Part IV

Bridges and Culverts Reconstruction Project

18. SELECTION OF BRIDGES AND CULVERTS

(1) Background and Project Objectives

The on-going Emergency Road Rehabilitation Project (ERRP) being undertaken by the Ministry of Transport and Roads (MTR) focuses on the improvement of the 65km urban roads with asphalt concrete pavement but does not include the rehabilitation or reconstruction of bridges and culverts.

The Bridges and Culverts Reconstruction Project is then formulated for seventeen bridge locations with the following objectives:

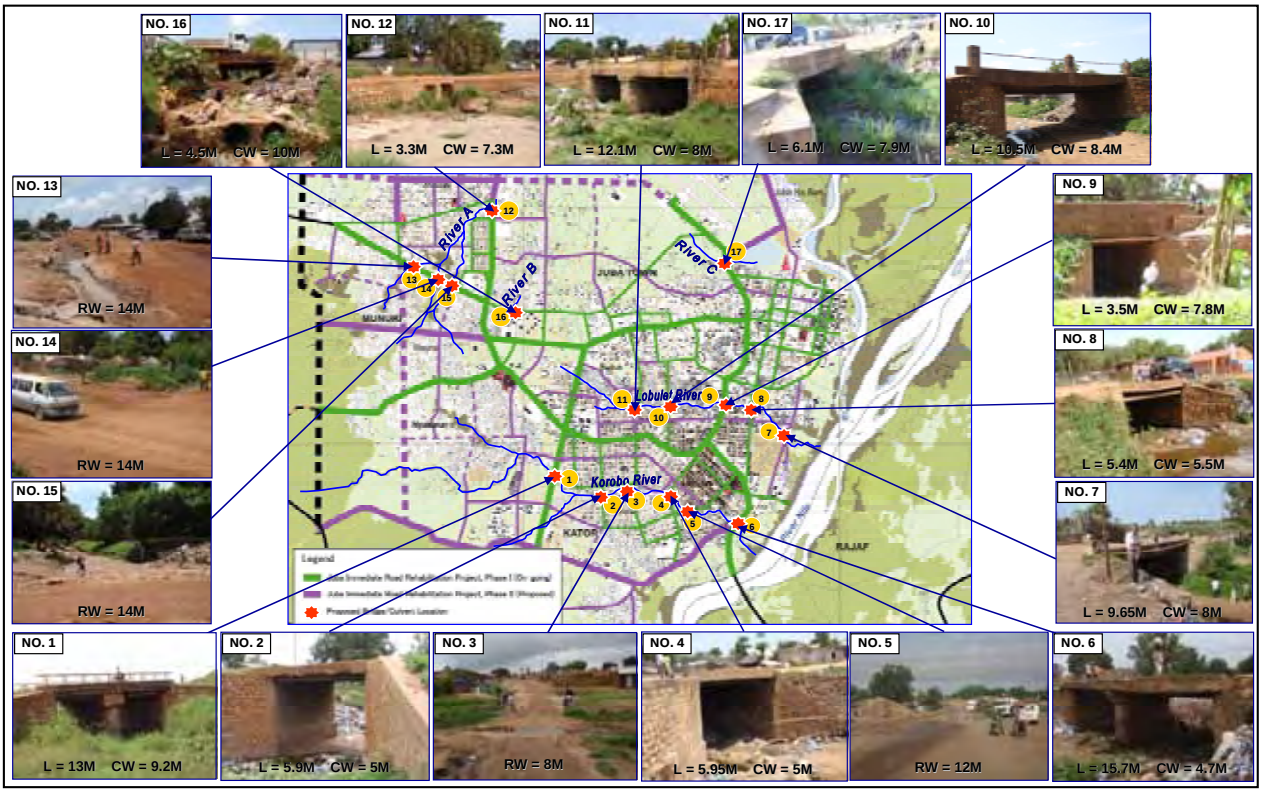
- improve mobility and accessibility within Juba by providing fix links in places where roads cross rivers and streams, making the roads accessible throughout the year,
- improve the road capacity by providing traveled way/carriageway with the same width as the road section,
- enhance traffic movement and safety by providing smooth transitions in the horizontal and vertical alignment of the roads at the bridge locations,
- separate motorized with non-motorized transport modes by providing sidewalks with sufficient width, and
- improve the structural safety by reconstructing bridges and culverts with sufficient capacity to resist the increasing live loads and loads due to natural calamities.

(2) Existing Conditions

The proposed 17 locations cover 5 river basins over arterial and collector roads with the following existing conditions:

- all bridge openings are found to be insufficient with freeboards less than 1m and flood overflows on banks noted,
- all carriageways are noted to be narrower than the road carriageways with most bridges having only one lane, thus less capacity than the road,
- bridge centerlines are offset from the road centerlines increasing risks for traffic accidents,
- sidewalks are not provided rendering safety risks for pedestrians and non-motorized transport modes,
- bridge structures are old with decks not sufficient for increasing live load demands and substructures not resistant to large ground excitations, and
- location without structures are not passable during heavy rains.

Condition of Existing Bridge and Culverts



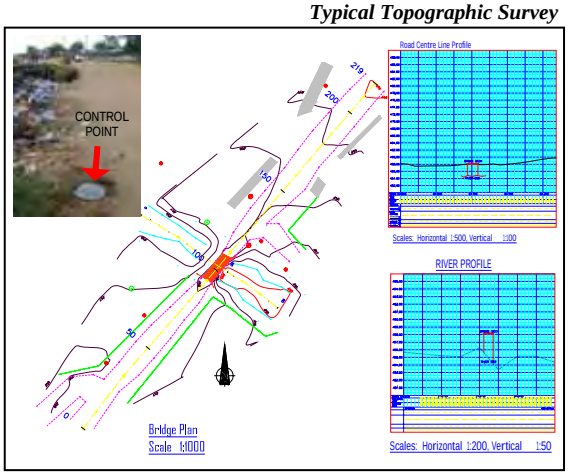
19. PRELIMINARY PLAN AND DESIGN

(1) Natural Condition Survey

Preliminary investigations were conducted at the project formulation level as follows:

- Topographic Surveys for the seventeen (17) bridge sites including establishment of control points, road centerline and profile survey, road cross-section survey, river cross-section survey, and road facilities and structures survey.

Typical Topographic Survey



- Geotechnical Surveys with a total of four boreholes at different locations spread for the 17 sites to determine the basic soil profile at site.
- River Condition and Flood Discharge preliminary investigation done to determine approximate flood level and river discharges.
- An Initial Environmental Examination (IEE) was carried out for the different locations with initial evaluation indicating few impacts and mostly desirable impacts to the environment.

IEE Evaluation for Bridges and Culverts

Environmental Elements	Evaluation
• Social Environment	- very small impact on involuntary settlement since bridge sites are on existing roads, - other aspects have desirable impacts – "E" including generation of employment, social infrastructure and services improvement and improvement in community life.
• Natural Environment	- impacts are evaluated as "D" (very few impacts)
• Pollution	- impacts are evaluated as "D" (very few impacts) with air pollution impact evaluated as "E" (desirable) due to reduction of dust.

(2) Bridge/Culvert Opening, Span Length and Bridge Length

The span length, bridge length and bridge/culvert openings are decided based on:

- anticipated design flood discharge and flood level supplemented by past experience on flood,
- the bridge proposed opening shall not constrict existing river width and shall at least be equal or greater than the existing,
- freeboard heights shall be maintained as: 1.0m for bridge and 0.60m for culvert, and
- for bridge opening equal to or less than 18m, a one-span bridge is proposed to avoid piers on river.

(3) Bridge Cross-Sections

The bridge cross-section is decided by:

- bridge deck cross-sections shall be based on the road functional class maintaining the curb-to-curb road width,
- the bridge shall be designed to accommodate the on-going road rehabilitation project and the requirements for the road functional class,
- when parking lane is provided in the on-going road rehabilitation project, additional lanes shall be provided on the bridge to consider future road widening, and
- provisions for future widening shall be considered where bridges are designed to accommodate only the on-going road rehabilitation project road section due to right-of-way and social impact problems.

