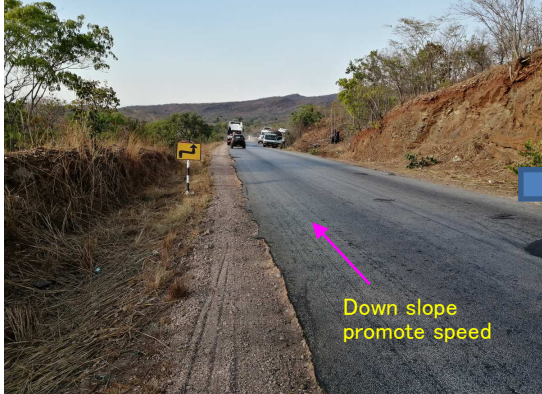

with a sharp curve immediately after a straight downhill with a turning point in the middle, which can easily mislead drivers. In the Project, it will be necessary for consideration of support activity by on methods for identifying and analysing problem sections and improvement methods to improve the current situation. The downhill lanes towards Chirundu at points 1 and 2 in the figure below show evidence of frequent accidents, including brake marks on the road surface, scattered window glass on the shoulder and wreckage from accidents off the road. Approximately 500m before point 2 (on the Harare side), asphalt rumble strips are placed to alert drivers to slow down, but this point is also easily misleading to drivers with a series of short curves in a single section that should be avoided on the road alignment design. These problem spots have a downhill gradient that is easy to speed up, a large difference in elevation between the road and the roadside, and a short straight section with a change in gradient, making it easy to delay visibility of the curve and insufficient superelevation, and no visual guide marker or markings. Furthermore, the road surface is slippery in some spots and is considered to be very dangerous, especially during or after rain. The Project will need to identify sections where the current situation needs to be improved urgently, study for improvement methods (e.g., installation of rumble strips additional sight line pegs on short straight sections) and take action on how to improve the situation.

Table 1-14: Frequent traffic accident spots on the target section (291to 306.5 km)

Accident spot	Cause of accident	Road alignment and structure
1	Excessive speed, overtaking	Accident on a narrow sharp bend immediately after excessive speed on a straight section of 6% downhill. In addition, overtaking accidents also occurred.
2	Excessive speed	Accident on a narrow sharp bend immediately after excessive speed on a straight section of 6% downhill.

3	Misjudgement	The combination of horizontal and longitudinal alignments is poor, and the driver cannot see the curve ahead.
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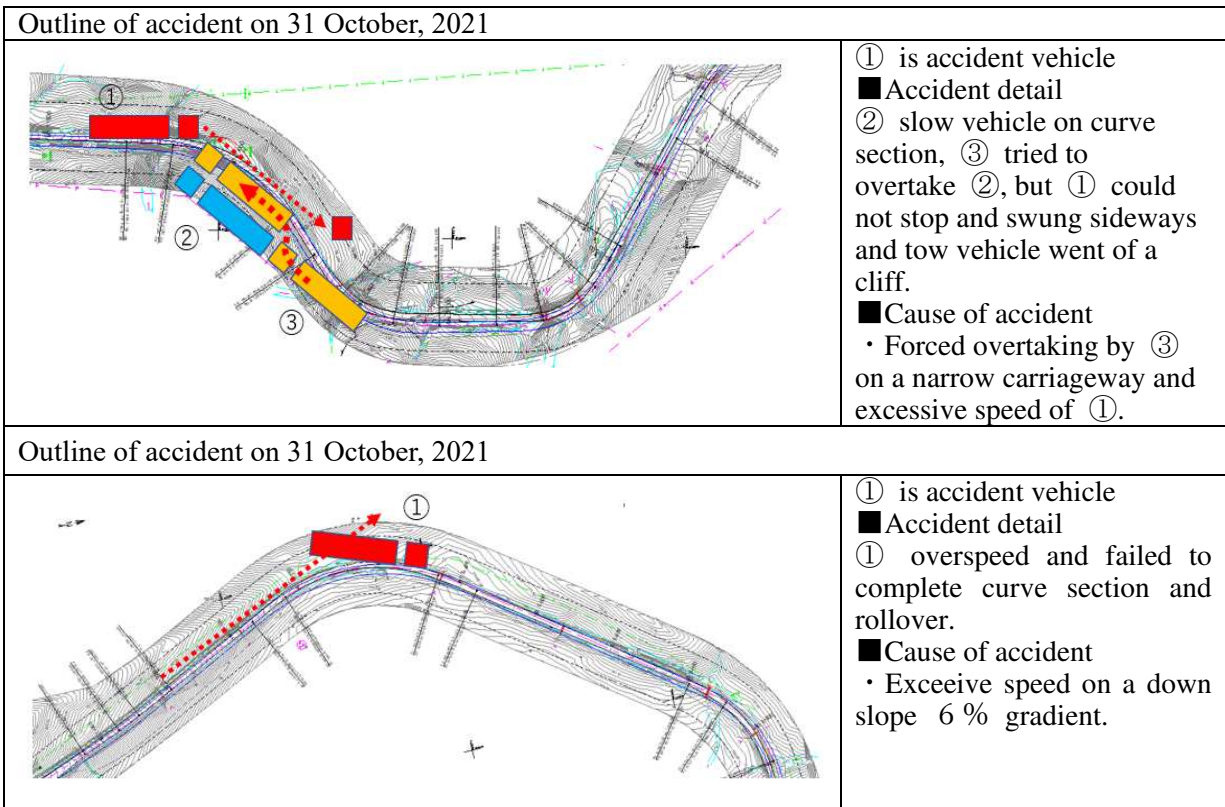
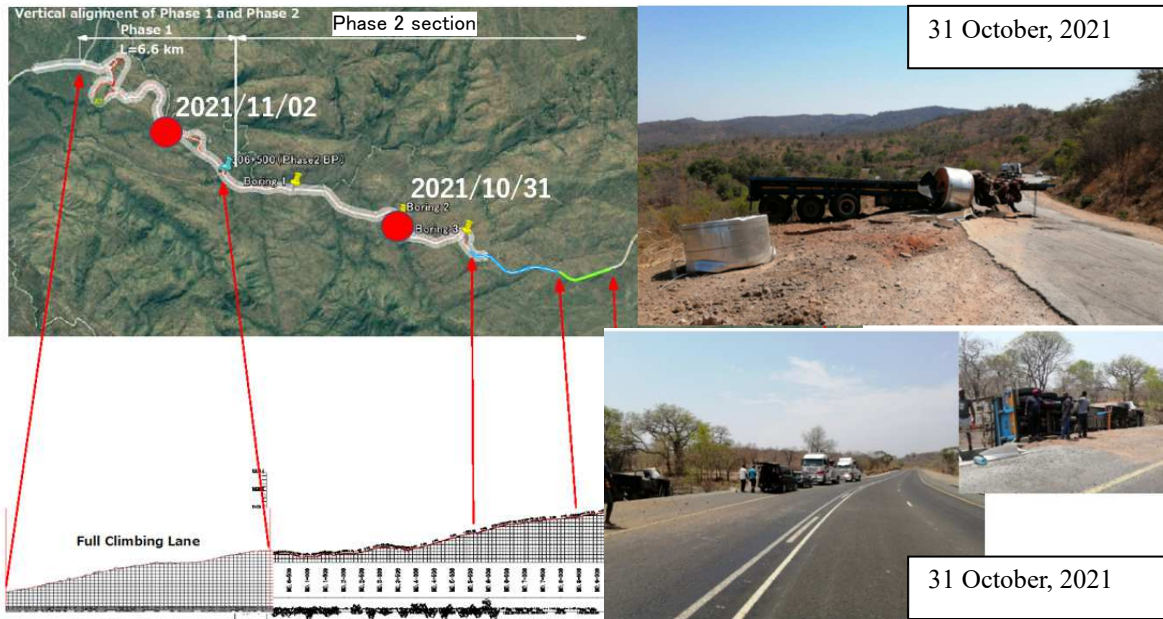
Source: survey team

	
<p>Accident spot 3 (293 km): Not visible sharp curve immediately after the slope break point.</p>	<p>Suddenly observe sharp curve just at the end of down slope (no traffic sign).</p>
	
<p>Accident spot 2 (300.5 km): Straight downhill (6% gradient) with sharp curve.</p>	<p>Down slope with steep S-curve. Accidental vehicle wreckage left along the road.</p>
	
<p>Accident spot 2 (302.5 km): Straight downhill (6% gradient) with sharp curve.</p>	<p>Down slope with steep S-curve. Accidental vehicle wreckage left along the road.</p>

Source: survey team

iv) Examples of road traffic accidents that occurred during field investigations

The following is a summary of two road traffic accidents encountered during the field survey, in October-November 2021.



Source: Survey team Fig. 1-14: Traffic accident occurred during the Survey period

1-5-2 Natural condition

(1) Topography and geology

A vein of stratified ultrabasic rock, known as The Great Dyke, is developed in the centre of the country, extending 550 km from north to south and 3-12 km wide. The Project site is connected to the Zambezi River lowlands through a steep section with an elevation difference of 500 m from the

undulating plateau at an elevation of about 1,000 m. The soil in the target section is classified as sandy soil with low organic content and high drainage properties.

(2) Earthquake

There are three seismic zones in Zimbabwe: the Zambezi Basin, the Eastern Border Area and the Central Region. The “Zambezi Basin”, where the target section is located, is the most seismically active area in the country. The area has recorded about 3,000 earthquakes since 1959, with the largest earthquake ever recorded occurring on 23 September 1963 (magnitude 6.1). The STACC standard (Bridge design) does not include consideration of seismic motion in the planning of culverts and retaining walls, and the Japanese standard does not require seismic studies for wall heights of 8.0 m or less.

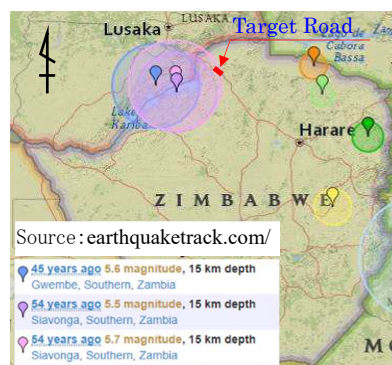


Fig. 1-15: Earthquake spots

(3) Topographic survey

Topographical surveying started on 5 October 2021. The work was completed during the survey team’s field survey, and the accuracy was checked on site. A drone survey was also carried out for utilization of DX in preparation for explanations to Zimbabwean officials, including residents, and Japanese companies.

Table 1-15: Summary of topographical surveys

Work items	Volume	Remarks
Preparation	1 unit	
Reference point setting	15 Nos.	0.5km interval
Reference point surveying	15 Nos.	Traverse survey
Topographical surveying	45ha	Covered 40m wide including intersection

work item	Volume	Remarks
Boundary survey	1 unit	
Road condition survey		Includes t structural integrity surveys.
Data collection	1 unit	Rainfall, standards and regulations, etc.
Data arrangement	1 unit	Includes digital data

Source: Survey team

(4) Geological survey

1) Existing road survey

Bearing capacity checks using a Benkelman beam were carried out at 100 m intervals on the road edge and the central on the left and right lanes to check the condition of the existing road foundation. Trial excavations (trial pits) were carried out every 200 m at the edge of the left and right carriageway to check the existing pavement structure. In addition, in areas that were expected to become cut sections due to the road plan, borehole investigations and supplementary investigations to determine the rock quantity were carried out more closely than those of the Phase 1 survey, based on the lessons learnt from Phase 1.



Photo: Benkelman beam survey

2) Trial excavation survey

Trial pit investigations at a depth of 1.5 m were carried out at the edge of the carriageway in 45 locations in accordance with South African standards (South African Institution of Civil Engineers, 2002) to confirm the condition of the pavement structure and foundations of the existing road. Laboratory tests on the material sampled from the trial pit were carried out in accordance with BS 5930 (1999) standards for each test. Concurrently with the trial



Photo: Trial pit survey

pit survey, a dynamic penetration test (DCP test, Dynamic Cone Penetrometer Test) was conducted in accordance with South African standards and the American Association of State Highway and Transportation Officials (AASHTO) standards.



Photo: Boring survey

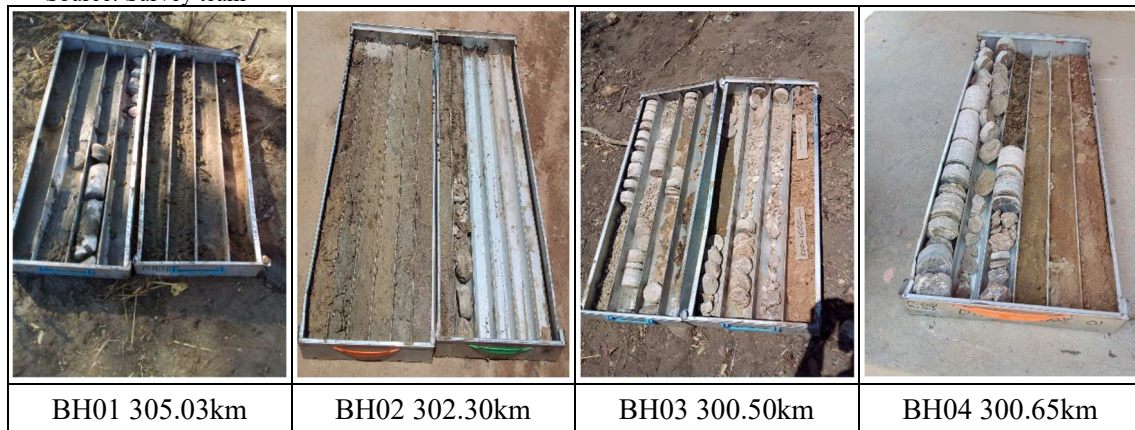
3) Borehole surveys

Borehole surveys were carried out at the 4 sites listed in the table below based on the site checks by the survey team. Standard penetration tests were also carried out in accordance with BS 1377 (1999) standards during the surveys. The condition of the core in each borehole and a summary of the results of the laboratory tests of the collected cores are given below.

Table 1-16: List of borehole test locations

No.	Location	Depth	No.	Location	Depth
BH01	305.03km	8m	BH03	300.50km	8m
BH02	302.30km	8m	BH04	300.65km	6m

Source: Survey team



Source: Survey team

Fig. 1-16: Boring Core

Table 1-17: Summary of laboratory test results

Location	Rock type	Uniaxial Comp. test (UCS)	Standard density Kg/m ³	Absorption rate	Rock hardness
BH01 1.6m	Biotite gneiss	32.5MPa	2482	0.9%	Hard rock
BH02	Weathered rock	-	-	Soft	Weathered rock

BH 03 @ 7.85m	Gneiss	27.0MPa	2858	0.0%	Hard rock
BH 04 @ 5.6m	Gneiss	22.3MPa	3230	0.0%	Decomposed rock

Source: Survey team Note: Uniaxial compressive strength category = soft rock 30~70N/mm²(Mpa)

It also shows the local conditions of the areas that are expected to become cut sections during road rehabilitation works according to the road plan.



Source: Survey team Fig. 1-17: Geological overview of the proposed cut

4) Other supplementary surveys

A simple seismic survey and Schmidt hammer test were conducted near the rock outcrop at the roadside as a supplementary survey to determine the rock type. The simple seismic survey was carried out using a portable seismic digital measuring device and the Schmidt hammer test was carried out by taking three readings at one location.



Photo: Digital measuring devices

5) Other reference information

The results of the borehole survey in the sharp curve spot of the Phase 1 section are given as a reference for the rock type of the target area (survey results: jointed weathered rock and medium-hard rock were identified). Comparing the borehole results from Phase 1 with those from the main survey, it is assumed that the distribution of hard rock is fairly limited in the main survey section.



Sample at 309.75km at 311.15km

(5) Existing pavements

1) Road base and subgrade

In this survey, trial excavations were carried out at 250 m intervals along the existing carriageway edge to check the layer thickness and material of the existing pavement, the material and condition of the road foundation and the level of the groundwater. The existing pavement was found to have a strong base course and subbase course with a gravel mix (bearing capacity value CBR 60-80) with a layer thickness of about 50 cm below the existing two-layer asphalt surface treatment

(DBST) and the subgrade also shows good values (CBR of around 30-15). The existing pavement is very firm and in good condition with no groundwater identified to a depth of around 1.5 m. A summary of the results of the exploratory investigations is presented below.

Table 1-18: Existing pavement composition

Description	Summary
Surface	Double Bituminous Surface Treatment (DBST)
Base	150mm, gravel or 3% cement stabilized
Subbase	300mm, granular (150mm, 2 layer)
Subgrade	250~300mm, CBR15 or more
Subgrade 2	150mm, CBR7~14
Base ground	150mm, CBR4~6



Photo: Existing pavement surface



Trial excavation

Source: Survey team

2) Pavement surface layer

The pavement surface layer of the carriageway is Double Bituminous Surface Treatment (DBST), which is common in Zimbabwe. The existing DBST pavement was in good condition with a rut depth of less than 5 mm according to flatness checks, although it had been subjected to repeated loading over the years due to heavy vehicle traffic. The averaged pavement surface



Photo 2: Flatness verification

temperature was more than 60.0°C between Hell's Gate and Chirundu at lower elevations, with a maximum temperature of 70.3°C at around 320 km. On the other hand, no rutting was observed on the DBST pavement under these severe temperature conditions, even in front of the customs facility in Chirundu waiting to cross the border where large vehicles stopped for a long time.

Table 1-19: Pavement temperatures at various survey points

Description	Karoi-Makuti (210-290km)	Makuti-Hell's gate (290-313km)	Hell's gate-Chirundu (313-351km)
Altitude (average)	1,178m	963m	476m
Pavement surface temperature (average)	55°C	61°C	64°C

Source: Survey team

3) Bearing capacity of the existing road

The bearing capacity of the existing road was checked by Benkelman beams at 200 m intervals on the centre and shoulder sides of the carriageway in the Harare and Chirundu directions respectively, and the results are presented below. The results of the bearing capacity survey showed that 81% of the results were very good or good, 18% were slightly weak and 1% were weak, confirming that the existing road can be fully utilised.

Table 1-20: Results of bearing capacity measurements of existing roads

Sec.	Length	Right Lane		To Harare		Left Lane		To Zambezi		Edge
		Edge	Center	Center	Center	Center	Edge			
Sec.-1										
306.50			0.40		0.45		0.23		0.21	
306.40							0.42		0.48	
306.30			0.41		0.60		0.23		0.34	
306.20										
306.10			0.31		0.40		0.24		0.36	
306.00										
305.80			0.21		0.32		0.48		0.12	
305.70			0.63		0.62		0.33		0.30	
305.60							0.19		0.40	
305.50			0.21		0.82		0.40		0.40	
305.40										
305.30										
305.20			0.87		0.82		0.20		0.38	
305.10										
305.00			0.26		0.22		0.40		0.26	
304.80										
304.70			0.07		0.11		0.26		0.13	
304.60			0.37		0.24		0.24		0.33	
304.50										
304.40			0.25		0.33		0.38		0.27	
304.30										
304.20			0.42		0.40		0.34		0.44	
304.10										
304.00			0.37		0.34		0.51		0.46	
303.80										
303.70			0.16		0.16		0.55		0.81	
303.60			0.11		0.42		0.55		0.38	
303.50							0.32		0.10	
303.40										
303.30										
303.20			0.58		0.21		0.25		0.48	
303.10										
303.00			0.67		0.36		0.26		0.39	
302.80										
302.70			0.41		0.32		0.34		0.44	
302.60										
302.50			0.56		0.89		0.34		0.45	
302.40										
302.30			0.16		0.70		0.30		0.23	
302.20										
302.10			0.34		0.64		0.41		0.37	
302.00										
301.80			0.67		0.38		0.26		0.26	
301.70										
301.60			0.68		0.88		0.24		0.28	
301.50										
301.40			0.04		0.06		0.32		0.23	
301.30										
301.20			0.13		0.04		0.15		0.20	
301.10										
301.00			0.07		0.47		0.64		0.26	
300.90										
300.80			0.26		0.88		0.28		0.23	
300.70										
300.60			0.70		0.68		0.66		0.67	
300.50										
300.40			0.50		0.08		0.21		0.28	
300.30										
300.20			0.09		0.23		0.16		0.20	
300.10										
300.00			0.63		0.18		0.19		0.22	
299.80										
299.70			0.24		0.26		0.26		0.10	
299.60			0.27		0.03		0.08		0.18	
299.50										
299.40			0.29		0.13		0.08		0.07	
299.30										
299.20			0.11		0.09		0.04		0.07	
299.10			0.04		0.03		0.23		0.33	
299.00										
298.80			0.06		0.64		0.09		0.18	
298.70										
298.60			0.11		0.06		0.02		0.03	
298.50			0.14		0.07		0.16		0.17	
298.40										
298.30			0.12		0.03		0.09		0.10	
298.20										
298.10			0.15		0.37		0.14		0.14	
298.00										
297.80			0.19		0.41		0.05		0.18	
297.70										
297.60			0.26		0.16		0.25		0.26	
297.50										
297.40			0.33		0.34		0.07		0.48	
297.30										
297.20			0.46		0.43		0.24		0.35	
297.10										
297.00			0.43		0.34		0.38		0.49	
296.80										
296.70			0.14		0.24		0.35		0.39	
296.60										
296.50			0.21		0.16		0.27		0.24	
296.40										
296.30			0.54		0.29		0.44		0.28	
296.20										
296.10			0.15		0.09		0.17		0.28	
296.00			0.72		0.36		0.38		0.34	
295.80										
295.70			0.09		0.06		0.09		0.11	
295.60			0.15		0.25		0.11		0.27	
295.50										
295.40			0.32		0.15		0.17		0.21	
295.30										
295.20			0.70		0.48		0.03		0.34	
295.10										
295.00			0.33		0.19		0.13		0.44	
294.80										
294.70			0.25		0.21		0.39		0.34	
294.60										
294.50			0.16		0.48		0.27		0.24	
294.40										
294.30			0.46		0.46		0.03		0.36	
294.20										
294.10			0.26		0.15		0.34		0.39	
294.00										
293.80			0.15		0.11		0.52		0.61	
293.70										
293.60			0.51		0.52		0.31		0.37	
293.50										
293.40			0.58		0.26		0.10		0.22	
293.30										
293.20			0.19		0.15		0.37		0.48	
293.10										
293.00			0.21		0.88		0.22		0.40	
292.80										
292.70			0.33		0.15		0.10		0.15	
292.60										
292.50			0.56		0.40		0.33		0.38	
292.40										
292.30			0.11		0.38		0.14		0.38	
292.20										
292.10			0.70		0.48		0.11		0.37	
292.00										
291.80			0.18		0.19		0.37		0.42	
291.70										
291.60			0.46		0.24		0.31		0.22	
291.50										
291.40			0.40		0.27		0.17		0.23	
291.30										
291.20			0.19		0.16		0.17		0.23	
291.10										
291.00			0.15		0.09		0.77		0.84	
290.80										
290.70			0.04		0.15		0.26		0.27	
290.60										
290.50			0.23		0.27		0.15		0.17	
290.40										
290.30			0.54		0.56		0.41		0.50	
290.20										
290.10			0.73		0.31		0.86		0.84	
290.00										
289.80			0.16		0.46		0.04		0.18	
289.70										
289.60			0.15		0.12		0.10		0.14	
289.50										
289.40			0.19		0.15		0.17		0.26	
289.30										
289.20			0.24		0.24		0.15		0.26	
289.10										
289.00			0.17		0.11		0.18		0.22	
288.80										
288.70			0.06		0.03		0.03		0.07	
288.60										
288.50			0.31		0.33		0.03		0.46	
288.40										
288.30			0.02		0.04		0.24		0.31	
288.20										
288.10			0.15		0.04		0.41		0.35	
288.00										
287.80			0.28		0.26		0.16		0.20	
287.70										
287.60			0.38		0.50		0.26		0.30	
287.50										
287.40			0.14		0.16		0.16		0.26	
287.30										
287.20			0.33		0.39		0.24		0.45	
287.10										
287.00			0.17		0.16		0.26		0.34	
286.80										
286.70			0.33		0.39		0.24		0.17	

Source: Survey team Legend: Very stiff Stiff

Two main causes of existing pavement damage

- i) Blockage of shoulder drainage: Road surface drainage is blocked from flowing into the drainage ditch due to overgrowth of vegetation on the shoulder → concentration of surface water at the edge of the shoulder → increased velocity and flow during longitudinal flow → scouring of fine grains and sand → scouring of shoulder pavement edge → progressive erosion at the edge → shoulder collapse.
- ii) Runoff from mountain side: Inflow of rainwater from mountain side → inadequate and poorly maintained mountain side ditches → rainwater crossing shoulders and road surface → erosion of edges and cracks → flooding of roadbed and roadbed → pavement collapse.

5) Maintenance status of existing pavements

Road maintenance in Zimbabwe is carried out during the rainy season with repairs to damaged road surfaces as needed and intensive repairs at the end of the rainy season. DOR carries out maintenance directly on the carriageway sections using its own machinery. There are few potholes on the carriageway surface, which is maintained relatively frequently, although the shoulders are seriously deteriorated in many sections. The Zimbabwean technical officers and engineers in charge of various technical fields accompanied the survey team during the field survey and had good discussions with survey team, and both MoTID and MoFED highly appreciate Japan's cooperation in the road sector to date (the Director of International Cooperation of MoFED attended the technical meeting with MoTID). They requested that cooperation in the road sector should continue broadly.

(6) Drainage-related surveys/existing structure surveys

1) Hydrological survey

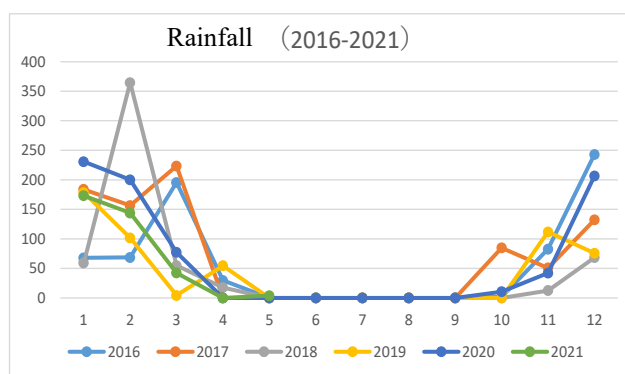
The hydrological related conditions of the target section and the surrounding area were investigated during the field survey in October 2021. The target road passes along the side of a ridge and the watershed area around the road is small and no signs of changes from the local conditions identified in the Phase 1 survey was seen. There is no sign of flood damage in the surrounding area. The annual rainfall in the target area is approximately 500-800 mm. It is divided into a dry season from April to October and a rainy season from November to March. The majority of Zimbabwe's land area is covered by highlands above 1,000 m. The average temperature is around 25°C, but in June and July there is a sharp temperature difference between daytime temperatures over 30°C and morning and evening temperatures below 10°C.



Photo: Existing road beside the river

Table 1–21: Rainfall in the vicinity of the target roads (2016–2021)

Mth.	2016	2017	2018	2019	2020	2021
1	68	184	59	178	231	173
2	69	157	365	102	200	144
3	196	223	55	4	77	42
4	30	0	18	55	0	0
5	0	0	0	0	0	4
6	0	0	0	0	0	0
7	0	0	0	0	0	0
8	0	0	0	0	0	0
9	0	0	0	0	0	0
10	2	85	0	0	11	
11	83	51	13	112	42	
12	243	132	69	76	207	
Total	689	832	578	527	768	364



Source: Survey team

2) Existing structure

2-1) Existing drainage structures

The field survey covered approximately 16.2 km from the start of Phase 1 (at 306.5 km) to Makuti (at 290.3 km), where pavement maintenance was completed in March 2021 by DOR, to investigate the condition of existing drainage structures on site and identify 74 culverts crossing the existing road. A breakdown of the types of existing culverts and representative photographs of the current condition are showelow.

i) Surface drainage facilities.

Concrete stone-pitch channels (cut side) and asphalt curves (fill side) and longitudinal trenches (chutes) raised at the pavement edge were identified in some parts of the target section. Many of the concrete stone channels on the cut side were found to be dysfunctional as watercourses due to vegetation.

ii) Cross-drainage.

The target road section is considered to have good road surface drainage conditions due to the steep topography with many steep gradient sections. The Marongora River flows to the east of the target road and the Mureche River to the west, and their branches cross the target road. There are 73 crossing drainage facilities on the target road section, with a frequency of about every 220 m. By structure, there are 3 box culverts and 70 pipe culverts, with 60 cm diameter pipe culverts in particular accounting for about 80% of the total. Sand deposit was observed at the in-out let in some of these existing culverts. There was no history of flooding or road overtopping in the target section during the field interviews.

Table 1–22: Summary of drainage structures

Section	Box culvert		Pipe culvert						Nos.	Share
	1*1.5*3m	2*1.5*3m	600	900	950	2*900	3*900	2*950		
1	1	2	14	1	0	2	1	0	21	29%
2	0	0	17	3	1	2	0	1	24	33%
3	0	0	7	0	1	0	0	0	8	11%







4	0	0	8	0	0	0	0	0	8	11%
5	0	0	8	1	0	0	0	0	9	12%
6	0	0	3	0	0	0	0	0	3	4%
Total	1	2	57	5	2	4	1	1	73	100%
	3 (4%)		70 (96%)							
Share	1%	3%	78%	7%	3%	6%	1%	1%	100%	

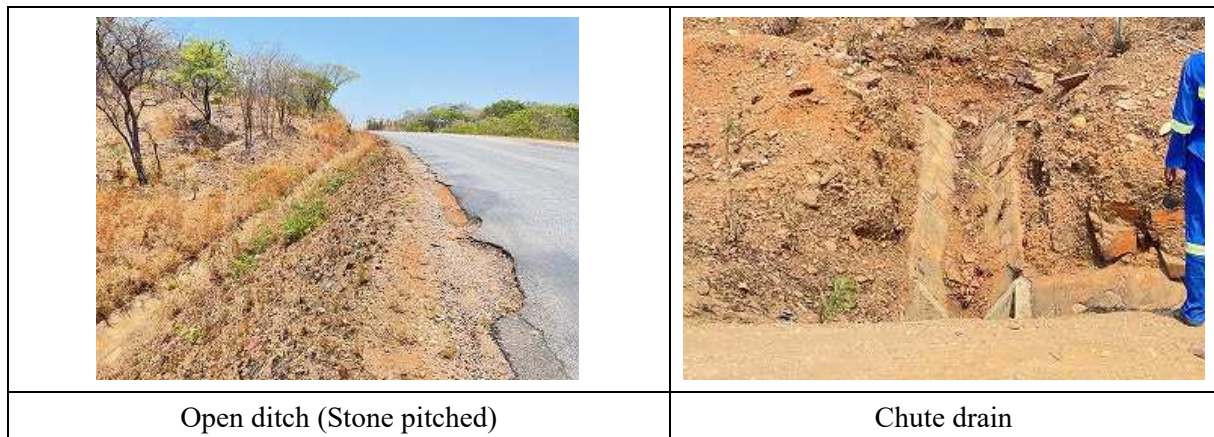
Source: Survey team

2-2) Structural soundness.

The soundness of the existing structure was visually confirmed during the field survey.

- No serious problems requiring reinforcement or maintenance were identified for the culvert at the crossing of the existing road.
- The in/out let and chute of the culvert were found to have peeling of the stone lining of the wing in some areas. There were also scattered blockages caused by sediment and weeds.
- Some open trapezoidal channels, such as cut sections, showed peeling of the stone lining and obstruction of the water flow cross-section due to sediment and weeds.

	
Box culvert (1,5 x 3,0m)	Box culvert (1,5x3,0mx2)
	
Pipe culvert (D0.9mx3)	Pipe culvert (D0.9mx2)
	
Pipe culvert (D0.6m)	Pipe culvert (D0.9m)



Source: Survey team

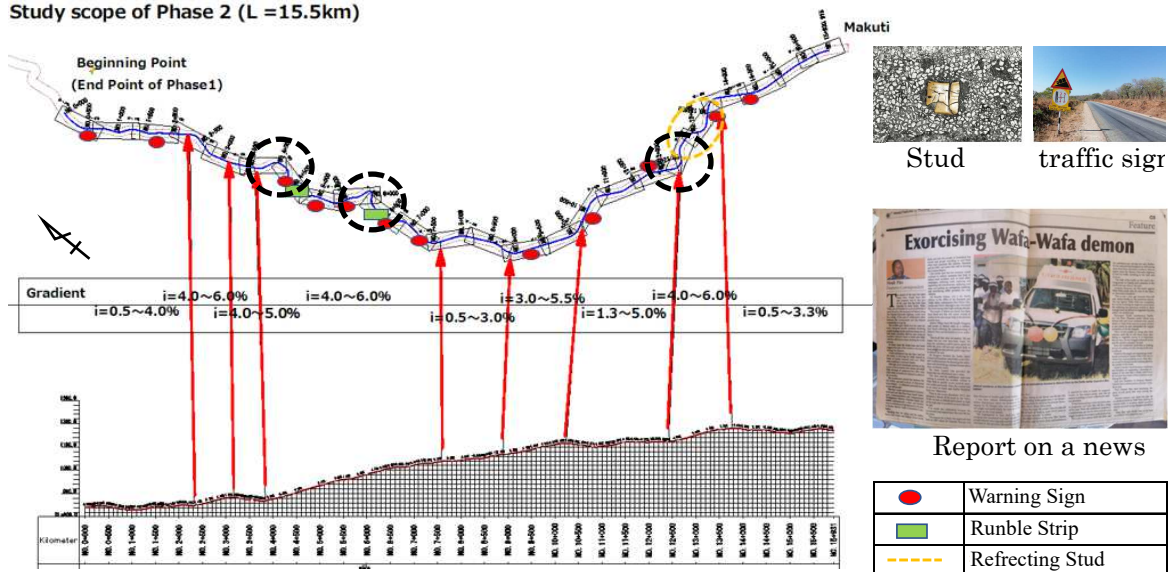
Fig.18: Typical condition of the existing drainage facilities

(7) Safety facilities

1) Rumble strips, road surface reflective studs and markings

A 15.5 km road safety facility survey was conducted between the start of Phase 1 and Makuti (306.5-291 km) from October to November 2021. In the 15.5 km surveyed section, 12 traffic signs were installed. In addition, at three sharp downhill bends in the directional lane of the Chirundu (at km 300, 301 and 302), four to five sets of road surface rumble strips, consisting of 10 sets of 20 cm wide DBST material at 5 cm intervals, were continuously installed on the pavement surface before the bends. These are not installed across the full width of the carriageway, so vehicles avoid them and pass when there are no oncoming vehicles. In addition, a small number of road surface reflector studs on existing roads are poorly placed and are permanently damaged by heavy vehicles stepping on them, and many are missing. In addition, the disappearing or very thin road surface markings are also not functioning. In addition, there are *wafa-wafa* points (*'wafa'* is a local word meaning 'death') on the target section, which have been reported in local newspapers and designated as problem areas that should be improved as soon as possible (black circles in the diagram below).

Study scope of Phase 2 (L =15.5km)



Source: Survey team

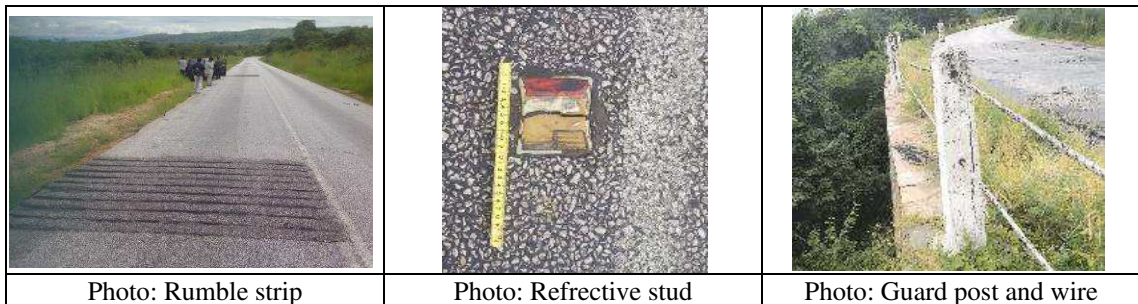
Fig. 1-19: Location of existing safety facilities and accident spots

2) Guard poles + wires

Guard poles and wires have been installed on the subject road in sections where there is a large differences in height between the carriageway and the roadside. Many of these facilities remain on the roadside in a damaged condition due to previous vehicle collisions. The guard poles are 18x18 cm thick, 80 cm high, made of concrete and tied with 1.5 cm thick wires.

3) Traffic Signs.

The following traffic signs were identified on the target road section. Some of these signs were identified as having visibility problems due to overgrown vegetation during the rainy season. Based on these local conditions, it is considered necessary to consider the specifications of the road shoulders and the location of the signs. In addition, as the smell of burnt brake pads on the downhill section was observed when heavy vehicles passed by during the field survey, it is considered necessary to consider the installation of a combination of signs encouraging engine braking together with deceleration facilities.



(8) Road reserves/obstructed properties

1) Road right of way

During the Phase 1 survey, the road right of way (ROW) width from Harare to 140km point was revised in the 2004 Official Gazette to 140m (70m each side from the centre of the road), and the executing agencies commented on efforts to widen the ROW from 31.5m to 70m in all subsequent sections. However, no progress has been made, including the section covered by this survey, which has a conventional right-of-way width of 31.5 m. Although the road alignment improvements in the Project will require the securing of road land in some sections, there are state-owned lands on both sides of the subject road section and there are no existing houses, etc. and it is considered that there will be no problems in securing land by the executing agencies as same as Phase 1.

2) Survey of existing utilities

The following is a list of utilities for above-ground and buried objects along the subject road that may be affected by road improvements, such as relocation or removal, as identified during the field survey.

i) Power lines.





Three power lines, estimated to be around 2000 V, are located on the right-hand side of the road towards Chirundu and the poles are erected closest to the existing road at around 302 km from Harare. These lines are connected to the Parks and Wildlife office staff quarters (Park Ranger Camp) at km 306 and then terminate at the Parks and Wildlife office (Parks and Wildlife) at km 306.5.

ii) Water pipes.

There is a water pipe with an outer diameter of about 100 mm crossing the road near the staff camp at the Parks & Wildlife office. The water supply pipe is connected to the park ranger camp.

iii) Telecommunication lines.

A telecommunication line and metal poles, which are broken in many places, are located on the left side of the road towards Chirundu (owned by TelOne). In addition, a fibreoptic cable (owned by EcoNet) is buried at the side of the road with concrete beacons indicating its location at intervals of about 1 km. These fibreoptic cables are not a problem due to the implementation of the works as an agreement has been concluded between DOR and the supplier that the supplier relocates them voluntarily if required due to road improvement.

			
Photo: Existing electric pole and line	Photo: Existing telecom line	Photo: Underground fibreoptic cable	Photo: Fibreoptic cable indication peg

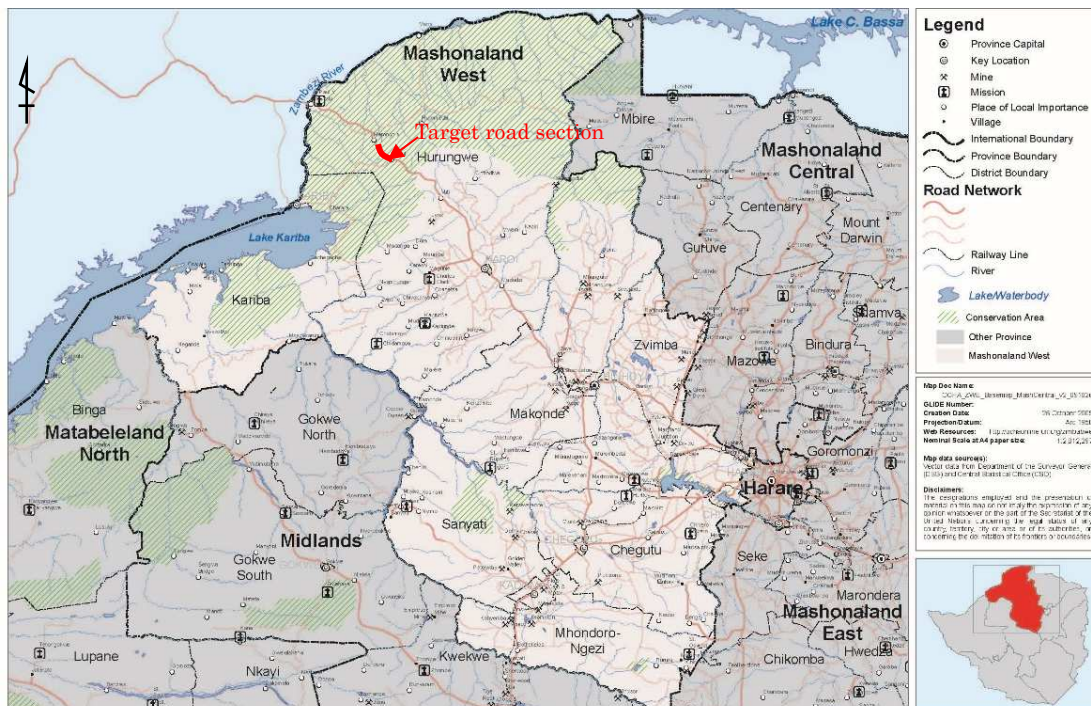
1-5-3 Environmental and Social Consideration

1-5-3-1 Environmental and Social Consideration in the Project

As a result of screening by JICA based on the request document from GOZ, the Project was classed as Category B at the start of the Survey. In the preparatory survey, the environmental and social consideration was implemented based on the JICA “Environmental and Social Consideration Guidelines” (April 2010) (hereafter called the JICA Guidelines). The contents of this report are prepared based on the JICA “Report Preparation Guidelines for Environmental and Social Consideration for Category B Projects” (November 2019).

1-5-3-2 Project area

The section covered by this survey (between 291 and 306.5 km from Harare), is a part of the northern section of the North-South Corridor which runs from the capital Harare (1,490m above sea level) through the Mashonaland-West highlands (1,000-1,200m above the sea level) to the Chirundu (400m above the sea level) located on the banks of the Zambezi River which borders neighbouring Zambia in the northwest direction. Zimbabwe's administrative units are divided into a hierarchy of Province, District, Ward, Area and Village. The section covered by the Project falls within the administrative area of Mashonaland West Province, Hurungwe District, Ward 7, and which includes the Makuti and Marongora communities. The target section is a continuation of Phase 1 conducted in 2018 and all sections are located within the Hurungwe Safari Area. The survey starts at the 306.5 km point, which is the end of Phase 1 and ends at the junction with a sub-road leading to a fuel station (EnergyPark) on the outskirts of Makuti town (at 291 km).



Source : UN Office for the Coordination of Humanitarian Affairs

Fig. 1-20: Map of Mashonaland West Province

1-5-3-3 Baseline Environmental and Social Conditions

To confirm the environmental and social status of the Project area, an Environmental Impact Assessment prepared by the Government of Zimbabwe during the Phase 1 survey (BN Environmental Consultancy Pvt. Ltd, (2018), Environmental Impact Assessment Report, Environmental and Socio-Economic Impact Assessment Study of the Upgrading and Realignment of the Harare-Chirundu Road from Chainage 300+000 to 313+600), Phase 1 JICA report, and other reports prepared by the Ministry of Environment, Water and Climate (MoEWC), Zimbabwe's National Statistics Office (ZIMSTAT) and other reports were reviewed. Moreover, interviews with relevant agencies and stakeholders and site visits were carried out.

(1) Pollution Control

1) Ambient Air quality

Air quality in the Project area is considered to be good, based on the environmental impact survey conducted during Phase 1. The survey confirmed the absence of any industrial activities generating air pollutants in the safari area, and no significant changes since the Phase 1 survey were observed at the time of this survey.

2) Water quality

The results of the water quality measurement survey at Marongola Dam conducted during the Phase 1 (see the Table below) shows that dissolved oxygen levels exceed Zimbabwe's environmental standards. The Marongola River and its tributaries flowing through the Project area were not surveyed during this survey, since the rivers were dry due to the dry season. The visual survey confirmed an accumulation of material accidental shed from vehicle loads on the riverbed.

Table 1-23: Water quality measurement surveys at Phase 1 Marongora Dam

Description	Value	EMA standard value *
Alkalinity	84mg/l HC03	
Biological Oxygen Demand	8.89mg/l	≤10
Chemical Oxygen Demand	63mg/l	≤150
Chloride	1mg/l Cl	≤400
Copper	<0.01mg/l Cu	<3
Dissolved Oxygen (100% saturation)	45.2	≥30
E. Conductivity	158 μS/ cm	≤3000
Iron	0.19 mg/l Fe	≤5.0
Manganese	< 0.01 mg/l Mn	≤0.4
Nickel	< 0.01 mg/l Ni	≤0.9
Nitrates	0.0286 mg/l NO3	≤30
pH	7.28	4-5 10-12
Oxygen absorbed (PV)	5.0 mg/l	≤25
Phosphates	0.05mg/l P	<30
Sulphates	2.0 mg/l S04	≤400
Total Dissolved Solids	176 mg/l	≤2000
Total Suspended solids	< 1 mg/l	≤100
Total Hardness	103 mg/l CaCO3	*
Turbidity	6.58 NTU	*
Zinc	< 1 mg/l Zn	≤15

Description	Value	EMA standard value *
Band Class		Yellow

Source: Phase 1 Environmental assessment report, EMA Effluent and Solid Waste Disposal) Regulations 2007, Yellow band

3) Soil

Site inspections conducted during Phase 1 and this survey confirmed the presence of residual materials (petroleum, sulphur and other chemicals) leaking from the cargo of vehicles and crushed glass from accidents around the known high traffic accident points in the target section covered by the Project. Although detoxification activities such as burying the contaminated material have been implemented at the site, many leaked materials are still left at the site. The degree of soil contamination has not been measured during the Phase 1 survey.

4) Noise and vibration

The safari area falls within the Silence Zone under the International Finance Corporation (IFC) Environmental, Health, and Safety Guideline (EHS) and the World Health Organisation (WHO) Guidelines for community noise (WHO Guidelines for Community Noise). The results of the surveys at the Marongola National Park Office, the ranger settlement and the primary school, which are in the vicinity of the Project target section, were above the standard values. On the other hand, the average noise level without vehicles was 38.5 dB which is within the IFC and WHO limits, however noise levels exceeded the limits (heavy vehicles: average 68.9 dB, light vehicles: average 56 dB) when vehicles were passing.

Table 1-24: Noise levels in the surrounding area

Survey point	Ambient noise level (dB)	Noise quality standard (EHS • WHO guideline) : Silence Zone (dB)	
		Daytime– (07:00 - 22:00)	Night-time– (22:00 - 07:00)
National Parks Office at Marongora	56	50	40
National Parks Village Compound	54		
Marongora Primary School	56		

Source: Phase 1 environmental impact assessment report

Table 1-25: Road noise levels

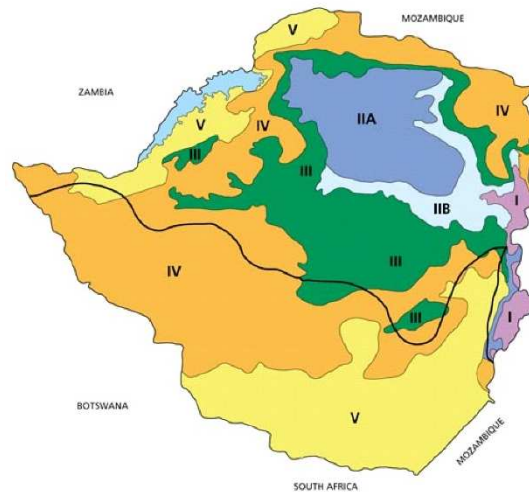
Survey point	By passing vehicle (dB)			
	Small cars	Bus	Large Trucks	No Vehicle passing
Marongora National Parks office	50	62	64.5	41
Opposite Marongora Workers Compound	68.5	60	50.6	41.5
Average of the Phase 1 survey.	59.2	64.4	68.9	38.5

Source: phase 1 environmental impact assessment report

(2) Natural environment

1) Climate

Zimbabwe's climate classification (see Fig. right) is divided into 5 categories based on rainfall, soil type, vegetation, etc. The Project area falls under Natural Regions II and III. The climate is tropical and is divided into 4 seasons: cool (mid-May to mid-August), hot (September to mid-November), wet (mid-November to mid-March) and dry (mid-March to mid-May). Annual rainfall is above the national average, with 700-800 mm in the Zambezi escarpment. Average temperatures range from 24-29° C in the hot season to 8-15° C in the cool season. Average wind speed is 4-6 km/s. The risk of drought and flooding is low (see Fig. Below).



Source: MOEWC, Zimbabwe Biodiversity Strategy and Action Plan

Fig. 1-21: Zimbabwe Climate zones

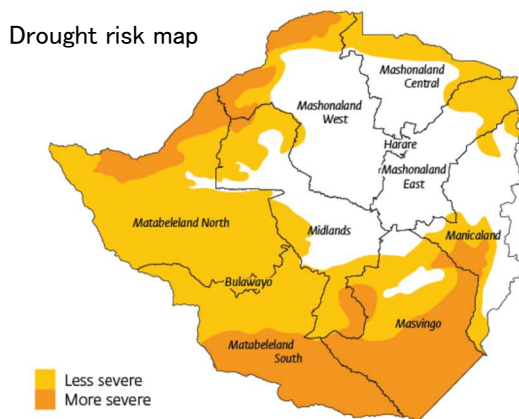


Figure 12a: Zimbabwe's drought-prone areas

Source: Zimbabwe National Water Authority

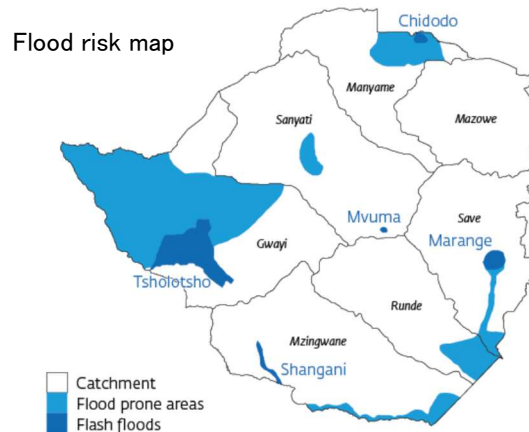


Figure 12b: Flood-prone areas

Source: OCHA

Source: WBG (2021) Climate Risk Profile: Zimbabwe

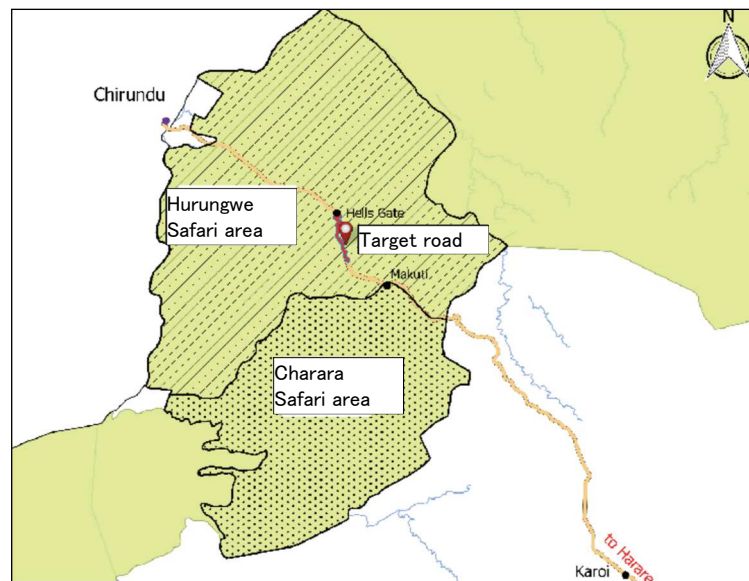
Fig. 1-22: Zimbabwe Flood and drought risk distribution

2) Protected areas

2-1) National protected areas

The target section of road is located within the Hurungwe Safari Area (2894.0 km²) (see the Fig. below). The management of state lands, including National Parks and Wildlife Land, is regulated by the Parks and Wildlife Act, Chapter 20:14, and lands are classified into five areas according to their ecological status, purpose and use: i) National Parks, ii) Botanical Reserve/Botanical Garden, iii) Sanctuary, iv) Safari Area and v) Recreational Park. Of these, national parks and bird sanctuaries strictly regulate the capture and removal of plants and animals in the area with the objective of protecting the ecosystems of wild flora and fauna. On the other hand, safari areas are established for the purpose of leisure and recreational activities and the hunting of animals.

In safari areas, hunting is permitted under a quota system of hunting rights, and hunting and trapping of wild animals for the purpose of academic research, public purposes and to ensure the safety of the residents in the area (Parks and Wildlife Act PART VII). The safari areas are managed by the Parks and Wildlife Management Authority (PWMA) under the National Parks and Wildlife Service of the Ministry of Environment, Water and Climate. Regulations governing public works and development activities such as road construction in the safari area are not explicitly stated, but the consent of the PWMA is required in the course of prior consultation for an Environmental Impact Assessment (EIA), and the consent of the PWMA for the targeted infrastructure project is also required and necessary mitigation measures are defined according to the characteristics



Source: Phase 1 Environmental Impact Assessment report

Fig. 1-23: Protected areas around targeted roads

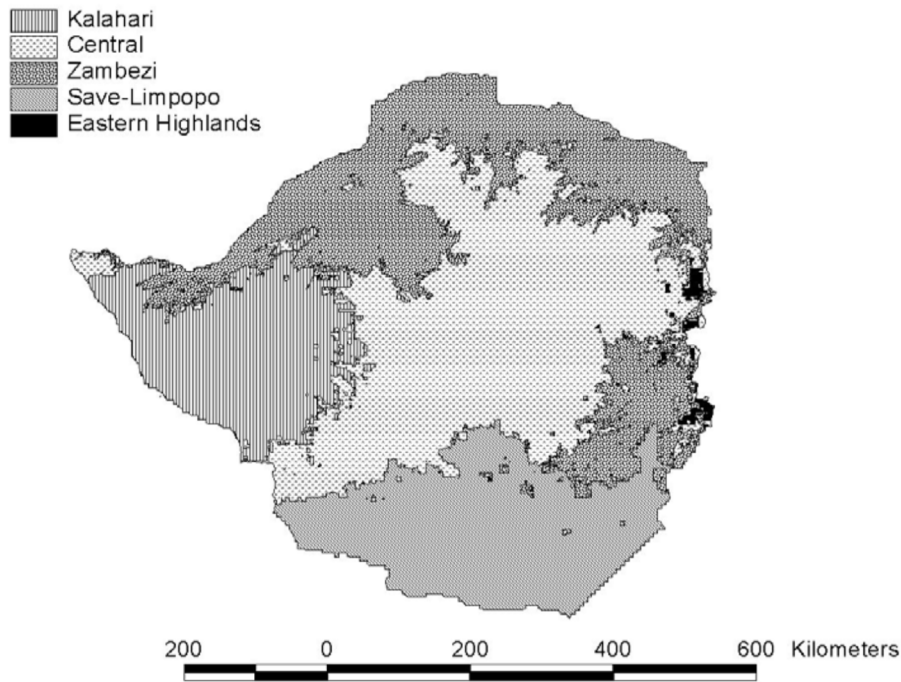
2-2) IUCN protected areas, etc.

The International Union for Conservation of Nature (IUCN) Protected Planet database lists the Hurungwe Safari Area as a Category VI Protected Area with sustainable use of natural resources. IUCN Category VI Protection Area requires cultural and natural resource management systems using traditional methods, as well as the conservation of local ecosystems and sustainable use of natural resources that are beneficial for both nature conservation and sustainable development. Category VI protection areas are equivalent to Japanese with the permission and approval of the prefectural governor. Zimbabwe is home to more than 650 bird species and several Important Birds Areas (IBAs) have been designated, mainly in national parks, but there are no Important Birds Areas in the area around the section covered by this survey.

3) Biodiversity, etc.

According to a report on biodiversity conservation prepared by the Ministry of Environment, Water and Climate (MoEWC) of Zimbabwe (Zimbabwe's Fourth National Report to The Convention on Biological Diversity, Ministry of Environment & natural resources Management (Republic of

Zimbabwe, December 2010), the area covered by the Project is classified as Central Ecoregion under Zimbabwe’s ecoregional classification.



Source : MOEWC, 2010, Zimbabwe’s Fourth National Report to the Convention on Biological Diversity

Fig. 1-24: Zimbabwe’s ecoregional divisions

3-1) Fauna

Over 100 species of mammals, 400 species of birds, 75 species of reptiles, 26 species of amphibians and 50 species of fish have been identified in the Hurungwe Safari Area. Of these, 14 (marked with © in the table below) are listed on the IUCN Red List of Wildlife, as well as 2 species that are known to inhabit in the area that are listed as Specially Protected Animals under the Parks and Wildlife Act: the python (*Python sabae*) and the cassowary snake-eagle (*Circaetus cinereus*). A total of 44 species (23 mammals, 14 birds and 7 reptiles), including leopard (*Panthera pardus*), African elephant (*Loxodonta Africana*) and lion (*Panthera leo*), were identified during the Phase 1 environmental and social considerations survey (dry season). Interviews with rangers from the Marongola Park Management Office conducted during the Phase 1 survey revealed that the Cassowary hyena (*Hyaena brunnea*) and leopard (*Panthera pardus*) are mainly found in the lowland plains of the Zambezi River basin and are very rarely seen in the hills within the target section. African elephants classified as VU (Vulnerable II) are classified as Appendix I species in East African countries such as Kenya and Tanzania, where hunting and trade are strictly regulated as endangered species under CITES. On the other hand, 4 countries – Namibia, Zimbabwe, Botswana and South Africa – African elephants are classified as Appendix II, which has a low threat of extinction under CITES due to recent overpopulation and damage to human and livestock populations. Similarly, lions are classified under Appendix II of the CITES “low threat of extinction”. On the other hand, African elephants and lions are not listed as specially protected

animals under Zimbabwean national law and hunting is allowed in safari areas under certain controls. African elephants are allowed to be hunted and captured at a rate of about 500 per year in order to control the population. In fact, there have been attacks by predators on residents and visitors in the Project area. In the safari area, collisions have occurred between vehicles travelling on the target road and wild animals crossing the road, but no road fencing is permitted to prevent the movement of wild animals, and other measures, such as the installation of deceleration signs, are considered necessary to prevent accidents.

Table 1-26: IUCN Threatened and other species in Zimbabwe

FAMILY	SCIENTIFIC NAME	COMMON NAME	IUCN CATEGORY
Manidae	<i>Manis teminckii</i> (<i>Smutsia teminckii</i>)	Pangolin ☉	LC
Muridae	<i>Aethomys silindensis</i>	Silinda Rock Rat	DD
Hystricidae	<i>Hystrix cristata</i>	Crested Porcupine ☉	LC
Canidae	<i>Lycaon pictus</i>	African Wild Dog	EN
Lutrinae	<i>Mellivora capensis</i>	Honey Badger ☉	LC
Viveridae	<i>Civettictis civetta</i>	African civet ☉	LC
Hyaenidae	<i>Hyaena brunnea</i>	Brown Hyaena ☉	NT
	<i>Proteles cristata</i>	Aardwolf	LC
Felidae	<i>Acinonyx jubatus</i>	Cheetah	VU
	<i>Panthera leo</i>	Lion ☉○	VU
	<i>Panthera pardus</i>	Leopard ☉	NT
	<i>Felis silvestris</i>	Wild Cat	LC
	<i>Caracal</i>	Caracal	LC
Elephantidae	<i>Loxodonta Africana</i>	African Elephant ☉○	VU
Rhinocerotidae	<i>Ceratotherium simum</i>	White Rhinoceros	NT
	<i>Diceros bicornis</i>	Black Rhinoceros	CE
Hippopotamidae	<i>Hippopotamus amphibious</i>	Common Hippopotamus	VU
Bovidae	<i>Hippotragus equines</i>	Roan Antelope	LC
	<i>Hippotragus niger</i>	Sable Antelope ☉	LC
	<i>Kobus ellipsiprymnus</i>	Waterbuck	LC
	<i>Sylvicapra grimmia</i>	Common Duiker ☉	LC
	<i>Syncerus caffer</i>	African Buffalo ☉○	LC
	<i>Tragelaphus angasii</i>	Nyala○	LC
	<i>Tragelaphus oryx</i>	Common Eland ☉	LC
	<i>Tragelaphus scriptus</i>	Bushbuck ☉	LC
	<i>Tragelaphus strepsciceros</i>	Greater Kudu ☉	LC
Muscicapidae	<i>Swinertonia swinertoni</i>	Swinerton's Robin	VU
Falconidae	<i>Falco naumanni</i>	Lesser Kestrel	VU
Gruidae	<i>Grus carunculatus</i>	Wattled Crane	VU
Psittacidae	<i>Agarponis nigrigenis</i>	Black - cheeked Lovebird	VU
Crocodylidae	<i>Crocodylus niloticus</i>	Nile Crocodile	LC

Source: report by the Ministry of the Environment. EX: Extinct, EW: Extinct in the Wild, CR: Critically Endangered IA, EN: Endangered IB, VU: Vulnerable II, NT: semi-threatened, LC: Least Concern, DD: insufficient information.

☉: occur in the Hurungwe Safari Area, ○: observed during Phase 1 survey

3-2) Flora

In the Phase 1 Environmental and Social Considerations Survey (dry season) the target area was divided into the following main vegetation areas: the Miombo Woodlands along the road, the Combretum-Diospyros quiloensis Woodlands behind it, the Combretum apiculatum Woodlands on

the north-western slopes, and the open area to the west is Mopane Woodlands. A total of 41 families, 129 species and 97 genera have been identified, 13 of which are listed as threatened on the IUCN Red List (individual species names not published). Two native species (*Adenium multiflorum* and *Borassus aethiopicum*) listed under Section 48 of the Parks and Wildlife Act have also been identified in front of the park office, which are mainly planted. There are no threatened or endemic species were identified during phase 1 survey.



Miombo Woodlands



Mopane Woodlands



Combretum-Diospyros quiloensis Woodlands



Combretum apiculatum Woodlands

Source: Phase 1 Environmental Impact Assessment report

Fig. 1-25: Vegetation in the target area

3-3) Applicability of “Important Natural Habitat” under JICA Guidelines (2010)

As stated above (in 3-1 Fauna and 3-2 Flora), threatened species as listed in IUCN Red List have been identified in the Hurungwe Safari Area. JICA Guidelines (2010) requires “Projects must not involve significant conversion or significant degradation of critical natural habitats and critical forests”. The Project is not expected to “involve significant conversion or significant degradation of critical natural habitats and critical forests” as stated in “Answers to Frequently Asked Questions about JICA’s Guidelines for Environmental and Social Considerations 20 July 2011 (Revised on 5 February 2016)”.

- The Project is an upgrade of the existing road and will be implemented mostly within the road’s right of way except for two curved sections where acquisition of additional land is required for widening. The environs of the Project are already fragmented by the existing road, are absent of food production or ecosystems and are not considered appropriate for threatened species which are sensitive to traffic noise and light.
- The threatened species identified within the safari area are distributed across a large area of

protected land and habitat away from the road traffic and far inside the safari area and neighbouring protected area. Considering some sections of the target road are used as wildlife corridors, project impacts can be avoided/ mitigated by implementing measures such as installing warning signs, avoiding the use of fences, prohibiting construction activities during night which is the time wildlife are active.

- Hurungwe Safari Area, where the Project is located, is an area where it is allowed to hunt wildlife (the Parks and Wildlife Act, Part VII) and is not categorized as either a national park or a bird sanctuary which strictly regulate the capture and removal of plants and animals in the park with the objective of protecting the ecosystems of wild flora and fauna. The nearest “critical natural habitat” for threatened species is Mana Pool National Park which is also designated as a UNESCO World Heritage Site as well as Ramsar wetland, located approx. 30km away from the Project area and the Project is not expected to cause impact on it.
- There are no indigenous people/ communities residing in the area, nor ancestral domain, or traditional use of natural resource in the area. Therefore the Project area is not considered as “areas that local communities traditionally think should be protected”.

4) Topography and geology

4-1) Topography

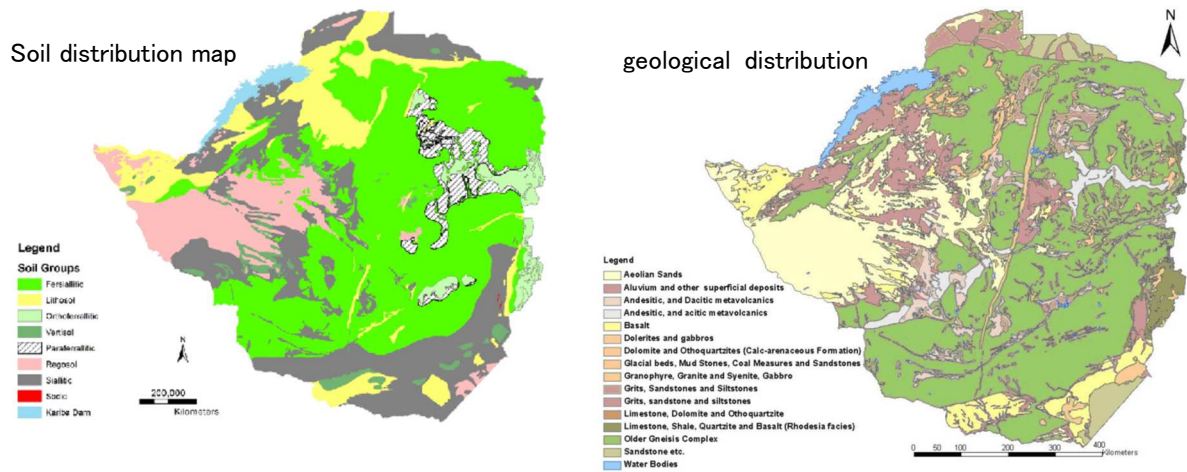
The Project area is located on the Zambezi Escarpment, a gentle slope at an altitude of 800-1,200m, leading north into the Zambezi Valley.



Fig. 1-26: Zimbabwe elevation map

4-2) Geology and stratigraphy

Soils in Mashonaland West consist mainly of fersiallitic, followed by lithosols, Siallitic. The geology is predominantly gneissic and comprises a succession of paragneiss and orthogneiss. Other geological units range from granitic leucogneisses to biotite gneisses, migmatites, quartzofeldspathic, hornblende-diopside and schists.



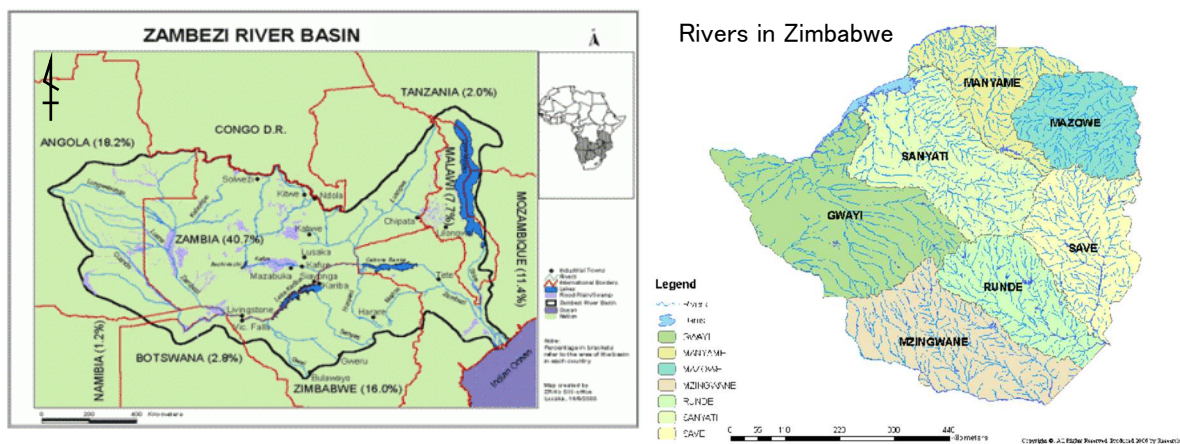
Source : MOEWC, Interconsult A/S. 1985. National M/P for rural water supply and sanitation, Volume 2.2 Hydrogeology
 Fig. 1-27: Zimbabwe Soil and Geological Distribution Map

4-3) Active fault

The frequency of earthquakes in the Project area is low and relatively small frequent earthquakes of magnitude 3 or less have been recorded. The seismic hazard map of Africa (by G. Grunthal and C. Bosse of Geofor Schungs Zentrum, in Potsdam Germany) classifies the Project area as an area of very low hazard risk with a probability of 10%.

5) Hydrology

The Project area is located in the Manyame catchment of the Zambezi River Basin (see figure below). The Marongora River flows through the Project area to the east of the target road and a–305 km – 304 km, the target road and the river are in close proximity, with branches crossing the road in some places.



Source : Zambezi River Authority, MOEWC,2010,Zimbabwe’s Fourth National Report To the Convention on Biological Diversity
 Fig. 1-28: Zambezi River Basin and Catchment Area

There has been some light flooding in the past in the vicinity of the Ranger Compound (305 km) due to rainfall during the rainy season, but the volume of water is low, and the river flow ceases during the dry season. There are also 2 dams in the vicinity of the target area and the Marongora Dam, located west of the Marongora National Park Office, is the main source of water supply for

the Project area, while the Makuti Dam, located east of the road at 298 km, is a waterhole for wildlife.

(3) Socio economic condition

1) Population

In Zimbabwe, the most recent Census survey was conducted in 2012. According to the future population forecast conducted by National Bureau of Statistics, the population of Hurungwe District in Mashonaland West has increased from approximately 330,000 into 400,000, and the most populous in the province and gender ratio is almost equal for both 2012 and 2022. In 2012, 95% of the resident population is from the county, with very limited population influx.

Table 1-27: Population distribution in Mashonaland West Province (2012, 2032 forecast)

District	2012				2022 forecast				Increased rate
	Male	Female	Total	%	Male	Female	Total	%	
Chegutu	77,454	77,065	154,519	10.2%	93,231	90,806	184,037	9.3%	19%
Hurungwe	165,706	165,342	331,048	21.9%	205,408	198,849	404,257	20.3%	22%
MhondoroNgezi	54,612	50,318	104,930	6.9%	52,401	47,900	100,301	5.0%	-4%
Kariba Rural	20,673	20,928	41,601	2.8%	26,724	26,076	52,800	2.7%	27%
Makonde	77,960	76,444	154,404	10.2%	109,941	106,388	216,329	10.9%	40%
Zvimba(urban)	132,963	131,536	264,499	17.5%	170,279	168,013	338,292	17.0%	28%
Sanyati	57,672	55,860	113,532	7.5%	111,921	103,688	215,609	10.8%	90%
Chinhoyi	37,037	41,328	78,365	5.2%	53,845	61,703	115,548	5.8%	47%
Kadoma (urban)	44,698	48,289	92,987	6.2%	56,866	64,098	120,964	6.1%	30%
Chegutu (urban)	24,119	26,754	50,873	3.4%	29,413	34,081	63,494	3.2%	25%
Kariba (urban)	13,249	13,351	26,600	1.8%	14,824	16,563	31,387	1.6%	18%
Norton	32,578	35,392	67,970	4.5%	50,208	56,748	106,956	5.4%	57%
Karoi	13,269	15,497	28,766	1.9%	17,302	22,122	39,424	2.0%	37%
Total	751,989	758,104	1,510,093	100%	992,363	997,035	1,989,398	100%	32%

Source : National Bureau of Statistics () ,2020 Information & Communication Technology, Access by Households & Use by Individuals Survey Report

Table 1-28: Population distribution by age in West Mashonaland Province (2012, 2032 forecast)

Age	2012				2022				Increased rate
	Male	Female	Total	%	Male	Female	Tot-I	%	
0 – 4	27,497	27,590	55,087	16.6%	32,907	32,103	65,010	16.1–	18%
5 – 9	24,978	24,618	49,596	15.0%	29,713	29,025	58,738	14.5%	-18%
10 – 14	23,139	21,521	44,660	13.5%	27,612	25,619	53,231	13.2%	-19%
15 – 19	18,892	16,604	35,496	10.7%	23,698	19,445	43,143	10.7%	-22%
20 – 24	14,642	14,834	29,476	8.9%	19,690	16,080	35,770	8.8%	-21%
25 – 29	12,089	12,986	25,075	7.6%	15,513	14,146	29,659	7.3%	-18%
30 – 34	10,667	10,322	20,989	6.3%	11,675	12,518	24,193	6.0%	-15%
35 – 39	8,733	8,320	17,053	5.2%	10,100	11,111	21,211	5.2%	-24%
40 – 44	5,724	4,944	10,668	3.2%	8,932	8,260	17,192	4.3%	-61%
45 – 49	3,959	4,172	8,131	2.5%	6,540	6,726	13,266	3.3%	-63%
50 – 54	3,306	4,947	8,253	2.5%	4,648	5,153	9,801	2.4%	-19%
55 – 59	2,715	3,903	6,618	2.0%	3,554	3,905	7,459	1.8%	-13%
60 – 64	2,626	3,174	5,800	1.8%	3,227	4,379	7,606	1.9%	-31%
65 – 69	1,941	2,318	4,259	1.3%	2,244	3,413	5,657	1.4%	-33%
70 – 74	1,768	1,882	3,650	1.1%	1,977	2,604	4,581	1.1%	-26%
75 – 79	1,204	1,248	2,452	0.7%	1,297	1,750	3,047	0.8%	24%
80 +	1,827	1,958	3,785	1.1%	2,082	2,613	4,695	1.2%	24%
Total	165,706	165,342	331,048	100.0%	205,409	198,850	404,259	100.0%	22%

Source : National Bureau of Statistics,2020 Information & Communication Technology, Access by Households & Use by Individuals Survey Report

2) Education and literacy

In Mashonaland West Province approximately 50% of population have achieved Lower Secondary graduation, slightly higher than the national average. In addition, as a result of the Zimbabwe Government's focus on basic education, the literacy rate is outstandingly high compared to other developing countries, and the country holds the highest literacy rate on the African continent, surpassing that of South Africa. As of 2019, the literacy rate (population aged 15 years and above who have completed primary school level education) in Mashonaland West Province was 97.2 %, almost the same as the national average of 97.4 %. The table below shows the educational achievement level of Zimbabwe's population aged 25 years and above in 2019.

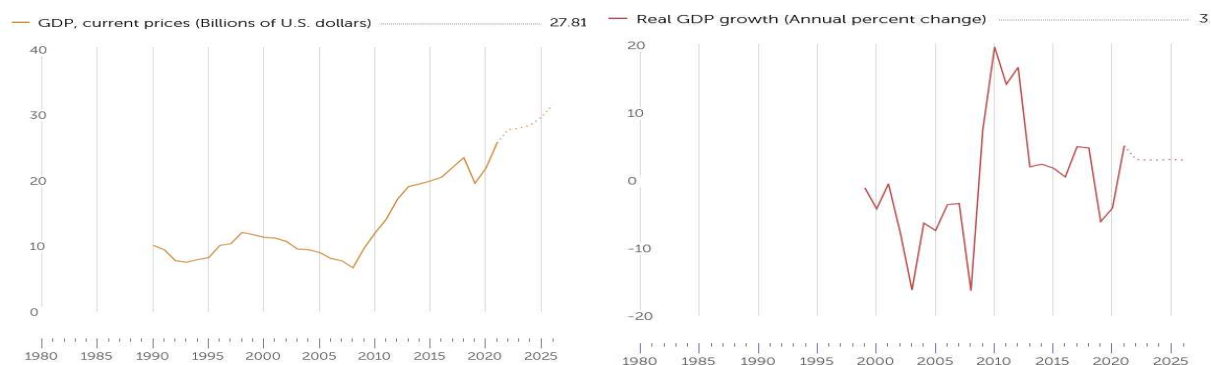
Table 1–29: Final education population distribution rates by province in Zimbabwe

Province	Never been to school	Early Childhood education	Primary	Lower Secondary	Upper Secondary	Certificates	Diploma	HND/Bachelor Degrees	Masters	Doctorate	Total
Bulawayo	1.4	0.0	17.2	54.5	3.2	2.4	10.3	8.2	2.7	0.0	100
Manicaland	5.9	0.0	38.5	46.9	1.5	1.3	3.7	1.9	0.2	0.0	100
Mashonaland Central	9.7	0.0	42.4	41.7	0.7	0.8	2.3	1.7	0.6	0.0	100
Mashonaland East	6.5	0.0	40.7	48.4	1.3	0.6	1.3	1	0.1	0.0	100
Mashonaland West	6.4	0.3	35.7	50.5	1.4	1.5	2.3	1.9	0.1	0.0	100
Matabeleland North	10.8	0.0	50.1	30.7	1.1	1.7	3	2.2	0.5	0.0	100
Matabeleland South	7.1	0.0	49.7	35	0.9	0.2	3.6	2.7	0.5	0.0	100
Midlands	7.3	0.1	36.9	47.8	1.7	1.3	2.6	1.1	1.2	0.0	100
Masvingo	7.2	0.4	40.8	44.8	1.0	1.9	2.0	1.4	0.5	0.0	100
Harare	3.1	0.1	26.4	48.3	2.3	3.4	8.6	6.6	1.1	0.1	100
Total	6.0	0.1	35.8	46.2	1.6	1.8	4.4	3.2	0.7	0.0	100

Source : National Bureau of Statistics, 2019, Education Statistics Report 2018-2020

3) Economy

Zimbabwe experienced extreme economic difficulty from 2000 onwards and recorded an economic growth rate of -12.1% in 2002. This was followed by hyperinflation of over 600 % in 2003 which reached 1,000 % in April 2006, resulting in severe food and commodity shortages and other factors that worsened the lives of the people. Although the economic situation showed a recovery trend after the introduction of the multiple foreign currency system in 2009, it has been in decline for the past 2 years, but it improved in 2021, with a growth rate of 3.9%. GDP in 2021 was USD 27.8 billion and GDP per capita was USD 1,760, which remains relatively low compared to neighbouring South Africa (GDP per capita: USD 7,080) and Botswana (GDP per capita: USD 7,777). Zimbabwe's main industries are tobacco, cotton and horticulture in the agricultural sector, and platinum, chrome, nickel, gold and diamonds in the mining sector, which are exported to neighbouring countries such as South Africa, the United Arab Emirates and Mozambique. On the other hand, the country imports mineral fuels, nuclear reactors and equipment, motor vehicles, drugs and electrical machinery.



Source: International Monetary Fund

Fig. 1-29: Zimbabwe GDP evolution (Oct. 2021)

4) Employment and livelihoods

The average annual household income in Mashonaland West Province in 2017 was USD 2,017 within which primary income covers USD 1,020. This is lower than the national average.

Table 1-30: Average annual household income (USD)

Source of income	Mash West	Harare	Total
Primary	1,020	4,019	1,591
Property	53	295	73
Agriculture	301	82	276
Household Enterprises	642	704	461
Gross Cash Income	2,017	5,099	2,401
Income Tax	-26	-92	-26
Net Transfers	185	692	338
Net Cash Income	2,175	5,699	2,712

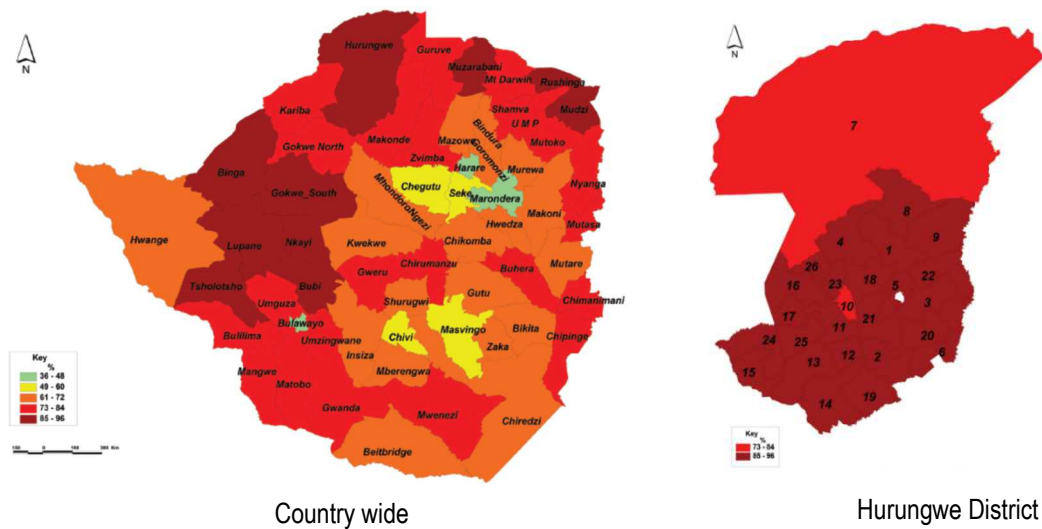
Source: National Statistical Office, 2017

According to the Office of National Statistics (2012, Mashonaland West Provincial Report), the working population (aged over 15 years old) in Hurungwe District is approximately 34% (111,114 people) of the total county population, with a gender ratio of 3:2. The largest employment types are paid employees and unpaid domestic help, accounting for 15% each. Agricultural workers account for 81% of all occupations, followed by services (4.2%) and construction (2.1%). In addition, child labour (aged 10-14) is reported to be about 3% of the population in the province (the 2012 census did not survey children under 10 years of age). The unemployment rate in Mashonaland West is high at 19.4%, but Hurungwe District has a lower unemployment rate than other districts in the province.

