Comprehensive Approach to Road Improvement Projects by Official Development Assistance of Japan
- Experience through the planning and designing for "The Project for Upgrading of Kukum Highway" in Solomon Islands-

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Road traffic problems in developing counties such as poor surface conditions, dangerous alignments and lack of traffic capacity are typical phenomena caused by aging road infrastructure without rationale structure, proper maintenance and so on. New road construction and rehabilitation of existing roads are implemented often to solve such problems and bring about effects on improving traffic conditions as well as increasing traffic capacity.

However, those construction and rehabilitation, which we call “hard measures” by themselves may have limited investment effects and restricted results for road safety and traffic congestions especially in urban areas. In addition, hard measures need a certain amount of initial investment cost, which sometimes lead to funding difficulty, and also need continual maintenance costs after traffic operation. In this context, financial capability of developing countries should be carefully assessed. In those views, it is desirable to encourage effective use or reformation of existing facilities and to develop institutional capacity and awareness which contribute to traffic smoothness.

In the Preparatory Survey of “the Project for Upgrading of the Kukum Highway in Solomon Islands (hereinafter referred to as “the Project”)”, conducted by Japan International Cooperation Agency (JICA) from 2013 to 2014, JICA tried to make a plan with a comprehensive approach which consists of not only improvements of existing road facilities, i.e. hard measures, but also design of the road operation improvement plan. Concretely, JICA proposed several ideas including appropriate treatment of bus bays and on-road parking based on surrounding road network and the environment, revitalization of existing underground pedestrian crossings, and educational activities to road users, which are so-called “soft measure” components.

This paper also introduces JICA’s approach which has been also deriving the Solomon Government’s spontaneous self-help efforts for countermeasures to congested traffic flow and articulates points to be applied to and considered in following similar situations.

Key Words : *Solomon Islands, Road Improvement, JICA, Congestions, ownership, planning, soft measure, hard measure*

1. Introduction

Honiara, the capital city of Solomon Islands with a population about 100,000, is located on the north coast of the Guadalcanal Main Island. Its city area is stretching east to west, sandwiched between hilly area and the sea. The international seaport is located at the west, and the international airport is at the east of Honiara city. In the city, railway transit is not introduced as a transport and almost all people's activities are relying on road transport. In the city center, the increasing of vehicle number causes heavy traffic congestion and, hence, has been an obstacle to keep smooth road traffic.

The road network in Honiara city is not formed based on appropriate comprehensive plans currently. The Kukum Highway, as a sole east-west 4-lane arterial with 2 lanes in some part, is connecting areas from the west end of the city area to the Honiara International Airport. However, the road in Honiara City is single trunk and very fragile because the most important logistic basements are connected with only this highway. This situation makes the traffic of the Kukum Highway. The typical bottleneck point is the City Council Roundabout in the city center.

The Government of Solomon Islands, under these circumstances, requested "the Project for Upgrading of the Kukum Highway in Solomon Islands" as grant aid assistance to Japan. The contents of the original request was (1) upgrading of the Kukum Highway which has poor drainage system and old pavement, (2)widening of an existing bridge on the Kukum Highway (the New Matanico Bridge), (3) improvement of the City Council Roundabout to increase traffic capacity. The location map of the Project is shown as **Figure 1.1**.

Responding to the request, JICA had conducted a preparatory survey for the Project from 2013. Through this survey, JICA proposed not only the improvement of the existing facilities but also the technical support combined with the facilities' improvement, which were not included in the original request.

This paper introduces countermeasures to traffic flow including bus and pedestrians' behaviors, which is examined for more effective onset of the Project, and articulates points to be applied to and considered in following similar projects in future.

2. Outline of the requested project

(1) Existing Conditions of the Kukum Highway

The existing conditions of the Kukum Highway are shown as **Table 2.1**. On evaluation of the conditions, the idea was lead to divide the Kukum highway