(4) Bridge Type

The choice of material and structural system is based on:

- Local available materials and technology – use of reinforced concrete structure which is easier to construct and requires minimal maintenance.
- The structural system shall be able to resist anticipated loads including truck/live loads and forces due to natural calamities.
- The structure type shall be:
  - RC box culvert when opening is less than 4m.
  - RC Portal and RC Girder bridge when bridge length and opening is 10m or greater.

- Spread footing is used for foundation when the bearing layer is shallow, otherwise piles are proposed.

(5) Proposed Bridges and Culverts

The proposed bridge configuration and types considering all items discussed for bridge planning and design are presented in the table of proposed bridges and culverts.

(6) Bridge and Culvert Prioritization

The bridge and culvert construction priority and importance as shown in the table of proposed bridges are decided based on:

- Road Functional Class,
- Existing Structural Stability,
- Traffic Functionality,
- Hydraulic Risk,
- Environmental/Social Impact,
- Harmony with ERRP, and
- Impact to Society and Economy in Case of Bridge Collapse.

(7) Urgent Bridges

Bridges with priority ranks A and B are considered bridges for urgent implementation, which includes:

- Priority "A" Bridges – Bridge Nos. 6, 9, 12
- Priority "B" Bridges – Culverts Nos. 13, 14, 15 and Bridge No. 1

(Bridge No. 1 is excluded from the Urgent Bridge Reconstruction due to budget limitation)

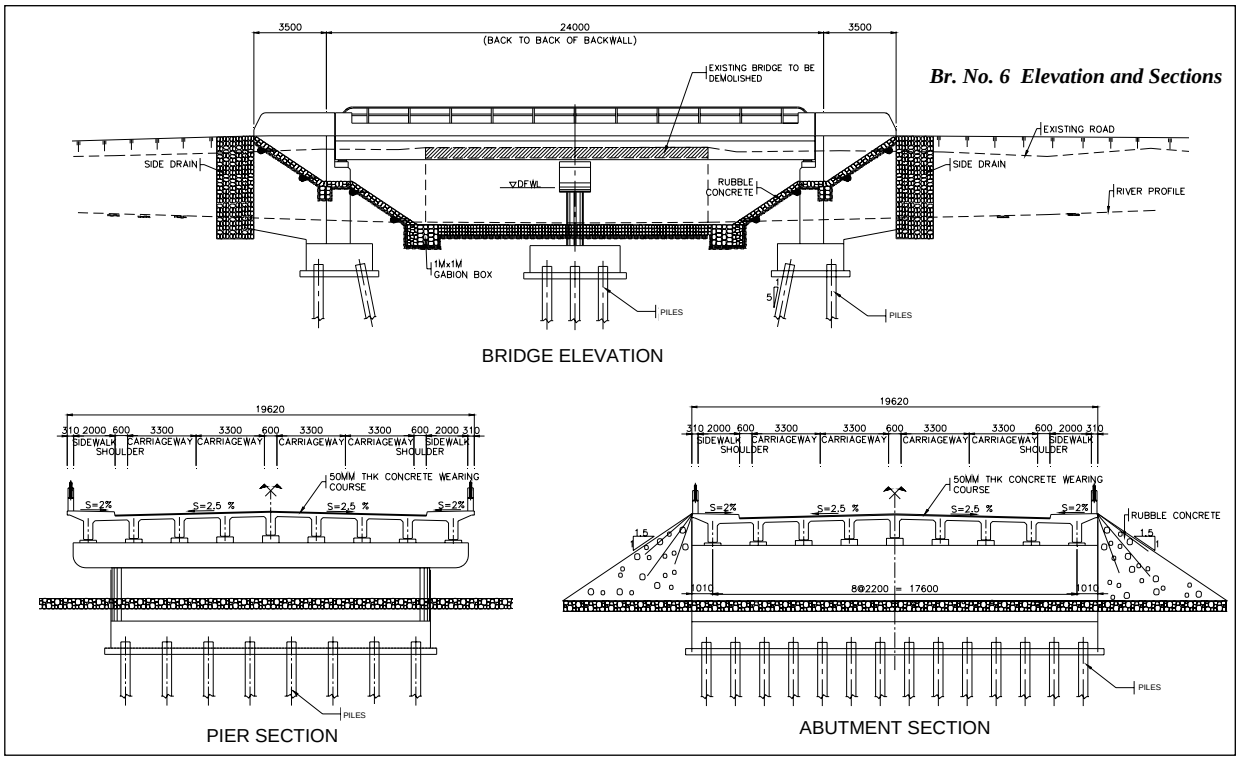
Proposed Bridges and Culverts

Br. No.	Type	No. Lanes	Length (m)	Width (m)	Priority Rank	Cost ($Million)
1	RCG	4	12	19.62	B	2.449
2	RCG	4	12	19.62	C	2.512
3	RCG	2	12	12.42	C	1.947
4	RCG	4	12	19.62	C	2.754
5	RCG	4	18	19.62	C	3.493
6	RCG	4	24	19.62	A	4.038
7	RCPB	2	10	15.22	C	2.289
8	RCPB	2	10	12.42	C	1.717
9	RCG	4	12	22.72	A	3.038
10	RCPB	2	10	12.42	C	1.508
11	RCPB	2	10	12.42	C	1.505
12	RCG	2	18	15.22	A	2.938
13	RCBC	2	22	18.00	B	0.780
14	RCBC	2	20	18.00	B	0.662
15	RCBC	2	20	18.00	B	0.813
16	*Included in the Urgent Road Rehabilitation Project					
17	RCBC	2	18	17.2	C	0.786

Notes: 1. RCG – Reinforced Concrete Girder Bridge
2. RCBC – Reinforced Concrete Box Culvert
3. RCPB – Reinforced Concrete Portal Bridge
4. Bridge with Priority Rank A and B are bridges for Urgent Bridge Reconstruction

The Exchange of Notes between the Government of Japan and the Government of National Unity was signed on November 19, 2009 for the Construction of the urgent 3 bridges and 3 culverts.

Br. No. 6 Elevation and Sections



PART V

CAPACITY DEVELOPMENT THRU PILOT PROJECT

20. 1ST PILOT PROJECT IMPLEMENTATION

(1) Objectives

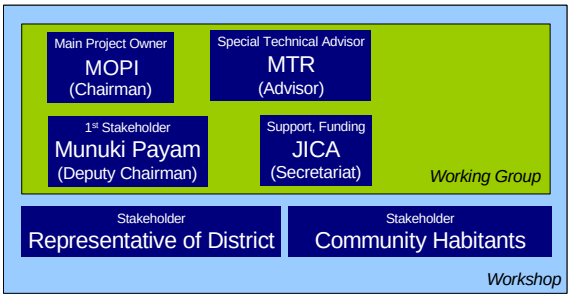
To reinforce the capacity for road administration in Juba, an actual project implementation is carried out thru pilot project with the MOPI and the MTR with the following objectives:

- to build an awareness on the importance of road maintenance by the corresponding agency,
- to develop within MOPI the series of knowledge and skills in planning, implementation, monitoring, and evaluation of maintenance works for road infrastructures,
- to improve the capacity on implementing road maintenance projects efficiently within own limited budget, and
- to generate employment within the community thru labor based road maintenance execution.

(2) Working Group (WG)

A working group, consisting of MTR, MOPI and the Munuki community, was organized to give directions and oversee the overall implementation of the pilot project. The activities of the WG include planning for the pilot project, technical discussions on design, project execution and supervision and workshops for Munuki community.

