

**The Republic of Zimbabwe
Ministry of Transport and
Infrastructural Development
(MoTID)**

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

APRIL 2018

**JAPAN INTERNATIONAL COOPERATION AGENCY
(JICA)**

**INGÉROSEC CORPORATION
EIGHT-JAPAN ENGINEERING CONSULTANTS INC.
ORIENTAL CONSULTANTS GLOBAL CO., LTD.**

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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 in the Republic of Zimbabwe and entrust the survey to INGEROSEC Corporation (consist of 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 2016 to January, 2018. 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.

April, 2018

Itsu ADACHI
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 390,000km² and a population of some 15.76 million (2016, UN) 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\$830 (2014, World Bank) and the composition ratio of GDP is 20.1% in the primary industry, 25.4% in the secondary industry and 54.5% in the tertiary industry.

2. Background and outline of the Project

The road network in Zimbabwe comprises total extension of 88,100 kilometers, of which only 17,400 kilometers (approximately 20%) was paved. In terms of condition, 21% of roads overall were in good condition, 38% were passable, and 41% were in a condition that hindered passage. On the other hand, due to the stabilization of the economy from 2009 onwards, the number of vehicles has increased continuously, meaning that roads have become busier and making it urgently necessary to secure road safety. GOZ has made the construction of infrastructure and social facilities (economic infrastructure including roads) one of the four primary areas in the Zimbabwe Agenda for Sustainable Socio-Economic Transformation (ZIM ASSET) that it compiled in October 2013, and it has made improvement of the road environment an important item. The North-South Corridor, which runs from South Africa to Zambia and is part of the section targeted by the Survey, is an important trunk road that acts as a major artery of physical

distribution in Southern Africa. It carries much of the overland transported goods that are exported and imported between South Africa, Mozambique, Zimbabwe and other inland countries such as Zambia, DR Congo and Malawi. The North-South Corridor passes through Harare and connects to Chirundu on the border with Zambia in the north; however, the section that passes through mountainous land in the north has many curves and undulations and is a single lane road on each side without improvement of sharp curve and installation of hill climbing lanes. Since this section experiences frequent traffic congestion due to the passage of numerous large-size vehicles that are especially slow when climbing hills and frequent road accidents, it hinders smooth traffic and represents a bottleneck in the physical distribution with inland countries. Against such a background, GOZ issued a request to GOJ for implementation of the Project for improvement of road section along the northern part of the North-South Corridor (hereinafter, the Project) under Japan's grant aid scheme. The Project aims to reduce traffic accidents and shorten the time required by adding hill climbing lanes and improving sharp curves for particularly narrow and dangerous parts of the trunk road in the northern mountainous area, and also contributes to ZIM ASSET. Based on the above, the Study is intended to confirm the necessity and validity of the Project, conduct optimum outline design under the grant aid scheme, formulate the implementation plan, and scale and calculate the rough project costs.

3. Outline of Study Findings and Project Contents (Outline of the rough design, facility plan and equipment plan)

(1) Survey schedule

JICA dispatched the Preparatory Survey Team to Zimbabwe to conduct the field survey from October 21, 2016 to June 11, 2017. 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 January 20 to 28, 2018. 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 were concluded with the Zimbabwean side.

(2) Outline of study findings and Project contents

In the 1st field survey, a survey was conducted on the following target sections: 141km from Karoi 210km north-west of the Capital Harare shown as the start point of the requested sections, via Makuti at 290km point, Hell's Gate at 313km point to Chirundu at 351km point on the border with Zambia as the end point and also on 13 problematic locations (total length of 27km), scattered between 54km at the point of 259~313km from Harare. And based on the evaluation by quantitative index and the requested amount of grant, the priority sections for improvement were selected. The 1st domestic work conducted after return to Japan, the Team settled

recommendations for the high priority sections for road improvement out of 141km, which is the subject of the 2nd site survey (12.5km between 300.5 to 313km from Harare). The 2nd site survey was conducted after the recommendation was notified and agreed by Zimbabwean side in writing. After the 2nd field survey, the domestic work was carried out and the Project target sections were selected as a total 6.50km of particularly steep section (306.5~313.0km from Harare) which is continuous in the direction of Harare from the lowland side end (Hell's Gate) within above mentioned 12.5km (+start/end transition section=total 13.6km). It was decided to upgrade the road according to the contents shown Table 1.

Table 1 Outline of the Project

Planned item	Unit	Adopted Value		Note
Road Reserve Width	m	70 (35m on each side from the existing road center)		(Right of way, ROW)
Width of Lane	m	3.5		Basic number of lane: 2
Climbing Lanes Width	m	3.5		Refer to the Standard Cross Section
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	—	Asphalt Surface Treatment		Main line=2 layers, Shoulder=1 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, Retaining walls, Safety barriers, Traffic signals, Road marking, Delineator, Parking area 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

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 4.5 months for implementation design, 4.0 months for tender work and 21.0 months for the construction work, and the Project cost is estimated as the Zimbabwean portion approximately \$US 623,000 (72 million equivalent-Yen).

5. Project Evaluation

(1) Relevance of the Project implementation

Project implementation will contribute to improving convenience for inhabitants of Northern Zimbabwe, as well as improving the trunk road network for physical distribution in Southern

Africa where the North-South Corridor is located. Accordingly, there is great significance in implementing the Project under The Government of Japan's Grant Aid scheme. In addition, the number of accidents, for the current road with a high accident occurrence rate as about one case per day, can be reduced by about 30% due to the rapid improvement of the target section. Moreover, in order to ensure the long-term sustainability of such achievements, the Zimbabwean implementing agency is judged to have sufficient manpower and funding considering their past achievement and future efforts to conduct maintenance and management of the road after the implementation of the Project.

(2) Effectiveness of project implementation

Implementation of the Project will improve road conditions of the target section and also secure smooth and safe traffic flow, thereby benefiting residents of Northern Zimbabwe and users of trunk road for physical distribution. The expected positive effects of the Project are briefly described next.

1) Quantitative effects

- ① Through improving the target section, by separating the slow-moving large vehicle (about 15 km/hr) into the climbing lane, other vehicles are improved to pass at 60/40 km/hr, thereby shortening travel times by about 19 minutes.
- ② Through improving the target section, the current number of accidents per year will be reduced from 110 to 20.
- ③ Improvement of the target section can benefit smooth and safe traffic flow for 500,000 passengers per year and cargo of about 5 million tons per year

Table 2 List of Quantitative effects

Indicators	Current Value (2016)	Target Value (2018) 【3years after completion of the Project】
The number of accident	110 vehicles/year	20 vehicles/year
Travel Time on the target section	26 minutes (between 6.5km)	7 minutes (between 6.5km)
Volume of Passengers	510,000 passenger/year	540,000 passenger/year
Volume of Cargo	4.3 million ton/year	4.8 million ton/year

Source: JICA Survey Team

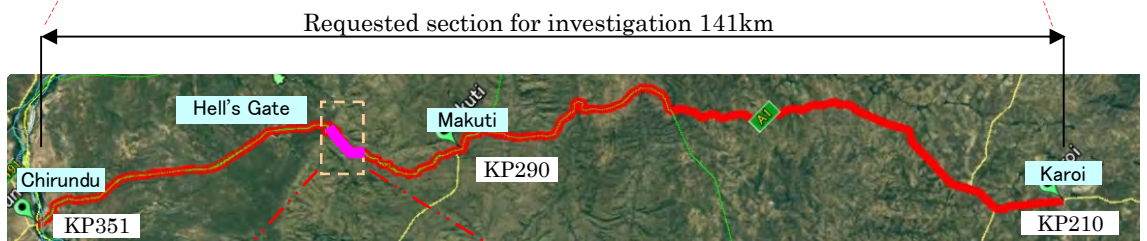
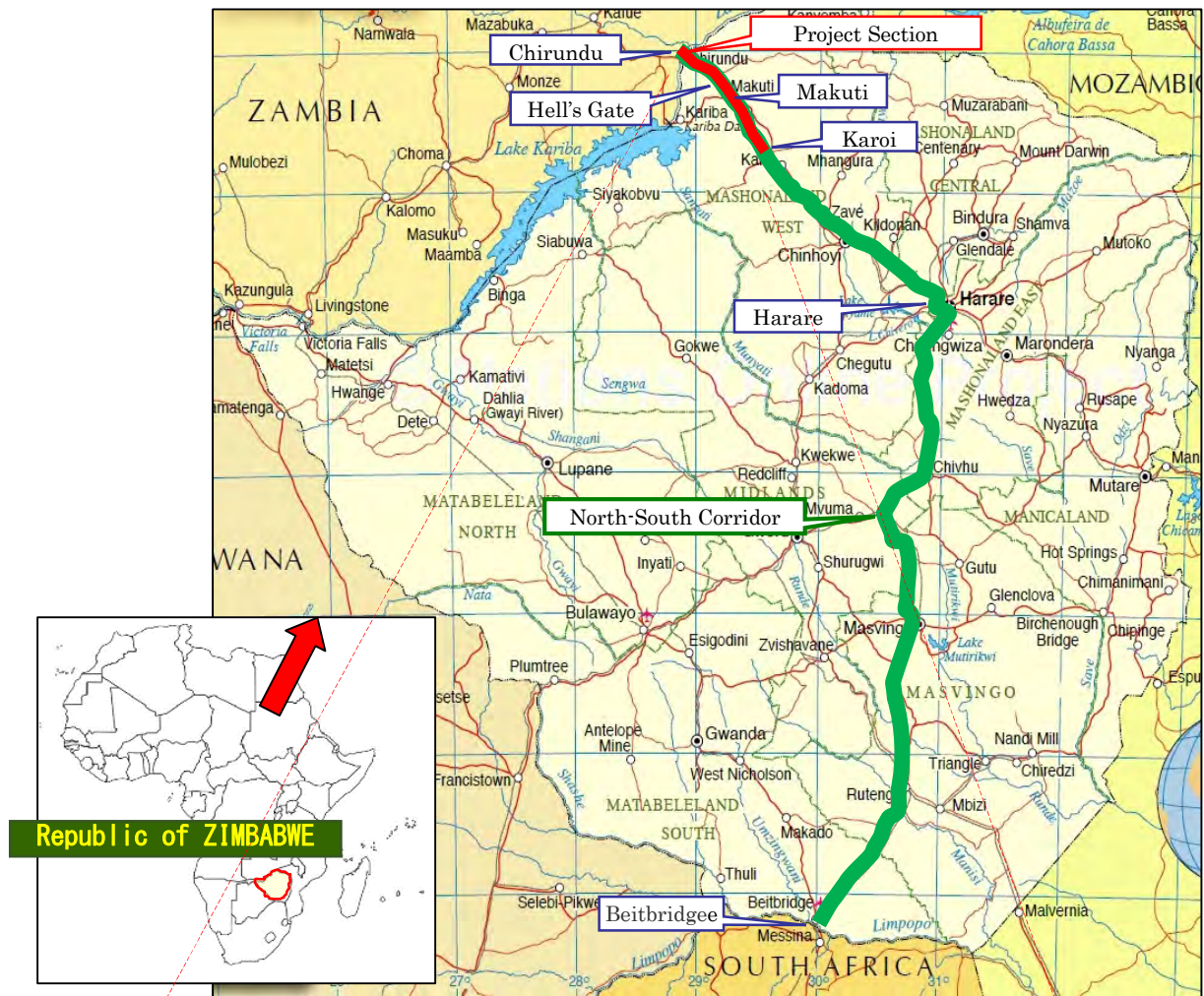
2) Qualitative effects

- ① Improvement of sharp curve will improve smooth and safe traffic flow.
- ② Installation of hill climbing lanes will separate vehicles travelling at the standard speed from slower speed vehicles, thereby prevention of accidents caused by overtaking accounting for about 23% of the total accident can be expected and smooth and safe traffic flow can be ensured.
- ③ The shortening of the travelling time will reduce transportation costs.

- ④ Through securing regularity of passenger and physical distribution and improving access to surrounding tourist spots by improvement of the target road, the Project will contribute to development of Northern Zimbabwe, help to vitalize economy and to rectify poverty differentials in the region.

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Note : KP=distance from Harare (km)



Location Map



PERSPECTIVE

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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 Background and Outline of the Request for Japan Grant Aid

(1) Background of the Request

The North-South Corridor, which runs from South Africa to Zambia and is part of the section targeted by this survey, is an important trunk road that acts as a major artery of physical distribution in Southern Africa. It carries much of the overland transported goods that are exported and imported between South Africa, Mozambique, Zimbabwe and other inland countries such as Zambia, DR Congo and Malawi. The Northern part of the North-South Corridor which passes through the capital Harare and connects to Chirundu on the border with Zambia in the north is; however, the section that passes through mountainous land in the north and has many curves and undulations is in the state without improvement of sharp curve and installation of hill climbing lanes. Since this section experiences frequent traffic congestion due to the passage of numerous large-size vehicles that are especially slow when climbing hills and frequent road accidents, it hinders smooth traffic and represents a bottleneck in the physical distribution with inland countries.

Against such a background, The Government of Zimbabwe (hereinafter, GOZ) issued a request to The Government of Japan (hereinafter, GOJ) for implementation of the Project for improvement of road section along the northern part of the North-South Corridor (hereinafter, the Project) under Japan's grant aid scheme. The Project aims to reduce traffic accidents and shorten the time required by adding hill climbing lanes and improving sharp curves for particularly narrow and dangerous parts of the trunk road in the northern mountainous area, and also contributes to ZIM ASSET. Based on the above, this survey is intended to confirm the necessity and validity of the Project, conduct optimum outline design under the grant aid scheme, formulate the implementation plan, and scale and calculate the rough project costs.

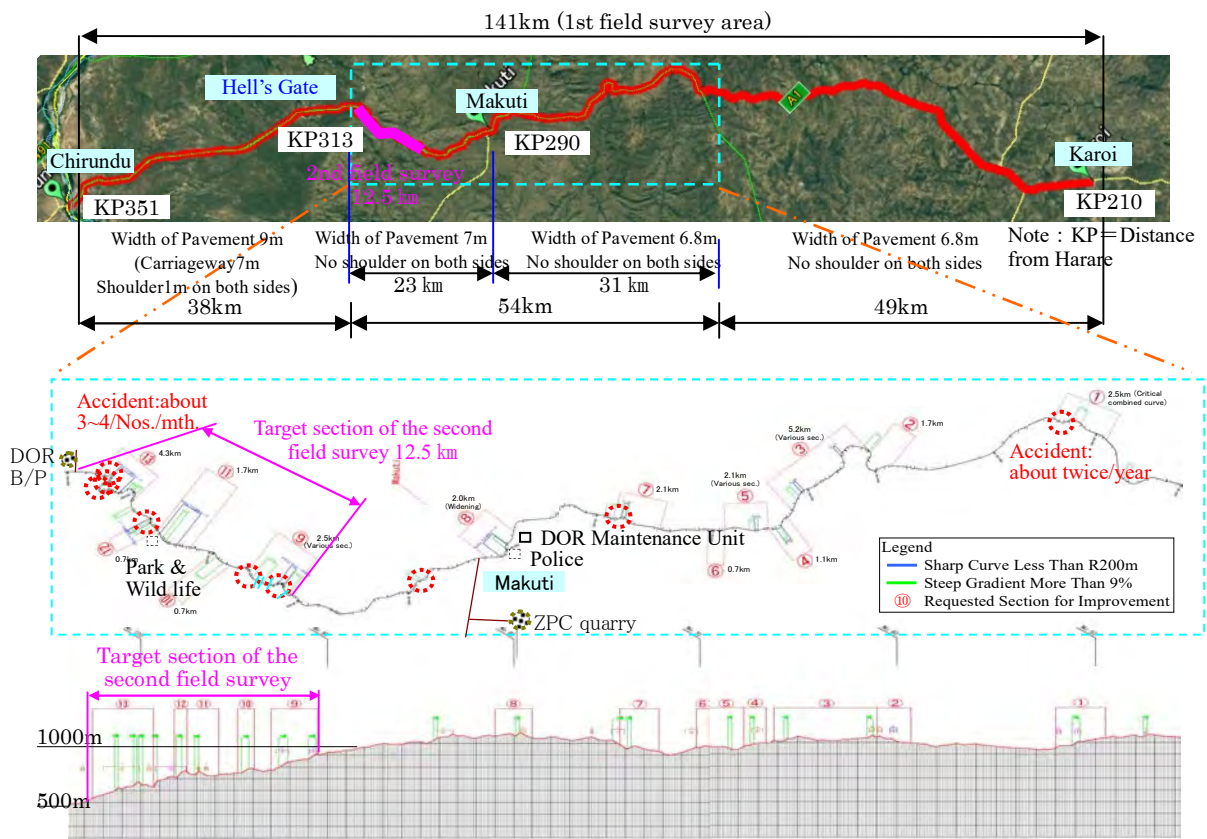
(2) Outline of the Request

The Request by Zimbabwe for this survey is to conduct a survey on the following target sections: 141km from Karoi Street District 210km north-west of the Capital Harare shown as the start point of the requested sections, via Makuti at 290km point, Hell's Gate at 313km point to Chirundu at 351km point on the border with Zambia as the end point and also on 13 locations (total extension 27km) indicated by GOZ, scattered between 54 km at the point of 259km~313km from the Karoi at 253km and to implement improvements on the priority sections by adding hill climbing lanes and improving sharp curves based on the evaluation by quantitative index and the requested amount of grant. In the Request, the section 54km is divided by two sections and the 1st section comprises 5 locations between Makuti ~ Chirundu (⑨~⑬, approximately 9.9km) and the 2nd section comprises 8 locations between Karoi ~ Makuti (①~⑧, approximately 17.4km).

(3) Field Surveys and Domestic Works

In the 1st field survey carried out between October and November 2016, we conducted a

survey on the situation of 141 km requested by Zimbabwe, and based on requests and criteria by Zimbabwe and analyze of the results of the field survey, we judged that the section between Makhti-Hell's Gate has the highest maintenance priority. During the 1st domestic work conducted after the return of the Team to Japan, we settled recommendations for the high priority sections for road improvement, which is the subject of the 2nd survey (13.6km between 300.0 to 313.6 km from Harare (12.5km (300.5 to 313.0km) + start/end transition section), and the 2nd survey was conducted after the recommendations was notified Zimbabwean side in writing and their agreement was obtained. After the 2nd field survey, the domestic work was carried out and we advanced the rough design with the Project target section selected as total 6.5km (306.5~313.0km from Harare) which is continuous in the direction of Harare from the lowland side end (Hell's Gate) of particularly steep section within 13.6km.



Source : JICA Survey Team

Figure 1-1-1 Target Section for the Survey

Table 1-1-1 13 Sections requested by Zimbabwe

Section	Overall Distance	Section Distance	Remark
①	49.5 – 52.0	2.5km	Sharp curves + steep gradients, and accidents frequently occur at the 51-kilometer point.
②	59.5 – 61.2	1.7km	Steep gradients.
③	61.2 – 66.4	5.2km	Steep gradients and sharp curves and where the road needs to be widened. * 1
④	66.5 – 67.6	1.1km	Steep gradients and sharp curves.
⑤	67.6 – 69.7	2.1km	Steep gradients and sharp curves and where the road needs to be widened. * 1

⑥	69.7 – 70.4	0.7km	Steep gradients.	
⑦	72.0 – 74.1	2.1km	Steep gradients and sharp curves	
⑧	79.5 – 81.5	2.0km	Road needs to be widened at the 79.5-km point.	
⑨	90.5 – 93.0	2.5km	Steep gradients and sharp curves	} Target section of the 2nd field survey (1st field survey cover ①~⑬)
⑩	94.0 – 94.7	0.7km	Steep gradients	
⑪	96.0 – 97.7	1.7km	Steep gradients and sharp curves	
⑫	97.7 – 98.4	0.7km	Steep gradients and sharp curves	
⑬	98.7 – 103.0	4.3km	Steep gradients and sharp curves *1	
Total		27.3km		

Source : JICA Survey Team Note: Overall distance assumes Karoi to be 0km. Distance between Harare and Karo is 200km. *1= necessary requested locations within sections.

CHAPTER2
SITUATION SURROUNDING THE PROJECT

CHAPTER2 SITUATION SURROUNDING THE PROJECT

2-1 Situation of the Project site and surroundings

2-1-1 Development status of related infrastructure

(1) Progress of the North-South Corridor improvement

The North-South Corridor that crosses longitudinally north-south of Zimbabwe is expected to be promptly improved as a measure to increased traffic demand and road deterioration after more than 50 years since construction. In the 1990s, tender of contractors for road improvement took place and consultations were held with successful bidding company, but implementation was not carried out. Currently, in the southern part of the North-South Corridor (from Beitbridge bordering South Africa to Harare), groundbreaking ceremony of Public Private Partnership (PPP) project was held by the Austrian company in May 2017. As for the northern part (between Harare-Chirundu bordering Zambia), discussions are under way to implement project as a Chinese loan project from 2016, however, the requested section by GOZ to GOJ is the section from Karoi located at 210 km north-west of Harare to Chirundu at 351 km point, which is part of the mentioned northern part. Due to consultation with Zimbabwean side during the field survey of the study and the narrowing-down of the priority target section need to be improved after the end of the 1st field study, the target section by Japanese side was selected and notified to stakeholders in February 2017 as it is 13.6 km from the suburb of Makuti, 300 km north-west of Harare to Hell's Gate at the 313.6 km point where the steep section of escarpment turns into a flat section.

(2) Target road condition (141km)

1) Survey of requested entire road section between Karoi and Chirundu (141km)

In the Project, confirmation of bottlenecks to safety and smoothness of road traffic for 141km total section from Karoi which is the start point of the requested section by GOZ to the end point Chirundu and 13 critical sections (total extension 27 km) indicated by Zimbabwean side is required. It is also necessary to select a high priority section as the project scope and proceed with the outline design.

In the 1st field survey, the following survey was conducted to grasp the current situation of the 141 km total section, confirming the priority section based on the evaluation of actual state by the quantitative indicator of the existing road and consideration of the requested amount, the narrowing-down of the recommended section for the 2nd field survey (13.6 km between 300.0 to 313.6 km from Harare (12.5km (300.5 to 313.0km) + start/end transition section) was conducted.

- Existing road geometry (curve, longitudinal linear, sight distance), width of carriageway / shoulder
- Vehicle speed for each section
- Traffic volume, Axle load survey
- Road surface condition

- Accident prone spot, road geometry of its surrounding, road surface condition
- Condition of drainage facility, relation with road deterioration

2) Road geometry, Sight distance, Traveling speed, Road width and flatness

2-1) Road geometry

The target road can be classified into the following four sections from the situation of the existing road. Main features of each section are shown below. The survey confirms that there is a higher need for road improvement in section B and C including critical sections than in other sections indicated by Zimbabwean side.

Table 2-1-1 List of geometric structures of existing roads

Section	A Karoi~ Start point of critical section	B Start point of critical section ~Makuti	C Makuti ~Hell's Gate	D Hell's Gate ~Chirundu
Distance from Harare (km)	210~259	259~291	291~313	313~351
Minimum Curve Radius	200m	120m	40m	300m
Sight distance (minimum value)	— ※	72m	42m	— ※
Vertical slope (maximum value)	5.1%	7.5%	7.6%	5.4%
Width of pavement (average value)	6.7m	6.9m	7.0m	9.0m

Source: JICA Survey Team ※ Sight distance in A and D sections are unmeasured because there are only few curves with small radius and it is unlikely to cause a problem in running vehicle.

2-2) Carriageway Width

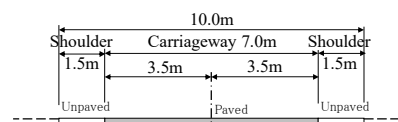
Carriageway width survey (width of pavement) was conducted for 13 critical sections indicated by Zimbabwean side and scattered in sections B and C above. The section with the narrowest average width is section ②, but the difference is as small as about 7m in each section.

Table 2-1-2 Transverse width in improvement requested sections

Section	Section B								Section C section				
	①	②	③	④	⑤	⑥	⑦	⑧	⑨	⑩	⑪	⑫	⑬
Carriageway width (m, average)	6.8	6.7	6.8	7.0	7.2	7.0	7.0	7.3	6.9	6.9	7.3	7.6	6.9

Source: JICA Survey Team

The specification of the existing road is the Zimbabwean' old standard 7/10 (Seven in ten=two lanes of 3.5m on one side + 1.5m unpaved shoulder on each side). Zimbabwean side request specifies current standard 10/10 (Ten in ten = two lanes of 3.5m on one side + 1.5m paved shoulder on each side) and 3.5m climbing lane for necessary section.



Source: JICA Survey Team

Figure2-1-1- Existing road (7/10 specification)

2-3) Sight distance

Confirmation of the sight distance (braking stop sight distance) at the curve part was conducted. The minimum values of the sight distance for each section are shown below. Among the five

sections (7, 9, 11, 12, 13) out of 13 critical sections that do not satisfy the sight distance of speed 60km/hr and the section ⑬ has the shortest sight distance and many inadequate curves.

Table 2-1-3 Minimum values of the sight distance for each section

Section	Section B								Section C				
	①	②	③	④	⑤	⑥	⑦	⑧	⑨	⑩	⑪	⑫	⑬
Sight distance (m, minimum value)	115	99	103	118	118	103	72	92	47	120	59	51	42

Source: JICA Survey Team Note: According to SATCC standard, the necessary sight distance in accordance with design speed is 80m at 60 km / h, 115m at 80 km / h.

2-4) Traveling speed

In order to investigate the installation of hill climbing lanes, tracking survey of large cars and calculation of traveling speed were carried out, and sections where climbing lanes are required to be installed were checked. With regard to the standards for hill climbing lanes, Minimum allowable speed differs between the Japanese road structure ordinance (section with half of the design speed) and SATCC (section with a decrease of 20 km / h from the design speed), and the evaluation of hill climbing lanes section in this survey is conformed to SATCC standards. The sections that the speed reduction was remarkable are the sections from ④ to ⑬ in the Harare direction lane and the sections ③, ⑧, ⑪ and ⑬ which recorded less than 30 km in the Zambia direction lane (about 15kmh for trailer).

Table 2-1-4 Heavy goods vehicle traveling speed for each section (measured value)

Section	Section B								Section C				
	①	②	③	④	⑤	⑥	⑦	⑧	⑨	⑩	⑪	⑫	⑬
Travelling speed (km/hr, Harare direction)	36	57	52	28	20	26	23	10	20	20	24	20	20
Travelling speed (km/hr, Zambia direction)	69	42	25	30	61	69	33	28	42	36	25	35	29

Source: JICA Survey Team

2-5) Road Surface Flatness

The results of the existing road surface flatness investigation (international roughness index, IRI) for 141km are shown below. There is a big difference on the road surface flatness between Harare side and Chirundu side at Makuti (end of section ⑧). Between Karoi and Makuti, the IRI value is about 5m / km, which is relatively flat, and some vibration is felt during running. On the other hand, between Makuti and Chirundu, the IRI value is about 8m / km, the flatness is poor.

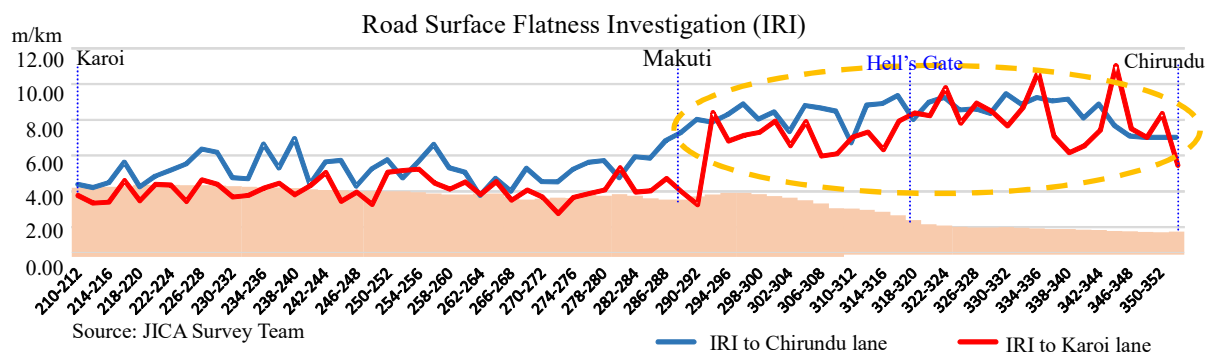


Figure 2-1-2 Results of Road Surface Flatness Investigation (IR)

2-6) Actual condition of traffic accident, occurrence point and situation

In the survey section, we confirmed 11 accident frequent occurrence points. In section ⑬ and Chirundu direction lane at the end point part of section ⑨, there are signs that accidents occur frequently such as brake trace on the road surface, window glass scattering on the shoulder, accident car debris outside the road, etc. These are noticeable in spots where the gradient changes in linear part of descending slope where speed tends to increase, and the curve visibility check is delayed immediately after this change. In section ⑨, attention attracting is given to drivers by countermeasures facility which is road surface treatment (rumble strip) that urges deceleration at the points of 300/301/302 km from Harare, but measures to combine visual guidance pegs and markings etc. are considered necessary. Also, in the steep section ⑬, the road surface is very slippery due to wear of pavement surface crushed stone and in danger. The breakdown of accident record by police that occurred in the target section during the 9 months from January 2016 is shown below. The data shows that accidents occurred very frequently, about 300 cases per year (about 1 case per day) and other features as shown below. Even during the field survey period of the Project, several rollovers of the trailer and vehicle fire caused by the accident were confirmed.

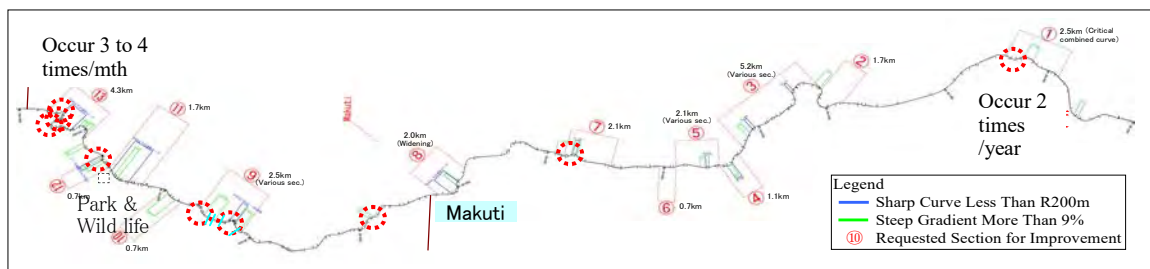
Table 2-1-5 Accidents occurred in the target road (2016)

By cause	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total	Average	Rate
Over speed	15	18	18	12	11	10	9	12	3	108	12.0	55%
Overtaking		1	1	3	1		2	3	2	13	1.4	7%
Failure	1		1	1	1	1	1		2	8	0.9	4%
Approach			3			1				4	0.4	2%
Animal		1	2		2	1	2		2	10	1.1	5%
Misjudgment	7	5	3		2	2	1			20	2.2	10%
Slow down neglect			1		1		1	2	2	7	0.8	4%
Others	4	3	7	2	1	1	2	4	4	28	3.1	14%
Total	27	28	36	18	19	16	18	21	15	198	22.0	
										Annual Estimation	264	

Note: The difference between the number by cause and the total number by vehicle type may be caused by omission of survey or transcription error. ■ Rainy Season

By vehicle type	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total	Average	Rate
Bus	2	1			1		1		1	6	0.7	3%
Truck	22	12	33	13	11	14	18	14	13	150	16.7	64%
Large truck			2	1	2	1	4	8	3	21	2.3	9%
Trailer	10	6	13	9	7	1			3	49	5.4	21%
Others		1	2		1		1	1	1	7	0.8	3%
Parking	1				1					2	0.2	1%
Total	35	20	50	23	23	16	24	23	21	235	26.1	
										Annual Estimation	313	

Source: Zimbabwe Police Record



Source: JICA Survey Team

Figure 2-1-3 Accident frequent occurrence points

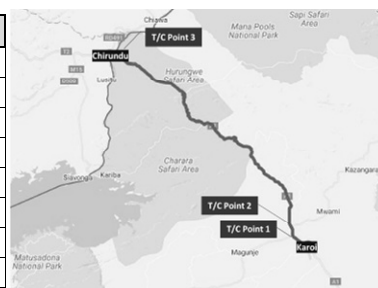
3) Traffic volume and traffic load

3-1) Traffic volume survey

The traffic volume survey of the target road was conducted for 3 points for 7 consecutive days from November 2 (Wed) to 8 (Tue) in 2016 at 2 intersections in the suburbs of Karoi and 1 spot along the road in Chirundu. The survey was conducted for 12 hours of 6: 00-18: 00 in the suburbs of Karoi, 24 hours of 6: 00-6: 00 in Chirundu. Vehicle types to be surveyed were designated 9 types from small to large vehicles and measurement was conducted by vehicle type. As a result of traffic survey, Cross sectional (both direction) traffic volume was about 3,000 cars (TCP 1) per day on the Harare side in Karoi at 210km point from Harare, about 2,100 cars (TCP 2) per day on the Chirundu side, about 700 cars (TCP 3) per day at Chirundu bordering Zambia. The traffic volume of the 2nd survey target section of 13.6km is located 10km ahead of the intersection in the direction of Lake Kariba in the suburb of Makuti, which is the only intersection after Karoi. And since there is no traffic flow in and out between the target section and Chirundu and no development of surrounding area, it seems that it approximates the actual traffic volume of Chirundu. The large vehicle contamination rate was as high as about 80% and the traffic volume at the peak of Chirundu was 78 cars/hour at 8 am. The results of the survey are shown below.

Table 2-1-6 Results of traffic volume survey

Vehicle Type		TCP1		TCP2		TCP3	
1	Sedan	1,094	37%	758	36%	107	15%
2	Taxi	14	0%	8	0%	2	0%
3	Minibus	55	2%	23	1%	17	2%
4	Large bus	309	10%	80	4%	15	2%
5	Truck 2axles	678	23%	452	21%	59	8%
6	Truck 3axles	50	2%	39	2%	31	4%
7	Trailer 4 axles	24	1%	12	1%	5	1%
8	Trailer 5axles	21	1%	16	1%	19	3%
9	Trailer 6 axles	740	25%	743	35%	473	66%
Total		2,985	100%	2,131	100%	728	100%
Breakdown	Sedan	1,108	37%	766	36%	109	15%
	Bus	364	12%	103	5%	32	4%
	Truck	728	24%	491	23%	90	13%
	Trailer	785	26%	771	36%	497	69%

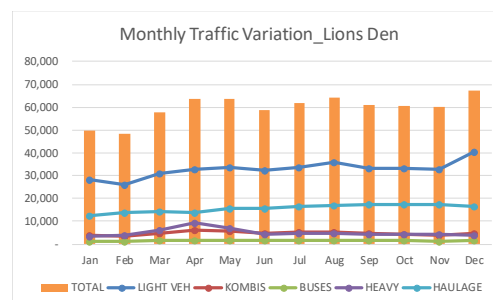


Source: JICA Survey Team
Figure 2-1-4
Traffic survey location

Source: JICA Survey Team Note: TC1=Intersection in the suburb of Karoi 1, TC2=Intersection 2, TC3=Chirundu
Traffic volume of Chirundu similar to the target section: 728 cars, 50% by direction, large vehicle rate 82%

3-2) Monthly traffic volume variation

With regard to monthly variation rate of traffic volume, the measurement result of 2013 in Lions Den located on the Harare side at 62 km from Karoi, which is considered to show the same tendency as the target section was confirmed. Within one year there are peaks in April and December, few cars in January and February, the other months have less variation. Since the number of traffic surveys conducted in November was almost the same as



Source: JICA Survey Team
Figure2-1-5 Monthly traffic variation

the annual average, the monthly variation rate was set as 1, and confirmation of the traffic volume was conducted.

3-3) Traffic growth rate forecast

In the Report of Zimbabwe National Transport Master Plan supported by AfDB and submitted to DOR by Canadian consultant in March 2017, traffic demand forecast was conducted taking into account of the impact of the improvement of the road between Harare and Beitbridge which completed the contract with the Austrian company and the impact of traffic volume change from Botswana route in Botswana transport M/P (Multi-Modal Transport Master Plan, 2017). In this report, the traffic growth rate was indicated for the short term (0.5-2%, 2017 - 2021), the mid term (2-5%, 2021 - 2026) and the long term (5-10%, 2026 - 2036). By adopting these intermediate values (1.25% in the short term, 3.5% in the mid term, 7.5% in the long term) and calculating the traffic volume during the estimated period 2017-2036 of the Project, the annual average growth rate will be 4.9%. Also, the estimated GDP growth rate in the neighboring countries during the period from 2013 to 2022 calculated by the International Monetary Fund (IMF) is similar to this 4.9% such as 4.0% for Zambia, 4.7% for DR Congo, 4.7% for Malawi. Meanwhile, 4.5% was adopted in the F/S for Harare to Chirundu road section by Development Bank of Southern Africa (DBSA) conducted in 2012. In addition, there is related information that average growth rate is 5% for registered vehicles in Zimbabwe for the past 20 years from 1995 to 2014. With the consideration of these conditions, study on the number of lanes and pavement design of this project, the value in M/P by AfDB was adopted, and the traffic growth rate was set as 4.9%. The current number of passengers per day at Chirundu border facility, which is considered to have an impact on this project, is about 450 cars, and about 40% connect Zambia and South Africa. Annual variation peaks is from August to October, and other month variations are small. The facility, which is not a complete



Photo 1 Chirundu Border Facility

one-stop border, checks immigration cars to Zambia and Zimbabwe in their respective countries, but the processing capacity of Zambia side seems less and the crossing border traffic volume per day has limited with this condition. Therefore, it is considered that the traffic volume of the target road section is also affected by these conditions.

3-4) Traffic Load Survey

Axle load measurement was conducted for 3 consecutive days from Saturday, November 5, 2016, at the load inspection station of Chirundu border facility and 452 axle load measurements were made. Overloading was confirmed 5.5% of the total, especially 34% of 47 cars for 5 axle vehicle were overloaded. The heaviest axle was confirmed as 12.3 ton/axle which is about 1.5 times heavier than the limited load 8~10 ton/axle and lower than other African countries. In Zimbabwe, overloaded vehicles are handled by payment for excess load and unloading for excess load is not carried out, so consideration of overloading status is required for pavement planning.

(3) Narrowing down of the priority target road section

1) Survey on Makuti - Hell's Gate (13.6km)

The goal of this project is to improve sharp curves and add hill climbing lanes for the priority section of road improvement within 141 km in the northern part of North-South Corridor, from Karoi at the 210 km point from Harare in the direction of Zambia, via Makuti at 290 km point, Hell's Gate at 313 km point, to Chirundu bordering Zambia. In order to achieve the goal, in the 1st field survey (October 2016) the total 141km and priority of improvement on the problem 13 sections indicated by Zimbabwean side request was confirmed, and the sections 9 to 13 (12.5 km between Makuti - Hell's Gate (13.6km with end transition section) was judged as a recommendation section and the subject to the 2nd field survey (February 2017). The criteria for narrowing down of priority section and the evaluation results are shown below.

Table 2-1-7 Criteria for narrowing down of priority section and the evaluation results

Criteria		Karozi - Makuti								Makuti - Hell's Gate				
Section		1	2	3	4	5	6	7	8	9	10	11	12	13
Road Safety	Black Spot	20	0	0	0	0	0	20	0	40	0	40	0	60
	Minimum Curve	0	15	15	0	0	0	15	15	0	0	15	0	30
	Stop Sight Distance	0	15	15	0	0	10	30	15	30	0	15	15	30
	Road Width	20	20	20	10	10	10	10	10	20	20	10	10	20
	Land Use	0	0	0	0	0	0	0	10	5	5	5	5	5
Reliability	Travel Speed	10	0	10	10	20	0	20	20	20	20	10	10	20
Total Point		50	50	60	20	30	20	95	70	115	45	95	40	165

Source: JICA Survey Team

In the 2nd field survey, topographic survey, confirmation of existing pavement composition and bearing capacity by trial pit survey and boring investigation on slope were conducted for recommended priority section of 12.5 km (13.6 km including start/end transition section) which is located between 300.5 and 313.0 km from Harare. In addition, regarding the study of the project specifications for road improvement, the basic condition of design was confirmed with Zimbabwean side (Department of Roads, DOR of MoTID) and prepared the result as Technical Note. And the project target section was selected as total 6.5km (306.5~313.0km from Harare) which is continuous to Harare direction from the lowland side end of escarpment (Hell's Gate) and the outline design was proceeded.

(4) Status of the selected target road section (Makuti – Hell's Gate, 13.6km)

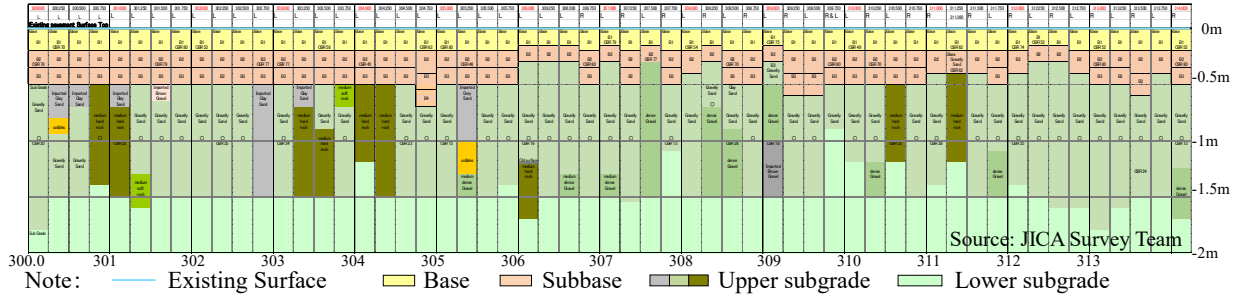
1) Existing Pavement

1-1) Existing Base/Subbase/Subgrade

In this survey, trial pit excavation investigation at the edge of existing carriageway was carried out at 250m intervals and existing pavement layer thickness and material, subgrade material and state, groundwater level were confirmed. The existing pavement was confirmed to consist of granular material Base/Subbase with about 50cm thickness (base and subbase, bearing capacity about CBR 60 to 80) in the lower part of a Double Bituminous Surface Treatment (DBST)

pavement surface. The subgrade part also shows good values (CBR 15 to 30). The groundwater level was not seen in the range up to about 1.5m in depth, and the existing pavement is very solid and in good condition. The outline of the results of trial pit investigation is shown below.

Table 2-1-8 Outline of trial pit investigation result on the existing road



Trial pit near KP306
(near the Park & Wild life office)



Trial pit near KP313
(near the end point)



Existing Pavement Surface
(thickness 3.5cm)

1-2) Existing Pavement Surface layer

The existing pavement surface layer of carriageway is DBST which is common in Zimbabwe. In the existing DBST pavement, although wheel passing part of large vehicle was fixed by the narrow width and the same part was repeatedly received loads for many years, it was in a good state that rutting depth was 5mm or less in the confirmation of flatness. The surface temperature of the pavement was more than 60°C on average for low altitude Makuti ~ Chirundu, and the maximum temperature was confirmed as 70.3°C at around 320km (see table below). Meanwhile, before custom clearance facility in Chirundu, the large-sized vehicle stopped for long hours at the edge of carriageway to the road shoulder, but rutting on the DBST pavement was not observed.



Photo 2 Road flatness check

Table 2-1-9 Pavement temperature for each section

Description	Karoi – Makuti	Makuti -Hells Gate	Hells Gate-Chirundu
Altitude (Average)	1,178m	963m	476m
Pavement temperature (Average)	55°C	61°C	64°C

Source: JICA Survey Team

1-3) Bearing capacity of existing pavement

Regarding bearing capacity of existing road, carriageway center and edge of Harare direction and Chirundu direction were measured at 200m intervals by Benkelman beam investigation. The results of bearing capacity survey are shown below with 81% of very stiff or stiff, 18% of flexible, 1% of very flexible spots were measured. It was confirmed that the existing road could be fully utilized.

Table 2-1-10 Results of measurement of existing road bearing capacity

STA	RHS (km) To Harare		LHS (km) To Zambia		
	Edge	Center	Center	Edge	
300.0	0.16	0.28	300.10	0.26	0.10
300.2	0.63	0.18	300.30	0.19	0.22
300.4	0.09	0.23	300.50	0.16	0.50
300.6	0.50	0.08	300.70	0.21	0.28
300.8	0.70	0.66	300.90	0.66	0.67
301.0	0.26	0.68	301.10	0.28	0.23
301.2	0.07	0.47	301.30	0.64	0.26
301.4	0.13	0.04	301.50	0.15	0.30
301.6	0.04	0.06	301.70	0.32	0.23
301.8	0.69	0.08	301.90	0.24	0.26
302.0	0.67	0.38	302.10	0.26	0.26
302.2	0.34	0.64	302.30	0.41	0.37
302.4	0.16	0.70	302.50	0.30	0.43
302.6	0.56	0.59	302.70	0.34	0.45
302.8	0.41	0.52	302.90	0.34	0.44
303.0	0.67	0.26	303.10	0.29	0.38
303.2	0.55	0.21	303.30	0.25	0.48
303.4	0.32	0.10	303.50	0.35	0.61
303.6	0.11	0.22	303.70	0.55	0.38
303.8	0.16	0.16	303.90	0.55	0.61
304.0	0.37	0.34	304.10	0.51	0.46
304.2	0.42	0.40	304.30	0.38	0.47
304.4	0.25	0.33	304.50	0.24	0.33
304.6	0.37	0.24	304.70	0.26	0.13
304.8	0.07	0.11	304.90	0.40	0.37
305.0	0.73	0.42	305.10	0.20	0.26
305.2	0.57	0.62	305.30	0.40	0.40
305.4	0.21	0.19	305.50	0.33	0.30
305.6	0.63	0.82	305.70	0.49	0.42
305.8	0.51	0.32	305.90	0.24	0.30
306.0	0.46	0.60	306.10	0.43	0.38
306.2	0.40	0.65	306.30	0.23	0.21
306.4	0.33	0.15	306.50	0.45	0.31
306.6	0.30	0.21	306.70	0.13	0.20
306.8	0.38	0.42	307.00	0.44	0.37
307.0	0.58	0.42	307.10	0.44	0.37
307.2	0.47	0.48	307.30	0.25	0.42
307.4	0.49	0.52	307.50	0.43	0.56
307.6	0.30	0.69	307.70	0.68	0.62
307.8	0.42	0.37	307.90	0.23	0.25
308.0	0.16	0.43	308.10	0.30	0.26
308.2	0.10	0.15	308.30	0.24	0.47
308.4	0.31	0.35	308.50	0.43	0.28
308.6	0.63	0.34	308.70	0.53	0.34
308.8	0.54	0.46	308.90	0.31	0.63
309.0	0.15	0.17	309.10	0.25	0.47
309.2	0.18	0.31	309.30	0.25	0.20
309.4	0.23	0.35	309.50	0.18	0.18
309.6	0.30	0.26	309.70	0.32	0.32
309.8	0.28	0.34	309.90	0.42	0.20
310.0	0.32	0.35	310.10	0.28	0.47
310.2	0.34	0.47	310.30	0.15	0.39
310.4	0.42	0.43	310.50	0.36	0.37
310.6	0.39	0.25	310.70	0.59	0.47
310.8	0.42	0.53	310.90	0.48	0.24
311.0	0.43	0.71	311.10	0.37	0.43
311.2	0.34	0.46	311.30	0.43	0.56
311.4	0.52	0.63	311.50	0.15	0.29
311.6	0.44	0.10	311.70	0.36	0.42
311.8	0.31	0.31	311.90	0.40	0.76
312.0	0.22	0.47	312.10	0.30	0.40
312.2	0.35	0.35	312.30	0.59	0.51
312.4	0.40	0.50	312.50	0.30	0.23
312.6	0.61	0.59	312.70	0.31	0.34
312.8	0.62	0.68	312.90	0.67	0.55
313.0	0.40	0.40	313.10	0.20	0.53
313.2	0.39	0.40	313.30	0.22	0.23
313.4	0.30	0.35	313.50	0.47	0.44
313.6	0.23	0.35	313.70	0.39	0.42
313.8	0.30	0.36	313.90	0.48	0.52
314.0	0.28	0.34			

Source: JICA Survey Team Note: Very stiff Stiff Flexible Very flexible

1-4) Major causes of deterioration of existing road

Damage to the pavement (mainly pot hole) which could not be confirmed at the previous survey (November 2016: dry season) was confirmed in a part of the target road. This is considered to be caused since rainy season has started and rainwater infiltration into the pavement surface and/or lower surface from the cutting side during rainfall. Moreover, as a result of confirming the roughness of the road surface and the part where the repair mark was seen, it was found that degradation of road surface and road shoulder was concentrated in the parts where rainwater in the vicinity was intensively flowing down to the roadside part because there is no drainage gutter on the side of the road, and where rainwater concentrated from the mountain side passed through on top of the road. These were not caused by the pavement type or structure but it is considered that deterioration has been progressing by the influence of drainage as a major reason.

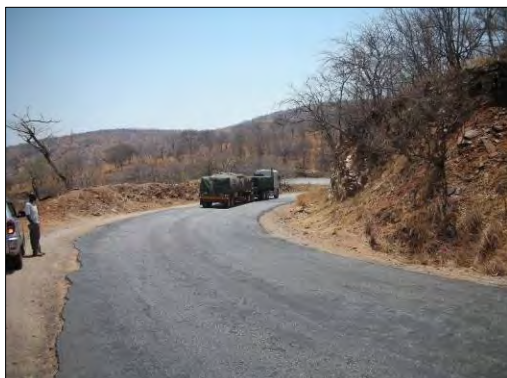


Photo 3 Road state at the 1st field survey (October 2016, dry season)



Photo 4 Road state at the 2nd field survey (February 2017, rainy season)

【Two main causes of damage of existing pavement】

i) Obstruction of road shoulder drainage:

Road surface drainage inhibited to flow into drainage gutter by plants growing thickly on road shoulder → Surface water concentration at shoulder end → Flow velocity / flow rate increase during flowing in longitudinal direction → Corrosion of fine grain and sand → Corrosion of shoulder pavement edge → Edge erosion progression → Shoulder collapse

ii) Running water from mountain side:

Rainwater inflow from mountain side → Inadequate maintenance of mountain side gutter → Rainwater crosses road surface and shoulder → Edge part and crack part erosion → Base/Subbase/Subgrade inundation → Pavement collapse

1-5) Maintenance situation of existing pavement

Regarding road maintenance in Zimbabwe, damaged road surface repair is undertaken on occasion during the rainy season, and intensive repair is undertaken after the rainy season. DOR maintains and manages directly using own machines. With respect to existing roads, repairs are performed relatively frequently, although deterioration of road shoulder of many sections is serious but there are few pot holes on the road surface. Also in the present preparatory survey, Zimbabwean side discussed well with Japanese experts, and staffs in each technical field of DOR accompanied the field survey. Also, cooperation to the road sector by Japan has been appreciated by MoTID and MoFED (the head of the International Cooperation Bureau of the Ministry of Finance was also present in technical meeting with MoTID). There was a request from them to continue widely cooperation in the road sector.

2) Existing major structures

2-1) Existing drainage facility

i) Road surface drainage facility

In a part of the target section, asphalt curb (filling slope side) which raised the asphalt material at shoulder edge and longitudinal gutter by concrete stone pitched channel (cutting slope side) were confirmed. It was often found that vegetated concrete stone pasting channel on the cutting slope side was often found to be malfunctioning as a waterway.

ii) Cross-sectional drainage

It is considered that there are many steep slope sections due to mountainous topography in the target road section and drainage condition is relatively good. The “Marongora river” flows to the east side and the “Mureche river” flows to the west side of the target road, and these branches cross the target road. Cross-sectional drainage facilities of the target road section are installed densely 89 places, about one place every 150m. By structure, there are 8 box culverts and 81 pipe culverts, especially pipe culvert with 60cm in diameter accounts for about 90% of all culverts. Among these existing culverts, half buried with earth observed. In the interview, there was no

history of floods or ponding in the target section.

Table 2-1-11 Outline of drainage structure

Type	Size	Quantity	Rate	Remark
Pipe Culvert	600	78	88%	Concrete structure
	900	3	3%	Ditto
Box Culvert	3000x1500x2Cells	1	1%	Ditto
	2000x2000x1cell	5	6%	Ditto
	1500x1500x1Cell	2	2%	Ditto
Total		89	100%	

Source: JICA Survey Team



2-2) Retaining wall

Masonry retaining wall was confirmed on the valley side of the road in a part of the target section (around 311.200 ~ 311.400km). In this project, since there are concerns about prolongation of construction period due to removal and reinstallation of these retaining walls and great influence on the construction while opening the traffic, there is a need for a linear examination that does not affect these existing retaining walls.



2-3) Road Safety fa Photo 9 Peripheral state of existing retaining wall section

i) Rumble strips

At three sharp curves on descending slope (300, 301, 302 km points) in the Chirundu direction lane, 4 or 5 sets rumble strips are installed continuously on the surface of the pavement in front of the curve (1 set is ten DBST material of width 20cm installed at 5cm intervals). Since these are not installed over the full width of the roadway, passing vehicles avoid these rumble strips if there is no oncoming vehicle.

ii) Road reflector stud

Broken remnants of road reflector studs can be found at the center and edge of existing

carriageway at 25m intervals. These facilities are thought to be very effective for safe passage of roads without lights at night, but since they were installed in a narrow width of carriageway, they deteriorated rapidly by being constantly stepped on by large vehicles. In case of planning these facilities, it is necessary to eliminate the insufficiency of the widths and to examine the setting position where it is difficult to step on.

iii) Guard pole + Wire

In the target road, guard poles and wires are installed in the section where the difference in elevation between carriageway and side of the road is large. These facilities remain on the side of the road with much damaged by past collision of vehicles. The guard poles are made of concrete with a thickness of 18 x 18cm and a height of 80cm and are bound with a wire of 1.5cm thickness.

iv) Traffic Sign

In the target road section, the following signs were confirmed. For some of these signs, visibility problems were confirmed caused by plants growing in the rainy season. Based on these local situations, it is considered necessary to examine specifications of shoulder and the installation position. In the field survey, the odor of brake pad burn in the descending section was confirmed when large vehicles were passing through, it is necessary to consider the installation plan by combining the deceleration countermeasure facility and the sign of enforcement of engine brake.

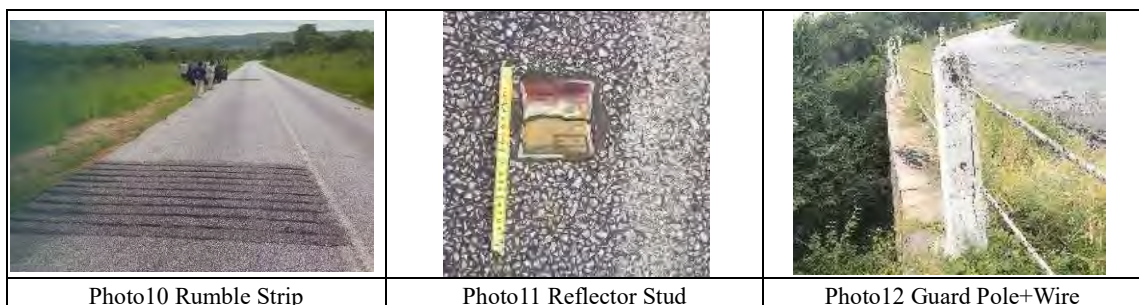


		
Photo 16 Width decrease sign	Photo 17 Curve warning sign	Photo 18 Large vehicle speed regulation sign

3) Road reserve and obstacles

3-1) Existing Road Reserve

The Right of Way (ROW) of Zimbabwe was set to 70m in total, 35m on both sides from the existing road center by 2004. After 2004, the revision has been notified in the Official Gazette as a total of 140m, 70m on both sides from the road center. The ROW of the target road is in the range of 70m in total, 35m on both sides from the existing road center, before the Official Gazette.

