No.

MINISTRY OF PUBLIC WORKS AND TRANSPORT,
THE KINGDOM OF CAMBODIA

# THE STUDY
# ON
# THE ROAD NETWORK DEVELOPMENT
# IN
# THE KINGDOM OF CAMBODIA

## FINAL REPORT

## VOLUME I
## SUMMARY

OCTOBER 2006

JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)

NIPPON KOEI CO., LTD.
KATAHIRA & ENGINEERS INTERNATIONAL

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**The Study on the Road Network Development in the Kingdom of Cambodia**

**Composition of Final Report**

Volume I Summary

Volume II Main Text

(1) Master Plan Study for the Road Network Development

[Part A Infrastructure Development for Road Network]

[Part B Institutional Development for Road Maintenance]

[Part C Capacity Development]

(2) Pre-Feasibility Study on the High Priority Projects

[Package A Improvement of NR.57]

[Package B Urgent Bridge Rehabilitation Program]

Volume III Drawings

[Package A Improvement of NR.57]

[Package B Urgent Bridge Rehabilitation Program]

Volume IV Data Book

**Exchange Rates**

US$ 1.00=KHR 4,113.5

# PREFACE

In response to the request from the Government of the Kingdom of Cambodia, the Government of Japan decided to conduct the Study on the Road Network Development in the Kingdom of Cambodia, and entrusted the Study to the Japan International Cooperation Agency (JICA).

JICA sent the Study Team, headed by Mr. Hiroki SHINKAI of Nippon Koei Co., Ltd. and organized by Nippon Koei Co., Ltd. and Katahira & Engineers International, to Cambodia three times from March 2005 to July 2006.

The Study Team had a series of discussions with the officials concerned of the Government of the Kingdom of Cambodia and Ministry of Public Works and Transport and conducted related field surveys. After returning to Japan, the Study Team conducted further studies and compiled the final results in this report.

I hope that this report will contribute to the promotion of the plan and to the enhancement of amity between our two countries.

I wish to express my sincere appreciation to the officials concerned of the Government of the Kingdom of Cambodia, Ministry of Public Works and Transport for their close cooperation throughout the Study.

October, 2006

Takashi KANEKO
Vice President
Japan International Cooperation Agency

October, 2006

Mr. Takashi KANEKO
Vice President,
Japan International Cooperation Agency
Tokyo, Japan

# LETTER OF TRANSMITTAL

We are pleased to submit to you the report on the Study on the Road Network Development in the Kingdom of Cambodia. The report compiled all findings obtained through the study from March 2005 to July 2006 in Cambodia conducted by Nippon Koei Co., Ltd. and Katahira & Engineers International in accordance with the contract with Japan International Cooperation Agency.

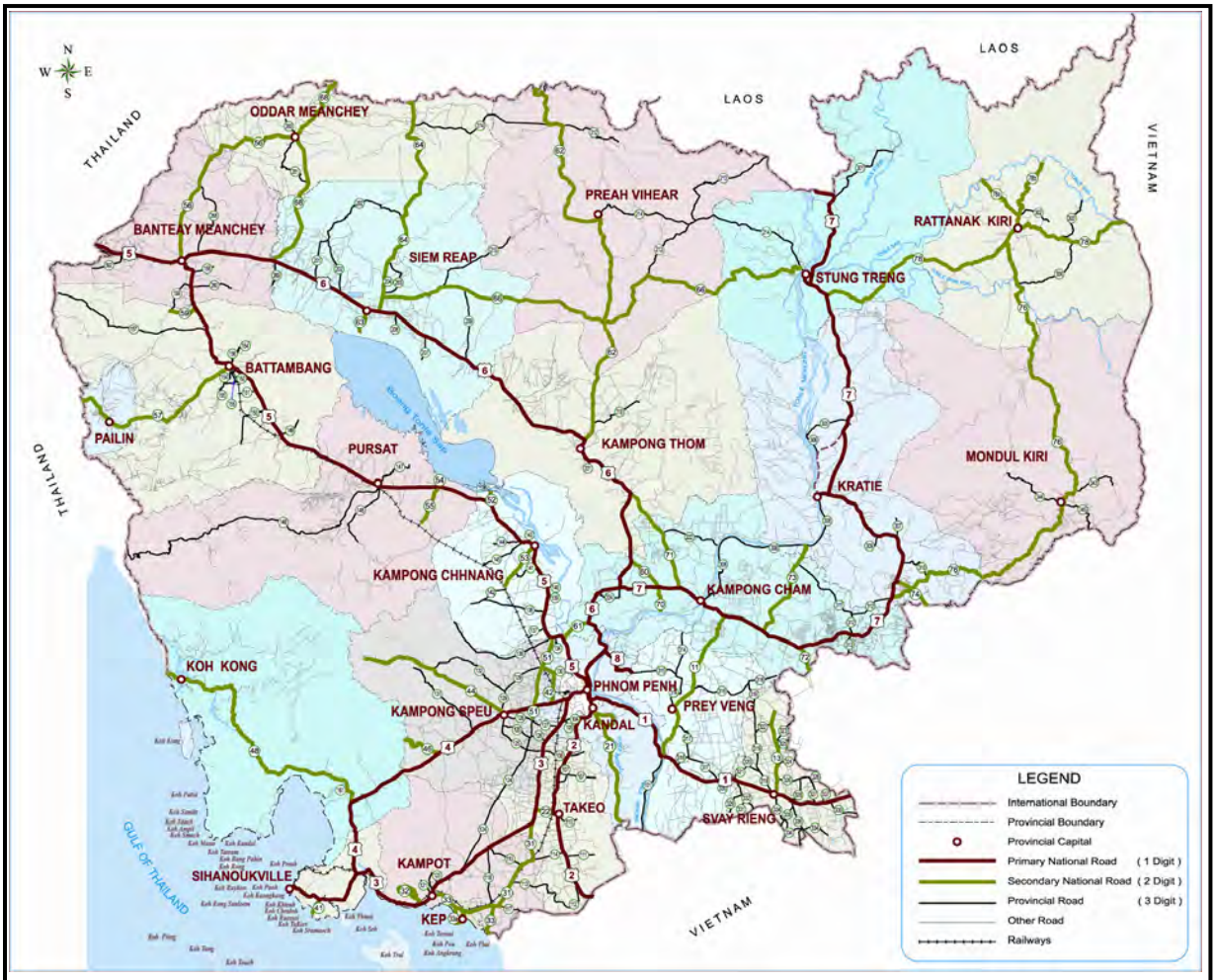
The report contains a master plan and a pre-feasibility study parts. The master plan proposes the road network development plan aiming at the year of 2020 based on the realistic and practical implementation plan taking into consideration financial plan. The subsequent pre-feasibility study on high priority projects concludes that the proposed projects will be technically and economically feasible and will be acceptable from the environmental aspects, and will contribute to the improvement of road situation in Cambodia.

We wish to take this opportunity to express our sincere gratitude to your agency and the Ministry of Foreign Affairs, and also wish to express our deep appreciation to the Government agencies concerned in the Kingdom of Cambodia, especially the counterpart agency of the Ministry of Public Works and Transport, for the close cooperation and assistance extended to us during the study.

We hope this report will contribute to the development of the Kingdom Cambodia.

Very truly yours,

Hiroki SHINKAI
Team Leader
The Study on the Road Network Development
in the Kingdom of Cambodia

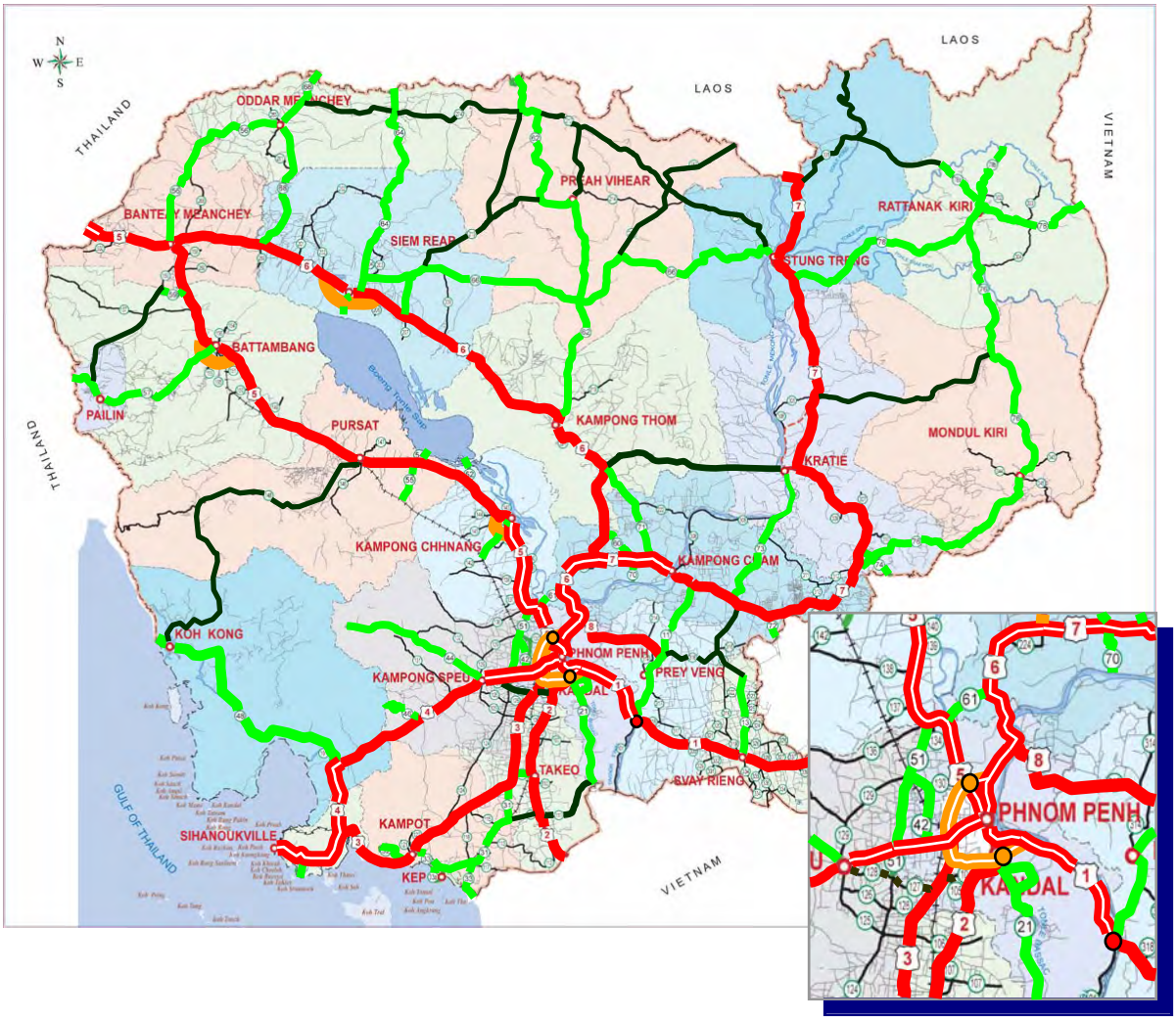



**LOCATION MAP**

EXISTING ROAD NETWORK IN CAMBODIA

| | |
|---|---|
| 1-DIGIT NATIONAL ROADS | 2,052km |
| 2-DIGIT NATIONAL ROADS | 2,643km |
| PROVINCIAL ROADS | 6,615km |
| RURAL ROADS | 18,948km |
| TOTAL | 30,258km |

**STUDY ON THE ROAD NETWORK DEVELOPMENT IN THE KINGDOM OF CAMBODIA**




## ROAD NETWORK DEVELOPMENT PLAN

| ROAD CLASSIFICATION | | SECTION TO BE IMPROVED | | | MAINTENANCE WORK ONLY | TOTAL |
|---|---|---|---|---|---|---|
| 1-DIGIT NATIONAL ROADS | | 4-LANE | 455km | | 0km | 2,052km |
| | | 2-LANE | 1,597km | | 0km | |
| 2-DIGIT NATIONAL ROADS | | 2-LANE | 2,643km | | 0km | 2,643km |
| PROVINCIAL ROADS | | 2-LANE | 1,554km | | 5,061km | 6,615km |
| RURAL ROADS | | 2-LANE | 0km | | 18,948km | 18,948km |
| NEW ROADS | RING ROAD | 4-LANE | 50km | | 0km | 50km |
| | BYPASSES | 2-LANE | 80km | | 0km | 80km |
| NEW BRIDGES | | 2-LANE | 3km. | | 0km | 3km |
| TOTAL | | | | | | 30,391km |

# THE STUDY ON THE ROAD NETWORK DEVELOPMENT IN THE KINGDOM OF CAMBODIA

## FINAL REPORT
## VOLUME I SUMMARY
## TABLE OF CONTENTS

# LIST OF ABBREVIATIONS

| | |
|---|---|
| AADT: | Annual Average Daily Traffic |
| AASHTO: | American Association of State Highways and Transportation Officials |
| AC: | Asphalt Concrete |
| ADB: | Asian Development Bank |
| AH: | Asian Highway |
| AHS: | Asian Highway Standard |
| ASEAN: | Association of SouthEast Asian Nations |
| AusAID: | Australian Agency for International Development |
| AS: | Australian Standard |
| BCR (B/C Ratio): | Benefit Cost Ratio |
| BCU: | Bridge Construction Unit |
| BHN: | Basic Human Needs |
| BM: | Bench Mark |
| BR: | Bridge |
| BVOC: | Basic Vehicle Operating Cost |
| CBDS: | Cambodian Bridge Design Standard |
| CBR: | California Bearing Ratio |
| CBTA: | Cross-Border Transport Agreement |
| CDC: | Council for the Development of Cambodia |
| CLV: | Cambodia, Laos and Vietnam |
| CMAA: | Cambodian Mine Action and Victim Assistance Authority |
| CMAC: | Cambodian Mines Action Center |
| CMVIS: | Cambodia Mine/UXO Victim Information System |
| CP: | Counterpart |
| CRDS: | Cambodian Road Design Standard |
| DBST: | Double Bituminous Surface Treatment |
| DD: | Detailed Design |
| DFL: | Design Flood Level |
| DF/R: | Draft Final Report |
| DMS: | Detailed Measurement Survey |
| DPWT: | Department of Public Works and Transport |
| DRI (DOR): | Department of Road Infrastructure |
| DRR: | Department of Rural Roads |
| DU: | Demining Unit |
| DTM: | Digital Terrain Models |
| EIA: | Environmental Impact Assessment |
| EIRR: | Economic Internal Rate of Return |

| | |
|---|---|
| EMP: | Environmental Management Plan |
| ESAL: | Equivalent Single Axle Load |
| F/R: | Final Report |
| F/S: | Feasibility Study |
| FIRR: | Financial Internal Rate of Return |
| FRMR: | Fund for Road Maintenance and Repair |
| FYMAP: | Five Year Mine Action Plan |
| GDP: | Gross Domestic Product |
| GIS: | Geographical Information System |
| GMS: | Greater Mekong Sub-region |
| GoJ: | Government of Japan |
| GPC: | Ground Control Points |
| GPS: | Global Positioning System |
| GRDP: | Gross Regional Domestic Product |
| H/A: | Highway/Arterial |
| HCM: | Highway Capacity Manual |
| HEC: | Heavy Equipment Center |
| H/MA: | Highway/Minor Arterial |
| HIV/AIDS: | Human Immunodeficiency Virus / Acquired Immunodeficiency Syndrome |
| HLP: | Heavy Load Platform |
| HV: | Heavy Vehicles |
| HWL: | High Water Level |
| IC/R: | Inception Report |
| IDA: | International Development Association |
| IDP: | Internally Displaced People |
| IEE: | Initial Environmental Examination |
| IEIA: | Initial Environmental Impact Assessment |
| IH: | International Highway |
| ILO: | International Labor Organization |
| IMC: | Inter-Ministerial Committee |
| IRC: | Inter-ministerial Resettlement Committee |
| IRITWG: | Infrastructure and Regional Integration Technical Working Group |
| IT/R: | Interim Report |
| JICA: | Japan International Cooperation Agency |
| JRA: | Japan Road Association |
| LOS: | Level of Services |
| JRSO: | Japan Road Structure Ordinance |
| LRCS: | Location Referencing and Condition Survey (by World Bank) |
| LV: | Light Vehicles |
| M/P: | Master Plan |

| | |
|---|---|
| MAFF: | Ministry of Agriculture Forestry and Fishery |
| MC: | Motorcycles |
| MCTU: | UN Mine Clearance Training Unit |
| MEF: | Ministry of Economy and Finance |
| MLMUPC: | Ministry of Land Management, Urban Planning & Construction |
| MOE: | Ministry of Environment |
| MOI: | Ministry of Interior |
| MOP: | Ministry of Planning |
| MOWRAM: | Ministry of Water Resources and Meteorology |
| MPWT: | Ministry of Public Works and Transport |
| MR: | Modulus Ratio |
| MRD: | Ministry of Rural Development |
| MSL: | Mean Sea Level |
| NA: | National Assembly |
| NGO: | Non Governmental Organization |
| NIS: | National Statistical Center |
| NMAD: | National Mine Action Database |
| NPRS: | National Poverty Reduction Strategy |
| NPV: | Net Present Value |
| NR: | National Road |
| NRMC: | National Road Maintenance Committee |
| NSDP: | National Strategic Development Plan |
| OD Survey: | Origin-Destination Survey |
| PAP(s): | Project Affected Person(s) |
| p0: | Initial Serviceability Index |
| PC: | Pre-stressed Concrete |
| P/C: | Provincial/Collector |
| PCDG: | Pre-stressed Concrete Deck Girder |
| PCU: | Passenger Car Unit |
| PDRD: | Provincial Department of Rural Development |
| PK: | Kilometer Post |
| PMAC: | Provincial Mine Action Committee |
| PMU: | Project Management Unit |
| PO: | Project Owner |
| PR: | Provincial Road |
| Pre-FS: | Pre-Feasibility Study |
| PR/R: | Progress Report |
| PRW: | Provisional Road Width |
| PRRO: | Provincial Rural Road Office |
| PSI: | Present Serviceability Index |

| | |
|---|---|
| pt: | Terminal Serviceability Index |
| PWRC: | Public Works Research Center |
| Q: | River Discharge |
| RAP: | Resettlement Action Plan |
| RB: | Road Board |
| RC: | Reinforced Concrete |
| RC Slab: | Reinforced Concrete Slab Bridge |
| RCDG: | Reinforced Concrete Deck Girder |
| RCBC: | Reinforced Concrete Box Culvert |
| RCC: | Road Construction Center |
| RCPC: | Reinforced Concrete Pipe Culvert |
| RD: | Road Density |
| RDI: | Road Density Index |
| RGC: | Royal Government of Cambodia |
| RMS: | Root Mean Square |
| ROW: | Right of Way |
| SC: | Steering Committee |
| SCF: | Standard Conversion Factor |
| SME: | Small and Medium Enterprise |
| SN: | Structural Number |
| STTC: | Saving in Travel Time Cost |
| SVRC: | Saving in Vehicle Running Cost |
| SVFC: | Saving in Vehicle Fixed Cost |
| T/A: | Technical Assistance |
| T/T Report: | Technology Transfer Report |
| UNDP: | United Nations Development Program |
| UNESCAP: | United Nations Economic and Social Commission for Asia and the Pacific |
| UNTAC: | United Nations Transitional Authority in Cambodia |
| TTC: | Travel Time Cost |
| UTM: | Universal Transverse Mercator |
| UXO(s): | Unexploded Ordnance(s) |
| VCR: | Traffic Volume/Capacity Ratio |
| VOC: | Vehicle Operating Cost |
| VPD: | Vehicles per Day |
| W/: | With |
| W/O: | Without |
| WB: | World Bank |
| WGS: | World Geodetic System |

# EXECUTIVE SUMMARY

## (1) BACKGROUND OF THE STUDY

In order to ensure the efficiency and sustainability of socio-economic development and poverty reduction, the Royal Government of Cambodia has prepared two development guidelines in the past, consisting of "SEDP II (2001-2005)", and "National Poverty Reduction Strategy 2003-2005 (NPRS)", and a new 5 years national development plan, entitled the "National Strategic Development Plan (2006-2010)", is enforced and effectives in January 2006,. Its policy has shifted from "rehabilitation" to "economic development" in which the Cambodia is now at the stage to make a new foundation of growth by aligning all the development participants domestically and internationally.