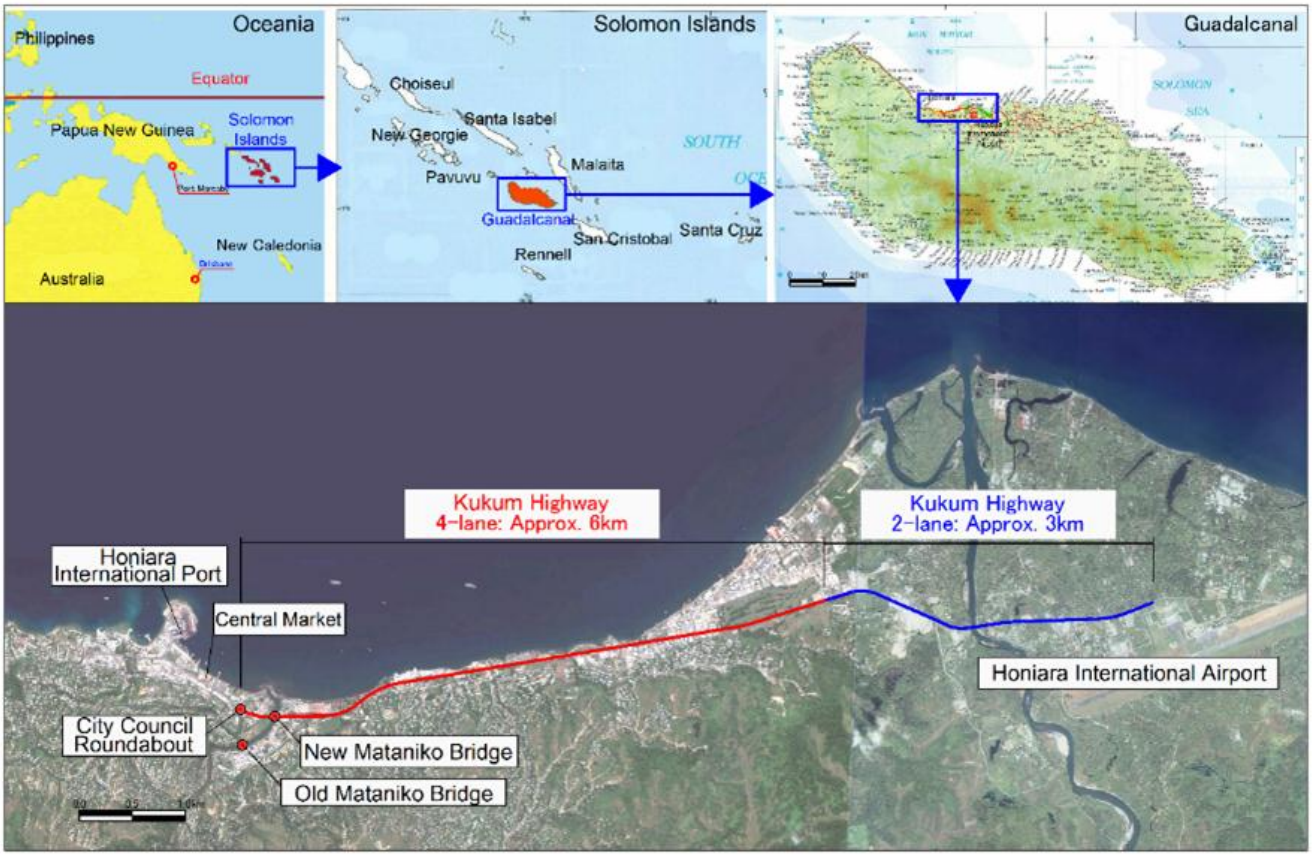


Figure 1.1 Location Map of the Project

from the City Council Roundabout to the Honiara International Airport into 3 sections, considering the damage level of the road surface. The definition of each section is also shown as **Table 2.1**. The Section-1 and -2 act as a trunk road and have large traffic volume. Both sections are aging and many damages are observed on these sections. In the aspect of the structural damage, the Section-1 has damages reaching to the base course, but the damage on the Section-2 is limited only to the surface part. As for improving poor drainage system, the Section-1 is required more technically rational planning and design compared to the Section-2, in order to acquire