3-2) Existing public utilities survey

Ground and underground public utilities along the target road, which may be affected by road improvement, such as relocation, removal etc., confirmed by the field survey, are shown below.

i) Electric line





Three electric lines presumed 2000V are installed on the right side of the road towards Chirundu, electric pole standing near 302km point from Harare is the closest to the existing road. These wires are connected to Park Ranger Camp at 306 km and acrossing the existing road and are terminated at 306.5km Park & Wildlife office.

ii) Water pipe

There is a water supply pipe with an outer diameter of about 100mm in an existing drainage pipe that crosses near the Park & Wildlife office Harare side. This water supply pipe is thought to supply water from the reservoir behind the office to the office and park ranger camp.

iii) Communication line

On the left side of the road towards Chirundu, communication lines and metal electric poles that are disconnected at many places are installed. In addition, optical fiber cables are buried same side, and concrete beacon showing the position at an interval of about 1km is installed. These optical fibers are not a problem with implementation of work, as agreement has been reached between DOR and cable owner for voluntary relocation by owner when necessary due to road improvement.

			
Photo 19 Electric Wire	Photo 20 Telecom Wire	Photo 21 Optical Fiber Sheath Pipe (about φ3cm)	Photo 22 Fiber location beacon

4) Procurement circumstances

Procurement circumstances (Suppliers, procurement method, procurement period, procurement price, quality, etc.) were investigated by examining the possibility of local procurement and third country procurement concerning materials and labor required for this project (aggregate, concrete, asphalt, construction equipment, etc.).

Table2-1-12 Outline of procurement circumstances

Name of investigation	Subject of investigation	Contents of investigation
Procurement of labor	Contractor/Consultant	Supplier of simple / skilled workers and civil engineers, survey of technical level and wage level by occupational types.
Procurement of paving materials such as aggregate	Local/aggregate supplier	Survey on the quality and procurement cost of neighboring aggregate plant manufactured products, supplier and procurement cost of plant yard, gemstone etc.
Asphalt composite and asphalt emulsion	Contractor/Paving contractor	Quality and procurement cost of neighboring asphalt plant manufactured products, shipping capacity, material quality, quality control system, quality at temporary plant etc.
Procurement of concrete	Ready-mixed concrete manufacturer/Contractor etc.	Probability of procurement, manufacturing / distribution situation, quality and cost survey of ready-mixed concrete, investigation on the possibility of site production by lease of concrete plant and cost.
Precast products such as curbstone and concrete pipe	Manufacturer	Investigation of quality and cost of manufacturer products
General paving and earthwork equipment	Contractor/Leasing company	Investigation of performance and lease cost of each equipment
Procurement of other equipment and materials	Construction material dealer/Contractor/Leasing company etc.	Investigation on prices of equipments and materials necessary for construction, import destination, procurement period, means of transportation, performance etc.
Electricity and water procurement	Public agencies/Contractor	Investigation of availability of general electric power, procurement method of drinking water / construction water (availability of tap water and river water, existence of wells in the surroundings, water quality, usage situation)
Transport capacity	Transporter	Investigation on costs and days of import procedures and land transport
Sub contractor	Local contractor	Investigation on special paving and other construction experience, construction ability, potential ability, technical capability, possessive machinery, number of personnel / technician etc.
Acquisition of ROW	Local/Counterpart	Selection of candidate sites for temporary building · material yard and · construction yard, investigation on necessity of ROW and detour route and possibility of land acquisition.
Disposal site of construction waste materials etc.	Local/Counterpart	Investigation on proper construction waste disposal methods and waste disposal sites. (Since safari area spreads, sufficient consideration is necessary)

Source: JICA Survey Team

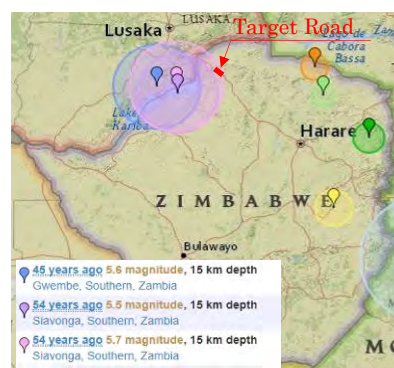
2-1-2 Natural condition

(1) Topography and Geology

Layered ultra-basic rocks called "The Great Dyke" are developing at the center of the country over 550km across north and south with width of 3-12 km. In the vicinity of the project site, a plateau connects to lowland part of Zambezi River through a steep part with an altitude difference of about 500m from the undulating terrain of about 1000m in altitude. The soil in the target section is classified as sandy soil, which is characterized by low organic content and high drainage property.

(2) Earthquake

Three earthquake zones, "Zambezi Basin", "Eastern Border Area" and "Central Region", are distributed in Zimbabwe. "Zambezi Basin" where the project site is located is an area where the earthquake activity is the most active in Zimbabwe; about 3,000 earthquakes have been recorded since 1959. The largest earthquake ever occurred on September 23, 1963, and the seismic intensity was magnitude 6.1. In the STACC standard (Bridge design), there is no description of consideration of earthquake ground motion in culvert and retaining wall plan, and Japan standard also does not require earthquake resistance examination in the case of less than 8.0m of wall height (the maximum H = 6.50m of this Plan).



Source : earthquaketrack.com/

Figure 2-1-6 Vicinity Earthquake Location

(3) Whether condition

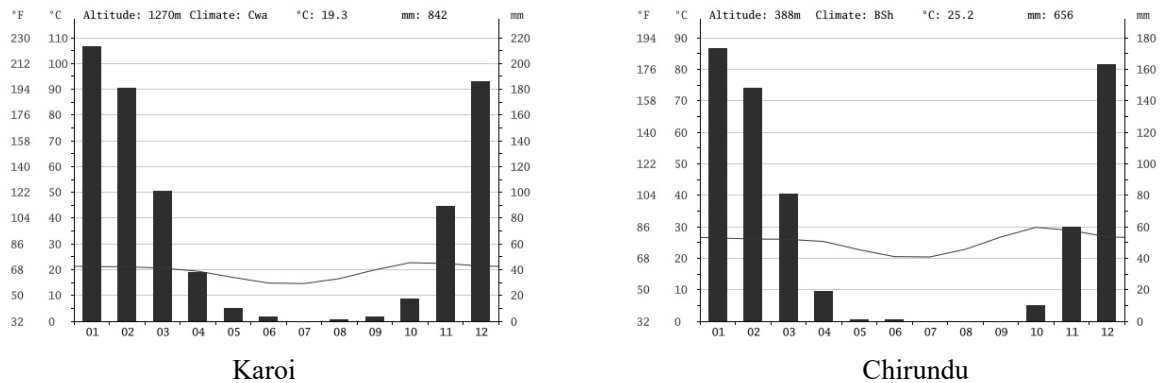
The target area has the dry season from April to October and the rainy season from November to March, and annual rainfall is around 800mm which is about half of that in Japan. Since the high altitude of 1000m or more occupies the majority of the land, the average temperature is around 25°C, but in June and July the difference in temperature is severe, it exceeds 30°C during the day, but it drops to under 10°C in the morning and evening.

Table 2-1-13 Annual rainfall data (by Zimbabwean Observatory)

Location	2010/11	2011/12	2012/13	2013/14
Nyanga	1,154.0	791.0	1,166.3	1,327.5
Bulawayo	554.8	297.2	472.2	751.2
Kariba Airport	749.1	755.9	675.1	790.2
Harare(Belvedere)	731.1	984.9	1,062.4	797.0
Gweru(Thornhill)	861.6	475.8	488.5	861.1
Beitbridge	402.6	215.7	574.9	414.1

Source : Fact & Figures 2015, Zimbabwe National Statistic Agency,

unit : mm



Source : <http://en.climate-data.org/>

Figure 2-1-7 Temperature and amount of rainfall at the project site

(4) Natural Conditions Survey

1) Topographic Survey

The topographic survey work items for the target route are as shown in the following table.

Table 2-1-14 Work Item for Topographic Survey

Work item	Quantity	Remark
Survey preparation	One set	
Bench mark installation	30 places	1 place / about 0.5km
Control survey	30 places	Traverse control point for target section including starting and end point
Topographical Survey	90ha	Target road section width 70m
Boundary survey	One set	

Source: JICA Survey Team

2) Soil and materials survey

Material testing was implemented on filling materials from a candidate borrow pit and stones from a candidate quarry in order to determine the feasibility of procuring materials for road construction and confirm the distances to be carried. Moreover, to determine the properties of foundation soil on the planned road section, samples were taken in the trial pit implemented at 250m intervals on the edge of existing road and subjected to related tests.

Table 2-1-15 Outline of Soil and materials survey

Work item	Quantity	Remark
(1) In-situ material sampling	6 places	Stone quarry 1 place, Sand 2 places, Borrow pit 3 places
(2) Laboratory test	Stone quarry 1 sample Sand 2 samples Borrow pit 3 samples	<u>Quarry sample</u> : particle size, specific gravity, water absorption rate, abrasion, stability, flatness, alkali-silica reaction <u>Sand sample</u> : particle size, specific gravity, water absorption rate, organic content, sand equivalence, stability, alkali-silica reaction <u>Borrow pit sample</u> : particle size, specific gravity, water absorption rate, liquid limit, plastic limit, liner shrinkage, atterberg, CBR, organic content
(3) Existing pavement survey	60 samples	Each 250m (Assumed depth 1.5m, confirmation of layer thickness, material type, water content and groundwater level) particle size, specific gravity, liquid limit, plastic limit, atterberg, CBR, organic content

Source: JICA Survey Team

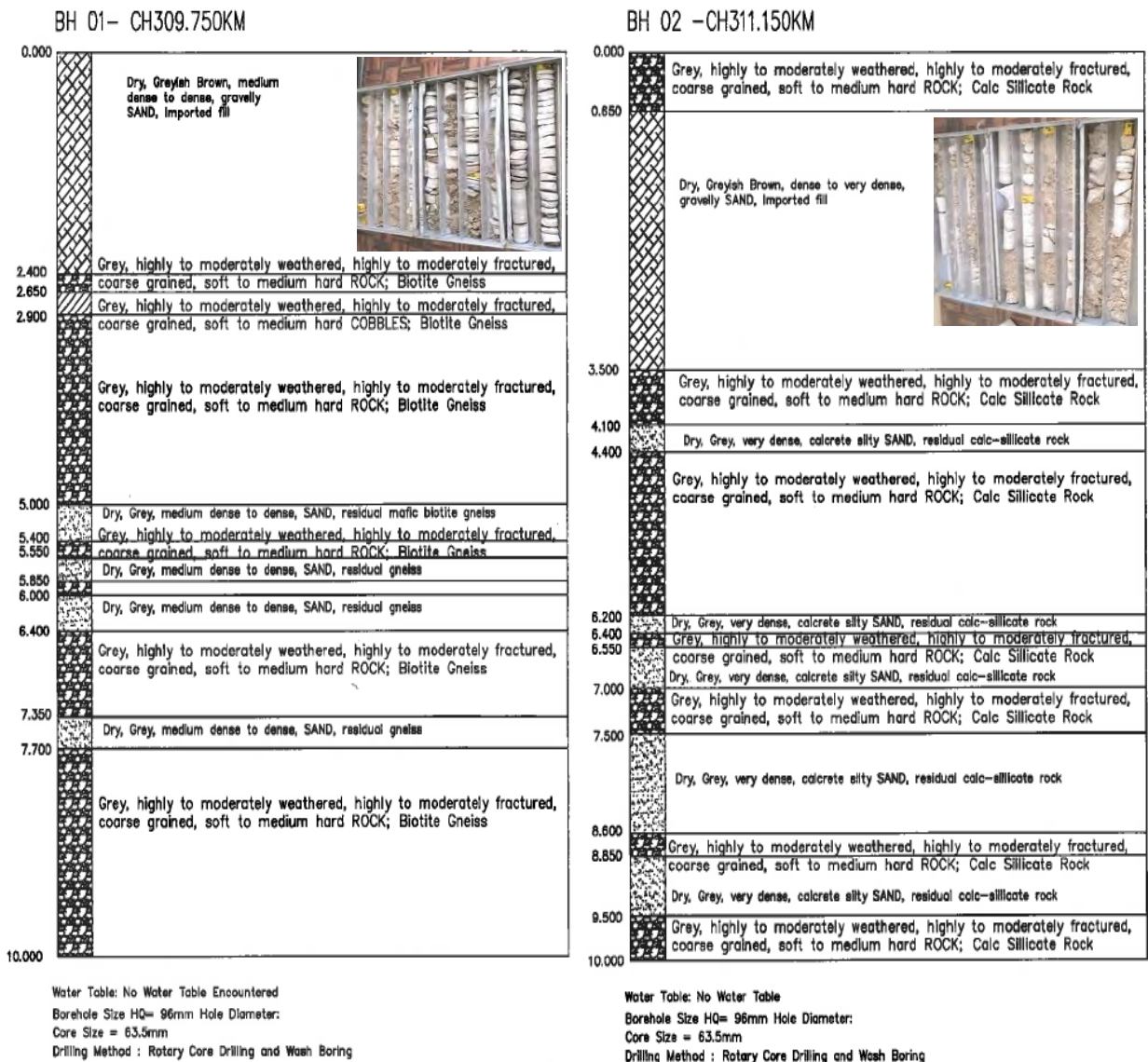
3) Existing pavement and boring survey

In this survey, the pavement and ground condition of the target site was grasped by measurement of the deflection amount of the existing road surface at 200m intervals together with the result of the trial pit investigation. Furthermore, it is assumed that drilling to the mountain side slope where rock drilling traces are seen is likely to occur in the section where it is thought necessary to improve the sharp curve, so the policy of grasping change of rock quality by boring survey, and reflecting it in the design was determined.

Table 2-1-16 Outline of existing pavement survey

Work item	Quantity	Remark
Benkelman-beam test	13km	Measurement of road surface bearing force At 200m intervals
Dynamic cone penetration (DCP) test	150 places	DCP test was implemented at 100m intervals on shoulder side. (If underground water was confirmed, simple exploratory drilling was implemented as necessary to confirm the water level.)
Current road surface survey	15km	Confirmation of Road surface condition (PSI survey)。
Mechanical boring	20m	2 places (309.75, 311.15km), Standard penetration test, Undisturbed sample collection

Source: JICA Survey Team



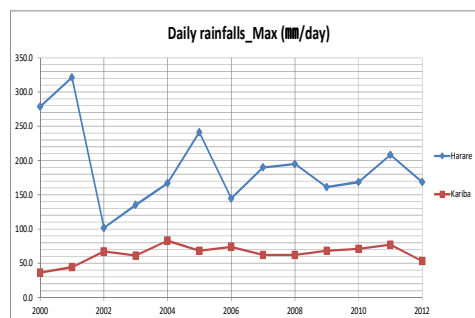
Source: JICA Survey Team

Figure 2-1-8 Results of boring survey

4) Hydrology/Drainage facilities

4-1) Rainfall in the target site

The rainfall data of the observation station (Kariba) near the target section and the observatory station near the capital city Harare in recent years (2000 to 2012) are shown below. The Daily maximum rainfall amount in the target area is less than 100mm / day in average and is less than half compared with Harare, which means it is a region where rainfall is relatively small in Zimbabwe. In addition, by the trial pit excavation at 250m intervals beside the carriageway, it was confirmed that there was no groundwater level up to 2m from road surface. Also, as a result of interview, road flooding and ponding did not occur in the past on the target road.



Source: JICA Survey Team

Figure 2-1-9 Variation of Dayly Rainfall

4-2) Rainfall intensity

Rainfall observation data (Daily maximum rainfall amount) at Kriba airport for 12 months from 2000 May to 2016 December was obtained from DOR as basic data to calculate rainfall intensity.

Table 2-1-17 Daily maximum rainfall amount (mm/day)

Year/Month	1	2	3	4	5	6	7	8	9	10	11	12	Max
2000	-	-	-	-	0	0	0	0	0	11	24.4	36.2	36.2
2001	43.7	20.4	44.2		0	0	0	0	0	0	20	27.7	44.2
2002	67.1	36.1	48		0	0	0	0	0	0	23.5	27.5	67.1
2003	54	24.7	42.1	0.7	0	0	0	0	0	0	45.6	61.1	61.1
2004	83	31.5	14.8	2.8	0	0	0	0	0	37.3	31.7	51.2	83
2005	39.4	68.1	58.5	0.4	0	0	0	0	0	0	29.5	50.7	68.1
2006	74	31.2	33.4	0.4	0	0	0	0	0	4.3	31.9	14	74
2007	52.2	15.5	62.1	0.3	0	0	0	0	0	0.3	13.5	54	62.1
2008	28.1	22	62.2	0.6	0	0	0	0	0	0.9	45.5	57.2	62.2
2009	29.8	48.6	19.4	0.4	0	0	0	0	0	0	37.9	68.2	68.2
2010	38.3	18.7	29.6	1.3	0	0	0	0	0	0	45.5	71	71
2011	45.8	63.2	77	1.4	0	0	0	0	0	0	41.2	35.4	77
2012	53.1	27.8	47.2	18.6	0	0	0	0	0	1.2	25.8	47.5	53.1
2013	26.1	78.6	9.7	0.4	0	0	0	0	0	26.9	8.7	39.5	78.6
2014	28.9	54	30.1	-	0	0	0	0	0	0.4	6	38.8	54
2015	26.2	33.5	42.3	0.3	0	0	0	0	0	5.2	12.3	33.4	42.3
2016	32.8	-	-	-	0	0	0	0	0	1.7	18.4	93	93

Source: JICA Survey Team

4-3) Design return period of drainage facilities

Since the design return period were not described in the design manual of Zimbabwe and SATCC, by consultation with DOR, the design return period were confirmed to be applied the probability for 5 years for side ditch, and for 20 years for cross-sectional drainage facility.

2-1-3 Environmental and Social Consideration

(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 Study. In the preparatory study, the environmental and social consideration was implemented based on the JICA “Environmental and Social Consideration Guidelines” (April 2010) (hereafter called the JICA Guidelines). Contents of this

report are based on the JICA “Report Preparation Guidelines for Environmental and Social Consideration Category B Projects” (not drafted as of June 2011).

(2) Basic Environmental and Social Conditions

1) Land use

The target section of the Study is north part of the North-South Corridor (Chainage from 300+000 to 313+600) located on high ground in Mashonaland West Province at elevation of 1,000~1,200 meters stretching in the north-west direction from the capital city Harare, which is at elevation of 1,490 meters, and it connects with Chirundu at elevation of 400 meters on the banks of Zambezi River, which is on the national border



Source: Environmental Management Agency

with neighboring Zambia. Administrative units in Zimbabwe are divided into Provinces, Districts, Wards, Areas and Villages, and the target section of the Project is included in the No. 7 ward of Hurungwe District in Mashonaland-West Province.

Figure 2-1-10 Topography around the Target Road

The target section of the Study begins from 300+000 after Makuti, passes through Hurungwe Safari Area, and after sharply descending from high elevation of 1,000 meters to lowland of 400 meters around Zambezi River, it ends at 313+600 near the Tse Tse Control Gate located at the end point of Zambezi Escarpment.

2) Natural environment

2-1) National parks, etc.

The target road passes through Zimbabwe’s Hurungwe Safari Area (2894.0 km²).

Legislation concerning management of nationally owned land including national parks, etc. that are classified as National Parks and Wildlife Land in Zimbabwe’s land ownership classifications¹, is stipulated in the Parks and Wild Life Act, Chapter 20: 14. Such land is divided into the following five categories according to ecosystem, objective and purpose of use: 1) National Park, 2) Botanical Reserve / Botanical Garden, 3) Sanctuary, 4) Safari Area, and 5) Recreational Park.

In national parks and sanctuaries (game protection areas), strict controls are enforced on capturing and removing flora and fauna from the viewpoint of protecting the ecosystem for wild animals and vegetation.

¹ Table 2.3.3 Forms of Land Ownership in Zimbabwe

Meanwhile, safari areas have been established with the aim of providing leisure and recreation activities such as hunting for local flora and fauna. Here, hunting is permitted under certain conditions based on a hunting rights quota system, and the hunting and capture of wildlife is permitted for purposes of academic research, public benefit and safety of residents. Accordingly, such areas are not classed as environmentally sensitive.

Management of safari areas is conducted by the Parks and Wildlife Management Authority under the Ministry of Environment, Water and Climate.

Although regulations concerning road works and other public works and development activities are not specified in particular, it is necessary to obtain Acknowledgement of Construction from the Parks and Wildlife Management Authority during the phase of EIA preliminary discussions, and the necessary mitigation measures are prescribed according to the characteristics of the target infrastructure works.

2-2) IUCN protected areas, etc.

According to the International Union for Conservation of Nature (IUCN) Protected Planet database², Hurungwe Safari Area through which the target road passes, is classified as a Category VI protected area with sustainable use of natural resources.

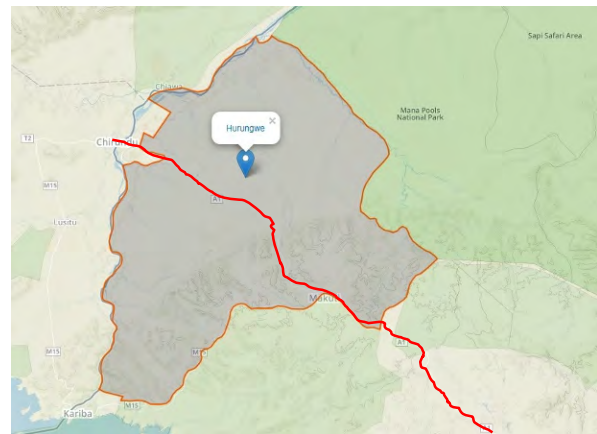
In IUCN Category VI protected areas with sustainable use of natural resources, it is required that the local ecosystem and ecology be preserved and that management systems be adopted for the traditional cultures and natural resources. Such protected areas are defined for the purpose of preserving beneficial ecosystems in terms of both natural protection and sustainable development and realizing sustainable use of natural resources.

Category VI protected areas with sustainable use of natural resources correspond to Japan's forest reserves³, in which a certain degree of development activity entailing alteration of land, etc. is permitted with the permission of the prefectural governor.

2-3) Biodiversity, etc.

① Fauna

The following table shows the endangered species of Zimbabwe that are included on the IUCN's Red List. The species that are shown in red exist in Hurungwe Safari Area, through which the target road passes.



Hurungwe Safari Area

Source: IUCN Protected Planet Database

Figure 2-1-11 IUCN Protected areas, etc.
around the Target Road

² <https://www.protectedplanet.net/>

³ "Symbiosis of Protected Areas and Local Residents", Masaki Yoneda (July 2005), JICA Institute For International Cooperation

Table 2-1-18 Endangered Species, etc. in Zimbabwe

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

Source: Ministry of the Environment report

Protection conditions are classified by categories in the International Union for Conservation of Nature (IUCN) Red List. EX: Extinct, EW: Extinct in the Wild, CR: Critically Endangered, EN: Endangered, VU: Vulnerable, NT: Near Threatened, LC: Least Concern, DD: Data Deficient

According to hearings with park rangers of Marongora Park Management Office, which has jurisdiction over Hurungwe Safari Area, the Brown Hyena and Leopard that are classified as Near Threatened (NT) mainly live in low-lying plains in the Zambezi River basin on the Chirundu side of the target section, but they are rarely observed in the hilly parts of the target section.

Concerning the African Elephant that is classified as VU (Vulnerable), whereas it is classified in the Washington Convention⁴ Appendix I5, which stipulates strict controls on hunting and trading for endangered species, in Eastern African countries such as Kenya and Tanzania, numbers have increased so much in recent years that harm is caused to humans and livestock and the classification has been lowered to Appendix II in the four countries of Namibia, Zimbabwe, Botswana and South Africa. Similarly, the Lion is also classed in the Washington Convention

⁴ Washington Convention: Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES). Zimbabwe has also ratified this.

⁵ <https://cites.org/eng/app/appendices.php>

under Appendix II signifying a lower level of endangerment.

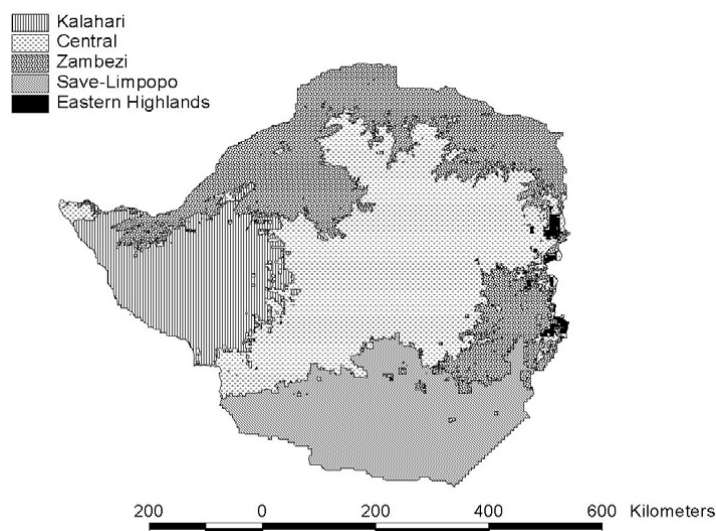
The African Elephant and Lion are not designated as Specially Protected Animals under domestic law in Zimbabwe, and managed hunting of them is permitted within safari areas. Around 500 African Elephants are hunted or captured every year in order to control the population.

Although collisions sometimes occur between vehicles traveling along the target road and wild animals crossing the road inside the safari area, it is not permitted to erect fences, etc. that will impede the migration of animals. Therefore, in order to prevent accidents, it is necessary to install speed reduction signs and take other countermeasures.

② Flora

The Zimbabwe Ministry of Environment, Water and Climate (MoEWC) compiled a report on preservation of biodiversity in December 2010⁶. In this, the target area of the Study is classed in Central Ecoregion according to the ecological zonal classification of Zimbabwe. Predominant vegetation in this area is shrub forest comprising mostly Zambezia Miombo, but there is no distribution of ecologically important vegetation.

In addition to the above, regarding the basic design of the Project, the JICA survey team upgrades the road within the area of existing road servitude (RoW: Right of Way) and any tree cutting is not expected outside of the RoW due to implementation of the project for widening and realigning the existing road.



Source: Ministry of Environment Report

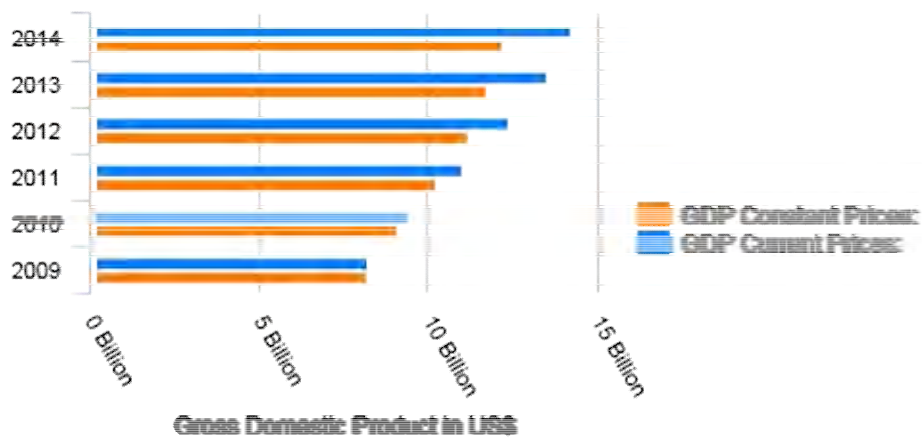
Figure 2-1-12 Ecological Zones of Zimbabwe

③ Birds

Zimbabwe is home to more than 650 species of birds, and numerous Important Birds Areas (IBAs) are designated primarily in the national parks. According to IUCN, there are two endangered species (Madagascar Pond Heron / scientific name: *Ardeola idea*, and White-winged

⁶ Zimbabwe's Fourth National Report To the Convention on Biological Diversity, Ministry of Environment & natural resources Management Republic of Zimbabwe, December 2010

capita GDP was 1,028 USD, much lower than in neighboring South Africa (per capita GDP 6,889USD) and Botswana (per capita GDP 7,125USD).

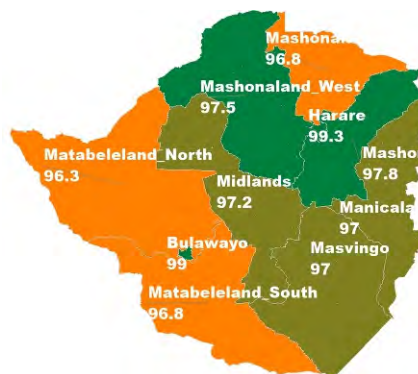


Source: National Statistics Agency

Figure 2-1-14 Movements in Zimbabwe’s GDP

3-2) Literacy

As a result of putting particular effort into elementary education, GOZ has achieved an extremely high literacy rate compared to other African countries. Within the African Continent, Zimbabwe has the highest literacy rate, even outstripping that of South Africa.

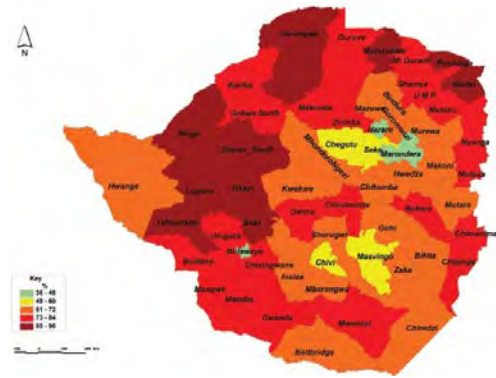


Source: National Statistics Agency National Census 2012

Figure 2-1-15 Literacy Rate in Zimbabwe

3-3) Poverty

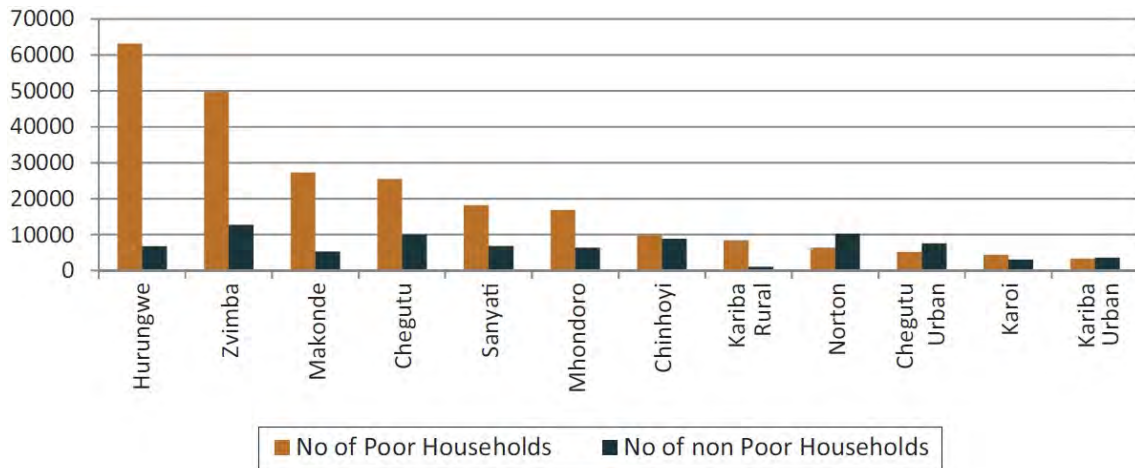
The poverty ratio in the Study target area of Hurungwe District, Mashonaland-West Province is 87.9%, higher than in other districts of Zimbabwe. Within Hurungwe District, poverty is especially high in the central and southern zones that are included in the target section.



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

Figure 2-1-16 Distribution of Poverty by District in Zimbabwe

Looking at the distribution of impoverished households in the Study target area of Mashonaland - West Province, it can be seen that most are situated inside Hurungwe District, which includes the target area. This is due to the fact that Hurungwe District contains many communities of family-run subsistence farms engaged in small-scale agriculture.



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

Figure 2-1-17 Distribution of Poor Households by District in the Study Target Area

3-4) Social structure

In Nyamakate District around 260+000~270+000km, where the target section of the Study begins, farmers who previously worked as tenants for white plantation owners but received Offer Letters for use of nationally owned land under the permanent settlement policy of the government following independence in 1980, now cultivate mainly tobacco, maize, cotton and other commercial crops and have formed communities on both sides of the road.

(3) Environmental and Social Consideration System and Organization in Zimbabwe

1) Legislation and Standards related to Environmental and Social Consideration

1-1) Environmental impact assessment (EIA)

The EIA process in Zimbabwe is shown in Figure 2-1-18. The EIA procedure in Zimbabwe is stipulated in the Environmental Management Act, Chapter 20: 27, and the target sectors for EIA

are stated in section 97 of the Act.

Since the project is classed under “Highway” in the “6. Infrastructure” sector, as a rule, it requires implementation and approval of EIA. The EIA process in Zimbabwe is described below.

① Creation of the Prospectus

Prior to the EIA, it is necessary to submit a Prospectus that gives a summarized description of the project, and an EIA to the General Director of the Environmental Management Agency (EMA). The Prospectus is similar to that required for initial environmental evaluation (IEE) in other countries. The items that need to be stated in the Prospectus are as follows:

- Project outline
- Current conditions of project (F/S, basic design, implementation design, implementation stage, etc.)
- Outline of envisaged environmental impacts

Even if approval for the Prospectus is granted following review by the DG within 20 working days, collateral conditions may be imposed on implementation of the EIA. As one of the results of Prospectus review, a list of the stakeholders that need to be consulted in the EIA phase will be compiled following definition by the EMA.

② Special provisions for EIA exemption

Projects that are found to satisfy the following conditions as a result of the Prospectus review are exempted from undergoing the EIA.

- Projects in which environmental impacts are limited and can be easily managed
- Projects in which the scope of environmental impacts and measures to address them are clearly included in the project plan
- Projects that do not entail large-scale involuntary resettlement of residents
- Projects that are not implemented in sensitive areas such as national parks, wetlands, commercial farmland, special protected areas, habitats for endangered species, and so on
- Projects that do not entail extreme discharge of environmental pollutants and solid wastes
Etc.

If the EIA is exempted, the project proponent needs to prepare an Environmental Management Plan (EMP) in place of the EIA. On the other hand, since this project is classed as a specific project (high-speed road) required to have an EIA, the special provisions for EIA exemption will not apply.

③ Necessary items in the EIA report

The EIA report must cover the following contents:

- Detailed description of the project contents and the activities implemented in the works, etc. implementation stage
- Reasons for selection of the project target area
- Detailed description of the direct, indirect, cumulative, short-term, and long-term environmental

impacts of the project

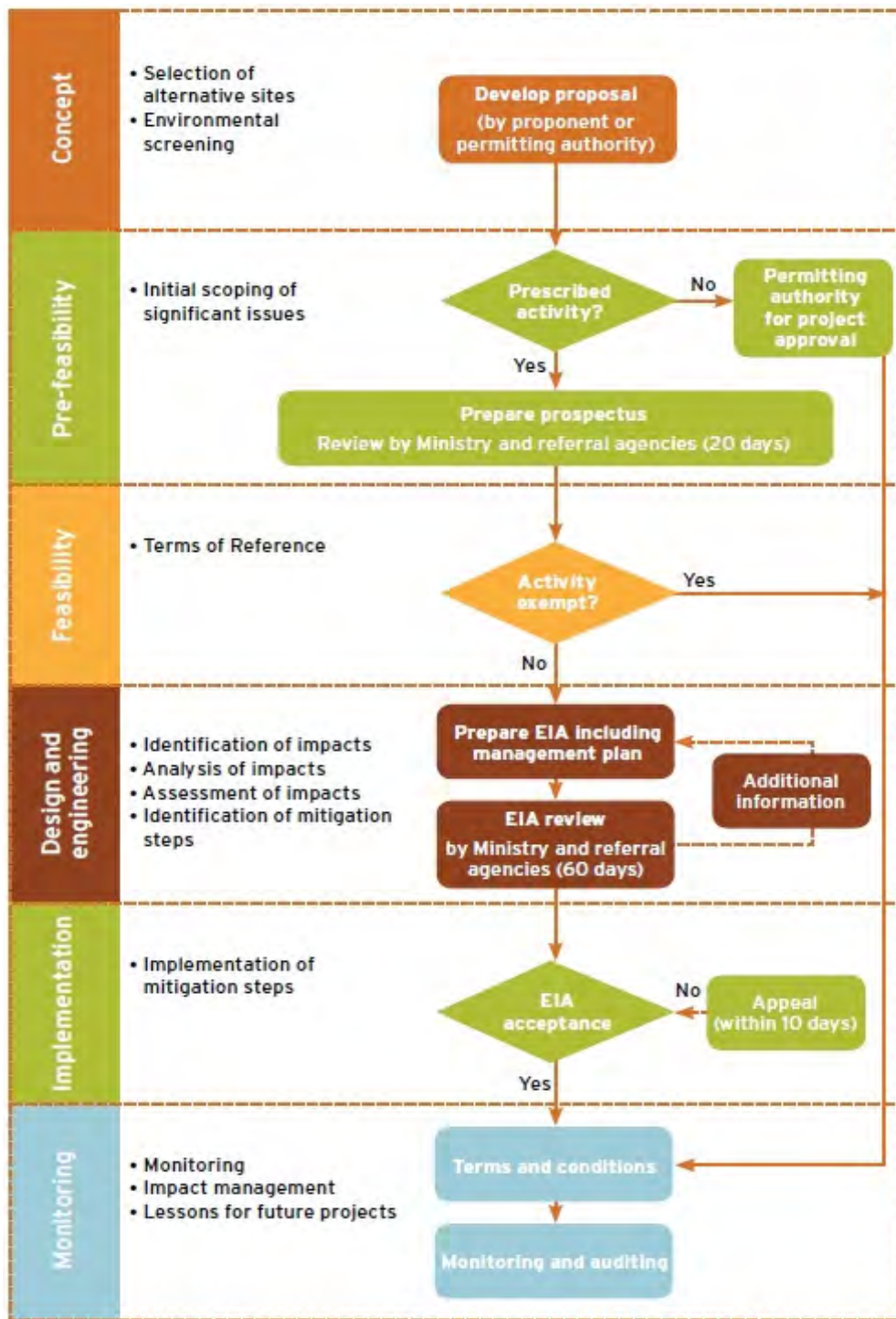
- Itemized breakdown of concrete measures for mitigating the negative environmental impacts
- Identification and description of the measures for monitoring the negative environmental impacts
- Possibility of the project imparting impacts over a wide area including other countries, and measures for minimizing environmental damage
- Methodology in creating the EIA report by the project proponent

④ EIA certification

If the EIA report is approved following review by the Environmental Management Agency (EMA) within 60 days of submission, the DG will issue EIA certification. The EIA certification is valid for two years from the day of issue.

⑤ Public Consultation implementation process

In Zimbabwe, it is required for Public Consultation to be implemented in the EIA process. The primary focus of the Public Consultation is to verify the environmental and social impacts of projects and to determine whether mitigation measures are acceptable to the affected parties (PAPs). The Public Consultation is implemented by means of questionnaire, group discussions, and unofficial and official interviews with community representatives.



Source: SADC Environmental Legislation Handbook 2012

Figure 2-1-18 EIA Process in Zimbabwe

1-2) Environmental standards, etc.

The main environmental standards related to road construction projects in Zimbabwe are as shown below.

Table 2-1-19 Main Environmental Standards in Zimbabwe

Item	Legislation and Standards
Air quality	· Environmental Management Act (Chapter 20: 27), Sections 57–59
	· SI No. 72 of 2009
Water quality	· Environmental Management Act (Chapter 20: 27), Sections 63–68
Solid wastes	· Environmental Management Act (Chapter 20: 27), Sections 69–76
	· Waste and Solid Waste Disposal Regulations, SI No. 6 of 2007
	· Hazardous Substances, Pesticides and Toxic Substances Regulations, SI No. 12 of 2007

Source: JICA Survey Team

1-3) Forms of land ownership in Zimbabwe

Forms of land ownership in Zimbabwe are as shown in the following table. Land adjoining the target section of the Study is categorized as National Parks and Wildlife Land (Safari area), A1 and A2 (community farmland and residential land in Nyamakate District), all of which is included in nationally owned land.

Table 2-1-20 Forms of Land Ownership in Zimbabwe

Large classification	Small classification	Description	Nationally owned / Privately owned	Government agency with jurisdiction
Forestry Land	—	National forest	Nationally owned land	Ministry of Environment, Water and Climate Ministry of Environment, Water and Climate
Mining Areas	—	National mines		Ministry of Mines and Mining Development
National Parks and Wildlife Land	—	National park, safari area, etc.		Parks and Wildlife Management Authority
Communal Land	—	Tribal common land traditionally managed by tribes (former Tribal Trust Land)		Ministry of Lands and Rural Resettlement
Subsistence Agricultural Resettlement Areas	A1	Nationally owned land recognized for use by residents for small-scale agriculture		
	Village	Nationally owned land recognized for resettlement based on the permanent residence policy		
Commercial Agricultural Areas	State Land	Nationally owned land used for commercial agriculture		Ministry of Lands and Rural Resettlement
	A2	Nationally owned land used for commercial agriculture, where right of use has been granted to residents based on Offer Letter		

Large classification	Small classification	Description	Nationally owned / Privately owned	Government agency with jurisdiction
	Private Land	Privately owned land used for commercial agriculture	Privately owned land	
Urban Land	State Land	Nationally owned land used for public facilities, etc.	Nationally owned land	Ministry of Local Government, Public Works and National Housing
	Private Land	Land used for private sector facilities, housing, etc.	Privately owned land	

Source: JICA Survey Team

1-4) Procedures for land acquisition and involuntary resettlement of residents

Out of the North-South Corridor (Harare-Chirundu), the road servitude (RoW: Right of Way) on the stretch from Harare to the 140-kilometer point (near Chinoi) was set at 140 meters (70 meters from the center line on each side) based on Government Gazette Vol. LXXXII, No.78 (24th September, 2004). Meanwhile, concerning the target section of the Study (Karo-Chirundu), the old setting of 70 meters (35 meters from the center line on each side) is still in effect, and procedure to revise this to 140 meters (70 meters from the center line on each side) is currently underway (as of November 2016). Since land within the RoW is government-owned and it is prohibited to build permanent structures in this area, as a rule no compensation arises in line with land acquisition and relocation of permanent structures so long as the project activities are conducted within the RoW. Meanwhile, concerning real estate outside of the RoW, in cases where it is necessary to acquire land and relocate permanent structures, farmland, etc. in line with road widening or other public works, if the said land is privately owned land, the land and permanent structures will be eligible for compensation, whereas if the land is state-owned and alternative sites are provided, only the permanent structures will be eligible for compensation. In calculating compensation amounts, the public works proponent refers the project plan and contents of private property that requires expropriation or removal to the Ministry of Local Government, Public Works and National Housing or Ministry of Lands and Rural Resettlement, and a designated land and building evaluator determines the compensation amount to be paid from the national treasury. In Zimbabwe, evaluation of real estate compensation amounts is conducted based on market prices as a rule.

1-5) Discrepancies with the JICA Guidelines and methods of resolution

The following table gives a comparison of the JICA Guidelines and Zimbabwe's environmental and social consideration-related legislation

Table 2-1-21 Comparison of JICA Guidelines and Zimbabwe’s Environmental & Social Consideration Legislation

Item	JICA Guidelines	Zimbabwe’s Environmental and Social Consideration Legislation	Discrepancies and methods of resolution
Environmental impact assessment (EIA) items	Air, Noise and vibration, Water quality, Soil, Solid wastes, Ecosystem, Natural environment, Cultural heritage, Land acquisition and involuntary resettlement of residents, Ethnic minorities and indigenous people, Livelihood, Works safety Management, etc.	Air, Noise and vibration, Water quality, Soil, Solid wastes, Ecosystem, Natural environment, Cultural heritage, Land acquisition and involuntary resettlement of residents, Ethnic minorities and indigenous people, Livelihood, Works safety Management, etc.	Concerning the air quality, water quality, soil quality analysis, etc. baseline survey in the EIA phase, more specific and stricter impact evaluation than in the JICA Guidelines is sought, so there are no discrepancies in particular.
Stakeholder discussions	Concerning the grasping of development needs, grasping of the whereabouts of environmental problems, and review of alternative plans, conduct discussions with the local stakeholders from an early stage.	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 planning of the EIA, etc.	Zimbabwe’s EIA Law is more specific than the JICA Guidelines regarding stakeholder discussions in that it requires the stakeholders to be identified in the, Prospectus review stage and so on, so there are no discrepancies in particular.

Source: JICA Survey Team

(4) Role of Related Agencies in Zimbabwe’s Environmental and Social Consideration

The following table shows the related agencies and their roles in Zimbabwe’s environmental and social consideration.

Table 2-1-22 Related Agencies in Zimbabwe’s Environmental and Social Consideration

Organization	Main Roles
Ministry of Environment, Water and Climate (MoEWC)	<ul style="list-style-type: none"> • Regulation and management of environmental affairs, adjustment and monitoring of environmental conservation, and control of environmental pollution • Education and promotion of public awareness regarding environmental management • Formulation of environmental management policy and supervision of its implementation
National Environmental Council	<ul style="list-style-type: none"> • Advising on policy formulation and implementation decisions by the Environmental Management Agency (EMA) • Environmental management planning, review of environmental action plan guidelines, and recommendations to the Minister of Environment • Review of the various environmental policies, plans and standards established by the government
Environmental Management Agency (EMA)	<ul style="list-style-type: none"> • Formulation of environmental standards on air pollution, water pollution, soil pollution, vibration and noise, solid wastes management, etc. • EIA report review, approval, monitoring • Management, and control and monitoring of use of ecologically fragile ecosystems
Environmental Management Board	<ul style="list-style-type: none"> • Composed of experts in environmental economy, pollution countermeasures, solid wastes management, soil, public water supply and sewerage, etc., this board manages operation of the Environmental Management Agency
Parks and Wildlife Management Authority	<ul style="list-style-type: none"> • This agency is responsible for managing protected areas such as national parks, safari areas, etc., protecting and managing indigenous flora and fauna.

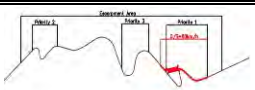

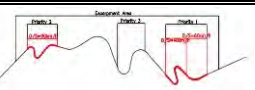
	<ul style="list-style-type: none"> The agency that grants authorization for infrastructure projects, development activity, etc. in safari areas
Ministry of Local Government, Public Works and National Housing	<ul style="list-style-type: none"> The agency that compiles community plans and city plans and coordinates various development activities in planning areas
Ministry of Lands and Rural Resettlement	<ul style="list-style-type: none"> The agency that reviews and authorizes involuntary resettlement of residents, land acquisition, and compensation procedures arising from infrastructure projects in rural areas
Ministry of Rural Development and Preservation of National Cultural Heritage	<ul style="list-style-type: none"> Management of historical structures, natural and cultural heritage, archeological remains, etc. Confirmation of buried objects such as archeological remains, etc. in infrastructure projects
Ministry of Mines and Mining Development	<ul style="list-style-type: none"> Confirmation of buried mineral resources in infrastructure projects Authorizing agency for use of explosives in road and slope excavation (blasting works)
National Museums and Monuments of Zimbabwe	<ul style="list-style-type: none"> Management of historical structures, natural and cultural heritage, archeological remains, etc. Confirmation of buried objects such as archeological remains (prehistoric wall paintings, etc.) in infrastructure projects

Source: JICA Survey Team

(5) Alternative Plans (including Zero Option)

In examining alternative plans for the project, four plans comprising the case of no project (Zero Option) and Plan-A to Plan-C, are compared and reviewed from the viewpoints of environmental and social consideration, traffic safety, etc.

Table 2-1-23 Comparison of Alternative Plans

Item	Zero Option	Plan-A	Plan-B	Plan-C
Plan outline	Case of no project implementation	 <p>Plan to set the design speed at 60 km/h and continuously improve high priority sections. In order to adopt a geometric structure according to the design speed, large-scale earthworks and bridges will be required in parts.</p>	 <p>In this plan, the design speed is set at 60 km/h, however, it is reduced to 40 km/h on sections where large-scale earthworks and bridges will be required.</p>	 <p>Plan to intermittently improve the high priority sections within the overall requested stretch of road</p>
Cost	—	Large-scale earthworks and bridges will be required, causing costs to increase; hence the improved section will become comparatively shorter.	Large-scale earthworks and bridges will be reduced, enabling costs to be cut; hence the improved section will become comparatively longer.	If multiple contractors are involved, process coordination will be needed; hence it is possible that management costs will increase.
Pollution countermeasures	B-: Road runoff will have a cumulative impact on the local water quality (surface water, groundwater).	A-: Large-scale topographical changes could arise, possibly leading to impact on the water environment. Noise and vibration impacts are predicted to arise in line with excavation works using heavy machinery, blasting, etc.	B+: Through installing appropriate drainage facilities, impact of road runoff on the local water quality (surface water, groundwater) will be mitigated.	B+: Through installing appropriate drainage facilities, impact of road runoff on the local water quality (surface water, groundwater) will be mitigated.
Natural environment	D: There will be no impacts.	A-: Large-scale earthworks and bridges will be required, making it possible that relatively large-size trees will need to be cut.	D: Tree cutting may arise within the RoW in some cases, however, there will be no extreme impacts on ecosystems.	D: Tree cutting may arise within the RoW in some cases, however, there will be no extreme impacts on ecosystems.

Item	Zero Option	Plan-A	Plan-B	Plan-C
Social environment	D: There will be no impacts.	D: There will be no extreme impacts.	D: There will be no extreme impacts.	D: There will be no extreme impacts.
Road performance	D: No improvement will be made.	A+: This plan will offer excellent surface speed design.	B+: The surface design speed will slow slightly.	B+: Surface design speed cannot be set.
Traffic safety	D: Smooth and safe traffic flow will not be improved.	B+: Hazardous areas will not be improved.	A+: Hazardous areas will be improved.	B+: Safety will deteriorate because improved sections will exist with non-improved sections.
Results of comparison		Negative environmental impacts are large.	This is the most desirable.	Improvement effects are minor.
A+/-: Major positive / negative impacts are projected, B+/-: A certain degree of positive / negative impacts are projected C: Impacts are unclear, D: There are no positive / negative impacts (as is)				

Source: JICA Survey Team

(6) 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 2-1-24 Scoping (Draft)

No.	Impact item	Forecast evaluation		Contents of environmental and social impacts
		During works	In service	
1. Pollution countermeasures				
1	Air quality	B-	D	[During works] · Impacts are envisaged due to dust and exhaust gases from works vehicles. [In service] · There will be no increase in traffic volume due to the project, and no further worsening of air pollution can be envisaged.
2	Water quality	B-	B-	[During works] · If the necessary countermeasures are not taken, wastewater from the concrete works and paving works will have an impact on local water quality (surface water and groundwater). [In service] · The quantity of rainwater runoff is expected to increase due to the road widening and installation of drainage facilities. · If appropriate drainage facilities are not installed, the road drainage will have an impact on local water quality (surface water and groundwater).
3	Solid wastes	B-	D	[During works] · Generation of solid wastes, residual soil, waste materials, etc. can be envisaged from works sites. [In service] · There will be no increase in traffic volume due to the project, and no further increase of solid wastes can be envisaged.
4	Noise and vibration	B-	D	[During works] · Noise and vibration impacts are envisaged due to carrying of materials by vehicles and excavation works using heavy machinery, blasting, etc. [In service] · There will be no increase in traffic volume due to the project, and no further worsening of noise and vibration can be envisaged.
2. Natural environment				
1	Nature preserve	D	D	· The target road of the project does not go near any national parks or bird nature reserves (sanctuaries) that are subject to flora and fauna

No.	Impact item	Forecast evaluation		Contents of environmental and social impacts
		During works	In service	
				protection regulations.
2	Ecosystem	C	C	[During works] <ul style="list-style-type: none"> It is necessary to confirm the habitats of rare species. Although trees will be cut inside the ROW, no major ecological impacts can be envisaged. [In service] <ul style="list-style-type: none"> It is necessary to confirm the habitats of rare species.
3	Water environment	D	D	[During works] <ul style="list-style-type: none"> Although it is possible that small-scale bridge works (installation of box culverts, etc.) will arise, no major impacts on water environment can be envisaged. [In service] <ul style="list-style-type: none"> No impacts on the local water environment can be envisaged.
4	Topography and geology	B-	B-	[During works] <ul style="list-style-type: none"> It is possible that cutting and filling will arise in line with improvements such as road widening for addition of another lane, alteration of road alignment on sharp curves and so on. It is envisaged that a certain degree of impacts will arise in filling earth borrow pits and residual earth dumps.
3. Social environment				
1	Involuntary resettlement of residents	C	C	[During works] <ul style="list-style-type: none"> It is necessary to confirm whether there will be involuntary resettlement of residents and land acquisition. It will be necessary to borrow some land (around 1 hectare) for storing equipment and materials during works. [In service] <ul style="list-style-type: none"> It is necessary to confirm whether there will be involuntary resettlement of residents and land acquisition.
2	Lifestyle and livelihood	C	C	[During works] <ul style="list-style-type: none"> It is necessary to confirm whether there will be involuntary resettlement of residents and land acquisition. [In service] <ul style="list-style-type: none"> It is necessary to confirm whether there will be involuntary resettlement of residents and land acquisition.
3	Cultural heritage	D	D	<ul style="list-style-type: none"> There is no registered cultural heritage, etc. around the target section of the Study.
4	Landscape	D	D	<ul style="list-style-type: none"> There are no areas that require landscape consideration around the target section of the Study.
5	Ethnic minorities & indigenous people	D	D	<ul style="list-style-type: none"> There are no ethnic minorities or indigenous people that require consideration around the target section of the Study.
6	Work environment	B-	D	[During works] <ul style="list-style-type: none"> Since it is possible that works on the target section of the Study will entail earthworks on steep cliff sections, excavation of slopes using explosives, etc., and so on, it will be necessary to show special care regarding safety management of workers.
4. Others				
1	Impact during works	B-	D	[During works] <ul style="list-style-type: none"> Traffic accidents must be prevented from happening during the works through establishing appropriate detours, guiding traffic and so on.
2	Monitoring	B+	B+	[In service] <ul style="list-style-type: none"> It will be necessary to monitor the project effects regarding reduction of traffic accidents, changes in traffic volume, and changes in running speed following the road improvements.
A+/- Major positive / negative impacts are projected B+/- A certain degree of positive / negative impacts are projected C Impacts are unclear D There are no positive / negative impacts Source: JICA Survey Team				

(7) TOR for the Environmental and Social Consideration Study

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

Table 2-1-25 TOR (Draft) for the Environmental and Social Consideration Study




No	Impact item	Survey Item	Survey Method
1. Pollution countermeasures			
1	Air quality	1) Environmental standards 2) Impact during works 3) Impact after going into service	1) Legislation (standard values, supervisory agencies) 2) Confirmation of execution methods (impact from works vehicles) 3) Existence of future pollution in light of traffic demand forecast and exhaust standards
2	Water quality	1) Water quality standards 2) Impact during works (surface water, groundwater) 3) Impact after going into service (surface water, groundwater)	1) Legislation (standard values, supervisory agencies) 2) Confirmation of execution methods (types of wastewater arising from works, methods of treatment) 3) Confirmation of drainage facility plans
3	Solid wastes	1) Treatment standards for industrial wastes, etc. 2) Methods of disposing of solid wastes arising from the construction works	1) Legislation (standards, supervisory agency) 2) Execution methods (cases of existing works)
4	Noise and vibration	1) Environmental standards 2) Impact during works 3) Impact after going into service	1) Legislation (standard values, supervisory agencies) 2) Confirmation of execution methods (slope excavation, etc.), impacted facilities, houses, etc.
2. Natural environment			
1	Ecosystem	1) Endangered species, etc. 2) Contents of regulations related to development activity	1) Hearing with the Environmental Management Agency
2	Topography and geology	1) Impact during works 2) Location and scope of borrow pits and soil dumps	1) Execution methods (cutting, filling, transport methods, disposal methods, etc.) 2) Hearing with the road manager
2. Social environment			
1	Involuntary resettlement of residents	1) Scope and scale of involuntary resettlement of residents and land acquisition 2) Legal systems	1) Confirmation of the scope and scale through site reconnaissance 2) Legislation (procedures, compensation, supervisory agency) 3) Past compensation experience 4) Inventory survey, livelihood survey ※ Concerning 2)~4), implement if land acquisition or involuntary resettlement of residents arises
2	Lifestyle and livelihood	1) Scope and scale of involuntary resettlement of residents and land acquisition 2) Compensation system	1) Confirmation of the scope and scale through site reconnaissance 2) Legislation (procedures, compensation, supervisory agency) 3) Past compensation experience 4) Inventory survey, livelihood survey Concerning 2) ~ 4), implement if land acquisition or involuntary resettlement of residents arises
3	Work environment	1) Safety measures	1) Execution methods (temporary installations, slope protection, closure to traffic, detours, traffic guidance, etc.) 2) Hearings with related persons 3) Survey of similar projects
3. Others			
1	Impact during works	1) Safety measures during works (impacts on nearby residents, etc.) 2) Safety measures in service (traffic safety)	1) Execution methods (works period, works days and times of the day, number of works vehicles, etc.) 2) Traffic volume, running speed, safety signs, etc.