Pilot Project Working Group

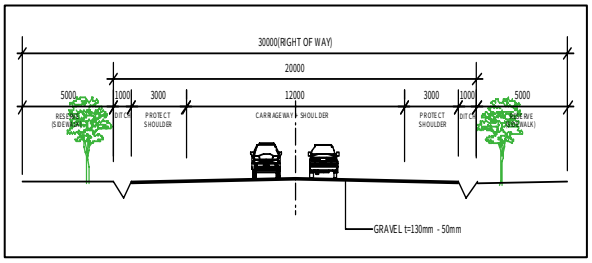


(3) Project Components

The target Pilot Project is Resurfacing of 770m local road from Munuki market with the following project components:

- **Road Description**:
  Road Class : Local Street
  ROW : 30m
  Cross-Section : 12m carriageway, 6m shoulder, 2m ditch
- **Resurfacing**:
  - Site clearing and regrading,
  - Road resurfacing with 130mm-50mm gravel sub-base course material
- **Drainage**:
  - Provision of 1m wide by 0.8m deep lateral earth ditch,
  - 600mmϕ RC pipe culverts on access road crossings and
  - 900mmϕ RC pipe culverts for road cross-drainage
- **Cost**:
  The total project cost amounted to US$ 170,000.

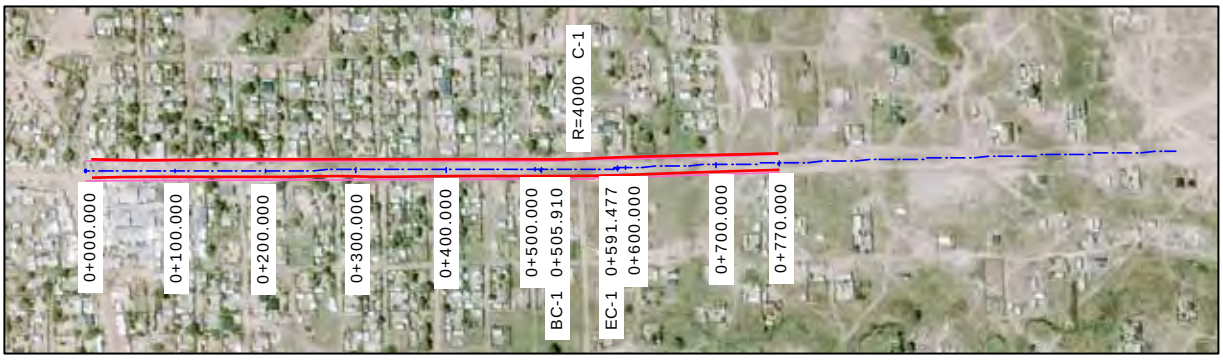
Typical Road Cross-Section



(4) Implementation Schedule

The pilot project started with the establishment of the working group in 2008. The project site was selected from a list of candidate sites considering the existing conditions and policy for pilot project. The actual implementation of the pilot project works started in June and completed on September of 2009. Project evaluation and feedback was done in October 2009.

Pilot Project Road



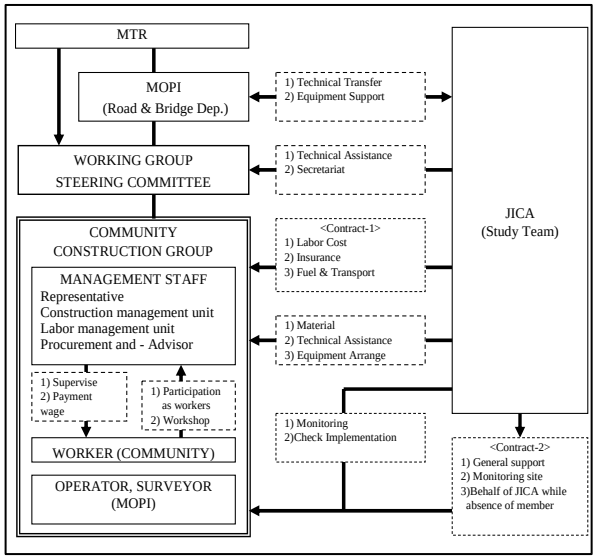
Pilot Project Overall Implementation Schedule

Work items	2008		2009										
	11	12	1	2	3	4	5	6	7	8	9	10	11
Establish for W/G													
Study of current situation of roads in Munuki													
P/P Policy													
Decision for Project Site													
Design and Cost Estimation													
Preparing the P/P Implementation Plan													
Implementation of P/P (inc. Preparatory works)													
Inspection and Evaluation for State-Road in Munuki													
Evaluation for P/P and Feedback to C/D Plan													

(5) Organization

- The Pilot Project was implemented by the Community Construction Group (CCG) consisting of representatives from the MTR, Road and Bridges Department of the MOPI and the Munuki Community.
- The management staffs, operators of equipment and surveyors of the CCG were basically members of the working group while unskilled workers were taken from community.
- The role of the organization, policy making, technical guidance and equipment rental were covered by the MTR while the overall supervision of the project was covered by MOPI.
- Technical support, supervision and fund support (wage, materials, others) were covered by JICA.
- Labor and safety management were taken from the community.
- The CCG consists of seven (7) members from the MTR, the MOPI and the Community while the 20 unskilled labors were recruited from the community.

Pilot Project Organization



(6) Target Capacity Development in Pilot Project

The pilot project basically focused on the capacity development of the MTR, the MOPI and the Community in road maintenance works with the different skills and knowledge as shown in the table targeted for the capacity development.

CD Targets in Pilot Project

Category	CD Items	MTR	MOPI	Community
Planning	Site Selection	○	◎	○
	Design & Cost Estimate	○	◎	
	Implementation	○	◎	
Construction	Schedule Management	○	◎	
	Quality Management	○	◎	
	Accomplishment Management	○	◎	
	Budget Control	○	◎	
	Labor Management	○	○	◎
	Equipment Management	○	◎	
	Safety Management	○	○	◎
Community Activities	Workshop	○	○	◎
	Labor Recruitment		○	◎

◎ *Main target organization,* ○*Sub target organization*

(7) Construction

The construction materials and equipment were basically arranged by the JICA Study Team while the pilot project implementation works were contracted-out to the Community Construction Group. The following activities were conducted during the construction phase:

- Site Survey to determine existing road profile and cross-sections
- Site clearance
- Excavation and waste disposal
- Road grading
- Spreading and Compaction of subgrade and sub-base resurfacing

Before

Road Condition

After

- Excavation and compaction of ditch for drainage
- Laying-out of RC pipe culverts
- Construction of culvert wingwalls
- Cleaning and moving-out

(8) Feedback of Pilot Project

▪ Impact to Road Users

A simple interview survey was conducted with the community and road users for the pilot project road. Some of the perceived positive and negative impacts of the project are summarized in the table below:

Perceived Impacts of Project

Category	+/−	Contents	Remarks
On Business	Positive	・Increase of customer ・improvement of transport efficiency	Increase of pedestrian Motorcycle
On Lifestyle	Positive	・Accessibility to facilities ・Comfortable walk spaces ・Decrease of illegal building ・Decrease of garbage on road ・Improvement of drain in case of rain	School, Well, Shops Flat level, Drain Occupy ROW Decrease of garbage Decrease of pool
	Negative	・Increasing danger of traffic accident ・Increase of dust ・Increase of illegal shops occupying public spaces	Speed-up of vehicles From high-speed car Occupation of public spaces

▪ Job Creation in Munuki Community

Positive impacts of the pilot project to community livelihood were identified thru:

- Job creation by hiring unskilled workers from the community, and
- Business opportunity in Munuki market due to purchase of small tools and construction materials.

