ISSN 1346-7328
国総研資料第 597 号
平 成 22 年 6 月

国土技術政策総合研究所資料

TECHNICAL NOTE of
National Institute for Land and Infrastructure Management

No.597 June 2010

平成 21 年度
企画部国際研究推進室　研究活動報告書

企画部　国際研究推進室

Report of the research activities of International Research and Promotion Division in FY 2009

International Research and Promotion Division,
Planning and Research Administration Department

国土交通省　国土技術政策総合研究所

National Institute for Land and Infrastructure Management

Ministry of Land, Infrastructure, Transport and Tourism, Japan

国土技術政策総合研究所資料　　　　　　Technical Note of NILIM
第 597 号　　2010 年 6 月　　　　　　No.597　　June 2010

平成21年度　企画部国際研究推進室　研究活動報告書

企画部　国際研究推進室

Report of the research activities of International Research and Promotion Division in FY 2009.

International Research and Promotion Divisions, Planning and Research Administration Department

概要

本資料は、企画部国際研究推進室が平成21年度に行なった国際研究活動をとりまとめた報告書である。

ｷｰﾜｰﾄﾞ　:　国際研究推進室、国際研究活動、インド、インドネシア共和国、研究協力

Synopsis

This document is the report which wrote up the research activities the International Research and Promotion Division performed in 2009.

Key Words　:　International Research and Promotion Division, International research activities, India, Republic of Indonesia, research cooperation

はじめに

国土技術政策総合研究所（以下、国総研という。）企画部国際研究推進室は、毎年「アジア地域国土整備関係研究所長等会議（以下、アジア所長会議という。）」を開催し、今年で18回目を迎えた（平成21年度までに19カ国、148名が参加)。会議にはアジア各国の政府関係者並びに社会資本整備に関係する研究機関の研究者を招聘し、情報交換及び技術の紹介並びに現地視察を行なってきた。しかしながら、アジア所長会議は単年度の単発的な国際会議で、その参加は各国の申請に基づくものであることから、研究所としての戦略的で管理可能な外交的活動たり得ているかという点で不十分であったことは否めなかった。また事実、この会議をきっかけとしてアジア諸外国との間で研究協力関係を構築できずにいたことも反省すべき点であった。

そのため国際研究推進室では、アジア所長会議後に相手国（研究所）を個別に訪問し、あるいは会議に先立ち、重要国を訪問しキーマンを特定するなどの工夫や研究体制（予算、人員、研究評価、本省と研究所との関係等）についてのフォローアップ調査を行なうなど、両国における国土整備関係の研究に関する現状と課題を共有するとともに、共同研究テーマの発掘・研究ニーズの発掘を行なっていくなどの活動を積極的に試みることとした。

その結果、平成21年度中に国総研はインド国立災害管理研究所（National Institute of Disaster Management, Ministry of Home Affairs, India）（以下、NIDMという。)、及びインドネシア共和国公共事業省道路・橋梁研究所（Research and Development Center for Roads and Bridges, Research and Development Agency, Ministry of Public Works, Indonesia）（以下、RDCRBという。）との間で研究協力に関する覚書を締結するに至った。

本資料は、研究協力に関する覚書を締結するまでの背景や覚書の内容について、並びに開催したワークショップの内容等を整理するとともに、今後の国総研の外交的活動について研究・整理した報告書である。

平成22年6月

国土技術政策総合研究所
企画部　国際研究推進室
室　長　　寺元　博昭
国際交流専門職　　中山　喜志夫
研究官　　木村　恵子
研究員　　松下　智祥

目次

1.　インドとの研究協力について

1. インドとの研究協力について

1.1. 背景

インドとの研究協力の覚書締結に至った背景には、「第17回アジア所長会議（平成20年10月21日～29日開催、会議テーマ：自然災害に対する防災・減災)」がきっかけである。インドからは財務省社会基盤整備部長のアミット氏（IRS）が参加来日された。会議最終日の総合討論においては、参加国同士が「自然災害に対する防災・減災に取り組んでいくことの重要性を認識するとともに今後の研究活動において相互に連携をしていく必要性を確認した。」との採択文をまとめ、閉幕した。

その後、この会議のフォローアップとして、災害に関する政策研究や人材育成などに関してインド政府内で中心的役割を担う内務省国立災害管理研究所（National Institute of Disaster Management of India(NIDM)）にヒアリング等に伺い、そのやり取りの中で当研究所と「地すべり等災害管理に関する共同ワークショップ」を開催することに至り、その際に覚書の締結を行なった。

次ページ以降に、覚書締結について及び共同ワークショップ開催について、並びに当研究室にて実施した今後の研究ニーズの把握調査についても報告する。

覚書締結の準備にあたり、国総研はインドを訪問している。下記に訪問の目的及び会合内容についての詳細を記載する。(海外出張調書)

海外出張調書

出 張 者 ：国際研究推進室　室長　　寺元博昭
　　　　　　　　　　　国際交流専門職　　中山喜志夫

出張件名：研究連携の効果を高める方策等に関する調査

出 張 先 ：インド・デリー市

出張期間：平成２１年３月２５日～平成２１年３月２９日　（５日間）

出張の目的：　当所と諸外国との研究連携を効果的に推進していくために、インドをモデル国として、地球温暖化による気候変動による洪水や干ばつなどの災害に対する国土保全方策やそのための研究ニーズについて調査を行うため、インド国立災害研究所の関係者や第１７回国土整備関係研究所長等会議参加者と意見交換を行った。