Photo 2.1 City Council Roundabout

Table 2.1 Road Conditions of the Kukum Highway by three sections

	Section-1	Section-2	Section-3
Section	From City Council Roundabout to Sta. 3+000 (about 3km)	from Sta. 3+000 to the King George VI H. School (about 3km)	from King George VI H. School to the Honiara International Airport (about 3km)
Road Width	4-lane	4-lane	2-lane
Pavement Condition	- Existing pavement is AC. - Deep mesh cracks exist at most of the section. - Roughness is bad due to repeated repair. - Base course is damaged at parts of the section. - Frequent repair is needed. - Traffic capacity is not enough. - Needs of reconstruction are high.	- Existing pavement is AC. - Shallow mesh cracks exist at some parts of the section - Roughness is better than Section-1. - Base course is not damaged at most of the section. - Frequent repair is not necessary. - Traffic ability is not bad. - Needs of reconstruction are not high.	- Existing pavement is DBST. - Cracks are not serious. - Needs of repair are not urgent.
Drainage Conditions	- 4 inundating sections with a total length of about 600m. - Embankment to improve the profile and additional installation of outlets are necessary. - Many existing malfunctioning drainage facilities are necessary to be repaired. - When inundating, driving and walking is difficult and dangerous. - Large scale work is necessary to improve the drainage conditions.	- 1 inundating section with a length of about 100m. - Repair of existing ditch and additional installation are necessary. - Level of disturbance of driving and walking by poor drainage is not serious. - Necessary work to improve drainage conditions is not large scale.	- Drainage improvement work has been done recently, therefore, no additional work is necessary.
Roadside Condition	Roadside is urbanized with public facilities, shops and residents.	Roadside is partially urbanized.	Roadside is mostly farms and grass land.
Present ADT	27,000-38,000	18,000-27,000	Approx. 18,000 (at King George VI H. School)

Photo 2.2 New Matanico Bridge

Photo 2.3 The Old Matanico Bridge

the draining route and outlet locations. As to the Section-3, which is running from urban to suburban areas, its traffic volume is smaller and its road conditions are better. Therefore, the urgency of the improvement of the Section-3 is lower than that of the Section-1 and -2.

The City Council Roundabout, the origin of the Section-1, is a five-finger intersection, which connects the Kukum Highway with three branch roads. The roundabout is one of the most typical congestion points due to the short weaving with small diameter of the roundabout. **(Photo 2.1)**

The New Matanico Bridge on the Section-1 was opened in 1984 and has been operated for 30 years. The bridge has only 2 lanes, despite the section in the vicinity of the bridge has 4 lanes, and this is one of the reasons of the congestions on the highway. Based on the result of structure analysis, it is judged that continuous use of the existing bridge is possible and it is planned to widen to 4-lane traffic capacity by constructing a new 2-lane bridge parallel to the existing bridge. **(Photo 2.2)**

The Old Matanico Bridge is located on one of the three roads which are connecting to the City Council Roundabout, and this bridge is supposed to form a part of the secondary east-west axis. The bridge is a Bailey Bridge with 1-lane, of which approach roads have 2 lanes, therefore the bridge was forced one-way operations and became a bottleneck and chronic traffic congestion occurs due to the waiting for intervals of the coming traffic from the opposite side. **(Photo 2.3)**

(2) Administrative Capacity of the Implementing Agency

The implementing agency of the Project is Department of Transport Infrastructure, the Ministry of Infrastructure Development (MID), the Government of Solomon Islands. The Department has 21 staffers. The consultant group assigned by ADB (about 40 members) are supporting for strengthening the organization. Through their support, the Central Project Implementation Unit (CPIU) has been established to implement/supervise road and transport infrastructure projects and their maintenance with co-working between local staff of MID and the consultants.

The budget of MID has fluctuated recently between 100 and 400 million Solomon dollar (between USD 10 and 50 million), however, it is examined that the MID could allocate necessary budget to implement their undertakings to be done under the Project.

3. Detailed Planning of the Project

(1) View Points of the Detailed Planning

"National Transport Plan 2011-2030", formulated by MID stipulates the importance of improvement of the Kukum Highway and the New Matanico Bridge connecting between the Honiara International Airport and the City Center, in which the Honiara International Sea Port and key areas are located. The Government of Solomon Islands has also given the highest priority on the project for upgrading of the Kukum Highway in National Infrastructure Investment Plan.

In fact, the Kukum Highway has very important role as the only one trunk road to connect areas between the Honiara International Airport and the city center, and to serve safe and smooth traffic. The request from the Government of Solomon Island is limited only to improvements of existing facilities. But it is obvious that construction of new trunk road is difficult to solve the traffic problems in Honiara city. Therefore the most important matter for the detailed planning is how to plan effective and efficient countermeasures with using existing road in-

frastructures at most and reforming road users' consciousness for proper use of roads, who were blocking smooth traffic flow in the city.