5) Poverty

Poverty rates in Zimbabwe are rising with Extreme Poverty rising from 30% to 38% between 2017 and 2019 and the general poverty rate rising from 43% to 51%. This is due to high inflation, water shortages in 2018-2019 and economic contraction. The poverty rate in Hurungwe District, Mashonaland West (see figure below) is 87.9%, which is relatively high compared to other districts in the province. The poverty line (The Total Consumption Poverty Line for one person per month

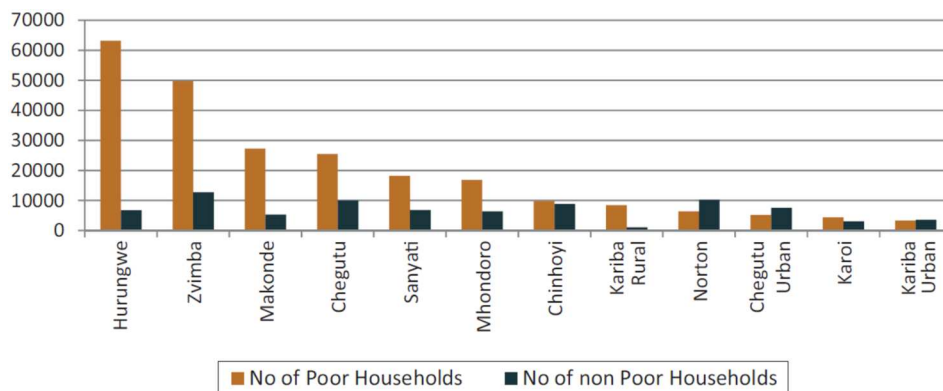
(USD)) in Mashonaland West Province has increased from USD94.00 in 2016 to USD118.60 in 2018, while the national average (This is lower than USD 122.02 in 2018).



Source: National Statistical Office, World Bank, UNICEF Zimbabwe Poverty Atlas August 2015

Fig. 1–30: Distribution of poverty rates nationally and in Hlungwe County

The distribution of the number of poor households by district within the Project’s target area of Mashonaland West Province (see Fig. below) shows that Hurungwe District has the highest number of poor households. This is due to the fact that Hurungwe District has a large number of farmer settlements engaged in small-scale, family micro- farming.

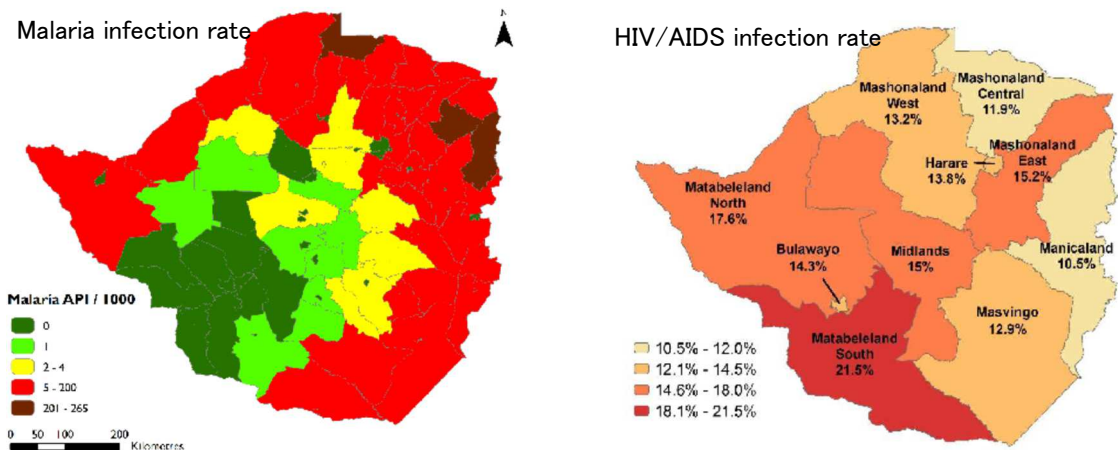


Source: National Statistics Office, World Bank, UNICEF Zimbabwe Poverty Atlas August 2015

Fig. 1–31: Distribution of poor households by county in the Project’s target area

6) HIV/AIDS and other communicable diseases

Life expectancy in Zimbabwe has dropped significantly from 65 to 43 years between 1990 and 2006, effecting particularly children (under 5 years), with the mortality rate rising from 76% to 82%. A possible contributing factor to this is the increase in HIV/AIDS infection among children. The overall HIV/AIDS prevalence in Zimbabwe has fallen from 24.6% to 15.6% and the HIV/AIDS infection rate in West Mashonaland Province is 13.2%, but the mortality rate from HIV/AIDS remains high. The risk of malaria transmission in Mashonaland West is also higher than in other parts of the district.



Source : Zimbabwe National Statistics Agency, 2016, The 2015 Zimbabwe Demographic and Health Survey (2015 ZDHS)

Fig. 1-32: HIV/AIDS (adults 15-49) and malaria infection rates

7) Existing infrastructure and services

According to the 2012 Mashonaland West Provincial Report and Information and Communication Technology Survey conducted by the Office of National Statistics, the living infrastructure situation in Hurungwe District is as follows.

Energy: the main source of supply is wood (90%), and electricity coverage is limited to 20% of all households. Other sources such as charcoal and gas are also used, as confirmed by interviews with residents in Phase 1. ZETDC cables and poles have been identified within the Project site.

Water and sewerage: 100% of households have water pipelines running into the residential compound, but the sewerage system is poorly maintained and only about 2.4% of households have flush toilets.

Telecommunications: telephone coverage in Mashonaland West is limited to 3.5% of all households, while mobile phone coverage is 89%. At some locations, optical fibre cables are laid down beside existing roads at a depth of approximately 1.5 m below ground level. An overhead cable is also located on the 300-306.8 km section, but is currently not functional.

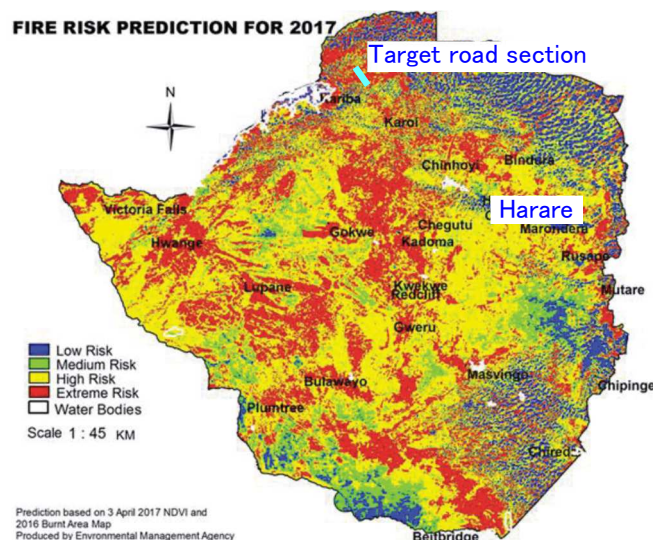
8) Cultural and other heritage

The Ministry of Home Affairs and the National Museums and Monuments of Zimbabwe (NMMZ) are responsible for the management of Zimbabwe's cultural heritage, including buried cultural heritage. As there have been no excavations or other surveys of buried cultural heritage in the area covered by the Project, it is necessary to conduct a survey of buried cultural heritage by the National Museums during the EIA (visual field survey by the archaeological curator). In principle, the scope of the archaeological survey is a 3km radius from the Project site, but according to interviews with the National Museum conducted in Phase 1, in the case of road construction, the survey can be limited to the area actually affected by the construction (pavement, cut and fill, etc.). It should be noted that the cultural heritage to be protected includes archaeological sites, such as prehistoric rock paintings, as well as modern industrial heritage, such as former mining sites. It was also reported that the border area with Zambia in the Zambezi River Basin, which is the target area of the Project,

is dotted with unidentified prehistoric rock paintings and the sites of Portuguese and German copper mines of the 18th and 19th centuries. The results of the Phase 1 environmental impact survey confirmed that there are no prehistoric sites or 18th-19th century copper mining sites in the Project area, but cemeteries are scattered throughout the Project area.

9) Fire outbreak

The Project area is classified as an area of very high risk of fire according to the fire hazard map of Zimbabwe. In addition to these naturally occurring fires, interviews with rangers have confirmed that fires have also occurred due to road traffic accidents. Due to the ecological impact of these fires, Fire Breaks have been introduced in the safari areas to reduce the spread of fires.

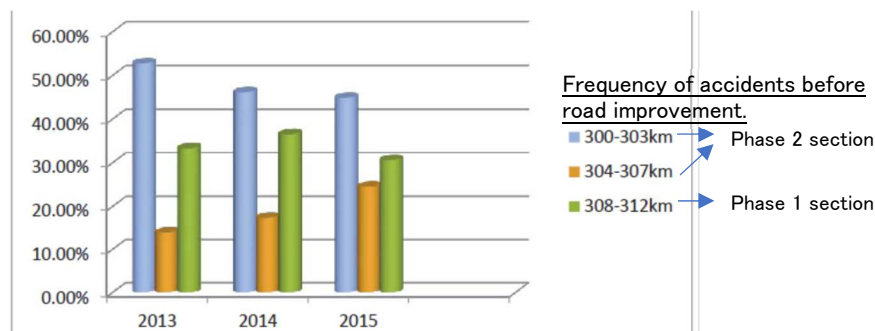


Source : Environmental Management Act Fire Hazard Map (2017)

Fig. 1-33: Fire hazard map

10) Traffic accidents

Traffic accidents occur frequently on the Project section at points where there are a series of sharp curves and gradients. A survey of road accidents between 300 km and 312 km in 2013-2015 conducted in Phase 1 resulted in a prominent number of accidents between 300 km and 303 km.



Source: phase 1 environmental impact survey report

Fig. 1-34: Number of road accidents by section

(4) Status by project section

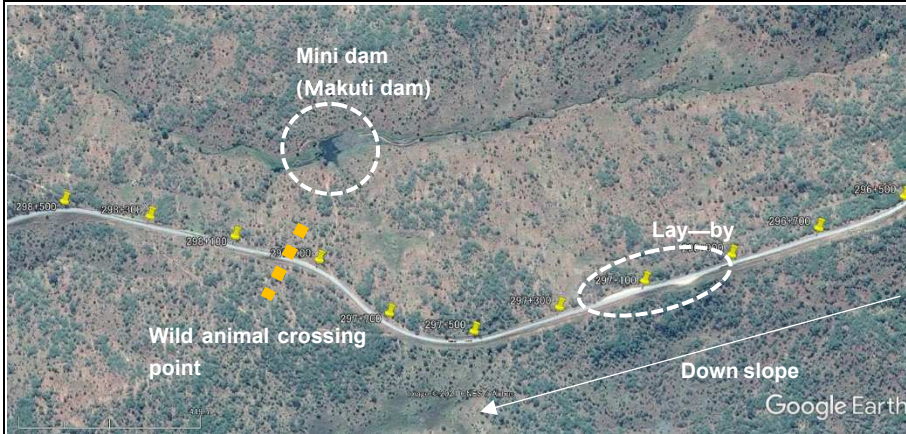


The status of each section covered by the survey and any special environmental and social considerations are described below. The section No. 6-9 of the following Tables are targeted Phase 2 section (298.7km- 306.5km) as highlighted in yellow.




Section No.	1	Distance (Km peg)	Makuti – 291km	EIA certification needs to be changed or revised
Road conditions	End of Phase 2 section (at 291 km), Section passing through the suburbs of Makuti			
				<p>Bus stop</p>
				<p>Petrol station</p>
Special note of environmental and social considerations	<ul style="list-style-type: none"> • A hotel (Makuti Lodge) and fuel station (Energy Park) are located close to the road (around 291+000) on the left side in the direction of Chirundu. The land for the filling station and hotel is privately owned. Street vendors sell souvenirs near the filling station sign. • There is a constant checkpoint on the road in front of the police facility (near 289+000). • There are plans to build a dry port. 			

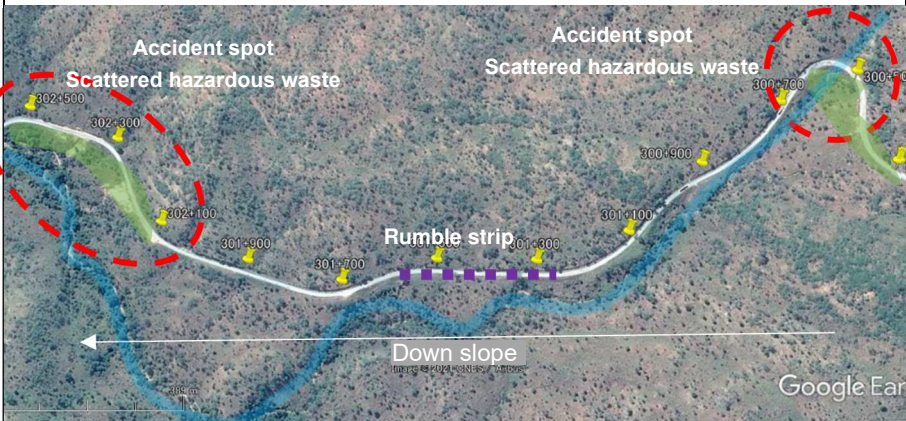

Section No.	2	Distance (Km peg)	291 – 292.5km	EIA certification needs to be changed or revised
Road conditions	<ul style="list-style-type: none"> • End of Phase 2 section (at km 291). • A side road connects to a petrol station (energy park). 			
				<p>Uphill to Makuti.</p>
				<p>Road brunch to filling station</p>
Special note of environmental and social considerations	<ul style="list-style-type: none"> • The subject road passes through a safari area. • No affected residents are expected to be affected, which would result in permanent structures or displacement of agricultural land. 			

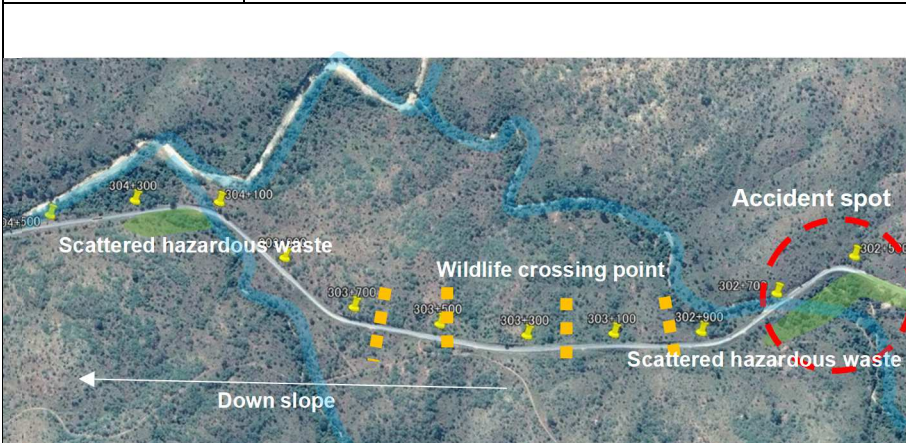

Section No.	3	Distance (Km peg)	292.5 – 294.5km	EIA certification needs to be changed or revised
Road conditions	<ul style="list-style-type: none"> Section with a series of downhill S-curves towards Chirundu. Section where accidents are most frequent. Road signs are in place. 			
<p>Source: Google Earth Pro</p>			<p>S shape curve</p>	<p>Scattered hazardous waste.</p>
Special note of environmental and social considerations	<ul style="list-style-type: none"> The subject road passes through a safari area. Visibility is limited due to a series of gradients and S-curves. The road is an accident-prone section and the roadside is littered with wreckage from accident vehicles, truck loads (sulphur, etc.) and other hazardous waste. It is not envisaged that the affected population will be relocated to permanent structures or agricultural land as a result of the implementation of the Project. 			

Section No.	4	Distance (Km peg)	294.5 – 296.5km	EIA certification needs to be changed or revised
Road conditions	<ul style="list-style-type: none"> A continuous section of up and down and curves along the road section Cut-through section 			
<p>Source: Google Earth Pro</p>			<p>Existing road view</p>	<p>Existing shouder view</p>
Special note of environmental and social considerations	<ul style="list-style-type: none"> The target road passes through the safari area. Borrow pit and access point to the old Chirundu road. Road widening will require certain scale of cut and fill, and tree cutting, depending on location. No residents are expected to be affected by permanent structure removal or relocation of agricultural land as a result of the Project implementation. 			




Section No.	5	Distance (Km peg))	296.5 – 298.5km	EIA certification needs to be changed or revised
Road conditions	<ul style="list-style-type: none"> Section of road where there are frequent collisions between vehicles on the road and wildlife crossing the road. Downhill and curved sections towards Chirundu 			
		 <p>Mini dam</p>		 <p>S shape curve</p>
Special note of environmental and social considerations	<ul style="list-style-type: none"> The target road passes through a safari area. There is a small dam on the right side of Chirundu direction for a waterhole for wildlife during the dry season, and frequent collisions between vehicles travelling on the road and wildlife crossing the road. No residents to be affected by permanent structure removal or relocation of agricultural land as a result of the Project implementation. 			

Section No.	6	Distance (Km peg)	298.5 – 300.5km (298.7km= Phase 2 start)	EIA certification needs to be changed or revised
Road conditions	<ul style="list-style-type: none"> Section with a series of downhill S-curves towards Chirundu. Section where accidents are most frequent. Road signs and rumble strips in place. 			
		 <p>S shape curve</p>		 <p>Scattered hazardous waste.</p>
Special note of environmental and social considerations	<ul style="list-style-type: none"> The section of the Project where a large number of accidents have occurred. The roadside is littered with hazardous waste, including wreckage from accident vehicles and truck loads (e.g., sulphur), which have since been contaminated and treated by EMA and transport companies. There are no entry restrictions. Widening a road in a curve section may require a certain amount of cutting, filling and tree cutting, depending on the location. No residents are expected to be affected by permanent structure removal or relocation of agricultural land as a result of the Project implementation. 			

Section No.	7	Distance (Km peg)	300.5 – 302.5km (Phase 2 section)	EIA certification needs to be changed or revised
Road conditions	<ul style="list-style-type: none"> The section with the highest number of accidents due to a series of steep S-curves on the descent towards Chirundu. Road signs and rumble strips in place. Some sections of road repaired due to damage caused by inadequate drainage treatment. 			
		 <p>S shape curve</p>		
Source : Google Earth Pro		Scattered hazardous waste.		
Special note of environmental and social considerations	<ul style="list-style-type: none"> Section of the Project where a high number of accidents have occurred, e.g., vehicles unable to complete an S-curve colliding with the side wall and overtaking vehicles travelling at a slower speed. The roadside is littered with hazardous waste, including wreckage from accident vehicles and truck loads (e.g. sulphur), which have since been contaminated and treated by the EMA and haulage companies. There are no entry restrictions. There is a river on the side of the road (on the left side in the direction of Chirundu) and there is concern about pollution run-off from accident vehicles. If the road is to be widened in the curve section, and a certain amount of cut and fill and tree cutting will be required depending on the location. No residents are expected to be affected by permanent structure removal or relocation of agricultural land as a result of the Project implementation. 			

Section No.	8	Distance (Km peg)	302.5 – 304.5km (Phase 2 section)	EIA certification needs to be changed or revised
Road conditions	<ul style="list-style-type: none"> Section of road where there are frequent collisions between vehicles on the road and wildlife crossing the road. Downhill and curved sections towards Chirundu 			
		 <p>Wildlife crossing paths.</p>		
Source : Google Earth Pro		Scattered hazardous waste.		

Special note of environmental and social considerations	<ul style="list-style-type: none"> • A river flows on the right in the direction of Chirundu, which is a waterhole for wildlife, and there are frequent collisions between vehicles passing on the road and wildlife crossing the road. • The roadside is littered with hazardous waste, including wreckage from vehicles involved in accidents and truck loads (e.g., sulphur), which have since been contaminated and treated by EMA and haulage companies. There are no entry restrictions. • The Marongora River and its tributaries cross the road at 2 points. There is no water during the dry season. • Intersected by the old Chirundu road. • No residents are expected to be affected by permanent structure removal or relocation of agricultural land as a result of the Project implementation.
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Section No.	9	Distance (Km peg)	304.5 – 306.5km (Phase 2 section)	EIA certification needs to be changed or revised
Road conditions	Phase 2 starting point (306.5km point)			
				
			Marongora river	
Source : Google Earth Pro				
Special note of environmental and social considerations	<ul style="list-style-type: none"> • The subject road passes through the safari area. • ZWMA Marongora Field Station (outside the target area), park ranger camps and lay-bys are located and people come and go. Street vendors sell drinks etc. • High safety risk as children from the camp use the roadside as a route to primary school. • There are 2 areas where baobabs are close to the roadside, but can be avoided. • The Marongora River is close to the road. It has been recorded to flood during past heavy rains. • The dam behind the field station serves as drinking water for the camp and as a waterhole for animals, with water purification and pumping facilities. • No residents are expected to be affected by permanent structure removal or relocation of agricultural land as a result of the Project implementation. 			

1-5-3-4 Environmental and social consideration systems and organisations

(1) Laws, regulations and standards relating to environmental and social considerations

1) Legal provisions, environmental standards, etc. relating to the environment

The main legal provisions and environmental standards in Zimbabwe relating to environmental and social considerations are listed in the Table below.

Table 1–31: Legal provisions relating to road-related projects

Item	Laws/standards
Policy and planning	<ul style="list-style-type: none"> • The National Conservation Strategy of 1987 • EIA Policy, August 1997 • The National Environmental Policy and Strategies (2003) adopted in 2005, • National Climate Change Response Strategy (2014) • Zimbabwe Climate Policy (2016) • Water Policy • Forestry Based Land Reform Policy • Wildlife Based Land Reform Policy • Environmental Education Policy and Strategies
National legal provisions	<ul style="list-style-type: none"> • Constitution of Zimbabwe 2013 • The Environmental Management Act (Chapter 20:27, No. 13 of 2002 , amended in 2006) • Environmental Management (Environmental Impact Assessment & Ecosystems Protection) Regulations, 2007. (Statutory Instrument 7 of 2007) • Environmental Management (Hazardous Substances, Pesticides and Toxic Substances) Regulations, 2018. (SI 268 of 2018) • Environmental Management (Importation & Transit of Hazardous Substances & Waste) Regulations, 2009. (Statutory Instrument 77 of 2009). • Environmental Management (Atmospheric Pollution Control) Regulations, 2009. (Statutory Instrument 72 of 2009) • Environmental Management (Access to Genetic Resources and Indigenous Genetic Resources Based Knowledge) Regulations, 2009. (Statutory Instrument 61 of 2009) • Roads Act (Chapter 13:18) • Road Traffic Act (13:11) • Water Act (Chapter 20:24) • Parks and Wildlife Act (Chapter 20:14); Trapping of Animals Act (Chapter 20:21) • Forest Act (Chapter 19:05) • Communal Land and Forest Produce Act, 1988 (Chapter 19:04) • Mines and Minerals Act (Chapter 21:05); Explosives Act (Chapter 10:08) • Environmental Management (Control of Alluvial Mining) • National Museums and Monuments Act (Chapter 25:11) • Regional, Town and Country Planning Act (Chapter 29:12) • Rural District Council Act (Chapter 29:13) • Public Health Act (Chapter 15:09); Labour Act (Chapter 28:01); Pneumoconiosis Act (Chapter 15:08); • National Social Security Act (Chapter 17:04)
International provisions and conventions	<ul style="list-style-type: none"> • SADC Protocol on Transport, Communications and Meteorology • The Basel Convention on Transboundary movement of Hazardous Waste • United Nations Convention to Combat Desertification (UNCCD) 1994. • United Nations Convention on Biological Diversity (UNCBD) 1994 • United Nations Framework Convention on Climate Change (UNFCCC) 1992. • Stockholm Convention on Persistent Organic Pollutants (POPs) 2012 • Rotterdam Convention on Prior Informed Consent (PIC) 2012 • Ramsar Convention on Wetlands 2012 • The Agreement on The Conservation of African-Eurasian Migratory Waterbirds 2012 • Convention on The International Trade on Endangered Species Cites 1981 • Minamata Convention on Mercury 2013 • Montreal Protocol 1992 • Kyoto Protocol 2009

Source: Survey team

Zimbabwe sets out environmental management policies and standards for water quality, air quality, soil, noise and waste. Where there are significant differences between Zimbabwean environmental standards and international standards, the more stringent standards are adopted.

Table 1–32: Key environmental standards in Zimbabwe

Item	Laws/standards
Air quality	• Environment Management Act (Atmospheric Pollution Control) Regulations, SI 72 of 2009 (Chapter 20:27)
Water quality	• Environmental Management Act (Chapter 20:27) , Sections 63–68
Noise	• Noise (sections 80–81);
Waste	• Environmental Management Act (Chapter 20:27) , Sections 69–76 • Environmental Management (Waste and Solid Waste Disposal Regulations, SI No. 6 of 2007) • Environmental Management (Hazardous Substances, Pesticides and Toxic Substances Regulations, SI 268 of 2018)
Bad odour	• Noxious smells (section 82);

Source: Survey team

2) Environmental Impact Assessment (EIA)

The procedures for EIA in Zimbabwe are set out in the Environmental Management Act, Chapter 20:27. It also stipulates that the EMA is to be established as a delegated body of the MoEWC to oversee the approval process and implementation of EIAs for projects. The EIA process in Zimbabwe is divided into 3 main steps, each of which is described below.

Step 1: Prospectus preparation and review

Prior to an EIA, the implementing agency or a registered environmental consultant prepares a prospectus outlining the Project and the EIA for assessing whether an EIA is required. The implementing agency submits 6 copies to the Environmental Management Agency (EMA) and pays an assessment fee (\$901.68). The EMA conducts the review within 20 working days from the date of receipt. The assessment may result in ancillary conditions being imposed if an EIA is required to be carried out. On the other hand, if the EIA is exempted, the implementing agency is required to prepare an Environmental Management Plan (EMP) on behalf of the EIA. As the proposed project falls under a specific project (highway) for which an EIA is mandatory, the special exception for exemption from EIA does not apply. The Project will not require a prospectus due to renewal/addendum of existing EIA certificated obtained for Phase 1, however MoTID decided to apply the project as a new project and a prospectus was prepared and submitted to EMA.

Step 2: EIA report preparation and review

The implementing agency employs a registered environmental consultant to prepare the EIA report. The report must cover the following cents.

- i) A detailed description of the Project and the activities to be carried out during implementation phases including construction
- ii) Justification for selecting the Project site
- iii) A detailed description of the direct, indirect, cumulative, short- and long-term environmental impacts of the Project on the environment
- iv) Breakdown of specific measures to mitigate negative environmental impacts.
- v) Identification and description of measures for monitoring negative environmental impacts.

- vi) The potential for the Project to affect a wide area, including other countries, and measure to minimise the impact of the Project on the environment.
- vii) The methodology to be used by the implementing agency in preparing the EIA report.

As part of the EIA process, public consultation is also required. The main focus is on examining whether the environmental and social impacts of the identified projects and mitigation measures for them are acceptable to the Project Affected People (PAPs). Methods of implementation include questionnaire formats, group discussions and formal/informal interviews with community and local representatives. The results of the implementation are documented in the EIA report. The implementing agency submits 6 copies of the EIA report to the EMA, who reviews the report within 60 working days from the date of receipt. If the EIA report is approved, the EIA certificate enters into force. The EIA certificate is valid for 2 years from the date of entry into force.

Step 3:. Execution and monitoring, preparation and submission of project progress reports

The implementing agency prepares and submits quarterly progress reports on the Project to the EMA after EIA certification. As the Project falls under 'Highway' of the sector '6. Infrastructure' sector subject to EIA in section 97 of the Act, an EIA is in principle required to be carried out and approved. The Project is a continuation of Phase 1 and EIA approval for the 300.0-306.5 km stretch in the Phase 1 was already obtained in August 2018. Therefore, renewal of the environmental certification (renewal) is required for this section. The renewal process takes about 14 days after submitting the application documents and the receipt of the application fee to EMA.

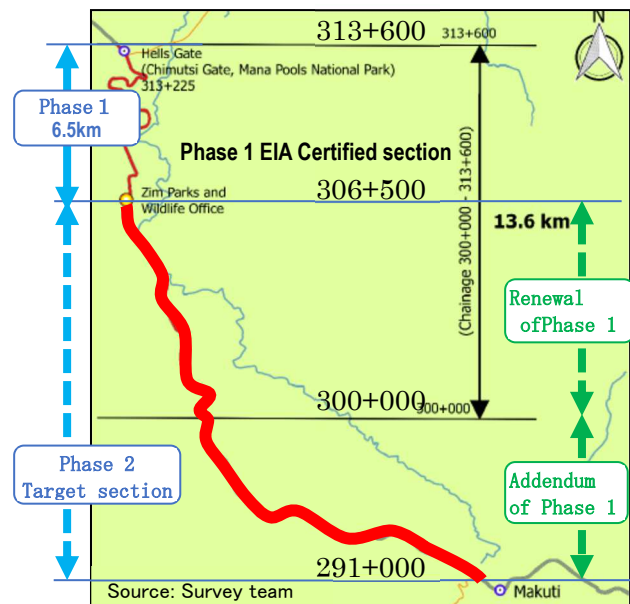


Fig. 1-35: Renewal and Addendum sections of Phase 1 EIAs

The remaining 291-300.0 km section was not covered under the EIA of the Phase 1. This section will be required to prepare an EIA report in Phase 2 and an Addendum to incorporate the section into the existing EIA certificate. The EMA is stipulated to start the assessment after submission of the draft EIA report and a receipt of the application fee (about 1% of the Project cost in the case of road projects) and to complete the assessment within about 60 days after the final EIA report is submitted. The EMA confirmed that they will review the EIA report of the project in the shortest possible time as a priority project. It should be noted that submission of a prospectus is not required but MoTID decided to apply this project as a new project and prepared and submitted a prospectus. MoTID plans to obtain a renewal/addendum in Mar 2023. Incidentally, the EIA certification in Phase 1 was completed in August 2018, 10 months after the EIA report was submitted to the EMA.

Table 1-33: Project scope and EIA certification status

Kilometrage	length	Road rehabilitation	EIA Certificate	
313.6km 306.5 300.0 291.0	7.2km	Phase 1 Road rehabilitated	obtained EIA certificate in September 2018	
	6.4km	Phase 2 survey section		Renewal of Phase 1 EIA Certificate
	9.0 km			Addendum of Phase 1 EIA Certificate

Source: Survey team

3) Public participation, public consultation and disclosure of information to the public

Disclosure of information is provided for in the Environmental Management Act (EMA, Chapter 20:27, Reg. 10) as part of the EIA procedure from the beginning of the Project and throughout the Project phase. The EMA identifies and lists the stakeholders to be consulted during the EIA process as a result of the prospectus review. The main purpose is to provide an overview of the Project and to gather stakeholder concerns and issues to inform the consideration of possible project impacts and mitigation measures. Information will be made widely available in advance through newspaper advertisements and other means to inform the public of the locations and contact points where the EIA Report can be viewed. Implementation methods include press releases, interviews, questionnaires, polls, public consultations and web meetings in a format that allows for the participation of a large number of participants, taking into account language, literacy and political constraints. EMA Section 4(2)(d) also requires implementing agencies to conduct environmental education and awareness-raising activities for communities and support them in strengthening their capacity and skills to cope with and adapt to environmental challenges.

4) Monitoring

Environmental management (Section 106) involves the EMA carrying out periodic environmental audits of operations to ensure that they are being implemented in accordance with the legal provisions and the conditions for granting an EIA certificate. The implementing agency is also required to submit the necessary records and reports for the assessment.

(2) Relevant bodies and their roles in environmental and social considerations

The relevant bodies and their roles in environmental and social considerations in Zimbabwe are listed in the table below. The three bodies responsible for environmental management are the Ministry of Environment, Water and Climate (MEWC), the National Environment Council and the Environmental Management Agency (EMA).

Table 1-34: Relevant organization involved in environmental and social considerations in Zimbabwe

Organization name	Main role
Ministry of Environment, Water and Climate (MEWC)	1. Various regulations and controls on environmental management, various coordination and monitoring of environmental protection, and control of environmental pollution 2. Regulation and penalties for activities of government agencies and

Organization name	Main role
	<p>others that affect the environment</p> <ol style="list-style-type: none"> Promoting education and public awareness on environmental management Formulating and supervising the implementation of environmental management policies Consideration of ratification of international treaties, etc.
National Environmental Council	<ol style="list-style-type: none"> Advise on various policy formulation and implementation decisions taken by EMA Review of guidelines for environmental management plans and environmental action plans and various recommendations to the Minister of the Environment Review of various national environmental policies, plans and standards
Environmental Management Agency (EMA)	<ol style="list-style-type: none"> Formulation of environmental standards for air pollution, water pollution, soil pollution, vibration and noise, waste management, etc. Review, approve and monitor EIA reports Regulation and monitoring of the management and use of ecologically fragile ecosystems Review and make recommendations for the revision of national legislation in accordance with international conventions
Environmental Management Board	<ol style="list-style-type: none"> Committee responsible for the operational management of the EMA, consisting of experts in environmental economics, pollution control, waste management, soil, water and sewer, etc.
Parks and Wildlife Management Authority	<ol style="list-style-type: none"> Organization responsible for the management of protected areas such as national parks and safari areas, and for the protection and management of endemic flora and fauna. Licensing authorities for infrastructure projects, development activities, etc. within safari areas.
Ministry of Local Government, Public Works and National Housing	<ol style="list-style-type: none"> Organization responsible for formulating regional and urban plans and coordinating various development activities within the planning area.
Ministry of Lands and Rural Resettlement	<ol style="list-style-type: none"> Organization responsible for reviewing and certifying rural resettlement, land acquisition and compensation procedures associated with infrastructure projects.
Ministry of Rural Development and Preservation of National Cultural Heritage	<ol style="list-style-type: none"> Management of historic buildings, natural and cultural heritage, archaeological sites, etc. Identification of archaeological sites and other underground deposits, etc. associated with infrastructure projects
Ministry of Mines and Mining Development	<ol style="list-style-type: none"> Identification of buried mineral resources associated with infrastructure projects Licensing authorities involved in the use of explosives for rock excavation (blasting works) on road slopes
National Museums and Monuments of Zimbabwe	<ol style="list-style-type: none"> Management of historic buildings, natural and cultural heritage, archaeological sites, etc. Identification of archaeological sites (e.g., prehistoric rock paintings) and other underground deposits, etc. associated with infrastructure projects

Source: Phase 1 JICA report

The Table below shows the environment related permit required for the Project implementation. For the natural resources needed for the Project it is required to obtain a combined permit from Hurungwe Rural District Council (Environmental Management (Environmental Impact Assessment & Ecosystems Protection) Regulations, 2007) .

Table 1–35: Environment related permit required for project implementation

Permit required	authority	Timing to obtain
Prior consultation and consent from PWMA	PWMA	During EIA
Protection of archaeological artefacts	National Museums and Monuments of Zimbabwe	During EIA
Blasting work	Ministry of Mines and Mining Development, PWMA	Prior construction
Extraction of natural resources including ground water within safari area	PWMA	Prior construction
Use of quarries	PWMA, Hurungwe Rural District Council	Prior construction
Water use	National water authority, Hurungwe Rural District Council	Prior construction
Waste management	Hurungwe Rural District Council	Prior construction
Tree cutting	MEWC	Prior construction

(3) Deviations from JICA guidelines and measures to resolve

A comparison of the JICA Guidelines (2010) and Zimbabwe’s environmental and social considerations regulations (see table below).

Table 1–36: Comparison of JICA Guidelines and Zimbabwe laws and regulations

Topic	JICA Guideline (2010)	Zimbabwe laws and regulations	Deviation and measures to resolve
Alternatives	1. Multiple alternatives must be examined in order to avoid or minimize adverse impacts and to choose better project options in terms of environmental and social considerations. In the examination of measures, priority is to be given to avoidance of environmental impacts; when this is not possible, minimization and reduction of impacts must be considered next. Compensation measures must be examined only when impacts cannot be avoided by any of the aforementioned measures. 2. Appropriate follow-up plans and systems, such as monitoring plans and environmental management plans, must be prepared; the costs of implementing such plans and systems, and the financial methods to fund such costs, must be determined. Plans for projects with particularly large potential adverse impacts must be accompanied by detailed environmental management plans (JICA Guidelines, Appendix 1)	99. Contents of environmental impact assessment report on a project shall: (a) give a detailed description of the project and the activities to be undertaken in implementing it; and (b) state the reasons for selecting the proposed site of the project. (EMA 2003)	No significant gaps. The proponent is to provide the comparison as the process to select the proposed site.
Scope of impacts to be considered	1. The impacts to be assessed with regard to environmental and social considerations include impacts on human health and safety, as well as on the natural environment, which are transmitted through air, water, soil, waste, accidents, water usage, climate change, ecosystems, fauna and flora, including trans-boundary or global scale impacts. These also include social impacts, including migration of population and involuntary	99. Contents of environmental impact assessment report on the Project shall: (a) give a detailed description of the Project and the activities to be undertaken in implementing it; and (b) state the reasons for selecting the proposed site of the Project; and (c) give a detailed description of the likely impact the Project may have on the environment or any segment thereof,	The scope of required environmental items to be studied is not explicitly stated. The proponent is to cover the items required by JICA as applicable.

Topic	JICA Guideline (2010)	Zimbabwe laws and regulations	Deviation and measures to resolve
	<p>resettlement, local economy such as employment and livelihood, utilization of land and local resources, social institutions such as social capital and local decision-making institutions, existing social infrastructures and services, vulnerable social groups such as poor and indigenous peoples, equality of benefits and losses and equality in the development process, gender, children's rights, cultural heritage, local conflicts of interest, infectious diseases such as HIV/AIDS, and working conditions including occupational safety. Items to be addressed in the specific project are narrowed down to the needed ones through the scoping process.</p> <p>2. In addition to the direct and immediate impacts of projects, the derivative, secondary, and cumulative impacts as well as impacts associated with indivisible projects will also be assessed with regard to environmental and social considerations, so far as it is rational. The life cycle impact of a project period is also considered. (JICA Guidelines, Appendix 1)</p>	<p>covering the direct, indirect, cumulative, short-term and long-term effects of the Project; and</p> <p>(d) specify the measures proposed for eliminating, reducing or mitigating any anticipated adverse effects the Project may have on the environment, identifying ways of monitoring and managing the environmental effects of the Project; and</p> <p>(e) indicate whether the environment of any other country is likely to be affected by the Project and any measures to be taken to minimise any damage to that environment; and</p> <p>(f) where applicable, indicate how the developer proposes to integrate biological diversity in the Project. (EMA 2003)</p>	
<p>Compliance with National legislations and international treaties</p>	<p>2. JICA confirms that projects comply with the laws or standards related to the environment and local communities in the central and local governments of host countries; it also confirms that projects conform to those governments' policies and plans on the environment and local communities.</p> <p>3. JICA confirms that projects do not deviate significantly from the World Bank's Safeguard Policies and refers as a benchmark to the standards of international financial organizations; to internationally recognized standards, or international standards, treaties, and declarations, etc.; and to the good practices etc. of developed nations including Japan, when appropriate. (JICA Guidelines, 2.6.)</p> <p>1. Projects must comply with the laws, ordinances, and standards related to environmental and social considerations established by the governments that have jurisdiction over project sites (including both national and local governments). They must also conform to the environmental and social consideration policies and plans of the governments that have such jurisdiction.</p> <p>2. Projects must, in principle, be undertaken outside of protected areas that are specifically designated by laws or ordinances for the conservation of</p>	<p>96 Environmental management plans.</p> <p>(2) Every specified authority shall prepare an environmental management plan within such period as the Minister may specify. (3) Every environmental management plan prepared in terms of subsection (2) shall contain the following— (f) a description of the manner in which the specified authority will ensure that its functions are exercised in a way that will ensure compliance with this Act, other relevant enactments, and environmental standards so as to achieve the management and protection of the environment.</p> <p>100 Consideration of environmental impact assessment report and issue of certificate: (2) (b) shall have regard to the extent to which the Project complies with the National Plan and any applicable local authority environmental management plan.</p> <p>116 Conservation of and access to biological diversity</p> <p>(1) The Minister shall take such measures as may be necessary for the conservation of biological diversity and the implementation of Zimbabwe's obligations under the United Nations Convention on Biological Diversity adopted in 1992 (EMA 2003)</p>	<p>There are some absent environmental standards in Zimbabwe. International standards such as WHO's, IFC's and developed countries' standards will be referred to in order to evaluate these items.</p>

Topic	JICA Guideline (2010)	Zimbabwe laws and regulations	Deviation and measures to resolve
	<p>nature or cultural heritage (excluding projects whose primary objectives are to promote the protection or restoration of such areas). Projects are also not to impose significant adverse impacts on designated conservation areas. (JICA Guidelines, Appendix 1)</p>		
Social Acceptability	<p>1. Projects must be adequately coordinated so that they are accepted in a manner that is socially appropriate to the country and locality in which they are planned. For projects with a potentially large environmental impact, sufficient consultations with local stakeholders, such as local residents, must be conducted via disclosure of information at an early stage, at which time alternatives for project plans may be examined. The outcome of such consultations must be incorporated into the contents of project plans.</p> <p>2. Appropriate consideration must be given to vulnerable social groups, such as women, children, the elderly, the poor, and ethnic minorities, all members of which are susceptible to environmental and social impacts and may have little access to decision-making processes within society. (JICA Guidelines, Appendix 1)</p> <p>In preparing EIA reports, consultations with stakeholders, such as local residents, must take place after sufficient information has been disclosed. Records of such consultations must be prepared; Consultations with relevant stakeholders, such as local residents, should take place, if necessary, throughout the preparation and implementation stages of a project. Holding consultations is highly desirable, especially when the items to be considered in the EIA are being selected, and when the draft report is being prepared. (JICA Guidelines, Appendix 2)</p>	<p>4. (2)(c) the participation of all interested and affected parties in environmental governance must be promoted and all people must be given an opportunity to develop the understanding, skills and capacity necessary for achieving equitable and effective participation.</p> <p>100. (3) In considering whether or not to approve the Project to which an environmental impact assessment report relates, the Director-General—c) may consult any authority, organisation, community, agency or person which or who, in his opinion, has an interest in the Project (EMA 2003)</p> <p>10(4) Before any environmental impact assessment report is furnished to the Director-General, the developer shall carry out wide consultations with stakeholders.</p> <p>(5) During a prospectus and environmental impact assessment report review period, the Director General shall verify whether full stakeholder participation was undertaken when the environmental impact assessment report was prepared. (6) Expenses associated with the stakeholder consultation process shall be borne by the developer. (EMA 2007)</p>	<p>National law does not specifically mention the need of consideration for vulnerable groups to encourage their participation in the decision-making process.</p> <p>Proponent is to make the necessary considerations to allow vulnerable group participation in public consultations.</p>
Ecossem and Biota	<p>1. Projects must not involve significant conversion or significant degradation of critical natural habitats and critical forests. 2. Illegal logging of forests must be avoided. Project proponents etc. are encouraged to obtain certification by forest certification systems as a way to ensure the prevention of illegal logging. (JICA Guidelines, Appendix 1)</p>	<p>4. (2) the following principles of environmental management shall apply to the actions of all persons and all government agencies, where those actions significantly affect the environment (i) sensitive, vulnerable and highly dynamic or stressed ecosystems require specific attention in management and planning procedures, especially where they are subject to significant human resource usage and development pressure</p> <p>113 The Minister may declare any wetland to be an ecologically sensitive area and may impose limitations on</p>	No significant gap

Topic	JICA Guideline (2010)	Zimbabwe laws and regulations	Deviation and measures to resolve
		<p>development in or around such area.</p> <p>116 Conservation of and access to biological diversity(1) The Minister shall take such measures as may be necessary for the conservation of biological diversity and the implementation of Zimbabwe's obligations under the United Nations Convention on Biological Diversity adopted in 1992, and may, in so doing— (a) identify the components of the biological diversity of Zimbabwe; (b) determine the components of biological diversity which are threatened with extinction; (c) prepare and maintain an inventory of the biological diversity of Zimbabwe; (d) determine actual and potential threats to the biological diversity and devise such measures as are necessary for preventing, removing or mitigating the effect of those threats; (e) devise measures for better protection and conservation of rare and endemic species of wild fauna and flora; (f) develop national strategies, plans and programmes for the conservation of the biological diversity; (g) promote the integration of conservation and sustainable use of biological diversity into relevant sectoral policies, plans and programmes; (h) require in writing any developer, including the Government, to integrate the conservation and sustainable utilisation of the biological diversity in any project the implementation of which has or is likely to have detrimental effects to the biological diversity; (i) protect the indigenous property rights of local communities in respect of biological diversity; (j) support the integration of traditional knowledge on conservation of biological diversity with scientific knowledge; (k) prohibit or restrict access by any person to or the exportation of any component of the biological diversity of Zimbabwe.</p> <p>(2) The Minister may, on the advice of the Board and in consultation with the responsible Minister, take such action or measures may be necessary for the conservation of the biological diversity of a specific locality and may, in so doing— (a) promote such land use methods as are compatible with the conservation of biological diversity of that locality; (b) select and manage environmental protection areas for the conservation of the various terrestrial and aquatic ecological systems; (c) establish and manage buffer zones near environmental protection areas; (d) prohibit or control the importation of and introduction into the wild of exotic animal and plant species; (e) identify, promote and integrate traditional knowledge into the conservation and sustainable utilisation</p>	

Topic	JICA Guideline (2010)	Zimbabwe laws and regulations	Deviation and measures to resolve
		of the biological diversity of that locality; and (f) determine special measures for the protection of species, ecosystems and habitats faced with extinction. (EMA 2003)	
Indigenous Peoples	<p>1. Any adverse impacts that a project may have on indigenous peoples are to be avoided when feasible by exploring all viable alternatives. When, after such an examination, avoidance is proved unfeasible, effective measures must be taken to minimize impacts and to compensate indigenous peoples for their losses.</p> <p>2. When projects may have adverse impacts on indigenous peoples, all of their rights in relation to land and resources must be respected in accordance with the spirit of relevant international declarations and treaties, including the United Nations Declaration on the Rights of Indigenous Peoples. Efforts must be made to obtain the consent of indigenous peoples in a process of free, prior, and informed consultation.</p> <p>3. Measures for the affected indigenous peoples must be prepared as an indigenous people's plan (which may constitute a part of other documents for environmental and social consideration) and must be made public in compliance with the relevant laws and ordinances of the host country. In preparing the indigenous peoples plan, consultations must be made with the affected indigenous peoples based on sufficient information made available to them in advance. When consultations are held, it is desirable that explanations be given in a form, manner, and language that are understandable to the people concerned. It is desirable that the indigenous peoples plan include the elements laid out in the World Bank Safeguard Policy, OP4.10, Annex B. (JICA Guidelines, Appendix 1)</p>	<p>16.1. The State and all institutions and agencies of government at every level must promote and preserve cultural values and practices which enhance the dignity, well-being and equality of Zimbabweans.</p> <p>3. The State and all institutions and agencies of government at every level must take measures to ensure due respect for the dignity of traditional institutions.</p> <p>33. The State must take measures to preserve, protect and promote indigenous knowledge systems, including knowledge of the medicinal and other properties of animal and plant life possessed by local communities and people. (Zimbabwe Constitution 2013)</p> <p>116 (1) (i) protect the indigenous property rights of local communities in respect of biological diversity; (j) support the integration of traditional knowledge on conservation of biological diversity with scientific knowledge; (2) e) identify, promote and integrate traditional knowledge into the conservation and sustainable utilisation of the biological diversity of that locality (EMA 2003)</p> <p>3. (a) protect the rights of local authorities and communities to their genetic materials and indigenous genetic resource based knowledge; (b) promote indigenous genetic resource-based knowledge by conserving and strengthening the indigenous communal systems of informal knowledge, collective innovations and transmission thereof which do not conform to the notions of— (i) private ownership, private intellectual property rights or individual privilege, or (ii) public or State ownership in the knowledge or innovations concerned; that are contrary to the moral, intellectual and cultural values of the communities in question; (c) ensure the conservation and sustainable use of genetic resources in order to maintain and improve their diversity as a means of sustaining the life-support and health-care systems of the people of Zimbabwe; (d) provide an appropriate system of access to genetic resources and indigenous genetic resource-based knowledge that is based upon the explicit prior informed consent of the concerned local or indigenous communities and the State; (e) implement</p>	<p>National law does not require preparation of indigenous people's plan (IPP) when projects may have adverse impacts on indigenous peoples.</p> <p>In case of any impact to indigenous people by the project is anticipated, proponent will consult the needs of IPPs.</p>

Topic	JICA Guideline (2010)	Zimbabwe laws and regulations	Deviation and measures to resolve
		<p>appropriate mechanisms for the fair and equitable sharing of the benefits arising from the use of genetic resources and indigenous genetic resource-based knowledge, that is to say, mechanisms that ensure the participation and agreement of concerned communities in making decisions regarding the distribution of benefits which may be derived from the use of genetic resources and indigenous genetic resource-based knowledge;</p> <p>7. A local authority or indigenous community, as the case may be, shall, in relation to any genetic resources and indigenous genetic resource-based knowledge that constitute part of the common, traditional or customary patrimony of the local authority or indigenous community, have the following general rights with respect to access to its genetic resources and indigenous genetic resource-based knowledge. (a) to be consulted with respect to such access where it is to be given to persons who are not residents of the local authority or members of the indigenous community concerned; and (b) to give its explicit prior informed consent to such access, where such access— (i) is to be given to persons who are not residents of the local authority or members of the indigenous community concerned, and (ii) may be detrimental to the integrity of its natural or cultural heritage; and (c) to be compensated for— (i) any ecological or environmental costs that may be incurred as a result of such access; and (ii) any benefits that may accrue from such access; and (d) to withdraw its consent to such access if it is or is likely to be detrimental to its natural or cultural heritage, or to place restrictions to such access in those circumstances. (EMA 2009)</p> <p>The government of Zimbabwe ratified United Nations Declaration on the Rights of Indigenous Peoples and African Charter on Human and Peoples' Rights 1981, however not to Convention Concerning Indigenous and Tribal Peoples in Independent Countries ILO 169.</p>	
Monitoring	1. After projects begin, project proponents etc. monitor whether any unforeseeable situations occur and whether the performance and effectiveness of mitigation measures are consistent with the assessment's prediction. They then take appropriate measures based on the results of such monitoring.	105 Developer to notify Director-General if project not implemented or altered. Every developer to whom a certificate has been issued in terms of section one hundred shall inform the Director-General without delay (a) if it becomes apparent that he will not be able to implement the project before the certificate's period of validity	The Zimbabwean legal provisions do not mandate the public disclosure of monitoring results. The project

Topic	JICA Guideline (2010)	Zimbabwe laws and regulations	Deviation and measures to resolve
	<p>2. In cases where sufficient monitoring is deemed essential for appropriate environmental and social considerations, such as projects for which mitigation measures should be implemented while monitoring their effectiveness, project proponents etc. must ensure that project plans include feasible monitoring plans.</p> <p>3. Project proponents etc. should make efforts to make the results of the monitoring process available to local project stakeholders.</p> <p>4. When third parties point out, in concrete terms, that environmental and social considerations are not being fully undertaken, forums for discussion and examination of countermeasures are established based on sufficient" information disclosure, including stakeholders' participation in relevant projects. Project proponents etc. should make efforts to reach an agreement on procedures to be adopted with a view to resolving problems. (JICA Guidelines, Appendix 1)</p>	<p>expires; or (b) if there is any change in the project which is likely materially to alter the project's effect on the environment; or © if it appears that the project may have an effect on the environment that differs materially, in kind or degree, from the effect outlined in the environmental impact assessment report prepared for the project.</p> <p>106 Environmental audits of projects (1) The Director-General, in consultation with such authorities as he considers appropriate, shall carry out or cause to be carried out periodic environmental audits of any projects, including projects whose implementation started before the fixed date, for the purpose of ensuring that their implementation complies with the requirements of this Act. (2) For the purposes of subsection (1), a developer shall keep such records and submit such reports to the Director-General as the Director-General may specify (EMA 2003)</p> <p>14.(2) The developer shall submit a quarterly environmental monitoring report on any issues raised in the Environmental Impact Assessment report or any other issues that arise as a result of the implementation of the project. Failure to submit quarterly report will make the developer liable to a fine not exceeding level fourteen or imprisonment for twelve months or both fine and imprisonment. (EMA 2007)</p>	<p>operator will discuss and agree with JICA on the procedures for releasing monitoring results.</p>
Information disclosure	<p>•EIA reports (which may be referred to differently in different systems) must be written in the official language or in a language widely used in the country in which the project is to be implemented. When explaining projects to local residents, written materials must be provided in a language and form understandable to them.</p> <p>•EIA reports are required to be made available to the local residents of the country in which the project is to be implemented. The EIA reports are required to be available at all times for perusal by project stakeholders such as local residents and copying must be permitted. (JICA Guidelines, Appendix 2)</p> <p>In preparing EIA reports, consultations with stakeholders, such as local residents, must take place after sufficient information has been disclosed. Records of such consultations must be prepared. (JICA Guidelines, Appendix 2)</p>	<p>10. (7) The Director-General may advertise in the print and electronic media when a prospectus or environmental impact assessment report is being reviewed. (EMA 2007)</p>	<p>National law does not require information disclosure nor use of local language considering local residents.</p> <p>Proponents is to discuss with JICA and agree the use of language and procedure to promote access of local residents to project related documents.</p>

Source: Survey team

1-5-3-5 Comparative study of alternatives (including proposals not to implement the project)

In considering alternatives to the project, a total of 4 options from Alt 1 to Alt 4, which ensure continuity with the Phase 1 project, are compared from the perspective of environmental and social considerations, road safety, etc., with no implementation of the project.

Table 1-37: Comparison of alternatives

Item	Option not to implement the project	Alt 1	Alt 2	Alt 3	Alt 4
Target section	—	1+2 306.5~298.7 Length: 7.8 km	1+2+3 306.5~296.1 Length: 10.4 km	1+2+3+4+5: 306.5~292.1 Length: 14.4 km	1+2+3+4+5+6 306.5~291.01 Length: 15.5 km
Outline of the plan	—	Plan to ensure continuity with Phase 1 and improve 2 high priority sections of the requested section (6 sections, see chapter 2-2).	Plan to ensure continuity with Phase 1 and improve 3 high priority sections of the requested sections (6 sections).	Plan to ensure continuity with Phase 1 and improve all 5 high priority sections of the requested sections (6 sections).	Plan to ensure continuity with Phase 1 and improve all 6 high priority sections of the requested sections (6 sections) and improve the section up to Makuti.
Road performance	No improvement.	Includes 1 section where climbing lanes are required	Includes 2 section where climbing lanes are required	Includes 3 section where climbing lanes are required	Includes 3 section where climbing lanes are required
Schedule • Cost	—	Construction period of around 20 months, lowest cost	Longer construction period and more expensive than Alt 1	Shorter construction period and lower cost than Alt 4	Construction period 34 months, highest cost
Road safety	Road safety is not improved.	Improvements are made to 2 accident-prone points.	2 accident-prone points and approach section improvements will be carried out.	3 accident-prone points to be improved.	Improvements are made to 3 accident-prone points.
Pollution control	Accumulated impacts on the surrounding soil and water quality (surface water/ground water) due to road drainage/accidental pollutants.	Rivers are close to and cross the road and may be affected during the rainy season. The construction period is assumed to be the shortest and the air quality, noise and vibration impacts associated with excavation works and construction vehicles the least. Pollution to soil and water quality will be reduced due to a reduction in the	Potential impact during the rainy season due to the proximity and crossing of rivers to the road. Air quality, noise and vibration impacts associated with excavation works and construction vehicles are assumed to be lower than in Alt 1. Less pollution to soil and water quality due to fewer road traffic	Potential impact during the rainy season due to the proximity and crossing of rivers to the road. Longer construction period than Alt 1 & 2 and longer air quality, noise and vibration impacts due to excavation works and construction vehicles are expected. Fewer traffic accidents and less pollution to soil and	Potential impact during the rainy season due to the proximity and crossing of rivers to the road. Longest construction period and prolonged air quality, noise and vibration impacts due to excavation works and construction vehicles are expected. Fewer traffic accidents and less pollution to soil and

Item	Option not to implement the project	Alt 1	Alt 2	Alt 3	Alt 4
		number of traffic accidents.	accidents than in Alt 1.	water quality than Alt 1&2.	water quality than Alt 1 and 2.
Ecosystems	Ongoing wildlife collisions.	Tree cutting due to widening of existing road ROW is the minimum of the alternatives. No significant impact on ecosystems is envisaged.	Tree cutting due to widening of existing road ROW is less than Alt 3 and 4. No significant impact on ecosystems is envisaged.	The potential for tree cutting due to the need to widen the existing road ROW is greater than Alt 1 and 2 and similar to Alt 4. No significant impact on ecosystems is envisaged.	Widening of existing road ROW would be required and the potential for tree cutting would be greater than Alt 1 and 2 and similar to Alt 3. No significant impact on ecosystems is envisaged.
Social environment	No impact.	Widening of the curves in 2 sections will be required and the need for land acquisition needs to be confirmed. No significant impact on the social environment is envisaged.	Widening of the curves in 2 sections will be required and the need for land acquisition needs to be confirmed. No significant impact on the social environment is envisaged.	Widening of the curves in 3 sections will be required and the need for land acquisition needs to be confirmed. No significant impact on the social environment is envisaged.	Widening of the curves in 3 sections will be necessary and the need for land acquisition needs to be identified. Land acquisition and business (roadside filling stations, street vendors) may be affected in the vicinity of Makuti.
Comparison results	Negative road performance and road safety aspects of the project as well as environmental impacts are not improved.	Two accident hotspots are improved, which have the lowest environmental and social impact and are high priority locations within the budget.	Two high priority accident points and their approaches are improved, but at a higher cost compared to Alt 1.	The most favourable proposal in terms of road performance and road safety of the project, but at a higher cost. It also has longer-term environmental impacts compared to Alt 1 and Alt 2.	The most favourable proposal in terms of road performance and road safety of the project but with the highest cost. In addition, longer-term environmental impacts and effects of land acquisition on existing businesses (filling stations, street vendors) are expected.

Source: Survey team

1-5-3-6 TOR for scoping and environmental and social consultations surveys

(1) Scoping

The environmental and social impacts anticipated in line with project implementation are as shown in the scoping (draft) described in the following Table.

Table 1–38: Scoping (Draft)

No.	Impact item	Predicted impact		Predicted environmental and social impacts
		Construction	Operation	
1. Pollution countermeasures				
1	Air quality	✓	✓	Before and during construction: temporary deterioration of air quality due to dust and exhaust gases from construction machinery and vehicles and dust from materials and equipment is expected. In particular, construction work during the dry season is expected to have a greater impact than during the wet season. In service: traffic will increase but air pollution will improve due to reduced traffic congestion is envisaged.
2	Water quality	✓	✓	Before and during construction: expected impact on water quality (surface water and groundwater) in the vicinity due to drainage from concrete and pavement works. In service: expected impact on surrounding water quality (surface water and groundwater) due to road drainage.
3	Soil contamination	✓	✓	Before and during construction: oil leaks from poorly maintained construction equipment and construction vehicles and leaks of hazardous substances during construction work can lead to soil contamination. The degree of soil contamination at the accident site should be investigated, and if contamination is found, an impact is envisaged. In service: the degree of soil contamination at the accident site will be investigated and if contamination is found, the impact is expected to continue. A decrease in soil contamination due to leakage from loads is assumed due to a decrease in the number of road traffic accidents.
4	Wastes	✓	✓	Before and during construction: contamination of soil and water quality due to waste from the construction site, construction overburden, excavated soil and rock, waste materials, hazardous substances, etc. and general waste from workers' accommodation is envisaged. In service: illegal dumping of waste due to increased traffic is envisaged.
5	Noise and vibration	✓	✓	Before and during construction: widespread impact from noise and vibration due to materials being carried in and out by construction vehicles and excavation work using heavy machinery and explosives is envisaged. In service: the increase in noise and vibration associated with the increase in traffic needs to be investigated.
6	Ground subsidence	-	-	During construction and in service: work causing land subsidence and soft ground in the project area is not envisaged.
7	Offensive odour	✓	-	Before and during construction: odours may be generated due to inappropriate waste treatment and drainage. After completion: no activities causing odours are envisaged.
8	Bottom sediment	-	-	During construction and in service: no activities affecting sediment quality are envisaged.
2. Natural environment				
9	Protected area	-	-	Before, during and after construction and in service: the target road of the project is located in a safari area designated under the Parks and Wildlife Act, Chapter 20:14, but not designated as national park nor sanctuary which prohibit activities for protection of wildlife and fauna. The project has been agreed by the Wildlife Management Authority in the safari area as it is a rehabilitation of an existing road.
10	Ecosystem and	✓	✓	Before and during construction: threatened and rare species have been identified within the target area. Confirmation of the habitat of rare species is required; there are concerns about the impact on wildlife and the ecosystem

No	Impact item	Predicted impact		Predicted environmental and social impacts
		Construction	Operation	
	biodiversity			due to tree felling and topsoil removal in the ROW, dust, noise and vibration from construction work, lighting, etc. In service: potential impact on water quality and ecology due to slope collapse and sediment run-off.
11	Hydrology	✓	-	Before and during construction: in sections where rivers are in close proximity to roads, construction drainage and sediment inflow may locally affect the flow regime. Flooding is expected to occur if the flow is obstructed, especially during the rainy season. In service: no impact from the project is envisaged.
12	Topography and geology	✓	-	Before and during construction: topsoil removal, cut and fill is envisaged due to road widening by adding an uphill lane and modification of road alignment in sharply curved sections. There is a possibility of triggering soil run-off and ground collapse. In service: no project-related impacts are envisaged.
3. Social environment				
13	Involuntary resettlement	✓	-	Before and during construction: the project site is a safari area with no residents and resettlement is not expected to occur. However, it is necessary to confirm the presence or absence of street vendors and businesses, and the availability of land acquisition in the road widening section. In addition, it is necessary to lease a certain amount of land (about 1 ha) as a storage area for materials and equipment, workers' camps, etc. during construction. In service: no resettlement or land acquisition will occur as a result of the project.
14	Poor people	✓	-	Before and during construction: the presence or absence of poor people needs to be confirmed. If the poor are identified, employment opportunities as construction workers may not be provided to the socially vulnerable, resulting in uneven distribution of wealth and widening the gap between the rich and the poor. After the project is in service: no impact on the poor due to the project is envisaged.
15	Ethnic minorities and indigenous peoples	-	-	Before, during and in service: there are no ethnic minorities or indigenous peoples residing, nor ancestral domains, nor use of natural resources in the area covered by this survey.
16	Local economies, such as employment, livelihood, etc.	✓	✓	During construction: the presence or absence of businesses in the project ROW needs to be confirmed. If present, relocation or temporary impact is envisaged due to the project. It is envisaged that there will be unfair employment by project stakeholders in the employment of construction workers. In service: it is envisaged that the project will stimulate the local economy and improve logistics between neighbouring countries due to the increased traffic demand caused by the project.
17	Land use and utilization of local resources	✓	✓	Before and during construction: it is envisaged that construction materials and construction workers will be procured from the region as far as possible, thereby promoting the revitalisation of the local economy. In service: it is envisaged that facilities for construction will be used effectively.
18	Water use	✓	-	Before and during construction: water for community drinking and domestic use is taken from the dam, with limited supply, especially during the dry season. The withdrawal of water for construction from the dam is expected

No	Impact item	Predicted impact		Predicted environmental and social impacts
		Construction	Operation	
				to have an impact on the community. In service: no project impacts are envisaged.
19	Existing social infrastructure and services	✓	-	Before and during construction: temporary impacts are expected during the relocation of infrastructure and cables in the project ROW. In service: no project impacts are envisaged.
20	Social institutions such as social infrastructure and local decision-making institutions	✓	✓	Before, during and in service: there is a possibility of mistrust and refusal to cooperate with the project due to insufficient participation and information sharing by decision-makers in the traditional local organisational structure, such as village leaders.
21	Misdistribution of benefits and damages	✓	✓	Before and during construction: Insufficient information sharing and participation opportunities for stakeholders may prevent stakeholders' opinions and concerns from being properly reflected in the project, resulting in uneven distribution of damage and benefits. In service: negative impacts are expected if adequate public participation is not provided
22	Local conflicts of interest	✓	✓	Before, during construction and in service: if the project is implemented with insufficient information shared with stakeholders and no agreement formed, there may be a risk of conflict between local residents.
23	Cultural heritage	✓	-	During construction graves have been identified in the vicinity of the project site. It is necessary to confirm whether they are present in the project ROW. In service: no impact is envisaged due to the project.
24	Landscape	✓	-	Before and during construction: negative impacts on the landscape are envisaged due to inappropriate construction site and waste management. In service: no impact is envisaged due to the project.
25	Gender	✓	-	Before and during construction: gender inequalities are envisaged due to inadequate gender considerations in employment opportunities/income and provision of working environment/facilities during construction. In service: no project impacts are envisaged.
26	Children's rights	✓	-	Before and during construction: check whether there are any cases of employment of children as workers. In service: no impact from the project is envisaged.
27	Infectious diseases such as HIV/AIDS	✓	-	Before and during construction: there is concern about the spread of infectious diseases such as new strains of COVID-19 by external workers. The construction schedule is expected to be affected by the shortage of workers, delays in the delivery of materials and movement restrictions due to the worsening of the COVID-19 pandemic. In service: no negative impact is envisaged due to the project.
28	Working conditions (including occupational)	✓	-	Before and during construction: accidents associated with earthworks on cliffs and excavation of slopes using explosives, etc., and physical illness due to noise and vibration may occur. In service: no labour operations associated with the project are envisaged.

No	Impact item	Predicted impact		Predicted environmental and social impacts
		Constr uction	Oper ation	
	safety)			
4. Others				
29	Transbounda ry impacts and climate change	✓	✓	Before and during construction: increased greenhouse gas (carbon dioxide) emissions are expected due to the operation of construction machinery and increased traffic caused by construction vehicles. In service: traffic will increase but a reduced impact is expected due to a possible reduction in emissions as a result of reduced traffic congestion.
30	Accidents	✓	✓	Before and during construction: an increase in the number of traffic accidents and wildlife collisions due to the increase in construction vehicles is assumed. Also, associated fire outbreaks are assumed. Negative safety impacts such as contact with construction vehicles are envisaged in some sections of the route to school for children and students. In service: it is envisaged that the project will reduce the number of traffic accidents by improving roads in areas where traffic accidents are frequent and reduce the number of collisions with wildlife by alerting people in wildlife crossing areas.
✓: Items to be covered for impact assessment considering the project impact is predicted or Impacts are unclear requiring further information.				

Source: Survey Team

(2) TOR for the Environmental and Social Consideration survey

Based on the above draft scoping, the terms of reference of the environmental and social consideration survey are shown below according to each expected impact.

Table 1-39: TOR (Draft) for the Environmental and Social Consideration Survey

No	Impact item	Survey Item	Survey Method
1. Pollution countermeasures			
1	Air quality	<ol style="list-style-type: none"> 1. legal provisions, environmental standards and management policies relating to air quality 2. understanding the current state of air quality 3. impacts during construction 4. impacts when in service 	<ol style="list-style-type: none"> 1. literature review and interviews 2. actual measurements of air quality 3. construction planning (construction methods, schedules, construction vehicles, equipment materials, pollution control measures, etc.) 4. results of traffic demand forecasts and predictions of future impacts against emission standards
2	Water quality	<ol style="list-style-type: none"> 1. legal provisions, environmental standards and management policies relating to water quality 2. current status of water quality and use 3. impacts during construction (surface water, groundwater) 4. impacts during service (surface water, 	<ol style="list-style-type: none"> 1. literature review and interviews 2. actual water quality measurements and interviews of nearby rivers 3. construction plans (e.g., construction methods, schedules, plans for drainage systems associated with construction, treatment methods) 4. confirm plans for drainage systems

No	Impact item	Survey Item	Survey Method
		groundwater)	
3	Soil contamination	<ol style="list-style-type: none"> 1. legal provisions, environmental standards and management policies relating to contaminated soil 2. understanding the current status of the soil 3. impacts during construction 	<ol style="list-style-type: none"> 1. literature review and interviews 2. soil measurements and interviews 3. construction plans (construction methods, schedules, handling and disposal of construction equipment, waste and hazardous materials)
4	Wastes	<ol style="list-style-type: none"> 1. legal provisions, environmental standards and management policies relating to industrial waste, etc. 2. impacts during construction 3. impacts during service 	<ol style="list-style-type: none"> 1. literature review and interviews 2. construction plans (e.g., types and quantities of waste expected to be generated, handling, countermeasures and disposal methods for waste and hazardous materials) 3. project design and planning (e.g., waste disposal methods, awareness-raising activities)
5	Noise and vibration	<ol style="list-style-type: none"> 1. legal provisions, environmental standards and management policies related to noise and vibration 2. impacts during construction 3. impacts during service 	<ol style="list-style-type: none"> 1. literature review and interviews 2. construction planning (e.g., construction methods, schedules, noise and vibration control measures associated with construction) 3. predicted future impacts in the light of traffic demand forecast results
6	Offensive odour	<ol style="list-style-type: none"> 1. impacts during construction 	<ol style="list-style-type: none"> 1. construction plans (e.g., construction methods, schedules, drainage and waste management plans associated with construction)
2. Natural environment			
7	Ecosystems	<ol style="list-style-type: none"> 1. legal provisions relating to ecosystems, protection policies, regulatory details for development activities and licensing procedures for tree felling. 2. presence or absence of endangered species, etc. 3. impacts during construction 4. impacts when in service. 	<ol style="list-style-type: none"> 1. Literature review, interviews with ZIMPARK and environmental management authorities 2. literature review, interviews with ZIMPARK and environmental management authorities 3. construction plan (construction method, schedule, location of ancillary facilities, noise, vibration and certification measures associated with construction, etc.), tree felling plan (number and type of trees to be felled, etc.) 4. project design and planning
8	Hydrology	<ol style="list-style-type: none"> 1. check the existing status of the river 2. impacts during construction 	<ol style="list-style-type: none"> 1. interviews and site visits 2. construction plans (e.g. construction methods, schedules, plans for drainage systems associated with construction, treatment methods)
9	Topography and geology	<ol style="list-style-type: none"> 1. confirm the current topography and geology of the target area 2. impact during construction 	<ol style="list-style-type: none"> 1. interviews, site visits and soil survey results 2. construction plans (e.g., cut and fill, method of transport, disposal method, location and extent of earth removal and soil dumping)

No	Impact item	Survey Item	Survey Method
			sites)
2. Social environment			
10	Involuntary resettlement	<ol style="list-style-type: none"> scope and scale of resettlement and land acquisition legal provisions and procedures for resettlement and land acquisition compensation policy by project number of residents and landowners affected by the project and compensation packages 	<ol style="list-style-type: none"> Confirmation of the scope and scale of the project through site visits Literature review and interviews, and Compensation situation in similar projects in the past and discussions with business owners Land use drawings, census surveys, livelihood surveys, asset surveys, livelihood improvement plans (Where land acquisition and resettlement will occur)
11	Poor people	<ol style="list-style-type: none"> poverty rates in project areas presence or absence of poor people among project-affected residents impacts during construction 	<ol style="list-style-type: none"> literature review/statistical survey census survey, interviews (where deprivation is identified), focus group discussions, interviews
12	Local economies, such as employment, livelihood, etc.	<ol style="list-style-type: none"> existence of businesses affected by the project and the scale of their impact compensation policy and compensation details for businesses affected by the project development plans in the project area impact of construction on affected businesses impact of construction on the community impact when in service. 	<ol style="list-style-type: none"> field visits to confirm the scope and scale of project impacts and to identify affected businesses, etc. literature review and interviews, past compensation situation literature review and interviews; and inventory survey (if affected business), livelihood survey *2) to 4) are carried out when land acquisition and resettlement occur. confirmation of the construction plan (e.g., number of workers required, type of workers, how workers will be procured, etc.). forecasting the number of vehicles to be driven by demand forecasts and the cumulative impact of local development plans.
13	Land use and utilization of local resources	<ol style="list-style-type: none"> impact of construction impacts when in service 	<ol style="list-style-type: none"> confirm the construction plan (e.g., materials procurement plan, number of workers, type of workers, method of procurement of workers, worker camps, etc.).
14	Water use	<ol style="list-style-type: none"> existing rivers/ dams Usage impact during construction 	<ol style="list-style-type: none"> site visits and interviews confirmation of the construction plan (e.g., water abstraction plan).
15	Existing social infrastructure and services	<ol style="list-style-type: none"> availability of public infrastructure facilities in the project ROW impact of construction 	<ol style="list-style-type: none"> site visits and interviews confirm the construction plan (e.g., materials procurement plan, number of workers, job categories of workers, procurement methods of workers, worker camps, etc.).
16	Social institutions such as social infrastructure	<ol style="list-style-type: none"> decision-making methods in the project area impacts before and during construction 	<ol style="list-style-type: none"> site visits, interviews, literature review information sharing and decision-making procedure plans for projects, and confirmation of approval attachment methods

No	Impact item	Survey Item	Survey Method
	and local decision-making institutions		for construction works.
17	Misdistribution of benefits and damages	<ol style="list-style-type: none"> 1. existence of damage and uneven distribution of benefits and risks in the project area 2. impacts before and during construction 	<ol style="list-style-type: none"> 1. site visits, interviews, literature review 2. construction plans (e.g., approval procedures, procurement methods for workers, project site and ancillary facilities)
18	Local conflicts of interest	<ol style="list-style-type: none"> 1. existence of conflicts of interest and risks in the project area 2. impacts before and during construction 	<ol style="list-style-type: none"> 1. site visits, interviews, literature review 2. confirm information-sharing and consensus-building plans and methods for the project, and approval-building methods for the construction work
19	Cultural heritage	<ol style="list-style-type: none"> 1. legal provisions, plans and policies pertaining to cultural heritage 2. presence or absence of cultural heritage sites on the project site 3. impact of construction 	<ol style="list-style-type: none"> 1. literature review and interviews 2. literature review, interviews and site visits 3. where cultural heritage exists in the project ROW, confirm the construction plan (construction plan, cultural heritage protection measures, etc.).
20	Landscape	<ol style="list-style-type: none"> 1. impact of construction 	<ol style="list-style-type: none"> 1. construction plan (construction site supervision plan, waste management plan, etc.) 2. project design drawings, as-built plans, etc.
21	Gender	<ol style="list-style-type: none"> 1. gender-related legal provisions, plans and policies 2. gender issues and challenges in the project area 3. construction impacts 	<ol style="list-style-type: none"> 1. literature review and interviews 2. literature review and interviews 3. identify construction plans (e.g., gender sensitive policies, etc.)
22	Children's rights	<ol style="list-style-type: none"> 1. legal provisions, plans and policies pertaining to children's rights 2. issues/problems such as child labour in the project area 3. construction impacts 	<ol style="list-style-type: none"> 1. literature review and interviews 2. literature review and interviews 3. confirm the construction plan (e.g., employment policy for workers) if there are child rights issues at the project site.
23	Infectious diseases such as HIV/AIDS	<ol style="list-style-type: none"> 1. legal provisions, plans and policies relating to infectious diseases 2. status of infectious diseases in the project area 3. impact of construction 	<ol style="list-style-type: none"> 1. literature review and interviews 2. interviews with relevant institutions and residents, statistical data 3. investigation of similar cases and confirmation of construction plans (e.g., health management plans for workers, awareness and training plans for workers, hygiene management plans, etc.)
24	Working conditions (including occupational safety)	<ol style="list-style-type: none"> 1. legal provisions, plans and policies pertaining to the working environment 2. impact of construction 	<ol style="list-style-type: none"> 1. literature review and interviews 2. investigation of similar cases, confirmation of construction plans (construction methods, schedules, construction safety measures, etc.)
3. Others			
25	Transboundary impacts	<ol style="list-style-type: none"> 1. climate change plans, measures and regulations 	<ol style="list-style-type: none"> 1. literature review and interviews

No	Impact item	Survey Item	Survey Method
	and climate change	2. status of climate change impacts in the project area 3. impact of construction on climate change 4. impact on climate change when in service	2. literature review, interviews 3. impact forecasts associated with increased GHG emissions, based on construction plans (construction methods, schedules, construction vehicles, equipment materials, pollution control measures, etc.) 4. traffic demand forecasts to predict the increase in the number of vehicles travelling and the impact of increased GHG emissions
26	Accidents	1. safety measures during construction (whether or not there is an impact on neighbours, etc.) 2. traffic accident situation in the project area 3. impact of construction 4. impact when in service	1. construction methods (e.g., duration of construction, days and hours of construction, number of construction vehicles, etc.) 2. literature review, interviews 3. construction plans (e.g., road safety measures) 4. impact forecasts based on the increase in the number of vehicles travelling due to demand forecasts and traffic safety measures (e.g., installation of traffic signs) by the project.

Source: Survey team

1-5-3-7 Environmental and social considerations survey result (including forecast results)

The results of the survey are summarised below. The section planned to be covered by the Project 2 is the section; 306.5km to 291.0 km, while the section; 300.0 km -306.5 km, was studied under the Phase 1 Study. The phase 1 study result was also used for this study.

Table 1-40: Environmental and Social Consideration Survey Results

No	Impact item	Survey Result
1. Pollution countermeasures		
1	Air quality	The section of the road lies in the National Park and has no industries so that the air quality is generally good. However, some section where traffic gets jammed by heavy traffic cause locally deteriorate air quality. During the construction phase, air quality is temporary deteriorated due to operation of construction equipment and vehicles.
2	Water quality	The survey during Phase 1 showed that the Marongora River traces of contamination on the riverbed which emanated from sites of an accident spillage. Whereas the Marongora Dam has all parameters within the standards. The sewerage system is poorly maintained in the area. The construction activities pose the risk of discharge contamination to water course.
3	Soil contamination	The chemicals such as sulphur that are observed in the project area are due to the residue from truck accidents. Contaminated soil will affect works and further spared of contamination. The project construction may induce further contamination of soils by chemicals/fuel spills and leakages from various materials and equipment that will be used on site. Raw materials used in the construction have a potential to become airborne and contaminate nearby soils.
4	Wastes	The portion of the road at the project shows poor waste management practices due to litter and many untreated fuel and chemical spillages remains due to traffic accidents in and around the road. Construction activities will produce large quantities of solid waste, hazardous waste and wastewater. If not well managed this can adversely affect the natural environment as well as impact valuable scenic views along the road in the area.
5	Noise and vibration	The area is classified as a low noise area based on the survey result (Phase1) without vehicle passing by whereas noise level increases when vehicles especially heavy trucks

No	Impact item	Survey Result
		pass by. During the construction, increased traffic, construction works such drilling works, blasting (if using), quarrying works are anticipated to increase existing noise level.
6	Offensive odour	There are no areas currently generating unpleasant odour and project activities are not anticipated to generate any odour.
2. Natural environment		
7	Ecosystems	The project area is located in national park and project activities requires to coordinate with PWMA and follow their regulations. Along the proposed project site, a total of 56 flora species and a total of 47 fauna species were recorded including protected snake species. The temporary loss of top soil (approximately 20,000m ³) and some construction activities might result in the destruction or damage to terrestrial wildlife habitats, biological resources or ecosystems that should be preserved.
8	Hydrology	The Marongora River and its tributaries in the project site dry up during the dry season, however in rainy season there were local floods in the area. Existing drainage channels are dysfunctional due to overgrown vegetation. Storm drainage is a major concern in the area causes deterioration of road pavement. Construction works might block existing drainage and road workings close to the Marongora River may induce bank erosion and subsequently cause siltation in the river and its tributaries, which result to affect water flow and incudes flood in the area.
9	Topography and geology	The project area is generally undulating with a high concentration of hills and the geology and subsequent different soil formation varies. The existing road needs cutting on the hill and may cause rock movement and breakages therefore, disturbing the general geology in localized areas and might cause soil erosion. The Rock exfoliation in the area and other natural phenomenon are prone to starting fires and the area lies in the high to extremely high fire risk rating according to the Environmental Management Act Fire Hazard. The project will likely to handle flammable materials and have risks to induce fires.
2. Social environment		
10	Involuntary resettlement	The project site is located in the National Park and there are no settlements within that section and. the project will not affect any houses or displace any farmers or families.
11	Poor people	
12	Local economies, such as employment, livelihood, etc.	Job creation and unemployment among young people are issue in the area. The project is expected to generate employment for the locals in the area. The target road is the main route to Zambia and other southern African countries. The project will provide an easy and safe alternative, and aid in increasing the levels of trade between Zimbabwe and other southern African countries.
13	Land use and utilization of local resources	The project section is located in the National Park which is state land and upgrading of existing road will not change land use. However, construction will require temporary use of land for workers camp, borrow pits, etc and local utility. The fuel, electricity, telephone network and sewage system are limited in the area and project will temporarily strain capacity.
14	Water use	100% of households have water pipelines running into the residential compound, whereas park office supply water from Marongora Dam. Construction will require a large volume of water and need to be supplied from existing reservoir or river.
15	Existing Social infrastructures and services	The nearest existing social infrastructure is a primary school however it is outside the project area. However, children use walk along the road to go to the school from the ranger's compound.
16	Social institutions such as social infrastructure and local decision-making institutions	The traditional decision-making institution exists in the local communities. Village leaders expressed their expectation to be involved in the project such as consultation, the ground breaking ceremonies. Leaders also informed of the need for cleansing ceremonies for the area where people died through accidents.