（相手側）Natinal Institute of Disaster Management

Joint director	Mr. Shaleen Kabra
Consultant	Mr. Arun Sahdeo
Head of Geohazards Division	Mr. Chandan Ghosh
Associate Professor	Mr. Surya Parkash
Commissioner of Income Tax	Mr. Amit Jain

出張内容及び成果：　インド国立災害研究所は、インドの自然災害に関する政策等について研究を行っており当所と類似した研究機能を有する機関である。

今回の意見交換で、日本との研究連携や日本主催のセミナー参加に興味を持っていることがわかった。研究連携方法としては、ワークショップの開催やメール等による情報交換等を考えているようであった。また、研究協力の分野は、地すべりや地震関係を考えているようである。地すべりは、世界一の発生件数とのことであった。

今回の調査で諸外国の研究機関と当所との研究連携の研究テーマや連携方法について全般的な意見交換を行い、研究連携の具体的フレームや研究分野について情報収集できたことは、当所の今後の新たな研究連携のフレーム造りを考えていくうえで大変に意義があることを実感できた。

その他：　インドのデリー市内の交通状況は交通量が圧倒的に多く、車は交通ルールを無視し縦横無尽に走りクラクション絶えず鳴らしつづけることに驚かされた。年間１０万人以上の交通事故死亡者が発生することにも頷ける状況であった。

また、デリー市内を流れるガンジス川支流のヤムナ川は、泥くさい臭いと生活排水によるものと思われる多少泡だった流れであった。著しい経済成長が続くインドの一面でもあるようだ。

今後は自然災害の研究連携の他にも交通安全関係や環境関係においても研究連携が必要であると感じさせられる状況であった。

Mission of This Research Tour

1. About us;

NILIM - National Institute of land and Infrastructure Management, a technical branch of the Ministry of Land, Infrastructure, Transport and Tourism in Japan

2. Mission of this research tour;
   1) Follow up the 17th Asian Conference of Public Works Research and Development – Prevention and Mitigation for national disasters, which was sponsored and held by Japan international and Corporation Agency(JICA) and NILIM
   2) Find out the real needs for the prevention and mitigation for national disaster in India in the scope of international research cooperation between Japan and India

3. When the needs for research cooperation in respect of the prevention and mitigation for national disasters are identified, we will try to consider the possibility of the research cooperation and technical information exchanges between the related research organization in India and us.

（Appendix Ⅰ）Questionnaire for National Institute of Disaster Management in India

（Appendix Ⅱ）Questionnaire for the Current Situation and Issues of Disaster Prevention Measures in India

（Appendix Ⅰ）

Questionnaire

National Institute of Disaster Management

Objective of this research

The objective of this study is to collect information on the research management of the INDIA. research institutes with a view to clarifying the overall research direction of the institute, the grand challenge of the research project to which the institute as a whole address, and the individual research themes as to how they manage, plan, implement them and how they publish the results. This survey is consisted of the following:

1. Organization, staffing, and funding of the research institute
2. Research management system
3. Individual research management cases

1. Organization, staffing, and funding of the research institute

Ⅰ. Staffing and employment

- Please describe the procedures for staff employment.
- Please indicate whether or not there is staff exchange with Universities and other research institutes.

Ⅱ. Management and allocation of research budget and its criteria

- Please describe the procedures and criteria for allocating research budget to each research unit, research theme, or researcher.
- Please explain how the allocated budget is used (proportion of labor cost, in-house facility improvement cost, and outsourcing cost, etc.).

Ⅲ. Establishment and dissolution of the research unit (laboratory, team...)

- Please indicate whether establishment of the research unit comes first and then the research follows, or the research theme comes first and then establishment (and eventual dissolution) of the research unit follows.

Ⅳ. Performance assessment of researchers

- Please indicate whether or not performance assessment of researchers is implemented.
- If implemented, please describe the criteria and weighting factor of the assessment.

２. Research management system

Ⅰ. Determination of the overall research policy

- Please describe the procedures to determine the overall research policy of the institute and whether or not there is any involvement of an advisory committee or alike.
- Please describe the procedures to prepare a strategic plan etc. which explains the overall research policy.

Ⅱ. Determination of the research themes (i.e. planning method)

- Please describe the procedures to identify research needs and to determine research themes; for instance, whether or not researchers opinions and/or requests from superior institutes are taken into consideration, or if the public is consulted.

Ⅲ. Methods to evaluate and publicize the research results

- Please describe the procedures to evaluate the research results.
- Please describe the procedures to publicize and disseminate the research results.
- Please indicate how much effect is gained by the publication and whether or not assessment of such effect is implemented.

3. Individual research management cases

Ⅰ. Flow of procedures of an actual research project

- By way of example, please describe an actual research project along the course from planning to research reporting.

Reference materials related to above matters would be appreciated. If possible, please give a description of the system with its advantages and disadvantages, current issues and so on.