Job Creation and Business Opportunity in Munuki

Category	Contents	Remarks
Wages for workers	App. US$ 11,000	20 workers from Munuki
Allowance for Payam	App. US$ 2,100	
Payment for Material and Tools	App. US$10,000	Purchased in Munuki market area
Total	App. US$23,100	

▪ Focus on Capacity Development for Next Pilot Project Step

- The initial focus of the pilot project is to improve the MOPI's capacity in construction implementation and supervision of road maintenance project – the case of road resurfacing work.
- The results of pilot project indicated that the MTR is more interested in planning, schedule and quality management while the MOPI is more interested in labor, equipment and safety management.
- The recommendation of this Study on road maintenance is to perform the maintenance tasks initially by force account and gradually shift to contract-out system. In this regard, the MOPI should be initially prepared to carry-out routine and periodic maintenance on its own by developing the capacities of its staff and technicians.
- The pilot project just carried-out utilized a labor-intensive method for road resurfacing works with minimum utilization of equipment and tools. This method will be beneficial to the community, in terms of job creation, if applied by the MOPI in its routine and periodic maintenance activities.
- Under the completed pilot project, the community is involved in planning and work execution thru labor support thus creating awareness on the importance of road maintenance. Future road maintenance works like routine maintenance activities can thus be delegated by the MOPI to the community as a community-based road maintenance system.
- The pilot project case for Resurfacing has been successfully implemented with the MTR, the MOPI and the Community. However, the roads in Juba are planned to be improved utilizing Gravel and Asphalt Concrete as the pavement structures. In this regard, it will be necessary to conduct more capacity development for the MOPI for maintenance of these road types.
- The focus of the next pilot projects shall then be maintenance activity works for Gravel and Asphalt Concrete roads.

21. 2ND PILOT PROJECT IMPLEMENTATION

(1) Objectives

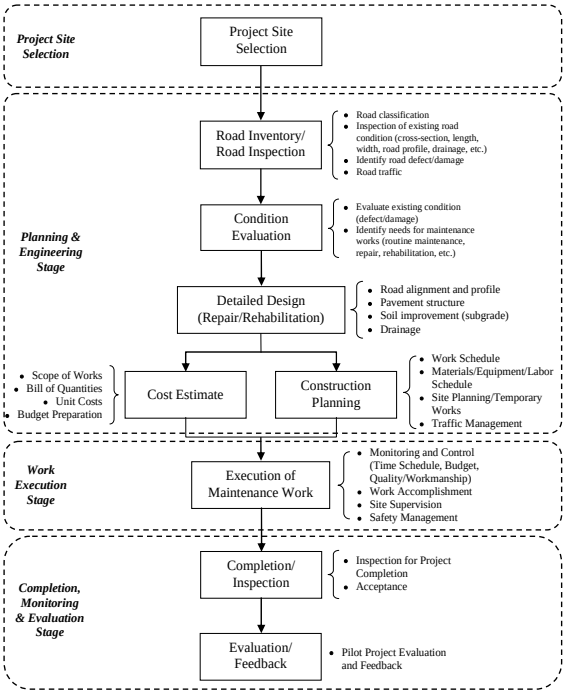
The 2nd Pilot Project is undertaken with the following objectives:

- to assess and assist in improving the capabilities of the MOPI in executing periodic maintenance/rehabilitation works for Gravel Pavement considering constraints in resources,
- to undertake maintenance/rehabilitation of a 500m long gravel type road pilot project, and
- to organize the community and generate employment within the community thru labor-based gravel road maintenance execution.

(2) Implementation Method and Schedule

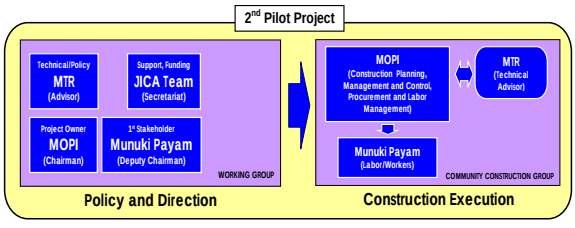
The method of implementation follows the cycle of maintenance work shown below:

Road Maintenance by Force Account



Moreover, the execution of the 2nd Pilot Project is done entirely by the MOPI on its own thru the CCG as opposed to the 1st Pilot Project which is assisted by a contractor.

Project Implementation Scheme



The project was undertaken from the end of January to early June 2010, as shown.

Overall Schedule of 2nd Pilot Project

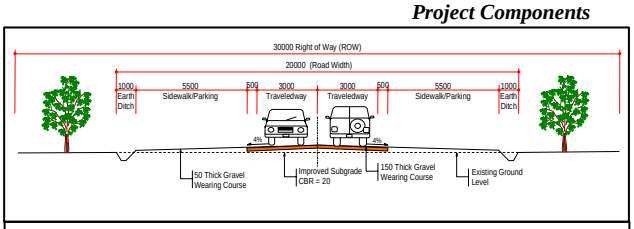
2nd PILOT PROJECT OVERALL IMPLEMENTATION SCHEDULE

Activities	Y 2010 Jan	Feb	Mar	Apr	May	Jun
1. Preparatory Works / Inception						
2. Organization of Working Group						
3. Selection of 2nd Pilot Project Road						
4. Preparation of Design, Cost Estimate and Implementation Plan						
5. Establishment of Community Construction Group						
6. 2nd Pilot Project Implementation/Execution						
7. Evaluation and Feedback						
8. Stakeholders' Meeting						
9. Report Preparation						
JICA Team Schedule (On-site)	JICA MEMBERS				JICA MEMBERS	
	LOCAL COORDINATOR					

(3) Project Components

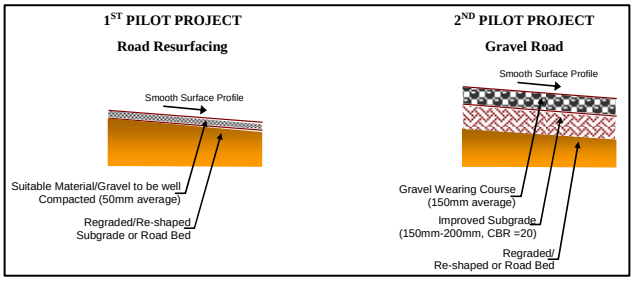
The project basically covers rehabilitation of existing road by gravel pavement/wearing course outlined below.

Project Components



Road Project Length	:	500m Gravel Road + 330m Resurfacing Extension
Gravel Wearing Course	:	150mm thick (7.0m wide) for 500m Traveledway 50mm thick for rest of road section (11.0m wide)
Cross Drainage	:	2x18m - ϕ600mm RC Pipe Culverts for main road 2x10m - ϕ600mm RC Pipe Culverts for other road
Road Side Drain	:	830m x1.0m wide (2sides) earth ditch for main road 150m (x2sides) earth canal for discharge of storm water to existing stream channel
Subgrade/Ground Improvement	:	Replacement of black cotton soil, L ~100m (D=0.3-0.6m)

Road Structure for 1st and 2nd Pilot Projects



The project cost amounted to US$121,920.

(4) Project Execution

- The pilot project site was selected and inspected by the WG to determine the project scope.
- Planning and basic design was undertaken with the JICA team guiding the MOPI on various planning issues.
- The pilot project was then executed by the CCG which is headed by the MOPI. Labor was recruited from the Munuki Payam while equipment either hired or provided by the MOPI.

Various aspects of project management was done by the MOPI including traffic management on site.

- Due to travel restriction during the national election, the CCG undertook the execution in the absence of the JICA team.
- However, when the project accomplishment was inspected on the return of the JICA Team, several work items did not comply with the basic design and planning.
- Corrective measures, especially the gravel structure was undertaken from the middle to the end of May.

Pilot Project Road

(5) Project Evaluation

The pilot project is evaluated based on achievement, effectiveness and efficiency.

- Road Inventory Data Base: There is no existing database on the road stock in Juba urban area.
- Planning and Design Stage: It is noted that there is still a need to improve the MOPI skills and knowledge in road inspection, design, scheduling, cost estimating and value engineering.
- Project Execution: Likewise, it is necessary to further improve the skills and knowledge in interpreting and implementing design and construction plans, schedule and output management, quality control and management, cost control, management of labor and equipment, materials procurement, meeting facilitation and reporting.
- Project Cost Performance. The project cost is competitive as a force account system with contract-out system and can be improved more if MOPI has its own set of equipment.
- Project Impact. The pilot project contributed to the physical improvement of a road section in Munuki, thus improving mobility and accessibility in the area. Likewise, the skills and knowledge of the MTR and the MOPI counterparts for gravel road are enhanced.
- Sustainability. Lack of policy on road maintenance, staff, resources including equipment and budget impairs project sustainability and expansion.