Source: JICA Survey Team




(8) Results of Environmental and Social Consideration Study



Conditions on each part of the target section of the Study and noteworthy items in terms of environmental and social consideration are described below.



At this time, the target section covered by Grant Aid for the Project is planned to be section 11 to 13, and for sections 1 to 10, implementation of assistance by Japanese Grant Aid is undecided.


Section No.	1	Distance (Km peg)	259+500 – 262+000	Section length	2.50 km
Road conditions	Numerous accidents occur on this section because vehicles go so fast they are unable to handle the downhill S-shaped curve in the direction of Chirundu.				
					
Source: Google Earth Pro					
Noteworthy items in terms of environmental and social consideration	Although Mike Village and other communities are close to the road in Nyamakate district (264+400 area) in the direction of Chirundu, there are no permanent structures inside the RoW (70 meters from the center line on both sides) that require relocation. Meanwhile, according to a hearing with the Village Head of Mike, it is possible that the community cemetery may need to be moved depending on the alignment plan (road widening, etc.).				



Section No.	2	Distance (Km peg)	269+300 – 271+000	Section length	1.70 km
Road conditions	S-shaped curve in the direction of Chirundu				
					
Source: Google Earth Pro					
Noteworthy items in terms of environmental and social consideration	In Nyamakate district, an Offer Letter granting rights to use state-owned land (safari area) was offered to former tenants of agricultural plantations that were owned by white owners in line with the government's resettlement policy following independence in 1980. As a result, a number of small-scale communities are dotted around this area. Although a number of permanent structures and farmland can be seen inside the RoW, these can be avoided in the alignment plan. On the left side of the road the direction of Chirundu, there is a sign cautioning drivers to take care inside the local safari area (Charara SA) (around 270+500).				



Section No.	3	Distance (Km peg)	271+000 – 276+200	Section length	5.20 km
Road conditions	Section of continuous curves the direction of Chirundu				
					
			Source: Google Earth Pro		
Noteworthy items in terms of environmental and social consideration	<p>The target road passes through a safari area.</p> <p>If the road is widened on curved sections inside valleys, it will be necessary to conduct a certain degree of cutting, filling and tree cutting in places.</p> <p>It is not forecast that inhabitants will be affected by relocation of permanent structures or farmland and so on caused by the Project.</p>				

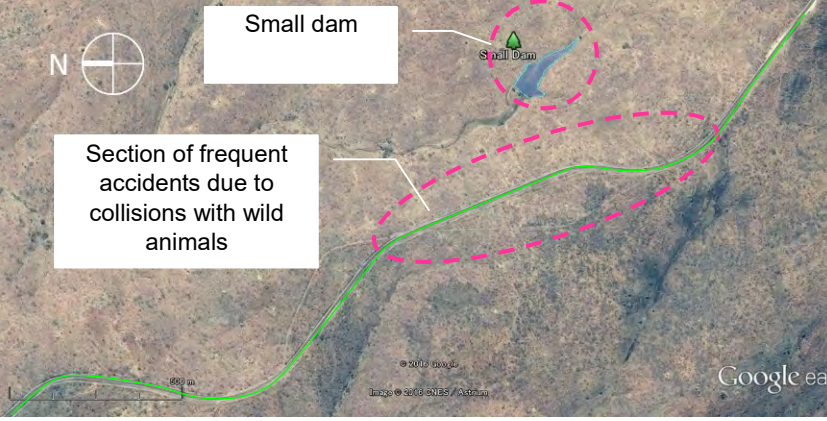


Section No.	4	Distance (Km peg)	276+600 – 277+700	Section length	2.10 km
Road conditions	Section of S-shaped curves in the direction of Chirundu				
					
Source: Google Earth Pro					
Noteworthy items in terms of environmental and social consideration	<p>The target road passes through a safari area.</p> <p>If the road is widened on curved sections inside valleys, it will be necessary to conduct a certain degree of cutting, filling and tree cutting in places.</p> <p>It is not forecast that inhabitants will be affected by relocation of permanent structures or farmland and so on caused by the Project.</p>				

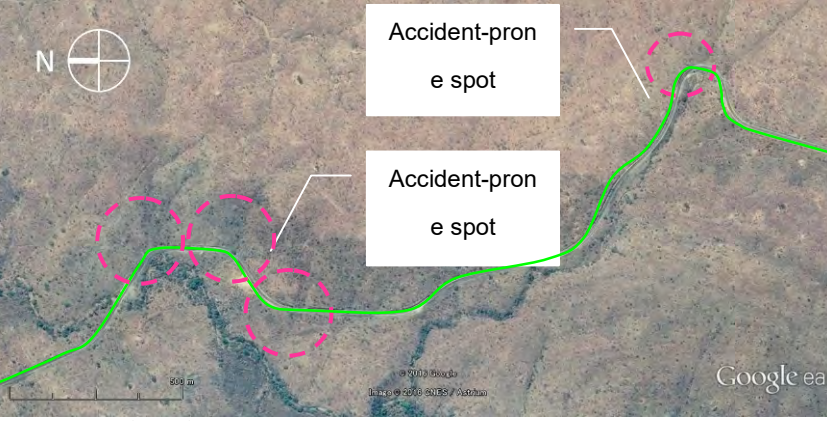


Section No.	5	Distance (Km peg)	77+400 – 279+500	Section length	2.10 km
Road conditions	S-shaped curve in the direction of Chirundu				
					
Source: Google Earth Pro					
Noteworthy items in terms of environmental and social consideration	<p>The target road passes through a safari area. There is a sign that cautions drivers to take care regarding crossing wild animals (around 278+200).</p> <p>If the road is widened, it will be necessary to conduct a certain degree of cutting, filling and tree cutting in places.</p> <p>It is not forecast that inhabitants will be affected by relocation of permanent structures or farmland and so on caused by the Project.</p>				



Section No.	6	Distance (Km peg)	279+500 – 280+200	Section length	0.70 km
Road conditions	S-shaped curve in the direction of Chirundu				
					
Source: Google Earth Pro					
Noteworthy items in terms of environmental and social consideration	<p>The target road passes through a safari area.</p> <p>If the road is widened, it will be necessary to conduct a certain degree of cutting, filling and tree cutting in places.</p> <p>It is not forecast that inhabitants will be affected by relocation of permanent structures or farmland and so on caused by the Project.</p>				

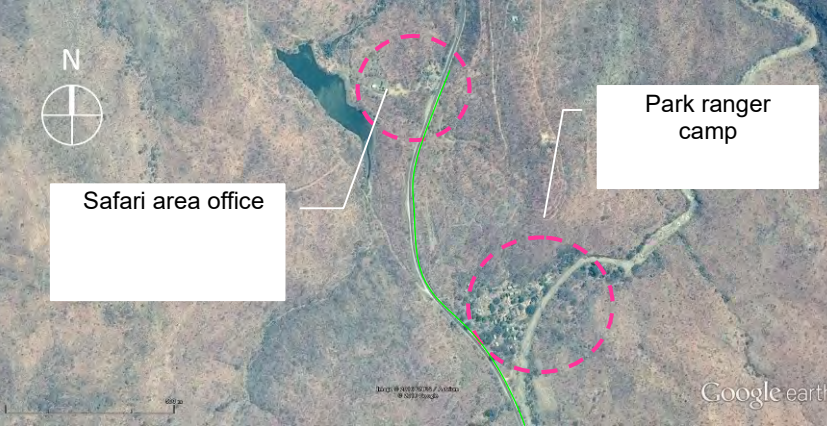


Section No.	7	Distance (Km peg)	282+200 – 284+300	Section length	2.10 km
Road conditions	S-shaped curve in the direction of Chirundu				
 <p>Source: Google Earth Pro</p>					
Noteworthy items in terms of environmental and social consideration	<p>If the road is widened on curved sections inside valleys, it will be necessary to conduct a certain degree of cutting, filling and tree cutting in places.</p> <p>It is not forecast that inhabitants will be affected by relocation of permanent structures or farmland and so on caused by the Project.</p> <p>During the field survey in October 2016, wild fires were observed having been caused by discarded cigarettes from vehicle drivers.</p>				



Section No.	8	Distance (Km peg)	289+000 – 291+000	Section length	1.00 km
Road conditions	This section passes through the town of Makuti. Parking space is required for vehicles for use in police checkpoint.				
 <p>Source: Google Earth Pro</p>					
Noteworthy items in terms of environmental and social consideration	<p>The target road passes through the town of Makuti.</p> <p>Although a hotel and gasoline station can be seen inside the RoW (around 291+000), these can be avoided in the alignment plan.</p> <p>A permanent checkpoint is established on the road in front of the police facilities (around 289+000), and this causes vehicles to build up on the road. Accordingly, establishment of a parking area is requested.</p>				

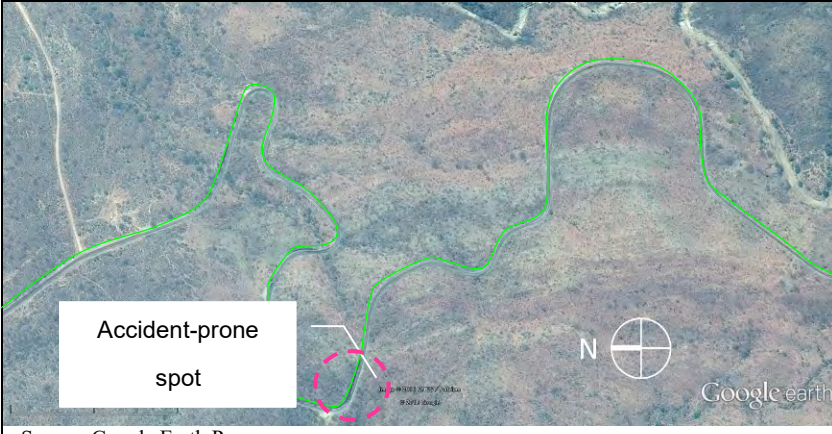

Section No.	—	Distance (Km peg)	297+000 – 300+000	Section length	3.00 km
Road conditions	On this section, numerous accidents are caused by vehicles clashing with wild animals trying to cross the road.				
					
Noteworthy items in terms of environmental and social consideration	<p>The target road passes through a safari area.</p> <p>There is a small dam that is used as a watering spot by animals on the right side of the road in the direction of Chirundu, and numerous accidents are caused by vehicles clashing with wild animals trying to cross the road.</p> <p>It is not forecast that inhabitants will be affected by relocation of permanent structures or farmland and so on caused by the Project.</p>				

Section No.	9	Distance (Km peg)	300+500 – 303+000	Section length	2.50 km
Road conditions	This section has continuous downhill sharp curves in the direction of Chirundu. Most accidents occur on this section as a result of vehicles not being able to handle the S-shaped curve.				
					
Noteworthy items in terms of environmental and social consideration	<p>Out of the target section of road, this section has the most accidents.</p> <p>According to hearings with the police in Makuti, in the past, there was a time when accidents entailing vehicles being unable to handle the S-shaped curve and crashing into side walls occurred five times in two hours in the same spot during rainfall. Numerous remains of crashed vehicles are scattered around the roadside. If the road is widened on curves, it will be necessary to conduct a certain degree of cutting, filling and tree cutting in places.</p>				

Section No.	10	Distance (Km peg)	303+900 – 304+600	Section length	0.70 km
Road conditions	Downhill S-shaped curve in the direction of Chirundu				
					
Source: Google Earth Pro					
Noteworthy items in terms of environmental and social consideration	<p>The target road passes through a safari area.</p> <p>If the road is widened, it will be necessary to conduct a certain degree of cutting, filling and tree cutting in places.</p> <p>It is not forecast that inhabitants will be affected by relocation of permanent structures or farmland and so on caused by the Project.</p>				

Section No.	11	Distance (Km peg)	305+800 – 307+500	Section length	1.70 km
Road conditions	Downhill curve in the direction of Chirundu				
					
Source: Google Earth Pro					
Noteworthy items in terms of environmental and social consideration	<p>The target road passes through a safari area. The safari area office and park ranger's camp are situated along the road.</p> <p>If the road is widened, it will be necessary to conduct a certain degree of cutting, filling and tree cutting in places.</p> <p>It is not forecast that inhabitants will be affected by relocation of permanent structures or farmland and so on caused by the Project.</p>				

Section No.	12	Distance (Km peg)	307+500 – 308+200	Section length	0.70 km
Road conditions	Downhill S-shaped curve in the direction of Chirundu				
					
Noteworthy items in terms of environmental and social consideration	<p>The target road passes through a safari area. A hill-climbing lane has been established on some parts. If the road is widened, it will be necessary to conduct a certain degree of cutting, filling and tree cutting in places.</p> <p>It is not forecast that inhabitants will be affected by relocation of permanent structures or farmland and so on caused by the Project.</p>				

Section No.	13	Distance (Km peg)	309+300 – 313+600	Section length	4.30 km
Road conditions	This section contains Zambezi Hill, which comprises continuous downhill sharp curves in the direction of Chirundu.				
					
Noteworthy items in terms of environmental and social consideration	<p>The target road passes through a safari area. This is the most difficult part of the Project target section, which contains a series of curves with small turning radius, however, maybe because vehicles slow down here, it doesn't experience many accidents.</p> <p>If the road is widened, it will be necessary to conduct a certain degree of cutting, filling and tree cutting in places.</p> <p>It is not forecast that inhabitants will be affected by relocation of permanent structures or farmland and so on caused by the Project.</p>				


(9) Evaluation of Impacts and Comparative Examination of Mitigation Measures

1) Evaluation of impacts

The following table shows the results of the evaluation of environmental and social consideration impacts in line with project implementation, based on the results of the environmental and social consideration impact study. At this time, the target section covered by Grant Aid for the Project is planned to be section 11 to 13, and for following evaluation of impacts, mitigation measures and environmental and social consideration check list, only the target section covered by Grant Aid for the Project will be evaluated and examined.

Table 2-1-26 Evaluation of Impacts

No.	Impact item	Impact evaluation at time of scoping		Impact evaluation based on survey results		Reason for evaluation
		During works	In service	During works	In service	
1. Pollution countermeasures						
1	Air quality	B-	D	B-	D	<p>[During works]</p> <ul style="list-style-type: none"> A certain degree of impacts are envisaged due to dust and exhaust gases from works vehicles. <p>[In service]</p> <ul style="list-style-type: none"> There will be no increase in traffic volume due to the project, and no further worsening of air pollution can be envisaged.
2	Water quality	B-	B-	B-	B-	<p>[During works]</p> <ul style="list-style-type: none"> Impact on local water quality (surface water and groundwater) from wastewater associated with the concrete works and paving works can be envisaged. <p>[In service]</p> <ul style="list-style-type: none"> Impact on local water quality (surface water and groundwater) due to road drainage can be envisaged.
3	Solid wastes	B-	D	B-	D	<p>[During works]</p> <ul style="list-style-type: none"> Generation of solid wastes, residual soil, waste materials, etc. can be envisaged from works sites. <p>[In service]</p> <ul style="list-style-type: none"> There will be no increase in traffic volume due to the project, and no further increase of solid wastes can be envisaged.
4	Noise and vibration	B-	D	B-	D	<p>[During works]</p> <ul style="list-style-type: none"> When blasting work (using explosives) is adopted as a construction method of the drilling work on slopes, noise and vibration impacts can be envisaged. <p>[In service]</p> <ul style="list-style-type: none"> There will be no increase in traffic volume due to the project, and no further worsening of noise and vibration can be envisaged.
2. Natural environment						

No.	Impact item	Impact evaluation at time of scoping		Impact evaluation based on survey results		Reason for evaluation
		During works	In service	During works	In service	
1	Nature preserve	D	D	D	D	<ul style="list-style-type: none"> The target road of the project does not go near any national parks or bird nature protected areas (sanctuaries) that are subject to flora and fauna protection regulations.
2	Ecosystem	C	C	B-	B-	<p>[During works]</p> <ul style="list-style-type: none"> Because the project target road passes through wildlife habitats, it is envisaged that collisions will sometimes occur between works vehicles and wild animals crossing the road. Although trees will be cut inside the ROW, no major ecological impacts can be envisaged. There is a possibility that careless handling of cigarettes, etc. by workers could lead to wildfires and major ecological consequences. <p>[In service]</p> <ul style="list-style-type: none"> Because the project target road passes through wildlife habitats, it is envisaged that collisions will sometimes occur between vehicles traveling along the road and wild animals crossing the road. There is a risk that installation of fences or guardrails, etc. to prevent movement of wild animals onto the road could impart serious ecological impacts.  <p>Photograph: Sign urging drivers to beware of animals crossing the road (near 278+200)</p>
3	Water environment	D	D	D	D	<p>[During works]</p> <ul style="list-style-type: none"> There are no river tributaries, etc. around the project target section that could trigger deterioration of water quality in downstream areas. Although water intake from reservoirs and sand extraction from around rivers will arise in line with 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. <p>[In service]</p> <ul style="list-style-type: none"> No impacts on the local water environment can be envisaged.
4	Topography	B-	B-	B-	B-	[During works]

No.	Impact item	Impact evaluation at time of scoping		Impact evaluation based on survey results		Reason for evaluation
		During works	In service	During works	In service	
	and geology					<ul style="list-style-type: none"> It is possible that cutting and filling will arise in line with improvements such as road widening due to addition of another lane, alteration of road alignment on sharp curves and so on. Concerning the quarry sites and borrow pits, existing borrow pits that are in operation by the DoR and have acquired authorization will be used. As for the surplus soil from construction, the soil will be used for embankment inside the road servitude, so any soil dumping sites will not be required. <p>[In service]</p> <ul style="list-style-type: none"> No impacts on the topography and geology can be envisaged.
3. Social environment						
1	Involuntary resettlement of residents	C	C	D	D	<p>[During works]</p> <ul style="list-style-type: none"> Since the target section of the Study is designated as nationally owned land, as a rule, land acquisition is not envisaged. There are no housing facilities or farmland in the target section of the Study, so no involuntary resettlement of residents can be envisaged. It will be necessary to borrow some land (around 1 hectare) for storing equipment and materials during works. [In service] There are no housing facilities or farmland in the target section of the Study, so no involuntary resettlement of residents can be envisaged.
2	Lifestyle and livelihood	C	C	D	D	<p>[During works]</p> <ul style="list-style-type: none"> There are no housing facilities or farmland in the target section of the Study, so no impacts on lifestyle and livelihood can be envisaged. <p>[In service]</p> <ul style="list-style-type: none"> There are no housing facilities or farmland in the target section of the Study, so no impacts on lifestyle and livelihood can be envisaged.
3	Cultural heritage	D	D	D	D	<ul style="list-style-type: none"> As a result of investigation of buried cultural heritage at the EIA conducted by the government of Zimbabwe, there is no particular cultural heritage, etc. that require consideration.
4	Landscape	D	D	D	D	<ul style="list-style-type: none"> There are no areas that require landscape consideration around the target section of the Study.
5	Ethnic minorities and indigenous people	D	D	D	D	<ul style="list-style-type: none"> There are no ethnic minorities or indigenous people that require consideration around the target section of the Study.

No.	Impact item	Impact evaluation at time of scoping		Impact evaluation based on survey results		Reason for evaluation
		During works	In service	During works	In service	
6	Work environment	B-	D	B-	D	[During works] <ul style="list-style-type: none"> Because the project target road passes through a safari area, it will be necessary to take steps such as assigning rangers to prevent workers from getting attacked by wild animals. Since it is possible that works on the target section of the Study will entail earthworks on steep cliff sections, excavation of slopes using explosives, etc., and so on, it will be necessary to show special care regarding safety management of workers.
4. Others						
1	Impact during works	B-	D	B-	D	[During works] <ul style="list-style-type: none"> Traffic accidents must be prevented from happening during the works through establishing appropriate detours, guiding traffic and so on.
2	Monitoring	B+	B+	B+	B+	[In service] <ul style="list-style-type: none"> It will be necessary to monitor the project effects regarding reduction of traffic accidents, changes in traffic volume, and changes in running speed.
A+/- Major positive / negative impacts are projected, B+/- A certain degree of positive / negative impacts are projected, C Impacts are unclear, D There are no positive / negative impacts						

Source: JICA Survey Team

2) Mitigation measures

Concerning the negative environmental social impacts that are envisaged as a result of the above evaluation of impacts, the following mitigation measures and structure for implementing mitigation measures are proposed.

Table 2-1-27 Mitigation measures

No.	Impact item	Mitigation measures	Implementation structure	Cost
I. Pollution countermeasures				
1	Air quality	<ul style="list-style-type: none"> Use works vehicles that comply with exhaust gas standards in Zimbabwe. Cover the cargo beds of equipment and materials haulage vehicles to stop sand and dust from flying off. Appropriately sprinkle water in the immediate area to stop sand and dust from being dispersed by works vehicles and heavy machinery. 	Contractor	N/A
2	Water quality	<ul style="list-style-type: none"> If public water supply and sewerage are not installed for handling sanitary sewage from site offices and other works facilities, utilize appropriate equipment such as oil traps, septic tanks, etc. to stop sewage from entering the public water body. 	Contractor	N/A
		<ul style="list-style-type: none"> Filling and cutting parts are covered with excavated 	Planning stage	110,000

No.	Impact item	Mitigation measures	Implementation structure	Cost
		topsoil and recovered from the local vegetation to prevent soil runoff.	(B/D, D/D) Contractor	USD
3	Solid wastes	· Have a designated operator collect solid wastes from site offices and other works facilities and dispose of them on designated waste disposal sites.	Contractor	N/A
4	Noise and vibration	· Minimize the scope of use of explosives when excavating rocky slopes.	Contractor	N/A
II. Natural environment				
1	Ecosystem	· Since installation of fences, etc. is not permitted due to obstruction of wildlife migration routes and risk of disturbing habitats, install signs to urge drivers to take care in order to prevent collisions, etc. with wild animals.	Planning stage (B/D, D/D)	7,000 USD
2	Water environment	· Water for use in concrete and paving works will be obtained from existing reservoirs that can offer ample volume. · A limited amount of drinking water to be used at the construction camp is taken from the well.	Planning stage (B/D, D/D)	5,000 USD
3	Topography and geology	· Concerning the quarry sites and borrow pits, existing borrow pits that are in operation by the DoR and have acquired authorization will be used. · As for the surplus soil from construction, the soil will be used for embankment inside the road servitude, so any soil dumping sites will not be required. · 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 filling and cutting sections, earth dumps and borrow pits, filling and cutting parts are covered with excavated topsoil and recovered from the local vegetation to prevent soil runoff.	Planning stage (B/D, D/D)	110,000 USD
III. Social environment				
1	Involuntary resettlement of residents	—	—	—
2	Cultural heritage	· National Museums and Monuments of Zimbabwe (NMMZ) will implement survey of buried cultural property (site reconnaissance based on visual observation by an archaeological curator) within the EIA.	Include in the study targets of the EIA	—
3	Landscape	—	—	—
4	Work environment	· Assign rangers to ensure that workers are not attacked by wild animals.	Planning stage (B/D, D/D) DoR	150,000 USD
IV. Others				
1	Impact during works	· Since a certain degree of noise and vibration, muddy water, dust, solid wastes, etc. will be generated in line with the roadworks, conduct water sprinkling to counter dust and thorough management of the solid wastes.	Contractor	Count in “I”

No.	Impact item	Mitigation measures	Implementation structure	Cost
2	Monitoring	· 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.	DoR Contractor	—

Source: JICA Survey Team

(10) Environmental Management and Monitoring Plan (Draft)

The following table describes the environmental management and monitoring plan (draft) in each stage of planning, during works and in service.

Table 2-1-28 Environmental Management and Monitoring Plan (Draft)

Implementation time	Monitoring item	Method	Timing	Implementing body
Planning Phase (Detailed Design)	Compliance with collateral conditions required from EIA	EIA Monitoring report	During design approval	DoR D/D consultant
	Consideration and measures for preventing accidents with wild animals	Agreement with the Parks and Wildlife Management Authority	During design approval	
Construction Phase	Conditions of compliance with the EIA collateral conditions and submission of a regular monitoring report	EIA Monitoring report	Quarterly	DoR SV Consultant Contractor
	Compliance with legislation concerning extraction of construction materials (soil, sand, and gravel)	Monitoring form	During construction planning	
	Residual soil treatment	Monitoring form	During construction planning	
	Measures for prevention of dust in the atmosphere during construction works	Monitoring form	During construction planning	
	Safety measures (transportation routes, times, etc.)	Monitoring form	During construction planning	
	Wastes management · Environmental Management Act (Chapter 20: 27), Sections 69–76 · Waste and Solid Waste Disposal Regulations, SI No. 6 of 2007 · Hazardous Substances, Pesticides and Toxic Substances Regulations, · SI No. 12 of 2007	Monitoring form	During construction planning	
Operational Phase	Compliance with collateral conditions required from EIA and submission of a regular monitoring report	EIA Monitoring report	Quarterly	DoR
	Number and type ⁷ of accidents	Monthly report	Monthly	Local Police (Makuti)

Source: JICA Survey Team

⁷ Self-loss accident, interpersonal / objective accident between vehicles, collision accident with wildlife, etc.

(11) EIA Support

1) EIA support based on the JICA Environmental Guidelines

In the 2nd field survey (mid-February to mid-March 2017) of the Study, support was provided for preparation of the TOR for the EIA consultant tender documents to be implemented by GOZ based on the JICA Environmental and Social Consideration Guidelines (April 2010) (hereafter called the “JICA Environmental Guidelines”). The schedule from announcement through contract for the EIA consultant procurement will be as follows:

- a) Announcement: End of March 2017
- b) Proposal submission deadline: April 30, 2017 (1 month after announcement)
- c) Notification of proposal evaluation results: by May 12, 2017 (within 2 weeks from receipt of the proposal)
- d) Contract negotiations: Middle of May 2017

In addition, the JICA study team conducted the third field survey (from 12th to 21st of May 2017) during the period of contract negotiation. JICA environmental and social consideration expert gave guidance about requirement of the JICA guideline to the EIA consultant. As the result of contract negotiation, the schedule for the EIA study conducted by the GoZ was confirmed as follows:

- e) Submission of Inception Report: by June , 2017
- f) Submission of Prospectus: by July, 2017
- g) Submission of Draft EIA report: by September, 2017
- h) Submission of Final EIA report to EMA: by November, 2017
- i) Approval of final EIA report by EMA: by April, 2018 (expected)

2) Stakeholder discussions opening support

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. Concerning the public consultation implementation method, the legislation in Zimbabwe specifies no concrete contents concerning methods or frequency, etc. Accordingly, in the TOR for tender documents, the following has been specified concerning procurement of the EIA consultants.

Conduct meaningful public consultation with communities and relevant stakeholders in the area of influence of the project at least twice during the environmental assessment process, once at the planning stage and once when the basic design is available for sharing with all stakeholders. Consult all local and national level stakeholders, including Community based organization and national and international NGOs actively working in the area.

3) Resultat of Stakeholder discussions

In the EIA conducted by the government of Zimbabwe, as stakeholder discussions, in addition to sending questionnaires to ministries and agencies concerning the Project and conducting hearing survey, public consultation with community residents (conducted on June 28, 2017) and public comments (period: July 23 - August 31, 2017) by advertisements on two local newspapers were carried out. The breakdown of targets of the stakeholder discussions conducted in the EIA of the Project is as follows.

Table 2-1-29 Targets of stakeholder discussions

No.	Target
1	Ministry of Lands and Rural settlements
2	Ministry of Local Government and Public Works and National Housing – Civil Protection Unit
3	ZRP – Makuti
4	Ministry of Information Communication, technology, Postal and Courier Services
5	Hurungwe Rural District
6	National Parks and Wildlife Authority
7	Transport Operators Association Zimbabwe
8	Zimbabwe National Water Authority (ZINWA)
9	Environmental Management Agency (EMA)
10	Makuti Village Head
11	Community Leaders (Councillor)
12	Telone
13	Zimbabwe Electricity Transmission and Distribution Company (ZETDC)
14	Econet (LIQUID Telecom)
15	MoTID
16	Marongora Community
17	Makuti Tsetse community
18	Makuti Motel
19	The Public - An advert in the Sunday mail and the Financial Gazette

Source : EIA Report by the government of Zimbabwe

The public consultation showed expectations for the reduction of the number of traffic accidents due to improvement of sharp curve points by the Project, and recieved request wishing to hire local residents along with road construction. On the other hand, there were no particular objections against the Project.

(12) Land Acquisition and Involuntary Resettlement of Residents

1) Necessity for Land Acquisition and Involuntary Resettlement of Residents

1-1) Land acquisition

Since all land around the target section of the Study is designated as nationally owned land

including safari areas, there will be no land acquisition in line with the road widening and alignment revisions.

1-2) Involuntary resettlement of residents

The project target section is situated at 300+000~313+600km and is entirely contained in nationally owned land (safari area). Moreover, since this land contains no residential facilities, farmland or other private real estate, involuntary resettlement of residents will not arise at all.

(13) Environmental and Social Consideration Check List

Table 2-1-30 Environmental and Social Consideration Check List

Classification	Environmental item	Main check items	Yes: Y No: N Not applicable: —	Specific Environmental and Social Consideration (Reasons for Yes/No, basis, mitigation measures, etc.)
1 Authorization and explanation	(1) EIA and environmental authorization	(a) Has an environmental assessment report (EIA report, etc.) been prepared? (b) Has the EIA report, etc. been approved by the government of the country concerned? (c) Does approval of the EIA report, etc. entail collateral conditions? If there are collateral conditions, will they be satisfied? (d) In addition to the above, have environmental authorizations been obtained from local responsible authorities where necessary?	(a) N (b) N (c) N (d) N	(a) So far, no EIA report has been prepared for the project target road improvement plan. As of November 2016, the DoR has started the procurement procedure (RFP) for the consultant to implement the EIA. (b) Ditto (c) Ditto (d) Since the project target section passes through a safari area, it will be necessary to conduct advance discussions with the Parks and Wildlife Management Authority. In addition, it will be necessary to undergo survey of buried cultural property by the National Museums and Monuments of Zimbabwe (NMMZ) in the EIA stage, seek permission to use explosives from the Ministry of Mines and Mining Development in the works stage, and obtain permission from the Ministry of Environment, Parks and Wildlife Management Authority, Water Authority, etc. concerning use of sediment borrow pits.
	(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 understanding been obtained? (b) Have comments from residents been reflected in the project contents?	(a) N (b) N	(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. (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.
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?	(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

Classification	Environmental item	Main check items	Yes: Y No: N Not applicable: —	Specific Environmental and Social Consideration (Reasons for Yes/No, basis, mitigation measures, etc.)
		(b) If air pollution around the route already exceeds environmental standards, will the project exacerbate the air pollution? Will air quality countermeasures be taken?		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) In the project, filling and cutting parts are covered with excavated topsoil and recovered from the local vegetation to prevent soil runoff. There are no river tributaries, etc. around the project target section that could trigger deterioration of water quality in downstream areas. (b) In the project, appropriate drainage facilities will be installed to ensure that surface water runoff doesn't pollute sources of groundwater, etc. Moreover, water for use in concrete and paving works will be obtained from existing reservoirs that can offer ample volume. (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 \emptyset standards, etc.?	(a) Y	(a) Zimbabwe has no standards, etc. related to noise and vibration, however, traffic volume on the project target road is limited and the project is not expected to cause increase in the traffic volume; hence it is not envisaged that the project will exacerbate noise and vibration.
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 target road of the project does not go near any national parks or bird nature reserves (sanctuaries) that are subject to flora and fauna protection regulations.
	(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	(a) N (b) Y (c) — (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 registered on the IUCN Red List. (c) No critical ecological impacts are envisaged. (d) Inside safari areas, installation of fences, 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. (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. (f) Ditto

Classification	Environmental item	Main check items	Yes: Y No: N Not applicable: —	Specific Environmental and Social Consideration (Reasons for Yes/No, basis, mitigation measures, etc.)
		<p>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.? 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>		
	(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	(a) Although water intake from reservoirs and sand extraction from around rivers will arise in line with 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.
	(4) Topography and geology	<p>(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?</p> <p>(b) Will filling, cutting and other civil engineering work trigger landslides and earth slips. Are appropriate countermeasures taken 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 taken to prevent soil runoff?</p>	(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 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.</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>As for the surplus soil from construction, the soil will be used for embankment inside the road servitude, so any soil dumping sites will not be required.</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 given 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</p>	(a) N (b) — (c) — (d) — (e) — (f) — (g) — (h) — (i) — (j) —	<p>(a) The project will not entail any land acquisition or involuntary resettlement of residents.</p> <p>(b) — (c) — (d) — (e) — (f) — (g) — (h) — (i) — (j) —</p>

Classification	Environmental item	Main check items	Yes: Y No: N Not applicable: —	Specific Environmental and Social Consideration (Reasons for Yes/No, basis, mitigation measures, etc.)
		<p>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>		
	(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' 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>	(a) N (b) — (c) — (d) N (e) N (f) N	<p>(a) The project entails improvement of an existing road; hence it is not envisaged that existing means of transport and the livelihoods of people engaged in them will be affected.</p> <p>(b) There is no residential land, etc. around the project target section.</p> <p>(c) Since the scale of the project works (road length, execution period) is limited, it is not envisaged that local public health will be seriously impacted.</p> <p>(d) Traffic volume on the project target road is limited; hence it is not envisaged that local road traffic will be negatively impacted during works or in service.</p> <p>(e) The project will entail conducting work while using the existing road; hence it is not envisaged that movement of users will be hindered.</p> <p>(f) The project does not include any structures that block sunlight or radio waves.</p>
	(3) Cultural	(a) Is there any risk that the project will cause harm to archeologically,	(a) N	(a) As a result of investigation of buried cultural heritage at the EIA conducted by the

Classification	Environmental item	Main check items	Yes: Y No: N Not applicable: —	Specific Environmental and Social Consideration (Reasons for Yes/No, basis, mitigation measures, etc.)
	heritage	historically, culturally or religiously important heritage or remains, etc.? Are measures considered in domestic laws in the country concerned?		government of Zimbabwe, there is no particular cultural heritage, etc. that require consideration.
	(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) There are no areas that require landscape consideration around the target section of the Study.
	(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) — (b) —	(a) There are no ethnic minorities or indigenous people that require consideration around the target section of the Study. (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 ensure that the safety of project workers and local residents is not threatened?	(a) Y (b) Y (c) Y (d) Y	(a) The necessary measures will be taken according to work environment legislation in the country concerned. (b) Because the project target road passes through a safari area, steps such as assigning rangers to prevent workers from getting attacked by wild animals will be taken. In cases of dangerous work on steep cliffs and excavation of slopes, etc. using explosives and so on, registered qualified workers who possess the appropriate technology will implement the work, and safety education will be thoroughly implemented for workers. (c) Safety education will be implemented for workers. (d) Since rangers from the local park office of the Parks and Wildlife Management Authority will be deployed, the safety of project workers and local residents will not be threatened.
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) Since a certain degree of noise and vibration, muddy water, dust, solid wastes, etc. will be generated in line with the roadworks, water sprinkling to counter dust will be implemented and solid wastes will be thoroughly managed. (b) The project entails improvement of an existing road; hence it is not envisaged that the works will impart a significant impact on the natural environment (ecosystem). (c) It is not envisaged that the works will impart a significant impact on the social environment.
	(2) Monitoring	(a) Out of the above environmental items, concerning those where impacts are envisaged, will the project proponent plan and implement monitoring?	(a) Y (b) Y (c) 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.

Classification	Environmental item	Main check items	Yes: Y No: N Not applicable: —	Specific Environmental and Social Consideration (Reasons for Yes/No, basis, mitigation measures, etc.)
		(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?	(d) Y	(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) —	(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) —	It is not envisaged that the project will impact environmental issues on the global scale.

Source: JICA Survey Team

(14) Monitoring Form (Draft)

Proposed monitoring form based on the Environmental Management and Monitoring Plan mentioned above is detailed in Appendix.

2-2 Basic Concept of the Project

(1) Superior Objectives and Project Targets

The target road (North-South Corridor, National Highway No. 3) is a part of the Pan African Highway passing north and south of Zimbabwe, and plays an important role as domestic transportation of Zimbabwe and also the connection between ports in South Africa and Mozambique and inland countries. Total 141km of the target road section in the northern section of the North-South Corridor, between Karoi located at about 210 km north-west of the capital Harare and Chirundu located at 351 km on the border with Zambia. About 100km from Karoi toward to Chirundu is a steep section down to Hell's Gate, passing through mountainous area about 10km that drops down about 400 meters from plateau level to lowland of Zambezi River bank. Approximately 38 km after Hell's Gate passes through the Zambezi River bank flatland of approx. altitude 500m above sealevel and connects to the Chirundu Bridge on the border. Despite having many curves and undulations and passing through mountainous area, the target section is a two-way road with single lane on each side. Since a quite number of large transportation vehicles that cannot increase speed when climbing slopes come and go frequently, traffic congestion and traffic accident occur frequently, which impedes smooth passage and has become a major bottleneck for the Corridor. This project aims to improve traffic safety and shorten travelling time by installing hill climbing lanes and improving sharp curves on particularly narrow and dangerous parts of trunk road in northern mountainous areas. And it is expected to contribute to the social/economic development of Zimbabwe and ZIM ASSET. Based on the above, the superior objectives and project targets are as follows.

- Superior Objectives

- Improvement of the smoothness and safety of the North-South Corridor, which is a major artery of physical distribution passing from southern Africa to Zambia.

- Project Targets

- Reduction of traffic accidents and traveling time by improvement of the traffic environment of target road in the northern mountainous part of the North-South Corridor.

(2) Outline of the Project

The Request by GOZ is to implement improvements on the priority section for road improvement by adding hill climbing lanes and improving sharp curves. The priority section, located in 141 km section in the northern part of the North-South Corridor, starts at the central post office in Harare, via Karoi 210 km in the direction of Zambia, Makuti at 290 km, and Hell's Gate at 313 km and terminates at Chirundu at 351 km on the border with Zambia. In this survey, in order to achieve the above objectives, the priority section was confirmed and narrowed down in the 1st field survey covering 141km (October 2016), and 13.6 km section between Makuti and Hell's Gate (12.5 km + start/end transition section) was evaluated as priority section for improvement and investigated as a subject of the 2nd field survey (February 2017). Regarding the

examination of specifications of plans for road improvement, basic specifications of the design was consulted with Zimbabwean side during the 2nd field survey; and the result was confirmed with a Technical Note and signed on both sides.

Regarding setting of the target scope of the Project, study of the project environment was conducted based on the Technical Note, and information from a survey of potential candidate sites for borrow pit and quarry between Harare-Chirundu currently implemented by DOR. An outline design and project cost calculation was carried out with the project target section as 6.5 km (high priority section) between Park & Wildlife office and Hell's Gate (306.5 - 313.0 km), which was a part of the scope of the 2nd field survey 13.6km (300.0 – 313.6km).

2-3 Outline Design of the Japanese Assistance

2-3-1 Design Policy

(1) Basic Concept

Taking into account the request of GOZ and the findings of the field surveys and discussions with related parties, the basic concept of the design will be to secure the safe and smooth flow of traffic. The basic policies for achieving this are as indicated below.

- ① The road will meet Zimbabwean design criteria as a trunk road.
- ② The road will be planned to fit within the overall North-South Corridor including other sections.
- ③ The plan will be examined to fit within the existing right of way (the existing route will be traced, existing pavement and structures will be utilized as far as possible).
- ④ Impacts on the social/natural environment will be examined with consideration to passage of Safari Area and appearance of wild animals.
- ⑤ Traffic volume and characteristics (large vehicles, small vehicles, bus traffic, long-distance driving, etc.) and related plans (Other sections of the North-South Corridor and example of similar road improvement projects in recent years) will be examined and reflected in the design.
- ⑥ Based on the findings of the natural conditions survey, facilities will be planned and designed to correspond to the natural conditions.
- ⑦ Plans will be examined with consideration to traffic safety including installation of safety facilities and so on.
- ⑧ The implementation schedule will be compiled in view of weather conditions, and diversions for minimizing the impact on existing traffic will be planned.
- ⑨ Materials will be selected with a view to utilizing local materials and products and in consideration of cost, ease of execution, quality, and procurement reliability.
- ⑩ Project cost will be reduced upon securing the necessary functions and durability.
- ⑪ The road will be planned which can contribute in good condition over the long term by conducting simple maintenance.

2-3-2 Basic Plan

(1) Overall Plan

1) Scope and Scale of the Project

The scope of the Project is a continuous section covering the sections 13 to 11 on the Table 1-1-1 of original request by Zimbabwean side (6.5km between 306.5 and 313.0km from Harare), which climbing the steep slope that continued to Harare direction from the lowland side end of escarpment (Hell's Gate, 313km point). For this section, in order to ensure road smoothness and safety, hill climbing lanes will be added and sharp curves will be improved, and road drainage facilities and accessory structures etc. will be installed. Outline of road plan assumed in this plan, such as section / specification, is shown below.

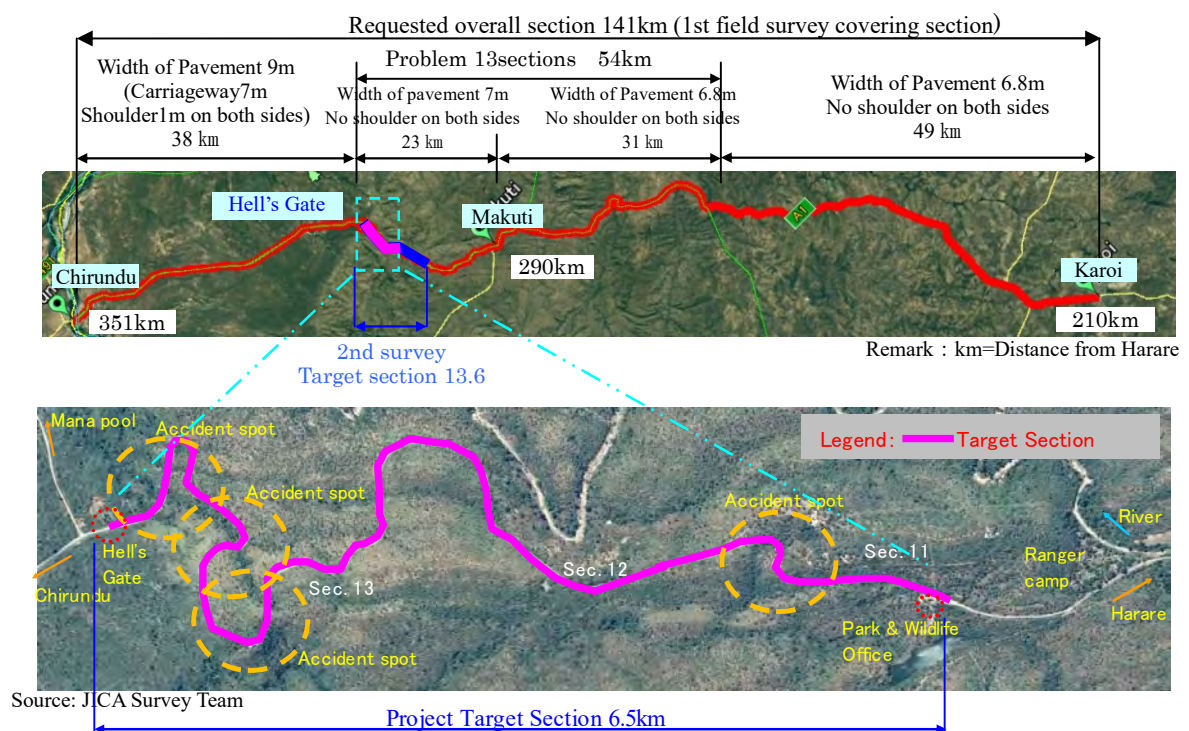


Figure 2-3-1 The Project Coverage Section (6.5km)

2) Outline of the Basic Plan

Design was examined and the plan was determined based on the above basic concept, the outline of the plan is shown below. In the field survey, contents of the plan were studied by confirming local conditions such as existing pavement, drainage facility, incidental facility, traffic, rain type, temperature / sunshine, vegetation etc, and by analyzing and organizing existing information and the results of consultation with the related parties. Also, each item of the assumed plan was consulted and confirmed with Zimbabwean side, summarized as a Technical Note showing the basic specifications, and the contents of the Technical Note were agreed and signed by both sides during the 2nd field survey.

- Improvement of current narrow-width road and unpaved road shoulder to width 3.5m carriage lane and 2.5m paved shoulder as requested by Zimbabwean side
- Addition of width of 3.5m hill climbing lane to steep section (all target distance)
- Improvement of sharp curve spots (application of design speed 60 (40) km and widening for curved section in accordance with radius)
- Installation of road drainage facilities to ensure road function (extension of existing transverse drain pipe, addition of gutter)
- Installation of road incidental facilities and safety facilities such as signs and protective walls etc. in order to secure a safe and smooth traffic flow.

Table 2-3-1 Basic specifications of the Project

Planned item	Unit	Adopted Value		Note
Road Reserve Width	m	70 (35m on each side from the existing road center)		(Right of way, ROW)
Width of Lane	m	3.5		Basic number of lane: 2
Climbing Lanes Width	m	3.5		Refer to the Standard Cross Section
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/h r	60 [40 for partial spots]		
		60 km/hr	40 km/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	—	Asphalt Surface Treatment		Main line=2 layers, Shoulder=1 layer
Design life of pavement	Year	15		
Rain Intensity	Year	Major facilities:20years,Others:5years		Drainage facility plan
Ancillary road structures	—	Concrete Curbstone, Concrete retaining walls, Safety barriers, Traffic signals, Road marking, Delineator, Parking area 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 Survey Team

(2) Design Conditions

1) Design Standards

The design standards of Zimbabwe are issued in 1987 and outdated, and now the Southern Africa Transport and Communications Commission (SATCC) standards are commonly used for Geometric Design of Trunk Roads, will therefore be applied to the design of the Project in principle. In addition, regarding matters not stated in the STACC standards, it is supposed to be complemented by Japanese standards ("Commentary and Application on the Road Structure Ordinance, June 2015, The Japan Road Association"), South African Standards and American

Association of State Highway and Transport Officials (AASHTO).

Table 2-3-2 Adopted design standards

Road design	•SATCC (Code of Practice for the Geometric Design of Trunk Roads) •JAPAN Standard (Road Structure Ordinance)
Drainage design	•Drainage Manual 6 th Edition (South African) •JAPAN Standard (Road Earthwork Guidelines)
Pavement design	•SATCC (Code of Practice for the Design of Road Pavements) •AASHTO (GUIDELINES FOR 1993 AASHTO PAVEMENT DESIGN)
Structure design	•SATCC (Code of Practice for the Design of Road Bridges and Culverts) •JAPAN Standard (Road Earthwork Guidelines)
Traffic sign	•SATCC (Road Traffic Signs Manual) •SADC (Road Traffic Signs Manual)

Source: JICA Survey Team

2) 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 in consideration of cost due to large-scale earth work and increase in environmental load etc. Since the design speed of 40 km / hr is not described in the SATCC standards, it conforms to the Road Structure Ordinance of Japan. The basic values of the geometric structure of the relevant curve radius, sight distance, etc. are shown in Table 2-3-1.

(3) Geometric structure

1) Road vertical alignment

Points of attention for vertical alignment plan in this project are as follows.

- Regarding vertical slope, vertical plan will be prepared to trace existing road.
- The Base/Subbase will be raised in some section according to the pavement design.

Incidentally, the longitudinal slope maximum value of the existing road is 7.6% and the minimum value is 0.08%. In this plan, tracing the existing road without changing vertical profile significantly is considered for suppression of increase in costs and environmental load caused by large-scale earth work. As the result of study, the maximum gradient is 7% (within design speed 40 km / hr) and minimum gradient is 0.08%.

2) Road horizontal alignment

Points of attention for horizontal alignment in this project are as follows.

- Alignment will be fit within the ROW (35m on each side from the existing road center).
- Basically horizontal alignment conforms to the design speed $V = 60\text{km / hr}$, however, in the section where the large-scale earthwork occurs when securing alignment of the prescribed design speed, the design speed of horizontal alignment will be set at $V = 40\text{km / hr}$.
- Existing Culvert will be extended basically on one side (horizontal alignment will be planned not to be extended on both sides).
- Considering the ease of construction, road widening will be planned on cutting side if possible as not to become a high filling which require ground survey and sensitive works (filling height 10m or more).

- Existing retaining wall (located at around 311km), is planned not to be touched, considering of prolonged construction due to removal and reinstallation of retaining wall.

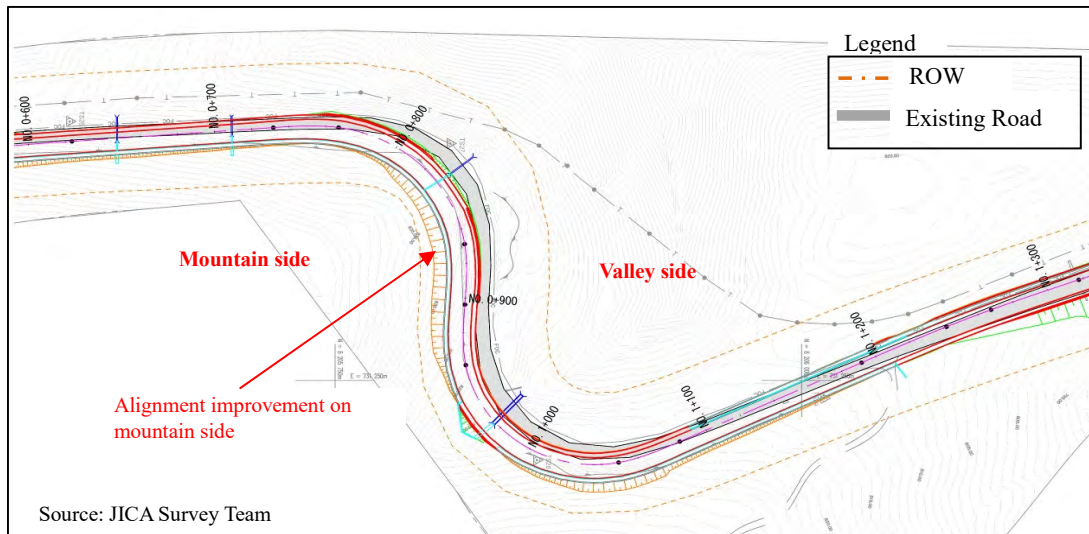


Figure 2-3-2 Example of alignment improvement 307.1~307.8 (Design speed =40 km/hr section)

3) Width of carriageway, climbing lane and shoulder

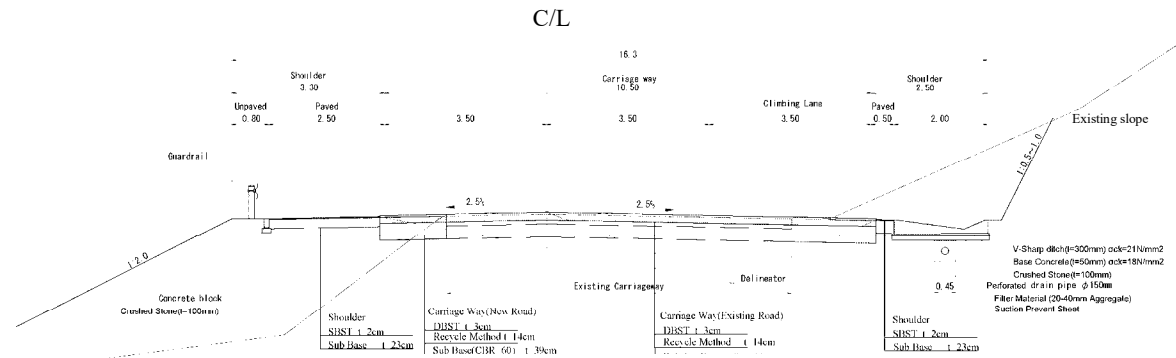
Zimbabwean side request specifies the width of carriageway to improve from old Zimbabwean road standards for width of carriageway 7/10 (Seven in ten = two lanes of 3.5m width on one side + 1.5m unpaved shoulder on each side) to a structure of the current standards 10/10 (Ten in ten =two lanes of 3.5m width on one side + 1.5 m paved shoulder sides on each side) and also a structure with hill climbing lanes of 3.5m added to 10/10. Also, in the letter from Zimbabwean side on narrowing down of the priority section in January 2017, a request for consideration of applicability of multiple lanes is indicated. Furthermore, at the time of the 2nd field survey, there was a request from DOR to consider examining 3 lanes between Hell's Gate and the Park & Wildlife office.

With regard to multiplication of lanes of target road, as a result of the traffic survey in this survey at Chirundu bordering Zambia which is similar traffic condition to the target section, total traffic volume of bothe direction is about 700 vehicles/ day with traffic volume of 78 vehicles / hour at peak time. Based on the traffic volume at peak time, when estimating the predicted value after 30 years at traffic elongation rate of 4.5%, the capacity of two lanes in two directions does not reach 2500 pcu / hour, so two lanes in two directions + hill climbing lane are reasonable for the target road. The necessity of the section adding hill climbing lane was confirmed by the topographic condition of the target section (see below), and the whole section is confirmed to be converted to 3 lanes.