付属資料　Ⅰ

現地ヒアリング調査　質問状

概要（目的）

インドの災害関係の研究機関について、機関としての研究の方向性、研究所全体として取り組む研究プロジェクトや研究の大課題、また個別の研究テーマについて、その管理と立案、実施、研究成果の公表等について情報を収集したい。

１．研究所の組織・人員構成・予算に関する質問
２．研究マネジメントに関する質問
３．個別の研究マネジメントに関する質問

１．研究所の組織・人員構成に関する質問

Ⅰ．職員の構成と採用方法

職員はどのような手順に則って採用しているのか。また、大学や他の研究機関との人事交流は実施しているのか。

Ⅱ．予算の管理と割り振り、配分する際の基準

予算はどのように各研究室や研究テーマ、あるいは研究者に割り振るのか。その時の判断基準はどのようなものか。

また予算の使用・活用方法はどのようなものか。例えば主に人件費や直営による施設整備、外部委託・発注等の内訳等について、可能なら知りたい。

Ⅲ．研究所の部・研究室、研究チームの作成・解散

研究所では、まず研究室ありきで研究を進めているのか、それとも研究テーマ毎にチームを結成・解散しているのか。

Ⅳ．研究員の評価手法

研究者の評価なども実施しているのか。しているのであれば、それはどのような基準に従って実施されているのか。さらに、その際の評価基準は、どこに重きを置いているのか。

２．研究マネジメントに関する質問（優先１）

Ⅰ．全体方針の設定

研究所としての全体方針、例えばポリシーなどはどのような手順で決定されるのか。例えば委員会などを開催しているのか。

また、それらのポリシーを説明するストラテジックプランなどは、どのような手順で作成されているのか。

Ⅱ．研究テーマの設定方法、計画立案

研究ニーズの把握とテーマの設定は、どのような手順で行っているのか。例えば、研究者からの吸い上げ、上位機関からの依頼、国民からの意見抽出など、テーマを決める手法・流れを知りたい。

Ⅲ．研究成果に関する評価手法・成果発表手法

研究によって得られた成果は、どのような手順に従って評価を実施しているのか。また、得られた成果はどのように公表・普及されているのか、その手法を知りたい。

更に、その公表の結果、効果はいかほどだったのか、またその効果自体の評価も実施しているのか。

３．個別の研究マネジメントに関する質問（優先 2）

Ⅰ．個別の研究テーマを対象とし、研究の立案から結果報告までの流れ

基本的には「２」の項目と同じ質問だが、個別の研究テーマについて、事例を用いてその計画立案から成果発表（あるいは研究結果報告）までの一連の流れを見せて欲しい。

上記項目についてお答えいただくと同時に、参考となる資料をいただきたい。それぞれについてのメリットや、そのシステムについての現時点での懸案事項（デメリット等）を教えて欲しい。

(Appendix Ⅱ)

Questionnaire on the Current Situation and Issues of National Disaster Prevention Measures

Please answer the following questions for each natural disaster.

1. Please fill in the current situation of prevention measures against natural disaster. Each step is shown based on the flow in Figure 1.
   (1) Concerning "Current situation," please select one item below for each step.
      - C: Complete ･･･Already completed.
      - A: Almost complete ･･･Almost completed. The measures based on the current technology are over but new technology is required to achieve the targeted levels, and so on.
      - D: During enforcement ･･･Currently implemented.
      - N: Non-start ･･･Not commenced yet.
   (2) Concerning "Issues for completion," please select one from items below for anything uncompleted for each step because of one of the items below. If it will be completed by systematic implementation, it is not required to make selections here.
      - T: Technology : Insufficiency of the technical measures
      - L: Legal System : Insufficiency of the legal system
      - O: Organization : Insufficiency of the organizational development
      - H: Human Ability : Insufficiency of technical capability of staff
      - F: Finance: Insufficiency of funds
   (3) Concerning "Priority," please select 3 items in the order of urgency among steps issues of which should be solved in each step. Indicate the number (1), 2), 3)).
2. For the items with high priority selected in 1 above, please describe the current situation and what assistance you expect from NILIM.
3. Please state any assistance you need to prepare the monitoring report.