(6) Recommendations

- The MOPI should establish a definite set of policies, strategies and programs in road development and maintenance and address the issues of strengthening its capacity for road rehabilitation and maintenance.
- Additional capacity development and technical cooperation programs are necessary to improve further MOPI's capability in road rehabilitation and maintenance, including:
  - Establishment of Road Inventory Database
  - Developing Manuals on Planning, Design, Road Maintenance and Repair, Construction Project Management and Control, etc.
  - Training of technical staff in inspection, design, planning and project control and management
  - Addressing the issue of lack of equipment for maintenance work and laboratory testing
- Involvement of the community in road maintenance requires improvement of basic skills for labor based technology.

Completion of 1st and 2nd Pilot Project Road

22. CAPACITY DEVELOPMENT PLAN

(1) Objectives

An intensive capacity development program for the transport sector is being undertaken in the Ministry of Transport and Roads (MTR) covering planning, construction and sustainable operation, maintenance and management of the transport infrastructure in Southern Sudan. However, since the MTR is responsible for maintenance of the national roads (arterials roads in functional classification) while the Ministry of Physical Infrastructure (MOPI) is in charge of the state roads and county roads (collectors and local streets) the focus of this capacity development shall be for the MOPI.

- The Capacity Development Plan in the Study is thus aimed to develop the maintenance knowledge, techniques and skills, as well as, the administrative compliance on road maintenance of the MOPI on collectors and local streets in Juba urban area.

(2) Participatory Workshop and Analysis

- Participatory workshops and analysis were conducted during the course of the Study to confirm the participation and ownership of the project stakeholders.
- Participants of the different workshops include Engineer, Technicians, Supervisors, Assistants and Administrators from both the MTR and the MOPI Directorate of Roads and Bridges.

(3) Levels of Capacity Development

Generally, capacity development has three levels such as individual level, organization level and institutional level. These three levels should be developed through the pilot project implementation. However, there are still many issues to be resolved for the capacity development of entire Roads and Bridges Directorate of the MOPI.

- The institutional and social levels constitute the enabling environment at which capacity levels for the MOPI road maintenance shall be based. Institutional reforms and policies on road maintenance will need restructuring.
- Within the MOPI, one of the most challenging tasks for capacity building is at the individual level. The more than 20 years of civil war in Sudan has left the technical capacities of the MOPI in road maintenance at a very disadvantaged state. Aside from lack of physical resources, including tools and equipment in road maintenance, the agency will need to focus on developing its human capital.
- In this regard, the capacity development discussed herein shall focus on the individual.

(4) Capacity Development Program

1) Basic Approach

a) Department of Road Maintenance (DORM), MOPI

- The DORM is expected to maintain the roads on its own force until such time that the capacity of the private sector will be developed.
- There is a need to maintain skilled staffs with ability to plan, design, construct and implement road maintenance projects.
- The maintenance staff of the DORM shall be given training particularly in labor-based maintenance technology which shall be formed into routine and emergency maintenance sections of this department
- When road maintenance is shifted to the private sector, trained staff may be transferred to private sector contractors, and expected to act as trainers for labor-based maintenance works.

b) Pavement Types

The predominant pavement types to be maintained in Juba urban area includes:

- Earth Surface and Gravel Pavement for local streets, and
- Asphalt Concrete Pavement for arterial roads and collector roads.

The main concern of the Study for the MOPI road maintenance shall be earth surface and gravel roads.

c) Maintenance Work Method and Contract Type

- The routine maintenance of low class streets is in urgent need and the main subject of the Study.
- This maintenance is practical to be executed employing community-based and labor-intensive maintenance method under the force account systems as administered by the MOPI.

d) Encouragement of Private Sector

- The routine and periodic maintenance of high class streets are planned to be executed by the private sector.
- The local contracting industry contractors are very weak at present. However, the private industry is expected to deliver the required services and works with quality and competitive price.
- Support from the Government is needed for the private industry in terms of encouragement policy, contract administration, construction technology and quality control.

(5) Target Group and Technology

The target groups for Capacity Development within the MOPI shall include:

Technical Level	Engineering Capacity Development	Construction Capacity Development
Planner Class	• Planner • Sr. Engineer	• Sr. Administrator
Engineer Class	• Engineer • Sr. Supervisor	• Administrator • Accountant
Technician Class	• Technician • Inspector • Supervisor	• Engineer • Technician • Mechanic

1) Engineering

Engineering CD Subjects and Groups

Subjects	Target Group		
	Planner	Engineer	Technician
1. Inspection Stage			
1.1 Inspection Manual		○	◎
1.2 Investigation and Inspection		○	◎
1.3 Data Base		◎	○
2. Planning Stage			
2.1 Master Plan, Feasibility Study	◎	○	
2.2 Design and Cost Estimate for Budgeting	○	◎	
2.3 Annual Construction / Maintenance Planning and Budgeting	◎	○	
3. Budgeting Stage			
3.1 Administration System / Procedure	◎	○	
3.2 Plan / Budget Justification and Explanation	◎	○	
4. Engineering Stage			
4.1 Engineering Standard (Design, Construction, Maintenance)		◎	
4.2 Detailed Design (Road, Bridge, Drainage, Pavement)		◎	
4.3 Topographic Survey		○	◎
4.4 Geographic Survey		○	◎
4.5 Material Testing		○	◎
4.6 Construct Document / Specification	○	◎	○
4.7 Cost Estimate		◎	○
5. Bidding and Contracting Stage			
5.1 Bidding Procedure (Pre-qualification, Bid Evaluation)		◎	
5.2 Contract Format		◎	
5.3 Award and Contracting	○	◎	
6. Execution (Construction and Maintenance) Stage			
6.1 Engineering Standard (Construction/Maintenance Specification)		◎	○
6.2 Construction Supervision (Schedule, Quality, Quantity, Safety)		◎	○
6.3 Construction / Maintenance Technique for Force Account		○	◎
6.4 Equipment Operation for Force Account		○	◎
7. Monitoring Stage			
7.1 Monitoring Manual		○	◎
7.2 Reporting System		○	◎

Note: ◎ Main Target Group ○ Secondly Target Group

2) Construction

Construction CD Subjects and Groups

Subjects	Target Group			
	Administrator	Accountant	Engineer	Technician
1. Contract Management				
1.1 Contract Administration	◎		○	
1.2 Out-sourcing Contract		◎	○	
2. Finance Management				
2.1 Project Budgeting		◎	○	
2.2 Project Accountant		◎	○	
3. Personnel Management				
3.1 Engineer Level	◎		○	
3.2 Labor Level	◎		○	
4. Construction Management				
(Schedule, Quantity, Quality, Safety, Environment, Public Relation)			◎	○
5. Construction Technology				
(Road, Bridge, Drainage, Pavement)			◎	◎
6. Maintenance Technology				
(Road, Bridge, Drainage, Pavement)			◎	◎
7. Equipment Technology (Operation, Maintenance)			○	◎

Note: ◎ Main Target Group ○ Secondly Target Group

3) Curriculum

a) Effective System for Road Maintenance

- Includes contract-out and force-account system for the MOPI.

b) Maintenance Techniques for Force-Account

- Small-scale maintenance works of local streets such as leveling, re-surfacing and re-gravelling.

c) Equipment Operation for Force-Account

- The training of operator and mechanics for equipment operation and maintenance.

d) Development of Engineering Level

- The engineering courses of road design, construction and maintenance including roads, drainages, pavement etc.

e) Construction Supervision

- To include supervision activities such as:
  - Inspection Forms
  - Preparation of Progress Reports
  - Quality Control/Assurance
  - Issuance of Change Order
  - Assessment of Invoice for Progress Payment/Change Order
  - Construction Safety

4) Development Method

a) Technical Cooperation Project Type

- It is highly recommended that training should be done in the field, not only in class room, such as on-the-job training and in-the-service training.
- As a conclusion, the Pilot Project Type – Technical Cooperation Project Type - is recommended to be the most practical and effective method of the capacity development including the following methods of capacity development courses:

  Course 1: Seminar/Workshop

  Course 2: Class Room

  Course 3: On-the-job Training

  Course 4: In-service Training

  Course 5: Training Tour in Foreign Countries

b) Incentive upon Completion

- To motivate trainees in capacity development, some incentives should be considered for participants.
- Such incentives should include provision of suitable employment opportunities and proper professional positions and issuance of diploma that should certify their capabilities as professionals.