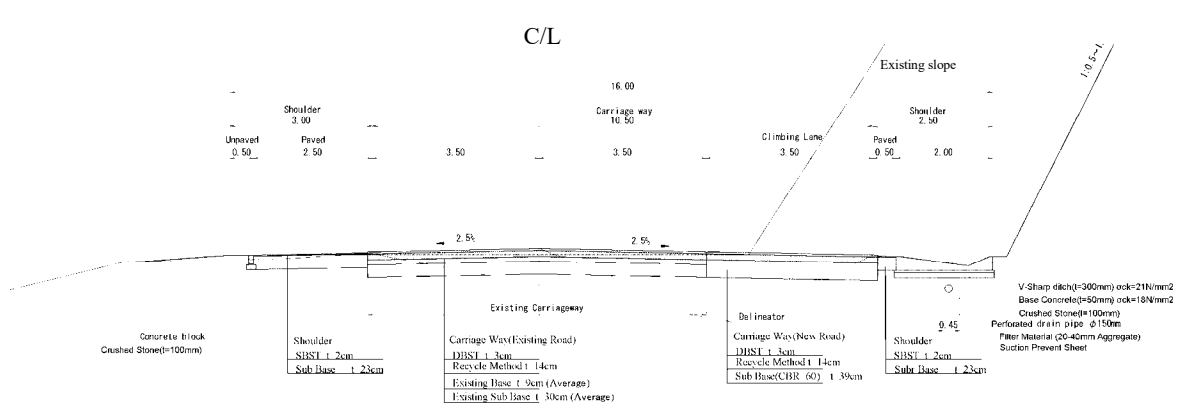
Regarding width of road shoulder, in consultation with DOR in February 2017, large-vehicle mixing ratio in the target road was very high (80% or more), extension of the width of shoulder was requested to be changed from 1.5m to 2.5m so that these vehicles can evacuate safely in case of emergency. In consideration of the results of the field survey and the above, the width

configuration was decided as shown in Figure 2-3-3 Standard Road Cross-section, to achieve traffic smoothness and safety improvement, upon considering standard road cross-section in this project.

Cut and Fill Section (2 lanes + Climbing lane)



Cut Section (2 lanes + Climbing lane)



Source: JICA Survey Team

Figure 2-3-3 Standard Road Cross-section

4) Installation of hill climbing lane

4-1) Installation section

The confirmation of the sections which require hill climbing lane was examined based on the actual measurement value and calculated value of the large vehicle speed using the speed gradient chart shown below. Based on the STACC standards, the speed decreasing sections where the speed becomes 40 km / hr or less were the 5 sections in the figure below. In addition, the installation sections were examined considering not to hinder smoothness and safety due to rapid change of lane due to close proximity of the climbing lane cutoff section of these five sections. The sections assumed to be added hill climbing lane are thought to be necessary for the above reason, for 6.5 km between Hell's Gate and Park & Wildlife office, and after that for Harare side section, and these sections are three - lane structure in appearance.

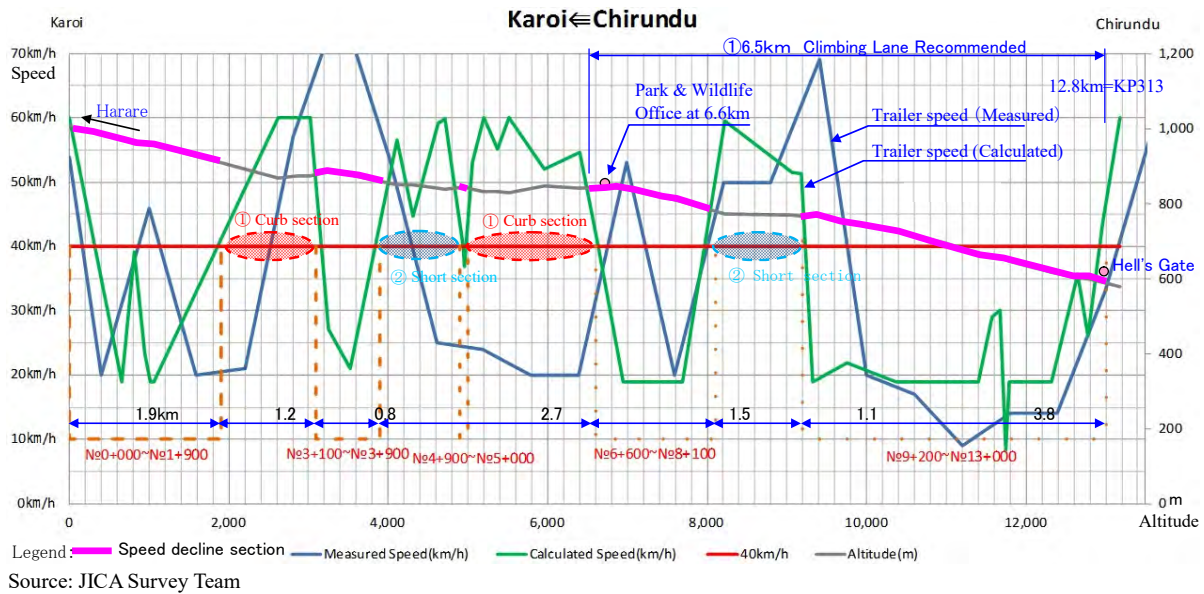


Figure 2-3-4 Vehicle speed chart and sections assumed to be added hill climbing lane

4-2) Installation type

In this project, in a section where the traveling speed of passing large-sized vehicles decreases to 20 km / hr or less, there is concern that the safety may be lowered due to retraction and merging of low speed vehicles for the conventional hill climbing lane system that adds a lane to the outside. Accordingly, the overtaking lane additional method (right side additional lane method), which is the method that small cars with high flexibility of vehicle speed adaptation overtake and can be expected to improve safety, was examined.

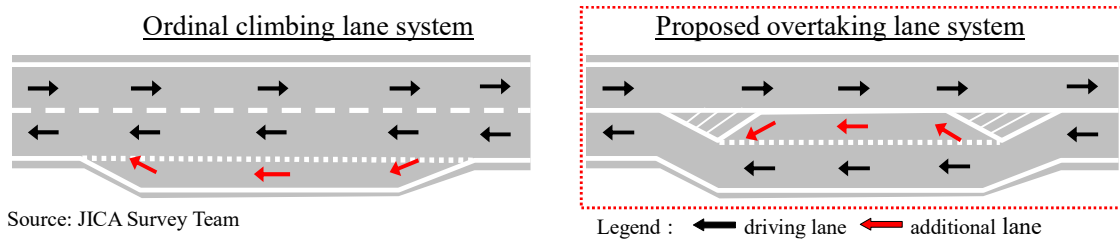


Figure 2-3-5 Image of additional lane methods

5) Curve widening and sight distance widening

The curve widening width per one lane according to the curve radius is shown on the Table 2-3-3. Basically it conforms to SATCC, however since there is no description in STACC about the small curve radius (R = 50m - 110m) at the design speed of 40 km / h section, it was planned according to Japan's Road Structure Ordinance.

Table 2-3-3 Curve widening

Curve Radius (m)	Curve Widening (m)
50~	0.75
60~	0.5
110~	0.4
125~	0.3
250~	0

Source: JICA Survey Team

Also, in the curved section, the cutting slope may be an obstacle to the sight distance, therefore it was confirmed whether the sight distance according to design speed was secured. Since the sight distance is secured in all curve sections as a result of the calculation, the design was done without sight distance widening. Calculation results of the sight distance widening are shown below.

Table 2-3-4 Confirmation of necessary sight distance

Location	Cut or Fill	Curve Direction	Curve Radius [m]	Typical Width (a)	Curve Widening (b)	Total Width (c=a+b)	Sight Distance (d)	Necessary Width (e)	Judgement (c>e= OK)
0 + 308	Fill	Left	300	6.25	0.00	6.25	–	–	OK
0 + 526	Cut	Right	1000	4.25	0.00	4.25	50	0.31	OK
0 + 767	Cut	Right	80	4.25	0.25	4.50	50	3.87	OK
0 + 939	Fill	Left	70	6.25	0.25	6.50	–	–	OK
1 + 242	Fill	Right	800	4.25	0.00	4.25	–	–	OK
1 + 523	Fill	Left	800	6.25	0.00	6.25	–	–	OK
1 + 781	Fill	Right	220	4.25	0.15	4.40	–	–	OK
2 + 353	Fill	Right	150	4.25	0.15	4.40	–	–	OK
2 + 546	Cut	Left	200	6.25	0.15	6.40	80	3.99	OK
2 + 934	Cut	Left	170	6.25	0.15	6.40	50	1.83	OK
3 + 428	Fill	Right	75	4.25	0.25	4.50	–	–	OK
3 + 588	Cut	Left	80	6.25	0.25	6.50	50	3.87	OK
3 + 708	Fill	Right	60	4.25	0.25	4.50	–	–	OK
3 + 882	Cut	Left	180	6.25	0.15	6.40	50	1.73	OK
4 + 373	Cut	Right	80	4.25	0.25	4.50	50	3.87	OK
4 + 554	Cut	Right	120	4.25	0.20	4.45	50	2.59	OK
4 + 886	Cut	Right	150	4.25	0.15	4.40	50	2.08	OK
5 + 149	Fill	Left	50	6.25	0.38	6.63	–	–	OK
5 + 345	Fill	Left	400	6.25	0.00	6.25	–	–	OK
5 + 487	Cut	Right	70	4.25	0.25	4.50	50	4.42	OK
5 + 690	Cut	Left	50	6.25	0.38	6.63	50	6.12	OK
6 + 108	Fill	Right	150	4.25	0.15	4.40	–	–	OK

Note : 0=306.64km from Harare

Source: JICA Survey Team

a= Width from lane center to ditch edge (width of 1/2lane(1.75m) + shoulder(0.5 or 2.5m) + ditch(2m))

b= Widening value calculated by the curve radius

d= Applicable Sight Distance 50m for Design Speed 40 km/h, 80m for 60 km/h

e= Necessary width calculated by the radius and applicable sight distance

※Horizontal sight distance in fill section not required

(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.
- 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 2036) was calculated, in consideration of the assumed growth rate during the construction period which is assumed to be completed in 2020.

Table 2-3-5 Basic data on cumulative traffic load calculation

Traffic volume survey :	Measured in Nov. 2016 (Private cars 109, Bus 32, Truck 90, Trailer 497, Total 728)
Growth rate :	2017~2021 = 1.25%, 2022~2026 = 3.5%, 2027~2036 = 7.5% (Intermediate value of M/P completed in 2017 by AfDB was set.), Average during construction period = 4.9%/year
Other considerations :	Temporary increase of construction vehicles during construction period: taking into account of construction vehicles in 2020, 2021 (50 vehicle/day)
Design period :	2022 (at the start of service, Traffic volume/day = 790) ~ 2036 (Traffic volume/day = 1,864)

Source: JICA Survey Team

4) 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 2-3-6 Allowable loads by vehicle type in Zimbabwe

Large vehicle type	1	2	3	4	5	6	7
Number of axle	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.

Axle load measurement was conducted for 3 consecutive days from November 5, 2016 at the load inspection station of border facility in Chirundu, and a total of 452 axle load measurements were conducted. The results of the measurement were converted into 8.16

Vehicle type	VEF
MGV	0.76
HGV	5.48

VEF per HGV
(Vehicle Equivalent Factor, VEF)

ton Vehicle Equivalent Factor (VEF) per vehicle for medium goods vehicles (MGV) such as buses and heavy goods vehicles (HGV) such as trucks and trailers, and used as basic data for paving design. 36% of the measured vehicles exceeded the limiting axle load, and the heaviest one was 5-axle type trailer, which was confirmed to be about 1.4 times than the limiting load (which is 12.3 tons/axle, but lower than in other African countries).

Table 2-3-7 Loads converted into VEF per vehicle

1. MGV VEF						Ref		
Type	Nos Axle	Sample	Average	Sample x Average	Korea Study	FS	Beitbridge	
1	2	11	0.72	7.87	2.59		0.7	
2	3	68	0.76	51.94	2.83	0.7	1.7	
Total		79		59.81				
			VEF=	0.76				
2. HGV VEF						Ref		
Type	Nos Axle	Sample	Average	Sample x Average	Korea Study	FS	Beitbridge	
3	4	12	1.80	21.56	2.87	0.7	1.7	
4	5	34	5.18	176.27	5.59			
5	6	520	5.20	2,703.47	5.18	7.34		
6	8	5	4.34	21.70	7.51		5.2	
7	7	156	6.78	1,057.52	6.58	8.92		
Total		727		3,981				
			VEF=	5.48				

Source: Chirundu Weigh Station data

5) 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 2020 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 2035 from VEF of each vehicle type and the cumulative traffic volume, the traffic load during the design period was calculated as 12.6 million axles (SATC T7 class). Paving structure was examined upon

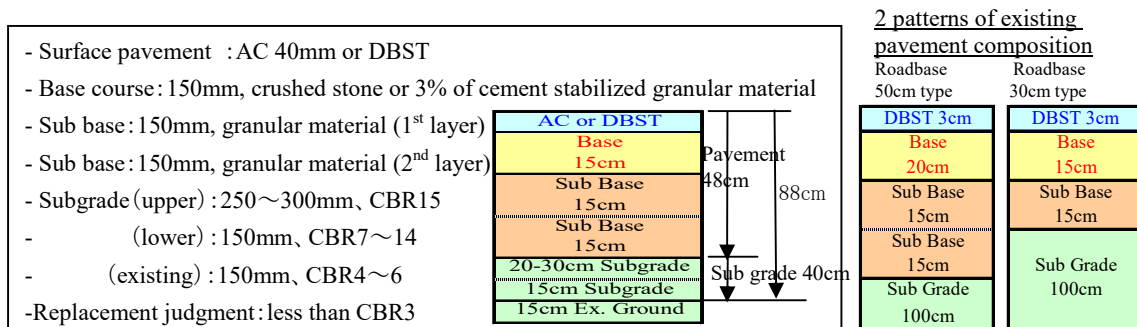
considering these results and the local material procurement conditions shown below.

6) Pavement materials

6-1) Confirmation of condition and utilization of existing pavement

i) Layer thickness of existing base course

As a result of the existing road excavation, two types of base/subbase course such as 50cm thickness type (similar to DOR standard, 20cm base and 15 + 15cm subbase) and 30cm thickness type (15cm base + 15cm subbase) were confirmed under existing asphalt surface treatment pavement. Base course of 50cm thickness type is roughly the same base course structure as the general example shown by DOR as shown below, and 30 cm thickness type is considered to have the same strength by adding one layer. In addition, the subgrade with depths up to 2m was confirmed to be of good quality with a large bearing capacity (CBR 15 ~ 32) compared to the general cases of DOR, and existing pavements are thought to retain the same or higher function as the general cases of DOR in many sections. The general examples of the pavement structure applied to the present North-South Corridor confirmed by DOR and distribution of 2 types of base course in 6.5 km of target scope are shown below.



Source: JICA Survey Team

Figure 2-3-6 Standard pavement structure for North-South Corridor and existing pavement composition

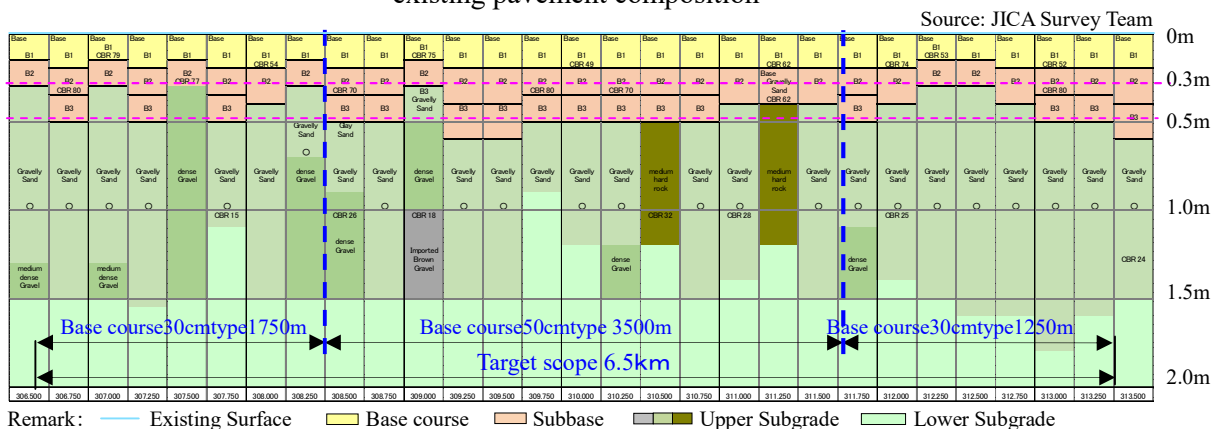


Figure 2-3-7 Results of layer thickness measurement of existing road

ii) Layer thickness and bearing capacity of existing pavement

In order to confirm the condition of the existing road, bearing capacity was confirmed by

Benkelman-beam survey at 200m intervals on the center and shoulder side of Harare and Chirundu direction. As a result of the survey, 81% of spots having very stiff or stiff, 18% of flexible and 1% of very flexible were confirmed, and the main part of the existing road was confirmed to be fully sufficient condition. Also, as a result of the exploratory excavation at the side of the existing carriageway, two types of road base compositions (standard type = 50 cm (20cm base + 30cm sub base), thin layer type = 30 cm (15cm base + 15cm sub base)) are confirmed.

Table 2-3-8 Results of bearing capacity measurement of the existing road and evaluation of bearing capacity value

STA	RHS(w/3.5m) To Harare		STA	LHS(w/3.5m) To Zambia	
	Edge	Center		Center	Edge
300.0	0.16	0.28	300.10	0.26	0.10
300.2	0.63	0.18	300.30	0.19	0.22
300.4	0.09	0.23	300.50	0.16	0.50
300.6	0.50	0.08	300.70	0.21	0.28
300.8	0.70	0.66	300.90	0.68	0.67
301.0	0.26	0.68	301.10	0.28	0.23
301.2	0.07	0.47	301.30	0.64	0.26
301.4	0.13	0.04	301.50	0.15	0.30
301.6	0.04	0.06	301.70	0.32	0.23
301.8	0.69	0.08	301.90	0.24	0.26
302.0	0.67	0.38	302.10	0.26	0.26
302.2	0.34	0.64	302.30	0.41	0.37
302.4	0.18	0.70	302.50	0.30	0.43
302.6	0.98	0.59	302.70	0.34	0.45
302.8	0.41	0.52	302.90	0.34	0.44
303.0	0.67	0.28	303.10	0.29	0.39
303.2	0.55	0.21	303.30	0.25	0.48
303.4	0.32	0.10	303.50	0.35	0.61
303.6	0.11	0.22	303.70	0.55	0.38
303.8	0.15	0.16	303.90	0.55	0.61
304.0	0.37	0.34	304.10	0.51	0.46
304.2	0.42	0.40	304.30	0.38	0.47
304.4	0.35	0.33	304.50	0.54	0.33
304.6	0.37	0.41	304.70	0.40	0.37
304.8	0.73	0.42	304.90	0.40	0.37
305.0	0.63	0.69	305.10	0.50	0.46
305.2	0.21	0.19	305.30	0.40	0.40
305.4	0.63	0.62	305.50	0.33	0.30
305.6	0.63	0.62	305.70	0.49	0.42
305.8	0.21	0.32	305.90	0.24	0.36
306.0	0.31	0.46	306.10	0.23	0.34
306.2	0.46	0.60	306.30	0.42	0.48
306.4	0.46	0.45	306.50	0.23	0.24
306.6	0.33	0.55	306.70	0.65	0.47
306.8	0.39	0.21	306.90	0.18	0.20
307.0	0.58	0.42	307.10	0.44	0.37
307.2	0.47	0.48	307.30	0.25	0.42
307.4	0.49	0.52	307.50	0.43	0.56
307.6	0.30	0.69	307.70	0.68	0.62
307.8	0.42	0.37	307.90	0.23	0.25
308.0	0.16	0.43	308.10	0.30	0.26
308.2	0.10	0.15	308.30	0.24	0.47
308.4	0.31	0.35	308.50	0.43	0.28
308.6	0.63	0.34	308.70	0.53	0.34
308.8	0.54	0.46	308.90	0.31	0.63
309.0	0.15	0.17	309.10	0.25	0.47
309.2	0.18	0.31	309.30	0.25	0.20
309.4	0.23	0.35	309.50	0.18	0.18
309.6	0.30	0.26	309.70	0.32	0.32
309.8	0.28	0.34	309.90	0.42	0.20
310.0	0.32	0.35	310.10	0.28	0.47
310.2	0.34	0.47	310.30	0.15	0.39
310.4	0.42	0.43	310.50	0.36	0.37
310.6	0.39	0.25	310.70	0.59	0.47
310.8	0.42	0.53	310.90	0.48	0.24
311.0	0.43	0.71	311.10	0.37	0.43
311.2	0.34	0.46	311.30	0.43	0.56
311.4	0.52	0.63	311.50	0.15	0.29
311.6	0.44	0.10	311.70	0.39	0.42
311.8	0.31	0.31	311.90	0.40	0.76
312.0	0.22	0.47	312.10	0.30	0.40
312.2	0.35	0.35	312.30	0.59	0.51
312.4	0.40	0.30	312.50	0.30	0.25
312.6	0.61	0.59	312.70	0.31	0.34
312.8	0.62	0.68	312.90	0.67	0.59
313.0	0.40	0.40	313.10	0.50	0.55
313.2	0.35	0.35	313.30	0.35	0.27
313.4	0.23	0.35	313.50	0.36	0.42
313.6	0.43	0.43	313.70	0.36	0.42
313.8	0.23	0.34	313.90	0.48	0.52
314.0	0.28	0.34			

Note: Thin roadbase area (30cm)

Target section of the Project (section of 6.5km)

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: JICA Survey Team Note: ESA=Equivalent Standard Axle (8.2t VEF)

iii) Utilization of existing pavement

Although the target road is considered to have a high mixing ratio of large vehicles and the traffic load is also relatively large, the existing pavement where 81% of the road surface is stiff or very stiff was examined to be utilized responding to design life by implementing countermeasures as strengthening and overlay of base course to allow the assumed design load.

6-2) Examination of applicable pavement type

Based on the results of the exploratory excavation and bearing capacity survey of existing road, it is considered desirable to study pavement type / structure that satisfy the design life by utilizing existing pavement which is confirmed to be in good condition in many places. The paving structure was examined upon taking into general account of the ground bearing capacity of the target road, local characteristics (groundwater level / water accumulation in the rainy season), traffic volume, the ratio of large-size vehicles, the rate of growth in traffic, material procurement, construction period, cost, corresponding technique and also the implementation situations in other similar projects, hearing surveys on Zimbabwean side. Based on the above, the optimum plan was selected among the following possible options.

Table 2-3-9 Pavement Composition of existing road and pavement type options in the Project

Item	Existing road	Option selected in the Project	Other options and points of attention
Surface	Double bituminous surface treatment (DBST)	DBST	AC surface was concerned with rutting risk due to high temperature of road surface; the CC surface was concerned with disadvantage of the time to traffic opening, therefore DBST was selected.
Road Base	Standard type (granular material) Base 20cm, Sub base 30cm	Base: Recycling construction method (Existing DBST + Base, total 14cm) Sub base: Existing base and subbase, total 38cm	As the method of overlay of crushed stone base course material requires a large amount of crushed stone transportation and more construction time, recycling method was chosen as it has advantage for cost and construction schedule. In addition, additional material on the top of the thin road base type is considered. Also, base course replacement is assumed for spots with low bearing capacity area.
	Thin layer type (granular material) Base 15cm, Sub base 15cm	Base: Recycling construction method (Additional material 11cm + Existing DBST + Base 7cm, total 21cm) Sub base: Existing base and subbase, total 23cm	
Sub grade	About 1~1.3m of sandy soil or gravel mixed soil	Soil material conforming to Zimbabwean standard	Considering the variation of the road surface bearing capacity value, the minimum value of the CBR test result was selected.

Source: JICA Survey Team Note: Recycle construction method =Cement formed asphalt-stabilized treatment is assumed (CAE, CFA method, etc.). AC=Asphalt Concrete, CC=Cement Concrete

7) Pavement design

Based on the above study, the pavement composition comprising of the double bituminous surface treatment (DBST) surface course, the base course applying recycling construction method, and subbase course applying existing granular material is deemed to be appropriate. As there are 2 kinds of road base thickness on existing roads, the policy of applying 2 types of pavement composition adapted to each condition was decided (see table below). Since there is no item corresponding to the recycling construction method selected by the above-mentioned optimum plan (refer to the remarks below) in the Zimbabwean standard and the SATCC standard, in order to study the paving structure, the pavement composition was verified while calculating with the AASHTO Guide for Design of Pavement Structures 1993 and referring to Japan's pavement ordinance. The design conditions used for pavement design and the paving structure selection result of the Project are shown below.

- Design period : 15 years, 2020~2035 (2018:D/D, 2019:Tender + Construction, 2020:Construction, 2021:Traffic opening)
- Design traffic load (W18) : Number of passing equivalent single axle loads (ESAL) converted to 18 kip(kilopounds) during the service life= 12.6 million axles
Traffic volume→Growth rate→Design traffic volume→Coefficient per vehicle→Accumulation during design period
- Reliability (R) : apply 95% from the target road rating (route of great importance), (Standard deviation ZR = -1.645, standard deviation of load and paving strength S0 = 0.40), (Over 90% applied to important trunk line even taking into consideration of low speed large cars)
- Serviceability index(dPSI) : Initial serviceability index P0 = 4.2 (AASHTO road test

Table 2-3-11 Confirmation of pavement composition

Layer	Material		Thickness(c m)	AASHTO		TA method	
				Layer coefficient	Structure index(SN)	Equivalent coefficient	TA value
Surface	DBST		3	0	0	0	0
Base course	Regenerat ion base course	Standard	14	0.30	1.654	0.55	7.7
		Thin layer	21	0.30	2.480	0.55	11.55
Sub Base Course	Granular material	Standard	39	0.126	1.935	0.25	9.75
		Thin layer	23	0.126	1.141	0.25	5.75
Total				a. Total SN	3.588 (SL)	a. Total TA	17.45 (SL)
					3.621 (TL)		17.30 (TL)
				b. Necessary SN	3.574	b. Necessary TA	15.5
Judgment				$a \geq b$	OK	$a \geq b$	OK

Source: JICA Survey Team Note: Design of Subgrade CBR=15, SL= Standard layer, TL= thin layer

(5) Drainage plan

1) Policy of Drainage plan

As a result of confirmation of the condition and flow capacity of existing cross-sectional drainage facilities, policy to utilize the existing facility rather than replacement with new facility was selected, and along with widening and linear modification by road improvement, the existing facility was studied to be extended. Moreover, the current situation of many occurrences of damage to existing pavement caused by stormwater related matters shown as below, were considered.

Table 2-3-12 Causes of existing road deterioration caused by stormwater

i) Caused by running water on shoulder	Road surface drainage is hindered to flow into side ditch due to vegetation on road shoulder → Concentration of surface water at ends of shoulder → Increase of flow speed and flow rate while flowing downward in longitudinal direction → Corrosion of ends of shoulder pavement→ Progression of erosion in ends of shoulder → shoulder collapse
ii) Caused by running water from mountain side	Rainwater inflow from mountain side→ Defectiveness of mountain side ditch and lack of maintenance → Rainwater transverse on road surface and shoulder → Erosion in ends and cracks → Inundation in base course and subgrade → Pavement collapse

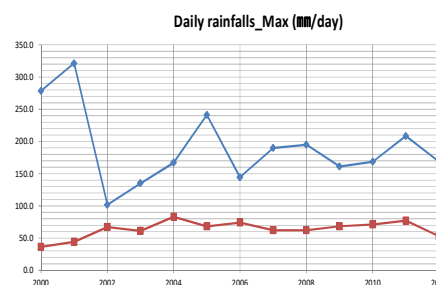
Source: JICA Survey Team

1-1) Rainfall amount

The maximum rainfall amount per day in the target area is less than 100mm / day in average and is less than half compared with the amount in Harare, and it is a region where rainfall amount is relatively small in Zimbabwe.

1-2) Existing drainage facilities

Existing cross-sectional drainage facilities within the 13.6km of 2nd field survey target section are densely



Source: MEWC

Note : — Harare — Kariba

Figure 2-3-8 Max. Rainfall per day

installed at 89 places (one place at about 150m intervals) and 52 places (one place at approximately 130m intervals) in the 6.5km design section. More than 50% of culvert's type is 60cm diameter pipe culvert. Moreover, there was no history obtained of floods and ponding during the survey.

Table 2-3-13 Outline of existing cross-sectional drainage facilities

Type		2 nd field survey section (13.6km)		Design section (6.5km)		Remark
		Quantity	Share	Quantity	Share	
Pipe Culvert	600	54	72%	27	52%	Concrete structure
	750	3	4%	3	6%	Ditto
	900	7	9%	6	12%	Ditto
	900 2Cells	9	12%	5	10%	Ditto
	950	1	1%	0	0%	Ditto
	950 2Cells	1	1%	0	0%	Ditto
Box Culvert	3000x1500x2Cells	2	3%	0	0%	Ditto
	3000x1500	1	1%	0	0%	Ditto
	2500x2500	3	4%	3	6%	Ditto
	2400x2400	2	3%	2	4%	Ditto
	1800x1800	6	8%	6	12%	Ditto
Total		89	100%	52	100%	

Source: JICA Survey Team

1-3) Confirmation of discharge capacity of existing cross-sectional drainage facility

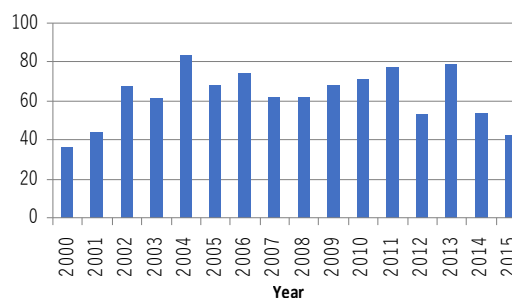
a) Calculation of the probable rainfall intensity

The probable rainfall intensity was calculated through observation data (Annual max. rainfall amount per day) obtained by DOR.

- Observation period : May, 2000~December, 2016
- Observation place : Kariba airport

The design rainfall intensity is calculated from observation data of above observation data. For

the calculation of design rainfall intensity, Gumbel equation, Log-Pearson 3 (LP 3) and the calculation formula of the design manual "Part JD" of Zimbabwe were used. As the results of calculation, the rainfall intensity of LP3 was the largest in each design planning year (return period) as shown below.



Source: DOR

Figure 2-3-9 Annual max rainfall per day (mm)

Table 2-3-14 Rainfall intensity per return period

Return Period	1/2	1/5	1/10	1/20	1/25	1/50	1/100
Gumbel	62	75	84	92	94	102	110
Log Pearson Type3	66	82	92	99	101	109	112
Zimbabwe Standard	—	54	—	69	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 2-3-15 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.

b) Catchment area classification

The catchment area of 13.6km section of the 2nd field survey area is divided into 29 catchment areas, and the total area is thought to be about 15.13 km². The catchment area on the Makuti side of the target road (near kp. 300 - 305) is large, and Hell's Gate side where more steep terrain is small.

As for the catchment area classification, the runoff flow was confirmed as catchment area which is considered to be the same because of installation position, running water direction, and road linear, rather than the very small (0.01 km² or less) catchment area of existing small culverts. The target section of 6.5 km corresponds to catchment areas of 9 to 29 (21 places) in the table below.

Table 2-3-16 Outline of catchment area

Catchment area No.	Area km ²	Existing culvert	Calculated Runoff (m ³ /sec)	Catchment area No.	Area km ²	Existing culvert	Calculated Runoff (m ³ /sec)
1	0.85	20	21.3	16	0.04	2	1.1
2	7.24	2	79.6	17	0.04	1	1.1
3	0.15	4	4.0	18	0.06	3	1.7
4	0.06	6	1.7	19	0.07	6	1.9
5	3.21	2	29.8	20	0.04	1	1.1
6	0.52	7	13.3	21	0.16	1	7.1
7	1.76	1	21.7	22	0.02	5	0.6
8	0.05	2	1.4	23	0.15	1	5.2
9	0.06	1	1.7	24	0.01	2	0.3
10	0.17	7	4.5	25	0.01	2	0.6
11	0.07	1	1.9	26	0.02	1	0.6
12	0.22	17	5.8	27	0.04	1	9.4
13	0.03	1	0.9	28	0.01	1	0.3
14	0.01	1	0.3	29	0.04	2	1.1
15	0.02	1	0.6	Total	15.13	101 (57)	-

Source: JICA Survey Team

Note: Existing culvert = Dual structure is counted per cell = it differs from area number

Calculated runoff = runoff flow x 1.2 (Safety factor) m³/Sec. *Catchment area 9~29 = Project Target Scope

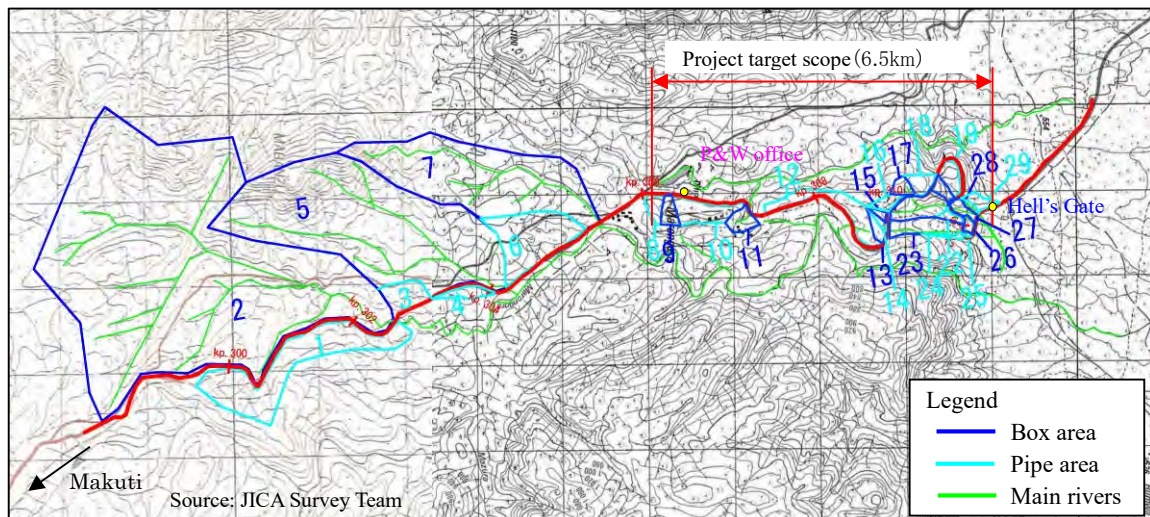


Figure 2-3-10 Drainage catchment area

c) 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
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➤ Difference between rational formula and modified rational formula

The above formula is used as the basic calculation method for both formulas, but according to the modified rational formula, 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.

d) 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: Sectional area of flowing of drainage facility (m ²)	S: Drainage slope (%) A: Sectional area of flowing of drainage facility (m ²) n: Manning coefficient

e) Confirmation of the discharge capacity of existing facilities

From the result of the run off flow calculation, it was confirmed that the size of the existing cross-sectional drainage facility having adequate capacity in run off flow calculation. Therefore, in this project, plan to extend existing facilities was decided without new construction or upgrading existing structures. The run off flow calculation results and drainage diagram are shown respectively in Table 2-3-17 and Figure 2-3-11.

Table 2-3-17 Discharge capacity of existing facilities

流域	サイズ	本数	断面積		潤辺	径深	勾配	粗度係数	流速	流量	判定	計画流出量
			A (m)	S (m)								
1	φ 600	14	3.958	26.389	0.150	7.0	0.012	6.224	24.635			
	φ 900	3	1.909	8.482	0.225	7.0	0.012	8.156	15.570			
	φ 950	3	2.126	8.954	0.237	7.0	0.012	8.444	17.952			
	Total	20								58.157	>OK	21.291
2(1)	B3000×H1500	2	9.000	12.000	0.750	2.0	0.013	8.980	80.820	>OK		79.556
3	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		4.033
4	φ 600	6	1.696	11.310	0.150	4.0	0.012	4.705	7.980	>OK		1.667
5	B3000×H1500	2	9.000	12.000	0.750	3.0	0.013	10.998	98.982	>OK		29.848
6	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		13.306
7	B3000×H1500	1	4.500	6.000	0.750	1.0	0.013	6.350	28.575	>OK		21.711
8	φ 600	2	0.565	3.770	0.150	13.0	0.012	8.482	4.792	>OK		1.399
9	B2400×H2400	1	5.760	7.200	0.800	5.0	0.013	14.823	85.380	>OK		1.667
10	φ 600	7	1.979	13.195	0.150	5.0	0.012	5.261	10.412	>OK		4.549
11	B1800×H1800	1	3.240	5.400	0.600	8.0	0.013	15.478	50.149	>OK		1.935
12	φ 600	13	3.676	24.504	0.150	4.0	0.012	4.705	17.296			
	φ 900	4	2.545	11.310	0.225	4.0	0.012	6.166	15.692			
	Total	17							32.988	>OK		5.829
13	B1800×H1800	1	3.240	5.400	0.600	10.0	0.013	17.304	56.065	>OK		0.853
14	φ 900	1	0.636	2.827	0.225	5.0	0.012	6.893	4.384	>OK		0.294
15	B2500×H2500	1	6.250	7.500	0.833	7.0	0.013	18.018	112.613	>OK		0.576
16	φ 750	2	0.884	4.712	0.188	4.0	0.012	5.470	4.835	>OK		1.127
17	B2500×H2500	1	6.250	7.500	0.833	6.0	0.013	16.681	104.256	>OK		1.127
18	φ 600	1	0.283	1.885	0.150	5.0	0.012	5.261	1.489			
	φ 900	2	1.272	5.655	0.225	5.0	0.012	6.893	8.768			
	Total	3							10.257	>OK		1.667
19	φ 600	2	0.565	3.770	0.150	8.0	0.012	6.654	3.760			
	φ 750	1	0.442	2.356	0.188	8.0	0.012	7.735	3.419			
	φ 900	3	1.909	8.482	0.225	8.0	0.012	8.719	16.645			
Total	6							23.824	>OK		1.935	
20(18)	B1800×H1800	1	3.240	5.400	0.600	12.0	0.013	18.956	61.417	>OK		1.127
21(15+16+17)	B2400×H2400	1	4.000	6.000	0.667	14.0	0.013	21.972	87.888	>OK		7.121
22	φ 600	2	0.565	3.770	0.150	6.0	0.012	5.763	3.256			
	φ 900	2	1.272	5.655	0.225	6.0	0.012	7.551	9.605			
	Total	4							12.861	>OK		0.576
23(13+14)	B1800×H1800	1	3.240	5.400	0.600	9.0	0.013	16.416	53.188	>OK		5.180
24	φ 900	2	1.272	5.655	0.225	7.0	0.012	8.156	10.374	>OK		0.294
25(24)	φ 900	2	1.272	5.655	0.225	13.0	0.012	11.115	14.138	>OK		0.589
26(22)	B1800×H1800	1	3.240	5.400	0.600	5.0	0.013	12.236	39.645	>OK		0.576
27(20+21)	B2500×H2500	1	6.250	7.500	0.833	5.0	0.013	15.228	95.175	>OK		9.374
28	B1800×H1800	1	3.240	5.400	0.600	5.0	0.013	12.236	39.645	>OK		0.294
29	φ 600	2	0.565	3.770	0.150	2.0	0.012	3.327	1.880	>OK		1.127

Project target scope

Source: JICA Survey Team



Source: JICA Survey Team

Figure 2-3-11 Outline of the drainage diagram

1-4) Roadside ditch

At the side of the existing road, soil ditch and concrete stone pitch side ditch on the cutting slope side asphalt curb raised with the asphalt material at edge of pavement and shute drain on the fill slope side, and inflow by shute drain from mountain side were observed. The structure which does not cause waterway dysfunction etc. due to vegetation by application of concrete V shape roadside ditch and shute drain was considered to the plan. In



Image of planned side ditch

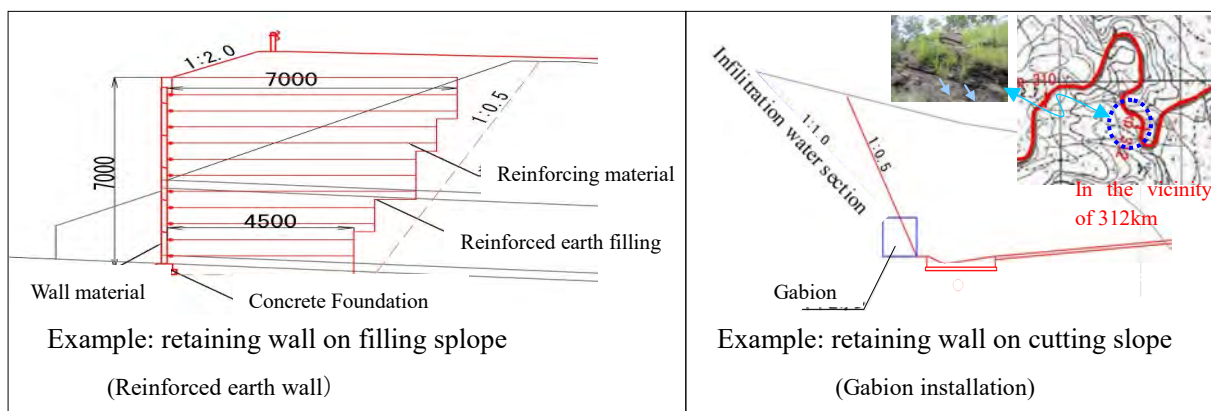
addition, as a countermeasure to prevent adverse effects by underground water penetration from the mountain side and to keep the pavement in a sound condition, the policy was to place a perforated pipe on the cut side (under the V shape roadside ditch, see Standard Cross Section).

(6) Incidental facilities

1) Retaining walls

With respect to installing a new retaining wall in cutting /filling spot due to geometrical improvement, based on similar construction example, materials procurement environment, standpoint of maintenance, application examples, the retaining wall structure has been studied taking into account of the structure, workability, landscape, etc. from the retaining wall type such as reinforced earth wall, concrete retaining wall, mass concrete retaining wall and Gabion retaining wall etc.

As a result of examination, reinforced earth wall (Terre armée) was selected for heigher than 5m, and concrete retaining wall (Reverse-T retaining wall / gravity type retaining wall) was selected for lower than 5m condition. Since there is a concern of instability of the slope due to slight spring water trace seen from the cutting slope in the vicinity of 312km spot, it was considered that the Gabion retaining wall will be installed to the toe-of-slope for smooth drainage. Following are examples of assumed retaining wall installation examples.



Source: JICA Survey Team

Figure 2-3-12 Examples of retaining wall installation

2) 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.



Example of sign installation near bus stop



Example of combination of sign and protective wall



Example of forked part of hill climbing lane

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. In addition, since the main traffic of the target road is dominated by large vehicles for long-distance logistics exceeding 2000km from major ports in southern Africa to inland areas, the installation of the parking area aiming at driver rest and provision of vehicle inspection places was examined at the end point of the target section.

Table 2-3-18 Safety facilities

Facility name	Installation location	Remarks
Guardrail	Filling section (heigher than 4m spots, Slope angle 1:2)	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 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 exceed because of 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.
Sand bank	0.8, 4.4km point	A sandbank with a height about 3.0m is installed to prevent deviation to the outside of the road in section with sharp curve and big height difference on valley side.
Parking area	Near the end point	A parking area will be installed as long-distance driver's break facility and for vehicle safety inspection before and after climbing lane and specified that the section was designed by Japan..

Source: JICA 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 lowlying and/or high groundwater level, and DOR engineers explained that the problem occurred remarkably in the vicinity of "Mopani tree" growing area. Furthermore, distribution of soft ground (black cotton soil or similar expansive material) is concerned in these parts, and similar situation is seen in a part of the flat part between Hell's Gate and Chirundu. In the 6.5 km section covered by this project, although these road surface properties are not observed, road surface repair marks are found near road sag and culvert section. In addition, although the problematic soil quality was not confirmed in the trial pit survey, the Benkelman beam survey confirmed spots where bearing capacity was slightly lower; therefore for these parts, road base replacement plan was assumed.

2) Obstructing facilities

Overhead lines (power line / telephone line) and underground lines (water supply / fiber cable) are installed within 6.5km of the project section, and it is possible that these may be partially relocated / removed in accordance with project implementation. The existing facilities installed in the ROW are shown below (details of the position are shown in "appendix-").

Table 2-3-19 List of location of obstructing facilities

Name	Location		Relocation length
1) Electric Power line	0.140km	Crossing	100m
2) Telephone line (Total 260m)	2.720~2.800km	Left	80m
	3.440~4.480km	Left	40m
	3.900~4.000km	Crossing	80m
	5.100~5.150km	Crossing	60m
3) Water supply pipe	0.010km	Crossing	50m
4) Fiber cable (Total 3,920m)	1.100~4.200km	Left	3,100m
	5.700~6.600km	Left	820m

Source: JICA Survey Team Note: location km = distance from 306.4km toward to the end point, relocation at owners own cost agreement was made between DOR and fiber cable owner

2-3-3 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 2-3-20 List of Basic design drawing

Item	Contents of drawing	Number of drawing
1	Road standard section drawing, Plan view drawing, Longitudinal section drawing	11
2	Drainage facilities structural drawing	11
3	Incidental facilities structural drawing	12

Source: JICA Survey Team

2-3-4 Implementation Plan

(1) Implementation Policy

1) Basic policy in implementaton

Since the Project will be implemented under the grant aid scheme of 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) Implementation 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, 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 particulate 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.
- ⑤ Implement the environmental management and monitoring plan (draft) shown in Table 2-1-28.

3) Securing of safety during construction

- ① Place full-time technical experts for construction safety and formulate safety measure plan and safety construction plan according to “The Guidance for the Management of Safety for Construction Works in Japanese ODA Projects, September 2014”.
- ② Since lane control will be required during construction, establish safety facilities (barricades (including concrete block etc.), color cones, revolving lights) and assign traffic controllers.
- ③ 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.
- ④ In order to prevent damages on personnel and workers by wild animals, arrange or accompany an adequately equipped park ranger at the construction site. Details of the ranger arrangement will be consulted and confirmed promptly by the client, related agencies, contractors and consultants after the commencement of construction work based on Figure 2-3-17 Flow of construction order etc.

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 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.

7) Land acquisition

Main camp yard (Local office, consultant supervision office, laboratory, worker residence, warehouse / material storage site, reinforcing bar / form processing plant, precast production yard, raw concrete factory, construction machinery storage space, material storage space etc.), secondary camp yard (raw concrete factory, construction machinery storage space, material storage space, etc.), and construction site are assumed to be installed in public land on roadside. The Client secures an appropriate land before the 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) Points of attention in the construction plan

Considerations on the construction plan are shown below.

a) 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. Example of cutting section
(Installation of detour is difficult)

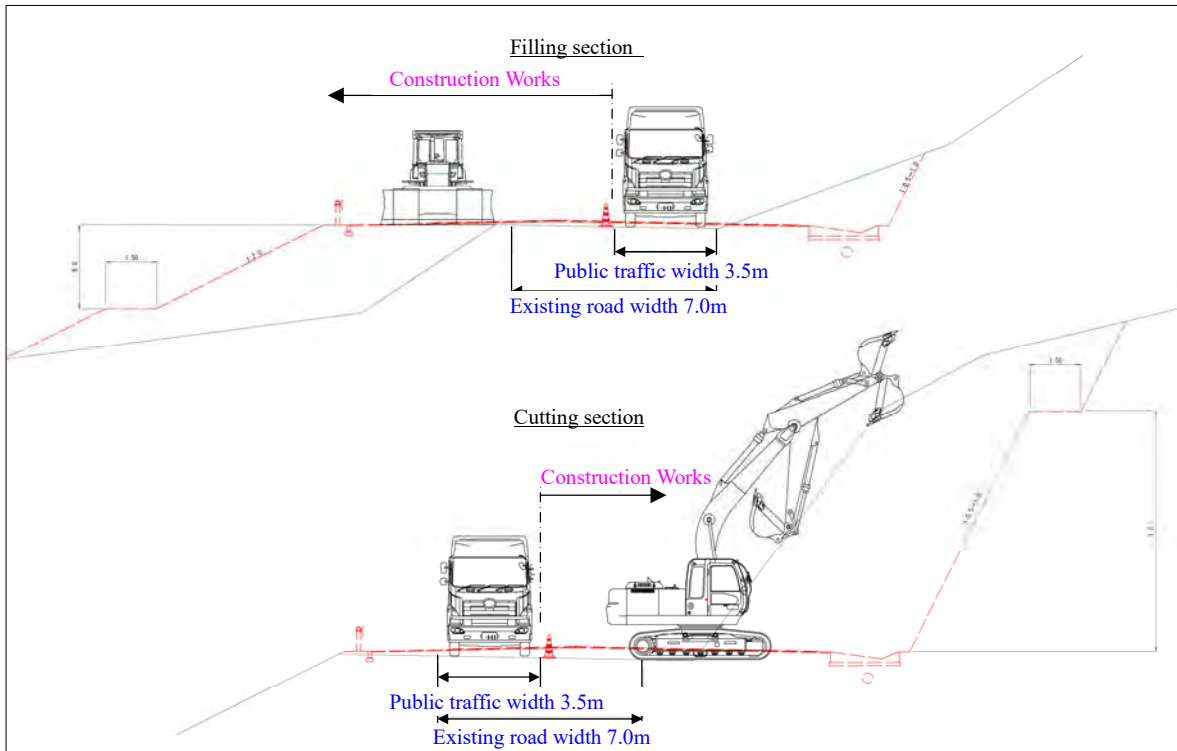


Figure 2-3-13 Cross section of road in construction

The length of the construction section is about 6.5km, with about 240,000m³ of excavation, 40,000m³ embankment volume and 200,000m³ of residual. The distribution of excavation and embankment is as shown in Figure below. Since large earth work amount located at some particular earth work section, considering the equalization of the progress of each section, the length of traffic restrictions during construction, and carry-in of construction machinery, etc., the excavation amount is set to approximately 34,000m³ per work section as shown in the table below.

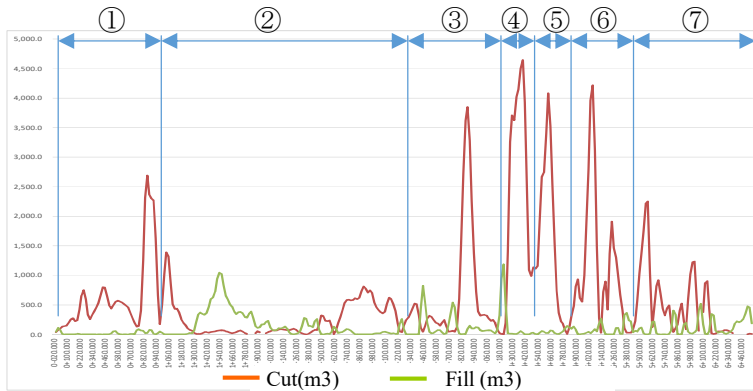


Table 2-3-21 Construction Section

Construction Section	Distance	Cut (m ³)
①	0.98km	32,600
②	2.28km	31,000
③	0.92km	32,600
④	0.32km	39,400
⑤	0.32km	37,200
⑥	0.60km	37,700
⑦	1.23km	32,500

Source: JICA Survey Team

Figure 2-3-14 Major Cut/Fill Distribution

As shown in Figure 2-3-13, regarding the cutting section, the scope of works is established by stopping one lane on the mountain side of the existing road, and the mountain side is constructed while providing public traffic with one-side alternate traffic road of the valley side lane. In addition, regarding the filling section, the scope of works is established by stopping one lane on the valley side and the valley side is constructed while providing public traffic with one-side alternate traffic road of the mountain side lane. As shown in Figure 2-3-15, the length of the work zone for construction is set to 40m per construction section from the arrangement of construction machinery, and the length of the traffic restriction zone is set to 50m. In addition, traffic guides are placed before and after the restriction area and at the entrance of vehicles.

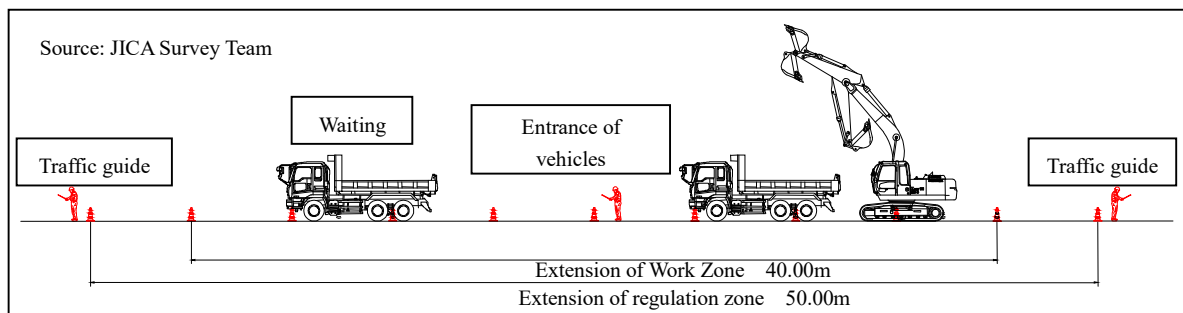


Figure 2-3-15 Traffic restriction zone and traffic guide distribution

b) 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.

c) Regulation related to construction

Although there is 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.

d) 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.

e) Construction order

Basically in this plan, the widening of the road will be implemented by cutting the mountain side of the current road. About 6.5km target section, there are large and small stream in which 52 cross drainage structures are installed such as 0.6m pipe culvert to 2.5m x 2.5m 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.) Also, the flow of construction order reflecting the above items is shown below.