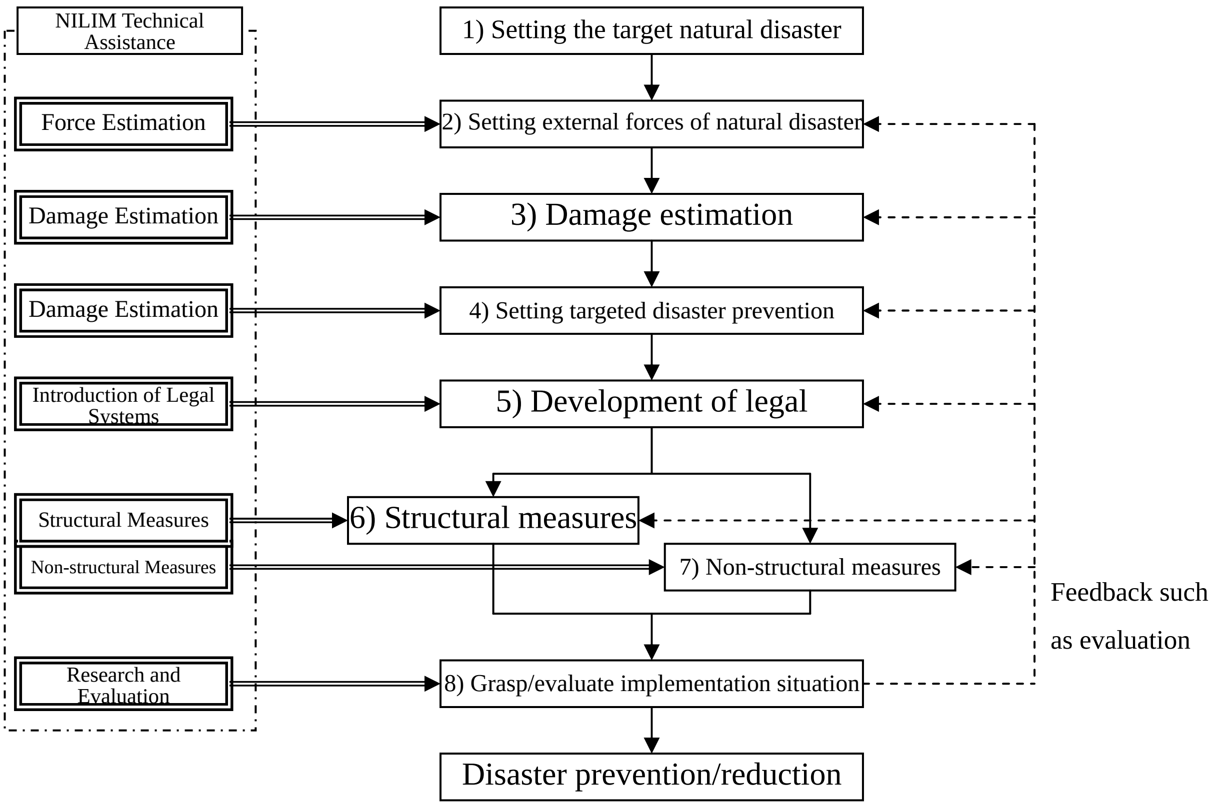


Figure-1. Implementation flow of disaster prevention/reduction

Reference: The outline of the implementation focusing on technology in the implementation flow of disaster prevention/reduction shown in Figure-1 is described below.

1) Setting target natural hazard
Clarify the natural hazard to be dealt with in your country.
(Earthquake, volcanic eruption, landslide, tsunami, flood, drought, Strong Wind (typhoon, tornado), etc.)

2) Setting scale of natural hazard
For the natural hazard selected in 1), estimate the frequency and scale of target hazard in each area of your country.
Example:
Earthquake ･･･ Estimation of occurrence frequency and seismic motion of each area
Typhoon ･･･ Maximum wind speed occurring once in 100 years
Flood ･･･ Scale of flood occurring once in 100 years

3) Damage estimation
Grasp the outline of what and where damage occur to public and private facilities and the resulting assumed human damage due to the phenomenon selected in 2).

4) Setting targeted disaster prevention levels
Set levels of measures and period of implementation based on the current damage estimation in 3) and estimation of cost required for disaster prevention/reduction and its effects, and national situations.

5) Development of legal systems
Develop legal systems required to achieve the targeted disaster prevention levels.

6) Implementation of structural measures
To achieve the purposes of legal systems, etc., implement structural measures.
Example:
Earthquake ･･･ Earthquake-proof retrofitting
Strong Wind ･･･ Measures against vibration
Flood ･･･ Levee raising

7) Implementation of non-structural measures
To achieve the purposes of legal systems, etc., implement non-structural measures.
Example:
Earthquake ･･･Raising resident awareness on earthquake response･Development of emergency system of governmental organizations after occurrence
Strong Wind･･･Typhoon track forecasting･Development of evacuation system
Flood Occurrence forecast･Structuring early warning system･Development of evacuation system

8) Grasp and evaluation of implementation situation
Grasp each policy implementation situation, compliance and appropriateness of progress.
Based on the implementation situation, devise specific improvement method for any item requiring improvement.

Questionnaire

Name of country ( )			
Target natural disaster ( )			
1. Disaster prevention situation	Current situation	Issues for completion	Priority
1) Setting the target disaster	C A D N	T L O H F Oth	
2) Setting extend forces of disaster	C A D N	T L O H F Oth	
3) Damage estimation	C A D N	T L O H F Oth	
4) Setting target disaster prevention levels	C A D N	T L O H F Oth	
5) Development of legal systems	C A D N	T L O H F Oth	
6) Structural measures	C A D N	T L O H F Oth	
7) Non-structural measures	—	—	—
7)-1 Proactive (Preventive) measures	C A D N	T L O H F Oth	
7)-2 Emergency measures	C A D N	T L O H F Oth	
7)-3 Recovery measures	C A D N	T L O H F Oth	
8) Grasp and evaluation of implementation situation	C A D N	T L O H F Oth	
Meaning of abbreviations	C: Complete A: Almost complete D: During enforcement N: Non-start	T: Technology L: Legal System O: Organization H: Human Ability F: Finance Oth: Others	

2. Please describe specific needs for assistance expected from Japan for priority items.

Priority 1):

Priority 2):

Priority 3):

3. Please describe if you need assistance in preparing a monitoring report. –

The example of answers of the questionnaire

Name of country (Japan)

Target natural disaster (Earthquakes)