(6) Strengthening of the Private Sector

The Strategic Plan of the MTR provides for the following capacity policies:

a. Short form of contract is not recommended for construction work of relatively small capital value or repetitive work e.g. routine maintenance in a given period.
b. Performance-based contract for management and maintenance of roads, e.g. Design and Build contract.
c. Work supervision services by experienced engineering firms through Quality and Cost-Based Selection (QCBS) system.

1) Roles of the Private Sector

The areas of engineering and construction shall be provided by the private sector which should be responsible for delivering the required services and works through competitive bidding at cost-effective basis.

a) Engineering

The Consultant shall be responsible for rendering engineering services including survey, feasibility study, engineering design, construction supervision and environmental assessment, etc.

- Design of Maintenance Works and Cost Estimate
- Bidding Assistance (Bidding, Evaluation, Contracting, etc.)
- Supervision of Construction Works

b) Maintenance Works

- *Private Construction Company* which is suitable for large size maintenance works shall perform:
  - major maintenance contracts under performance-based contract and
  - emergency maintenance, if required.
- *Community-based Road Maintenance Company* which is suitable for small maintenance works shall:
  - execute small scale maintenance works of collectors and local streets to the required standard level and
  - serve as the agency of community regarding roads works including maintenance.

  The objectives of the community-based road maintenance include;
  - creation of employment opportunities,
  - developing the road maintenance knowledge of the people in the community,
  - increasing social status of rural people living in road corridors,
  - increasing community cohesion, and
  - increasing the empowerment of community.

2) Government's Support for the Private Sector

To encourage and develop the local construction industry, the government support is absolutely indispensable including the following:

- Standard Contractors' Classification System to enable them to bid on projects suited for their technical and financial capacity. Such classification should be done based on:
  - Financial Status
  - Personal, Equipment and Equipment Capabilities
  - Work Experiences of similar works in recent years
  - Litigation History if available
- Continuous Supply of Maintenance Projects consistent with the Government's annual road maintenance plan and properly informed to the public for private sector preparation.
- Establishment of Community-based Road Maintenance Companies to address the issues of unemployment, poverty alleviation and for community cohesion and security.
- Compulsory Engagement of Local Contactor as sub-contractor for large projects under international tender to support the local construction industry.
- Preference of Local Contractor in International Bidding for Road Project in the country since local contractors may lack the necessary experience for internationally bid projects. Local contractors should be given bonus points during prequalification.
- Provision of Access to Credit / Banking / Insurance since construction projects require bid and performance guarantees. Local contractors may not have the financial capacities to secure these requirements so that the government should give some form of assistance to the local contractors.
- Practice Training for Business and Engineering.

  The government is recommended to give reasonable opportunities for local contractors to undertake practical sizes of works, such as routine maintenance of collectors and local streets, as "Pilot Project Type" scheme of training to help them build their experience and capacity on road maintenance and construction and be able to challenge future road projects.

(7) Action Plan

The following proposed programs and action plan is recommended to be implemented at the earliest possible time.

CD Programs

Program 1: Establishment of Road Maintenance and Management System of the MOPI	
Program Objectives	This program aims to establish the practical and effective road maintenance and management system for the MOPI, CES.
Program Activities	• Recommendation of the road maintenance and management system adoptable for Department of Road Maintenance (DORM) of the MOPI. • Preparation of the annual road maintenance plan and budget for the DORM. • Establishment of Force-account section for road maintenance in the DORM • Development of Contract –out system for road maintenance to private sector. • Capacity Development for the above activities
Counterpart	DORM, MOPI
Target Group	• Planner • Sr. Engineer • Sr. Administrator and DORM.
Inputs from Foreign Donors	• Sr. Road Management Expert • Sr. Road Maintenance Expert
Duration	Scheduled for two (2) years

Program 2 : Capacity Development of Road Maintenance Technology Under Force-Account Scheme for MOPI (Pilot Project I)	
Program Objectives	This program is planned to develop the road maintenance technology through implementing pilot project of the force-account team of the Department of Road Maintenance (DORM), MOPI
Program Activities	• Practice of road inspection and inventory • Selection of pilot street suitable for gravel pavement (GR) • Design and cost estimate of gravel pavement of pilot street improvement (Pilot Project) • Study on construction / maintenance method of pavement and drainage. • Procurement of construction equipment and materials • Organization of working group mainly composed of community. • Execution of road / maintenance work of pilot streets under force-account schemes • Preparation of road maintenance manual (gravel road) • Evaluation on pilot project implementation • Capacity development for the above activities
Counterpart	DORM, MOPI
Target Group	• Project Manager • Sr. Engineer, Engineer, Technician • Construction supervisor • Equipment operator • Accountant
Inputs from Foreign Donors	• Sr. Highway Engineer • Sr. Road Maintenance Engineer • Procurement of construction equipment and materials
Duration	Scheduled for two (2) years

Program 3: Capacity Development of Road Maintenance Technology under Contact-out Scheme for Public and Private Sector (Pilot Project II)		
Program Objectives	This program aims to develop the road maintenance technology through implementing pilot project for the public sector (the Department of Road Maintenance, MOPI) and private sector (local contractors)	
Program Activities	**Public Sector** • Practice of road improvement and inventory • Selection of pilot streets suitable for asphalt concrete pavement (AC) • Design and cost estimate of AC pavement of pilot streets improvement (Pilot Project) • Study on construction / maintenance method of pavement and drainage • Preparation of tender and contract document • Construction supervision of pilot streets under contract-out scheme • Preparation of road maintenance manual (AC) • Evaluation on pilot work implementation • Capacity development for the above activities **Private Sector** • Construction of pilot street • Procurement of construction equipment and materials	
Counterpart	DORM, MOPI	
Target Group	Public Sector • Project Manager • Sr. Engineer, Engineer • Construction supervisor	Private Sector • Construction Manager • Construction Engineer and Technician • Contract Administrator
Inputs from Foreign Donors	• Sr. Highway Engineer • Sr. Road Maintenance Engineer • Project Cost	
Duration	Scheduled for two (2) years	

Program 4: Equipment Operation and Management for Small-scale Road Maintenance	
Program Objectives	The MOPI, the State is expected to execute the small-scale routine maintenance mainly for local streets under force-account scheme until such time that the maintenance capacity of private contractors will be developed to execute the required works. This program is, therefore, planned to develop equipment operation and management capacity of the MOPI for small-scale road maintenance.
Program Activities	• Purchase of minimum number of equipment for road maintenance required for the MOPI • Preparation of manual for equipment operation and management • Capacity development of equipment operation and management
Counterpart	MOPI
Target Group	• Force-account team, DORM, MOPI • Maintenance Engineer • Equipment Operator
Inputs from Foreign Donors	• Sr. Mechanical / Equipment Engineer • Equipment Supply
Duration	Scheduled for one (1) years