With the assistance from foreign governments and international credit organizations, most of the transport infrastructures in the 1-Digit national roads have been rehabilitated and reconstructed in the last 15 years. However, majority of the 2-Digit national roads and provincial roads in the regions and countryside still remain in the deteriorated state without any improvement for long time.

Such condition, together with the expanding economic influence by the neighboring country in and around the local border and the inability of the government's administrative services to be extended to the district and rural areas has lead to an increase in the socio-economic gap between Phnom Penh and the rural areas. This situation has become a large problem in Cambodia in terms of governance.

## (2) PURPOSE OF THE STUDY

The major objectives of the Study are:

1) To formulate a road network development master plan covering the whole country of Cambodia, aiming at the year of 2020,
2) To carry out a pre-feasibility study for high priority projects selected in the short-term plan (2010), and
3) To undertake a transfer of knowledge and technology.

## (3) STUDY AREA AND THE ROADS FOR THE STUDY

The study area covers the entire territory of Cambodia The roads for the Study are 1-Digit and 2-Digit national roads and provincial roads under MPWT and local roads under MRD.

## (4) TARGET YEAR OF THE MASTER PLAN

The target year of the master plan is set as the year of 2020, which consists of Short term (2016 ~2010), Medium term (2011 ~ 2015) and Long term (2016 ~ 2020).

## (5) COMPOSITION OF MASTER PLAN

The master plan consist of two parts, namely

(1) Master Plan Study for the Road Network Development and

(2) Pre-feasibility Study on the High Priority Projects

In order to make a reliable and practical road development master plan, we have to examine not only the physical structure of the road network but also examine the soft component regarding the institutional development of road maintenance and the capacity building of personnel in charge. Based on the above, the master plan study consists of the following three components:

Part A: Infrastructure Development of Road Network

Objectives: To establish the road development plan in the long term consisting of road network plan, road improvement plan and implementation plan

Part B: Institutional Development of Road Maintenance

Objectives: To prepare the improvement plan of road maintenance system including procurement of budget, operation and administration

Part C: Capacity Building

Objectives: To conduct the technology transfer to the counterpart through the study and prepare the capacity development plan for personnel in charge of road administration

## (6) COORDINATION WITH STAKEHOLDER

Restoration of 1-Digit roads and some major 2-Digit roads are almost completed owing to the support of each country donor in the past 15 years, except in some sections. However, discrepancies in the opinions among the different supporting group regarding a project implementation have become remarkable recently, which has caused non-consistency in the execution of project implementation.

Taking into account the above situation, the Study team pursued the study with the cooperation of international finance organization and donor countries and participated in the infrastructure working committee (IRITWG) which is organized regularly as a lower level of donor meeting to avoid repetition of support. Furthermore, the Study team carried out the study in coordination with ministries and government offices (eight ministries and government offices) through the Steering Committee together with two JICA experts dispatched in MPWT in order to reach an agreement of opinions.

Although it is difficult to identify specific stakeholders at the stage of master plan development, the Study Team held the workshop with participation of NGO considering that information disclosure is necessary, and exchanged opinions about problems in compensation and procedure about inhabitant's resettlement. In the workshop, the Study team explained the finding of the road master plan to the NGO.

## (7) CONCLUSION AND RECOMMENDATIONS

The Study team recommends that the Cambodian government uses the findings of the road master plan study as the base of long-term national development program and hopes that the projects suggested in the study would be conducted and completed successfully by 2020.

# I. MASTER PLAN STUDY FOR ROAD NETWORK DEVELOPMENT

## Part A: INFRASTRUCTURE DEVELOPMENT OF ROAD NETWORK

### (A-1) ROAD NETWORK MASTER PLAN

The Study team established the road network master plan covering the whole country which has been formulated based on the philosophies and strategies as shown below:

**Proposed Vision: "rehabilitation" to "economic development"**

The nation is in the transition from rehabilitation of internal turmoil to development in peace. Therefore, the road network development in Cambodia has to proceed in order to realize sustainable and stable socio-economic development with poverty alleviation of the people and stabilization of daily life, especially in rural areas, as a nation located in the global center of the Greater Mekong Region.

**Philosophy 1: Road development which contribute to the national governance and economic development**

Strategy 1: Multi Growth Pole Development

Strategy 2: National Integration

Strategy 3: Development of International Corridor

**Philosophy 2: Road Development which contributes to the regional development and poverty reduction**

Strategy 4: Enhancement of Rural Economic Development

Strategy 5: Regional Development for Poverty Reduction

The concept and image of the above strategies is shown in **Table ES-1** and **Figure ES-1**, while the future road network plan in 2020 is shown in **Figure ES-2**.

**Table ES-1 Road Development Concept**

| Vision | Philosophy and Strategy | Objectives | Target |
|---|---|---|---|
| "Rehabilitation" to "Economic Development" | **Philosophy 1: Road development which contribute to the national governance and economic development** | | |
| | **Strategy 1: Multi Growth Pole Development** (Contribution to capital city and regional centers) | To contribute to multi-core national development instead of that of sole initiative by Phnom Penh | Expansion to 4-lane on the national roads connecting to Phnom Penh and introduction of Ring Road, Bypasses construction at major regional cities such as Siem Reap and Kampong Chnang |
| | **Strategy 2: National Integration** (Road network development to expand national administration ) | To contribute to national integrity and administration with remote areas where road access is very limited | Improvement into all-weather roads at the sections of two digit national roads so as to realize easy connection to Phnom Penh even in the rainy season |
| | **Strategy 3: Development of International Corridor** (Expansion of trade and commodity flows to and from neighboring countries ) | To contribute to expansion of trade with neighboring countries, distribution industry and increase in employment | Functional strengthening of one and two digit national roads, improvement of two digit national roads in the areas adjacent to boarders, improvement of accessibility to rails, water ways and distribution centers. |
| | **Philosophy 2: Road development which contributes to the regional development and poverty reduction** | | |
| | **Strategy 4: Enhancement of Rural Economic Development** (Road network to support regional economy) | To contribute to promotion of regional industries, expansion of investment and increase in employment | Enhancement of road access, especially by two digit national roads, to high potential areas of tourism, agriculture and manufacturing |
| | **Strategy 5: Regional Development for Poverty Reduction** (Alleviation of poverty and reduction of income disparity) | To contribute to enhancement of Basic Human Need (BHN); employment, education, safety and health | Improvement of three digit national roads and rural roads located in CLV border area, north east corner of Cambodia, strategically selected areas for national development by strengthened road maintenance works |

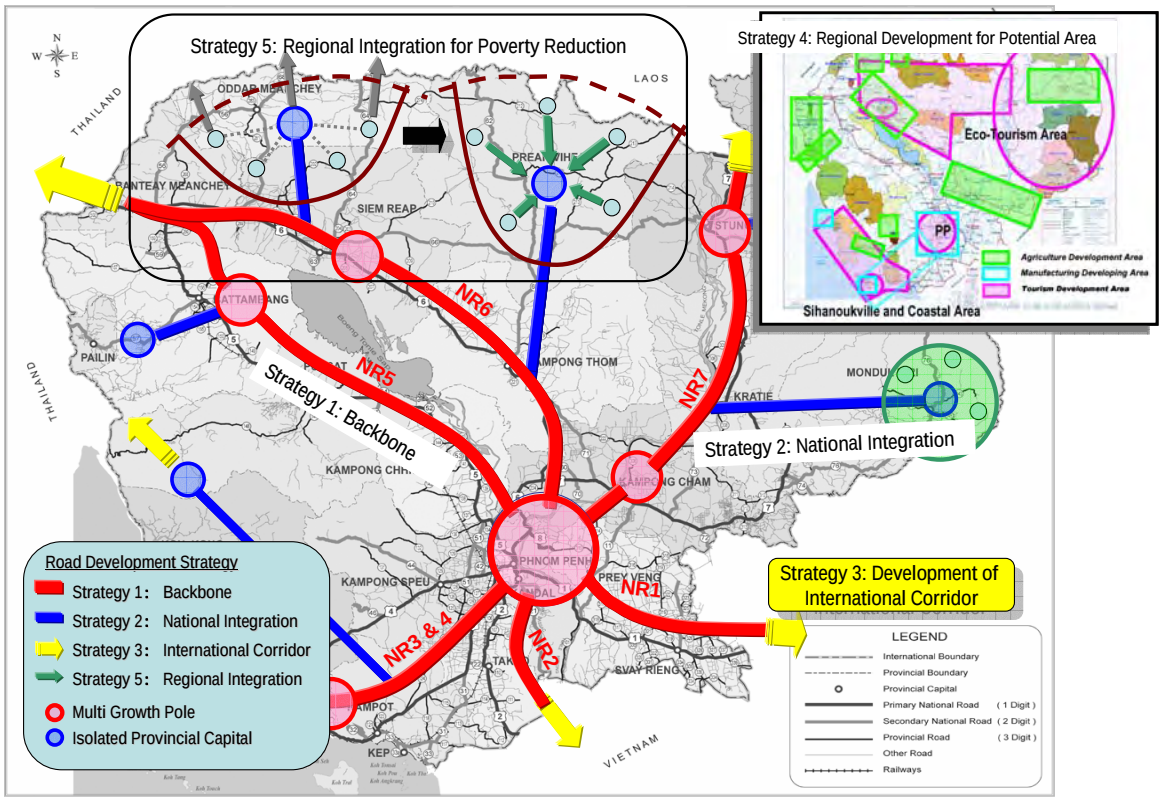



**Figure ES-1 Road Network Development Strategy**

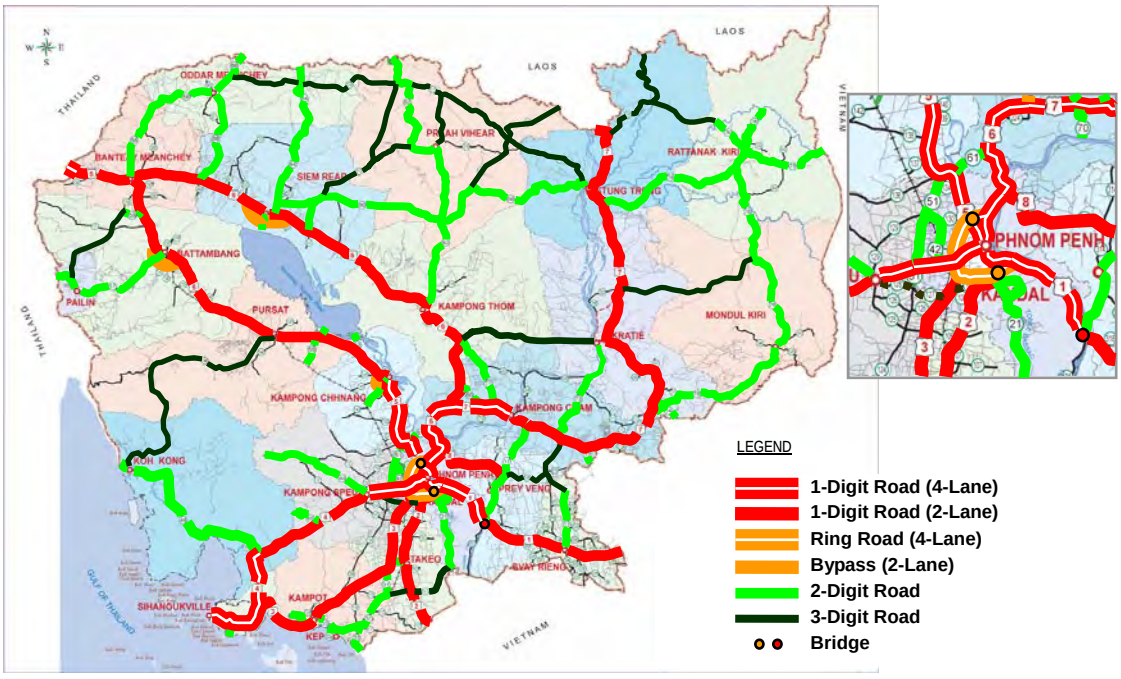



**Figure ES-2 Road Network Master Plan (2020)**

## (A-2) ROAD DESIGN CONCEPT

The design concept has been established in order to build a reliable road network system in Cambodia.

**Table ES-2 Design Policy for Road Structure**

| Road Classification | Policy of Road Design |
|---|---|
| 1-Digit National Roads | To improve the road level to be all weather condition with sufficient capacity and standard for international corridor |
| 2-Digit National Roads | To improve the road to be highway class function under all weather condition by asphalt concrete pavement or DBST |
| Provincial Roads & Rural Roads | To maintain the road function level to be trafficable in accordance with traffic demand by strengthening the road maintenance system |

## (A-3) ROAD IMPLEMENTATION PROGRAM AND INVESTMENT PLAN

Based on the road network development and design policy, the road improvement plan has been worked out in terms of numbers of traffic lanes, road width, type of pavement (asphalt concrete or DBST) and bridge improvement. The implementation program has been determined in line with the criteria as follows:

(i) Improvement measures on each proposed roads was evaluated from the view points of socio-economic factors and easiness of implementation which determines the priority order of these road projects into high, medium and low priority based on the marks obtained.

(ii) Checking on the movement of donors and international financing agencies to avoid the duplication of implementation, and on-going projects are included in the short-term plan.

(iii) Maximum value of investment is allocated in each term taking into account the availability of financing.

(iv) Bridge becoming bottlenecks of traffic in 1-Digit and 2-Digit roads shall be improved under the "Urgent Bridge Rehabilitation Program" either in the short term or medium term plans.

**Table ES-3 Priority Projects Proposed in the Short term Plan (2006 - 2010)**

| Projects Proposed in the Short Term | | Length (km) | Improvement Measures | Project Status (as of July, 2006) | Project Cost (US$ M) |
|---|---|---|---|---|---|
| 1-Digit NR | NR.1 (1-1, PP-Neak Leuong) | 60.0 | Road upgrading | Under construction | 65.0 |
| | NR.1 (1-2, Neak Leuong Bridge) | 2.0 | New bridge construction | F/S completed by Japan | 70.0 |
| | NR.2 (2-2, Takeo-VN Border) | 57.0 | Road upgrading | Completed in 2006 | 12.0 |
| | NR.3 (3-2, Kampot-Veal Rinh) | 54.0 | Road upgrading | Under construction | 17.5 |
| | NR.5 (5-5, Sisophon -Thai Border) | 47.0 | Road upgrading | Under construction | 11.6 |
| | NR.6 (6-4, Siem Reap - Sisophone) | 48.0 | Road upgrading | Under construction | 30.4 |
| | NR.7 (7-3,4 Kratie-Laos Border) | 193.0 | Road upgrading | Under construction | 50.0 |
| 2-Digit NR | NR.33 (33-1, Kampong Trach-Lork) | 17.0 | Road upgrading | Committed by ADB | 5.0 |
| | NR.48 (Chamker Loung-Thai Border) | 161.0 | Road upgrading | Under construction | 29.7 |
| | NR.57 (Battambang-Pailin-Thai Border) | 103.0 | Road upgrading | Pre-F/S completed by Japan | 45.0 |
| | NR.62 (62-1, Thanal Baek - Tbeng Meanchey) | 243.0 | Road upgrading | Under construction | 37.0 |
| | NR.64 (Svay Thom - Dang Rek) | 134.0 | Road upgrading | Committed by Thai | 27.8 |
| | NR.65 (Dam Deck - Trapeang Prey) | 21.0 | Road upgrading | Under construction | 4.0 |
| | NR.71 (Treung -Kompong Thmar | 58.0 | Road upgrading | Under construction | 17.0 |
| | NR.72 (Kreat Tboung - Smach) | 14.0 | Road upgrading | Completed by DPWT | 4.0 |
| | NR.78 (78-2, Bang Lung - Vietnam Border) | 70.0 | Road upgrading | Committed by Vietnam Gov. | 26.0 |
| Urgent Bridge Rehabilitation Program | | | | | |
| | Phase I: South-east Block | - | Bridge rehabilitation | Requested to Japanese Gov. | 12.0 |
| | Phase II: North-west Block | - | Bridge rehabilitation | Undecided | 12.0 |

Note) Marked Projects are not yet executed nor committed.

## (A-4) TOTAL PROJECT COST AND INVESTMENT ALLOCATION PLAN

The following is the summary of project cost and investment plan based on the result of project prioritization as well as amount of fund to be procured.

**Table ES-4 Summary of Investment**

| Description | Total Amount ($ million) | Short-term 2006 - 2010 | Medium-term 2011 - 2015 | Long-term 2016 - 2020 | Remarks |
|---|---|---|---|---|---|
| **A. Required Cost** | | | | | |
| (1) Road Improvement/Rehabilitation Project | | | | | |
| 1-Digit Roads | 1,157 | 207 | 337 | 613 | NR1, 2nd Mekong Bridge, NR2, NR3, NR4, NR5, NR6, NR7, NR8 |
| 2-Digit Roads | 676 | 196 | 231 | 249 | NR11, NR21, NR33, NR48, NR57, NR62, NR64, NR68, NR78, and other 28 routes |
| 3-Digit Roads | 202 | 0 | 15 | 187 | PR104, PR114 and other 16 routes |
| Urgent Bridge Rehabilitation Program | (40) | (20) | (20) | (0) | Short-term: Phase I (South-east BL) and Phase II (North-west BL) |
| | | | | | Medium-term: Phase III (South-west BL) and Phase IV (North-east BL) |
| Total (1) | **2,035** | **403** | **583** | **1,049** | |
| (2) Road Maintenance Works | | | | | |
| 1 digit, 2 digit, 3 digit and rural roads | 481 | 113 | 169 | 199 | daily and routine maintenance only |
| Total (2) | **481** | **113** | **169** | **199** | |
| Total (B)=(1)+(2) | **2,516** | **516** | **752** | **1,248** | |
| **B. Fund to be Procured** | | | | | Financial procurement plan of Case 2 |
| International fun Total (3) | 1,284 | 428 | 428 | 428 | Support by International Banks, Bilateral Loans, Grant Aids |
| Domestic fund Total (4) | 982 | 135 | 288 | 559 | Allocation of Added Tax and Road Use Tax to Road Sector |
| Total (B)=(3)+(4) | 2,266 | 563 | 716 | 987 | |
| Difference (surplus/▲shortage) | ▲ 250 | 47 | ▲ 36 | ▲ 261 | Surplus in the short-term shall be transferred to medium-term. |
| Additional fund required | **250** | **0** | **0** | **250** | To be procured by introduction of BOT system or 3rd private sector |

A Present financial status of the Cambodian government is very tight and has many problems and issues to be solved in order to secure the necessary funds planned in the Study. The following improvement is recommended by the Study team.

(i) To allocate a full amount of added tax (2 cent/litter on gasoline and 4 cent/litter on diesel) to fund for road construction and maintenance works and raise the rates of tax in the long term with the economic development of the nation.