No	Impact item	Survey Result
17	Misdistribution of Benefits and Damages	There no existing misdistribution of benefits in the area and no impact anticipated by the project.
18	Local Conflicts of Interest	There no existing conflicts in the area and no impact anticipated by the project.
19	Cultural Heritage	There are no graves, caves, or places of cultural heritage in project area, also. there are no archaeological remains within the 10km stretch. The closet burial is near parks residential area which are far from the study area and unlikely to be interfered with during operation.
20	Landscape	The area has scenic open views but much litter and untreated spillage from traffic accidents degrades the view quality. The construction works might cause landscape deterioration if construction sites, borrow pits, campsites are not kept tidy and might pose a nuisance to road users.
21	Gender	Gender ratio is almost equal. The local hire during construction will need consideration in gender ratio and providing facility for women.
22	Children's rights	There is no exiting issue in children's right and no impact anticipated by the project by ensuring the project employee only those locals above the legal age.
23	Infectious diseases such as HIV/AIDS	HIV/AIDS infection rate in West Mashonaland Province falling but the mortality rate from HIV/AIDS remains high. The migrant workers will pose a health risk to the community as this would promote the spread of sexually transmitted infections, some of which will leave some prone to contracting HIV/AIDS.
24	Working conditions (including occupational safety)	The project is located in the national park and there is a threat of attack by wild animals. The hilly topography involves works on slopes, use of heavy vehicles and machinery and there is an inherent risk of the injury of workers on site if proper safety measures are not put into place. Also, the climate variability shows that more extreme weather cases may occur and worsen the working environments.
3. Others		
25	Transboundary impacts and climate change	Temporarily increase in traffic volume due to construction vehicle will increase emission in the area. Road improvement will improve traffic flow and will contribute to the reductio of the GHG emission reductions. Refer details to section "1-4-16 climate change"
26	Accidents	The project section has high number of the vehicular accidents due to poor road surface, over speeding, overtaking involving large heavy vehicles. Also, existing road marking and road surface reflector studs are poorly placed and damaged. The construction works will result in the temporary disruption of traffic flows and increase traffic volume with increased number of heavy construction vehicles, which might increase traffic accidents. There are also risks involving children who uses the road from the ranger compound to a school. The project area is in a high fire zone area and construction work might have a risk to cause a fire or might be affected by vehicle fire.

1-5-3-8 Impact assessment

The following table shows the results of the evaluation of environmental and social consideration impacts based on the results of the environmental and social consideration impact study.

Table 1-41: Impact Assessment

No	Impact item	Scoping		Impact Assessment		Reasoning for Evaluation
		Construction	Operation	Construction	Operation	
1. Pollution countermeasures						
1	Air Quality	✓	✓	B-	D	<p>[Before and during Construction]</p> <ul style="list-style-type: none"> A certain degree of impacts is envisaged due to dust and exhaust gases from blasting, construction equipment and vehicles. Heavy vehicles might cause traffic congestion and worsen air quality. Raw materials, such as sand and quarry stone, used in the construction stored onsite has a potential to become airborne. <p>[Operation]</p> <ul style="list-style-type: none"> The traffic flow will be improved and no significant change in air quality is envisaged as a result of the project.
2	Water Quality	✓	✓	B-	B-	<p>[Before and during Construction]</p> <ul style="list-style-type: none"> Impact on local water quality from wastewater associated with the construction works can be envisaged and generation of silt loads from soil erosion; waste disposal, accidental spillage, and subsequent washing away or percolation of oils, and other chemicals, discharge of untreated sewage, etc. Impact due to storm water washing away percolated oils and other chemicals might lead to contamination of the surface and ground waters. <p>[Operation]</p> <ul style="list-style-type: none"> Impact due to storm water washing away percolated oils and other chemicals might lead to contamination of the surface and ground water.
3	Soil Contamination	✓	✓	B-	B+	<p>[Before and during Construction]</p> <ul style="list-style-type: none"> Soil pollution through oil, fuel spillage and chemicals might occur if there are leaks on machinery and equipment and from trucks spilling their load. Due to previous traffic accidents, there are chemicals, fuel spills and leakages along the roadside of the project area. If not treated and excavated during construction work, they can be harmful to workers, flora, fauna, and aquatic life in the area. <p>[Operation]</p> <ul style="list-style-type: none"> Improved road will reduce traffic accidents and will reduce risks of soil contamination by chemical and fuel spillage.
4	Wastes	✓	✓	B-	D	<p>[Before and during Construction]</p> <ul style="list-style-type: none"> Generation of solid wastes, surplus soil and rocks, waste materials, hazardous material, etc. can be expected from work sites. If not handled properly, will degrade environment and health of workers and local communities. Domestic waste is expected from the worker's camp. If not handled properly, waste will degrade environments and health of workers and local communities. <p>[Operation]</p> <ul style="list-style-type: none"> No impact is anticipated as a result of the project.

No	Impact item	Scoping		Impact Assessment		Reasoning for Evaluation
		Construction	Operation	Construction	Operation	
5	Noise and Vibration	✓	✓	B-	D	<p>[Before and during Construction]</p> <ul style="list-style-type: none"> Construction works such as drilling, blasting (if using), earth moving, quarrying, heavy trucks and construction machinery movements, are expected to cause temporary discomfort to workers, nearby sensitive receptors and annoyance to wildlife. <p>[Operation]</p> <ul style="list-style-type: none"> No impact is anticipated as a result of the project.
6	Offensive Odour	✓	-	D	D	No material/activities expected during construction/operation to generate odour as a result of the project
2. Natural environment						
7	Ecosystems	✓	✓	B-	B-	<p>[Before and during Construction]</p> <ul style="list-style-type: none"> Incompliance to the regulation of national park might cause negative impact to local ecosystem. Removal of topsoil and construction activities will destroy vegetation and wildlife habitat. Some fauna species like snakes and other burrowing species might be displaced or killed when the soil and rocks are moved during road re-alignment. It is envisaged that collisions with wild animals might occur with construction vehicles, and installation of, fences or guardrails, etc. to prevent movement of wild animals. There is a possibility that careless handling of flammable materials by workers could lead to wildfires and ecological consequences. <p>[Operation]</p> <ul style="list-style-type: none"> It is envisaged that collisions with wild animals might occur by vehicles, and installation of fences or guardrails, etc will prevent movement of wild animals.
8	Hydrology	✓	-	B-	B-	<p>[Before and during Construction]</p> <ul style="list-style-type: none"> Abstraction of sand from the river results in the degradation of banks and the riverbed. However, improvement of small-scale drainage facilities such as box culverts, paving and concrete works, scale will be limited and no impacts on the local water environment can be envisaged. Existing drainage might be blocked temporary and cause local flooding. <p>[Operation]</p> <ul style="list-style-type: none"> Drainage facilities might become blocked with litter and overgrown vegetation and lead to stormwater flooding onto road surface.
9	Topography and Geology	✓	-	B-	B-	<p>[Before and during Construction]</p> <ul style="list-style-type: none"> Cutting and filling will arise in line with improvements such as road widening and road alignment. Erosion might occur for the section where excavations will be conducted. Loss of soil structure through compaction by locating machinery and construction material for longer period and reduced infiltration into the ground.

No	Impact item	Scoping		Impact Assessment		Reasoning for Evaluation
		Construction	Operation	Construction	Operation	
						<ul style="list-style-type: none"> in case of using blasting, ground movement of a hard rock and destabilize slopes and rock strata. [Operation] <ul style="list-style-type: none"> Erosion and ground movement might occur for the section excavated.
3. Social environment						
10	Involuntary Resettlement	✓	-	D	D	<ul style="list-style-type: none"> No impact is anticipated as a result of the project.
11	Poor people	✓	-	D	D	<ul style="list-style-type: none"> No impact is anticipated as a result of the project.
12	Local economies, such as employment, livelihood, etc.	✓	✓	A+	A+	[Before and during Construction] <ul style="list-style-type: none"> Employment creation to the local communities will improve the livelihoods. [Operation] <ul style="list-style-type: none"> The improved road will aid in increasing the levels of trade between Zimbabwe and other southern African countries and result to improve revenue for the Country.
13	Land use and Utilization of Local Resources	✓	✓	B-	D	[Before and during Construction] <ul style="list-style-type: none"> Setting up of new borrow pits and campsite etc., cause disturbance to surrounding environments. This additional utility demand may affect the capacity of local utility supplies and may also compromise its availability to the local people. [Operation] <ul style="list-style-type: none"> No significant impact is anticipated as a result of the project.
14	Water use	✓	-	B-	D	[Before and during Construction] <ul style="list-style-type: none"> Water use for construction worker and workers will required. A permit will be required for water abstraction. [Operation] <ul style="list-style-type: none"> No significant impact is anticipated as a result of the project.
15	Existing Social Infrastructures and Services	✓	-	D	D	<ul style="list-style-type: none"> No significant impact is anticipated as a result of the project.
16	Social institutions such as social infrastructure and local decision-making institutions	✓	✓	B-	D	[Before and during Construction] <ul style="list-style-type: none"> Exclusion of local communities and traditional leaders in the process of project preparation will affect to build consensus on the project implementation. [Operation] <ul style="list-style-type: none"> No significant impact is anticipated as a result of the project.
17	Misdistribution of Benefits and Damages	✓	✓	D	D	<ul style="list-style-type: none"> No significant impact is anticipated as a result of the project.
18	Local Conflicts of Interest	✓	✓	D	D	<ul style="list-style-type: none"> No significant impact is anticipated as a result of the project.

No	Impact item	Scoping		Impact Assessment		Reasoning for Evaluation
		Construction	Operation	Construction	Operation	
19	Cultural Heritage	✓	-	B-	D	<p>[Before and during Construction]</p> <ul style="list-style-type: none"> There are no known graves nor archaeological sites within the project site. However, there might be accidental finds during excavation activities. <p>[Operation]</p> <ul style="list-style-type: none"> No significant impact is anticipated as a result of the project.
20	Landscape	✓	-	B-	D	<p>[Before and during Construction]</p> <ul style="list-style-type: none"> Construction site, work camp may become a nuisance if they are not tidy and cleaned, and raw materials, equipment etc. are not stored properly. <p>[Operation]</p> <ul style="list-style-type: none"> No significant impact is anticipated as a result of the project.
21	Gender	✓	-	B-	D	<p>[Before and during Construction]</p> <ul style="list-style-type: none"> Local employment related construction might prioritise male than female and cause negative impact to livelihood and benefit sharing. Lack of facility for women at construction site and camp might discourage job application from women and cause inconvenient during work. <p>[Operation]</p> <ul style="list-style-type: none"> No significant impact is anticipated as a result of the project.
22	Children's Rights	✓	-	D	D	<ul style="list-style-type: none"> No significant impact is anticipated as a result of the project
23	Infectious diseases such as HIV/AIDS	✓	-	A-	D	<p>[Before and during Construction]</p> <ul style="list-style-type: none"> possibility of spread of sexually transmitted infections (some of which might lead to contraction of HIV/AIDS) by migrant workers. Generation of solid and liquid wastes at the camp and construction sites may lead to outbreak of diseases. <p>[Operation]</p> <ul style="list-style-type: none"> No significant impact is anticipated as a result of the project.
24	Working conditions (including occupational safety)	✓	-	B-	D	<p>[Before and during Construction]</p> <ul style="list-style-type: none"> Construction activities can be detrimental to the health of the workforce and nearby communities such as noise, air pollution, water pollution etc. There is an inherent risk of the injury of workers on site due to the negligent use and/or lack of maintenance and of construction machinery, absence of protective clothing for workers, earthworks on steep cliff sections, excavation of slopes using explosives, etc among others. Project workers might get attacked by wild animals, snakes etc. Working under extreme weather (heat, rain, etc) will increase accidents and works health condition. <p>[Operation]</p> <ul style="list-style-type: none"> No significant impact is anticipated as a result of the project.
4. Others						

No	Impact item	Scoping		Impact Assessment		Reasoning for Evaluation
		Construction	Operation	Construction	Operation	
25	Transboundary Impacts and Climate Change	✓	✓	B-	B+	[Before and during Construction] <ul style="list-style-type: none"> Increase in construction vehicles on road and temporary closure of lane will result in the disruption of traffic flows and increase in GHG emission. [Operation] <ul style="list-style-type: none"> Improve road condition will improve traffic flow.
26	Accidents	✓	✓	B-	A+ B-	[Before and during Construction] <ul style="list-style-type: none"> The construction works will result in the temporary disruption of traffic flows by increase traffic volume with heavy construction vehicles, which might increase traffic accident Use of flammable materials, rock exfoliation and other natural phenomenon are prone to starting fires. [Operation] <ul style="list-style-type: none"> Improved road alignment, road surface conditions, and road safety facilities will offer a safe alternative to travelling along the North – South corridor. Improve road condition might increase vehicle speed and increase traffic accidents.
<p>✓: Items to be covered for impact assessment considering the project impact is predicted or Impacts are unclear requiring further information. A+/-: Significant positive/negative impact is expected, B+/-: Positive/negative impact is expected to some extent C: Extent of positive/negative impact is unknown. (A further examination is needed, and the impact could be clarified as the study progresses) D: No impact is expected</p>						

Source: Survey Team; Environmental and Socio-Economic Impact Assessment Study of the Upgrading and Re-Alignment of Harare – Chirundu Road from Chainage 290+000 to 300+500, section 1-5-3-7, 1-5-3-8, 1-5-3-9, submitted in December 2022

1-5-3-9 Environmental management plan

Based on the Impact assessment, the following Environment Management Plan is proposed for the Project. Employing the mitigating measures proposed can avoid/ minimise the negative impacts anticipated.

Table 1-42: Environmental Management Plan (draft)

Environmental Items	Management Plan	Implementing / Supervising Agency	Authority	Cost
1. Pre Construction (Design and Planning) Phase				
General	The road designs and related ancillary facilities such as drainage and safety facilities must meet all the relevant standards.	MoTID General Consultant (GC)		n.a. (not applicable)
	Fulfil all regulatory requirements before commencement of any work on the site and obtain all relevant permits for	MoTID	Zimbabwe National Water	n.a.

Environmental Items	Management Plan	Implementing / Supervising Agency	Authority	Cost
	<p>works including operation of borrow pits, quarrying and camp sites.</p> <ul style="list-style-type: none"> • Sand extraction permit. • a water abstraction permit • a blasting permits • certificates of fitness for all employees • registration with National Social Security Authority (NASSA) • Plan for pollution control 		<p>Authority (ZINWA)</p> <p>EMA</p>	
	<ul style="list-style-type: none"> • Implement monitoring in accordance with the collateral conditions (items requiring reporting, report method, frequency, etc.) in the monitoring plan to be prepared at the same time as the EIA. 	MoTID GC Contractor	EMA	n.a.
Soil Contamination	<ul style="list-style-type: none"> • Identify the area where the soil might be contaminated and remove and dispose contaminants at designated hazardous sites by polluters under the "Polluter Pays Principle" in coordination with EMA. • It is recommended that all the contaminated soil piles identified be removed after consent is obtained from EMA. 	MoTID GC Polluters	EMA Zimbabwe Parks and Wildlife Authority (PWMA)	Polluters cost
Ecosystem	<ul style="list-style-type: none"> • Consult and agree with PWMA on project measures to avoid and minimize impact to fauna and flora. 	MoTID GC	PWMAs	
Local economies, such as employment, livelihood, etc.	<ul style="list-style-type: none"> • Prioritise recruitment of local community and use of local materials, products and facilities for construction related works. 	MoTID Contractor GC Village heads and elders	EMA	n.a.
Land use and utilization of local resources	<ul style="list-style-type: none"> • No permanent structures will be permitted in national park. • Use the same contractor's camp as Phase 1 and existing borrow pits where environment impact is minimum. In case of setting up new camp site, select the site avoiding sensitive areas such as wetlands, sensitive vegetation types or sensitive landscape units and place within an existing disturbed area as much as possible. Consideration must be given to fuel and supplies and water availability. cutting trees for firewood or setting traps for small animals are discouraged • Existing utility such as telecom cables disturbing works must be removed before construction starts. 	MoTID Contractor GC Village heads and elders	EMA PWMAs Hurungwe Rural District Council (HRDC)	n.a.
Social institutions such as social infrastructure and local decision-making institutions	<ul style="list-style-type: none"> • Hold regular information dissemination and consultations with local communities and village heads and elders. • Ensure that concerns raised by local and traditional elders are addressed. 	MoTID GC Village heads and elders	EMA	n.a.
Gender	<ul style="list-style-type: none"> • Prioritise recruitment of local people for construction works including consideration for gender equality. 	MoTID GC Contractor	EMA Ministry of Women	n.a.

Environmental Items	Management Plan	Implementing / Supervising Agency	Authority	Cost
	<ul style="list-style-type: none"> • Provide separate facilities for women such as toilet, changing room, etc. 	Village heads and elders	Affairs (MWA)	
Working conditions (including occupational safety)	<ul style="list-style-type: none"> • Deliver trainings to contractor's personnel and workers to ensure awareness of health and safety and environmental safeguard requirements. 	MoTID GC Contractor	EMA Ministry of Health and Child Welfare (MoHCW) Ministry of Public Service, Labour & Social Welfare (MPSLSW)	n.a.
2. Construction Phase				
Air quality	<ul style="list-style-type: none"> • Use water sprinklers and dust suppressants, on access roads and other dust generation sites to stop sand and dust from being dispersed by works vehicles and heavy machinery. • Cover the cargo beds of equipment and materials haulage vehicles, and all earthworks or soil storage to prevent sand and dust from blowing off site. • Locate all stockpiles sufficiently away from sensitive receptors. • Provide and maintain suitable gravel or coarse aggregate surfaces in the entry and exit routes, storage and parking bays. • Enforce vehicle speed limits to minimize dust generation. • In case of using blasting, conduct according to strict guidelines designed to control vibration. • Regularly service and maintain all vehicles, equipment and machinery used for construction to ensure that emission levels are kept within national standards. • Provide protective respirators and dust filters to employees and site workers. Use signboards to remind workers to wear protective devices. • Take measures of air quality and manage activities to comply with Threshold Level Values (e.g., PM10 and PM 2.5). 	MoTID GC Contractor	EMA National Security Authority (NSSA)	n.a.
Water Quality	<ul style="list-style-type: none"> • Develop a construction activity schedule that will outline methods and appropriate seasons to carry out certain activities. • Avoid direct discharge of construction water, hazardous substances into the water systems installing appropriate equipment such as oil traps, septic tanks, etc. Provide adequate water supply and sanitation facilities, washing area for vehicles. 	MoTID GC Contractor	EMA	5,000 USD

Environmental Items	Management Plan	Implementing / Supervising Agency	Authority	Cost
	<ul style="list-style-type: none"> Contaminated water storage facilities if any, shall not be allowed to overflow and appropriate protection from rain and flooding shall be implemented. Cut and fill areas to be covered with excavated topsoil and covered with the local vegetation or reseeded to prevent soil runoff. Use only materials which are known to have no residual pollutants. 			
Soil Contamination	<ul style="list-style-type: none"> Develop and implement an Integrated Solid and hazardous Waste Management System (ISWMS). Recover, treat, and dispose of chemical, fuel, oil spills and leakages appropriately. If any contaminated site cannot be treated immediately, mark and separate the area and consult with EMA for appropriate action. 	MoTID GC Contractor	EMA	n.a.
Wastes	<ul style="list-style-type: none"> Establish an ISWMS on site and apply “reduce, reuse and recycle” waste hierarchy. The surplus soil and rubble from construction will be used for construction where possible to minimise off-site disposal. Setup regular self and external audit of the ISWMS. Have a designated operator collect solid wastes from site offices and other works facilities and dispose of them to designated waste disposal sites. 	MoTID GC Contractor	EMA	n.a.
Noise and Vibration	<ul style="list-style-type: none"> Implement a noise management plan for practical noise mitigation measures such as scheduling of works, use of movable noise screens and good site management practices to further alleviate the potential construction noise impacts. Conduct noise sensitive operations in consideration to the location of the sensitive receptors and time of the day. Use low noise and low vibration equipment where possible in consideration to the scale and type of works. If using blasting, minimise blasting noise and vibration through introduction of blasting mats over blasting areas. Maintain all equipment and vehicles in good working order and ensure they are all within manufacturers limits of noise generation. Fit with noise reduction devices where necessary. Provide and ensure wearing protective gear for staff working at noisy sites as stipulated in the Factories Act and other relevant construction related legislation. Monitor and maintain noise levels within WHO standards and guidelines. Inform local communities in the proximity area to activities generating noise and vibration impacts on schedule, possible negative impact and proposed mitigation measures in advance. Register and respond to complaints as per grievance and response mechanisms 	MoTID GC Contractor	EMA PWMA NSSA	n.a.

Environmental Items	Management Plan	Implementing / Supervising Agency	Authority	Cost
Ecosystems	<ul style="list-style-type: none"> • Avoid and minimise removal and/or destruction of trees and vegetation. • Avoid installation of fences, etc. which will obstruct wildlife migration routes and risk disturbing habitats. • Control vehicle speed and install warning signs (e.g. speed limit, wildlife corridors) to urge drivers to take care in order to prevent collisions, etc. with wild animals. • Comply rules under the PWMAs area such as no poaching, working time. • Protect the two animals the Python (<i>Python sabae</i>) and Brown Snake Eagle (<i>Circaetus cinereus</i>), and if found report to the Morongora National Park staff. 	MoTID GC Contractor	EMA PWMA	7,000 USD
Hydrology	<ul style="list-style-type: none"> • Ensure construction drainage is installed as required. • Clean and maintain drainage regularly and keep functional. • Monitor soil/bank erosion and runoff to watercourse. • Monitor river water levels. 	MoTID GC Contractor	EMA PWMA	n.a.
Topography and Geology	<ul style="list-style-type: none"> • If blasting is used, monitor blasted areas and its surrounding for ground movements. • Use existing quarry sites and borrow pits that are in operation. • Select appropriate works methods upon conducting adequate geological survey, and take appropriate measures to prevent landslides and earth slips arising from filling, cutting, etc. • In order to prevent sediment runoff from cut and fill sections, earth dumps and borrow pits, cover cut and fill parts with excavated topsoil and reseeded or planted with local vegetation to prevent soil runoff. 	MoTID GC Contractor	EMA PWMA	110,000 USD
Water use	<ul style="list-style-type: none"> • Draw water for construction and drinking from the existing reservoir or same sources as used in phase 1 project. 	MoTID GC Contractor	EMA/ PWMA ZINWA HRDC	5,000 USD
Social institutions such as social infrastructure and local decision-making institutions	<ul style="list-style-type: none"> • Hold regular information dissemination and consultations with local communities and traditional leaders. • Establish grievance redress mechanism and ensure that concerns raised by local and traditional elders are addressed 	MoTID Village heads and elders	EMA	n.a.
Cultural heritage	<ul style="list-style-type: none"> • In case of archaeological objects discovered on the site during construction work, report to National Museums and Monuments of Zimbabwe (NMMZ) and act accordingly. • Involve traditional healers in spiritual cleansing of the area where people died. 	MoTID GC Contractor Village heads and elders	NMMZ	n.a.
Landscape	<ul style="list-style-type: none"> • Keep the construction sites and work camp clean and tidy. 	MoTID / GC/ Contractor	PWMA	n.a.

Environmental Items	Management Plan	Implementing / Supervising Agency	Authority	Cost
Infectious diseases such as HIV/AIDS	<ul style="list-style-type: none"> Conduct Sexually Transmitted Diseases (STDs) awareness campaigns in the camp as well as in the nearby settlements. 	MoTID GC Contractor Village heads and elders	MoHCW HRDC	n.a.
Working conditions (including occupational safety)	<ul style="list-style-type: none"> Supply all workers with the necessary protective clothing such as safety goggles, helmets, masks, boots, etc. particularly during blasting, drilling, while working with asphalt, and handling tar. Comply with all regulations regarding health and safety of all staff and workers. Coordinate with PWMA for assignment of park rangers. Use adequate signposting for Health and safety Train workers periodically and provide with proper gear including communication equipment and reflective jackets. Set up a fully equipped first aid kit and a Health Safety and Environment Officer who has first aid training and knowledge of safety regulations. Clearly mark and control access points to construction sites and the area excavated from public. Disseminate information on construction schedule and expected impacts, contact point to local communities and stakeholders in timely manner. 	MoTID GC Contractor	MoHCW MPSLSW	150,000 USD
Transboundary impacts and climate change	<ul style="list-style-type: none"> Prepare and implement detailed Traffic Control Plans prior to commencement of works on any section of road.. 	MoTID GC Contractor	EMA	n.a.
Accidents (traffic)	<ul style="list-style-type: none"> Prepare and implement detailed Traffic Control Plans. The traffic control plans shall contain details of temporary diversions, details of arrangements for construction under traffic and details of traffic arrangements after cessation of work each day Allocate trained personnel with proper PPE for traffic control at construction sites, school routes, etc. Provide road safety facilities such as barricades, signs, markings, flags as may be required for the information and protection of traffic approaching or passing through the section under construction works, wildlife corridor, school route. Provide safe and convenient passage for vehicles to use during construction. 	MoTID GC Contractor Village heads and elders	Police PWMA	n.a.
Accidents (fire)	<ul style="list-style-type: none"> The project site is in a high fire zone area and must be fire guarded. Carry out risk assessments, training of personnel and conduct regular fire drills as part of emergency preparedness in liaison with EMA and Marongora National Parks staff. Use of fire, open flame and smoking during construction must be controlled. Use adequate signposting to 	MoTID GC Contracto	EMA PWMA	n.a.

Environmental Items	Management Plan	Implementing / Supervising Agency	Authority	Cost
	discourage risk behaviour at sites prone to the fire hazard.			
Decommissioning phase				
Air quality	<ul style="list-style-type: none"> • Use water sprinklers and dust suppressants, on access roads and other dust generation sites to stop sand and dust from being dispersed by works vehicles and heavy machinery. • Cover the cargo beds of equipment and materials haulage vehicles. • Locate stockpiles sufficiently away from sensitive receptors to prevent any risk of contamination. • Enforce vehicle speed limits to minimize dust generation. • Ensure all vehicles, equipment and machinery are regularly serviced and well maintained to ensure that emission levels are kept within national standards. • Provide protective respirators and dust filter masks to employees and site workers. Use signboards to remind workers to wear protective devices. • Take measures of air quality and manage activities to comply with threshold level values. 	MoTID GC Contractor	EMA NSSA	n.a
Water quality	<ul style="list-style-type: none"> • Avoid direct discharge of construction water, sewage, to the water systems. 	MoTID GC Contractor	EMA	n.a
Soil contamination	<ul style="list-style-type: none"> • Clean all soils contaminated with fuel and chemicals on the site area. 	MoTID GC Contractor	EMA	n.a.
Waste	<ul style="list-style-type: none"> • Sell or donate all reusable materials to locals or community projects 	MoTID GC Contractor	EMA HRDC	n.a.
Noise and Vibration	<ul style="list-style-type: none"> • Implement a noise management plan for practical noise mitigation measures such as scheduling of works, use of movable noise screens and good site management practices to further alleviate the potential construction noise impacts. • Conduct noise sensitive operations in consideration to the location of the sensitive receptors and time of the day. • Use low noise and low vibration equipment where possible in consideration to the scale and type of works. • Provide personal protective equipment for staff working at noisy sites as stipulated in the Factories Act and other relevant construction related legislation. • Monitor and maintain noise levels within WHO standards and guidelines. • Inform local communities in the proximity area to activities generating noise and vibration impacts on schedule, possible negative impact and proposed 	MoTID GC Contractor	EMA PWMA NASSA	

Environmental Items	Management Plan	Implementing / Supervising Agency	Authority	Cost
	mitigation measures in advance. Register and respond to complaints as per grievance and response mechanisms			
Land use and utilization of local resources	<ul style="list-style-type: none"> Remove the camp within three months of completing the road and rehabilitate the area to its original state. 	MoTID GC Contractor Village heads and elders	PWMA HRDC	n.a.
Water use	<ul style="list-style-type: none"> Any water facilities provided by the contractor to be handed over to the relevant authorities. 	MoTID GC Contractor	ZINWA PWMA HRDC	n.a.
Social institutions such as social infrastructure and local decision-making institutions	<ul style="list-style-type: none"> Inform local communities in proximity to the project of activities on the proposed decommission schedule and potential economic and social impact and proposed mitigation measures in advance. Register and respond to complaints as per grievance and response mechanisms and ensure that concerns raised by local and traditional elders are addressed. 	MoTID GC Contractor Village heads and elders	EMA	Motid cost
Operational phase				
Ecosystem	<ul style="list-style-type: none"> Avoid the area to be fenced to allow animal movement across the road. Install clearly wildlife corridor/ crossing warning signs to avoid road kills. 	MoTID	EMA PWMA	n.a.
Hydrology	Maintain drainage system periodically and regularly clear plant growth and litter to keep the drainage system functional.	MoTID	EMA PWMA	n.a.
Topography and geology	<ul style="list-style-type: none"> Monitor ground level for ground movements. Monitor soil erosion in the area of cut and fill, excavated, river banks. 	MoTID	EMA PWMA	n.a.
Accidents	<ul style="list-style-type: none"> Ensure traffic safety facilities are maintained and functioning. 	MoTID	Police PWMA	n.a.

Source: Survey Team; Environmental and Socio-Economic Impact Assessment Study of the Upgrading and Re-Alignment of Harare – Chirundu Road from Chainage 290+000 to 300+500, section 1-5-3-7, 1-5-3-8, 1-5-3-9, submitted in December 2022

1-5-3-10 Environmental monitoring plan

(1) Environment Monitoring Plan

An environment monitoring plan to use in monitoring compliance with environmental requirements of the project shown below table.

Table 1-43: Environmental Monitoring Plan (draft)

Environment item	Monitoring items	Monitoring location	Frequency	Implementing/Supervising Agency	Authority	cost
1. Design and Planning Phase						
General	Status of obtaining all planning, engineering and EIA permits	-	-	MoTID GC Contractor	EMA	n.a.-

Environment item	Monitoring items	Monitoring location	Frequency	Implementing/Supervising Agency	Authority	cost
Baseline Environmental Quality	<ul style="list-style-type: none"> Air quality Noise and Vibration Surface water 	Sensitive receptor, Marongora River and tributary crossed/ along the road alignment	Once, Prior to start of construction	MoTID GC Contractor	EMA	MoTID cost including sampling contractor and laboratory analysis
Soil Contamination	<ul style="list-style-type: none"> Soil quality Status of decontamination activities Result of Site Risk Assessment 	Road sides around accident prone spots	Once, prior to start of construction	MoTID GC Contractor	EMA PWMA	MoTID cost including sampling contractor and laboratory analysis
Local economies, such as employment, livelihood, etc.	<ul style="list-style-type: none"> Number of employed locals for construction works. 	-	Monthly from commission of contractor	MoTID GC Contractor, Village heads and elders	EMA	n.a.
Land use and utilization of local resources	<ul style="list-style-type: none"> Local facilities used and material sourced. 	-	Monthly from commission of contractor	MoTID GC Contractor, Village heads and elders	EMA PWMA HRDC	n.a.
Social institutions such as social infrastructure and local decision-making institutions	<ul style="list-style-type: none"> Number of public consultations, information dissemination held, including participants list and Q&A 	-	Monthly	MoTID GC Village heads and elders	EMA	n.a.
Gender	<ul style="list-style-type: none"> Gender ratio of employee facility for women 	-	Monthly from commission of contractor	MoTID GC Contractor Village heads and elders	EMA MWA	n.a.
Working conditions (including occupational safety)	<ul style="list-style-type: none"> Number of trainings held 	-	Monthly from commission of contractor	MoTID GC Contractor	EMA MoHCW MPSLSW	n.a.
2. Construction Phase						
General	<ul style="list-style-type: none"> Status of compliance to environmental management plan. 		Monthly	MoTID	EMA	
Air quality	<ul style="list-style-type: none"> Visual inspection of Dust 	<ul style="list-style-type: none"> construction sites where activities generate dust 	Daily	MoTID GC Contractor	EMA NSSA	n.a.

Environment item	Monitoring items	Monitoring location	Frequency	Implementing/Supervising Agency	Authority	cost
		• Sensitive receptors				
	SO ₂ , NO ₂ , CO, O ₃ , , TSP, PM ₁₀ , PM _{2.5} , Pb	Sensitive receptors	Quarterly or as required by EMA			MoTID cost including sampling contractor and laboratory analysis
	• Watering of construction roads and other construction works.	Construction sites	Daily			n.a.
	• Maintenance status of equipment • Rehabilitation status of haul/access road	Construction sites/haul/access road	Monthly			n.a.
Water quality	• Visual indication of siltation and clogging of drainage canals	Points where road crosses river, reservoir	Daily during rainy season	MoTID GC Contractor	EMA	n.a.
	• pH, Temperature, Colour, Turbidity, E. Conductivity, Total Hardness, TSS, TDS, BOD, COD, DO, Oxygen absorbed (PV), Phosphates, Sulphates, Nitrates, Chloride, Arsenic, Cadmium, Copper, Coliforms, Chromium, Cyanide, Iron, Lead, Manganese, Nickel, Total Mercury, Zinc, Oil and Grease	Points where road crosses river, reservoir	Quarterly or as required by EMA			MoTID cost including sampling contractor and laboratory analysis
Soil Contamination	• Visual inspection of construction sites, equipment maintenance areas, storage areas, contaminated water storage facilities and heavy equipment.	Construction sites	Daily	MoTID GC Contractor	EMA	n.a.
	• Soil quality of excavated soil of past traffic accident sites prior to disposal	Accident sites	Once prior to dispose			MoTID cost including sampling contractor and laboratory analysis
	• In case of accident spill, soil quality level, status of recovery, treat, and dispose of contaminant	Accident sites	Immediately in case of spill			
Wastes	• Volume of waste generated and disposed by type	Construction sites, worker camp	Daily	MoTID GC Contractor	EMA	n.a.

Environment item	Monitoring items	Monitoring location	Frequency	Implementing/Su pervising Agency	Authority	cost
	<ul style="list-style-type: none"> Disposal method and management of solid wastes against ISMP and hazardous waste management plan 					
	<ul style="list-style-type: none"> Inspect disposal sites, toilet facilities etc. are provided and that wastes are properly removed and treated. 	Construction sites, worker camp	Weekly			n.a.
Noise and Vibration	<ul style="list-style-type: none"> Noise Level Vibration level 	Sensitive receptors	Daily Twice a day (Daytime and night)	MoTID GC Contractor	EMA PWMA NASSA	MoTID cost
Ecosystem	<ul style="list-style-type: none"> Area of topsoil removal Number and species of trees removed. Handling of protect species Compliance to regulation of national park. 	Construction sites	Monthly	MoTID GC Contractor /	EMA PWMA	n.a.
Hydrology	<ul style="list-style-type: none"> Stream flow, water level State of drainage facilities 	Points where road crosses river, reservoir	Daily during rainy season	MoTID GC Contractor	EMA PWMA	n.a.
Topography and geology	<ul style="list-style-type: none"> Level of ground subsidence/ change in ground level. 	blasted areas	Daily	MoTID GC Contractor	EMA PWMA	n.a.
	<ul style="list-style-type: none"> Visible sign of erosion Condition of erosion control device 	blasted areas, slopes, river banks along the project.	Daily			n.a.
Water use	<ul style="list-style-type: none"> Volume of water drawn from source 		Daily	MoTID GC Contractor	EMA PWMA ZINWA HRDC	n.a.
Social institutions such as social infrastructure and local decision-making institutions	<ul style="list-style-type: none"> Number of public consultations, information dissemination held, including participants list and Q&A 		Quarterly	MoTID GC Contractor Village heads and elders	EMA	n.a.
	<ul style="list-style-type: none"> Number of complaints received and status 		Monthly			n.a.
Cultural heritage	<ul style="list-style-type: none"> Finding of archaeological objects Status of handling the finds 		As required	MoTID GC Contractor, Village heads and elders	NMMZ	n.a.
Landscape	<ul style="list-style-type: none"> Tidiness of construction sites, workers camp. 	construction sites,	Daily	Contractor/ GC/	PWMA	n.a.

Environment item	Monitoring items	Monitoring location	Frequency	Implementing/Su pervising Agency	Authority	cost
		workers camp.		MoTID		
Infectious diseases such as HIV/AIDS	• Number of cases	-	Monthly	MoTID GC Contractor, Village heads and elders	MoHCW	n.a.
Working conditions (including occupational safety)	• Status of Health and Safety Management Plan and Emergency Response Plan implementation • Working hours • Number, type and location of accidents • Health condition of workers	-	Monthly	MoTID GC Contractor	MoHCW MPSLSW	n.a.
Transboundary Impacts and Climate Change	• Status of traffic jam, traffic volume	-	Weekly	MoTID GC Contractor	EMA	n.a.
Accidents (traffic)	• Number, type and location of accidents • Status of implementing Traffic control Plan	-	Weekly	MoTID GC Contractor, Village heads and elders	Police PWMA	n.a.
Accidents (fire)	• Training and fire drills Record • Status of H&S measures in place on site.	-	Quarterly	MoTID GC Contractor	EMA PWMA	n.a.
Decommissioning phase						
Air quality	• Visual inspection of dust	• construction sites where activities generate dust • Sensitive receptors	Daily	Contractor, GC, MoTID	EMA NSSA	n.a.
	• Watering of construction roads and other construction works.	Construction sites	Daily			n.a.
	• Maintenance status of equipment • Rehabilitation status of haul/access road	Construction sites/haul/access road	Monthly			n.a.
Soil contamination	• Visual inspection of construction sites, equipment maintenance areas, storage areas, contaminated water	Construction sites	at the end of construction phase	MoTID GC Contractor	EMA	n.a.

Environment item	Monitoring items	Monitoring location	Frequency	Implementing/Su pervising Agency	Authority	cost
	storage facilities and heavy equipment.					
	• In case of likely contaminated area, concentrations of As, Ba, Cd, Fe, Pb, Hg, Ni, Se, Zn	Construction sites, worker camp	at the end of construction phase			MoTID cost including sampling contractor and laboratory analysis
Waste	• Volume of waste generated and disposed by type • Disposal method and management of wastes against ISMP.	Construction sites, worker camp	Daily	MoTID GC Contractor /	EMA HRDC	n.a.
	• Inspect to disposal sites, toilet facilities etc. provided	Construction sites, worker camp	Daily			n.a.
Noise and Vibration	• Noise Level • Vibration level	Sensitive receptors	Daily Twice a day (Daytime and night)	MoTID GC Contractor	EMA PWMA NASSA	MoTID cost
Land use and utilization of local resources	• Rehabilitation status	Construction sites, worker camp, borrow pits etc.	Daily	MoTID GC Contractor, Village heads and elders	EMA PWMA HRDC	n.a.
Water use	• Any water facilities	-	Once	MoTID GC Contractor	ZINWA HRDC PWMA	n.a.
Social institutions such as social infrastructure and local decision-making institutions	• Number of public consultations, information dissemination held, including participants list and Q&A	-	Prior to decommission	MoTID GC Contractor Village heads and elders	EMA	n.a.
	• Number of complaints received and status	-	Daily			n.a.
Operational phase						
Ecosystem	• Change in fauna behaviour and flora • Compliance to regulation of national park.		Annually	PWMA	PWMA	n.a.
Hydrology	• Condition of drainage system and clearing of growth around the road	Points where road crosses river, drainage culvert	Annually prior to rainy season	MoTID	EMA	n.a.
Topography and geology	• Continuing maintenance carried out on slops, cuts, and embankments	area of road realignment,	Annually	MoTID	EMA PWMA	n.a.

Environment item	Monitoring items	Monitoring location	Frequency	Implementing/Supervising Agency	Authority	cost
		slopes, embankment				
Accidents	<ul style="list-style-type: none"> • Status of traffic jam, traffic volume • Number, type and location of accidents • Status of traffic safety facilities 		Annually	MoTID	Police PWMA	n.a.

Source: Study team; Environmental and Socio-Economic Impact Assessment Study of the Upgrading and Re-Alignment of Harare – Chirundu Road from Chainage 290+000 to 300+500, section 1-5-3-7, 1-5-3-8, 1-5-3-9, submitted in December 2022

(2) Monitoring report

A Project proponent that has been issued Environmental Approval is primarily responsible for monitoring their projects. MoTID will implement a monitoring plan for the Project to ensure that the identified project impacts are appropriately managed with the proposed management measures and relevant regulatory requirements. During the construction, the Contractor’s Environmental Manager will carry out an assessment of the Project’s environmental performance under the supervision of GC and MoTID, and submit to monthly monitoring report detailing performance for the period to MoTID. Project management unit of MoTID prepares a quarterly summary report which includes a monitoring form covering the result of specified monitoring items and submit to EMA and relevant authority and JICA.

1-5-3-11 Stakeholder consultation and Public Disclosure

(1) Target stakeholders

It is necessary to share sufficient information with government agencies, local authorities, local individuals and groups involved in each step of the project, including planning and design, to enhance their understanding of the project and to understand their concerns and recommendations, which should be reflected in project decision-making. The possible stakeholders (draft) for the project are listed in the table below.

Table 1-44: Target groups for stakeholder consultation

No.	Target groups
Government	
1	Ministry of Lands, Agriculture, Fisheries, Water, Climate And Rural Development
2	Ministry of Information, Publicity and Broadcasting Services
3	Ministry of Information Communication, technology, Postal and Courier Services
4	Zimbabwe Republic Police (ZRP) – Makuti
Government Authority/Parastatals	
5	Zimbabwe Parks and Wildlife Management Authority (ZWMA)
6	Environmental Management Agency (EMA)
7	Zimbabwe Electric Supply Authority (ZESA)
8	Zimbabwe National Water Authority (ZINWA)
9	Zimbabwe Revenue Authority
Rural and local Government	

No.	Target groups
10	Hurungwe District Council
11	Rural Development Councils
12	Community Leaders (Councillor, Chief, Makuti Village Head)
Community and private companies.	
13	Transport Operators Association Zimbabwe (Cross Boarder buses and Haulage Tracks Operators)
14	Telecom providers (Telone, ZOL, Econet, Telecel and Netone)
15	The Public - Marongora Community, Makuti Tsetse community, Makuti Motel

Source: Survey team

(2) Public Disclosure

In accordance to the Environmental Management Act, an advert was placed in the local media informing the general public including Urban Local Authorities, Rural District Councils and all Interested and Affected Parties (IAPs) about an impending project and its EIA, submission of comments and contact points.

(3) Status of stakeholder consultation implementation

During the field survey (October 2021), interviews were conducted to Zimbabwe Parks and Wildlife Management Authority, Makuti Village leader, Hurungwe Rural District Council chief. Interviews with EMAs were conducted by email rather than in person. As a part of the environmental impact survey, two public consultation was conducted in July and November 2022 and questionnaires, letters, focus group discussions and interviews were used to collect data.

Table 1-45: Stakeholders interviewed during the field survey

Date	Organization	Contents	Stakeholder	Method
Initial interview				
Oct. 21, 2021	Zimbabwe Parks and Wildlife Management Authority (ZWMA)	<ul style="list-style-type: none"> Clarification on necessary concurrence procedure for phase 2 Traffic impacts, climate change observed Feedback of Phase 1 Request for data sharing 	<ul style="list-style-type: none"> Jeremiah Cahkuya (TFCA Programme Officer) Faron Chaita(SWO) David D. Chatindo (Senior Ranger) Augustine Malunga(Senior Ranger) 	Interivew
Oct. 22, 2021	Makuti Village	<ul style="list-style-type: none"> Traffic impact observed information sharing on social aspects Feedback of Phase 1 	Joseph Nyaguwa (Village head)	Interivew
Oct. 25, 2021	Hurungwe Rural District Council	<ul style="list-style-type: none"> Clarification on necessary arrangement/ permit to be obtained Development plan, community profile Request for data sharing 	Luke Kalavina (Chief Executive Officer)	Interivew
Nov. 16-17, 2021	Environmental Management Agency (EMA)	EIA process	Mangisi Phanuel Kudakwashe (Manager - EIA & Ecosystems)	Email

Date	Organization	Contents	Stakeholder	Method
			Protection)	
The 1st Public Consultation				
Jul, 11-12, 2022	Makuti Bar meeting, National Park Camp, Makuti Tsetse Control centre, Makuti Women Camp, Marongora National Park Camp,	how they feel about the upgrading and re-alignment of the Harare – Chirundu Road (R3) stretching from chainage 290+000 to the chainage 300+500	70 people	Focus group discussions
Jul, 11, 2022	Makuti Primary School Head		Mufoswa	Quwarionnair Interivew
Jul, 12, 2022	Energy Park Manager			Quwarionnair Interivew
Jul, 12, 2022	Makuti Village		Joseph Nyaguwa (Village head)	Quwarionnair Interivew
Jul, 12, 2022	Councilar		Mulisa Nomatter	Quwarionnair Interivew
Jul, 12, 2022	Zimbabwe Republic Polic e(ZRP)		Mjugauri. C (inspector)	letter
Jul, 12, 202	Zimbabwe Electricity Transmission and Distribution Company (ZETDC)		n/a	letter
The 2nd Public Consultation				
Nov.2022	Government ministries and Parastals	how they feel about the upgrading and re-alignment of the Harare – Chirundu Road (R3) stretching from chainage 290+000 to the chainage 300+500	Parks and Wildlife Authority, Hurungwe RDC, Ministry of Women Affairs, Community, Small and Medium Enterprise Development, Ministry of Local Government, Public Works & National Housing, TelOne, ZRP	letter

Source: Survey team

The following opinions on environmental and social considerations in the preceding Phase 1 were provided during the interviews. These opinions need to be considered and incorporated into the design and planning of the project.

- Dust control measures were inadequate.
- Coordinate with Zimbabwe National Parks and Wildlife Management Authority (ZWMA) on how the area will be restored to its original state after the construction is completed, so that it can be used as effectively as possible as a safari area.
- Information to residents was adequately implemented at the right time. The local economy has been very stimulated as residents were employed and local resources such as hotels were utilised during the construction.

Through two public consultations as well as public disclosure on the project, positive and negative concern were raised as follows;

- The project reduces accidents in the area
- The youths and people in the area who are jobless will be recruited to work in the construction project.
- Traffic flow will increase and this increases businesses in the area.

- Movements and transportation to Chirundu and Zambia are going to be easy and safe.
- There are no graves, caves, or places of cultural heritage in the project area
- Transportation of school children for sports from school to Marongora will be safe.
- Businesses like service station in the area will improve and they will employ more people when traffic increases.
- The negative impacts are outweighed by the positive impacts

In conclusion, the upgrading, re-alignment, and rehabilitation of the road is supported by all stakeholders interviewed due to the following reasons

1-5-3-12 EIA assistance

(1) EIA support based on JICA environmental guidelines

During the fieldwork for this survey (October-November 2021), in accordance with the JICA Guidelines for Environmental and Social Considerations (April 2010) (JICA Environmental Guidelines), survey team carried out EIA implementation support for the Government of Zimbabwe's procurement of an Environmental and Social Impact Assessment (ESIA) consultant. MoTID's EIA implementation arrangements are listed below.

Table 1-46: MoTID's EIA responsibility personnel

Description	Name	Position
Supervision	Irene D. Michael	Director Planning and Designs
Implementation	Virginia Mawere	Planning section, Engineer
Support	Muzim Misheck	Planning section, technician

During the field survey, the following interviews and site visits were conducted to confirm the environmental and social situation in the project area, consult with stakeholders and confirm the necessity and procedures for conducting an EIA.

Table 1-47: Schedule and content of interviews and site visits

Date	Activities	MOTID Participants
20 October 2021	Confirmation of Phase 2 activities with MOTID officials, content of field surveys and information gathering	Virginia Mawere (MoTID, engineer)
21 October 2021	Discussions with Wildlife Management Authority	Irene. D. Michael (MoTID) Albert Muchena (MoTID) Emmanule Mubaiwa Muzim Misheck
22 October 2021	Interview with Makuti village head	Muzim Misheck
	Field survey	Muzim Misheck
23 October 2021	Field survey	Muzim Misheck
24 October 2021	Field survey	Muzim Misheck
25 October 2021	Field survey	Muzim Misheck
27 October 2021	Sharing of field survey results	Virginia Mawere (MoTID, engineer)
4 November 2021	Check on progress of information gathering and coordination with EMA	Virginia Mawere (MoTID, engineer) Muzim Misheck (MoTID)

Date	Activities	MOTID Participants
November 2021	Confirmation with environmental management, EIA procedures, required documentation, review times, revision of applicable legal provisions	Mangisi Phaniel Kudakwashe, Manager- EIA & Ecosystems Protection

* EMA was interviewed by email rather than in person.

MOTID has agreed to hire a consultant at the project design planning stage to start EIA preparations and submit a draft EIA report to JICA by the end of July 2022 and obtain a renewed or revised EIA certificate from EMA by the end of September 2022. The actual schedule for the EIA as of December 2022 is as follows.

Table 1-48: EIA schedule

No.	Activity	Responsible party	2021			2022												2023	
			10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	Consult EMA for required procedure & documents	DOR																	
2	Coordinate with Parks & Wildlife Management Authority	DOR																	
3	Finalise Scope of Phase 2 EIA	DOR																	
4	Prepare EIA consultant purchase	DOR																	
5	Tender (apply JICA guidelines)	DOR																	
6	Submit EIA review application to EMA	Subcon																	
7	Prepare EIA report	Subcon																	
8	Submit EIA report to JICA for review	DOR																	
9	Review EIA report (60days or shorter)	EMA																	
10	Issuance of permit (10days)	EMA																	

Source: Survey team

1-5-3-13 Land acquisition and resettlement

(1) Necessity of land acquisition and resettlement

As the existing ROW of the Project site is 31.5 m wide and the entire area of the section covered by the Project is designated as state-owned land, no land acquisition is envisaged for the widening of the road or changes to its alignment. However, if a site wider than the ROW is required in the curved section, a procedure in accordance with the Roads Act (“35 Declaration that lands forms part of the road” of PART VII) will be required. If the land outside the existing ROW is privately owned, compensation will be paid to the owner for the removal of permanent structures and trees and for the acquisition of the land. The entire section covered by the survey (between 291 and 306.5 km) is located on state-owned land (Safari Area). The study confirmed that there are no residents in the project area and resettlement is not expected to occur.

(2) Legal framework for land acquisition and resettlement

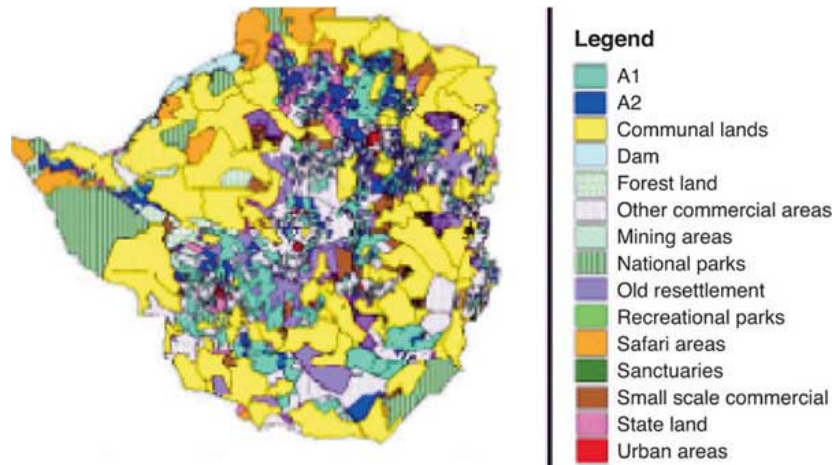
1) Land ownership patterns

The land tenure status in Zimbabwe is shown in the table below. Of these, the land adjoining the section covered by this survey is classified as national parks and wildlife habitats (safari areas) A1 and A2 (agricultural land and residential land within the settlement of Nyamakate District), all of which are included in state ownership.

Table 1-49: Land tenure status in Zimbabwe

Major category	Sub-category	Description	State/private ownership	Supervisory authority
Forestry Land	—	National forest	State-owned	Ministry of Environment, Water and Climate
Mining Areas	—	State-owned mines		Ministry of Mines and Mining Development
National Parks and Wildlife Land	—	National parks, safari areas, etc.		Parks and Wildlife Management Authority
Communal Land (Area)	—	Tribal common lands (formerly Tribal Trust Land) managed by traditional tribes		Ministry of Lands and Rural Resettlement
Subsistence Agricultural Resettlement Areas	A1	State lands used for small-scale agricultural purposes where residents are granted the right to use them.		
	Village	State-owned land used for residential purposes where the right to use the land is granted to relocated residents under the resettlement policy.		
Commercial Agricultural Areas	State Land	State-owned land used for commercial agricultural purposes		
	A2	State-owned land used for commercial agricultural purposes where the Offer Letter grants residents the right to use it.		
	Private Land	Privately owned land used for commercial agricultural purposes	Private land	
Urban Land	State Land	State-owned land used for public facilities	State-owned	Ministry of Local Government, Public Works and National Housing
	Private Land	Land used for private institutions, housing, etc.	Privately owned	

Source: MoTID



Source: GOZ-SADC-FANR (2003)

Fig. 1-36: Distribution of Zimbabwe by land tenure status

2) Land acquisition and resettlement procedures

The extent of the RoW in Zimbabwe is defined as 31.5 m by the Road Act ("34 Width of Road" of PART VII, Chapter 13:18 Road Act, Acts 6/2001, 22/2001 (s. 4), 14/2002 (s. 20)). As the RoW is state-owned land and the construction of permanent structures such as houses is prohibited, in principle, no land acquisition is required as long as the project is planned within the RoW. The Chirundu-Harare Road was declared in the Government Gazette of 2004 (Government Gazette, (September 24, 2004, Number 78, Government Notice 456 of 2004) which states that the RoW from Harare to the 140 km point (Makonde) of ROW has been widened to 140 m and the remaining section of the ROW is in the process of being widened. In Phase 1, the policy for compensation confirmed in cases where a permanent structure exists between ROW 31.5m and 140m before the 2004 amendments to the RoW width and where land acquisition and resettlement will occur as a result of the implementation of public works projects is, 1) If the site in question is privately owned, the site and the permanent structure are subject to compensation, and 2) If the site in question is state-owned land, only the permanent structure is subject to compensation. The calculation of the amount of compensation is determined based on an assessment by an evaluator appointed by the Ministry of Local Government, Public Works and National Housing, after the implementing authority of the public works project has submitted a project plan and a description of the private property to be expropriated or removed. The Project will provide compensation in line with national law as well as JICA guidelines (2010).

1-5-3-14 Environmental and social considerations checklist

The checklist identified with the DOR is as follows.

Table 1–50: Environmental and social considerations checklist

Classification	Environmental item	Main check items	Y: Yes N: No -: Not applicable	Specific Environmental and Social Consideration (Reasons for Yes/No, basis, mitigation measures, etc.)
1. Authorization and explanation	(1) EIA and environmental authorization	<p>(a) Has an environmental assessment report (EIA report, etc.) been prepared?</p> <p>(b) Has the EIA report, etc. been approved by the government of the necessary ntry concerned?</p> <p>(c) Does approval of the EIA report, etc. entail collateral conditions? If there are collateral conditions, will they be satisfied?</p> <p>(d) In addition to the above, have environmental authorizations been obtained from local responsible authorities where unnecessary?</p>	<p>(a) N</p> <p>(b) N</p> <p>(c) N</p> <p>(d) N</p>	<p>(a) Environmental Impact Assessment (EIA) certification for the section covered by Phase 2 of the Project between 306 and 300 km from Harare was already obtained in September 2018 during Phase 1. The section will require renewal of the environmental certification, but no EIA report will be required. The remaining section between 300 and 291 km has not had an EIA carried out during Phase 1 and will require an EIA report in Phase 2 and changes/revisions to incorporate this section into the existing EIA certification. As of November 2021, the renewal process and preparation of the EIA report have necessary not started.</p> <p>(b) Ditto</p> <p>(c) Ditto</p> <p>(d) Prior consultation with Parks and Wildlife Management is required at the EIA stage as the section covered by the project passes through a safari area in Zimbabwe. Other procedures will also be required, such as a survey of archaeological sites by the National Museum at the EIA stage, permission to use explosives from the Ministry of Mines and Mineral Resources at the construction stage, and permission to use borrow pits and disposal area from the Ministry of Environment, Parks and Wildlife Management, Water Authority, Hurungwe Rural District Council, etc.</p>
	(2) Explanations to local stakeholders	<p>(a) Concerning the project contents and impacts, have appropriate explanations (including information disclosure) been conducted for the local stakeholders, and has their understanding been obtained?</p> <p>(b) Have comments from residents been reflected in the project contents?</p>	<p>(a) N</p> <p>(b) N</p>	<p>(a) Under Zimbabwe’s EIA Law, after the stakeholders that need to be consulted in the EIA have been identified in the Prospectus review stage, it is required that public consultations should be implemented in the EIA and the comments from stakeholders should be reflected in the EIA report. The law also stipulates about an appeal process for stakeholders regarding the EIA, etc. planning.</p> <p>(b) Ditto</p>
	(3) Examination of alternative plans	(a) Have multiple alternative project plans (including environmental and social items for review) been examined?	(a) Y	(a) Concerning the road improvement parts and design standards, etc., alternative plans have been examined and the optimum plan has been considered from the viewpoints of environmental social impacts and traffic safety.

Classification	Environmental item	Main check items	Y: Yes N: No -: Not applicable	Specific Environmental and Social Consideration (Reasons for Yes/No, basis, mitigation measures, etc.)
2 Pollution countermeasures	(1) Air quality	(a) Are there any impacts from air pollutants discharged from passing vehicles, etc.? Are environmental standards, etc. in the country concerned complied with? (b) If air pollution around the route already exceeds environmental standards, will the project exacerbate the air pollution? Will air quality countermeasures be taken?	(a) Y (b) —	(a) Concerning vehicles in Zimbabwe, it is necessary to satisfy the exhaust standards concerning control of exhaust gases (SI No. 72 of 2009). (b) Since the target area is included in a safari area, there are no major sources of air pollution. Moreover, traffic volume on the project target road is limited and the project is not expected to lead to an increase in traffic volume; hence it cannot be envisaged that the project will exacerbate air pollution.
	(2) Water quality	(a) Will downstream water quality be deteriorated by soil runoff from exposed soil on filling and cutting sections, etc.? (b) Will surface runoff from the road pollute necessary groundwater, sources, etc.? (c) Will wastewater from parking areas, service areas, etc. comply with discharge standards in the necessary country concerned?	(a) N (b) N (c) N	(a) The roads covered by the Project are in close proximity to or intersect the main and branch lines of the river. In the Project, the embankment and cut sections will be covered with topsoil from the excavation and the local vegetation will be restored to prevent soil run-off. (b) In the Project, appropriate drainage facilities will be provided to ensure that runoff from the road surface does not contaminate groundwater and other water sources, and appropriate management will be carried out, including waste disposal and thorough emergency measures in the event of necessary leakage of hazardous substances. (c) The Project includes no plans for parking areas or service areas.
	(3) Solid wastes	(a) Will solid wastes from parking areas, service areas, etc. be appropriately treated and disposed according to regulations in the country concerned?	(a) —	(a) The Project includes no plans for parking areas or service areas.
	(4) Noise and vibration	(a) Will noise and vibration from passing vehicles comply with standards, etc. in the country concerned standards, etc.?	(a) Y	(a) As there are no standards for noise and vibration caused by passing vehicles in Zimbabwe, the Project will adopt the WHO standards as in Phase 1. The baseline survey conducted in Phase 1 confirmed that the noise and vibration levels were within the standards when there were no vehicles travelling but exceeded the standards when there was vehicular traffic. During construction, noise and vibration levels are expected to increase due to increased traffic due to construction vehicles. Thorough site management, such as the installation of soundproofing sheets and limited construction hours, will be implemented to avoid and mitigate the impact of noise and

Classification	Environmental item	Main check items	Y: Yes N: No -: Not applicable	Specific Environmental and Social Consideration (Reasons for Yes/No, basis, mitigation measures, etc.)
				vibration on wildlife and local residents. After the Project is in service, as in Phase 1, the Project is not expected to further increase existing noise and vibration levels, as traffic volumes on the subject road will be limited and the project is not expected to increase the volume of passing traffic.
3. Natural Environment	(1) Nature preserve	(a) Is the site situated in a nature preserve designated by legislation of the country concerned or international treaty, etc.? Will the project have an impact on nature reserves?	(a) —	(a) The Project's subject road passes through the Hurungwe Safari Area (IUCN Category VI Resource Conservation Area) designated under Zimbabwe's Parks and Wildlife Act, Chapter 20:14. It is not a National Park or Sanctuary subject to wildlife protection regulations. Regulations governing public works and development activities such as road construction in the safari area are not explicitly stated, but the consent of the PWMA is required in the course of prior consultation for an Environmental Impact Assessment (EIA), and the consent of the PWMA for the targeted infrastructure project is also required. MoTID have already obtained a consent from PWMA for the project.
	(2) Ecosystem	(a) Does the site contain any virgin forest, tropical natural forest, ecologically important habitats (coral reefs, mangrove swamps, mudflats, etc.)? (b) Does the site contain habitats of valuable species that require protection under legislation of the country concerned or international treaty, etc.? (c) If there is concern over critical ecological impacts, will measures be taken to reduce these? (d) Will countermeasures be taken with respect to impedance of migration routes for wildlife and livestock, severance of habitats, traffic accidents involving animals and so on? (e) With construction of the road lead to forest destruction, hunting, desertification, drying of wetlands, etc. due to ensuing	(a) N (b) Y (c) N (d) Y (e) N (f) N	(a) The site doesn't contain any ecologically important habitats, etc. (b) The Project target road passes through one of Zimbabwe's safari areas that is a habitat for numerous species of wildlife necessary registered on the IUCN Red List. (c) No critical ecological impacts are envisaged based on following reasons: 1) The Project is an upgrade of the existing road and will be implemented mostly within the Road right of way except for two curved sections where acquisition of additional land is required for widening. The environs of the Project is already fragmented by the existing road, is absent of food production and critical ecosystems, and is not considered appropriate for threatened species which are sensitive to traffic noise and light. 2) The threatened species identified within the safari area are distributed across a large area of protected land and habitat away from the road traffic and far inside the safari area and neighbouring protected area. Considering some sections of the target road are used as wildlife corridors, project impacts can be avoided/ mitigated by implementing measures such as installing warning signs, avoiding the use of fences, prohibiting

Classification	Environmental item	Main check items	Y: Yes N: No -: Not applicable	Specific Environmental and Social Consideration (Reasons for Yes/No, basis, mitigation measures, etc.)
		<p>developments? Is there any risk of the ecosystem being disturbed by influx of alien species (not native to the local area) harmful pests, etc.? Have countermeasures been prepared for such cases?</p> <p>(f) If road will be constructed in undeveloped areas, will be development bring about major damage to the natural environment?</p>		<p>construction activities during night which is the time wildlife are active. 3) Hurungwe Safari Area, where the Project is located, is an area where it is allowed to hunt wildlife (the Parks and Wildlife Act, Part VII) and is not categorized as either a national park or a bird sanctuary which strictly regulate the capture and removal of plants and animals in the park with the objective of protecting the ecosystems of wild flora and fauna. The nearest “critical natural habitat” for threatened species is Mana Pool National Park which is also designated as a UNESCO World Heritage Site as well as Ramsar wetland, located approx. 30km away from the project area and the Project is not expected to cause impact on it. 4) There are no indigenous people/ communities residing in the area, nor ancestral domain, or traditional use of natural resource in the area. Therefore, the Project area is not considered as “areas that local communities traditionally think should be protected”.</p> <p>(d) Inside safari areas, installation of fences, activities during night etc. is not permitted due to obstruction of wildlife migration routes and risk of disturbing habitats in Zimbabwe. Therefore, signs will be installed to urge drivers to take care in order to prevent collisions, etc. with wild animals.</p> <p>(e) Since the Project entails improvement of an existing road, it is not envisaged that forest destruction, hunting, desertification, drying of wetlands, etc. will arise.</p> <p>(f) Ditto</p>
	(3) Water environment	(a) Will alteration of topography and construction of tunnels and other structures impart negative impacts on surface water and groundwater flows?	(a) N	<p>(a) Construction-related impacts on the aquatic environment, such as bank erosion and sediment deposition in the Marongora River and its tributaries, due to the rehabilitation of box culverts for small drainage channels and road widening and rehabilitation works, are expected.</p> <p>Sedimentation ponds and construction drainage channels will be installed and protective measures will be taken for the revetments.</p>
	(4) Topography and geology	(a) Are there any locations on the route where landslides and earth slips seem likely to occur? If there are, are appropriate work methods and measures adopted?	(a) N (b) N (c) N	<p>(a) There are no locations of fragile geology where landslides and earth slips seem likely to occur on the route.</p> <p>(b) In the Project, appropriate work methods will be selected upon conducting ample geological investigation, and</p>

Classification	Environmental item	Main check items	Y: Yes N: No -: Not applicable	Specific Environmental and Social Consideration (Reasons for Yes/No, basis, mitigation measures, etc.)
		<p>(b) Will filling, cutting and other civil engineering work trigger landslides and earth slips. Are appropriate countermeasures necessary to prevent landslides and earth slips?</p> <p>(c) Will soil runoff from filling and cutting sections, borrow pits and earth dumps arise? Are appropriate countermeasures necessary taken to prevent soil runoff?</p>		<p>appropriate countermeasures will be taken to prevent landslides and eanecessary slips as a result of filling, cutting, etc.</p> <p>(c) Filling and cutting parts are covered with excavated topsoil and recovered from the local vegetation to prevent soil runoff.</p> <p>Concerning the quarry sites and borrow pits, existing quarry sites and borrow pits that are in operation by the DOR and have acquired authorization will be used.</p> <p>For soil dumping sites, no new dumping sites will be created by using the soil dumping sites near the project that were used in Phase 1. The site have sufficient capacity to store the generated soil under Phase 2.</p>
4 Social environment	(1) Involuntary resettlement of residents	<p>(a) Will involuntary resettlement of residents arise in line with the project implementation? If it does arise, will efforts be made to minimize the impact of resettlement?</p> <p>(b) Will appropriate explanations concerning compensation and life rebuilding measures be necessary in advance to residents that need to resettle?</p> <p>(c) Will a survey of the involuntary resettlement of residents be implemented, and will a resettlement plan that includes compensation based on reacquisition price and restoration of the basis of livelihood following resettlement be compiled?</p> <p>(d) Will compensation money be paid before resettlement?</p> <p>(e) Is the compensation policy compiled into a document?</p> <p>(f) Do plans give appropriate consideration to vulnerable groups, i.e., women, children, elderly, impoverished people, ethnic minorities and indigenous people, etc. targeted for resettlement?</p> <p>(g) Will prior consent be obtained from the residents to be resettled?</p>	<p>(a) N</p> <p>(b) —</p> <p>(c) —</p> <p>(d) —</p> <p>(e) —</p> <p>(f) —</p> <p>(g) —</p> <p>(h) —</p> <p>(i) —</p> <p>(j) —</p>	<p>(a) The Project requires a wider site than the road ROW in some areas, such as at curves. Resettlement will not occur as this is a safari area and there are no permanent structures or residents.</p> <p>(b) Where compensation to property will occur in areas where a site wider than the ROW is required, the owner will be fully briefed in line with national law as well as JICA guidelines (2010).</p> <p>(c) Where compensation to assets occurs where a site larger than the ROW is required, a survey is carried out in line with national law as well as JICA guidelines (2010).</p> <p>(d) Where compensation payments to assets arise, DOR pays all such payments prior to site acquisition in line with national law as well as JICA guidelines (2010).</p> <p>(e) The safari area where the Project's road is located is public land, but if a site wider than the road ROW is required, a procedure in accordance with the Road Act is required as well as JICA guidelines (2010).</p> <p>The compensation policy is currently being confirmed by DOR.</p> <p>(f) There are no residents on the project road section.</p> <p>(g) Same as above.</p> <p>(h) Same as above.</p> <p>(i) Same as above.</p> <p>(j) Establish a grievance procedure where compensation to property occurs where a site wider than the ROW is required.</p>

Classification	Environmental item	Main check items	Y: Yes N: No -: Not applicable	Specific Environmental and Social Consideration (Reasons for Yes/No, basis, mitigation measures, etc.)
		<p>(h) Will a structure be established to appropriately implement the involuntary resettlement of residents? Will ample implementation capacity and budget measures be adopted?</p> <p>(i) Is it planned to conduct monitoring of the impacts of resettlement?</p> <p>(j) A system been established to process complaints?</p>		
	(2) Lifestyle and livelihood	<p>(a) If the road is to be constructed based on new development, will there be any impacts on existing means of transport and the livelihoods of people engaged in them? Will there be any major changes in land use and means of livelihood, unemployment and so on? Do plans consider mitigation of such impacts?</p> <p>(b) Will the project impart any other negative impacts on residents? If necessary, will consideration be given to mitigate impacts?</p> <p>(c) Is there a risk if diseases (including HIV and other infections) arising due to population influx from other areas? If necessary, will consideration be given to appropriate public health measures?</p> <p>(d) Will the project impart any other negative impacts on road traffic (congestion, increased road accidents, etc.) in surrounding areas?</p> <p>(e) Will the road hinder movement of residents?</p> <p>(f) Will road structures (flyovers, etc.) block sunlight or radio waves?</p>	<p>(a) N (b) N (c) Y (d) N (e) N (f) N</p>	<p>(a) The Project involves the improvement of existing roads and is not expected to have a negative impact on existing modes of transport or the livelihoods of the residents engaged in them.</p> <p>(b) The Project is not expected to have a negative impact on communities around the section of road.</p> <p>(c) During the construction of the Project, the contractor will be on site and a temporary risk to public health in the area is envisaged. Training will be provided to workers and local residents on infectious diseases and other illnesses.</p> <p>(d) Traffic will increase during construction due to construction vehicles and material transport vehicles. Temporary impact on road traffic in the surrounding area is envisaged. Traffic restrictions for construction vehicles will be implemented to avoid or mitigate the impact on road traffic. After construction, it is envisaged that traffic congestion and traffic accidents will decrease due to road widening.</p> <p>(e) The project involves the rehabilitation of the existing road and, as in Phase 1, construction will be carried out while keeping the road open to general traffic (one-way reciprocal traffic for one to two hours each), so no disruption to user movement is envisaged.</p> <p>(f) The Project does not include any road structures that would cause sun blockage or radio interference.</p>
	(3) Cultural heritage	<p>(a) Is there any risk that the project will cause harm to archeologically, historically, culturally or religiously important heritage or remains, etc.? Are measures</p>	<p>(a) N</p>	<p>(a) The results of the archaeological survey carried out during the EIA conducted by the Government of Zimbabwe in Phase 1 confirmed that there were no cultural or other assets requiring special consideration. In addition, no valuable heritage sites or</p>

Classification	Environmental item	Main check items	Y: Yes N: No -: Not applicable	Specific Environmental and Social Consideration (Reasons for Yes/No, basis, mitigation measures, etc.)
		considered in domestic laws in the country concerned?		historic sites are envisaged in the sections not included in the EIA.
	(4) Landscape	(a) If there is landscape that requires special consideration, will it be negatively impacted? If it is impacted, will the necessary countermeasures be taken?	(a) N	(a) Although the section covered by this survey passes through a safari area, it is a rehabilitation of an existing road and does not envisage any land alterations or construction of structures that would affect the safari landscape.
	(5) Ethnic minorities and indigenous people	(a) Will consideration be given to mitigating impacts on the culture and lifestyle of ethnic minorities and indigenous people? (b) Will the rights of ethnic minorities and indigenous people regarding land and resources be respected?	(a) N (b) N	(a) There are no ethnic minorities or indigenous people reside, nor ancestral domain nor use of natural resource that require consideration around the target section of the Survey. (b) Ditto
	(6) Work environment	(a) Will work environment legislation in the country concerned be upheld in the project? (b) Will hard safety considerations be adopted for project workers and officials, for example, installation of safety equipment for necessary venting industrial accidents, management of harmful substances, etc.? (c) Will soft safety measures be planned and implemented for project workers and officials, for example, formulation of a health and safety plan, implementation of safety education (including road safety and public health) for workers, etc.? (d) Will appropriate measures be adopted regarding the project security personnel to ensure that the necessity of project workers and local residents is not threatened?	(a) Y (b) Y (c) Y (d) Y	(a) The Project will take the necessary measures in accordance with the working environment legislation of the country concerned; and (b) As the section covered by the Project passes through a safari area inhabited by wild animals, measures such as the deployment of rangers to prevent workers from being attacked by wild animals shall be taken. In addition, work involving hazards such as earthworks on cliffs and excavation of slopes using explosives, etc., and work involving hazardous substances, should be carried out by registered and qualified contractors with appropriate skills. In addition, safety management plans and manuals for workers are prepared, and safety training for workers and daily safety management are thoroughly implemented. Clinics should also be set up at the work site. (c) The Project will provide safety training for workers. (d) Appropriately trained construction security personnel will be deployed, as well as rangers from the local park office of the Department of Parks and Wildlife Management, so that the safety of project personnel and local residents will not be compromised.
5 Others	(1) Impact during works	(a) Will mitigation measures be prepared for pollution during works (noise, vibration, muddy water, dust, exhaust gases, solid wastes,	(a) Y (b) Y (c) N	(a) Road works generate a certain amount of noise and vibration, muddy water, dust and waste, so soundproofing sheets should be installed, construction hours should be regulated, and water spraying and waste

Classification	Environmental item	Main check items	Y: Yes N: No -: Not applicable	Specific Environmental and Social Consideration (Reasons for Yes/No, basis, mitigation measures, etc.)
		etc.)? (b) Will the works impart negative impacts on the natural necessary environment (ecosystem)? Will mitigation measures be prepared regarding the impacts? (c) Will the works impart negative impacts on the socinecessary environment? Will mitigation measures be prepared regarding the impacts?		management for dust control should be ensured. (b) There is a potential risk of noise and vibration from construction works affecting wildlife and contact between construction vehicles and wildlife. The Project will regulate construction hours and construction vehicle traffic. (c) No significant negative impacts on the social environment are envisaged from the construction works of the Project.
	(2) Monitoring	(a) Out of the above environmental items, concerning those where impacts are envisaged, will the project proponent plan and implenecessary monitoring? (b) How have items, methods, frequencies, etc. in the plan been established? (c) Will the project proponent establish a monitoring structure (organization, personnel, equipment, budget, etc. and continuation)? (d) Are methods and frequencies, etnecessaryprescribed for reporting to the responsible authorities by the project proponent?	(a) Y (b) Y (c) Y (d) Y	(a) Monitoring will be implemented according to the collateral conditions (report items, methods, frequencies, etc.) in the monitoring plan prepared at the same time as the EIA. (b) Ditto (c) Ditto (d) Ditto
6 Points for consideration	See other environmental check lists	(a) Where necessary, additionally evaluate the applicable check items in the forestry check list (cases where large-scale tree cutting will be conducted in line with construction of a solid wastes disposal site, etc.).	(a) N	(a) The Project entails improvement of an existing road; hence it will not cause large-scale cutting of trees.
	Cautions in using the environmental check list	(a) Where necessary, also check impacts on transboundary or global environmental problems (elements concerning transboundary disposal of solid wastes, acid rain, ozone layer destruction, and global warming, etc.).	(a) N	(a) The Project contributes to GHG emission reductions by reducing congestion and is not expected to have a negative impact on global environmental issues.

Source: Survey Team

1-5-3-15 Monitoring form (Draft)

The monitoring form proposed under the aforementioned Environmental Management and Monitoring Plan is attached at the end of this report.

1-5-3-16 Climate change

(1) Status and projections of climate change in Zimbabwe

1) Trends to date

Zimbabwe has been experiencing a warming trend since the 1970s. The annual mean temperature has increased by about 0.03°C/year between 1970 and 2016, and annual mean rainfall has shown a decreasing trend over the past decades. The El Niño Southern Oscillation (ENSO) has had a significant impact on rainfall in Zimbabwe. Rainfall during the rainy season from October to March tends to be below average during the warmer ENSO (or El Niño) periods and above average during the colder ENSO (or La Niña) periods. In addition, the Indian Ocean Dipole/Zone Mode (IODZM) has caused rainfall deficits (or droughts) whereas the Tropical Convergence Zone (ITCZ) has increased rainfall. The amount of rainfall varies from year to year between 400mm and 1000mm. Having wet and dry year alternate makes trend less significant to compare temperature rise. Extreme climate events have become more significant in occurrence, intensity, and magnitude. Events from 1900 to 2017 include 7 drought events, 12 floods, and 5 storms. The temperature and rainfall in Zimbabwe vary geographically. Precipitation decreases along a line from northern and eastern parts of the country toward western and southern parts of the country, while temperature is slightly higher in southern and western parts of the country.

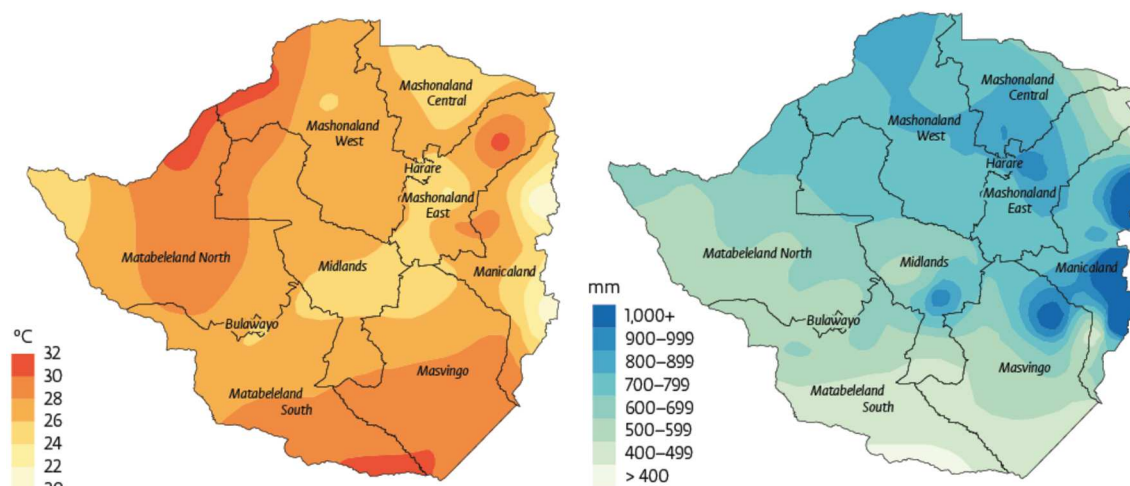
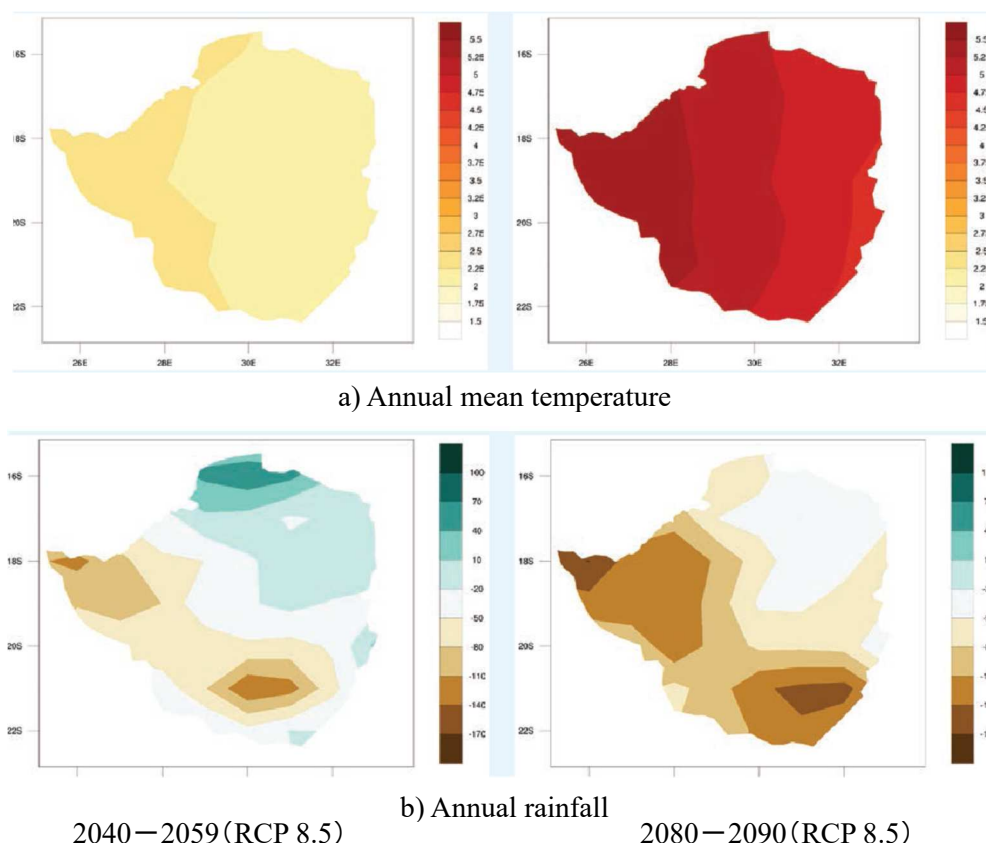


Fig. 1-37: Annual mean temperature (left) and rainfall (right) in Zimbabwe (1991–2020)

2) Projected trends

According to a World Bank report (Climate Risk Profile: Zimbabwe, 2021), annual precipitation in Zimbabwe is projected to decrease by 4.4% (RCP 8.5: High reference scenario where radiative forcing exceeds 8.5 W/m² in 2100 and future temperature increase is around 5°C) between 2040 and 2059 and by 2.8% between 2080 and 2099. This will be particularly pronounced during the wet season (October to March), when the north and east of Zimbabwe are predicted to experience above-

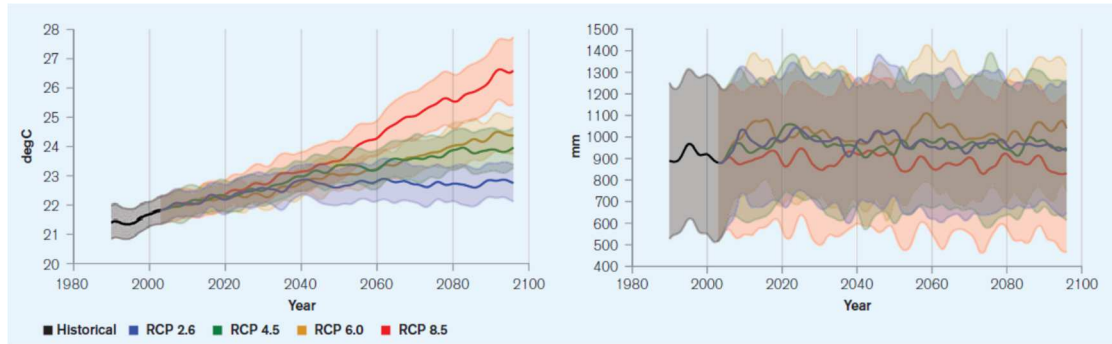
normal rainfall, whereas the west and south will tend to receive less rainfall than in the past. Annual mean temperatures are projected to increase by 2.2°C (RCP 8.5) between 2040 and 2059 and by 5.1°C (RCP 8.5) by 2080 or 2099. The geographical distribution of temperature increases is relatively uniform across the country with a slightly higher warming trend projected in the southern and western parts of the country, particularly more pronounced in the summer months (September to December). As a result of climate change, the occurrence of extremes in temperature and precipitation is expected to become more pronounced. Under the RCP 8.5 scenario, the number of annual days with maximum temperatures above 35°C increasing by 39 days between 2040 and 2059 and by 108 days between 2080 and 2099. The number of consecutive annual drought days is projected to increase by 13 days from 2040 to 2059 and 25 days from 2080 to 2099. Drought occurrence is projected to increase by 21% (RCP 8.5) between 2040 and 2059 and by 47% (RCP 8.5) between 2080 and 2099, which Western Zimbabwe is projected to be particularly likely to experience drought conditions. Climate induced heat stress, droughts, and reduced rainfall amount are likely to increase the frequency and intensity of wildfires, while the increased occurrence of extreme rain is projected to increase experience of flood¹. Climate change has the potential to alter the extent and scope of impacts such as floods and droughts, resulting in huge social and financial losses to the Zimbabwean economic sector.