CD Action Plan

Program	**Main Subjects**	**Target Group**			**2010**	**2011**	**2012**	**2013**	**2014**	**2015**
		Planner Class	Engineer Class	Technician Class						
1. Establishment of Road Maintenance and Management System of the MOPI - Department of Road Maintenance, MOPI	- Recommendation of Road Maintenance System - Preparation of Annual Maintenance plan - Establishment of Force Account / Contract-out System	◎ ◎ ◎	○ ○ ○		■	■				
2. Capacity Development of Road Maintenance Technology under Force-Account Scheme **(Pilot Project I)** - Department of Road Maintenance, MOPI - Community	- Design of Gravel Pavement - Organization of Working Group of Community - Execution of Pilot Works		◎ ◎ ◎	○ ○ ○		■	■			
3. Capacity Development of Road Maintenance Technology under Contract-out Scheme **(Pilot Project II)** - Department of Road Maintenance, MOPI - Private Sector	- Design of Asphalt Concrete Pavement - Preparation of Tender And Contract Documents - Execution of Pilot Works		◎ ◎ ◎	○ ○ ○			■	■		
4. Capacity Development of Equipment Operation and Management for Small-scale Road Maintenance - Department of Road Maintenance, MOPI - Private Sector	- Purchase of Equipment for Road Maintenance - Capacity Development of Equipment Operation and Management		◎ ◎	○ ○		■				

Note: ◎ Main Target Group ○ Secondary Target Group

Conclusions and Recommendations

STUDY INTENTION

- The Study proposes a set of measures to solve the present transport issues and formulates a functional transport system for the target year 2025. The output of the Study is expected to contribute to the development of urban transport system and encouragement of socio-economic activities in Juba urban area.
- The actual implementation of proposed projects is highly expected to commence immediately after the end of the Study, with the joint efforts of the central and state governments as well as private sector.
- Such joint efforts and cooperation between the two sectors, public and private, shall be encouraged under the guidance and direction of the government.
- To this end, it is noted that the thoughtful understanding and unprejudiced support of the master plan in policy makers and budgeting agencies of Southern Sudan and the international society are indispensable for the successful implementation of the master plan.

CONCLUSIONS

1. Urban Transport Development Master Plan

(1) Plan Justification

- The Master Plan for Urban Transport Infrastructure in Juba urban area is formulated in comprehensive and systematic manner to cope with the present and future transport demands, and to support the socio-economic development in Juba urban area and Southern Sudan.
- The Master Plan identified the investment requirements within the following time frame.
  - Short Term (2009-2015) : US$ 510 Million
  - Medium Term (2016-2020): US$ 640 Million
  - Long Term (2021-2025) : US$ 710 Million
- The Master Plan is justified to be technically feasible and acceptable from the environmental and social viewpoint including the road network development plans for the Short, Medium and Long Terms as well as the plan beyond the year 2026.

(2) Plan Components

The Master Plan defines ”Juba Urban Area” as the area enclosed by the proposed Circumferential Street No.4 (C4), and identified a number of projects and measures with the following main components.

a) Road Network Development

- Formulation of “Circumferential and Radial Street” Network System

Arterial Streets

4-Circumferential Streets	6-Radial Streets
C-1 : 10.1km	R-1 : 6.5km (Juba – Yei)
C-2 : 16.7km	R-2 : 5.8km (Juba – Mundri)
C-3 : 34.2km	R-3 : 7.7km (Juba – Terekeka)
C-4 : 53.4 km	R-4 : 6.3km (Juba – Bor)
Total : 114.4km	R-5 : 12.0km (Juba - Lafon)
	R-6 : 7. km (Juba – Nimule)
	Total : 46.0km

- Collector Street Development inside C-4: 116.0km
- Local Street Rehabilitation inside C-4: 498.2km

b) Public Transport Development

- Policy and Regulation on Operation
- Designation of Bus Routes
- Construction of Bus Terminal
- Vehicle Regulation

c) Traffic Management

- Policy and Regulation on Management
- Enforcement of Practical Traffic Rules and Regulations
- Practice of Traffic Safety Education

d) Transport Institution

- Human Resource Development
- Institutional Development

(3) Project Implementation

In order to smoothly implement the proposed projects, the establishment of the Inter-Ministry Committee for Transport (IMCT) is proposed with the role of formulating the transport development policy and plan, and coordinating between Ministries.

2. Pre-Feasibility Study Projects

(1) Project Selection

- The Four (4) Projects for Pre-Feasibility Study are selected among the high priority projects under the Short-Term period with the intension of providing urgent measures for rapid increase of urban population due to returning refugees/IDPs and migration from rural areas and permanent measures for the systematic formation of future urban structure thus

preventing the disorderly urban development in Juba.

- The Pre-Feasibility Study also proposes an effective road maintenance system which is in urgent need to support the socio-economic activities of the people focusing on collector and local street maintenance, as well as the urban environment improvement in the Central Commercial District (CCD).

(2) Project Components

1) Formulation of Urban Street Maintenance System

a) Administrative Jurisdiction of Urban Street

- The MTR, GOSS is responsible for the improvement and maintenance of arterial streets.
- The MOPI, State is responsible for the improvement and maintenance of collectors and local streets

b) Maintenance Works

- Three (3) types of maintenance works (re-surfacing, gravel pavement and asphalt concrete pavement) are proposed to be adopted in consideration of area characteristics, traffic volume and social acceptance.
- Temporary leveling of existing street (not improved/maintained streets) is suggested to be carried out wherever required.
- Leveling and re-surfacing maintenance works of seriously deteriorated local streets is recommend to be executed with community-based labor intensive method.

Annual Budget Required for Maintenance in 2010 and 2016, The MOPI, CES

Road	Year 2012		Year 2016	
	Length (km)	Cost (US$)	Length (km)	Cost (US$)
Improved Streets *	21.3	495,000	95.9	2,520,000
Not-Improved Streets	10.0	400,000	20.0	800,000

*: Maintenance Cost only

2) Urban Street Improvement in Central Commercial District (CCD)

- The CCD is a historical area developed as the center of commercial, business and institutional activities and is presently suffering from deteriorated road surfaces, heavy traffic congestion and severe urban environment. Therefore, the urban scenery of this district is aimed to be improved at an international level.
- The Project is composed of the following:

Road Class	With On-going Project		Without On-going Project)	
	Length (Km)	Construction Cost (US$ Mil.)	Length (Km)	Construction Cost (US$ Mil.)
Arterial Street	3.91	7.92	0	0
Collector Street	8.84	24.53	0.5	1.2
Major Local Street	4.24	9.15	3.0	6.4
Minor Local Street	9.73	6.78	9.1	6.3
	26.72	**48.38**	**12.6**	**13.9**

- The urban street improvement in the area, with acceptable environmental and social impacts, is justified technically and economically feasible based on the economic indicators and is concluded to be executed as early as possible to accelerate the socio-economic activities in the Juba urban center and Southern Sudan as a whole.
  - Net Present Value (US$ Million) : 18.9
  - Benefit Cost Ratio : 1.39
  - Economic Internal Rate of Return (%) : 12.4

3) Route Location Study

- The route alignments for the arterial streets of C2, C3 and R5 are newly established, while those of C1, R1 to R4, section of R5 and R6 basically following the alignment of the existing roads.
- Several alignments of C3 Nile Bridge No.1 (south side) crossing the White Nile River are examined in terms of engineering, traffic efficiency, cost and environmental and social consideration. A detailed feasibility study of the bridge is, however, recommended to be undertaken at the earliest possible time to identify and resolve various engineering, environmental and social issues.
- Preparatory works should be conducted as soon as possible in order to minimize further encroachment and reserve the road right of way required for road construction in the future. This will save land acquisition and relocation costs, minimize negative social and environment impacts, and induce the systematic urban development in the area.

4) Urban Street Network Development in Southern Juba

- Juba urban area is rapidly expanding towards the east and southward of Juba due to continuous increase in population and settlement. The provision of a well planned transport infrastructure in the area is a vital need for the promotion of the systematic urban development of the region.