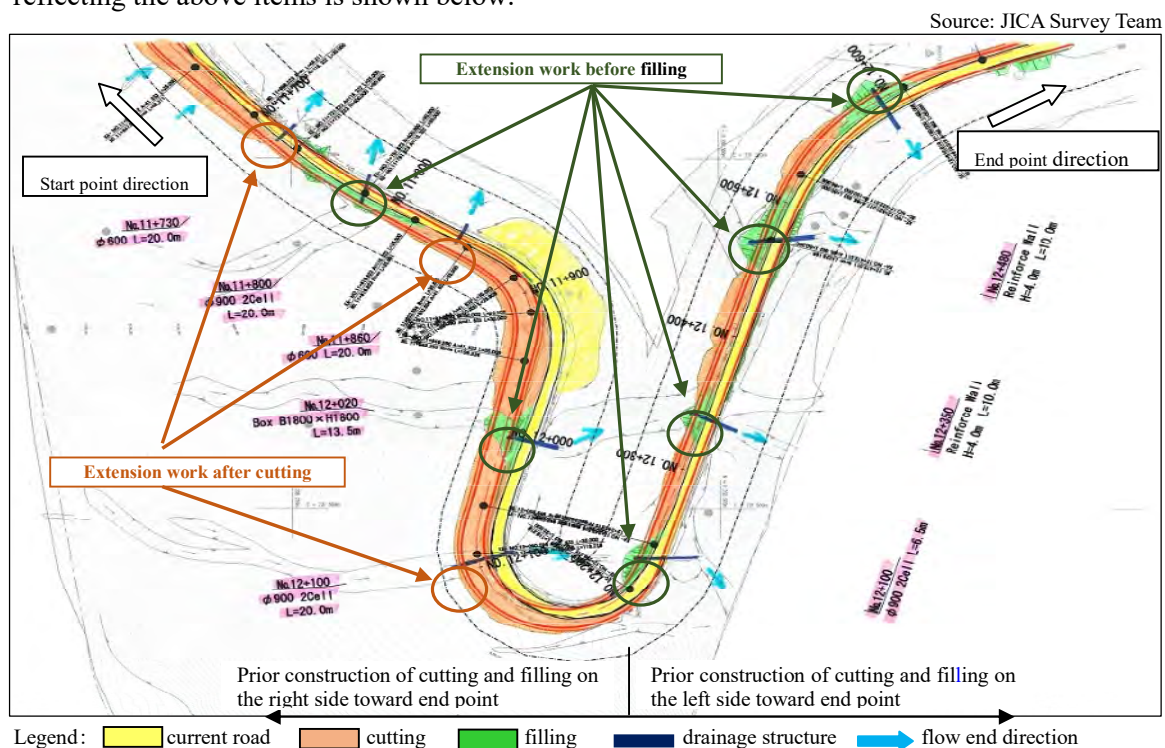
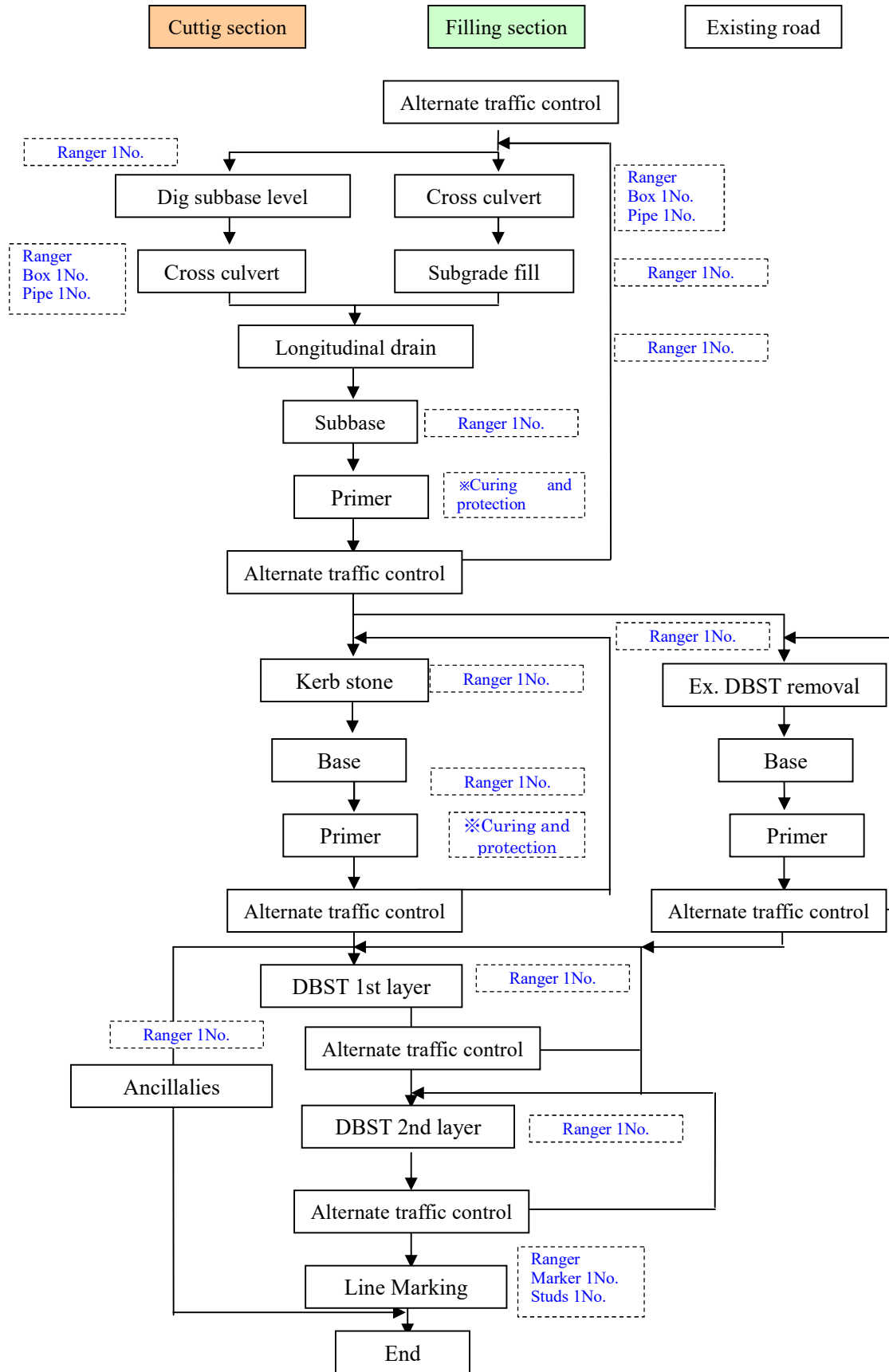


Figure 2-3-16 Image of Cutting, filling and cross drainage structure associated with road improvement

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



Source: JICA Survey Team

Figure 2-3-17 Flow of construction order

(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

a) Construction work

Upgrading of existing road over the target section of approximately 6.5km

- 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.)

b) Procurement of labor, construction materials and equipment

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

c) Safety measures

Safety management and measures concerning execution of the construction works

d) Consulting service

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

2) Scope of work by Zimbabwe

a) 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.

b) 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

c) Relocation of public facilities

- Relocation of obstructing facilities (water pipes, telephone cables, power line, underground fiber cable etc.)
- Assignment of Zimbabwean supervisory staff and securing of expenses for the relocation work

d) 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 & Wild life (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 (0.8% of project cost assumed (consultation within 0.08 ~ 2%))
- Support for opening project-related bank accounts and receiving remittances in Zimbabwe

(4) Detailed Design and Consultant Supervision Plan

1) Implementation schedule 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.

【Detailed design stage】

- Detailed survey on the current status of the Project site to add complement to contents of the basic design, such as confirmation of road bearing capacity for the utilization of existing pavement of the target section, implementation of sampling / indoor test, confirmation of sediment / rock on the cutting assumed part and confirmation of ground where the structures will be installed on etc..
- Addition of complement to detailed drawings
- Reconfirmation of the basic conditions, confirmation of the validity of the specifications, detailed check of drawings and quantity statement, review of the design contents.
- Preparation of tender documents such as detailed design drawings, specification sheets and quantity charts.

【Tender stage】

- Obtaining approval from the responsible and executing agency regarding tender documents.
- Support for tender, tender evaluation, contract negotiation conducted by the responsible and executing agency from the technical aspect.
- Report of result of tender to JICA

In the Project, it is considered that the following items are required to be set in pre-qualification (PQ) as requirements of bidders based on characteristics of the assumed construction.

- ① Confirmation of finance, management situation and experience of construction works
- ② Experience in conducting road works and paving works in projects with similar natural conditions

- ③ Experience in conducting road works and paving works in projects with similar site conditions (Mountain road, Rock drilling, Construction method etc.)
- ④ Qualifications or experience with similar works of paving management engineers and paving quality control engineers

【Supervision of works stage】

- Confirmation concerning the quality, finished formation, work progress and safety management of construction in accordance with the contract and regular report to the executing agency and JICA
- The secretariat of the quality management meeting sponsored regularly by the executing agency (attendees are executing agency, JICA, contractor, consultant.)
- Monitoring of unit price transition of specific materials every 3 months and report of results to the executing agency.
- Conducting progress of works inspection in response to requests from contractors and report of the results to the executing agency and JICA.
- Conducting completion inspection at the completion of the Project and report of the result to the executing agency and JICA.
- Conducting defect inspection one year after completion of the Project and report of the result to the executing agency and JICA.

After completing the contractor selection, the contractor shall promptly submit the construction plan(including safety measure plan and safety construction plan) to the consultant for review. At the start of the construction, based on the construction plan of the contractor and the construction supervision plan of the consultant, the main items such as the construction period, construction method, construction supervision method, specification, quality standard range (allowable value and passable line), confirmation frequency, will be confirmed.

In addition, the scope of responsibility of the client (securing land, removal of obstacles, provision of various facilities, correspondence to related organizations, etc.),that of responsibility of the contractor (quality, finished formation, work progress control) and that of responsibility of the consultant (design / specification setting, proposal to the client of the matter requiring contractual judgment at the time of construction), will be compiled as a construction management standard, which will be agreed between the client, consultant, contractor (three parties) and signed by them(revision of this standard needs agreement of three parties through discussion).

Regarding the specifications to be applied to the construction of the Project, the contractor confirms the possibility of the problem, and if there is possibility of potential problem, countermeasures are examined, confirmed and decided in advance by the three parties. With regard to the decided specifications, if the contractor has any doubts after the start of construction, the contractor will promptly issue reasonable proof of doubt and report it to the consultant. The consultant calls three-party discussion and confirms the contract clause and countermeasure proposal.

(5) Quality Control Plan

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 achieve the construction quality as described in the contract.

Table 2-3-22 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)	1 time/day	
		Pavement Thickness	By Spec./ standards	
Prime coat	Material	Bituminous material	Quality Certificate	Every material
			Temperature and amount during storage / spraying	Every distribution
Pavement surface	Material	Bituminous material	Quality Certificate/Component Analysis Table	every material
		Aggregate	Grain Size Distribution	Every mixture, 1 time/Month
			Water Absorption rate	Every material
			Aggregate Strength Test	
	Paving installation		Bitumen Spraying Amount	By Specification standards
			Crushed Stone Spraying Amount	By Specification standards
			Spreading, leveling, and rolling	As required
Concrete	Material	Cement	Quality Certificate, Chemical / physical test result	Every material
		Water	Component Test Results	Every material
		Admixture	Quality Certificate/Component Analysis Table	Every material
		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: JICA Survey Team

(6) Procurement Plan of Materials and Equipment

1) Policy for procurement

1-1) 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.

1-2) 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. Considering the above points, procurement source has been planned as shown in the table below based on the following principles.

- 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.

Table 2-3-23 Procurement of Main Material

Material name	Procurement source			Remark
	Zimbabwe	Japan	3 rd 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	●			Domesitic 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			South Africa	
Road Marking Paint	●			Imports available on the local market

Note:

Source: JICA Survey Team

Crushed stone: The procurement candidate site is the crushed stone quarry in Harare (purchase from supplier) or a place where ZPC (Zimbabwe Power Company, Ministry of Mining and Natural Recourses) acquired the crushing production permit for the turbine addition work of the Kariba dam power station, where crushed stone production is continuing by Chinese operators and is scheduled to be completed by 2018. In order to utilize in this construction work, consultation and agreement with DOR and relevant organizations are required.

Sand: Procurement from chiuwa river managed by ZINWA (Zimbabwe National Water

Authority). Materials procured by DOR from ZINWA will be used (purchase costs will not occur. Purchase fee will be incurred in case of direct procurement of river sand from ZINWA).

- Soil: It is possible to procure it from an existing borrow pit where DOR manages for road repair.
- Disposal area: It is possible to utilize the inside of the ROW at the road side in the Chirundu direction from the end point of the target section.
- Fuel: For gasoline and diesel oil, it is possible to procure from tax exempt imports used by Zimbabwean government.
- Bitumen: They are not domestically produced, however, imported goods from South Africa can be procured in Zimbabwe.
- Water: There is no existing water supply and well that can be used in the construction, and the running water of the river also disappears in the dry season, so the dam managed by ZINWA dotted near the target road is considered to be the procurement place. In addition, it is necessary to pay a fee to procure water, the fee is 1US\$/20m³.

Table 2-3-24 Candidate sites of Quarry and Borrow pit

Item	Location	Quality, Remark
Crushed stone	• Harare crushed stone quarry	• Granite, about 300km of distance to target section,
	• ZPC crushed stone quarry (Charara)	• Granite, about 80km to target section
Sand	Chiuwa river	vicinity of 248km, about 60km to target section
Borrow Pit	DOR Borrow pit	Gravel mixed sandy soil, vicinity of 294km, about 15 km to target section
	DOR Borrow pit	Gravel mixed sandy soil, vicinity of 296km, about 10km to the target section

Source: JICA Survey Team

1-3) Construction Machinery

Regarding procurement of construction machinery in Zimbabwe, except for special ones, it can be borrowed from local private construction companies; however, rental unit price of equipments excluding dump truck (2t, 10t), ordinary truck (3 to 3.5t), vibration roller (hand guide type, mass of 0.8 to 1.1t, tandem type, mass of 6 to 7.5t) and formed stabilizer (cutting width of 2.0m, depth of 30cm), are 2 to 10 times higher than the unit price in South Africa, therefore procurement in Zimbabwe is remarkably disadvantageous. In addition, the project for construction of multiple lanes of the Southern section of the North-South Corridor (580km from Harare to Beitbridge) was signed on May 17 (PPP, 3 years construction period by Austrian construction company), and land acquisition is scheduled to begin. It is highly probable that its construction period will overlap with ours and it is likely that the procurement of equipment from Zimbabwe will be difficult. In the mining and construction works in Zimbabwe, construction equipment is usually procured by purchasing and renting from neighboring South Africa, therefore taking into consideration of

economic efficiency, reliability of procurement, and construction condition of Zimbabwe, construction equipment will be procured from South Africa. In addition, in the Project, DOR is considering the possibility of utilization of mobile crushing plants provided by Japan in 1999.

Table 2-3-25 Main Works Machinery Procurement Sources

Equipment name	Standards & Specifications etc.	Procurement source			Remark
		Zimbabwe	Japan	3 rd country	
Bulldozer	3t,15t,21t			South Africa	Procurable in Zimbabwe
Back hoe	0.28, 0.45, 0.8m ³			Ditto	Ditto
Dump truck	2t,10t			Ditto	Ditto
General truck	3t load			Ditto	Ditto
General truck	6t load 2.9 t lifting load			Ditto	Ditto
Semi-trailer	25t load			Ditto	Ditto
Truck crane	4.9t,16t			Ditto	Ditto
Rough terrain crane	25t			Ditto	Ditto
Large breaker	800kg,1300kg			Ditto	Ditto
Motor grader	3.1m,3.7m			Ditto	Ditto
Road roller	Makadam10t-12t			Ditto	Ditto
Tire roller	8t~20t			Ditto	Ditto
Vibratory roller	Hand guide type 0.8t, Tandem type 6t			Ditto	Ditto
Vibratory roller	Combined boarding type 3t			Ditto	Ditto
Tamper	60~80kg			Ditto	Ditto
Agitator truck	4.4m ³			Ditto	Ditto
Asphalt kettle	6000L	●			
Asphalt distributor	6000L	●			
Chip Spreader		●			
Water sprinkler truck	10000L			South Africa	Procurable in Zimbabwe
Linemarker	Handy type	●			
Dissolution tank	200~350kg, 2layers	●			
Formed stabilizer	Cutting width 2.0m, depth 30cm			South Africa	Procurable in Zimbabwe
Air Compressor	3.7,11m ³ /min			Ditto	Ditto
Generator	15~300kVA			Ditto	Ditto
Concrete Mixer	0.5m ³			Ditto	Ditto

Source: JICA Survey Team

2) Important points to consider in Procurement

The important points to consider in procurement are as follows.

- ① Compile a procurement schedule that doesn't put pressure on the overall construction schedule.
- ② Procure local products as far as possible in order to contribute to local economic vitalization.
- ③ Concerning materials that cannot be procured locally, procure from Japan or third countries upon considering quality reliability, ease of procurement, available quantities and economy.
- ④ Concerning products procured from Japan or third countries, consider transportation from ports in South Africa and Mozambique. For inland transportation from ports, use trailer trucks for construction machinery and trucks for general goods (materials).
- ⑤ Since there is a possibility of receipt limit for remittance from overseas, it is necessary to

confirm the actual results in similar cases including remittance to subcontractors and materials procurement companies.

(7) Tax Exemptions and Customs Procedures

1) Tax exemptions

Tax exemption is a general rule in the grant aid project in Japan. Therefore, regarding tariffs, domestic taxes, etc., recipient countries received an explanation to take exempted procedures and agreed in writing. Therefore, the project cost was calculated without tax. As for the materials and equipment required for the Project, bituminous materials that are supposed to be imported and fuels that are supposed to be procured in Zimbabwe are considered. In the field survey, at the Ministry of Finance and Economic Development (MoFED), discussions were held by MoFED officials + JICA experts belonging to MoFED, DOR officials representing MoTID and JICA study team. The outline of the discussions and the flow of procedures and days of tax exemption procedures obtained from MoFED are shown below.

1-1) Explanation from JICA study team

- Outline of the Project and explanation of interim report (request, JICA survey, assumed construction schedule)
- Domestic procurement items (mainly fuels) and imported items (bituminous materials etc.) are considered as expected tax exempted products
- Submitting tax exemption related documents (general tax exemption countermeasures and procedure image in grant aid project)

1-2) Comments from MoFED (at the 2nd site survey)

- MR S. Phiri (Economist in Public Sector Investment Program Division) is in charge of the Project.
- MoFED needs information of items that is supposed to require tax exemption measures, its quantity, and the timing (submitted by the JICA study team after consultation).
- It is assumed to be necessary that domestic procurement items require to be handled with VAT and imported items require to be handled with tax exemption when importing.
- MoFED will arrange 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 in Zimbabwe (unlike VAT), however tax exemption is considered to be possible by taking the procedure described in the following 1-3).
- 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 MoFED previously through MoTID (permanent facility which will be used for 6 to 12 month).

f) Equipment import:

Equipment for temporary use which will be re-exported will be exempt from taxes, however, prior application to MoFED will be required through MoTID. Broken equipment which is difficult for re-export will be evaluated by ZIMRA. Tax and penalty fee will be charged if equipment that was brought without tax is sold.

g) Material purchase:

Imported items and domestic materials will be exempted from custom duty and VAT (15%) if Japanese contractor follows the designated procedure by related Ministories.

1-3) Fuel tax exemption procedure (at the 2nd site survey)

The CMED affiliated with the Ministry of Transport and Infrastructural Development imports fuels etc. for government projects for public works with exempt duty. Before or during the Project, the amount of fuel required for the Project is informed to DOR, which issues Duty Free Certificate, and CMED imports it. The contractor purchases duty-free fuel from CMED. However, CMED also requires a handling fee (not tax, but handling charge which is about 5 cents / liter).

1-4) Comments from MoFED (at the 3rd site survey)

1-4-1) Tax exemption procedure

Considering circumstances of preceding projects under the Grant Aid, the followings were discussed and confirmed about simplification of procedure with MoFED and Zimbabwe Revenue Authority (ZIMRA) at the time of the third site survey.

i) VAT refund /Import tax exemption procedure

Concerning the VAT refund procedure, the following procedure, which simplified procedure confirmed at the second site survey, was suggested by MoFED and ZIMRA.

VAT refund

a. Request for VAT refund from the Contractor to ZIMRA.

b. Application documents consist of the letter from MoTID, a copy of G/A, a copy of contract and original receipts. However, bedding and furniture etc. of lodgings not directly related to construction are excluded.

- c. Confirmation of application documents by ZIMRA within 30 days from the application date and refund from ZIMRA to the Contractor.

Import tax exemption

- a. Request for Import tax exemption from the Contractor to ZIMRA.
- b. Application documents consist of the letter from MoTID, a copy of G/A, a copy of contract and list of imported items. Applications must be made for each custom clearance.
- c. Confirmation of application documents and exemption of tax on imported items by ZIMRA.
- d. In case that the Contractor can not apply for advance, they can pay custom duty at the time of customs clearance and submit a refund request to ZIMRA afterwards.

Since January 2018 where new government was formed, tax exemption procedure was simplified based on the "National Budget Statement 2018" for contractor to apply directly to ZIMRA. Also it is specified that VAT will be refunded within 30 days after requesting. The new procedure flow was consulted and confirmed by the Director of International bureau, Department of Accounting General, Department of Revenue and Policy of MoFED during this survey period. MoFED needs to manage ZIMRA to implement properly tax exemption procedures.

ii) Corporate income tax/Personal income tax

Concerning income tax, Japanese and third country companies (consultants, contractors), as well as Japanese and third countries experts are exempt from taxes. Zimbabwean companies (cooperating companies) and Zimbabweans are subject to taxation.

iii) Fuel tax

For fuel tax exemption, it was supposed to use duty-free fuel sold by CMED under MoTID. However, if there is a problem of quality and quantity as a result of check at the time of procurement, refund method shall be applied instead.

2) Customs clearance

The imported materials and equipment to Zimbabwe are provisionally cleared at Durban Port in South Africa and are generally cleared at Beitbridge which is the border with Zimbabwe. It is necessary to consider the procurement plan with a margin, considering the number of days required such as one day at Durban Port, two to three days at Beitbridge.

(8) Soft Component Plan

This is not applicable in the Project.

(9) Implementation Schedule

1) Setting of the Works Period

In the event where the Project is implemented under the grant aid scheme of GOJ, the following table shows the draft schedule for detailed design and construction supervision. The estimated entire schedule is approximately 29.5 months, comprising approximately 8.5 months for the detailed design and tender activities and 21.0 months for the construction works.

- Cost estimation standards for civil engineering, Ministry of Land, Infrastructure, Transport and Tourism, 2016 Edition (issued by Construction Research Institute)
- Estimation Chart of Construction machinery hire, 2016 Edition (issued by Japan Construction Machinery and Construction Association)
- Construction Cost, march 2016 (issued by Construction Research Institute)
- Cost estimation research, march 2016 (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), April 2016 (issued by Japan International Cooperation Agency)

3-4) 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: 2.0
- Coefficient of correction of labor productivity per unit for skilled labor: 3.5
- Coefficient of correction of labor productivity per unit for simple machine construction: 70%
- Coefficient of correction of labor productivity per unit for general machine construction: 70%

3-5) 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.

2-4 Obligations of Recipient Country

2-4-1 General Items in the Government of Japan's Grant Aid Scheme

The following lists the general scope of works of the Zimbabwean side confirmed in the minutes of meeting agreed upon by both governments.

- Secure the land needed for the Project before the commencement of construction work.
- Exempt Japanese nationals from customs tax, domestic tax and other forms of public charges 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 0.8% of the project cost estimated)).

2-4-2 Specific Requirements for the Project

The items undertaken by the Zimbabwean side that are specific to this 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 construction and possible related costs are shown below. Since these costs are assumed to be US \$ 623,000, which is equivalent to about 2.6% of the DOR budget in 2015 of US \$ 24 million, it is comfortably affordable for the Zimbabwean side. In addition, it is necessary to secure these budgets in fiscal 2018 and 2019.

Table 2-4-1 Outline of the scope of works and the cost burden on the Zimbabwean side

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
2	A/P costs, B/A costs	Authorization for payment (A/P) expenses, Bank account (B/A) opening expenses	\$25,000
3	Assignment of wildlife rangers	Assignment expenses of rangers during survey and construction	\$150,000
4	Relocation of public utilities	Electric power line (11 k V, ZESA), telephone line (overhead wire), small diameter water pipe	\$8,000
5	EIA examination fee	About 0.8% of the Project cost	\$120,000
6	VAT refund	Refund expenses of VAT15% (cement, Re-bar, etc.)	\$290,000
Total			\$623,000

(Unit : US\$)

Source: JICA Survey Team Note: The optical fiber relocation which is embedded in the ground of the existing road side will be done at the owner's expense. ECZ=Engineering Council of Zimbabwe
The estimated refund amount in case of utilizing local subcontractor is not included,

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 : 140m×70m next to the land for DOR Makuti maintenance unit, 17km on Harare side from the start point. 70x45m Sub camp 2 locations, near the Tsetse Control Gate and Park & Wildlife office.

Concrete plant : 30m×70m, 2 locations near the start point and the end point

Disposal yard : 60m×5000m, 5km from the end point

- Required period : about 2 years

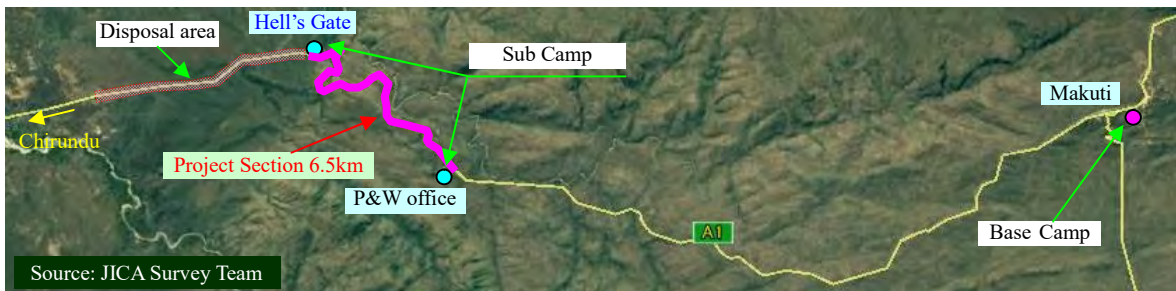


Figure 2-4-1 Candidate sites for Camp yard, plant, and disposal area

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

Immediately following signing of the official exchange of notes (E/N), the implementing agency is requested to stage an explanation meeting geared to thoroughly conveying 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.

2-5 Project Operation and Maintenance Plan

The following maintenance work will be required in order to keep the Project facilities in good condition following construction. Since surface treatment pavement scheduled to be adopted in the Project is a type that achieves pavement life planned on the basis of periodic maintenance, 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 edge, it 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 maintenance work and there are no operational problems. Since it will be especially important to repair damaged parts immediately, the local side will be expected to conduct daily rounds of inspection at sufficient intervals for early detection.

2-6 Project Cost Estimation

2-6-1 Initial Cost Estimation

The breakdown of expenses based on the cost burden classification of Zimbabwean side is estimated as follows.

(1) Cost burden on the Zimbabwean side

① Cost of registering construction company	: US\$ 30,000 (approximately 3.5 million yen)
② Cost for issuing A/P and opening B/A	: US\$ 25,000 (approximately 2.9 million yen)
③ Cost for wild life rangers	: US\$ 150,000 (approximately 17.3 million yen)
④ Cost for relocation of existing structures	: US\$ 8,000 (approximately 0.9 million yen)
⑤ EIA examination fee	: US\$ 120,000 (approximately 13.9 million yen)
⑥ VAT	: US\$ 290,000 (approximately 33.5 million yen)
Total	: US\$ 623,000 (approximately 72.0 million yen)

Note: The estimated refund amount in the case of utilizing the local subcontractor is not included in ⑥,

(2) Estimation conditions

The conditions at the point of estimation in March 2017 were as follows.

1) Exchange rate

US\$1 = ¥115.63

2) Implementation period

The Project intends for 29.5 months being set aside for the 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 Government of Japan.

2-6-2 Operation and Maintenance Cost

As is 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 3 million yen during the Project life. Since this is equivalent to 0.4% of the annual maintenance budget \$6.35million (700 million yen) of Zimbabwe in fiscal 2016, this cost is considered to be easily affordable for the Zimbabwean side.

Table2-6-1 Main maintenance items and costs

(US\$1=110 yen) Source: JICA Survey Team

Type	Cycle	Maintenance contents	Specifications	Unit	Work quantity	Unit cost (\$)	Times	Cost (\$)
Routine	Every year	Patching	1% of pavement road area	m ²	710	9.08	12	77,400
		Base/Subbase repair	1% of pavement road area	m ²	710	12.36	12	105,300
		Shoulder repair	1% of sidewalk area	m ²	140	5.55	12	9,300
		Cleaning of structures	5% of the length of structures	m	325	1.28	12	5,000
		Subtotal-I	15-years aggregate=					
Periodic	Every 5 years	Base/Subbase repair	2% of pavement road area	m ²	1,420	12.36	3	52,700
		Overlay	2% of pavement road area	m ²	1,420	9.08	3	38,700
		Shoulder repair	2% of sidewalk area	m ²	280	5.55	3	4,700
		Repair of structures	1% of the length of structures	m	65	437.00	3	85,200
		Subtotal-II	15-years aggregate =					
Total routine and periodic maintenance-III (=I+II)								378,300
Operation and maintenance cost			10 % of III	Set	-	-		37,830
Total								416,130
Cost per year								27,742

2-7 Points of Attention for Implementation of the Project

In order to smoothly implement the Project works and realize and sustain an adequate Project effect, the Zimbabwean side will need to pay particular attention to the following points.

(1) Securing the land acquisition and implementation of removal and relocation

After the signing of the Exchange of Notes(E/N) making the official decision of Project implementation, MoTID will need to secure promptly and reliably the project related land including road, borrow pit / soil disposal yard, construction camp site etc. and implement relocation / removal of existing obstacles.

(2) Speeding-up of tariff exemption and customs clearance procedures

After the Exchange of Notes (E/N) marking the official decision of Project implementation, MoTID will need to appeal to the necessary organizations and agencies to ensure speedy and sure exemption from tariffs and customs clearance.

(3) Implementation of Project explanation meetings for roadside residents

After the Exchange of Notes (E/N) marking the official decision of Project implementation, MoTID will promptly need to stage meetings to explain the Project to roadside residents or their representatives.

(4) Traffic safety

It will be necessary to appeal thoroughly to road users to follow the guidance of traffic controllers during the works.

(5) Notification of inconvenience during the construction works

Since the works are expected to cause inconvenience to passing traffic, it will be necessary to thoroughly inform road users via radio and other public media.

CHAPTER 3
PROJECT EVALUATION

CHAPTER 3 PROJECT EVALUATION

3-1 Preconditions for Project Implementation

3-1-1 Preconditions for Project Implementation

The preconditions necessary for Project implementation will be as follows.

- Securing the right of way (ROW) of 35m on each side (total 70m in width) from the center of the existing road, which is necessary for road improvement of the Project.
- Securing free of charge camp sites, plant sites and borrow pits for construction works and to obtain authorization for digging is necessary.
- It will be necessary to complete relocation and removal of obstructing objects in the scope of road construction before the start of the tender procedure.
- It will be necessary to complete acquiring the environmental permit, which has been currently proceeding by Zimbabwe before Exchange of Note for Detailed Design and Construction arrangement (Assumed by April 2018).
- It will be necessary to support customs clearance procedures and facilitate the prompt and definite implementation of tariff exemption measures regarding the equipment and materials procured for the Project. Failing to do so could lead to works delays.
- In the Project, improvement works are assumed to be implemented while preserving the traffic flow of the existing road. Therefore, in order to prevent serious accidents during and after the works, it is desirable to implement public education on road safety for road users and local residents.
- In order to extend the service life of the road and structures following completion of the works, it will be necessary for the Zimbabwean side to immediately start maintenance work after issuing the works completion certificate.
- In addition to implementing routine maintenance, removing obstacles and conducting cleaning work, etc., it will be important to definitely implement periodic inspections and conduct prompt and appropriate repairs when damage is found on the road and structures.
- Accordingly, it will be necessary to secure the necessary budget, personnel, materials and equipment so that maintenance can be implemented on an ongoing basis.

3-1-2 External Conditions for Attainment of the Overall Project Plan

The following external conditions will be needed in order to realize the Project implementation.

- ① Appropriate maintenance of pavement and drainage facilities will be implemented after completion of the Project.
- ② Regulation of overloaded vehicles will be conducted.
- ③ Understanding/cooperation will be obtained from police and road users for enlightening traffic safety.
- ④ There will be no significant change in the economic situation.

- ⑤ Procurement of equipment during construction and receipt of funds for operation in Zimbabwe will be smoothly carried out.

3-2 Project Evaluation

3-2-1 Relevance

Project implementation will contribute to improving convenience for inhabitants of Northern Zimbabwe, as well as improving the trunk road network for physical distribution in Southern Africa where the North-South Corridor is located. Accordingly, there is great significance in implementing the Project under The Government of Japan's Grant Aid scheme.

In addition, for the current road with a high accident occurrence rate as about one case per day, the number of accidents can be reduced by about 30% due to the prompt improvement of the target section. Moreover, in order to ensure the long-term sustainability of such achievements, the Zimbabwean implementing agency is judged to have sufficient capacity considering their past achievement and future efforts to conduct maintenance and management of the road after the implementation of the Project.

- ① The Project will be expected to benefit the northern region of Zimbabwe and the inland countries which are utilizing the North-South Corridor.
- ② The Project contributes to strengthening the trunk road transport network and is effective for removing impediments caused by traffic congestion currently occurring in the target road section to improve social and economic activities.
- ③ Improvement of sharp curve, addition of hill climbing lane and installation of auxiliary facilities will improve road smoothness and safety.
- ④ The Project road can be operated and maintained utilizing the independent funds, human resources and technology of the Zimbabwean side and it will not require excessively sophisticated technology.
- ⑤ The Project will contribute to the improvement and strengthening of the trunk road network, which are common objectives and policies of the national development plan in Zimbabwe.
- ⑥ The Project entails hardly any negative environmental and social impacts.
- ⑦ The Project can be implemented without any great difficulty under Japan's Grand Aid scheme.

3-2-2 Effectiveness

Implementation of the Project will improve the road conditions of the target section and also secure smooth and safe traffic flow, thereby greatly benefiting the residents of Northern Zimbabwe and users of the trunk road for physical distribution. The expected positive effects of the Project are described below.

1) Quantitative Effects

- ① Through improving the target section, by separating the slow-moving large vehicle (about 15 km/hr) into the climbing lane, other vehicles are improved to pass at 60/40 km/hr, thereby

shortening travel times by about 19 minutes.

- ② Through improving the target section, the number of accidents per year will be reduced from current 110 to 20.
- ③ Improvement of the target section can benefit smooth and safe traffic flow for 500,000 passengers per year and about 5 million tons of cargo per year.

Table 3-2-1 List of Quantitative Effects

Source: JICA Survey Team

Indicators	Current Value (the result value in 2016)	Design Value (2023) 【3years after completion of the Project】
The number of accidents (incident/year)	110 incidents	20 incidents
Travelling time on the target section (minutes)	26 minutes (6.5km section)	7minutes (6.5km section)
Volume of Passengers (passenger/year)	510 000 passengers	540 000 passengers
Volume of Cargo (ton/year)	4.3 million ton	4.8 million ton

Note: Measurement points and method concerning number of passengers, cargo volume and number of accidents are as follows.

The number of passengers was estimated by 2 for sedan, 3 for Taxi, 20 for minibus and 60 for large bus based on the traffic survey between Karoi and Chirundu. The cargo volume was calculated from 452 samples of actual vehicle weight at Chirundu (cargo volume 4.7 ~ 24 ton / vehicle). The number of accidents was obtained from police station in Makuti. Monitoring of effect will be measured and confirmed by DOR in the target year.

Regarding confirmation of the project effect target value for the number of traffic accidents, improvement of road conditions such as addition of hill climbing lane, road shoulder setting, installation of incidental facilities, etc. is considered to result in reduction of accidents due to overtaking and vehicle breakdown and to improve up to about 20 cases per year due to drivig manner violation and animals etc. in comparison to current number of accident occuring about 110 cases per year. (See table below).

Table 3-2-2 Number of accident by cause in the target section

Cause of accident	Number of accident/year		Remarks
	At present	after construction	
Overspeed	60	9	Evaluated considering the situation of accident occurrence during this survey (accidents caused due to driver's manners)
Overtaking	7	0	
Breakdown	5	0	
Approach	2	0	
Animals	6	3	Complete eradication is difficult, but it is evaluated to be reduced by half due to improvement of visibility.
Misjudgement	11	0	
Neglect of slow sign	4	0	

Others	15	8	Evaluated to be reduced by half due to improvement of road condition
Total	110	20	

Source: JICA Survey Team

2) Qualitative Effects

- ① Improvement of sharp curve will improve smooth and safe traffic flow.
- ② Installation of hill climbing lanes will separate vehicles travelling at the standard speed from slower speed vehicles, thereby prevention of accidents caused by overtaking accounting for about 23% of the total accident can be expected and smooth and safe traffic flow can be ensured.
- ③ The shortening of the travelling time will reduce transportation costs.
- ④ Through securing regularity of passenger and physical distribution and improving access to surrounding tourist spots by improvement of the target road, the Project will contribute to development of Northern Zimbabwe, help to vitalize economy and to rectify poverty differentials in the region.

Appendices

- Appendix 1 Member List of the Survey Team
- Appendix 2 Survey Schedule
- Appendix 3 List of Parties Concerned in the Recipient Country
- Appendix 4 Minutes of Discussions (M/D)
- Appendix 5 Other Relevant Data (Technical Note signed with Zimbabwean side)
- Appendix 6 Environmental Monitoring Sheet
- Appendix 7 References (Outline Design Drawings)

Appendix 1

Member List of the Survey Team

No.	Name	Work Responsibility	Affiliation
1	Shuntaro KAWAHARA	Team Leader	JICA international cooperation expert
2	Masayuki FURUKAWA	Planning and management	JICA Infrastructure and Peacebuilding Department, Transportation and Telecommunications Group, Team 1
3	Yukie KUMAZAWA	Ditto	Ditto
4	Hideaki MORITA	Work chief / Traffic planning 1	INGEROSEC Corporation
5	Mitsuhide SAITO	Vice work chief / Traffic planning 2	INGEROSEC Corporation
6	Satoshi MIZUNO	Road and pavement design 1	Eight-Japan Engineering Consultants Inc.
7	Ryo SAITO	Road structures and drainage design	Eight-Japan Engineering Consultants Inc.
8	Panganayi Cleopatra	Survey of natural conditions	Oriental Consultants Global Co., Ltd.
9	Tetsuro IZAWA	Road and pavement design 1	Oriental Consultants Global Co., Ltd.
10	Akira OHARA	Environmental & social consideration	INGEROSEC Corporation
11	Fujio OGAWA	Execution planning and estimation	INGEROSEC Corporation

Appendix 2 Survey Schedule

(1) 1st Field Survey

MM/DD 2016	Team Leader JICA Mr. S. Kawahara	Planning Coordinator JICA Mr. M. Furukawa	Chief Consultant /Road planner Hideaki MORITA	Deputy Chief /Road planner 2 Mitsuhide SAITO	Road and Pavement Design Satoshi MIZUNO	Road and Drainage Structure Ryo SAITO	Road and Pavement Design 2 Tetsuro IZAWA	Natural Condition Survey Cleopatra PANGANAYI	Environmental Examination Akira OHARA	Construction Plan /Cost Estimation Fujio OGAWA	
21	Fri							Tokyo - Singapol 11:10 - 17:20			
22	Sat		Tokyo - Harare 0:30 - 17:10	Tokyo - Harare 0:30 - 17:10	Tokyo - Harare 0:30 - 17:10	Tokyo - Harare 0:30 - 17:10	Tokyo - Harare 0:30 - 17:10	Singapol - Harare 02:10 - 12:15	Tokyo - Harare 0:30 - 17:10	Tokyo - Harare 0:30 - 17:10	
23	Sun		9:00 Internal meeting	9:00 Internal meeting	Internal meeting	Internal meeting	Internal meeting	Internal meeting	Internal meeting	Internal meeting	
24	Mon		EOJ, JICA, DOR	EOJ, JICA, DOR	EOJ, JICA, DOR	DOR Design Dep.	DOR Design, Safety Dep.	DOR Design, Material Dep.	DOR Design, Env. Dep.	DOR Design, Cont. Dep.	
25	Tue		DOR, inception	DOR, inception	DOR, inception	Move to site	Local Consultant Traffic, etc.	Local Consultant Env.	Local market research		
26	Wed		Move to site	Move to site	Move to site	Site reconnaissance	Site reconnaissance	Move to site	Move to site	Move to site	
27	Thu		Site reconnaissance	Site reconnaissance	Site reconnaissance	Site reconnaissance	Site reconnaissance	Site reconnaissance	Site reconnaissance	Site reconnaissance	
28	Fri		Unsuitable soil Deture	Surface Texture, IRI	Traffic, Axle load	Food, swamp reserch	Accident spot , safety facility	Investigation control	Environment	Unsuitable soil Deture	
29	Sat		Slope, Structure	Vehicle speed	Slope	Structure	Gradient, Curve (GPS)	Investigation control	Environment	Slope, Structure	
30	Sun		Internal meeting	Internal meeting	Internal meeting	Internal meeting	Internal meeting	Internal meeting	Internal meeting	Internal meeting	
31	Mon		Related organization	Related organization	Related organization	Structure	Existing Pavement	Investigation control	Environment	B/P	
1	Tue		Related organization	Related organization	Related organization	Structure	Accident spot , safety facility	Investigation control	Related organization	Quarry	
2	Wed		Move to Harare	Move to Harare	Move to Harare	Move to Harare	Move to Harare	Investigation control	Move to Harare	Move to Harare	
3	Thu	Haneda 00:30 - Harare 17:15	Haneda 00:30 - Harare 17:15	Other doner	DOR, recipient task	DOR, Standard	Similar structure example	Similar Pavment	Investigation control	DOR, Env. Dep.	Local Consultant
4	Fri	EOJ, JICA, DOR	EOJ, JICA, DOR	EOJ, JICA, DOR	Alt. Plan draft	Alt. Plan draft	Similar structure example	Similar Pavment	Move to Harare	Related organization	Local Contractor
5	Sat	Site reconnaissance	Site reconnaissance	Site reconnaissance	Alt. Plan draft	Alt. Plan draft	Alt. Plan draft	Alt. Plan draft	Alt. Plan draft	Alt. Plan draft	Alt. Plan draft
6	Sun	Internal meeting	Internal meeting	Internal meeting	Internal meeting	Internal meeting	Internal meeting	Internal meeting	Internal meeting	Internal meeting	Internal meeting
7	Mon	M/D draft explanation	M/D draft explanation	M/D draft explanation	Other doner	Alt. Plan draft	Alt. Plan draft	Alt. Plan draft	Alt. Plan draft	Alt. Plan draft	Alt. Plan draft
8	Tue	Progress confirmation	Progress confirmation	Progress confirmation	Utility agency	Alt. Plan draft	Alt. Plan draft	Alt. Plan draft	Alt. Plan draft	Alt. Plan draft	Alt. Plan draft
9	Wed	M/D draft discussion	M/D draft discussion	M/D draft discussion	Progress confirmation	Progress confirmation	Progress confirmation	Progress confirmation	Progress confirmation	Progress confirmation	
10	Thu	M/D signing EOJ, JICA report	M/D signing EOJ, JICA report	M/D signing EOJ, JICA report	M/D signing EOJ, JICA report	M/D draft discussion	Data correction	Data correction	Investigation control	Data correction	Data correction
11	Fri	M/D signing reserve Harare 19:00 -	M/D signing reserve Harare 19:00 -	Utility agency M/D signing reserve	Harare - 19:00	Data correction	Harare - 19:00	Harare - 19:00	Harare - 07:20 - 9:00	Harare - 19:00	Harare - 19:00
12	Sat	- Haneda 22:45	- Haneda 22:45	Internal meeting	- Tokyo 22:45	Internal meeting	- Tokyo 22:45	- Tokyo 22:45	Singapol - Tokyo 08:05 - 15:35	- Tokyo 22:45	- Tokyo 22:45
13	Sun			Harare - 19:00							
14	Mon			- Tokyo 22:45							

(2) 2nd Field Survey

MM/DD 2017	Chief Consultant /Road planner	Deputy Chief /Road planner 2	Road and Pavement Design	Road and Drainage Structure	Road and Pavement Design 2	Natural Condition Survey	Environmental Examination	Construction Plan /Cost Estimation
	Hideaki MORITA	Mitsuhide SAITO	Satoshi MIZUNO	Ryo SAITO	Tetsuro IZAWA	Cleopatra PANGANAY	Akira OHARA	Fujio OGAWA
3	Fri					Tokyo -		
4	Sat					Abition - Harare		
5	Sun					Data correction	Data correction	
6	Mon					Data correction	Data correction	
7	Tue					Move to site	Move to site	
8	Wed					Site reconnaissance	Site reconnaissance	
9	Thu					Move to Harare	Move to Harare	
10	Fri					Data correction	Consultation with local contractors	
11	Sat	Tokyo - Harare	Tokyo - Harare	Tokyo - Harare	Tokyo - Harare	Data correction	Data correction	Tokyo - Harare
12	Sun	Internal meeting	Internal meeting	Internal meeting	Internal meeting	Internal meeting	Internal meeting	Internal meeting
13	Mon	EOJ, JICA, DOR	EOJ, JICA, DOR	EOJ, JICA, DOR	EOJ, JICA, DOR	EOJ, JICA, DOR	EOJ, JICA, DOR	Procurement survey
14	Tue	Consultation with relevant departments	Consultation with relevant departments	Consultation with relevant departments	Consultation with relevant departments	Consultation with relevant departments	Consultation with relevant departments	Procurement survey
15	Wed	Move to Chirundu	Move to Chirundu	Move to Chirundu	Move to Chirundu	Move to Chirundu	Move to Chirundu	Move to Chirundu
16	Thu	Site reconnaissance	Site reconnaissance	Site reconnaissance	Site reconnaissance	Site reconnaissance	Site reconnaissance	Site reconnaissance
17	Fri	Site reconnaissance	Site reconnaissance	Site reconnaissance	Site reconnaissance	Site reconnaissance	Site reconnaissance	Site reconnaissance
18	Sat	Site reconnaissance	Site reconnaissance	Site reconnaissance	Site reconnaissance	Site reconnaissance	Site reconnaissance	Site reconnaissance
19	Sun	Move to Harare	Move to Harare	Move to Harare	Move to Harare	Move to Harare	Data Organization	Move to Harare
20	Mon	Consultation with local contractors	Consultation with local contractors	Consultation with local contractors	Consultation with local contractors	Consultation with local contractors	Site reconnaissance	Procurement survey
21	Tue	Consultation with local contractors	Consultation with local contractors	Consultation with local contractors	Consultation with local contractors	Consultation with local contractors	Site reconnaissance	Tokyo - Harare
22	Wed	Technical Note discussion	Technical Note discussion	Technical Note discussion	Technical Note discussion	Technical Note discussion	Site reconnaissance	Procurement survey
23	Thu	Technical Note singing EOJ, JICA report	Technical Note singing EOJ, JICA report	Technical Note singing EOJ, JICA report	Consultation with local contractors	Harare - Abition	Site reconnaissance	Consultation with local contractors
24	Fri	Harare -	Consultation with local contractors	Consultation with local contractors	Consultation with local contractors		Site reconnaissance	Consultation with local contractors
25	Sat	- Tokyo	Move to Chirundu	Move to Chirundu	Move to Chirundu		Site reconnaissance	Move to Chirundu
26	Sun		Internal meeting	Internal meeting	Internal meeting		Internal meeting	Internal meeting
27	Mon		Site reconnaissance	Site reconnaissance	Site reconnaissance		Site reconnaissance	Site reconnaissance
28	Tue		Move to Harare	Move to Harare	Site reconnaissance		Site reconnaissance	Move to Harare
1	Wed		Consultation with local contractors	Harare -	Site reconnaissance		Site reconnaissance	Consultation with local contractors
2	Thu		Move to Bate Bridge	- Tokyo	Site reconnaissance		Site reconnaissance	Move to Bate Bridge
3	Fri		Site reconnaissance		Site reconnaissance		Site reconnaissance	Site reconnaissance
4	Sat		Move to Harare		Site reconnaissance		Site reconnaissance	Move to Harare
5	Sun		Data Organization		Move to Harare		Move to Harare	Data Organization
6	Mon		Consultation with local contractors		Consultation with local contractors		Consultation with local contractors	Procurement survey
7	Tue		Consultation with local contractors		Consultation with local contractors		Consultation with local contractors	Procurement survey
8	Wed		Consultation with local contractors		Consultation with local contractors		Consultation with local contractors	Consultation with local contractors
9	Thu		Consultation with local contractors		Consultation with local contractors		Consultation with local contractors	Consultation with local contractors
10	Fri		Consultation with local contractors		Consultation with local contractors		Consultation with local contractors	Consultation with local contractors
11	Sat		Data Organization		Harare -		Data Organization	Harare -
12	Sun		Internal meeting		- Tokyo		Internal meeting	- Tokyo
13	Mon		EOJ, JICA report				EOJ, JICA report	
14	Tue		Harare -				Data Organization	
15	Wed		- Tokyo				Harare -	
16	Thu						- Tokyo	

(3) 2nd Field Survey

MM/DD 2017	Chief Consultant /Road planner	MM/DD 2017	Environmental Examination
	Hideaki MORITA		Akira OHARA
3	Sat	13	Sat
4	Sun	14	Sun
5	Mon	15	Mon
6	Tue	16	Tue
7	Wed	17	Wed
8	Thu	18	Thu
9	Fri	19	Fri
10	Sat	20	Sat
11	Sun	21	Sun

(4) 3rd Field Survey

2018	Team Leader	Planning Coordinator	Project Management	Chief Consultant /Road planner 1	Road and Pavement Design
	JICA Mr. Kawahara	JICA Ms. Kumazawa	JICA Mr. Ide	Hideaki MORITA	Satoshi MIZUNO
20	Sat	22:00 Dep. Narita	18:35 Dep. Narita		
21	Sun	17:15 Arrive Harare	12:35 Arrive Harare	0:30 Tokyo - 17:15 Harare	0:30 Tokyo - 17:15 Harare
22	Mon	* 9:00 Meeting with JICA Zimbabwe, *11:00 Coutresy call to EOJ, *14:30 Meeting with DoR			
23	Tue	* 9:00 Meeting with DoR, *14:30 Meeting with MoFED			
24	Wed	* 9:00 Meeting with DoR, *14:30 Meeting with ZIMRA			
25	Thu	* Signing of M/D, * Report to EoJ (Afternoon) /JICA Zimbabwe			
26	Fri	Site visit North-South Corridor			
27	Sat	Site visit North-South Corridor			
28	Sun	13:35 Depart Zim	14:40 Depart Zim	22:45 Arr. Tokyo	22:45 Arr. Tokyo
29	Mon				

Appendix 3 List of Parties Concerned in the Recipient Country

Ministry of Transport and Infrastructural Development, MoTID	
Joram M. Gumbo	Minister
Munesu Munodawafa	Permanent Secretary
Department of Road, DOR, MoTID	
M. E. Gumbie	Principal Director
Theodius K. Chinyanga	Director of Operation
M. Ruwende	Director of Design
Irene. D. Michael	Director of Planning
Tafara	Design and Pavement Engineer
Paliray	Material Engineer
Noel	Structure Engineer
Chimka	Environmental Expert
Muzim Misheck	Planning & Transportation Technician
Mungli	Deputy Provincial Road Engineer, Mash West Province
Mr. Nyikadzino	Chief Laboratory Engineer
A. Chigwereve	Chief Maintenance Engineer
Ministry of Finance and Economic Development, MoFED	
M. Makuwaza	Director of international cooperation
Forbes Kanogwere	Chief Economist
Sharon Timbe	Senior Economist
M. Chinganbo	Principal Accountant
D. Musimba	Principal Economist
Samuel Phiri	Principal Economist, PSIP
J. W. Pfunye	Deputy Director, PSIP
F. Ngorora	Director, PSIP
Ministry of Environment, Water and Climate, MEWC	
Abu. Z. Matiza	Director
Ruzengwe Manatsa	Water Dep. Expert
Nadidzano Kudzai	Climate Change Dep. Expert
Environment, Management Agency (EMA), MEWC	
Nando Ntandokamlimu	Expert
Parks and Wildlife Management Authority, MEWC	
I. Tentendaupenyu	Principal Ecologist
R. Chikerema	Chief Ecologist
African Development Bank (AfDB) Master Plan Team	
Amos Ditima	Senior Economist
EIA Consultant team for DOR	
B. Nhachi	Environmental Expert
Embassy of Japan	
Yoshinobu HIRAISHI	Ambassador Extraordinary and Plenipotentiary
D. TSUNAKAKE	Deputy Head of Mission Counsellor
Kenji MIYAGAWA	Counsellor
Masa ISHIDA	Economic Attache
JICA Zimbabwe Office	
Syumon YOSHIARA	Resident Representative
Sakae KASHIHARA	Project Formulation Advisor
Kiyoka OCHIDA	Project Formulation Advisor
Yoshinori KITAMURA	JICA ODA Advisor (for MoFED)
Jamese Nyahunde	Program Officer
JICA South Africa Office)	
Tomohiro SEKI	Resident Representative

**Minutes of Discussions
on the Preparatory Survey for the Project for
Improvement of Road Section along the Northern Part of the North-South
Corridor**

In response to the request from the Government of the Republic of Zimbabwe (hereinafter referred to as "Zimbabwe"), the Government of Japan decided to conduct a preparatory survey for the Project for Improvement of Road Section along the Northern Part of the North-South Corridor (hereinafter referred to as "the Project"), and entrusted the preparatory survey to Japan International Cooperation Agency (hereinafter referred to as "JICA").

JICA sent the Preparatory Survey Team for the Outline Design (hereinafter referred to as "the Team") to Zimbabwe, headed by Mr. Shuntaro KAWAHARA, Senior Advisor and is scheduled to stay in the country from 3 November to 11 November, 2016.

The Team held a series of discussions with the relevant officials concerned of the Government of Zimbabwe and conducted a field survey in the Project area. In the course of the discussions, both sides have confirmed the main items described in the attachment. The Team will proceed to further works and prepare the Preparatory Survey Report.

Harare, 10 November, 2016



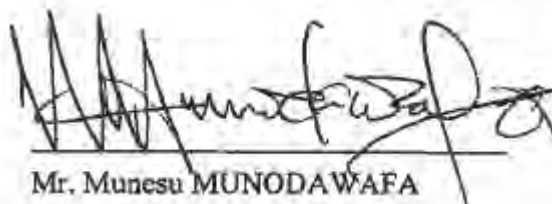
Mr. Shuntaro KAWAHARA

Leader

Preparatory Survey Team

Japan International Cooperation Agency

Japan



Mr. Munesu MUNODAWAFA

Permanent Secretary

Ministry of Transport & Infrastructural
Development

Zimbabwe

ATTACHMENT

1. Objective of the Project

The objective of the Project is to improve transportation and logistics situation as well as traffic safety of the northern part of the North-South Corridor by constructing climbing lanes and improving horizontal and/or vertical alignment, thereby contributing to economic growth of Zimbabwe and neighboring countries.

2. Title of the Preparatory Survey

Both sides confirmed the title of the survey as "the Preparatory Survey for the Project for Improvement of Road Section along the Northern Part of the North-South Corridor"

3. Project Sites

Both sides confirmed that the sites of the Project are in Zimbabwe, which is shown in Annex 1.

4. Line Ministry and Executing Department

Both sides confirmed the line agency and executing agency as follows:

- 4-1. The line ministry is Ministry of Transport & Infrastructural Development (MOTID), which would be the ministry to supervise the executing department.
- 4-2. The executing department is Department of Roads (DOR). The executing department shall coordinate with all the relevant agencies to ensure smooth implementation of the Project and ensure that the undertakings are taken by relevant agencies 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 from Makuti to Chirundu of which locations are shown in Annex 1; and
- To improve sharp curves from Makuti to Chirundu of which locations are shown in Annex 1.

5-2. JICA will assess the appropriateness of the above requested items through the

survey and will report findings to the Government of Japan. The final components of the Project would be decided by the Government of Japan.

6. The Design Policy of the Project Sites

Both sides confirmed that there are three characteristic sections from Karoi to Chirundu road, namely "Rolling terrain" (from Karoi to Makuti), "Hilly terrain" (from Makuti to Hell's gate) and "Flat terrain" (from Hell's Gate to Chirundu).

Both sides confirmed that the design policy of "Hilly terrain" is expected to be as follows:

- The basic design speed is sixty (60) km/hour; and
- For the locations where environmental and construction impact seems to be huge, forty (40) km/hour design speed will be applied.

7. The Policy to Prioritized the Project Sites

Both sides confirmed that the project site is preferably from the Hell's gate to Makuti continuously.

8. Japanese Grant Scheme

8-1. The Zimbabwe side understands the Japanese Grant Scheme and its procedures as described in Annex 3, Annex 4 and Annex 5.

8-2. The Zimbabwe side understands to take the necessary measures, as described in Annex 6, for smooth implementation of the Project, as a condition for the Japanese Grant to be implemented. The detailed contents of the Annex 6 will be worked out during the survey and shall be agreed no later than by the explanation of the Draft Preparatory Survey Report.

The contents of Annex 6 will be used to determine the following:

- (1) The scope of the Project;
- (2) The timing of the Project implementation; and
- (3) Timing and possibility of budget allocation.