To perceive current traffic circumstances, traffic volume survey and travel speed survey on and around the Kukum Highway have been conducted first as a part of the preparatory survey conducted by JICA. The results of the surveys show the following points;

(a) It had been reported that "deficiency of traffic capacity at the City Council Roundabout" and "bottleneck at the New Matanico Bridge, where 4-lane becomes 2-lane" caused chronic traffic congestions of 1-2 km long. But the result of the surveys found that one of the starting points to reduce vehicles' speed is "the congestion point around the Central Market due to the bus pooling and pedestrians' crossing" (The details of the result is described in the following (2)).

(b) The traffic congestions starting from the Central Market Area and Old Matanico Bridge extended tails of their queues into to the roundabout. These queues of vehicles made the traffic inside the roundabout stacked and further worsened the congestions on the Kukum Highway.

We have reviewed the original request of the Project submitted by the Government of Solomon Islands, duly considering these results of the surveys/analysis.

The review of the requested Project was conducted in collaboration with the Government of Solomon Islands, as enhancement of its ownership and sharing of rational thinking way, i.e. technical transfer, are very important and JICA is always pursuing those effects. The limitation of amount of the Japanese grant assistance was taken into account also, consequently, it is essential to formulate the most effective comprehensive plan and to implement the undertakings to be taken by the recipient country with absolute certainty on a timely basis. Undertakings by the recipient country are usually identified in the general matters, e.g. land acquisitions, issue of a Development Consent, relocation of the existing utilities, etc. Under the Project, however, in addition, more several specific matters were discussed, identified and mutually confirmed what, when, how and who would take action precisely. In particular, to effect and keep the impact of the countermeasures at the Central Market Area, it is necessary to establish the rules and methods for operation and maintenance of the facilities at the Area, which prioritizes the participatory decision making mechanism among related organizations of the Government of Solomon Islands and other civil societies. The participation which contributes to ensure the sustainable impact with their ownership is significantly important.

(2) Outline of the Traffic Survey in the Project Area

We introduce the result of "Travel Speed Survey" and "Traffic Situation Survey at the Central Market Area" which are providing very important data to select components of the Project and add technical assistance, choosing from the various surveys' result conducted through the site survey in Honiara.

(a) Travel Speed Survey

The travel speed survey was conducted along the Kukum Highway between Town Ground Roundabout and Honiara International Airport. The survey was conducted for 2 days (Nov. 26 (Tue) and Nov. 27 (Wed) in 2013) in total 6 hours, between 8:00 to 10:00 when traffic started increasing, 10:00 to 12:00

Figure 3.1 The Location of the Check Points

Table 3.1 The Result of the Travel Speed Survey

Checkpoint	Distance (km)	West to East (km/h)			East to West (km/h)		
		First Survey	Second Survey	Direction	First Survey	Second Survey	Direction
1. Hotbread RA				Start			End
2. Central Market	0.35	15.4	7.9	↓	20.0	30.7	↑
3. City Council RA	0.7	18.5	19.7		7.2	14.5	
4. New Mataniko Bridge	1.1	28.8	28.8		3.8	6.7	
5. Lawsontama Junction	1.43	36.0	39.6		3.9	4.8	
6. St. B Provincial Cathedral	1.83	35.1	48.0		4.8	9.8	
7. Kukum Police Station	2.61	33.4	52.0		14.0	44.6	
8. Vura Junction	3.2	35.4	36.0	End	42.5	44.3	Start

when morning congestion peak occurred and 15:00 to 17:00 when evening congestion peak occurred. The travel speed was surveyed using a sedan car traveling at the speed of following traffic flow by measuring the elapsed time at the checkpoints along the Highway. The location of the checkpoints is shown in **Figure 3.1.**

The result of the travel speed survey is shown in **Table 3.1**. It was at 9:00's when the flow to the west was the slowest and at 16:00's when the flow to the east was the slowest. The result shows that travel speed increased after passing the Central Market Area on both directions, and the Central Market Area was the starting point of the congestions.