- The project is composed of the following:

	Length (Km)	Construction Cost (US$ Mil.)
Arterial C-2	8.0	73.6
C-3	12.6	199.3
Collector Lologo	3.6	33.1
Collector Nyakuron	2.2	20.2
	26.4	326.2

- The project is justified to be technically and economically feasible and acceptable from the environmental and social viewpoint with the following economic indicators.
  - Net Present Value (US$ Mil.) : 11.6~70.2
  - Benefit Cost Ratio : 1.31~1.73
  - Economic Internal Rate of Return (%) : 11.3~15.0

3. Bridges and Culvert Reconstruction Project

- The project is formulated for seventeen (17) bridges to assume the structural safety of bridges and improve mobility and accessibility within Juba urban area.
- The improvement priority of each bridge and culvert is evaluated in terms of urgency, structural stability and traffic needs and classified as follows:
  - Priority "A" bridges - 3 Bridges
  - Priority "B" bridges - 1 Bridge, "B" culverts - 3 Culverts
- The priority "A bridges" and priority "B" culverts are recommended for the early implementation.
- The Exchange of Notes between the Government of Japan and the Government of National Unity was signed on November 19, 2009 for the Construction of the 3 bridges and 3 culverts.

4. Capacity Development Thru Pilot Project

(1) 1st and 2nd Pilot Projects Implementation

- A section of a local street in Munuki was successfully maintained as the pilot projects adopting the ***re-surfacing*** and ***gravel pavement*** maintenance method implemented by the Community Construction Group (CCG) consisting of representatives from the MTR, the MOPI and the Munuki Payam in the pilot project area.
- The MOPI demonstrated the capability to implement such level of road maintenance works by direct management/force account system including labor arrangement, materials procurement and equipment provision. The community showed the strong willingness in joining such community construction groups to improve their crucial infrastructure facility necessary for their daily activities.
- It is, therefore, concluded that the routine maintenance of low class streets such as collectors and local streets may be carried out by the community–based, labor-intensive maintenance method under the direct administration and engineering guidance of the MOPI.

(2) Capacity Development Plan

- The state of the present road maintenance technology and system, as observed during the pilot project implementation, suggests an urgent need of developing the technology and system of the MOPI, as far as the maintenance of low class streets in Juba urban area.
- The proposed capacity development programs include the following which shall be implemented in form of a Technical Cooperation Project Type.

  Program 1;

  Establishment of Road Maintenance and Management System, the MOPI, State

  Program 2;

  Capacity Development on Road Maintenance Technology under the Force-Account Scheme, the MOPI, State (Pilot Project I)

  Program 3;

  Capacity Development on Road Maintenance Technology under the Contract-Out Scheme, the MOPI, State (Pilot Project II)

  Program 4;

  Capacity Development on Equipment Operation and Management, the MOPI, State

(3) Government's Support for Strengthening of the Private Sector

- The areas of engineering and construction shall be provided by the private sector who should be responsible for delivering the required service and works through competitive bidding at cost-efficient basis.
- Support from the government is needed for the private industry in terms of encouragement, policy, contract administration, construction technology and quality control.
- Such supports include the continuous supply of maintenance projects, compulsory engagement and preference of local contractors in international bidding and provision of access to credit, banking and insurance.

RECOMMENDATIONS

(1) Plan Authorization

- The authorization of the Master Plan by the government of Southern Sudan is vital for the systematic implementation of the projects recommended in the Plan. The plan authorization should assure all efforts to be integrated towards the same directions and targets of Juba Urban Transport Development.

- Projects in the Master Plan should be included in the National Development Plan to initiate the implementation arrangement and secure the funds required for the smooth implementation of projects.

(2) Plan Premise

- The future land use pattern and urban structure are presumed in the Study focusing on the expansion of Juba urban area and the future transport patterns in the region, since there is no official land use plan or urban structure development plan.

- Juba urban area is being widely and drastically developed at present. Therefore, the modification of the Master Plan may be required according to changes and development in the region such as socio-economic activities and land use pattern in the future.

(3) Project Arrangement

- The Master Plan provides only the concepts and outlines of the projects proposed in the Plan. Feasibility Studies and Detailed Engineering Studies should be conducted to define project details including engineering requirement, economic justification and environmental and social impacts.

- To implement the project as scheduled, such Feasibility Studies and Detailed Engineering Studies should be performed a few years before the commencement of project construction to avoid unnecessary delay due to implementation problem such as acquisition of road right of way and resettlement of the people affected by the projects.

- The Feasibility Study on C3 Nile Bridge No.1 (south side) should be conducted as soon as possible because of the urgency of the project and the catalyst required for the dynamic development in the region.

(4) Constitution of Inter-Ministry Committee for Transport (IMCT)

- The clear and comprehensive transport development policy, strategy and plan for Juba urban area are indispensable for the development, management and operation of efficient urban transport infrastructures.

- The Inter-Ministry Committee for Transport (IMCT) is recommended to be organized in order to discuss and enforce such clear and consistent plan. In order to have a smooth and effective coordination, the members of the committee should be composed of all ministries, traffic police and other agencies related to the Juba urban transport development, management and operation.

(5) Establishment of a Task Force for Road ROW Reservation

- The proposed routes for the arterial streets (4-circumferential streets and 6-radial streets) are identified only at the Pre-Feasibility Study level.

- A Task Force is recommended to be established to define the road right of way (ROW) in order to reserve the ROW land and minimize encroachment within the areas of the proposed routes and to induce the systematic development in Juba urban area.

(6) Adoption of Community Based Local Street Maintenance System

- The routine maintenance of local streets (leveling of existing deteriorated street surface, re-surfacing with minimum materials and minor gravelling works etc.) if carried out with labor-intensive maintenance method by the community-based working groups can also be expected to contribute to job creation.

- Community-based groups are recommended to be organized with the guidance of the Ministry of Physical Infrastructure (MOPI), Central Equatorial State (CES) who should also be responsible for the technical supervision, material supply, equipment provision and labor costs, among others.

- Such maintenance works of local streets can be executed under a force account scheme of the MOPI who can employ the necessary labor-forces on labor contract bases. The

MOPI should maintain the minimum equipment and tools required for such maintenance works.

(7) Community Participation in Project Planning and Implementation

- Public consultation meetings are strongly recommended to be held at the proper timing to build public concerns though a professional and transparent manner, during the planning, design, construction and operation and maintenance stages.
- The existing transport problem should be identified, and measures to cope with such problems should be discussed during the public consultation meetings at the project planning stage so that a common recognition on problem solution may be shared between the community and project implementing agency.

(8) Environmental Impact Assessment

- Initial Environmental Examination (IEE) is a mandatory requirement in planning projects, and Environmental Impact Assessment (EIA) shall be conducted for project where negative impacts are anticipated, in advance during the detailed engineering stage of such project.
- For projects with negative social impact such as land acquisition and project affected person are indentified, the land acquisition plan and resettlement action plan (RAP) should be prepared during the conduct of the EIA.

(9) Traffic Safety Education and Enforcement

- It is widely understood that when roads are improved, vehicles tend to travel at higher speeds resulting in increase in traffic accident. A traffic safety education program should be established involving education in schools and periodic education of drivers.
- The strengthening of traffic enforcement is also indispensible not only for the street adherence to traffic rules but also for maintaining certain urban activities of people and trust by community.

(10) Road Improvement and Land Development

- Road improvement, which is expected to lead to land development by the private sector, shall be implemented prior to or simultaneously with land development so that systematic and controlled land development can be achieved.
- Some roads with high potential for land development are recommended to be improved through the public-private partnership (PPP) scheme which shall be exercised whenever possible.

(11) Organization and Human Capacity Development

- The Plan includes a large number of transport projects embracing road improvement, public transport, and traffic management, which require large investments and implementation capacity. An effective organization for the systematic implementation approach is the vital key to the successful realization of the plan.
- Human capacity development programs for management and maintenance engineers, as well as for other fields, is the major task that should be strongly instituted to develop the required experience through on-the-job training and other systemized training programs.

Urban Road at Juba CCD

Developed Urban Road Example

ORGANIZATION OF THE STUDY

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