1. Disaster prevention situation	Current situation	Issues for completion	Priority
1) Setting the target disaster	C $\boxed{A}$ D N	$\boxed{T}$ L O H $\boxed{F}$ Oth	
2) Setting extend forces of disaster	$\boxed{C}$ A D N	T L O H F Oth	
3) Damage estimation	C $\boxed{A}$ D N	$\boxed{T}$ L O H F Oth	
4) Setting target disaster prevention levels	C $\boxed{A}$ D N	T L O H F Oth	
5) Development of legal systems	C $\boxed{A}$ D N	T L O H F Oth	
6) Structural measures	C $\boxed{A}$ D N	$\boxed{T}$ L O H $\boxed{F}$ Oth	2)
7) Non-structural measures	–	–	–
7)-1 Proactive (Preventive) measures	C $\boxed{A}$ D N	$\boxed{T}$ L O $\boxed{H}$ F Oth	1)
7)-2 Emergency measures	$\boxed{C}$ A D N	T L $\boxed{O}$ H F Oth	
7)-3 Recovery measures	C $\boxed{A}$ D N	T L O H F Oth	
8) Grasp and evaluation of implementation situation	C A $\boxed{D}$ N	$\boxed{T}$ L O H F Oth	3)
Meaning of abbreviations	C: Complete A: Almost complete D: During enforcement N: Non-start	T: Technology L: Legal System O: Organization H: Human Ability F: Finance Oth: Others	

2. Please describe specific needs for assistance expected from NILIM for priority items.

Priority 1): Proactive measures require improvement of resident awareness but it is difficult to improve and continue risk awareness against earthquake damage. We request technology transfer for irradiation to improve and maintain resident awareness and development of human resources to implement it.

Priority 2): We request transfer of technology for bridge seismic strengthening and lectures on the ways to raise funds to implement it.

Priority 3): We have prepared emergency response manual for the crisis management team but it is difficult to evaluate it as to actual use of it. We request lectures on how to evaluate it.

3. Please describe if you need assistance in preparing a monitoring report.

1.2.　第１回ワークショップの開催について

ワークショップは、平成 22 年 1 月 13 日～15 日にかけて、(独）土木研究所との共催によりつくばで開催し、インドからは NIDM 国際担当兼地すべり専門家の Dr. Surya 氏と科学技術省データマネジメント課長の Dr. Singh 氏が参加した。ワークショップでは、両国における土砂災害とその施策及び地すべり対策や関連する技術に焦点をあてて、両国の抱える課題と取り組みの現状について発表と討議が行われた。また会議の成果として、今後も継続的な研究協力を行なっていくため覚書締結に至ったものである。

1.2.1.　プログラム

INDIA-NIDM / JAPAN-NILIM&PWRI
JOINT-WORKSHOP on Landslide and Disaster Management
13-16 January/2010

13 January 2010

08.00	Dr. Surya and Dr. Singh, Arrival
	(TOKYO,NARITA-airport, Air- India:AI306)
	And move to NILIM by Airport Bus with an attendant

PRE-SESSION SEMINAR on Landslide and Disaster

(Participants ; Related-Researchers, Officers and Some academia members)

(Venue; International Conference Room at NILIM)

13.30 – 15.00	(1)-1 Presentation by NIDM (Dr. SURYA)
	-Landslide Disaster and Countermeasures in India
	(1)-2 Discussion
15.00 – 15.15	Coffee Break
15.15 – 16.15	(2)-1 Presentation by NILIM
	(Director of Risk Management Center, Mr.TERADA)
	-Erosion and Sediment Control in Japan
	(2)-2 Presentation by PWRI
	(Seiner Researcher, Mr.CHIDA)
	-Landslide Disaster and Countermeasures in Japan
16.15 – 17.00	(2)-3 Discussion

(Accommodation)
Hotel BESTLAND (located in TSUKUBA-City)

14 January 2010

OPENING ADDRESS

13.15 – 13.30	Japan's side Director General of NILIM (Mr. NISHIKAWA)
	Chief Executive of PWRI (Dr. SAKAMOTO)

SESSION WORKSHOP on Research-Cooperation

(Participants ; Related-Researchers and Officers)

(Venue; International Conference Room at NILIM)

13.30 – 14.30	(1)-1 Presentation by NIDM (Dr. SURYA)
	-Landslide Disaster and Countermeasures in India
	(2)-1 Presentation by NILIM (ED.for Research,Mr.TERAKAWA)
14.30 – 15.00	Discussion regards to Research-Cooperation on Landslide and Disaster

	Management between India(NIDM) and Japan(NILIM,PWRI)
	(Coffee Break)
15.00 – 17.00	Discussion for MOU & ARRANGEMENT and Observation Tour
	-NILIM &PWRI Experimental Equipments related to Landslide
	-LABORATORY at UNIVERSITY of TSUKUBA etc

CLOSING ADDRESS

18.00 – 19.30	Welcome Reception at Restraint La Porta

(Reception & Accommodation)
Hotel BESTLAND (located in TSUKUBA-City)

15 January 2010

MOVE from TSUKUBA to SHIKOKU & TECHNICAL TOUR

(Dr. Surya and Dr. Singh from India, Staffs of PWRI and Local Officers in SHIKOKU)