(ii) To allocate a part of road user tax (car registration tax, car holding tax, etc) to the resource for road construction and maintenance works

(iii) To take action against smuggling of petrol products and improve the system of cash flow focusing in disconcerted communication among MEF, MPWT and MRD and other authorities concerned.

# Part B: INSTITUTIONAL DEVELOPMENT OF ROAD MAINTENANCE

## (B-1) CONCEPT OF ROAD MAINTENANCE MANAGEMENT

MPWT and road authorities have been undertaking the road network management in rather haphazard manner and negative impact on socio-economy has begun to appear in the regions surrounding the several sections of related roads.

The Study Team proposed term-wise goals of road maintenance management as shown in **Table ES-5**, namely, short term, medium term and long term goals for development. These goals are to be achieved with the annual maintenance program and with strengthened the capacity development and the achievement be expressed in terms of practical indicator.

**Table ES-5 Road Maintenance Concept**

| | | Short Term | Medium Term | Long Term |
|---|---|---|---|---|
| Vision | | Development of Standardized Mechanism Framework | Establishment of Sustainable Mechanism | Independent Road Maintenance Mechanism |
| Goal | | ・ Trafficable 100% (1-Digit NR)<br>60% (2-Digit NR)<br>40% (3, 4-Digit PR)<br>・ Application of guideline for Project Cycle management<br>・ Establishment of NRMC<br>・ Introduction of management by NRMC | ・ Trafficable 100% (1-Digit NR)<br>80% (2-Digit NR)<br>60% (3, 4-Digit PR)<br>・ Mobilization of Human Resources (Establishment of Regional Center)<br>・ Train to Local Contractor<br>・ Sustainable System Management by NRMC | ・ Trafficable 100% (1-Digit NR)<br>100% (2-Digit NR)<br>80% (3, 4-Digit PR)<br>・ Decentralization<br>・ Establishment of Management by MPWT |
| Institutional Management | | ・ Application of Road Law | ・ Achieve Quality Assurance (QA) | ・ NRMC transfer management to Road Development & Improvement Planning |
| Organization | Planning | MPWT DOR, PWRC/DPWT | MPWT DOR, PWRC/DPWT | MPWT DOR, PWRC/DPWT |
| | Implementation | DPWT Force Account/Contract Out | DPWT Force Account/Contract Out | Contract Out |
| | Assessment | NRMC/MPWT DOR, PWRC | MPWT DOR, PWRC/NRMC | DPWT/MPWT DOR, PWRC |
| Finance | | Earmarked Fund (Added Tax)/Foreign Assistance | Earmarked Fund (Added Tax) | Earmarked Fund (Added Tax) |
| Human & Organization Development | | ・ Formulation of National Program<br>・ Improving individual ability using guideline | ・ Developing ability for leaders course<br>・ Quality Management System<br>・ Strengthening of Private sector | ・ Method of Asset Management |

## (B-2) PROPOSAL FOR IMPROVED ROAD MAINTENANCE FUND

The amount of road maintenance fund required for the realization of the goals are estimated to be $480.5 mil ($113.0 mil for short term, $168.9 mil for medium term and $198.6 mil for long term), applying unit maintenance cost set out by activity of road maintenance work to the expected required amount of works.

The required term-wise maintenance costs are less than estimated revenues from Road User Special Tax of corresponding planning period, the expenditure/revenue ratios are estimated at 84.5%, 92.0% and 75.2% for short term, medium term and long term, respectively.

However, the Road User Special Tax is not properly managed and funds necessary for road maintenance are not properly disbursed and delays and sometimes total postponement of the next fiscal year are commonly seen because of shortage of fund caused by poor management. This is not the issues only on the side of MPWT and MEF, but the issues attributed to financing and budgetary systems of the nation.

The problem of road maintenance works in Cambodia is not lying in the shortage of fund but in usage of available fund ever established.

## (B-3) ESTABLISHMENT OF NRMC

Present issues in current road management system, among other things, are as the below;.

(1) Lack of standard procedure in the request for budget stage,

(2) Non- transparency at procurement stage,

(3) Insufficient quality control at implementation stage, and

(4) Lagged disbursement and payment by MEF.

In order to improve the present situation, the Study Team strongly recommended the establishment of National Road Maintenance Committee (NRMC) to promote capacity development on MPWT and DPWT officials and to realize timely budget disbursement by MEF. The Study Team recommended all the concerned authorities work and study together so as to improve the capability of each Ministries concerned with well-established the mutual understandings.

But MEF opposes to the establishment of NRMC for the reason of difficulty in financial procedure which NRMC has to manage and disburse the fund for road maintenance, which is added tax, although they understand the proposals.

## (B-4) PREPARATION OF ROAD MAINTENANCE GUIDELINE AND CAPACITY DEVELOPMENT PLAN

Meanwhile, MEF proposes to establish the Inter-Ministerial Committee (IMC) for the approval of maintenance program and smooth implementation of maintenance activities. Even though this organization shall not handle financing and budgeting matters.

However, road authorities will adopt the maintenance management in either case of proposals, it is necessary to strengthen the mutual understanding between concerned ministries for sustainable maintenance management mechanism. The Study Team recommends MPWT to commence the preparation/coordination of Guidelines for the enhancement of the level of road maintenance works for the following subjects by the end of 2006;

- Guideline for Budget Planning,
- Guideline for Procurement,
- Guideline for Request and Disbursement,
- Guideline for Accounting,
- Guideline for Preparation of Maintenance Works, and
- Guideline for Quality Control.

The compilation of these Guidelines should be proceed so as to overcome the critical issues which lie in present system taking into account the existing regulations, capability, organization, contract system and constraints.

In order to fully realize and sustain the effects of the capacity development, training is an important component to improve MPWT/DPWT capacity to manage its maintenance operations. The Study Team proposes their training plan, in short term, for a system to effectively and efficiently manage, implement and evaluate.

# Part C: CAPACITY DEVELOPMENT

## (C-1) CAPACITY DEVELOPMENT THROUGH THE MASTER PLAN STUDY

The JICA Study Team gave priority to knowledge and technology transfer throughout the one-year implementation of the Study. The technology transfer was aimed at capacity development of the counterpart members of the related Ministries, primarily in the Ministry of Public Works and Transportation, in researching, planning, designing, and presenting skills as governmental officers. The related agencies of road network administration, which are MRD, MEF, and MOE, have been targeted as well.

The Study Team requested one counterpart for one Japanese expert in principle, and collaborate with not only MPWT but also MRD, MEF and MOE to exchange the skills and knowledge. The major events implemented during the Study (18 months) are shown in the next table.

**Table ES-6 Major Events of Capacity Development Program**

| Capacity Development Program | Targets/ Participants | Period/ Times | Remarks |
|---|---|---|---|
| On-the-job Training | CP 11 person | 18 months | Data correction and site visit |
| Periodical Workshop | 20-60 | 5 times | Periodically carried out |
| Workshop with NGO | 30 | 2 times | Explanation of Master Plan |
| Seminar | 60-70 participants /time | 3times | After critical Steering Committees Meeting (2005.8, 2006.3, 2006.7) |
| Group Training Coarse in Japan | CP 2 person | 1-2 months | -Urban Environment and Transportation<br>-Regulation and Type Approval System for Safety and Environmental Protection of Motor Vehicle |

## (C-2) RECOMMENDATIONS

In order to realize the appropriate road network administration suggested by the Master Plan Study, the Ministry needs a consistent vision for Capacity Development. At the same time, a strategic system and mechanism should be designed in order to disseminate the capacity development efficiently. The key points of the strategic program guided by the analysis of the above-mentioned problems are listed below.

- **Top management** should utilize the Strategic Capacity Development for the purpose of enhancing the organization responsible for the road network administration
- A consistency training program should be organized **according to the levels**
- **A mechanism** for the rapid dissemination of results should be designed
- **On-the-Job Training** from seniors to juniors should be a function of the Ministry
- **Site visits** should be utilized together with lectures for deeper understanding
- A motivation system including **promotion and payment** should be reviewed.

# II. PRE-FEASIBILITY STUDY OF THE HIGH PRIORITY PROJECTS

## Package A: IMPROVEMENT OF NATIONAL ROAD NO.57

The Project was selected as one of the highest priority projects in the Master Plan Study and therefore the pre-feasibility study was conducted. This route length is 104km, including the improvement of 12 bridges, connecting the province of Battambang with Pailin city to Thai Border.

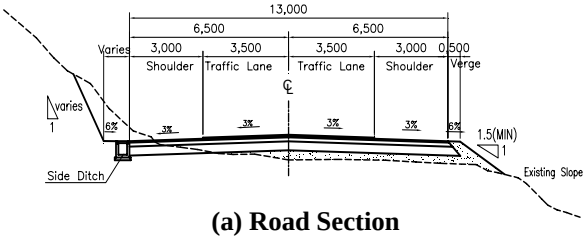
According to the Annex of the Sub-decree No.72.ANRK.BK, August 11, 1999, a full scale EIA is required for this project since the project length is 104 km. Considering the present situation in Cambodia, however, the necessary survey could not be conducted at time unless the Project is committed.

### (A-1) PRELIMINARY DESIGN

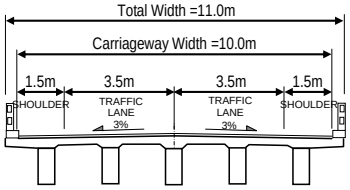
This road is classified as R4/U4. Because it constitutes the backbone of the inter-provincial national network and link up directly the Provincial Capitals from 1-Digit NR.

**Table ES-7 Summary of Geometric Design Criteria**

| Design Elements | | Type/Value | Remarks |
|---|---|---|---|
| Road Classification | | R4/U4 | |
| Design Speed (km/hr) | | 90<br>(60) | (60) :<br>Urban/Mountainous |
| Cross -Sectional Elements | Carriageway Width (m) | 14.0 | |
| | Traffic Lane Width (m) | 3.5 | |
| | Shoulder Width (m) | 3.0 | AC Binder Course only |
| Horizontal Alignment | Horizontal Curve | | |
| | Minimum Radius (m) | 335<br>(135) | () for Design Speed 60km/hr |
| Vertical Alignment | Maximum Grade (%) | 6 | |




**(a) Road Section**




**(b) Bridge Section**

**Figure ES-3 Typical Cross Section**

### (A-2) PROJECT COST AND IMPLEMENTATION SCHEDULE

Project cost has been estimated 47.4 Million US$ including cost of clearing of Landmines/UXOs and relocation of utilities, etc.

The project was divided into two stages, based upon the progress of landmine clearance.

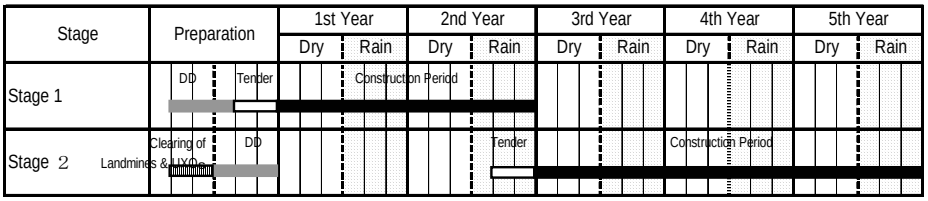



**Figure ES-4 Implementation Schedule**

### (A-3) CONCLUSION

This Study for NR.57 has shown that this project is technically and economically viable with a high economic internal rate of return, compiled at 14.8%.

This project should be implemented as early as possible due to its importance as indicated in the implementation schedule.

# Package B: THE URGENT BRIDGE REHABILITATION PROGRAM (PHASE I: SOUTH-EAST BLOCK)

This Program was selected as one of the highest priority projects in the Master Plan Study and therefore the pre-feasibility was conducted. Major project component is the rehabilitation of 8 bridges.

In total 14 properties required compensation in the areas of four (4) bridges, which are Bridge No.1, 2, 5 and 8. Even though a large scale of resettlement will not occur, necessary actions related to the resettlement have to be taken properly and carefully.

## (B-1) PRELIMINARY DESIGN

The roads where the bridges were selected are National Roads No.3, No.7, No.11 and No33, and one of the main arterial roads in Cambodia. Hence, these roads are classified as R4/U4. Project cost has been estimated 11.8 Million US$ including compensation/resettlement cost and relocation of utilities and etc. The project features of these bridges are shown in the following table;

**Table ES-8 Dimensions, Economic Factors and Environmental Factors for each Bridges**

| Bridge No. | Road No. | Type | Length (m) | Deck Width (m) | Span (m) | Project Cost (x1000 US$) | EIRR (%) | Affected Property to be compensated in PRW | Impact to Environment |
|---|---|---|---|---|---|---|---|---|---|
| 1 | NR.3 | PCDG | 60.6 | 12.0m =2@3.5m (Traffic Lane) +2@1.5m (Shoulder) +2@1.0m (Sidewalk) | 3 @ 20 | 1,317.0 | 15.04 | 3 | — |
| 2 | NR.3 | RCDG | 54.6 | | 3 @ 18 | 1,139.3 | 8.71 | 1 | — |
| 3 | NR.7 | PCDG | 140.8 | | 4 @ 35 | 2,966.0 | 1.52 | 0 | — |
| 4 | NR.11 | PCDG | 42.6 | | 2 @ 21 | 985.8 | 17.69 | 0 | — |
| 5 | NR.11 | PCDG | 92.6 | | 4 @ 23 | 2,032.4 | 17.38 | 8 | — |
| 6 | NR.11 | PCDG | 69.6 | | 3 @ 23 | 1,497.0 | 14.50 | 0 | — |
| 7 | NR.11 | PCDG | 54.6 | | 3 @ 18 | 1,224.0 | 16.40 | 0 | — |
| 8 | No.33 | RCS | 30.6 | | 3 @ 10 | 651.0 | 6.89 | 3 | — |
| Total | | | 546.0 | | | 11,812.5 | | 15 | |

## (B-2) IMPLEMENTATION SCHEDULE

The project has been divided in two stages based upon the accessibility and similarity of major components of bridge rehabilitation works.

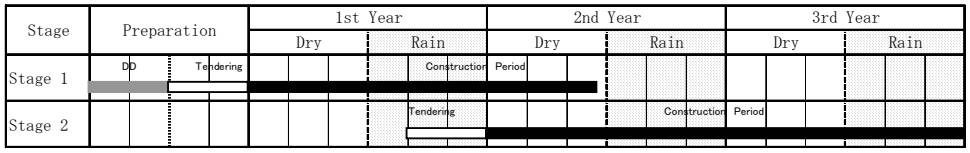



**Figure ES-5 Implementation Schedule**

## (B-3) CONCLUSION

The range of EIRR is from 7.6 to 24.3 percentages for each bridge. The EIRR for some bridges is not so high, however these bridges are located not only in the main arterial roads, NR.3, NR.7 and NR.33, but also in international routes, AH11 and AH123. Moreover, these bridges are heavy damaged. Based on these overall views, this program should be implemented as early as possible due to its importance as indicated in the implementation schedule.

# MASTER PLAN STUDY FOR ROAD NETWORK DEVELOPMENT

# PART A

## INFRASTRUCTURE DEVELOPMENT OF ROAD NETWORK

# CHAPTER A-1 INTRODUCTION

## 1.1 Background of the Study

In response to the request from the Royal Government of Cambodia, the Government of Japan decided to conduct the Study on the Road Network Development in the Kingdom of Cambodia and entrusted its execution to Japan International Cooperation Agency (JICA), the official agency responsible for the implementation of technical cooperation program of the Government of Japan. In March 2005, JICA dispatched the Study Team to undertake the Study in accordance with the agreement and scope of works mutually agreed by both governments.

## 1.2 Objectives of the Study

The major objectives of the Study are:

1) To formulate a road development master plan covering the whole country of Cambodia with a target year of 2020, including the study of the institutional development of road maintenance;

2) To carry out a pre-feasibility study for selected high priority projects; and

3) To undertake a transfer of knowledge and technology.

## 1.3 Study Area

The study area covers the entire territory of Cambodia and the surrounding countries: Vietnam, Thailand and Laos. The roads targeted in the Study are 1-Digit to 2-Digit national roads and provincial roads under the jurisdiction of the MPWT, and local roads in rural areas under the jurisdiction of the MRD.

## 1.4 Work Schedule of the Study

The Study takes nineteen (19) months approximately, beginning in March 2005 and completing in September 2006. The Study is widely divided into two phases, namely Phase 1: Master Plan Study and Phase 2: Pre-feasibility Study as shown in **Figure 1.1** below:

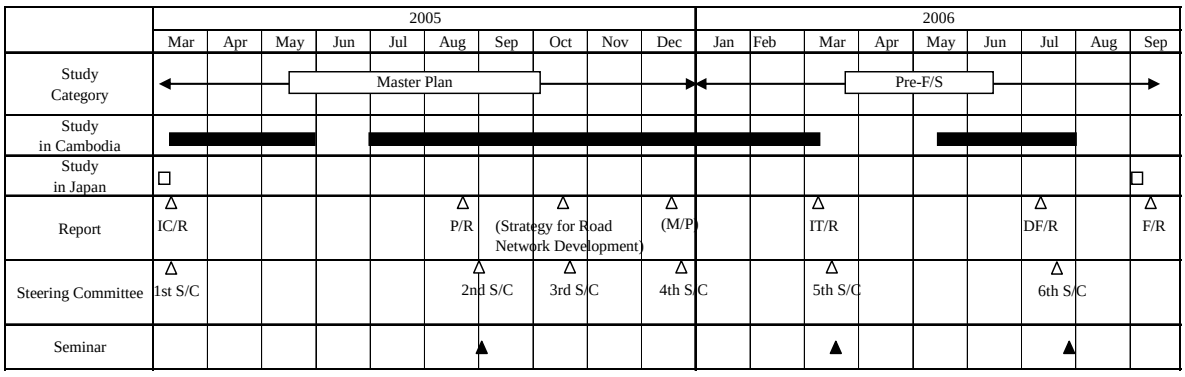



**Figure 1.1 Overall Work Schedule**

## 1.5 METHODOLOGY

The study has been conducted to propose those plans which are likely to be realized on the basis of in-depth analysis on present issues and proposals of improvement. The total flow of the Study is shown in the following **Figure 1.2**.

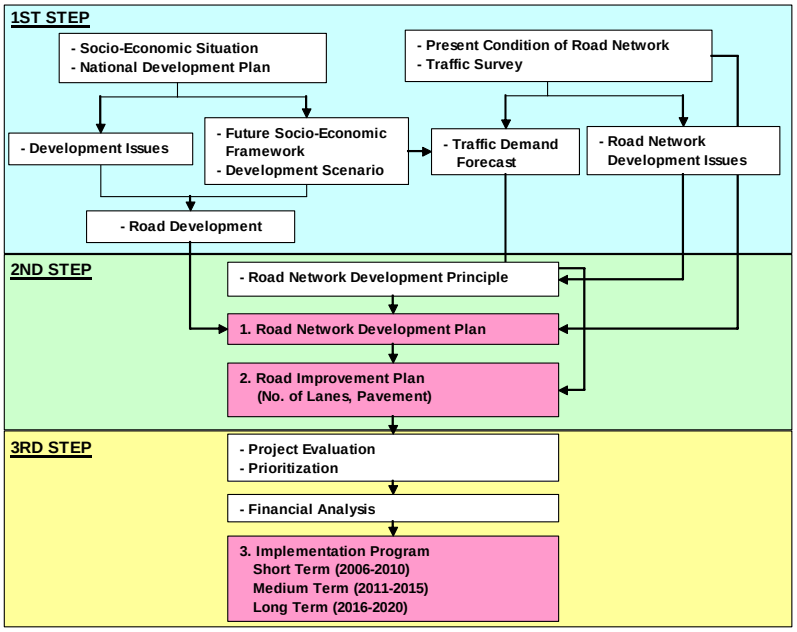



**Figure 1.2 Formulation Flow of M/P**

## 1.6 Organization of the Study Team and Steering Committee

The JICA Study Team, consisting of 21 experts, works with the counterpart personnel assinged by the countepart agencies and the Kingdom of Cambodia has established a Steering Committee under the chairmanship of the Ministry of public Works and Transport for the smooth implementation of the Study.