Source: Meteorological Services Department of Zimbabwe, WBG (2021)

Fig. 1–38: Predicted Annual mean temperature and annual rainfall in Zimbabwe based on average between 1986–2005 (RCP 8.5)

¹ Zimbabwe Revised Nationally Determined Contribution 2021



Source: WBG (2021) Climate Risk Profile: Zimbabwe

Fig. 1-39: Future projections for annual temperature and rainfall in Zimbabwe

(2) Climate change measures in Zimbabwe

Zimbabwe's responsible authorities for climate change are the Ministry of Environment, Water and Climate (MEWC), the Steering Committee and the Environmental Management Agency. The MEWC is responsible for compliance with multilateral environmental agreements, reducing the vulnerability of Zimbabwe to the effects of climate change and preparing the National Climate Change Adaptation Plan. The National Steering Committee, chaired by the Office of the President and the Cabinet and comprising the heads of ministries and agencies, sets policy direction for the implementation of National Development Contribution in line with national development goals. EMA is responsible for ensuring sustainable management of natural resources and protection of the environment, prevention of pollution and environmental degradation, preparation of environmental plans for management and protection of the environment.

Zimbabwe's climate change plans and policies are as follows.

- • Revised National Climate Policy (2022)
- • National Adaptation Plan (2019)
- • Third National Communication to the United Nations Framework Convention on Climate Change (UNFCCC) (2017)
- • Zimbabwe Agriculture Investment Plan (2013–2017)
- • Nationally Determined Contribution (2016)
- • National Climate Change Response Strategy (2015)

The Ministry of Local Government, Public Works and Urban Development enacted the Disaster Risk Management Act, under the Civil Protection Act 1989. It focuses on post-disaster risk management response and formulates policies focusing on the preparedness, response, and recovery components of disaster risk management.

(3) Climate change mitigation and adaptation measures for projects

The project aimed to identify and assess the climate risks in the project and to incorporate appropriate measures into the project to reduce vulnerability to climate change and to maintain and increase adaptive capacity and resistance (Climate Change Response Support Tool, Climate Change

Response Office, Global Environment Department, JICA, 2019). Mitigation and adaptation measures for the project are presented below.

1) Calculation results of climate change mitigation measures for projects.

The GHG emission reductions from the project were quantitatively calculated by applying the "Climate Change Support Tool / Mitigation Measures Quantitative Assessment of GHG Emission Reductions (Absorption)", "JICA Climate-FIT Version 3.0, September 2019". The GHG emission reductions are shown in the table below.

Table 1-51: GHG emission reductions (tCO₂/year)

Description	2025	2035	2040
Baseline emissions	8,643	11,004	19,609
114mphasi reductions from	172	220	393
Reduction rate	(approx. 2.0%)	(approx. 2.0%)	(approx. 2.0%)

Source : Survey team

2) Climate change adaptation measures for projects

2-1) Outline of the Project

The below table shows the outline of the project. For further details, please refer to the sections cited.

Table 1-52: Project Outline

Item	Outline
a. Project objectives and expected effects	Objective : Improve sharp curve section by construct climbing lanes and widening for the northern mountainous section of the North-South Corridor Road Expected effects: 1) contribute to strengthen the trunk road transport network in reducing congestion and accidents that currently occur on the targeted road sections 2) improve road smoothness and safety by improving sharp curves 3) contribute to improve and strengthen the trunk road network as per Zimbabwe's National Development Plan objectives and policies
b. Project period	Tentative duration for detailed design and construction supervision : approx. 29.5 months (approx. 2.5 year) After operation : design life of pavement is planned as 15 years * tentative year of construction start: February 2024
c. Facility plan components of the project	Improve road alignment Improve the current narrow carriageway and unpaved shoulder Add climbing lanes to steep gradient sections Improvement of sharp curves 6-4 Installation of road drainage facilities Installation of road ancillary and safety facilities
d. Technical assistance plan components of the project	Objective: Capacity development of MoTID Topic to be covered : 1) road ancillaries for road safety 2) geometrical road design for road safety 3) stabilization of road shoulder Method: Theoretical and on-site training by Japanese consultant

Item	Outline
e. Location of the project	Location: within the Hurungwe Safari Area, Hurungwe District, Western Mashonaland Province, Target section : 7.8km from a point of 306.5 km from Harare (the end of Phase 1) to a point of 291 km outskirts of Makuti town
f. Implementation system and operating organization	Implementing agency: DOR of MoTID Agency of Environment and climate change : MEWC, EMA

Source : Survey team

2-2) Risk exposure in the project

The components and activities of the project that are exposed to climate-related hazards are ① Road Pavement, ② Drainage Facilities, ③ Slope, ④ Road Ancillary and Safety Facilities. The planned design life of the pavement is 15 years, and the return periods are 5 years for roadside ditches and 20 years for cross-drainage structures.

2-3) Hazards associated with the project

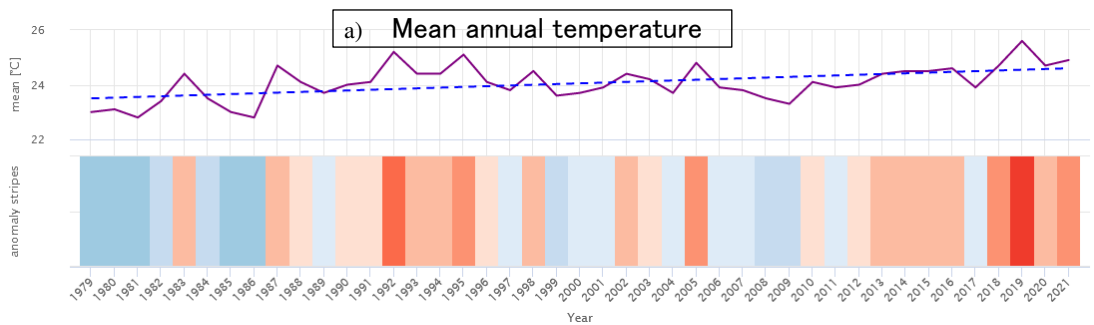
Current climate status of the project area is obtained from the climate data of Kariba Airport, which is near the project area (approx. 40 km away), and through information obtained through interviews during the Phase 2, preceding studies². According to the RCP 8.5 scenario (WBG,2021), the northern part of Zimbabwe where the Project is located is predicted to have increases in temperature and precipitation between 2040 and 2059, and to have further increases in temperature and decreases in precipitation between 2080 and 2099. The climate data from Kariba Airport between 1979 and 2022 (see the below figure) shows a trend towards temperature increase (mean annual temperature of 23.5°C in 1979 to 24.6°C in 2022) and slight precipitation increase (mean total precipitation of 1027.9 mm in 1979 to 1053.2 mm in 2022). The mean total precipitation of the project area (Hurungwe Safari Area) shows a trend towards increasing precipitation in the past 5 years (below figure) and varies significantly in the range of 200 mm to 800 mm, which is 1/8 to 1/2 of the mean total precipitation of Japan. This increasing trend matches with the RCP 8.5 scenario of the next 20 to 40 years. However according to the perceptions surveys carried out with local people (Muringa, et al. 2019, Kupika et al, 2019), the people perceive that the precipitation is decreasing. This is considered due to the change in the start of the rainy season, shortening of the rainy season and decrease in the precipitation during the rainy season. The preceding studies also reported trends such as increase in frequency and intensity of extreme climate, extreme heat and drought, change of rainy season timing and duration, and change in precipitation.

²Muringa, et al. 2019, Small-scale fishers' perceptions of climate change and its consequences on fisheries: the case of Sanyathi fishing basin, Lake Kariba, Zimbabwe; Kupika et al, 2019, Local Ecological Knowledge on Climate Change and Ecosystem-Based Adaptation Strategies Promote Resilience in the Middle Zambezi Biosphere Reserve, Zimbabwe; Muchuru et. al, Chakuya et al, 2021, Water sources during drought period in a Savanna wildlife ecosystem, northern Zimbabwe

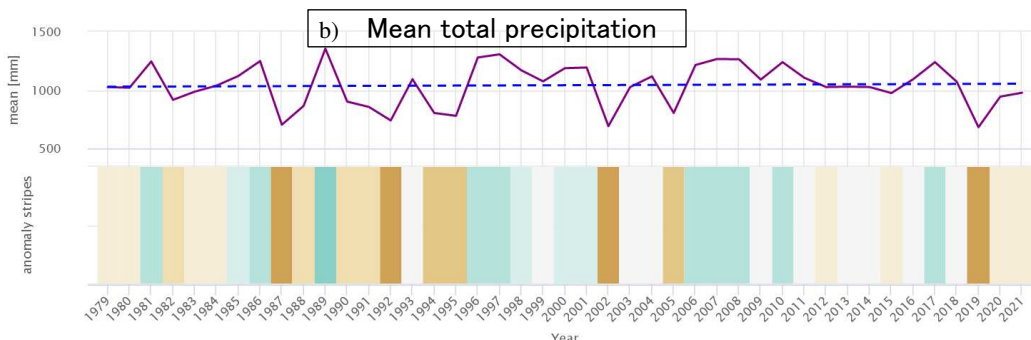
Table 1-53: Current climate status of project area

Hazard	Climate status
Increase in temperature	Climate data from Kariba Airport between 1979 and 2022 shows a trend towards temperature increase
Occurrence of heatwave, high temperature, cold snap	Frequency increase and significant intensity increase since 2008 High temperatures: 1983, 1987, 1992, 1995, 2013, 2015, 2010, 2016, Cold snaps started to occur in 2008. Hailstorms occurred in 2012/2013 and 2014/2015.
Occurrence of drought	Frequency is increasing, but not observed complete dry out. 1981/1982, 1982/1983, 1983/1984, 1986/1987, 1991/1992, 1994/1995, and 1996/1997, 2001/2002; 2007/2008; 2013/2014.
Decrease in precipitation	Climate data from Kariba Airport shows a trend towards slight increase in the mean total precipitation in last 40 years, and the project area (Hurungwe Safari Area) shows an increase in mean total precipitation in past 5 years.
Change in precipitation pattern	Delay in start of rainy season and shortening of rainy season
Change in frequency and intensity of extreme rain	Frequency and intensity increase. In 2008, erosion occurred at Kariba. In 2009, flooded due to storm
Occurrence of flood	Occurrence of flooding are very rare. According to a park ranger, rain caused flooding in the ranger compound in 2019.

Source : Survey team



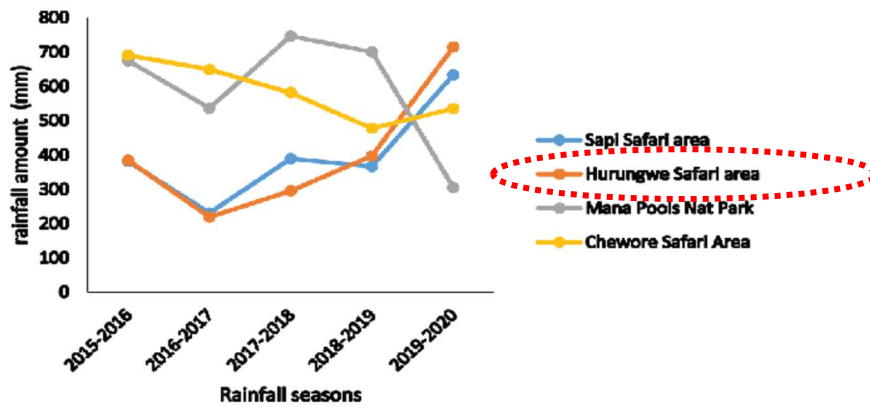
Purple line. Mean annual temperature, Dashed blue line: the linear climate change trend, anomaly stipes: each coloured stripe represents the average temperature for a year - blue for colder and red for warmer years comparing to the average of 24°C between 1979 and 2022.



Purple line. Mean total precipitation, dashed blue line: the linear climate change trend, anomaly stipes: each coloured stripe represents the total precipitation of a year - green for wetter and brown for drier years comparing to the average of 1025.1mm between 1979 and 2022.

Source: Meteoblue, Climate Change Kariba Airport, https://www.meteoblue.com/en/climate-change/kariba-airport_zimbabwe_6297111

Fig. 1-40: Kariba airport, a) Annual mean temperature, b) Annual mean rainfall amount (1979-2022)



source: Chakuya et al, 2021, Water sources during drought period in a Savanna wildlife ecosystem, northern Zimbabwe

Fig. 1-41: Hurungwe Safari area annual rainfall amount (2015-2020)

2-4) Climate Risk Assessment

Based on the impacts that are occurring/thought to be occurring in the project area combined with the exposure and hazards given, the change in the frequency and intensity of extreme rain is thought to significantly impact the project components of road pavement and drainage facilities. Currently the erosion and deterioration are observed on the pavement and shoulders due to rainwater flows. If the extreme rain events increase in frequency and intensity in the future, the capacity of drainage facilities will be exceeded and will lead to the erosion of road edges and consequent narrowing of the road width. This will lead to potential increase of road accidents. DOR carries out maintenance on the carriageway sections using its own machinery during and at the end of the rainy season. The carriageway surface is maintained relatively frequently, whereas currently the road shoulders are seriously deteriorated in many sections due to lack of maintenance. Considering the current status, the project plan and design has incorporated the measure to avoid and mitigate toward the future risks.

Table 1-54: Climate Risk Assessment

Components	a. Impact that is/is likely to be occurring i“ the project un”er the current climate	b. Potential impacts on the project under future climate	c. "Vulnerabilities" pertaining to the project
① Road Pavement	During rainy season, some sections, especially curve section, have a concentration of surface water and /or rainwater seeping into the pavement from the cut side and pavement surface where drainage ditches are absent. This leads to damages such as potholes, dents and road surface slippage and causes erosion and scouring of pavement edge leading to	In case of the extreme rain occurrence in frequency and intensity increases in the future, damage to road edge and surface will worsen and damaged areas will increase. This can lead to increase road accidents.	DOR carries out maintenance on the carriageway using its own machinery during and at the end of the rainy season and the carriageway surface is maintained relatively frequently, whereas the road shoulders are seriously deteriorated in many sections due to lack of maintenance. For this concern, the project plans the following measures. (1) the amount of widening of the carriageway abutting the shoulder

Components	a. Impact that is/is likely to be occurring i“ the project un”er the current climate	b. Potential impacts on the project under future climate	c. "Vulnerabilities" pertaining to the project
	<p>shoulder collapse. This narrowed road width leaves the road condition as prone to accidents.</p>		<p>will conform to the road widening standard of the SATCC and Japanese road standard which will allow design in consideration of the local climate.</p> <p>(2) the project plans to apply the stabilization method of adding a new pavement layer on top of the existing pavement as applied in the Phase 1, as the performance has been proved in its constructability and impermeability.</p> <p>(3) Considering that the specifications of the road shoulder greatly affect the durability, the pavement edge will be strengthened using stabilization and in-situ cast concrete kerbing.</p> <p>(4) The project will incorporate maintenance plans and the implementing agencies into the project operation plan to ensure the proper maintenance of road facilities.</p> <p>(5) soft component assistance will cover the capacity strengthening of the implementing agencies to strengthen road shoulders</p>
② Drainage facilities	<p>Deterioration was concentrated on the carriageway and shoulders where storm water flowed down the roadside due to the absence of the roadside drainage ditch and where concentrated storm water from the mountain sides crosses the road surface. There is also some road surface drainage being blocked from flowing into the existing cross-drainage due to the overgrowth of vegetation and sediments,</p>	<p>In the case of the extreme rain occurrence in frequency and intensity get increase in the future, the overflow of storm water beyond the capacity of drainage facilities, will deteriorate the road pavement and shoulder over wider areas.</p>	<p>Absence of roadside drainage ditches and overgrowth of vegetation and sediments at cross-drainage are causing dysfunction of drainage. For this concern, the project plans the following measures.</p> <p>(1) Plan roadside ditches and longitudinal ditches with concrete structures to avoid failure of water drainage flows by overgrowth of vegetation.</p> <p>(2) The dimensions of the existing cross-drainage facilities are adequate for the flow capacity. Therefore, the project will extend the existing facilities without the need for rehabilitation and widening of the existing structures or construction of new ones.</p> <p>(3) Incorporate maintenance plans for drainage facilities and the implementing agencies into the project operation plan</p>

Source : Survey team

2-5) Project Plan for Potential Adaptation Options

Due to the uncertainty of the predicted climate change and its impact, there are climate risks which will exceed the expected climate conditions incorporated into the design standard. Road standards incorporating climate change adaptation as well as specification against the extreme rain is yet to be developed in Japan. With this being the current status, there is a need to support the strengthening of the capacity of the implementing agencies to improve the periodic and prior road maintenance in order to maintain the durability of road facilities constructed against climate risks after the project completion. Considering that in many cases the deterioration of road surface and erosion of road shoulders are caused by the seepage of storm water from road surface and road shoulder into foundations, the technical assistance component of the project will provide the strengthening of the capacity of the implementing agencies to strengthen road shoulders as needed. The project will also advise MoTID on the correct budget, staff and materials to conduct appropriate routine and periodic maintenance of road and drainage facilities.

Table 1-55: Project Plan for Potential Adaptation Options

Component	Impact climate risks that are likely to be significant in the future for the project	Adaptation options	Considerations in the Project Plan (legend : ○ = support through the project △ = support through the project indirectly)
① Road Pavement	Having the Project designed and planned pavement surface considering the climate change risk, significant climate risk is not anticipated for the short term. However close to the end of the planned pavement life, there is the possibility that road deterioration problems reoccur. Furthermore in case of climate change worsens, the extreme rain occurrence in frequency and intensity will increase in the future, and the road width will narrow as a result of the erosion of road edges and will lead to potential increase in road accidents.	Strengthen the road maintenance capacity of the implementing agencies to carry out appropriate repair and strengthen road facilities based on the understanding of climate change risks	○ The Project will conduct technical transfer on strengthening road shoulders (the mechanism of pavement degradation, similar case studies, trial construction, determination of causes of degradation, etc.) through a technical assistance component △ The scope of the Project does not cover capacity development of routine and periodic road maintenance, but it will advise MoTID to establish the institution to conduct maintenance plans for drainage facilities and to implement them accordingly.
② Drainage Facilities	The project designed and planned drainage facilities by calculating runoff flow based on the rainfall intensity conforming to the manual of Zimbabwe. In case climate change worsens, and extreme rain events increase in frequency and intensity it is possible that unexpected volume of storm water, beyond the capacity of drainage facilities will occur and will lead to potential damage to road facilities constructed by the project.	Strengthen the road maintenance capacity of the implementing agency to carry out periodic and prior rain season maintenance of drainage facilities based on the understanding of climate change risks	△ The scope of the Project does not cover capacity development of routine and periodic drainage maintenance, but it will advise MoTID to establish the institution to conduct maintenance plans for drainage facilities and to implement them accordingly.

Sourcrvey team

1-6 Points to consider in the implementation of grant aid projects

In order to ensure the smooth implementation of the projects covered by this cooperation and to fully realize and sustain the project effects, the Zimbabwean side should pay special attention to the following points.

(1) Early implementation of relocation and removal to secure sites

MoTID's response to secure project-related land, including roads, earth removal/dumping sites, construction campsites, etc., and relocation/removal of obstacles, soon after the signing of the exchange letter in which the implementation of the project will be officially determined.

(2) Acceleration of tax exemption and customs clearance procedures

Implementation of MoTID's approach to the relevant organizations and agencies for duty exemption and customs clearance as soon and surely as possible after the signing of the exchange letter in which the implementation of the plan will be officially determined.

(3) Implementation of project briefings for residents along the proposed section of the project.

Soon after the signing of the exchange letter in which the implementation of this plan is officially determined, a project briefing will be held by the MoTID entity with the residents along the project line or their representatives.

(4) Traffic safety

Thorough informing to road users to follow the instructions of traffic controllers during construction.

(5) Thorough notification of inconveniences during construction

Since inconvenience to passing traffic is expected due to construction, ensure that road users are notified of the inconvenience during construction through radio and other public information media.

CHAPTER 2
CONTENTS OF THE PROJECT

Chapter 2 Contents of the Project

2-1 Project outline

(1) Superior goal and project objective

The North-South Corridor, as a part section of the Pan-African Highway that passes through Zimbabwe from north to south, has an important position in connecting not only Zimbabwe but also other inland countries with ports in South Africa and Mozambique. The subject road is the section of the northern section of the North-South Corridor from Makuti, located approximately 290 km west of the capital Harare, to Chirundu, 351 km west of the border with Zambia. Until Makuti, the road passes through a hilly section with partial undulations at an altitude of about 1000 m. After Makuti, it becomes a mountainous section with gradually increasing gradients and curves, and after 306.5 km, the road descends 400 m all the way to the lowlands on the Zambezi Riverbank and then a steep section to Hell's Gate at 313 km. About 38 km after Hell's Gate passes through a flat area at an altitude of about 500 m above the sea level on the banks of the Zambezi River, connecting to the Chirundu Bridge at the border. The subject section is adjacent to the 6.5km section (Phase 1) between 306.5 km and 313 km mentioned above, where road rehabilitation was completed through Japan's grant aid. Despite the many curves and undulations through the mountainous area, this is a two-way road with one lane in each direction and the frequent traffic congestion and accidents caused by large transport vehicles, which do not go fast enough when climbing the hills, have become a major bottleneck, hindering smooth traffic flow. This project aims to reduce traffic accidents and shorten the time required to reach the destination by installing an uphill lane and rehabilitating sharp curves on a particularly narrow and dangerous section of the main road in the northern mountainous area, and is expected to contribute to Zimbabwe's national planning and economic development. Based on the above, the high-level goal and the project objective are listed below.

- Superior Objectives

The North-South Corridor, a major logistics artery from Southern Africa to Zambia, will be smoother and safer, contributing to smooth integration into the Southern African regional economy.

- Project Targets

To improve the traffic environment on roads in the northern mountainous section of the North-South Corridor to reduce traffic accidents, ease traffic congestion, and shorten transit times.

(2) Overview of the project

The request from Zimbabwe is for road improvement of a high priority section of the 141km northern section of the North-South Corridor from Karoi, 210km north-west of Harare, to Chirundu on the Zambian border at 351km. In 2018, Japan's grant aid project was started for road improvement of a 6.5km section adding a climbing lane and improving sharp curves between Park

& Wildlife Office (306.5km) and Hell's Gate (313.0km) (Phase 1 project, completed in 2022).

This study was carried out for a 15.5 km stretch from the 306.5 km point at the Mukti side end of the Phase 1 section to the Mukti suburb at the 291 km point, which is considered to be a high priority section for road rehabilitation, to determine quantitative indicators and examine the high priority sections that can be addressed for the similar cost as the Phase 1 project, and to present the optimum proposal as a Phase 2 project. In order to achieve the above-mentioned objectives, the first field survey (October 2021) was conducted to check the status of a 15.5 km section of the road. Based on the results of the survey, the planning parameters and basic design specifications for the road rehabilitation were studied and compiled into a Technical Note (Technical Note) and both parties confirmed the contents of the Technical Note. In the first round of domestic work after returning to Japan, the scope of the project was narrowed down in terms of priority, technology and cost, and the project scope was set at 7.8 km between 298.7 and 306.5 km from Harare, where continuity with Phase 1 and priority for rehabilitation were high, and schematic design and project cost calculations were carried out. During the second field survey, the above results were explained to the Zimbabwe side and agreement was reached on the project plan.

2-2 Outline Design of the Japanese Assistance

2-2-1 Design Policy

(1) Basic Concept

Taking into account the request of Government of Zimbabwe, the findings of the field surveys and discussions with related parties, the basic concept of the design is set to secure the safe and smooth flow of traffic in the target section. The basic policies for achieving this are as indicated below.

1) Road design policy

- ① The road meets Zimbabwean design criteria as a trunk road.
- ② The road is consistent with other sections in the overall North-South Corridor including other sections.
- ③ The plan is designed within the existing right of way as much as possible (the existing route is traced, existing pavement and structures are utilized as much as possible).
- ④ Impacts on the social/natural environment is examined with consideration to passage in Safari Area and appearance of wild animals.
- ⑤ Traffic volume and characteristics (large vehicles, small vehicles, bus traffic, long-distance driving, etc.) and related development plans (Other sections of the North-South Corridor and example of similar road improvement projects in recent years) are examined and reflected in the design.
- ⑥ Based on the findings of the natural conditions survey, facilities are planned and designed to correspond to the natural conditions.
- ⑦ The plan is examined with consideration of traffic safety including installation of safety

facilities.

- ⑧ The implementation schedule reflectsconsiders weather conditions and the construction plan reflectsconsiders impact on existing traffic flow.
- ⑨ Materials are selected with a view of utilization of local materials and products, cost, easiness of execution, quality, and procurement reliability.
- ⑩ The Project cost is reduced upon securing the necessary functions and durability.
- ⑪ The road is planned to make the maintenance easy and keep the road in good condition for the long term.

2-2-2 Basic Plans

(1) Overall Plan

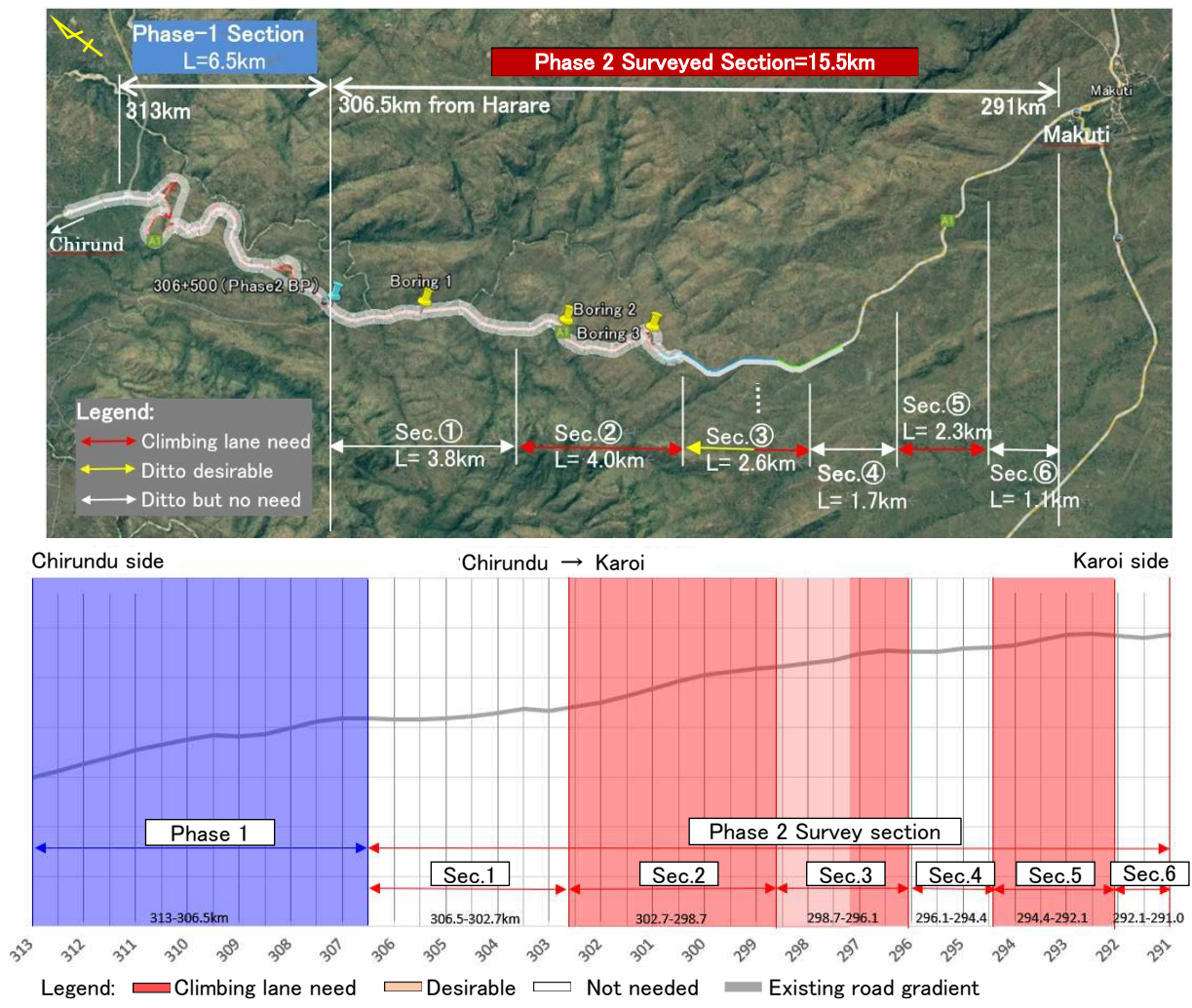
1) Overview of existing roads in the survey section.

The field survey investigated the existing road alignment, pavement and drainage conditions from the start of Phase 1 (306.5 km from Harare) to a point 291 km, outskirts of Makuti town, 15.5km to the direction of Harare. As a result of the field survey, the target road section was classified into the following 6 sections based on the characteristics of the horizontal and longitudinal alignment. The basis for the decision to add a climbing lane is shown in 7) Climbing lanes 7-1) Determination of where installation is required. As a result of the study, the project section is 7.8km adjacent to Phase 1 section including construction of two climbing lane sections and improvement of six steep curve section.

Table 2-1: Overview of the 6 sections classified according to the existing road characteristics

Section	Location	km	Horizontl alignment	Vertical alignment
1	306.5~302.7	3.8 km	Section including gentle S-curves	Partially steep sections, but these sections are not long.
2	302.7~298.7	4.0 km	Steep S-curves and 2 accident-prone points	Longitudinal gradient of 4-6% needs to be considered for a climbing lane
3	298.7~296.1	2.6 km	Steep S-curves and approach sections to accident-prone areas	Except for a 1.5 km gentle gradient section, a longitudinal gradient of 4-6% needs to be considered for a climbing lane.
4	296.1~294.4	1.7 km	Section including a gentle S-curve	Relatively gentle longitudinal gradient section
5	294.4~292.1	2.3 km	Bad combination of flat and longitudinal alignment and 1 accident point	Longitudinal gradient of 4-6% needs to be considered for a climbing lane
6	292.1~291.0	1.1 km	Good visibility, no alignment problems	Relatively gentle longitudinal gradient section

Source: Survey team



Source: Survey team Fig. 2-1: 6 sections divided by horizontal and longitudinal profile characteristics

2) Scope and scale of the plan

2-1) Establishment of alternatives

The outline design and estimation of the road improvement was carried out based on the characteristics of the target road described above. The following 4 alternatives (Alt-1 to Alt-4) were set up and examined in order to confirm the extent to which the estimated cost can be met as a Phase 2 project.

Table 2-2: Assumed alternatives for the Phase 2 section

Source: Survey team

Section	Start	End	Distance km	Climbing lane necessary section				Alternatives	
				Calculated km	Measured km	No need km	Expected lanes	Covering section	km
1	306.5	302.7	3.8			3.8	2	Alt-1 (1+2)	7.8
2	302.7	298.7	4.0	4.0			3	Alt-2 (1+2+3)	10.4
3	298.7	296.1	2.6		2.6		3	Alt-3 (1+2+3+4+5)	14.4
4	296.1	294.4	1.7			1.7	2	Alt-4 (1+2+3+4+5+6)	15.5
5	294.4	292.1	2.3	2.3			3		
6	292.1	291.0	1.1			1.1	2		

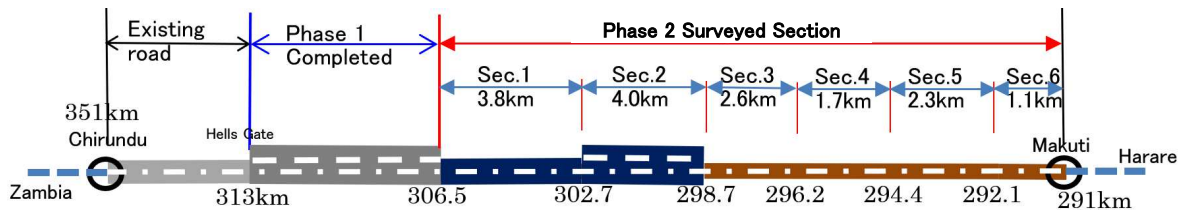
Total	15.5	6.1	2.5	6.9		
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Note: > Calculate= Sections where a climbing lane is required, both in theoretical calculation and measured values.
 > Measured = Additional climbing is desirable (some gentle gradients exist in the section (1.5 km)).
 > No need= Section where a climbing lane is not required : Priority option

2-2) Possible target sections

i) Priority option (Alt-1 option)

As a result of the above comparative study, the alternatives that are assumed to be in the scope of the Project within the anticipated amount is the Alt-1 proposal. The Alt-1 can provide (i) continuity with the section repaired by Phase 1 and include (ii) 2 accident-prone points and climbing lanes based on the result of both theoretical and actual values.



Source: Survey team Fig. 2-2: Image of the prevailing proposal for road improvement

ii) Other options

If sections 2 and 3 are targeted, where it is desirable to add a climbing lane at an anticipated amount as another improvement option, about 1.3 km of section 1 in the direction of Chirundu from section 2 (up to around the 304 km point) could be accommodated. In this proposal, the remaining 2.5 km to the start of Phase 1 will remain in the old specification, so it will be necessary to leave it to the Zimbabwe side to promptly address the safety issues caused by the mix of road widths of the new and old specifications, which will change significantly and become discontinuous after the improvement. In addition, if only the section -2 + 3 (partial) + 5 (7.4 km in total) requiring a climbing lane will be applied within the section under the survey as another improvement option, the road improvement will be more discontinuous because of the remaining 4 sections with a narrow road width of old specification.

(2) Design conditions

1) Design standards

As the design standards in Zimbabwe were published in 1987 and are now generally based on SATCC standards (Geometric Design of Trunk Roads), this project will in principle conform to SATCC. In addition, it is the policy of the project to supplement items that are not included in the SATCC standards by using Japanese standards ('Commentary and Operation of the Road Structure Order, June 2015, Japan Highway Association') and South African standards and American Association of State Highway and Transport Officials (AASHTO).

Table 2-3: Applicable design standards

Road design	<ul style="list-style-type: none"> • SATCC (Code of Practice for the Geometric Design of Trunk Roads) • JAPAN Standard
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Drainage design	<ul style="list-style-type: none"> • Drainage Manual 6th Edition (South African) • JAPAN Standard
Pavement design	<ul style="list-style-type: none"> • SATCC (Code of Practice for the Design of Road Pavements) • AASHTO (GUIDELINES FOR 1993 AASHTO PAVEMENT DESIGN)
Structural design	<ul style="list-style-type: none"> • SATCC (Code of Practice for the Design of Road Bridges and Culverts) • JAPAN Standard
Traffic signs	<ul style="list-style-type: none"> • SATCC (Road Traffic Signs Manual) • SADC (Road Traffic Signs Manual)

Source: Survey team

2) Outline of the Basic Plan

The following overview plan was studied and established based on the basic policy. The field survey analysed and summarised for existing pavements, drainage facilities, ancillary facilities, traffic, rainfall type, temperature and sunlight, vegetation and various existing information, as well as the results of discussions with the relevant authorities, to examine the contents of the plan. In addition, a Technical Memorandum of Understanding (MOU) was agreed upon and signed by both parties, which showed the basic specifications for each item of the plan, including MoTID's offer to increase the carriageway width from 3.5 to 3.75 m in accordance with the updated SATCC standards as indicated in discussions with the Zimbabwean side in October 2021.

Table 2-4: Basic specifications of the project

Planned item	Unit	Adopted Value		Note
Road Reserve Width	m	Lion's Den-Chirundu : 31.5m (15.75m on each side from the existing road center)		Right of way (ROW)
Number of lanes	lane	2		
Width of Lane	m	3.75		Follow SATCC
Climbing Lanes Width	m	3.75		Follow SATCC
Shoulder Width	m	2.5		Aligned with Phase 1
Road Cross-slopes	%	2.5		Same for shoulder
Max. Superelevation	%	10		
Max. Vertical Gradient	%	—		Trace existing gradient
Design Speed	km/h	60 [40 for partial spots]		
		60 km/h	40 km/h	
Minimum Curve Radius	m	110	50	
Minimum Curve Length	m	150	70	
Omission of Transition Curve	m	1000	500	Omission for Large curvature
Sight distance (Stopping)	m	80	50	
Pavement Type	—	Asphalt Surface Treatment		Main line=2 layers, Shoulder=2 layer
Design life of pavement	Year	15		
Rain Intensity	Year	Major facilities: 20years, Others: 5years		
Ancillary road structures	—	Concrete Kerbstone, Concrete retaining walls, Safety barriers, Traffic signals, Road marking, Delineator, Parking area etc.		

Fil) slope	—	1:1.5~4.0 (depending on filling height)	
Cut Slope	Rock	1:0.3~0.5 (depending on rock type)	
	Others	1:1.0	

Source: Survey team Note: Road lane width of 3.75 m as notified by MoITD during the first field survey is applied.

(3) Road planning

1) Design speed

Although the design speed is basically set at 60 km / hr, design speed of difficult places such as steep cliff is set at 40 km / hr was applied same as Phase 1 in consideration of cost due to large-scale earth work and increase in environmental load etc. The table below shows the design speed for each section considered based on the road alignment (curve radius and curve length) and sight distance. In the field survey, it was found that a large proportion of accidents were caused by misjudgement, so it was decided that the design speed of 60 km/h should be ensured for the sight distance.

Table 2-5: Design speeds based on geometric structure

No.	Chainage	Curve direction	Curve radius (m)	Number of lanes	Design Speed			Apply Sight Distance (m)
					Design Speed (km/h)	Curve radius (km/h)	Curve Length (km/h)	
1	296,316	R	310.000000	3	60	60	60	80
2	297,435	R	320.000000	3	60	60	60	80
3	297,849	L	-320.000000	3	60	60	60	80
4	298,412	L	-350.000000	3	60	60	60	80
5	298,899	R	310.000000	3	60	60	60	80
6	299,563	L	-200.000000	3	60	60	60	80
7	299,848	R	200.000000	3	60	60	60	80
8	300,267	R	150.000000	3	60	60	60	80
9	300,495	L	-60.000000	3	40	40	60	80
10	300,763	R	210.000000	3	40	60	60	80
11	300,920	L	-200.000000	3	40	60	40	80
12	301,114	R	200.000000	3	40	60	60	80
13	301,553	L	-200.000000	3	40	60	40	80
14	301,690	R	150.000000	3	60	60	60	80
15	302,024	R	200.000000	3	60	60	60	80
16	302,280	L	-110.000000	3	60	60	60	80
17	302,499	L	-110.000000	3	60	60	60	80
18	302,791	R	220.000000	2	60	60	60	80
19	303,296	R	800.000000	2	60	60	60	80
20	303,719	R	150.000000	2	60	60	60	80
21	304,091	L	-150.000000	2	60	60	60	80
22	304,749	L	-500.000000	2	40	60	40	80
23	304,878	R	400.000000	2	40	60	60	80
24	305,100	L	-400.000000	2	40	60	60	80
25	305,451	R	125.000000	2	40	60	40	80
26	305,645	L	-500.000000	2	60	60	60	80
27	305,983	R	350.000000	2	60	60	60	80
28	306,320	R	400.000000	2	60	60	60	80
	306,500							

Source: Survey team ※The sight distance was taken as the value for a design speed of 60 km/h.

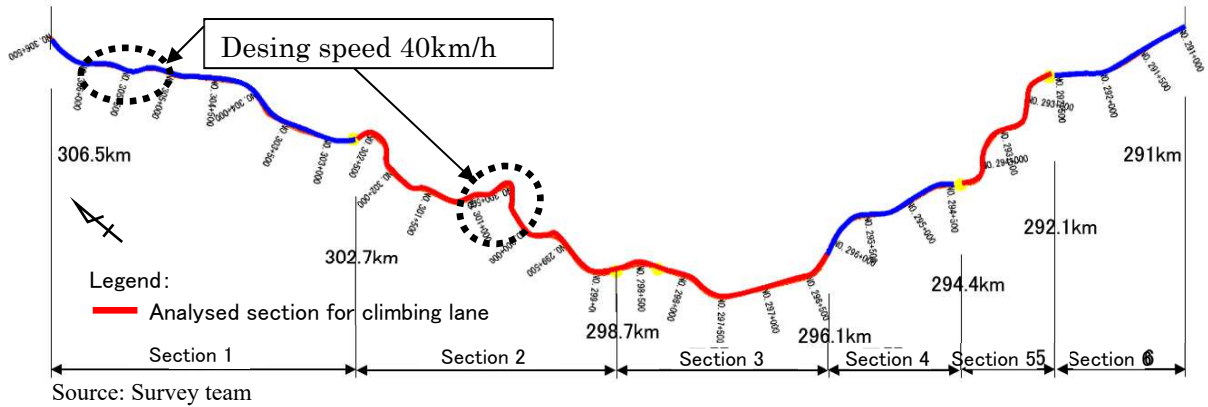


Fig. 2-3: Location map of 40 km/h design speed section (otherwise 60 km/h)

2) Horizontal road alignment

2-1) Basic policy

The following points are to be considered in planning the horizontal alignment of the target section.

- i) As far as possible, the plan should fit within the road right of way.
- ii) The basic concept of the alignment is based on a design speed of 60 km/h. However, in sections where large earthworks would occur if the design speed were secured, a design speed of 40 km/h is applied, as same as Phase 1.
- iii) For sections where the existing culverts were in good condition, the alignment plan was based on the assumption of a one-sided extension to facilitate reliable construction for road widening.
- iv) The embankment is planned to be widened on the cut side as much as possible for ease of construction.

2-2) Control points of road alignment

The control points for planning the road alignment of the target section are listed below.

- i) Consider widening on one side, with the current road end as the control.
- ii) Ensure consistency with the Phase 1 construction start point.
- iii) Do not widen to the river side where construction risks are high.
- iv) The alignment plan should be such that large embankments do not occur.

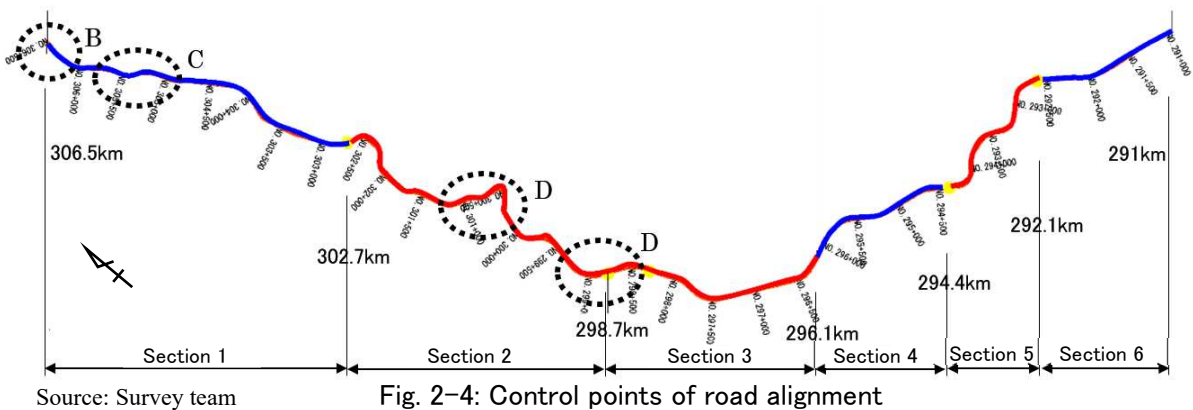
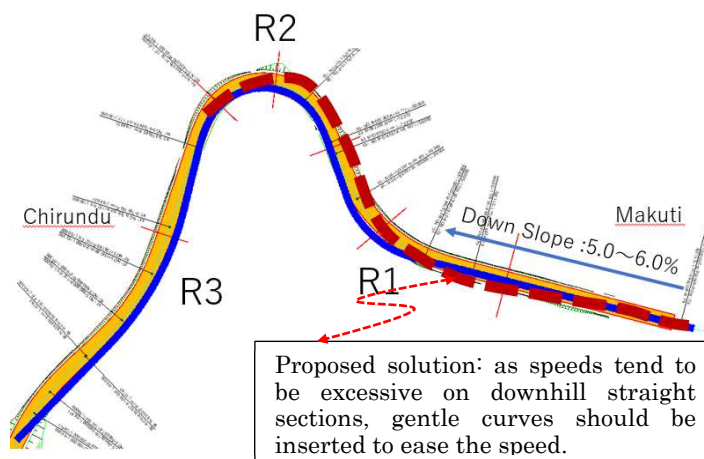


Fig. 2-4: Control points of road alignment

Alignment improvements trial image for Section 2

The following Fig. shows the trial alignment improvements image relating to the accident frequencies in the vicinity of 300.5 km, where the steepest curve in the subject section is located. In this section, accidents occur when vehicles from Makuti side cannot complete the turn due to overspeeding when passing through a steep downhill S-curve of about 6%. The general improvement plan is to widen the current road section and increase the curve radius from 95 m to 150 m, as shown in the yellow line on the right Fig., to improve visibility and travelability. On the other hand, as the above section is a steep downhill, it is very important to consider and take measures on the alignment to mitigate the increase in speed and reduce accidents due to the alignment improvement. In this project, a study of the alignment was carried out to make the driver aware and to control the speed by inserting curves into the straight section like the red dashed line in the right figure.



Source: Survey team Fig. 2-5: Improvement image of alignment

3) Longitudinal road alignment

The following points are to be considered for the road longitudinal planning of the target section.

- The longitudinal gradient is to be handled by adding a climbing lane to these sections rather than improving the longitudinal alignment, which requires large-scale construction work, and the longitudinal alignment was planned to reflect the existing road. The 302.7 km section at the end of the Chirundu side, which could be the starting point for adding a climbing lane in Section-2, is a change point (sag) from downhill to uphill, so an easy identifying road alignment of the start of climbing lane was considered.
- The planned height of the roads was determined in accordance with the pavement design, taking into account the roadbed raising.

4) Road width configuration

The existing road width in the target section is the Zimbabwe Road Standard 7/10 (Seven in ten = two lanes of 3.5m on each side + 1.5m unpaved shoulders on both sides) at the time of construction. The 1.5m shoulders of the current road are either unpaved or have hardly been kept to their original width due to overgrowth and erosion of weeds. The 7 m carriageway section has suffered significant damage due to erosion from the edges, especially on curves where rainwater is concentrated. It should be noted that current Zimbabwean standards have to be applied when improving the existing road.

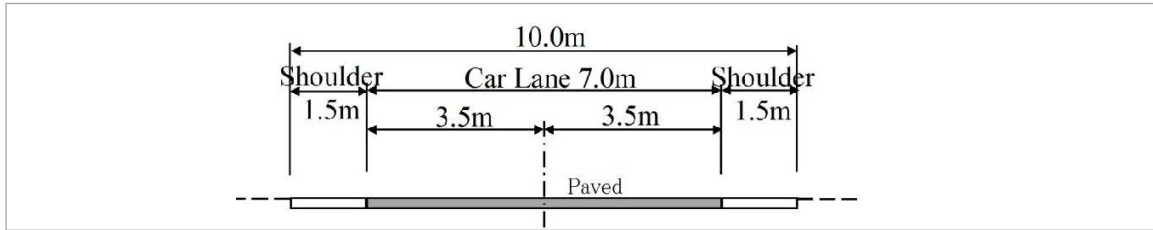
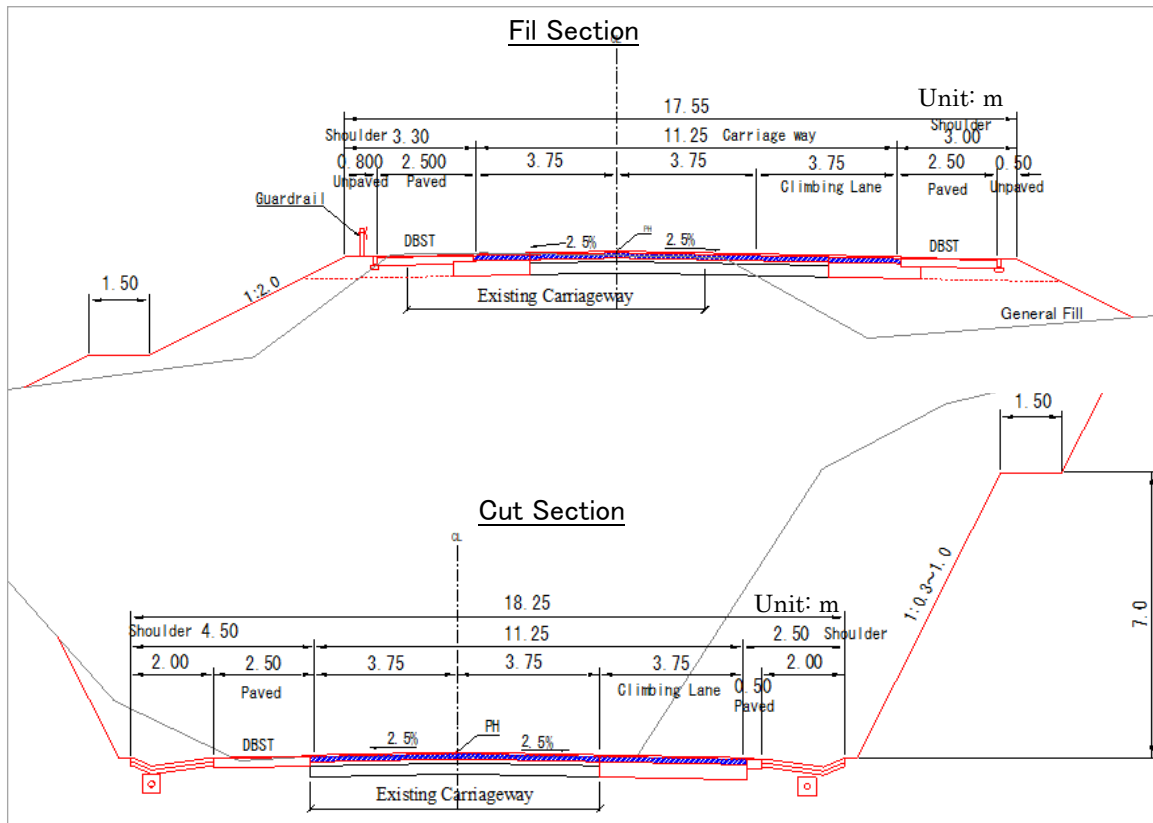


Fig. 2-6: Cross section of the existing road (Zimbabwe Roads Standard 7/10)



Source: Survey team

Fig. 2-7: Cross section of the proposed road

Furthermore, in discussions with the DOR during Phase 1, the subject road, which has a very high mixing rate of large vehicles, was given 2.5 m wide widened shoulders to allow large vehicles to safely evacuate in an emergency, and the Phase 2 section was studied with similar shoulder widths to ensure the continuity of the road.

5) Widening of curved sections

Curved sections were widened in accordance with SATCC standards, and the Japanese road standard was used as reference for sections with small curve radii, as there are no SATCC widening standards for these sections. In addition, the following procedure was used to verify the widening of the curves, as it was observed during the field survey that many most pavement damage occurred on the shoulders of heavy vehicles and on curves with a curve radius of less than 100 m, and the roadside lines disappeared in some areas.

- i) In accordance with the widening standards of the SATCC and the Japanese road standard.

- ii) Analysis of the travel trajectories of large vehicles, many of which were identified in the field, to determine the amount of widening required.
- iii) A field survey of the shoulder in Phase 1 to determine the amount of widening of the carriageway abutting the shoulder, based on the disappearance of the roadside lines and median lines and the degree of damage to the shoulder.

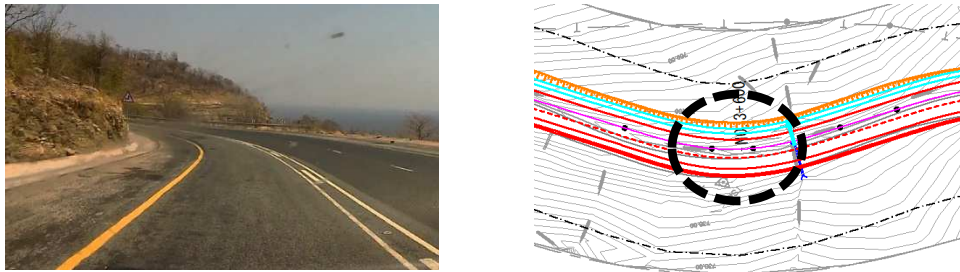


Fig. 2-8: Example of pavement damage on the shoulder (curve radius 80 m, at 310.1 km)

5-1) Confirmation of SATCC standards

As a result of the application of the new standards for the north-south corridor in this project, the lane width has been increased from 3.5 m to 3.75 m. As a result, the curve radius of 230 m that required curve widening in Phase 1 has changed to 130 m or less in this project. There are 3 curves in the 15.5km section of the survey that require widening of the curve section, and 2 curves in Section 1 and 2 that are expected to be improved by the project. For 1 curve with a curve radius of 60 m at a design speed of 40 km/h, which is not included in the SATCC standards, the figures of the Japanese road standard were applied.

5-2) Analysis based on vehicle travel trajectories

As the semi-trailer vehicles shown in the SATCC in the table on the right are smaller than the actual semi-trailer vehicles running on the existing road, a running track considering the actual road trajectory of a semi-trailer vehicle was studied at 2 locations where the curve section needs to be widened. As a result, at a curve radius of 60 m (R60), a widening of 0.6 m was necessary, while at a curve radius of 110 m (R110), no widening was required.

Table 2-6: SATCC standard vehicle

Type	Inter-Axle	FOH	ROH	Car width
Sedan	3.1m	0.7	1.0	1.8
Truck	6.1	1.2	1.8	2.5
Trailer	6.7+3.4+6.1	1.2	1.8	2.5
Bus	7.6	2.1	2.6	2.6
Semi-trailer	6.1+9.4	0.9	0.6	2.5

Note: FOH= Front overhang, ROH= Rear overhang

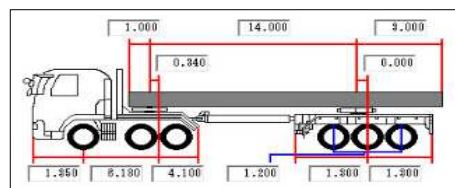
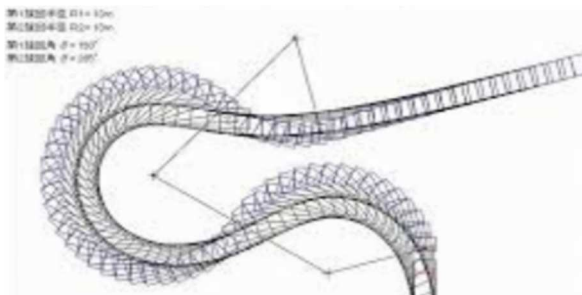


Fig. 2-9: Trailer dimension (L 24.2m) for trajectory calculation



Source: Survey team

Fig. 2-10: Widening image based on travel trajectory



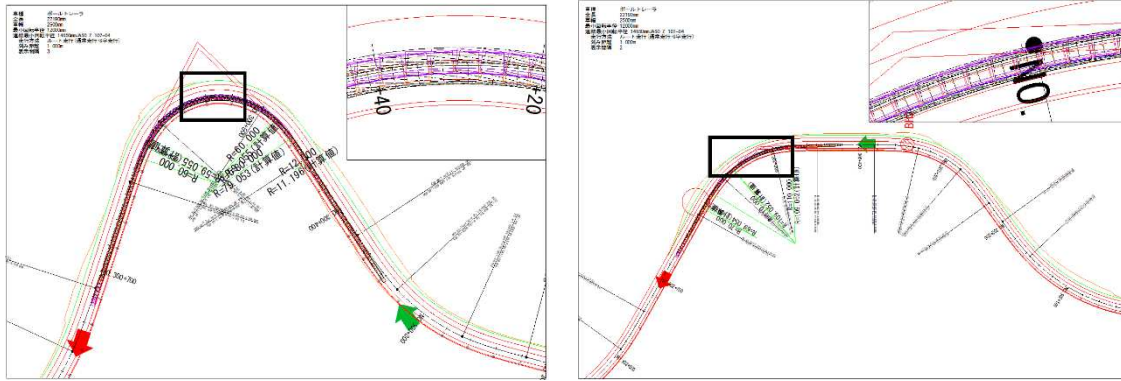
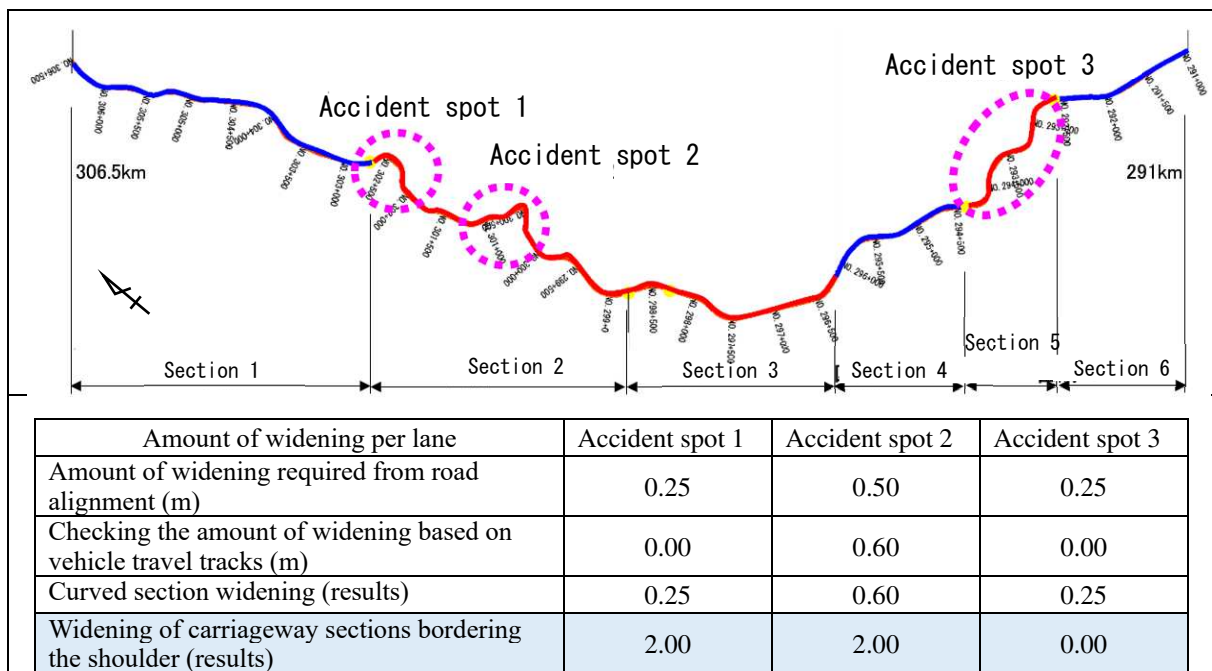


Fig. 2-11: Vehicle tracks (left: at 300.6 km (R60), right: at 302.5 km (R110))

5-3) Widening points and amount of widening

The table below shows the 3 sharp curves that require widening within the 15.5 km surveyed section and the amount of widening in each spot. In view of the actual lane running tendencies of semi-trailer vehicles, it was decided to widen the carriageway width by 2.0 m in contact with the shoulder at the 2 points of high accident frequency in the section covered by Phase 2.



Source: Survey team

Fig. 2-12: Location of widening points and amount

6) Sight distance

A field survey and diagrammatic check was carried out to determine whether there were any areas inside sharp bends where sight distance needs to be ensured. In the surveyed section, curves No.8 and No.14, which did not satisfy sight distance of the design speed of 60 km/h, were widened by 0.43 m (round value of 0.5 m widening was adopted) to ensure a sight distance of 60 km/h for the entire project area.

- As there are many accidents due to misjudgement in the project section, it was assumed that a sight distance of 60 km/h could be secured at the design speed, thereby contributing to the

reduction of accidents.

- The analysis result of the amount of widening required is only 0.43 m, so there is no significant impact on the construction cost.

Table 2-7: Verification of sight distance widening on curves

No.	Chainage	Curve direction	Curve radius (m)	Number of lanes	Design Speed			Apply Sight Distance (m)	Necessary Width (A)	Cut/Fill	Judge		Widening for the sight distance	Total Width (L)	Total Width (R)
					Design Speed (km/h)	Curve radius (km/h)	Curve Length (km/h)				L (>A OK)	R (>A OK)			
1	296.316	R	310.000000	3	60	60	60	80	2.58	Fill	-	-	0.00	6.875	4.875
2	297.435	R	320.000000	3	60	60	60	80	2.50	Fill	-	-	0.00	6.875	4.875
3	297.849	L	-320.000000	3	60	60	60	80	2.50	Cut	OK	-	0.00	6.875	4.875
4	298.412	L	-350.000000	3	60	60	60	80	2.28	Fill	-	-	0.00	4.375	4.875
5	298.899	R	310.000000	3	60	60	60	80	2.58	Fill	-	-	0.00	4.375	4.875
6	299.563	L	-200.000000	3	60	60	60	80	3.99	Fill	-	-	0.00	4.375	4.875
7	299.848	R	200.000000	3	60	60	60	80	3.99	Cut	-	OK	0.00	4.375	4.875
8	300.267	R	150.000000	3	60	60	60	80	5.30	Cut	-	NG	0.43	4.375	4.875
9	300.495	L	-60.000000	3	40	40	60	80	12.85	Fill	-	-	0.00	4.975	5.475
10	300.763	R	210.000000	3	40	60	60	80	3.80	Cut	-	OK	0.00	4.375	4.875
11	300.920	L	-200.000000	3	40	60	40	80	3.99	Fill	-	-	0.00	4.375	4.875
12	301.114	R	200.000000	3	40	60	60	80	3.99	Cut	-	OK	0.00	4.375	4.875
13	301.553	L	-200.000000	3	40	60	40	80	3.99	Fill	-	-	0.00	4.375	4.875
14	301.690	R	150.000000	3	60	60	60	80	5.30	Cut	-	NG	0.43	4.375	4.875
15	302.024	R	200.000000	3	60	60	60	80	3.99	Cut	-	OK	0.00	4.375	4.875
16	302.280	L	-110.000000	3	60	60	60	80	7.19	Fill	-	-	0.00	4.625	5.125
17	302.499	L	-110.000000	3	60	60	60	80	7.19	Fill	-	-	0.00	4.625	5.125
18	302.791	R	220.000000	2	60	60	60	80	3.63	Fill	-	-	0.00	4.375	4.375
19	303.296	R	800.000000	2	60	60	60	80	1.00	Cut	-	OK	0.00	4.375	6.875
20	303.719	R	150.000000	2	60	60	60	80	5.30	Cut	-	-	0.00	6.875	6.875
21	304.091	L	-150.000000	2	60	60	60	80	5.30	Fill	-	-	0.00	6.875	6.875
22	304.749	L	-500.000000	2	40	60	40	80	1.60	Cut	OK	-	0.00	6.875	4.375
23	304.878	R	400.000000	2	40	60	60	80	2.00	Fill	-	-	0.00	6.875	4.375
24	305.100	L	-400.000000	2	40	60	60	80	2.00	Cut	OK	-	0.00	6.875	4.375
25	305.451	R	125.000000	2	40	60	40	80	6.35	Fill	-	OK	0.00	7.125	4.625
26	305.645	L	-500.000000	2	60	60	60	80	1.60	Cut	OK	-	0.00	6.875	4.375
27	305.983	R	350.000000	2	60	60	60	80	2.28	Cut	-	OK	0.00	4.375	4.375
28	306.320	R	400.000000	2	60	60	60	80	2.00	Cut	-	OK	0.00	6.875	6.875
	306.500														

Source: Survey team

7) Climbing lane

7-1) Determination of climbing lanes installation location

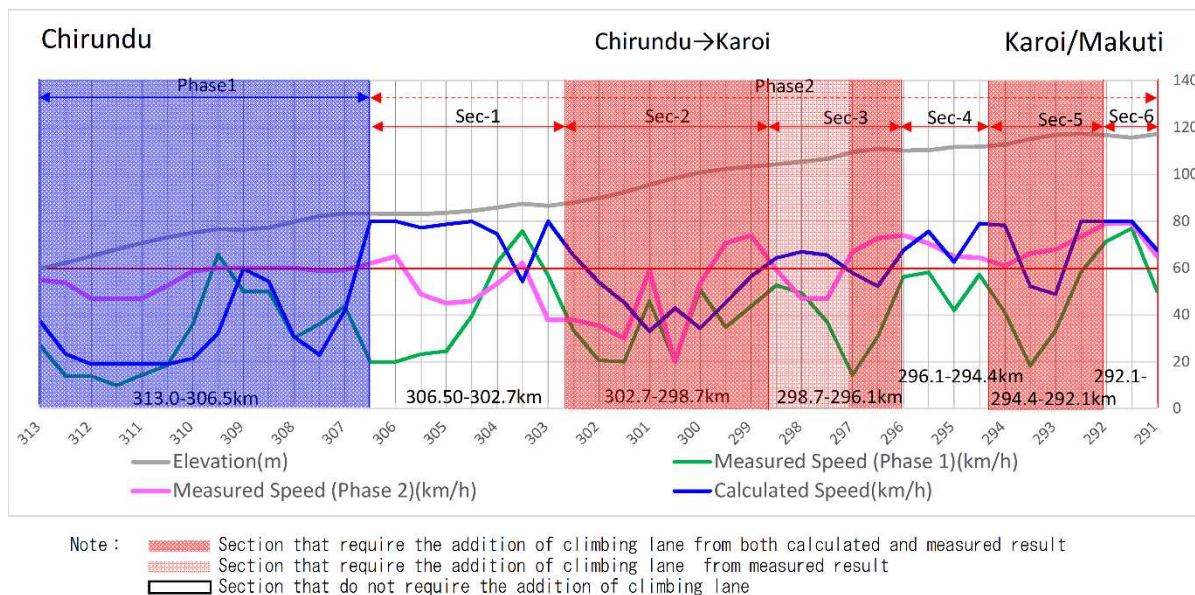
The results of the field survey, the target road section can be broadly divided into the 6 sections shown in the table below, based on the characteristics of the horizontal alignment and longitudinal profile.

Table 2-8: Classification of surveyed sections by the features of alignment

Section	Location	Length (km)	Horizontal alignment		Vertical alignment
1	306.5 ~ 302.7km	3.8	Section containing gentle S-curves		Partially steep sections, but these sections are not long.
2	302.7 ~ 298.7km	4.0	Steep S-curves, including two accident-prone points.		A longitudinal gradient of 4-6% uphill, requiring a climbing lane study.
3	298.7 ~ 296.1	2.6	Section with a series of S-curves.	1.5km (298.7~297.2)	Relatively gentle gradient sections
				1.1km (297.2~296.1)	Steep sections with a longitudinal gradient of around 6%, requiring climbing lane consideration
4	296.1 ~ 294.4km	1.7	Section containing a gentle S-curve		Relatively gentle longitudinal gradient section
5	294.4 ~ 292.1km	2.3	Poor combination of flat and longitudinal alignment, frequent accident points		Uphill gradient of 4-6% longitudinal gradient, requiring climbing lane consideration
6	292.1 ~ 291.0km	1.1	Good visibility, no alignment problems		Relatively gentle longitudinal gradient section

Source: Survey team

The speed gradient map calculated from the road gradient for the above 6 sections and the values obtained from tracking and measuring heavy vehicles passing on the current road were used to determine the sections requiring a climbing lane. In the determination, measurements from Phase 1 survey (green line), Phase 2 measurements (pink line), and theoretical calculated speed from longitudinal gradient (blue line) were used for the analysis to identify the sections requiring installation of a climbing lane. In addition, part of Section 3 is considered to be a desirable section for the addition of a climbing lane, as the theoretical calculated speed is above 60 km/h, but the actual measured speed is below 60 km/h.



Source: Survey team Fig. 2-13: Speed gradient map and assumed climbing lane addition section

7-2) Method of climbing lane installation

The installation of a climbing lane with an additional lane on the outside in this plan may reduce safety due to low-speed vehicles waiting and merging, so, as in Phase 1, the study was conducted as an additional overtaking lane system (additional lane on the right-hand side), which is expected to improve safety.

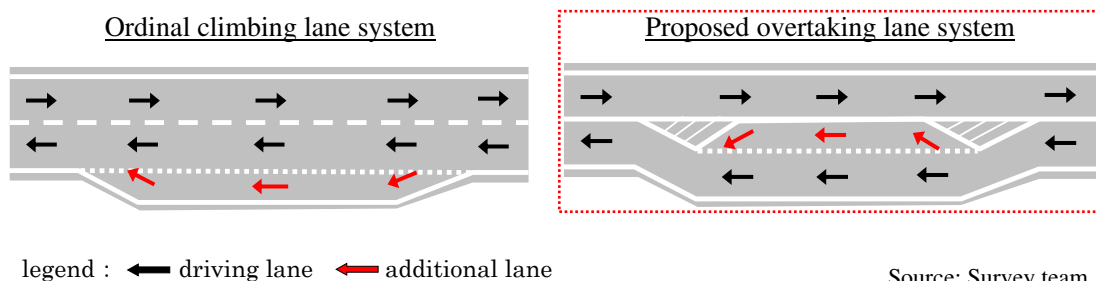


Fig. 2-14: Image of additional climbing lane system

8) Design traffic

8-1) Traffic volume survey

A traffic volume survey of the project's roads was carried out by the local consultant managed by the survey team. A summary of the survey is given below.

- > Survey period: from 1st (Mon.) to 8th (Mon.) November 2021.
- > Survey locations: in Karoi (2 locations (T/C1, 2)) and in Chirundu (1 location (T/C3))
- > Survey hours: t/c 1 and 2 = 12 hours (6:00-18:00); t/c 3 = 24 hours (6:00 – 6:00).

A summary of the results of traffic volume survey between Karoi and Chirundu is summarised below.

- Traffic volumes measured at Chirundu were used as the source data for the design traffic volumes, as the target road section has no branches or entry/exit points between the survey section and Chirundu.
- Daily traffic volumes were around 820-890 vehicles, with anomalies on Thursday (588 vehicles) and Friday (151 vehicles).
- The above is thought to be due to problems at the South African-Zimbabwean border customs clearance, which were also observed in October.
- The design traffic volume was set at 855 vehicles per day, which is the average of the 6-day period excluding the above anomalies.

The key results obtained from the survey are summarised below.

- The design traffic volume increased by 117% from 728 vehicles/day during the Phase 1 survey.
- The vehicle breakdown is 60% 6-axle vehicles and 28% passenger cars, with these 2 vehicle types accounting for 88% of the total.
- Heavy vehicle traffic, including buses, accounted for 72%.
- The day/night rate is 30%, night traffic after 18:00 is around 40% of bus traffic and 25% of trailer traffic.

Table 2-9: Results of the traffic survey

Date		Ordinary car		Bus		Truck		Trailer			Daily traffic
		Sedan	Taxi	Mini bus	Large bus	2 Axle	3 Axle	4 Axle	5 Axle	6 Axle~	
2021/11/1	Mon.	225	1	24	21	31	14	5	14	488	823
2021/11/2	Tue.	253	1	22	25	36	16	7	3	533	896
2021/11/3	Wed.	237	2	21	21	24	20	10	3	541	879
2021/11/4	Thr.	178	0	25	8	22	14	5	2	334	588
2021/11/5	Fri.	56	0	2	7	2	6	3	0	75	151
2021/11/6	Sat.	271	1	27	24	25	16	13	5	469	851
2021/11/7	Sun.	226	1	11	18	20	20	11	3	535	845
2021/11/8	Mon.	210	1	26	17	23	23	14	6	511	831
Remarks	8 days	1,656	7	158	141	183	129	68	36	3,486	5,864
	6 days	1,422	7	131	126	159	109	60	34	3,077	5,125
	Average (Nos.)	237	1	22	21	27	18	10	6	513	855
	Share	28%	0%	3%	2%	3%	2%	1%	1%	60%	
	Day/Night	33%	29%	37%	47%	28%	19%	25%	6%	28%	↑ Design traffic
		28%		5%		5%		62%			

Source: Survey team Note: 72% heavy vehicle mixing rate, outliers in 11/4 and 11/5

Table 2-10: Traffic volumes (ADT estimates for Phase 2 surveys)

Location	Sedan	Taxi	Small bus	Large bus	Truck 2-3 axle	Trailer 4-6 axle	Total (Nos.)
Karoi (TC 1,2)	100	210	58	25	82	1,241	1,716
Chirundu (TC 3)	379	1	23	20	45	513	981

Source: Survey team Note: Includes two days with abnormal values.

Table 2-11: Traffic volumes (Reference: ADT estimates from Phase 1 survey)

Location	Sedan	Taxi	Small bus	Large bus	Truck 2-3 axle	Trailer 4-6 axle	Total (Nos.)
Karoi (TC 1)	675	8	190	34	449	484	1,840
Karoi (TC 2)	467	5	49	14	303	475	1,313
Chirundu (TC 3)	108	2	15	18	91	603	837

Source: Survey team

8-2) Traffic growth rate

Traffic growth rate to be used for pavement design, the intermediate values of the Low (0.5~2%), Mid (2~5%) & High (5~10%) scenarios of the Zimbabwe traffic-related M/P conducted by the AfDB in 2018 were used. The growth rate was set at 1.25% for the detailed design and construction period 2022-2025, 3.5% for the first 7 years after opening traffic (half of the design period) and 7.5% thereafter, and the traffic growth rate for the entire period 2022-2040 was calculated to be 4.65%, taking into account the 15-year period covered by the pavement design. This figure was slightly higher than the average IMF GDP figure of 3.7% for Zimbabwe and neighbouring countries (Zambia, Congolese and Botswana) over the past decade.

8-3) Axle load survey

The 8.16t Vehicle Equivalent Factor (VEF) for each type of vehicle used in pavement design was set and the overloading situation was identified at the weighing station at the border facility at Chirundu, for 6 days starting on 1 November 2021. It was conducted continuously and a total of 139 axle load measurements were taken. The trend of passing vehicles showed that 97% of the vehicles had 6 or more axles, confirming the increase in vehicle size (see table below). As for overweight vehicles, no change was observed in the main loaded items of the vehicles passing through, and as in the Phase 1 survey, the number of overweight vehicles was lower than in other African countries, with only 1.4% of the total number of vehicles exceeding the SATCC weight limit.

Table 2-12: Results of axle load survey

Item	Survey dates: 1-6 (Mon-Sat)/Nov/2021; number of vehicles surveyed: 139 Measuring time: 6 am to 6 pm (12 hrs), axis weight measuring station: Chirundu.							Total Nos.
	1	2	3	4	5	6	7	
Number of axes Type								

Number of surveys (units)	0 0%	0 0%	0 0%	1 1%	3 2%	106 76%	29 21%	139 100%
Average weight (tonnes)	-	-	-	45.7	47.4	46,0	50.1	-
Vehicle load factor (ESAL per vehicle)	-	-	-	21.15	10.65	6.46	4.23	-
Average of above (ESAL per vehicle)	(Note: Axes 4 and 5 are excluded due to small sample size; empty vehicle rate: 3%)							6.19

Source: Survey team

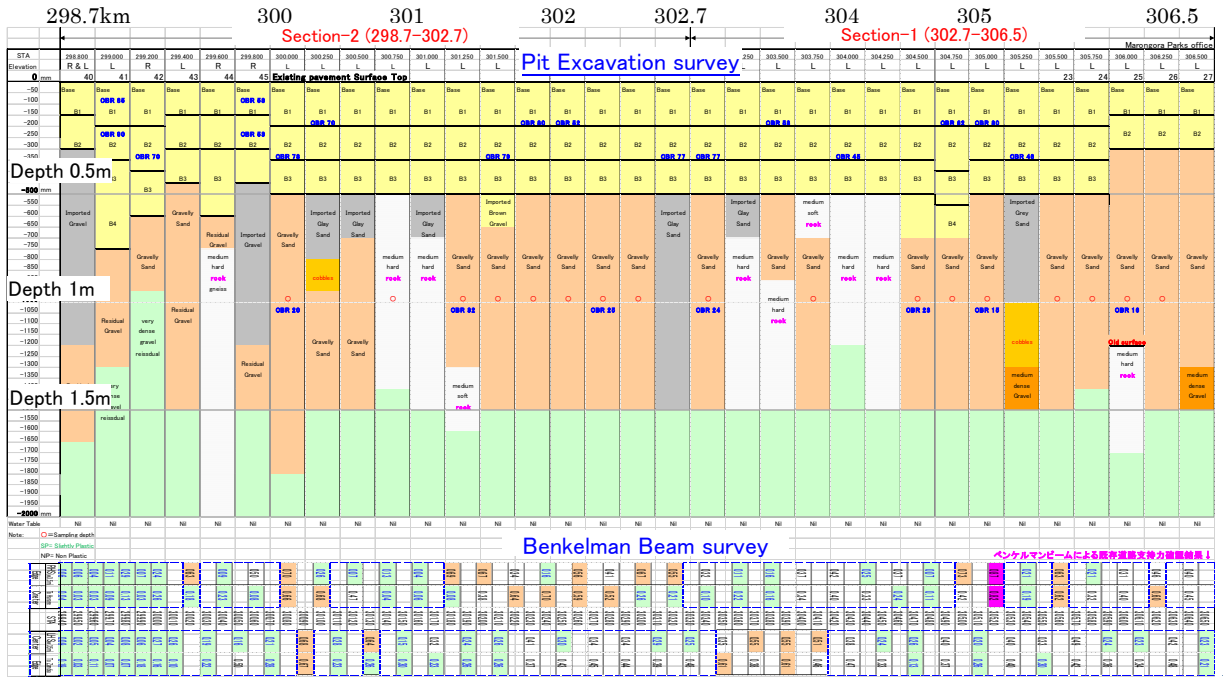
9) Bearing capacity survey of existing roads

9-1) Existing pavements condition survey

In this survey, 1.5 m deep trial excavations were carried out at 200 m intervals along the edge of the existing roadway to check the layer thickness and material of the existing pavement, the material and condition of the roadbed and the groundwater table. The existing pavement was found to have a solid gravel-mixed base course (bearing capacity value CBR 65) with a layer thickness of about 15 cm, which is the Zimbabwean national standard, and a subbase course (CBR 65) with a layer thickness of about 15 cm, which is the Zimbabwean national standard, under the 2-layer asphalt surface treatment. The subgrade material also showed good bearing capacity values (CBR of around 22) with no groundwater levels identified up to a depth of around 1.5 m.

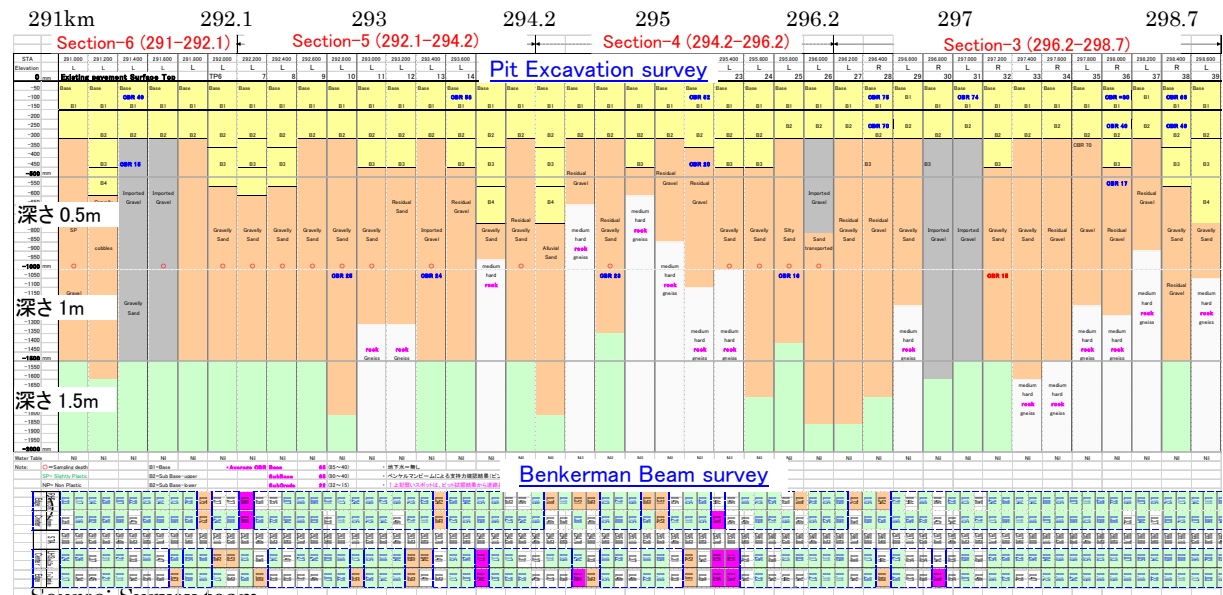
9-2) Confirmation of the bearing capacity of the existing road

In this survey, a Benkelman beam bearing capacity confirmation survey was conducted at 100 m intervals in the middle and at the end of each lane to confirm the soundness of the existing road. The results of the survey showed that the existing road in the surveyed section was found to be 88.6% stiff/very stiff, 10.4% slightly weak and 1.1% very weak according to Southern African standards. Furthermore, the results of the exploratory excavation and the results of the Benkelman beam test were contrasted for each of the same locations, which suggested that the cause of the problem areas with weak bearing capacity may not be the effect of the existing road material, but the local effect of surface water and repairs using inappropriate materials and methods. These problem areas will need to be addressed by partial material replacement. The following table is provided to compare the results of the bearing capacity tests on the current road with the pavement configurations identified by trial excavation. Although the target road is considered to have a high mixing rate of heavy vehicles and a relatively high traffic load, the existing pavement has been confirmed to be very solid. It will be possible to meet the design life of the road by using the road base in good condition, adding a layer of aggregate material to the top and constructing a stable treated layer using the road improvement method same as Phase 1.