(b) Traffic Conditions at the Central Market Area

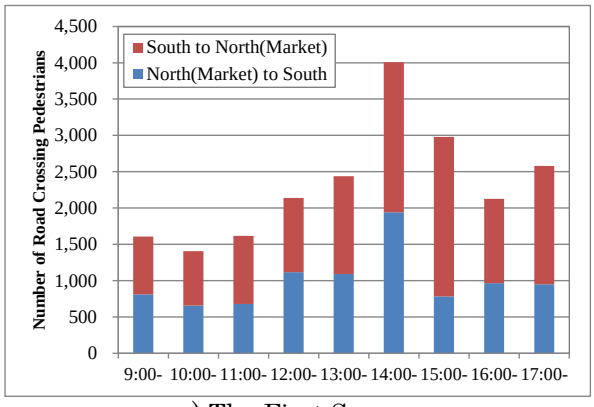
Bus bays around the Central Market are too small to accommodate arriving buses; therefore buses are waiting on the through traffic lanes to enter the bus bays **(Photo3.1)**. The waiting buses on the through lanes cause traffic congestions.

We conducted surveys of "Bus Stop Duration Survey" and "Number of Passengers Waiting for Buses" to get basic data for planning of bas bays.

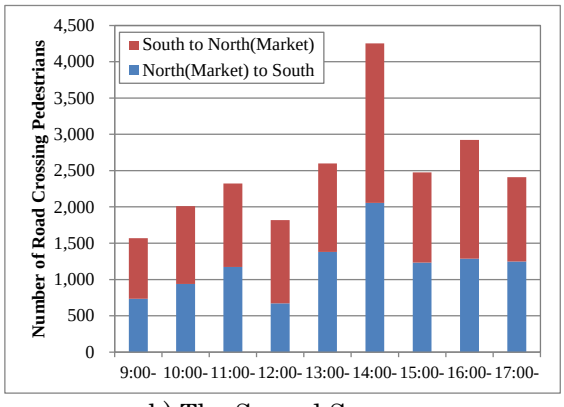
The underpass near the Central Market had been closed and there is no road crossing facility for pedestrians around the Central Market. Therefore chaotic frequent road crossing of pedestrians are causing traffic congestion around the Central Market. **(Photo3.2)** We conducted surveys of "Number of Pedestrians Crossing the Road" **(Figure 3.2)** and "Pedestrian's Moving Path" (described in next clause) to get basic data for planning of road crossing facilities.

Photo 3.1 A Bus Bay

Photo 3.2 Pedestrians Road Crossings



a) The First Survey



b) The Second Survey

Note: The first survey was conducted on Mar. 4 (Mon) and the second survey was conducted on Mar. 5 (Tue) in 2014.

Figure 3.2 Number of Pedestrians Crossing the Road by Hour

Figure 3.3 Pedestrian's Moving Path

(c) Pedestrian's Moving Path Survey

Pedestrian's moving path survey was conducted around the Central Market for 2 days on 6(Thu.) and 7(Fri.) March, 2014. The Surveyors made interview to pedestrians about their moving path around the Central Market. Sample number was 315 pedestrians.

Their trip purposes were shopping (41%), business activities (25%) and commuting to work places/school (22%). Their transportation modes were bus (71%) and waking (15%). **Figure 3.3** shows moving pass of pedestrians. Main departure point and destination were the Central Market and the bus bays around the Central Market.

3) Outline Design of the Project (Selecting the Project's Components)

In order to solve the problems along the Kukum Highway as shown in **Figure 3.4**, we considered the following 3 points for selecting the components of the project;

- Improvement of the traffic flow with relieving road damages occurred in rainy seasons due to poor drainage and aging pavement.
- Improvement of the traffic flow with removing the bottleneck
- Strengthening the city road network with providing an alternative route to the Kukum Highway.

As the result of the examination, the 6 items have been selected as the components of the Project shown as below;