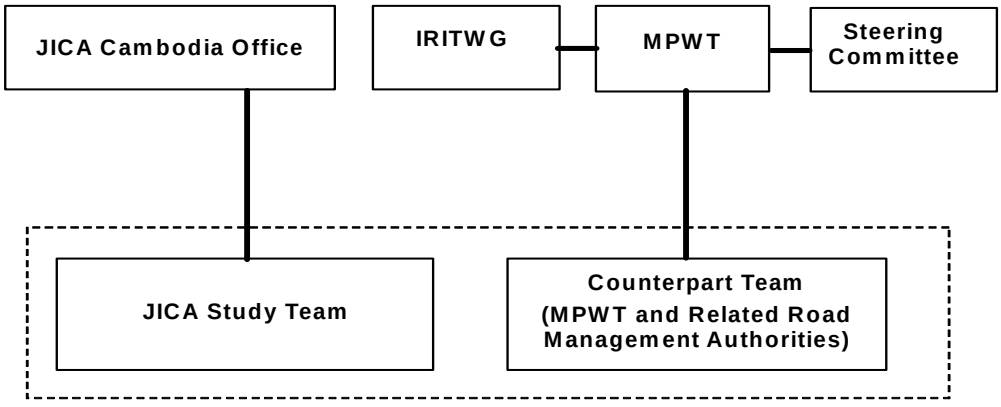



**Figure 1.3 Organization Chart for the Study**

# CHAPTER A-2 NATURAL CONDITIONS AND SOCIO-ECONOMIC PROFILE

## 2.1 Natural Conditions

### 2.1.1 Topography of Cambodia

Cambodia covers an area of 181,035 square kilometers, which is divided into three topographic regions; Central Plain Region, Mountainous Region and Coastal Region. The proportions of these regions against total area are about 51%, 39% and 10% respectively.

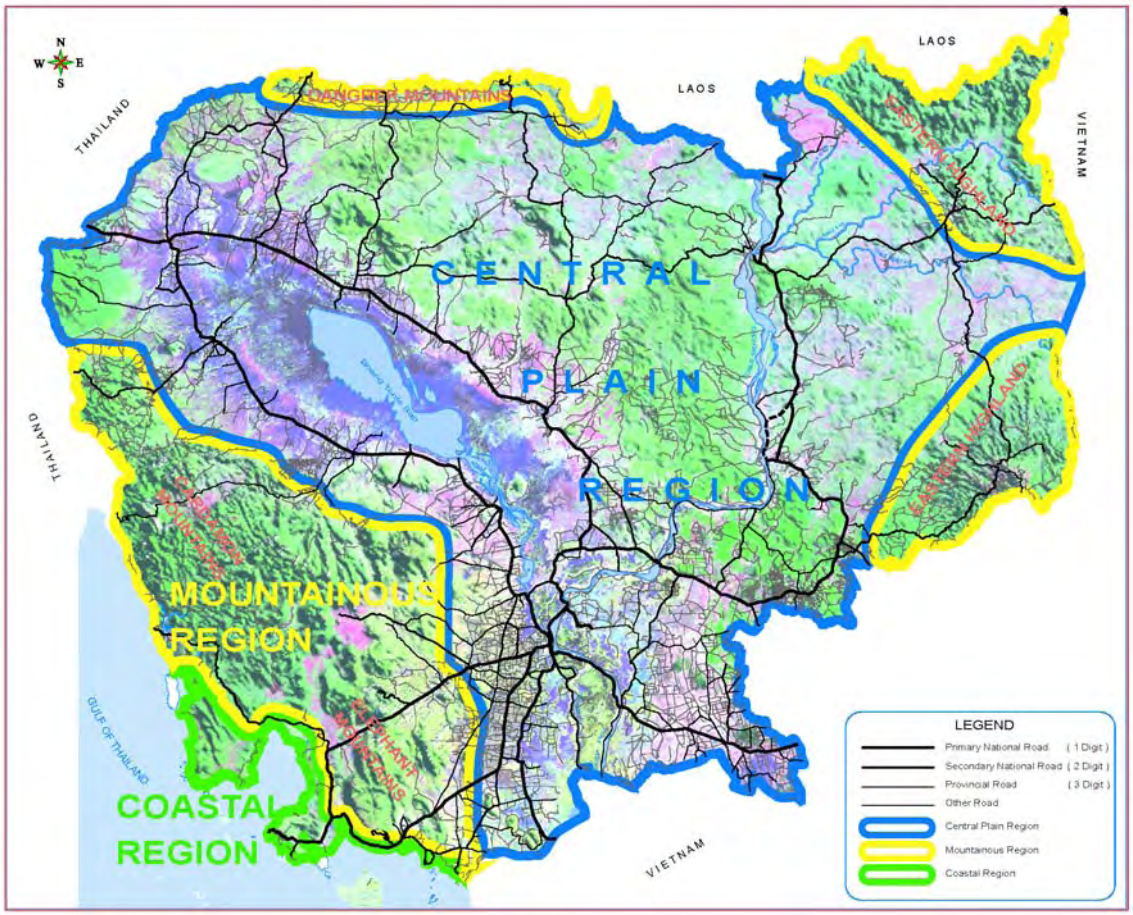



**Figure 2.1 Topography of Cambodia**

### 2.1.2 Climate of Cambodia

Climate of Cambodia is dominated by the tropical monsoons and distinctly marked seasonal differences. The monsoonal airflows are caused by alternating high pressure and low pressure over the Central Asian landmass. Temperatures are fairly uniform throughout the Tonle Sap Basin, with only small variations from the annual average of around 25°C. The annual rainfall in the Tonle Sap Basin-Mekong Lowlands is between 1,300 and 1,900 mm, while in the mountains along the coast they have the precipitation of the range from 2,500 to more than 5,000 mm.

## 2.2 Socio-Economic Situation

Cambodia is surrounded by three countries: Thailand, Laos and Vietnam. The societies of these four countries are influenced by the others' cultures and socio-economic activities. In particular, linkages of economic activities including the labor forces and the trades have become increasingly active in recent years.

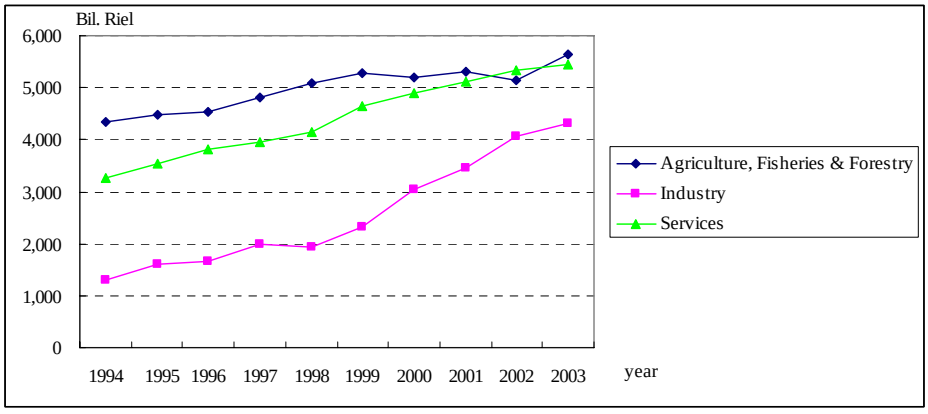
Major socio-economic indicators of these four countries are summarized in **Table 2.1** below. Cambodia is the second smallest of the four countries with respect to population, land size, and economic size, and has the lowest GDP per capita.

**Table 2.1 Socio-Economic Indicators of Cambodia, Thailand, Vietnam and Laos in 2003**

| Indicator | Cambodia | Thailand | Vietnam | Laos |
|---|---|---|---|---|
| POPULATION | | | | |
| Total population (millions) | 13.3 | 63.96 | 80.90 | 5.68 |
| Population density (persons per square kilometer) | 73 | 123 | 246 | 25 |
| Annual Population Increase (%) | 1.9 | 0.8 | 1.5 | 2.8 |
| EDUCATION (2000) | | | | |
| Literacy rate, adult female (% of those 15 and above) | 57% | 94% | 91% | 53% |
| Literacy rate, adult male (% of those 15 and above) | 80% | 97% | 94% | 76% |
| LAND | | | | |
| Surface area ('1000 sq. km) | 181 | 513 | 332 | 237 |
| NATIONAL ACCOUNTS | | | | |
| At Current Market I Basic Prices (in Billions US Dollar) | | | | |
| GDP by industrial origin | 3.96 | 150.01 | 38.71 | 2.13 |
| ***Growth of Output*** *annual change, % of GDP* | 5.1 | 6.7 | 7.3 | 5.8 |
| At Current Market Prices, in Dollar Per Capita GDP | 314.5 | 2345.4 | 478.4 | 379.1 |

Source: ADB, Key Indicators 2003: Education for Global Participation
World Bank, http://devdata.worldbank.org/data-query/

As civil order has been sustained, the economy has grown as well. **Figure 2.2** indicates the growth in GDP in constant year 2000 prices.




Source: National Institute of Statistics

**Figure 2.2 GDP Economic Growth by Sectors in Constant Price 2000**

# CHAPTER A-3 TRANSPORT SECTOR IN CAMBODIA

The modes of transportation in Cambodia consist of road transport as well as railway, inland waterway and aviation. In Cambodia, road transport has an overwhelming share of the transported volume of passenger and freight, and other means of transportation play a complementary role of road transport. It shall be essential in the Study on road network development to consider harmonization with the development plan of other transportation modes such as railway and inland waterway. Though in the Study of the Road Network over Cambodia is expected the establishment of the road development plan which is coherent with the development of transport modes other than road transport, the air transport shall be excluded from the subject of this study because role of the air transport in the country is limited to negligible minor level.

Both railway and inland waterway have higher efficiency of energy consumption per unit transported volume in comparison with road transport and have superiority in long-distance mass volume transit. Along with increase of recognition of energy saving and environment protection, policy of modal shift, from road transport to railway and waterway transport, become a global issue now.

Railway in Cambodia consists of 2 lines of the north line connecting the capital city, Phnom Penh, and Poipet on the border with Thailand, and the south line connecting Phnom Penh with Sihanoukville having the country's a sole deep port. And, as for inland waterway, the mainstream of Mekong River, Basak River and Tonlesap River form a waterway network. These networks of railway and inland waterway connect Cambodia's key centers, and it is expected that the organic linkage with road transport as a leading mode of land transportation realizes an efficient integrated transportation system. **Figure 3.1** shows road, railway, inland waterway and major connecting points of these transit methods.

Railway and inland waterway in Cambodia can be expected to play a role as long-distance interregional mass transportation for heavy and dangerous materials in freight transportation using its superiority in this field. By shifting such cargo transport from roadway to railway and/or inland waterway, following economic and socio-environmental effect can be anticipated.

i) Decrease of damage and deterioration of pavement structure of roads due to running of heavy weight vehicles and deduction of road maintenance cost

ii) Alleviation of traffic congestion of trunk roads

iii) Mitigation of environmental deterioration along trunk road such as air pollution, dust problem and noise

iv) Decrease of traffic accidents on roads

v) Economic benefit by reduction of fuel consumption

**Figure 3.2** shows example of modal shift using a case of National Road No.4 and railway southern line which are connecting Phnom Penh with Sihanoukville.

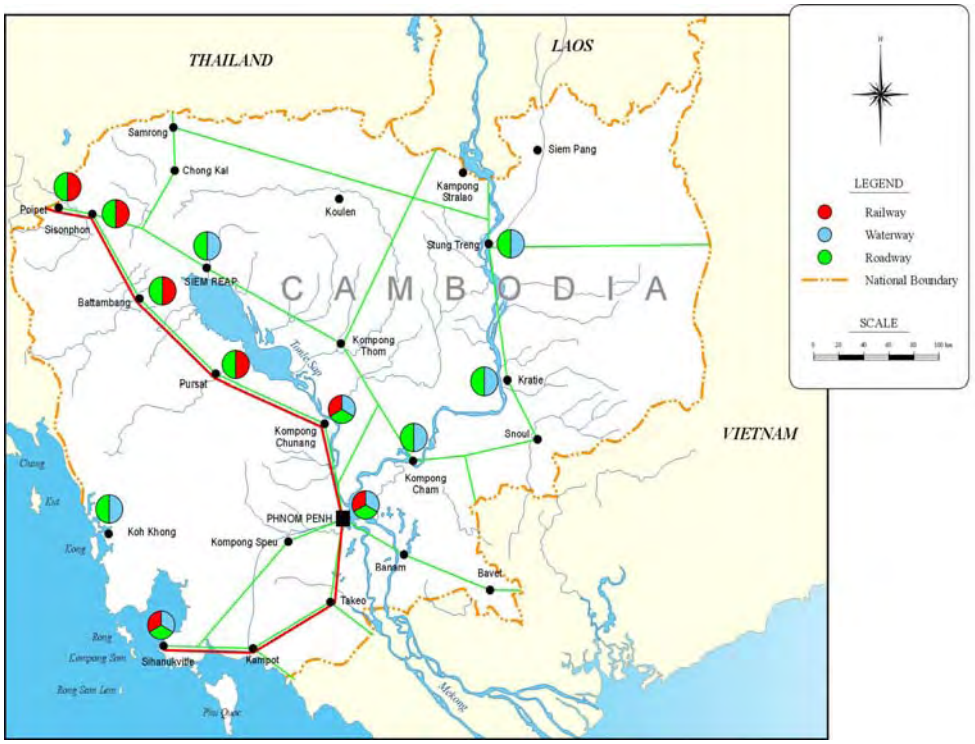



**Figure 3.1 Network of Railway/Inland Waterway and Major Connecting Points**

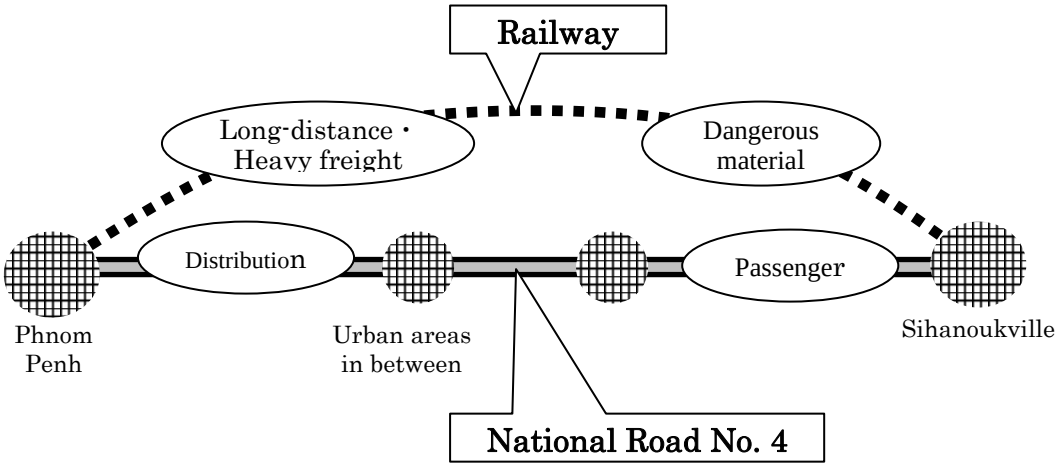



**Figure 3.2 Share of Roles by Road and Railway in Land Transport**

# CHAPTER A-4 EXISTING ROAD NETWORK CONDITIONS

## 4.1 Existing Road Network System

Function/Definition

- National Road – backbone of inter-provincial national network and links up provincial capitals and major points of entry/exit to country
- Provincial Road – forms the basic network within the province and links provincial capitals to district centers
- Rural Road – forms the basic network within the rural area and serve mainly local trips

**Table 4.1 Road Length by Classification**

| Road Classification | Road Length (km) |
|---|---|
| 1-Digit National Road | 2,052 (7%) |
| 2-Digit National Road | 2,643 (9%) |
| Provincial Road (3 & 4-Digits) | 6,615 (22%) |
| Rural or Tertiary Road | ~18,948 (62%) |
| Total Length | 30,258 |

* As of Jan 2006 (National and Provincial Roads based on LRCS Inventory; Rural Road is based on MRD Inventory)

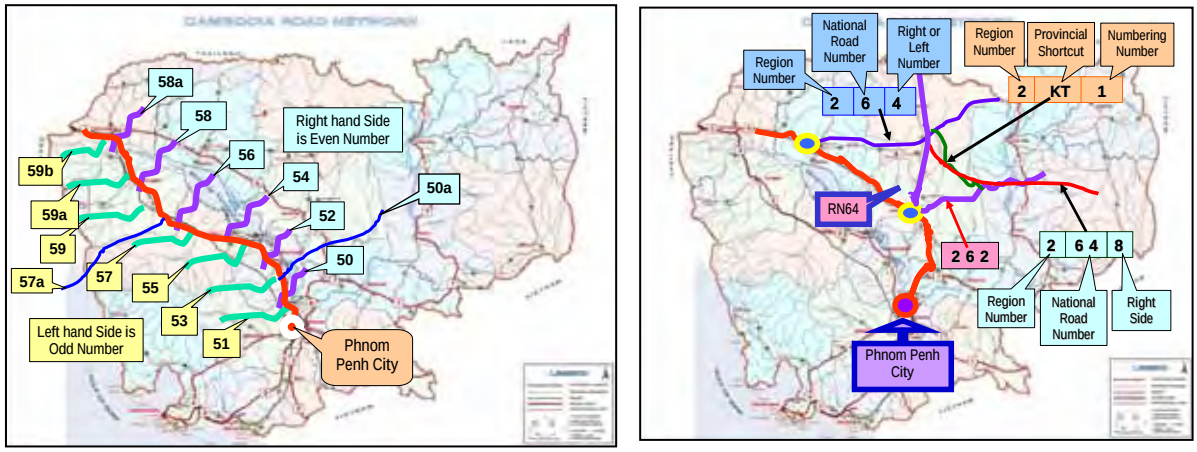

**Figure 4.1 Cambodia Road Network Map**

Road Numbering System

The new road numbering system assigns road number identification based on the road administrative classification as summarized in **Table 4.2**.

**Table 4.2 Road Numbering**

| Road Classification | Digit Number |
|---|---|
| Primary National Road | 1-Digit (1-9) |
| Secondary National Road | 2-Digit (10-99) / 2-Digit with alphabet |
| Provincial Road | 3, 4, & 5-Digit (alphanumeric) |




(a) 1-Digit and 2-Digit National Road

(b) Provincial Road

**Figure 4.2 Sample of New Road Number System**

Road Density/Road Density Index

Total road network density of 0.169km/km$^2$ and road density index of 0.663 are comparable with other Asian countries. However, paved road density and density index of 0.014 and 0.054 is lowest among Asian countries.

The road density (to determine the degree of infrastructure development) and road density index (to compare the denseness of the road network considering population) for all roads and for paved roads in Cambodia are calculated and shown in **Figures 4.4** and **4.5** respectively. It is seen that although some road densities may be low, its road density index are seen to be high.