Note : Existing base Subbase Subgrade Sandy soil Rock
 Benkerman Beam Result: Very stiff Stiff Little weak Weak

Fig. 2-15: Existing pavement feature and bearing capacity (between 298.7 and 306.5 km)



Source: Survey team

Fig. 2-16: Existing pavement feature and bearing capacity (between 291 – 298.75km)

Table 2-13: Determination of Benkerman beam measurement results

Category	%	Status	Max Deflection	Capable Traffic
Very stiff	37%	Sound	less 0.3mm	10-100 million ESA
Stiff	44%	Sound	0.3-less 0.5	3-10 million ESA
Flexible	18%	Warning	0.5-less 0.75	1-3 million ESA
Very flexible	1%	Severe	More than 0.75	0.003-1 million ESA

Source: Survey team Note: ESA=Equivalent Standard Axle (8.2t VEF)



Excavation pit near 306km
(Near the parks office)



Near 300km



Near 297km

(4) Road Pavement Plan

1) Planning policy and applicable standards

Based on traffic load and confirmation of the conditions of the existing pavement and the ground, etc. that were obtained in the field survey, examination of pavement structure was conducted while considering applicable materials and specifications from the viewpoint of the assumed quality/quantity/ growth rate/load of traffic, and utilization of existing pavement, environment / social consideration, equipment and material procurement conditions and cost reduction. The applicable standards were planned based on SATCC (Code of Practice for the Design of Road Pavements). And the policy in the process of verification of the pavement composition was decided to compare and confirm with reference to the American Standard (AASHTO) and the Japanese manual for pavement.

- The design life was selected for 15 years within Zimbabwean national standard of 15 to 20 years by the consultation with Zimbabwe.
- Allowable traffic load was considered according to the results of traffic volume survey and axle load survey.
- Possibility of utilization of existing pavement was confirmed and considered.
- Pavement surface layer was considered with reference to actual performances and maintainability in Zimbabwe.

2) Pavement surface layer type on carriageway

As for the pavement surface layer of carriageway, there are three choices such as Double Bituminous Asphalt Surface Treatment (DBST) common in Zimbabwe, asphalt concrete which is common in Japan and cement concrete. For the following reasons, Bituminous Surface Treatment (BST) was applied. In BST, it is considered that specifications of the pavement edge part greatly affect the durability. Therefore, plan to install a concrete kerb stone at the edge of shoulder pavement was considered.

- DBST is commonly used in Zimbabwe and has sufficient experience for its maintenance for many years.
- The current road, which has been under construction for about 50 years, has also adopted surface-treated pavement, and although pavement erosion and deterioration can be seen at the edge of the shoulder, the carriageway section is in service under proper management with no

potholes or large-scale surface deterioration.

- Even with consideration of traffic volume, BST has sufficient durability.
- There is concern over fluidization of asphalt concrete (Hot Mix Asphalt, HMA) after application due to possibility that the road surface temperature may exceed 70°C.
- In order to conduct construction while opening existing traffic, it is desirable to use a pavement type that allows immediate traffic opening compared with concrete pavement requiring long recuperation period.
- Since DBST is a pavement type that requires periodic maintenance after service, it should be noted to pay sufficient attention that regular and proper management is essential.

3) Traffic volume and Traffic growth rate

Based on the results of traffic volume survey, the cumulative traffic volume during the planning period of 15 years (up to 2040) was calculated, in consideration of the assumed growth rate during the construction period which is assumed to be completed in 2025.

Table 2-14: Basic data on cumulative traffic load calculation

Traffic volume survey	Measured in Nov. 2021 (Private cars 238, Bus 43, Truck 45, Trailer 529, Total 855)
Growth rate	2022 ~ 2025 = 1.25%, 2026 ~ 2032 = 3.5%, 2033 ~ 2040 = 7.5% (Intermediate value of M/P completed in 2017 by AfDB was set.) , Average during construction period=4.65%/year
Other considerations	Temporary increase of construction vehicles during construction period : taking into account of construction vehicles in 2024, 2025(50 vehicle/day)
Design period	2026 (at the start of service, Traffic volume/day=929) ~2040 (Traffic volume/day=2,027)

Source: JICA Survey Team

4) Design period traffic volume and traffic load

The Vehicle Equivalent Factor (VEF) per vehicle type was confirmed by calculating standard axle load of 8.16 ton (18 kip) converted number based on actual measurement of axle load. The cumulative traffic volume was calculated considering the assumed growth rate during the construction period which is assumed to be completed in 2025 based on the results of the traffic volume survey. Concerning the cumulative traffic load during the planning period of 15 years, as a result of calculating the Equivalent Standard Axle Load (ESAL) up to 2040 from VEF of each vehicle type and the cumulative traffic volume, the traffic load during the design period was calculated as 14.7 million axles (SATC T7 class (10-17 million)). Paving structure was examined upon considering these results and the local material procurement conditions.

5) Axle load survey

In Zimbabwe, allowable load of the large vehicle is set (refer to the table below), however overloaded vehicles are not prohibited to drive and excess charge is collected without unloading instructions for overloaded vehicles. Therefore, the cumulative traffic load calculation was decided to be considered based on actual measurement results.

Table 2-15: Allowable loads by vehicle type in Zimbabwe

Large vehicle type	1	2	3	4	5	6	7
Number of axles	2	3	4	5	6	7	< 7
Max allowable load (ton)	18	26	36	44	50	56	62

Source: DOR Note: limiting axle load=front axle 8ton, rear axle 8~10ton, limiting load per vehicle is shown above.

The results of the axle load survey were used as basic data for pavement design by calculating the 8.2 tonne standard axle equivalent value per vehicle (VEF) for each type of vehicle, such as buses, trucks and trailers. The results of the VEF calculation showed a slight increase in VEF per trailer with 4 or more axles compared to the Phase 1 survey. The pavement design of this project was based on these survey values and the pavement configuration was examined.

Table 2-16: Standard axle load equivalent per vehicle (VEF)

Description	Category	Bus		Truck		Trailer		
		Small	Large	2 Axle	3 Axle	4 Axle	5 Axle	6 Axle
	Type	1	2	3	4	5	6	7
Phase 1 survey	Average VEF	0.19	0.76	5.48	5.48	5.48	5.48	5.48
Phase 2 survey	Average VEF	0.19	0.76	5.48	5.48	6.19	6.19	6.19

Note: VEF = Standard axle equivalent load per heavy vehicle (Vehicle Equivalent Factor).

6) Pavement materials and composition

6-1) Pavement structure of existing roads

The existing pavements are basically constructed according to Zimbabwean pavement standards based on interviews with DOR (see below). The existing pavements on the target road section were confirmed to be generally constructed in accordance with these pavement configurations through trial excavations at the side of the carriageway that were carried out to verify the current condition.

Table 2-17: Existing road pavement configurations (general example)

<ul style="list-style-type: none"> - Surface pavement : Asphaltic concrete (AC) 40mm or DBST - Base course : 150mm, crushed stone or 3% of cement stabilized granular material - Subbase : 150mm, granular material (1st layer) - Subbase : 150mm, granular material (2nd layer) - Subgrade (upper) : 250~300mm, CBR15 - (lower) : 150mm, CBR7~14 - (existing) : 150mm, CBR4~6 - Replacement judgment : less than CBR3 	
--	--

6-2) Pavement specification determination according to SATCC criteria

The applicable pavement surface layer and each pavement layer type for the Project was examined based on the SATCC standard pavement type options by taking into account the condition of the road base of the existing road as identified during the field



Surface= Asphalt treatment (SD, Surface Dressing)
 Base= Granular CBR80
 Subbase= Granular CBR30
 Subgrade= CBR15 (SATCC T7S5 class)

Fig. 2-17: SATCC pavement structure

survey. SATCC has 2 options for the surface layer, surface treatment and asphalt/concrete, and 3 options for the base and subbase course, gravel-mixed granular material, cement stabilised, and asphalt stabilised. For traffic loads in class T7 and subgrade bearing capacity class S5 (CBR 15-29), asphalt surface treatment + 15 cm crushed stone base course + 12.5 cm granular material subbase course is recommended.

6-3) Examination of pavement composition of the project road

Based on the results of trial excavations and bearing capacity checks of the existing road, it is considered possible to meet the design life by adding pavement layer similar to Phase 1 on top of the existing pavement. If a new upper layer is constructed directly on top of the existing DBST surface layer without leaving the existing DBST surface layer or with only partial excavation treatment (grooving), pavement damage may occur due to slippage at the boundary of old and new layers. As the results of the Phase 1 pavement works were satisfactory, it was assumed that the same method would be applied in this project and the type and thickness of each pavement layer would be studied, taking into account cost reduction and environmental impact reduction by making effective use of the good quality existing road base.

Table 2-18: Pavement composition of the existing road and pavement type options in the plan

Item	Existing road	Recommendable pavement option
Surface	DBST	DBST (considering construction and maintenance experience in Zimbabwe)
Base	About 15 cm : Granular	Road rehabilitation by adding crushed stone and granular material above the existing base
Subbase	About 15~30 cm : Granular	Utilisation of existing subbase
Subgrade	About 70~100 cm : Sandy soil	Utilisation of existing subgrade

Source: Survey Team Note: AC = asphaltic concrete.

7) Pavement design

The pavement design for the project utilised the US AASHTO Guide for the Design of Pavement Structures 1993 and Japan pavement standards to identify pavement configurations. The design conditions used for the pavement design are presented in the following sections.

- Design period : 15 years, 2026~2040 (after construction in 2026)
- Design traffic load (W18) : Number of passing equivalent single axle loads (ESAL) converted to 18 kip(kilopounds) during the service life= 14.7 million axles
 Traffic volume→Growth rate→Design traffic volume→
 Coefficient per vehicle→Accumulation during design period

- Reliability (R) : apply 85% from the target road rating (route of great importance), (Standard deviation ZR = -1.037, standard deviation of load and paving strength S0 = 0.40)
- Serviceability index(dPSI) : Initial serviceability index P0 = 4.2 (AASHTO road test results)
Ultimate serviceability index Pt = 2.5 (AASHTO standard value for trunk road)
- Paving course coefficient(a) : DBST a = 0
regenerated base course a = 0.30
Granular material base course a = 0.126 (equivalent to CBR60)
Evaluation of existing base course → section CBR per layer → Evaluated CBR
Recycled base course is assumed to be constructed by stirring; mixing and rolling of cement and asphalt material by on-road recycling machine (CAE, CFA construction method etc.)
- Subgrade resilient modulus (MR) : 22,500 (equivalent to CBR15)
Evaluation of existing sub grade → maximum CBR32, minimum 15, applied CBR = 15 (Taking the risk of overestimation into account, the minimum value was set)
- Drainage coefficient(m) : Base course m = 1.0, Sub base course m = 1.0 (There was no groundwater level at any point up to 1.5 m in depth, general value was set.)

Based on the above design conditions, the pavement structure was studied taking into account the ground bearing capacity of the subject road, regional characteristics (presence or absence of water retention during the rainy season) and the assumed cumulative traffic load (T7 class). A configuration of 2-layer asphalt surface treated surface layer, roadway recycled base course and granular material subbase course was selected as the preferred pavement structure for the project (see diagram above). In order to validate the above pavement plan, the results of a comparison check between the US standard (AASHTO) and the Japanese pavement standards are shown below.

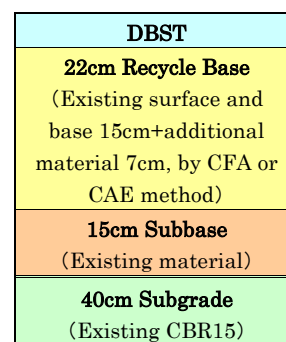


Fig. 2-18: Recommended pavement structure

Table 2-19: Confirmation of pavement composition

Layer	Material	Thickness(cm)	AASHTO		TA method	
			Layer coefficient	Structure index (SN)	Equivalent coefficient	TA value
Surface	DBST	3	0	0	0	0
Base	Regenerated base course	22	0.30	2.598	0.65	14.3
Subbase	Granular material	15	0.13	0.768	0.25	3.75
Total			a. Total SN	3.366	a. Total TA	18.05
			b. Necessary SN	3.342	b. Necessary TA	17.00
Judgment			$a \geq b$	OK	$a \geq b$	OK

Source: JICA Survey Team Note: Design of Subgrade CBR=15 (40cm thickness)

(5) Drainage plan

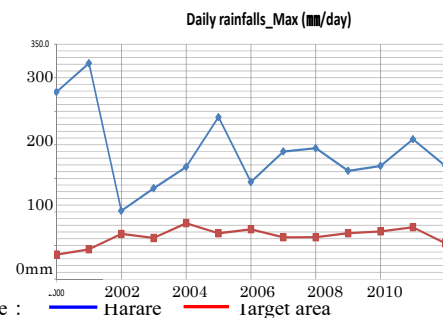
1) Policy of Drainage plan

The drainage plan was based on the design policy of the Phase 1 design, and improvement measures were considered and worked out for the issues raised during Phase 1. For the existing cross-sectional drainage facilities, the condition of the culverts and flow capacity were checked, and the policy was to utilise the existing structures as much as possible, and the study was based on extension and improvement in conjunction with widening and alignment modification due to road improvement.

2) Rainfall amount

The maximum daily rainfall in the target areas is usually less than 100 mm, which is less than half that of Harare City, and the area has relatively low rainfall in Zimbabwe.

Table 2-20: Ddaily rainfall in Harare and target areas



3) Existing drainage facilities

The drainage facilities targeted by the project are those 7.8 km from the completed Phase 1 improvement point in the direction of Harare.

Table 2-21: Overview of existing cross-drainage facilities

Se-tion	Box culvert		Pipe culvert						Total (Nos.)
	1x1.5*3m	2x1.5*3	600	900	950	2x900	3x900	2x950	
298.7 - 306.5km	1	2	31	4	1	4	1	1	45
Share	2%	4%	70%	9%	2%	9%	2%	2%	100%

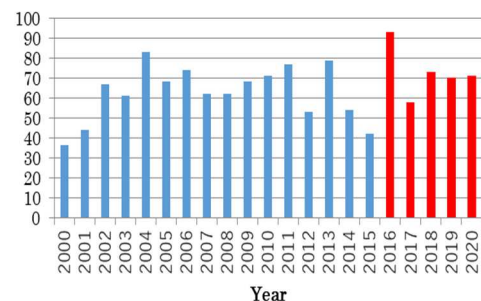
Source: Survey team

4) Confirmation of the flow capacity of existing cross-sectional drainage facilities.

4-1) Calculation of rainfall intensity

The rainfall intensity was calculated using observed data (maximum daily rainfall) around the target area obtained from the field survey. The data obtained are shown in the table on the right (lit-le changed from the rainfall data during the Phase 1 project).

Table 22: Maximum daily rainfall(2000~2022)



- Data observation period: May 2000 - Dec 2020.
(Data for 2000-2015 were obtained during Phase 1).
- Data observation location: Kariba Airport

Based on the above observed data, design rainfall intensities were calculated using the Gumbel formula and the Log peason3 (LP3), which is the design rainfall intensity in Phase 1, and the formula in the Zimbabwean design manual Part JD. The calculation results are shown in the Table below. In determining the design rainfall intensity, each calculation method was compared, and the

highest value was adopted.

Table 2-23: Rainfall intensity by probability year (mm/hour)

Return Period	1/2	1/5	1/10	1/20	1/25	1/50	1/100
Gumbel	71	86	96	105	108	117	126
Log Pearson Type3	75	88	93	98	99	102	104
Zimbabwe Standard	-	54	-	-	69	80	87

Source: JICA Survey Team Note: Zimbabwe Standard : calculation with L=5000 km, riverbed slope I= 2% using calculation formula described in design manual "Part JD"

The return period was discussed by meeting with DOR as there is no description in the design manual of Zimbabwe and SATCC and the following return period was selected to each drainage facility type.

Table 2-24: Design planning years of drainage facilities

Drainage facility	Return Period	Rainfall intensity	Reference (Japanese standard)
Roadside ditch	5years	82 mm/h	3years
Cross-sectional drain	20years	99 mm/h	5~30years※

Source: JICA Survey Team Note: Japanese standards: return period will be decided according to the importance of drainage facilities.

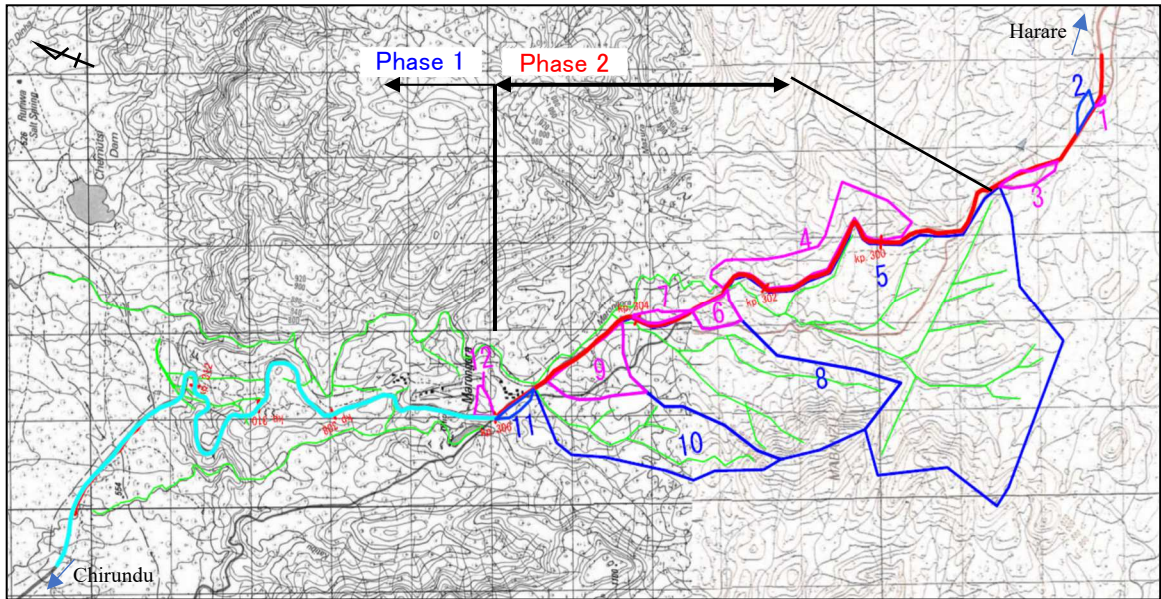
4-2) Catchment area classification

The target road section (291.0-306.5 km) is divided into 12 catchments, which are estimated to total around 14.03 km². Some of the 74 existing culverts identified have very narrow catchments (less than 0.01 km²). Therefore, the culverts were divided into 12 catchments that could be regarded as the same catchment area to some extent based on their location, flow direction and road alignment, and the possible runoff volume was checked using the total water flow cross-sections.

Table 2-25: Outline of catchment area

Catchment area No.	Area (km ²)	Existing Culvert (Nos.)	Calculated Runoff (m ³ /sec)	Catchment area No.	Area (km ²)	Existing Culvert (Nos.)	Calculated Runoff (m ³ /sec)
1	0.01	1	0.3	7	0.06	6	1.7
2	0.05	1	1.4	8	3.21	2	29.8
3	0.09	4	2.5	9	0.52	7	13.3
4	0.85	20	21.3	10	1.76	1	21.7
5	7.24	2	79.6	11	0.05	3	1.4
6	0.15	4	4.0	12	0.06	1	1.7

Note: Existing double culverts are listed per Cell (different from the number of locations). Planned discharge = discharge x 1.2 (safety factor) m³/sec. Watersheds 1-3 are outside the project scope.



Source: Survey team

Fig. 2-19: Drainage catchment area

4-3) Calculation of Runoff flow

The manual of Zimbabwe indicates the calculation method of the runoff flow using "Rational Formula". On the other hand, when applying rational formula to large catchment area, it is possible that a deviation may arise between the actual situation and calculated result. Therefore, "for drainage facilities with relatively large catchment area, the runoff flow was calculated using "The Standard Design Flood (SDF) method (modified rational formula). The calculation results of each catchment area size and runoff flow are shown below.

- Roadside ditch : Rational Formula
- Cross-sectional drainage facility : The Standard Design Flood (SDF) method (modified rational formula)

$Q = \frac{CIA}{3,6}$	where:	Q	=	peak flow (m ³ /s)
		C	=	run-off coefficient (dimensionless)
		I	=	average rainfall intensity over catchment (mm/hour)
		A	=	effective area of catchment (km ²)
		3,6	=	conversion factor

➤ Difference between rational formula and modified rational formula

The above formula is used as the basic "alculation method for both formulas, but according to the modified rational "ormula, each value of "C: run off coefficient, I: average rainfall intensity, A: area of catchment " will be calculated taking the coefficients into consideration in order to fit the actual situation.

4-4) Calculation of the Discharge Capacity

The discharge capacity is calculated using the following Manning formula.

Formula :	$Q = \left(\frac{1}{n}\right) \times A \times R^{\frac{2}{3}} \times S^{\frac{1}{2}}$		
R:	Hydraulic mean depth (m)	Q:	Capacity of flowing (m ³ /s)
S:	Drainage slope (%)	A:	Sectional area of flowing of drainage facility (m ²)
n:	Manning coefficient		

4-5) Confirmation of the discharge capacity of existing facilities

The results of the flow calculations confirm that the dimensions of the existing cross-sectional drainage facilities are adequate for the flow capacity. Therefore, the project is planned to extend the existing facilities without rehabilitation and widening of the existing structures or construction of new ones (see table below).

Table 2-26: Flow capacity of existing facilities

Catchment Area	Size	Number of barrels	Cross-section Area		Hydraulic Radius	Slope	Roughness coefficient	Velocity of flow	Capacity		Peak Flow
			A (m)	S (m)							R=A/S (m)
12	φ 600	1	0.283	1.885	0.150	13.0	0.012	8.482	2.400	>OK	1.527
11	φ 600	2	0.565	3.770	0.150	6.0	0.012	5.763	3.256		
	φ 900	1	0.636	2.827	0.225	6.0	0.012	7.551	4.802		
	Total	3							8.058	>OK	1.231
10	B3000×H1500	1	4.500	6.000	0.750	1.0	0.013	6.350	28.575	>OK	23.721
9	φ 600	3	0.848	5.655	0.150	6.0	0.012	5.763	4.887		
	φ 900	4	2.545	11.310	0.225	6.0	0.012	7.551	19.217		
	Total	7							24.104	>OK	14.540
8	B3000×H1500	2	9.000	12.000	0.750	1.0	0.013	6.350	57.150	>OK	32.610
7	φ 600	6	1.696	11.310	0.150	4.0	0.012	4.705	7.980	>OK	1.822
6	φ 600	2	0.565	3.770	0.150	3.0	0.012	4.075	2.302		
	φ 900	2	1.272	5.655	0.225	3.0	0.012	5.340	6.792		
	Total	4							9.094	>OK	4.407
5(4)	B3000×H1500	2	9.000	12.000	0.750	3.0	0.013	10.998	98.982	>OK	86.920
4	φ 600	14	3.958	26.389	0.150	5.0	0.012	5.261	20.823		
	φ 900	3	1.909	8.482	0.225	5.0	0.012	6.893	13.159		
	φ 950	3	2.126	8.954	0.237	5.0	0.012	7.136	15.171		
	Total	20							49.153	>OK	23.265
3	φ 600	3	0.848	5.655	0.150	5.0	0.012	5.261	4.461		
	φ 900	1	0.636	2.827	0.225	5.0	0.012	6.893	4.384		
	Total	4							8.845	>OK	2.694
2	φ 600	1	0.283	1.885	0.150	6.0	0.012	5.763	1.631	>OK	1.527
1	φ 600	1	0.283	1.885	0.150	6.0	0.012	5.763	1.631	>OK	0.322

Source: Survey team Note: Catchments 1-3 are outside the project scope

5) Roadside ditch

Soil ditches or concrete masonry ditches on the cut side, chutes and asphalt kerb at the pavement edges on the fill side and masonry ditches from the mountain side have been identified on the existing roadside. In this project, the application of roadside ditches and longitudinal ditches with concrete structures was examined to ensure that they do not cause waterway dysfunction due to vegetation.



Photo: Phase 1 maintained ditches

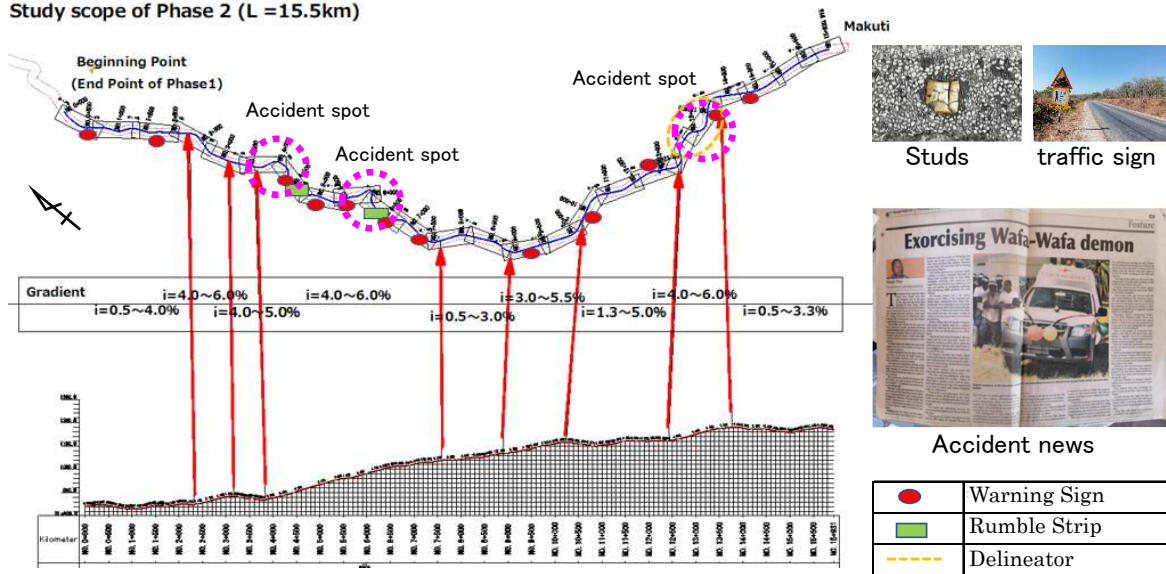
(6) Road ancillary facilities-plan

1) Existing road ancillaries

A survey of existing road safety facilities in 15.5 km (306.5 km - 291 km) between the start of Phase 1 and Makuti was conducted in October-November 2021. The 15.5 km survey section had some facilities on the existing road, including 12 traffic signs, 3 rumble strips and several road surface reflective studs, but the reflective studs were damaged and there were few road surface

markings. There are "Wafa-Wafa" points in the target road section of the road, which have a very high number of accidents, as reported in the local newspaper in October 2021, and these have been de“ignat”d as problem areas that should be improved as soon as possible (Wafa is a local word meaning "death").In addition, in order to reinforce the main objective of the project, which is to improve safety by improving the alignment, etc., the types, patterns and locations of warning facilities such as a combination of traffic signs, road surface markings and rumble strips, and accident damage reduction facilities such as guardrails were considered to be effective measures for accident prevention.

Study scope of Phase 2 (L =15.5km)



Source: Survey team Fig. 2-20: Existing safety facilities and accident spots

2) Accident history and cause interviews and countermeasures

In order to confirm the details of road accidents that occurred in the surveyed section, the number of accidents by cause for the 5 years from 2016 to 2020 was obtained from the local police to show the causes of the accidents, the number of accidents by cause and the points to note on accident countermeasures by the survey team.

Table 2-27: Causes and number of road accidents

Cause of accident	2016	2017	2018	2019	2020	Total	Share
1. Vehicle failure	5	3	4	7	4	23	9%
2. Excessive speed	9	7	1	9	7	33	12%
3. Overtaking	4	1	2	5	4	16	6%
4. Bad road	22	14	10	25	17	88	33%
5. Misjudgement	19	7	17	12	22	77	29%
6. Road markings	0	0	0	0	0	0	0%
7. Road obstruction	2	1	5	4	3	15	6%
8. Animals	3	2	3	3	4	15	6%
Total (Nos.)	64	35	42	65	61	267	100%

Source: Interviews with local police

Table 2-28: Major causes of road accidents and points to note for countermeasures

Cause of accident	Share	Notes
4. Bad road	33%	The most common causes of accidents can be improved by improving the alignment, ensuring adequate road widths and road pavements.
5. Misjudgement	29%	Improved visibility through alignment improvements and sight distance widening would improve visibility.
2. Excessive speed	12%	Accidents are driver-dependent, and alignment improvements that reduce speed are undesirable.
3. Overtaking	6%	Improved by installation of additional lanes.
6. Road marking	0%	Although the cause of accidents is zero, the number of these installed is small and may be a contributing factor to the occurrence of the above-mentioned accidents.

Source: Survey team

3) Safety facility study for speed control

The target section passes through undulating terrain connected to a mountainous area, which means that vehicles can easily reach very high speeds, especially when passing on steep downhill slopes, and thus there is a high risk of accidents occurring. In this project, the following safety measures were studied as further safety measures, as well as improving the alignment (improving the horizontal alignment and increasing visibility by widening the sight distance) with the aim of reducing the number of accidents.

3-1) Analysis for effective establishment of facilities

A common speed control measure in Zimbabwe is to install only one warning sign before the curve, but in this project, the location of warning signs was examined on the basis of driver reaction time. In addition to visual warning signs, a rumble strip, which gives the driver a sense of warning by vibration, was also installed to provide an effective measure to control speed. Various literatures indicate that the brake operation reaction time is around 0.3 to 2.3 s (refer fig. right). Based on these results, the reaction time for brake operation was assumed to be 3 seconds and calculated for design speeds of 40 km/h and 60 km/h on the Project section. The driving distance of the detection of a hazard and the braking operation is 33 m at a design speed of 40 km/h and 50 m at a design speed of 60 km/h. Therefore,

since the road design uses many transition curves and the length of the transition section is 50 m, one warning sign and rumble strip should be installed at the start of the transition section. In addition, as the cause of the accident suggests that the warning signs were not recognised, the following safety facilities were planned to encourage drivers to control their speed by installing preliminary warning signs to make drivers aware of the curve in advance.

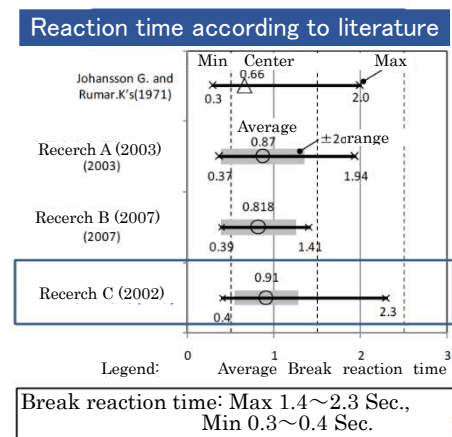
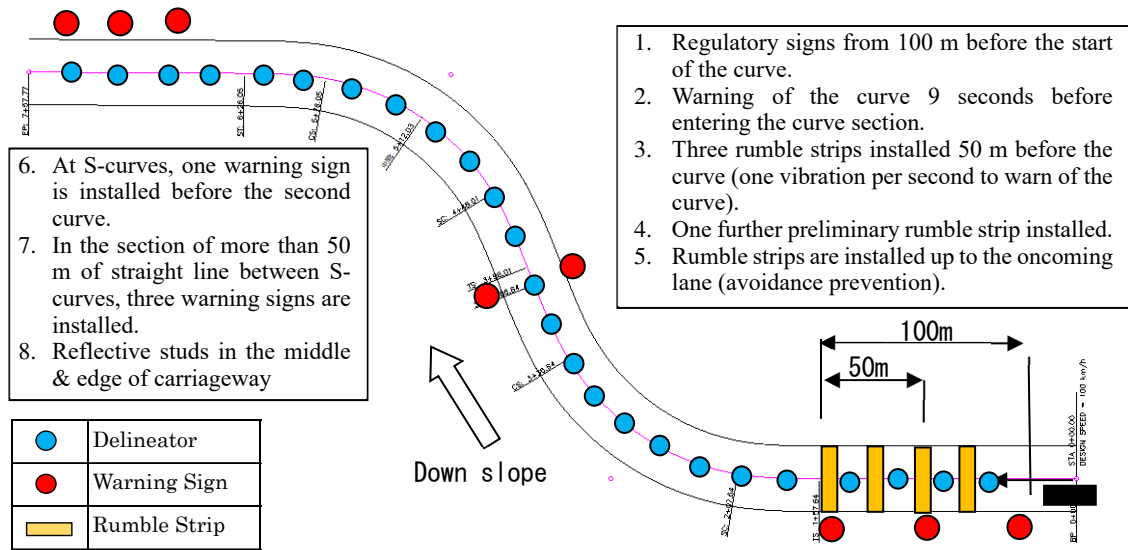


Fig. 2-21: Brake operation reaction time



Source: Survey team Fig. 2–22: Layout plan of safety facilities for speed control measures

4) Road incidental facilities

In the target section, brake marks on road surface and wreckages of accident cars beside the road are remarkable especially in spots where the road is downslope and straight which is followed by steeply curve. For these problematic linear shapes such as broken back curve with a short straight line in the curve, linear improvement such as replacement of straight section by compound curve, warning facility by combination of traffic signs, line markings, full width installation of rumble strips, and the types, patterns, installation locations that will be effective measures for preventing accidents, such as accident damage reduction facilities such as guardrails, protective walls and sand traps, has been studied. Similar examples of safety measures are shown below.



The installation plan has been considered so as not to cause deterioration in visibility due to dense growth of vegetation in the rainy season. Also, in order to ensure traffic safety during nighttime and rainfall, the installations of reflective studs at the center and both ends of the carriageway and sight guide facilities on retaining walls and guardrails, are considered. Furthermore, as the road is mainly used by heavy vehicles for long-distance logistics from major ports in Southern Africa to landlocked countries over 2,000 km, the study was conducted to ensure that these road users are also taken into consideration.

Table 2-29: Safety facilities

Facility name	Installation location	Remarks
Guardrail	Filling section (higher than 4m spots)	The target section is a mountainous area, and it will be a serious accident if a vehicle deviates outside the road. And many of accidents in the present situation also are caused by deviation of vehicles to the outside of road and therefore installation considered to prevent deviation of the vehicle.
Sight guide marker	10m before guardrail installation section	In the section where there is a difference in height between the road and outside of the road other than the above guardrail installation section, sight guide markers are installed for improvement of visibility of road linear and safety.
Road markings	Carriageway area	Clear lane indication.
Road stud	Center and both sides of carriageway (all stretch)	Safety is improved from day and night by installing road studs in addition to the above-mentioned sight guide marker.
Warning sign	Before steep slope section and continuous curve section	Warning signs are installed to alert drivers. (Steep slope section, continuous curve section, design speed change section)
Rumble strip	Down slope before the design speed change point (0.6, 3.2, 4.2km)	From the start point to the end point, the speed is likely to be exceeded because of the continuous downhill slope. Particularly in the section where the design speed changes by 40 km / h, there is a concern that the traveling speed exceeds the design speed, therefore rumble strips are installed at down slope before the design speed change point..
Falling rock protection wall	Cut slope where there is a risk of overturned stones	Prevention of falling rocks and boulders onto the carriageway

Source: Survey team

(7) Others

1) Unsuitable soil countermeasures

Looking at the whole northern section of the North-South Corridor, there is pavement deterioration across the pavement width, which is considered to be due to subgrade part in a part of the section. These were considered to be caused by low-lying and/or high groundwater level, and DOR engineers explained that the problem occurred remarkably in the vicinity of "Mopani tree" growing area. On the other hand, these deteriorated road surface characteristics are not observed in the Phase 2 section, and no soft soil or high groundwater table has been identified in the roadside test excavation results, so large-scale defect replacement, etc. is not envisaged in this project. However, spot pavement roughness is observed on the valley side of the road sag and curve sections, so the area around the spots with weak bearing capacity identified in the Benkelman beam survey will be re-assessed in accordance with the relevant standards during detailed design, and action will be considered if necessary.

2) Obstructing facilities

Obstructions around the target road include electric cables and old telephone lines at ground level along the existing road, and fibre optic cables underground where two lines (32 mm HDPE sleeves) of 'LiquidTelecoms' are buried at a depth of about 1.2 m at the edge of the existing carriageway . and The cables will be relocated as necessary needed. The fibre cable has a contract with the DOR for voluntary removal by the contractor. In addition, one water pipe crossing the road



Photo: Existing fibre cable

has been identified near the staff residential area of the park management office. As these obstructions were dealt with smoothly by the Zimbabwean side in Phase 1 with very limited response and cost, it is expected that the same response will not cause any problems in Phase 2. Therefore, the Zimbabwean side will be notified of the extent to which buried objects and overhead lines that will be an obstacle to the project will be dealt with, based on the results of Phase 1 of the project.

2-2-3 Outline Design Drawing

The outline design drawings prepared based on the basic plan are as indicated below. The drawings are attached to the appendices.

Table 2-30: List of Outline design drawing

Item	Contents of drawing	Number of drawings
1	Horizontal and longitudinal plan drawing	12
2	Road standard section drawing	1
3	Incidental facilities structural drawing	5

Source: Survey Team

2-2-4 Construction implementation planning/procurement planning

2-2-4-1 Implementation Policy

Since the Project will be implemented under the grant aid scheme of the Government of Japan (GOJ), the following points have to be taken into consideration as a guideline for construction.

- ① Formulate the construction method and construction schedule in reflection of the local natural conditions such as weather, terrain and local features (Inside Safari Area) and current traffic conditions on the target road.
- ② In consideration of maintenance capacity on the Zimbabwean side, adopt common construction methods that do not require special construction machinery or technology following construction.
- ③ In compiling the construction plan, give ample consideration to the social environment and traffic safety.
- ④ Utilize locally procurable materials as much as possible in order to contribute to vitalization of the local economy.

2-2-4-2 Implementn Conditions

The contractor needs to pay attention to the following and implement construction.

(1) Adherence to Labor Standards

The contractor will comply with appropriate labor conditions and customs in line with employment based on the existing construction legislation in Zimbabwe (Labour Act [Chapter 28:01]) , and will strive to prevent disputes with workers and secure safety during the works period.

(2) Social and environmental consideration during the construction period

- ① Select construction methods with a view to minimizing dust and particulate, etc.
- ② Establish plants, etc. that generate noise and dust away from inhabited areas.
- ③ Transport waste materials that arise as a result of construction to an appropriate site that does not affect surrounding environment for landfill disposal, etc.
- ④ Appropriately treat wastewater discharged from plants according to Zimbabwean standards.

(3) Securing of safety during construction

- ① Since lane control will be required during construction, establish safety facilities (barricades (including concrete block etc.), colour cones, revolving lights) and assign traffic controllers.
- ② Install signs that indicate not to enter in construction site and construction information boards to ensure safety and prevent occurrence of troubles with third parties.
- ③ In order to prevent damages on personnel and workers by wild animals, arrange or accompany an adequately equipped park ranger at the construction site (Rangers' costs are borne by the Zimbabwean side).

(4) Need for means of communication on site

Since mobile phones can be used on the Project section, it has been decided to let construction personnel carry mobile phones. Moreover, traffic controllers will carry portable transceivers, and a traffic safety management system to ensure the safety of general traffic and local residents will be established.

(5) Observance of local customs

A construction time schedule in accordance with the local religious customs (e.g., Christmas holiday, etc.) and daily habits will be considered when formulating the construction plan.

(6) Customs clearance

The construction plan will be formulated upon considering the number of days required for importing, unloading and clearing customs, etc. (Approx. 60 days from Japan, 20 days from South Africa) .

(7) Land acquisition

The Client secures an appropriate land before the tender pre-qualification (PQ) public notice and the consultant confirms the situation and goes to the PQ procedure if all necessary issue completed.

(8) Coordination of construction time schedule

The consultant will verify sufficiently and coordinate the implementation policy of works by Zimbabwean side. Also, if Zimbabwean side relocates obstructing facilities in accordance with this construction, the relocation process and its implementation policy will sufficiently be verified and coordinated.

(9) Pos of attention in the construction plan

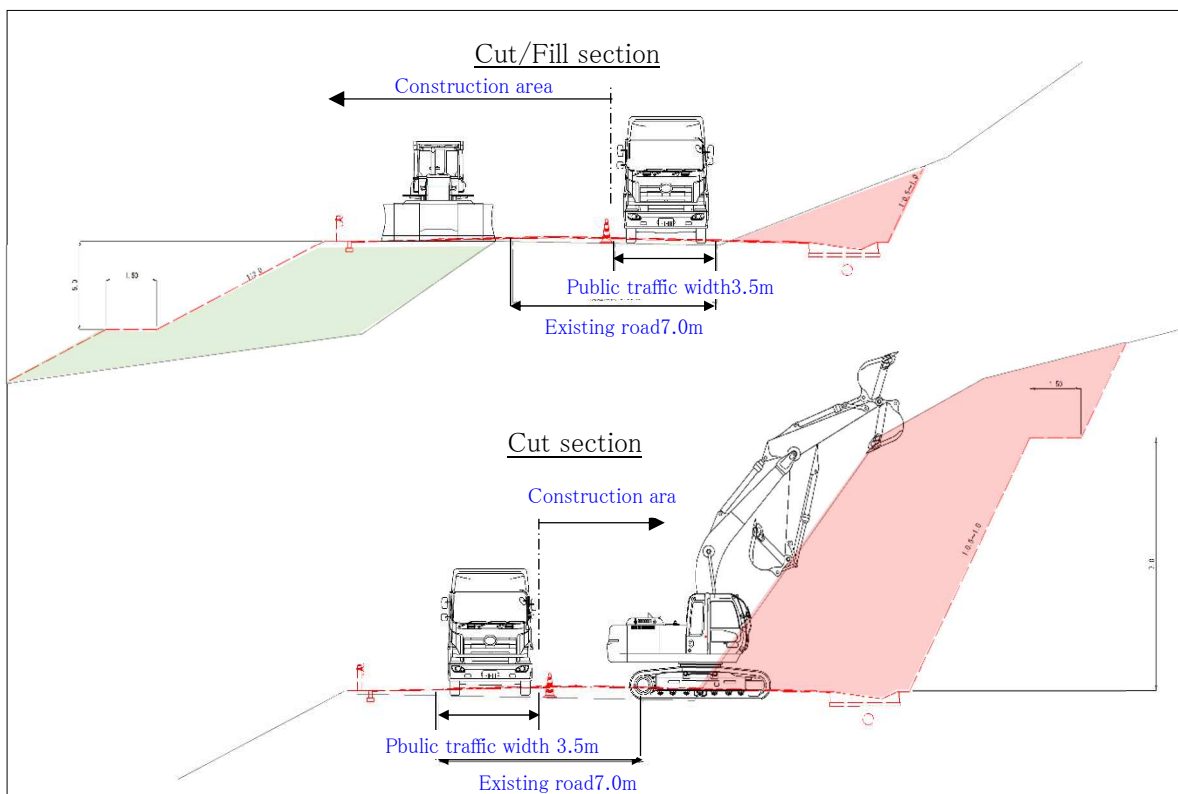
Considerations on the construction plan are shown below.

1) Securing of current road traffic

The target road is the main route of logistics from Southern Africa to Zambia and other inland countries, and there is a lot of trailer traffic, and it is difficult to close vehicular traffic. Therefore, although it is necessary to proceed with construction while securing these traffic, since the target section is a steep topography with many narrow sections where providing detour road is difficult, construction will be implemented while securing current road traffic by one-side alternate traffic control (minimum width of 3.5m, which is half of the current road width of 7.0m).



Photo: Difficult to put detour



Source: Survey team

Fig. 2-23: Image for public traffic management during construction

2) Working hours

Since many wild animals are nocturnal, from the viewpoint of consideration (noise) to wild animals and securing the safety of construction workers, the time zone in which various constructions are

permitted within the safari area is limited from 7: 00 to 17: 00. Therefore, from evening to early morning, the construction machinery and materials etc. are moved to construction machinery storage place in the secondary camp yard. For the possibility of nighttime construction, confirmation and consultation with related organizations are necessary.

3) Regulation related to construction

Although there are no clearly stipulated regulations on construction in the Safari Area, prior consultation with Parks and Wildlife Management Authority (PWMA) is necessary. Since it is confirmed that distribution of soft rock and granular material from the result of geological survey, blasting work is not assumed, however in case of blasting work in rock excavation, permission of “Ministry of Mines and Mining Development” is necessary.

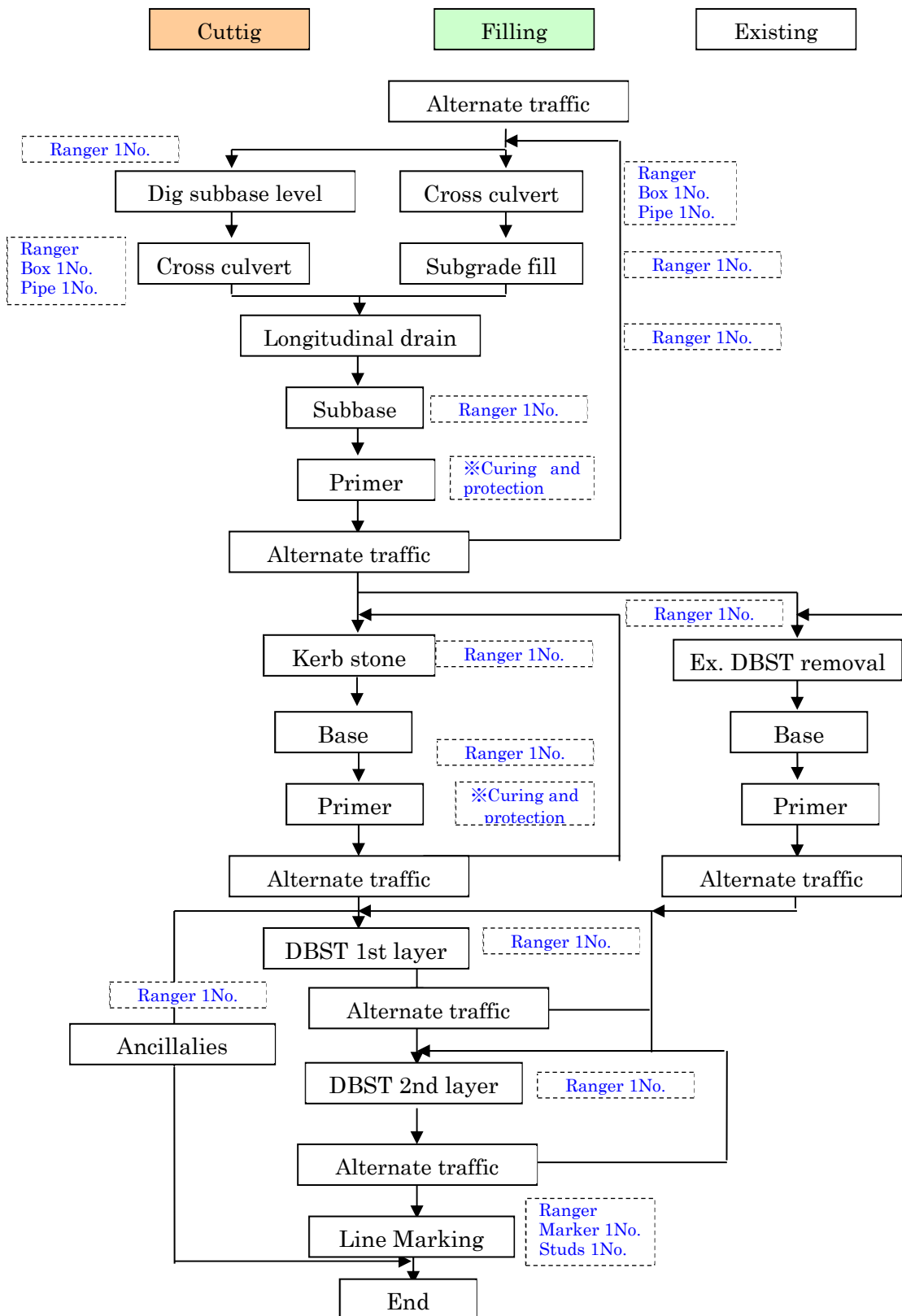
4) Rainfall influence

It rains almost daily during rainy season, but mainly in the afternoon with short rainfall time and temporarily strong but the amount of rainfall is small. And there is no water stagnation in the target section due to the mountainous topography.

5) Construction order

The flow of construction order reflecting the above items is shown below Figure.

Basically, in this plan, the widening of the road will be implemented by cutting the mountain side of the current road. About 7.8km target section, there are large and small stream in which 44 cross drainage structures are installed such as 0.6m pipe culvert to 2.0m x 1.5m 3 cells box culverts. The cross drainage structure of that part needs to be extended along with the widening of the road. In addition, since it is assumed that the filling is to be implemented using excavated material generated by the cutting area, the cross drainage structure of the filling section will be extended to a predetermined length preceding the filling, and that of the cutting section will be extended after cutting work. Furthermore, since construction is carried out with current road traffic as one-way alternate passage, one side construction on the same side will be implemented in continuous cutting and filling sections. (for example, when cutting the right side bank towards the end point, continuous filling will be implemented on the right side.). When construction is carried out by work teams, it is necessary to assign rangers belonging to the PWMA shown in the Fig. for each type of work to prevent harm from wild animals. In addition, if multiple teams are constructing at the same time, the number of rangers needs to be increased in proportion to the construction area.



Source: Survey team

Fig. 2-24: Construction sequence flow

2-2-4-3 Scope of Works

The works to be undertaken by the Japanese and Zimbabwean sides during the Project are outlined below.

(1) Scope of work by Japan

1) Construction work

Upgrading of existing road over the target section of approximately 7.8km.

- Temporary installations and main structural works for road upgrading (earth works, Base/Subbase works, binder course and surface course works, drainage structures, road auxiliary facilities, etc.)
- Temporary installations and removal (Main camp yard, second camp yard, construction machinery storage place etc.)

2) Procurement of labor, construction materials and equipment

Procurement of the labor, construction materials, equipment and machinery for road upgrading

3) Safety measures

Safety management and measures concerning execution of the construction works

4) Consulting service

Detailed design, soft component, drawing up of tender and contract documents, assistance for tender, and supervision of works

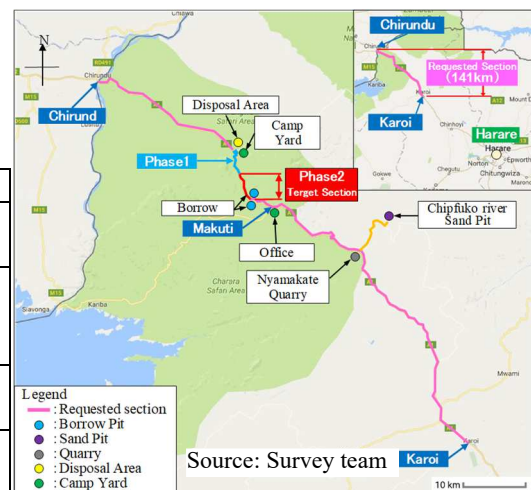
(2) Scope of work by Zimbabwe

1) Securing of land acquisition

The Zimbabwean side will secure the road right of way (ROW), land necessary for facilities such as camp yards, etc. given in the “Work execution plan,” and site for disposal of construction waste materials and surplus soil.

Table 2-31: Potential quarry and borrow pit

Item	Location	Note
Aggregate	Nyamakate quarry	Granitic, 42 km away
Sand	DOR pit (Nyamakate area, Chipfuko river)	55km away
Soil	DOR pit, near 296km	Laterite
	DOR pit, near 298km	Laterite



2) Customs clearance and procedure for tax exemptions

Provision of conveniences and prompt implementation to facilitate customs clearance and tax exemption in Zimbabwe based on the list of imported equipment and materials of works prior to commencement of the construction works

3) Relocation of public facilities

- Relocation of obstructing facilities (water pipes, telephone cables, power line, underground fibre cable etc.)

- Assignment of Zimbabwean supervisory staff and securing of expenses for the relocation work

4) Others

- Provision of conveniences to facilitate immigration, execution of works and stay, etc. of Japanese engaged in implementation of the Project
- Appointment of counterpart and securing of personnel and expenses
- Securing of expenses for personnel of Parks & Wildlife (Assignment of rangers during implementation of detailed design and construction works)
- Registration of companies and engineers to ENGINEERING COUNCIL OF ZIMBABWE (Contractor, Consulting Company)
- EIA examination fee (1% of project cost assumed)
- Support for opening project-related bank accs and receiving remittances in Zimbabwe

2-2-4-4 Detailed Design and Consultant Supervision Plan

(1) Implementation of consulting service

In implementation of the Project, it is premised that exchange of letters (E/N) concerning Grant Aid for this project will be concluded between the Governments of Japan and Zimbabwe, followed by Grant agreement (G/A) which will be concluded between JICA and GOZ. After concluding the E/N and G/A, the consultant will conclude a consulting contract with DOR which is executing agency of GOZ in accordance with the scope and procedure of Japan's grant aid based on the recommendation letter issued by JICA. After concluding the contract, detailed design, tender assistance work and construction supervision will be implemented. Below are the main service contents included in the consulting contract.

1) Detailed design stage

- Conduct a detailed survey of the existing conditions of the subject section, including confirmation of road surface bearing capacity for utilization of the existing pavement, sampling/indoor testing, confirmation of sediment/rock at the assumed cut, and confirmation of the ground at the location of the structure, to supplement and add to the basic design.
- Supplement and add detailed drawings.
- Review the design by reconfirming the basic conditions, checking the adequacy of the specifications, and examining the drawings and quantity calculations.
- Prepare bid documents such as detailed design drawings, specifications and bills of quantities.
- Obtain approval of the bid documents from the responsible/implementing agency.

2) Tender stage

The DOR, assisted by the consultant, selects a Japanese national construction contractor through a public competitive bidding process. The Zimbabwe Government's representative in this tender and contract should be an approving authority for the contract and a person who is competent in the technical field. The assistant consultants' tasks at the tender stage are as follows.

- (i): pre-qualification; (ii) tender publication; (iii) tender and tender evaluation; (iv) contract

conclusion.

- Provide technical support for bidding, bid evaluation, and contract negotiation conducted by the responsible/implementing agency.
- Report the results of the bidding, etc. to JICA.

In this plan, the following item setting is considered necessary in the Prequalification (PQ) as a requirement for contractors who can bid on the project, based on the characteristics of the anticipated construction work.

- ① Confirmation of financial and business conditions and construction results
- ② Have a track record of road construction and pavement work in natural conditions similar to those of the proposed project.
- ③ Have a track record of construction work under site conditions (mountain roads, rock excavation, construction methods, etc.) similar to those of this plan.
- ④ Have qualifications or similar experience as a pavement construction management engineer or pavement quality management engineer.

3) Consultant's on-site construction supervision structure

After the contractor contract is signed, the consultant issues instructions to the contractor to start construction and is stationed on site to start construction supervision work. The construction supervision work includes reporting on the progress of the construction work to the Zimbabwe side and providing the contractor with information on work progress, quality, safety and payment, as well as improvement measures and suggestions regarding the construction work. In addition, regular reports are made to the Embassy of Japan in Zimbabwe and the JICA Zimbabwe office. Furthermore, a completion (defect) inspection is carried out one year after the completion of construction supervision.

- Verify the quality, workmanship, progress, and safety control of the work in accordance with the contract, and report to the executing agency and JICA on a periodic basis.
- Serve as the secretariat for the quality control meetings periodically organized by the executing agency (attendees are the executing agency, JICA, the contractor, and the consultant).
- Monitor unit price trends of specified materials every three months and report the results to the implementing agency.
- Conduct piecemeal inspection on the request from the contractor and report the results to the executing agency and JICA.
- Conduct a final inspection on completion of the project and report the results to the implementing agency and JICA.
- Conduct a defect inspection one year after completion of the project and report the results to the executing agency and JICA.

Upon completion of the contractor selection, the contractor shall promptly submit a construction plan (including safety measures plan and safe construction plan) to the Consultant and be reviewed. At the beginning of construction, based on the contractor's construction plan and the consultant's

construction supervision plan, key items such as construction period, construction method, construction supervision method, specifications, quality standard range (allowable values and acceptable lines), frequency of confirmation, and completion criteria shall be confirmed. In addition, the scope of responsibility of the client (site, removal of obstructions, provision of various facilities, response to related organizations, etc.), the scope of responsibility of the contractor (achievement of quality, workmanship, and construction schedule), and the scope of responsibility of the consultant (design and specification setting, and recommendations to the client on matters requiring contractual judgment during construction) are summarized in a construction management standards document. The client, consultant, and contractor (three parties) agree on the scope of responsibility and sign the document (revisions to the document are agreed upon through consultation among the three parties). With regard to the specifications to be applied to the construction in this plan, the contractor shall confirm whether or not there is a possibility of defects, and if a possibility is considered, the three parties shall confirm and determine the specifications after reviewing and confirming a plan for dealing with the problem in advance. If the contractor has any doubts about the determined specifications after the start of construction, reasonable proof regarding the doubts shall be promptly provided by the contractor and reported to the Consultant. The consultant will convene a three-way conference to review the contract provisions and coping actions.

2-2-4-5 Quality Control Plan

The project plans to conduct regular quality control meetings between DOR, consultant, contractor and JICA with the aim of ensuring construction quality. The meetings will be organised by the DOR and the consultant will assume the secretariat function. The following items will be reviewed and discussed.

- i) Information sharing on design concepts and construction considerations.
- ii) Confirmation of measures necessary to ensure construction quality.
- iii) Confirmation of draft measures for construction safety management by the consultant and the contractor, and request to the DOR for necessary measures
- iv) Technical discussions on design changes
- v) Confirmation and consultation on handover (including partial handover) and completion inspections
- vi) Checking of progress and facilitation of implementation (if necessary) for the fulfilment of the items to be borne by Zimbabwe side.

The contractor establishes a test room in the camp yard and procures quality control test equipment for materials necessary for construction work such as soil quality, crushed stone, asphalt material, concrete material, etc., and conducts related tests. The main quality control items associated with the construction of the Project are shown in the table below. The consultant confirms the test results of the contractor and let them ensure that they achieve the construction quality as described in the contract.

Table 2-32: Lists of items of quality control

Item		Test method	Test frequency	
Base course (granular material)	Mixing material	Liquid Limit, Plasticity Index	every mixture	
		Grain Size Distribution		
		Aggregate Strength Test		
		Unconfined Compression Test (Regeneration Method Material)		
		Compaction Test		
Laying	Density Test (Compaction Rate)	1time/day		
	Pavement Thickness	By Spec./ standards		
Prime coat	Material	Bituminous material	Quality Certificate	
		Temperature and amount during storage / spraying	Every material	
Pavement surface	Material	Bituminous material	Quality Certificate/Component Analysis Table	
		Aggregate	Grain Size Distribution	every material
	Water Absorption rate		Every mixture, 1time/Month	
	Aggregate Strength Test		Every material	
	Paving installation	Bitumen Spraying Amount	By Specification standards	
		Crushed Stone Spraying Amount	By Specification standards	
		Spreading, levelling, and rolling	As required	
Concrete	Material	Cement	Quality Certificate, Chemical / physical test result	
		Water	Component Test Results	
		Admixture	Quality Certificate/Component Analysis Table	
		Fine aggregate	Absolute Dry Specific Gravity	Every material
			Grain Size Distribution, fineness modulus	
			Lump of Clay, Soft Mote Rate	
		Coarse aggregate	Absolute Dry Specific Gravity	Every material
			Grain Size Distribution	
		Compounding test time	Compressive Strength Test	Every mixture
		Installation time	Slump, Air Volume, Temperature	Every material
Strength	Compressive Strength Test (7 days, 28 days)	Every material		
Reinforcing bars	Material	Quality Certificate, Tensile Test Results	Per lot	

Source: Survey team

2-2-4-6 Procurement Plan of Materials and Equipment

(1) Policy for procurement

1) Labor

With a view to creating employment opportunities, promoting technology transfer and vitalizing the local economy, local engineers and laborers will be utilized to the fullest extent; however, for jobs beyond the local technical level, skilled workers will be dispatched from Japan or third countries.

2) Construction materials

The field survey found that the general materials (cement, aggregate, timber, etc.) for use in the

construction works are produced in Zimbabwe. Imported reinforcing bars and shape steels are available on the local market and can be procured in Zimbabwe. Crushed stone, sand and soil could be sourced from the existing Nyamakate quarry used in Phase 1 works and sand pit of Chipfuko river and Borrow pit site for road maintenance managed by DOR. Fuel (petrol and diesel) could be sourced from tax-free imports for Zimbabwe Government use. Water (e.g., concrete works) for use in the construction works could be sourced from wells laid in the camp yard used during Phase 1 project. The Zambezi River is considered to be a possible procurement location for water used for dust control sprinkling, etc. in the construction section, as the amount of water used is large and the wells in the camp yard are insufficient (transport distance: approx. 35 km, results from Phase 1 construction). Based on these conditions, the procurement policy for construction materials was as follows.

- ① Procure locally produced items as much as possible.
- ② Procure imported products in cases where they are constantly available on the local market.
- ③ Concerning materials that cannot be procured locally, procure from Japan or third countries upon considering ease of procurement, price, quality, delivery time and other relevant issues.
- ④ For the procurement of crushed stone for road construction, it is considered practical to procure materials by using local quarry operators or local contractors, considering that mining licences would be required, and the procedure would take a long time if aggregate was assumed to be produced by mining directly from the quarry.

Table 2-33: Procurement of Major Material

Material name	Procurement source			Remark
	Zimbabwe	Japan	3rd country	
[General material]				
Filling material	●			Local material, Borrow pit of DOR
Base course material	●			Borrow pit of DOR
General Cement	●			Production in Zimbabwe
Fine aggregate	●			Sand pit
Coarse aggregate	●			Domestic or ZPC stone quarry
Reinforcing bars	●			Imports available on the local market
Steel sheet pile	●			Imports available on the local market
General steel material (Steel pipe, Shape steel)	●			Imports available on the local market
Admixture	●			Imports available on the local market
Water reducing material	●			Imports available on the local market
Asphalt	●			Imports available on the local market
Asphalt emulsion	●			Imports available on the local market
PVC pipe	●			Production in Zimbabwe
Gabion wire	●			Production in Zimbabwe
Wood (plywood, square material, plate material)	●			Production in Zimbabwe
Fuel (Gasoline, light oil)	●			Purchase items procured by Zimbabwean government

Guardrail	●			Imports available on the local market
Road sign	●			Imports available on the local market
Road reflector stud	●			Imports available on the local market
Road Marking Paint	●			Imports available on the local market

Source: JICA Survey Team

3) Construction Machinery

Regarding procurement of construction machinery in Zimbabwe, except for special ones, it can be borrowed from local private construction companies within Zimbabwe, including specialised items (formed stabilisers, used for road rehabilitation methods).

Table 2-34: Procurement of major construction equipment

Equipment name	Standards & Specifications etc.	Procurement source			Remarks
		Zimbabwe	Japan	3 rd country	
Asphalt distributor	6000L	●			Can be hired locally.
Asphalt kettle	6000L	●			
Chip spreaders		●			
Concrete plants	30m ³ /hr	●			
Bulldozers	3t~32t	●			
Backhoe	0.11m ³ ~0.8m ³	●			
Wheel loaders	0.35m ³ ,2.2m ³	●			
Dump trucks	2t~10t	●			
Trucks	3t~11t	●			
Semi-trailers	25t, 40t	●			
Truck cranes	4.9t~25t	●			
Rough terrain cranes	20t~50t	●			
Motor grader	3.1m,3.7m	●			
Road rollers	Macadam 10t-12t	●			
Tyre rollers	8t~20t	●			
Vibration rollers	0.6t,1.1t,5t	●			
Asphalt sprayers		●			
Concrete cutters	20cm	●			
Tampers	60~80kg	●			
Vibratory compactors	40~60kg	●			
Agitator trucks	4.4m ³	●			
Air compressors	3.7,11m ³ /min	●			
Engine generators	15~300kVA	●			
Concrete mixers	0.5m ³	●			
Concrete pump trucks	90~110m ³ /hr	●			
Stabilisers	W=2.0m, D=0.4, 0.6m	●			
Formed stabilisers	Lorry-connected, cutting width 2.4 m, depth 30 cm	●			
Concrete breakers	20kg	●			
Water sprinkler trucks	10000L	●			
Crawler drills	150kg	●			
Line markers	Hand type	●			
Submersible pumps	50,150,200mm	●			
Large breakers	800kg,1300kg	●			

Source: JICA Survey Team

(2) Important points to consider in Procurement

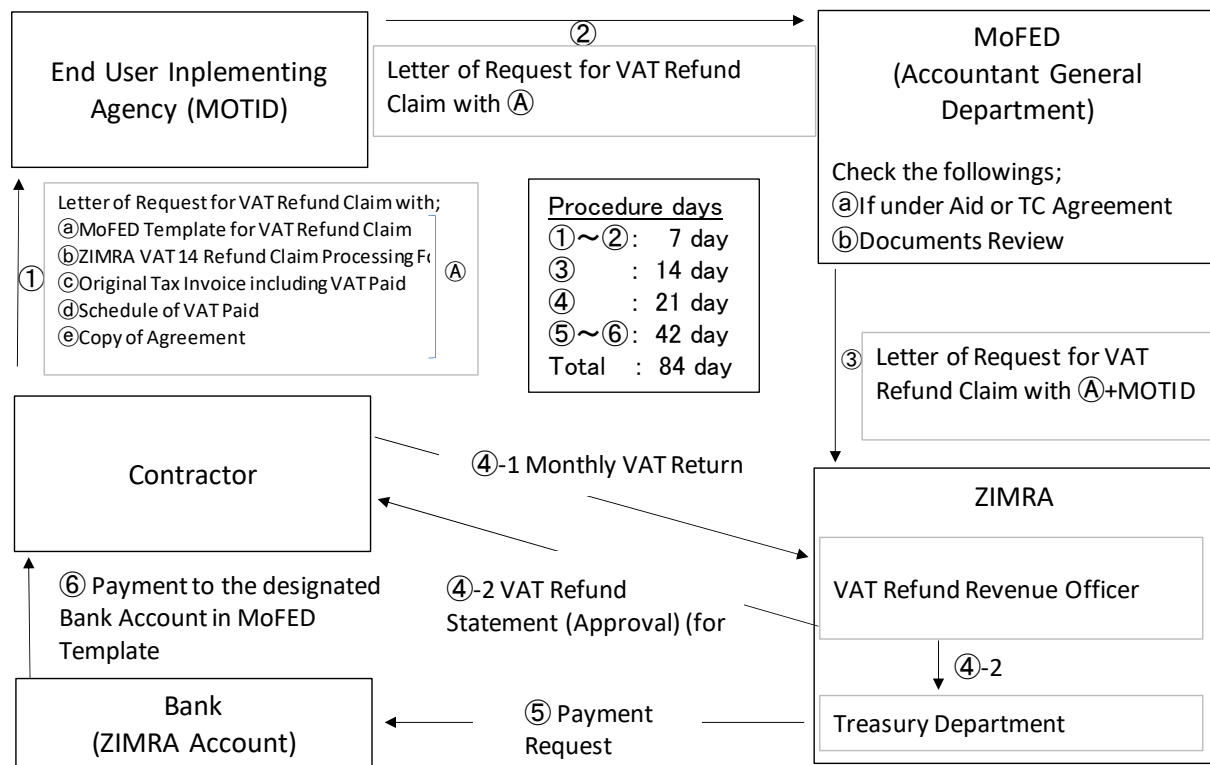
Procurement considerations for this project are as follows.

- ① Develop a procurement plan that is consistent with the construction process.
- ② Procure locally produced goods as much as possible to contribute to the revitalisation of the local economy.
- ③ Equipment will be procured from the capital, Harare. As the distance from Harare to the site is approximately 300 km, transportation costs to the site will be taken into account for eqnt that needs to be transported by semi-trailers, etc.

2-2-4-7 Tax exemptions, customs clearance

(1)Tax exemptions

In principle, grant aid projects are tax-exempted. Therefore, it is explained to and agreed in writing with the recipient country to follow procedures for exemption from customs duties, domestic taxes and fiscal levies. Therefore, the Project cost calculations do not include taxes. Based on the results of Phase 1, it is assumed that the main materials and equipment required for the Project can be procured domestically. During the field survey, discussions were held with MoFED officials, JICA experts from MoFED, MoTID officials and the survey team.



Source: Survey team

Fig. 2-25: Flowchart of tax exemption procedures and refunds

During the discussions, the survey team provided an overview of the Project (Phase 1 results, JICA survey for Phase 2, expected process) and explained the expected duty-free items. The above fig. is a summary of the relevant discussions during the Phase 1 survey and an updated flow of the tax

exemption procedures and required period obtained from MoFED during the Phase 2 survey for reference.

Summary of consultations during Phase 1 (indicative information)

- It is assumed to be necessary that exemption of VAT is required for domestic procurement items and exemption related to importing for.
- MoFED arranges tax exemption for imported items if an imported items master list is provided by the supplier.
- Since tax is charged with fuel at the time of importing, it is difficult to separate it when selling fuel in Zimbabwe (unlike VAT), however tax exemption is considered to be possible by taking the procedure described in the following procedure.
- The tax collection of Zimbabwe is implemented with the following policies.
 - a) Basic policies of tax collection start with the status confirmation of each employer and employee (who works with whom and where they work).
 - b) Tax on profit.
 - c) No double taxation applicable.
 - d) Personal income tax:

Considering above a) and c), Japanese experts who get salary and pay tax in Japan are not necessary to pay it in Zimbabwe. However, Japanese contractor needs to collect and submit personal income tax to ZIMRA, if they employ local labor directly (Company registration is also necessary).
 - e) Corporate income tax:

If grant aid (non-profit purpose) is source of income, above b) will be applied, but it depends on the content of E/N. However, in case of establishment of branch office, it is necessary to consult with MoFED previously through MoTID (permanent facility which will be used for 6 to 12 month).
 - f) Equipment imports:

Equipment for temporary use which will be re-exported is exempted from taxes, however, prior application to MoFED is required through MoTID. Broken equipment which is difficult for re-export is evaluated by ZIMRA. Tax and penalty fee are charged if the equipment is sold. The detail procedure is as follows.

 - After bidding and before the contract with the contractors, the contractors (including local suppliers) will notify MoTID of the master list of goods to be imported, the total amount (including the rough estimate of light oil, etc.) and the timing of import.
 - MoTID should include the total amount in their budget in next fiscal year or allocate the budget from current budget.
 - MoTID pays the required amount from the budget for each arrival of imported goods.
 - g) Material purchase:

Imported items and domestic materials are exempted from custom duty and VAT (15%) if

Japanese contractor follows the designated procedure (refer above Fig.: Flowchart of tax exemption procedures and refunds) by related ministries.

- Fuel tax exemption procedure

The Central Mechanical Equipment Department (CMED), an operating agency of the Transport Purchase Fund under MoTID, imports fuels and other items for government utilities by Duty-Free. The Contractor informs DOR of the quantity of fuel to be used in the works before or during the Project commences. DOR issues a Duty Free Certificate, CMED imports the required quantity duty-free and the contractor purchases duty free diesel from CMED. However, CMED handling charge (not tax, but a handling charge (about 5 cents/litre)) needs to be paid.

(2) Customs clearance procedures

Imported equipment and materials to Zimbabwe generally clear provisional customs at the South African port of Durban and clear main customs at the Beit bridge border with Zimbabwe, requiring one day at the port of Durban and 2 to 3 days at the Beit bridge, so it is necessary to consider a procurement plan with sufficient time to allow for this.

2-2-5 Soft Component (Technical assistance) Plan

(1) Background of Soft Component

1) Outline of the project.

The 141km mountainous section of the northern section road of the North-South Corridor, the major logistics route in Zimbabwe, has become a bottleneck on the corridor due to traffic accidents and congestion caused by low speeds on the narrow, steep and sharply curved sections of the road. To improve this situation, 6.5 km of road improvement was completed in May 2021 through Japan's grant aid (Phase 1). Following the above, a preparatory survey started in September 2021 as Phase 2 for road improvement of the adjacent section.

2) Rationale for planning soft component implementation.

2-1) MoTID's request for improvement of road conditions

Department of Roads (DOR) of the Ministry of Transport and Infrastructural Development (MoTID), which is the Executing Agency of Phase-1, allocated their staffs to Phase-1 in order to improve their capacity for quality and process management through project management. In addition, MoTID is carrying out road maintenance around the country through the Emergency Road Rehabilitation Programme-2 (2021-2023) to improve the northern section of the corridor.

2-2) Key objectives of the NDS1

In November 2020, a new national plan, NDS1, a five-year medium-term plan covering the period 2021-2025, was launched. Currently, the activities of the relevant national agencies in Zimbabwe in relation to the strategy are active and aimed at smooth implementation. The NDS1 recognises that the poor condition of the majority of the existing road network has a direct and indirect impact on road traffic safety and has identified the following items to improve road transport services with the aim of reducing the road accident and fatal accident rate by 25% per annum.

- ① Road authorities to install and maintain appropriate road signage on new and existing roads.
- ② Install road markings and signs that are resistant to damage and highly visible.
- ③ Implement traffic management measures, including traffic signage, in line with local standards.
- ④ Address the remediation of all engineering defects in 'black spots.

2-3) Significance of support through the soft component

Road traffic accidents are still frequently observed in the northern section of the North-South corridor, including the section under survey, and road traffic safety measures are an important issue to be addressed. The road design of the project is required to reduce the number of traffic accidents in the target section through the installation of road signs, etc. as set out in the NDS1 and improvement of road geometry. The involvement of the implementing agencies is also important, as road signs etc. are required to be easily understood by local drivers in accordance with Zimbabwe standards for road traffic safety. It is therefore desirable for the implementing agencies to acquire basic knowledge on road traffic safety and work with consultants on road design to reduce road accidents. Therefore, there is a strong need to support the strengthening of the capacity of implementing agencies in road traffic safety through soft component. In addition, the implementing agencies need to properly maintain and manage the roads after the project is completed, but in Zimbabwe there are many areas across the country where erosion from the road shoulders has narrowed the road width and made it unsafe for traffic safety. There is also significant need to support the capacity strengthening of the implementing agencies to strengthen road shoulders so that they can respond appropriately against erosion from the shoulders, as it is necessary to prevent similar problems from occurring after a long period of time has passed in the project section. Based on the above, soft component will be provided in the following 3 steps in the Phase 2 project. The step-by-step task is designed to link the understanding of the current situation, theoretical understanding of engineering deficiencies and effective repair of narrow roads to the direct and indirect impact of improving road traffic safety and to provide a concrete implementation image for reducing accidents, which is the theme of NDS1.

2-4) Issues to be improved on the existing road network

In view of the above issues and looking at the situation of existing roads in Zimbabwe, the following issues should be addressed in order to improve the existing road network, including the target section, to a better situation.

Table 2-35: Issues to be improved on the existing road network

Task	Overview
A	More effective roadside ancillary measures for road safety are needed
B	Need to address problem areas in road geometry to improve road safety aspects
C	Need to address road safety degradation caused by pavements disappearing from the edge due to erosion of shoulder edges.

Note that issues A and C above are direct improvements to road facilities. However, to improve road

safety, it is important not only to consider the ancillary facilities of Issue A, but also to acquire knowledge on how to deal with these problems as Issue B in order to correct the engineering defects of roads. Because understanding of these problems in road geometry, such as sharp curves and steep gradients, play a major role in making these ancillary facilities necessary which are also mentioned in NDS1.

(2) Objectives of Soft Component

In order to address the issues mentioned in 1 (2) 2) above, following objectives of the soft component are set.

Table 2-36: Soft component objectives

Objective	Task	Status to be achieved
1	A	Enable MOTID to consider appropriate road ancillaries for road safety (accident prevention).
2	B	Improves MOTID's understanding of road geometry in terms of improving road safety aspects.
3	C	Enable MOTID to strengthen road shoulders (especially at the edges)

(3) Outputs of Soft Component

1) Direct results to be achieved

Following table shows the direct outputs to be achieved at the end of the soft component.

Table 2-37: Outputs to be achieved

Output	Task	Direct output	Remarks
I	A	Capacity of MoTID to understand effect of multiple types of road safety equipment (humps and markings) and their changes in location and pattern of the equipment (vehicle slowing effect) is improved.	Pilot trials using oil paints at accident-prone spots (curves, straights and gradients) along a 141km section, including Phase-1 to measure the effect of reducing passing speeds
II	B	Understanding of MoTID to road design at geometrically difficult points in order to improve traffic safety is improved.	Practical design experience through survey and existing road condition surveys to be carried out (assuming the use of local consultant facilities, equipment and technicians).
III	C	Capacity of MoTID to stabilize road shoulder by in-situ concrete kerbs using MoTID's own facility is improved.	Availability of pick-up trucks, backhoes, small rollers, small mixers, work teams, etc. needs to be confirmed (including the possibility of using MoTID's existing equipment).

2) Implementation plan of the soft component

The soft component implementation plan is presented below to assist in addressing current issues improve the existing road network in Zimbabwe, including the target section, to a better state.

6) i) Objective 1: Enable MoTID to consider appropriate road ancillaries for road safety (accident prevention)

As the northern section of the north-south corridor contains hazardous areas on the road alignment (e.g., sharp curves), the pilot area will be used as a trial area where road ancillary facilities (signs,

markings, etc.) will actually be installed in an enforcement action to check their effectiveness (e.g., in slowing down passing vehicles) with the implementing agency. Examine the specifications and dimensions of roadside ancillary facilities together with the implementing agency, analyse the effectiveness of their installation, and confirm the optimal method of installing roadside ancillary facilities and their effectiveness.

ii) **Objective 2: MoTID improves understanding of road geometry structures relevant to improving road safety aspects**

The mechanisms of road traffic accidents are explained and road geometry considerations and technical points from the perspective of road traffic safety (e.g., sight distance, points for setting horizontal and longitudinal alignments and points for horizontal and longitudinal alignment combinations) are transferred to the implementing agencies. In addition, road planning/design exercises are conducted with the implementing agencies to improve their understanding of road geometry considerations from the perspective of road safety.

iii) **Objective 3: Enable MoTID to strengthen road shoulders, especially at the edges**

As road shoulders are often eroded and narrowed throughout Zimbabwe, including along the North-South corridor, implementing agencies should transfer technology on shoulder strengthening methods that they can implement themselves (e.g., strengthening using stabilisation and in-situ cast concrete kerbs, which has been proven in Tanzania). The specifications and dimensions for shoulder strengthening will be studied together with the implementing agencies, and actual shoulder strengthening will be carried out in the pilot area together with the implementing agencies. After implementation, points for improvement are discussed with the implementing agency.

Table 2-38: Soft component implementation plan (draft)

Objective 1	Enables MOTID to consider appropriate road ancillaries for road safety (accident prevention).
Action	(1) Similar case study of Zimbabwe, existing documents review and Japanese case studies explanation. (2) C/P and support team to check the situation at existing road problem areas (3) Discuss and review the preferred specifications and proposed dimensions for road ancillaries. (4) Discuss safety facility alternatives. (5) Trial of alternatives by the executing agency and consideration of the most suitable proposal.
Method	Theoretical and on-site training by Japanese consultant (explanation of common points and mechanisms of traffic accidents and explanation of Japanese case studies and technical points, etc.)
Period	1 to 2 months
Objective 2	Understanding of MoTID to road design at geometrically difficult points in order to improve traffic safety is improved.
Action	(1) Practical design experience by the executing agency using the results of field surveys (survey, existing road study, etc.) (2) Understanding of the design and local conditions by field inspection after the design experience (3) Confirmation of issues on the geometrical structure of roads which have frequent accidents

	(4) Study of improvement plans
Method	Theory, planning/designing practice and on-site training by Japanese consultants (explanation of common points at accident-prone locations and mechanisms of traffic accidents, explanation of points to be considered and technical points in road geometry, support for planning/designing practice, etc.) (design practice using equipment, facilities and technicians of local consultants))
Period	1 to 2 months
Objective 3	Capacity of MoTID to stabilize road shoulder and in-situ concrete kerbs using MoTID's own facility is improved.
Action	(1) Review existing documents of similar cases in Zimbabwe and other countries and sharing overview of implementation examples (2) Status check of issues on the existing road with the executing agency (3) Discussion and consideration on desirable specifications and 50mphasizes50on4) Consideration of alternatives for shoulder strengthening (e.g., cast-in-place kerbs, stabilisation (cementitious and asphalt-based), etc.) (5) Trial construction by the executing agency and study of the best solution.
Method	Theoretical and on-site training by a Japanese consultant (explanation of the mechanism of pavement degradation from the road shoulder, outline of similar examples and technical and key points, explanation of key points through trial construction (determination of causes of degradation, explanation of water concentration areas (slope, curves, etc.) and explanation of influence of surface water and groundwater conditions, etc.)
Period	1 to 2 months

3) Assumed location of the project implementation

In the six sections of 15.5 km from the start of Phase 1 to Makuti identified in this survey, two high accident locations were identified in Section-2 and one in Section-5. Since it is assumed that the 2 accident-prone points in Section-2 will be improved by the project, Objectives 1 and 2 above are to conduct field trials for accident control near the accident-prone points in Section-5 (around 293.2km) as for desirable activities to lead to a reduction in the occurrence of accidents in the entire surveyed section.