The contents of Annex 6 will be updated as the Preparatory Survey progresses, and will finally be the Attachment to the Grant Agreement.

9. Schedule of the Survey

9-1. The Team will conduct second on-site survey in Zimbabwe from middle of February, 2017 to early March, 2017.

9-2. JICA will prepare the Draft Preparatory Survey Report in English and dispatch a



mission to Zimbabwe in order to explain its contents around August, 2017.

9-3. If the contents of the Draft Preparatory Survey Report is accepted in principle and the undertakings are fully agreed by the Zimbabwe side, JICA will complete the Final Report in English and send it to Zimbabwe around November, 2017.

9-4. The above schedule is tentative and subject to change.

10. Environmental and Social Considerations

10-1. The Zimbabwe side confirmed to give due environmental and social considerations during implementation of the Project, and after completion of the Project, in accordance with the JICA Guidelines for Environmental and Social Considerations (April, 2010) (The "Guidelines").

10-2. The Team explained that the Project is tentatively categorized as "Category B" because its potential adverse impact on the environment are not likely to be significant although the Project is located in a sensitive area and it falls into sensitive sectors under the Guidelines.

10-3. Both sides confirmed that the Zimbabwe side will bear to conduct the Environmental Impact Assessment (EIA), including public consultations and information disclosure, and prepare EIA report of the Project according to the Guidelines.

10-4. The Zimbabwe side explained that Zimbabwe side will engage a consultant for the EIA by the middle of the December, 2016 and the consultant will start the preparation of the EIA report after the scope of the Project is confirmed with both sides. The Team will draft and send the work zone of the Project around May, 2017 and the Zimbabwe side will take the sent information into consideration and confirm whether any additional assessments are required.

10-5. Both sides confirmed that necessary duration to obtain the EIA certificate from the date of submission of the EIA report to the Environmental Management Agency (EMA) is sixty (60) to one hundred and twenty (120) days in general.

10-6. Both sides agreed that the Zimbabwe side shall share information of the progress of EIA with the Team, such as Prospectus report, results and conditions of review of Prospectus, Terms of References of EIA, public consultation plan, records of public consultation, etc., in order that the Team can monitor the progress of EIA and give necessary advices to the Zimbabwe side according to the Guideline.

10-7. Both sides confirmed that the Zimbabwe side will obtain the EIA certificate and submitted it to JICA before concluding the Grant Agreement in order to reflect the results of the EIA into the detailed design of the Project.

10-8. The above schedule is tentative and subject to change.

11. Other Relevant Issues

11-1. 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.

11-2. Both sides confirmed that there will be no duplication of project sites and equipment with other projects.

11-3. Department of Roads shall answer to the Questionnaire received from the Team in English with relevant documents by 11 November 2017.

11-4. Both sides confirmed that the schedule until second on-site survey is as follows:

- The Team will submit their recommendation options to Zimbabwe side by end of December, 2016; and
- Zimbabwe side shall reply their comments to the Team by middle of January 2017.

In the end, the Team expressed its sincere gratitude for the kind cooperation of the Government of Zimbabwe, in particular, the DOR officials.

Annex 1 Project Site

Annex 2 Organization Chart

Annex 3 Japanese Grant

Annex 4 Flow Chart of Japanese Grant Procedures

Annex 5 Financial Flow of Japanese Grant

Annex 6 Major Undertakings to be taken by Each Government

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JAPANESE GRANT

The Japanese Grant (hereinafter referred to as the "Grant") is non-reimbursable fund provided to a recipient country to procure the facilities, equipment and 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. The Grant is not supplied through the donation of materials as such.

Based on a JICA law which was entered into effect on October 1, 2008 and the decision of the GOJ, JICA has become the executing agency of the Japanese Grant for Projects for construction of facilities, purchase of equipment, etc.

1. Grant Procedures

The Grant is supplied through following procedures :

- Preparatory Survey
 - The Survey conducted by JICA
- Appraisal & Approval
 - Appraisal by the GOJ and JICA, and Approval by the Japanese Cabinet
- Authority for Determining Implementation
 - The Notes exchanged between the GOJ and a recipient country
- Grant Agreement (hereinafter referred to as "the G/A")
 - Agreement concluded between JICA and a recipient country
- Implementation
 - Implementation of the Project on the basis of the G/A

2. Preparatory Survey

(1) Contents of the Survey

The aim of the preparatory Survey is to provide a basic document 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 country necessary for the implementation of the Project.

- Evaluation of the appropriateness of the Project to be implemented under the Grant Scheme 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.

The contents of the original request by the recipient country are not necessarily approved in their initial form as the contents of the Grant project. The Outline Design of the Project is confirmed based on the guidelines of the Japanese Grant scheme.

JICA requests the Government of the recipient country to take whatever 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 organization of the recipient country which actually implements the Project. Therefore, the implementation of the Project is confirmed by all relevant organizations of the recipient country based on the Minutes of Discussions.

(2) Selection of Consultants

For smooth implementation of the Survey, JICA employs (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 appropriateness of the Project.

3. Japanese Grant Scheme

(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 country to make a pledge for assistance, which is followed by the conclusion of the G/A between JICA and the Government of the recipient country to define the necessary articles, in accordance with the E/N, to implement the Project, such as payment conditions, responsibilities of the Government of the recipient country, and procurement conditions.




(2) 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 country to continue to work on the Project's implementation after the E/N and G/A.

(3) Eligible source country

Under the Grant, in principle, Japanese products and services including transport or those of the recipient country are to be purchased. The Grant may be used for the purchase of the products or services of a third country, if necessary, taking into account the quality, competitiveness and economic rationality of products and services necessary for achieving the objective of the Project. However, the prime contractors, namely, constructing and procurement firms, and the prime consulting firm are limited to "Japanese nationals", in principle.

(4) Necessity of "Verification"

The Government of the recipient country or its designated authority will conclude contracts denominated in Japanese yen with Japanese nationals, in principle. Those contracts shall be verified by JICA. This "Verification" is deemed necessary to fulfill accountability to Japanese taxpayers.

(5) Major undertakings to be taken by the Government of the Recipient Country

In the implementation of the Grant Project, the recipient country is required to undertake such necessary measures as Annex. The Japanese Government requests the Government of the recipient country to exempt all customs duties, internal taxes and other fiscal levies such as VAT, commercial tax, income tax, corporate tax, resident tax, fuel tax, but not limited, which may be imposed in the recipient country with respect to the supply of the products and services under the verified contract, since the Grant fund comes from the Japanese taxpayers.

(6) "Proper Use"

The Government of the recipient country is required to maintain and use properly and effectively the facilities constructed and the equipment purchased under the Grant, to assign staff necessary for this operation and maintenance and to bear all the expenses other than those covered by the Grant.

(7) "Export and Re-export"

The products purchased under the Grant should not be exported or re-exported from the



recipient country.

(8) Banking Arrangements (B/A)

a) The Government of the recipient country or its designated authority should open an account under the name of the Government of the recipient country in a bank in Japan (hereinafter referred to as "the Bank"), in principle. JICA will execute the Grant by making payments in Japanese yen to cover the obligations incurred by the Government of the recipient country or its designated authority under the Verified Contracts.

b) The payments will be made when payment requests are presented by the Bank to JICA under an Authorization to Pay (A/P) issued by the Government of the recipient country or its designated authority.

(9) Authorization to Pay (A/P)

The Government of the recipient country should bear an advising commission of an Authorization to Pay and payment commissions paid to the Bank.

(10) Environmental and Social Considerations

The Government of the recipient country must carefully consider environmental and social impacts by the Project and must comply with the environmental regulations of the recipient country and JICA Guidelines for Environmental and Social Consideration (April, 2010)

(11) Monitoring

The Government of the recipient country must 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 must regularly report to JICA about its status by using the Project Monitoring Report (PMR).

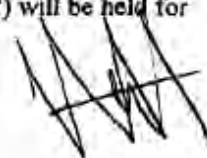
(12) Safety Measures

The Government of the recipient country must ensure that the safety is highly observed during the implementation of the Project.

(13) Construction Quality Control Meeting

Construction Quality Control Meeting (hereinafter referred to as the "Meeting") will be held for

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quality assurance and smooth implementation of the Works at each stage of the Works. The member of the Meeting will be composed by the Client, 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, before start of construction.
- b) Discussing the issues affecting Works such as construction progress, modification of the design, test, inspection, safety control and the Client's obligation progress, during of construction.



Flow Chart of Japanese Grant Procedures

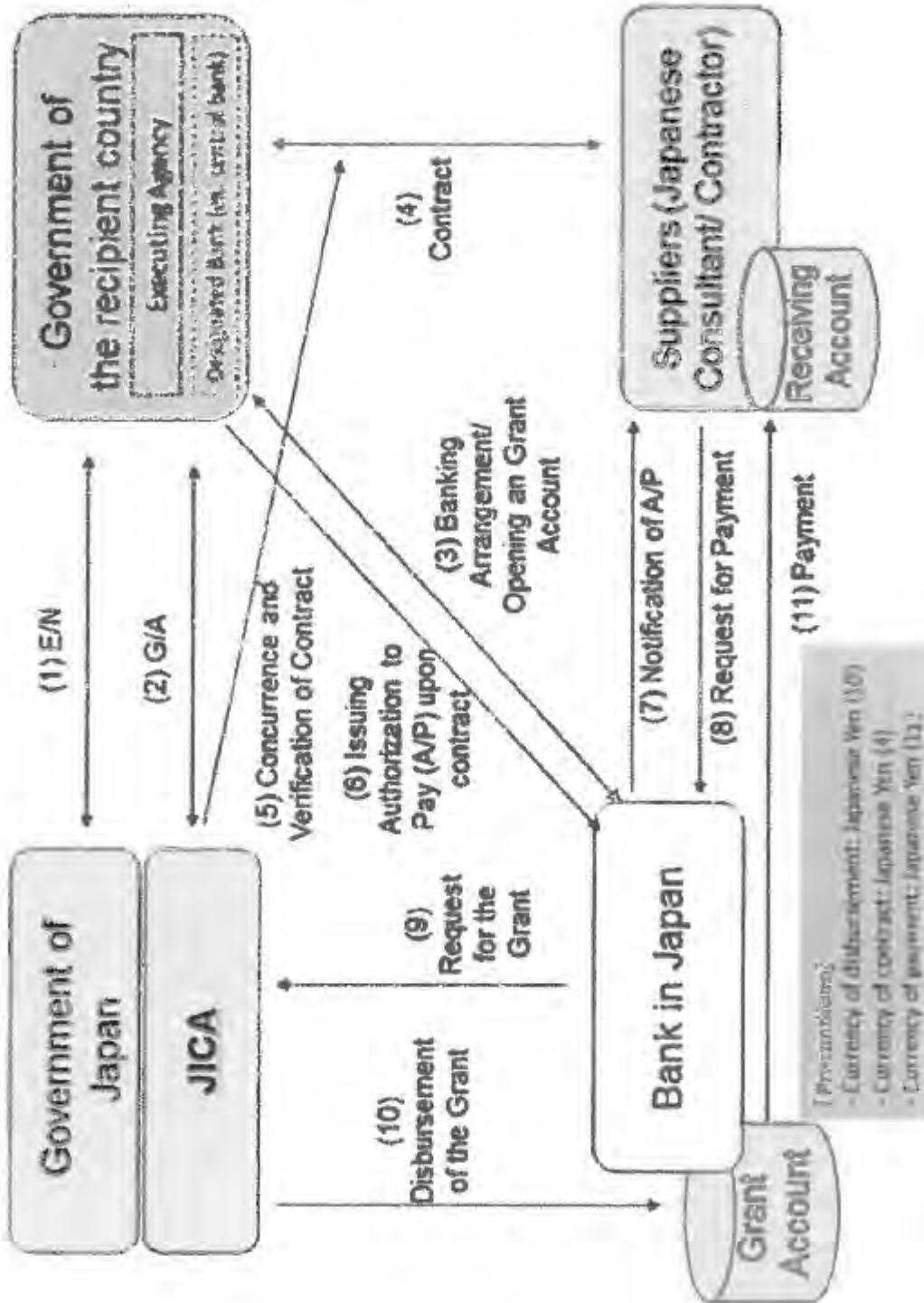
Annex 4

Stage	Flow & Works	Recipient Government	Japanese Government	JICA	Consultant	Contract	Others
Application							
Project Formulation & Preparation							
Appraisal & Approval							
Implementation	<p>(E/N: Exchange of Notes) (G/A: Grant Agreement) (A/P : Authorization to Pay)</p>						
Evaluation & Follow up							

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Financial Flow of Japanese Grant

Financial Flow of Japanese Grant (A/P Type)



(B/A: Banking Arrangement, A/P: Authorization to pay, N/A: Not Applicable)

3

Major Undertakings to be taken by each Government

Major Undertakings to be taken by Recipient Government

1. Before the Tender

NO	Items	Deadline	In charge	Cost	Ref.
1	To approve EIA	before G/A	DOR		
2	To open Bank Account (Banking Arrangement (B/A))	within 1 month after G/A	TBD		
3	To implement EIA	before start of the construction	DOR		
4	To secure the following lands, if necessary 1) project sites 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 tender document	DOR		
5	To clear, level and reclaim the following sites, if necessary 1) remove utilities 2) existing facilities 3) leveling and reclaiming the sites	before notice of the tender document	DOR		
6	To obtain the planning, zoning, building permit	before notice of the tender document	DOR		
7	To submit the result of DD	end of DD	DOR		

2. During the Project Implementation

NO	Items	Deadline	In charge	Cost	Ref.
1	To bear the following commissions to a bank in Japan for the banking services based upon the B/A 1) Advising commission of A/P 2) Payment commission for A/P	within 1 month after the signing of the contract every payment	TBD TBD		
2	To ensure prompt unloading and customs clearance at the port of disembarkation in recipient country 1) Tax exemption and customs clearance of the products at the port of disembarkation	during the Project	TBD		
3	To accord Japanese nationals and/or physical persons of third countries whose services may be required in connection with the supply of the products and the services under the verified contract such facilities as may be necessary for their entry into the recipient country and stay therein for the performance of their work	during the Project			
4	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; Such customs duties, internal taxes and other fiscal levies mentioned above include VAT, commercial tax, income tax and corporate tax of Japanese nationals, resident tax but not limited, which may be imposed in the recipient country with respect to the supply of the products and services under the verified contract	during the Project			

5	To bear all the expenses, other than those to be borne by the Grant Aid, necessary for construction of the facilities as well as for the transportation and installation of the equipment	during the Project			
6	To submit Project Monitoring Report.	every month	DOR		
7	To implement EMP and EMoP	during the construction	DOR		
	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		

(B/A: Banking Arrangement, A/P: Authorization to pay, N/A: Not Applicable)

3. After the Project

NO	Items	Deadline	In charge	Cost	Ref.
1	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			
2	To implement EMP and EMoP	for a period based on EMP and EMoP	DOR		

Major Undertakings to be Covered by the Japanese Grant

No	Items	Deadline	Cost Estimated (Million Japanese Yen)*	
1	To construct roads		TBD	
	- Improvement of roads			
2	To implement detailed design, tender support and construction supervision (Consultant)		TBD	
3	Contingencies		TBD	
	Total		TBD	

*: The cost estimates are provisional. This is subject to the approval of the Government of Japan.




(2) 3rd Field Survey

Minutes of Discussions
on the Preparatory Survey for the Project for
Improvement of Road Section along the Northern Part of the North-South Corridor
(Explanation on Draft Preparatory Survey Report)

With reference to the minutes of discussions signed between Ministry of Transport & Infrastructural Development (hereinafter referred to as the "MoTID") and the Japan International Cooperation Agency (hereinafter referred to as "JICA") on 10th November 2016 and in response to the request from the Government of the Republic of Zimbabwe (hereinafter referred to as "Zimbabwe ") dated 8th July 2015, 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 Improvement of Road Section along the Northern Part of the North-South Corridor (hereinafter referred to as "the Project"), headed by Mr. Shuntaro KAWAHARA, Senior Advisor from 22nd January to 26th January, 2018.

As a result of the discussions, both sides agreed on the main items described in the attached sheets.

Harare, 14th February, 2018




Mr. Shuntaro KAWAHARA

Leader
Preparatory Survey Team
Japan International Cooperation Agency
Japan



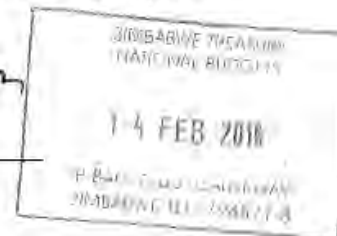
Eng. J.S. Mtsho
Permanent Secretary

Ministry of Transport & Infrastructural Development
Zimbabwe



Mr. W.L. Manungo
Permanent Secretary

Ministry of Finance & Economic Development
Zimbabwe



ATTACHEMENT

1. Objective of the Project

The objective of the Project is to improve transportation and logistics situation as well as traffic safety of the northern part of the North-South Corridor (Harare - Chirundu) by constructing climbing lanes and improving horizontal and/or vertical alignment, thereby contributing to economic growth of regions surrounding the North-South Corridor.

2. Project site

Both sides confirmed that the site of the Project is in the northern part of the North-South Corridor between Makuti and Hell's Gate (6.5km between the 306.5km-post and the 313.0km-post measured from Harare), which is shown in Annex 1.

3. Line Ministry and Executing Department

Both sides confirmed the line agency and executing agency as follows:

- 3-1. The line ministry is Ministry of Transport & Infrastructural Development (MOTID), which would be the ministry to supervise the executing department.
- 3-2. The executing department is Department of Roads (DOR). The executing department shall coordinate with all the relevant agencies to ensure smooth implementation of the Project and ensure that the undertakings are taken by relevant agencies properly and on time.

4. 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.

5. Cost estimate

Both sides confirmed that the cost estimate including the contingency described in Annex 2 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 and so on.

6. Confidentiality of the cost estimate and technical specifications

Both sides confirmed that the cost estimate in Annex 2 should never be duplicated or disclosed to any third parties until all the contracts under the Project are concluded.

7. Procedures and Basic Principles of Japanese Grant

The Zimbabwe side agreed that the procedures and basic principles of Japanese Grant as described in Annex 3 shall be applied to the Project. In addition, the Zimbabwe side agreed to

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take necessary measures according to the procedures.

8. 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.

9. 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 2024 and shall monitor the progress based on those indicators.

[Quantitative indicators]

Indicators	Current Value (the result value in 2016)	Design Value (2024) [3years after completion of the Project]
The number of accidents (incident/year)	110	20
Travelling time on the target section (minutes)	26* ¹	7* ²
Volume of Passengers (passenger/year)	510 000	540 000
Volume of Cargo (ton/year)	4.3 million	4.8 million

*1: average travelling time of vehicles clogged with heavy vehicles

*2: expected average travelling time on drivings lanes

[Qualitative indicators]

- Improvement of sharp curves will ensure smooth and safe traffic flow.
- Installed hill climbing lane will contribute to separate vehicles travelling at the standard speed from slower vehicles, thereby reducing accidents caused by overtaking, which account for approximately 23% of the total accident, and ensuring smooth and safe traffic flow.
- Through securing regularity of passenger and logistics, the Project will contribute to the social and economic vitalization of the vicinity of the North-South Corridor including neighbouring countries.
- The shortening of the travelling time will reduce transportation costs.
- Through improving access to surrounding tourist spots, the Project will contribute to regional economic vitalization.
- Through improving the target road, the Project will contribute to development of Zimbabwe and help to rectify poverty and social disparities in the surrounding area.

10. Undertakings of the Project

10-1. Undertakings 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.

10-2. Relocation of public utilities within the Project site

Both sides confirmed that MoTID would secure all related site for the Project before the tender.

10-3. Tax Exemption

Both sides confirmed the tax concessions for the Project is explained as described in 1. (2)-NO.6 of Annex 5 and Annex 6.

11. Monitoring during the implementation

The Project will be monitored by the Executing Department 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.

12. 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, no later than six months after completion of the Project.

13. 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.

14. Schedule of the Survey

JICA will finalize the Preparatory Survey Report based on the confirmed items. The report will be sent to the Zimbabwe side around March 2018.

15. Environmental and Social Consideration

15-1. General Issues

15-1-1. 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 considered to be a large-scale road project, is not located in a sensitive area, or has none of the sensitive characteristics under the "JICA Guidelines

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for Environmental and Social Considerations (April 2010)", hence it is not likely to have a significant adverse impact on the environment.

15-1-2. 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.

15-2. Environmental Issues

15-2-1. Environmental Impact Assessment (EIA)

Both sides confirmed the EIA report will be approved by Environmental Management Authority by May 2018.

15-2-2. Environmental Management Plan and Environmental Monitoring Plan

Both side agreed that environmental mitigation measures and monitoring shall be conducted based on Environmental Management Plan (EMP) and Environmental Monitoring Plan (EMoP), which is listed in the Final Environmental Impact Assessment Report (submitted to Environmental Management Agency (EMA) by MoTID on 10th November, 2017).

Both sides confirmed the EMP and EMoP of the Project is as Annex 9, respectively.

15-3. Environmental and Social Monitoring

15-3-1. Environmental Monitoring

Both sides agreed that the Zimbabwe side will submit results of environmental monitoring to JICA with PMR by using the monitoring form attached as Annex 10. The timing of submission of the monitoring form is described in Annex 5.

15-3-2. 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 10 on its website.

16. Other Relevant Issues

16-1. Disclosure of Information

Both sides confirmed that the Preparatory Survey Report from which 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.

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16-2. Safety Measures

To avoid accidents on site during the implementation of the Project, the Zimbabwe side agreed to cause the consultant and the contractor to enforce safety measures such as setting safety assurance to the site, providing information for security control to public, and deploying adequate security personnel, based on "The Guidance for Management of Safety for Construction Works in Japanese ODA Projects".

16-3. No programme overlapping

Both sides confirmed that the target road (6.5km between the 306.5 km-post and the 313.0 km-post measured from Harare) is not overlapping with sections to be improved by other donors' fund.

16-4. Further cooperation to improvement of the North-South Corridor

The Zimbabwe side conveyed their expectation that the remaining priority section (7.1km from 300.0km-post to 306.5km-post and from 313.0km post to 313.6km-post measured from Harare) will be improved by Japanese fund as the second phase. The Team explained that necessity of the further cooperation must be examined by Government of Japan and JICA.

Annex 1 Project Site

Annex 2 Project Cost Estimation

Annex 3 Japanese Grant (including attachment1,2)

Annex 4 Project Implementation Schedule

Annex 5 Major Undertakings to be taken by the Government of Zimbabwe

Annex 6 Tax Refund and Exemption Procedure

Annex 7 Project Monitoring Report (template)

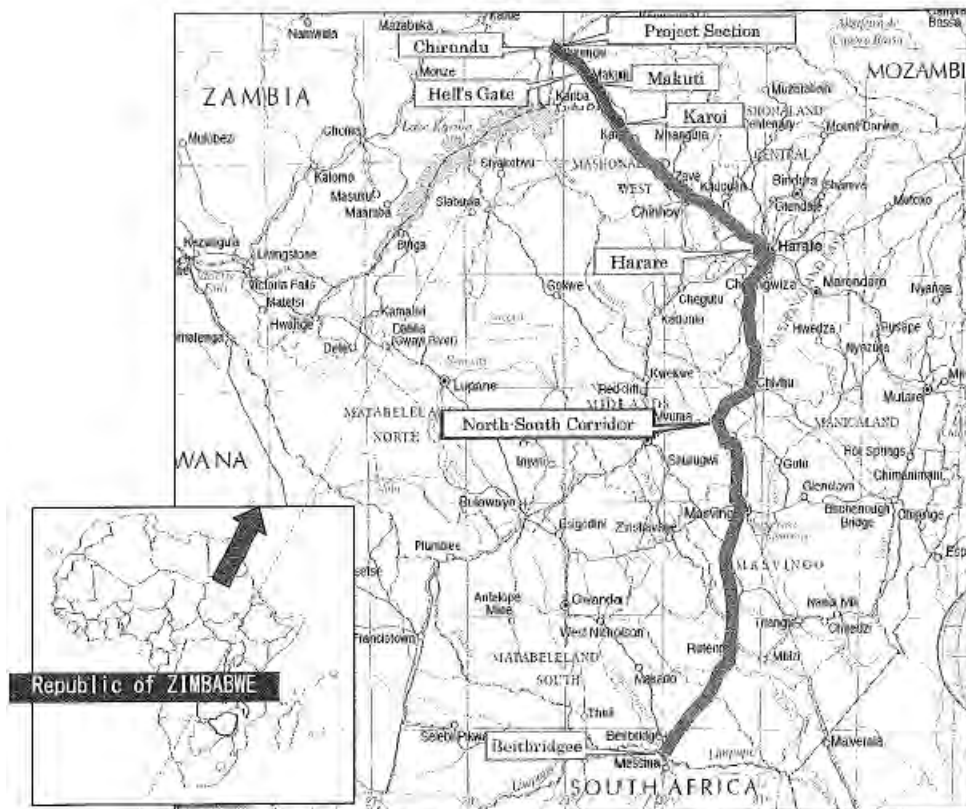
Annex 8 Environmental Check List

Annex 9 Environmental Management Plan/Environmental Monitoring Plan

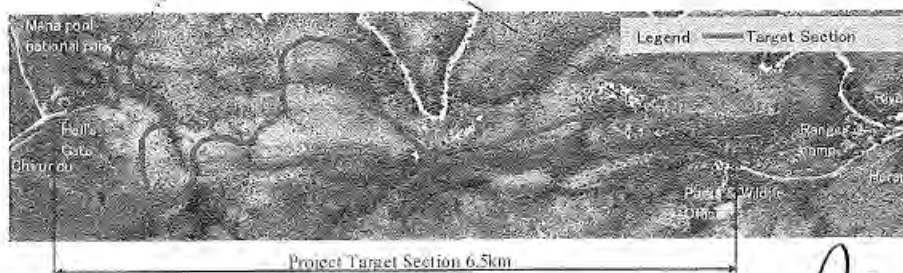
Annex 10 Environmental and Social Monitoring Form



Project Site



Requested section for investigation 141km



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Project Cost EstimationCONFIDENTIAL

(1) Cost borne by the Government of Japan

Confidential

(2) Cost borne by the Government of Zimbabwe

Total initial cost : USD 0.623 million

- Bank Charges : USD 0.025 million
- Company registration for the Project : USD 0.30 million
- Assingment of wildlife rangers: USD 0.150 million
- Relocation of public utilities : USD 0.080 million
- EIA examination fee *¹ : USD 0.12 million
- VAT refund *² : USD 0.290 million

Total annual maintenance cost : USD 0.028 million

*¹: EIA examination fee calculated as construction cost multiplied by minimum rate of the fee is provisional and subject to negotiation between DOR and EMA. Rate of EIA examination fee/project cost varies from 0.08% to 1.5% according to the degree of environmental impacts of a project.

*²: Amount of VAT refund will be calculated based on actual amount of products and services purchased in Zimbabwe by the Japanese Contractor of the Project. As of now, minimum amount is provisionally described according to the amount of materials expected to be purchased in Zimbabwe.

(3) Cost Estimation Condition

- Estimated timing : March 2017
- Exchange rates : USD 1.00 = JPY 115.63

(4) Others : The project is implemented in accordance with the system of Japan's Grant Aid. The above cost estimation does not assure the ceiling cost on the E/N and shall be reviewed by the Government of Japan before signing of the E/N between the two Governments. Cost borne by the Government of Zimbabwe is also provisional and will be assured according to progress of the Project.



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

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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)."

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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 O/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, contracting 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

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Recipient (or executing agency), the Consultant, the Contractor and JICA. The functions of the Meeting are as follows:

- 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.

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4) Export and Re-export

The products purchased under the Japanese Grant should not be exported or re-exported from the Recipient.

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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				
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) Detail 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
	(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			

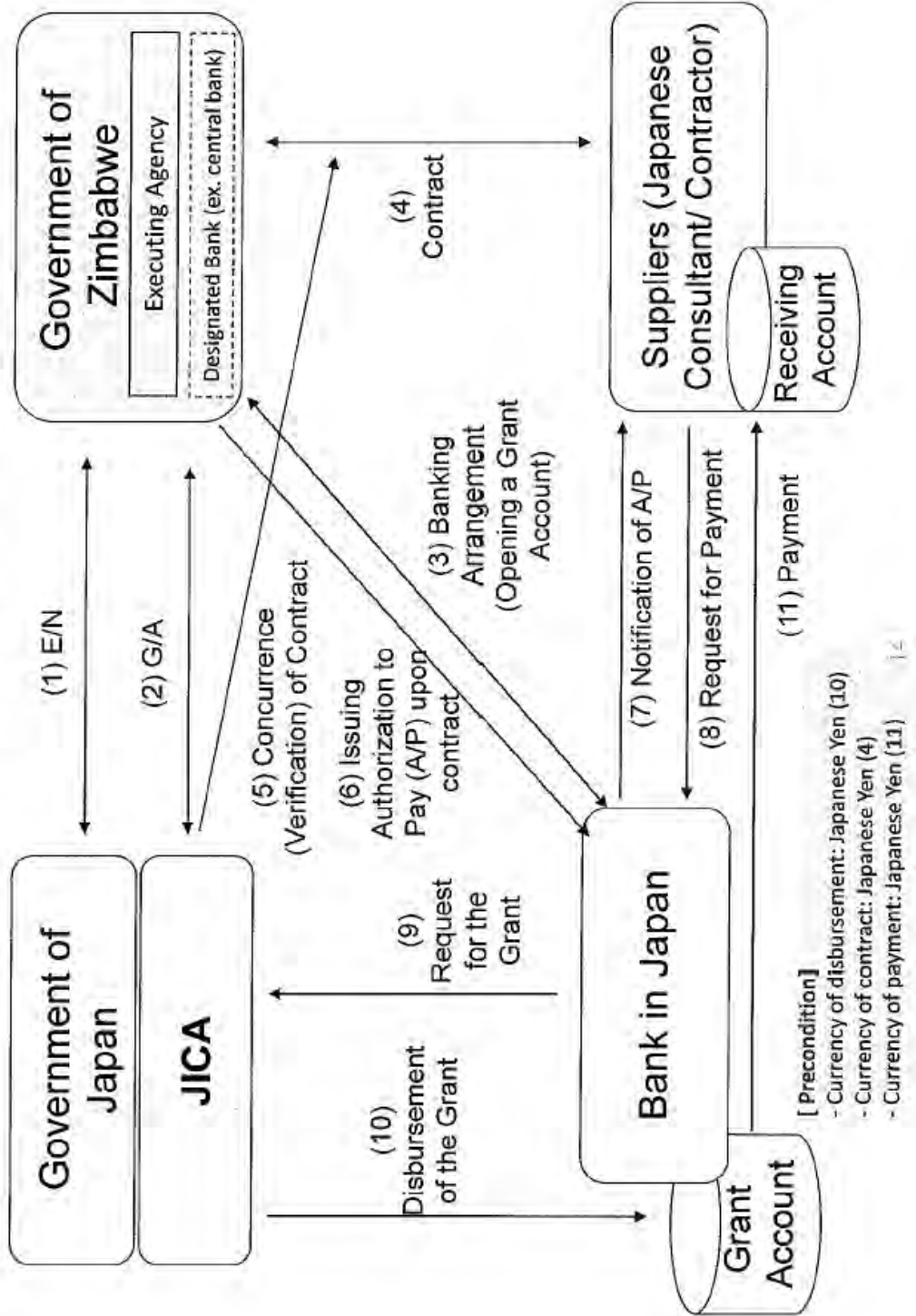
notes:

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.

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Financial Flow of Japanese Grant (A/P Type)

FINAL REPORT 2



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Implementation schedule

YY/MM	2018						2019																						
	7	8	9	10	11	12	1	2	3	4	5	6																	
Implementation design	█						(Field survey, implementation design)																						
							█												(Tender assistance)										
																			▲ (Contractor agreement)										

YY/MM	2019												2020												2021					
	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3							
Main works and Execution supervision	█						(Domestic preparation)																							
	█						(Preparatory works)																							
	█						(Removal works for existing structure, clearing)																							
							█												(Road earth work)											
																			█			(Paving works)								
							█												(Drainage works)											
																			█			(Retaining wall works)								
																						█			(Ancillary works)					
																									█			(Clearing)		
	▼																								▼			(Quality control meeting)		

Legend: ▼ Rainy season

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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	Cost (USD)	Ref.
1	To approve EIA	within 1 month after the signing of the G/A	DOR	120,000	
2	To open Bank Account (Banking Arrangement (B/A))	within 1 month after G/A	MoFED	25,000	
3	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		
4	To secure the following lands, if necessary a) project sites b) temporary construction yard and stock yard near the Project area Quarry, borrow pit and disposal site near the Project area	before notice of the tender	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 tender	DOR utility companies	8,000	
6	To obtain the planning, zoning, building, construction permit	before notice of the tender	DOR		
7	To submit the result of detailed design (DD)	end of DD	DOR		
8	To Assign of Wildlife rangers including assignment expenses of rangers during DD and construction	during DD and construction	DOR, PWMA	150,000	
9	To submit Project Monitoring Report (with the result of Detail Design)	before notice of tender	DOR		

Note: DOR: Department of Road, MoFED: Ministry of Finance and Economic Develop, MoTID: Ministry of Transport and Infrastructural Development, PWMA: Parks and Wildlife Management Authority, USD: US dollar

(2) During the Project Implementation

NO	Items	Deadline	In charge	Cost	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		
	To bear the following commissions to a bank in Japan for the banking services based upon the B/A				
2	a) Advising commission of A/P	within 1 month after the signing of the contract	MoFED		
	b) Payment commission for A/P	every payment	MoFED		※1
3	Company registration for the Project Costs of registration of the consultant (ECZ) and the contractor (ECZ), 2 years each assumed	before start of the construction	DOR	30,000	
4	To ensure prompt unloading and customs clearance at the port of disembarkation in recipient country	during the Project	DOR		

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	a) Tax exemption and customs clearance of the products at the port of disembarkation	during the Project	DOR		
5	To accord Japanese nationals and/or physical persons of third countries whose services may be required in connection with the supply of the products and the services under the verified contract such facilities as may be necessary for their entry into the recipient country 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 exclusively for the Project be exempted or be borne by its designated authority without using the Grant.	during the Project	DOR MoFED ZIMRA	290,000	
7	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		
8	To submit Project Monitoring Report.	every month	DOR		
9	To submit Project Monitoring Report (Final).	within one month after signing of Certificate of Completion for the works under the contract	DOR		
10	To implement EMP and EMoP	during the construction	DOR		
	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: B/A: Banking Arrangement, A/P: Authorization to pay, N/A: Not Applicable.

※1 The estimated cost is included in the cost shown in 1 (i)-No2

(3) After the Project

NO	Items	Deadline	In charge	Cost	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		

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2. Other obligations of the Government of Zimbabwe funded with the Grant

NO	Items	Deadline	Amount (Million Japanese Yen)*
1	To construct roads/bridges - Reconstruction of the roads To conduct the following transportation a) Marine(Air) transportation of the products from Japan and the third country to the recipient country b) Internal transportation form the port of disembarkation to the Project site		/
2	To implement detailed design, bidding support and construction supervision(Consulting Service)		/
3	Contingency		/
	Total		Confidential

* The Amount is provisional, confidential and subject to the approval of the Government of Japan.

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Tax Refund and Exemption Procedure

Activity	Taxes Arising	Tax Exemption Facility
Importation of equipment and components for use on the project	VAT and Customs Duty on imported equipment and components for exclusive use on the Project	Section 122 of the Customs and Excise Regulations (2001) already provides for a <i>Rebate of Duty</i> on goods imported by a foreign organisation under an Aid or Technical Cooperation Agreement. Goods imported for use on the project will, thus, be exempt from Customs Duty and Value Added Tax (VAT).
Purchases of local goods and services for use on the project.	Value Added Tax on locally procured goods and services.	The Minister of Finance and Economic Development has approved the VAT exemption of goods and services purchased on the domestic market for use on the project. Administratively, the exemption will be implemented through a VAT refund facility, which Government extended, through the 2018 National Budget, to all goods and services for use on Approved Projects by all Development Partners .
Engagement of Local Contractors	<ul style="list-style-type: none"> • Corporate Income Tax on local contractor's income. • Pay as you Earn on Local contractor's employees 	In order to expedite completion of projects, refunds will be processed within a period not exceeding 30 days.
Engagement of Foreign Contractors	Corporate Income Tax arising from business	Local contractors and workers engaged on the project will be subject to corporate income tax on their income from the project. The Minister of Finance and Economic Development has approved the exemption of receipts and accruals of foreign contractors

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(Companies)	income accruing from the project and attributable to a Permanent Establishment.	engaged on the project from income tax.
Engagement of Foreign Engineers and Experts	Withholding Tax on Fees	The Minister of Finance and Economic Development has approved the exemption of withholding taxes on fees for services of a technical, managerial, administrative or consultative nature arising from the project.

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Project Monitoring Report
on
Improvement of Road Section along the Northern Part of the North-South Corridor
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 (_____): _____

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 2-2

1: Project Description	
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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		

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).

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(PMR)

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.

2-5 Project Cost

2-5-1 Cost borne by the Grant(Confidential until the Bidding)

Components			Cost (Million Yen)	
	Original (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			Cost (1,000 Taka)	
	Original (proposed in the outline design)	Actual (in case of any modification)	Original ^{1),2)} (proposed in the outline design)	Actual
1.				

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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:
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:

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	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.

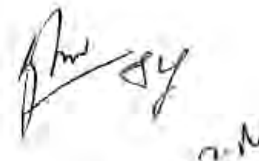
5-3 Monitoring Plan of the Indicators for Post-Evaluation

Please describe monitoring methods, section(s)/department(s) in charge of monitoring, frequency, the term to monitor the indicators stipulated in 1-3.

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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. Drawing (PMR (final) only)

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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	Condition of payment Price (Increased) F=C+D
Item 1	●●t	●	●	●	●	●
Item 2	●●t	●	●	●		
Item 3						
Item 4						
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
Item 1	●	●	●			
Item 2						
Item 3						
Item 4						
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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Environmental and Social Consideration Check List

Classification	Environmental item	Main check items	Yes: Y No: N Not applicable: —	Specific Environmental and Social Consideration (Reasons for Yes/No, basis, mitigation measures, etc.)
1 Authorization and explanation	(1) EIA and environmental authorization	(a) Has an environmental assessment report (EIA report, etc.) been prepared? (b) Has the EIA report, etc. been approved by the government of the country concerned? (c) Does approval of the EIA report, etc. entail collateral conditions? If there are collateral conditions, will they be satisfied? (d) In addition to the above, have environmental authorizations been obtained from local responsible authorities where necessary?	(a) N (b) N (c) N (d) N	(a) The final EIA report has been submitted to the EMA on 7 th of November 2017. (b) Ditto (c) Ditto (d) Contractor shall consult relevant agencies listed in the EMP of the EIA report, such as the Ministry of Mines and Mining Development, the Ministry of Environment, Parks and Wildlife Management Authority, Water Authority, etc., to obtain necessary authorization/permission prior to finalize construction planning.
	(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 understanding been obtained? (b) Have comments from residents been reflected in the project contents?	(a) N (b) N	(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. (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.
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.

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Classification	Environmental item	Main check items	Yes: Y No: N Not applicable: —	Specific Environmental and Social Consideration (Reasons for Yes/No, basis, mitigation measures, etc.)
	(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) In the project, filling and cutting parts are covered with excavated topsoil and recovered from the local vegetation to prevent soil runoff. There are no river tributaries, etc. around the project target section that could trigger deterioration of water quality in downstream areas. (b) In the project, appropriate drainage facilities will be installed to ensure that surface water runoff doesn't pollute sources of groundwater, etc. Moreover, water for use in concrete and paving works will be obtained from existing reservoirs that can offer ample volume. (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 \emptyset standards, etc.?	(a) Y	(a) Zimbabwe has no standards, etc. related to noise and vibration, however, traffic volume on the project target road is limited and the project is not expected to cause increase in the traffic volume; hence it is not envisaged that the project will exacerbate noise and vibration.
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 target road of the project does not go near any national parks or bird nature reserves (sanctuaries) that are subject to flora and fauna protection regulations.
	(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?	(a) N (b) Y (c) — (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 registered on the IUCN Red List. (c) No critical ecological impacts are envisaged. (d) Inside safari areas, installation of fences, 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. (e) Since the project entails

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Classification	Environmental Item	Main check items	Yes: Y No: N Not applicable: -	Specific Environmental and Social Consideration (Reasons for Yes/No, basis, mitigation measures, etc.)
		(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.? Have countermeasures been prepared for such cases? (f) If road will be constructed in undeveloped areas, will be development bring about major damage to the natural environment?		improvement of an existing road, it is not envisaged that forest destruction, hunting, desertification, drying of wetlands, etc. will arise. (f) Ditto
	(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	(a) Although water intake from reservoirs and sand extraction from around rivers will arise in line with 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.
	(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. As for the surplus soil from construction, the soil will be used for embankment inside the road servitude, so any soil dumping sites will not be required.
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	(a) N (b) - (c) - (d) - (e) -	(a) The project will not entail any land acquisition or involuntary resettlement of residents. (b) - (c) -

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Classification	Environment Item	Main check items	Yes: Y No: N Not applicable: -	Specific Environmental and Social Consideration (Reasons for Yes/No, basis, mitigation measures, etc.)
		<p>concerning compensation and life rebuilding measures be given 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>(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>(f) -</p> <p>(g) -</p> <p>(h) -</p> <p>(i) -</p> <p>(j) -</p>	<p>(d) -</p> <p>(e) -</p> <p>(f) -</p> <p>(g) -</p> <p>(h) -</p> <p>(i) -</p> <p>(j) -</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' lives? If necessary, will consideration be given to mitigate impacts?</p> <p>(c) Is there a risk of diseases (including HIV and other infections) arising due to population influx from other areas? If necessary, will consideration be given to</p>	<p>(a) N</p> <p>(b) -</p> <p>(c) -</p> <p>(d) N</p> <p>(e) N</p> <p>(f) N</p>	<p>(a) The project entails improvement of an existing road; hence it is not envisaged that existing means of transport and the livelihoods of people engaged in them will be affected.</p> <p>(b) There is no residential land, etc. around the project target section.</p> <p>(c) Since the scale of the project works (road length, execution period) is limited, it is not envisaged that local public health will be seriously impacted.</p> <p>(d) Traffic volume on the project target road is limited; hence it is not envisaged that local road traffic will be negatively impacted during works or in service.</p> <p>(e) The project will entail conducting work while using the existing road;</p>

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Classification	Environmental item	Main check items	Yes: Y No: N Not applicable: —	Specific Environmental and Social Consideration (Reasons for Yes/No, basis, mitigation measures, etc.)
		appropriate public health measures? (d) Will the project impart any other negative impacts on road traffic (congestion, increased road accidents, etc.) in surrounding areas? (e) Will the road hinder movement of residents? (f) Will road structures (flyovers, etc.) block sunlight or radio waves?		hence it is not envisaged that movement of users will be hindered. (f) The project does not include any structures that block sunlight or radio waves.
	(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) As a result of investigation of buried cultural heritage at the EIA conducted by the government of Zimbabwe, there is no particular cultural heritage, etc. that require consideration.
	(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) There are no areas that require landscape consideration around the target section of the Study.
	(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) — (b) —	(a) There are no ethnic minorities or indigenous people that require consideration around the target section of the Study. (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 ensure that the safety of project workers and local residents is not threatened?	(a) Y (b) Y (c) Y (d) Y	(a) The necessary measures will be taken according to work environment legislation in the country concerned. (b) Because the project target road passes through a safari area, steps such as assigning rangers to prevent workers from getting attacked by wild animals will be taken. In cases of dangerous work on steep cliffs and excavation of slopes, etc. using explosives and so on, registered qualified workers who possess the appropriate technology will implement the work, and safety education will be thoroughly implemented for workers. (c) Safety education will be implemented for workers. (d) Since rangers from the local park office of the Parks and Wildlife Management Authority will be deployed, the safety of project workers and local residents will not be threatened.

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Classification	Environmental Item	Main check items	Yes: Y No: N Not applicable: -	Specific Environmental and Social Consideration (Reasons for Yes/No, basis, mitigation measures, etc.)
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) Since a certain degree of noise and vibration, muddy water, dust, solid wastes, etc. will be generated in line with the roadworks, water sprinkling to counter dust will be implemented and solid wastes will be thoroughly managed. (b) The project entails improvement of an existing road; hence it is not envisaged that the works will impart a significant impact on the natural environment (ecosystem). (c) It is not envisaged that the works will impart a significant impact on the social environment.
	(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
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) -	(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) -	It is not envisaged that the project will impact environmental issues on the global scale.

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Chapter 9: Environmental Management Plan

9.1 Purpose of EMP

The purpose of this EMP is to ensure that potential environmental impacts arising from the construction of the Road are appropriately managed and avoided where possible. It provides guidance for both project personnel and contractors during planning, construction, operation and decommissioning phases.

9.2 Organisation and Responsibility

In order for the EMP to be effective there is need for planning, monitoring, checking and reviewing of activities to support the actual implementation. The activities necessary to support the implementation process include training, inspections, reviews, documentation of progress and reporting.

9.3 Training, Awareness and Competency

Environmental awareness is very important in the implementation of the EMP. It is therefore recommended that all staff undergo environmental awareness training starting by induction training of all workers. A project specific training plan that identifies the competency requirements for all personnel allocated with environmental responsibilities can then be developed to ensure that all the workers are equipped with the necessary skills to manage all environmental issues. Training for all personnel identified in the training plan must be completed before commencement of the associated construction activities.

9.4 Supervision of Construction Activities

All construction and installation activities including those carried out by subcontractors and suppliers can be supervised, or regularly checked through the completion of site inspections by the Contractors Environmental Manager, to ensure that requirements identified in the EMP have been implemented. The frequency and extent of this supervision will vary according to the degree of competence displayed by the workforce and the level of risk to the environment.

9.5 Inspection of other Operational Standards

Appointed environmental representatives will carry out weekly inspections of their respective construction areas, to verify that housekeeping or supporting controls are being implemented effectively. These inspections will utilise the site standards as the minimum standards that should be achieved, with necessary actions being recorded and raised during progress meetings.

9.6 Environmental Inspection and Reporting

The Contractors Environmental Manager will carry out an assessment of the Project's environmental performance, based upon the reports from the environmental management representatives during the period, reports from the environmental specialists and from his own site inspections. This can be carried out at a frequency of no greater than monthly intervals but could be held more regularly depending on the nature of the construction activity. An assessment of the performance over the month can be made and quantified. A monthly report detailing performance for the period can be provided to the Clients Project Manager and can include a summary of environmental inspections completed, complaints and incidents.

9.7 Environmental Monitoring

Monitoring of noise, vibration, dust and water quality can be carried out in accordance with the specialist environmental procedures and environmental targets developed. The Contractor's Environmental Manager may maintain a register of all environmental monitoring.

9.8 Control of Non-Compliance

Non-complying processes or activities may initiate a Non-Compliance Report, which would identify the nature of the problem, the proposed corrective action, action taken to prevent recurrence of the problem and verification that the agreed actions have been carried out.

9.9 Team Meetings

Weekly meetings chaired by the Project Environmental Manager may be held to review performance and co-ordinate short-term planning of forthcoming activities. Environmental management representatives would use these meetings to report on the findings of their inspections together with any systematic or recurring issues. Actions from these meetings would be recorded via minutes and reviewed by the Project Manager.

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Table 3.3 Environmental Management and Monitoring Plan for Predicted Impacts during the Planning phase

Environmental Issue	Management of Issue	Implementing Agency	Monitoring Agency	Time Frame
Design and Planning Phase				
Proposed road designs	The road designs must meet all the relevant standards	MoTID/BN	MoTID	Before construction
Stakeholder involvement	People tend to be hostile to a project if they are not aware of it. Stakeholder consultations must be conducted to ensure that those affected by the project are made aware of the project.	BN/MoTID	EMA	Before construction
To provide temporary employment to local youths	Deliberate employment of local youths	MoTID	Village heads and community elders	Before construction
Regulatory Requirements	It is essential to fulfill all regulatory requirements before commencement of any work on the site. Obtaining <ol style="list-style-type: none"> 1. Sand extraction permit. 2. a water abstraction permit 3. a blasting permit 4. certificates of fitness for all employees 5. registration with NASSA 6. Plan for pollution control 7. All relevant permits must be sort. 	MoTID	ZINWA/EMA	Before construction starts
Contaminated Sites clean-up and Site Risk Assessment	Specific sites with heaps of contaminated soils should be cleaned and disposed of at designated hazardous sites	MoTID All the Polluters	NASSA EMA /Polluters/ National Parks/MoTID	Before construction starts
Site establishment and Contractor Risk awareness training	Ensure contractor is aware of health and safety and environmental requirements for the site through training	MoTID	MoTID/EMA Ministry of Health	Before construction starts
Camp Site establishment	Identify Contractor's camp (for Workers)	Contractor/MoTID	MoTID	Before construction

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Environmental issue	Management of issue	Implementing Agency	Monitoring Agency	Time Frame
Removal of all cables in the construction area	The Tel-one overhead cables , liquid Telecom cables and ZETDC cables must be removed before construction starts	Tel-one, Liquid Telecom & ZETDC	MoTID	starts Before construction starts
Graves	There are a number of what appear to be graves within the RoW particularly at the 309+385 km peg and the 311+000 km peg. This should be avoided at the road design stage.	MoTID	MoTID	Before construction starts
Construction Phase				
Vegetation clearance	All works shall be carried out in a manner that the destruction to the flora and fauna is minimized. Trees and vegetation shall be removed only if they impinge directly on the proposed works or necessary temporary works. The Contractor shall make every effort to avoid removal and/or destruction of trees.	MoTID	EMA	During construction of the road
Protection of the specially protected species the Python (<i>Python sabae</i>) and Brown Snake Eagle (<i>Circaetus cinereus</i>)	The two animals shall be protected by the construction team. They shall not be killed. If found report to the Morangore National Park staff	MoTID	National Parks	During construction of the road
Destruction or damage of terrestrial wildlife habitats, Biological resources or ecosystems that should be preserved.	Avoid unnecessary removal of plants and soil	MoTID	EMA	During construction of the road
Wildlife corridor disturbance	The area must not be fenced to allow animal movement across the road as this site falls within Parks and Wildlife Authority area.	MoTID	EMA	Throughout the existence of the road
Control of rock vibration during drilling.	Use appropriate drilling machinery to control rock vibration during drilling.	MoTID	MoTID	During construction of the road

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Environmental issue	Management of issue	Implementing Agency	Monitoring Agency	Time Frame
The tight curves	All tight curves must be adequately signposted.	MoTID	MoTID	During Construction
Blasting	The blasted areas should be monitored for ground movements.	MoTID	MoTID	During and after construction
Generation of dust	All stockpiles shall be located sufficiently away from sensitive receptors. All vehicles delivering materials shall be covered to avoid spillage and dust emission. The contractor shall enforce vehicle speed limits to minimize dust generation. The contractor shall sprinkle water on dust sensitive areas to suppress it on all exposed areas as required. All earthworks shall be protected in a manner acceptable to minimize generation of dust.	MoTID	EMA	During construction of the road
Emissions from vehicles and machinery	All vehicles, equipment and machinery used for construction shall be regularly serviced and well maintained to ensure that emission levels are kept within acceptable standards.	Contractor	MoTID	During construction of the road
Noise	All machinery and equipment should be well maintained and fitted with noise reduction devices where necessary. Maintenance of vehicles, equipment and machinery shall be regularly and properly maintained, to the satisfaction of the Engineer, to keep noise at a minimum.	Contractor	MoTID	During construction of the road
Hazardous substances	The contractor, prior to the commencement of work, shall provide list of harmful or hazardous and risky chemicals/material that will be used in the	MoTID	EMA	During construction of

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Environmental issue	Management of issue	Implementing Agency	Monitoring Agency	Time Frame
	project work to the Resident Engineer.			the road
Traffic control and safety	The Contractor shall take all necessary measures for the safety of traffic during construction and provide, erect and maintain such barricades, including signs, markings, flags, lights and flagmen as may be required by the Resident Engineer for the information and protection of traffic approaching or passing through the section of the highway under improvement.	Contractor	MoTID	During construction of the road
Traffic jams and Congestion	Detailed Traffic Control Plans shall be prepared and submitted to the Engineer for approval prior to commencement of works on any section of road. 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. Personnel used for traffic control by the contractor shall be properly trained, provided with proper gear including communication equipment and reflective jackets. All signs, barricades, pavement markings used for traffic management shall be to the standards and approved by the Resident Engineer/ Police.	Contractor	MoTID	During construction of the road
Public and Worker safety	All reasonable precautions will be taken to prevent danger of the workers and the public from accidents etc. The contractor shall supply all workers with the necessary protective clothing such as safety goggles, helmets, masks, boots, etc. The contractor has to comply with all regulations regarding health and safety of all staff and workers.	Contractor	MoTID MOHCW	During construction of the road

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Environmental issue	Management of issue	Implementing Agency	Monitoring Agency	Time Frame
Protection of Archaeological, Cultural and Religious Resources	All archaeological objects discovered on the site during construction work shall be reported to the NMMZ. Nan's grave must be well labelled and identified. Avoid construction waste and rubble from covering it	MoTID	NMMZ	During construction of the road
Hydrology and water quality	The project proponent must ensure that there is no direct disposal of hazardous substances into ground water. Contaminated water storage facilities shall not be allowed to overflow and appropriate protection from rain and flooding shall be implemented.	MoTID	EMA	During construction of the road
Sanitation Facilities	No paint products may be disposed on site and brush/roller washing facilities shall be established to the satisfaction of the Engineer. The Contractor shall provide sanitation facilities on site. Proper toilets must be provided that have the capacity to serve a facility of such magnitude.	MoTID	EMA	During construction of the road
To prevent onsite soil contamination To prevent and manage fuel, Bitumen and oil spills and leakages	Install appropriate trap systems to collect bitumen, fuel and oil spills and leakages Recover, treat and dispose chemical, fuel, oil spills and leakages appropriately Develop and implement a hazardous chemicals record, use and have proper management system. Audit the bitumen management system Organize induction training for all employees handling hazardous substances	MoTID	EMA	During construction of the road

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Environmental issue	Management of issue	Implementing Agency	Monitoring Agency	Time Frame
<p>To adequately manage the veld fire risk during construction</p> <p>To prevent accidents, injury and or loss of life</p>	<p>Establish a solid waste management program for recovery, re-use and recycling.</p> <p>Establish a preventive maintenance program for vehicles, equipment and machinery.</p> <p>The project site must be fire guarded</p> <p>Risk assessments must be carried out and induction training for all staff and workers must be conducted.</p> <p>Use adequate sign-posting to discourage risk behaviour at sites prone to the fire hazard</p> <p>Conduct regular fire drills as part of emergency preparedness in liaison with EMA and Morongora National Parks staff</p>	MoTID	EMA National Parks	During construction of the road
To provide an adequate and safe water supply on site	Water for construction can be drawn from the Marongora Dam and recommended sources upon obtaining the relevant water extraction permit from ZINWA within the area	MoTID	EMA National Parks ZINWA	During construction of the road
To reduce noise generation during construction	<p>Monitor the bacteriological and chemical quality of drinking water as per the legal requirements.</p> <p>Maintain all equipment and vehicles in good working order and ensure they are all within manufacturers limits of noise generation.</p> <p>Implement noise abatement procedures e.g. (shuttering etc.) and ensure noise levels are within WHO standards and guidelines</p>	MoTID	EMA National Parks	During construction of the road
To minimize noise impacts on the Morongora, Workers compound and offices areas.	<p>Use low noise and low vibration equipment where possible</p> <p>Site noise sensitive operations at least more than 100m from the noise source</p>			

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Environmental issue	Management of issue	Implementing Agency	Monitoring Agency	Time Frame
To minimize the impacts of vibration drilling machinery	Undertake all incidental noisy operations during day working hours Provide protective gear (muffs) for staff working at noisy sites Monitor noise levels during activity peak periods to maintain set occupational exposure levels (e.g. <75dB) Register and respond to complaints as per grievance and response mechanisms Include performance in noise management in the annual environmental performance report	MoTID	EMA/NASSA	During construction of the road
To minimize dust generation and reduce dust related pollution	Take measures to maintain and or comply with set Threshold Level Values (e.g. PM10 and PM 2.5) Provide and maintain suitable gravel or coarse aggregate surfaces in the entry and exit routes, storage and parking bays. Watering access roads and other dust generation sites during construction to suppress dust Provide protective respirators and dust filters to employees and site workers Use sign posts to remind workers to wear protective devices	MoTID	EMA NASSA	During construction of the road
To minimize waste generation during construction	Establish an integrated solid waste management system (ISWMS) on site to prevent unnecessary wastage of materials Audit construction materials weekly All materials shall be opened and used with an intention to recycle Self and or external audit of the set Integrated Solid Waste Management System (ISWMS)	MoTID	EMA	During construction of the road
Decommissioning Impacts				
Objective	Activity	Implementing Agency	Monitoring Agency	
To Clean all contaminated soils with fuel and chemicals	Clean all contaminated soils on the area	MoTID	EMA	After construction
To minimize waste generated from demolitions of camp	Sale or donate all reusable materials to locals	Contractor/ MoTID	MoTID	Three months

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Environmental issue	Management of issue	Implementing Agency	Monitoring Agency	Time Frame
structures	Remove the camp within three months of completing the road and rehabilitate the area to its original state			after construction
To hand over Water facilities	Any water facilities provided by the contractor to be handed over to the relevant Authorities	MoTID	ZINWA	After construction
1997 Nan's grave	Identify and make sure the grave is visible and not covered by construction rubble.	MoTID	NMIMZ	After construction
Operational phase				
Maintain the cleanliness of the road	Continue to clean and maintain the road	MoTID	EMA	Monthly

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Chapter 10: Environmental Monitoring programme

10.1 Introduction

This section presents an initial monitoring program for the project proponent to use in monitoring compliance with environmental requirements by the construction contractor. A number of factors, including methods and frequency of reporting, will be determined upon award of the construction contract to the successful bidder and the specific construction means and methods established at that time.