07.00 – 08.30	From KENKYUGAKUEN Station to TOKYO (HANEDA-airport) by Train
09.35 – 10.55	From TOKYO to SHIKOKU (TAKAMATU-airport) by Air
	(Lunch & Move to Landslide-site by Office car)
13.50 – 15.50	TECHNICAL TOUR(Ⅰ)at MIYAMAE-Landslide
	Guided by SHIKOKU-SABO Work Office

(Accommodation)
OBOKEIYAAWA Hot-spring
Hotel AWANOSHO

16 January 2010

TECHNICAL TOUR & MOVE from SHIKOKU to TOKYO

(Participants from India with Staffs of PWRI and Local Officers in SHIKOKU)

09.30 – 13.40	TECHNICAL TOUR(Ⅱ) at ZENTOKU-Landslide
	Guided by SHIKOKU-SABO Work Office
	(Lunch & Move to TAKAMATU-airport by Office car)
17.50 – 19.05	By Air from SHIKOKU(TAKAMATU-airport) to TOKYO(HANEDA)
19.55 – 21.00	TOKYO(HANEDA) to Hotel(IKEBUKURO) directly by AIRPORTBUS

(Accommodation)
Hotel SUN-SHINE PRINCE HOTLE (located at IKEBUKURO)

17 January 2010

(Participants from India without attendants)

07.15 – 09.15	Move from Hotel to TOKYO (NARITA) directly by AIRPORTBUS
12.00	Departure, Air- India:AI307, PM18:00 Arrival(New Delhi)

1.2.2.　記者発表資料

資料配付の場所
1．国土交通記者会
2．国土交通省建設専門紙記者会
3．国土交通省交通運輸記者会
4．筑波研究学園都市記者会
平成２２年１月８日　同時配付

National Institute for Land and Infrastructure Management

平成 22 年 1 月 8 日
国土交通省国土技術政策総合研究所
独 立 行 政 法 人 土 木 研 究 所

インド国立災害管理研究所との共同ワークショップ開催について

国土技術政策総合研究所及び土木研究所は、平成 22 年 1 月 13 日から 3 日間の日程で、インド国立災害管理研究所と「地すべりと災害管理に関する共同ワークショップ」を開催することとなりましたのでお知らせ致します。

≪開催の経緯と概要≫

国土技術政策総合研究所及び土木研究所では、アジア各国で頻発する自然災害に対する効果的な防災・減災対策について、毎年つくばで開催する「アジア地域国土整備関係研究所長等会議」等を通じて、各国政府の研究者等と広く議論をしてきました。

この度、国土技術政策総合研究所及び土木研究所では、これまでの議論を踏まえ、インド国立災害研究所と「地すべり対策と災害管理に関する共同ワークショップ」を開催することとなりました。

インドは、我が国最大の ODA 供与国であり、経済成長著しい国ではありますが、一方で、とても災害の多い国であり、災害対策は喫緊の課題となっています。

今回のワークショップでは、地すべり対策ほか防災・減災対策に関する我が国が有する世界レベルの技術的知見や研究成果を提供するほか、今後の効果的な技術支援のあり方や研究連携の推進策等について議論し、研究協力に関する文書を取り交わす予定です。

記

1.　開 催 日:　平成 22 年 1 月 13 日(水)～15 日(金)
2.　場　　所:　国土技術政策総合研究所　 茨城県つくば市旭１番地
3.　内　　容:　会議　平成 22 年1月 13 日(水)～14 日(木)
　　日・インド両国における「地すべりと災害管理」及び
　　「今後の研究協力の推進」に関するディスカッション
　テクニカルツアー　平成 22 年1月 15 日(金)
　　四国　善徳地すべり対策ほか

(問い合わせ先)	
共同ワークショップ運営と災害管理について	国土技術政策総合研究所 企画部国際研究推進室 電話 029-864-4457
地すべり災害の技術協力について	独立行政法人土木研究所 企画部研究企画課 電話 029-879-6750

資料配付の場所
1．国土交通記者会
2．国土交通省建設専門紙記者会
3．国土交通省交通運輸記者会
4．筑波研究学園都市記者会
平成２２年１月21日　同時配付

NILIM
National Institute for Land and Infrastructure Management

平成２２年１月２１日
国土交通省国土技術政策総合研究所

インド国立災害管理研究所と国土技術政策総合研究所との研究協力に関する覚書の締結について

このたび、国土技術政策総合研究所は、インド国立災害管理研究所(National Institute of Disaster Management of India)と防災・減災に関する研究協力のための覚書締結に合意いたしました。

経済成長著しいインドは、我が国最大の ODA 供与国である一方、地すべりや地震などの災害大国でもあります。インドにおいて、国立災害管理研究所は、自然災害の防災・減災に関する政策研究等を行うなど中心的役割を担っており、今回の覚書の締結により、わが国が有する防災技術のインドへの普及や適応性検討、能力向上のための相互交流や現地調査の実施など、各種の研究協力が推進され、両国の社会・経済の発展に寄与することが期待されます。

覚書を締結することに合意し、握手される西川所長とインド国立災害管理研究所の責任者シュルヤ氏

（問い合わせ先）国土技術政策総合研究所　企画部　国際研究推進室　電話 029-864-4457

1.2.3.　当日の配布資料

・Sabo works in Japan (presented by NILIM)