(4) Methods to Check Achieved Output

The following methods and indicators will be used to check the extent to which the outputs defined in 3. Above are achieved.

Table 2-39: Methods to check achieved output

Output	Direct results (draft)	Methods to check achieved output
1	Alternative planning of road safety facility measures. a) Measuring the effect of vehicle speed reduction by sign position/pattern b) Measurement of the effect of road surface facilities (e.g., markings, humps, etc.) on vehicle speed reduction by their location and pattern.	-a), b) Measuring the effect of reductions (by position, type and pattern) -Confirmation by evaluation sheets before and after soft component implementation (identification of issues, whether there is potential for improvement, future application proposals, issues, review meetings held by MoTID).
2	c) Number of participants, duration of participation and level of understanding of the design experience support. (Experiencing road geometry improvements at road safety problem areas, as required for road safety improvement studies)	-c) Number of sessions and number of participants -Pre- and post-implementation questionnaires - (identification of issues, potential for improvement, future application)

		proposals, issues, review meetings held by MoTID).
3	Alternative planning of shoulder edge strengthening methods d) Review of alternatives to shoulder edge strengthening and field practice (e.g., cast-in-place kerbs) e) Study of alternatives for shoulder strengthening and field practice (e.g., stabilisation (cementitious, asphalt-based))	-d), e) Consideration of alternatives -Confirmation by evaluation sheets before start and after implementation (identification of issues, potential for improvement, future application proposals, issues, review meetings held by MoTID).

Note: Visualise the results by measuring effectiveness at the start and at the end of the assistance by using the relevant parts of the effectiveness indicator form (e.g., pavement diagnosis) of JICA's Road Asset Management Platform.

(5) Activities of Soft Component (Input Plan)

The following table shows outline of activities of the soft component.

Table 2-40: Outline of activities

Output	Activities	Experts	Target group
1	a) Pattern and location planning of marking b) Pattern and location planning of humps	-Road planning, 1.43MM -Road design, 1.43MM	Planning, design, operation, laboratory, provincial office in DOR (10-15 people, 2-3 from each affiliation)
2	c) Design experience training for MoTID	-Road planning, 1.23MM -Road design, 1.30MM	Same as above (using local consultant facilities and manpower (0.3MM))
3	d) Road shoulder edge reinforcement planning (e.g., cast-in-place kerb) e) Planning of shoulder strengthening (stabilization, etc.)	-Road planning, 1.33 MM -Construction planning, 0.77MM	Same as above 1

Note: Design experience assumes use of local consultants' facilities and equipment.

(6) Method of procurement of soft component implementation resources

This activity is appropriate for the direct support type of ordering consultant, who is familiar with the background and local conditions of the target road and can provide similar examples in Japan and other countries in Africa and elsewhere.

(7) Implementation schedule of Soft Component

The following table shows the expected implementation schedule of Soft Component.

Table 2-41: Implementation schedule (draft)

Description	Year 202X									
	Mth. 1	2	3	4	5	6	7	8	9	
Detailed design (Assumed)	-----									
For Objective 1	□	■	←Road planner + Road design							
For Objective 2		■	←Road planner + Road design							
For Objective 3			■	←Road planner + Construction planning						
Report submission			△		▲					

Note: □ Work in Japan ■ in Zimbabwe ■ Preparation △ Progress report ▲ Completion report

(8) Deliverables of Soft Component

The following table shows the expected deliverables of the soft component.

Table 2-42: Possible deliverables

Deliverables	Outline	Remarks
Completion report	Background, overview, implementation schedule/scope, discussed items, in-service training, implementation evaluation/analysis and recommendations for Objectives 1, 2 and 3.	Deliverables (e.g., input summaries, schedules, photographs, measurement results), training materials, OJT procedures (e.g., standards and specifications)
Related documents	Confirmation by evaluation sheet, results of implementing agency questionnaire.	

(9) Responsibilities of Zimbabwe side

In order to achieve the output of the soft component, the following responsibilities of the executing agency need to be implemented.

Table 2-43: Responsibilities of Zimbabwe side

Output	Executing agency	Concerns and measures
1	Counterpart's allocation (Planning, design, operation, laboratories, provincial offices in DOR), Securing budgets for implementation, Pre-implementation discussions with police stations and park management officers for safety management	Concerns: Mismatch of themes Measures: sultation with the executing agency
2	Ditto	Ditto
3	Ditto	Ditto

2-2-4-9 Implementation Schedule

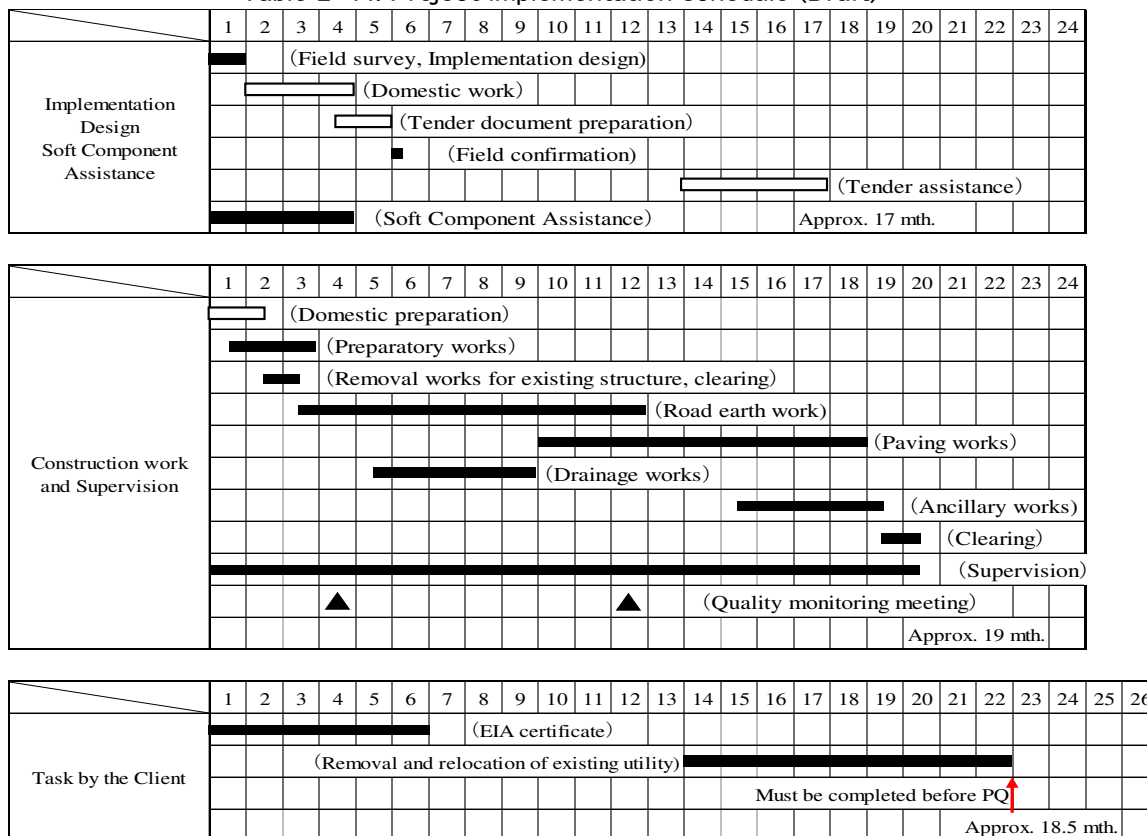
1) Setting of the Works Period

The draft schedule for detailed design and construction supervision is shown in the table below. The Project is supposed to be implemented under grant aid scheme. The estimated entire schedule is approximately 36 months, comprising approximately 17 months for the implementation design and approximately 19 months for the construction work.

2) Implementation schedule

In the Project, construction period will be assumed considering construction method, material procurement, etc. that will minimize the impact of construction in order not to hinder existing traffic during construction. The Project implementation schedule (draft) assuming Japanese governments grant aid scheme is shown below as a reference.

Table 2-44: Project implementation schedule (Draft)



Source: Survey team

3) Project cost estimation condition/method

3-1) Estimation period

The cost was estimated based on unit price in November 2021.

3-2) Exchange rate etc.

Transaction currency : Currency unit in Zimbabwe is US Dollar.

Exchange rate : Currencies used for cost estimation are Japanese Yen and US Dollar.

Each currency exchange rate from the of cost estimation (November 2021) to the past 3 months (August to October 2021) is as follows.

$$1.00 \text{ US\$} = 112.05 \text{ yen (TTS)}$$

3-3) Taxes

The grant aid projects are implemented on the principle of tax exemption. Therefore, the recipient country is requested to handle as a mandatory matter for customs and domestic tax exemptions. For considering the above conditions, the estimated project cost have been calculated excluding taxes.

3-4) Cost estimation standards to be conformed

In Zimbabwe, since the official cost estimation data on road improvement works similar to the Project is not being managed, cost estimation for the Project adopts the cost estimation standard of Japan as shown below. Incidentally, special standards which are not included in the above standard are attached to the cost estimation document collection.

- Cost estimation standards for civil engineering, Ministry of Land, Infrastructure, Transport and Tourism, 2021 Edition (issued by Construction Research Institute)
- Cost estimation standards for civil engineering (Common edition), Ministry of Land, Infrastructure, Transport and Tourism, 2021 Edition (issued by Construction Research Institute)
- Cost estimation standards for civil engineering (Road/River edition), Ministry of Land, Infrastructure, Transport and Tourism, 2021 Edition (issued by Construction Research Institute)
- Estimation Chart of Construction machinery hire, 2021 Edition (issued by Japan Construction Machinery and Construction Association)
- Construction Cost, November 2021 (issued by Construction Research Institute)
- Cost estimation research, November 2021 (issued by Economic Research Association)
- Manual of Design and Cost estimation for Preparatory Survey (Trial version), March 2009 (issued by Japan International Cooperation Agency)
- Complementary edition for Manual of Design and Cost estimation for Preparatory Survey (Civil engineering) (Trial version), October 2019 (issued by Japan International Cooperation Agency)

3-5) Correction of labor productivity per unit

The correction of quantity per unit will be implemented as follows based on complementary edition of design / cost estimation manual for preparatory survey (civil engineering field) (trial version).

- Coefficient of correction of labor productivity per unit for unskilled labor : 2.5
- Coefficient of correction of labor productivity per unit for skilled labor : 4.5
- Coefficient of correction of labor productivity per unit for simple machine construction : 55%
- Coefficient of correction of labor productivity per unit for general machine construction : 60%

3-6) Price fluctuation coefficient

To estimate the cost amount taking into consideration price fluctuation prediction (both price increase and decrease) capable of predicting from the past economic trend, based on complementary edition of design / cost estimation manual for preparatory survey (civil engineering field) (trial version), the price fluctuation coefficient from the cost estimation time point to the assumed tender time point is set.

2-2-6 Safety measure plan

(1) Ensuring safety during construction

- i) The contractor shall assign a dedicated construction safety engineer and formulate a 'Safety Plan' and 'Safe Construction Plan' in accordance with the 'ODA Construction Safety

Management Guidance, September 2014’.

- ii) The contractor shall explain the formulated ‘Safety Measures Plan’ and ‘Safe Construction Plan’ to the sub-contractors and ensure that the ‘Safety Measures Plan’ and ‘Safe Construction Plan’ are thoroughly implemented by the construction workers.
- iii) As lane restrictions are required, safety equipment (including barricades (concrete blocks, etc.), coloured cones and revolving lights) and guides are to be deployed and traffic diversion is to be carried out.
- iv) Ensure safety and prevent problems with third parties by installing no-entry signs and construction information boards at the construction site.
- v) Wildlife protection officers (rangers) are deployed or attached to construction sites to prevent harm to staff and workers from wild animals.

The details of ranger deployment shall be discussed and confirmed by the executing agency, relevant organisations, contractors and consultants ediatly after the start of construction based on the construction sequence flow diagram, etc.

2-3. Obligations of Recipient Country

2-3-1 General Items in the Government of Japan’s Grant Aid Scheme

The followings are obligation of the Zimbabwean side confirmed in the minutes of discussions agreed by both sides.

- Secure the land necessary for the Project before the tender.
- Exempt Japanese nationals from customs tax, domestic tax and other forms of fiscal levies for service and materials that are supplied under approved contracts.
- Provide necessary convenience and assistance to the Japanese nationals who enter and reside in Zimbabwe for the Project implementation in order to facilitate supply of service and materials under approved contracts.
- Complete the environmental and social consideration procedures and necessary surveys required in Zimbabwe (EIA examination fee to be considered (about 1% of the project cost estimated).

2-3-2 Specific Requirements for the Project

Major undertakings to be undertaken by the Zimbabwean side that are specific to the Project and are not included in the general requirements for grant aid are as follows.

(1) Securing of land for the road works and demolition/relocation of existing structures

1) The cost burden on the Zimbabwean side

In the Project, construction is supposed to be implemented in the ROW of Zimbabwean standard, and the land has been already secured. Existing structures that may need to be removed or relocated for the construction and possible related costs are shown below. Since these costs are assumed to be US \$ 690,640, which is equivalent to about 2.9% of the DOR`s budget in 2021 of US\$24 million,

it is comfortably affordable for the Zimbabwean side. In addition, it is necessary to secure these budgets in fiscal year of 2023.

Table 2-45: Outline of the scope of works and the cost burden on the Zimbabwe side

		(Unit : US\$)	
Item		Contents	Cost burden
1	Company registration for the Project	Costs of registration of the consultant (ECZ) and the contractor (ECZ), 2 years each assumed	\$15,000 \$15,000
2	A/P costs, B/A costs	Authorization for payment (A/P) expenses, Bank account (B/A) opening expenses	\$20,640
3	Assignment of wildlife rangers	Assignment expenses of rangers during survey and construction	\$150,000
5	EIA examination fee	About 1% of the Project cost	\$200,000
6	VAT refund	Refund expenses of VAT15% (cement, Re-bar, etc.)	\$290,000
Total			\$690,640

2) Securing of temporary camp yard and disposal yard

The following places were considered as candidate sites for construction camp yards and earth disposal yards along the target road.

- Expected locations and scale of temporary camp yards

Base camp for construction works : 100m×150m, Sites used in Phase 1 (around 313 km) or next to the land for maintenance unit of DOR, 17km on Harare side from the start point

Concrete plant : 30m×70m, 2 refer above area

Disposal yard : Sites used in Phase 1 (around 313 km)

- Required period : about 2 years

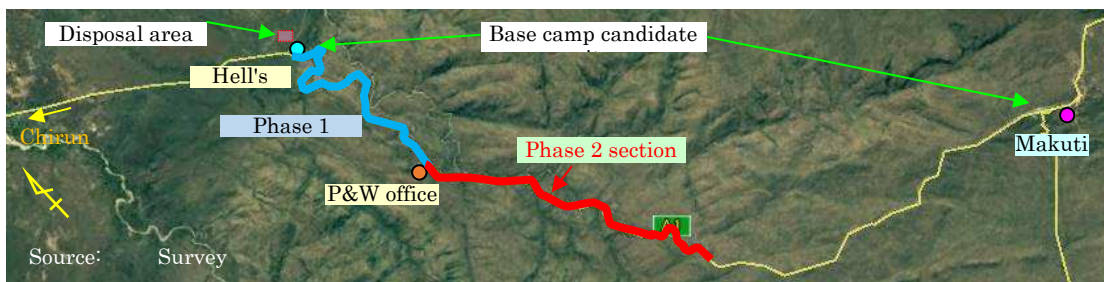


Fig. 2-26: Candidate sites for Camp yard, plant, and disposal area

(2) Implementation of a project explanation meeting for roadside residents

Immediately after signing to the exchange of notes (E/N), the executing agency is requested to hold an explanation meeting for the Project in order to explain safety measures, noise countermeasures during the construction period and work methods, etc. to the roadside residents or their representatives.

(3) Traffic safety measures

It is requested that road users will be thoroughly informed to comply with instructions by traffic controllers during the construction period.

(4) Thorough notification of inconvenience during the construction period

Since the construction work is expected to cause inconvenience to the passing traffic, it is requested that such inconveniences be thoroughly informed to road users via TV, radio, newspapers and other public media.

2-4 Project operation and maintenance plan

The following maintenance work will be required in order to keep the Project facilities in good condition after the Project. Since surface treatment pavement scheduled to be adopted in the Project is require periodic maintenance in order to achieve planned lifetime, it is extremely important to conduct daily and periodic inspections and prompt and early response to problem areas. In addition, since existing road deterioration is remarkable due to water invading the inside of the pavement from the pavement surface or the edit is important to build maintenance plans and structures taking it into special consideration.

(1) Routine maintenance

- Daily round of inspection of the road
- Constant cleaning and repairs of side ditches and drainage facilities
- Removal of weed on road shoulder and in the side ditches
- Early sub-base repairs and patching up and sealing up the road surface (filling holes)

(2) Periodic maintenance work

- Road surface repairs
- Roadbase repairs
- Repairs of structures

Currently, each DOR state office conducts the above-mentioned maintenance work and there are no operational problems. Since it will be especially important to repair damaged parts immediately, the state office wile expected to conduct daily rounds of inspection at sufficient intervals for early detection.

2-5 Project cost estimation

2-5-1 Initial Cost Estimation

The breakdown of expenses by Zimbabwean side is estimated as follows.

(1) Cost burden on the Zimbabwean side

- | | | |
|---|----------------|----------------------------------|
| ① Cost of construction company registration | : US\$ 30,000 | (approximately 3.5 million yen) |
| ② Cost for issuing A/P and opening B/A | : US\$ 20,640 | (approximately 2.3 million yen) |
| ③ Cost for wildlife rangers | : US\$ 150,000 | (approximately 17.3 million yen) |
| ④ EIA examination fee (Assumed) | : US\$ 200,000 | (approximately 22.4 million yen) |

⑤ VAT refund : US\$ 290,000 (approximately 33.5 million yen)

Total : US\$ 690,640 (approximately 77.4 million yen)

Note: The estimated refund amount in the case of utilizing the local subcontractor is not included in ⑤,
A/P= Authorization to Pay, B/A= Bank Arrangement

(2) Cost estimation conditions

The conditions at the point of estimation in November 2021 were as follows.

1) Exchange rate

US\$1 = ¥112.05

2) Implementation period

The Project period is around 36 months including detailed design, tender assistance and construction work as shown in the implementation schedule.

3) Other

The Project will be implemented in accordance with the grant aid scheme of the Government of Japan.

2-5-2 Operation and Maintenance Cost

As shown in the following table, the average annual operation and maintenance cost for routine and periodic maintenance for the target road is estimated to be approximately 2.8 million yen during the Project life. Since this is equivalent to 0.02% of the annual maintenance budget \$128million (14.3 billion yen) of Zimbabwe in fiscal 2021, this cost is considered to be easily affordable for the Zimbabwean side.

Table 2-46: Maintenance items and costs

Type	Cycle	Maintenance contents	Specifications	Unit	Work quantity	Unit cost (\$)	Times	Cost (\$)
Routine	Every year	Patching	1% of pavement road area	m ²	735	9.08	12	80,400
		Roadbed repair	1% of pavement road area	m ²	735	12.36	12	109,000
		Shoulder repair	1% of sidewalk area	m ²	390	5.55	12	26,000
		Cleaning of structures	5% of the length of structures	m	41	1.60	12	800
		Subtotal-I	15-years aggregate=					
Periodic	Every 5 years	Roadbed repair	2% of pavement road area	m ²	1,470	12.36	3	54,500
		Overlay	2% of pavement road area	m ²	1,470	9.08	3	40,000
		Shoulder repair	2% of sidewalk area	m ²	780	5.55	3	13,000
		Repair of structures	1% of the length of structures	m	10	437.00	3	13,500
		Subtotal- II	15-years aggregate =					
Total routine and periodic maintenance-III (= I + II)								336,900
Operation and maintenance cost			33,690	Set	-	-		33,690
Total								370,590
Cost year								24,706

Source: Survey team Note: Cost of maintenance for 7.8km Note: Estimate rate US\$1=110 yen

CHAPTER 3
PROJECT EVALUATION

Chapter 3 Project evaluation

3-1 Preconditions

The preconditions for the implementation of the Project are set out below.

- The availability of Right of Way (ROW) with a 3.75m carriageway and 2.5m shoulder on each side from the centre of necessary road, which is required to carry out the road improvements in the Project (in case that necessary land would change based on the result of detailed design).
- Permission is required for the use of land for construction campsites, plant installation and earth removal/dumping sites.
- Relocation and removal of utilities (water pipe, distribution line, etc.) within the road construction area must be completed before the start of the tender process.
- The acquisition of environmental permits, currently being progressed by the Zimbabwean side, must be completed within 1 month after the signing of the G/A for the construction works (current assumption is September 2022).
- Prompt response to customs clearance and tax exemptions for procured materials and equipment to prevent construction delays is required.
- It is very important to secure the budget, manpower, equipment and materials required for maintenance and repairment by Zimbabwe side after the completion of the Project in order to extend the lifetime of the roads and structures. In addition, the implementation of daily and routine maintenance, obstruction removal, cleaning and periodic inspections need to be carried out in order to find any damage and repair it immediately.

3-2 Necessary inputs by Zimbabwe

The necessary inputs by Zimbabwe are show below.

- Necessary counterparts are assigned for soft component activities.
- Rangers are assigned during construction in order to minimize risk of wild animals.
- It is very important to secure the budget, manpower, equipment and materials required for maintenance and repairment by Zimbabwe side after the completion of the Project in order to extend the lifetime of the roads and structures. In addition, the implementation of daily and routine maintenance, obstruction removal, cleaning and periodic inspections need to be carried out in order to find any damage and repair it immediately.

3-3 Important assumption

The important assumption that needs to be fulfilled for the Project is shown below.

- 1) Overloaded vehicles are controlled.
- 2) No significant deterioration in economic conditions of Zimbabwe
- 3) Related development plans are not changed significantly.
- 4) Smooth procurement of construction equipment and receipt of contractor construction funds in Zimbabwe.

- 5) The custom clearance system between Zimbabwe and South Africa which is south part of the South-North Corridor, is operated without any defect. If there are any defects, vehicles will use South Africa – Botswana – Zambia route and it may affect the Project output.

3-4 Project evaluation

3-4-1 Relevance

The Government of Zimbabwe aims to achieve an upper-middle income society by 2030 and has identified 14 priority areas in its 5-year National Development Strategy (2021-2025) to achieve this goal. One of the 14 priority areas is infrastructure development, which emphasises the importance of developing and maintaining major transport corridors to facilitate domestic and international trade. The North-South Corridor, which runs from the South African port of Durban through Zimbabwe and Botswana to Zambia and the Democratic Republic of Congo, is the largest in the region, with an annual transport volume of over 4 million tonnes (2016, African Regional Nacala Corridor Integrated Development Information Collection and Verification Study), mainly for the region's mineral exports and essential goods imports. The Africa Infrastructure Development Programme (PIDA), prepared by the African Union (AU), predicts that by 2040 the corridor will be the largest corridor in Africa with an annual transport volume of over 50 million tonnes.

The mountainous section (approximately 141 km) of the northern section of the North-South Corridor has many narrow and sharply curved sections, but due to the high degree of difficulty in design and construction, the Government of Zimbabwe has not progressed with road improvement. This project will contribute to the promotion of the use of the corridor by reducing traffic accidents and easing traffic congestion by constructing a climbing lane and widening sharp curves in a 7.8km section adjacent to Phase 1, which is particularly in need of improvement. The Project is highly appropriate as it meets Zimbabwe's development challenges and policies and contributes to the economic revitalisation of the Southern African region, including Zimbabwe, through the development of the North-South Corridor.

- 1) The Project will contribute to strengthen the trunk road network and is expected to benefit not only Zimbabwe but also other Southern African countries using the North-South Corridor.
- 2) The Project will improve the smoothness and safety of the road by alleviating the current traffic congestion and reducing the number of accidents in the target section, which is identified as a priority in the NDS 1.

3-4-2 Effectiveness

By implementing the Project, the road conditions in the target section will be improved and safe and smooth flow of traffic will be secured. Therefore, it is expected that there will be a great benefit to the residents of the Project area and the users who pass through the logistics trunk route. The expected effects of the Project are shown below.

1) Quantitative effect

- ① The improvement of the target road section will allow slow-speed heavy vehicles (around 20 km/h) to be separated into climbing lanes and other vehicles allowed to pass at speeds of 60/40 km/h, reducing transit time by around 9 minutes.
- ① The number of annual accidents will be reduced from the current 61 to 10.
- ② The Project will contribute to the safe and smooth passage of approximately 530,000 passengers and 4.45 million tonnes of cargo per year along the section.

Table 3-1: List of quantitative effects

Index name	Base value (Actual value in 2021)	Target value (2028) [3 years after project completion]
Passage time in target section (7.8km) (minutes)	17	8
Number of traffic accidents in target section (7.8km) (incident/year)	61	10
Volume of passengers (thousand person/year)	530	560
Volume of cargo (million ton/year)	4.45	5.01

Note: The locations and methods of measuring the volume of passengers, the volume of cargo and the number of accidents is as follows.

- Volume of passengers is estimated based on traffic survey between Karoi and Chirundu. It is assumed that 2 passengers are in small cars, 10 passengers are in minibuses and 34 passengers are in large buses.
- Volume of cargo is estimated based on actual vehicle weights measured in Chilundu (A truck is 17 tonnes and a trailer is 37 tonnes.).
- The growth rate of traffic was estimated by applying a growth rate of 0.8%/year for passenger numbers and 0.7%/year for freight volumes, based on actual data for the period 2016-2021.

This evaluation is based on the assumption that there are no problems with the customs clearance system at the Zimbabwe-South Africa border, which is the southern section of the North-South Corridor. In the event of any problems at the border, passing vehicles may use the South Africa-Botswana-Zambia route, which could affect the effectiveness of the Project.

As for the number of traffic accidents, it is considered that the annual 61 accidents will be reduced to 10 accidents because overtaking and breakdowns will be reduced by improving road conditions through the construction of climbing lanes, shoulders and ancillary facilities. After the Project, the traffic accidents will be induced by driving manner violations and animals (see table below).

Table 3-2: Number of accidents by cause in the target section

Cause of accident	At present	After construction	Remarks
Vehicle failure	4	2	Assessed as halved due to improved road conditions
Excessive speed	7	4	Consideration of accidents occurring during this survey (due to driving manner)
overtaking	4	0	
Bad road	17	0	

Misjudgement	22	0	
Road marking	0	0	
Obstacle	3	2	Assessed as halved due to improved road conditions
Animal	4	2	Difficult to avoid completely, but assessed as halved due to improved visibility
Total (Nos.)	61	10	

Source: Survey team

2) Qualitative effects

- ① Shortening travelling time contributes to reduction of transportation costs.
- ② Traffic safety and smoothness are improved including perspective of drivers.
- ③ Employment of women is facilitated.
- ④ Capacity on traffic safety measures and road maintenance is improved.

APPENDIX

Appendices

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Appendix 1. Member List of the Survey Team

Name	Position	Identity
Kaoru OKADA	Team Leader (1st site survey)	JICA, Grant aid project management Division-1, Financial cooperation implementation department
Yoshiro MASUDA	Team Leader (2nd site survey)	
Takahiro UCHIDA	Planning and management	
Keisuke MORISITA	Ditto	
Hideaki MORITA	Chief consultant/ Road planner 1	INGEROSEC Corporation
Shigehito ENDO	Deputy chief / Road planner 2	Eight-Japan Engineering Consultants Inc.
Ikumasa KAWASAKI	Road and pavement	Ditto
Takeshi MAEDA	Structure and drainage	Oriental Consultants Global Co., Ltd.
Fujio OGAWA	Construction planner, Cost estimator	INGEROSEC Corporation
Akiko MIYAKAWA	Environmental and social consideration	INGEROSEC Corporation
Panganayi Cleopatra	Natural conditions survey 1	Oriental Consultants Global Co., Ltd.
Mitsuhide SAITO	Natural conditions survey 2	INGEROSEC Corporation
Sueo HIROSE	Technical auditor	INGEROSEC Corporation

Appendix 2. Survey Schedule

(1) 1st Site survey

Mh.	Day	JICA	Chief Consultant/Road Planner 1	Deputy Chief/Road Planner 2	Road and Pavement Design	Structural and Drainage Design	Procurement and Construction Plan/Cost Estimation	Environmental Examination	Natural Condition Survey 1 (Soil Survey)	Natural Condition Survey 2 (Topographic survey)
		Mr Uchida	Hideaki Morita	Shigeto Endo	Ikumasa Kawasaki	Takeshi Maeda	Fujio Ogawa	Akiko Miyakawa	Panganayi Cleopatra	Mitsuhide Saito
1	Fri		Tokyo~	Tokyo~		Tokyo~	Tokyo~		Tokyo~	
2	Sat		~Harare	~Harare		~Harare	~Harare		~Harare	
3	Sun		Quarantine	Quarantine		Quarantine	Quarantine		Quarantine	
4	Mon		Quarantine	Quarantine		Quarantine	Quarantine		Quarantine	
5	Tue		Quarantine	Quarantine		Quarantine	Quarantine		Quarantine	
6	Wed		Existing data review	Existing data review		Existing data review	Existing data review		Existing data review	
7	Thu		Existing data review	Existing data review		Existing data review	Existing data review		Existing data review	
8	Fri	Tokyo~	Document preparation	Document preparation	Tokyo~	Document preparation	Document preparation	Tokyo~	Document preparation	
9	Sat	~Harare	Quarantine	Quarantine	~Harare	Quarantine	Quarantine	~Harare	Quarantine	
10	Sun		Quarantine	Quarantine	Quarantine	Quarantine	Quarantine	Quarantine	Quarantine	
11	Mon		Confirmation of Assumptions	Confirmation of Assumptions	Quarantine	Confirmation of Assumptions	Confirmation of Assumptions	Quarantine	discussion of Local Consultant Web	
12	Tue		Preparation of meeting and discussion	Preparation of meeting and discussion	Quarantine	Preparation of meeting and discussion	Preparation of meeting and discussion	Quarantine	discussion of Local Consultant Web	
13	Wed	Online meetings (with consultants, JICA Zimbabwe office, DOR, MoTID, MoFED and other related agencies)	9:00 DOR lack of meeting, 14:00 JICA	9:00 DOR lack of meeting, 14:00 JICA	Discussion with DOR Web	EOI, JICA, DOR	EOI, JICA, DOR	Discussion with DOR environmental staff Web	EOI, JICA, DOR	
14	Thu		Confirmation in general	Move to site	Discussion with DOR Web	Move to site	Move to site	Discussion with DOR environmental staff Web	Move to site	
15	Fri		Confirmation of	Site reconnaissance	Discussion with DOR Web	Site reconnaissance	Site reconnaissance	Discussion with DOR environmental staff Web	Site reconnaissance	
16	Sat		Quarantine	8:00 Move to site	Site reconnaissance	Quarantine	Site reconnaissance	Quarantine	investigation control	
17	Sun		Quarantine	Reconnaissance + OSBP 14:00 meeting with MoTID	Site reconnaissance	Quarantine	Site reconnaissance	Quarantine	investigation control	Tokyo~
18	Mon		Online meetings (Ditto)	8:30 Move to Harare	Site reconnaissance	Discussion with DOR Web	Site reconnaissance	Explanation of site conditions	Discussion with DOR environmental staff Web	investigation control
19	Tue		Courtesy call MoFED	9:00 DOR site visit result Top. Note related issue	Site reconnaissance	Discussion with DOR Web	Site reconnaissance	Explanation of site conditions	Discussion with DOR environmental staff Web	investigation control
20	Wed		Courtesy call MoFED	MoTID M/D discussion	Site reconnaissance	Discussion with DOR	Site reconnaissance	Fuel and equipment survey (MoFED)	Discussion with DOR environmental staff	investigation control
21	Thu		M/D discussion	M/D discussion	Move to Harare	Move to site	Move to Harare	Survey of materials, equipment and prices	Move to site	investigation control
22	Fri		M/D discussion	M/D discussion	Discussion with DOR	Site reconnaissance	Discussion with DOR	Survey of materials, equipment and prices	Site reconnaissance	investigation control
23	Sat		8:30 Move to site	8:30 Move to site	Data correction	Site reconnaissance	Data correction	Data correction	Site reconnaissance	investigation control
24	Sun		8:45 Move to Harare	8:45 Move to Harare	Internal meeting	Internal meeting	Internal meeting	Internal meeting	Internal meeting	Quarantine
25	Mon		10:00 Ambassador's residence 14:00 MD signing	10:00 Ambassador's residence	Technical Note discussion	Move to Harare	Technical Note discussion	Survey of materials, equipment and prices	Move to Harare	Discussion with DOR / local consultant Web
26	Tue		JICA Zimbabwe report Harare~	JICA Zimbabwe report	Technical Note discussion	Move to Harare	Technical Note discussion	Harare~	Harare~	Discussion with DOR / local consultant Web
27	Wed		M/D singing	EOI, JICA report	Technical Note singing	Technical Note singing	~Tokyo	~Tokyo	~Tokyo	Discussion with DOR / local consultant Web
28	Thu		~Harare	~Harare	~Harare	~Harare	~Harare	~Harare	~Harare	Discussion with DOR / local consultant Web
29	Fri		~Tokyo	~Tokyo	~Tokyo	~Tokyo	~Tokyo	~Tokyo	~Tokyo	Discussion with DOR / local consultant Web
30	Sat				Site reconnaissance		Site reconnaissance		Site reconnaissance	Move to site
31	Sun				Move to Harare		Move to Harare		Move to Harare	Internal meeting
1	Mon				Discussion with DOR		Discussion with DOR		Discussion with DOR environmental staff	investigation control
2	Tue				Discussion with DOR		Discussion with DOR		Discussion with DOR environmental staff	investigation control
3	Wed				Discussion with DOR		Discussion with DOR		Discussion with DOR environmental staff	investigation control
4	Thu				Discussion with DOR (Soft components)		Discussion with DOR (Soft components)		Discussion with DOR (Soft components)	investigation control
5	Fri				Discussion with DOR (Soft components)		Discussion with DOR (Soft components)		Discussion with DOR (Soft components)	investigation control
6	Sat				Data correction		Data correction		Data correction	investigation control
7	Sun				Data correction		Data correction		Data correction	investigation control
8	Mon				Discussion with DOR		Discussion with DOR		Discussion with DOR	Move to Harare
9	Tue				Discussion with DOR		Discussion with DOR		Discussion with DOR	Move to Harare
10	Wed				Summary of results		Summary of results		Summary of results	Discussion with DOR
11	Thu				Harare~		Harare~		Harare~	Discussion with DOR
12	Fri				~Tokyo		~Tokyo		~Tokyo	Harare~

(2) 2nd site survey

Mth.	Day	JICA		Chief Consultant/Road Planner 1	Road and Pavement Design
		Mr Masuda	Mr Uchida	Hideaki Morita	Ikumasa Kawasaki
5	23 Mon		Tokyo~		
	24 Tue		Move	Tokyo~	Tokyo~
	25 Wed	Tokyo~	~Harare	~Harare	~Harare
	26 Thu	Move	DOD・M/D draft	DOD・M/D draft	DOD・M/D draft
	27 Fri	~Harare	DOD・MD discuss	DOD・MD discuss	DOD・MD discuss
	28 Sat	Site visit	Site visit	Site visit	Site visit
	29 Sun	Site visit	Site visit	Site visit	Site visit
	30 Mon	MD discussion	MD discussion	MoTID discussion	MoTID discussion
	31 Tue	MoFED, EOJ	MoFED, EOJ	MoFED, EOJ	MoFED, EOJ
6	1 Mon	Harare~	Harare~	Move	Move
	2 Tue	Move	Move	~Tokyo	~Tokyo
	3 Wed	~Tokyo	~Tokyo		

Appendix 3. List of relevant parties

The DOR, the counterpart of the survey, and the relevant parties met with during the period of the survey are listed below.

Ministry of Transport and Infrastructural Development (MoTID)	
F. Mhona	Minister
T. K. Chinyanga	Permanent Secretary
Department of Road (DOR, MoTID)	
A. Amos	Chief Director
Irene. D. Michael	Director of Planning & Design
Enerst Shenje	Deputy director of Planning
Ndoga	Deputy director of Designr
M. Pasipamire	Director of maintenance
Albert Muchena	Planning section, Engineer
Emmanule Mubaiwa	Planning section, Engineer
Virginia Mawere	Environmental Expert
Muzim Misheck	Planning & Transportation Technician
Ministry of Finance and Economic Development (MoFED)	
Margireta Makuwaza	Director - International Cooperation Department (ICD)
Marcos Nyaruwanga	Drector, Infrastructure Development and Fiscal Policy Decentralization
Enia D. Rugare	Deputy Director, ICD
Sharon Timbe	Economist, ICD
Zimbabwe Parks and Wildlife Management Authority (ZWMA)	
Jeremiah Cahkuya	TFCA Programme Officer
Augustine Malunga	Senior Ranger
David D. Chatindo	Senior Ranger
Hurungwe Rural District Council	
Luke Kalavina	Chief Executive Officer
EIA Consultant team for DOR	
B. Nhachi	Environmental Expert
Embassy of Japan	
Satoshi TANAKA	Ambassador
Masataka NAKAMURA	Counsellor
JICA Zimbabwe Office	
Kyosuke KAWAZUMI	Representative
Masatomo TOYODA	Deputy representative
Kenjiro AZUMA	JICA expert for MoFED
Andrea Zhou	Staff

Appendix 4. Minutes of Discussions (M/D)

Appendix 4-1 1st site survey period

Minutes of Discussions
on the Preparatory Survey for the Project for the Road Improvement of
the Northern Part of the North-South Corridor (Phase 2)

In response to the request from the Government of the Republic of Zimbabwe (hereinafter referred to as “Zimbabwe”), Japan International Cooperation Agency (hereinafter referred to as “JICA”) dispatched the Preparatory Survey Team for the Outline Design (hereinafter referred to as “the Team”) of the Project for the Road Improvement of the Northern Part of the North-South Corridor (Phase 2) (hereinafter referred to as “the Project”) to Zimbabwe. The Team held a series of discussions with the officials of the Government of Zimbabwe and conducted a field survey.

In the course of the discussions, both sides have confirmed the main items described in the attached sheets.

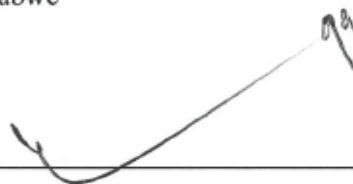
Harare, 30th November, 2021

岡田 薫

OKADA Kaoru
Leader
Preparatory Survey Team
Japan International Cooperation Agency
Japan



Theodius Kudzanayi Chinyanga
Permanent Secretary
Ministry of Transport & Infrastructural
Development
Zimbabwe



George T Guvamatanga
Permanent Secretary
Ministry of Finance & Economic
Development
Zimbabwe

(☑)

GTG

TCC

ATTACHMENT

1. Objective of the Project

The objective of the Project is to reduce traffic accidents, relieve traffic congestion and shorten travel time by constructing climbing lanes and widening sharp curve points in the northern part of the North-South Corridor, thereby contributing to the safe and smooth logistics in the North-South Corridor.

2. Title of the Preparatory Survey

Both sides confirmed the title of the Preparatory Survey as “the Preparatory Survey for the Project for the Road Improvement of the Northern Part of the North-South Corridor (Phase 2)”.

3. Project site

Both sides confirmed that the sites of the Project are in the northern part of the North-South Corridor between Makuti and Chirundu in Zimbabwe, which is shown in Annex 1.

4. Responsible authority for the Project

Both sides confirmed the authorities responsible for the Project are as follows:

- Department of Roads (hereinafter referred to as “DOR”), the Ministry of Transport & Infrastructural Development (hereinafter referred to as “MOTID”) will be the executing agency for the Project (hereinafter referred to as “the Executing Agency”). The Executing Agency shall coordinate with all the relevant authorities to ensure smooth implementation of the Project and ensure that the undertakings for the Project shall be managed by relevant authorities properly and on time. The organization charts are shown in Annex 2.

5. Items requested by the Government of Zimbabwe

5-1. As a result of discussions, both sides confirmed that the items requested by the Government of Zimbabwe are as follows:

- To construct climbing lanes at necessary section from Makuti to Chirundu of which locations are shown in Annex 1;
- To improve sharp curves at necessary section from Makuti to Chirundu of which locations are shown in Annex 1; and
- To assist capacity development of staffs of DOR on road maintenance and repairment.

5-2. JICA will assess the feasibility of the above requested items through the survey and will report the findings to the Government of Japan. The final scope of the Project will be decided by the Government of Japan.

6. Procedures and Basic Principles of Japanese Grant

6-1. The Zimbabwe side agreed that the procedures and basic principles of Japanese Grant (hereinafter referred to as “the Grant”) as described in Annex 3 shall be applied to the Project.

As for the monitoring of the implementation of the Project, JICA requires Zimbabwe side to submit the Project Monitoring Report, the form of which is attached as Annex 4.

6-2. The Zimbabwe side agreed to take the necessary measures, as described in Annex 5, for smooth implementation of the Project. The contents of the Annex 5 will be elaborated and refined during the Preparatory Survey and be agreed in the mission dispatched for explanation of the draft Preparatory Survey Report.

The contents of Annex 5 will be updated as the Preparatory Survey progresses, and eventually, will be used as an attachment to the Grant Agreement.

7. Schedule of the Survey

7-1. The Team will proceed with further survey in Zimbabwe until November 2021.

7-2. JICA will prepare a draft Preparatory Survey Report in English and dispatch a mission to Zimbabwe in order to explain its contents around April 2022.

7-3. If the contents of the draft Preparatory Survey Report is accepted and the undertakings for the Project are fully agreed by the Zimbabwe side, JICA will finalize the Preparatory Survey Report and send it to Zimbabwe around July 2022.

7-4. The above schedule is tentative and subject to change.

8. Environmental and Social Considerations

8-1. The Zimbabwe side confirmed to give due environmental and social considerations before and during implementation, and after completion of the Project, in accordance with the JICA Guidelines for Environmental and Social Considerations (April, 2010).

8-2. The Project is categorized as “B” from the following considerations:

The project is not likely to have significant adverse impact on the environment under the JICA guidelines for environmental and social considerations (April 2010) in terms of its sectors, characteristics and areas.

The Zimbabwe side confirmed to conduct the necessary procedures concerning the

environmental assessment (including stakeholder meetings, Environmental Impact Assessment (EIA) /Initial Environmental Examination (IEE) and information disclosure, etc.) and make EIA/IEE report of the Project based on the report submitted by JICA. Zimbabwe side will make draft EIA application after JICA submit the draft Preparatory Survey Report in April 2022. Zimbabwe side will submit final EIA application for its approval from the responsible authorities after JICA submit the Preparatory Survey Report in July 2022. The EIA/IEE approval shall be received from the responsible authorities and submitted to JICA by September 2022.

9. Other Relevant Issues

9-1. The Design Policy

Both sides confirmed that the design policy of the Project will be consistent with those of “the Project for the Road Improvement of the Northern Part of the North-South Corridor” for safe and smooth traffic.

9-2. Soft Component Assistance

Both sides confirmed that soft component assistance will be included in the Project in order to assist capacity development of staffs of DOR on road safety and maintenance as planned in Annex 6. The soft component assistance plan will be elaborated and refined during the Preparatory Survey and be agreed in the mission dispatched for explanation of the draft Preparatory Survey Report.

9-3. Input by Zimbabwe

The Zimbabwe side shall, at its own expenses, provide the Team with the followings in cooperation with agencies concerned.

- (1) Security-related information as well as measures to ensure the safety of the Team members;
- (2) Information as well as support in obtaining medical service;
- (3) Data and information related to the Preparatory Survey;
- (4) Counterpart personnel;
- (5) Suitable office space with necessary equipment and services;
- (6) Credentials or identification cards;
- (7) Entry permits necessary for the survey team members to conduct field surveys;
and
- (8) Support in obtaining other privileges and benefits if necessary.

9-4. Other Projects

Both sides confirmed that there will be no duplication of project sites and equipment with other projects.



9-5. Tax Exemption

Both sides confirmed that procedures of tax exemption on VAT and tax for imported goods for the Project is explained as Annex 7.

9-6. Safety Measures

Both sides confirmed that DOR shall take necessary measures to ensure and maintain the security of the Project site and the persons related to the implementation of the Project, in cooperation with relevant authorities during the Project period. Such security measures shall reasonably reflect needs of the Consultant/the Contractor engaging in the Project, as shown in Annex 5.

Both sides agreed that in case the additional security cost would be necessary for the implementation of the Project, such cost shall be borne by the Recipient without using the Grant.

9-7. Gender Mainstreaming

Both sides confirmed that following gender elements shall be duly reflected in the scope of Preparatory Survey.

- (a) Collection of information and gender disaggregated data for assessment of gender needs.
- (b) Collection of measures on equal employment conducted in other related projects or other donor's projects.
- (c) Examination of gender-responsive measures based on the assessment, such as:
 - Facility design that reflects gender-specific needs.
 - Project implementation plan that reflects gender-specific needs.

Annex 1 Project Site

Annex 2 Organization Chart

Annex 3 Japanese Grant

Annex 4 Project Monitoring Report (template)

Annex 5 Major Undertakings to be taken by the Government of Zimbabwe

Annex 6 Soft Component Assistance Plan (Draft)

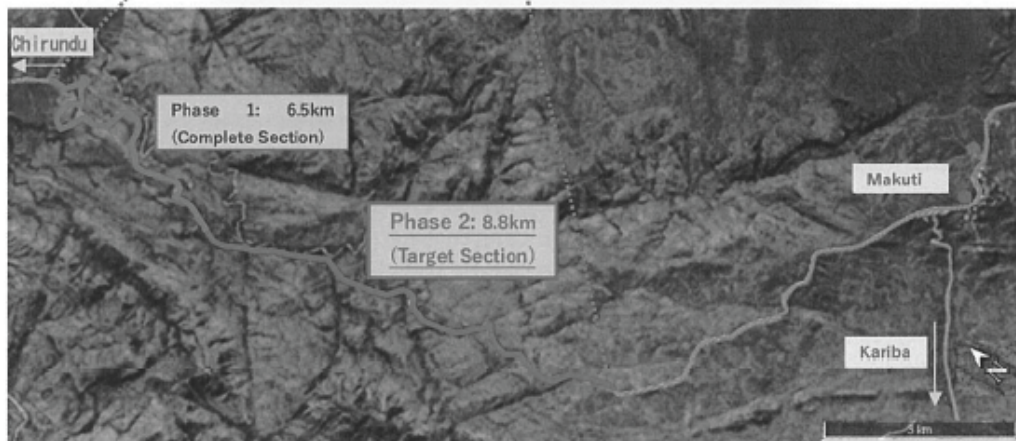
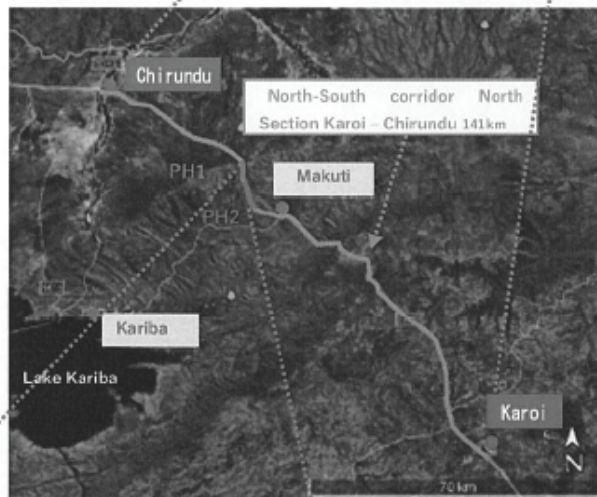
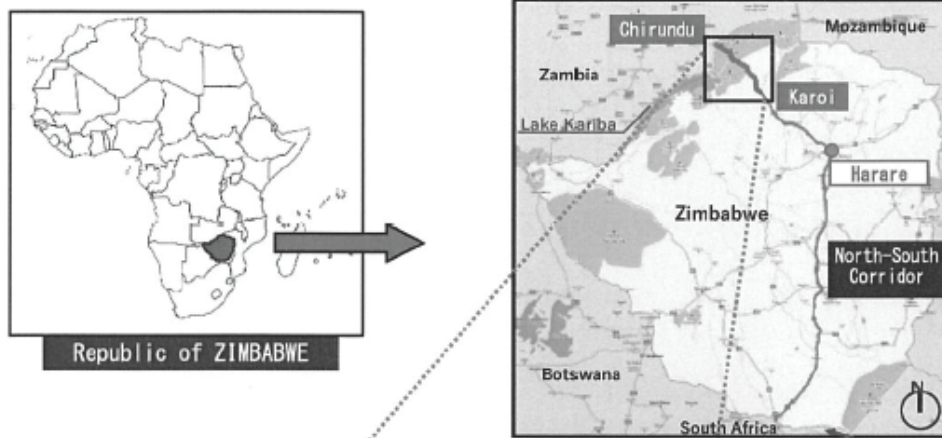
Annex 7 Procedures of Tax Exemption



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Project Site

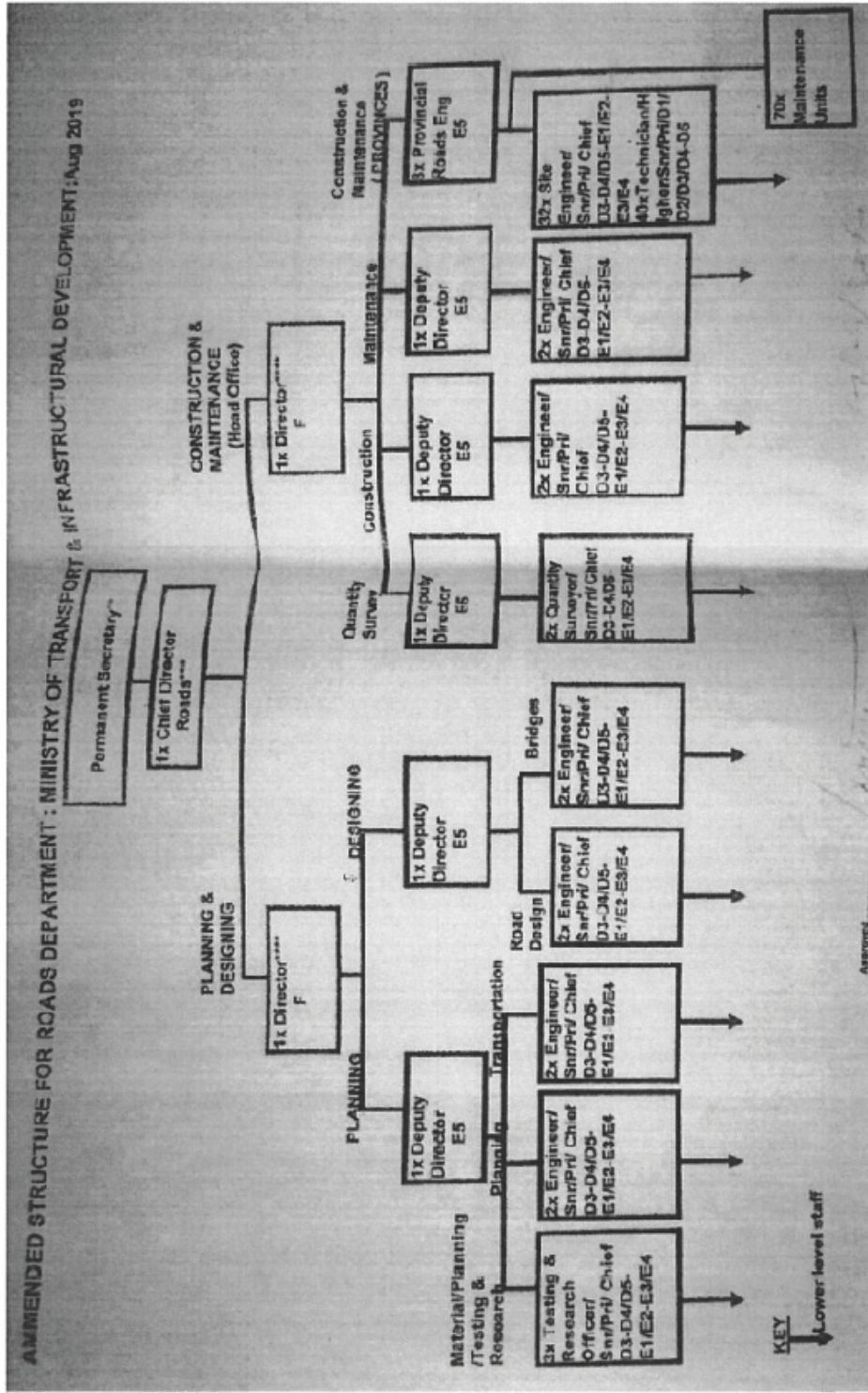


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Organization Chart



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Japanese Grant

The Japanese Grant is non-reimbursable fund provided to a recipient country (hereinafter referred to as “the Recipient”) to purchase the products and/or services (engineering services and transportation of the products, etc.) for its economic and social development in accordance with the relevant laws and regulations of Japan. Followings are the basic features of the project grants operated by JICA (hereinafter referred to as “Project Grants”).

1. Procedures of Project Grants

Project Grants are conducted through following procedures (See “PROCEDURES OF JAPANESE GRANT” for details):

(1) Preparation

- The Preparatory Survey (hereinafter referred to as “the Survey”) conducted by JICA

(2) Appraisal

- Appraisal by the Government of Japan (hereinafter referred to as “GOJ”) and JICA, and Approval by the Japanese Cabinet

(3) Implementation

Exchange of Notes

- The Notes exchanged between the GOJ and the government of the Recipient

Grant Agreement (hereinafter referred to as “the G/A”)

- Agreement concluded between JICA and the Recipient

Banking Arrangement (hereinafter referred to as “the B/A”)

- Opening of bank account by the Recipient in a bank in Japan (hereinafter referred to as “the Bank”) to receive the grant

Construction works/procurement

- Implementation of the project (hereinafter referred to as “the Project”) on the basis of the G/A

(4) Ex-post Monitoring and Evaluation

- Monitoring and evaluation at post-implementation stage

2. Preparatory Survey

(1) Contents of the Survey

The aim of the Survey is to provide basic documents necessary for the appraisal of the Project made by the GOJ and JICA. The contents of the Survey are as follows:

- Confirmation of the background, objectives, and benefits of the Project and also institutional capacity of relevant agencies of the Recipient necessary for the implementation of the Project.
- Evaluation of the feasibility of the Project to be implemented under the Japanese Grant from a technical, financial, social and economic point of view.

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- Confirmation of items agreed between both parties concerning the basic concept of the Project.
- Preparation of an outline design of the Project.
- Estimation of costs of the Project.
- Confirmation of Environmental and Social Considerations

The contents of the original request by the Recipient are not necessarily approved in their initial form. The Outline Design of the Project is confirmed based on the guidelines of the Japanese Grant.

JICA requests the Recipient to take measures necessary to achieve its self-reliance in the implementation of the Project. Such measures must be guaranteed even though they may fall outside of the jurisdiction of the Executing Agency of the Project. Therefore, the contents of the Project are confirmed by all relevant organizations of the Recipient based on the Minutes of Discussions.

(2) Selection of Consultants

For smooth implementation of the Survey, JICA contracts with (a) consulting firm(s). JICA selects (a) firm(s) based on proposals submitted by interested firms.

(3) Result of the Survey

JICA reviews the report on the results of the Survey and recommends the GOJ to appraise the implementation of the Project after confirming the feasibility of the Project.

3. Basic Principles of Project Grants

(1) Implementation Stage

1) The E/N and the G/A

After the Project is approved by the Cabinet of Japan, the Exchange of Notes (hereinafter referred to as "the E/N") will be signed between the GOJ and the Government of the Recipient to make a pledge for assistance, which is followed by the conclusion of the G/A between JICA and the Recipient to define the necessary articles, in accordance with the E/N, to implement the Project, such as conditions of disbursement, responsibilities of the Recipient, and procurement conditions. The terms and conditions generally applicable to the Japanese Grant are stipulated in the "General Terms and Conditions for Japanese Grant (January 2016)."

2) Banking Arrangements (B/A) (See "Financial Flow of Japanese Grant (A/P Type)" for details)

- a) The Recipient shall open an account or shall cause its designated authority to open an account under the name of the Recipient in the Bank, in principle. JICA will disburse the Japanese Grant in Japanese yen for the Recipient to cover the obligations incurred by the Recipient under the verified contracts.
- b) The Japanese Grant will be disbursed when payment requests are submitted by the Bank to JICA under an Authorization to Pay (A/P) issued by the Recipient.

3) Procurement Procedure

The products and/or services necessary for the implementation of the Project shall be procured in accordance with JICA's procurement guidelines as stipulated in the G/A.

4) Selection of Consultants

In order to maintain technical consistency, the consulting firm(s) which conducted the Survey will be recommended by JICA to the Recipient to continue to work on the Project's implementation after the E/N and G/A.

5) Eligible source country

In using the Japanese Grant disbursed by JICA for the purchase of products and/or services, the eligible source countries of such products and/or services shall be Japan and/or the Recipient. The Japanese Grant may be used for the purchase of the products and/or services of a third country as eligible, if necessary, taking into account the quality, competitiveness and economic rationality of products and/or services necessary for achieving the objective of the Project. However, the prime contractors, namely, constructing and procurement firms, and the prime consulting firm, which enter into contracts with the Recipient, are limited to "Japanese nationals", in principle.

6) Contracts and Concurrence by JICA

The Recipient will conclude contracts denominated in Japanese yen with Japanese nationals. Those contracts shall be concurred by JICA in order to be verified as eligible for using the Japanese Grant.

7) Monitoring

The Recipient is required to take their initiative to carefully monitor the progress of the Project in order to ensure its smooth implementation as part of their responsibility in the G/A, and to regularly report to JICA about its status by using the Project Monitoring Report (PMR).

8) Safety Measures

The Recipient must ensure that the safety is highly observed during the implementation of the Project.

9) Construction Quality Control Meeting

Construction Quality Control Meeting (hereinafter referred to as the "Meeting") will be held for quality assurance and smooth implementation of the Works at each stage of the Works. The member of the Meeting will be composed by the Recipient (or the Executing Agency), the Consultant, the Contractor and JICA. The functions of the Meeting are as followings:

- a) Sharing information on the objective, concept and conditions of design from the Contractor, before start of construction.
- b) Discussing the issues affecting the Works such as modification of the design, test, inspection, safety control and the Client's obligation, during of construction.

(2) Ex-post Monitoring and Evaluation Stage

- 1) After the project completion, JICA will continue to keep in close contact with the Recipient in order to monitor that the outputs of the Project is used and maintained properly to attain its

expected outcomes.

- 2) In principle, JICA will conduct ex-post evaluation of the Project after three years from the completion. It is required for the Recipient to furnish any necessary information as JICA may reasonably request.

(3) Others

1) Environmental and Social Considerations

The Recipient shall carefully consider environmental and social impacts by the Project and must comply with the environmental regulations of the Recipient and JICA Guidelines for Environmental and Social Considerations (April, 2010).

2) Major undertakings to be taken by the Government of the Recipient

For the smooth and proper implementation of the Project, the Recipient is required to undertake necessary measures including land acquisition, and bear an advising commission of the A/P and payment commissions paid to the Bank as agreed with the GOJ and/or JICA. The Government of the Recipient shall ensure that customs duties, internal taxes and other fiscal levies which may be imposed in the Recipient with respect to the purchase of the Products and/or the Services be exempted or be borne by its designated authority without using the Grant and its accrued interest, since the grant fund comes from the Japanese taxpayers.

3) Proper Use

The Recipient is required to maintain and use properly and effectively the products and/or services under the Project (including the facilities constructed and the equipment purchased), to assign staff necessary for this operation and maintenance and to bear all the expenses other than those covered by the Japanese Grant.

4) Export and Re-export

The products purchased under the Japanese Grant should not be exported or re-exported from the Recipient.



PROCEDURES OF JAPANESE GRANT

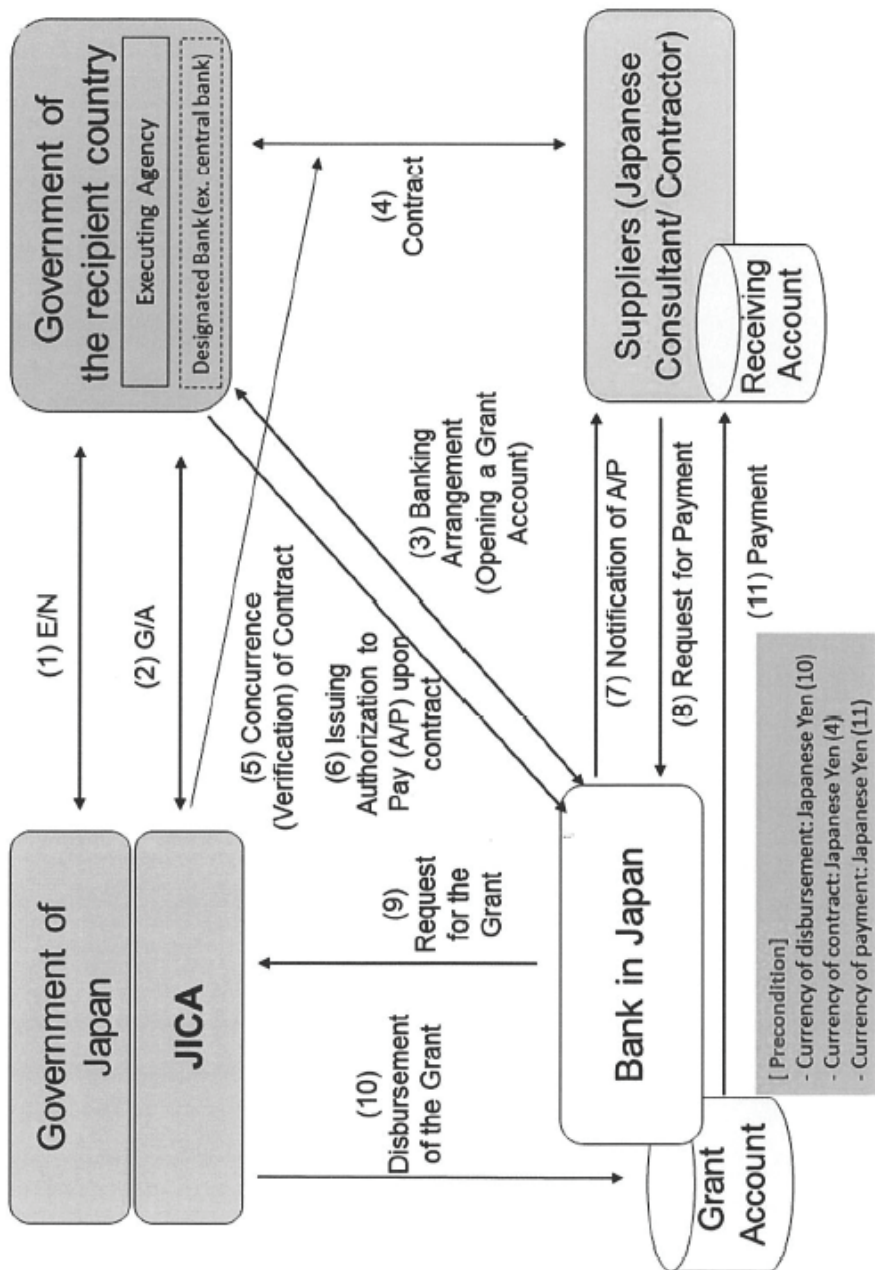
Stage	Procedures	Remarks	Recipient Government	Japanese Government	JICA	Consultants	Contractors	Agent Bank
Official Request	Request for grants through diplomatic channel	Request shall be submitted before appraisal stage.	X	X				
1. Preparation	(1) Preparatory Survey Preparation of outline design and cost estimate		X		X	X		
	(2) Preparatory Survey Explanation of draft outline design, including cost estimate, undertakings, etc.		X		X	X		
2. Appraisal	(3) Agreement on conditions for implementation	Conditions will be explained with the draft notes (E/N) and Grant Agreement (G/A) which will be signed before approval by Japanese government.	X	X (E/N)	X (G/A)			
	(4) Approval by the Japanese cabinet			X				
	(5) Exchange of Notes (E/N)		X	X				
3. Implementation	(6) Signing of Grant Agreement (G/A)		X		X			
	(7) Banking Arrangement (B/A)	Need to be informed to JICA	X					X
	(8) Contracting with consultant and issuance of Authorization to Pay (A/P)	Concurrence by JICA is required	X			X		X
	(9) Detailed Design (D/D)	—	X			X		
	(10) Preparation of bidding documents	Concurrence by JICA is required	X			X		
	(11) Bidding	Concurrence by JICA is required	X			X	X	
	(12) Contracting with contractor/supplier and issuance of A/P	Concurrence by JICA is required	X				X	X
	(13) Construction works/procurement	Concurrence by JICA is required for major modification of design and amendment of contracts.	X			X	X	
	(14) Completion certificate	—	X			X	X	
	4. Ex-post monitoring & evaluation	(15) Ex-post monitoring	To be implemented generally after 1, 3, 10 years of completion, subject to change	X		X		
(16) Ex-post evaluation		To be implemented basically after 3 years of completion	X		X			

Notes:

1. Project Monitoring Report and Report for Project Completion shall be submitted to JICA as agreed in the G/A.
2. Concurrence by JICA is required for allocation of grant for remaining amount and/or contingencies as agreed in the G/A.



Financial Flow of Japanese Grant (A/P Type)



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Project Monitoring Report
on
Project Name
Grant Agreement No. XXXXXXXX
20XX, Month

Organizational Information

Signer of the G/A (Recipient)	Person in Charge (Designation) _____ Contacts _____ Address: _____ Phone/FAX: _____ Email: _____
Executing Agency	Person in Charge (Designation) _____ Contacts _____ Address: _____ Phone/FAX: _____ Email: _____
Line Ministry	Person in Charge (Designation) _____ Contacts _____ Address: _____ Phone/FAX: _____ Email: _____

General Information:

Project Title	
E/N	Signed date: Duration:
G/A	Signed date: Duration:
Source of Finance	Government of Japan: Not exceeding JPY _____ mil. Government of (_____): _____



1: Project Description

1-1 Project Objective

--

1-2 Project Rationale

- Higher-level objectives to which the project contributes (national/regional/sectoral policies and strategies)
- Situation of the target groups to which the project addresses

--

1-3 Indicators for measurement of "Effectiveness"

Quantitative indicators to measure the attainment of project objectives		
Indicators	Original (Yr)	Target (Yr)
Qualitative indicators to measure the attainment of project objectives		

2: Details of the Project

2-1 Location

Components	Original <i>(proposed in the outline design)</i>	Actual
1.		

2-2 Scope of the work

Components	Original* <i>(proposed in the outline design)</i>	Actual*
1.		

Reasons for modification of scope (if any).

(PMR)



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2-3 Implementation Schedule

Items	Original		Actual
	<i>(proposed in the outline design)</i>	<i>(at the time of signing the Grant Agreement)</i>	

Reasons for any changes of the schedule, and their effects on the project (if any)

2-4 Obligations by the Recipient

2-4-1 Progress of Specific Obligations
 See Attachment 2.

2-4-2 Activities
 See Attachment 3.

2-4-3 Report on RD
 See Attachment 11.

2-5 Project Cost

2-5-1 Cost borne by the Grant(Confidential until the Bidding)

Components	Original		Cost (Million Yen)	
	<i>(proposed in the outline design)</i>	<i>Actual (in case of any modification)</i>	<i>Original^{1),2)} (proposed in the outline design)</i>	<i>Actual</i>
1.				
Total				

Note: 1) Date of estimation:
 2) Exchange rate: 1 US Dollar = Yen

2-5-2 Cost borne by the Recipient

Components	Original		Cost (1,000 Taka)	
	<i>(proposed in the outline design)</i>	<i>Actual (in case of any modification)</i>	<i>Original^{1),2)} (proposed in the outline design)</i>	<i>Actual</i>
1.				

Note: 1) Date of estimation:
 2) Exchange rate: 1 US Dollar =



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Reasons for the remarkable gaps between the original and actual cost, and the countermeasures (if any)

(PMR)

2-6 Executing Agency

- Organization's role, financial position, capacity, cost recovery etc,
- Organization Chart including the unit in charge of the implementation and number of employees.

Original (at the time of outline design)

name:

role:

financial situation:

institutional and organizational arrangement (organogram):

human resources (number and ability of staff):

Actual (PMR)

2-7 Environmental and Social Impacts

- The results of environmental monitoring based on Attachment 5 (in accordance with Schedule 4 of the Grant Agreement).
- The results of social monitoring based on in Attachment 5 (in accordance with Schedule 4 of the Grant Agreement).
- Disclosed information related to results of environmental and social monitoring to local stakeholders (whenever applicable).

3: Operation and Maintenance (O&M)

3-1 Physical Arrangement

- Plan for O&M (number and skills of the staff in the responsible division or section, availability of manuals and guidelines, availability of spareparts, etc.)

Original (at the time of outline design)

Actual (PMR)

3-2 Budgetary Arrangement

- Required O&M cost and actual budget allocation for O&M

Original (at the time of outline design)

Actual (PMR)

4: Potential Risks and Mitigation Measures

- Potential risks which may affect the project implementation, attainment of objectives, sustainability
- Mitigation measures corresponding to the potential risks

Assessment of Potential Risks (at the time of outline design)

Potential Risks	Assessment
1. (Description of Risk)	Probability: High/Moderate/Low
	Impact: High/Moderate/Low
	Analysis of Probability and Impact:
	Mitigation Measures:
	Action required during the implementation stage:
2. (Description of Risk)	Probability: High/Moderate/Low
	Impact: High/Moderate/Low
	Analysis of Probability and Impact:
	Mitigation Measures:
	Action required during the implementation stage:
3. (Description of Risk)	Probability: High/Moderate/Low
	Impact: High/Moderate/Low
	Analysis of Probability and Impact:
	Mitigation Measures:
	Action required during the implementation stage:
Actual Situation and Countermeasures	
(PMR)	



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5: Evaluation and Monitoring Plan (after the work completion)

5-1 Overall evaluation

Please describe your overall evaluation on the project.

5-2 Lessons Learnt and Recommendations

Please raise any lessons learned from the project experience, which might be valuable for the future assistance or similar type of projects, as well as any recommendations, which might be beneficial for better realization of the project effect, impact and assurance of sustainability.

5-3 Monitoring Plan of the Indicators for Post-Evaluation

Please describe monitoring methods, section(s)/department(s) in charge of monitoring, frequency, the term to monitor the indicators stipulated in 1-3.



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Attachment

1. Project Location Map
 2. Specific obligations of the Recipient which will not be funded with the Grant
 3. Monthly Report submitted by the Consultant
- Appendix - Photocopy of Contractor's Progress Report (if any)
- Consultant Member List
 - Contractor's Main Staff List
4. Check list for the Contract (including Record of Amendment of the Contract/Agreement and Schedule of Payment)
 5. Environmental Monitoring Form / Social Monitoring Form
 6. Monitoring sheet on price of specified materials (Quarterly)
 7. Report on Proportion of Procurement (Recipient Country, Japan and Third Countries) (PMR (final) only)
 8. Pictures (by JPEG style by CD-R) (PMR (final) only)
 9. Equipment List (PMR (final) only)
 10. Drawing (PMR (final) only)
 11. Report on RD (After project)



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Monitoring sheet on price of specified materials

1. Initial Conditions (Confirmed)

Items of Specified Materials		Initial Volume A	Initial Unit Price (¥) B	Initial total Price C=A×B	1% of Contract Price D	Condition of payment Price (Decreased) E=C-D		Price (Increased) F=C+D
1	Item 1	●●t	●	●	●	●	●	●
2	Item 2	●●t	●	●	●	●		
3	Item 3							
4	Item 4							
5	Item 5							

2. Monitoring of the Unit Price of Specified Materials

(1) Method of Monitoring : ●●

(2) Result of the Monitoring Survey on Unit Price for each specified materials

Items of Specified Materials		1st month, 2015	2nd month, 2015	3rd month, 2015	4th	5th	6th
1	Item 1	●	●	●			
2	Item 2						
3	Item 3						
4	Item 4						
5	Item 5						

(3) Summary of Discussion with Contractor (if necessary)

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Report on Proportion of Procurement (Recipient Country, Japan and Third Countries)
(Actual Expenditure by Construction and Equipment each)

	Domestic Procurement (Recipient Country) A	Foreign Procurement (Japan) B	Foreign Procurement (Third Countries) C	Total D
Construction Cost	(A/D%)	(B/D%)	(C/D%)	
Direct Construction Cost	(A/D%)	(B/D%)	(C/D%)	
others	(A/D%)	(B/D%)	(C/D%)	
Equipment Cost	(A/D%)	(B/D%)	(C/D%)	
Design and Supervision Cost	(A/D%)	(B/D%)	(C/D%)	
Total	(A/D%)	(B/D%)	(C/D%)	

(*)

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Major Undertakings to be taken by the Government of the Republic of Zimbabwe

1. Specific obligations of the Government of the Republic of Zimbabwe which will not be funded with the Grant

(1) Before the Bidding

No.	Items	Deadline	In charge	Estimated Cost (USD)	Ref.
1	To open Bank Account (Banking Arrangement (B/A))	within 1 month after the signing of the G/A	MoFED	25,000	
2	To issue Authorization to Pay (A/P) to a bank in Japan (the Agent Bank) for the payment to the consultant	within 1 month after the signing of the contract	MoFED		
3	To approve EIA and secure the necessary budget for implementation.	within 1 month after the signing of the G/A	DOR	120,000	
4	To secure the following lands, if necessary a) project sites b) temporary construction yard and stock yard near the Project area c) quarry borrow pit and disposal site near the Project area	before notice of the bidding document(s)	DOR		
5	To clear, level and reclaim the following sites, if necessary a) electric line b) water line c) fiber line d) telephone line	before notice of the bidding document(s)	DOR, Utility Companies	8,000	
6	To obtain the planning, zoning, building, construction permit	before notice of the bidding document(s)	DOR		
7	To assign of Wildlife rangers including assignment expenses of rangers during the Detailed Design and construction	during Detailed Design and construction	DOR, PWMA	150,000	
8	To submit Project Monitoring Report (with the result of Detailed Design)	before notice of the bidding document(s)	DOR		

Note: A/P: Authorization to pay, B/A: Banking Arrangement, DOR: Department of Road, MoFED: Ministry of Finance and Economic Development, PWMA: Parks and Wildlife Management Authority, USD: US dollar

(2) During the Project Implementation

No.	Items	Deadline	In charge	Estimated Cost (USD)	Ref.
1	To issue A/P to a bank in Japan (the Agent Bank) for the payment to the contractor	within 1 month after the signing of the contract	MoFED		
2	To bear the following commissions to a bank in Japan for the banking services based upon the B/A		MoFED		

No.	Items	Deadline	In charge	Estimated Cost (USD)	Ref.
	a) Advising commission of A/P	within 1 month after the signing of the contract			
	b) Payment commission for A/P	every payment			※1
3	Company registration for the Project Costs of registration of the consultant and the contractor, 2 years each assumed	before start of the construction	DOR	30,000	
4	To ensure prompt customs clearance and to assist the contractor with internal transportation in country of Recipient	during the Project	DOR		
5	To accord the Japanese physical persons and/or physical persons of third countries whose services may be required in connection with the supply of the products and/or the services such facilities as may be necessary for their entry into the country of the Recipient and stay therein for the performance of their work	during the Project	DOR		
6	To ensure that customs duties, internal taxes and other fiscal levies which may be imposed in the country of the Recipient with respect to the purchase of the products and/or the services be exempted	during the Project	DOR MoFED ZIMRA		
7	To bear all the expenses, other than those covered by the Grant, necessary for the implementation of the Project	during the Project	DOR		
8	To provide facilities for distribution of electricity, water supply and drainage and other incidental facilities necessary for the implementation of the Project outside the sites a) Electricity The distributing line to the site. b) Water Supply The city water distribution neat the Park & wildlife office Harare side. (if necessary) c) Communication line The distributing line to the site.	before start of the construction	DOR		
9	To submit following Project Monitoring Reports		DOR		
	a) Project Monitoring Report (Monthly report)	every month			
	b) Project Monitoring Report (Final).	within one month after signing of Certificate of Completion for the works under the contract			
10	To implement EMP and EMoP	during the construction	DOR		
11	To submit results of environmental monitoring to JICA, by using the monitoring form, on a quarterly basis as a part of Project Monitoring Report	during the construction	DOR		

Note: EMP: Environmental Management Plan, EMoP: Environmental Monitoring Plan, ZIMRA: Zimbabwe Revenue Authority

※1 The estimated cost is included in the cost shown in 1.(1)-No1.

(3) After the Project

No.	Items	Deadline	In charge	Estimated Cost (USD)	Ref.
1	To maintain and use properly and effectively the facilities constructed and equipment provided under the Grant Aid a) Allocation of maintenance cost b) Routine check/Periodic inspection	After completion of the construction	DOR	28,000 /year	
2	To implement EMP and EMoP	for a period based on EMP and EMoP	DOR		
3	To submit results of environmental monitoring to JICA, by using the monitoring form, semiannually - The period of environmental monitoring may be extended if any significant negative impacts on the environment are found. The extension of environmental monitoring will be decided based on the agreement between DOR and JICA.	for three years after the Project	DOR		

2. Other obligations of the Government of the Republic of Zimbabwe funded with the Grant

No.	Items	Deadline	Amount (Million Japanese Yen)*
1	To construct roads - Reconstruction of the roads To conduct the following transportation a) Marine (Air) transportation of the products from Japan and the third country to the country of Recipient b) Internal transportation from the port of disembarkation to the Project site		/
2	To implement Detailed Design, bidding support and construction supervision (Consulting Service)		
3	Contingencies		
Total			XXX

* The Amount is to be decided. This is subject to the approval of the Government of Japan.

**The Preparatory Survey for the Project for the Road
Improvement of the Northern Part of the North-South
Corridor (Phase 2)**

in

The Republic of Zimbabwe

Soft Component Assistance Plan (Draft)

October 2021

Japan International Cooperation Agency

(JICA)

INGEROSEC Corporation

Eight-Japan Engineering Consultants Inc.

Oriental Consultants Global Co., Ltd.

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Soft Component Assistance Plan (Draft)

1. Background

(1) Outline of the Project

The northern section of the North-South Corridor, which is a 141km mountainous section of the corridor, is a major logistics route in Zimbabwe. In May 2021, a 6.5km section of the corridor was developed under Japanese Grant Aid “the Project for the Road Improvement of the Northern Part of the North-South Corridor” (Phase-1). In addition, the preparatory survey for Phase-2 which is adjacent section to Phase-1 was started in September 2021.

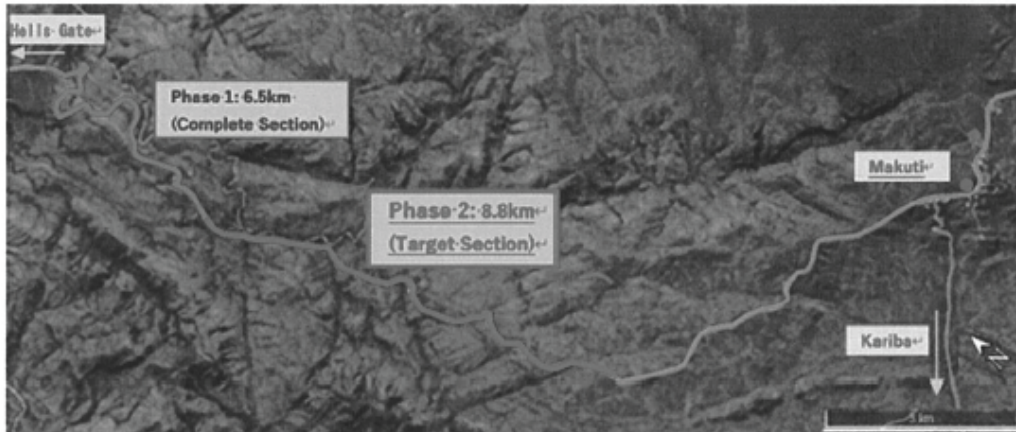


Fig.: Location of Phase-1 and Phase-2

(2) Background of Soft Component Assistance

1) MoTID's request for improvement of road conditions

Department of Roads (DOR) of the Ministry of Transport and Infrastructural Development (MoTID), which is the Executing Agency of Phase-1, allocated their staffs to Phase-1 in order to improve their capacity of quality and process management through project management. In addition, MoTID is carrying out road maintenance around the country through the Emergency Road Rehabilitation Programme-2 (2021-2023) to improve the northern section of the corridor.

2) Issues to be improved in existing road networks

On the other hand, looking at the condition of existing roads around the country, following issues should be addressed in order to improve the existing road networks around the country.

Table: Issues to be improved in existing road networks

Issue	Summary
A	Pavements that are disappearing from the road edges due to shoulder edge erosion
B	Lack of effective road facilities for traffic safety
C	Lack of measures to improve traffic safety in geometrically difficult areas

The above issues A and B can be solved through improvements to road facilities. However, as for geometrically difficult areas such as sharp curves and steep slopes, it is important to understand geometric structure of roads as well as road facilities to improve traffic safety.