10.2 Monitoring during the Planning Stage (Site Clearance)

The planning stage is critical as it gives both the proponent and the contractor an opportunity to critically look at the project's activities. It is at this stage that the following parameters are monitored:

- Daily inspections to ensure that site clearance and preparation activities are not going beyond the area needed for the road,
- Noise survey should be undertaken to determine workers exposure and construction equipment noise emission.
- Daily monitoring to ensure that the activity is not producing a lot of dust.
- Daily monitoring of vehicle movement to avoid fuel and oil leakage from the vehicles.
- Daily monitoring of waste generation

10.3 Monitoring during the Construction Stage

The construction has the most critical activities and as such, monitoring is to be carried out on the contractor, mobile equipment and construction materials. The following aspects are to be effectively monitored at the construction stage:

- Daily monitoring to ensure that fugitive dust from cleared areas, access roads and raw materials are not creating dust nuisance.
- Daily inspections to be conducted ensure that trucks carrying raw materials and heavy equipment are parked at the designated area on the proposed site so as to prevent traffic congestion along the highway.
- Conduct daily inspections to ensure that flagmen are in place and that adequate signs are posted along the roadway. This is to ensure that traffic along the Highway has adequate warnings and direction.
- The assessment of the quantity of solid waste generated to be undertake daily and records kept of its ultimate disposal. Additionally, solid waste generation and disposal of the construction site should also be monitored.
- Where possible, construction crews should be sourced from within the study area. This will ensure that the local community will benefit from the investment.

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10.4 Monitoring during the Operational Phase of the road

The operational stage of the project has minimal impacts as few activities are involved on the road:

- Annual checks on the drainage system and clearing of growth around the road.
- The integrity of the road structure should be conducted preferably every two (2) years.

Table 10-1: Environmental Monitoring Plan for Predicted Impacts

Item	Monitoring Action	Timing	Supervision
1. Prior to construction			
Obtaining all planning , Engineering and EIA permits	Application of permits to be done ahead of the project by MoTID	Prior to Commissioning of the Bridge	MoTID
2. During Construction Phase			
Dust Suppression	Observe watering of construction roads and other construction works to determine if contract Requirements are followed.	Inspect daily as part of construction monitoring	Resident Engineer Contractor EMA
Maintenance of construction access and parking lot	Confirm maintenance schedule for all haul/access roads and verification that road has been rehabilitated and left in as good condition as when work started, when not needed	Monthly during construction	Contractor EMA MoTID
Air Emissions	Observe operation to determine if equipment is being properly maintained to control emissions	Monthly	MoTID EMA
Noise	Monitor to determine that construction activities are not exceeding 75dB	Daily during Construction	Contractor EMA
Erosion Protection	Monitor to determine if erosion protection devices such as traps have been installed in accordance with contract requirements	Monthly	Contractor Resident engineer EMA
Archaeology	Monitor site clearance and excavation for evidence of previously unidentified historic or cultural sites or artefacts and order that construction in the immediate area of any such finds be discontinued until proper investigation takes place. Protect Nan's grave	During construction	Contractor NMMZ

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Item	Monitoring Action	Timing	Supervision
Toilet facilities	Inspect to ensure that adequate toilet facilities are provided for construction workers and that wastes are properly removed and treated.	During construction	MoTID Contractor
EMP Implementation	Check to determine that all the environmental facilities are installed properly and the environmental management action plan is followed strictly.	Once a month	MoTID EMA
3. Operational Impact Monitoring of Road			
Construction noise	Undertake noise monitoring at the construction sites	Once a month	MoTID
Security			
Road maintenance	Monitor to ensure that appropriate continuing maintenance is being carried out on highway slopes, cuts, and embankments	Once a month	MoTID
Dust control	Monitor the dust levels to ensure that dust is not a nuisance to the environment	Once a month	MoTID/EMA
4. Impact monitoring of Road			
Noise	Monitor the noise levels for the road	Daily Duration: 2 days Twice a day (daytime and night)	EMA MoTID Contractor
Waste Management	Monitor the continual dumping waste in the area	Daily	MoTID

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Environmental Monitoring Sheet

1. Planning Phase (Detailed Design D/D):

(1) Response to conditions required from EIA

Condition required	Response

(2) Measures for preventing accidents with wild animals

Measure	Design specification

2. Construction Phase:

(1) Response to conditions required from EIA

Condition required	Response

(2) Compliance with legislation concerning extraction of construction materials (soil, sand, and gravel, water)

Item	Location	Authorization required	Approval status (Yes / No)
Borrow pit for soil		Ministry of Mines and Mining Development, EMA, etc.	
Sand pit		Ministry of Mines and Mining Development, EMA, etc.	

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Quarry		Ministry of Mines and Mining Development, EMA, etc	
Water		Zimbabwe National Water Authority (ZINWA)	

(3) Residual soil treatment

Item	Location	Authorization required	Approval status (Yes/No)	Measures for prevention of dust and soil erosion	Implementation status
Soil dumping site		Parks and Wildlife Management Authority, EMA, etc.			

(4) Measures for prevention of dust in the atmosphere during construction works

Item	Referred contract article	Measures for prevention of dust	Implementation status
Dust			

(5) Safety measures (transportation routes, times, etc.)

Item	Referred contract article	Safety Measures	Implementation status
Working hours			
Traffic control			
Material transportation			
Protect people from dangerous works			
Protect workers from wild animals			

(6) Wastes management

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5/June/2017

Memorandum of Technical Note

The criteria shown below in highway designing were agreed by DOR and JICA Survey Team for the Project for improvement of road section along the northern part of the North-South Corridor 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
No. of Lanes		No.	2
Lane Width		M	3.5
Shoulder Width		M	2.5 paved
Climbing Lane Width		M	3.5
Crossfall on Carriageway		%	2.5
Crossfall on Shoulder		%	2.5
Minimum Radius of Horizontal Curve		M	D/S60=100, D/S40=50 (Absolute)
Maximum Superelevation		%	10
Stopping Sight Distance		M	80
Fill Slope	Soil	Angle	1:1.5~4.0 (by slope height)
Cut Slope	Rock	Angle	1:0.3~0.5 (by rock type)
	Other than Rock	Angle	1:1.0
Pavement Design Life		Year	15
Pavement Type		-	Carriageway: DBST, Shoulder: SBST
Drainage (design return period)		Year	Minor culvert:5years, Major Culvert:20years

Note: [] = Minimum value, DBST= Double Bituminous Surface Treatment, SBST= Single Bituminous Surface Treatment.

Remarks:**1) Existing ROW (Right of Way)**

ROW = Karoi-Chirundu 70m (35m both side from existing road center (Harare-Lion's Den 140m (70m both side)

2) Proposed Road Section

Project section will be adopted to the selected plan B (From Hell's Gate toward to Makuti continuously, refer to the JICA survey team letter, ZM/JP/2016/DEC/01, dated 28/Dec./2016, and MoTID reply letter on 25 Jan. 2017)

3) Specific Features

- Safety facilities = Rumble strip, sand barrier, delineator, sign board, guard rail, etc. will be considered
- Parking Area = Parking area will be considered for car stopping/parking along the road.

4) Other Consideration

- Adequate material source shall be secured (ZPC stone quarry (66km away from Makuti) will be used for project cost estimate).
- 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 Sep. 2018).



Eng. M. E. Gumbie
Principal Director, DOR
MoTID, Zimbabwe

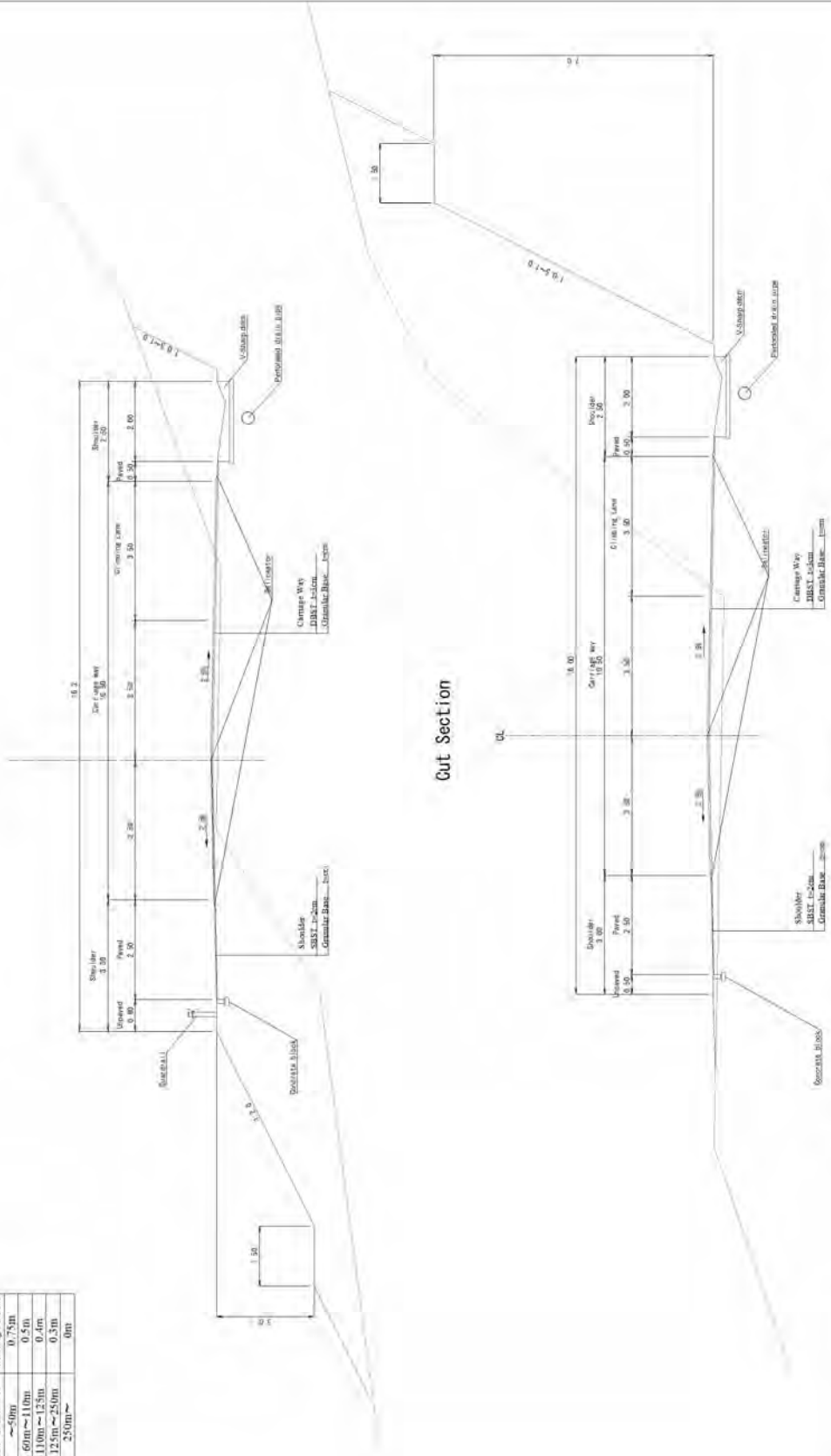


H. MORITA
Chief Consultant of JICA Survey Team
INGÉROSEC Corporation, JAPAN

Typical Cross Section

Fill Section

Curve Widening	
Radius of Curvature	Widening Per Lane
~50m	0.75m
60m~110m	0.50m
110m~125m	0.4m
125m~250m	0.3m
250m~	0m



Notes:	Client:	JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)
	Consultant:	INGERROSEC 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
	Job:	TYPICAL CROSS SECTION
	Scale:	1:100
	Drawing No.:	
	Date:	

Draft Environmental Monitoring Form

1. Planning Phase (Detailed Design D/D):

(1) Response to conditions required from EIA

Condition required	Response

(2) Measures for preventing accidents with wild animals

Measure	Design specification

2. Construction Phase:

(1) Response to conditions required from EIA

Condition required	Response

(2) Compliance with legislation concerning extraction of construction materials (soil, sand, and gravel, water)

Item	Location	Authorization required	Approval status (Yes / No)
Borrow pit for soil		Ministry of Mines and Mining Development, EMA, etc.	
Sand pit		Ministry of Mines and Mining Development, EMA, etc.	
Quarry		Ministry of Mines and Mining Development, EMA. etc	
Water		Zimbabwe National Water Authority (ZINWA)	

(3) Residual soil treatment

Item	Location	Authorization required	Approval status (Yes / No)	Measures for prevention of dust and soil erosion	Implementation status
Soil dumping site		Parks and Wildlife Management Authority, EMA, etc.			

(4) Measures for prevention of dust in the atmosphere during construction works

Item	Referred contract article	Measures for prevention of dust	Implementation status
Dust			

(5) Safety measures (transportation routes, times, etc.)

Item	Referred contract article	Safety Measures	Implementation status
Working hours			
Traffic control			
Material transportation			
Protect people from dangerous works			
Protect workers from wild animals			

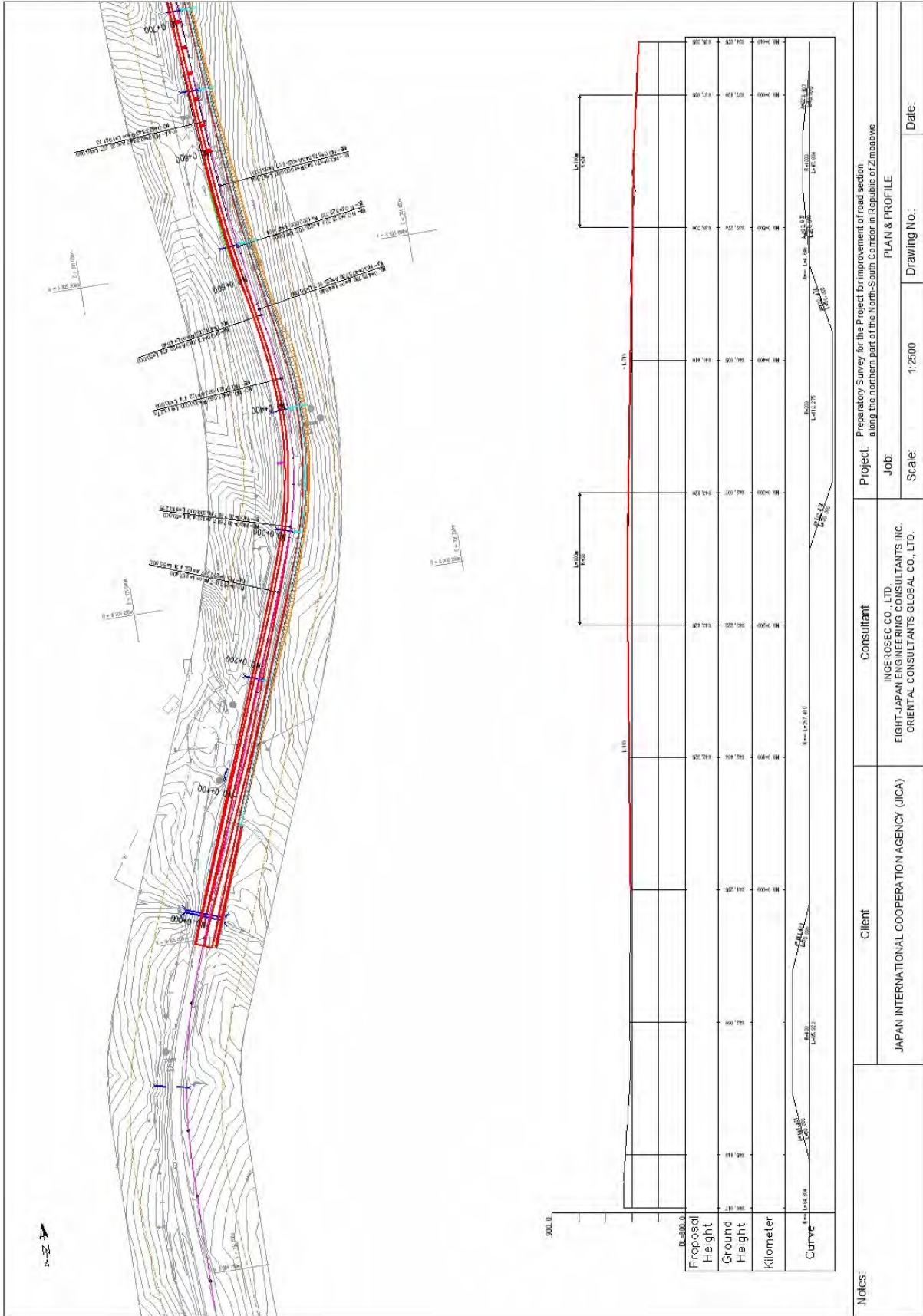
(6) Wastes management

Item	Referred contract article	Measures for waste treatment	Implementation status
Solid waste			
Wastewater			
Hazardous waste			

Appendix 7 References (Outline Design Drawings)

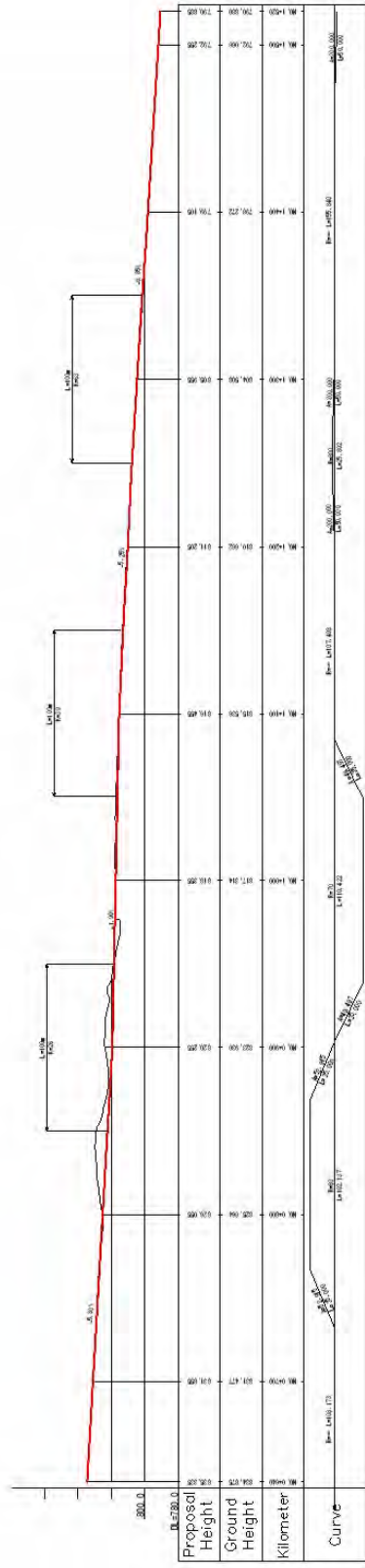
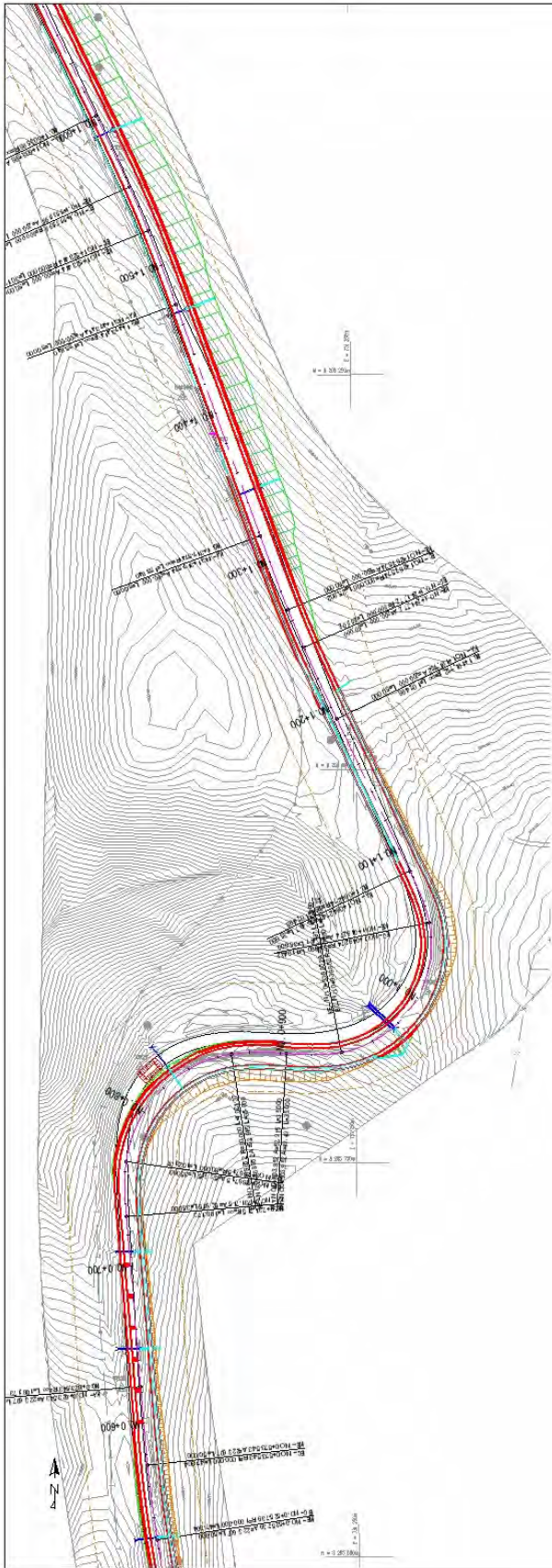
List of the Outline Drawings

Items	Contents	No. of Sheets
1	Plan, Profile, Cross Section	11
2	Drainage Structures	11
3	Ancillaries	12

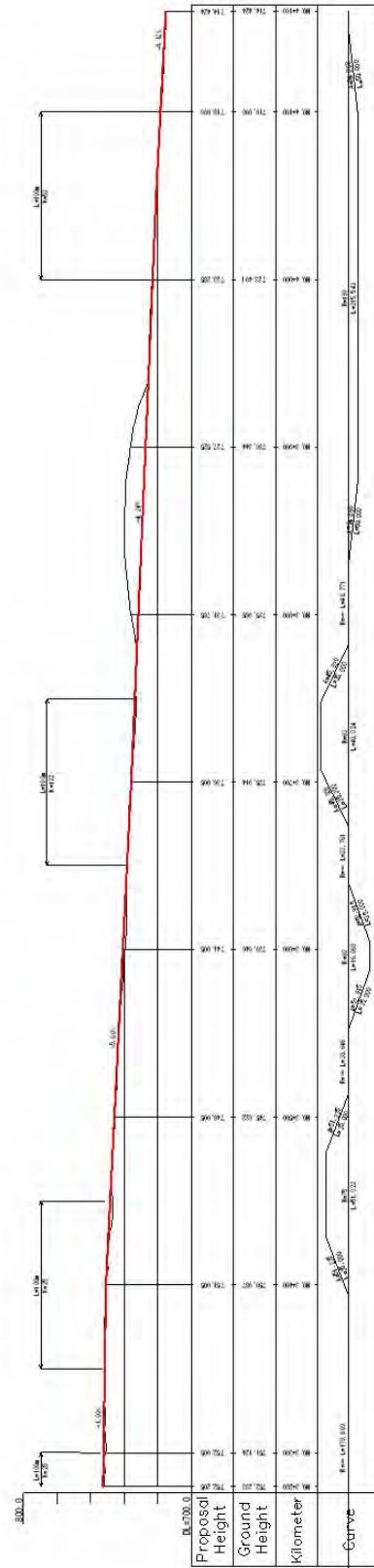
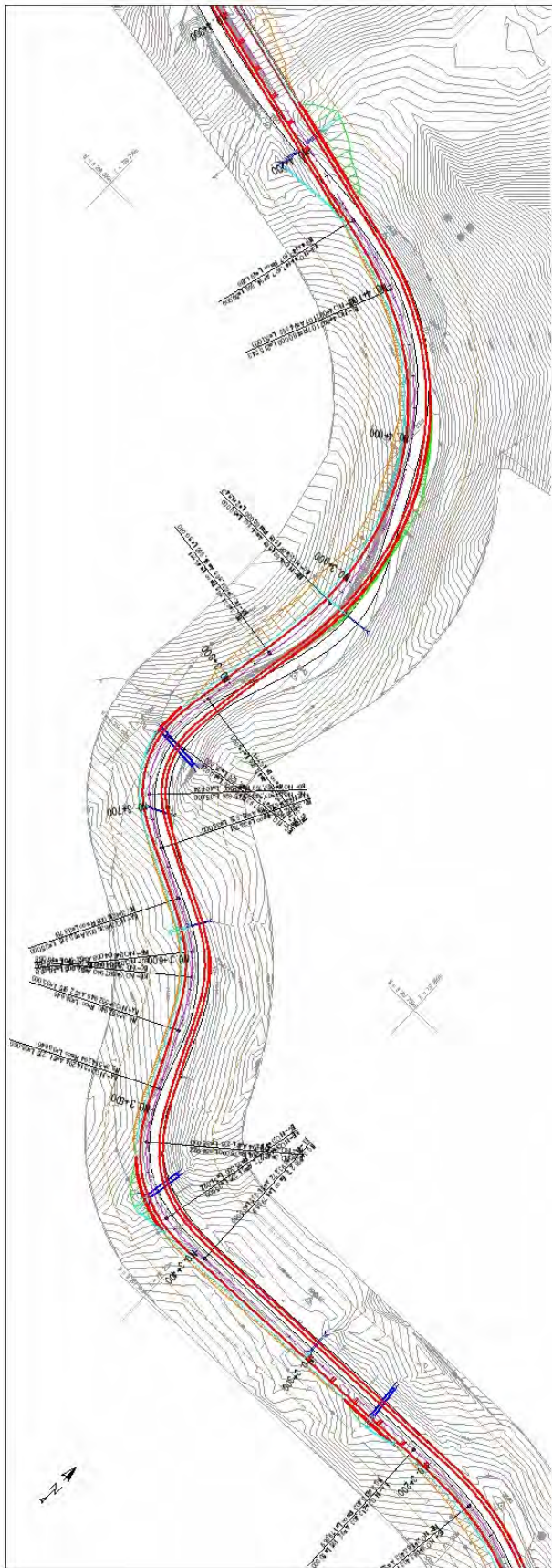


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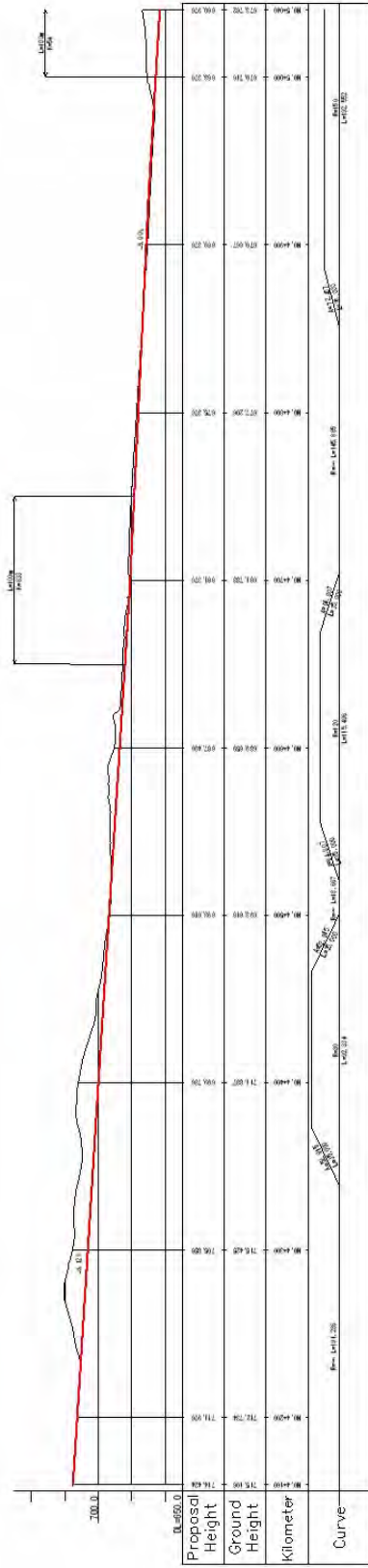
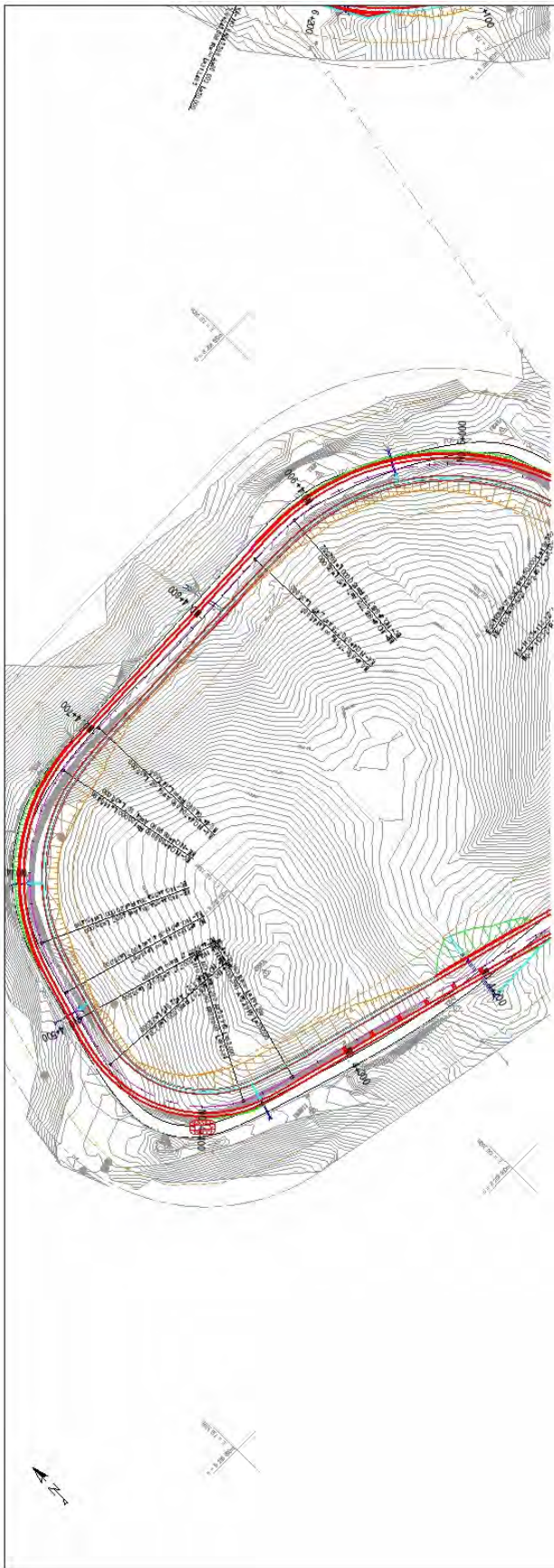
Client	JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)
	Consultant
	INGERASEC CO., LTD. EIGHT-JAPAN ENGINEERING CONSULTANTS INC. ORIENTAL CONSULTANTS GLOBAL CO., LTD.
Project:	Preparatory Survey for the Project for improvement of road section along the northern part of the North-South Corridor in Republic of Zimbabwe
	Job:
	Scale:
Drawing No.:	1:2500
	Date:



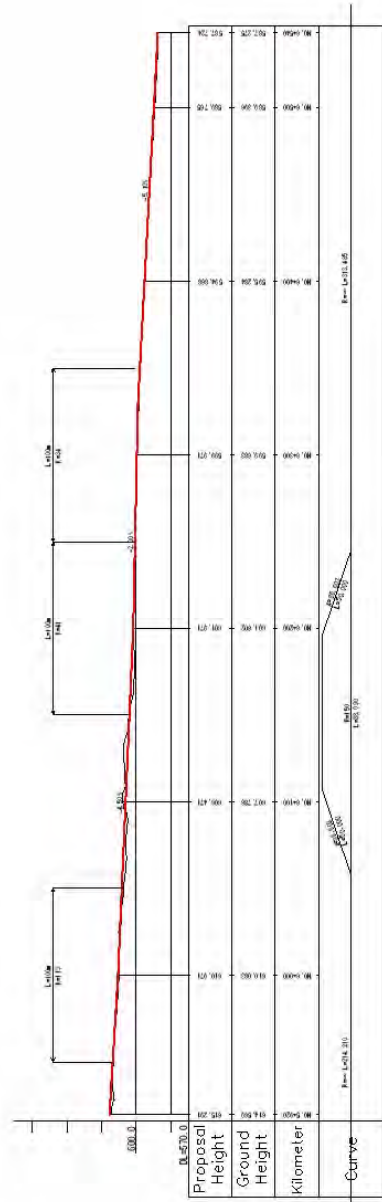
Notes:	Client	JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)	Consultant	INGEROBEC CO., LTD. EIGHT-JAPAN ENGINEERING CONSULTANTS INC. ORIENTAL CONSULTANTS GLOBAL CO., LTD.	Project	Preparatory Survey for the Project for Improvement of road section along the northern part of the North-South Corridor in Republic of Zimbabwe
	Scale:	1:2500	Drawing No.:		Job:	PLAN & PROFILE
					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	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
	Job: PLAN & PROFILE	JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)	EIGHT-JAPAN ENGINEERING CONSULTANTS INC. ORIENTAL CONSULTANTS GLOBAL CO., LTD.	Job: PLAN & PROFILE
	Scale: 1:2500			Scale: 1:2500
				Drawing No. _____ Date: _____



Notes:	Client		Consultant		Project	
	JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)		INGE-ROSEC CO., LTD. EIGHT-JAPAN ENGINEERING CONSULTANTS INC. ORIENTAL CONSULTANTS GLOBAL CO., LTD.		Preparatory Survey for the Project for improvement of road section along the northern part of the North-South Corridor in Republic of Zimbabwe	
					Job: PLAN & PROFILE	
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					Date:	

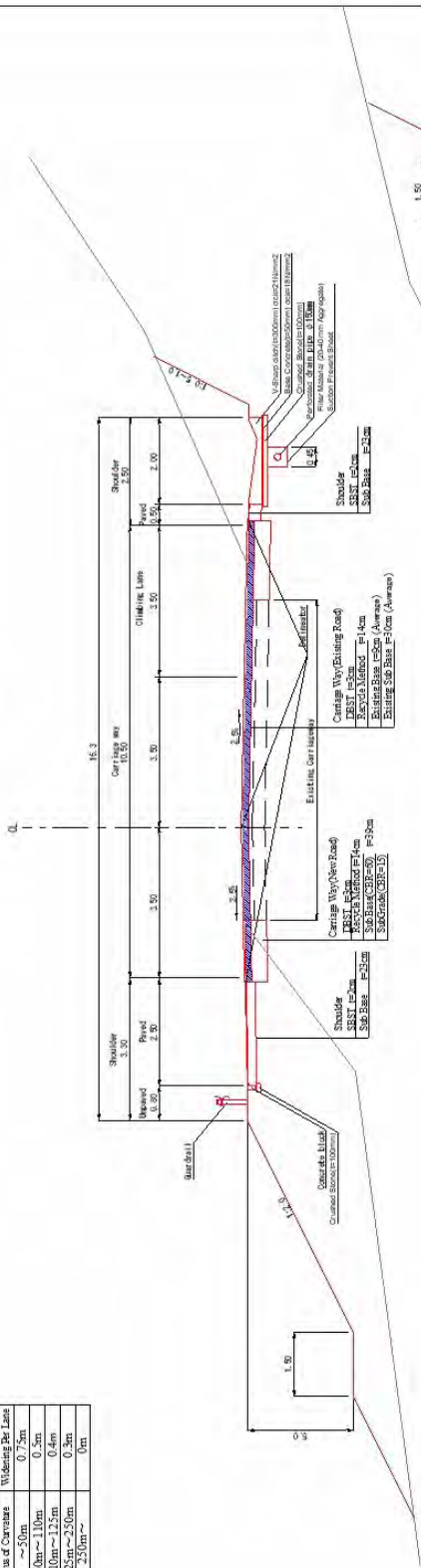


Notes:	Project:	Preparatory Survey for the Project for improvement of road section along the northern part of the North-South Corridor in Republic of Zimbabwe	
	Job:	PLAN & PROFILE	
	Scale:	1:2500	Drawing No.:
	Client:	JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)	Date:
	Consultant:	INGE ROSEC CO., LTD. EIGHT-JAPAN ENGINEERING CONSULTANTS INC. ORIENTAL CONSULTANTS GLOBAL CO., LTD.	

Typical Cross Section

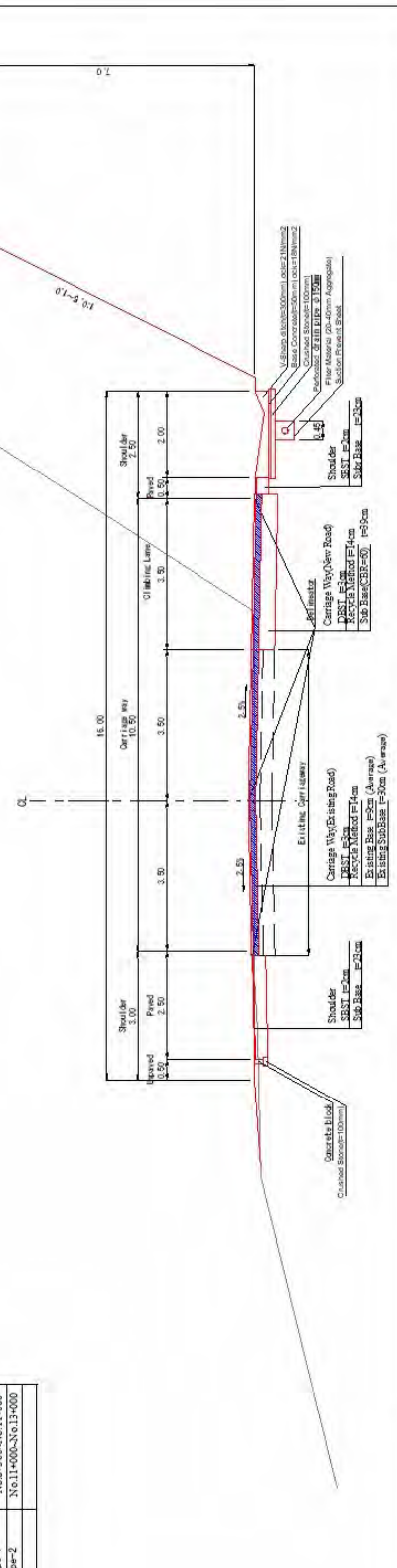
Pavement Type-1 (Fill Section)

Curve Widening	
Radius of Curvature	Widening Per Lane
→ 50m	0.75m
60m~110m	0.5m
110m~172.5m	0.4m
172.5m~250m	0.3m
250m~→	0m



Pavement Type	
Type	Station
Type-1	No.0+000~No.6+000
Type-2	No.6+000~No.8+000
Type-1	No.8+500~No.11+000
Type-2	No.11+000~No.13+000

Pavement Type-1 (Cut Section)

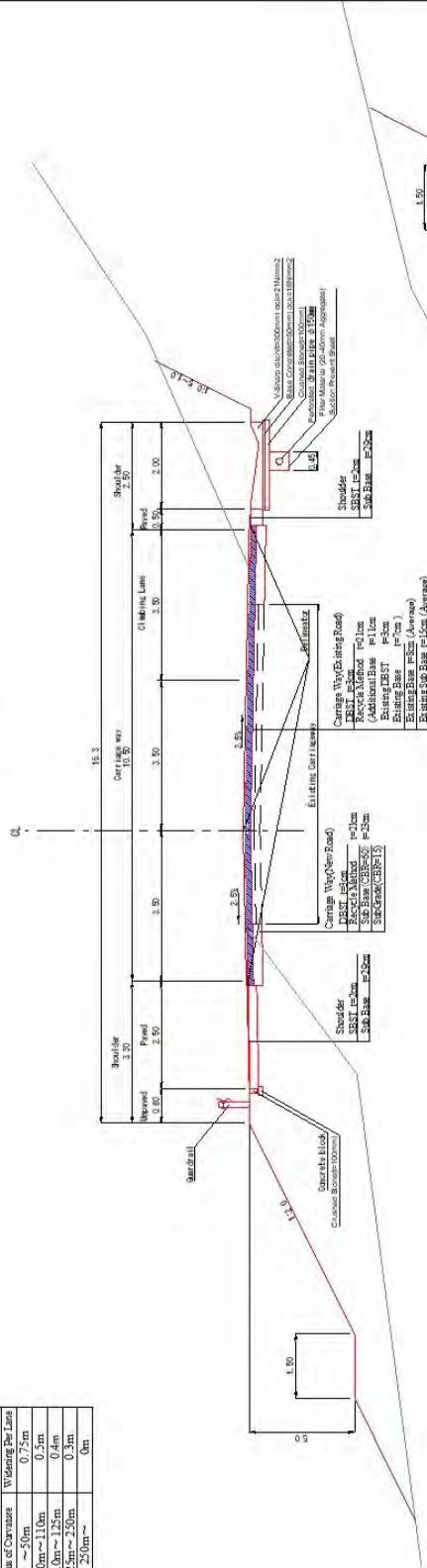


Notes:	Client	JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)	Consultant	INGEROSE CO., LTD. EIGHT-JAPAN ENGINEERING CONSULTANTS INC. ORIENTAL CONSULTANTS GLOBAL CO., LTD.	Project	Preparatory Survey for the Project for improvement of road section along the northern part of the North-South Corridor in Republic of Zimbabwe
	Scale	1:100	Job	TYPICAL CROSS SECTION	Drawing No.	Date

Typical Cross Section

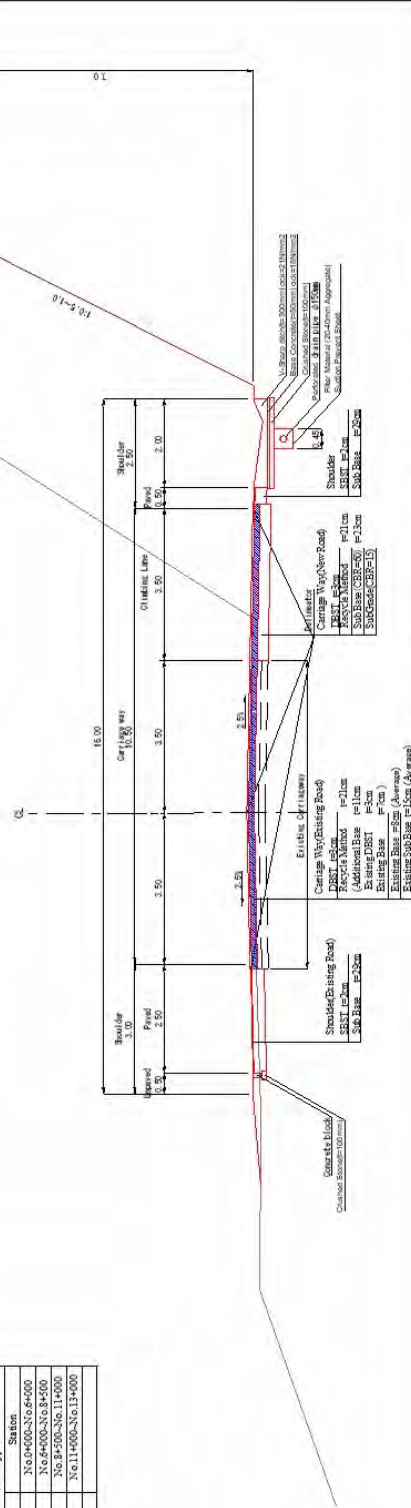
Pavement Type-2 (Fill Section)

Curve Widening	
Radius of Curvature	Widening Per Lane
~50m	0.75m
60m~110m	0.5m
110m~125m	0.4m
125m~250m	0.3m
250m~	0m



Pavement Type-2 (Cut Section)

Pavement Type	
Type	Scale
Type-1	No.0-4000-No.84000
Type-2	No.4-4000-No.84000
Type-1	No.8-5000-No.114000
Type-2	No.11-4000-No.134000



Notes:

Client

Consultant

Project

JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)

INGERSECCO. LTD.
EIGHT-JAPAN ENGINEERING CONSULTANTS INC.
ORIENTAL CONSULTANTS GLOBAL CO., LTD.

Preparatory Survey for the Project for improvement of road section along the northern part of the North-South Corridor in Republic of Zimbabwe

JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)

INGERSECCO. LTD.
EIGHT-JAPAN ENGINEERING CONSULTANTS INC.
ORIENTAL CONSULTANTS GLOBAL CO., LTD.

Preparatory Survey for the Project for improvement of road section along the northern part of the North-South Corridor in Republic of Zimbabwe

Date:

Scale:

1:100

Job:

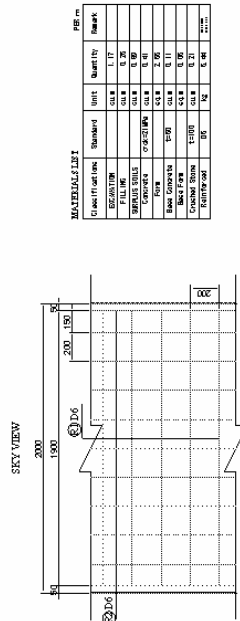
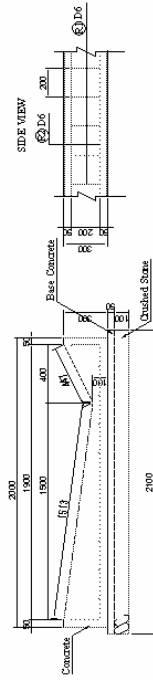
TYPICAL CROSS SECTION

Drawing No.:

Drainage

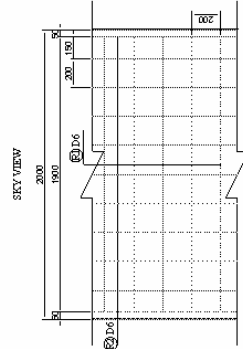
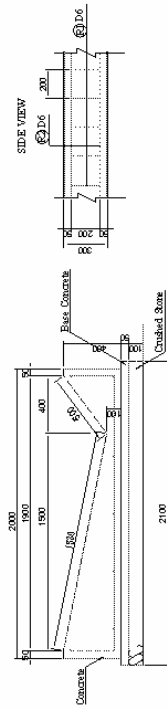
V-Shaped Ditch

Type-1



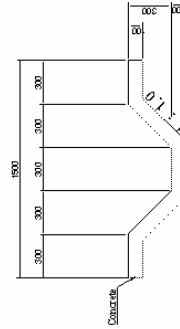
MATERIALS LIST				M³	
Classification	Standard	Unit	Quantity	Remark	
CONCRETE		CU.M	1.17		
PIPE CONCRETE		CU.M	0.16		
GRAVEL		CU.M	0.16		
PIPE		CU.M	0.16		
CRACKED STONE		CU.M	0.16		
REINFORCEMENT		KG	6.48		

Type-2



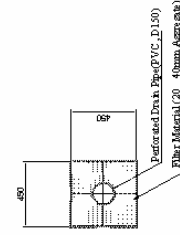
MATERIALS LIST				M³	
Classification	Standard	Unit	Quantity	Remark	
CONCRETE		CU.M	1.17		
PIPE CONCRETE		CU.M	0.16		
GRAVEL		CU.M	0.16		
PIPE		CU.M	0.16		
CRACKED STONE		CU.M	0.16		
REINFORCEMENT		KG	6.48		

Vertical Drainage / Open Ditch



MATERIALS LIST				M³	
Classification	Standard	Unit	Quantity	Remark	
CONCRETE		CU.M	0.8		
GRAVEL		CU.M	0.1		
PIPE		CU.M	0.1		

Perforated Drain Pipe



MATERIALS LIST				M³	
Classification	Standard	Unit	Quantity	Remark	
PERFORATED DRAIN PIPE		LINEAR M	1.0		
FIBER MATERIAL		KG	1.0		

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

JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)

Job:

Drainage

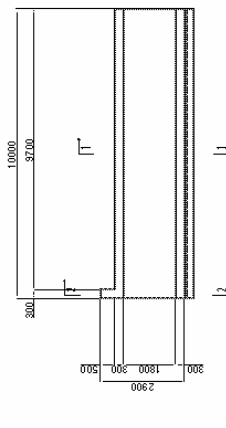
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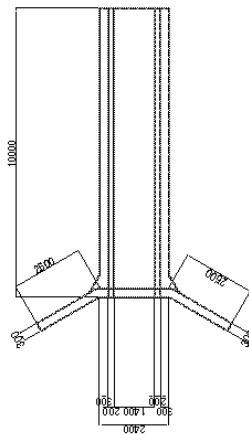
Date:

Box Culvert B1800xH1800

Side View S=1:150

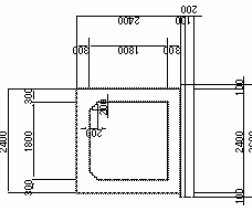


Sky View S=1:150

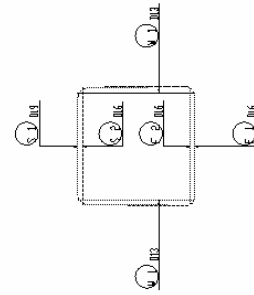
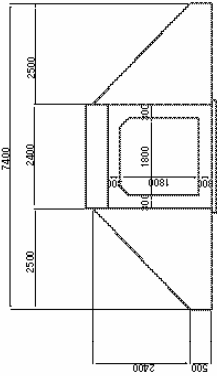


Cross Section S=1:100

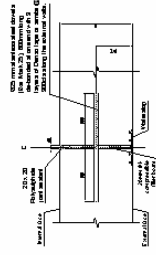
1 - 1



2 - 2



Expansion Joint



MATERIALS LIST (Box Culvert)

CLASSIFICATION	STANDARD	UNIT	QUANTITY	REMARK
EXCAVATION		m ³	1000	
REINFORCING		m ³	1750	
CONCRETE	18.40%	m ³	232	
FORM	10%	m ²	1042	
BASE CONCRETE	1:100	m ³	70	
BASE FORM	1:100	m ²	70	
CRIGGED STONE	1:100	m ³	52	
REINFORCED	D10	kg	1046	
	D16	kg	451	
	D19	kg	339	

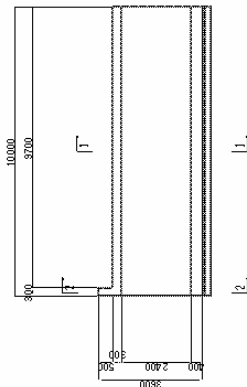
MATERIALS LIST (WING)

CLASSIFICATION	STANDARD	UNIT	QUANTITY	REMARK
CONCRETE	18.40%	m ³	31	
FORM	10%	m ²	302	
REINFORCED	D10	kg	462	

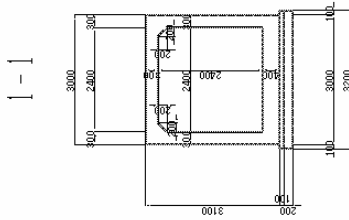
Notes:	Client	Consultant	Preparatory Survey for the Project for improvement of road section along the northern part of the North-South Corridor in Republic of Zimbabwe
	JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)		Box(1)
		As shown	Drawing No.:

Box Culvert B2400xH2400

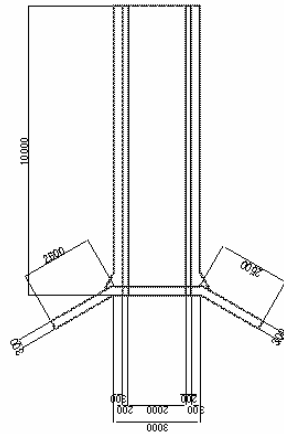
Side View S=1:150



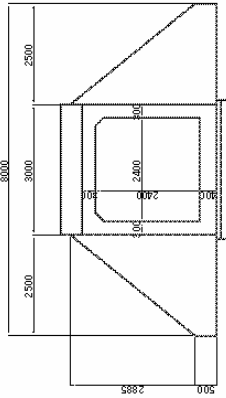
Cross Section S=1:100



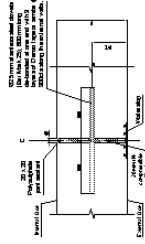
Sky View S=1:150



2-2



Expansion Joint

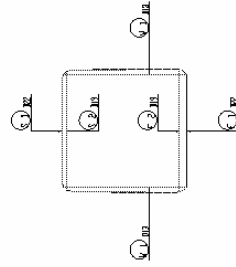


MATERIALS LIST (Box Culvert) PER 10m

CLASSIFICATION	STANDARD	UNIT	QUANTITY	REMARK
EXCAVATION		m ³	221.1	
REINFORCING		m ³	18.7	
CONCRETE		m ³	15.2	
FORM		m ²	15.2	
BASE CONCRETE		m ³	2.2	
BASE DRAIN		m ³	2.8	
GRAVELLED FLOOR		m ²	6.4	
REINFORCED		m ²	456	
D18		m ²	159	
D19		m ²	15	
D20		m ²	158	

MATERIALS LIST (Wing)

CLASSIFICATION	STANDARD	UNIT	QUANTITY	REMARK
CONCRETE		m ³	1.2	
FORM		m ²	4.8	
REINFORCED		m ²	167	
D18		m ²	66	



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

JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)