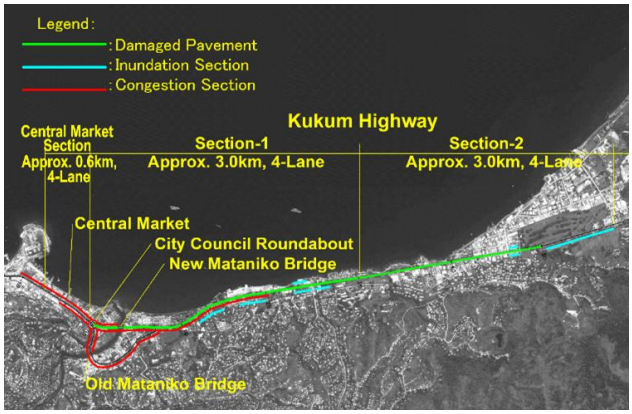


Figure 3.4 Location of Problems Area along the Kukum Highway

- Upgrading of the Kukum Highway (Section-1: from City Council Roundabout to Ministry of Fishery, approx. 3km)
- Countermeasure against traffic congestion around the Central Market
- Improvement of City Council Roundabout
- Widening of New Matanico Bridge (from 2-lane to 4-lane)
- Replacement of Old Matanico Bridge (from 1-lane to 2-lane)
- Technical Assistance for Smooth Pedestrian's Flow

We show the details about the improvement methods at the Central market Area, which is collaboration between upgrading of facilities and technical assistance.

(a) Improvement of Facilities at the Central Market Area

Since the major cause of the traffic congestion around the Central Market are buses occupying the traffic lanes and chaotic frequent highway crossing of pedestrians, the countermeasures against traffic congestion around the Central Market are the provision of bus bays with adequate size and the provision of road crossing facilities that are to be a crosswalk

