Implementation Support and Follow-up for Knowledge Co-Creation Program "Practical Technology on Intelligent Transport Systems (ITS)"

Final Report

Summary

April 2019

Japan International Cooperation Agency (JICA)

Oriental Consultants Global Co., Ltd.
Oriental Consultants Co., Ltd.
Transportation Research Institute Co., Ltd.
Metropolitan Expressway Company Limited

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General Abbreviations

Abb.	English
AFC	Automated Fare Collection
AI	Artificial Intelligence
ANPR	Automatic number-plate recognition
ATMS	Advanced Traffic Management System
BRT	Bus Rapid Transit
CCTV	Closed-circuit Television
CDR	Call Detail Record / Call Data Record
C-ITS	Cooperative Intelligent Transport Systems
CKE	Colombo Katunayake Expressway
CMC	Colombo Municipal Council
DICT	Department of Information and Communication Technology
DoMT	Department of Motor Traffic
DOST	Department of Science and Technology
DOTr	Department of Transport
DPWH	Department of Public Works and Highways
DSRC	Dedicated Short Range Communications
ERP	Electronic Road Pricing
ETC	Electronic Toll Collection System
EV	Electronic Vehicle
GDP	Gross Domestic Product
GTFS	General Transit Feed Specification
ICT	Information and Communication Technology
ICTA	Information and Communication Technology Agency of Sri Lanka (Pvt)Ltd.
IoT	Internet of Things
ITU	International Telecommunication Union
JICA	Japan International Cooperation Agency
KOICA	Korea International Cooperation Agency
LCC	Lusaka City Council
LGU	Local Government Unit
LRT	Light Rail Transit
LTFRB	Land Transportation Franchising &Regulatory Board
LTO	Land Transportation Office
MaaS	Mobility as a Service
MCC	Millennium Challenge Corporation
MHID	Ministry of Housing and Infrastructure Development
MLGH	Ministry of Local Government and Housing
MLG	Ministry of Local Government
MMDA	Metropolitan Manila Development Authority
MMWD	Ministry of Megapolis and Western Development
MoTC	Ministry of Transport and Communications
MOU	Memorandum of Understanding
MoWS	Ministry of Works and Supply
MRT	Mass Rapid Transit
NCR	National Capital Region
NCTS	National Center for Transportation Studies, University of the Philippines Diliman
NEDA	National Economic and Development Authority
NTC	National Transport Commission
NTC	National Telecommunication Committee
OCH	Colombo Outer Circular Highway
OBD	On-board diagnostics
ODA	Official Development Assistance
PNP	Philippines National Police

PPP	Public Private Partnership
PTPS	Public Transportation Priority System
PUVMP	Public Utility Vehicle Modernization Program
RDA	Road Development Authority
RDA	Road Development Agency
RFID	Radio Frequency Identifier
RTS	Rapid Transit System
RTSA	Road Transport and Safety Agency
SATREP	Science and Technology Research Partnership for Sustainable Development
SCOOT	Split, Cycle and Offset Optimization Technique
SD&CC	State Development & Construction Corporation
SDGs	Sustainable Development Goals
SLT	Sri Lanka Telecom
SLTB	Sri Lanka Transport Board
SNS	Social Networking Service
SPMU	Special Projects Management Unit
SURP	School of Urban & Regional Planning, University of the Philippines Diliman
UP	University of Philippines
WPRPTA	Road Passenger Transport Authority Western Province
VICS	Vehicle Information and Communication System
VMS	Variable Message Signs
ZICTA	Zambia Information and Communications Technology Authority

1 Introduction

1.1 Background

Economic development has led to a rapid increase in travel demand and the number of motor vehicles in the developing countries including Southeast Asian countries. Although the construction of infrastructure is struggling to keep up with the traffic demands, chronic traffic congestion occurs even in provincial cities as well as in Metropolitan area. It is a common problem in most of the countries whose growing level is different. The traffic congestion interferes with the smooth transportation of people and goods, which adversely affects the economic activities, and it becomes the cause of frequent traffic accidents and deterioration of the living environment due to air pollution. Those are serious social problems and urgent action is required to address them.

On the other hand, in addition to the absolute capacity shortage of the existing infrastructure, current urban roads and intercity roads have not been designed to meet the current rapid increase in traffic demand and vehicle size. Therefore, road widening work and/or road alignments renewal work is required. However, the cost for such works will be the pressure to the government budget, and such situations worsen the chronic traffic problems.

Under such situation, the efforts to maximize the capacity of existing road infrastructure by applying Intelligent Transport Systems (hereinafter referred to as “ITS”) have been implemented worldwide. The traffic control system, traffic signal and/or variable message sign are commenced to introduce in the developing countries also. However, many of them are implemented individual projects basis without considering the comprehensive long-term plan. In some case, the existing system might become a technical barrier when executing agencies in the developing countries try to proceed to connect advanced control system with the existing ones through the communication network, if the function of the existing ones did not include the future connectivity or interoperability. In order to introduce and disseminate ITS, it is important to have an appropriate system configuration that corresponds to each country's circumstances, traffic conditions and future prospects. In addition, it is also essential to make recommendations to the policies and the related organizations. JICA has conducted many projects to support of the formulation of urban transport master plan and ITS implementation in many countries including the Knowledge Co-Creation Program for countries around the world.

Through the above support, it is important to collect and analyze the traffic issues and needs of the target countries, and to consider the possibility of introduction of ITS is useful for formulation of the cooperation projects. The collected information related to ITS is also effective for many Japanese companies which intend to expand its market in overseas.

1.2 Objectives

Based on the above background, the consulting service aims as follows:

1) Collection of information related to training contents, check & review, various arrangement and support on the training
2) Follow-up of the situation after the participants return to their countries in order to improve the training effectiveness
3) Implementation of study and ITS seminar in the selected countries considered particularly effective among the participating countries, dissemination of Japanese ITS technologies and understanding of needs related to ITS in the country
4) Holding ITS seminar in the selected counties and analyzing of study results, organizing of the of ITS cooperation policy through them
5) Record information about participants

1.3 Outline of the Consulting Service

The consulting service consists of supports of implementation of the Knowledge Co-Creation Program "Practical Technology on ITS" in Japan, and the implementation of studies and ITS seminar in the target countries selected from the participants' countries each fiscal year. The Consultant also analyzed those results and organized the ITS cooperation policy and the future training program.

Table 1-1 shows implementation results of each year. The study in the target counties conducted twice in a fiscal year. In the first period, traffic issues and the ITS potential needs, etc. were surveyed, and in the second period, ITS seminar was held in the target countries on the basis of the obtained result of the survey. In the Seminar, Japanese companies and presentation speakers introduced their solutions or technology which correspond to the target country's ITS related needs

Table 1-1 Implementation results of each year

Fiscal year	Knowledge Co-Creation Program (Japan)	Study and ITS seminar	
2016	July 4, 2016 - July 29, 2016	Zambia	1st period : November 20, 2016 – December 10, 2016 2nd period : February 21, 2017 – March 5, 2017
2017	June 26, 2017 - July 21, 2017	Sri Lanka	1st period : November 12, 2017 – November 29, 2017 2nd period : May 7, 2018 - May18, 2018
2018	June 25, 2018 - July 20, 2018	Philippines	1st period : November 4, 2018 – November 21, 2018 2nd period : February 4, 2018 - February 15, 2019

2 Knowledge Co-Creation Program "Practical Technology on Intelligent Transport Systems (ITS)"

2.1 Selection Meeting of the Participants of the Program and Discussion of the Contents

1) Contents

(1) Course Objective of the program and Expected Module Output

After discussions with the related parties, the training overall goals and expected module output were set as follows:

- Course Objective

  A plan to introduce ITS will be formulated in the respective participants' organizations.

- Expected Module Output

  To achieve the above course objective, participants are expected;

  1) to understand the outline and related technologies of ITS,
  2) to deepen understanding of the role of the government to introduce ITS,
  3) to formulate an action plan through specifying the applicable ideas, and
  4) to share what they learnt (including the action plan) with related officials in each country.

(2) Contents of the Course

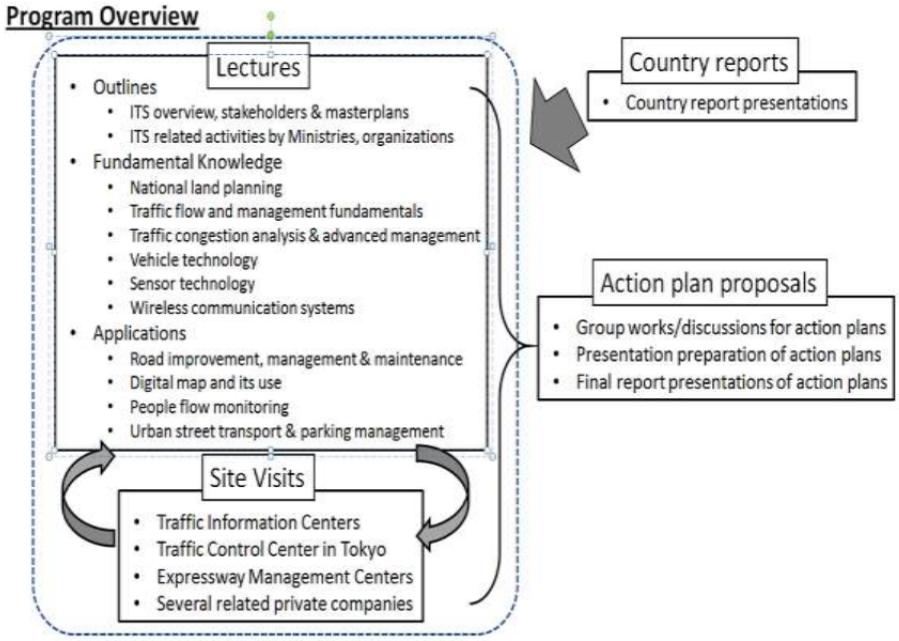
The curriculum shown in Figure 2-1 has been developed to achieve the above output.

Since ITS technology is a tool applied in the field of road management and traffic management based on elemental technologies in a wide range of fields such as traffic engineering, mechanical engineering, information and communication technology, etc., the curriculum of the training consists of contents that participants can comprehensively and systematically learned. The program also consists of not only lectures but also introductions to ITS technologies in Japanese companies, site visits of factories and showrooms, and site visits at facilities that operate actual traffic management and provide information, so that the participants can understand the situation of actual implementation and operation, and obtain the latest technical information including networking.

In addition, the participants took some lectures that related government agencies introduced the efforts from the aspect of systems and policies necessary for the introduction of ITS, and conducted group work twice, receiving advice from Institute of Industrial Science, The University of Tokyo, other experts from government agencies and consultants. At the end of the program, the participants presented at the final report presentation including an action plan in their own country based on the contents learned in the training. This program is designed to give a practices or a presentation to deepen understanding.

In considering the contents of the program, based on the results of the program in each fiscal year, related parties including implementing organization (The University of Tokyo) discussed the

improvement measures at the meeting after the program, and they were reflected the results in the program in the next fiscal year.



Source: General Information (JICA)

Figure 2-1 Overview of Knowledge Co-Creation Program "Practical Technology on Intelligent Transport Systems (ITS)"

2) Selection of the Participants

(1) Target Regions or Countries

The target regions or countries were invited through G.I. (General Information), giving priority to the countries and counterpart organizations of ITS related projects currently or scheduled. Table 2-1 shows a table that lists the dispatching countries of participants from fiscal 2016 to 2018.

There were 51 participants from 21 countries in 3 years.

Table 2-1 Countries of Origin of Participants for 3 Years

Region	2016 [19]	2017 [19]	2018 [13]
Southeast Asia	Indonesia (2), Laos (2), Philippines (2)	Philippines	Philippines, Cambodia, Malaysia, Viet Nam
South Asia	India, Pakistan (3), Sri Lanka (2)	India, Pakistan (3) , Sri Lanka (3)	India, Pakistan
Central Asia	Kazakhstan, Kyrgyz	Kazakhstan (2)	
Middle East		Egypt (3)	Egypt, Iran, Jordan
Africa	Ghana, Nigeria (2), Zambia (2)	Ghana, Uganda, Kenya, Rwanda	Ghana, Kenya, Zambia, Rwanda
South and Central America		Argentina, Uruguay	

Source: JICA Study team [ ] number of participants

(2) Attributes of the Participants

Looking at the age composition of the participants, there were many in thirties, and there were many participants with relatively long experience years.

Since there are many departments involved in the ITS field, the participants belong to various departments in charge of road traffic management and public transportation, and some of participants are also departments in charge of police, research institutes, ICT technology, and vehicle registration.

Source: JICA Study team make reference from application documents

Figure 2-2 Attributes of Participants from 2016 to 2018

(3) Supports for the Course

A) Active Learning

The method of Active leaning was adopted from the course of 2016 fiscal year in order to deepen participants' understanding of the lecture by their own initiative.

At the end of each lecture, two participants became a pair, and one person summarized the contents of the lecture and another supplemented it. This method is called "Shearing Time" and the participants could improve their concentration on the contents of the lecture.

Figure 2-3 Time Management of Sharing Time by Today's Leader

In addition, the participants elected “Today's leader” on a daily basis, who express appreciation to the lecturer on behalf of all participants at the end of each lecture and manage Sharing Time during program term. As a result, a sense of responsibility was created, and it was effective in the smooth implementation of the program, such as actively becoming a leader of the participants at the visiting site.

B) Feedback Sheet

Until 2017, the participants had recorded what they learnt in the lecture and comments of the lecture by hand on the feedback sheet immediately at the end of the lecture in the classroom in order to have it used as a record for future improvement of the lecture’s quality. However, the records were not enough due to limited time. Therefore, in 2018, the participants recorded in text data and the data is collected weekly. As a result, the participants could remember the lecture with the recorded feedback sheet for future work. The participant could also use it for sharing information in his/her own organization after returning home country.

C) Utilization of Google Photo and Google Calendar

The consultant team acquired a specific Google account, and shared the photos taken during the program with the participants, and made it possible to view them even after returning home. In addition, the Google Calendar was set so that the participants could check the schedule of each lecture, the location information of the site visit, and the URL of the lecturers and the website of the visiting organizations previously.

D) Confirmation of Duplicated Lecture Contents and newly added contents

Since there were several indications from the participants about the duplication of the lecture contents, at the evaluation meeting in 2017, the consultant team checked the textbook used in 2017, organized the overlapping contents, and coordinated with the lecturers of University of Tokyo to improve the lectures. Since the participants had also commented that it would be better to add the lectures on public transportation and parking management, the consultant team pointed out to add such contents to the lectures.

E) Addition of the lecture “ITS World Trend”

Since there were many questions about the trends in ITS in overseas as well as in Japan, the consultant team added the contents of ITS global trends after the ITS Master Plan lecture from 2017 and provided the latest information in Western countries that had been collected at the ITS World Congress.

At the same time, the lecturers added the information on technical comparison which is applied in different countries such as signal control method.

F) Group Work

In the group work, the participants were divided into some groups by the theme of measures to

address traffic problems, and each participant presented a draft action plan, which was prepared by oneself in advance, and discussed it with other group members such as some lecturers from the University of Tokyo, private companies, consultants, and other participants. Consequently, the participants had a chance to know other participants' issues and solutions. The participants were also able to brush up their own ideas more by obtaining other viewpoints through the mentioned process.

Before group work, the consultant team showed the relation among observed traffic problems, real causes of traffic problems and measures to mitigate them in 2017. Then the team pointed out that the ITS is one of the tools/solutions categorized under the measures in order to clarify the relations among them. After that, the participants conducted exercises to consider the process leading to the solution, which is equivalent to the action plan, from observed traffic problems in their country by referring their own country report as a preparatory process of the action plan. It was an effective procedure for the participants to understand logical approach.

In 2018, there was not enough time to do so. Therefore before commencement of the group work, the team requested the participants to organize the cause of traffic problem, measures to mitigate it, and reason of select it. It seems to be also effective for preparation of action plan. However if there is enough time, the previous procedure is recommendable.

G) Individual Consultation

Since the participants in 2016 proposed that they would like to discuss problems/issues individually, the consultant team conducted individual consultations with those who proposed it. It continued afterwards in 2017 and 2018 also.

2.2 Coordination with the organizations to accept the participants' Site Visit

Table 2-2 shows the organizations to accept the participants' site visits and contents of lecture or site visit program. The program is composed of lectures related to ITS technologies/solutions of individual companies, and factory tour, and facility tour such as traffic control centers at the Metropolitan Police Department, information provision center at VICS centers and JARTIC.

Table 2-2 Main Acceptance Organizations and Contents of Lecture or Site Visit

Site Visit Destination	Contents of Lecture or Site Visit Program
JARTIC (Japan Road Traffic Information Center)	Introduction of the organization, Observation at Broadcast Facility, etc.
VICS (Vehicle Information and Communication System) Center	Introduction of the organization, Observation at VICS information center, etc.
Toshiba Infrastructure Systems & Solutions Corporation	Advance Traffic Management System, Facility management system, Implementation of traffic control in Vietnam expressway, Urban transportation system, Observation at Toshiba Science Museum, etc.
FUJITSU	SPATIOWL (Cloud Service Based On Location Information, Traffic Image Analysis)
Traffic Control Center of Metropolitan Police Dept.	Observation at Traffic Control Center

Site Visit Destination	Contents of Lecture or Site Visit Program
NEXCO East	Observation at traffic & Facility Control Center at Expressway and Iwaki Toll Booth
NEC	Comprehensive Solution for Public Transportation, AFC (Auto Fare Collection), Policy of Traffic Management
Omron	Observation at Kusatsu Factory (Traffic Signal Control Equipment) , Image Processing Technology, Weigh-In-Motion Technology, etc.
Mitsubishi Heavy Industries	Observation at Futami Plant (ETC, Toll Booth), Introduction of ETC, ERP, RFID based ETC, ANPR System, Finger Print Matching Technology, CDR and Traffic Flow Analysis
Sumitomo Electric Industries	Traffic Signal Control, How to design of intersection, Lecture of Traffic Management, Exercise of Signal Phase, Observation at Factory of Traffic Signal Controller
Hitachi	Image Processing Technology for Traffic Volume Count, Robot Camera in Tunnel, Introduction of Demonstration Experiment of Bus Location System, Introduction of remote inspection support system using head mounted display, etc.
Nagoya Electric Works	Mobile VMS, Project in India (PPP, SATREPS)

2.3 Participation in Country Report Presentations and Support of Group Work

The consultant team attended the country report presentation where the participants presented the situation in each country to collect necessary information. Before the presentation, the consultant team checked and analyzed the contents of the country report as much as possible, and the participants made corrections as necessary.

As for the Group Work, in order to facilitate discussions smoothly, groupings were conducted on the basis of individual themes which participants interested in through the discussions and consultations with the related parties.

1) Country Report Presentation

(1) Issues regarding Traffic Situation and ITS in Each Country Presented by Participants

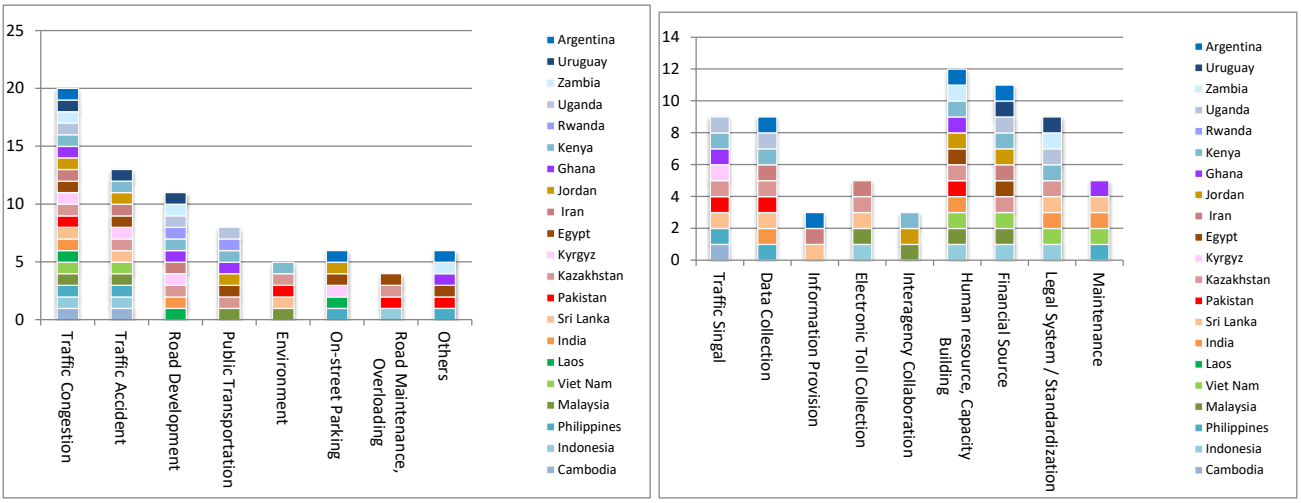
At the country report presentation, the participants reported own country's traffic problems and technical issues. Those are summarized in the following items;

A) Traffic Problem

Although the focusing traffic issues may differ depending on the duties of the participants' organization, most of the participants pointed out the worsening of traffic congestion, with no regard to the participants' country. In addition, the participants from Southeast Asian and Middle Eastern countries pointed out traffic accidents. On the other hand, the member from Africa pointed out inadequate road maintenance and lack of public transportation.

B) Technical Problems related to ITS

Regarding the problems related to ITS, the most of the participants pointed out the issues of "Lack of human resource who have the ability", followed by "Lack of financial resources" and "Legal system and Standardization".



Source: JICA Study team (In case that countries participating in multiple years, the latest city report was referred)

Figure 2-4 Traffic Problems and Issues related to ITS in the Country Report

Source: JICA Study team

Figure 2-5 Situation in Country Report Presentation

(2) Current Situation of Existing ITS in Each Country

Based on the country report and related information obtained during the program, participating countries are classified by ITS development stage as shown in Table 2-3 in reference to ITS Annual Report 2012 “ITS in Japan” issued by ITS JAPAN.

Table 2-3 Classification of ITS Development Stages in Participating Countries

ITS Consideration Stage	ITS Implementation Stage	ITS Project Development Stage	ITS Integration Stage in the Organization	ITS Integration Stage in Pan Organization	ITS Optimization Stage in Region
・Preparation for establishment of organization promoting ITS ・Some stakeholders recognize the necessity for ITS	・Adoption of basic traffic management system ・Manual fee collection ・Establishment of ITS organization collaborated among industry, academia, government	・Formulation of ITS Master Plan ・ITS systems are individual and independent ・Static road information ・Travel information ・Commencement of collection of real time traffic condition data ・Adoption of prepaid card	・Integrated multi-mode traffic management organization ・Static demand management ・Traffic data collection from multiple sources ・Electronic payment	・Integrated multi-mode traffic management organization based on highway route ・Dynamic demand management ・Compatible multi-mode transport card ・Location-based multi-mode traffic information provision	・Integrated multi-mode traffic management in consideration of whole area ・Dynamic demand management from the viewpoint of the whole performance improvement ・Integrated multi-mode card (Transportation fee, parking fee, goods purchase payment, goods purchase) ・Location-based multi-mode traffic information provision incorporated
CAMBODIA	EGYPT	IRAN	ARGENTINA		
GHANA	PAKISTAN	INDIA	URUGUAY		
KENYA	SRI LANKA	INDONESIA			
KYRGYZSTAN		JORDAN			
LAOS		KAZAKHSTAN			
RWANDA		MALAYSIA			
UGANDA		PHILIPPINES			
ZAMBIA		VIET NAM			

Source: JICA Study team

■ **Traffic Condition in Each Development Stage of ITS and Development Status of ITS**

<table>
<tr><th>ITS Consideration Stage (CAMBODIA)</th><th>ITS Implementation Stage (SRI LANKA)</th></tr>
<tr><td>Traffic congestion in the city (Phnom Penh)
 </td><td>Traffic congestion in the city (Colombo)
 </td></tr>
<tr><td>The project of traffic signal (Phnom Penh)
 </td><td>Traffic signal in CBD area (Colombo)
</td></tr>
<tr><th>ITS Project Development Stage (JORDAN)</th><th>ITS Integration Stage in the Organization (ARGENTINA)</th></tr>
<tr><td>Traffic congestion during Ramadan (Amman)
 </td><td>Traffic congestion on highway (Buenos Aires)
 </td></tr>
<tr><td>CCTV monitoring and traffic signal control Software
 </td><td>Pilot project with Waze on Connected Citizens Program (Buenos Aires)
</td></tr>
</table>

Source: Country report, Action Plan

Figure 2-6 Traffic Situation and ITS Improvement Situation in Participating Countries

2) Group Work

(1) Objective of Group Work

The objective of group Work is widening participants' viewpoint and deepening of understanding on ITS through the process of preparation of action plan, which includes discussions with experts and other participants.

(2) Group Work Procedure

Group work was conducted twice each year. The first time is in the middle of the course and the second time is one day before the action plan presentation. The group was organized based on the solutions to be applied for the traffic issues, which is selected by the participants through the questionnaire survey in advance. The consultant team provided several options of the topics of solutions, and the grouping procedure and group work itself had been improved based on the experience of previous year.

The consultant team prepared the following four topics and the group was integrated or divided into two depend on the number of applicants.

1) Traffic Management: Urban Roads
2) Traffic Management: Expressway
3) Road Management
4) Public Transportation (related to road traffic)

The lecturers and experts from private companies and traffic management organization, and consultants took part in the discussion as advisors.

Source: JICA Study team (left:2017, right: 2018）

Figure 2-7 Discussion in Group Work

(3) Effect of Group Work

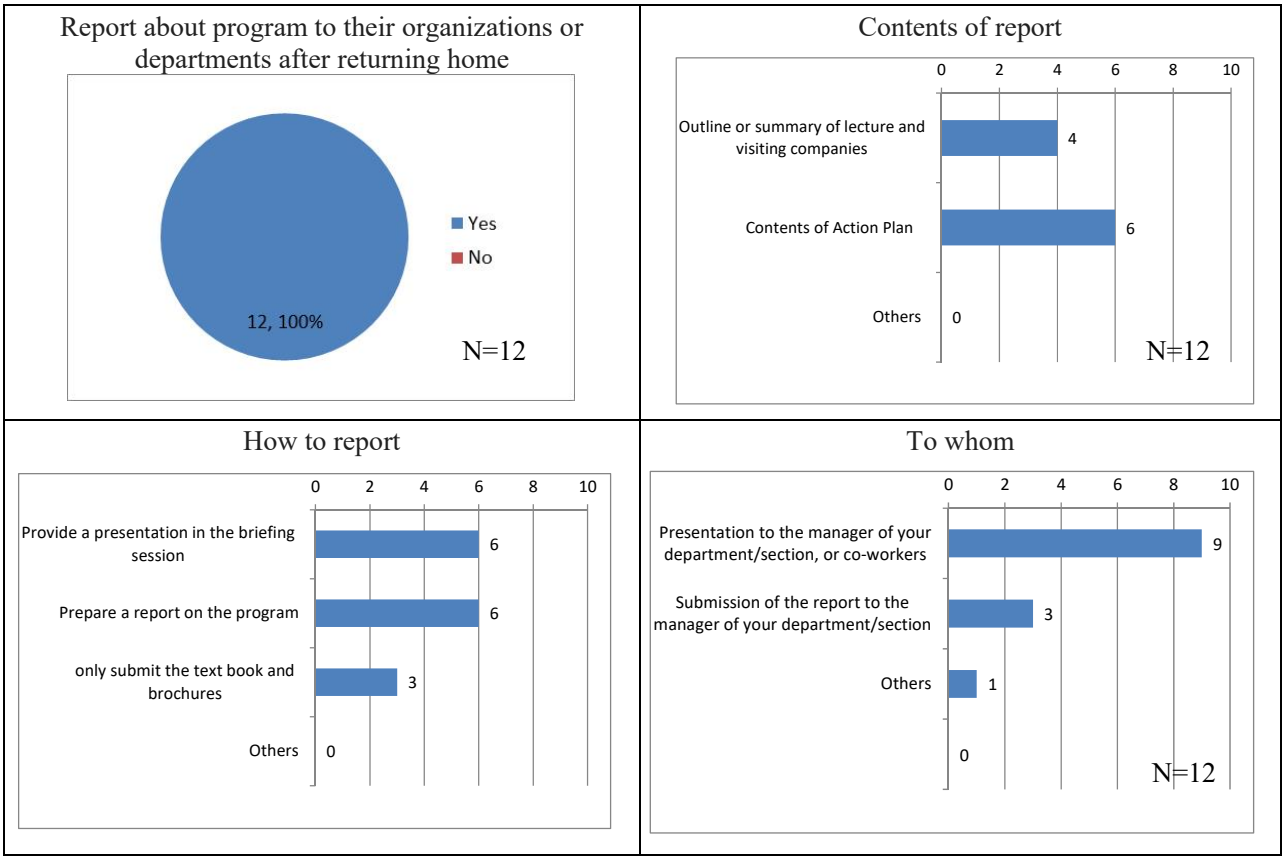
In the group work, it was noted to give an opportunity for the participants to think about countermeasures for dealing with traffic problems in each country / region based on the information and knowledge obtained in the course, and considered to advise effective approach and opinion for the direction of the countermeasures.

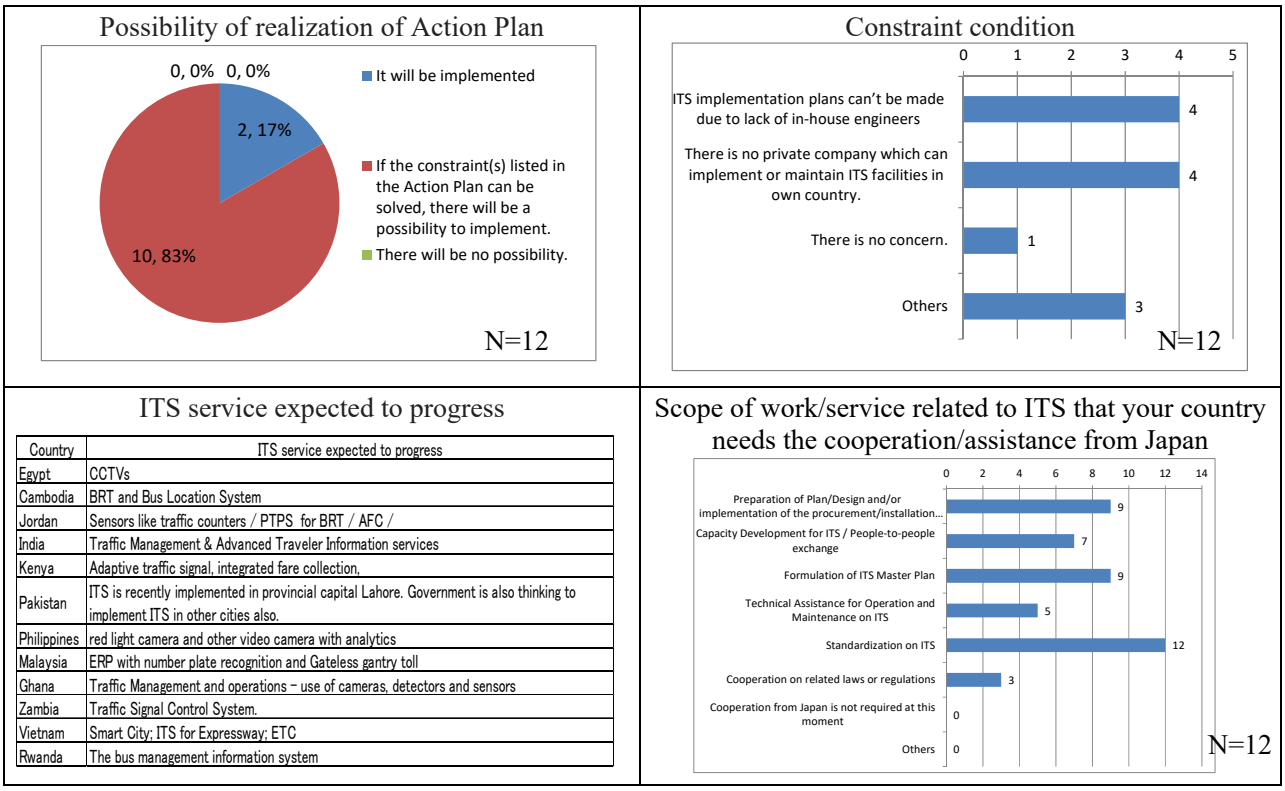
As a result, it is considered that this group work helped the participants to put together a more logical and more realistic plan when they make the action plan including the countermeasure.

In addition, the participants came to recognize that it was important not to complete the solution of traffic problems overnight, but to proceed with various related measures through consideration of phased development plan of short, medium and long term. The process of brushing up their own action plan through questioning and exchanging of views with the lecturers experts from ITS related manufacturers, consultants, and other participants in the program during two times of group works contributed to deepening of traffic issues and its factors or causes.

2.4 Support for Participants – Follow-up after the course

As mentioned above, the module output of this course includes not only the participants understanding of the ITS technology but also the "action plan" created as implementation plan by participants to be shared with relevant officials in their countries. In order to monitor it, follow-up questionnaires were distributed to the participants after around 2 months from the completion of the program for checking the status of reports of the participants in their organization after returning from Japan. Figure 2-8 shows a result of questionnaires in 2018. Twelve participants out of thirteen responded in 2018.





ITS service expected to progress

Country	ITS service expected to progress
Egypt	CCTVs
Cambodia	BRT and Bus Location System
Jordan	Sensors like traffic counters / PTPS for BRT / AFC /
India	Traffic Management & Advanced Traveler Information services
Kenya	Adaptive traffic signal, integrated fare collection,
Pakistan	ITS is recently implemented in provincial capital Lahore. Government is also thinking to implement ITS in other cities also.
Philippines	red light camera and other video camera with analytics
Malaysia	ERP with number plate recognition and Gateless gantry toll
Ghana	Traffic Management and operations – use of cameras, detectors and sensors
Zambia	Traffic Signal Control System.
Vietnam	Smart City; ITS for Expressway; ETC
Rwanda	The bus management information system

Source: JICA Study team (result of follow-up questionnaire in 2018)

Figure 2-8 Result of Follow-up Questionnaire

2.5 Final Report Presentation

1) Contents of Action Plan

(1) ITS Solution (Action Plan) presented by each participant

The introduction menu of ITS proposed by the participants in the action plan tended to differ depending on the responsibilities of each participant's affiliation. In the case in 2018, the contents can be organized as shown in Table 2-4.

The most popular menus were "improvement of public transportation", "urban traffic management", and "enhancement of traffic information collection". As an indicator showing the development stage of ITS, the ITS Annual Report 2012 published by ITS-JAPAN shows the classification of the development stage of "ITS in Japan". Many participants listed “traffic management in urban area” and those countries are categorized in Consideration Stage or Implementation Stage. The menus of “improvement of public transportation” and “enhancement of traffic information collection” are listed by the participants whose countries are categorized in Implementation Stage, Project Development Stage and Consideration Stage.

Table 2-4 Main Menu of Action Plan Proposed at Final Report Presentation (2018)

Stage of Development	Country	Traffic management in urban area	Public transportation improvement	Enhancement of traffic data collection	Implement and improvement of ETC	Advanced law enforcement	Expansion of traffic control center	Information provision on expressway	Others
Project Development Stage	Iran			✓	✓				
	India	✓	✓	✓	✓	✓			Automatic parking
	Jordan			✓			✓		EV facility management
	Malaysia				✓	✓			ITSM/P /Safe driving support
	Philippines		✓				✓		Updated ITSM/P
	Vietnam			✓				✓	Digital map software
Implementation Stage	Egypt			✓	✓				ITSM/P
	Pakistan	✓	✓	✓		✓			
Consideration Stage	Cambodia		✓						
	Ghana	✓					✓		
	Kenya	✓	✓			✓			
	Rwanda	✓	✓	✓					
	Zambia	✓		✓					Overload management
	Total	6	6	6	4	3	3	1	

Source: JICA Study team

(2) Constraints against Implementing Action Plans

The participants pointed out the constraints shown in Table 2-5 when they implement the action plan. The most frequent issues were "funds," followed by "lack of human resource and concerns about technology skills," and there was no relationship between the different stages of development.

"Lack of human resource and concerns about technical skills" are not only matters pointed out in country reports and action plans, but also matters that were frequently mentioned as issues in exchange opinions and discussions during the course. For instance, one participant requested the University of Tokyo to give a lecture on traffic management in her country.

ITS requires not only the knowledge and experience of traffic management, traffic engineering, public transportation and road management, etc. but also a wide range of technologies such as the latest ICT knowledge.

In many departments, even though they have experts in the field of civil engineering and transportation, it is rare for the same staff to have specific knowledge such as information communication technology, software, and special equipment, etc. The participants seemed to deepen

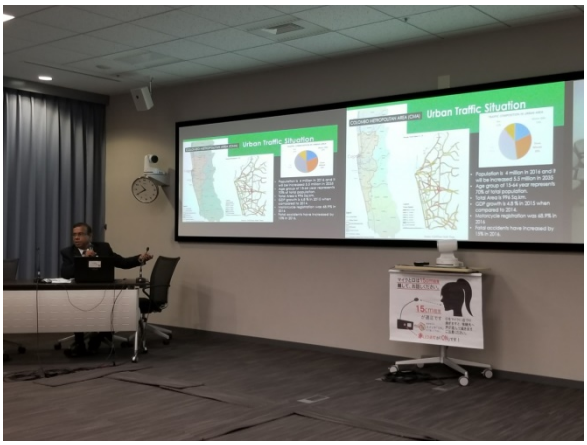
the understanding that ITS experts are necessary through the course.

As in the previous year, some participants pointed out "standardization and integration", “cooperation among organization ", “undeveloped ITS MP ", and “undeveloped institutional design "as constraints. Some participants had concerns such as policy change when the government changed and policy maker’s understanding of ITS.

Table 2-5 Constraints on the Implementation of the Action Plan

Stage of Development	Country	Funds	Lack of human resource	Standardization and integration	Cooperation among organization	Undeveloped ITSMP	Undeveloped institutional design	Operation and maintenance	Others
Project Development Stage	Iran								Acceptability
	India			✓					Technology development, cost-benefit analysis, frequency allocation, etc.
	Jordan	✓	✓			✓			Old infrastructure
	Malaysia	✓	✓						Key player to promote
	Philippines	✓	✓	✓	✓			✓	
	Vietnam	✓	✓	✓					System of PPP/BOT
Implementation Stage	Egypt								None
	Pakistan	✓							Development of Application
Consideration Stage	Cambodia	✓			✓				Collaboration with the private sector
	Ghana	✓	✓			✓	✓		Encroachment on Right of way
	Kenya	✓	✓						
	Rwanda	✓	✓	✓					No Concept
	Zambia	✓	✓	✓	✓	✓	✓		Understanding of politician
	Total	10	8	5	3	3	2	1	

Source: JICA Study team



Source: JICA Study team (2017)

Figure 2-9 Final Report Presentation

2) Qualitative Improvement of the Program

(1) Result of Exchange Opinions in the Evaluation Meeting

The following are the main opinions and requests from the participants at evaluation meeting in 2018. The contents of the lectures can be divided for policy makers and technical experts, and some participants pointed out that they did not sometimes understand the contents of lectures, as each participant differ from the specialized fields and interests.

In addition, in order to formulate an action plan, many participants request to increase the lectures on ITS technology applicable in developing countries. They also pointed out about duplication in some lectures as it was pointed out previous years.

Table 2-6 Opinions and requests from participants at the evaluation meeting in 2018

Contents	Comment	Speaker
Subjects that were not necessary	Each ministry talked about their duties. Starting with the outline and composition of the lectures, all eventually came to autonomous driving.	Iran/Mr. Pooriya
	At a company visit, they introduced a project on sensors in the medical and educational sectors, but it has nothing to do with ITS. It's good to know, but not on course. This time is devoted to other visits related to the course.	Egypt/Mr. Ahmed Ashraf
	In my opinion, the course has too many technical lectures. The participants can be classified into two groups (policy officers and technical experts) according to their background, so they need to be considered. Some participants are highly interested in practical things such as the signal phase exercises at Sumitomo Electric. We have gained a lot of knowledge about autonomous driving, but I am interested in wireless communication standards, and some people find such content useful.	India/Mr. Satheesh
Subjects not included but should be included	"Relationship between organizations in Japan" I was a government officer and wanted to know the relationship between organizations or between government and the private sector. It is important to me.	Iran/ Mr. Pooriya
	Since engineers often use software in the practice of, I would like to learn more about software knowledge.	Philippines/Mr. Ryan Kenya/Ms. Abi

Contents	Comment	Speaker
	The data showing the introduction effects about ITS was not explained how Japan reached the present condition. For instance, we needed more discussion on the safety at the intersection such as how VICS reduced the accident. There has been no argument that this is an advantage of ITS. I am from a research institute. Is there any research document in English about the impact of ITS that has published in Japan? I want to get them because any data is useful.	Malaysia/Mr. Mohd
Course terms	The presentations by the lecturers and engineers were all well done, but I felt that the time was short. There were duplicates in some of the lectures. For example, the lectures on traffic information provision should be given at the Japan Road Traffic Information Center, etc., to make the best use of time. It takes a very short time to master everything, so I want another month. It had better to modify some lectures to improve the program.	Philippines/Mr. Ryan
Action Plan/ Contents of lectures	My question is whether ITS technology used in Japan is applicable in my country. There were many lectures, and I deepened my understanding of technology, but my confusion was increasing. What is the best model for my country, what are the obstacles and problems? Therefore, I struggled to create an action plan. I also talked with the consultant team and proposed the best plan I could think of. I wanted data to solve practical problems. For example, what I saw in the site visit was too advanced in my country, and there were many questions, such as whether there was an infrastructure to introduce this technology, and was it possible to develop human resources that could handle systems. I would like you to start discussion of action plan early to utilize knowledge. I recommend discussing what is the problem to implement in my county after the site visit.	Malaysia/Mr. Mohd
	I had the same problem in my proposal of problem solution and I chose ETC.	Iran/ Mr. Pooriya
	Old technology such as vehicle detector is used in Japan. There was a lecture on probe data analysis at the end of the course, but we need to look at what we can use. Image sensors are already used technology, but they are expensive. I wonder if every country can purchase. This course should consider what to do in developing countries. It was not possible to obtain useful information in the site visit. At Nagoya Electric Industry, issues and experiences were shared and helpful regarding the project at Ahmedabad. These should be included.	India/Mr. Satheesh

Source: JICA Study team

3 Study and ITS Seminar in the Selected Countries

3.1 Selection of Study Target Country

1) Objectives of the Study and ITS Seminar

1) To understand real traffic problems/issues and current ITS development condition in the participants' countries, particularly urban area as follow-up of the Knowledge Co-Creation Program

2) To promote the action plan formulated by the participant(s) by determining potential solutions utilizing ITS and identifying potential needs for ITS from Japanese experts' viewpoints through conducting of meetings and site visits with related organizations

3) To introduce the information of applicable ITS technologies or solutions from Japanese companies and experts for the stakeholder through conducting of follow-up study and seminar

Consequently, it is required to consider the direction of future ITS cooperation program/project from Japan through the study and the seminar in the selected countries during three years.

2) Selection of the Target County

To promote the introduction of ITS into developing countries, target countries were strategically selected from different ITS development stages and countries from different regions, because the required component of ITS differs depending on the economic development status, the traffic issues, and the deployment status of existing systems. The study team conducted studies and held seminars in three years, and tried to grasp the reaction and difference, collected information to consider the direction of ITS related cooperation.

3.2 Result of the Study and Seminar

1) Period and Contents of the Study

Table 3-1 shows the period of study in each year. The study divided into two times of site works. , The first time site work includes collecting information through the interviews with related organizations, understanding of the traffic condition and the collection of information on existing ITS facilities at the selected country. The second time site work focusing on holding ITS seminar at the selected country.

Based on the results of the first study, the study team identified the potential needs of ITS to be addressed traffic problems in the target country. The theme of the seminar and the topic of presentation is selected based on the identified potential needs. In addition, the team asked experts from Japanese companies and universities to make presentations as the seminar presenters and discussed the contents of the presentation that meet the potential needs.

Table 3-1 Study Period

Fiscal year	Country	Period of Study
2016	Zambia	1st period : November 20, 2016 – December 10, 2016 2nd period : February 21, 2017 – March 5, 2017
2017	Sri Lanka	1st period : November 12, 2017 – November 29, 2017 2nd period : May 7, 2018 - May18, 2018
2018	Philippines	1st period : November 4, 2018 – November 21, 2018 2nd period : February 4, 2018 - February 15, 2019

Source: JICA Study team

The contents of study in first period are as follows;

(1) Collection of Related Information using Existing Documents

- Collection of documents/information related to road development/rehabilitation plans, transport plans, public transportation plans and ITS plans, and study of the collected documents/information
- Survey of responsibility demarcation, organization structure and budget for planning, designing, construction, operation and maintenance of related government agencies concerning ITS introduction such as road, transport, public transportation, and information communication technology

(2) Study of Effectiveness of the Existing ITS

- Situation and issues related to existing ITS equipment specifications and system
- Plans for future expansion of equipment
- Equipment/system manufacturers, equipment procurement information
- Information on Maintenance of existing ITS equipment

(3) Study and Analysis of Traffic Issues, and Needs for ITS Implementation

- Survey of needs through interviews, analysis of obtained information
- Clarification of the contents of contributions, such as provision of information or improved traffic convenience, that can be expected from the implementation of each possible ITS option

(4) Collection of Procurement Information on ITS related Equipment

- Collection of information from government agencies and/or private companies about the procurement conditions of ITS-related equipment
- Organizing of collected information, and comprehension of the products that are possible to procure in the countries (including information about Japanese/foreign companies' subsidiary/branch, or local manufacturers, etc.)
- Types of contracts, responsibility of the client (government agency) and obligation of the contractor in general

2) Interviewed Organizations

The study team interviewed the following stakeholders related to ITS, such as government agencies, private companies, and universities to collect the above information.

Table 3-2 List of organization to be interviewed

Organization		Zambia	Sri Lanka	Philippines
Government Agency	Transportation Policy maker	Ministry of Transport and Communications (MoTC)	Ministry of Megapolis and Western Development Ministry of Transport & Civil Aviation*	Department of Transportation (DOTr)
	Road Administrators	Ministry of Works and Supply (MoWS) Road Development Agency (RDA) Lusaka City Council (LCC)	Road Development Authority (RDA) Colombo Municipal Council (CMC)	Department of Public Works and Highways (DPWH)
	Traffic Administrators	Road Transport and Safety Agency (RTSA) Zambia Police	Police Department of Motor Traffic(Vehicle registration, Driver's license)	Land Transportation Office (LTO) Metropolitan Manila Development Authority (MMDA) Quezon City
	Public Transportation Administrators and Operators		National Transport Commission (NTC) Sri Lanka Transport Board (SLTB) Road Passenger Transport Authority -Western Province	Land Transportation Franchising &Regulatory Board (LTFRB)
	Communication Administrators	Zambia Information and Communications Technology Authority (ZICTA)	Information & Communication Technology Agency of Sri Lanka (ICTA)	Department of Information and Communication Technology (DICT) National Telecommunications Commission (NTC)
	Others	Ministry of Local Government and Housing (MLGH)	State Development & Construction Corporation (SD&CC：State-owned enterprises)	
Private companies		Japanese companies (Toyota Tsusho Zambia, Toyota Motor Corporation) Bus operator (DotComZambia, Juldan Motors) System Integrator/ Construction Company (Syntell, BricTech)	Telecommunication carrier (Sri Lanka Telecom, Mobitel (Pvt) Ltd, Dialog Axiata PLC) System Integrator (Axionent (Pvt) Ltd.) Car Navigation Company (SALA GEOINFORMATION SYSTEMS(Pvt)Ltd)	Expressway Companies (SKYWAY O&M Corporation,NLEX) Toll Collection Company (Easytrip) Application company (Sakay.ph) Japanese companies (Soft bank (Cimen), Ubiquitous Technologies Philippines,Inc.)
Universities			University of Moratuwa	National Center for Transportation Studies, University of the Philippines Diliman (NCTS) School of Urban & Regional Planning, University of the Philippines Diliman (SURP)

* Organizations that attended the seminar but were unable to meet during the study period in the country

Source: JICA Study team

3) Results of the Study

(1) Zambia

A) Traffic Problems

The traffic problems in Zambia (especially the capital Lusaka) that were identified in the study are shown below. While the number of registered vehicles is increasing, the government is promoting infrastructure development such as road development plan by Lusaka city comprehensive urban development plan and Lusaka 400 Project, etc., but the progress of implementation has been significantly delayed. Furthermore, deployment of the mass transit has not progressed. Therefore, traffic congestion in the morning and evening peak hours has occurred. The increase in traffic accidents is also recognized as a problem.

Table 3-3 Traffic Problems in Zambia (Lusaka)

Classification	Traffic Problems
Road Safety	Not possible to identify the accident occurrence location(Black Spot) Deficiency of tool for Enforcement, Monitoring, and Information Provision
Traffic Congestion	Vehicle traffic concentration into CBD (Excess demand) Not realized dynamic traffic signal control that meets the traffic condition, Traffic control at intersection of traffic signal when power failure occurs (Decrease of capacity)
Public Transportation	Not punctual bus operation, Not effective Bus operation Lack of bus terminal, No transport hub between city bus and intercity bus
On-street Parking	Lack of parking lot, On-Street Parking is observed frequently and part of it becomes bottleneck of the traffic
Overloading, Road Maintenance	Road damage becomes obvious due to Overloaded Heavy Truck Issue on Weighbridge (long queue to wait the investigation, possible to drive overloading vehicle by paying excess charge)

Source: JICA Study team

B) Situation/Condition of Existing ITS

ITS in Zambia hardly developed so far as follows;

Table 3-4 ITS Facilities and Related Services in Zambia (Lusaka)

Contents	Situation of Development of ITS
Traffic Signal	Although existing traffic signals are operated in 37 locations in 2016 within Lusaka, the signal control is standalone type (no actuated signal control system). Type of control system is SCOOT.
Traffic Information Provision	Traffic information is provided through Radio Phoenix (89.5kHz) at 7:50 AM and 1:00 PM daily
Car Navigation System	Although Car navigation system produced by Garmin (USA) and TomTom (Netherland) are commercially available, they are not widely distributed.
Variable speed information board	One variable speed information board that displays the regulated speed and the traveling speed are installed for trial purposes only at one place in Lusaka city.
Digital Signage	Digital signage is installed along the road and above the road that displays advertisement. (Traffic information and attention calling information are not provided.
Data Center	Data centers for government and private enterprises by ZICTA have been in operation since January 2017.

Source: JICA Study team

C) Expected Needs related to ITS Implementation

Based on the results of the study in Zambia, the consultant team identified expected needs related to ITS implementation as follows:

Table 3-5 Expected Needs related to ITS Implementation in Zambia

Menu	Expected Needs related to ITS Implementation
Reduction of Traffic Accident	• Introduction of Traffic Accident Management System by Visualization of Accident Occurrence Condition • Traffic Monitoring/Enforcement by using CCTV Camera or Sensor (Traffic Control Center)
Improvement of Intersection Capacity (Upgraded Traffic Signal Control Systems)	• Introduction of a signal controller that can operate stably even during a power failure • Traffic Signal Control based on Traffic Demand/Synchronized Signal Control and Optimization of Traffic Demand by utilizing them
Effective Traffic Management (Monitoring of traffic condition & Information Provision)	• Precise prehension of Traffic Condition by Traffic Monitoring • Accurate and Timely Traffic Information Provision
Improvement of Public Transportation	• Bus Operation Management and Information Provision by introducing Bus Location Service and Information Provision to the user • Exclusive Lane for Bus and Adequate Traffic Signal Control to Ensure the On-time System such as Public Transportation Priority System (PTPS)
Reservation of Road Space	• Illegal Parking Suppression System and Parking Lot Guidance System
Proper Traffic Demand Management	• Reduction of Traffic Demand in CBD by introducing Road Pricing • Promotion of Use of Public Transportation by Park and Bus Ride
Effective Overloaded Vehicle Management	• Introduction of Weigh in Motion

Source: JICA Study team

D) Result of the Seminar

The outline of the ITS seminar in Zambia is shown as follows;

Date: March 2nd , 2017 (Thursday) 8:30-13:00

Venue: Taj Pamodzi Hotel

Organized by Co-organized by Ministry of Transport and Communications and JICA

The program of ITS seminar in Zambia is shown in the following table based on discussion among experts from Japanese companies, JICA and MoTC,

The keynote speeches are provided by the co-organizers, then the ITS training program participant; Mr. Chalwe Mwamba provided the presentation on Knowledge Co-Creation Program on ITS in Japan and action plan. Then from the member of the consultant team provided the presentation on study result and overview of ITS menu based on traffic issues in Zambia. After that, two Japanese experts' presentations were made. Nippon Signal Company Limited provided the presentation about traffic signal control and West Nippon Expressway Company Limited provided the presentation about Countermeasure for overloaded vehicles. In this session, since ITS hasn't introduced in Zambia yet, the consultant team requested Japanese companies to make presentations on ITS

technology for participants in consideration of understanding and sharing how ITS can be used for traffic issues that Zambia has. In the discussion time, the consultant team considered informing Zambian side on the following two important factors when Zambian related organizations try to implement the ITS related projects.

- Human Resources Development
- Establishment of mechanism to implement ITS related Program/Project (Institutional/Regulatory Framework on ITS)

As the human resources development related topic, Mr Sawamura who assists Zambian private companies as Senior Volunteer emphasized importance of management such as key business challenges, Kaizen, strategy management. In addition, the Consultant intended to introduce Japanese framework on ITS as a sample of establishment of mechanism to implement ITS related Program/Project.

Date: 2nd March 2017 (Thursday) 8:30－13:00
Venue: Lusaka city , Taj Pamodzi Hotel
Co-organized by Ministry of Transport and Communications and Japan International Cooperation Agency (JICA)

Time	Program	
8:00~	Registration	
8:30~	I. Opening Remarks	Mr.Hiroaki Kurita *JICA Study Team*
8:40~	II. Keynote Speeches	
10 min.	Ministry of Transport and Communications	Eng. Misheck Lungu *Permanent Secretary, Ministry of Transport and Communications*
10 min.	JICA Zambia Office	Mr.Hisanao Noda *Resident Representative, Japan International Cooperation Agency (JICA) Zambia Office*
9:00~	III. Presentation	
9:00~	Presentation1: ITS Training Program in Japan and Action Plan Question & Answer (10 minutes)	Mr. Chalwe Mwamba *Economist-Transport, Ministry of Transport and Communications*
9:30~	Presentation2: Overview of ITS Menu based on Traffic Problem in Zambia Question & Answer (10 minutes)	Dr. Hiroshi Warita *JICA Study Team*
10:00~	Presentation3: Proposal on Traffic Signal Question & Answer (10 minutes)	Mr. Ichiro Hayashi, *Nippon Signal, Co., Ltd.*
30 min	Coffee Break	
11:00~	Presentation4: Countermeasure for Overloaded Vehicles Question & Answer (10 minutes)	Mr. Nobuyuki Sagawa *West Nippon Expressway Company Limited*
11:30~	IV. Discussion Time	
11:30~	Introcduction from Moderater (Topic 1: Institutional design)	Mr. Tetsuya Sato *JICA Study Team*
11:35~	Presentation5: Growth and Challenges Question & Answer (10 minutes)	Mr. Yasushi Sawamura, *Japanese Business Advisor*
12:05~	Introcduction from Moderater (Topic 2: Sustainabilty)	Mr. Tetsuya Sato *JICA Study Team*
12:15~	Discussion Time	
12:45~	V. Closing Address	
13:00~ 14:00	Networking Lunch	

Source: JICA Study team

Figure 3-1 ITS Seminar Program in Zambia

The invitees of the seminar were mainly invited from the government agencies and private companies interviewed in the first study. The total number of participants was 67 attendees including

30 government officers in Zambia, 2 donors and 2 international organizations, 8 private enterprises in Zambia, 13 in Japanese side, and 14 media as follows:

Table 3-6 Attendees of ITS Seminar in Zambia

Government Agencies	Attendees
Ministry of Transport and Communications (MoTC)	7
Ministry of Housing and Infrastructure Development (MHID)	1
Ministry of Works and Supply (MWS)	2
Ministry of Local Government (MLG)	4
Road Development Agency (RDA)	5
Zambia Information and Communications Technology Authority (ZICTA)	3
Lusaka City Council (LCC)	4
Zambia Police	2
National Housing Authority	1
Ministry of Information and Broadcasting	1
International Organizations	**Attendees**
United Nations Development Programme (UNDP)	1
African Development Bank Group	1
Private Companies	**Attendees**
Bric-tech Construction Ltd	2
Syntell (Pty) Ltd	1
Dot Com Zambia	1
Toyota Tsusho Zambia	2
A PLUS URBAN TECHNICS	2
Japanese	**Attendees**
JICA Zambia Office	3
JICA Headquarters	2
Nippon Signal Co., Ltd.	2
West Nippon Expressway Co., Ltd.	1
Nippon Koei Co., Ltd.	1
JICA Study Team	4
Others	**Attendees**
Media	14
Total	67

Source: JICA Study team

Figure 3-2 Photo during ITS Seminar in Zambia

Through the seminar, as traffic demand further increases in the future, the study team wanted to appeal the importance of "Human Resource Development, Institutional Design" for the environmental arrangement on ITS utilization.

- Human Resources Development
- Establishment of mechanism to implement ITS related Program/Project (Institutional/Regulatory Framework on ITS)

Consequently Mr. John Chilwe who is Assistant Director Transport of MoTC, expressed in his closing address that it is essentially required to establish Zambian aspect to solve the traffic issue for Zambian people even though currently there are different aspects existing in the different government agencies. In order to achieve it, he also expressed that MoTC will provide much effort to inform what discussions are made in order to build consensus among stakeholders on traffic issues. The momentum for related organizations to advance various discussions grew in cooperation with one another.

In addition, in interviews with MoTC after the seminar, the Study Team suggested that it is desirable to formulate ITS master plan but at least it is necessary to make road map in order to proceed with ITS development. The team also advised that it is necessary for each project to be clarified in the plan, and individual projects would not be able to be implemented unless the implementing agency, agency and budget for operation and maintenance, and funding sources for project implementation have been clarified.

(2) Sri Lanka

A) Traffic Problems

The urbanization area in the metropolitan area of Colombo is expanding year by year along the main corridor, then the traffic demand from the suburbs to the central area is increasing, and the traffic congestion is intensifying. Although new routes and extension plans on expressways, flyovers, LRT construction plans, etc. have been promoted, the increase of number of vehicles registration is faster than the economic growth rate, and infrastructure development is not caught up with the increase.

Table 3-7 Traffic Problems in Sri Lanka (Colombo)

Classification	Traffic Problems
Road Safety	Chronic traffic congestion occurs in the central road network
Traffic Congestion	Increasing Tendency, There are many Three Wheeler and motorcycle accidents. The main factor is aggressive / careless operation, over speed The number of deaths per 100,000 is four times that of Japan
Public Transportation	Management of public transportation is Insufficient because there are many private buses and individual operators. It is difficult to manage bus operation in compliance with Time Table due to traffic congestion in the city
On-street Parking	There are relatively few on-street parking problems due to implement of designated street parking and parking lots
Overloading, Road Maintenance	In Colombo municipality, since there is an inflow regulation of overloaded vehicles, it is not a big problem, but there may be a problem between cities.

Source: JICA Study team

B) Situation/Condition of Existing ITS

The ITS facilities and services in Sri Lanka have been partially introduced or planned in recent years, and private company is starting to enter road information board projects and parking lot management projects implemented under the PPP scheme. ITS in Sri Lanka developed so far is shown as follows;

Table 3-8 ITS Facilities and Related Services in Sri Lanka

Contents	Situation of Development of ITS
Traffic Signal	Traffic signals are installed at the intersections of most major arterial roads in the metropolitan area of Colombo, and their operation and maintenance is conducted by SC & CC which is a state-run company under the purview of the Ministry of Housing and Construction, and exchanged the MOU with RDA. Most of them are preset individual control, but some of them are synchronized control (Green Wave) and actuated control using Loop Coil in recent years.
ATMS (Advanced Traffic Management System)	Technical assistance for KOICA was implemented. In this project, Advanced traffic signal system with Intersection improvement by real time control in CMR (Colombo Metropolitan Region), Equipment for data collection (CCTV, AVI, vehicle detector) and VMS installation, Incident management system, Parking enforcement system, Speed enforcement system, Traffic monitoring system and Traffic Management Center were planned and designed. There is information that the US MMC will extend the scope and provide funding for the implementation.
Public Transportation Management	The state-run company Sri Lanka Transport Bord (SLTB) has introduced a GPS tracking system to 2,200 out of 5600 buses operating as of 2017, and operated Bus location monitoring and claims management in the control room. The National Transport Commission (NTC), who operates intercity buses, has also introduced a Bus operation management system using GPS. They also are developing a mobile app for providing real-time information to passengers.
Smart Card	Although the mobile carrier Dialog has begun to introduce payment using the Smart Card "Touch Travel Card" (Type-A MiFARE DESFire) in some SLTB vehicles, it has not yet spread to the public.
Traffic Control on Expressway	On the Southern Expressway, traffic detector equipment (CCTV image processing), variable message sign (VMS), and traffic control center are installed. In CKE, in addition to CCTV camera image sensor, VMS, ETC using RFID tag is installed. In the VMS, it is necessary to display in three languages, and visibility is an issue.
Traffic accident monitoring	CCTV monitoring center has been set up in the police, and the police visually have been detecting incidents in 24 hour.
Road Information Board	In Colombo municipality, some road signs and direction boards have been installed and maintained by PPP model that combines advertisement. Sixty Free wifi spots also have been implemented in the PPP project.

Contents	Situation of Development of ITS
Vehicle Registration Management	DoMT is proceeding with the introduction of new vehicle management system using passive RFID tags. The organization has also released web tools and mobile apps that allow users to search the license plate, owner, model, and year of manufacture, etc.
Parking Management	CMC has installed paid roadside parking, and some private companies are introducing a parking meter called Smart Parking by PPP. Besides cash, users can pay with smart cards and mobile apps. In addition, the private company is also commissioned the operation of mobile application for parking lot search and reservation from CMC.
Ride-hailing Service	In the western province, Uber and other local company, Digital Mobility Solutions Lanka (Pvt) Ltd., have launched Ride-hailing services, and users can use the mobile app "Pick me". This "Pick me" is available not only to cars but also to Three wheelers that are an important paratransit in Sri Lanka, is available to paying cash or credit cards.
Car Navigation	Some private companies are developing car navigation services. SALA GEOINFORMATION SYSTEMS (Pvt) Ltd sells/provides both communication-enabled and non-communication-enabled navigation. It can use voice guidance in Sinhalese language and Tamil language besides English, as well as point, telephone, and address search. The back mirror Android Google Navigation is also available. Traffic information provision has not been implemented.
Fleet Management Service	Mobile phone companies Dialog and Mobitel are developing fleet management services using OBD. It provides information of position, license plate number, vehicle type, speed, total driving distance, temperature, and fuel consumption, etc. All data aggregation / processing is performed on the center side, and the on-board unit side sends data to the end.
ICT Business by ICTA	ICTA, a private company owned 100% by the government, is establishing a network to link government agencies (inter-agencies) and share information, called LGN (Lanka Government Network). ICTA also plans to connect 860 government agencies by optical fiber network.

Source: JICA Study team

C) Expected Needs related to ITS Implementation

Based on the results of the study in Sri Lanka, the consultant team identified expected needs related to ITS implementation as follows:

Table 3-9 Expected Needs related to ITS Implementation in Sri Lanka

Menu	Expected Needs related to ITS Implementation
Promotion of Utilization of Traffic and Transportation Data	• Development of common platform that can be accessed by each government sector, and development of system that will be used effectively in multi-purpose ways, such as traffic management, road planning, urban planning, etc. in collaboration with academics (since the environment for collecting various traffic data such as implementation of ATMS, bus location system, smart card, parking lot search application etc. is being established.)
Accurate and Timely Traffic Information Provision	• Traffic dispersion in arterial road by installing VMS that provide traffic information to drivers
Multipurpose traffic management using RFID tags	• Utilization of RFID tags for multipurpose traffic management measures such as traffic monitoring, law enforcement of violating vehicles, parking lot management, traffic signal control and ERP (since vehicle registration management system by RFID tag will be introduced soon.)
Improvement of Public Transportation	• Promoting seamless transit MaaS (Mobility as a Service) by providing bus location information to passengers utilizing existing bus locations system, integrating and providing information on Time Table of multiple operators, PTPS linked with signals

Menu	Expected Needs related to ITS Implementation
Efforts to Enhance Road Safety Awareness	• Providing information on near miss spot using probe data, traffic safety education using a driving simulator, and enhancing traffic safety awareness for citizens and drivers by strengthening traffic safety education for after ATMS maintenance
Strategies for Ensuring System Interoperability	• Establishment of direction of deployment by formulating national level ITS Master Plan and roadmap • Standardization, institutional design, collaboration between industry, academia and government in their own country, human resource/capacity development

Source: JICA Study team

D) ITS Seminar in Sri Lanka

The outline of the ITS seminar in Sri Lanka is shown as follows;

Date: May 15, 2018 (Thursday) 9:00-15:30
Venue: Waters Edge
Organizer: JICA
Coordinator: Road Development Authority (RDA)

The program of ITS seminar in Sri Lanka is shown in the following table based on the discussion result among experts from Japanese companies and university, JICA and RDA. In the seminar, the Sri Lankan side did not give a presentation because Sri Lankan side requested to conduct the seminar only introducing Japanese technology. Therefore, the members of study team made a presentation first on the result of the study. They reported on traffic problems, issues with existing ITS technologies, and the potential needs of ITS in Sri Lanka, and presented them as an introduction for subsequent presentations by Japanese experts. Then, Japanese companies introduced ITS technology to improve traffic problems in Sri Lanka and technologies and solutions to upgrade ITS.

For each presenter, the study team provided the existing conditions on ITS and traffic problems in Sri Lanka which was found in the first study period before requesting preparation of the presentation material, and asked to include not only Japanese cases but also cases and experiences in developing countries. The program is shown below;

Date: 15th May 2018 (Tuesday) 9:00－15:25
Venue: Waters Edge,316, Ethul Kotte Road, Battaramulla, Sri Lanka
Organized by Japan International Cooperation Agency (JICA)
Coordinated by Traffic Management Unit, Road Development Authority

Time	Program	
8:30~	Registration	
9:00~	Opening Remarks	
9:05~	Oil Lamp Ceremony	
9:15~	I. Keynote Speeches	
20min.	Road Development Authority	Eng. Nihal Sooriyarachchi *Chairman, Road Development Authority*
10min.	JICA	Mr. Fusato TANAKA *Chief Representative* *JICA Sri Lanka Office*
9:45~	II. Presentation	
9:45~	Presentation1: Potential Needs on ITS in Sri Lanka	Mr. Tetsuya SATO, Mr. Toshio DOKO *JICA Study Team*
10:05~	Tea Break (30 min)	
10:35~	Presentation2: Promotion of Utilization of Traffic and Transportation Data	Dr. Nobuyuki OZAKI *Toshiba Infrastructure Systems & Solutions Corporation*
11:00~	Presentation3: NEC's ITS Solution for Improvement of Public Transportation	Mr. Satoshi SHONAI *NEC Corporation*
11:25~	Question & Answer for Presentation 1,2 and 3 (40 minutes)	Mr.Hiroaki KURITA *JICA Study Team*
12:05~ 13:15	Networking Lunch	
13:15~	Presentation4: Intelligent Transport Systems (ITS) Challenge in Sri Lanka	Mr. Hideki KOMORI *NAGOYA ELECTRIC WORKS CO.,LTD.*
13:40~	Presentation5: Promoting a safe mobility through the cross-sector collaboration in Cambodia: Implications learnt from the study on young motorcycle drivers	Dr. Yuto KITAMURA *Associate Professor, Graduate School of Education, The University of Tokyo*
14:15~	Question & Answer for Presentation 4,5 and ALL (50 minutes)	Mr.Hiroaki KURITA *JICA Study Team*
15:05~	III. Closing Address	Dr. Takashi OGUCHI *Professor, Director, Advanced Mobility Research Center (ITS center),The University of Tokyo*
15:25	Close	

Source: JICA Study team

Figure 3-3 ITS Seminar Program in Sri Lanka

Dr. Saman, Deputy Director, Highway Designs Division RDA, who is one of the former participants of Knowledge Co-Creation Program, nominated the seminar invitees in the Sri Lankan side as coordinator. Consequently, Chairman and CEO who are heads of each organization also participated and total number of participants were 97, which include 57 attendees from Sri Lankan government, 18 attendees from private companies in Sri Lank and 22 attendees from Japan.

Table 3-10 Attendees of ITS Seminar in Sri Lanka

Government Agencies	Attendees
Road Development Authority (RDA)	23
Ministry of Highways and Road Development	1
Ministry of Transport & Civil Aviation	3
Ministry of Megapolis & Western Development	3
Colombo Municipal Council (CMC)	2
National Transport Commission (NTC)	7
Road Passenger Transport Authority	3
Sri Lanka Police	3
Department of Motor Traffic (DoMT)	4
Urban Development Authority (UDA)	1
Sri Lanka Transport Board (SLTB)	3
State Development & Construction Corporation (SC&CC)	4
Private Companies	**Attendees**
Dialog Axiata PLC	3
Access International (Pvt) Ltd.	1
Axionent (Pvt) Ltd.	2
Sri Lanka Telecom (SLT)	3
Mobitel (Pvt) Ltd	3
Sala Geo Information Systems (Pvt) Ltd	2
Academic	**Attendees**
University of Moratuwa	2
University of Peradeniya	1
University of Ruhuna	1
Japanese Side	**Attendees**
JICA	4
JETRO	2
Presenters (Japanese Companies, University)	10
JICA Study Team	6
Total	97

Source: JICA Study team

Figure 3-4 Photo during ITS Seminar in Sri Lanka

In the seminar, most of the questions were categorized in the technical topics from universities or private companies because Sri Lankan side requested not to set up the free discussion time and participants felt difficult to speak proactive opinions freely if senior members of the organization did not speak in advance, although it is the general atmosphere in Sri Lanka. However, the participants

of the Sri Lankan side showed high interest in the solutions and cases presented by the Japanese participants, and in the time after the seminar, participants from the Sri Lankan side (government and private companies) exchanged information such as providing existing conditions from Sri Lankan side consultation, and inquiries to the presenters, which reached two hours. One Japanese company received consultation from National Transport Commission (NTC), and another Japanese company received a request for quotation of additional vehicles, which had been delivered before, etc. Therefore, it is considered to have been achieved the initial purpose of the seminar, i.e. 1) Introduction of ITS technologies that Japanese companies have and 2) Creation of networking opportunities for Japanese participants with Sri Lankan participants.

On the other hand, it did not become a discussion about a policy, direction or coordination among the different government agencies like a direction of ITS implementation in the future in Sri Lanka which had been made in the seminar in Zambia. However, after the seminar, Sri Lanka organizations seem to exchange opinions on traffic issues or ITS and it seems to be the good sign triggered by the seminar.

(3) Philippines

A) Traffic Problems

While Metro Manila is proceeding increasingly overcrowded, existing urban areas have expanded to the neighboring provinces, which become metropolitan area (Mega Manila) substantially, and many residents in these surrounding areas are commuting to Metro Manila.

As a result, the traffic volume to and from Metro Manila area increases, and the middle class is shifting its commuting mode from buses and jeepneys to private cars with economic growth, then chronic traffic congestion occurs in the Metro Manila area. According to JICA study result, the daily economic loss by traffic congestion is estimated to be Php 3.5 billion (7 billion yen) in 2017.

The traffic problems in the Philippines (especially Metro Manila) identified by the study team are shown below.

Table 3-11 Traffic Problems in Philippines (Metro Manila)

Classification	Traffic Problems
Road Safety	The average travel speed is 20km / h on most major roads. Although MMDA has identified 77 Chokepoints, the basis is not clear and there is no definition of traffic congestion.
Traffic Congestion	There is no national fatality statistics of traffic accident. An updated version of the TRAFFIC SAFETY ACTION PLAN has also been formulated, but the president has not approved it so that it is not practicable. DPWH has identified black spots, has begun countermeasures, and is implementing Road Safety Audit. There are many motorcycle accidents.
Public Transportation	There are many operators including individual operators, and unauthorized buses and jeepneys are in operation. DOTr is promoting a public transport vehicle modernization program, and is promoting a PUV vehicle modernization and a road-based public transportation restructuring program.
On-street Parking	Illegal parking and illegal vendors are blocking the right of way, which is also a cause of traffic congestion.

Classification	Traffic Problems
Overloading, Road Maintenance	There is a lot of overload on the national roads and expressways in the suburbs, and enforcement is performed using Mobile Enforcement Stations, but it is not enough.

Source: JICA Study team

B) Situation/Condition of Existing ITS

In the Philippines, basic ITS facilities and services have already been introduced. Expressway companies are also purchasing and implementing technologies from various countries, from procurement to operation of ITS, using a PPP model. In addition, ICT utilization services by start-up companies have also been launched.

The ITS facilities and related services in the Philippines obtained by the study are shown below.

Table 3-12 Facilities and Related Services in Philippines

Contents	Situation of Development of ITS
Traffic Monitoring Center (MMDA and LGUs)	MMDA has Metrobase Command Center, and five major teams, Digital Media Group, No Contact Group, Metrobase Operation Group, Technical Group, and Traffic Signal Group, are on the same floor and work together to manage traffic. However, it is an individual system, and the interface is not connected or unified. In addition, the utilization of data is not sufficient, such as visually checking only the image of CCTV camera. Each LGU also has an operation center that includes traffic monitoring and disasters and emergencies.
Traffic Control Center (Expressway)	Expressway companies or group companies own traffic control centers. It seems that traffic information is not provided to users using VMS.
Traffic Signal	No interoperability among different systems or brands, Software that enables central control and synchronized control, but many are not connected controllers. It has also not been coordinated with LGUs.
ETC	Each expressway company had been using ETC that adopted the European method CEN-DSRC and Smart Card method, but the mutual use by the RFID method has started partially recently. NLEX plans to end DSRC operations in 2020. According to NLEX, the current utilization rate of ETC is 24%, and San Miguel Group (SLEX, Skyway, etc.) is 37%, it is not so high yet.
Utilization of Traffic Data by Private Sectors	MMDA has signed an MOU of a program that mutually uses traffic information as a connected citizens program with Waze, but it does not proceeding, because there is no know-how to use it and the Waze side is requesting the administrator's expense for account management. Grab, ride hayling company, collaborated with the World Bank, and carried out a pilot project of traffic condition analysis based on Probe Data called Open Traffic in the Philippines, and has signed an MOU on the use of and data with DOTr.
Public Transportation Management	Soft Bank conducted a demonstration experiment on the operation control of an electric tricycle using ICT called PRT (Packed Rapid Transit) in the demonstration project of NEDO in the Intramuros area. Local business companies are continuing business thereafter. DOTr is planned to be promoted the “Automatic Fare Collection System (AFCS)” and “Public Transportation Information and Management Center Project” in a loan project of Korea Export-Import Bank.
Public transportation route search	Startup company, Sakay.ph has developed a public transportation route search application that utilizes GTFS (General Transit Feed Specification), which is an open data format for public transportation, and can search local paratransit such as Jeepney. In the future, they are aiming for MaaS business such as booking and payment.
Vehicle Registration Management	In order to properly manage the vehicle registration, LTO has begun changing the license plate with QR code and issuing RFID stickers when updating vehicle registration since June 2018. LTO is also looking into the possibility of identifying traffic offenders using this RFID and road pricing.

Contents	Situation of Development of ITS
Bus Terminal	DOTr is currently constructing three intermodal terminals, aiming to switch between intercity and city buses, and to become a park and ride base. RFID antennas have been installed at the bus terminal.
Smart Card	Smart card that can be used in MRT and LRT in Metro Manila, called the beep card, which can be used in bus, and can also be used by touch and go at CAVITEX and NLEX toll stations on expressways. In addition, it can be used at convenience stores and fast food, and can be top-up.
Overloading Vehicle Management	DPWH is currently planning to introduce Weigh in Motion at inspection stations that control overloading on Nueva Ecija and Nueva Vizcayato.

Source: JICA Study team

C) Expected Needs related to ITS Implementation

Based on the results of the study in the Philippines, the consultant team identified expected needs related to ITS implementation as follows:

Table 3-13 ITS Facilities and Related Services in Philippines

Menu	Expected Needs related to ITS Implementation
Collection and Utilization of Traffic Data	• Development of a common platform where each sector can access real-time traffic data that can be acquired from various sensors including private traffic data and images from CCTV cameras • Development of analysis, processing, and distribution systems while utilizing image processing or AI technologies, etc.
Multipurpose traffic management using RFID tags	• Utilization of RFID tags for multipurpose traffic management measures such as traffic monitoring, law enforcement of violating vehicles, parking lot management, traffic signal control and ERP (since vehicle registration management system by RFID tag will been introducing now.)
Efficient operation of public transportation franchise	• Establishment of public transportation control center where administration office of public transportation monitors whether private buses with franchise are correctly running on a decided route, are not in violation of traffic, etc. in line with the transformation by the public transportation vehicle modernization program, and also provide information on the bus location to passengers • Improvement of the quality of individual public transportation operators (efficient management such as equalizing distance and time intervals of each vehicle, managing driver's attendance, safe driving education, etc.)
Linkage of traffic signals between LGUs, DPWH and MMDA's roads	• Area traffic signal control connecting signals among LGUs, DPWH and MMDA which are not connected and not interoperable currently
Expansion of i-ACT functions, human resource development on sustainable ITS	• Expansion of functions on i-ACT (Interagency Council for Traffic) such as implementation of cross-sectional projects which focus on traffic planning and traffic management field including ITS (since agencies cooperated only in traffic enforcement now) • Human resource development in cooperation with university institutions in areas such as ITS and Big Data

Source: JICA Study team

D) Result of the Seminar

The outline of the ITS seminar in the Philippines is shown as follows;

Date: February 13th , 2019 (Wednesday) 9:00-15:30

Venue: Edsa Shangri-La

Organizer: JICA

Coordinator: Metropolitan Manila Development Authority (MMDA)

The program of ITS seminar in the Philippines is shown in the following table based on the discussion result among experts from Japanese companies and university, JICA and MMDA.

In the Metro Manila area, ITS facilities and services have already been developed as a base, however the facilities and data has not been fully utilized, and the situation of traffic congestion has not yet been alleviated. Therefore, through the seminar, the study team intended to emphasize DATA Utilization as well as value of DATA. Then the team also explained the importance of ITS and ICT as a tool to collect, analyze and utilize various types of DATA for evidence based management or policy making.

Therefore, the study team provided information of result of the study for the candidates of the presenters of the seminar in advance, and requested them to prepare their presentations that include importance of DATA and DATA utilization.

As for the seminar program, Mr. Ryan, who is a former participant of Knowledge Co-Creation Program, gave a presentation on the contents of the ITS training in Japan and the development status and plans of ITS that MMDA is working on after the Keynote Speech. After that, Associate Professor Sakai, Advanced Mobility Research Center (ITS Center), Institute of Industrial Science, of the University of Tokyo, introduced efforts of traffic and road management by using traffic data in Japan. After that, the consultant explained the traffic and transportation problem in the Philippines and existing ITS facilities and services as a report of the first period study result. As mentioned above, the presenter of the consultant team raised the topic of DATA and DATA Utilization. The team pointed out that the utilization of the traffic data which obtained by using the ITS is insufficient currently and it is crucial to develop the mechanism for collecting, analyzing, utilizing DATA by collaboration among industry, academia and government. Furthermore, the team explained necessity of develop human resources for DATA Utilization. The team also informed that upgrading of the existing ITS will be essentially required taking "Power of DATA" into consideration. As some sample cases, the speakers from the study team introduced trends in urban planning utilizing DATA from developed cities in Toronto and Columbus, USA, and DATA utilization sample of Waze's Citizen Connected Program and the existing DATA utilization case of Sakay.ph in the Philippines, and recommended development of a common platform with industry-academia-government collaboration.

Then after the introduction of ITS JAPAN, a break took place, then the ITS services or solutions from Japanese companies are presented The detailed program is shown below;.