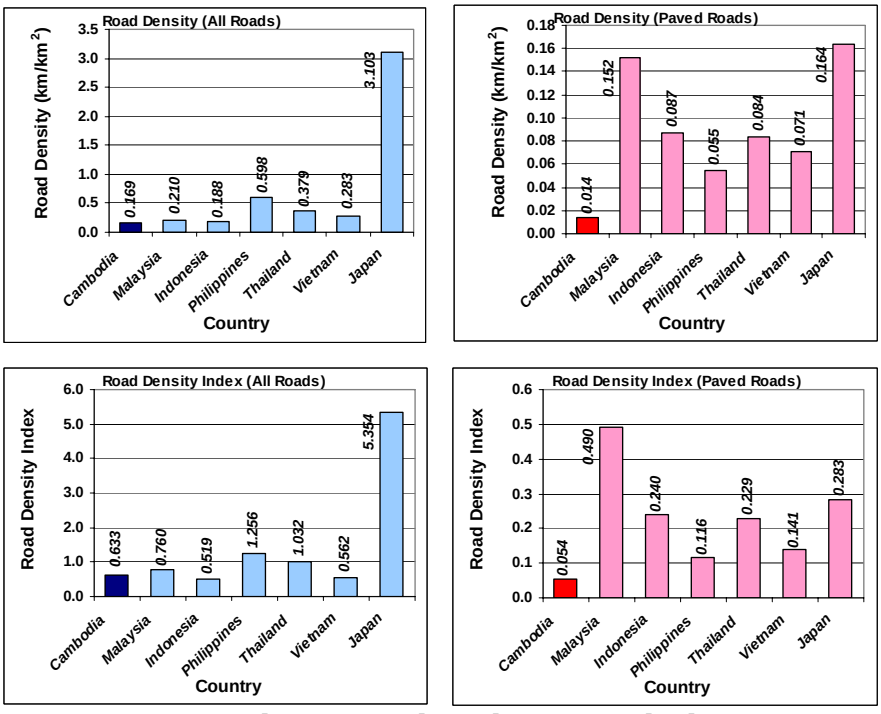



**Figure 4.3 Road Density and Road Density Index by Country**

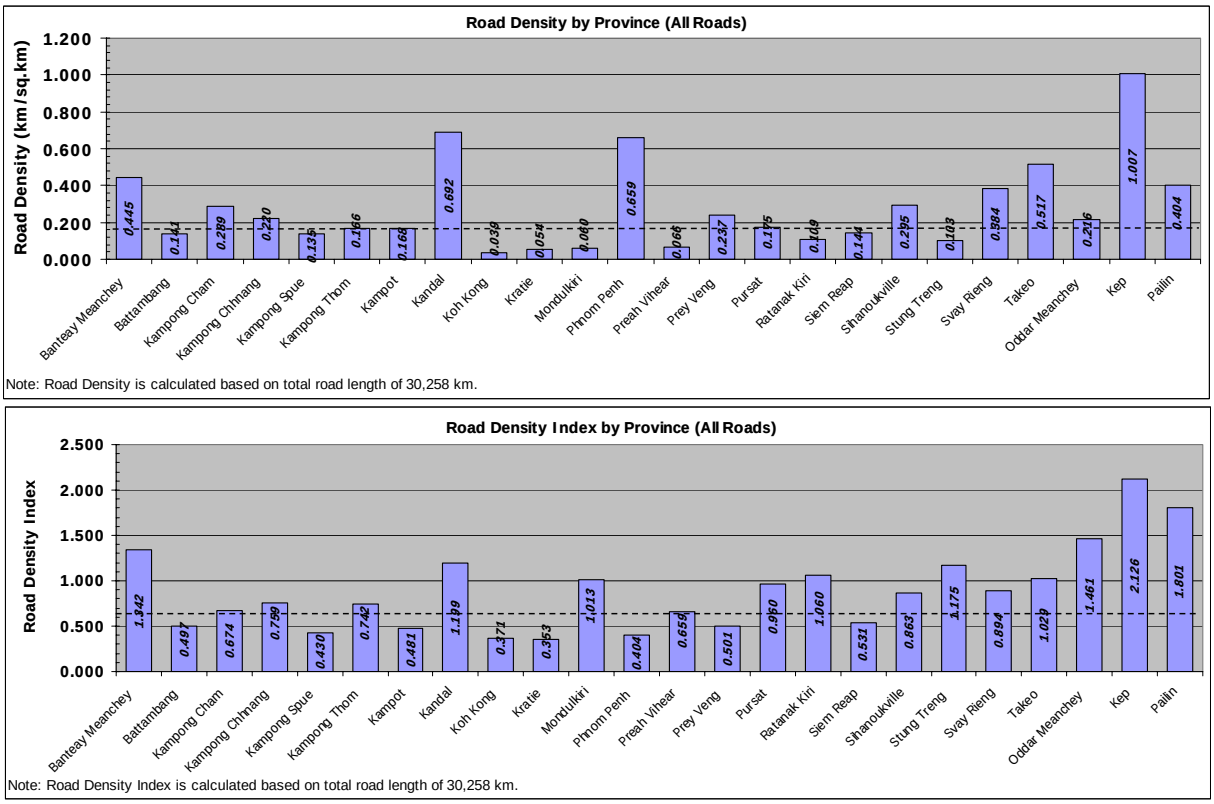



**Figure 4.4 Road Density and Road Density Index of All Roads per Province**

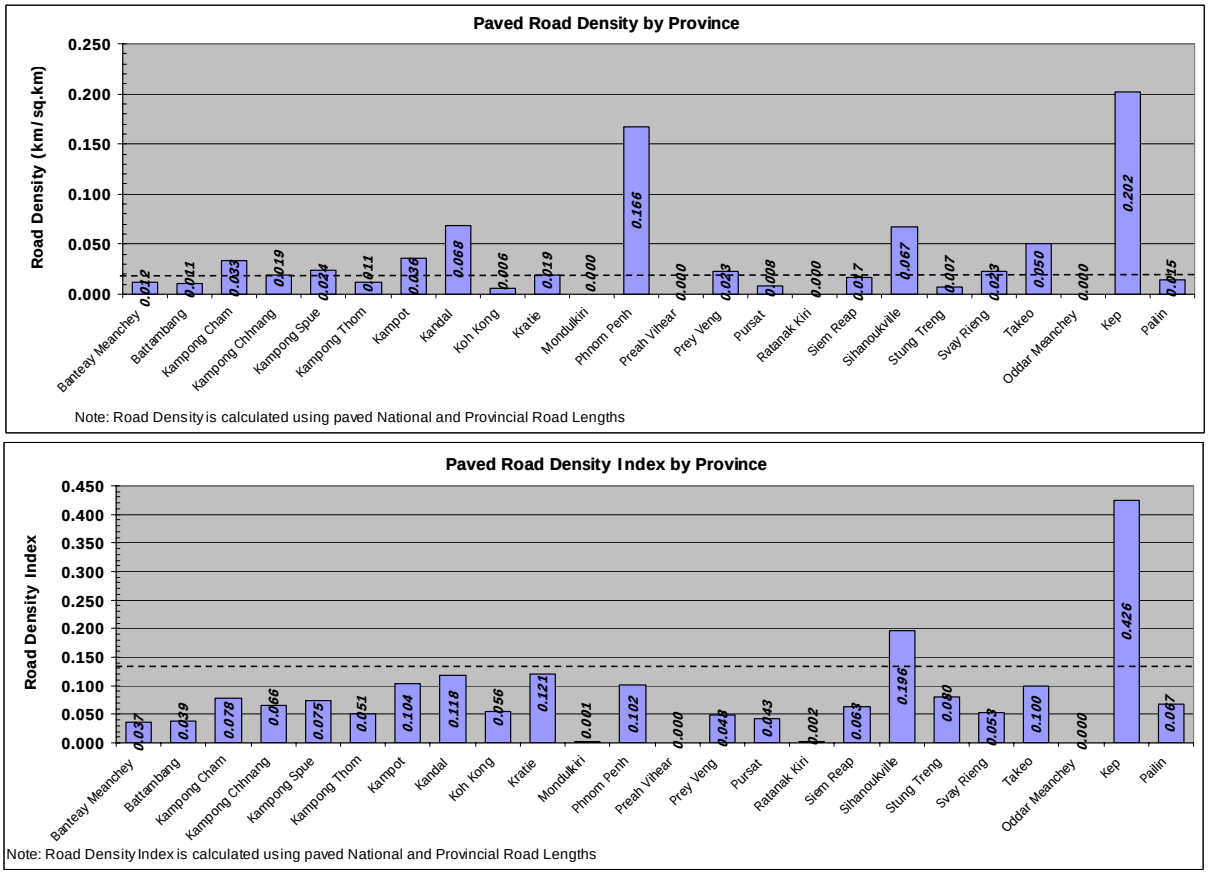



**Figure 4.5 Road Density and Road Density Index of Paved Roads per Province**

International Highway Route

Some of the 1-Digit national highway becomes part of the international/regional highway network:

- AH1 – NR.1, NR.5
- AH11 – NR.4, NR.6, NR.7
- AH123 – NR.48, NR.3, NR.33
- GMS Route – NR.66, NR.78

Total Length = 1,956 km (49% Class III and 32% below Class III)

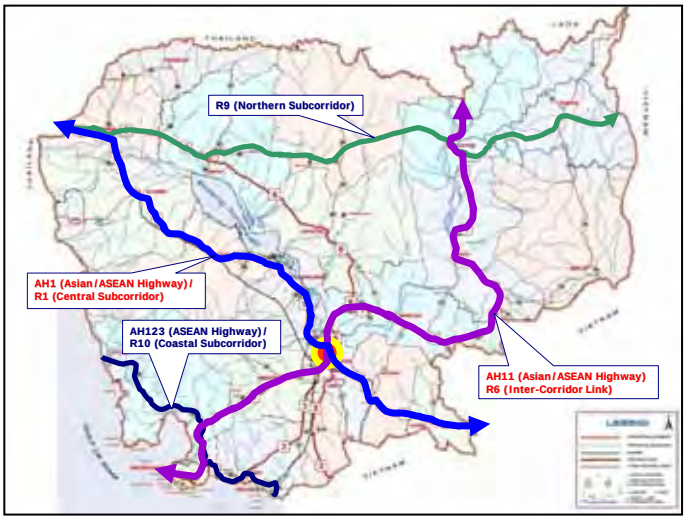



**Figure 4.6 International Highway Route in Cambodia**

**Table 4.3 Status of International Highway Route**

| Route No. | Length (km) | Class II | Class III | Below Class III |
|---|---|---|---|---|
| AH 1 | 572.4 | 11.2 | 561.2* | - |
| AH 11 | 755.0 | 364.0 | 391.0** | - |
| AH 123 | 163.3 | 2.4 | 8.7 | 152.2 |
| Northern Subcorridor | 464.9 | - | - | 464.9 |
| Total | 1,955.6 | 377.6 | 960.9 | 617.1 |

Road Network Coverage

- 1-Digit road links Phnom Penh to major provincial centers except 8 provinces connected by 2-Digit roads with fair to poor condition.
- Access to district centers provided by provincial roads but 98.3% have either laterite or earth pavement.
- Access to commune and villages provide by rural roads which comprise 62% of the road network in Cambodia. However, majority of rural road conditions vary from poor to very poor.
- Connection to 2 international airports provided by 1-Digit national roads and 8 national airports provided by 1-Digit road and 2-Digit national roads.
- Access to inland ports and sea ports are provided by 1-Digit and 2-Digit national roads.
- Crossings to major rivers provided by only 3 bridges (Mekong, Tonle Sap and Bassac Rivers). Others crossings are supplemented by ferry services.
- Although access to industrial, tourism, agricultural and residential areas are provided by 1-Digit to 3-Digit roads, conditions of roads varies from good (1-Digit) to poor and very poor (2-Digit/3-Digit).

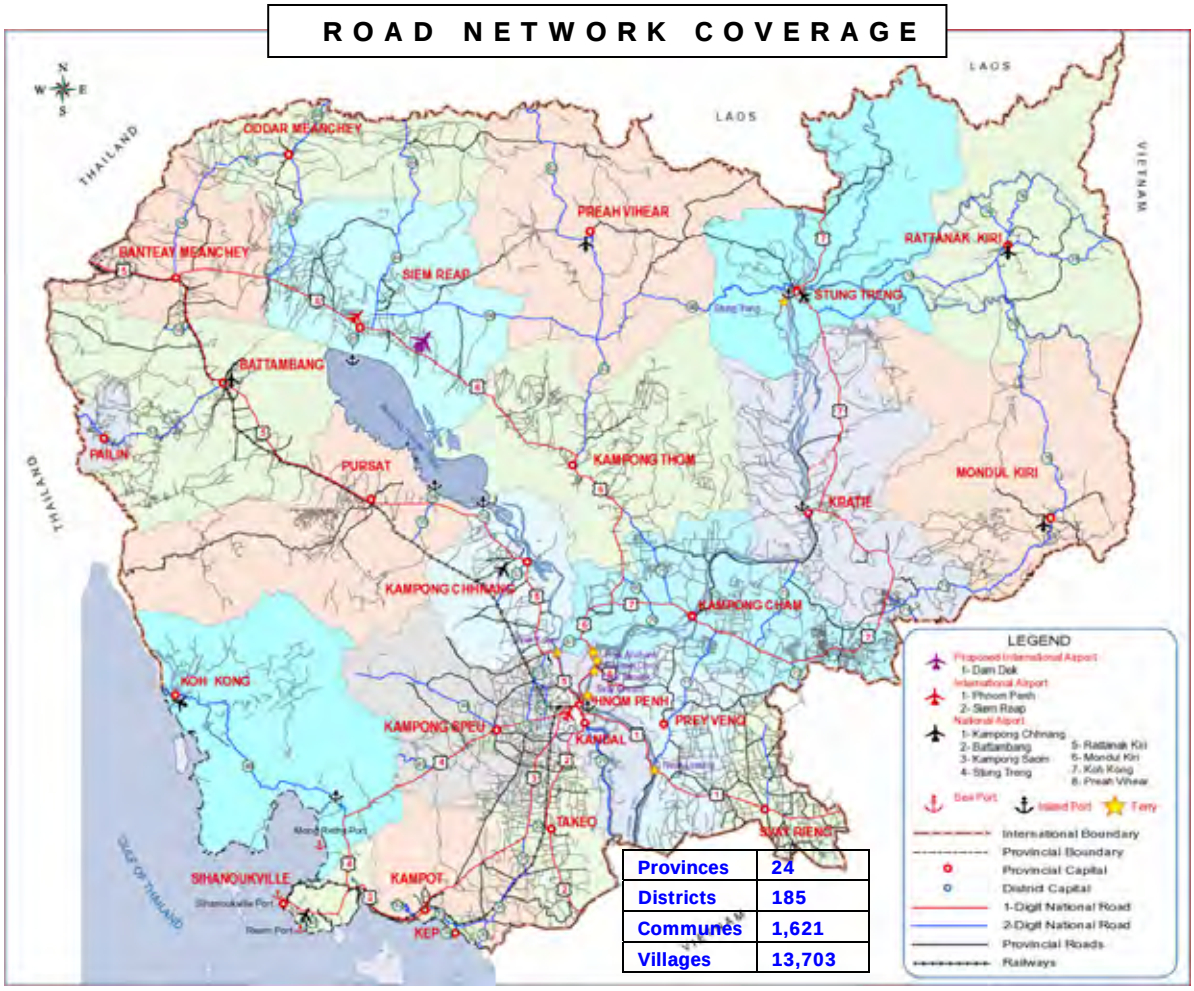



**Figure 4.7 Road Network Coverage in Cambodia**

## 4.2 Current Road Rehabilitation/Maintenance Studies and Projects

Major road projects in Cambodia are provided by bilateral/multi-lateral donors.

1-Digit Project Status (July 2005)

- Completed : 76%
- On-going : 10.2%
- Under Tender : 13.8%

**Figure 4.8 Major Road Projects**

**IMPLEMENTATION SCHEDULE OF MAJOR ROAD IMPROVEMENT PROJECTS**

| National Road Number | Donor | YEAR | | | | | | | | | | | | | | Total Road Length(km) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2010 | |
| NR1 | ADB, Japan | | | | 105 KM | | | | | | | 56 KM | | | | 166.6 |
| NR2 | ADB, Japan | | | | | | 63 KM | | | 51.6 KM | | | | | | 120.1 |
| NR3 | WB, Japan, Korea | | | | | | 169.5 KM | | | | 32.8 KM | | | | | 202.3 |
| NR4 | USA | 214.2 KM | | | | | | | | | | | | | | 214.2 |
| NR5 | ADB | | | | | 358.6 KM | | | | | | 47.2 KM | | | | 405.8 |
| NR6 | Japan, ADB, WB | | | | | 317.5 KM | | | | | | 98.2 KM | | | | 415.7 |
| NR7 | Japan, ADB, China | | 259.3 KM | | | | | | | | | 192.8 KM | | | | 452.1 |
| NR11 | ADB | | | | | | 90.4 KM | | | | | | | | | 90.4 |
| NR21 | ADB | | | | | | | 77.5 KM | | | | | | | | 77.5 |
| NR31 | WB | | | | | | | 51.7 KM | | | | | | | | 51.7 |
| NR33 | WB,ADB | | | | | | | 39.8 KM | | | | | | 11.9 KM | | 51.7 |
| NR48 | Thailand | | | | | | | | | | 152 KM | | | | | 163.3 |
| NR51 | WB | | | | | | | | 38 KM | | | | | | | 38.0 |
| NR62(NR64) | WB | | | | | | | | | | 134 KM | | | | | 134.0 |
| NR65 | WB | | | | | | | | | 19.9 KM | | | | | | 21.5 |
| NR66 | WB | | | | | | | | | 11 KM | | | | | | 334.9 |
| NR64(NR67) | Thailand | | | | | | | | | | 123.7 KM | | | | | 123.7 |
| NR71 | ADB, WB | | | | | | 33.6 KM | | | | 15.5 KM | | | | | 57.6 |
| NR68 | ADB | | | | | | | | | | | | | 79 KM | | 117.7 |

*Road number in parenthesis ( ) is old road number

**Figure 4.9 Implementation Schedule of Major Road Projects**

## 4.3 Existing Road Conditions Based on Inventory

- Development of a complete and accurate road network inventory in Cambodia is still a matter of time.
- Data from sources gathered by Study Team varies in terms of road jurisdiction and length: LRCS, DRI, DPWT.
- Study Team uses LRCS inventory data since it provides more data on road condition and gives actual measurements of road length. Additional data were taken from supplemental survey and as-built/design drawings.
- Supplemental road survey was conducted on NR.66, NR.76, PR.216 and bridge and culvert survey on NR.5.