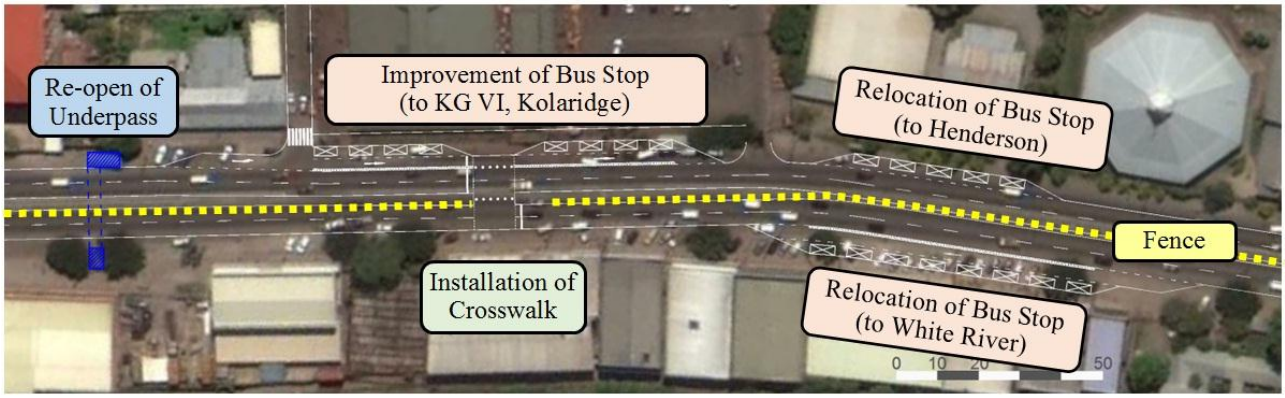


Figure 3.5 The outline of the improvement plan around the Central Market

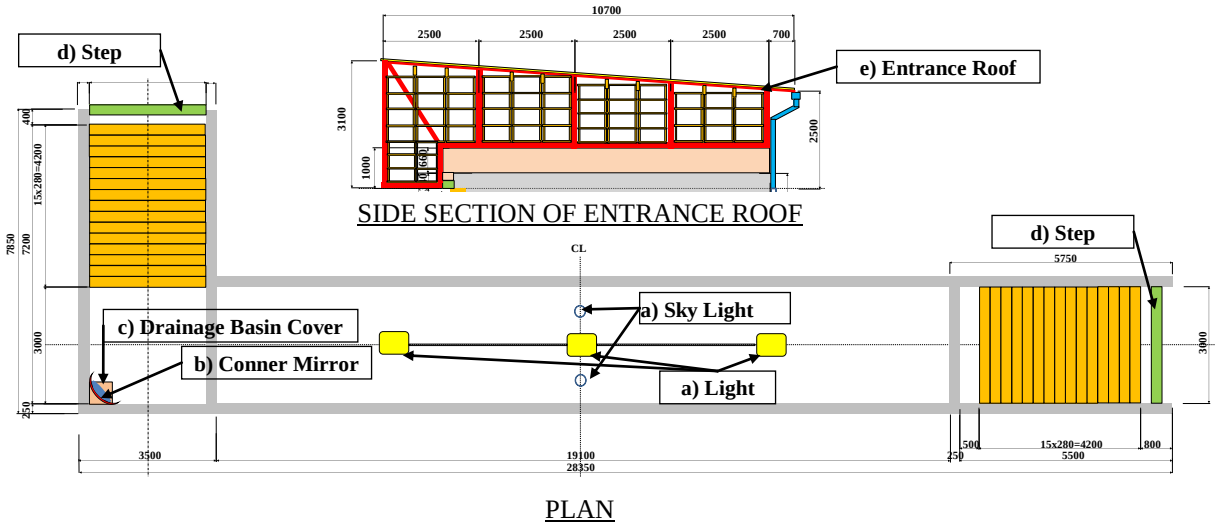


Figure 3.6 Drawings to Renovate Underpasses

and an underpass. Median fence is to be installed to prevent free road crossing. The outline of the improvement plan around the Central Market is shown as **Figure 3.5**.

The existing underpass will be reopened after renovation. The crosswalk is to be controlled by traffic officers instead of traffic signal due to unstable power supply and maintenance. To encourage pedestrians to use the underpass, the existing underpass should be renovated by repainting, lighting and installing corner mirrors and colorless entrance/exit roofing. The drawings to renovate underpasses are shown in **Figure 3.6**.

(b) Soft Measures to the Operation for Smooth Pedestrians' flow

As the countermeasures against traffic congestion around the Central Market, installation of a crosswalk and median fence and renovation of existing underpass were proposed in the Project. These countermeasures had been implemented in the past, however, the underpass was closed several years later due to security and sanitary reasons and the median fence has been demolished due to lack of traffic control of road crossings. In order to avoid repeating such unsuccessful experience and to promote pedestrians to use the underpass continuously, introducing a security guard to observe the safety and cleanliness of the underpass and to lock and unlock the underpass entrances every morning and evening is necessary. Also inauguration of traffic officers to conduct traffic control at the crosswalk from early morning to late evening every day is necessary to maintain the smooth traffic flow and to secure the pedestrians' safety and convenience. The imaginary picture with the treatment is shown as **Figure 3.7.**

To secure the proper operation and management of crosswalk and underpass, this project supports to establish the operational organization and method as a soft measures of the project.

Figure 3.7 Road Crossing Secured by Gurads (Imaginary Picture)

4. Evaluation of the Project

(1) Expected Effects on the Design Stage

The expected effects in a quantitative way of the project are shown in **Table 4.1**.

The project is supposed to have good effects to reduce traffic congestion length and improve the

Table 4.1 Quantitative Effects of the Project

Quantitative Effect Indicator	Base Year (2013)	Evaluate Year (2021) (Three years after the project completion)
Reduce traffic congestion length (queue) from City Council Roundabout toward to the east at 9am	670m	300m
Improvement of average travel speed from Vura Junction to Hotbread Roundabout at 9am	20km/hr.	30km/hr.

traffic speed in peak hours. We assumed that not only the facility improvement, but also the technical assistance to the operation contributes to solve traffic congestions in the city area.

(2) Unexpected Impact

(a) The Solomon side's Initiatives

We selected the Project components to maximize the effectiveness and efficiency for solving the issues with the limited budget. Through the discussions with the officials from the Solomon Government, both parties agreed that the countermeasures for traffic congestions at the Central Market Area should be added to the Project. The purpose of the technical transfer is to redirect the mind of road users and related persons to use road facilities properly and to improve the road traffic situation at the Central Market Area. Then on the stage of the planning, we placed a high value on collaborative works with the Solomon side. As the result of this approach, the Solomon side has started to improve and operate the existing facilities prior to the commencement of the Project with their initiative. This is not a foreseeable impact at the planning phase.

(b) Starting the One-Way Operation

In order to keep smooth traffic at the City Council Roundabout, the one way operation on the sections from the Old Matanico Bridge to the roundabout was started on a trial basis. The situation has drastically changed compared to the previous year situation; drivers fought frequently over the one lane on the old bridge from both sides. This might indicate that the mind redirection has certainly started through the survey of the Project.