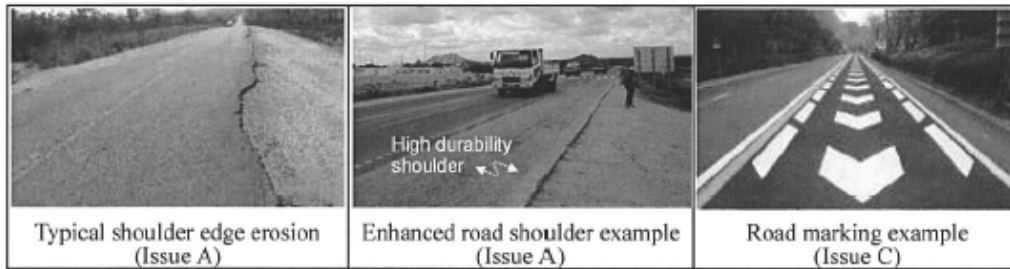


Fig.: Issues to be improved in the existing road networks

3) Necessity for Soft Component Assistance

It is important to develop roads themselves as well as develop capacity of MoTID through the soft component assistance in order to improve traffic safety.

2. Targets of Soft Component Assistance

In order to address the issues mentioned in 1 (2) 2) above, following targets of the soft component assistance are set.

Table: Targets of the soft component

Objective	Task	Overview
1	A	Reinforcement of shoulders (especially at the edges)
2	B	Study of roadside facilities for traffic safety (accident prevention)
3	C	Improving understanding to road geometry to improve road safety

3. Outputs of Soft Component Assistance

(1) Direct results to be achieved

Following table shows the direct outputs to be achieved at the end of the soft component assistance.

Table: Outputs to be achieved

Output	Direct output	Remarks
I	Capacity of MoTID to stabilize road shoulder by in-situ concrete kerbs using MoTID's own facility is improved.	Availability of pick-up trucks, backhoes, small rollers, small mixers, work teams, etc. needs to be confirmed.
II	Capacity of MoTID to understand effect of multiple types of road safety equipment (humps and markings) and their changes in location and pattern of the equipment (vehicle slowing effect) is improved.	Pilot trials using oil paints at accident-prone spots (curves, straights and gradients) along a 141km section, including Phase-1 to measure the effect of reducing passing speeds
III	Understanding of MoTID to road design at geometrically difficult points in order to improve traffic safety is improved.	Practical design experience through survey and existing road condition surveys to be carried out (assuming the use of local consultant facilities, equipment and technicians).



G T G

T K C

(2) Implementation of Soft Component Assistance (draft)

Draft implementation plan of the soft component assistance is shown below.

Table: Draft implementation plan of the Soft Component Assistance

Output 1	Capacity of MoTID to stabilize road shoulder by in-situ concrete kerbs using MoTID's own facility is improved.
Activities	(1) Review of cases in other countries and existing documents and sharing overview of implementation examples (2) Status check of issues in existing road with the executing agency (2) Discussion and consideration on desirable specifications and dimensions. (3) Study of alternatives for strengthening the road shoulder. (4) Trial construction by the executing agency and study of the best solution.
Method	Theoretical and on-site training by a Japanese consultant (explanation of the mechanism of pavement degradation from the road shoulder, outline of similar examples and technical and key points, explanation of key points through trial construction (determination of causes of degradation, explanation of water concentration areas (slope, curves, etc.) and explanation of influence of surface water and groundwater conditions, etc.)
Period	1 to 2 months
Output 2	Capacity of MoTID to understand effect of multiple types of road safety equipment (humps and markings) and their changes in location and pattern of the equipment (vehicle slowing effect) is improved.
Activities	(1) Review of the current situation in the country, review of existing materials, explanation of the Japanese case study (2) Status check of issues on existing road (3) Discussion and consideration of desirable specifications and dimensions (4) Study on alternatives for safety facilities. (5) Trial of the alternatives and study on the best solution by the executing agency.
Method	Theoretical and on-site training by Japanese consultant (explanation of common points and mechanisms of traffic accidents and explanation of Japanese case studies and technical points, etc.)
Period	1 to 2 months
Output 3	Understanding of MoTID to road design at geometrically difficult points in order to improve traffic safety is improved.
Activities	(1) Practical design experience by the executing agency using the results of field surveys (survey, existing road survey, etc.) (2) Understanding of the design and local conditions by field inspection after the design experience (3) Confirmation of issues on the geometrical structure of roads which have frequent accidents (4) Study of improvement plans
Method	Theory, planning/designing practice and on-site training by Japanese consultants (explanation of common points at accident-prone locations and mechanisms of traffic accidents, explanation of points to be considered and technical points in road geometry, support for planning/designing practice, etc.) (design practice using equipment, facilities and technicians of local consultants))
Period	1 to 2 months

4. Methods to Check Achieved Output

The following methods and indicators will be used to check the extent to which the outputs defined in 3. above are achieved.

Table: Methods to check achieved output

Output	Direct results (draft)	Methods to check achieved output
1	Planning of alternatives of shoulder edge strengthening method a) Strengthening of shoulder edge (in-situ kerb, etc.) b) Strengthening of the shoulder (stabilization, etc.)	- Number of proposals of a) and b) - Questionnaire before and after soft component assistance
2	Planning of alternatives of traffic safety facilities c) Planning of road marking patterns and locations d) Planning of the pattern and location of humps	- Measurement of the effect of deceleration in c) and d) - Questionnaire before and after soft component assistance
3	e) Design experience of MoTID participants	- Number of trial of e) - Questionnaire before and after soft component assistance

5. Activities of Soft Component Assistance (Input Plan)

The following table shows outline of activities of the soft component assistance.

Table: Outline of activities

Output	Activities	Experts	Target group
1	a) Road shoulder edge reinforcement planning (e.g. cast-in-place kerb) b) Planning of shoulder strengthening (stabilization, etc.)	-Road planning, 0.7 MM -Construction planning, 1MM	Planning, design, operation, laboratory, provincial office in DOR (10-15 people, 2-3 from each affiliation)
2	c) Pattern and location planning of marking d) Pattern and location planning of humps	-Road planning, 0.7MM -Road design, 1MM	Same as above
3	e) Design experience training for MoTID	-Road planning, 0.6MM -Road design, 1MM -Local Engineer, 3MM	Same as above (using local consultancy facilities)

6. Implementation schedule of Soft Component Assistance

The following table shows the expected implementation schedule of Soft Component Assistance.

Table: Implementation schedule (draft)

	Year 202X									
	Mth. 1	2	3	4	5	6	7	8	9	
Detailed design (assumed)	-----									
For Objective-1					□	■	←Road planning / Construction Planning			
For Objective 2	□	■	←Road planning / Road design							
For Objective-3			□	■	←Road planning / Road design					
Output					△			▲		

Note: □ Work in Japan ■ in Zimbabwe △ Progress Report ▲ Completion Report

7. Deliverables of Software Component Assistance

The following table shows the expected deliverables of the soft component assistance.

Table: Possible deliverables

Deliverables	Outline	Remarks
Completion report	Deliverables, training materials, OJT procedures, etc.	
Related documents	Results of questionnaires	

8. Responsibilities of Zimbabwe side

In order to achieve the output of the soft component assistance, the following responsibilities of the executing agency need to be implemented.

Table: Responsibilities of Zimbabwe side

Output	Executing agency	Concerns and measures
1	Counterparts allocation (Planning, design, operation, laboratories, provincial offices in DOR)	Concerns: Mismatch of them Measures: Consultation with the executing agency
2	Ditto	Ditto
3	Ditto	Ditto

Procedures of Tax Exemption

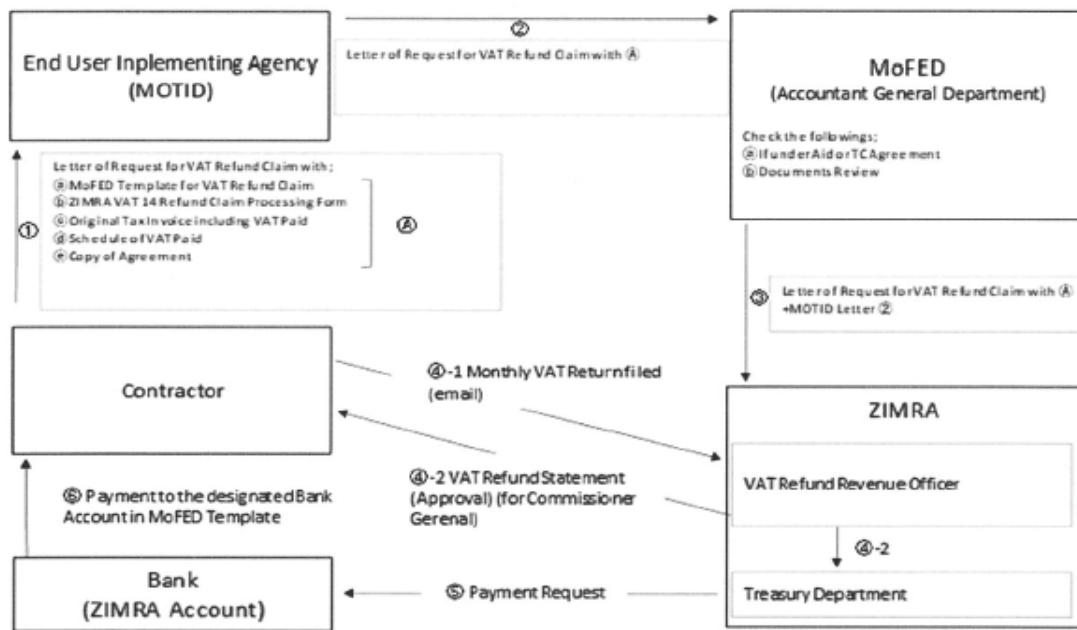
1. Refund of Value Added Tax (VAT)

The VAT refund procedures are follows.

Maximum days for each procedure is as follows. However, if the documents submitted by the applicant (including local suppliers) are incomplete, the days required for correction will be added to the maximum days below.

- (1) ①~②: MoTID shall send the complete request to MoFED (Office of Accountant General) within 7 calendar days after receiving the complete request from the applicant with the refund request letter.
- (2) ③: MoFED shall send the complete request to ZIMRA (VAT Refund Revenue Officer) within 14 calendar days after receiving the complete request form from MoTID with the refund request letter.
- (3) ④~⑥: ZIMRA will notify the applicant of the VAT Refund Statement within 21 calendar days after receiving the complete request form from MoFED. In addition, applied amount of VAT must be refunded to a bank account of the applicant within 42 calendar days after its application.

VAT Refund Procedures



2. Exemption of Tax for Imported Goods

Delays in customs clearance will result in unnecessary costs and, as a result, delays in the Projects. Therefore, the Government of Zimbabwe should take necessary budgetary measures in advance. The procedures are as follows.

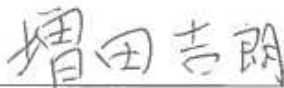
- (1) After bidding and before the contract with the contractors, the contractors (including local suppliers) will notify MoTID of the master list of goods to be imported, the total amount (including the rough estimate of light oil, etc.) and the timing of import.
- (2) MoTID should include the total amount in their budget in next fiscal year or allocate the budget from current budget.
- (3) MoTID pays the required amount from the budget for each arrival of imported goods.

Minutes of Discussions
on the Preparatory Survey for the Project for
the Road Improvement of
the Northern Part of the North-South Corridor (Phase 2)
(Explanation on Draft Preparatory Survey Report)

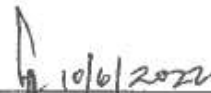
With reference to the minutes of discussions signed between Ministry of Transport & Infrastructural Development, Ministry of Finance & Economic Development and the Japan International Cooperation Agency (hereinafter referred to as "JICA") on 30th November, 2021 and in response to the request from the Government of the Republic of Zimbabwe (hereinafter referred to as "Zimbabwe") dated July, 2019, JICA dispatched the Preparatory Survey Team (hereinafter referred to as "the Team") for the explanation of Draft Preparatory Survey Report (hereinafter referred to as "the Draft Report") for the Project for the Road Improvement of the Northern Part of the North-South Corridor (Phase 2) (hereinafter referred to as "the Project").

As a result of the discussions, both sides agreed on the main items described in the attached sheets.


Harare, 2022



MASUDA Yoshiro
Leader
Preparatory Survey Team
Japan International Cooperation Agency
Japan


10/6/2022

Theodius Kudzanayi Chinyanga
Permanent Secretary
Ministry of Transport & Infrastructural
Development
Zimbabwe


George T Guyamatanga
Permanent Secretary
Ministry of Finance & Economic Development
Zimbabwe

MINISTRY OF FINANCE AND
ECONOMIC DEVELOPMENT
SECRETARY TO THE TREASURY

17 JUN 2022

P. BAG 7705, CAUSEWAY
ZIMBABWE TEL: 04-250967

ATTACHEMENT

1. Objective of the Project

The objective of the Project is to reduce traffic accidents, relieve traffic congestion and shorten travel time by constructing climbing lanes and widening sharp curve points in the northern part of the North-South Corridor, thereby contributing to the further utilization and smooth logistics in the North-South Corridor.

2. Title of the Preparatory Survey

Both sides confirmed the title of the Preparatory Survey as “the Preparatory Survey for the Project for the Road Improvement of the Northern Part of the North-South Corridor (Phase 2)”.

3. Project site

Both sides confirmed that the sites of the Project are in the northern part of the North-South Corridor between Makuti and Chirundu in Zimbabwe, which is shown in Annex 1.

4. Responsible authority for the Project

Both sides confirmed the authorities responsible for the Project are as follows:

- Department of Roads (hereinafter referred to as “DOR”), the Ministry of Transport & Infrastructural Development (hereinafter referred to as “MOTID”) will be the executing agency for the Project (hereinafter referred to as “the Executing Agency”). The Executing Agency shall coordinate with all the relevant authorities to ensure smooth implementation of the Project and ensure that the undertakings for the Project shall be taken care by relevant authorities properly and on time. The organization chart is shown in Annex 2.

5. Contents of the Draft Report

After the explanation of the contents of the Draft Report by the Team, the Zimbabwe side agreed to its contents. JICA will finalize the Preparatory Survey Report based on the confirmed items. The report will be sent to the Zimbabwe side around July, 2022.



6. Cost estimate

Both sides confirmed that the cost estimate including the contingency explained by the Team is provisional and will be examined further by the Government of Japan for its approval. The contingency would cover the additional cost against natural disaster, unexpected natural conditions, etc.

7. Confidentiality of the cost estimate and technical specifications

Both sides confirmed that the cost estimate and technical specifications of the Project should never be disclosed to any third parties until all the contracts under the Project are concluded.

8. Procedures and Basic Principles of Japanese Grant

The Zimbabwe side agreed that the procedures and basic principles of Japanese Grant (hereinafter referred to as "the Grant") as described in Annex 3 shall be applied to the Project. In addition, the Zimbabwe side agreed to take necessary measures according to the procedures.

9. Timeline for the Project implementation

The Team explained to the Zimbabwe side that the expected timeline for the Project implementation is as attached in Annex 4.

10. Expected outcomes and indicators

Both sides agreed that key indicators for expected outcomes are as follows. The Zimbabwe side will be responsible for the achievement of agreed key indicators targeted in year 2028 and shall monitor the progress for Ex-Post Evaluation based on those indicators.

[Quantitative indicators]

Index name	Base value (Actual value in 2021)	Target value (2028) [3 years after project completion]
Number of traffic accidents in target section (7.8km) (incident/year)	61	10
Passage time in target section (7.8km) (minutes)	17	8
Volume of passengers (thousand person/year)	530	560
Volume of cargo (million ton/year)	4.45	5.01

Note: The locations and methods of measuring the volume of passengers, the volume of cargo and the number of accidents are as follows.

- Volume of passengers is estimated based on traffic survey between Karoi and Chirundu. It is assumed that 2 passengers are in a small car, 10 passengers are in a minibus and 34 passengers are in a large bus.
- Volume of cargo is estimated based on actual vehicle weights measured in Chilundu (A truck is 17 tons and a trailer is 37 tons.).

[Qualitative indicators]

- Shortening travelling time contributes to reduction of transportation costs.
- Traffic safety and smoothness are improved including perspective of drivers.
- Employment of women is facilitated.
- Capacity of DOR on traffic safety measures and road maintenance is improved.

11. Ex-Post Evaluation

JICA will conduct ex-post evaluation after three (3) years from the Project completion, in principle, with respect to five evaluation criteria (Relevance, Effectiveness, Efficiency, Impact, Sustainability). The result of the evaluation will be publicized. The Zimbabwe side is required to provide necessary support for the data collection.

12. Technical assistance ("Soft Component" of the Project)

Considering the sustainable operation and maintenance of the products and services granted through the Project, following technical assistance is planned under the Project. The Zimbabwe side confirmed to deploy necessary number of counterparts who are appropriate and competent in terms of its purpose of the technical assistance as described in the Draft Report.

<Outputs of the Soft Component>

- 1) Capacity of MOTID to understand effect (vehicle slowing effect) of multiple types of road safety equipment (humps and markings) is improved by changing the location and pattern.
- 2) Understanding of MOTID to road design on geometrically difficult points is improved in order to improve traffic safety.
- 3) Capacity of MOTID to stabilize road shoulder by in-situ concrete kerbs using MOTID's own facility is improved.



13. Undertakings of the Project

Both sides confirmed the undertakings of the Project as described in Annex 5. With regard to exemption of customs duties, internal taxes and other fiscal levies as stipulated in NO 5, (2) of Annex 5, both sides confirmed that such customs duties, internal taxes and other fiscal levies shall be clarified in the bid documents by the Executing Agency during the implementation stage of the Project.

The Zimbabwe side assured to take the necessary measures and coordination including allocation of the necessary budget which are preconditions of implementation of the Project. It is further agreed that the costs are indicative, i.e. at Outline Design level. More accurate costs will be calculated at the Detailed Design stage.

Both sides also confirmed that the Annex 5 will be used as an attachment of G/A.

In addition, both sides confirmed that procedures and target period of tax exemption on VAT and tax for imported goods for the Project is explained as Annex 6.

As shown in Annex 5, Both sides confirmed that the Executing Agency shall take necessary measures to ensure and maintain the security of the Project site and the persons related to the implementation of the Project, in cooperation with relevant authorities such as rangers.

14. Monitoring during the implementation

The Project will be monitored by the Executing Agency and reported to JICA by using the form of Project Monitoring Report (PMR) attached as Annex 7. The timing of submission of the PMR is described in Annex 5.

15. Project completion

Both sides confirmed that the Project completes when all the facilities constructed and equipment procured by the Grant are in operation. The completion of the Project will be reported to JICA promptly by the Executing Agency, but in any event not later than six months after completion of the Project.

16. Environmental and Social Considerations

16-1 General Issues

16-1-1 Environmental Guidelines and Environmental Category

The Team explained that 'JICA Guidelines for Environmental and Social



Considerations (April 2010)' (hereinafter referred to as "the Guidelines") is applicable for the Project. The Project is categorized as B because the Project is not likely to have significant adverse impact on the environment under the JICA guidelines for environmental and social considerations (April 2010) in terms of its sectors, characteristics and areas.

16-1-2 Environmental Checklist

The environmental and social considerations including major impacts and mitigation measures for the Project are summarized in the Environmental Checklist attached as Annex 8. Both sides confirmed that in case of major modification of the content of the Environmental Checklist, the Zimbabwe side shall submit the modified version to JICA in a timely manner.

16-2 Environmental Issues

16-2-1 Environmental Impact Assessment (EIA)

Based on the Draft Report, Zimbabwe side will make draft EIA application and submit final EIA application for its approval from Environmental Management Agency after JICA submits the Report in September 2022.

Both sides confirmed the EIA report will be approved by Environmental Management Agency in November, 2022 and the certificate of EIA will be issued in January 2023.

In addition, stakeholder meetings will be announced through newspaper or any other means and conducted by DOR by public consultation style. The 1st stakeholder meeting will be conducted by middle of June and the 2nd stakeholder meeting will be conducted by middle of July, 2022.

Both sides agreed that the result of the stakeholder meetings will be share with JICA by DOR immediately after the stakeholder meetings are conducted.

16-2-2 Environmental Management Plan and Environmental Monitoring Plan

Both sides confirmed Environmental Management Plan (EMP) and Environmental Monitoring Plan (EMoP) of the Project will be finalized based on the result of the environmental and social consideration survey conducted by DOR around September 2022.

Both side agreed that once the EMP and EMoP are finalized, the EMP and EMoP will be confirmed by both sides and environmental mitigation measures and monitoring shall be conducted based on the EMP and EMoP, which may be updated



during the detailed design stage.

16-2-3 Other specific environmental and social issues which need to be confirmed/agreed between the parties.

Both sides confirmed that the environmental and social consideration survey is being conducted by DOR till September, 2022 and some parts of the environmental and social consideration on the Project are not confirmed. Therefore, based on the result of the environmental and social consideration survey, the Draft Report will be finalized and shared with DOR to confirm its contents related to the environmental and social consideration.

16-3 Social Issues

16-3-1 Land Acquisition and Resettlement

Both sides confirmed land acquisition and resettlement for the Project are not required.

16-4 Environmental and Social Monitoring

16-4-1 Environmental Monitoring

Both sides confirmed that the monitoring form attached as Annex 9 will be finalized based on the result of the environmental and social consideration survey conducted by DOR around September, 2022.

Both sides also agreed that the Zimbabwe side will submit results of environmental monitoring to JICA with PMR by using the monitoring form after finalizing and confirming by both sides.

The timing of submission of the monitoring form is described in Annex 5.

16-4-2 Information Disclosure of Monitoring Results

Both sides confirmed that the Zimbabwe side will disclose results of environmental and social monitoring to local stakeholders through their website / in their field offices.

The Zimbabwe side agreed JICA will disclose results of environmental and social monitoring submitted by the Zimbabwe side as the monitoring forms attached as Annex 9 on its website.

17. Other Relevant Issues

17-1. Disclosure of Information

Both sides confirmed that the Preparatory Survey Report from which the Project cost is excluded will be disclosed to the public after completion of the Preparatory Survey.

The comprehensive report including the Project cost will be disclosed to the public



after all the contracts under the Project are concluded.

17-2. Climate Change

Both sides confirmed that the Project contributes to climate change mitigation through the reduction of 170 ton CO₂/year by relieving traffic congestion.

17-3. Gender Mainstreaming

Both sides confirmed that gender mainstreaming should be duly practiced for the Project implementation as the Project is categorized as GIS (Gender Integrated Project). In particular, Both sides agreed on the following gender elements to be integrated into the Project.

- (a) Facility design that reflects gender-specific needs during construction stage
- (b) Equal wages for Men and Women

Annex 1 Project Site

Annex 2 Organization Chart

Annex 3 Japanese Grant

Annex 4 Project Implementation Schedule

Annex 5 Major Undertakings to be taken by the Government of Zimbabwe

Annex 6 Procedures of Tax Exemption

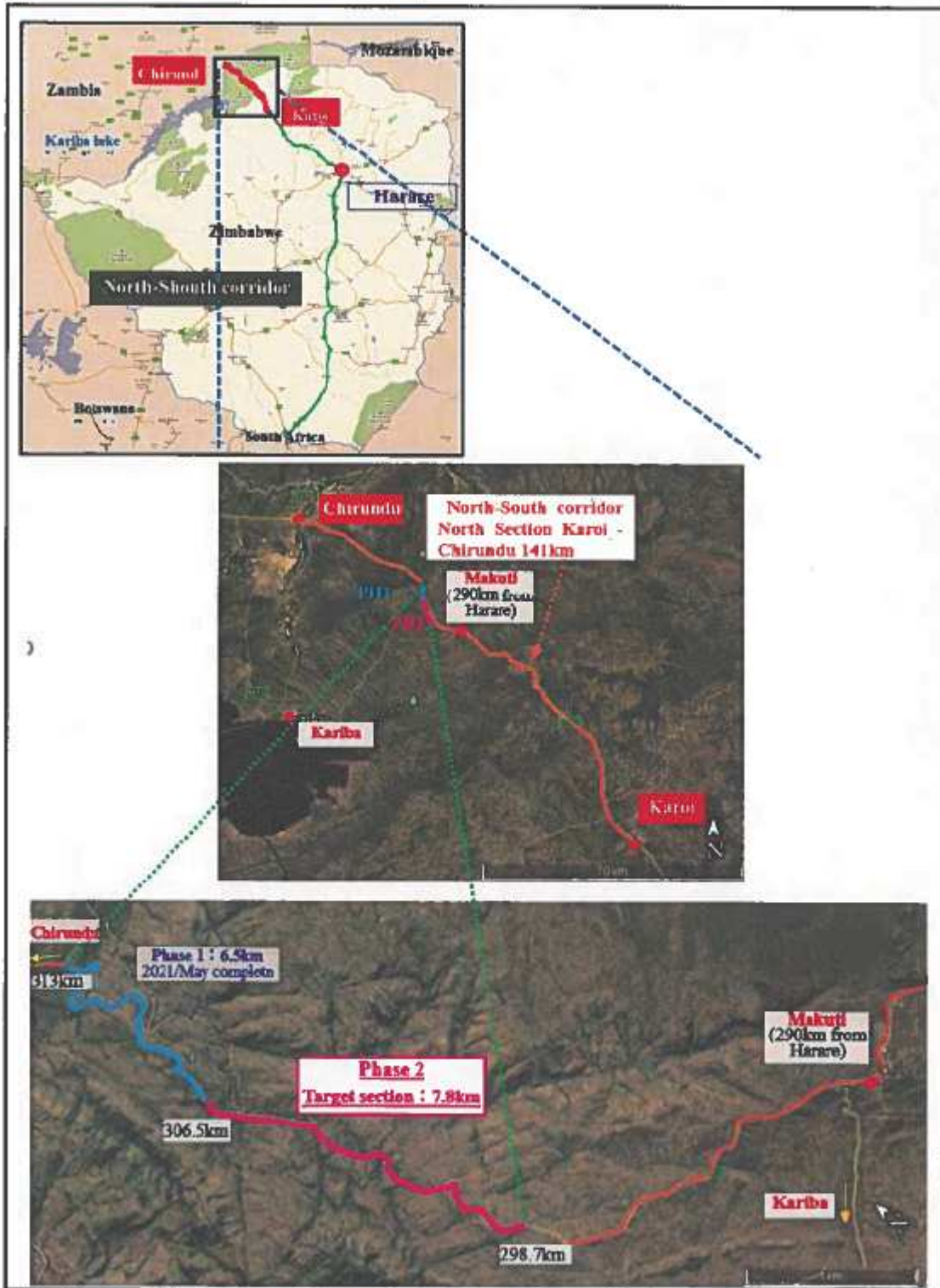
Annex 7 Project Monitoring Report (template)

Annex 8 Environmental Check List

Annex 9 Environmental and Social Monitoring Form



Project Site



gm

JAPANESE GRANT

The Japanese Grant is non-reimbursable fund provided to a recipient country (hereinafter referred to as “the Recipient”) to purchase the products and/or services (engineering services and transportation of the products, etc.) for its economic and social development in accordance with the relevant laws and regulations of Japan. Followings are the basic features of the project grants operated by JICA (hereinafter referred to as “Project Grants”).

1. Procedures of Project Grants

Project Grants are conducted through following procedures (See “PROCEDURES OF JAPANESE GRANT” for details):

(1) Preparation

- The Preparatory Survey (hereinafter referred to as “the Survey”) conducted by JICA

(2) Appraisal

- Appraisal by the government of Japan (hereinafter referred to as “GOJ”) and JICA, and Approval by the Japanese Cabinet

(3) Implementation

Exchange of Notes

- The Notes exchanged between the GOJ and the government of the Recipient

Grant Agreement (hereinafter referred to as “the G/A”)

- Agreement concluded between JICA and the Recipient

Banking Arrangement (hereinafter referred to as “the B/A”)

- Opening of bank account by the Recipient in a bank in Japan (hereinafter referred to as “the Bank”) to receive the grant

Construction works/procurement

- Implementation of the project (hereinafter referred to as “the Project”) on the basis of the G/A

(4) Ex-post Monitoring and Evaluation

- Monitoring and evaluation at post-implementation stage

2. Preparatory Survey

(1) Contents of the Survey

The aim of the Survey is to provide basic documents necessary for the appraisal of the the Project made by the GOJ and JICA. The contents of the Survey are as follows:

- Confirmation of the background, objectives, and benefits of the Project and also institutional capacity of relevant agencies of the Recipient necessary for the implementation of the Project.
- Evaluation of the feasibility of the Project to be implemented under the Japanese Grant from a technical, financial, social and economic point of view.



- Confirmation of items agreed between both parties concerning the basic concept of the Project.
- Preparation of an outline design of the Project.
- Estimation of costs of the Project.
- Confirmation of Environmental and Social Considerations

The contents of the original request by the Recipient are not necessarily approved in their initial form. The Outline Design of the Project is confirmed based on the guidelines of the Japanese Grant. JICA requests the Recipient to take measures necessary to achieve its self-reliance in the implementation of the Project. Such measures must be guaranteed even though they may fall outside of the jurisdiction of the executing agency of the Project. Therefore, the contents of the Project are confirmed by all relevant organizations of the Recipient based on the Minutes of Discussions.

(2) Selection of Consultants

For smooth implementation of the Survey, JICA contracts with (a) consulting firm(s). JICA selects (a) firm(s) based on proposals submitted by interested firms.

(3) Result of the Survey

JICA reviews the report on the results of the Survey and recommends the GOJ to appraise the implementation of the Project after confirming the feasibility of the Project.

3. Basic Principles of Project Grants

(1) Implementation Stage

1) The E/N and the G/A

After the Project is approved by the Cabinet of Japan, the Exchange of Notes (hereinafter referred to as "the E/N") will be signed between the GOJ and the Government of the Recipient to make a pledge for assistance, which is followed by the conclusion of the G/A between JICA and the Recipient to define the necessary articles, in accordance with the E/N, to implement the Project, such as conditions of disbursement, responsibilities of the Recipient, and procurement conditions. The terms and conditions generally applicable to the Japanese Grant are stipulated in the "General Terms and Conditions for Japanese Grant (January 2016)."

2) Banking Arrangements (B/A) (See "Financial Flow of Japanese Grant (A/P Type)" for details)

a) The Recipient shall open an account or shall cause its designated authority to open an account under the name of the Recipient in the Bank, in principle. JICA will disburse the Japanese Grant in Japanese yen for the Recipient to cover the obligations incurred by the Recipient under the verified contracts.

b) The Japanese Grant will be disbursed when payment requests are submitted by the Bank to JICA under an Authorization to Pay (A/P) issued by the Recipient.

3) Procurement Procedure

The products and/or services necessary for the implementation of the Project shall be procured in accordance with JICA's procurement guidelines as stipulated in the G/A.



4) Selection of Consultants

In order to maintain technical consistency, the consulting firm(s) which conducted the Survey will be recommended by JICA to the Recipient to continue to work on the Project's implementation after the E/N and G/A.

5) Eligible source country

In using the Japanese Grant disbursed by JICA for the purchase of products and/or services, the eligible source countries of such products and/or services shall be Japan and/or the Recipient. The Japanese Grant may be used for the purchase of the products and/or services of a third country as eligible, if necessary, taking into account the quality, competitiveness and economic rationality of products and/or services necessary for achieving the objective of the Project. However, the prime contractors, namely, constructing and procurement firms, and the prime consulting firm, which enter into contracts with the Recipient, are limited to "Japanese nationals", in principle.

6) Contracts and Concurrence by JICA

The Recipient will conclude contracts denominated in Japanese yen with Japanese nationals. Those contracts shall be concurred by JICA in order to be verified as eligible for using the Japanese Grant.

7) Monitoring

The Recipient is required to take their initiative to carefully monitor the progress of the Project in order to ensure its smooth implementation as part of their responsibility in the G/A, and to regularly report to JICA about its status by using the Project Monitoring Report (PMR).

8) Safety Measures

The Recipient must ensure that the safety is highly observed during the implementation of the Project.

9) Construction Quality Control Meeting

Construction Quality Control Meeting (hereinafter referred to as the "Meeting") will be held for quality assurance and smooth implementation of the Works at each stage of the Works. The member of the Meeting will be composed by the Recipient (or executing agency), the Consultant, the Contractor and JICA. The functions of the Meeting are as followings:

- a) Sharing information on the objective, concept and conditions of design from the Contractor, before start of construction.
- b) Discussing the issues affecting the Works such as modification of the design, test, inspection, safety control and the Client's obligation, during of construction.

(2) Ex-post Monitoring and Evaluation Stage

- 1) After the project completion, JICA will continue to keep in close contact with the Recipient in order to monitor that the outputs of the Project is used and maintained properly to attain its expected outcomes.
- 2) In principle, JICA will conduct ex-post evaluation of the Project after three years from the completion. It is required for the Recipient to furnish any necessary information as JICA may reasonably request.



(3) Others

1) Environmental and Social Considerations

The Recipient shall carefully consider environmental and social impacts by the Project and must comply with the environmental regulations of the Recipient and JICA Guidelines for Environmental and Social Considerations (April, 2010).

2) Major undertakings to be taken by the Government of the Recipient

For the smooth and proper implementation of the Project, the Recipient is required to undertake necessary measures including land acquisition, and bear an advising commission of the A/P and payment commissions paid to the Bank as agreed with the GOJ and/or JICA. The Government of the Recipient shall ensure that customs duties, internal taxes and other fiscal levies which may be imposed in the Recipient with respect to the purchase of the Products and/or the Services be exempted or be borne by its designated authority without using the Grant and its accrued interest, since the grant fund comes from the Japanese taxpayers.

3) Measures to ensure more efficient implementation of the Grant

i) In the event that the E/N and the G/A concerning a project cannot be signed by the end of the following Japanese fiscal year of the cabinet decision concerned by the GOJ, the authorities concerned of the two Governments will discuss the cancellation of the project.

ii) In the event that the period, specified in the G/A, during which the grant is available expires before the completion of the disbursement, the authorities concerned of the GOJ will thoroughly review the status, situation and perspective of the implementation of the project concerned before extending the said period. The authorities concerned of the two Governments will discuss the termination of the project including a refund, unless there are concrete prospects for its completion.

iii) Regardless of the period mentioned in ii) above, the authorities concerned of the two Governments will, in the event that five years have passed since the cabinet decision concerned by the GOJ before the completion of the disbursement, except as otherwise confirmed between them, discuss the termination of the project including a refund, unless there are concrete prospects for its completion.

4) Proper Use

The Recipient is required to maintain and use properly and effectively the products and/or services under the Project (including the facilities constructed and the equipment purchased), to assign staff necessary for this operation and maintenance and to bear all the expenses other than those covered by the Japanese Grant.

5) Export and Re-export

The products purchased under the Japanese Grant should not be exported or re-exported from the Recipient.



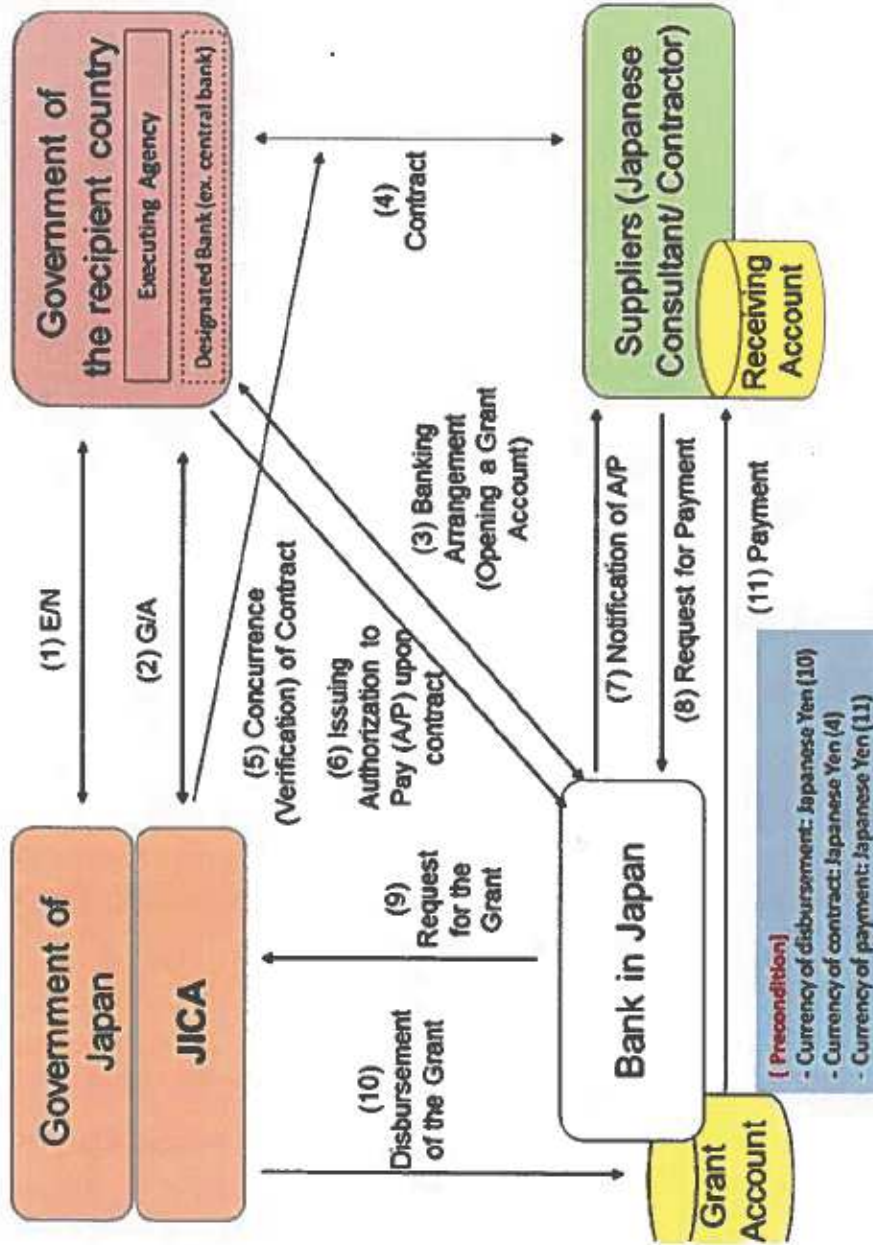
PROCEDURES OF JAPANESE GRANT

Stage	Procedures	Remarks	Recipient Government	Japanese Government	JICA	Consultants	Contractors	Agent Bank
Official Request	Request for grants through diplomatic channel	Request shall be submitted before appraisal stage.	X	X				
1. Preparation	(1) Preparatory Survey Preparation of outline design and cost estimate		X		X	X		
2. Appraisal	(2) Preparatory Survey Explanation of draft outline design, including cost estimate, undertakings, etc.		X		X	X		
	(3) Agreement on conditions for implementation	Conditions will be explained with the draft notes (E/N) and Grant Agreement (G/A) which will be signed before approval by Japanese government.	X	X (E/N)	X (G/A)			
	(4) Approval by the Japanese cabinet			X				
3. Implementation	(5) Exchange of Notes (E/N)		X	X				
	(6) Signing of Grant Agreement (G/A)		X		X			
	(7) Banking Arrangement (B/A)	Need to be informed to JICA	X					X
	(8) Contracting with consultant and issuance of Authorization to Pay (A/P)	Concurrence by JICA is required	X			X		X
	(9) Detailed Design (D/D)	—	X			X		
	(10) Preparation of bidding documents	Concurrence by JICA is required	X			X		
	(11) Bidding	Concurrence by JICA is required	X			X	X	
	(12) Contracting with contractor /supplier and issuance of A/P	Concurrence by JICA is required	X				X	X
	(13) Construction works/procurement	Concurrence by JICA is required for major modification of design and amendment of contracts.	X			X	X	
	(14) Completion certificate	—	X			X	X	
4. Ex-post monitoring & evaluation	(15) Ex-post monitoring	To be implemented generally after 1, 3, 10 years of completion, subject to change	X		X			
	(16) Ex-post evaluation	To be implemented basically after 3 years of completion	X		X			

Notes:

1. Project Monitoring Report and Report for Project Completion shall be submitted to JICA as agreed in the G/A.
2. Concurrence by JICA is required for allocation of grant for remaining amount and/or contingencies as agreed in the G/A.

Financial Flow of Japanese Grant (A/P Type)



Project Implementation Schedule

	2022			2023												2024								
	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9
Implementation Design Soft Component Assistance	Field survey, implementation design																							
	Domestic work																							
	Tender document preparation																							
	Field Confirmation															Tender assistance Approx. 16 mth								

	2024												2025																		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
Implementation Design Soft Component Assistance	Domestic preparation																														
	Preparation works																														
	Removal works for existing structure, cleaning																														
	Road earth work																														
	Drainage works																														
	Paving works																														
Ancillary works																															
Cleaning																															
Supervision																															
▲ Quality monitoring meeting												Approx. 20 mth																			

Major Undertakings to be taken by the Government of Zimbabwe

1. Specific obligations of the Government of Zimbabwe which will not be funded with the Grant

(1) Before the Tender

NO	Items	Deadline	In charge	Estimated Cost	Ref.
1	To sign the banking arrangement (B/A) with a bank in Japan (the Agent Bank) to open bank account for the Grant	within 1 month after the signing of the G/A	MOFED		
2	To issue A/P to the Agent Bank for the payment to the consultant	within 1 month after the signing of the contract(s)	MOFED		
3	To bear the following commissions to the Agent Bank for the banking services based upon B/A		MOFED		
	1) Advising commission of A/P	within 1 month after the signing of the contract(s)	MOFED	90USD	
	2) Payment commission for A/P	every payment	MOFED	910USD	
4	To approve IEE/EIA(Conditions of approval should be fulfilled, if any) and secure the necessary budget for implementation for EMP and EMoP (and fulfilling conditions of approval, if any).	before completion of the detailed design	DOR	200,000USD	
5	To secure and clear the following lands 1) right of way for Sta. 298.7km -Sta.306.5km with little additional land at steep curve spots. 2) temporary construction yard and stock yard near the Project area 3) borrow pit and disposal site near the Project area	before notice of the bidding documents	DOR		
6	To obtain the planning, zoning, building permit	before notice of the bidding documents	DOR		
7	To clear, level and reclaim the following sites 1) remove utilities (water pipe near campsite of park&wildlife office, power poles and power distribution along the targeted road, telephone line and optical fiber cable)	before notice of the bidding documents	DOR		
8	To submit Project Monitoring Report (with the result of Detailed Design)	before preparation of the bidding documents	DOR		

(B/A: Banking Arrangement, A/P: Authorization to pay, MOFED: Ministry of Finance and Economy Development, DOR: Department of Roads, Ministry of Transport and Infrastructural Development)

(2) During the Project Implementation

NO	Items	Deadline	In charge	Estimated Cost	Ref.
1	To issue A/P to the Agent Bank for the payment to the supplier and the contractor	within 1 month after the signing of the contract(s)	MOFED		
2	To bear the following commissions to the Agent Bank for the banking services based upon the B/A		MOFED		
	1) Advising commission of A/P	within 1 month after the signing of the contract(s)		540USD	
	2) Payment commission for A/P	every payment		19,100USD	
3	To ensure prompt customs clearance and to assist the Supplier(s) with internal transportation in the country of the Recipient	during the Project	DOR		
4	To accord Japanese physical persons and/or physical persons of third countries whose services may be required in connection with the supply of the products and the services such facilities as may be necessary for their entry into the country of the Recipient and stay therein for the performance of their work	during the Project	DOR		
5	To ensure that customs duties, internal taxes and other fiscal levies which may be imposed in the country of the Recipient with respect to the purchase of the products and/or the services be exempted or be borne by its designated authority without using the Grant;	during the Project	DOR MOFED ZIMRA	290,000USD	
6	Company registration costs for the Project for the consultant and the contractor, 2 years each assumed	during the Project	DOR	30,000USD	
7	To bear all the expenses, other than those covered by the Grant, necessary for the implementation of the Project	during the Project	DOR		
8	To notify JICA promptly of any incident or accident, which has, or is likely to have, a significant adverse effect on the environment, the affected communities, the public or workers.	during the construction	DOR		
9	To submit Project Monitoring Report	every month	DOR		
	To submit Project Monitoring Report (final) (including as-built drawings, equipment list, photographs, etc.)	within 1 month after issuance of Certificate of Completion for the works under the contract(s)	DOR		
10	To submit a report concerning completion of the Project	within 6 months after completion of the Project	DOR		
11	To provide facilities for distribution of electricity, water supply and drainage and other incidental facilities necessary for the implementation of the		DOR		

	Project outside the site(s)				
12	To ensure the safety of persons engaged in the implementation of the Project	during the Project	DOR		
13	To take necessary measures for security and safety of the Project site (measures for security) 1) Deployment of rangers at the Project site to avoid risks of wild animals	during the construction	DOR	150,000USD	
14	To implement EMP and EMoP	during the construction	DOR		
15	To submit results of environmental monitoring to JICA, by using the monitoring form, on a quarterly basis as a part of Project Monitoring Report	during the construction	DOR		

(ZIMRA: Zimbabwe Revenue Authority)

(3) After the Project

NO	Items	Deadline	In charge	Estimated Cost	Ref.
1	To implement EMP and EMoP	for a period based on EMP and EMoP			
2	To submit results of environmental monitoring to JICA, by using the monitoring form, semiannually - The period of environmental monitoring may be extended if any significant negative impacts on the environment are found. The extension of environmental monitoring will be decided based on the agreement between the Executing Agency and JICA.	for 3 years after the Project			
3	To maintain and use properly and effectively the facilities constructed and equipment provided under the Grant Aid 1) Allocation of maintenance cost 2) Operation and maintenance structure 3) Routine check/Periodic inspection	After completion of the construction			

(EMP: Environmental Management Plan, EMoP: Environmental Monitoring Plan)

2. Other obligations of the Government of Zimbabwe funded with the Grant

NO	Items	Deadline	Amount (Million Japanese Yen)*
1	To construct roads - Improvement of roads 1) To conduct the following transportation a) Marine(Air) transportation of the products from Japan to the country of the Recipient b) Internal transportation from the port of disembarkation to the Project site		/
2	To implement detailed design, bidding support, construction supervision and soft component assistance (Consulting Service)		
3	Contingencies		
	Total		Confidential

* The Amount is provisional. This is subject to the approval of the Government of Japan.

Procedures of Tax Exemption

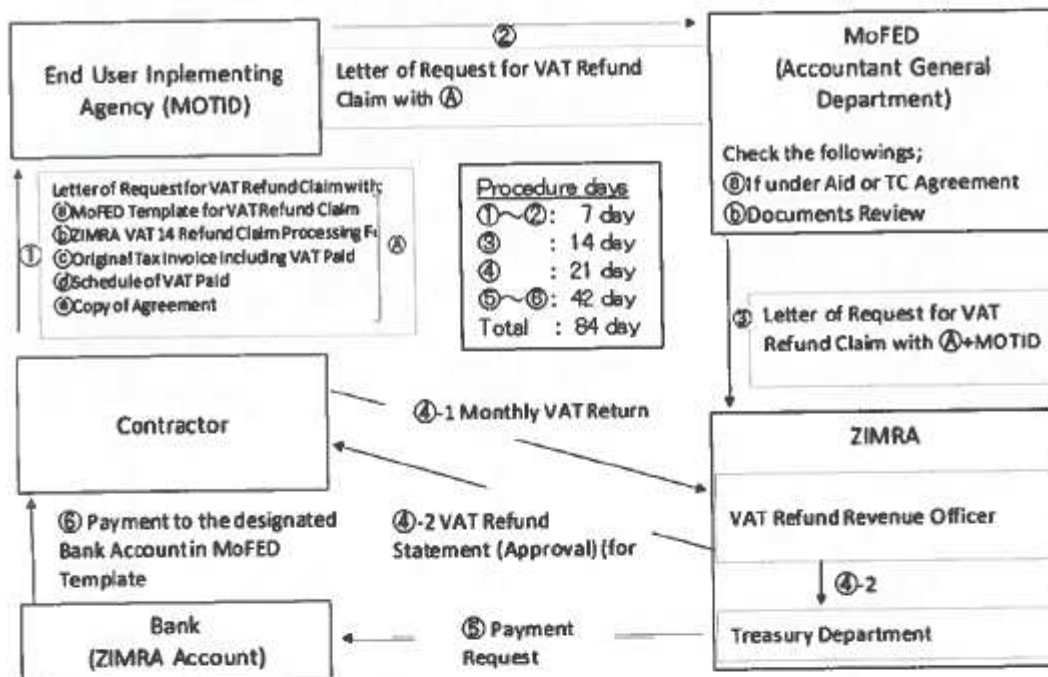
1. Refund of Value Added Tax (VAT)

The VAT refund procedures and the target days for each procedure are follows.

However, if the documents submitted by the applicant (including local suppliers) are incomplete, the days required for correction will be added to the maximum days below.

- (1) ①~②: MOTID shall send the complete request to MOFED (Office of Accountant General) within 7 calendar days after receiving the complete request from the applicant with the refund request letter.
- (2) ③: MOFED shall send the complete request to ZIMRA (VAT Refund Revenue Officer) within 14 calendar days after receiving the complete request form from MOTID with the refund request letter.
- (3) ④~⑥: ZIMRA will notify the applicant of the VAT Refund Statement within 21 calendar days after receiving the complete request form from MOFED. In addition, applied amount of VAT must be refunded to a bank account of the applicant within 42 calendar days after ZIMRA notified the applicant of the VAT Refund Statement.





2. Exemption of Tax for Imported Goods

Delays in customs clearance will result in unnecessary costs and, as a result, delays in the Projects. Therefore, the Government of Zimbabwe should take necessary budgetary measures in advance. The procedures are as follows.

- (1) After bidding and before the contract with the contractors, the contractors (including local suppliers) will notify MOTID of the master list of goods to be imported, the total amount (including the rough estimate of light oil, etc.) and the timing of import.
- (2) MOTID should include the total amount in their budget in next fiscal year or allocate the budget from current budget.
- (3) MOTID pays the required amount from the budget for each arrival of imported goods.

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<p><u>Project Monitoring Report</u> on <u>Project Name</u> Grant Agreement No. <u>XXXXXXX</u> 20XX, Month</p>

Organizational Information

Signer of the G/A (Recipient)	Person in Charge <u>(Designation)</u> _____ Contacts <u>Address:</u> <u>Phone/FAX:</u> <u>Email:</u>
Executing Agency	Person in Charge <u>(Designation)</u> _____ Contacts <u>Address:</u> <u>Phone/FAX:</u> <u>Email:</u>
Line Ministry	Person in Charge <u>(Designation)</u> _____ Contacts <u>Address:</u> <u>Phone/FAX:</u> <u>Email:</u>

General Information:

Project Title	
E/N	Signed date: Duration:
G/A	Signed date: Duration:
Source of Finance	Government of Japan: Not exceeding JPY _____ mil. Government of (_____): _____

1: Project Description

1-1 Project Objective

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1-2 Project Rationale

- Higher-level objectives to which the project contributes (national/regional/sectoral policies and strategies)
- Situation of the target groups to which the project addresses

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1-3 Indicators for measurement of "Effectiveness"

Quantitative indicators to measure the attainment of project objectives

Indicators	Original (Yr)	Target (Yr)

Qualitative indicators to measure the attainment of project objectives

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2: Details of the Project

2-1 Location

Components	Original <i>(proposed in the outline design)</i>	Actual
1.		

2-2 Scope of the work

Components	Original* <i>(proposed in the outline design)</i>	Actual*
1.		

Reasons for modification of scope (if any).

(PMR)

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2-3 Implementation Schedule

Items	Original		Actual
	(proposed in the outline design)	(at the time of signing the Grant Agreement)	

Reasons for any changes of the schedule, and their effects on the project (if any)

2-4 Obligations by the Recipient
2-4-1 Progress of Specific Obligations
 See Attachment 2.

2-4-2 Activities
 See Attachment 3.

2-4-3 Report on RD
 See Attachment 11.

2-5 Project Cost
2-5-1 Cost borne by the Grant (Confidential until the Bidding)

Components	Original		Cost (Million Yen)	
	(proposed in the outline design)	Actual (in case of any modification)	Original ^{1,2)} (proposed in the outline design)	Actual
1.				
Total				

Note: 1) Date of estimation:
 2) Exchange rate: 1 US Dollar = Yen

2-5-2 Cost borne by the Recipient

Components	Original		Cost (1,000 Taka)	
	(proposed in the outline design)	Actual (in case of any modification)	Original ^{1,2)} (proposed in the outline design)	Actual
1.				

Note: 1) Date of estimation:
 2) Exchange rate: 1 US Dollar =

Reasons for the remarkable gaps between the original and actual cost, and the countermeasures (if any)

(PMR)

2-6 Executing Agency

- Organization's role, financial position, capacity, cost recovery etc.
- Organization Chart including the unit in charge of the implementation and number of employees.

Original (at the time of outline design)

name:

role:

financial situation:

institutional and organizational arrangement (organogram):

human resources (number and ability of staff):

Actual (PMR)

2-7 Environmental and Social Impacts

- The results of environmental monitoring based on Attachment 5 (in accordance with Schedule 4 of the Grant Agreement).
- The results of social monitoring based on in Attachment 5 (in accordance with Schedule 4 of the Grant Agreement).
- Disclosed information related to results of environmental and social monitoring to local stakeholders (whenever applicable).

3: Operation and Maintenance (O&M)

3-1 Physical Arrangement

- Plan for O&M (number and skills of the staff in the responsible division or section, availability of manuals and guidelines, availability of spareparts, etc.)

Original (at the time of outline design)

Actual (PMR)

3-2 Budgetary Arrangement

- Required O&M cost and actual budget allocation for O&M

Original (at the time of outline design)

Actual (PMR)

4: Potential Risks and Mitigation Measures

- Potential risks which may affect the project implementation, attainment of objectives, sustainability
- Mitigation measures corresponding to the potential risks

Assessment of Potential Risks (at the time of outline design)

Potential Risks	Assessment
1. (Description of Risk)	Probability: High/Moderate/Low
	Impact: High/Moderate/Low
	Analysis of Probability and Impact:
	Mitigation Measures:
	Action required during the implementation stage:
Contingency Plan (if applicable):	
2. (Description of Risk)	Probability: High/Moderate/Low
	Impact: High/Moderate/Low
	Analysis of Probability and Impact:
	Mitigation Measures:
	Action required during the implementation stage:
Contingency Plan (if applicable):	
3. (Description of Risk)	Probability: High/Moderate/Low
	Impact: High/Moderate/Low
	Analysis of Probability and Impact:
	Mitigation Measures:
	Action required during the implementation stage:
Contingency Plan (if applicable):	
Actual Situation and Countermeasures (PMR)	

5: Evaluation and Monitoring Plan (after the work completion)

5-1 Overall evaluation

Please describe your overall evaluation on the project.

5-2 Lessons Learnt and Recommendations

Please raise any lessons learned from the project experience, which might be valuable for the future assistance or similar type of projects, as well as any recommendations, which might be beneficial for better realization of the project effect, impact and assurance of sustainability.

5-3 Monitoring Plan of the Indicators for Post-Evaluation

Please describe monitoring methods, section(s)/department(s) in charge of monitoring, frequency, the term to monitor the indicators stipulated in 1-3.



Attachment

1. Project Location Map
2. Specific obligations of the Recipient which will not be funded with the Grant
3. Monthly Report submitted by the Consultant
- Appendix - Photocopy of Contractor's Progress Report (if any)
 - Consultant Member List
 - Contractor's Main Staff List
4. Check list for the Contract (including Record of Amendment of the Contract/Agreement and Schedule of Payment)
5. Environmental Monitoring Form / Social Monitoring Form
6. Monitoring sheet on price of specified materials (Quarterly)
7. Report on Proportion of Procurement (Recipient Country, Japan and Third Countries) (PMR (final) only)
8. Pictures (by JPEG style by CD-R) (PMR (final) only)
9. Equipment List (PMR (final) only)
10. Drawing (PMR (final) only)
11. Report on RD (After project)



Environmental Check List

Classification	Environmental item	Main check items	Y: Yes N: No -: Not applicable	Specific Environmental and Social Consideration (Reasons for Yes/No, basis, mitigation measures, etc.)
1. Authorization and explanation	(1) EIA and environmental authorization	<p>(a) Has an environmental assessment report (EIA report, etc.) been prepared?</p> <p>(b) Has the EIA report, etc. been approved by the government of the country concerned?</p> <p>(c) Does approval of the EIA report, etc. entail collateral conditions? If there are collateral conditions, will they be satisfied?</p> <p>(d) In addition to the above, have environmental authorizations been obtained from local responsible authorities where necessary?</p>	<p>(a) N</p> <p>(b) N</p> <p>(c) N</p> <p>(d) N</p>	<p>(a) Environmental Impact Assessment (EIA) certification for the section covered by Phase 2 of the Project between 306 and 300 km from Harare was already obtained in September 2018 during Phase 1. The section will require renewal of the environmental certification, but no EIA report will be required. The remaining section between 300 and 291 km has not had an EIA carried out during Phase 1 and will require an EIA report in Phase 2 and changes/revisions to incorporate this section into the existing EIA certification. As of November 2021, the renewal process and preparation of the EIA report had not started.</p> <p>(b) Ditto</p> <p>(c) Ditto</p> <p>(d) Prior consultation with Parks and Wildlife Management is required at the EIA stage as the section covered by the Project passes through a safari area in Zimbabwe. Other procedures will also be required, such as a survey of archaeological sites by the National Museum at the EIA stage, permission to use explosives from the Ministry of Mines and Mineral Resources at the construction stage, and permission to use borrow pits and disposal area from the Ministry of Environment, Parks and Wildlife Management, Water Authority, Hurungwe Rural District Council, etc.</p>
	(2) Explanations to local stakeholders	(a) Concerning the project contents and impacts, have appropriate explanations (including information disclosure) been conducted for the local stakeholders, and has their	<p>(a) N</p> <p>(b) N</p>	(a) Under Zimbabwe's EIA Law, after the stakeholders that need to be consulted in the EIA have been identified in the Prospectus review stage, it is required that public consultations should be implemented in the EIA and the comments from

Classification	Environmental item	Main check items	Y: Yes N: No -: Not applicable	Specific Environmental and Social Consideration (Reasons for Yes/No, basis, mitigation measures, etc.)
2 Pollution countermeasures		understanding been obtained? (b) Have comments from residents been reflected in the project contents?		stakeholders should be reflected in the EIA report. The law also stipulates about an appeal process for stakeholders regarding the EIA, etc. planning. (b) Ditto
	(3) Examination of alternative plans	(a) Have multiple alternative project plans (including environmental and social items for review) been examined?	(a) Y	(a) Concerning the road improvement parts and design standards, etc., alternative plans have been examined and the optimum plan has been considered from the viewpoints of environmental social impacts and traffic safety.
	(1) Air quality	(a) Are there any impacts from air pollutants discharged from passing vehicles, etc.? Are environmental standards, etc. in the country concerned complied with? (b) If air pollution around the route already exceeds environmental standards, will the project exacerbate the air pollution? Will air quality countermeasures be taken?	(a) Y (b) -	(a) Concerning vehicles in Zimbabwe, it is necessary to satisfy the exhaust standards concerning control of exhaust gases (SI No. 72 of 2009). (b) Since the target area is included in a safari area, there are no major sources of air pollution. Moreover, traffic volume on the Project target road is limited and the Project is not expected to lead to an increase in traffic volume; hence it cannot be envisaged that the Project will exacerbate air pollution.
	(2) Water quality	(a) Will downstream water quality be deteriorated by soil runoff from exposed soil on filling and cutting sections, etc.? (b) Will surface runoff from the road pollute groundwater, sources, etc.? (c) Will wastewater from parking areas, service areas, etc. comply with discharge standards in the country concerned?	(a) N (b) N (c) N	(a) The roads covered by the Project are in close proximity to or intersect the main and branch lines of the river. In the Project, the embankment and cut sections will be covered with topsoil from the excavation and the local vegetation will be restored to prevent soil run-off. (b) In the Project, appropriate drainage facilities will be provided to ensure that runoff from the road surface does not contaminate groundwater and other water sources, and appropriate management will be carried out, including waste disposal and thorough emergency measures in the event of leakage of hazardous substances.



Classification	Environmental item	Main check items	Y: Yes N: No -: Not applicable	Specific Environmental and Social Consideration (Reasons for Yes/No, basis, mitigation measures, etc.)
				(c) The Project includes no plans for parking areas or service areas.
	(3) Solid wastes	(a) Will solid wastes from parking areas, service areas, etc. be appropriately treated and disposed according to regulations in the country concerned?	(a) —	(a) The Project includes no plans for parking areas or service areas.
	(4) Noise and vibration	(a) Will noise and vibration from passing vehicles comply with standards, etc. in the country concerned standards, etc.?	(a) Y	(a) As there are no standards for noise and vibration caused by passing vehicles in Zimbabwe, the Project will adopt the WHO standards as in Phase 1. The baseline survey conducted in Phase 1 confirmed that the noise and vibration levels were within the standards when there were no vehicles travelling, but exceeded the standards when there was vehicular traffic. During construction, noise and vibration levels are expected to increase due to increased traffic due to construction vehicles. Thorough site management, measures such as the installation of soundproofing sheets and limited construction hours, will be implemented to avoid and mitigate the impact of noise and vibration on wildlife and local residents. After the Project is in service, as in Phase 1, the Project is not expected to further increase existing noise and vibration levels, as traffic volumes on the subject road will be limited and the Project is not expected to increase the volume of passing traffic.
3. Natural Environment	(1) Nature preserve	(a) Is the site situated in a nature preserve designated by legislation of the country concerned or international treaty, etc.? Will the project have an impact on nature reserves?	(a) —	(a) The Project's target road passes through the Hrungwe Safari Area (IUCN Category VI Resource Conservation Area) designated under Zimbabwe's Parks and Wildlife Act, Chapter 20:14. It is not a National Park or Sanctuary subject to wildlife protection regulations. Regulations governing public works and development activities such as road

Classification	Environmental item	Main check items	Y: Yes N: No -: Not applicable	Specific Environmental and Social Consideration (Reasons for Yes/No, basis, mitigation measures, etc.)
				construction in the safari area are not explicitly stated, but the consent of the PWMA is required in the course of prior consultation for an Environmental Impact Assessment (EIA), and the consent of the PWMA for the targeted infrastructure project is also required. MOTID have already obtained a consent from PWMA for the Project.
	(2) Ecosystem	<p>(a) Does the site contain any virgin forest, tropical natural forest, ecologically important habitats (coral reefs, mangrove swamps, mudflats, etc.)?</p> <p>(b) Does the site contain habitats of valuable species that require protection under legislation of the country concerned or international treaty, etc.?</p> <p>(c) If there is concern over critical ecological impacts, will measures be taken to reduce these?</p> <p>(d) Will countermeasures be taken with respect to impedance of migration routes for wildlife and livestock, severance of habitats, traffic accidents involving animals and so on?</p> <p>(e) With construction of the road lead to forest destruction, hunting, desertification, drying of wetlands, etc. due to ensuing developments? Is there any risk of the ecosystem being disturbed by influx of alien species (not native to the local area) harmful pests, etc.?</p>	<p>(a) N (b) Y (c) N (d) Y (e) N (f) N</p>	<p>(a) The site doesn't contain any ecologically important habitats, etc.</p> <p>(b) The Project target road passes through one of Zimbabwe's safari areas that is a habitat for numerous species of wildlife registered on the IUCN Red List.</p> <p>(c) No critical ecological impacts are envisaged based on following reasons: 1) The Project is an upgrade of the existing road, and will be implemented mostly within the Road right of way except for two curved sections where acquisition of additional land may be required for widening. The environs of the Project is already fragmented by the existing road, and is absent in food production nor ecosystem and is not considered appropriate for threatened species which are sensitive to traffic noise and light. 2) The threatened species identified within the safari area are distributed across a large area of protected land and habitat away from the road traffic and far inside the safari area and neighbouring protected area. Considering some sections of the target road are used as wildlife corridors, project impacts can be avoided/mitigated by implementing measures such as installing warning signs, avoiding the use of fences, prohibiting construction activities during night which is the time wildlife are active. 3) Hurungwe Safari Area, where the Project is located, is an area where it is</p>

Classification	Environmental item	Main check items	Y: Yes N: No -: Not applicable	Specific Environmental and Social Consideration (Reasons for Yes/No, basis, mitigation measures, etc.)
		<p>Have countermeasures been prepared for such cases?</p> <p>(f) If road will be constructed in undeveloped areas, will development bring about major damage to the natural environment?</p>		<p>allowed to hunt wildlife (the Parks and Wildlife Act, Part VII) and is not categorized as either a national park or a bird sanctuary which strictly regulate the capture and removal of plants and animals in the park with the objective of protecting the ecosystems of wild flora and fauna. The nearest "critical natural habitat" for threatened species is Mana Pool National Park which is also designated as a UNESCO World Heritage Site as well as Ramsar wetland, located approx. 30km away from the Project area and the Project is not expected to cause impact on it. 4) There are no indigenous people/communities residing in the area, nor ancestral domain, or traditional use of natural resource in the area. Therefore, the Project area is not considered as "areas that local communities traditionally think should be protected".</p> <p>(d) Inside safari areas, installation of fences, activities during night etc. is not permitted due to obstruction of wildlife migration routes and risk of disturbing habitats in Zimbabwe. Therefore, signs will be installed to urge drivers to take care in order to prevent collisions, etc. with wild animals.</p> <p>(e) Since the Project entails improvement of an existing road, it is not envisaged that forest destruction, hunting, desertification, drying of wetlands, etc. will arise.</p> <p>(f) Ditto</p>
	(3) Water environment	(a) Will alteration of topography and construction of tunnels and other structures impart negative impacts on surface water and groundwater flows?	(a) N	<p>(a) Construction-related impacts on the aquatic environment, such as bank erosion and sediment deposition in the Marongora River and its tributaries, due to the rehabilitation of box culverts for small drainage channels and road widening and rehabilitation works, are expected.</p> <p>Sedimentation ponds and construction</p>

Classification	Environmental item	Main check items	Y: Yes N: No -: Not applicable	Specific Environmental and Social Consideration (Reasons for Yes/No, basis, mitigation measures, etc.)
				drainage channels will be installed and protective measures will be taken for the revetment.
	(4) Topography and geology	(a) Are there any locations on the route where landslides and earth slips seem likely to occur? If there are, are appropriate work methods and measures adopted? (b) Will filling, cutting and other civil engineering work trigger landslides and earth slips. Are appropriate countermeasures taken to prevent landslides and earth slips? (c) Will soil runoff from filling and cutting sections, borrow pits and earth dumps arise? Are appropriate countermeasures taken to prevent soil runoff?	(a) N (b) N (c) N	(a) There are no locations of fragile geology where landslides and earth slips seem likely to occur on the route. (b) In the Project, appropriate works methods will be selected upon conducting ample geological investigation, and appropriate countermeasures will be taken to prevent landslides and earth slips as a result of filling, cutting, etc. (c) Filling and cutting parts are covered with excavated topsoil and recovered from the local vegetation to prevent soil runoff. Concerning the quarry sites and borrow pits, existing quarry sites and borrow pits that are in operation by the DOR and have acquired authorization will be used. For soil dumping sites, no new dumping sites will be created by using the soil dumping sites near the project that were used in Phase 1. The site has sufficient capacity to store the generated soil under Phase 2.
4 Social environment	(1) Involuntary resettlement of residents	(a) Will involuntary resettlement of residents arise in line with the project implementation? If it does arise, will efforts be made to minimize the impact of resettlement? (b) Will appropriate explanations concerning compensation and life rebuilding measures be given in advance to residents that need to resettle? (c) Will a survey of the involuntary resettlement of	(a) N (b) - (c) - (d) - (e) - (f) - (g) - (h) - (i) - (j) -	(a) The Project requires a wider site than the road ROW in some areas, such as at curves. Resettlement will not occur as this is a safari area and there are no permanent structures or residents. (b) Compensation to property will occur in areas where a site wider than the ROW is required, the owner will be fully briefed in line with national law as well as JICA guidelines (2010). (c) Compensation to assets occurs where a site larger than the ROW is required, a survey is carried out in line with national law as well as JICA guidelines (2010). (d) Where compensation payments to



Classification	Environmental item	Main check items	Y: Yes N: No -: Not applicable	Specific Environmental and Social Consideration (Reasons for Yes/No, basis, mitigation measures, etc.)
		<p>residents be implemented, and will a resettlement plan that includes compensation based on reacquisition price and restoration of the basis of livelihood following resettlement be compiled?</p> <p>(d) Will compensation money be paid before resettlement?</p> <p>(e) Is the compensation policy compiled into a document?</p> <p>(f) Do plans give appropriate consideration to vulnerable groups, i.e. women, children, elderly, impoverished people, ethnic minorities and indigenous people, etc. targeted for resettlement?</p> <p>(g) Will prior consent be obtained from the residents to be resettled?</p> <p>(h) Will a structure be established to appropriately implement the involuntary resettlement of residents? Will ample implementation capacity and budget measures be adopted?</p> <p>(i) Is it planned to conduct monitoring of the impacts of resettlement?</p> <p>(j) Has a system been established to process complaints?</p>		<p>assets arise, DOR pays all such payments prior to site acquisition in line with national law as well as JICA guidelines (2010).</p> <p>(e) The safari area where the Project's road is located is public land, but if a site wider than the road ROW is required, a procedure in accordance with the Road Act is required as well as JICA guidelines (2010).</p> <p>The compensation policy is currently being confirmed by DOR.</p> <p>(f) There are no residents on the Project road section.</p> <p>(g) Same as above.</p> <p>(h) Same as above.</p> <p>(i) Same as above.</p> <p>(j) A grievance procedure is established when compensation to property occurs where a site wider than the required ROW.</p>
	(2) Lifestyle and livelihood	(a) If the road is to be constructed based on new development, will there be any impacts on existing means of transport and the livelihoods of people	(a) N (b) N (c) Y (d) N (e) N	(a) The Project involves the improvement of existing roads and is not expected to have a negative impact on existing modes of transport or the livelihoods of the residents engaged in



Classification	Environmental item	Main check items	Y: Yes N: No -: Not applicable	Specific Environmental and Social Consideration (Reasons for Yes/No, basis, mitigation measures, etc.)
		<p>engaged in them? Will there be any major changes in land use and means of livelihood, unemployment and so on? Do plans consider mitigation of such impacts?</p> <p>(b) Will the project impart any other negative impacts on residents' lives? If necessary, will consideration be given to mitigate impacts?</p> <p>(c) Is there a risk if diseases (including HIV and other infections) arising due to population influx from other areas? If necessary, will consideration be given to appropriate public health measures?</p> <p>(d) Will the project impart any other negative impacts on road traffic (congestion, increased road accidents, etc.) in surrounding areas?</p> <p>(e) Will the road hinder movement of residents?</p> <p>(f) Will road structures (flyovers, etc.) block sunlight or radio waves?</p>	(f) N	<p>them.</p> <p>(b) The Project is not expected to have a negative impact on communities around the section of road covered by the Project.</p> <p>(c) During the construction of the Project, the contractor will be on site and a temporary risk to public health in the area is envisaged. Training will be provided to workers and local residents on infectious diseases and other illnesses.</p> <p>(d) Traffic will increase during construction due to construction vehicles and material transport vehicles. Temporary impact on road traffic in the surrounding area is envisaged. Traffic restrictions for construction vehicles will be implemented to avoid or mitigate the impact on road traffic. After construction, it is envisaged that traffic congestion and traffic accidents will decrease due to road widening.</p> <p>(e) The Project involves the rehabilitation of the existing road and, as in Phase 1, construction will be carried out while keeping the road open to general traffic (one-way reciprocal traffic for one to two hours each), so no disruption to user movement is envisaged.</p> <p>(f) The Project does not include any road structures that would cause sun blockage or radio interference.</p>
	(3) Cultural heritage	(a) Is there any risk that the project will cause harm to archeologically, historically, culturally or religiously important heritage or remains, etc.? Are measures considered in domestic laws in the country concerned?	(a) N	(a) The results of the archaeological survey carried out during the EIA conducted by the Government of Zimbabwe in Phase 1 confirmed that there were no cultural or other assets requiring special consideration. In addition, no valuable heritage sites or historic sites are envisaged in the sections not included in the EIA.

Classification	Environmental item	Main check items	Y: Yes N: No -: Not applicable	Specific Environmental and Social Consideration (Reasons for Yes/No, basis, mitigation measures, etc.)
	(4) Landscape	(a) If there is landscape that requires special consideration, will it be negatively impacted? If it is impacted, will the necessary countermeasures be taken?	(a) N	(a) Although the section covered by this survey passes through a safari area, it is a rehabilitation of an existing road and does not envisage any land alterations or construction of structures that would affect the safari landscape.
	(5) Ethnic minorities and indigenous people	(a) Will consideration be given to mitigating impacts on the culture and lifestyle of ethnic minorities and indigenous people? (b) Will the rights of ethnic minorities and indigenous people regarding land and resources be respected?	(a) N (b) N	(a) There are no ethnic minorities or indigenous people reside, nor ancestral domain nor use of natural resource that require consideration around the target section of the Survey. (b) Ditto
	(6) Work environment	(a) Will work environment legislation in the country concerned be upheld in the project? (b) Will hard safety considerations be adopted for project workers and officials, for example, installation of safety equipment for preventing industrial accidents, management of harmful substances, etc.? (c) Will soft safety measures be planned and implemented for project workers and officials, for example, formulation of a health and safety plan, implementation of safety education (including road safety and public health) for workers, etc.? (d) Will appropriate measures be adopted regarding the project security personnel to	(a) Y (b) Y (c) Y (d) Y	(a) Take the necessary measures in accordance with the working environment legislation of the country concerned; and (b) As the section covered by the Project passes through a safari area inhabited by wild animals, measures such as the deployment of rangers to prevent workers from being attacked by wild animals shall be taken. In addition, work involving hazards such as earthworks on cliffs and excavation of slopes using explosives, etc., and work involving hazardous substances, should be carried out by registered and qualified contractors with appropriate skills. In addition, safety management plans and manuals for workers are prepared, and safety training for workers and daily safety management are thoroughly implemented. Clinics should also be set up at the work site. (c) Provide safety training for workers. (d) Appropriately trained construction security personnel will be deployed, as well as rangers from the local park office

Classification	Environmental item	Main check items	Y: Yes N: No -: Not applicable	Specific Environmental and Social Consideration (Reasons for Yes/No, basis, mitigation measures, etc.)
		ensure that the safety of project workers and local residents is not threatened?		of the Department of Parks and Wildlife Management, so that the safety of project personnel and local residents will not be compromised.
5 Others	(1) Impact during works	(a) Will mitigation measures be prepared for pollution during works (noise, vibration, muddy water, dust, exhaust gases, solid wastes, etc.)? (b) Will the works impart negative impacts on the natural environment (ecosystem)? Will mitigation measures be prepared regarding the impacts? (c) Will the works impart negative impacts on the social environment? Will mitigation measures be prepared regarding the impacts?	(a) Y (b) N (c) N	(a) Road works generate a certain amount of noise and vibration, muddy water, dust and waste, so soundproofing sheets should be installed, construction hours should be regulated, and water spraying and waste management for dust control should be ensured. (b) There is a potential risk of noise and vibration from construction works affecting wildlife and contact between construction vehicles and wildlife. Construction hours and construction vehicle traffic is regulated. (c) No significant negative impacts on the social environment are envisaged from the construction works of the Project.
	(2) Monitoring	(a) Out of the above environmental items, concerning those where impacts are envisaged, will the project proponent plan and implement monitoring? (b) How have items, methods, frequencies, etc. in the plan been established? (c) Will the project proponent establish a monitoring structure (organization, personnel, equipment, budget, etc. and continuation)? (d) Are methods and frequencies, etc. prescribed for reporting to the responsible authorities by the project proponent?	(a) Y (b) Y (c) Y (d) Y	(a) Monitoring will be implemented according to the collateral conditions (report items, methods, frequencies, etc.) in the monitoring plan prepared at the same time as the EIA. (b) Ditto (c) Ditto (d) Ditto



Classification	Environmental item	Main check items	Y: Yes N: No -: Not applicable	Specific Environmental and Social Consideration (Reasons for Yes/No, basis, mitigation measures, etc.)
6 Points for consideration	See other environmental check lists	(a) Where necessary, additionally evaluate the applicable check items in the forestry check list (cases where large-scale tree cutting will be conducted in line with construction of a solid wastes disposal site, etc.).	(a) N	(a) The Project entails improvement of an existing road; hence it will not cause large-scale cutting of trees.
	Cautions in using the environmental check list	(a) Where necessary, also check impacts on transboundary or global environmental problems (elements concerning transboundary disposal of solid wastes, acid rain, ozone layer destruction, and global warming, etc. are considered).	(a) N	(a) The Project contributes to GHG emission reductions by reducing congestion and is not expected to have a negative impact on global environmental issues.



Environmental and Social Monitoring Form

1. Pre-Construction Phase (including Detailed Design)

(1) Response/Actions to Conditions/Comments from Government Authorities

Condition/Comment	From	Monitoring Results during Report Period

(2) Soil Contamination (road sides around accidents prone spots)

Surveyed point	Date	Frequency	Method	Parameter measured above limit	Action to be taken

(3) Noise and Vibration

Item	Unit	Measured Value		Referred standard		Monitoring survey			
		Mean	Max.	WHO	Category	Date	Measured point	Frequency	Method
Noise level									
Vibration level									

(4) Surface Water Quality * to be adjusted depends on type of spillage

Item	Unit	Measured Value		Referred	Monitoring survey			
		Mean	Max.	National	Date	Measured	Frequency	Method
pH								
Temperature								
Colour								
Turbidity								
E. Conductivity								
Total Hardness								
TSS								
TDS								
BOD								
COD								
DO								
Oxygen								
Phosphates								
Sulphates								
Nitrates								
Chloride								
Arsenic								

Item	Unit	Measured Value		Referred	Monitoring survey			
		Mean	Max.	National	Date	Measured	Frequency	Method
Cadmium								
Copper								
Coliforms								
Chromium								
Cyanide								
Iron								
Lead								
Manganese								
Nickel								
Total Mercury								
Zinc								
Oil and Grease								

(5) Ground Water Quality * to be adjusted depends on type of spillage

Item	Unit	Measured Value		Referred Standard	Monitoring survey			
		Mean	Max.	National	Date	Measured point	Frequency	Method
Physical Characteristic								
pH								
Colour								
Water level								
Water temperature								
Electric conductivity								
Water flow								
Depth								
Stiff Diagram Analysis								
Sodium								
Potassium								
Calcium								
Magnesium								
Bicarbonate								
Chloride								
Sulphate								
Nitrate								
Toxic and other deleterious substance								
Arsenic								
Cadmium								
Chromium								
Cyanide								
Lead								
Mercury, Total								
Total Coliforms								

Item	Unit	Measured Value		Referred Standard	Monitoring survey			
		Mean	Max.	National	Date	Measured point	Frequency	Method
Fecal Coliforms								

(6) Compensation for land outside the Road width (if required)

Monitoring items	Monitoring Results during Report Period

(7) Community Involvement

a. Information disclosure

Disclosed Items	date	method	location	Number of	Monitoring Results

b. Public Consultation

Date	venue	participants	Number	agenda	Issue raised

(8) Traffic accidents

Year			Month				Resulting environment	
Date /	Accident Type	Location	Vehicle Type	Cause	Number of injury / death		Spillover/fire Etc.	Action taken

2. Construction Phase

(1) Response/Actions to Conditions/Comments from Government Authorities

Condition/Comment	From	Monitoring Results during Report Period

(2) Obtaining Permit

a. Extraction of construction materials

Item	Volume extracted	Location	Authorization required from	Approval status

				(Yes / No)
Borrow pit for				
Sand pit				
Quarry				
Water				

b. Waste material

Item	Volume released	Location	Authorization required	Approval status (Yes / No)
Effluent water				
Solid waste				
Hazardous material				
Soil				

c. Tree cutting

Type of tree	Number of trees to cut	Number of trees to be replaced/balled	Authorization required from	Approval status (Yes / No)

(3) Air Quality (dust in the atmosphere)

Item	Referred Contract article	Measures	Implementation status
SO ₂			
NO ₂			
CO			
O ₃			
Soot and dust			
SPM			
Dust			

(4) Soil Contamination (road sides around accidents prone spots)

Surveyed point	Date	Frequency	Method	Parameter measured above limit	Action to be taken

(5) Noise and Vibration

Item	Unit	Measured Value		Referred Standard		Monitoring survey			
		Mean	Max.	WHO	Category	Date	Measured point	Frequency	Method
Noise level									
Vibration level									

(6) Surface Water Quality * to be adjusted depends on type of spillage

Item	Unit	Measured Value		Referred	Monitoring survey			
		Mean	Max.	National	Date	Measured point	Frequency	Method
pH								
Temperature								
Colour								
Turbidity								
E. Conductivity								
Total Hardness								
TSS								
TDS								
BOD								
COD								
DO								
Oxygen								
Phosphates								
Sulphates								
Nitrates								
Chloride								
Arsenic								
Cadmium								
Copper								
Coliforms								
Chromium								
Cyanide								
Iron								
Lead								
Manganese								
Nickel								
Total Mercury								
Zinc								
Oil and Grease								

(7) Ground Water Quality * to be adjusted depends on type of spillage

Item	Unit	Measured		Referred	Monitoring survey			
		Mean	Max.	National	Date	Measured	Frequency	Method
Physical Characteristic								
pH								
Color								
Water level								
Water temperature								
Electric conductivity								
Water flow								
Depth								

Item	Unit	Measured		Referred	Monitoring survey			
		Mean	Max	National	Date	Measured	Frequency	Method
Stiff Diagram Analysis								
Sodium								
Potassium								
Calcium								
Magnesium								
Bicarbonate								
Chloride								
Sulphate								
Nitrate								
Toxic and other deleterious substance								
Arsenic								
Cadmium								
Chromium								
Cyanide								
Lead								
Mercury, Total								
Total Coliforms								
Fecal Coliforms								

(8) Wastes management

Item	Referred Contract article	Monitoring item	Implementation status
Solid waste			
Wastewater			
Hazardous waste			

(9) Fauna and Flora

Monitoring items	Monitoring Results during Report Period

(10) Occupational Safety (transportation routes, times, etc.)