Job: Box(2)

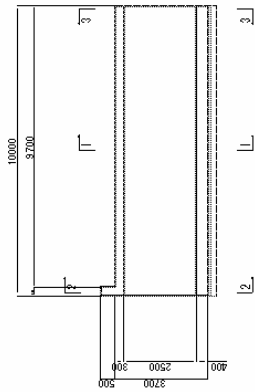
Scale: As Shown

Drawing No.:

Date:

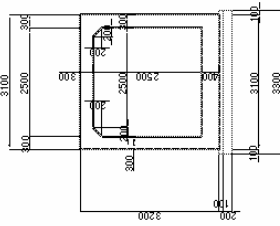
Box Culvert B2500xH2500

Side View S=1:150

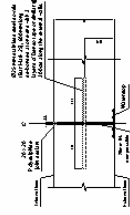


Cross Section S=1:100

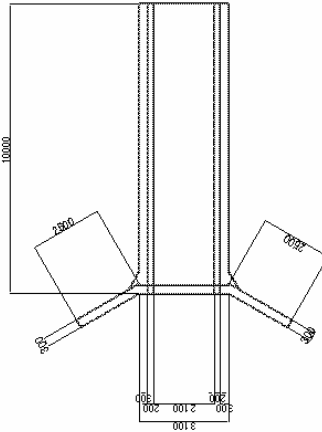
1-1



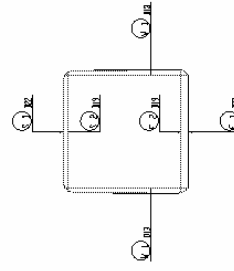
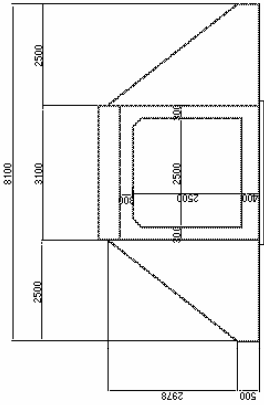
Expansion Joint



Sky View S=1:150



2-2



MAXIMUMS (Box Culvert)				PER IAN			
Classification	Structure	Left	Right	Classification	Structure	Left	Right
ROADWAY	10/10	10/10	10/10	ROADWAY	10/10	10/10	10/10
STRUCTURE	10/10	10/10	10/10	STRUCTURE	10/10	10/10	10/10
CONCRETE	10/10	10/10	10/10	CONCRETE	10/10	10/10	10/10
STEEL	10/10	10/10	10/10	STEEL	10/10	10/10	10/10
PAVING	10/10	10/10	10/10	PAVING	10/10	10/10	10/10
FINISH	10/10	10/10	10/10	FINISH	10/10	10/10	10/10
UTILITIES	10/10	10/10	10/10	UTILITIES	10/10	10/10	10/10
ENVIRONMENT	10/10	10/10	10/10	ENVIRONMENT	10/10	10/10	10/10
SAFETY	10/10	10/10	10/10	SAFETY	10/10	10/10	10/10
QUALITY	10/10	10/10	10/10	QUALITY	10/10	10/10	10/10
CONSTRUCTION	10/10	10/10	10/10	CONSTRUCTION	10/10	10/10	10/10
OPERATION	10/10	10/10	10/10	OPERATION	10/10	10/10	10/10
MAINTENANCE	10/10	10/10	10/10	MAINTENANCE	10/10	10/10	10/10
ENVIRONMENT	10/10	10/10	10/10	ENVIRONMENT	10/10	10/10	10/10
SAFETY	10/10	10/10	10/10	SAFETY	10/10	10/10	10/10
QUALITY	10/10	10/10	10/10	QUALITY	10/10	10/10	10/10
CONSTRUCTION	10/10	10/10	10/10	CONSTRUCTION	10/10	10/10	10/10
OPERATION	10/10	10/10	10/10	OPERATION	10/10	10/10	10/10
MAINTENANCE	10/10	10/10	10/10	MAINTENANCE	10/10	10/10	10/10
ENVIRONMENT	10/10	10/10	10/10	ENVIRONMENT	10/10	10/10	10/10
SAFETY	10/10	10/10	10/10	SAFETY	10/10	10/10	10/10
QUALITY	10/10	10/10	10/10	QUALITY	10/10	10/10	10/10

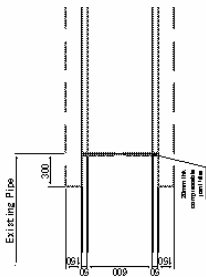
Notes:

Client	JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)
Consultant	Preparatory Survey for the Project for Improvement of road section along the northern part of the North-South Corridor in Republic of Zimbabwe Box (3)
As Shown	Drawing No.:
Date:	

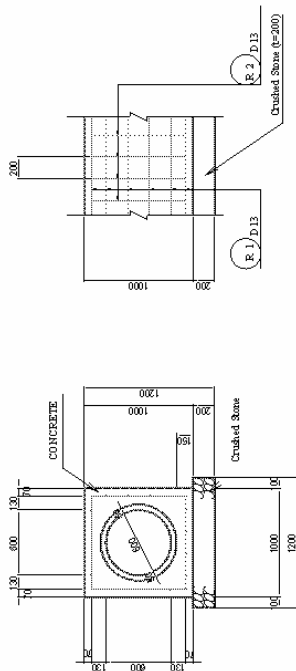
Pipe Culvert(1)

Pipe Culvert $\phi 600$

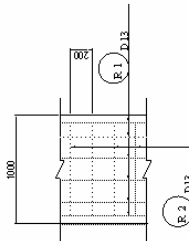
Expansion Joint



SIDE VIEW



SKY VIEW

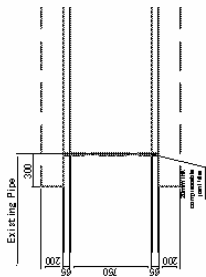


MATERIALS LIST

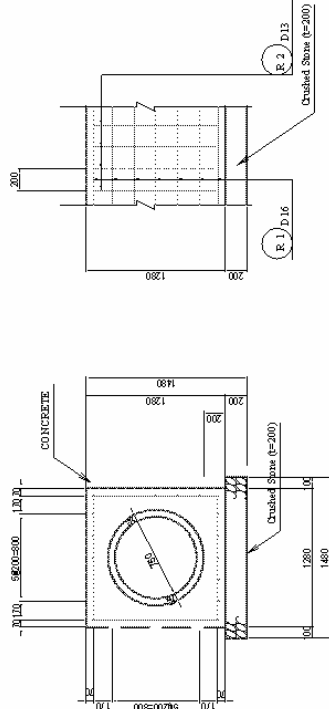
CLASSIFICATION	STANDARD	UNIT	QUANTITY	REMARK	PER m
EXCAVATION		cum	3.00		
FILLING		cum	1.46		
STRENGTH SOILS		cum	1.28		
CONCRETE	code-BRMA	cum	0.62		
FORM	Plywood	sqm	2.00		
CRUSHED STONE	φ=200	cum	0.24		
REINFORCED	D13	kg	46.07		

Pipe Culvert $\phi 750$

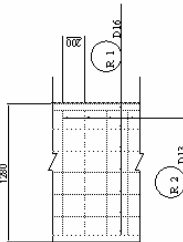
Expansion Joint



SIDE VIEW



SKY VIEW



MATERIALS LIST

CLASSIFICATION	STANDARD	UNIT	QUANTITY	REMARK	PER m
EXCAVATION		cum	6.06		
FILLING		cum	1.74		
STRENGTH SOILS		cum	2.13		
CONCRETE	code-BRMA	cum	1.03		
FORM	Plywood	sqm	2.56		
CRUSHED STONE	φ=200	cum	0.30		
REINFORCED	D13	kg	31.74		
	D16	kg	37.44		

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

Job: Pipe(1)

Scale: 1:40

Drawing No.:

Date:

Client

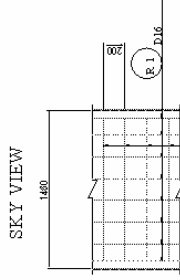
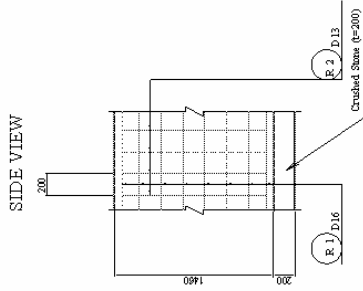
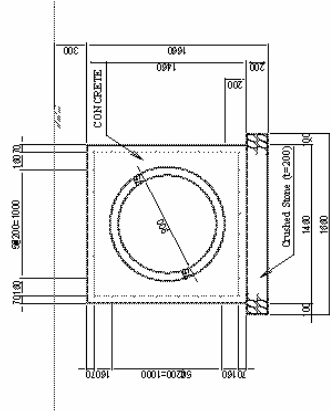
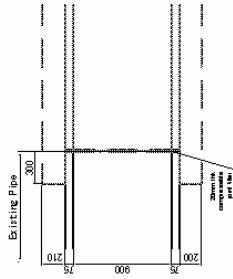
Consultant

JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)

Pipe Culvert(2)

Pipe Culvert $\phi 900$

Expansion Joint



MATERIALS LIST

CLASSIFICATION	STANDARD	UNIT	QUANTITY	REMARK
EXCAVATION		cum	482	
PILE DRIB		cum	192	
TURNBLES SOLES		cum	269	
CONCRETE	code-18Mpa	cum	217	
FORM	Plywood	sqm	292	
CRUSHED STONE	F-200	cum	032	
REINFORCED	D13	kg	3332	
	D16	kg	4368	

NOTES:

Client

Consultant

Project: Preparatory Survey for the P project for improvement of road section along the northern part of the North-South Corridor in Republic of Zimbabwe

JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)

Pipe(2)

Job

Date:

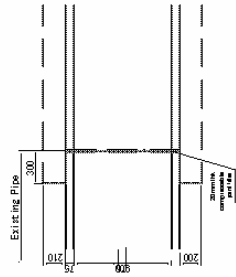
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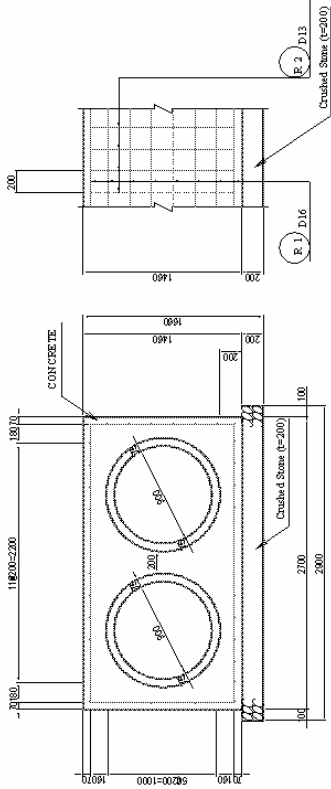
Pipe Culvert(3)

Pipe Culvert 2@φ900

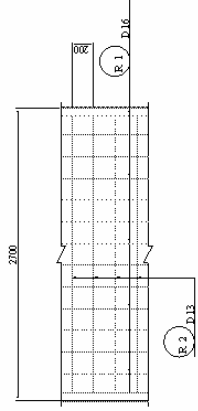
Expansion Joint



SIDE VIEW



SKY VIEW



MATERIALS LIST

CLASSIFICATION	STANDARD	UNIT	QUANTITY	REMARK
EXCAVATION		cum	7.25	
FILLING		cum	1.92	
STEELPLATE SAILS		cum	5.12	
CONCRETE	code B3006	cum	2.21	
FORM	Prewood	sqm	2.92	
CRUSHED STONE	φ=200	cum	0.38	
REINFORCED	D13	kg	88.27	
	D16	kg	62.40	

Notes:

Client
JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)

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
Pipe (3)

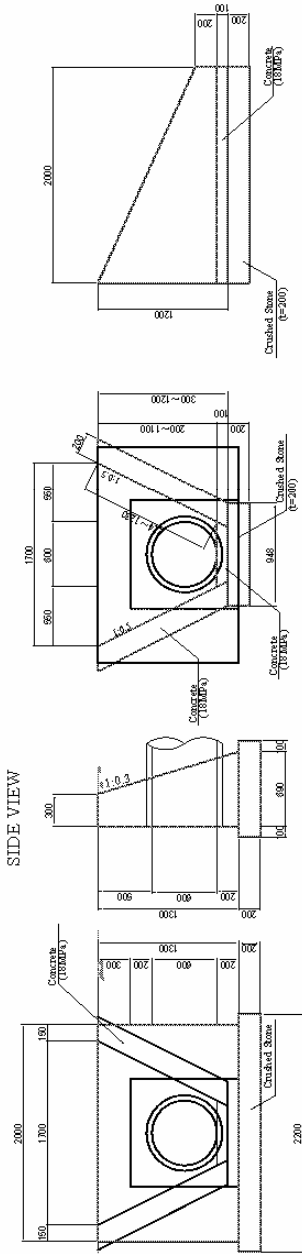
Scale: 1:40 Drawing No.: Date:

Pipe Culvert(4)

Inlet and Outlet (φ600)

Open Ditch

Head Wall



Hand Wall

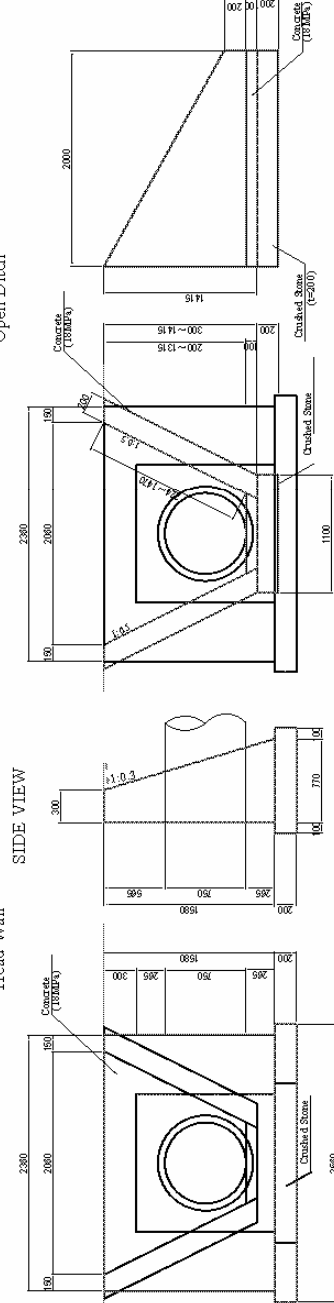
CLASSIFICATION	STANDARD	UNIT	QUANTITY	REMARK
EXCAVATION		cum	1.33	
FILLING		cum	0.44	
STRENGTH SOILS		cum	0.86	
CONCRETE FORM	o-c-BMFA	cum	0.79	
	Plywood	sqm	3.31	
CRUSHED STONE	φ=200	cum	0.39	

Open Ditch

CLASSIFICATION	STANDARD	UNIT	QUANTITY	REMARK
EXCAVATION		cum		
FILLING		cum		
STRENGTH SOILS		cum		
CONCRETE FORM	o-c-BMFA	cum	0.16	
	Plywood	sqm	1.45	
CRUSHED STONE	φ=200	cum	0.38	

Inlet and Outlet (φ750)

Head Wall



Hand Wall

CLASSIFICATION	STANDARD	UNIT	QUANTITY	REMARK
EXCAVATION		cum	1.79	
FILLING		cum	0.52	
STRENGTH SOILS		cum	1.21	
CONCRETE FORM	o-c-BMFA	cum	1.33	
	Plywood	sqm	7.62	
CRUSHED STONE	φ=200	cum	0.5	

Open Ditch

CLASSIFICATION	STANDARD	UNIT	QUANTITY	REMARK
EXCAVATION		cum		
FILLING		cum		
STRENGTH SOILS		cum		
CONCRETE FORM	o-c-BMFA	cum	0.16	
	Plywood	sqm	1.45	
CRUSHED STONE	φ=200	cum	0.38	

Notes:

Client

Consultant

Project: Preparatory Survey for the P project for improvement of road section along the northern part of the North-South Corridor in Republic of Zimbabwe

JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)

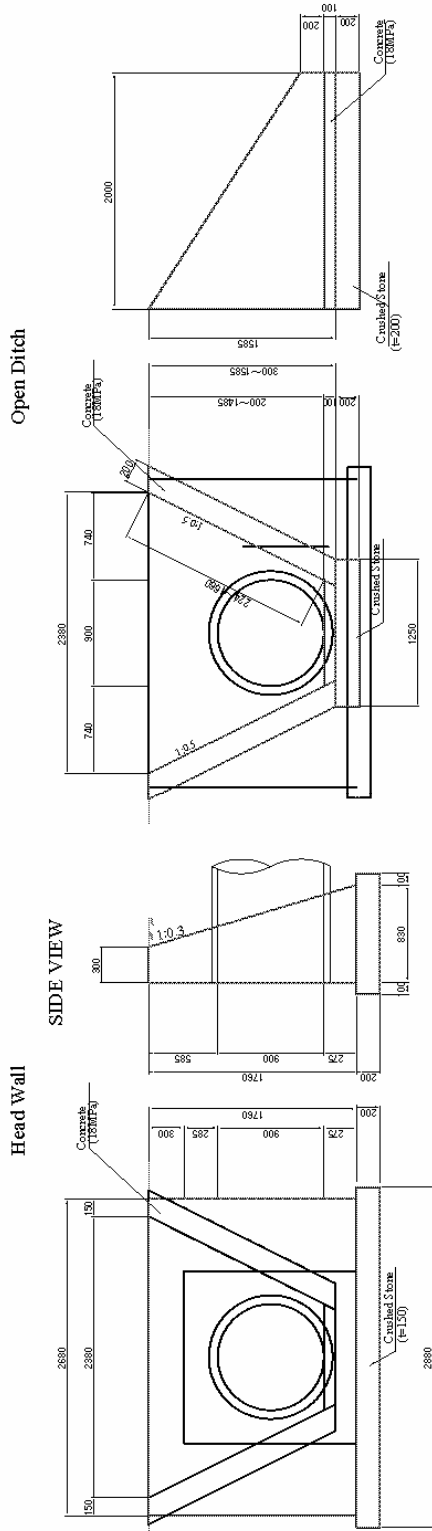
Scale: 1:40

Drawing No.:

Date:

Pipe Culvert(5)

Inlet and Outlet (φ900)



Hand Wall

CLASSIFICATION	STANDARD	UNIT	QUANTITY	REMARK
EXCAVATION		cum	2.16	
FILLING		cum	0.38	
SUPPLUS SOILS		cum	1.52	
CONCRETE	cd=18MPa	cum	1.72	
FORM	Plywood	sqm	9.64	
CRUSHED STONE	φ=200	cum	0.39	

Open Ditch

CLASSIFICATION	STANDARD	UNIT	QUANTITY	REMARK
EXCAVATION		cum		
FILLING		cum		
SUPPLUS SOILS		cum	0.18	
CONCRETE	cd=10MPa	cum	1.88	
FORM	Plywood	sqm	1.88	
CRUSHED STONE	φ=200	cum	0.30	

Notes:

Client
JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)

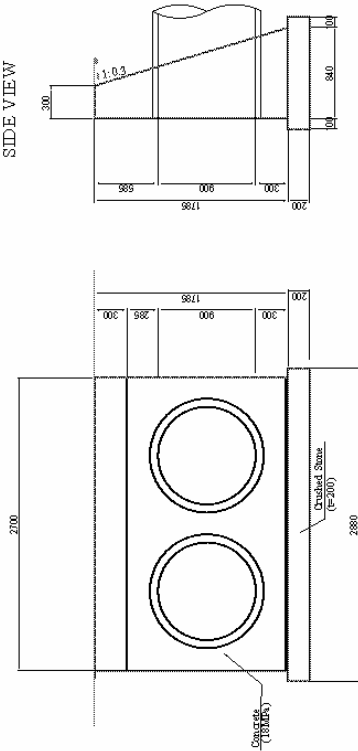
Consultant

Project: Preparatory Survey for the Project for Improvement of road section along the northern part of the North-South Corridor in Republic of Zimbabwe
Job: Pipe(5)
Scale: 1:40
Drawing No.:
Date:

Pipe Culvert(6)

Inlet and Outlet (2@φ900)

Head Wall

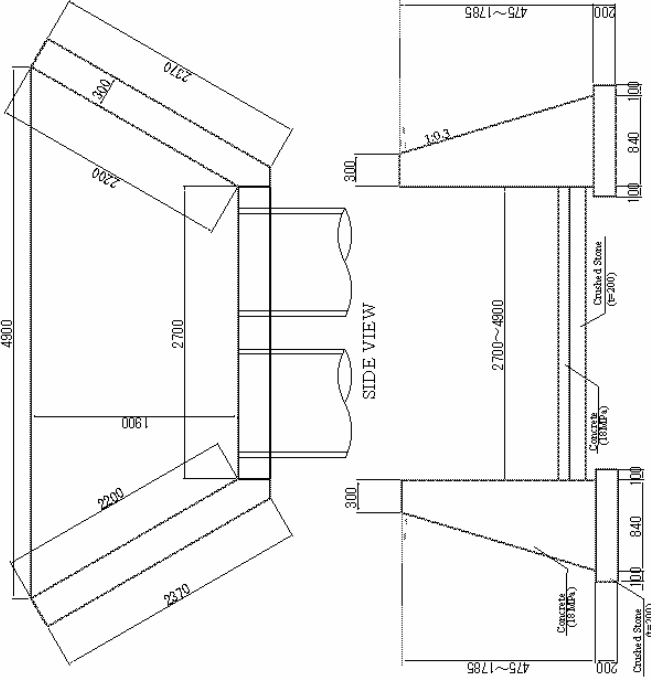


Head Wall

CLASSIFICATION	STANDARD	UNIT	QUANTITY	REMARK
EXCAVATION		cum	2.20	
FILLING		cum	0.38	
STURPLE SOILS		cum	1.56	
CONCRETE	cd=18MPa	cum	0.50	
FORM	Plywood	sqm	98.2	
CRUSHED STONE	φ=200	cum	0.60	

Open Ditch

SKY VIEW



Open Ditch

CLASSIFICATION	STANDARD	UNIT	QUANTITY	REMARK
EXCAVATION		cum	67.5	
FILLING		cum	3.73	
STURPLE SOILS		cum	2.61	
CONCRETE	cd=18MPa	cum	3.09	
FORM	Plywood	sqm	102.8	
CRUSHED STONE	φ=200	cum	2.19	

Notes:

Client

Consultant

Project: Preliminary Survey for the Project for improvement of road section along the northern part of the North-South Corridor in Republic of Zimbabwe

JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)

Job:

Pipe (6)

Scale: 1:40

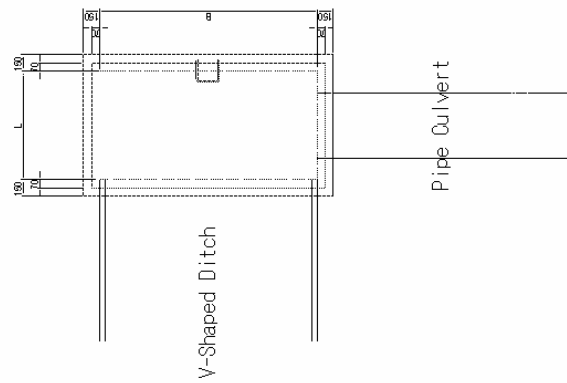
Drawing No.:

Date:

Catch Pit

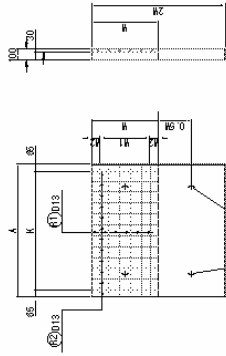
Catch Pit

Cover



V-Shaped Ditch

Pipe Culvert



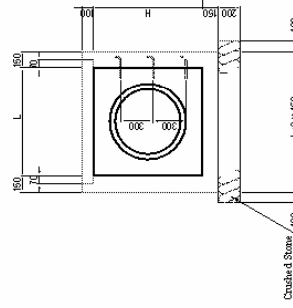
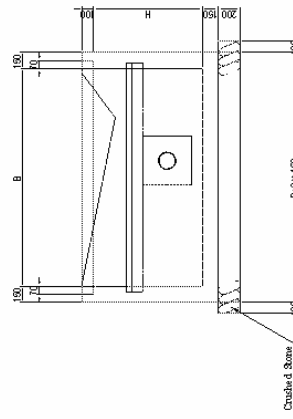
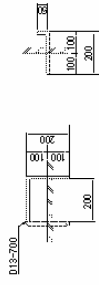
Dimension Table

TYPE	B	L	H	Remark
Type-1	2000	1000	1000	φ 600
Type-2	2000	1200	1200	φ 750
Type-3	2000	1400	1400	φ 900
Type-4	2000	1520	1520	φ 950
Type-5	2000	500	600	

Dimension Table

TYPE	A	K	W	W1	WE	REMARK
Type-1	2130	2000	1000	565	400	82.5
Type-2	2130	2000	1200	705	600	52.5
Type-3	2130	2000	1400	795	600	97.5
Type-4	2130	2000	1520	825	700	62.5
Type-5	2130	2000	500	315	200	37.5

Step S=1:20



Notes:

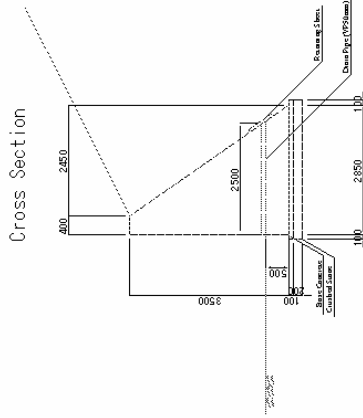
Client
JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)

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
Job: Catch Pit
Scale: 1:40
Drawing No.:
Date:

Gravity Retaining Wall

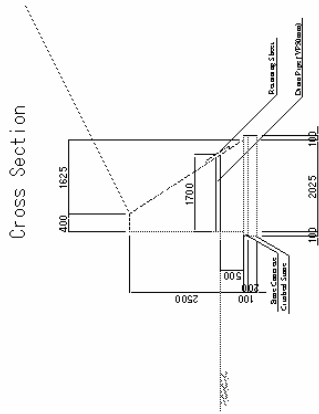
Type-1 (H=3.5m)



MATERIAL LIST

ITEM	STANDARD	UNIT	QUANTITY	REMARKS
Excavation		cum	24.0	
Subgrade Soil		cum	7.5	
Concrete	44Mpa.2	cum	25.8	
Form	Plywood	sqm	89.1	
Base Concrete	F100	cum	3.05	
Base Form		sqm	2.0	
Curbed Stone		cum	6.10	
Reinforcing Steel	1975mm	kg	1.5	
		no.	2	

Type-2 (H=2.5m)



MATERIAL LIST

ITEM	STANDARD	UNIT	QUANTITY	REMARKS
Excavation		cum	27.8	
Subgrade Soil		cum	5.4	
Concrete	18Mpa.2	cum	30.3	
Form	Plywood	sqm	60.9	
Base Concrete	F100	cum	2.25	
Base Form		sqm	2.0	
Curbed Stone		cum	4.45	
Reinforcing Steel	1975mm	kg	3.4	
		no.	2	

Note: Expected material for foundation = equivalent fill material expected

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

Job: Cartilever Retaining Wall

Scale: S=1:100

Date:

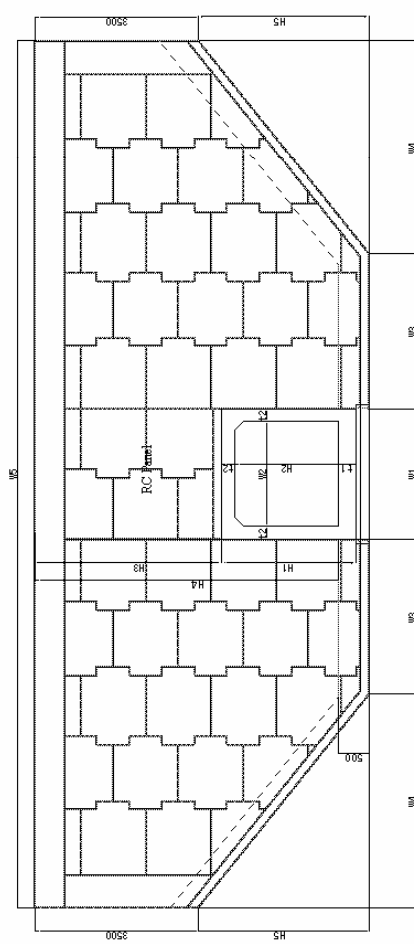
Client: JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)

Consultant: INGEROSEC CO., LTD.
EIGHT-JAPAN ENGINEERING CONSULTANTS INC.
ORIENTAL CONSULTANTS GLOBAL CO., LTD.

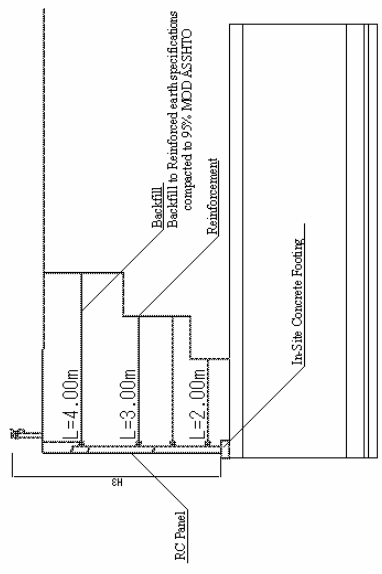
Drawing No.:

Reinforced Earth Wall

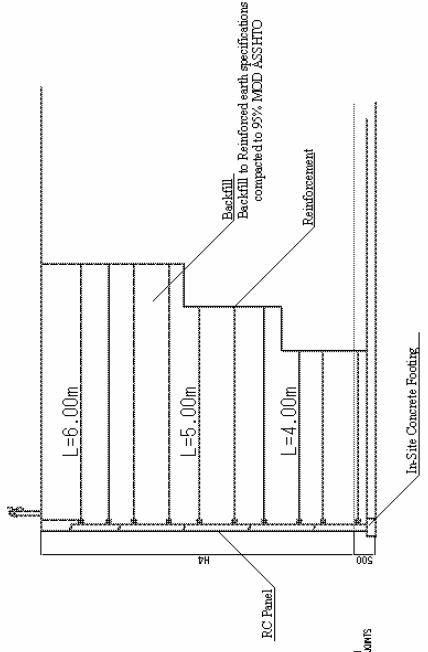
Front View



Cross Section(A-A)



Cross Section(B-B)



DIMENSION TABLE

T TYPE	W1	W2	W3	W4	W5	H1	H2	H3	H4	H5	L1	L2
Typ-1	3000	400	7500	3000	5000	3000	3000	2600	2520	2200	400	300
Typ-2	3100	1300	7500	4000	5000	3100	2500	3000	2750	2200	400	300

MATERIAL LIST(Type-1)

ITEM	STANDARD	UNIT	QUANTITY	REMARKS
Excavation		cum	45.4	
Backfill		cum	35.36	
Surface Soil		cum	3.76	
Base Course		cum	2.88	
Base Form	1200	sqm	7.20	
Crushed Stone	1200	cum	4.32	
Backfill		cum	136.67	
Reinforcement		m	2443.00	

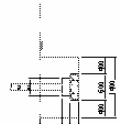
Note: Expected material for foundation = equivalent to selected fill material expected.

MATERIAL LIST(Type-2)

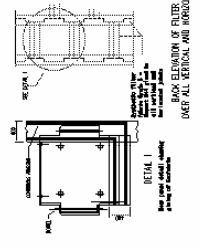
ITEM	STANDARD	UNIT	QUANTITY	REMARKS
Excavation		cum	33.39	
Backfill		cum	4.18	
Surface Soil		cum	4.18	
Base Course		sqm	10.08	
Base Form	1200	cum	2.09	
Crushed Stone	1200	sqm	3.29	
Backfill		cum	102.73	
Reinforcement		m	1743.60	

Note: Expected material for foundation = equivalent to selected fill material expected.

In-Site Concrete Footing



TYPICAL SHAPES DETAILS OF THE RC PANEL

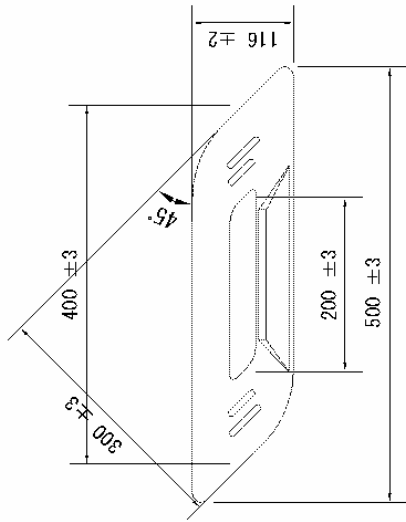


Note: Expected material for foundation = equivalent to selected fill material expected
 Preliminary Survey for the Project for Improvement of road section along the northern part of the North-South Corridor in Republic of Zimbabwe

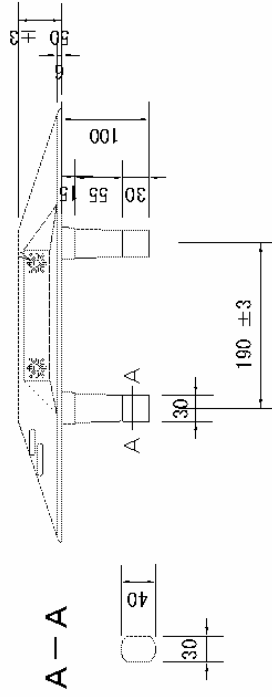
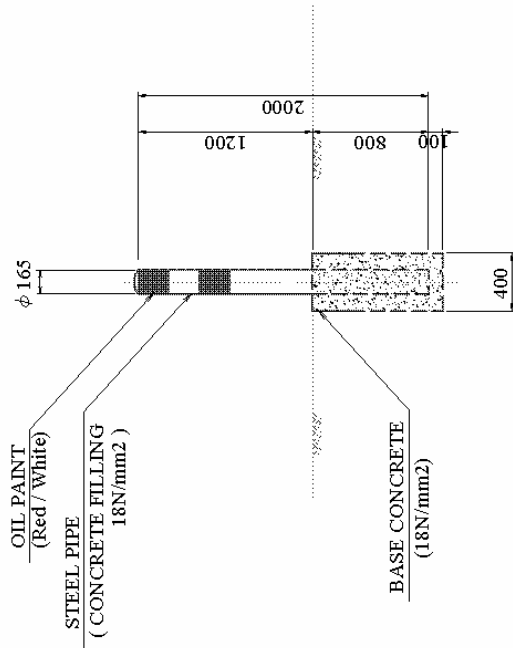
Project	Reinforced Earth Wall
Job	
Scale	S=1:100
Client	JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)
Consultant	INGEROSOC CO., LTD. EIGHT-JAPAN ENGINEERING CONSULTANTS INC. ORIENTAL CONSULTANTS GLOBAL CO., LTD.
Drawing No.	
Date	

Ancillary Works Structure (2)

Delineator(Chatter Bar)
S=1:110

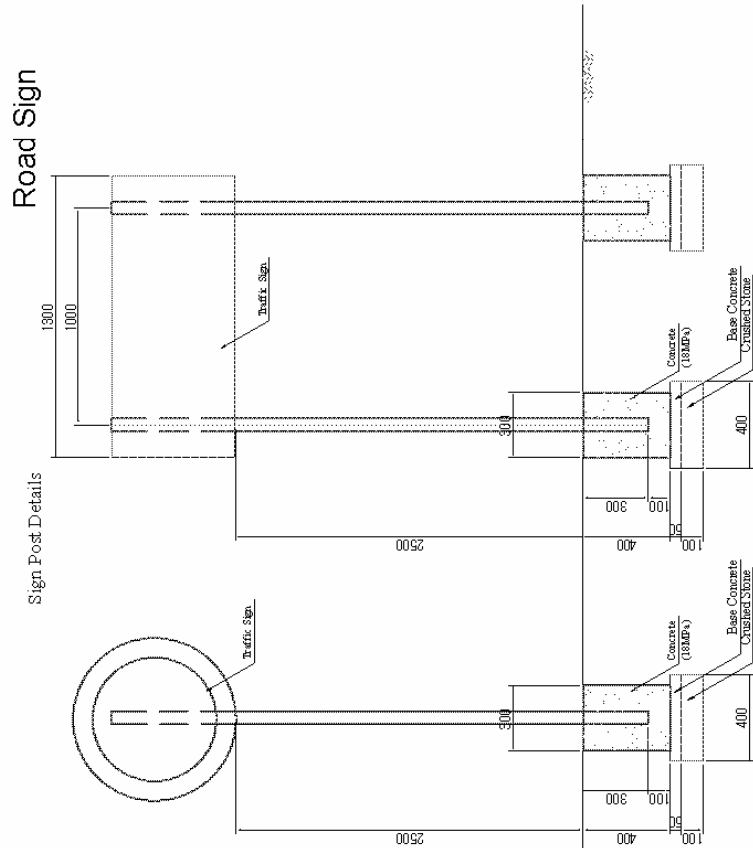
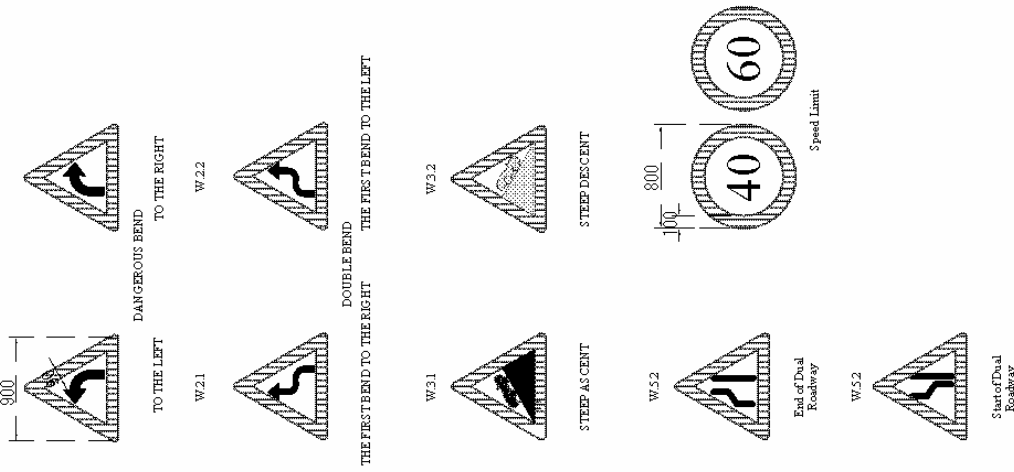


Guard Post S=1:30



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
	JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)	INGERROSEC CO. LTD. EIGHT-JAPAN ENGINEERING CONSULTANTS INC. ORIENTAL CONSULTANTS GLOBAL CO., LTD.	Job: Ancillary Works Structure (2) Scale: As Shown
			Drawing No.: Date:

Ancillary Works Structure (3)



MATERIALS LIST

Classifications	Standard	Unit	Quantity	Remark
EXCAVATION		cu.m	0.45	
FILLING		cu.m	0.32	
SURPLUS SOILS		cu.m	0.10	
Concrete	circle=18MPa	cu.m	0.04	
Form	sq.m	sq.m	0.45	
Base Concrete	t=50	cu.m	0.01	
Base Form		sq.m	0.05	
Crushed Stone	t=100	cu.m	0.02	
Traffic Sign		piece	1	

MATERIALS LIST

Classifications	Standard	Unit	Quantity	Remark
EXCAVATION		cu.m	0.90	
FILLING		cu.m	0.64	
SURPLUS SOILS		cu.m	0.20	
Concrete	circle=18MPa	cu.m	0.08	
Form	sq.m	sq.m	0.95	
Base Concrete	t=50	cu.m	0.02	
Base Form		sq.m	0.15	
Crushed Stone	t=100	cu.m	0.03	
Traffic Sign		piece	2	

NOTES:

Client

Consultant

JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)
 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

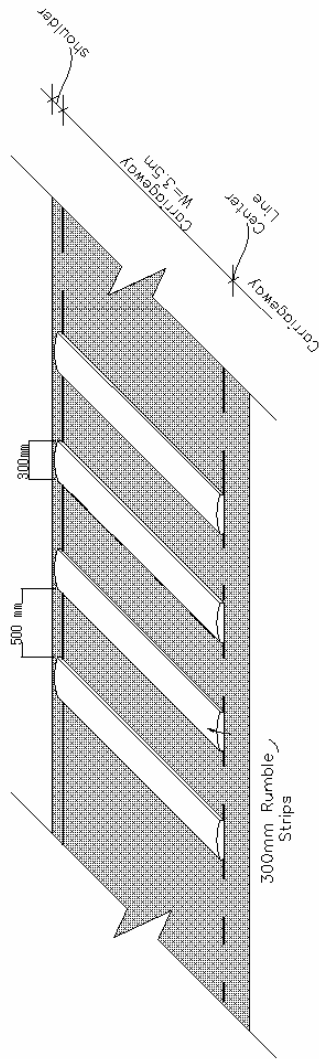
Job: Ancillary Works Structure (2)

Scale: 1:20 Drawing No.: Date:

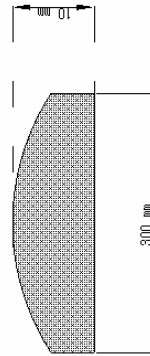
Ancillary Works Structure (5)

Rumble Stripes

PLAN VIEW OF THE RUMBLE STRIPES



RUMBLE STRIPE DETAIL



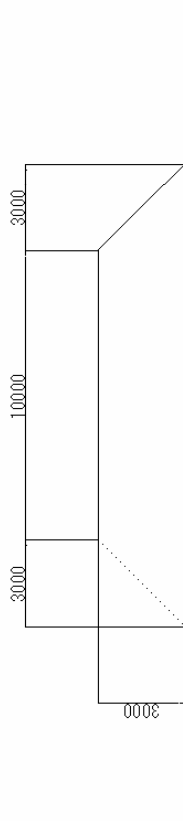
- Notes:
1. Rumble Strips should normally be in groups of four (4) strips.
 2. The height of the rumble stripe shall be no more than 10 mm.
 3. The stripe width should be 300mm.
 4. The start or end strip should be located 20 to 30m before the road.
 5. Pre-working into soil, it shall be located 20 to 30m before the road depending on speed.
 6. Rumble stripes should be made of high strength thermoplastic resin course the top for better visibility.
 7. Strips should continue across the full width of the corrugatey, including the shoulders but be terminate as that they do not cross the road.
 8. A sand gap is left between the road strip and the starting part of the rumble strip for drainage of the road corrugatey.
 9. Materials of rumble strip : single bitumen surface treatment 10mm type equivalent.

Notes:	Client	Consultant	Project
	JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)	INGEROSEC CO., LTD. EIGHT-JAPAN ENGINEERING CONSULTANTS INC. ORIENTAL CONSULTANTS GLOBAL CO., LTD.	Preparatory Survey for the Project for improvement of road section along the northern part of the North-South Corridor in Republic of Zimbabwe Job: Scale: NoScale
			Drawing No.:
			Date:

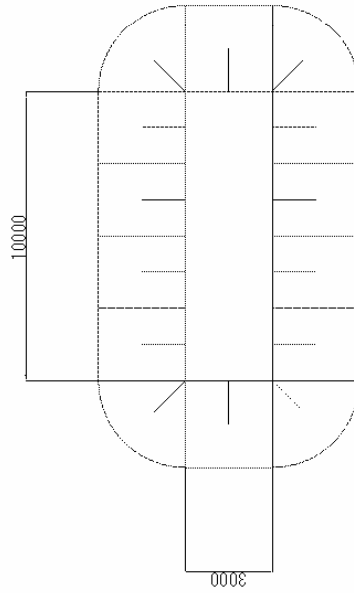
Ancillary Works Structure (6)

Sand Bank

Said View



Sky View



MATERIALS LIST

CLASSIFICATION	STANDARD	UNIT	QUANTITY	REMARK	PER each
Embankment		m ³	165		

Notes:

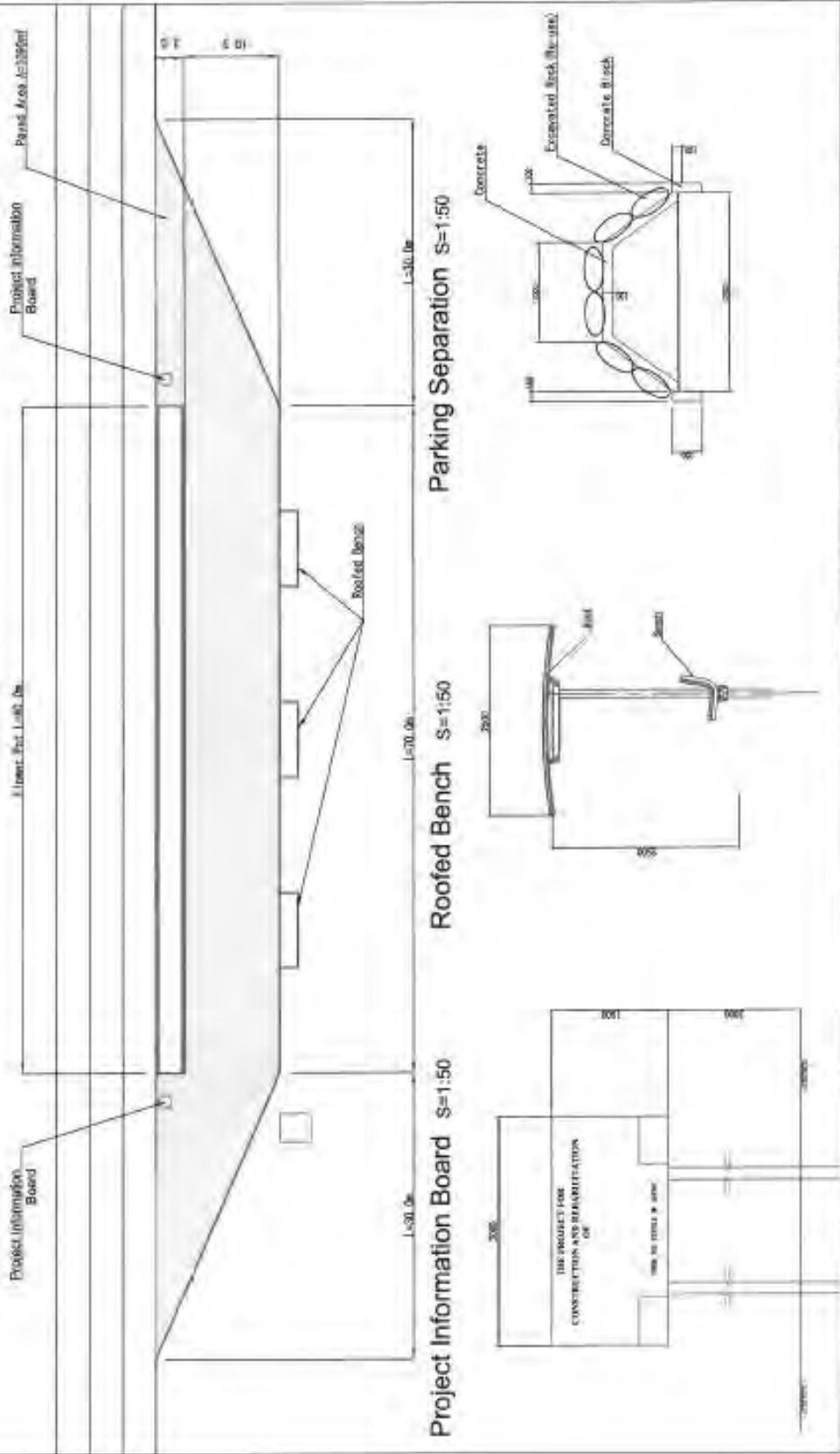
Client
JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)

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
Job: Ancillary Works Structure (6)
Scale: 1:150
Drawing No.:

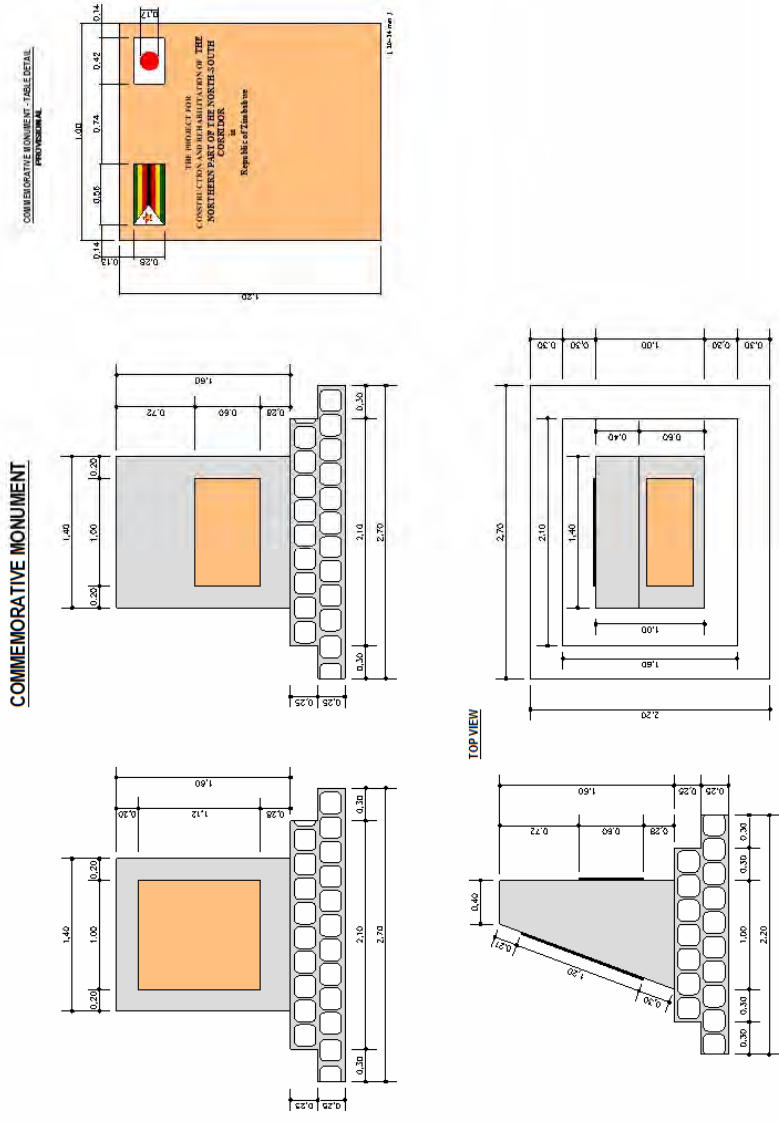
Date:

Ancillary Works Structure (7) Parking Place

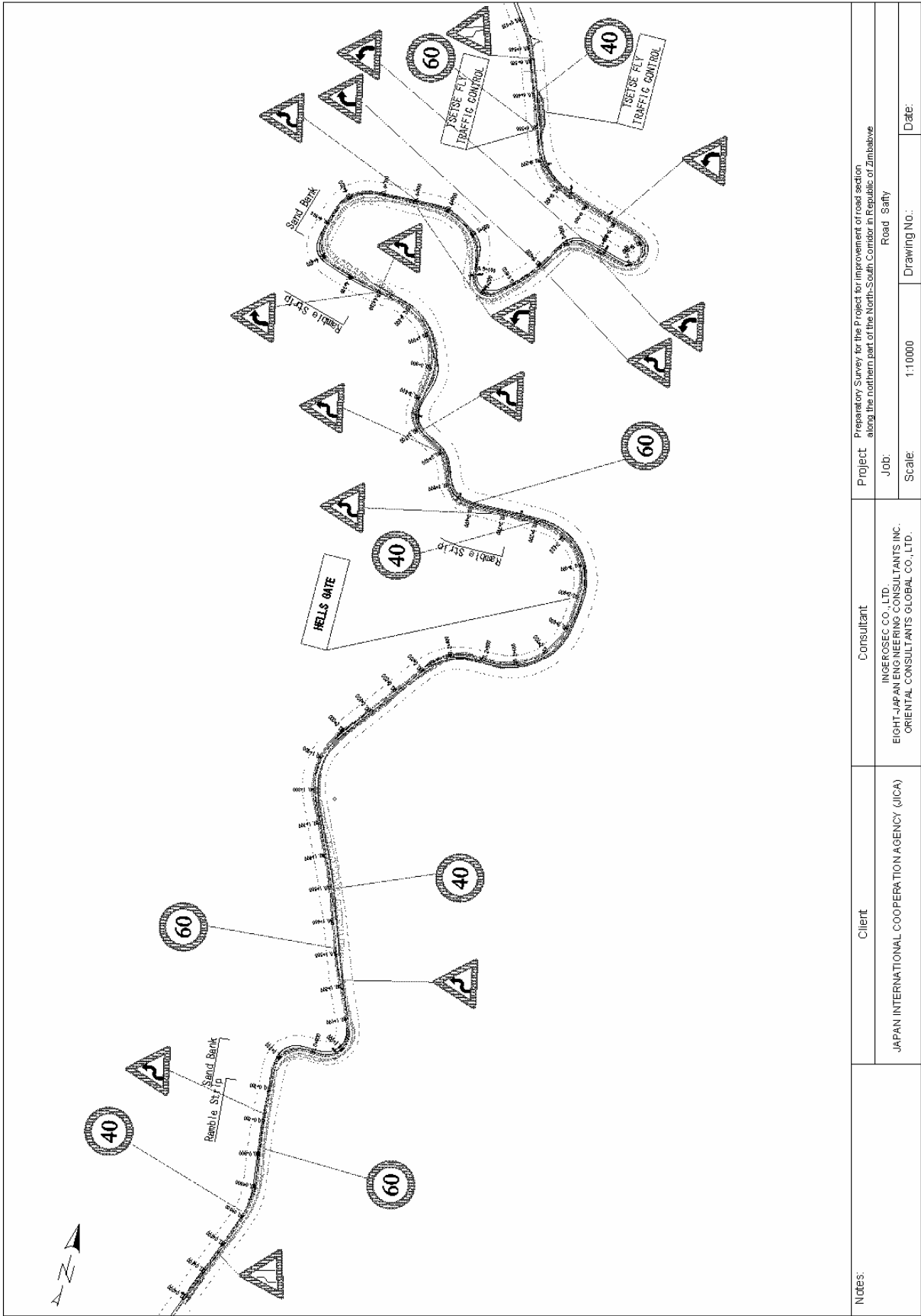


Notice	Client	JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)	Consultant	INGENIEROS CO. LTD. EIGHT JAPAN ENGINEERING CONSULTANTS INC. ORIENTAL CONSULTANTS GLOBAL CO. LTD.	Project	Preparatory Survey for the Project for Improvement of road section about the section part of the road section, Coastal Republic of Zimbabwe
						Job
					Scale:	Drawing No.
						Sheet

Ancillary Works Structure (8)



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
			Job:	Commemorative Monument (8)
			Scale:	1:150
	JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)	EIGHT-JAPAN ENGINEERING CONSULTANTS INC. ORIENTAL CONSULTANTS GLOBAL CO., LTD.		Date:



Notes:	Client	Consultant	Project
	JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)	INGERSEC CO., LTD. EIGHT-JAPAN ENGINEERING CONSULTANTS INC. ORIENTAL CONSULTANTS GLOBAL CO., LTD.	Preparatory Survey for the Project for improvement of road section along the northern part of the North-South Corridor in Republic of Zimbabwe
			Job: Road Safety
		Scale: 1:10000	Drawing No.:
			Date: