

**Basic Research on
Technical Cooperation of Performance
Based Road Maintenance Contract**

Summary

February 2023

Japan International Cooperation Agency (JICA)

Oriental Consultants Global Co., Ltd.

CTI Engineering International Co., Ltd.

Hanshin Expressway Company Limited

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Table of Contents

List of Figres

List of Tables

Abbreviations

| | Page |
|--|------------|
| Chapter 1 Introduction..... | 1-1 |
| 1.1 Background and Purposes of this research | 1-1 |
| 1.2 What is PBC? | 1-1 |
| 1.3 Outline of this research | 1-3 |
| Chapter 2 Research on PBCs of Donor Agencies | 2-1 |
| 2.1 Outline and Purpose | 2-1 |
| 2.2 Analysis Results..... | 2-1 |
| Chapter 3 Research Result in the Selected Countries | 3-1 |
| 3.1 Outline and Purpose | 3-1 |
| 3.2 PBC Implementation Status in Research Countries | 3-1 |
| 3.3 Issues during PBC Operation Observed in Research Countries | 3-6 |
| Chapter 4 Classification & Organizing Work of PBC..... | 4-1 |
| 4.1 Purpose of the Work..... | 4-1 |
| 4.2 Cross-cutting Comparative Analysis through Research Countries | 4-1 |
| 4.3 Considerations derived from the Work..... | 4-1 |
| Chapter 5 Analysis of PBC Implementation Process | 5-1 |
| 5.1 Purpose of the Analysis | 5-1 |
| 5.2 Analysis Results..... | 5-1 |
| 5.3 PBC Implementatipon Benefit Simulation by HDM-4..... | 5-4 |
| Chapter 6 PBC Standard Specifications Thought Process..... | 6-1 |
| 6.1 Template for Draft PBC Standard Specifications (JICA Version)..... | 6-1 |
| 6.2 Basic Policy on Developing a Draft PBC Standard Specifications (JICA Version) | 6-1 |
| 6.3 Classification of Performance Specifications..... | 6-2 |
| 6.4 Composition of Performance Indicators and Setting of Payment Unit Price..... | 6-3 |
| 6.5 Performance Indicator Items | 6-3 |
| 6.6 Inspection and Payment Conditions..... | 6-4 |
| Chapter 7 Formation and Deployment of Technical Cooperation Incorporating PBC..... | 7-1 |
| 7.1 Introduction..... | 7-1 |
| 7.2 Deployability and Advantage of JICA Technical Cooperation Project..... | 7-1 |

| | | |
|------------------|--|------------|
| 7.3 | Proposal on Implementation Process that Harmonizes the Situation of the Partner Country..... | 7-2 |
| 7.4 | Direction of JICA Technical Cooperation..... | 7-3 |
| Chapter 8 | Measures on Promotion of PBCs | 8-1 |
| 8.1 | PR Materials | 8-1 |
| 8.2 | Training Materials | 8-2 |
| 8.3 | Sample Standard Specifications | 8-3 |
| Chapter 9 | Conclusion | 9-1 |
| 9.1 | Outline and Purpose | 9-1 |
| 9.2 | Theme and Findings through Study and Analysis in the Research..... | 9-1 |
| 9.3 | Considerations on PBC system design | 9-9 |
| 9.4 | Approaches on Assistance of Road Maintenance Technology under JICA Technical Cooperation (Draft) | 9-9 |

List of Figures

| | Page |
|--|------|
| Figure 1.3.1: Research Countries | 1-3 |
| Figure 1.3.2: Structure of the Report & Connections between Chapters..... | 1-5 |
| Figure 5.1.1: PBC Implementation Process | 5-1 |
| Figure 5.3.1: Route Map for HDM-4 Simulation (Northern Corridor: Mombasa – Nairobi) .. | 5-4 |
| Figure 5.3.2: Transition of Road Surface Roughness (IRI) in 9 years | 5-5 |
| Figure 7.3.1: Implementation Process for JICA Technical Cooperation Project..... | 7-2 |
| Figure 7.4.1: 4 Approaches for Improvement of Road Asset Management | 7-4 |
| Figure 8.3.1: Table of Contents of Sample Standard Specifications..... | 8-3 |

List of Tables

| | Page |
|---|------|
| Table 1.2.1: Benefits of PBC by Stakeholder | 1-2 |
| Table 3.2.1: Summary of PBC by Road Agency | 3-1 |
| Table 3.2.2: Summary of PBC by Donor (Completed) | 3-3 |
| Table 3.2.3: Summary of PBC by Donor (as of 2022)..... | 3-3 |
| Table 3.2.4: Comparison between CG and CGNS..... | 3-4 |
| Table 3.2.5: Overview of PBCs | 3-4 |
| Table 3.2.6: Basic and Common Items of PBC..... | 3-5 |
| Table 3.3.1: Major Issues and Efforts for the Solution in PBC Operation Process..... | 3-7 |
| Table 4.3.1: List of the Results of the Classification and Organizing Work of the Case Studies | 4-3 |
| Table 5.2.1: Major Issues and Solutions in PBC Implementation Process (WB Report and Case Study in Kenya) (1 of 2) | 5-2 |
| Table 5.2.2: Major Issues and Solutions in PBC Implementation Process (WB Report and Case Study in Kenya) (2 of 2) | 5-3 |
| Table 5.3.1: Comparison of Quantified Defects per 1km..... | 5-5 |
| Table 5.3.2: Comparison of Total Benefit (Million Kshs.)..... | 5-5 |
| Table 6.2.1: Summary of Basic Policy on JICA Version (Draft) | 6-1 |
| Table 6.3.1: Comparison of Classification of Performance Specifications | 6-2 |
| Table 8.1.1: Overview of the Leaflet | 8-1 |
| Table 8.1.2: Overview of the Video..... | 8-1 |
| Table 8.2.1: Overview of the Training Materials | 8-2 |
| Table 9.2.1: New Findings and/or Confirmations through the Research in Contrast to Well-known Advantages of PBC | 9-1 |
| Table 9.2.2: Findings/Re-findings and Proposals for Issues of PBC mentioned in Donors 'Reports | 9-3 |

Abbreviations

| | |
|-------|--|
| AC | Asphalt Concrete |
| ADB | Asian Development Bank |
| AFG | Afghanistan |
| AI | Artificial Intelligence |
| AIIB | Asian Infrastructure Investment Bank |
| AMPER | Asset Maintenance Contractor Performance Evaluation Report |
| APL | Approved Product List |
| APRP | Annual Public Roads Programme |
| ARD | Average Rate of Deterioration |
| ARICS | Annual Road Inventory and Condition Survey |
| As | Asphalt |
| AZE | Azerbaijan |
| BDS | Bid Data Sheet |
| BMS | Bridge Management System |
| BOM | Bureau of Maintenance |
| BOQ | Bill of Quantity |
| CAREC | Central Asia Regional Economic Cooperation |
| CBM | Community Based Maintenance |
| CFX | Central Florida Expressway |
| CG | Conservacion Global |
| CGNS | Conservacion Global Mixtos |
| CLP | Chilean Peso |
| CMA | Capital Maintenance Agreement |
| CPD | Continuing Professional Development |
| CREMA | Contrato de Rehabilitación y Mantenimiento (Road Rehabilitation and Maintenance Contracts) |
| CP | Counterpart |
| CPI | Consumer Price Index |
| DART | Dar Rapid Transit Agency |
| DBE | Disadvantaged Business Enterprise |
| DBMOT | Design Build Maintenance Operation and Transfer |
| DBOM | Design-Build-Operation-Maintenance |
| DBST | Double Bituminous Surface Treatment |
| DO | Department Order |
| DOR | Department of Roads |
| DOT | Department of Transport |
| DPWH | Department of Public Works and Highway |
| DPWT | Department of Public Works and Transport |
| DRIMS | Dynamic Response Intelligent Monitoring System |

| | |
|---------|---|
| DX | Digital Transformation |
| EBRD | European Bank for Reconstruction and Development |
| EIB | European Investment Bank |
| EMK | Equivalent Maintenance Kilometer |
| EU | European Union |
| EWH | East-West Highway |
| FDC | Florida Department of Correction |
| FDOT | Florida Department of Transportation |
| FIDIC | Fédération Internationale Des Ingénieurs-Conseils or International Federation of Consulting Engineers |
| FTE | Florida Transportation Engineering |
| GC | General Conditions |
| GDP | Gross Domestic Products |
| GEO | Georgia |
| GIS | Geographic Information System |
| GIZ | Deutsche Gesellschaft für Internationale Zusammenarbeit |
| HDM-4 | Highway Development and Management Model Four |
| ICB | International Competitive Bidding |
| IDA | International Development Association |
| IMP | Initial Mobilization Period |
| IRI | International Roughness Index |
| ITB | Instruction to Bidders |
| JCC | Joint Coordination Committee |
| JICA | Japan International Cooperation Agency |
| JV | Joint Venture |
| KAZ | Kazakhstan |
| KeNHA | Kenya National Highways Authority |
| KeRRA | Kenya Rural Roads Authority |
| KGZ | Kyrgyz Republic |
| KIHBT | Kenya Institute of Highways and Building Technologies |
| KRB | Kenya Roads Board |
| Ksh | Kenyan Shilling |
| KURA | Kenya Urban Roads Authority |
| KWS | Kenya Wildlife Service |
| LOS | Level of Service |
| MIS | Management Information System |
| MON | Mongolia |
| MOP | Ministerio de Obras de Publicas |
| MoTIHUD | Ministry of Transport, Infrastructure, Housing, Urban Development and Public Works |

| | |
|---------------|---|
| MPPW | Ministry of Physical Planning and Works |
| MPRDC | Madhya Pradesh Road Development Corporation |
| MPW | Ministry of Public Works |
| MPWT | Ministry of Public Works and Transport |
| MRP | Maintenance Rating Program |
| MQI | Maintenance Quality Indicator |
| NCA | National Construction Authority |
| NCB | National Competitive Bidding |
| NHA | National Highway Authority |
| NRA | National Road Agency |
| NRIMP | National Roads and Management Program |
| NWG | National Working Group |
| OPRC or OPBRC | Output and Performance-Based Road Contracts |
| OPWT | Office of Public Works and Transport |
| PAK | Pakistan |
| PBC | Performance-based Road Maintenance Contract |
| PBMC | Performance-Based Maintenance Contract |
| PBRM | Performance Based Routine Maintenance |
| PC | Particular Conditions |
| PCI | Pavement Surface Condition Index |
| PCR | Project Completion Report |
| PDM | Project Design Matrix |
| PHP | Philippines Peso |
| PJT | Project |
| PM | Periodic Maintenance |
| PMMR | Performance-based Management and Maintenance of Roads |
| PMS | Pavement management System |
| PPP | Public Private Partnership |
| PPRA | Public Procurement Regulatory Authority |
| PPTA | Public-Private Transport Act |
| PQ | Prequalification |
| PQI | Pavement Quality Index |
| PRC | People's Republic of China |
| PRoMMS | Provincial Road Maintenance Management System |
| PSMC | Performance-specified Maintenance Contract |
| PSRMC | Performance Specified Road Maintenance Contract |
| RAD | Road Administration Division |
| RBIA | Road and Bridge Information Application |
| RCOP | REGLAMENTO PARA CONTRATOS DE OBRAS PUBLICAS |
| RF | Road Fund |

| | |
|----------|--|
| RH | Rehabilitation |
| RHD | Roads and Highways Department |
| RM | Routine Maintenance |
| RMC | Road Management Cluster |
| RMG | Road Maintenance Group |
| RMLF | Road Maintenance Levy Fund |
| RMS | Road Management System |
| ROW | Right-of-Way |
| RQI | Riding Quality Index |
| RSGMP | Road Sector Governance and Maintenance Project |
| RT | Response Time |
| RTDC | Road and Transport Development Center |
| SCU | Self Control Unit |
| SLA | Service-level Agreement |
| SSATP | Sub-Saharan Africa Transport Policy Program |
| STD | Standard Tender Document |
| SWG | Sub Working Group |
| TA | Technical Assistance |
| TANROADS | Tanzania National Roads Agency |
| TAJ | Tajikistan |
| TED | Technical & Environment Division |
| TKM | Turkmenistan |
| ToT | Training of Trainer |
| TXDOT | Texas Department of Transportation |
| USAID | United States Agency for International Development |
| USD | Us Dollar |
| UTM | Unidad Tributaria Mensual |
| UZB | Uzbekistan |
| VDOT | Virginia Department of Transportation |
| VFM | Value for Money |
| VIMS | Vehicle Intelligent Monitoring System |
| VMS | Virginia Maintenance Service |
| VOC | Vehicle Operation Cost |
| vpd | vehicle per day |
| WB | World Bank |
| WIM | Weight in Motion |
| WM | Winter Maintenance |
| 4WD | Four-Wheel Drive |

Chapter 1 Introduction

1.1 Background and Purposes of this research

In developing countries, many road agencies have changed the contract mode for road maintenance work from the conventional “Specification-based” to "Performance-based" in order to improve work efficiency due to limited human and financial resources.

Performance-Based Road Maintenance Contract (PBC) is a relatively new contract mode, and therefore even in donor-assisted projects, many issues such as (i) lack of understanding of PBC among concerned parties, (ii) incompatibility with the current legal system and (iii) difficulty in securing national budget were encountered. These hinder the sustainable implementation and development of PBCs at post-donor assistance phase.

Considering the above, this research aims to make a proposal for JICA’s Technical Cooperation incorporating PBC, to be implemented in partner countries in future. This research was conducted to identify and analyze areas not covered by previous donors' projects, current implementation status and issues in each country; establishing considerations and possibility of deployment in case of implementing technical cooperation throughout desktop survey and field studies. Furthermore, draft standard specifications with high versatility to be applied various countries, training materials for promoting understanding of PBC among concerned parties and PR materials for presenting achievement and direction of JICA technical cooperation were created as the deliverables of this research.

1.2 What is PBC?

(1) Overview of PBC

The client specifies the required performance standards for road assets in the contract (may include requirements such as road surface flatness, number of potholes per 1km, or maximum height of roadside grass and outgrowth). The Contractor is responsible for planning and carrying out the NECESSARY and DESIRABLE work to maintain required performance standards. The Contractor determines how to meet these standards, including what work to do, where, how, and when to do it. Payment to the Contractor is a fixed, monthly lump-sum price, with the full amount paid if the Contractor meets 100% of the performance standards.

(2) Benefit and Issue of PBC

Table 1.2.1 indicates expected benefits of introduction of PBC.

Table 1.2.1: Benefits of PBC by Stakeholder

| Road User | Road Agency (i.e. the Client) |
|---|---|
| <ul style="list-style-type: none"> ✓ Lowers travel costs ✓ Lowers vehicle operation costs ✓ Minimizes traffic accidents ✓ Improves travel comfort | <ul style="list-style-type: none"> ✓ Reduces road maintenance costs in the mid- to long-term ✓ Minimizes time that roads are closed due to unfavorable events (e.g. accidents, natural disasters etc.) ✓ Early detection and countermeasures of defects ✓ Reduces the workload of staff in office and field |
| The Contractor | Local Community |
| <ul style="list-style-type: none"> ✓ Provides financial stability in the long term ✓ Secures long-term employment ✓ Increases profitability and business opportunities through creativity and technical innovation ✓ Even out the workload of staff to improve efficiency | <ul style="list-style-type: none"> ✓ Creates additional employment opportunities ✓ Improves the quality of the living environment ✓ Improves traffic safety ✓ Improves the stability of logistics and travel ✓ Boosts the local economy |

(3) Issues and Disadvantages of PBC

This research identified the following issues and disadvantages when PBCs were not properly designed or implemented.

✓ **Inadequate Risk Distribution between the Client and the Contractor**

If the Contractor bears an excessive amount of risk, they may submit an unnecessarily high bid or the contract may be terminated.

✓ **Insufficient Initial Rehabilitation Work**

If the initial rehabilitation work under another contract is insufficient, the Contractor may have to repeatedly perform unnecessary repairs to restore and achieve the designated performance level in the contract.

✓ **Insufficient Control of Overloaded Vehicles**

Use by overloaded vehicles may cause severe damage on pavement, a case beyond the Contractor's purview.

✓ **Inadequate Disclosure of Project Information Prior to Tender**

If the information provided by the Client before tendering is NOT accurate or sufficient, the Contractor may underestimate the tender price. This can lead to conflicts among the parties involved during the contract.

✓ **Insufficient Capacity of Concerned Parties**

Insufficient capacity, such as (i) the Client's inability to inspect and/or evaluate the work or (ii) the Contractor's inadequate maintenance work, can compromise the sustainability of performance levels specified in the contract.

1.3 Outline of this research

(1) Research Countries

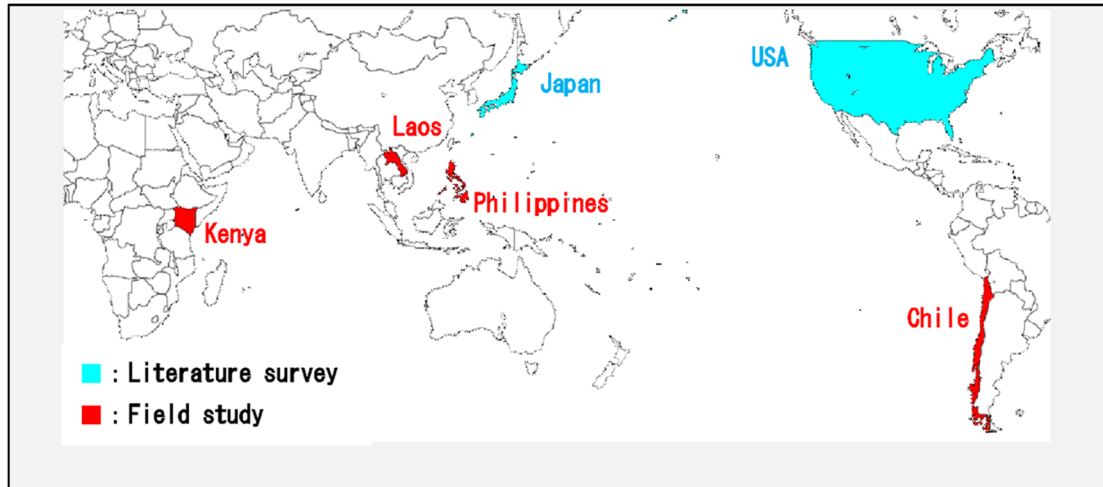


Figure 1.3.1: Research Countries

(2) Theme and Work Approach of this research

【Theme】

There are already cases of PBC introduction in many countries under the leadership and assistance of the WB, but there are still issues with its establishment after the end of assistance. This research will consider (i) how JICA Technical Cooperation can contribute in order to locally establish PBC to be introduced with donor's assistance in line with the actual situation in each recipient country, and (ii) how PBC can be applied to complement the organizational vulnerability which comes with conventional technical cooperation of road maintenance.

【Work Approach】

This research takes the following approach:

- 1) Studying considerations, points of view, template of standard specifications and training materials for conducting design of PBC system.
- 2) Advantages and disadvantages of PBC have already been examined and discussed in many documents and thus this research organizes them, and the cases confirmed in this research countries respectively in order to extract considerations and lessons learned for assisting PBC application project in future.
- 3) While there are various types of PBC, this research analyzes the variations and their background factors in order to organize the considerations for creating a new PBC framework.
- 4) Analyzing actual PBC implementation processes with trial and error for institutional and systematic improvement in each country, using lessons learnt when deploying a new PBC.

Based on the above discussions and considerations, this research proposes a draft that should be added to JICA technical cooperation for road maintenance technology.

(3) Structure of the Report

Figure 1.3.2 indicates structure of the report and connections between chapters.

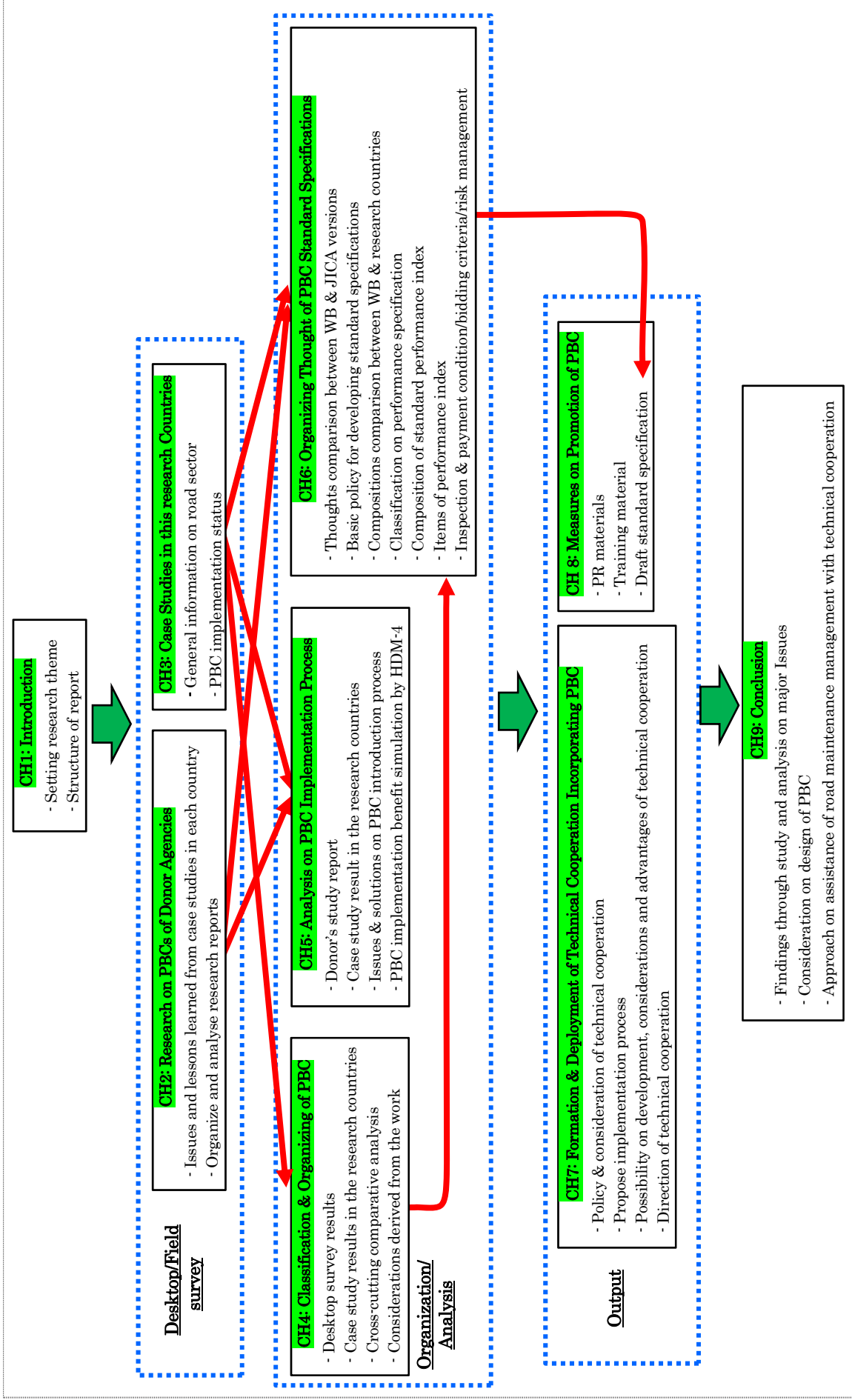


Figure 1.3.2: Structure of the Report & Connections between Chapters

Chapter 2 Research on PBCs of Donor Agencies

2.1 Outline and Purpose

This chapter organizes and summarises outcomes of the projects related to road maintenance/PBC implemented by the Japan International Cooperation Agency (JICA), World Bank (WB), and Asian Development Bank (ADB), and various study reports on PBC issued by WB and ADB for extracting findings and lessons learned.

So far, many countries have attempted to introduce PBC, and some of them started with a trial introduction and finally achieved sustainable implementation using their budgets. On the other hand, PBC failed to take root in many countries with the end of donors' assistance. This research analyses the background and issues that led to success or failure in these countries and uses the results as considerations when planning technical cooperation incorporating PBC in the future.

2.2 Analysis Results

Findings and lessons learned in PBC implementing countries include a small number of cases based on the unique background of each country, but in many cases, they have high similarities and common points each other confirmed among the research countries. These are described below.

(1) Risk Management based on Contractor's Capacity

- By providing sufficient and accurate information to the contractor before bidding, troubles, and confusion during the contract period have been reduced.
- For work items in which it is difficult to predict the work volume, efforts should be made to optimize the bid price by reducing the contractor's risk through the introduction of Hybrid-PBC, which pays by the unit price/quantity method.
- In the case of contract conditions that cause the contractor to bear excessive risk, the contractor may include the corresponding cost in the bid price, which may result in a higher contract amount. Given this, fair risk distribution between the client and the contractor is very important.
- It is important to determine the reduction rate with careful consideration of the balance between the risk caused by non-compliance items and the cost required for the correction.
- Securing the simple payment calculation method and its transparency will enable the contractor to formulate a realistic budget and input plan with an eye on risk avoidance, contributing to the stable continuity of the contract.

(2) Gradual Expansion of PBC Scope

- It is desirable to gradually extend the contract period and expand the scope of the PBC application as the contractor's capacity improves and experience accumulates.

- Consider hiring a consultant as a staff on the client side at the stage where the ability of PBC personnel is still insufficient.

(3) Developing a System that Serves as the Foundation for Efforts for Capacity Building of the Client/Contractor

- For all concerned personnel of PBC to acquire sufficient understanding and capacity to undertake their duties, it is important to develop and continuously implement a substantial training program. It is also important to secure a healthy competitive environment in the market and optimize bidding/contract prices by making efforts to increase the number of potential contractors with implementation capacities.

(4) The Importance of Efforts to Deploy PBCs with Their Budgets

- The introduction and expansion of PBC were facilitated under the strong leadership of government officials. At the same time, however, it is important to revise the current legal system and budgetary measures so as not to hinder the implementation of PBC.
- It is necessary to formulate a detailed action plan up to the successful implementation of PBC, considering each country's unique characteristics, environment, and legal system. Furthermore, coordination and cooperation with donor agencies are also important to ensure success.
- Building a mechanism to secure long-term stable financial resources such as establishing a road fund is important.
- By outsourcing the management of road assets to the private sector, the client reduced the burden on budgetary measures associated with the reduction of maintenance costs.

As mentioned above, while there are many similarities and common points with the research results, ADB's analysis report of CAREC countries states that the approach to setting the response time for remedying defects is different as follows. Therefore, it is also important to take into account this thinking when designing PBC systems in partner countries.

- It is necessary to set the response time (RT) required for remedying defects pointed out by inspections in the event of unpredictable and sudden events (accidents, natural disasters, etc.). On the other hand, for routine maintenance items (potholes, cracks, cleaning, etc.), there is a concern that the contractor's thinking will change to deal with only the defect pointed out in the inspection within the RT, so there is a choice not to set the RT.

Chapter 3 Research Result in the Selected Countries

3.1 Outline and Purpose

This chapter mentions how PBC was introduced in four countries (Kenya, the Philippines, Laos, and Chile) in which field studies were conducted and in two countries (Japan and the United States) in which a literature survey was conducted, as well as the current implementation status, issues and efforts in each country, and findings and lessons learned through them.

3.2 PBC Implementation Status in Research Countries

(1) Kenya

In Kenya, using the country's financial sources (Road Maintenance Levy Fund: RMLF), four road agencies for each road class implement road maintenance management by PBC, targeting domestic contractors. Table 3.2.1 shows a summary of PBC by the agency.

Table 3.2.1: Summary of PBC by Road Agency

| Agency | KeNHA | KURA | KeRRA | | KWS |
|---|---|---|---|--|--|
| Road class | Trunk road | Urban road | Rural road | | National Park road |
| Type of road maintenance | - Pure PBC - Hybrid PBC - Routine maintenance | - Hybrid PBC - Routine maintenance | - Low volume sealing under Roads 10000 program | - Hybrid PBC | - Hybrid PBC - Routine maintenance |
| Road surface type | Paved, Unpaved | Paved | Paved | Paved, Unpaved | Unpaved |
| Financial source | RMLF | RMLF | Government | RMLF | RMLF |
| Major PBC items | Site clearance, removal of debris, maintenance of slopes, protection works, existing shoulders, culverts, drains, riverbed shoulders, and road furniture. Prevention of encroachment. | Documentation, road usability, road user comfort & road durability. Prevention of encroachment. | Removal of obstructions, drains cleaning, bush, and grass cutting light carriageway reshaping | No implementation of PBC because the agency concentrated on road upgrading works in 2020/21. | Road safety, drainage, vegetation, structures & river beds |
| IMP | 3-months | 3-months | 3-months | | 3-months |
| Inspection type | Monthly & Unannounced | Monthly & Unannounced | Monthly & Unannounced | | Monthly & Unannounced |
| Use of consultant | No | No | No | | No |
| Contract period (Ave.) | 36-months | 24-months | 36-months | | 24-months |
| Contract amount (only PBC portion) (Ave.) | 97,800 (KsH/km-month) | 41,250 (KsH/km-month) | 11,433 (KsH/km-month) | | 14,277 (KsH/km-month) |
| Contractor category (NCA classification) | NCA 2,3 | NCA 3 | NCA 4 | | NCA 4 |
| Contract road length (Ave.) | 45 km | 110.5 km | 40 km | | 53 km |

| Agency | KeNHA | KURA | KeRRA | | KWS |
|---------------------------------------|---------------|--------------|----------|--|-------|
| Total road length under PBC (FY20/21) | 7,298 km | 636 km | 267.5 km | | 70 km |
| Total PBC amount (FY20/21) | 11.8 Bil. Ksh | 769 Mil. Ksh | NA | | NA |

IMP: Initial Mobilization Period, NCA: National Construction Authority

(2) Philippines

In the Philippines, road rehabilitation projects including PBC as a project component have been implemented with the assistance (including financial assistance) of the WB and JICA, but these projects have already been completed. Table 3.2.2 summarizes the PBC achievement of both projects.

(3) Laos

In Laos, the introduction of PBC started in 2010 with the support of the WB, and since then, with the assistance (including financial assistance) of several donors (e.g. ADB, AIIB, EIB), a road rehabilitation project that includes PBC as a project component has been implemented. In addition, JICA technical cooperation supported on solving issues in the initial stage of PBC introduction and improving the understanding and capacity of related parties. Table 3.2.3 shows a summary of the PBCs currently ongoing as of 2022. As a result of implementation experience in these projects and efforts to improve the capacity of related parties through JICA technical cooperation, Laos started PBC projects using its budget in 2022.

(4) Chile

In Chile, until the early 1990s, the Ministry of Public Works which has jurisdiction over road administration implemented road maintenance works by applying its force. Then since 1992, the Ministry started contracting out the works to the private sector by applying a "Fixed-term road maintenance contract (GC)". Furthermore, PBC which began to be introduced in neighbouring countries, was introduced on a trial basis from 1996 to 2004, and its effects were verified, and a more improved hybrid PBC (CGNS) was introduced and is being implemented since 2007. The main characteristics of both types are shown in Table 3.2.4.

Table 3.2.2: Summary of PBC by Donor (Completed)

| Donor | Project name | Road class | No. of contract | Type of contractor | Type of work | Contract road length (Ave.) | Road surface type | Contract period | Contract amount (only PBC portion) (Ave.) | Use of consultant | Inspection type |
|-------|---|--------------------------------|-----------------|-------------------------------|--|-----------------------------|-------------------|---------------------|---|-------------------|---------------------|
| WB | National Roads Improvement & Management Program Phase II (NRIMP-II) | National Road (Inter-province) | 4 | JV (International & National) | * Initial rehab work * Hybrid PBC * Emergency work | 170km | Asphalt | 2013 – 2018 5yrs | 1,301 – 2,581 (USD/km-month) | Yes | Monthly & as needed |
| JICA | Assisted Road Upgrading & Preservation Project | National Road (Inter-province) | 4 | JV (International & National) | * Initial rehab work * Hybrid PBC * Emergency work | 156km | Asphalt | 2015 – 2020 5yrs | 346 – 979 (USD/km-month) | Yes | Monthly & as needed |

Table 3.2.3: Summary of PBC by Donor (as of 2022)

| Donor | Project name | Road class | No. of contract | Type of contractor | Type of work | Contract road length (Ave.) | Road surface type | Contract period | Contract amount (only PBC portion) (Ave.) | Use of consultant | Inspection type |
|-----------------|--|---------------------------------|-----------------|-------------------------------|--|-----------------------------|-----------------------|-----------------|---|-------------------|---------------------|
| ADB | Road Sector Governance & Maintenance Project (RSGMP) | National & District road | 6 | JV (International & National) | * Initial rehab work * Hybrid PBC * Emergency work | 54km | Asphalt, DBST, Gravel | 2 – 3.5yrs | Paved: 160 – 310 (USD/km-month) Gravel: 116 – 213 (USD/km-month) | Yes | Monthly & as needed |
| ADB | Road Sector Governance & Maintenance Project (RSGMP) | National & District road | NA | Local community | * Labor-based PBC (cleaning & vegetation control) | 17 – 38km | NA | 1yr | 240 (USD/km-month) | No | Monthly |
| WB | Lao Road Sector Project 2 (LRSP-2) | Provincial road & District road | 10 | JV (International & National) | * Initial rehab work * Hybrid PBC * Emergency work | 111km | DBST, Gravel | 3yrs | Paved: 65 – 160 (USD/km-month) Gravel: 14 – 100 (USD/km-month) | Yes | Monthly & as needed |
| IDA – AIIB | Output Performance-based Road for Contracts NR13 Improvement & Maintenance Project | National road | 1 | International (Chinese) | * Initial rehab/improve work * Hybrid PBC | 58 | Concrete | 7yrs | 2,282 – 3,883 (USD/km-month) | Yes | Monthly & as needed |
| IDA – AIIB, EIB | Output Performance-based Road for Contracts NR13 South Improvement & Maintenance Project | National road | 4 | JV (International & National) | * Initial rehab/improve work * Hybrid PBC * Emergency work | 69 | Asphalt | 7 – 8yrs | 838 – 933 (USD/km-month) | Yes | Monthly & as needed |

Table 3.2.4: Comparison between CG and CGNS

| Type | Conservación Global (CG) | Conservación Global Mixtos (CGNS) |
|-----------------------------|---|--|
| Financial source | National budget | National budget |
| Contract period | 2-yrs | 4-yrs |
| Contract amount (Ave.) | USD4-million | USD8.5-million |
| Contract road length (Ave.) | 450km | 340km |
| Type of work | <ul style="list-style-type: none"> - Routine maintenance - Periodic maintenance | <ul style="list-style-type: none"> - Initial rehabilitation - Routine maintenance-1 - Routine maintenance-2 - Periodic maintenance |
| Inspection | <ul style="list-style-type: none"> - Routine: Monthly - Periodic: Annually | <ul style="list-style-type: none"> - Routine maintenance-1: Monthly - Routine maintenance-2: Bi-monthly - Periodic maintenance: Annually |
| Payment | Unit rate x work quantity | <ul style="list-style-type: none"> - Initial rehabilitation: No payment - Routine maintenance-1: Unit rate x work quantity - Routine maintenance-2: Performance-based - Periodic maintenance: Unit rate x work quantity |

Note

Routine maintenance-1: applied in low-priority roads, Routine maintenance-2: applied in high priority roads

(5) Japan

Achievement of PBC in Japan is quite limited because the contractor is not empowered substantial portion of autonomy as road administrator. For instance, variation in payment amount (i.e. reduction and/or bonus depending on accomplished compliance status) which is a particular payment mode of PBC is not introduced in Japan. Table 3.2.5 shows an overview of PBC projects currently being implemented or already completed in Japan.

Table 3.2.5: Overview of PBCs

| Agency | Project name | Work contents | PBC item | Contract period |
|-------------------------------|---|---|---|-----------------|
| Nara Road Public Corporation | Road Maintenance Contract of 2nd Han-Na Toll Road | Repair work of road & furniture, cleaning, vegetation control, snow control | Vegetation control | 3 |
| Omiya National Highway Office | Road Maintenance Contract in Omiya | Patrol, and repair work on pavement | | 3 |
| Expressway Corporations | NEXCO-East | Comprehensive maintenance works | <ul style="list-style-type: none"> • Cleaning (road surface, rest area) • Vegetation control | Sub-contracting |
| | NEXCO-Central | | <ul style="list-style-type: none"> • Cleaning (road surface, rest area, contract office) • Vegetation control • Snow control • Accident control • Tool/equipment control • Maintenance on pavement • Preservation on carriageway | |
| | NEXCO-West | | <ul style="list-style-type: none"> • Cleaning (road surface, rest area, contract office) • Vegetation control | |
| | Hanshin-Expressway | | <ul style="list-style-type: none"> • Vegetation control | |
| Fuchu-City (Tokyo) | Comprehensive Road Maintenance Contract | <ul style="list-style-type: none"> • General management (report, meeting, work handover) • Patrol • Maintenance works (cleaning, vegetation control, control of vermin and pests, traffic signs) • Repair works | | 3 |

| Agency | Project name | Work contents | PBC item | Contract period |
|----------------------|--|---|---|-----------------|
| | | <ul style="list-style-type: none"> • Accident·disaster control • Customer service • Occupied property/non-statutory public property control | | |
| Sanjo-City (Niigata) | Comprehensive Maintenance Contract of Social Infrastructures | <ul style="list-style-type: none"> • Preparation work • Overall management • Counter business • Patrol • Road maintenance • Park maintenance • Drainage maintenance • Work handover • Snow control | <ul style="list-style-type: none"> • Road maintenance • Park maintenance • Drainage maintenance • Work handover | 3~5 |

(6) United States of America

Since the PBC road maintenance contract in the US was adopted in Virginia in 1995, the scope of application has expanded to include Florida, Georgia, North Carolina, and Texas. However, companies lacking advanced know-how regarding maintenance and management were eliminated, and as a result, the four major companies came to occupy the majority of the market share in the country. Over 25 years have passed since 1995, and due to the accumulation of experience on the part of the client in each state and the accumulation and maturity of know-how on the part of the industry, the contract form, contractor procurement process, inspection method, bonus/penalty provisions, etc. have been established. In the US, it can be said that the application of PBC has advanced to a stage where both the client and the contractor can enjoy benefits. PBC implementation status in the US varies from state to state, but some basic and common items are shown in Table 3.2.6.

Table 3.2.6: Basic and Common Items of PBC

| Study Item | Contents |
|------------|--|
| Contract | <p><u>Period</u> 3 – 10 years (Usually 3 – 5 years with renewal option while Florida accepts 10 years.)</p> <p><u>PBC Items</u></p> <ul style="list-style-type: none"> ● Maintenance and minor repair (e.g. cleaning, removing obstacles, potholes, slopes, guardrails/fences, traffic signal/lightings, tunnels, bridges, traffic signs, vegetation control, road markings) ● Snow control ● Emergency works <p><u>Required Performance & Response Time</u></p> <ul style="list-style-type: none"> ● Implemented according to each province's Maintenance Rating Program (MRP). If the measured performance does not meet the MRP standards, the contractor will be penalized. The control standard values and photographs of specific examples are described in the "MRP Handbook" in Florida. https://fdotwww.blob.core.windows.net/sitefinity/docs/default-source/maintenance/rdw/mrp/mrphandbook2020.pdf?sfvrsn=1497bb43_2 |
| | <p><u>Inspection Method</u></p> <ul style="list-style-type: none"> ● The Client (i.e. state government employee or consultant) periodically randomly selects and inspects a portion of the road asset. It does not mean that 100% of inspected samples must be maintained above the standard value, but the samples should be maintained in the range of 80% to 95% according to the importance of the road and traffic volume. ● For items related to response time, each state checks the log created by the contractor. In addition to emergency work and snow control, the time for road user service and completion of maintenance work is stipulated, and there is an obligation to achieve 100% of the requirements. ● In many states, the clients hold seminars and/or training to eliminate variations due to subjective inspectors. |

3.3 Issues during PBC Operation Observed in Research Countries

Some issues that emerged during the PBC operation process in the research countries are common to many countries, while others are based on the unique background of each country. Table 3.3.1 shows major issues and efforts for the solutions.

Table 3.3.1: Major Issues and Efforts for the Solution in PBC Operation Process

| Process | Issues | Solution |
|---------------------------|--|---|
| Budgeting | Hurdle against continuous PBC implementation by the national budget. | Proactive involvement of high-ranking officials in the government. |
| Contract | 【Inadequate Risk Distribution】 Risk distribution between the client and the contractor is unclear, or the burden is imposed on the contractor excessively. | Standardization and clarification of the task distribution between the parties in the contract. Making effort to quantify risk. |
| | Deficient or missing inflation clauses. | Adding an inflation clause and setting an appropriate inflation index. |
| | 【Inadequate Disclosure of Project Information】 Due to insufficient/inaccurate information disclosed to bidders at the bidding, troubles frequently occur after the start of work. | Standardize disclosure information (type, content, quantity). In addition, the client will add information updates and refinement work to its ordinary work. |
| Contract Procurement | If the tender documents are in English, the local language translation is necessary because the parties concerned cannot fully understand the contract. | Include translation work in the training program for the client side to promote understanding of the contract. |
| | 【Insufficient Capacity of Concerned Parties】 Problems caused by insufficient understanding of PBC by both parties are confirmed at each stage of work implementation. | Enhancing training programs and adding training participation to qualifications for bidding. |
| Implementation Capability | If road maintenance work is excessively transferred to PBC, the know-how of on-site work will not remain with the client. | Limit the PBC consignment percentage. |
| | 【 Unexpected Repair Work caused by Deterioration of Infrastructure】 Road conditions deteriorate due to unfavourable manners and/or illegal behaviour by roadside residents and/or road users, and therefore the contractor's burden increases to remedy the conditions. | Implementation of enlightenment activities for roadside communities. In addition, if the damage is recognized as a result of the act, payment will be made in the form of unit price and quantity instead of PBC. |
| Implementation Phase | 【 Unexpected Repair Work caused by Deterioration of Infrastructure】 【Insufficient Control of Overloaded Vehicles】 Carrying out repair work for damage that is not the contractor's fault (overloaded vehicles, construction defects by other contractors, etc.). | Specify countermeasures (damage evaluation method, payment method, etc.) as a force majeure clause in the contract. |
| | Premature termination /abandonment during the contract by the contractors awarded with low-price bidding. | Introduction of contractor selection methods, including low-price bidding countermeasures (minimum price setting, applying penalties, etc.). |
| | Payment delays due to delays in the payment approval process on the client side. | Unify approval authority and simplify processes. |
| | If there is no advance payment system, the financial burden on the contractor at the initial work stage will increase. | Introduction of an advance payment system similar to a general construction contract. |
| | Since the scope of PBC is limited under the current legal system, the effect of introducing PBC is also limited. | Relaxation of the legal system. |
| | | |

Note: Texts in **bold** are particularly important.

Chapter 4 Classification & Organizing Work of PBC

4.1 Purpose of the Work

As we have discussed in Chapters 2 and 3, there are various types of PBC, and therefore it is necessary to design a PBC that matches the local policy and current situation to successfully establish and introduce it into the partner countries. Given this, we will analyse the variations of each item that defines the contents of PBC across countries, classify and organize them, and present the viewpoints for designing PBC that suits the local situation in this chapter.

4.2 Cross-cutting Comparative Analysis through Research Countries

Table 4.2.1 shows a list of the results of the classification and organizing work of the case studies. As for the details of the specified performance, since there are a wide variety of items, Chapter 6, 6.4 to 6.7 provides a comparative evaluation and organisation of each case, so please refer to that.

4.3 Considerations derived from the Work

- It is important to draw a roadmap from the introduction of the JICA technical cooperation project to its development, keeping in mind the concepts of PBC, namely, comprehensiveness (broadening) of target facilities under performance-based maintenance, and prolongation of the contract period.
- When expanding the scope of facilities covered by PBC, it is necessary to consider the capacity of the PBC personnel. In addition, for emergency work where it is difficult to predict the work quantity and the number of occurrences, it is common to reduce the contractor's risk by paying based on the unit price and work quantity. Furthermore, we believe that this will also contribute to the optimization of bid prices.
- Based on the recognition that high traffic volume roads = high standard roads = high required performance, it is necessary to screen and select contractors who can meet these requirements, or to select roads with standards and road length that local contractors can handle as PBC targets.
- It is effective to gradually extend the contract road length as the ability and experience of PBC stakeholders (especially contractors) improve to avoid risks such as premature termination of the contract.
- It is important to set performance indexes mainly for (i) safety risk items and (ii) damage items that contribute to the extension of road performance through appropriate repair works.
- It is important to set the response time (RT) with an emphasis on promptness for safety risk items. In addition, considering the burden of the implementation system on the client

side at the time of follow-up inspection, it should be considered to ease it at the operational level, but in order not to lose the tension against the performance compliance of the contractor, it is also necessary to consider items for which RT is NOT set.

- It is important not to trade off the relationship between the simplification of inspection methods and the accuracy of the inspection results, but to work on improving training programs to achieve both. In addition, if the contract road is long, it is important to consider establishing a sample section inspection system after considering fairness to reduce the burden of inspection work.
- It is important to sustain regular payments for the contractor's financial stability and it leads secure good road performance.
- It is important to set a reduction clause in the contract with an appropriate reduction rate to secure the contractor's motivation. Here, it is desirable to set the reduction rate according to the importance of the contract road.
- Many governments are aiming to promote the local construction industry, and in the field of road maintenance where quick response to damage is desired, there is rationality in utilizing companies nearby the target roads.
- Introducing low-risk PBC is also a significant step towards the development of local companies by making the companies bear more responsibility and risk as well as the expansion of the company's capabilities.

Table 4.3.1: List of the Results of the Classification and Organizing Work of the Case Studies

| Contents | Kenya | | | Laos | | Philippines | | Chile | Japan (local government) | USA |
|--|--|--|---|--|--|--|---|--|--|--|
| | KeNHA (Quantity) Yes (Quantity) (Hybrid) | KeRRA (Quantity) Yes (Quantity) (Hybrid) | KURA (Quantity) Yes (Quantity) (Hybrid) | KWS (Quantity) Yes (Quantity) (Hybrid) | KeNHA Pilot No Quantity (Hybrid) | ADB (Quantity) Yes (Quantity) (Hybrid) | WB (Quantity) Yes (Quantity) (Hybrid) | | | |
| Presence or absence of initial rehab. Work | Yes (Quantity) (Hybrid) | Yes (Quantity) (Hybrid) | Yes (Quantity) (Hybrid) | Yes (Quantity) (Hybrid) | No Quantity (Hybrid) | Yes (Quantity) (Hybrid) | Yes (Quantity) (Hybrid) | Yes (within PBC) PBC | No Quantity (Hybrid) | No Quantity PBC |
| Emergency work | Roadside/cleaning/vegetation | Roadside/cleaning/vegetation | Roadside/cleaning/vegetation | Roadside/cleaning/vegetation | Carriageway /roadside /cleaning/vegetation | Carriageway/roadside/cleaning/vegetation | Carriageway /roadside/cleaning/vegetation | Carriageway/roadside/cleaning/vegetation | Carriageway/roadside/cleaning/vegetation | Carriageway/roadside/cleaning/vegetation |
| Range of PBC items | Trunk road | Rural road | Urban road | National roadf, Rural road | Trunk road | Rural road, village road | National road | National road, rural road | Municipal road | State road |
| Ave. traffic volume (veh/day) | 4,600 | 700 | 12,800 | National: 1,900 Rural: 400 | Unknown | Unknown | Unknown | Main: 2,400 Branch: 1,800 | 37,000 | 74,000 |
| Single route or network | Network | Network | Network | Network | Network | Network | Network | Network | Network | Network |
| Road length (Ave.) | Short (L<75km) Visual | Short (L<75km) Visual | Short (L<75km) Visual | Short (L<75km) Visual | Short (L<75km) Visual | Mid (75<L<150km) Visual | Short (L<75km) Visual | Long (150km<L) Visual | Long (150km<L) Visual | Long (150km<L) Visual & tool |
| Inspection method | Monthly | Monthly | Monthly | Monthly | Monthly | Monthly | Monthly | Monthly | Quarterly | 2 – 3times/yr |
| Frequency of inspection and payment | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes (plus bonus system) |
| Presence or absence of payment reduction | 3yrs Client | 3yrs Client | 3yrs Client | 3yrs Client | 3yrs Client | 3yrs Consultant | 3yrs Consultant | 4yrs Client | 2-5yrs Client | 3-10yrs Client |
| Contract period | National | National | National | National | National | Loan & national | Loan | National | National | National |
| Supervision | Local Mid | Local Small | Local Small | Local Small | Local Mid | Local | International | Local | Local | Local |
| Financial source | Local Mid | Local Small | Local Small | Local Small | Local Mid | Local | International | Local | Local | Local |
| Scale and attribute of the contractor | Local Mid | Local Small | Local Small | Local Small | Local Mid | Local | International | Local | Local | Local |

Chapter 5 Analysis of PBC Implementation Process

5.1 Purpose of the Analysis

To realize the establishment and success of PBC, it is important to take a step-by-step approach according to the capacity levels of the concerned parties (i.e. the client and the contractor) in the process from planning to implementation. In this chapter, the results of analysing the efforts and the lessons learned at each stage, and the conditions for proceeding to the next stage, etc. through the literature survey and field studies will be utilized for considering contents of the formulation and development of JICA technical cooperation incorporating PBC. Figure 5.1.1 shows PBC implementation chain defined by WB.

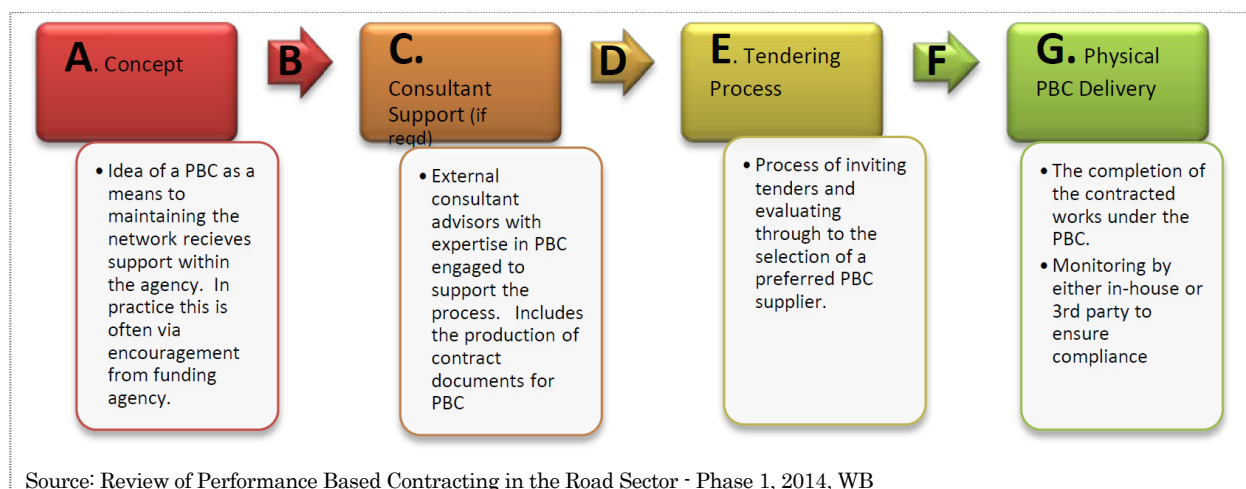


Figure 5.1.1: PBC Implementation Process

5.2 Analysis Results

Table 5.2.1 shows major issues and recommended solutions in the WB report (left columns) and issues and solutions implemented in the technical cooperation project in Kenya (right columns) at each implementation stage.

Table 5.2.1: Major Issues and Solutions in PBC Implementation Process (WB Report and Case Study in Kenya) (1 of 2)

| Stage | WB Report | | Case Study in Kenya | |
|-------------------------------------|---|---|---|--|
| | Cause of failure | Recommended Solution | Observed issues | Solution Implemented |
| A: Concept | <ul style="list-style-type: none"> Lack of understanding of the philosophy and importance of PBC among relevant organizations prevents the first steps towards implementation. | <ul style="list-style-type: none"> Clarify the purpose of the implementing agency and present a contract model that aligns with it. Carefully verify the purpose and suitability of PBC for the organization's issues and goals, as it may not be the best solution in all cases. Appoint personnel with strong leadership. Create a standard document for procuring consultants. | <ul style="list-style-type: none"> Lack of identification of issues related to introducing PBC resulted in no decision on implementation, even though the method was known among road agencies. It was difficult for individual actors to take practical action because potential leaders were scattered across multiple agencies. | <ul style="list-style-type: none"> Presented a comprehensive overview and advantages of PBC. Conducted project activities by involving all relevant organizations. Created opportunities for lateral communication and discussion among organizations. |
| B: Transition from A to C | <ul style="list-style-type: none"> Insufficient discussion with donors. Difficulty procuring qualified consultants for project management. | <ul style="list-style-type: none"> Create a standard document for procuring consultants. | <ul style="list-style-type: none"> It was difficult to implement practical work unless there was a deep understanding of project activities among practitioners. | <ul style="list-style-type: none"> Created a draft contract document. Conducted a pilot project. Developed a training program. |
| C: Consultant support (if required) | <ul style="list-style-type: none"> Inability to develop appropriate procurement documents due to insufficient capacity of consultants. | <ul style="list-style-type: none"> Implement an evaluation system that balances cost competition with aptitude for work implementation. Use a two-step evaluation system consisting of pre-qualification and tender. Adhere to the standard procurement guidelines issued by the World Bank. | <ul style="list-style-type: none"> Existing public procurement laws and regulations did not accommodate the PBC method. Bidders with insufficient capacity were unable to take on high-risk work. | <ul style="list-style-type: none"> Invited personnel from the public procurement department and demonstrated the benefits of PBC through the pilot project. Used Hybrid-PBC to mitigate risk. Simplified the tender document based on the capacity of contractors. |
| D: Transition from C to E | <ul style="list-style-type: none"> Insufficient budget due to incorrect cost estimates by the consultant. | <ul style="list-style-type: none"> Seek donor assistance in developing a cost estimate system. Engage with the construction industry as potential bidders. Discuss potential risks, such as poor quality control and overloaded vehicles, that may affect the success of PBC | <ul style="list-style-type: none"> Difficulty in assessing the validity of tender prices due to a wide range of lump-sum prices. Low or unsuccessful bids due to insufficient understanding by contractors. Illegal dumping and construction work threaten road performance. Unacceptable gap between required service level and actual road condition. | <ul style="list-style-type: none"> Created a standard for cost estimates and sample estimates. Conducted training programs for contractors. Clarified the distribution of responsibilities between the client and contractor through coordination among relevant agencies. Conducted initial repair work before PBC works. |

Table 5.2.2: Major Issues and Solutions in PBC Implementation Process (WB Report and Case Study in Kenya) (2 of 2)

| Stage | WB Report | | Case Study in Kenya | |
|--------------------------|--|---|--|--|
| | Cause of failure | Recommended Solution | Observed issues | Solution Implemented |
| Trial | | | | |
| E: Tendering process | <ul style="list-style-type: none"> A thriving construction industry may result in fewer bidders. A gap in cash flow between initial expenses and monthly lump-sum payments may threaten the financial stability of the contractor. | <ul style="list-style-type: none"> Select the best contract model (PBC or others) for each country/agency to mitigate the risk of unsuccessful tenders. Engage in discussions and disclose information with the construction industry to optimize tender prices. | <ul style="list-style-type: none"> Troubles during the contract due to insufficient understanding by relevant parties, especially a lack of contractors with sufficient PBC experience. Overpayment due to oversight of defects during inspection. Neglected defects. Shortage of tenderers. | <ul style="list-style-type: none"> Made training programs mandatory. Conducted follow-up inspections. Strengthened the reduction rate. Subdivided contract lots to make them more accessible to mid-sized and small contractors. |
| F: Contract signing | | | | |
| G: Physical PBC delivery | <ul style="list-style-type: none"> Contractor fails to achieve the required service level. The contract is terminated during the contract due to a very low bid. | <ul style="list-style-type: none"> Hire a project management consultant with sufficient knowledge and experience. Provide sufficient training and information to contractors before the tender process. Evaluate the financial status of tenderers during the tender evaluation process. | <ul style="list-style-type: none"> Insufficient capacity of the client for inspection work. The contract was terminated during the contract due to a very low bid. | <ul style="list-style-type: none"> Hired a consultant. Hired an inspector directly under the PBC management of the client. Proposed a comprehensive tender evaluation system. Conducted a training program on cost estimation. |
| Further development | | | <ul style="list-style-type: none"> The risk for contractors increased due to the introduction and implementation of Pure PBC. Rapid expansion of PBC led to a shortage of contractors and training opportunities. | <ul style="list-style-type: none"> Applied Pure PBC only to newly constructed or improved roads. Adjusted the contract scale to mid-sized to help mid-sized contractors. Improved the training system. |

5.3 PBC Implementatipon Benefit Simulation by HDM-4

(1) Purpose and Outline

To assess the effect of implementing PBC, a simulation analysis was conducted using HDM-4 (Highway Development and Management System) on a principal trunk road in Kenya (see the route map in Figure 5.3.1). The cost-effectiveness of PBC was confirmed by comparing the benefits of “implementing PBC” and “conventional road maintenance work”.



Figure 5.3.1: Route Map for HDM-4 Simulation (Northern Corridor: Mombasa – Nairobi)

(2) Simulation Analysis Result

The transition of road surface roughness (IRI: International Roughness Index) in 9 years between PBC and the conventional method is shown in Figure 5.3.2. The graph shows that PBC ensures smooth road surfaces long term more than the conventional method. Furthermore, by comparing quantities of defects (i.e. edge breaks and potholes) on road, PBC shows its superiority as shown in Table 5.3.1. Concerning the comparison of the total benefit in 9 years, the results are shown in Table 5.3.2. The table also indicates the superiorities of PBC as follows.

- Reduction benefit of road user cost: 15% higher
- Road agency cost: 20% lower

- Total benefit: 24% higher (Approx. 5.1 Million Kshs.)

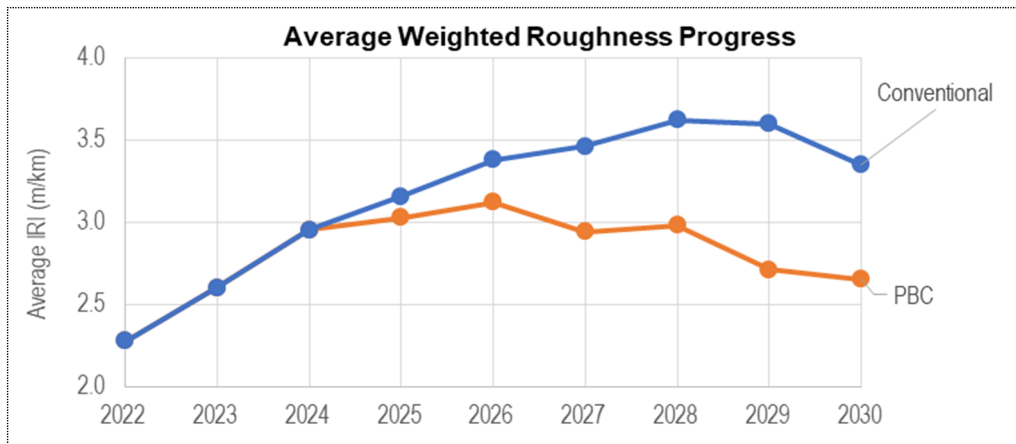


Figure 5.3.2: Transition of Road Surface Roughness (IRI) in 9 years

Table 5.3.1: Comparison of Quantified Defects per 1km

| Case | Average IRI (m/km) | Edge Break (sq.m) | No. of Potholes |
|--------------|--------------------|-------------------|-----------------|
| PBC | 2.8 | 11.8 | 0.9 |
| Conventional | 3.2 | 12.8 | 1.2 |

Table 5.3.2: Comparison of Total Benefit (Million Kshs.)

| Case | Reduction benefit of Road User Cost | Road Agency Cost | Total Benefit |
|----------------|-------------------------------------|------------------|----------------------|
| PBC | 30,474 (115%) | 4,000 (80%) | 26,474 (124%) |
| Conventional | 26,419 (100%) | 5,000 (100%) | 21,419 (100%) |
| Balance | 4,055 | -1,000 | 5,055 |

Chapter 6 PBC Standard Specifications Thought Process

6.1 Template for Draft PBC Standard Specifications (JICA Version)

The WB's latest PBC sample contract documents were published in 2021, and considering that there are still very few records of its use, the 2006 version was used as reference material when preparing the draft JICA version. With reference to the case study/analysis in the research, the following two points were considered, and a standard specification template was created.

- ✓ Supporting the build-up of a PBC framework using the country's budget.
- ✓ In order for JICA experts to be able to conduct efficient support, the JICA version provides concrete performance specifications and their formats as templates with standard items, terms used and their specifications.

6.2 Basic Policy on Developing a Draft PBC Standard Specifications (JICA Version)

This draft formulates 7 items as basic policy as shown in Table 6.2.1.

Table 6.2.1: Summary of Basic Policy on JICA Version (Draft)

| Item | Basic policy | Remarks |
|--|--|--|
| 1. Standard contract document | <ul style="list-style-type: none"> • Organize the composition of the entire PBC contract documents, GCC, and ingenuities, based on the case study result. • It should be noted that in the case of implementing PBC with the country's own budget, it is necessary to prepare standard contract documents that comply with the public procurement laws of each country. (Efforts of the Kenya technical cooperation project are introduced.) | <ul style="list-style-type: none"> • Preparation of standard contract documents is beyond the scope of this research, but it is mentioned here because it is significant when preparing the document. • Standard contractual clauses should be standardized by each country and/or donor based on domestic public procurement laws. |
| 2. Classification of performance specification | <ul style="list-style-type: none"> • Hybrid PBC is the standard. • Response to paved/unpaved roads. • Set categories based on traffic volume (in principle 2 ranks). | <ul style="list-style-type: none"> • Maintenance work for pavement is paid for performance-based in principle, but it is also possible for the client to reduce the risk of the contractor in particular small-mid scale by paying in unit rates and actual work quantity. • Set a high standard for heavy traffic volume roads and regular standards for medium traffic volume roads. |
| 3. Structure of performance indicator | <ul style="list-style-type: none"> • Performance indicator consists of 5 levels for easy understanding of the definition of required performance, index and payment condition. • Level 1: Road usability, road user comfort and road durability • Level 2: Road function (= payment criteria) • Level 3: Road element (pavement shoulder, drainage, etc.) • Level 4: Damage item to be confirmed by visual inspection or easy measurement) • Level 5: Performance requirement | <ul style="list-style-type: none"> • Clarify the relationship between performance, index and the corresponding damage. • Prepare a format that is easy to select. • Clarify check items for confirming the achievement of performance. • Enable to inspect visually or by simple measurement. • Pay by unit rate and work quantity basis in case of emergency work. |

| Item | Basic policy | Remarks |
|---------------------------------------|--|--|
| 4. Item of standard performance index | <ul style="list-style-type: none"> Based on the WB's standard specifications, approximately 50 items were added in accordance with the case study results. IRI and vehicle speed are added as the index. To reduce the risk for the contractor, costly repair work was made mandatory to report to the client. | <ul style="list-style-type: none"> Table of performance index (draft) Index to be used is selected based on actual road condition IRI and vehicle speed are defined as referential indexes because those require means of measurement. |
| 5. Inspection and payment | <ul style="list-style-type: none"> Level 2 (Kenyan type), which has a clear relationship between performance and its corresponding indicators and is easy to calculate payment road length (i.e. it encourages contractors to implement the works), is used. Two-step inspection (interim & monthly) is recommended. Set up several measures on the exemption from reduction. | <ul style="list-style-type: none"> Doubt that the practitioners will be able to conduct appropriate inspection work with a limited understanding, sample inspection was undertaken. |
| 6. Qualification for tenderer | <ul style="list-style-type: none"> Participation in PBC training is required. Classify ranks of contractors based on contract scale (road length, contract amount, etc.) | <ul style="list-style-type: none"> Recommend participation of training as a bidding requirement. |
| 7. Risk management | <ul style="list-style-type: none"> Guidance as considerations for PBC procurement. Measures on low price bidding prevention (Kenya). Setting items to be covered by PBC (see Kenyan PBC Guidelines). Basic procedures for the PBC work implementation (same as above). Weight adjustment for reduction rate (same as above). | <ul style="list-style-type: none"> Facilitating cost estimate method on the financial proposal, ensuring transparency and eliminating unsuccessful bidding. Eliminating breach of contract and delays in work. Eliminating Low price bidding and fraud. |

6.3 Classification of Performance Specifications

Performance specifications are classified into several types according to the features of the roads to apply PBC as shown in Table 6.3.1 and the JICA Version (draft) sets 4 classifications.

Table 6.3.1: Comparison of Classification of Performance Specifications

| | WB sample standard contract document (2006) | Kenya (PPRA standard contract document) | Laos (ADB project) | JICA Version (draft) |
|----------------|---|---|--|---|
| Pavement type | Paved and unpaved | Paved and unpaved | Paved (unpaved) | Paved and unpaved |
| Traffic volume | Paved: 4 levels Unpaved: 3 levels (Fair, Good, Very Good, Excellent) | Paved: 2 levels Unpaved: 2 levels (High, Standard) | Same to WB | Paved: 2 levels Unpaved: 2 levels (High, Standard) |
| Classification | 7 classes | 4 classes | 7 classes | 4 classes |
| Feature | <ul style="list-style-type: none"> Detailed settings for a wide range of road classes (Good) | <ul style="list-style-type: none"> Setting simple classification (Good) Selected by paved/unpaved and | <ul style="list-style-type: none"> WB document is partially modified and applied (Good) Relatively detailed settings according | <ul style="list-style-type: none"> 2 classifications on paved and unpaved (Good) 2 classifications on traffic volume (high & standard) (Good) |

| | WB sample standard contract document (2006) | Kenya (PPRA standard contract document) | Laos (ADB project) | JICA Version (draft) |
|--|---|---|--|---|
| | <ul style="list-style-type: none"> Selected by paved/unpaved and traffic volume (Good) Setting service level on typical damage (Good) Many classifications (No good) | <ul style="list-style-type: none"> traffic volume (Good) Setting service level on typical damage (Good) | to pavement type and traffic volume (Good) | <ul style="list-style-type: none"> 4 types of service levels are recommended, and which one to select is depending on the client's decision (Good) |

6.4 Composition of Performance Indicators and Setting of Payment Unit Price

Performance indicators must be set appropriately according to the grade of the contract roads. On the other hand, consideration should also be given to the ability of the contractor and ease of contract management. The indicator is hierarchically set as inspection items for the "desired condition" to accomplish service levels such as ensuring "comfort" and "durability", and is confirmed in monthly inspections. The indicators need to be set with due consideration of the relationship between "inspection items" and "payment unit price". According to the case study, the following 5 levels from "definition of the performance type" to "definition of the specification" were organized and examined.

| | |
|-----------------------------|--|
| Level 1 (Performance type): | Classified according to "Road Usability", "Road User Comfort" and "Road Durability" in general. |
| Level 2 (Road function): | Performance level set to achieve Level 1. For example, smooth and safe traffic, provision of traffic information, sufficient capacity of drainage facilities, etc. |
| Level 3 (Road element): | Road element that should be checked to achieve Level 2. |
| Level 4 (Damage type): | Specific damage, such as damaged guardrails or silted and blocked side ditches. |
| Level 5 (Specification): | Requirements and response times are always specified in pairs. The achievement of this item will be confirmed on-site. |

According to the above considerations, the configuration of the performance indicators is as follows.

- 5 levels hierarchy.
- Level 2, which is easy to inspect and has little risk to the client, is set as the payment unit price.
- A configuration that clearly classifies services and configured indicators.

6.5 Performance Indicator Items

Standard performance evaluation items are set based on the WB version, and some indicators are added from the following viewpoints with reference to a total of 51 case studies.

- Selected items are improved during operation based on the characteristics of the contract roads.

- (ii) Preparing 2 types of indicators namely "standard indicators" and "selective indicators" to be added depending on the actual situation is recommended.
- (iii) An easily measured indicator (minimum vehicle speed) was added.
- (iv) Added indicators corresponded to concrete pavement.
- (v) Added target facilities (e.g. medians, sidewalks, pedestrian bridges, street lights, construction signs, road markings, waste disposal, bridge surface drainage, ROW) will be covered by PBC.

6.6 Inspection and Payment Conditions

In PBC, based on the km/month fixed price paid when 100% of the required performance specified in the contract is achieved, the client and the contractor must jointly inspect the site on a regular basis (usually every month) to confirm the achievement degree. During the inspection, the locations and sections that do not meet the required performance are recorded on the inspection sheet as non-compliant road section length, and the reduced road length is calculated by the following formula.

$$\text{Payment amount} = \text{Unit price per km of } \Sigma \text{ item-}i \times \text{compliance road section length}$$

$$\text{Compliance road section length} = \text{contract road length} - \text{reduced road length}$$

$$\text{Reduced road length} = \text{non-compliance road section length} \times \text{reduction rate (on each facility)}$$

The JICA Version was created based on the following ideas.

- Implementation in a country with its own budget but with PBC little experience. Based on the Kenyan case, where inspections are relatively easy to conduct, this method is basically applying the concept and the calculation sheets of the WB sample documents and is a general method.
- Concerning the setting of inspection sections, it's necessary to clearly indicate the risks of evading inspections and the importance of cooperation with the road administration office. In addition, the Chilean case presented an opportunity to illustrate how to deal with risks.
- There are 2 inspections: an interim inspection and a payment inspection, and it is expected that the interim inspection will effectively function as a relief measure to the contractor.
- The Kenyan method (the same concept as the WB) is used as a basis for calculating the reduction road section length because of the ease of calculation and the ease of the reduction rate adjustment and recombination. It is also recommended that the reduction rates are set appropriately.

Chapter 7 Formation and Deployment of Technical Cooperation Incorporating PBC

7.1 Introduction

PBC already has more than 30 years of history and many countries have been attempting to introduce and develop it. Particularly in developing countries with limited organizational and financial resources, PBC has the potential to be an effective option, though not the only one, to improve their road maintenance system. JICA has been undertaking many technical cooperation projects in partner countries aimed at strengthening their respective road maintenance management capacities. This chapter examines the possibility and direction in the case of applying PBC in JICA technical cooperation.

7.2 Deployability and Advantage of JICA Technical Cooperation Project

While the ageing of road assets and their efficient renewal methods is becoming an urgent issue in many countries, if a road agency in a partner country considers introducing PBC to develop and/or upgrade its road maintenance system even though both the client and contractor have institutional and/or financial constraints, JICA will be able to present the effective introduction/implementation approach of PBC together with other methodologies and tools as part of a technical cooperation project.

(1) Deployability

- JICA can implement a project by involving relevant organizations in partner countries that have experience with PBC, such as:

Road administration, Legal, Procurement, Road Fund, Local entities, Private business registry departments and so on.

- JICA can suggest the most appropriate road maintenance method for each partner country by combining various methods.
- The draft standard specification for PBC developed by JICA is versatile and practical, making it easy to introduce in partner countries.

(2) Advantages

- A JICA expert can support the counterpart agency throughout the PBC implementation process, allowing for timely adjustments and modifications.
- The Project Design Matrix (PDM) outlines the goals and tasks/activities/inputs of each concerned party in the JICA technical cooperation project. The PDM can be modified or updated based on the actual situation and any changes in the project, contributing to the project's effectiveness.
- Small-scale PBC, directly managed by the Client and suggested by JICA, has the potential to be relatively easy to implement with little risk. Technical transfer is also directly provided to the Client, making it easier for the project's outcomes to be sustained after completion.

- JICA has accumulated exceptional achievements and knowledge in road maintenance training programs, which have been planned and implemented in many projects. These programs are more effective at addressing the needs of partner countries than other donor projects.
- Training program and pilot project for learning the operation method of the standard specification (draft) will be included in the package of the JICA technical cooperation project. This will allow the counterparts to deepen their understanding through practical activities in the project.
- Experts involved in JICA technical cooperation projects specialize in capacity development and technology transfer for their counterparts. If there is a gap in the scope of other donor projects and the capacity of the counterparts, the JICA project can support it through training and/or workshops.
- The use of DX, which incorporates Japanese technology, can improve the accuracy of inspections and work efficiency, potentially increasing the motivation of the counterparts. The trial introduction and implementation of DX can be included in the scope of the project.

7.3 Proposal on Implementation Process that Harmonizes the Situation of the Partner Country

It is presumed that there will be differences between countries regarding the introduction and development of PBC, as well as related legal systems and financial measures, in the partner countries. The implementation process of JICA technical cooperation project (Fig. 7.2.1), aims to respond flexibly to these issues and reach the sustainable implementation and development of PBC, and the work outlines in each step are described below.

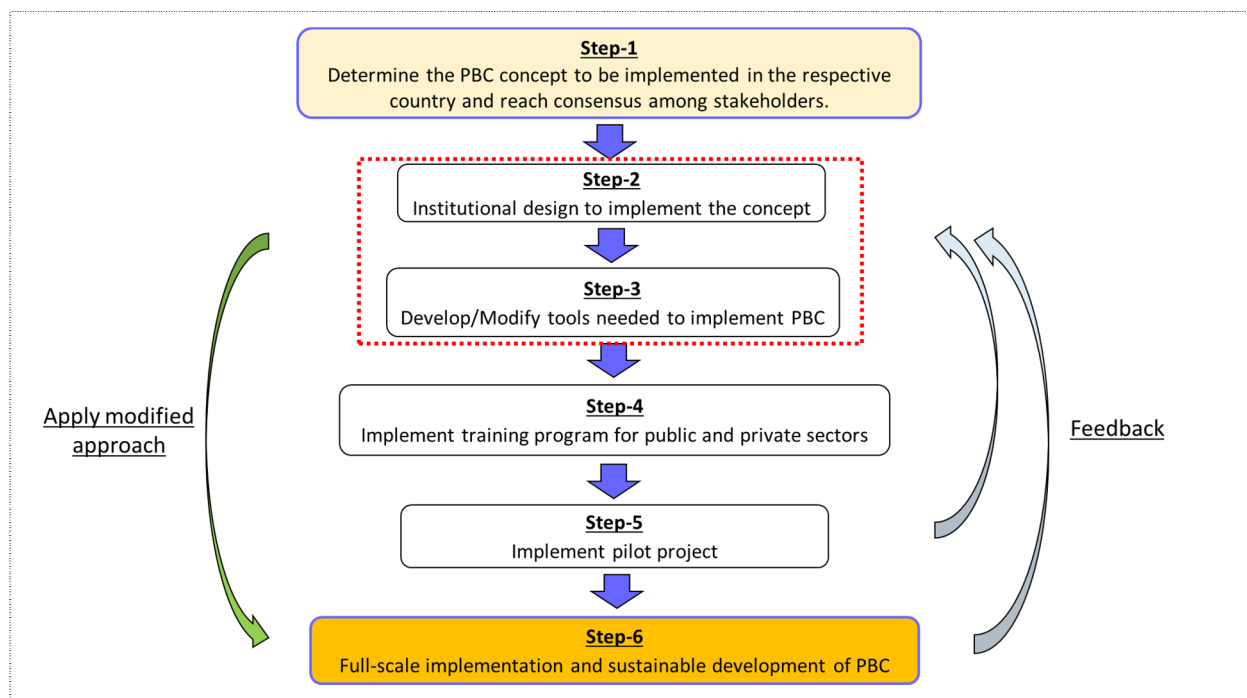


Figure 7.3.1: Implementation Process for JICA Technical Cooperation Project

【Work Outline of Each Step】

Step-1: Determining the PBC concept

The following topics shall be confirmed:

- | | |
|--|---|
| <ul style="list-style-type: none"> ✓ Roadmap for full-scale implementation ✓ Changes in contract type/rules ✓ Changes in the Client's role/responsibility ✓ Case studies (such as those from the World Bank) | <ul style="list-style-type: none"> ✓ Feasible and appropriate schemes ✓ Assessment of the Client's capabilities ✓ The importance of leadership, etc. |
|--|---|
-

Step-2: System design

The design should include the following elements:

- | | |
|---|---|
| <ul style="list-style-type: none"> ✓ Confirmation of compliance with the Public Procurement Act and make any necessary adjustments. ✓ Preparation of standard contract documents or designate reference documents. ✓ Determining the target road assets for PBC. ✓ Allocating responsibilities between the Client and the Contractor. | <ul style="list-style-type: none"> ✓ Determining the contract period, road length, required performance levels, etc. ✓ Planning a training program for the contractor. ✓ Reorganizing or establishing the necessary organizations/committees for implementation. |
|---|---|
-

Step-3: Tool design

The design should include the following elements:

- ✓ Preparation of tender documents.
 - ✓ Development of training materials and/or guidelines.
 - ✓ Enhancing the capacity of future leaders and trainers.
-

Step-4: Implementing the training program

The training will be conducted for the client first, followed by the contractor, to improve the understanding of PBC on both sides.

Step-5: Pilot project

A small-scale, short-term pilot project (approximately one year) will be implemented to allow the Client and Contractor to experience a PBC. Any issues or lessons learned during the project will be used to improve the process.

Step-6: Full-scale implementation

The full-scale implementation, using modified/updated design/tools, will be conducted. A feedback + improvement cycle will be established to ensure sustainable implementation and future development.

7.4 Direction of JICA Technical Cooperation

(1) Approach to Improvement of Road Maintenance Work

Figure 7.4.1 shows 4 approaches for work efficiency and improvement of road asset management.

- i. To improve the initial quality of infrastructure through appropriate design and quality control during the construction period.
- ii. To establish a road maintenance management cycle consisting of inspection, diagnosis, planning, repair, and recording.
- iii. To strengthen budget and organization management (financial resource system, budget allocation system, securing personnel, utilization of outsourcing).
- iv. To eliminate damage acceleration factors (control of overloaded vehicles, preventing illegal dumping, etc.).

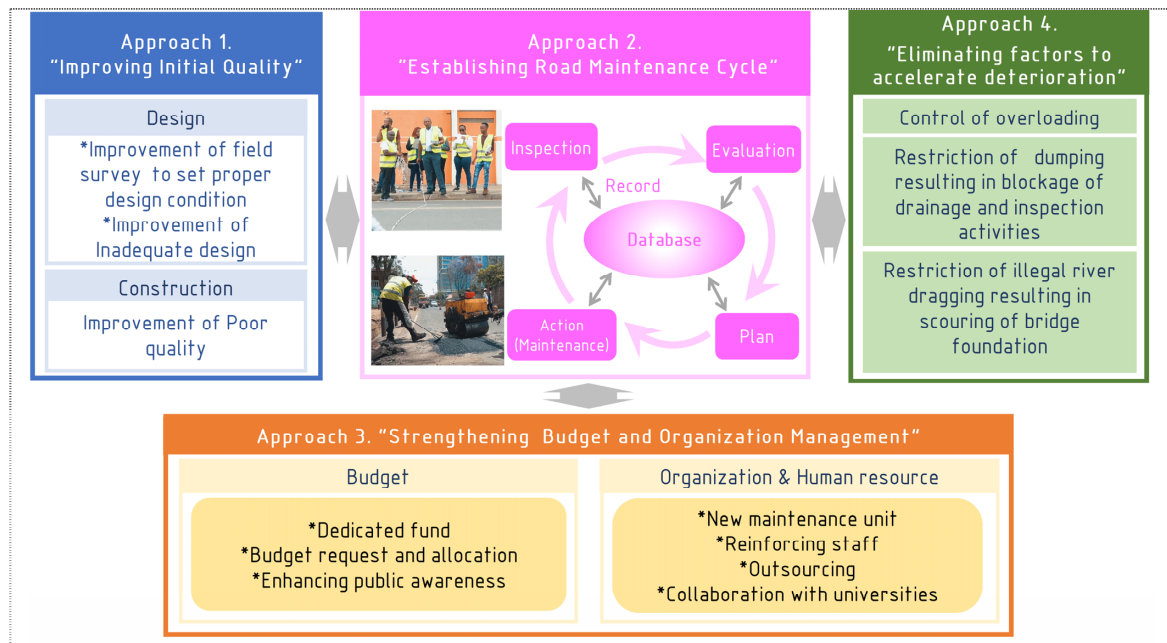


Figure 7.4.1: 4 Approaches for Improvement of Road Asset Management

(2) Positioning of PBC Component in JICA Technical Cooperation

- ✓ PBC is not an all-purpose tool that the maintenance system will surely improve by its introduction, but as studied and organized in the research, beneficial introduction results will be expected, if the appropriate system design is conducted, the client and the contractor accumulate their experiences and capabilities, and adequate budgetary measure is taken for it. Therefore, it would be appropriate to add PBC to one menu of organizational and system improvement approaches in JICA technical cooperation for the improvement of road asset management in future.
- ✓ In addition, as already mentioned in this report, while there are various types of PBC, it is necessary to carefully consider the local situation in each partner country (e.g. road conditions, organizational conditions, capabilities of local industries, etc.). Then the cooperation should be deployed and developed with an emphasis on the field-oriented PBC system design and the improvement of the capacities of the relevant parties, rather than prioritizing the principles.

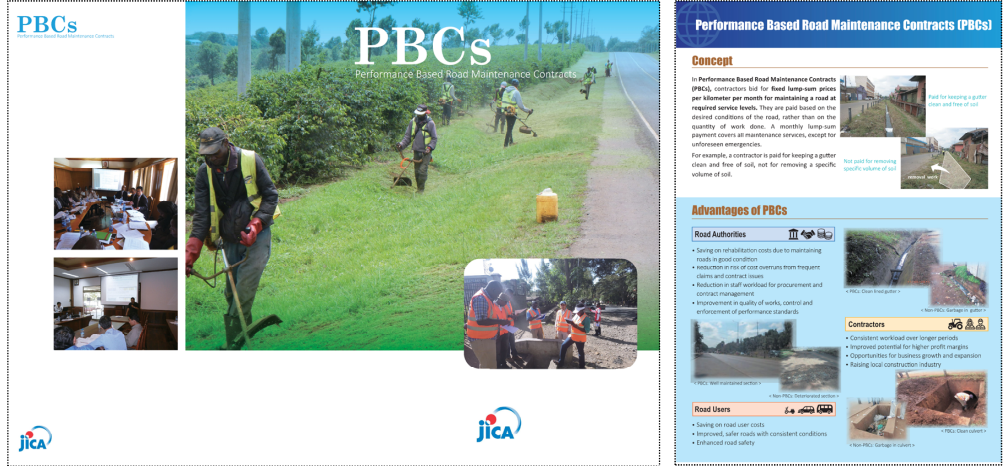
Chapter 8 Measures on Promotion of PBCs

8.1 PR Materials

(1) Leaflet

A leaflet was created to deepen the understanding of JICA technical cooperation incorporating PBC among partner countries and other donor agencies. Table 8.1.1 shows an overview and image of the leaflet.

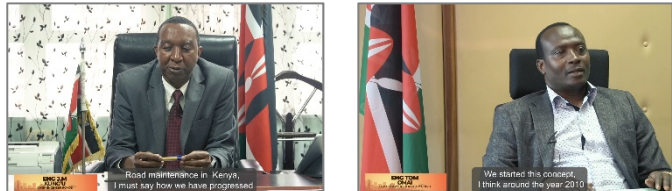
Table 8.1.1: Overview of the Leaflet

| | |
|----------------|--|
| Brief contents | <ul style="list-style-type: none"> * Concepts and advantages of PBC * Introduction of JICA technical projects (cases in Kenya and Laos) * Considerations when introducing PBC * PBC vs Conventional maintenance methods * PBC implementation process * Advantage of JICA technical cooperation, etc. |
| Style | A4 size 8 pages (Color) |
| Image |  <p style="text-align: center;">Front/Back cover Main text</p> |

(2) PR Video

A PR video was created with the aim of effective promotion of achievement and advantage of JICA technical cooperation among road agencies in partner countries. The video introduces the efforts during the introduction and deployment of PBC conducted in a technical cooperation project in Kenya, along with the impressions and opinions of former JICA experts, counterparts, and contractors. Table 8.1.2 shows an overview and image of the video.

Table 8.1.2: Overview of the Video


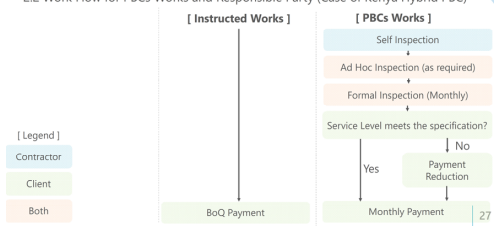
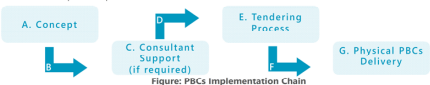
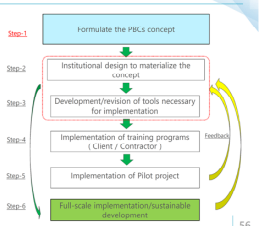
| Part | Contents |
|--|---|
| Part1: Background of the introduction of PBC | <ul style="list-style-type: none"> • General overview and benefit of PBC • Background of introduction in Kenya and current implementation status. • Interviewees: MOTIHUD & KRB  |

| Part | Contents |
|---|--|
| Part2: Introduction of the work on site | <ul style="list-style-type: none"> Interviewees: KeNHA, KeRRA, KWS and contractors    |
| Part3: History of PBC deployment | <ul style="list-style-type: none"> Interviewee: KIHBT    |
| Part4: Conclusion | <ul style="list-style-type: none"> Interviewee: Former JICA expert   |

8.2 Training Materials

Training materials were created to promote a basic understanding of PBC for use in lectures related to road maintenance technology to be held during the JICA training program. Table 8.2.1 shows an overview and image of the materials.

Table 8.2.1: Overview of the Training Materials

| | |
|-------------|--|
| Composition | Part 1: Overview of PBC Part 2: PBC Work methods/procedures Part 3: Consideration when introducing PBCs Part 4: Introduction to the JICA capacity building program |
| Image | <div style="display: flex; justify-content: space-between;"> <div style="width: 48%;"> <p>1. Outline of PBCs</p> <p>1.1 What Are Performance Based Road Maintenance Contracts?</p> <ul style="list-style-type: none"> Drainage maintenance: The contractor is paid for keeping the drainage clean and free of soil at all times (the outcome of his efforts), not for removing 2 cubic metres of soil from a drainage (his actual work output) in a certain month.  <p style="text-align: right;">9</p> </div> <div style="width: 48%;"> <p>2. Work Management under PBCs</p> <p>2.2 Work Flow for PBCs Works and Responsible Party (Case of Kenya Hybrid PBC)</p>  <p style="text-align: right;">27</p> </div> </div> <div style="display: flex; justify-content: space-between; margin-top: 20px;"> <div style="width: 48%;"> <p>3. Considerations when Introducing PBCs</p> <p>3.1 Issues and Solutions (World Bank report)</p> <p>Many of the failures are caused by problems in the initial stage, and it is appropriate to spend about 4 to 5 years from concept to Tendering process (A – E) including pilot project to promote understanding and prepare standard documents.</p> <ul style="list-style-type: none"> ✓ Concept: leader who fully understands PBCs within the agency to lead PBC projects ✓ Tendering Process: Discussions with the construction industry from the early stages disclosing information for appropriate bidding price ✓ Physical PBCs Delivery: Sufficient information disclosure and training programs for contractors prior to procurement  <p style="text-align: center;">Figure: PBCs Implementation Chain</p> <p style="text-align: right;">44</p> </div> <div style="width: 48%;"> <p>4. Capacity Building by JICA</p> <p>4.3 Implementation Process</p> <p>STEP-1: Formulate the PBCs concept</p> <ul style="list-style-type: none"> • Roadmap to the realization of PBCs • Understanding of contract forms and client roles under PBCs • Case studies (WB, etc.) • Feasible and appropriate schemes • Ability evaluation of both client and contractor • Importance of leadership, etc.  <p style="text-align: right;">56</p> </div> </div> |

8.3 Sample Standard Specifications

Based on the concept shown in Chapter 6, "Sample Standard Performance Specification for Road Maintenance Term Contract, JICA Version" was created. This specification is expected to be used in JICA technical cooperation projects in the future. Figure 8.3.1 shows the table of contents.

| Table of Contents | |
|--|-----------|
| WORKS AND SERVICES' REQUIREMENTS | 4 |
| Guideline for use of the sample performance specification | 1 |
| SECTION V A: SPECIFICATIONS | 3 |
| A: STANDARD SPECIFICATIONS | 3 |
| SECTION V B: PERFORMANCE SPECIFICATIONS | 4 |
| 1. Introduction on Service Level Categories | 4 |
| 2. Description of the Road | 5 |
| 3. Works and Services to be provided | 7 |
| 4. Compliance with Service Level Requirements | 9 |
| 5. Programme of Performance | 9 |
| 6. Service Criteria | 12 |
| 7. Self-Control Unit (SCU) | 13 |
| 8. Site Inspection and Patrolling/Reporting | 13 |
| 9. Monthly Statement | 14 |
| 10. Formal Inspection | 16 |
| 11. Handover Report | 17 |
| APPENDICES | 18 |
| Appendix A: Performance Standards for Paved High Road | 19 |
| Appendix B: Performance Standards for Paved Standard Road | 27 |
| Appendix C: Performance Standards for Unpaved High Road | 34 |
| Appendix D: Performance Standards for Unpaved Standard Road | 40 |
| Appendix 1: Defect Detection/ Rectification Record Form | 46 |
| Appendix 2: Daily Work Record Form | 47 |
| Appendix 3: Daily Patrol Record | 48 |
| Appendix 4: Monthly Photo Record | 49 |
| Appendix 5: Incident Condition and Activity Report | 50 |
| Appendix 6: Detail Self Inspection Result Record Form (Paved Road) | 51 |
| Appendix 7: Payment Reduction Calculation Table | 52 |
| Appendix 8: Monthly Statement | 54 |
| SECTION V C: PERFORMANCE SPECIFICATIONS AND SPECIAL | 55 |
| SECTION V D: SAMPLE OF BILL OF QUANTITIES | 56 |

Figure 8.3.1: Table of Contents of Sample Standard Specifications

Chapter 9 Conclusion

9.1 Outline and Purpose

In Chapter 1, major issues in the research were put forth and in each subsequent chapter, a description of how this study and analysis were carried out to improve or solve them. Here, the research content is organized and presented as conclusions.

9.2 Theme and Findings through Study and Analysis in the Research

【Theme】 (Re-posting of 1.3 (2))

There are already cases of PBC introduction in many countries under the leadership and assistance of the WB, but there are still issues with its establishment after the end of assistance. This research will consider (i) how JICA Technical Cooperation can contribute in order to locally establish PBC to be introduced with donor's assistance in line with the actual situation in each recipient country, and (ii) how PBC can be applied to complement the organizational vulnerability which comes with conventional technical cooperation of road maintenance.

【Findings through the Research】

Table 9.2.1 shows the new findings and/or re-findings through the research in contrast to the generally well-known advantages of PBC.

Table 9.2.1: New Findings and/or Confirmations through the Research in Contrast to Well-known Advantages of PBC

| 【Well-known advantage】 | 【Findings/Confirmations】 |
|--|---|
| <p><u>Advantages for the client (Road administrator)</u></p> <ul style="list-style-type: none"> ● Reduces the workload of staff in the office and field. ● Reduces road maintenance budget <p><u>Advantages for the contractor</u></p> <ul style="list-style-type: none"> ● Increases profitability and business opportunities through creativity and technical innovation ● Secures long-term employment <p><u>The advantage for road users</u></p> <ul style="list-style-type: none"> ● Secures good road condition | <p><u>Advantages for the client (Road administrator)</u></p> <ul style="list-style-type: none"> ● The case study results in Japan and USA confirmed cost reduction for the client, and the same advantage was confirmed during interview surveys in other research countries. ● A 9-year simulation of the total benefit comparison between PBC-type maintenance and conventional maintenance on the same route using HDM-4 in Kenya showed that the former had 24% more benefits than the latter. <p><u>Advantages for the contractor</u></p> <ul style="list-style-type: none"> ● The USA study results confirmed technological innovation and improved profitability of the contractor, and interview surveys in other countries concurred. ● Regarding the improvement and stabilization of employment, the advantages were confirmed through literature/interview surveys in all the research countries except Japan. Particularly in Kenya, it was confirmed that there were efforts to eliminate entry barriers against companies with weak financial bases and insufficient |

| 【Well-known advantage】 | 【Findings/Confirmations】 |
|------------------------|--|
| | <p>experience (budget/contract allocation for the companies mainly composed of light works).</p> <p><u>The advantage for road users</u></p> <ul style="list-style-type: none"> ● Road conditions (IRI values, road elements, etc.) on the PBC routes were better than those on non-PBC routes in accordance with comparative surveys in the research countries. |

Table 9.2.2 also shows new or confirmed efforts made by each country through the research, as well as proposals for the issues mentioned in the study reports issued by donor agencies.

Table 9.2.2: Findings/Re-findings and Proposals for Issues of PBC mentioned in Donors' Reports

| 【Donors' reports】 | 【Findings/Confirmations and proposals】 |
|--|--|
| <p>● In developed and middle income countries, PBCs have been developing and expanding without external donations, but in developing countries, there were many cases that continuous implementations were terminated with the end of donors' assistance. This is because the current legal system and budgetary measures are not in harmony with the PBC contract model. In addition, if the government agency lacks an understanding of PBC and/or is reluctant to introduce it, implementation is unlikely.</p> | <p>● Although Kenya and Laos are developing countries, they are implementing PBC with their own budgets.</p> <p>《Kenya》 The government established a Road Fund and decided to “outsource” road maintenance work. And JICA technical cooperation project introduced PBC as a type of “term contract” in the outsourcing method. Furthermore, revisions were made to the Public Procurement Law in line with PBC implementation.</p> <p>《Laos》 The counterpart staff, who have been engaged in PBC projects from the initial stage of introduction and have accumulated and improved their experience and skills in PBC, were promoted to the policy-making level within the ministry. At the time of outsourcing, they attempted to convert from the conventional method to PBC for economic advantage.</p> |
| <p>● In many cases, the understanding of PBC is insufficient for both the client and the contractor.</p> | <p>● In Kenya and Laos, PBC was included in the JICA technical cooperation projects for road maintenance work. Major activities in the projects are outlined below.</p> <p>《Kenya》 <u>Phase 1</u> The standard contract documents and the manuals necessary for implementing simple PBC as a pilot project were created and utilized in the project.</p> <p><u>Phase 2</u> Based on the lessons learned through the pilot project, efforts were made to create PBC guidelines for contractors, develop training programs, and train instructors through the Training of Trainers (TOT) program. These programs and teaching materials were handed over to KIHBT (i.e., the training implementation organization).</p> <p><u>Phase 3</u> Utilizing and improving the teaching materials handed over in Phase 2, KIHBT took the lead in conducting training for the client and the contractor. Also, in order to ensure the economic</p> |

| 【Donors' reports】 | 【Findings/Confirmations and proposals】 |
|---|---|
| | <p>independence of KIHBT, the training for the contractors is charged, and attendance of training is added as a requirement for participation in PBC bidding.</p> <p>《Laos》</p> <p>A pilot project commenced in 2012 with the support of the WB, but the training program for the client and the contractor was not appropriately implemented, and therefore the understanding and knowledge of the PBC on both sides were insufficient. Given this, support was requested for JICA technical cooperation project, which activities were in progress at the time. The project mainly focused on the following items for support.</p> <ul style="list-style-type: none"> - Training on the basic content and method of PBCs - Improvement of inspection forms - Development of guidelines for PBC management - Considering contractors who are unfamiliar with PBC, the project proposed a contract model that (i) narrows down the facilities to be covered by PBC and (ii) includes initial rehabilitation work to clarify liability for management defects. |
| <ul style="list-style-type: none"> ● Efforts to avoid bearing excessive risks to the contractor are important. | <ul style="list-style-type: none"> ● Efforts for risk management observed at each stage of PBC implementation in the research countries mentioned in Chap 5 (Table 5.3.1) are shown below. <p><u>Preparation stage</u></p> <ul style="list-style-type: none"> - Coverage of PBC was expanded after quantifying the risks through repeated discussions and trial and error among the concerned parties. (USA) - For the contractors who are unfamiliar with PBC, the contract was limited to maintenance work excluding road surface. (Kenya) - Since there are variations in the condition of the road surface, maintenance on the road surface was not included in the PBC while maintained by unit price and work quantity method. (Kenya) - Majority of pavement types in Laos was DBST with insufficient durability, and the existing pavements were severely degraded, so initial rehabilitation work was carried <p><u>Pilot stage</u></p> <ul style="list-style-type: none"> - If the contractor was not capable to estimate the bid price appropriately, there were risks |

| 【Donors' reports】 | 【Findings/Confirmations and proposals】 |
|---|---|
| | <p>of non-fulfilment of work and unfavourable contract termination due to lack of funds. Given this, JICA technical cooperation project developed a cost estimate manual and applied it through the pilot projects for brushing it up. (Kenya)</p> <p><u>Implementation stage</u></p> <ul style="list-style-type: none"> - Regarding overloaded vehicles, the contractor took pictures of the vehicles and reported to the client, however no effective solution has been reached. (Laos) - If the inspection failed due to illegal dumping by residents and/or drivers, exemption/mitigation measures on payment reduction were taken. (Laos, Kenya, Chile) - Areas/road segments with a high risk of landslides occurrence, ground subsidence, floods, etc. are excluded from the PBC coverage sections. (Philippines) <p><u>Further development stage</u></p> <ul style="list-style-type: none"> - It is important to confirm the initial condition of the road and the factors that contribute to pavement deterioration (e.g. overloaded vehicles, traffic volume, etc.) before the start of work, as the contractor's risk increases when introducing Pure PBC. (Kenya) |
| <ul style="list-style-type: none"> ● Depending on the scale of the contract (road length, contract period, work content, etc.), the assumed requirements for the contractor differ. ● In developed countries, there is a sound competitive environment between companies, so it is easy to establish a PBC. | <ul style="list-style-type: none"> ● As the market expanded, many companies tried to enter the market. However, since a high level of know-how is required to carry out the work, companies that do not have it were gradually weeded out, and as a result, contract agreements are currently concentrated in the 4 major companies. In addition, these companies sometimes partially outsource their work to local companies to improve efficiency while maintaining quality. (USA) ● In line with the government's policy to support small and medium enterprises, a system was designed to subdivide and outsource contract lots so that even micro-enterprises could easily enter the market. On the other hand, a system is in place to prevent mismatches by stipulating the level of contractors subject to contracts for each client according to the company category (the maximum amount allowed for one contract). (Kenya) ● When designing the PBC system, it is appropriate to specify the facilities and activities to be covered by PBC based on the road conditions and/or the technological capabilities of potential contractors. |

| 【Donors' reports】 | 【Findings/Confirmations and proposals】 |
|---|---|
| <ul style="list-style-type: none"> ● WB's sample documents have a track record of being widely used as a template for PBC contract documents of other donors' projects including ADB, but they cannot be applied as they are in each country, and they require many corrections and additional descriptions for practical applications. This is one of the obstacles against promotion of PBC. ● When setting performance standards, there were many cases in which the consultants in charge of designing the system arbitrarily set the standards without relying on the results of review and analysis of past cases. And therefore, the standards set did not match to actual situation (e.g. too difficult inspection method, excessively high/too low required values, etc.), which also hinders the promotion of PBC. ● As mentioned in Chapter 2, it is not appropriate to set response time (RT) on all items because there are concerns about disadvantages (i.e. changes in the behaviour of the contractor and an increase in the workload of the client). | <ul style="list-style-type: none"> ● The performance indicators in the Draft PBC Standard Specifications (JICA Version) are set based on the following concepts. This is highly flexible and versatile, as it is composed so that indicators can be selected depending on local conditions. <ul style="list-style-type: none"> (i) Selected items are improved during operation based on the characteristics of the contract roads. (ii) Preparing 2 types of indicators namely "standard indicators" and "selective indicators" to be added depending on the actual situation is recommended. (iii) An easily measured indicator (minimum vehicle speed) was added. (iv) Added indicators corresponded to concrete pavement. (v) Added target facilities to be covered by PBC. ● Although it is recommended that the inspection be carried out on the entire road sections, in consideration of the balance between contract road length and workload to the client, it is also proposed to carry out an inspection in sample sections as an option. ● In the JICA Version, the performance indicators to be inspected are set at level 2 (road function: flat and safe driving, good visibility, etc.). This means that all level 3 items (road element: pavement, shoulder, etc.) being satisfied is a payment condition. In this method, even if only one indicator item in level 3 is not satisfied, the corresponding road section will be disqualified, so the inspection will be a "negative check". Performance achievement is also judged by "Pass" or "Fail" for each item, making the on-site confirmation work simple and easy, and since there are not many inspection items, it is easy to calculate the payment reduction. ● While recognizing the risk of easily setting the RTs, based on the case of Kenya, where the PBC implementation is proceeding smoothly with a local budget, the JICA Version will implement inspections twice (interim and payment), the interim inspection is used as a substantial relief measure (payment reduction will be exempted if non-compliance items in the interim inspection are corrected and confirmed). |

| 【Donors' reports】 | 【Findings/Confirmations and proposals】 |
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| <ul style="list-style-type: none"> ● Issues and their solutions at each stage during the PBC implementation are summarized in Chapter 5. | <ul style="list-style-type: none"> ● Issues and their countermeasures at each stage in the research country are also summarized in Chapter 5. In the particular Kenyan case, examples of the efforts for establishment and expansion are shown below. <ul style="list-style-type: none"> - Because there were concerns about increased risk on the contractor due to the expansion of Pure PBC, it was decided that Pure PBC be only applied to roads that have been newly constructed or improved; whose performance was fully restored. - Due to the rapid increase of PBC, there was concern about the lack of capacity on the contractor side. Systems such as subdividing the contract lot and enhancing training systems were created to allow participation of small-mid scale contractors and/or contractors with little PBC experience. |
| <ul style="list-style-type: none"> ● Other matters that were not paid attention in the past, but should be referred when considering road asset management incorporating PBC in the future. | <ul style="list-style-type: none"> ● Positioning of PBC Component in JICA Technical Cooperation (Chapter 7) <p>In technical cooperation projects with capacity building for road maintenance incorporating PBC, there are 2 possible approaches as follows.</p> <ul style="list-style-type: none"> (i) Setting a project purpose focusing on introducing and establishing PBC. (ii) Positioning PBC as one of the achievements or activities aiming to strengthen the current system by entrusting it to the private sector. <p>In contrast to (i), which has a longer-term perspective and focuses on activities related to PBC, (ii) is considered to have limited input and activities for PBC.</p> <ul style="list-style-type: none"> ● To explore the possibility of collaboration with other donors' projects and implement technical cooperation projects. ● To ensure the economic independence of the training institution and secure sustainable implementation of the training programs, the programs should have a fee. ● A Proposal regarding the implementation process of the technical cooperation project tailored to the partner country situation (Chapter 7) |

【Donors' reports】

【Findings/Confirmations and proposals】

- The environment surrounding PBC varies between countries, and thus we propose a sustainable PBC implementation that supports its development while responding flexibly to specific differences.
- The tools and training programs necessary for implementation developed through each step in pilot projects and later full-scale PBC implementation, and the issues collected from them will be used as feedback, with further clarifications and improvements made. It is important to use these to achieve sustainable implementation and future development.
- Donors mainly provide financial assistance for large-scale PBCs, generally leaving small-scale PBCs to be funded locally. However, to establish a PBC, it is considered effective to implement a small-scale PBC under the direct management of the client with its own budget. JICA can then provide support through technical cooperation in such cases. (Chapter 7)
- A training program and pilot project for learning the standard specification (draft) operation method will be included in the package of the JICA technical cooperation project. This will allow the counterparts to deepen their understanding through practical activities in the project. (Chapter 7)
- PBC is not the only tool but the maintenance system will surely improve by its introduction, as seen by its beneficial preliminary results when the appropriate system design is put in place, experience and capabilities of the concerned parties are accumulated and developed, and supported by an adequate budget. Therefore, adding PBC to the JICA technical cooperation for the improvement of road asset management in future is recommended. (Chapter 7)
- When JICA supports the introduction of PBC through technical cooperation, creating a system that allows the client to utilize the data collected and accumulated by the contractor will contribute to the sophistication and refinement of medium to long-term maintenance planning.

9.3 Considerations on PBC system design

- ✓ To reduce the contractor's risk burden, it is important to implement initial repair work under a separate contract and then apply a hybrid PBC appropriately.
- ✓ An initial determination of the contents of the PBC (Road length, PBC items and required performances, payment reduction rate, contract period, payment frequency, etc.) is necessary.
- ✓ When developing and expanding PBCs, it's important to create a system that enables the utilization of road funds.
- ✓ The responsibilities between the client and the contractor should be divided and clearly indicated in the bidding documents.
- ✓ The data and information provided by the client to the bidders when distributing the bidding documents should be refined and standardized.
- ✓ The variations in the items consisting of PBC and the underlying factors found through the research will be good references when designing subsequent PBCs.

9.4 Approaches on Assistance of Road Maintenance Technology under JICA Technical Cooperation (Draft)

- ✓ Positioning PBCs as one of road maintenance methods in JICA technical cooperation.
- ✓ Recognizing PBC as one of the forms of "term contracts".
- ✓ Confirming the financial resources that the partner country intends to utilize (local or external funds).
- ✓ Considering an approach to implement PBCs managed directly by the client (i.e. road agency).
- ✓ Adapting the starting point and implementation method of PBCs flexibly according to each partner country's local conditions and restrictions.
- ✓ Promoting the capacity building of both the client and the contractor in a well-balanced ecosystem.