(c) Re-opening of the Underpass Pedestrian Way

The next impact is re-opening of underpasses for pedestrian; one in front of the Central Market and another one block to west from the Market. When we started the survey in November 2013, both underpasses were used like a toilet or garbage pit with bad smell, rocked out and completely abandoned. JICA Survey Team explained to the Solomon side the necessity of countermeasures for traffic congestions at the Central Market Area and had discussions with related organizations of the Solomon side to seek the possibility to utilize the existing underpasses, with safety and comforts, through the process to select components of the Project. These underpasses were re-opened on the same day of the 2nd stakeholders' meeting in Honiara. Through the series of discussions between JICA Survey Team and the Solomon side, the re-opening was proposed as one of the possible countermeasures. However prior to the Project commencement, it was implemented by the Honiara City Council, as a related organization to solve the traffic congestion at the Central Market Area. We are sure that JICA study acted as a trigger to promote capacity development of the related organizations of the Solomon side. These actions taken by the Solomon side mean their mind redirection has occurred and good results of the technical transfer through the survey and discussions. For the re-opening of the underpasses, minimum necessary measures have been conducted, e.g. cleaning and re-painting inside of the underpasses.

5. Conclusion

We learned lessons from this survey in order to achieve effective and efficient implementation of similar projects in future, with using existing facilities and redirecting of related persons' mind as follows;

(1) Involvement of Related Administrative Organizations

This Project responds to such crucial issues as relieving traffic congestions in the capital city and improvement of the most important trunk road in Solomon Islands. Therefore related officials from both governments are very interested in the Project and we took highly consideration to discuss sufficiently for smooth implementation of necessary measures. Especially as for the undertakings to be taken by the Solomon side, we obtained their commitment to conduct them smoothly by making clear necessary processes with 5 W's and 1 H method and sharing its result as the implementation plan. This action is promoting to ensure the Solomon side's timely implementation of their undertakings by forming a framework to make clear each side's working demarcation and responsibilities, and the checking system of the progress.

More specifically, we made up time frames along applications, negotiation, permissions and starting or usage, for each items to be undertaken, e.g. budget allocation, tax exemption, land acquisition, environmental and social considerations, relocation of obstacles, securing temporary yard, quarry sites and damp sites, which must be completed before the commencement of the tender procedure. To set the time frames, we took into high considerations to the expected events, each work flow, necessary time for the works and affecting assumptions, and examined the feasibility to meet the dead lines. When we

expected undertakings might be difficult to be conduct due to affecting assumptions, we proposed counterplans and showed them in the schedule. As a monitoring system, we agreed that the Solomon side would submit the monthly progress report to JICA resident office until the completion of all undertakings shown on the schedule, for ensuring its implementation and responding to the unexpected events.

Considering the situations that some projects are affected by delay of recipient side's undertakings, it is very important for us to achieve effective results with this attempt. In fact, as some undertakings are not easy to be conducted by the implementing agency, through the series of discussions, we also request the related agencies to support to the implementing agency for smooth implementation of the undertakings.

Some procedures necessary for the project implementation, such as budget allocation, tax exemption and development consent, are required to arrange coordination with other organizations within the Government. We understood that we reached the agreement through the fruitful discussions with MID. On the other hand, MID would be required to hold their initiative, ownership and responsibility for this matter. In the aspect of this context, our activities through the survey also contributed to redirect the mind of the MID's officials.

(2) Public Relations

Several stakeholders' meetings for the Project were held during the site survey. The purpose of the meetings was to explain the outline of the Project and obtain consensus from the aspects of Environmental and Social Considerations under the Project. The Government of Solomon Islands announced the meeting and stimulated participation to the various stakeholders. As a result, many people, such as government officials, public enterprises, traffic enterprises, representatives from the residents along the Highway, attended the meetings. The media in the Solomon were also interested in the meetings and came to cover these meetings. Opinions from the participants were mainly positive to the Project and no negative view was raised. Many participants were interested in the countermeasures to solve the traffic congestions at the Central Market Area and focused on this topic during the question-and-answer sessions of the meetings. Some participants pointed out that he/she understood the importance of the countermeasure, but only the improvement of facilities were inadequate to produce enough effects. We responded to the participants that these points made us to propose the technical assistance as an educational activity to promote road users themselves to follow the traffic rules and use road facilities properly.

Many articles related to the Project were published on the local major papers including articles about the stakeholders' meetings. It is concluded that properly information sharing and provision at early stage as well as co-working with stakeholders and related officials lead to successful projects and unexpected effects additionally.

(Received April 24, 2015)