**Table 4.4 Road Length Distribution for National and Provincial Roads**

| Road Classification | Paved Road (km) | Unpaved Road (km) | Total (km) |
|---|---|---|---|
| 1-Digit National | 1,543 (75.2%) | 509 (24.8%) | 2,052* |
| 2-Digit National | 526 (19.9%) | 2,117 (80.1%) | 2,643 |
| Provincial (3 & 4-Digit) | 109 (1.6%) | 6,506 (98.4%) | 6,615 |
| Rural Road | 63 (0.3%) | 18,885 (99.7%) | 18,948 |
| Total (km) | 2,241 (7.4%) | 28,017 (92.6%) | 30,258 (100%) |

*Includes 64.1km NR.8 Source: LRCS Inventory, 2004 and MRD Inventory

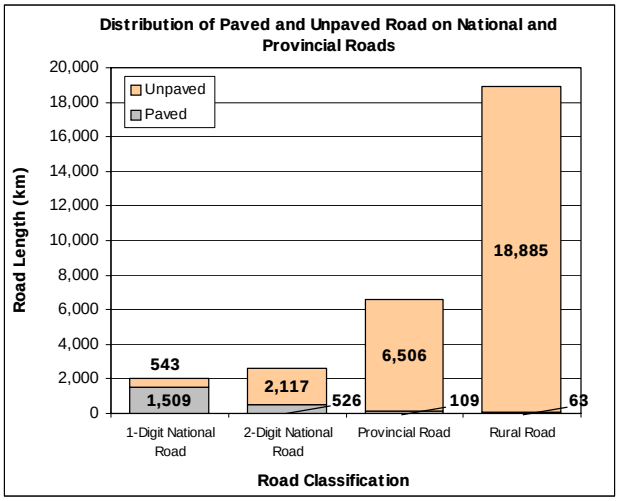



**Figure 4.10 Pavement Distribution for National and Provincial Roads**

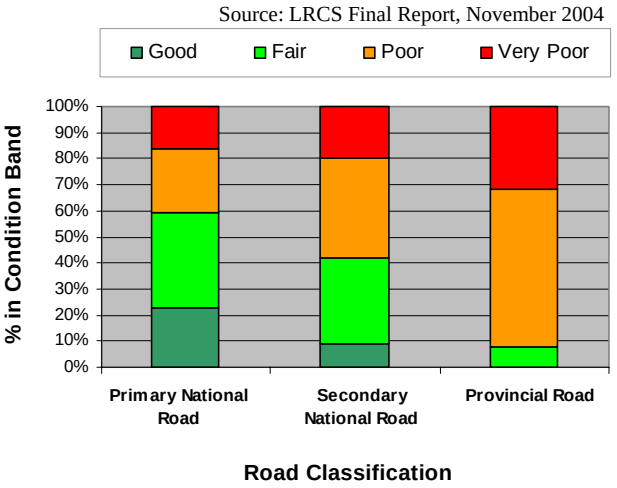



**Figure 4.11 Relative Condition of Road Network**

## Road Condition

- Only 7.4% of the total road network is paved, most of which belonging to the 1-Digit national road and some to the 2-Digit roads.
- About 80.1% of the 2-Digit roads are unpaved while 98.4% of the provincial roads are unpaved. Practically almost all rural roads are unpaved at 99.7%.
- On-going projects for 1-Digit roads, once completed, will bring the road conditions to good and fair. However, 2-Digit national road conditions vary from good to poor with 60% of the road in poor and very poor condition. Moreover, 3-Digit road conditions vary from fair to very poor with more than 90% in poor to very poor condition.
- 19% of the 2-Digit roads are narrow at less than 4.5m wide while 62.3% have widths insufficient for 2-lane traffic. Moreover, 33% of the 3-Digit roads are less than 4.5m wide while 85% have widths insufficient for 2-lane traffic.

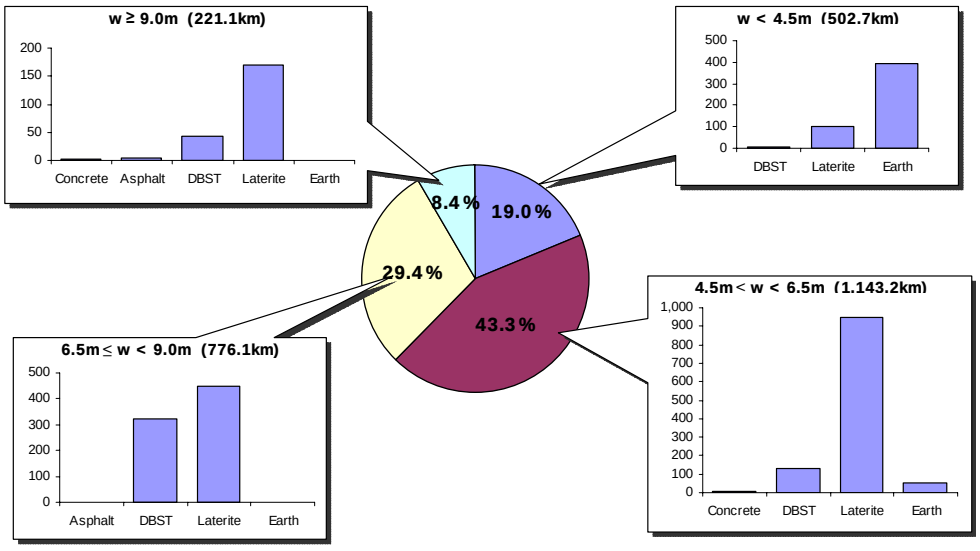



**Figure 4.12 Distribution of 2-Digit National Road by Width and Pavement Type**

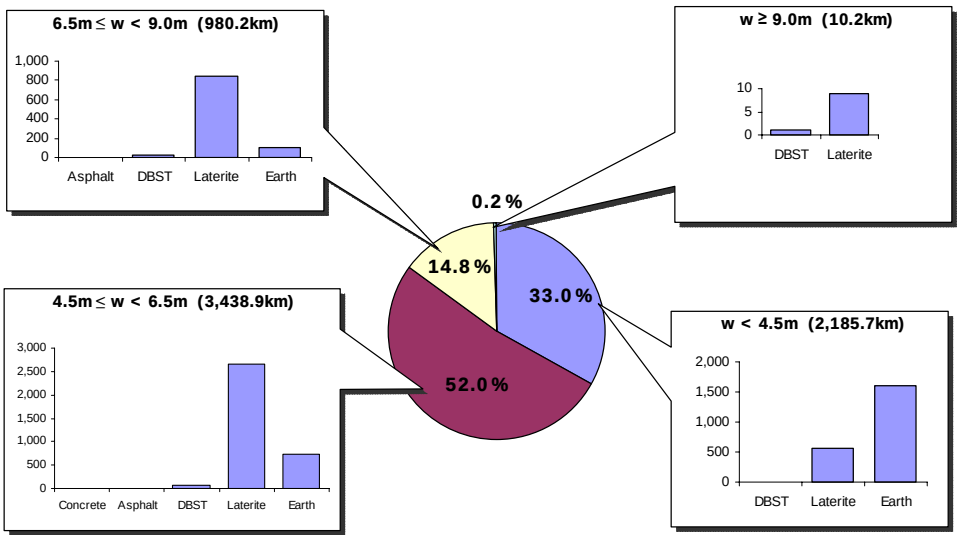



**Figure 4.13 Distribution of Provincial Road by Width and Pavement Type**

## Bridge Condition

1-Digit Roads

- 26 bridges (608m) or 4.4% of the bridges along 1-Digit roads are still temporary bridges and will need replacement by permanent bridges as recommended in this Study.
- Moreover, 31 permanent bridges (602m) which are narrow (<7m wide) will be widened or replaced to satisfy Cambodian bridge standard requirements.
- Conditions of permanent bridges are classified as good (86.9%) and fair (13.1%).
- Improvement of 1-Digit road bridges cover 57 bridges (temporary and narrow bridges) with a total length of 1,210m.

2-Digit Roads

- For the 2-Digit roads, new bridges have to be built at 107 locations while 17 historical bridges need to be replaced (new alignment) with permanent bridges. Moreover, 392 (50.1%) bridges along 2-Digit national roads are still temporary which need to be replaced by permanent bridges.
- Permanent bridge conditions vary from good to poor with more than half of the bridges in good condition. At least 2 temporary bridges collapsed along the 2-Digit roads during this Study.
- Improvement for 2-Digit road bridges will cover 655 bridges (temporary, historical, no existing bridge and narrow bridges) with total length of 11,785m.

Provincial Roads

- More than half of the provincial bridges (618 bridges or 54.5%) are temporary bridges while 3 locations need new bridges. About 10 bridges are in collapsed state while the permanent bridge conditions vary from good to poor with 71.2% in good condition.
- Bridge improvement for provincial roads will cover only road sections included in the Master Plan

under this Study while other bridges not included for improvement will require maintenance works. About 207 bridges in 3-Digit roads will be improved totaling to about 4,372m.

Since no data exist for Rural Road bridges, maintenance works is recommended.

**Table 4.5 Bridge Inventory Along 1-Digit National Road (Including On-going Projects)***

| Road No. | Temporary Bridges*** No. (Length, m) | Type | Permanent Bridges - No. (Length, m) | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | Narrow Bridges (w < 7m)*** | | | Wider Bridges (w > 7m) | | |
| | | | w<4.5m | 4.5m≤w<7m | Total | 7m≤w<10m | w≥10.0m | Total |
| NR.1 | - | Concrete | - | - | - | 1 (149.6) | 19 (919.9) | 20 (1,069.5) |
| | | Steel | - | - | - | - | 3 (90.8) | 3 (90.8) |
| NR.2 | 14 (232.8) | Concrete | - | 3 (19.0) | 3 (19.0) | 10 (158.5) | 5 (214.9) | 15 (373.4) |
| | | Steel | - | - | - | 1 (8.0) | - | 1 (8.0) |
| NR.3 | 11 (245.3) | Concrete | - | 15 (169.9) | 15 (169.9) | 21 (507.8) | 24 (642.6) | 45 (1,150.4) |
| | | Steel | - | 2 (65.0) | 2 (65.0) | 1 (290.0) | - | 1 (290.0) |
| NR.4 | - | Concrete | - | - | - | 39 (1,064.5) | 1 (8.2) | 40 (1,072.7) |
| | | Steel | - | - | - | - | - | - |
| NR.5 | - | Concrete | - | 7 (238.1) | 7 (238.1) | 53 (616.3) | 83 (1,423.3) | 136 (2,039.6) |
| | | Steel | - | 1 (45.3) | 1 (45.3) | 25 (873.4) | - | 25 (873.4) |
| NR.6 | - | Concrete | - | 2 (54.9) | 2 (54.9) | 39 (1,213.8) | 130 (2,909.6) | 169 (4,123.4) |
| | | Steel | - | - | - | 5 (338.5) | 2 (816.9) | 7 (1,155.4) |
| NR.7 | 1 (130.0) | Concrete | - | 1 (10.0) | 1 (10.0) | 3 (1,075.0) | 67 (3,111.4) | 70 (4,186.4) |
| | | Steel | - | - | - | - | - | - |
| Total | 26 (608.1) | Concrete | - | 28 (491.9) | 28 (491.9) | 166 (4,785.5) | 329 (9,229.9) | 495 (14,015.4) |
| | | Steel | - | 3 (110.3) | 3 (110.3) | 32 (1,509.9) | 5 (907.7) | 37 (2,417.6) |
| | | Total | - | 31 (602.2) | 31 (602.2) | 198 (6,295.4) | 334 (10,137.6) | 532 (16,433.0) |

*On-going bridge projects are included in the inventory as permanent bridges

**Source: Study Team 2005 Inventory (NR.5 & NR.6) and Collected as-built and design drawings

***In the Master Plan under this Study, temporary bridges and narrow bridges will be improved to satisfy Cambodian bridge standard.
Total number and length of 1-Digit bridges for improvement = 57 bridges (1,210m)

## Table 4.6 Bridge Inventory Along 2-Digit National Road and Provincial Road

| Road Class | Temporary Bridges*** No. (m) | Historical Bridges*** No. (m) | No Existing Bridges*** No. (m) | Type | Permanent Bridges - No. (Length, m) | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Narrow Bridges (w < 7m)*** | | | Wider Bridges (w > 7m) | | |
| | | | | | w<4.5m | 4.5m≤w<7m | Total | 7m≤w<10m | w≥10.0m | Total |
| 2-Digit National | 392 (7,392) | 17 (364.8) | 107 (1,901) | Concrete | 37 (366.4) | 74 (872.5) | 111 (1,238.9) | 65 (2,816.9) | 56 (2,749.8) | 121 (5,566.7) |
| | | | | Steel | 9 (168.0) | 19 (719.8) | 28 (887.8) | 6 (161.9) | - | 6 (161.9) |
| 3-Digit Prov'l | 313 (5,956) | - | 3 (165) | Concrete | 106 (1,989.0) | 117 (1,608.6) | 223 (3,597.6) | 7 (82.0) | 3 (70.4) | 10 (152.4) |
| | | | | Steel | 30 (723.0) | 9 (289.0) | 39 (1,012.0) | 1 (30.0) | - | 1 (30.0) |
| 4-Digit Prov'l | 305 (5,824) | - | - | Concrete | 135 (1,790.7) | 88 (1,291.1) | 223 (3,081.8) | 1 (43.0) | 1 (30.0) | 2 (73.0) |
| | | | | Steel | 10 (260.0) | 4 (85.0) | 14 (345.0) | - | - | - |
| Total | 1010 (19,172) | 17 (364.8) | 110 (1,966) | Concrete | 278 (4,146.1) | 279 (3,772.2) | 557 (7,918.3) | 73 (2,941.9) | 60 (2,850.2) | 133 (5,792.1) |
| | | | | Steel | 49 (1,151.0) | 32 (1,093.8) | 81 (2,244.8) | 7 (191.9) | - | 7 (344.3) |
| | | | | Total | 327 (5,297.1) | 311 (4,866.0) | 638 (10,163.1) | 80 (3,133.8) | 60 (2,850.2) | 140 (6,136.) |

*On-going bridge projects are included in the inventory as permanent bridges

**Source: LRCS 2004 Inventory and Study Team 2005 Inventory

***Temporary bridges, historical bridges, narrow bridges and waterways without bridges will require improvement measures to satisfy Cambodian bridge standard. However, in this Study, the master plan covers only the improvement of 2-Digit roads and some 3-Digit roads in support of the development objectives and the road network completion. Routine maintenance shall be done on bridges not included for improvement. Total for 2-Digit road bridge improvement = 655 bridges (11,785m). Total for 3-Digit road bridge improvement included in master plan = 207 bridges (4,372m).


NR.1


NR.2


NR.3


NR.4


NR.5


NR.6


NR.7


NR.33


NR.48


NR.57


NR.62


NR.76


NR.78


NR.64


PR.308

**Photo 4.1 Typical Road Condition**


Collapsed Bailey Bridge (NR.33)


Collapsed Concrete Truss Bridge (NR.6)


Timber Bridge (NR.78)


Concrete Truss Bridge (NR.31)


Bailey Bridge (NR.11)


Historical Laterite Bridge (NR.6)


Steel Girder + Truss (NR.5)


Concrete Bridge (NR.6)


Kizuna Bridge (PC Box)(NR.7)

**Photo 4.2 Typical Bridges Along National and Provincial Roads**

## 4.4 Review of Past Flood and Damages

- Significant sections of Cambodia (located at the lower Mekong basin) is prone to flood generated by the upper reaches of Mekong River.
- In year 2000, rainfall started 2 months earlier and lasting longer than usual causing the Great Lake flood storage capacity to be filled up in July. Tropical depressions in the months of August and September brought enormous rainfall causing the floodwater to be absorbed by the flood plain along Mekong, Tonle Sap and Bassac Rivers.
- The year 2000 flood is considered one of the most destructive, bringing the total damages amounting to US$128 million. It affected 21 provinces 131 districts, 883 commune and 5,158 villages – most of which were completely under water and became isolated.
- The loss due to damages in the road infrastructure is estimated to reach US$47 million which is

about 16.8% of the road investment prior to the year 2000 flood. Many of the roads along Mekong River and the Great Lake were either breached or overtopped by floodwater causing disruption in land transportation.

- The road functions as important link and access during such flood emergency, acts as evacuation areas and protects other areas by acting as dikes.
- Flood risks of major roads during major flood were investigated with minimal sections expected to be under water once road improvement works are completed. However, embankment slope protection should be strengthened against flood.

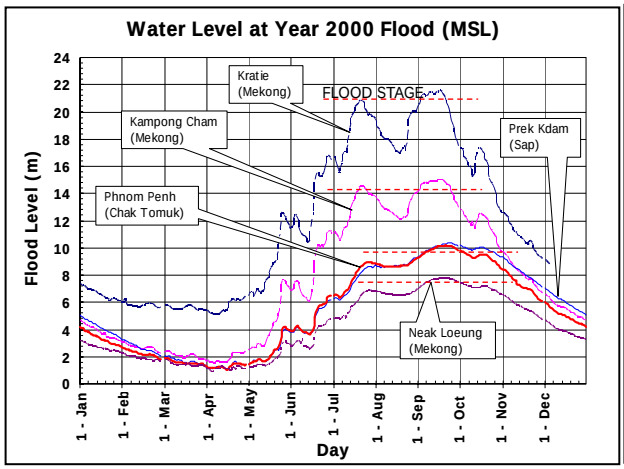



**Figure 4.14 Year 2000 Water Hydrographs**

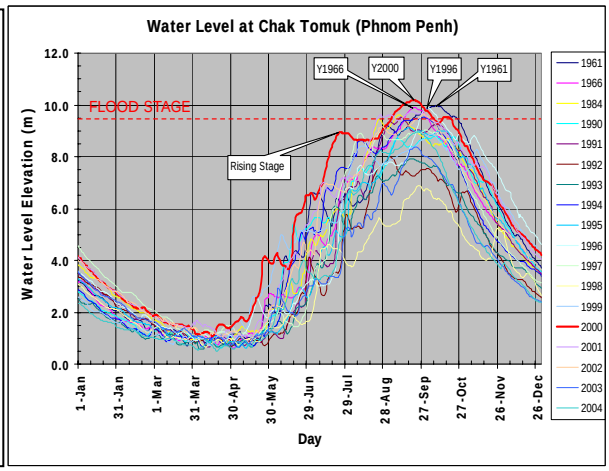
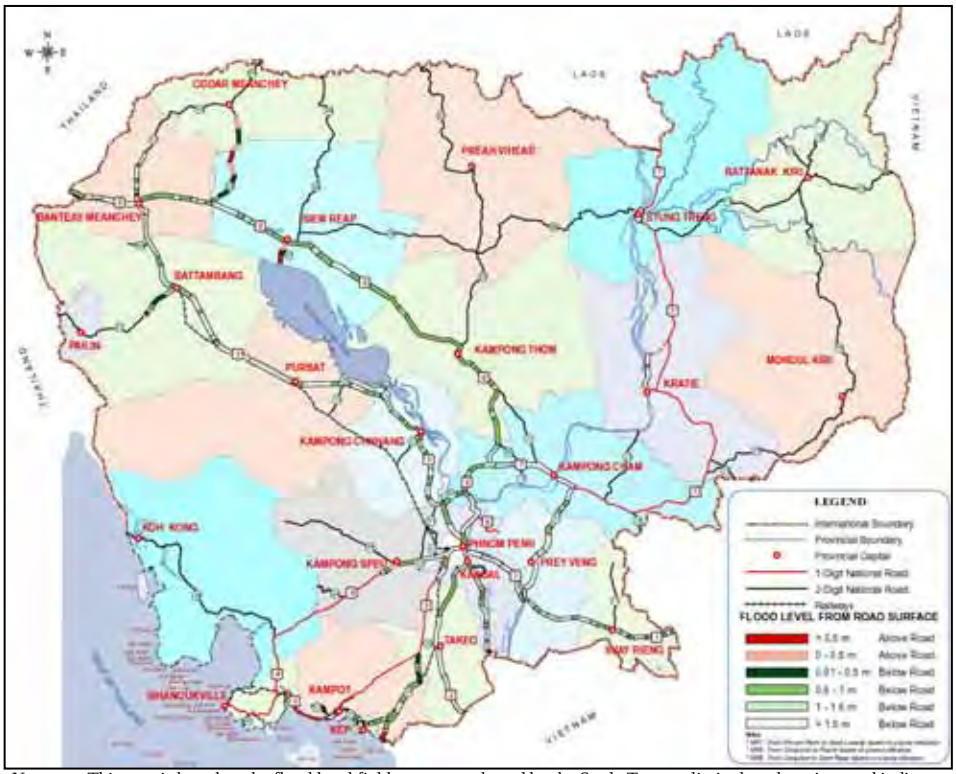



**Figure 4.15 Year 2000 Water Hydrographs at Phnom Penh (Chak Tomuk)**




Note: This map is based on the flood level field survey conducted by the Study Team at limited road sections and indicates possibility of flood occurring on existing roads with a similar scale as the year 2000 flood.