Date: February 13, 2019 (Wednesday) 9:00am－5:00pm
Venue: Edsa Shangri-La Garden Ballroom, Mandaluyong City
Organized by Japan International Cooperation Agency (JICA)
Coordinated by Metropolitan Manila Development Authority (MMDA)

Time	Program	
8:30~	Registration	
9:00~9:20	Philippine National Anthem and Photo Session	
9:20~9:25	Opening Remarks	Dr. Hilario Sean O. Palmiano *Asst. Professor, Institute of Civil Engineering, University of the Philippines*
9:25~9:50	I. Keynote Speeches	
9:25~9:40	Metropolitan Manila Development Authority	Sec. Danilo Delapuz Lim *Chairman, MMDA*
9:40~9:50	JICA	Mr. Yoshio Wada *Chief Representative JICA Philippines Office*
9:50~10:15	Coffee Break (25 min)	
10:15~	II. Presentation	
10:15~10:50	Presentation1: Highway Policy based on Objective Data (including 10min Q&A)	Mr. Koichi Sakai *Associate Professor, Advanced Mobility Research Center, The University of Tokyo*
10:50~11:15	Presentation2: ITS Training Program in Japan and MMDA ITS Current situation	Engr. Ryan A.Tacbad *MMDA*
11:15~11:40	Presentation3: Potential Need on ITS in Philippines and Power of Data	Dr. Hiroshi Warita, Mr. Tetsuya Sato *JICA Study Team*
11:40~11:50	Presentation4: ITS Japan and its Activities	Mr. Hiroaki Shishikura *ITSJAPAN*
11:50~12:10	Question & Answer for Presentation 2, 3 and 4 (20 minutes)	
12:10~13:10	Networking Lunch	
13:10~13:35	Presentation5: NEC's Intelligent Transport Systems (ITS) Technology Portfolio	Dr. Hiroshi Yoshida *NEC Corporation*
13:35~14:00	Presentation6: Advancement of Road Monitoring with Data Analysis	Mr. Yu Noguchi *FUJITSU Ltd.*
14:00~14:25	Presentation7: MHI Group's ITS Solution using RFID technology	Mr. Yoshio Sakai *Mitsubishi Heavy Industries Machinery Systems, Ltd.*
14:25~14:55	Question & Answer for Presentation 5,6 and 7 (30 minutes)	
14:55~15:20	Coffee Break (25 min)	
15:20~15:45	Presentation8: Highway Solutions	Mr. Masashi Hoshino *Toshiba Infrastructure Systems & Solutions Corporation*
15:45~16:10	Presentation9: A case study of an EV public transportation system using IT and small electric vehicle	Mr. Tomoyuki Iwakuma *SoftBank Corp.*
16:10~16:40	Question & Answer for Presentation 8 and 9 (30 minutes)	
16:40~16:55	Closing Remarks	Dr. Ricardo G. Sigua *Professor, Institute of Civil Engineering, University of the Philippines*

(The venue is reserved until 17:30. If participants need individual meeting between Philippines side and Japanese side, the place is available to use.)

Source: JICA Study team

Figure 3-5 ITS Seminar Program in Philippines

Invitations to the seminar were sent to MMDA with the cooperation of the local government agencies and private companies interviewed in the first survey.

Participants in the seminar is not only MMDA which is the coordinator, but also the major stakeholders of ITS, such as DOTr, DPWH, NEDA, LTO, LTFRB, LGUs, Metro Manila peripheral provinces (Cavite, Laguna), Metro Cebu, Davao City, etc. In addition, from private companies, expressway companies, toll collection company, IT companies participated, and from universities as well. Total number of participants are 101 which include 54 attendees from Philippine government, 13 attendees from private companies 5 attendees from the University in the Philippines, 28 attendees from Japan , and one participated from US embassy.

Table 3-14 Attendees of ITS Seminar in Philippines

Government Agencies	Attendees
Metropolitan Manila Development Authority (MMDA)	26
Department of Transportation (DOTr)	3
Department of Public Works and Highways (DPWH)	5
National Economic and Development Agency (NEDA)	2
Land Transportation Office (LTO)	3
Land Transportation Franchising & Regulatory Board (LTFRB)	1
Department of Information and Communication Technology (DICT)	1
National Telecommunications Commission (NTC)	3
Department of Science and Technology (DOST)	1
Philippine National Police (PNP)	1
Makati City (LGU)	1
Quezon City (LGU)	1
Manila City (LGU)	1
Metro Cebu	1
Davao city	1
Province of Cavite	2
Province of Laguna	1
Private Sector	**Attendees**
NLEX Corp.	4
SKYWAY O & M CORP.	3
MANILA TOLL EXPRESSWAY SYSTEMS INC.	1
Sakay.ph	2
Thinking Machines Data Science	1
Easytrip	1
Ubiquitous Technologies Philippines,Inc.	1
NEC PHILIPPINES	1
Academic	**Attendees**
NCTS, University of the Philippines	2
SURP University of the Philippines	2
NCPAG University of the Philippines	1
Japanese side	**Attendees**
JICA	9
Embassy of Japan	1
Presenters (Japanese Companies, University)	11
JICA Study Team , Staff	7
Others	**Attendees**
Embassy of USA	1
Total	101

Source: JICA Study team

Figure 3-6 Group Photo in ITS Seminar in Philippines

Although the under-secretary level personnel of DOTr and DPWH did not attend the seminar, it could be a great success with a total number of 101 attendees with the participation of major stakeholders involved in ITS of industry, academia and government from the Philippine side.

In addition, the participation of Japanese companies was more than the past two years. There were nine presentations in the seminar, and the presentations from Japanese side include coherent theme of the seminar on "Power of DATA" - the importance of the utilization of DATA applying ITS technology. The message on "Power of DATA" intended to extend to the Philippine side seemed to be successful since Dr. Sigua, mentioned the importance of data contributing to addressing the existing traffic problems, the effectiveness of ITS tools, government support for ITS Philippines, and other related matters in his Closing Remark.

In the questionnaire survey result for the seminar participants, although they understood the financial constraint, they understood the importance of data. For instance, "The overall content of the seminar offers quality solutions regarding traffic problems. But, because of financial constraints, maybe the integration of existing data can be taken as a first step in providing development for traffic issues, so the framework created by the JICA team is the most feasible in my point of view and the government can create a local team for creating this integration of local, private & govt data.(MMDA)"

On the other hand, the participating Japanese companies were actively communicating with Philippine government officials and private companies at break times and lunch times. At the question time, participants from Davao City requested to make Japanese companies join POC (Proof of concept) in a smart city project. As a whole, introduction of ITS solutions from Japanese companies and creation of networking opportunities with the Philippine side seem to be achieved.

4) Overall Result through Three Years of Study and Seminar in the Selected Countries

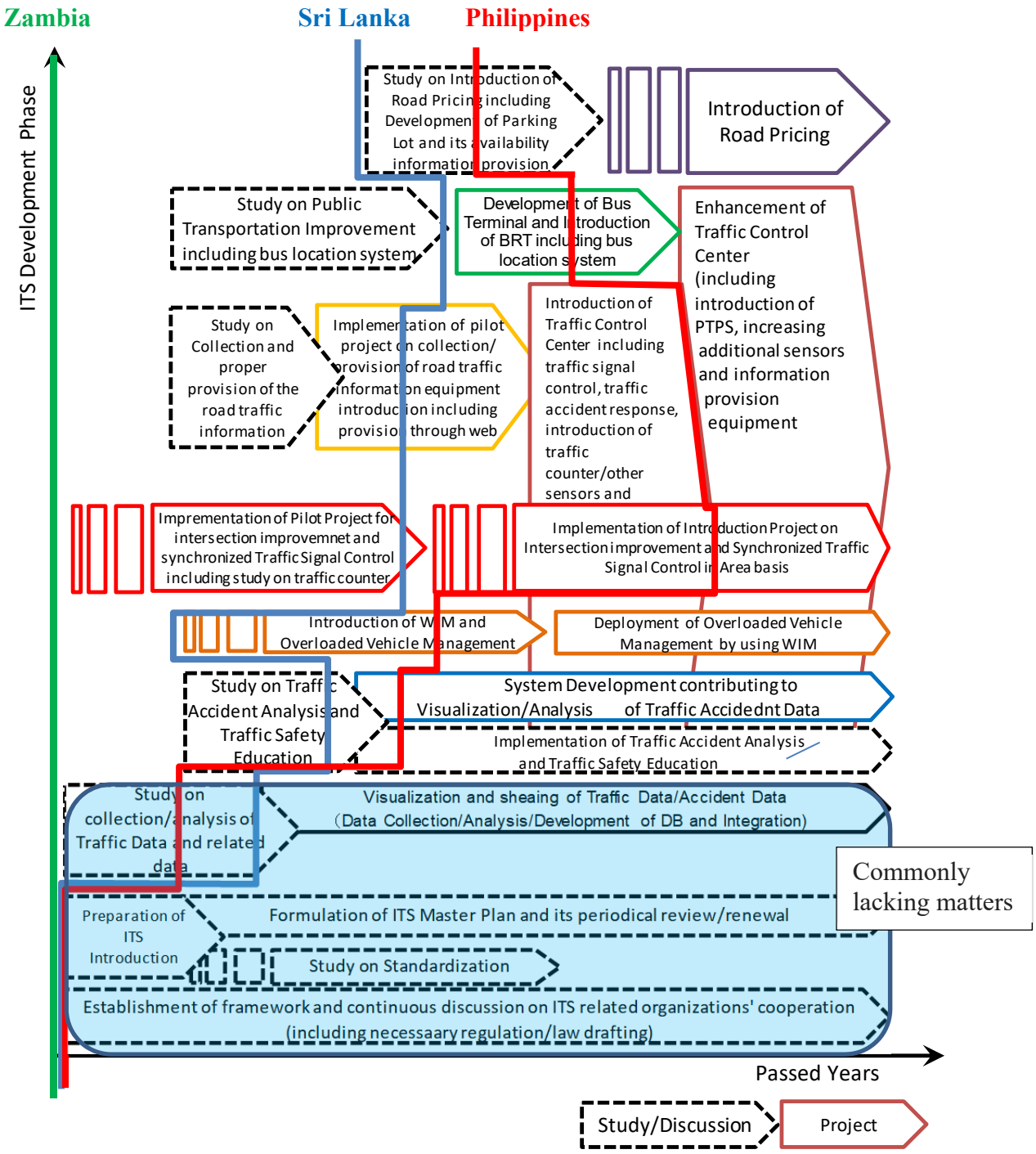
In this consulting service, studies and seminars were conducted in the selected different countries, i.e. Zambia, Sri Lanka, and the Philippines selected from the different ITS development stages.

As economic development progresses, urban areas expand, car owners increase, and infrastructure

development such as roads and public transportation cannot keep up with the demand for it, and traffic problems such as traffic congestion and traffic accidents are getting worse. As shown in Figure 3-7, in order to address these problems, there is a tendency that ITS facilities and services have been introduced mainly for expressways and signals in road traffic management, and IC cards and bus locations system have been introduced for public transportation management. In addition, even in the private sector of ICT, parking lot management, public transportation search service or other services are developed by using smartphone applications etc.

However, even in advanced countries among those three countries, human resource development, cooperation among related organizations, institutional design, standardization, etc. are not well cooperated and organized, and those counties have still many issues.

On the other hand, the consultant team re-acknowledged that Japan's experiences and know-how such as “human resource development” and “system development or institutional design” is the strong point. It is recommended supporting initiatives to address the weak points shown in the following figure of the developing countries from Japan. It is noted that the Knowledge Co-Creation Program on “ITS” is considered as one of the opportunities of such cooperation.



Source: JICA Study team

Figure 3-7 Development Status of ITS Solutions