Item	Referred Contract article	Monitoring item	Implementation status
Working hours			
Traffic control			
Material transportation			
Community safety			
Protect workers from			

(11) Community Involvement

a. Information disclosure

Disclosed Items	date	method	location	Number of distributed	Monitoring Results during Report Period

b. Public Consultation

Date	venue	participants	Number	agenda	Issue raised

c. Community Hiring

total	Number of community members hired		Vulnerable group
	male	female	

(12) Traffic accidents

Year			Month				Resulting environment damage	
Date / Time	Accident Type	Location	Vehicle Type	Cause	Number of		Spillover/fire Etc.	Action taken
					injury	death		

(13) Grievance Redress Ma

date	Grievance reported	Response	Date responded	Status (open/close)	Responsible agency

3. Operational Phase

(1) Response/Actions to Conditions/Comments from Government Authorities

Condition/Comment	From	Monitoring Results during Report Period

(2) Noise and Vibration

Item	Unit	Measured Value		Referred Standard		Monitoring survey			
		Mean	Max.	WHO	Category	Date	Measured point	Frequency	Method
Noise level									
Vibration level									

(3) Surface Water Quality * to be adjusted depends on type of spillage

Item	Unit	Measured Value		Referred		Monitoring survey			
		Mean	Max.	National	Date	Measured point	Frequency	Method	
pH									
Temperature									
Colour									
Turbidity									
E. Conductivity									
Total Hardness									
TSS									
TDS									
BOD									
COD									
DO									
Oxygen									
Phosphates									
Sulphates									
Nitrates									
Chloride									
Arsenic									
Cadmium									
Copper									
Coliforms									
Chromium									
Cyanide									
Iron									
Lead									
Manganese									
Nickel									
Total Mercury									
Zinc									
Oil and Grease									

(4) Ground Water Quality * to be adjusted depends on type of spillage

Item	Unit	Measured		Referred	Monitoring survey		
		Mean	Max.	National	Date	Measured point	Frequency
Physical Characteristic							
pH							
Color							
Water level							
Water temperature							
Electric conductivity							
Water flow							
Depth							
Stiff Diagram Analysis							
Sodium							
Potassium							
Calcium							
Magnesium							
Bicarbonate							
Chloride							
Sulphate							
Nitrate							
Toxic and other deleterious substance							
Arsenic							
Cadmium							
Chromium							
Cyanide							
Lead							
Mercury, Total							
Total Coliforms							
Fecal Coliforms							

(5) Wastes management

Item	Referred Contract article	Monitoring item	Implementation status
Solid waste			
Wastewater			
Hazardous waste			

(6) Fauna and Flora

Monitoring items	Monitoring Results during Report Period

(2) Traffic accidents

Year			Month				Resulting environment damage	
Date / Time	Accident Type	Location	Vehicle Type	Cause	Number of		Spillover/fire Etc.	Action taken
					injury	death		



Appendix 5. Soft Component Assistance Plan

The draft schedules of soft component implementation are shown below, and please refer Chapter 3, Item 3-2-4-8 for the main parts of the soft component assistance plan.

Activities for Objective 1 (Enable enforcement DOR to implement measures to improve road safety at accident-prone areas)

Date	Day	Expert 1 (Road Planning)	Expert 1 (Road Design)
1	Thu	Preparation in Japan (Pre-identification of similar issues, similar sample materials)	
2	Fri	Preparation in Japan (Pre-identification of similar issues, similar sample materials)	
3	Sat	Departure (Japan)	
4	Sun	Arrival (Zimbabwe)	
5	Mon	MoTID Consultation (explanation of the overview, purpose and schedule, and background check on NDS1)	
6	Tue	MoTID consultation (confirmation of current status, issues, and requests, explanation of Japanese case studies (planning and design aspects))	
7	Wed	On-site inspection of neighborhood conditions (confirmation of similar examples of issues)	
8	Thu	Confirmation of issue analysis, relevant standards and relevant agencies	Discussion of draft tentative signs and draft markings
9	Fri	Check for similar cases and similar locations within the country. Confirmation of special values and contraindications.	Confirmation of special values and contraindications. Consideration of the creation template of temporary sign and marking.
10	Sat	Inspection of production site, equipment, and personnel	
11	Sun	Preparation for baseline survey	
12	Mon	Implementation of baseline survey (planning, design)	
13	Tue	Explanation of the results of the baseline survey (planning, design)	
14	Wed	Support for checking and preparing materials and equipment	
15	Thu	Target selection and discussion of measurement methods	Installation practice support (signs)
16	Fri	Confirmation of effectiveness determination method	Installation practice support (markings)
17	Sat	On-site transfer (Harare→Chinhoyi State DOR Office→Makuti)	
18	Sun	Prior confirmation of the site conditions	
19	Mon	Test installation of temporary sign locations, patterns, intervals, quantities and measurement points, etc.	
20	Tue	Installation support of temporary signs by pattern and measurement of effectiveness (location 1)	
21	Wed	Installation support of temporary signs by pattern and measurement of effectiveness (location 1)	
22	Thu	Installation support of temporary signs by pattern and measurement of effectiveness (location 2)	
23	Fri	Installation support of temporary signs by pattern, measurement of effectiveness (location 2), opinion exchange	
24	Sat	Confirmation of lessons, consideration of improvements	
25	Sun	Preparation for implementation	
26	Mon	Test installation of temporary marking locations, patterns, intervals, quantities, measurement points, etc.	
27	Tue	Installation support of temporary markings by pattern and effectiveness measurement (location 1)	

28	Wed	Installation support of temporary markings by pattern and effectiveness measurement (location 1)
29	Thu	Installation support of temporary markings by pattern and effectiveness measurement (location 2)
30	Fri	Installation support of temporary markings by pattern and effectiveness measurement (location 2), opinion exchange
31	Sat	On-site transfer (Harare→Makuti)
32	Sun	Summary of the results of implementation
33	Mon	Confirmation of key points and lessons, consideration of development for better accident reduction effects
34	Tue	Discussion from maintenance perspectives. Discussion of standardization feasibility.
35	Wed	Grasping necessary materials, equipment, personnel, budget, outsourcing, etc.
36	Thu	Endline survey
37	Fri	Endline evaluation
38	Sat	Document filing
39	Sun	Document filing
40	Mon	Organizing the items considered for nationwide expansion, estimating the effect of accident reduction, confirming the benefits to NDS1.
41	Tue	Organizing the consideration for optimal plan and standardization
42	Wed	Summary of support activities

Note: NDS1=National Development Strategy 1

Activities for Objective 2 (Improve understanding of road geometry related to safety aspects of problematic road locations)

Date	Day	Expert 1 (Road Planning)	Expert 1 (Road Design)
1	Thu	Document preparation (related to road planning)	Documentation (related to road design)
2	Fri	Document preparation (reflecting the results of Objective 1)	Document preparation (reflecting the results of Objective 1)
3	Sat	Document filing	
4	Sun	Document filing	
5	Mon	MoTID consultation (explanation of the overview, purpose and schedule, confirmation of requests, and check for the current status of materials and equipment of MoTID)	
6	Tue	Approach to improving traffic safety through understanding of geometric structures (approach to correcting engineering defects)	
7	Wed	Check for the current status of planning section and quality control section	Check for the current status of design section, construction supervision section and state office
8	Thu	Check for the situation in the Southern African region	Explanation of Japanese Case Study
9	Fri	Implementation of baseline survey (road planning and CAD design aspects)	
10	Sat		
11	Sun		
12	Mon	Explanation of the results of baseline survey (road planning and CAD design)	
13	Tue	Confirmation of potential utilization in terms of survey, planning, design, and maintenance	
14	Wed	Basic understanding in use for standardization	
15	Thu	Target spot in national level (planning division)	Target spot refinement (design section)
16	Fri	Explanation of the overview of CAD training	

17	Sat		
18	Sun		
19	Mon	Understanding of measurement results→drawing→application to design→ Turning to 3D	
20	Tue	Civil 3D (Group A, Team 1)	Civil 3D (Group B, Team 1)
21	Wed	Civil 3D (Group A, Team 2)	Civil 3D (Group B, Team 2)
22	Thu	Civil 3D (Group A, Team 3)	Civil 3D (Group B, Team 3)
23	Fri	Summary and consideration of utilization methods	
24	Sat	Preparation for implementation	Preparation for implementation
25	Sun		
26	Mon	Utilization of GIS maps→Utilization of measurement results→Diagramming materials→Utilization for design	
27	Tue	Infraworks (Group A, Team 1)	Infraworks (Group B, Team 1)
28	Wed	Infraworks (Group A, Team 2)	Infraworks (Group B, Team 2)
29	Thu	Infraworks (Group A, Team 3)	Infraworks (Group B, Team 3)
30	Fri	Summary and consideration of utilization methods	
31	Sat	Confirmation of lessons, consideration of improvements	Confirmation of lessons, consideration of improvements
32	Sun	Document filing	Document filing
33	Mon	Consideration of requests and utilization plan of Civil 3D and Infraworks	
34	Tue	Endline survey	
35	Wed	Endline evaluation	
36	Thu	Grasping necessary materials, equipment, personnel, budget, and outsourcing, etc.	
37	Fri	Summary and consideration of reflection in practice and standards	
38	Sat	Document filing	Departure (Zimbabwe)
39	Sun	Document filing	Arrival (Japan)

Activities for Objective 3 (Improv understanding of shoulder strengthening methods)

Date	Day	Expert 1 (Road Planning)	Expert 1 (Road Design)
1	Mon	Document preparation	
2	Tue	Document preparation	
3	Wed	MoTID consultation (explanation of the overview, purpose and schedule)	
4	Thu	Check for the current status of materials and equipment of MoTID	
5	Fri	Inspection of similar cases, explanation of overview of examples in other countries	
6	Sat	Preparation for implementation	Departure (Japan)
7	Sun	Preparation for implementation	Arrival (Zimbabwe)
8	Mon	Implementation of baseline survey	Check for the on-site equipment, materials, and personnel
9	Tue	Explanation of the result of baseline survey and confirmation of requests	
10	Wed	Confirmation of maintenance specifications, budget status, and contracting methods	Check for the current status of shoulders and similar cases of repair
11	Thu	Confirmation of quality standards, formulations and quality confirmation methods	Discussions on current maintenance and management methods
12	Fri	Pre-discussion with MoTID officials before on-site trainings	
13	Sat	On-site transfer (Harare→Chinhoyi State DOR Office→Makuti)	
14	Sun	Prior confirmation of site conditions	
15	Mon	Visit to DOR maintenance unit, joint discussion on how to understand and	

		deal with the situation on site	
16	Tue	Work verification (demonstration by quality check group)	Work verification (demonstration by construction implementation group)
17	Wed	Training of cleanfill, spreading, agitation, and compaction	Training of cleanfill, spreading, agitation, and compaction
18	Thu	Training of cleanfill, spreading, agitation, and compaction	Training of cleanfill, spreading, agitation, and compaction
19	Fri	Edge excavation, curbstone placement and surface installation training	Edge excavation, curbstone placement and surface installation training
20	Sat	Preparation for implementation	Preparation for implementation
21	Sun	Document filing	Document filing
22	Mon	The same training for in oncoming lane	The same training for in oncoming lane
23	Tue	The same training for in oncoming lane	The same training for in oncoming lane
24	Wed	The same training for in oncoming lane	The same training for in oncoming lane
25	Thu	The same training for in oncoming lane	The same training for in oncoming lane
26	Fri	Summary and consideration of deployment/utilization methods	
27	Sat	Transfer (field→Harare)	Departure (Zimbabwe)
28	Sun	Document filing	Arrival (Japan)
29	Mon	Grasping the key points, areas for improvement and lessons	
30	Tue	Consultation on maintenance and management (e.g., optimal implementation methods with limitation of equipment, materials, and personnel), support for understanding LCC, and support for creating implementation plans	
31	Wed	Grasping required equipment and materials, personnel, budget and outsourcing	
32	Thu	Endline survey	
33	Fri	Endline evaluation	
34	Sat	Document filing	
35	Sun	Document filing	
36	Mon	Formation of optimal team for improving other sections' conditions	
37	Tue	Summary (generalize objective 1→2 → 3 Summary)	
38	Wed	Report to MoTID and JICA	
39	Thu	Departure (Zimbabwe)	
40	Fri	Arrival (Japan)	

Appendix6. Other Relevant Data

Appendix 6-1 Technical Note signed with Zimbabwean side)

Memorandum of Technical Note

5/November/2021

Memorandum of Technical Note

The criteria shown below in highway designing were agreed by DOR and JICA Survey Team for the Project for the Road Improvement of the Northern Part of the North-South Corridor (Phase 2) in the Republic of Zimbabwe

Design Items		Units	Proposed Design Parameter
Design Speed (D/S)		Km/hr	60 [few spot 40]
Right of Way Width		m	70
Number of Lanes		No.	2
Lane Width		m	3.75 c/c
Shoulder Width		m	2.5 paved
Climbing Lane Width		m	3.75 c/c
Crossfall on Carriageway		%	2.5
Crossfall on Shoulder		%	2.5
Minimum Radius of Horizontal Curve		m	D/S 60=100, D/S 40=50 (Absolute)
Maximum Superelevation		%	10
Stopping Sight Distance		m	80
Fill Slope	Soil	Angle	1:1.5~4.0 (by slope height)
	Rock	Angle	1:0.3~0.5 (by rock type)
Cut Slope	Other than Rock	Angle	1:1.0
Pavement Design Life		Year	15
Pavement Type		-	Carriageway: DBST, Shoulder: DBST
Design return period of road drainage		Year	5years: Minor drainage (side ditch, etc.) 20years: Major drainage (road crossing culvert, etc.)

Note: [] = Minimum value, DBST= Double Bituminous Surface Treatment, c/c= road center to edge line marking center

Remarks:

1) Existing ROW (Right of Way)

- ROW = Harare-Lion's Den 140m (70m both side), thereafter the 31.5m road servitude prevails upto Chirundu.

2) Scope of Phase-2 Section

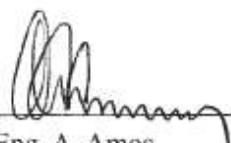
- Road specification considered consistency with JICA Phase-1 project (construction completed in Mar./2021).
- Phase-1 starting point (306.5km point from Harare GPO) will be Phase-2 starting point to Harare direction
- The Project ending point will be decided before Apr./2022 based on the result of the survey analysis.

3) Specific Features

- Safety facilities = Rumble strip, delineator, sign board, guard rail, marking, etc. will be considered

4) Other Consideration

- Adequate camp site area, disposal area (for demolished structures and construction waste) shall be secured.
- Removal and Relocation of existing facilities within ROW (electric line, water pipe, telephone line, fiber cable, sign board, etc.) required before the contractor's pre-qualification (PQ, expected by Apr./ 2023).


Eng. A. Amos
Chief Director, DOR,
MoTID, Zimbabwe


H. MORITA
Chief Consultant of JICA Survey Team
INGÉROSEC Corporation, JAPAN

1. Pre-Construction Phase (including Detailed Design)

(1) Response/Actions to Conditions/Comments from Government Authorities

Condition/Comment	From	Monitoring Results during Report Period

(2) Soil Contamination (road sides around accidents prone spots)

Surveyed point	Date	Frequency	Method	Parameter measured above limit	Action to be taken

(3) Noise and Vibration

Item	Unit	Measured Value		Referred standard		Monitoring survey			
		Mean	Max.	WHO	Category	Date	Measured	Frequenc	Method
Noise level									
Vibration level									

(4) Surface Water Quality * to be adjusted depends on type of spillage

Item	Unit	Measured Value		Referred	Monitoring survey			
		Mean	Max.	National	Date	Measured	Frequency	Method
pH								
Temperature								
Colour								
Turbidity								
E.								
Total								
TSS								
TDS								
BOD								
COD								
DO								
Oxygen								
Phosphates								
Sulphates								
Nitrates								
Chloride								
Arsenic								
Cadmium								
Copper								
Coliforms								

Item	Unit	Measured Value		Referred	Monitoring survey			
		Mean	Max.	National	Date	Measured	Frequency	Method
Chromium								
Cyanide								
Iron								
Lead								
Manganese								
Nickel								
Total Mercury								
Zinc								
Oil and								

(5) Ground Water Quality * to be adjusted depends on type of spillage

Item	Unit	Measured Value		Referred Standard	Monitoring survey			
		Mean	Max.	National	Date	Measured point	Frequency	Method
Physical Characteristic								
pH								
Colour								
Water level								
Water temperature								
Electric								
Water flow								
Depth								
Stiff Diagram Analysis								
Sodium								
Potassium								
Calcium								
Magnesium								
Bicarbonate								
Chloride								
Sulphate								
Nitrate								
Toxic and other deleterious substance								
Arsenic								
Cadmium								
Chromium								
Cyanide								
Lead								
Mercury, Total								
Total Coliforms								
Fecal Coliforms								

(6) Compensation for land outside the Road width (if required)

Monitoring items	Monitoring Results during Report Period

(7) Community Involvement

a. Information disclosure

Disclosed Items	date	method	location	Number of	Monitoring Results

b. Public Consultation

Date	venue	participants	Number	agenda	Issue raised

(8) Traffic accidents

Year			Month				Resulting environment	
Date /	Accident Type	Location	Vehicle Type	Cause	Number of		Spillover/fire Etc.	Action taken
				injury	death			

2. Construction Phase

(1) Response/Actions to Conditions/Comments from Government Authorities

Condition/Comment	From	Monitoring Results during Report Period

(2) Obtaining Permit

a. Extraction of construction materials

Item	Volume extracted	Location	Authorization required from	Approval status (Yes / No)
Borrow pit for soil				
Sand pit				
Quarry				
Water				

b. Waste material

Item	Volume released	Location	Authorization required	Approval status (Yes / No)
Effluent water				
Solid waste				
Hazardous				

Item	Volume released	Location	Authorization required	Approval status (Yes / No)
Soil				

c. Tree cutting

Type of tree	Number of trees to cut	Number of trees to be replaced/balled	Authorization required from	Approval status (Yes / No)

(3) Air Quality (dust in the atmosphere)

Item	Referred Contract article	Measures	Implementation status
SO2			
NO2			
CO			
O3			
Soot and dust			
SPM			
Dust			

(4) Soil Contamination (road sides around accidents prone spots)

Surveyed point	Date	Frequency	Method	Parameter measured above limit	Action to be taken

(5) Noise and Vibration

Item	Unit	Measured Value		Referred Standard		Monitoring survey			
		Mean	Max.	WHO	Category	Date	Measured point	Frequency	Method
Noise level									
Vibration level									

(6) Surface Water Quality * to be adjusted depends on type of spillage

Item	Unit	Measured Value		Referred	Monitoring survey			
		Mean	Max.	National	Date	Measured	Frequency	Method
pH								
Temperature								
Colour								
Turbidity								
E.								
Total								

Item	Unit	Measured Value		Referred National	Monitoring survey			
		Mean	Max.		Date	Measured	Frequency	Method
TSS								
TDS								
BOD								
COD								
DO								
Oxygen								
Phosphates								
Sulphates								
Nitrates								
Chloride								
Arsenic								
Cadmium								
Copper								
Coliforms								
Chromium								
Cyanide								
Iron								
Lead								
Manganese								
Nickel								
Total Mercury								
Zinc								
Oil and								

(7) Ground Water Quality * to be adjusted depends on type of spillage

Item	Unit	Measured		Referred National	Monitoring survey			
		Mean	Max.		Date	Measured	Frequency	Method
Physical Characteristic								
pH								
Color								
Water level								
Water temperature								
Electric								
Water flow								
Depth								
Stiff Diagram Analysis								
Sodium								
Potassium								
Calcium								
Magnesium								
Bicarbonate								
Chloride								
Sulphate								
Nitrate								
Toxic and other deleterious substance								

Item	Unit	Measured		Referred	Monitoring survey			
		Mean	Max.	National	Date	Measured	Frequency	Method
Arsenic								
Cadmium								
Chromium								
Cyanide								
Lead								
Mercury, Total								
Total Coliforms								
Fecal Coliforms								

(8) Wastes management

Item	Referred Contract article	Monitoring item	Implementation status
Solid waste			
Wastewater			
Hazardous			

(9) Fauna and Flora

Monitoring items	Monitoring Results during Report Period

(10) Occupational Safety (transportation routes, times, etc.)

Item	Referred Contract article	Monitoring item	Implementation status
Working hours			
Traffic control			
Material transportation			
Community safety			
Protect workers from			

(11) Community Involvement

a. Information disclosure

Disclosed Items	date	method	location	Number of distributed	Monitoring Results during Report Period

b. Public Consultation

Date	venue	participants	Number	agenda	Issue raised

c. Community Hiring

Number of community members hired			
total	male	female	Vulnerable group

(12) Traffic accidents

Year			Month				Resulting environment damage	
Date / Time	Accident Type	Location	Vehicle Type	Cause	Number of		Spillover/fire Etc.	Action taken
					injury	death		

(13) Grievance Redress Ma

date	Grievance reported	Response	Date responded	Status (open/close)	Responsible agency

3. Operational Phase

(1) Response/Actions to Conditions/Comments from Government Authorities

Condition/Comment	From	Monitoring Results during Report Period

(2) Noise and Vibration

Item	Unit	Measured Value		Referred Standard		Monitoring survey			
		Mean	Max.	WHO	Category	Date	Measured point	Frequency	Method
Noise level									
Vibration level									

(3) Surface Water Quality * to be adjusted depends on type of spillage

Item	Unit	Measured Value		Referred	Monitoring survey			
		Mean	Max.	National	Date	Measured	Frequency	Method
pH								
Temperature								
Colour								

Item	Unit	Measured Value		Referred	Monitoring survey			
		Mean	Max.		National	Date	Measured	Frequency
Turbidity								
E.								
Total								
TSS								
TDS								
BOD								
COD								
DO								
Oxygen								
Phosphates								
Sulphates								
Nitrates								
Chloride								
Arsenic								
Cadmium								
Copper								
Coliforms								
Chromium								
Cyanide								
Iron								
Lead								
Manganese								
Nickel								
Total Mercury								
Zinc								
Oil and								

(4) Ground Water Quality * to be adjusted depends on type of spillage

Item	Unit	Measured		Referred	Monitoring survey			
		Mean	Max.		National	Date	Measured	Frequency
Physical Characteristic								
pH								
Color								
Water level								
Water temperature								
Electric								
Water flow								
Depth								
Stiff Diagram Analysis								
Sodium								
Potassium								
Calcium								
Magnesium								
Bicarbonate								
Chloride								

Item	Unit	Measured		Referred	Monitoring survey			
		Mean	Max.	National	Date	Measured	Frequency	Method
Sulphate								
Nitrate								
Toxic and other deleterious substance								
Arsenic								
Cadmium								
Chromium								
Cyanide								
Lead								
Mercury, Total								
Total Coliforms								
Fecal Coliforms								

(5) Wastes management

Item	Referred Contract article	Monitoring item	Implementation status
Solid waste			
Wastewater			
Hazardous			

(6) Fauna and Flora

Monitoring items	Monitoring Results during Report Period

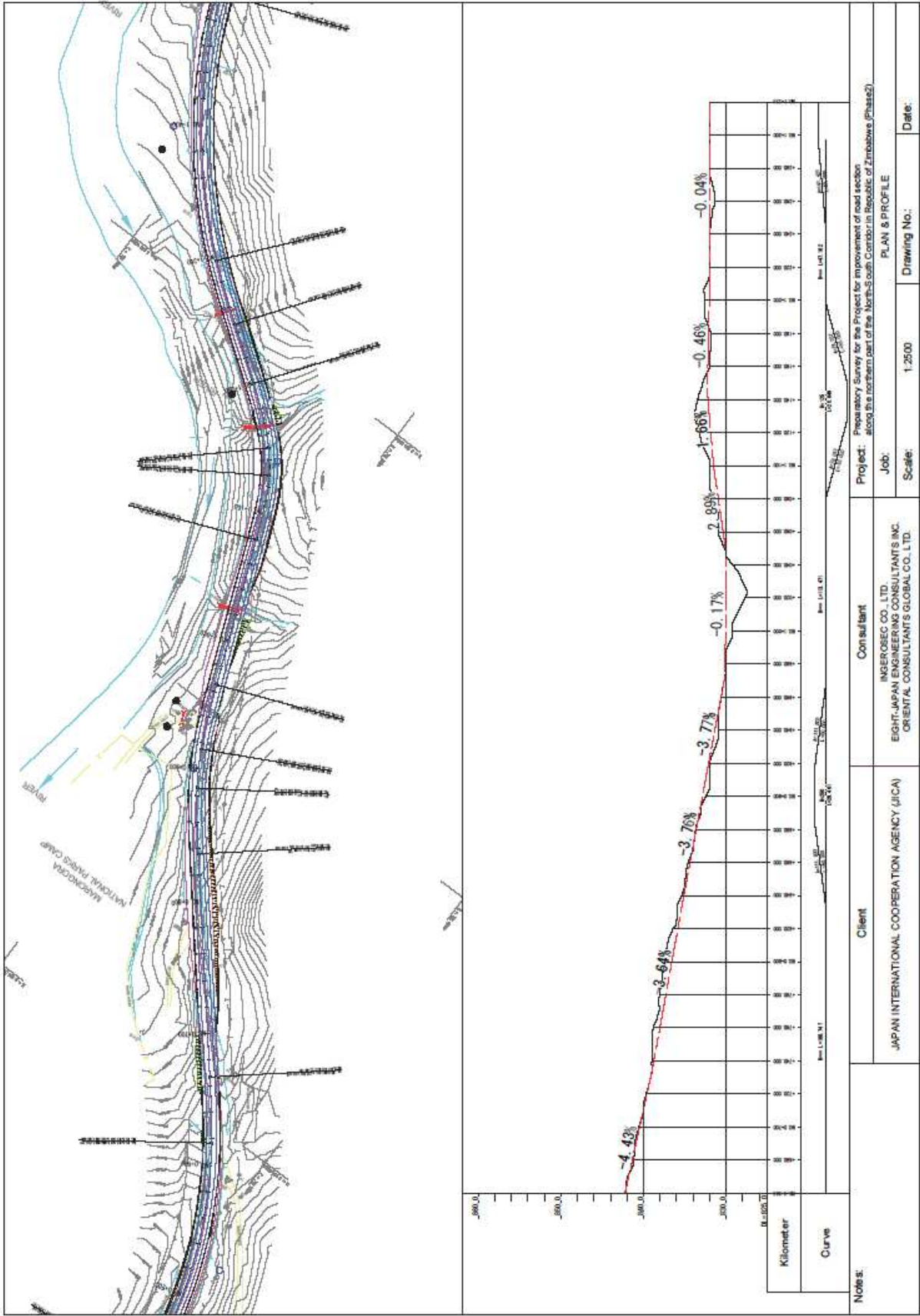
(7) Traffic accidents

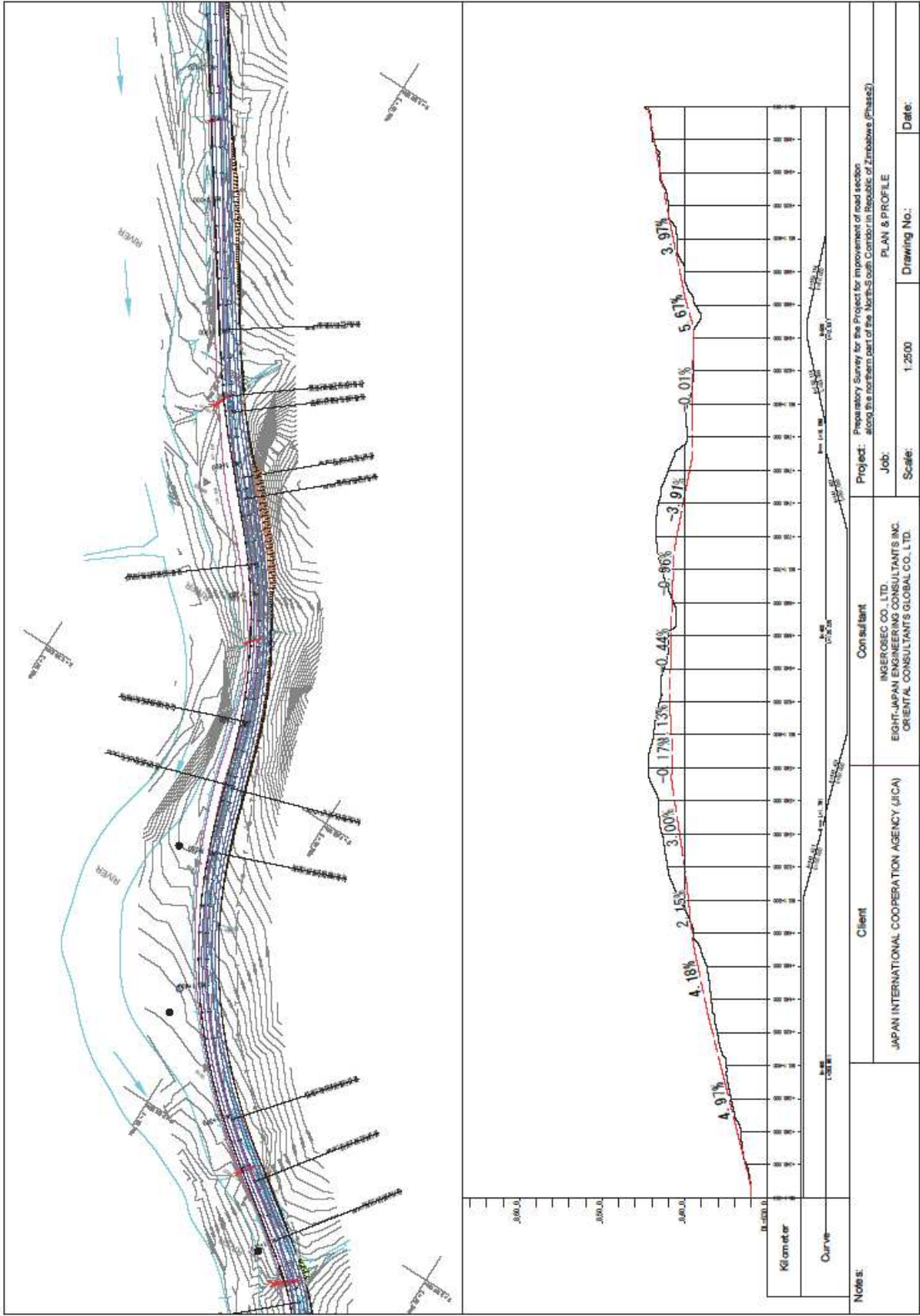
Year			Month				Resulting environment damage	
Date / Time	Accident Type	Location	Vehicle Type	Cause	Number of		Spillover/fire Etc.	Action taken
					injury	death		

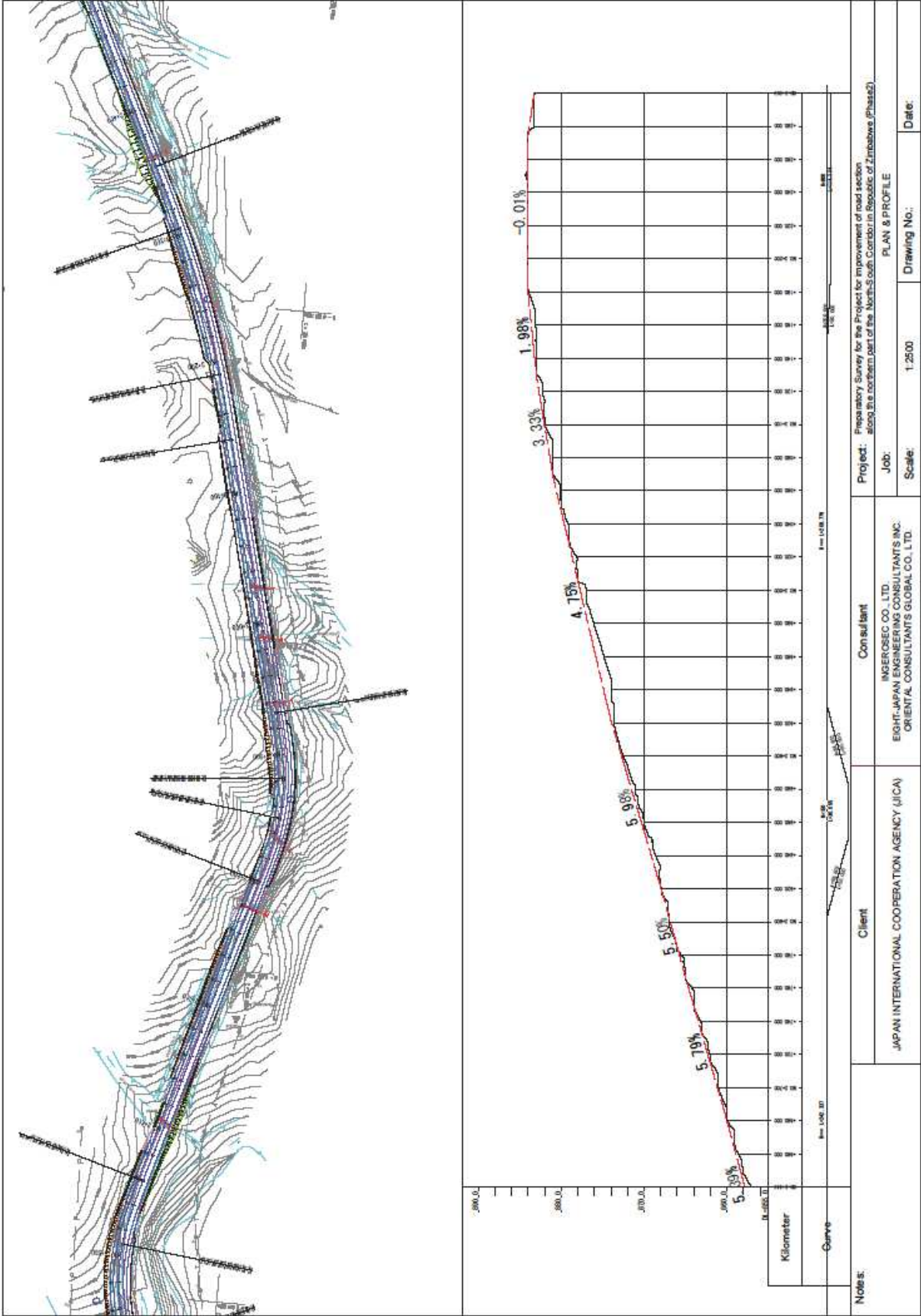
Appendix 7 References (Outline Design Drawings)

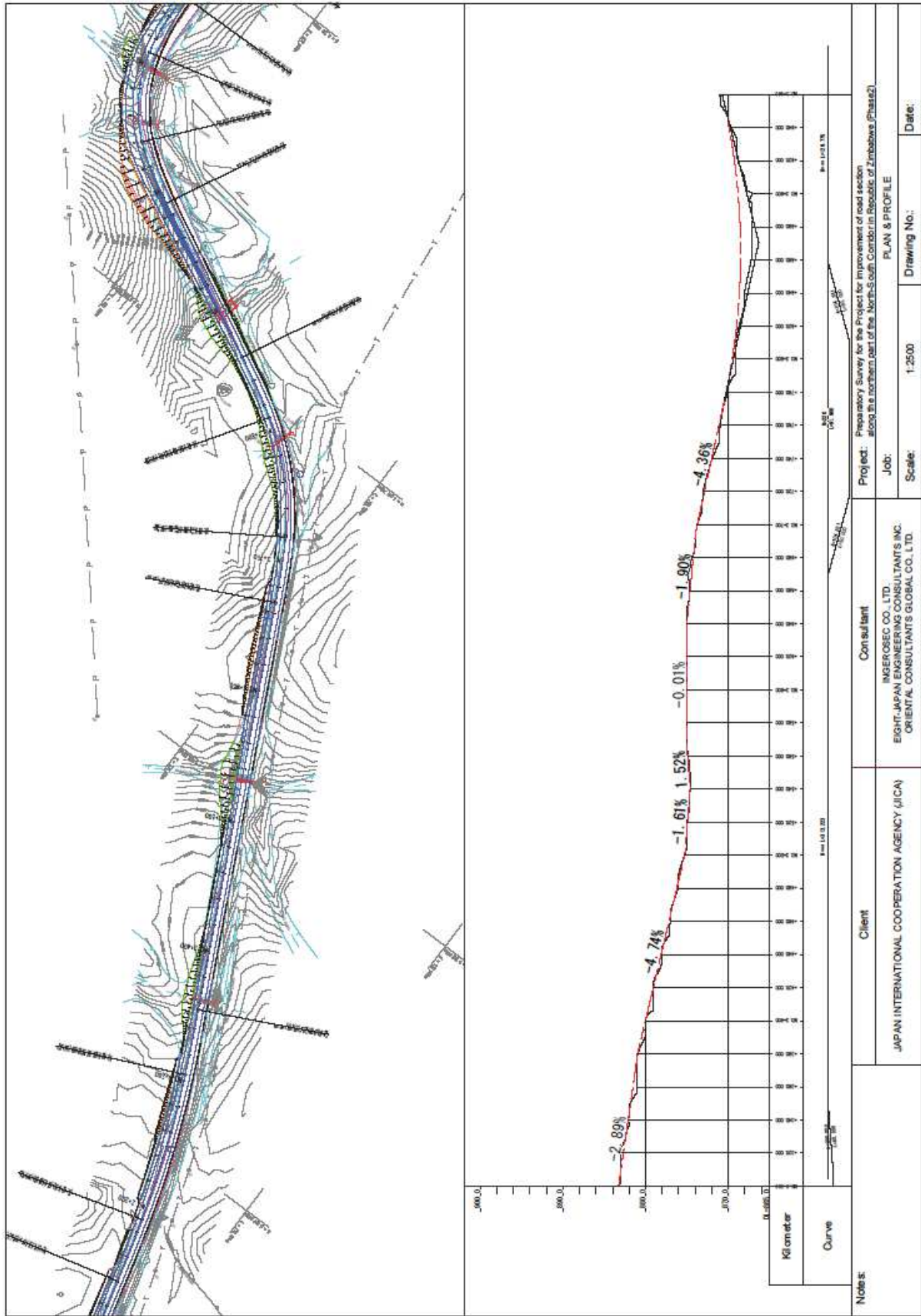
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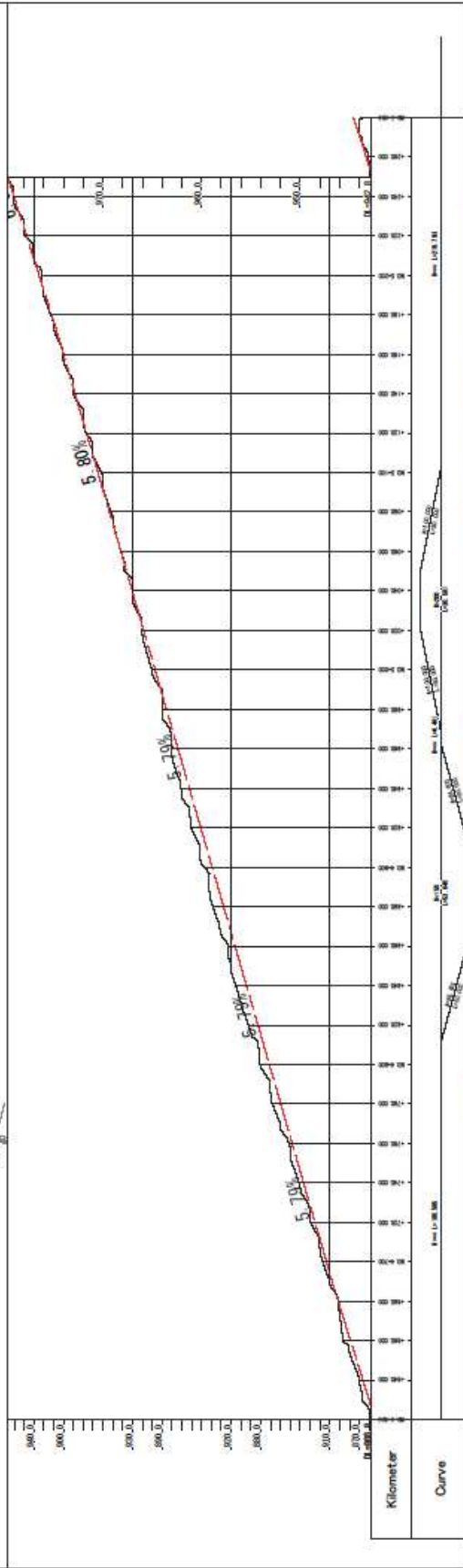
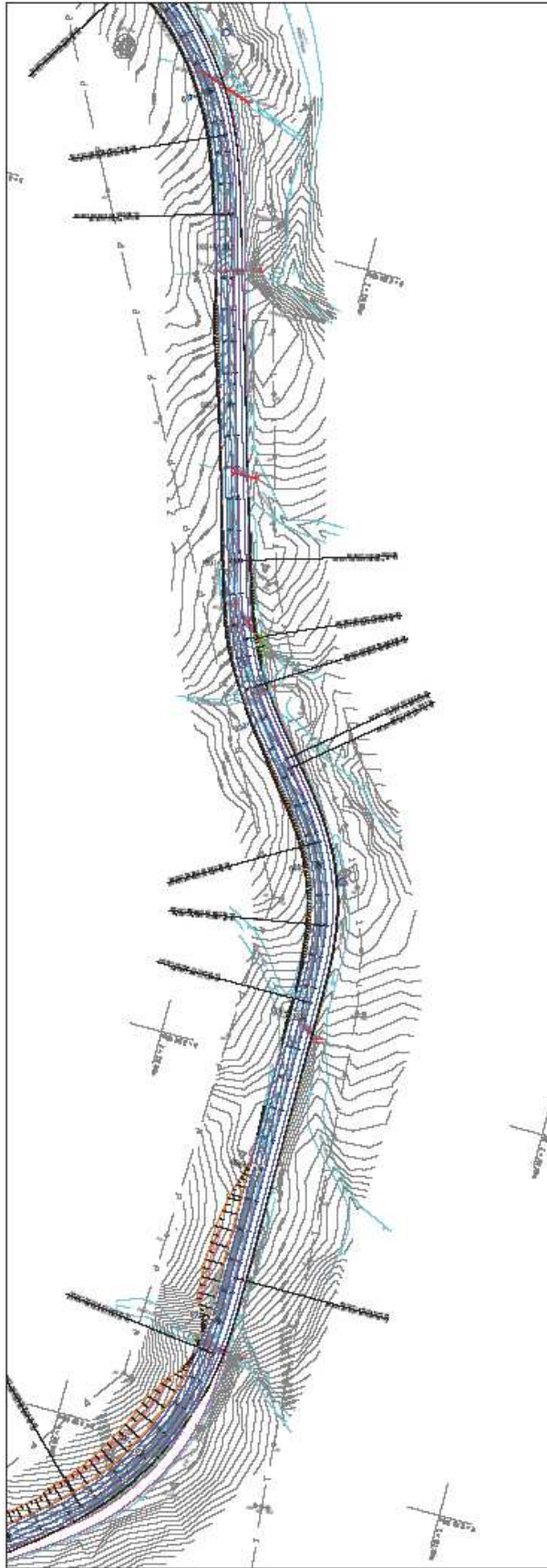
Item	Contents of drawing	Number of drawing
1	Horizontal and longitudinal plan drawing	12
2	Road standard section drawing	1
3	Incidental facilities structural drawing	5



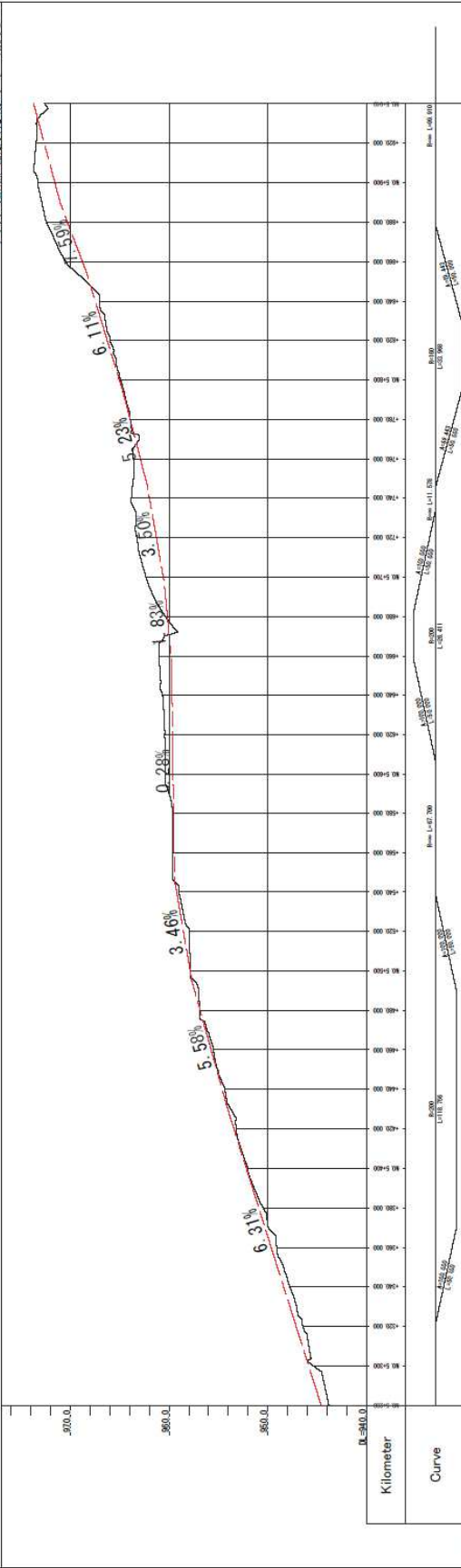
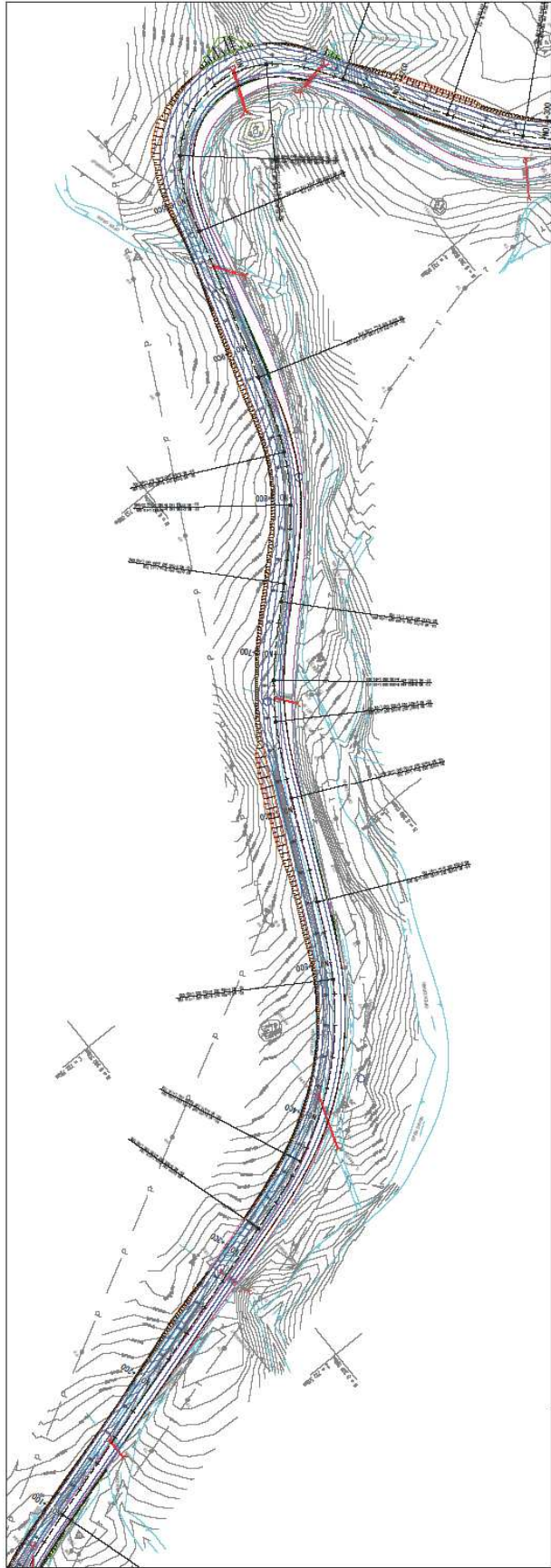




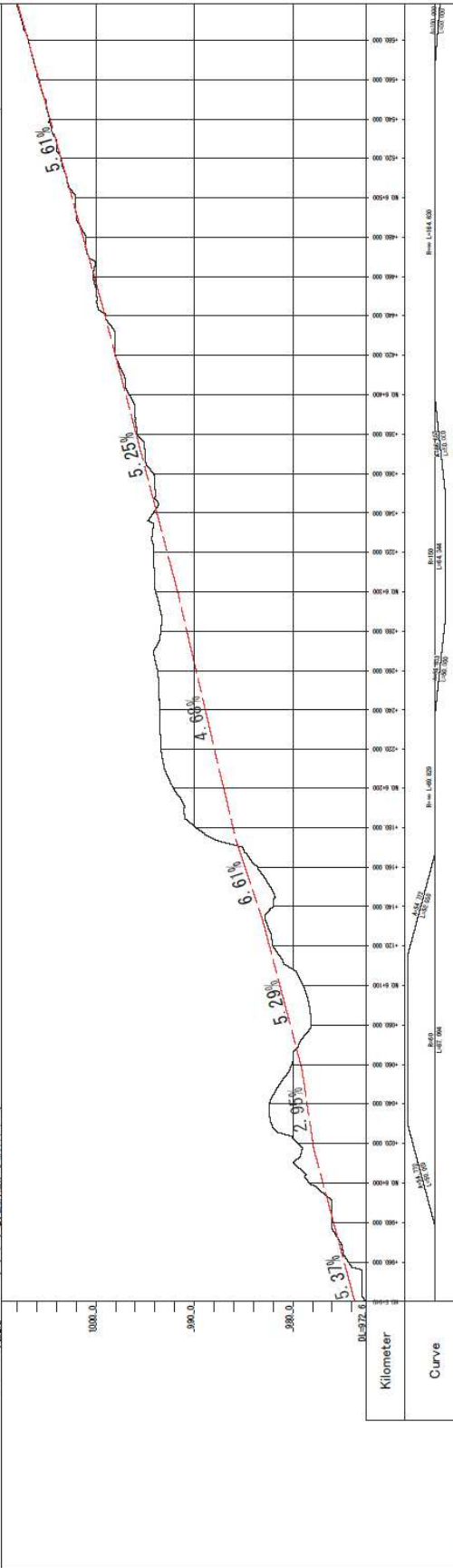
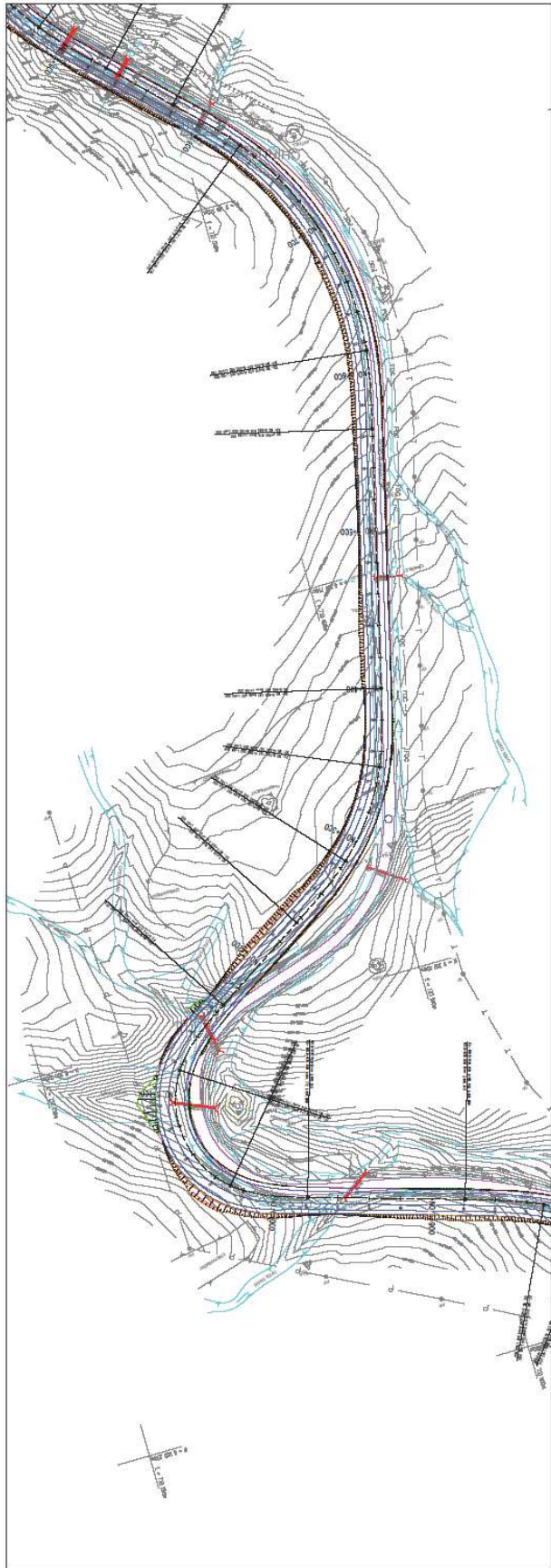




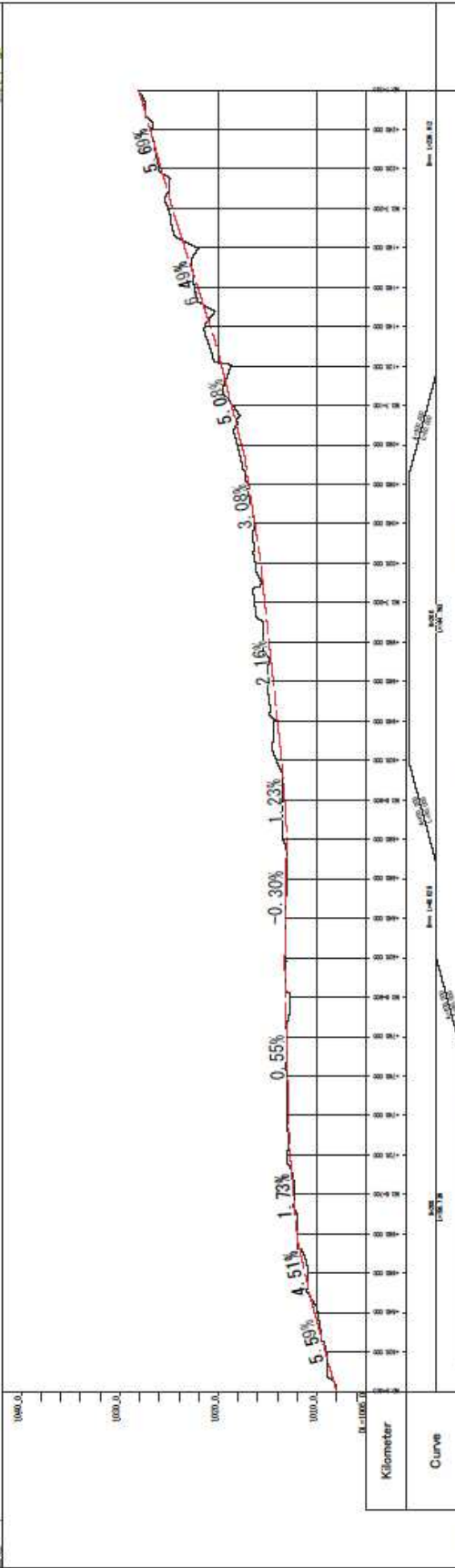
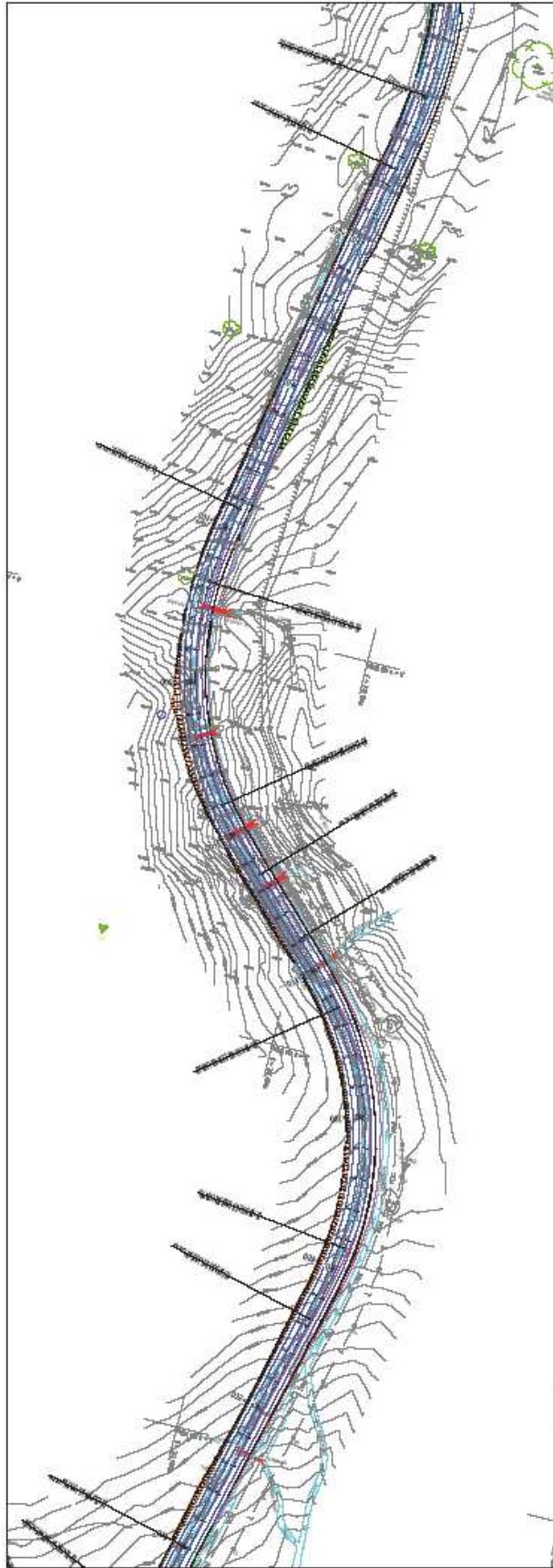
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Drawing No.:		JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)	
Date:			



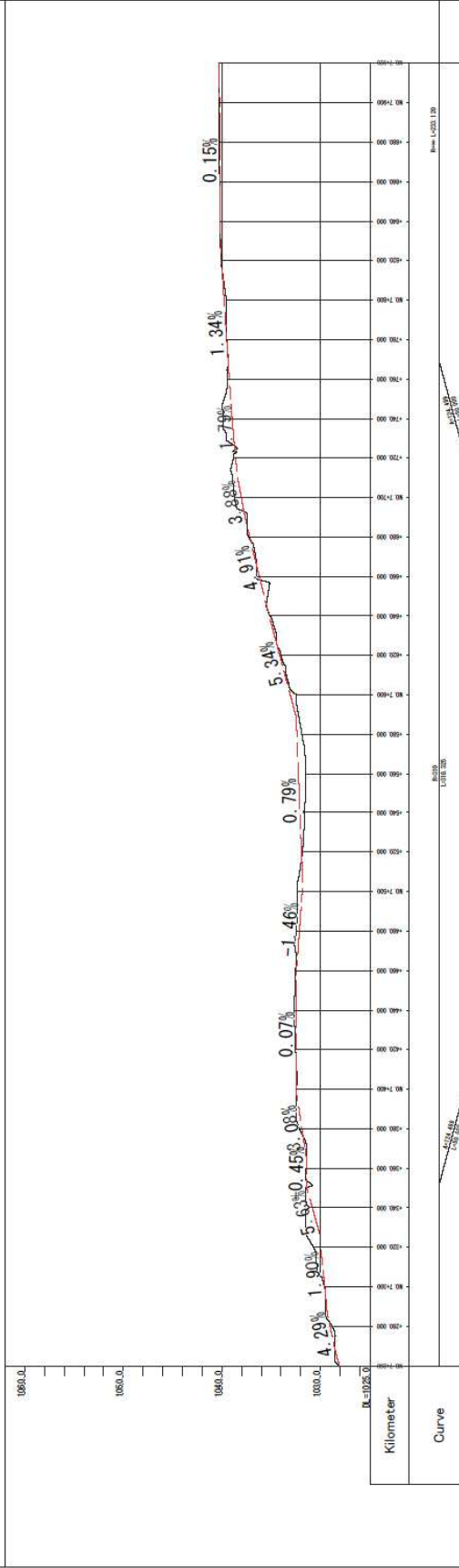
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	Consultant	INGERDEC CO., LTD. EIGHT JAPAN ENGINEERS CONSULTANTS INC. ORIENTAL CONSULTANTS GLOBAL CO., LTD.
	Project	Preparatory Survey for the Project for improvement of road section along the northern part of the North-South Corridor in Republic of Zimbabwe (Phase2)
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	Drawing No.:	
	Date:	



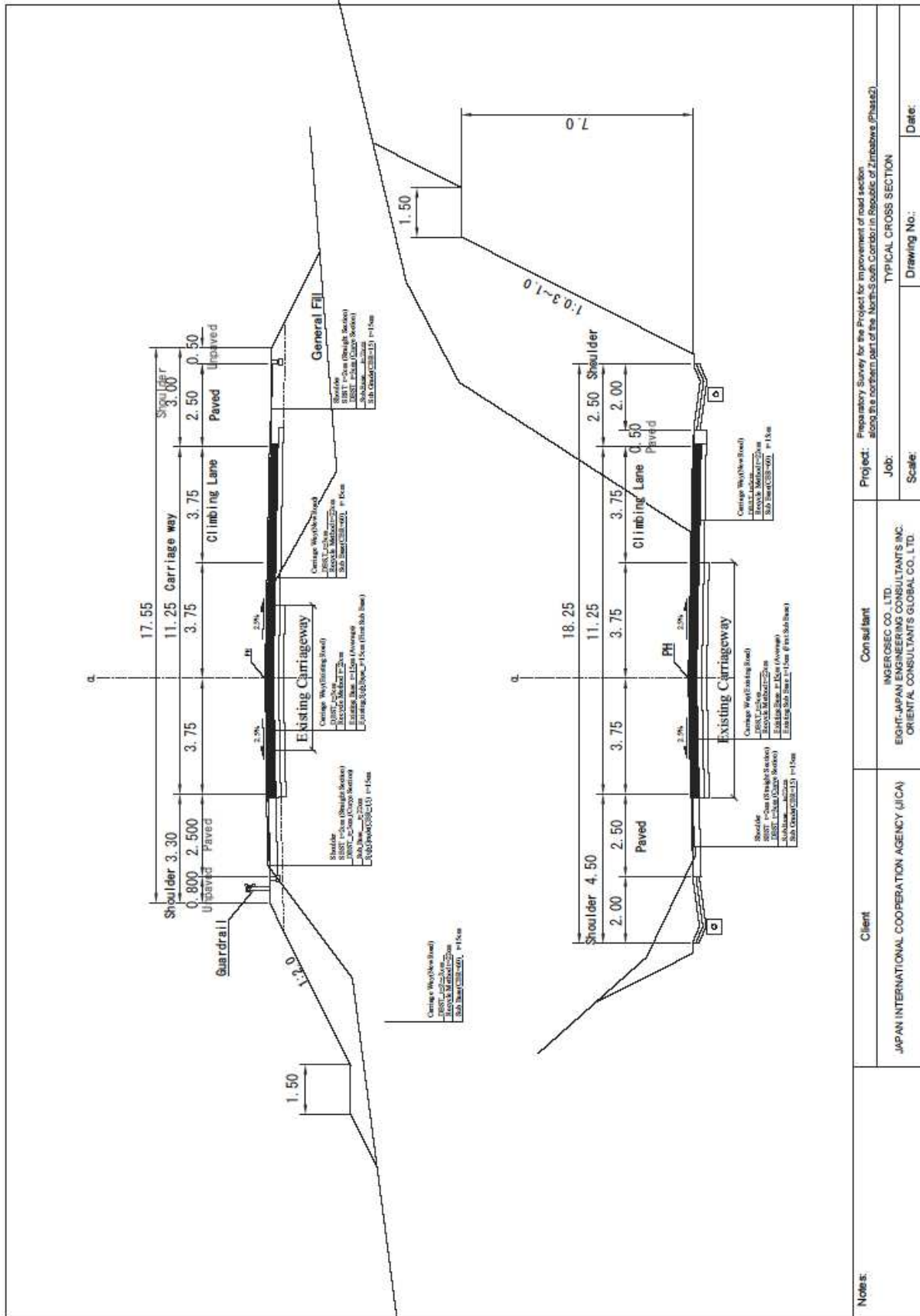
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			Date:



Notes:		Client		Consultant		Project: Preparatory Survey for the Project for Improvement of road section along the northern part of the North-South Corridor in Republic of Zimbabwe (Phase2)	
JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)		EIGHT-JAPAN ENGINEERING CONSULTANTS INC. ORIENTAL CONSULTANTS GLOBAL CO. LTD.		INGERSEEC CO. LTD. EIGHT-JAPAN ENGINEERING CONSULTANTS INC. ORIENTAL CONSULTANTS GLOBAL CO. LTD.		Job: PLAN & PROFILE	
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						Drawing No.:	
						Date:	



Notes: Project: Preparatory Survey for the Project for improvement of road section along the northern part of the North-South Corridor in Republic of Zimbabwe (Phase2) Job: PLAN & PROFILE Scale: 1:2500 Drawing No.: Date:		Client JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)		Consultant INGEROSEC CO. LTD. EIGHT-JAPAN ENGINEERING CONSULTANTS INC. ORIENTAL CONSULTANTS GLOBAL CO., LTD.	
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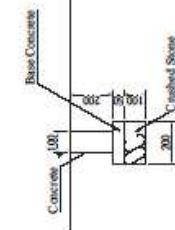


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TYPICAL CROSS SECTION			Drawing No.:
			Date:

Ancillary Works Structure (1)

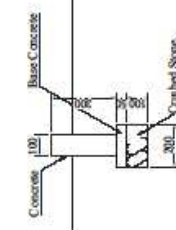
Concrete Block S=120

Type-1



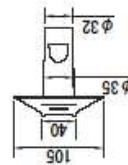
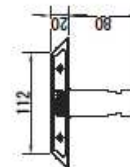
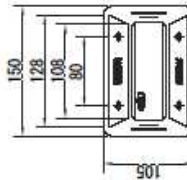
MATERIALS LIST		Unit	Quanty	Search
Classifications	Standard			
EXAMINATION		cu m	0.25	
FILLING		cu m	0.20	
SUPPLIES		cu m	0.03	
Concrete	crack 100%	cu m	0.02	
Form		sq m	0.40	
Base Concrete	t=50	cu m	0.01	
Base Form		sq m	0.05	
Gravel Stone	t=100	cu m	0.02	
Joint		sq m	0.02	Unit 1/ 50

Type-2

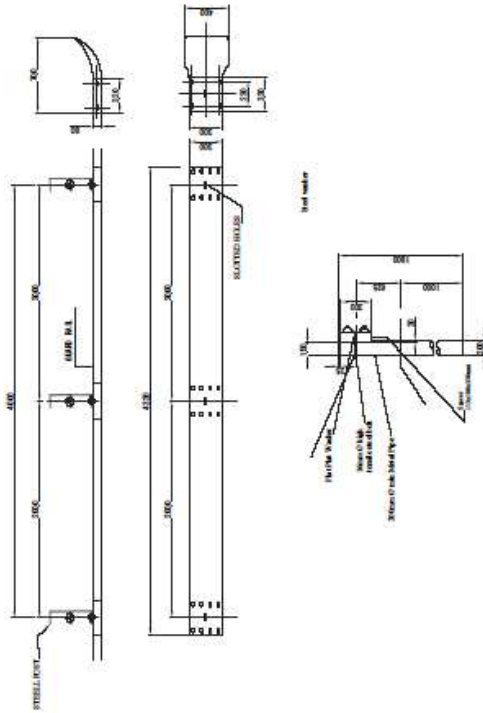


MATERIALS LIST		Unit	Quanty	Search
Classifications	Standard			
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FILLING		cu m	0.20	
SUPPLIES		cu m	0.03	
Concrete	crack 100%	cu m	0.02	
Form		sq m	0.40	
Base Concrete	t=50	cu m	0.01	
Base Form		sq m	0.05	
Gravel Stone	t=100	cu m	0.02	
Joint		sq m	0.02	Unit 1/ 50

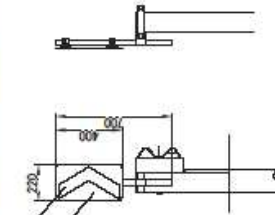
Delineator(Chatter Bar) S=115



Guard Rail S=140



Delineator on Guard rail



Notes:

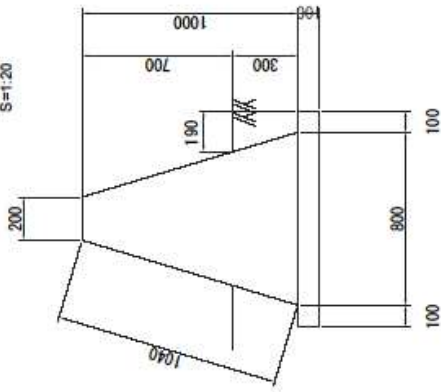
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JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)

Consultant
INGEROSEC CO., LTD.
EIGHT-JAPAN ENGINEERING CONSULTANTS INC.
ORIENTAL CONSULTANTS GLOBAL CO., L.TD.

Project: Preparatory Survey for the Project for Improvement of road section along the northern part of the North-South Corridor in Republic of Zimbabwe (Phase2)
Job: Ancillary Works Structure (1)
Scale:
Drawing No.:
Date:

Ancillary Works Structure (2)

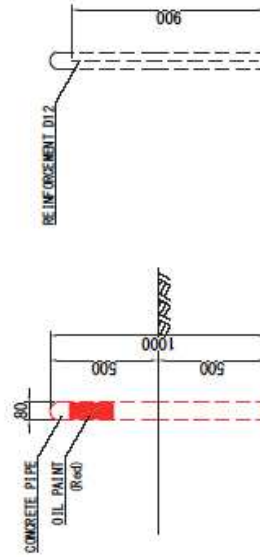
Rockfall Protection Wall
S=1:20



MATERIALS LIST

Classification	Standard	Unit	Quantity	FBI	Remark
Concrete	en1199	cu m	0.96		
Form		sq m	2.00		
Foundation	t-200	cu m	0.10		
JOINT		sq m	0.96		

Delimeter Post
S=1:20



Notes:

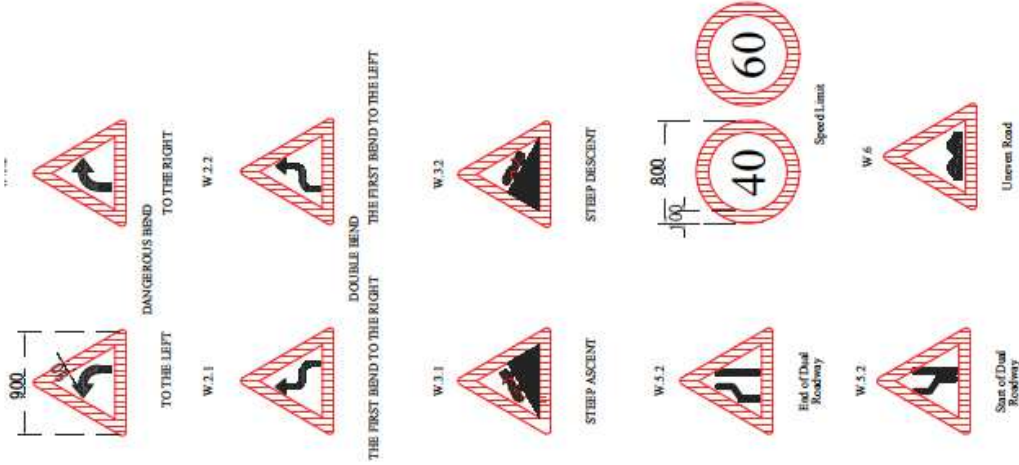
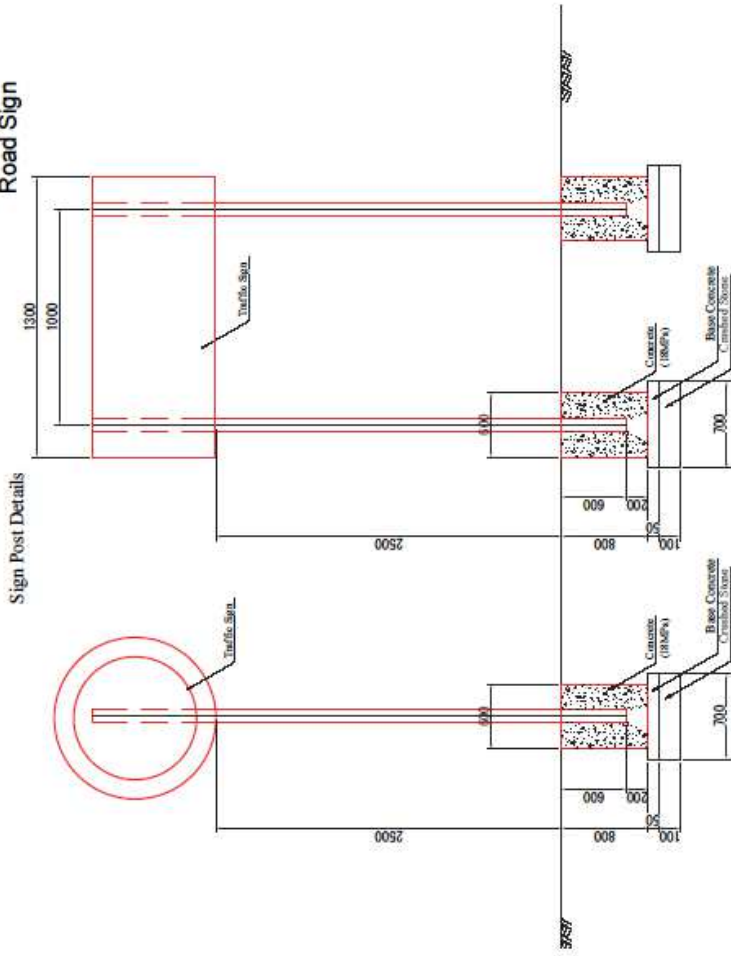
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JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)

Consultant
INGEROSEC CO., LTD.
EIGHT-JAPAN ENGINEERING CONSULTANTS INC.
ORIENTAL CONSULTANTS GLOBAL CO., LTD.

Project: Preparatory Survey for the Project for improvement of road section along the northern part of the North-South Corridor in Republic of Zimbabwe (Phase2)
Job: Ancillary Works Structure (2)
Scale:
Drawing No.:
Date:

Ancillary Works Structure (3)

Road Sign



MATERIALS LIST

Class / Item	Standard	Unit	Quantity	Per each
EXCAVATION		m ³	0.50	0.50
FILLING		m ³	4.00	4.00
REINFORCING BARS		m	0.70	0.70
Concrete	C18/20	m ³	0.50	0.50
Form		m ²	3.04	3.04
Base Concrete	C18/20	m ³	0.04	0.04
Base Form		m ²	0.25	0.25
Grouted Stone	100	m ³	0.08	0.08
Traffic Sign		pieces	1	1

MATERIALS LIST

Class / Item	Standard	Unit	Quantity	Per each
EXCAVATION		m ³	2.75	2.75
FILLING		m ³	2.40	2.40
REINFORCING BARS		m	0.25	0.25
Concrete	C18/20	m ³	0.20	0.20
Form		m ²	1.00	1.00
Base Concrete	C18/20	m ³	0.00	0.00
Base Form		m ²	0.14	0.14
Grouted Stone	100	m ³	0.04	0.04
Traffic Sign		pieces	1	1

Notes:

Project: Preliminary Survey for the Project for improvement of road section along the northern part of the North-South Corridor in Republic of Zimbabwe (Phase 2)

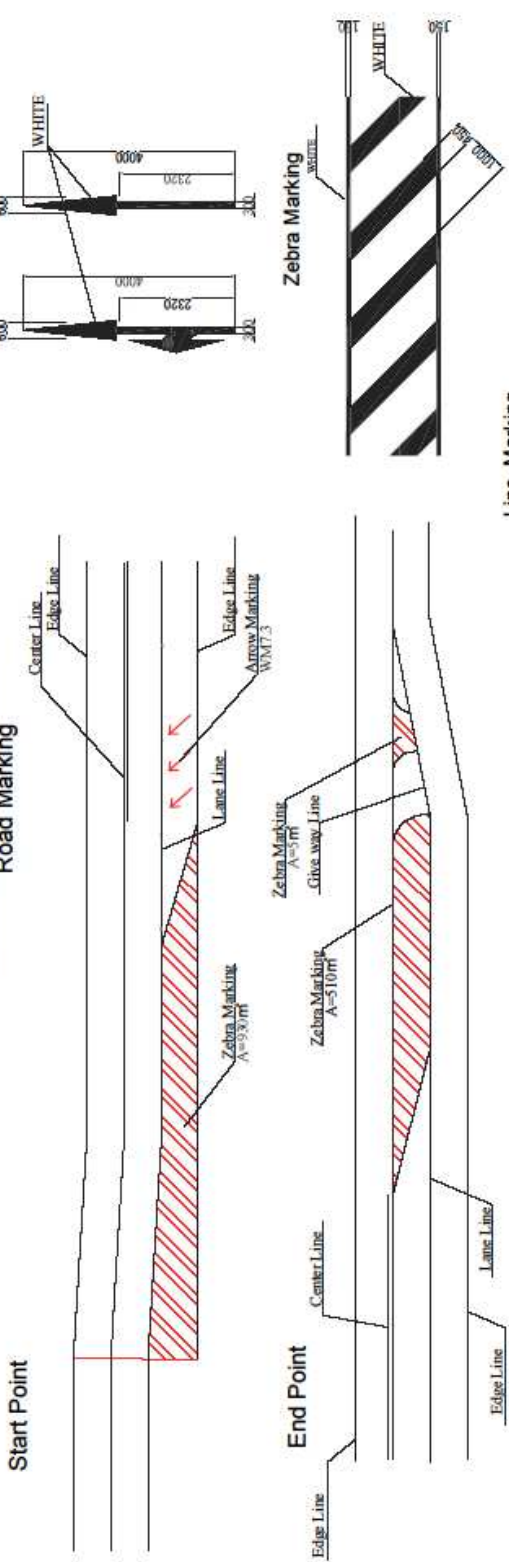
Job: Ancillary Works Structure (3)

Scale: Drawing No.: Date:

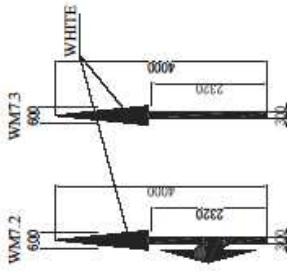
Client: JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)

Consultant: INGEROSEC CO. LTD. EIGHT-JAPAN ENGINEERING CONSULTANTS INC. ORIENTAL CONSULTANTS GLOBAL CO., LTD.

Ancillary Works Structure (4) Road Marking



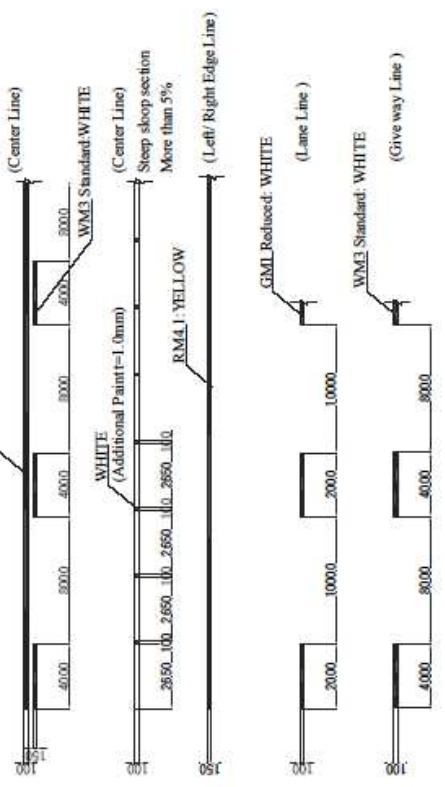
Arrow Marking



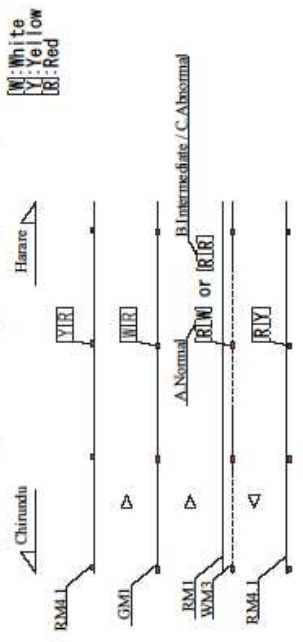
Zebra Marking



Line Marking



Delineator (Chatter bar) Color Coding and Longitudinal Spacing



Longitudinal Delineator (Chatter Bar) Spacing (m)		
A Normal	B Intermediate	C Abnormal
Radius of Curvature		
110 > R		
110 > R		
110 > R		
24	12	6

Note:
 RM - Regulatory Markings
 WM - Warning Markings
 GM - Guidance Markings

Notes:

Project: Preparatory Survey for the Project for improvement of road section along the northern part of the North-South Corridor in Republic of Zimbabwe (Phase2)
 Job: Ancillary Works Structure (4)
 Scale:
 Drawing No.:
 Date:

Consultant
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