**Figure 4.16 Flood Level from Road Surface**

## 4.5 Mine and UXO Contamination

UXO and Landmine History

The results of more than three decades of conflicts, within the country and outside its borders have made the Kingdom of Cambodia one of the most heavily landmine/UXO contaminated countries in the world. The sources of these landmine/UXO contaminations can be traced to:

- World War II
- French Indochina Wars (1950)
- Vietnam War (1969-1975)
- Gen. Lon Nol rebellion and the rise of Khmer Rouge (1970-1975)
- Khmer Rouge Period (1975-1979)
- Guerilla War throughout Cambodia (1979-1993)
- Renewed Khmer Rouge Offensives (1994-1998)

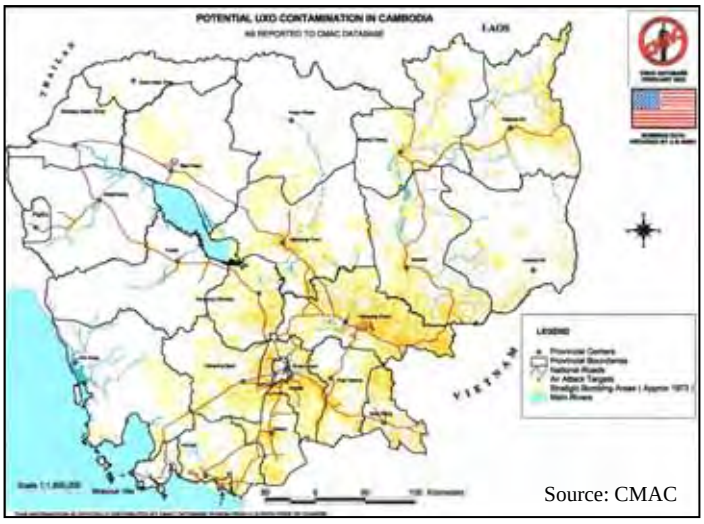



**Figure 4.17 Potential UXO Contamination in Cambodia**

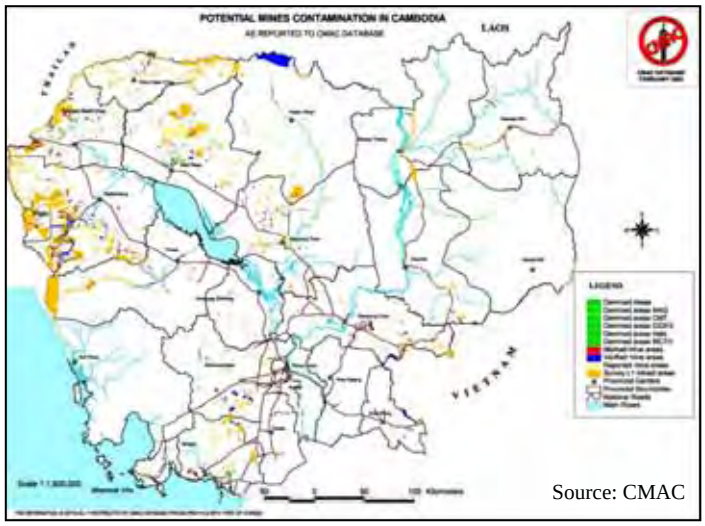



**Figure 4.18 Potential Landmine Contamination in Cambodia**

Landmine and UXO Problems

(1) Contamination

Landmine and UXO contamination covers about 3,075 areas or 4,466 square kilometers which is equivalent to about 46.2% of all Cambodian villages. Among the suspected areas, 61% are concentrated in five provinces of Battambang, Banteay Meanchey, Oddar Meanchey, Preah Vihear and Pailin. This indicates that 5.18 million Cambodians are at risk due to this contamination.

It is observed that:

- northern provinces along Thailand and Cambodian border are more heavily mined areas than other parts of Cambodia, and
- provinces along the Vietnamese and Cambodian border are more affected by Unexploded Ordnance (UXO) than other parts of Cambodia.

(2) Casualties

The extent of problems faced by the country is seen in the next figures in terms of victims and casualties of landmine/UXO accidents. After a decade of peace in Cambodia an average of 70 civilians continue to fall victim to landmine and UXO each month, which is a remarkable decrease (due to mine action programs) from an average of 600 victims per month after the years following the conflict.

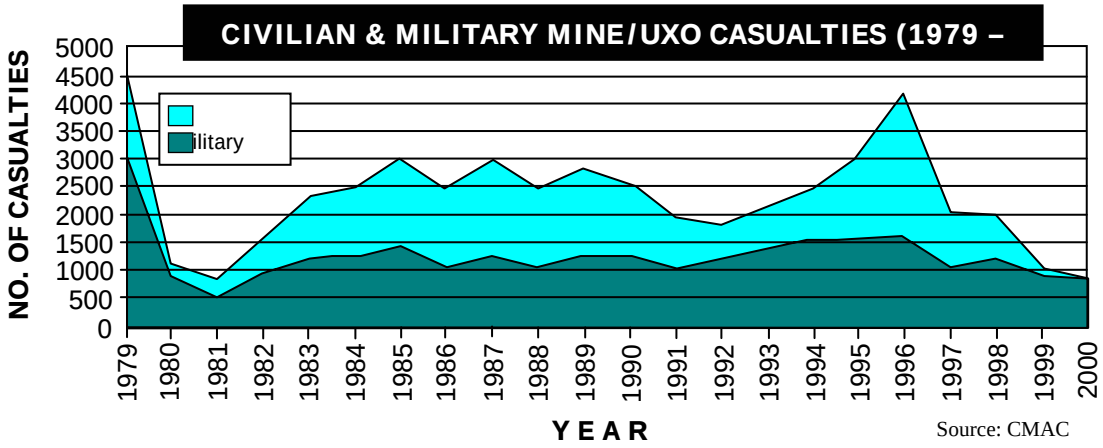



**Figure 4.19 Civilian and Military Mine/UXO Casualties (1979-2000)**

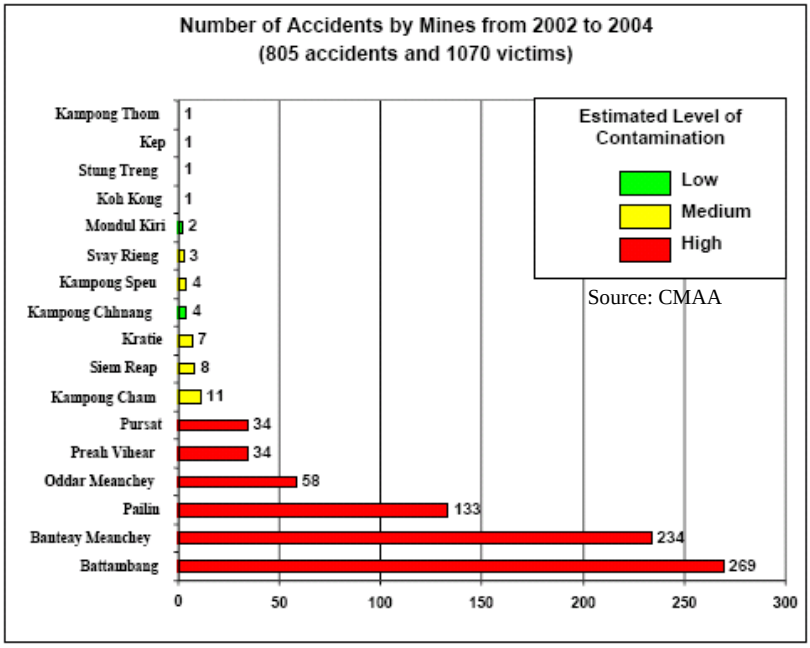



**Figure 4.20 Number of Landmine/UXO Accidents per Province**

Landmine and UXO Clearing Operations

(1) Organizations Involved in Clearing Operations

The seriousness of landmine/UXO problem in Cambodia prompted the Government and international

organizations to deploy teams that will clear the land of mine/UXO problems. The organizations involve in mine action operations include:

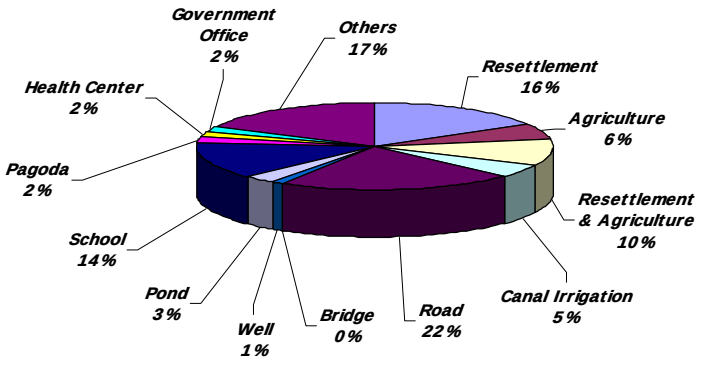
- Cambodian Mine Action and Victim Assistance Authority (CMAA) administers and regulates all demining and UXO clearance operations and assistance to mine victims in the country.
- Cambodian Mine Action Center (CMAC) is the core body responsible for demining operations and is mandated to clear land for resettlement, agriculture, community development and infrastructure reconstruction.
- Other organizations including UNDP, UN MCTU, Handicap International, HALO Trust, Norwegian Peoples Aid, Mines Advisory Group, Netherlands, Japan, France, Germany, USA, etc. have contributed in the mine action operations.

(2) Progress in Clearing Operations

The combined efforts of Cambodian authorities and international communities succeeded in decreasing casualty rates and returning thousands of hectares of land to productive agricultural use. The following summarizes the mine operation progress from 1992 to 2005:

- Total Area Cleared : 145.28 hectares
- Anti-Personnel Mines Destroyed : 310,990 units
- Anti-Tank Mines Destroyed : 5,573 units
- UXO Cleared/Destroyed : 1,027,876 units
- Fragments Cleared : 332,052,440

In 2004, about 11.16 square kilometer of land was cleared with the site type distribution shown in **Figure 4.21**.




Source: CMAC

**Figure 4.21 Distribution of Cleared Areas in 2004**

(3) Integration of Mine Action with National Priorities

- CMAA will strengthen national coordination framework with different government bodies, ministries, institutions, authorities etc. to obtain priorities on mine action clearance requirements consistent with national development priorities,
- CMAA will coordinate mine-action activities through the "National Mine Action Database" (NMAD) which is the primary repository of all mine-related information in Cambodia,
- The Provincial Mine Action Committee (PMAC) is established to ensure that mine clearance activities are consistent with the national, provincial and/or commune development plans, strategies and priorities.

## 4.6 Identification of Bottlenecks and Necessary Countermeasures

- Road Condition Problems:
  - Poor Pavement Condition – only 19.3% of the 11,310km national and provincial roads are paved while 80.7% are either earth, gravel or laterite roads. More than 60% of 2-Digit roads and more than 90% of the provincial roads are in poor to very poor condition.
  - Narrow Roads – some sections of 1-Digit road needs motorbike lanes; 2-Digit (62%<6.5m wide) and provincial (85%<6.5m wide) roads need to be widened to accommodate 2-lanes with sufficient width,
  - Upgrading to International Class – NR.1, 5, 4, 6, 7 need to be upgraded to Asian/ASEAN class; NR.48, 3, 33 and NR.66, 78 need to be improved to ASEAN/GMS class,
  - Insufficient slope protection – roads along flood plain should have sufficient embankment slope protection,
  - Temporary and No Existing Bridges – will have to be replaced by permanent bridges; additional bridges need to be constructed where none exist; roads with historical bridges need realignment and construction of new bridges,
  - Narrow Bridges and Bridges in Poor Condition – permanent narrow bridges need to be widened to accommodate the required traffic lanes; permanent bridges in poor condition will need rehabilitation or replacement,
  - Road Maintenance Problem – focus on road maintenance should be stressed to prolong the life of the roads and make it passable during rainy season.
  - Landmine and UXO Contamination – more than 46.2% of all Cambodian villages are suspected of being contaminated by landmine and UXO which presents safety risk to road infrastructure development. Road development should be coordinated with CMAA to prioritize mine action operations.

- Road Network Problems:
    - Insufficient Bridge Crossing Major Rivers – additional bridges necessary along major rivers,
    - Missing Road Links – roads in very poor state or roads practically inadequate to convey traffic safely should be reconstructed or new roads provided to complete the road network,
    - Low Pavement Ratio/Insufficient Paved Road – pavement ratio for 2-Digit and provincial roads need to be increased,
    - Traffic Congestion on Major Cities/Areas – bypasses will need to be built to serve through traffic on built-up/congested areas,
    - Vulnerability to Flood on some sections – road section areas prone to flood damage (along Mekong, Tonle Sap and Bassac Rivers) will need improvement on slope protection and embankment stability.

# CHAPTER A-5 EXISTING TRAFFIC CONDITIONS

## 5.1 Traffic Accident Survey and Analysis

Trend of Traffic Accidents

- It is alarming that traffic accidents in Cambodia increased 144% from 2000 to 2004.
- Fatalities more than doubled in the same period.
- Motorcycle accident accounts to more than 50% of the traffic accidents.

Comparison with Other Countries

- Fatality rates in Cambodia have risen from 12.08 per 10,000 vehicles in 2000 to 21.46 in 2004.
- Such rate is twice that of Thailand and more than ten times of Japan.

**Table 5.1 Road Traffic Fatality Rates**

| Year | Cambodia | Thailand | Vietnam | Japan |
|---|---|---|---|---|
| 2000 | 12.08 | 5.75 | 10.77 | 1.21 |
| 2001 | 11.98 | 5.16 | 11.73 | 1.16 |
| 2002 | 13.05 | 5.35 | 11.76 | 1.00 |
| 2003 | 18.42 | 5.41 | 9.39 | 1.00 |
| 2004 | 21.46 | 7.10 | 8.34 | 0.95 |

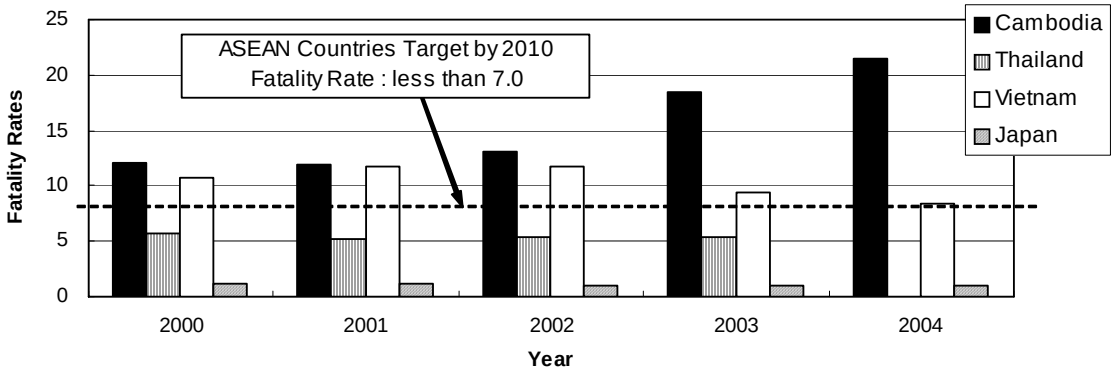



**Figure 5.1 International Comparison of Fatality Rates**
**(=Fatalities / 10,000 vehicles)**

Accidents By Type of Road User

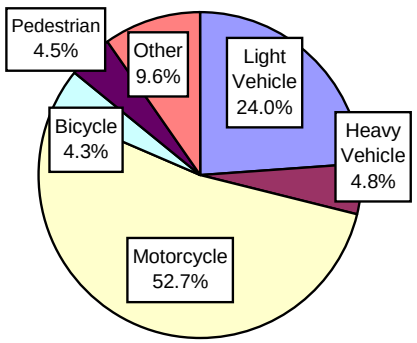
It is noted that accidents involving road motorcycles accounts to 52.7% while 24% involves light vehicles. It would be necessary to focus traffic safety on measures to reduce motorcycle accidents.

Collision of motorcycles with motorcycles accounts for 48% of the accident while motorcycle collisions with other vehicles take 27% of the accident.

Major Causes of Traffic Accident

- Main cause of traffic accident is driving error by road user. This includes over speeding, dangerous overtaking, poor road observation and misuse of lane

**Damage by Type of Road User (2004)**
**total number : 8,339**

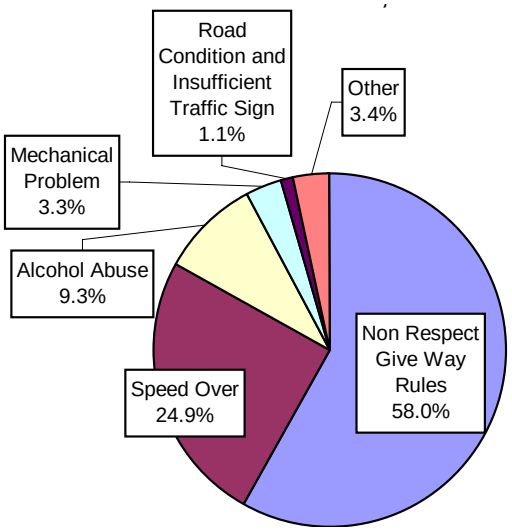



Source : Land Transport Department, MPWT

**Figure 5.2 Incidents by Transportation Mode (2004)**

done by trucks, buses and passenger cars involving slower speed vehicles such as motorcycles in a mixed traffic situation.

- Other causes include vehicle mechanical problem, alcohol abuse, road condition, insufficient traffic safety signs and insufficient traffic law enforcement.




Source : Land Transport Department, MPWT

**Figure 5.3 Cause of Accident (2004)**
**Total number : 4,255**

## Traffic Accident on Major National Road

- An interview survey regarding traffic accidents in NR.1, NR.4, NR.5, NR.6, NR.7 was conducted by the Study at different provincial and district traffic police.
- Among the routes considered, NR.5 has the highest accident rate at 2.5/km. It is observed that along this route, traffic signs and guardrails are in poor condition and that several bridges and culverts have narrow sections.
- On NR.6 to 7 and NR.4, accident rates are 1.93 and 1.88/km. Causes of accidents includes over speeding, dangerous overtaking and poor condition of road (NR.6)
- Motorcycle accident accounts for the majority of the accident.
- Among the provinces, Phnom Penh has the highest accident rate from 6.8 to 10.26/km involving basically motorcycle accidents. Moreover, it is noted that accident rates at urban centers are higher than rural areas.

<u>Availability of Traffic Accident Data</u>

- The study team encountered difficulty in obtaining traffic accident data from the provincial/district police stations.
- The data obtained regarding traffic accidents at different provincial/district police stations contain very limited information and does not indicate the exact location of each accident. This makes it difficult to pinpoint black spots or hazardous locations at different road sections.

**Table 5.2 Traffic Accident on Major Roads**

| Road No. | Province | Distance (km) | Number of Accident (Times) | Severity of Injure (persons) | | | |
|---|---|---|---|---|---|---|---|
| | | | | Fatalities | Injures | | |
| | | | | | Serious | Not Serious | Total |
| NR.1 | Phnom Penh | 3.0 | 24 | 4 | 29 | 9 | 38 |
| | Kandal | 44.3 | 22 | 5 | 22 | 23 | 45 |
| | Prey Veng | 48.6 | 52 | 17 | 69 | 45 | 114 |
| | Svay Rieng | 64.7 | 76 | 20 | 60 | 59 | 119 |
| | **Total** | **160.6** | **174** | **46** | **180** | **136** | **316** |
| Accident Rate (per km) | | - | 1.08 | 0.29 | - | - | 1.97 |
| NR.4 | Kandal | 19.0 | 145 | 20 | 142 | 92 | 234 |
| | Kampong Speu | 77.7 | 173 | 61 | 179 | 153 | 332 |
| | Koh Kong | 49.3 | 22 | 3 | 11 | 39 | 50 |
| | Sihanouk Ville | 68.2 | 62 | 32 | 43 | 39 | 82 |
| | **Total** | **214.2** | **402** | **116** | **375** | **323** | **698** |
| Accident Rate (per km) | | - | 1.88 | 0.54 | - | - | 3.26 |
| NR.5 | Phnom Penh | 12.2 | 83 | 12 | 73 | 59 | 132 |
| | Kandal | 27.7 | 27 | 17 | 14 | 12 | 26 |
| | Kampong Chhnang | 93.3 | 160 | 31 | 95 | 135 | 230 |
| | Pursat | 97.2 | 122 | 34 | 80 | 84 | 164 |
| | Battam Bang | 111.7 | 316 | 67 | 175 | 242 | 417 |
| | Banteay Meanchey | 68.9 | 318 | 34 | 105 | 335 | 440 |
| | **Total** | **411.0** | **1,026** | **195** | **542** | **867** | **1,409** |
| Accident Rate (per km) | | - | 2.50 | 0.47 | - | - | 3.43 |
| NR.6A ~ NR.6 ~ NR.7 | Phnom Penh | 10.4 | 107 | 27 | 73 | 44 | 117 |
| | Kandal | 29.9 | 88 | 26 | 92 | 66 | 158 |
| | Kampong Cham | 199.4 | 427 | 112 | 399 | 372 | 771 |
| | Kratie | 94.8 | 22 | 5 | 44 | 6 | 50 |
| | **Total** | **334.5** | **644** | **170** | **608** | **488** | **1,096** |
| Accident Rate (per km) (without Kratie) | | - | 1.93 (2.60) | 0.51 (0.69) | - | - | 3.28 (4.36) |

Source: Provincial Traffic Police and District Traffic Police

## 5.2 Situation of Car Registration

**Trend of Car Registration**

We can see unevenness in total registration number by year in **Table 5.3**. The table also indicates that the total number of cars did not change in comparison with 1990's, but only passenger car (light vehicle) increased from 4,181 in 1990's to 13,856 in 2004. Out of 485,612 in total registration number, motorcycle accounts for 74%, light vehicles for 22% and heavy vehicles for 4%.

As seen in **Table 5.4**, 28,609 vehicles (74.9%) were registered in Phnom Penh. However, there is another fact that a large number of non-registered cars existed in the rural areas, so that we cannot say that motorization is not progressing in the rural areas, if the number of non-registered car is added to the registered number.

**Analysis of Car Registration**

The survey reveals that there are many ratios of non-registered cars, especially, in the rural areas. **Figure 5.3** shows about 60% of motorcycle, 20% of light vehicles and heavy vehicles are non-registered. If non registration vehicles are added, number of registration increases to 1,060,000 of them or 2.2 times from 485,600 of them.

**Figure 5.4**, "The Situation of Car Registration along the Route NR.5", indicates that the number of non-registered vehicles is increasing away from the capital Phnom Penh or in the areas near the border. It is assumed that most of the non-registered cars come from smuggling.

The Study team considers this problem as unfair to the people with car possession who pay registration charge and car holding tax honestly and seriously. The Study team, therefore, recommends for MPWT to take an appropriate action for the improvement of registration system. Introduction or strengthening of penalty system will become one solution. In addition, if the registration system is improved and administered surely, the annual revenue of the country increases, and financial circumstances will be improved.

## Table 5.3 Trend in the number of car registrations from 1990 to 2004

| Year | Motorcycles (I) | | | | | Light Vehicles (II) | | | | | | Heavy Vehicles (III) | | | | | | Grand Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | State Owned | O. I. Owned | CD & ONU Owned | Private Owned | Total (I) | O. I. Vehicle | Car | Mini Bus | Pick-up | State Owned | Total (II) | Bus | Truck | Trailer | Special Vehicle | State Owned | Total (III) | |
| 1990 | 0 | 0 | 0 | 43,733 | 43,733 | 135 | 2,849 | 221 | 533 | 443 | 4,181 | 105 | 683 | 0 | 0 | 748 | 1,536 | 49,450 |
| 1991 | 0 | 0 | 0 | 27,432 | 27,432 | 148 | 3,421 | 218 | 570 | 750 | 5,107 | 105 | 506 | 0 | 0 | 677 | 1,288 | 33,827 |
| 1992 | 0 | 0 | 0 | 36,443 | 36,443 | 405 | 3,996 | 305 | 727 | 147 | 5,580 | 42 | 576 | 0 | 3 | 72 | 693 | 42,716 |
| 1993 | 0 | 0 | 0 | 12,544 | 12,544 | 150 | 3,276 | 310 | 1,336 | 150 | 5,222 | 102 | 1,171 | 0 | 14 | 70 | 1,357 | 19,123 |
| 1994 | 0 | 0 | 0 | 12,818 | 12,818 | 147 | 4,340 | 182 | 1,027 | 147 | 5,843 | 146 | 742 | 0 | 16 | 69 | 973 | 19,634 |
| 1995 | 0 | 0 | 0 | 19,080 | 19,080 | 220 | 4,528 | 384 | 986 | 150 | 6,268 | 153 | 1,131 | 0 | 27 | 73 | 1,384 | 26,732 |
| 1996 | 0 | 0 | 0 | 18,422 | 18,422 | 527 | 3,838 | 890 | 1,450 | 528 | 7,233 | 107 | 1,211 | 119 | 37 | 279 | 1,753 | 27,408 |
| 1997 | 0 | 0 | 0 | 10,794 | 10,794 | 290 | 4,516 | 795 | 1,931 | 497 | 8,029 | 65 | 1,569 | 79 | 199 | 146 | 2,058 | 20,881 |
| 1998 | 0 | 0 | 0 | 21,756 | 21,756 | 393 | 2,785 | 485 | 1,138 | 199 | 5,000 | 51 | 799 | 35 | 21 | 45 | 951 | 27,707 |
| 1999 | 0 | 0 | 0 | 20,147 | 20,147 | 323 | 4,654 | 1,112 | 2,672 | 244 | 9,005 | 56 | 857 | 32 | 36 | 18 | 999 | 30,151 |
| 2000 | 386 | 278 | 68 | 24,064 | 24,796 | 860 | 4,134 | 986 | 2,190 | 369 | 8,539 | 39 | 636 | 2 | 12 | 205 | 894 | 34,229 |
| 2001 | 909 | 756 | 65 | 41,960 | 43,690 | 486 | 3,684 | 593 | 1,624 | 323 | 6,710 | 71 | 626 | 3 | 0 | 20 | 720 | 51,120 |
| 2002 | 823 | 437 | 21 | 15,675 | 16,956 | 289 | 4,740 | 903 | 2,346 | 289 | 8,567 | 182 | 1,189 | 81 | 0 | 35 | 1,487 | 27,010 |
| 2003 | 714 | 380 | 61 | 26,736 | 27,891 | 427 | 4,705 | 1,028 | 1,804 | 303 | 8,267 | 107 | 1,089 | 0 | 7 | 79 | 1,282 | 37,440 |
| 2004 | 1,352 | 384 | 198 | 20,730 | 22,664 | 242 | 9,832 | 1,205 | 2,376 | 201 | 13,856 | 202 | 1,430 | 8 | 12 | 12 | 1,664 | 38,184 |
| Total | 4,184 | 2,235 | 413 | 352,334 | 359,166 | 5,042 | 65,298 | 9,617 | 22,710 | 4,740 | 107,407 | 1,533 | 14,215 | 359 | 384 | 2,548 | 19,039 | 485,612 |

## Table 5.4 Number of registered cars by province in 2004

| No. | Province | Motorcycles (I) | | | | | Light Vehicles (II) | | | | | | Heavy Vehicles (III) | | | | | | Grand Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | State Owned | O.I. Owned | CD & ONU Owned | Private Owned | Total (I) | O.I. Vehicle | Car | Mini Bus | Pick-up | State Owned | Total (II) | Bus | Truck | Trailer | Special Vehicle | State Owned | Total (III) | |
| 1 | Banteay Meanchey | 0 | 0 | 0 | 46 | 46 | 0 | 79 | 2 | 24 | 0 | 105 | 9 | 26 | 0 | 0 | 0 | 35 | 186 |
| 2 | Battambang | 0 | 0 | 0 | 241 | 241 | 0 | 175 | 17 | 56 | 0 | 248 | 12 | 46 | 0 | 0 | 0 | 58 | 547 |
| 3 | Kampong Cham | 0 | 0 | 0 | 1254 | 1254 | 0 | 260 | 93 | 140 | 0 | 493 | 16 | 330 | 0 | 0 | 0 | 346 | 2093 |
| 4 | Kampong Chhnang | 0 | 0 | 0 | 137 | 137 | 0 | 26 | 7 | 34 | 0 | 67 | 0 | 20 | 0 | 0 | 0 | 20 | 224 |
| 5 | Kampong Speu | 0 | 0 | 0 | 288 | 288 | 0 | 62 | 83 | 143 | 0 | 288 | 0 | 44 | 0 | 0 | 0 | 44 | 620 |
| 6 | Kampong Thom | 0 | 0 | 0 | 204 | 204 | 0 | 42 | 18 | 41 | 0 | 101 | 1 | 63 | 0 | 0 | 0 | 64 | 369 |
| 7 | Kampot | 0 | 0 | 0 | 102 | 102 | 0 | 54 | 33 | 48 | 0 | 135 | 0 | 39 | 0 | 0 | 0 | 39 | 276 |
| 8 | Kandal | 0 | 0 | 0 | 1751 | 1751 | 0 | 443 | 118 | 218 | 0 | 779 | 2 | 85 | 0 | 0 | 0 | 87 | 2617 |
| 9 | Koh Kong | 0 | 0 | 0 | 0 | 0 | 0 | 23 | 13 | 16 | 0 | 52 | 0 | 3 | 0 | 0 | 0 | 3 | 55 |
| 10 | Kratie | 0 | 0 | 0 | 311 | 311 | 0 | 29 | 7 | 15 | 0 | 51 | 1 | 9 | 0 | 0 | 0 | 10 | 372 |
| 11 | Mondul Kiri | 0 | 0 | 0 | 0 | 0 | 0 | 5 | 0 | 9 | 0 | 14 | 0 | 2 | 0 | 0 | 0 | 2 | 16 |
| 12 | Phnom Penh | 1352 | 384 | 198 | 15538 | 17472 | 242 | 8045 | 665 | 1318 | 201 | 10471 | 137 | 497 | 8 | 12 | 12 | 666 | 28609 |
| 13 | Preah Vihear | 0 | 0 | 0 | 74 | 74 | 0 | 4 | 0 | 3 | 0 | 7 | 0 | 3 | 0 | 0 | 0 | 3 | 84 |
| 14 | Prey Veaeng | 0 | 0 | 0 | 191 | 191 | 0 | 50 | 56 | 40 | 0 | 146 | 0 | 92 | 0 | 0 | 0 | 92 | 429 |
| 15 | Pursat | 0 | 0 | 0 | 38 | 38 | 0 | 44 | 4 | 15 | 0 | 63 | 0 | 23 | 0 | 0 | 0 | 23 | 124 |
| 16 | Ratanak Kiri | 0 | 0 | 0 | 0 | 0 | 0 | 11 | 0 | 6 | 0 | 17 | 0 | 8 | 0 | 0 | 0 | 8 | 25 |
| 17 | Siemreap | 0 | 0 | 0 | 270 | 270 | 0 | 195 | 4 | 86 | 0 | 285 | 24 | 37 | 0 | 0 | 0 | 61 | 616 |
| 18 | Sinahoukville | 0 | 0 | 0 | 0 | 0 | 0 | 162 | 41 | 81 | 0 | 284 | 0 | 16 | 0 | 0 | 0 | 16 | 300 |
| 19 | Stung Treng | 0 | 0 | 0 | 89 | 89 | 0 | 6 | 1 | 2 | 0 | 9 | 0 | 0 | 0 | 0 | 0 | 0 | 98 |
| 20 | Svay Rieng | 0 | 0 | 0 | 34 | 34 | 0 | 42 | 21 | 11 | 0 | 74 | 0 | 16 | 0 | 0 | 0 | 16 | 124 |
| 21 | Takeo | 0 | 0 | 0 | 141 | 141 | 0 | 67 | 22 | 61 | 0 | 150 | 0 | 64 | 0 | 0 | 0 | 64 | 355 |
| 22 | Oddar Meanchey | | | | | | | | | | | | | | | | | | |
| 23 | Kep | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 0 | 0 | 0 | 3 | 0 | 1 | 0 | 0 | 0 | 1 | 4 |
| 24 | Pailin | 0 | 0 | 0 | 21 | 21 | 0 | 5 | 0 | 9 | 0 | 14 | 0 | 6 | 0 | 0 | 0 | 6 | 41 |
| Total | | 1352 | 384 | 198 | 20730 | 22664 | 242 | 9832 | 1205 | 2376 | 201 | 13856 | 202 | 1430 | 8 | 12 | 12 | 1664 | 38184 |

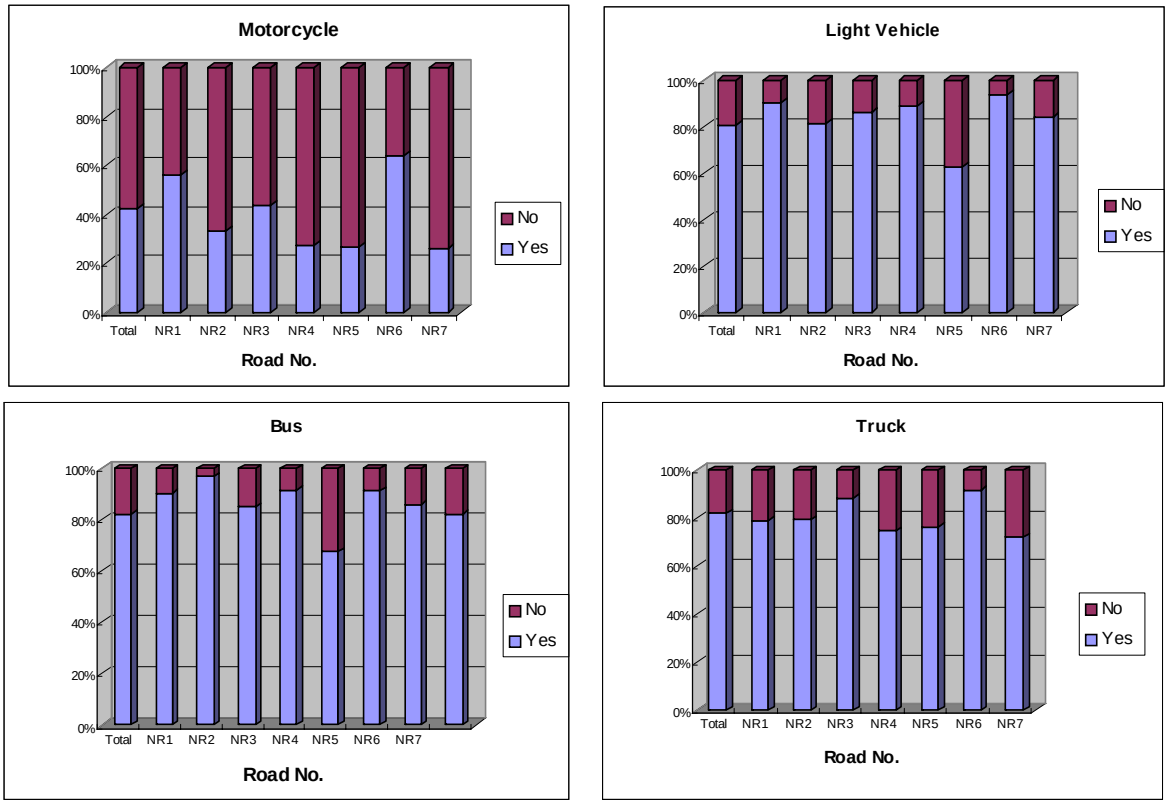



**Figure 5.4 Summary of the Car Registration Survey**

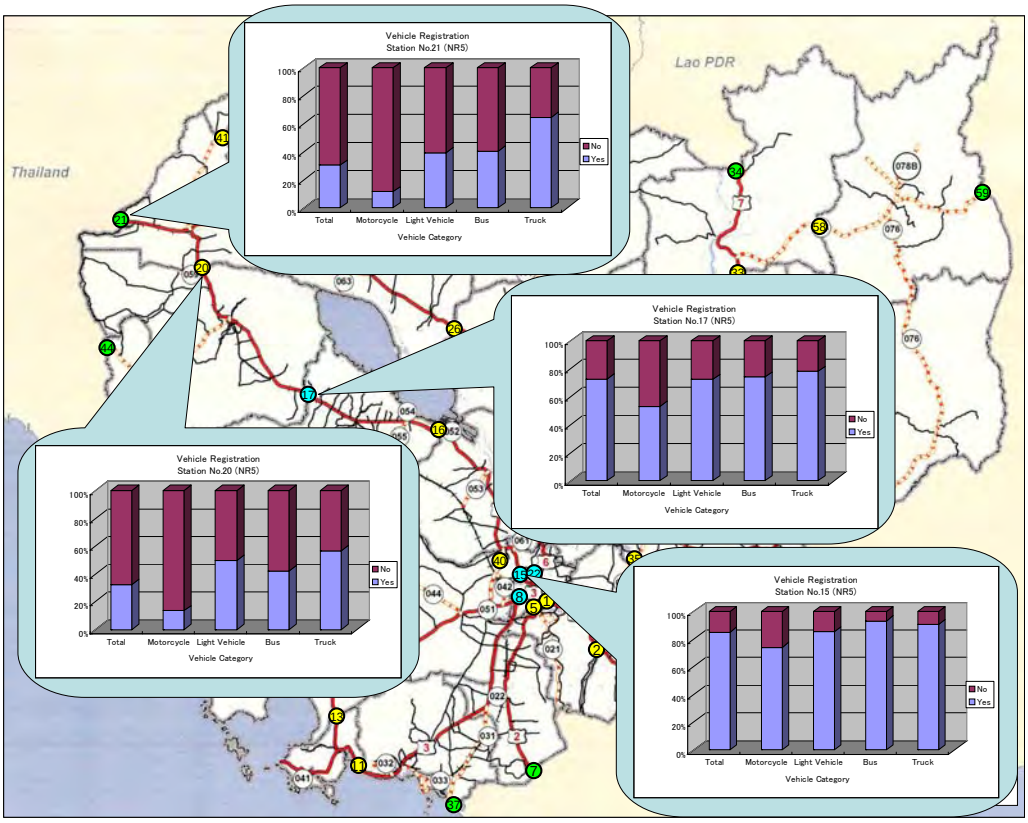



**Figure 5.5 Situation of Car Registration along the Route NR.5**