・Landslide Disaster and Mitigation Measures in Japan (presented by PWRI)

Depredation, early 1920'S

Sabo works in Japan

Sa bo
↓ ↓
(Chinese Character) 「砂」 「防」
means
↓ ↓
「Sediment」 「Prevention」

Sediment –related disaster prevention

▲Immediately after works(1920's)
French style stair stepped channel works
(Ushibuse river, Nagano Prefecture)

1

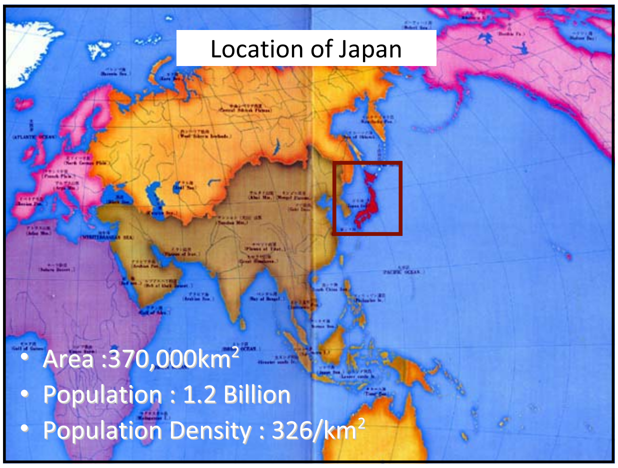
Contents

- Natural and Social Conditions in Japan
- Actual Condition of Recent Disasters
    - Classification of Sediment-related Disasters
    - Number of Sediment-related Disasters in Recent Years
    - Characteristics of Sediment-related Disasters
- Sabo Works for the Prevention of Sediment-related Disasters
    - Structural Measures
    - Non-structural Measures
- Priority Research Subjects of Erosion and Sediment-Control Research Division

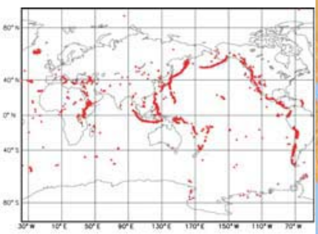
2

Natural and Social Conditions in Japan

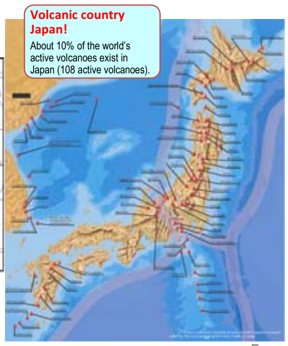
3



Distribution of active volcanoes in the world



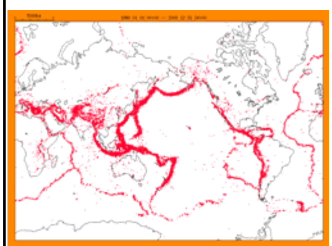
Distribution of active volcanoes in Japan



Volcanic country Japan!
About 10% of the world's active volcanoes exist in Japan (108 active volcanoes).

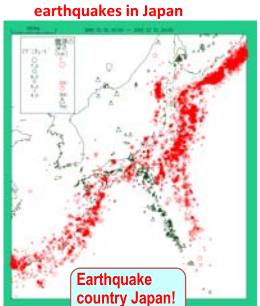
5

Distribution of epicenters of earthquakes in the world



with M=4.0 or more in 1990-2000

Distribution of epicenters of earthquakes in Japan



Earthquake country Japan!
About 20% of the world's earthquakes occur in Japan.

with M=4.0 or more in 1990-2000

6

Vulnerable Japanese islands!

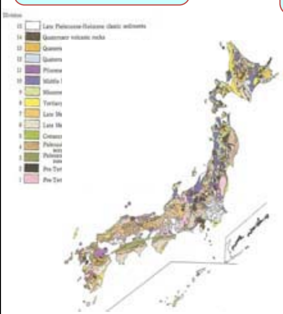
With many faults and complex geology, the Japanese islands are vulnerable to collapses.

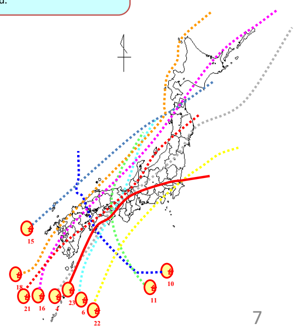
Geologic distribution in Japan

Rainy country Japan!

Heavy rains caused by the rainy season and typhoons are one of the severest in the world.

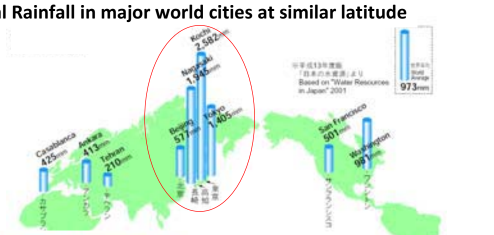
Landfalls of typhoons in 2004

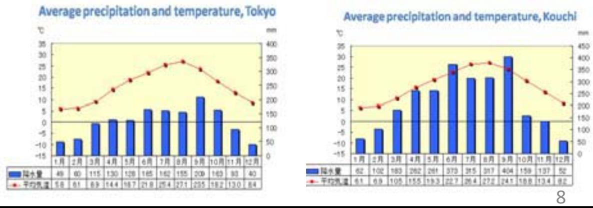




7

■**Annual Rainfall in major world cities at similar latitude**



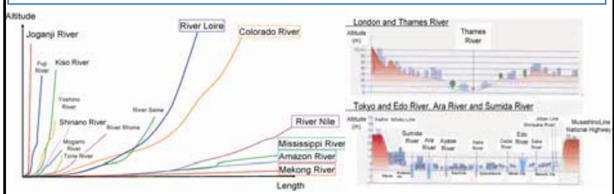


8

Japan is very vulnerable to the water-related disasters, which calls for extensive flood management measures.

Severe terrain conditions of Japan

Many rivers are very steep with a short distance from the source of the sea, resulting in rapid flow.
Further more, most of urban areas are located in low lying areas that are lower than the water level during floods.



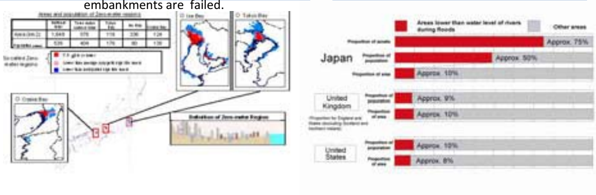
9

Japan is very vulnerable to the water-related disasters, which calls for extensive flood management measures.

Severe terrain conditions of Japan

Population and city functions are concentrated in areas below
Zero-meters level in coastal areas of three major bays.
Catastrophic disasters are anticipated once the embankments are failed.

Approximately half of the population and three quarters of total assets are concentrated in low lying areas.
Major damage is anticipated when flooding occurs.



10

Actual Condition of Recent Disasters

11

Debris flow disasters occur frequently in recent years

Debris flow disaster occurred under the influence of the Bai-u front along Yamatetani river in Matsuyama City (June 20, 2001)

A debris flow caused by a torrential rainfall in Nishi-machi, Kochi City (September 25, 1998)

The debris flow flowing, involving woody debris, down the Aratani River at Saeki Ward, Hiroshima City, Hiroshima Prefecture (June, 1999)

12

Hime River in 1987

(Near Himekawa Spa, Itoigawa City)

Hime River poured an enormous amount of sediment due to localized

torrential rain under the influence of the Bai-u front in 1995.

13

Characteristics of Volcanic Disaster

・Various Phenomena Caused by Eruptions

Ash Deposits, Ash Fall (2000, Mt. Usu)

Pyroclastic Flow (1992,Unzendake))

Lava Flow (1986,Izu ohshima)

Snowmelt-type Volcanic mud Flow (1926,Tokachidake)

Debris Flow (1984,Sakurajima)

Volcanic Gas (2001,Miyakejima)

14

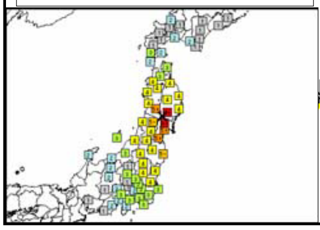
The Iwate-Miyagi Nairiku Earthquake

・Time of occurrence:
8:43 am, Jun. 14th, 2008

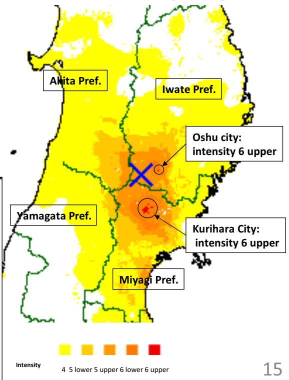
・Intensity : M7.2

・Focal depth:8 km

・Maximum seismic intensity:
Intensity 6 upper



Seismic Intensity Map



15

Estimated Seismic Intensity Map (JMA)

Outline of Sediment-related Disaster

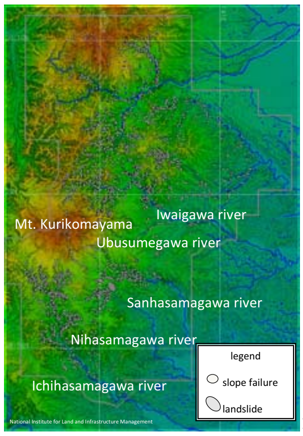
●Over 3,500 slope failures.

●15 river blockages (natural dams) (7 river blockage built upstream of Ichihasamagawa river).

●A large landslide occurred on the Nihasamagawa River (upstream of Aratozawa Dam).

●A debris flow on the Sanhasamagawa River caused serious damage to hotels at the Komanoyu Spa.

●Number of people missing or dead: 18

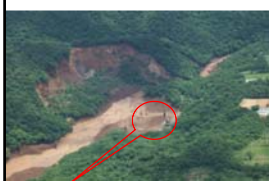


16

Debris Flow and Post-disaster Situation on Sanhasamagawa River

Landslide on eastern slope of Mt. Higashikurikomayama, forming a debris flow destroying the Komanoyu Hot Springs Hotel

7 fatalities



Komanoyu Hot Springs

Photographed June 15th 2008

17

Landslide Occurring Upstream of Aratozawa Dam

Photos: Public Works Research Institute, Earth and Sand Management and Research Group, Landslide Unit

18

Natural dam blocking river flow at Numakuraurasawa, with overflow and erosion

Photographed around 1:00 pm on June 20th 2008

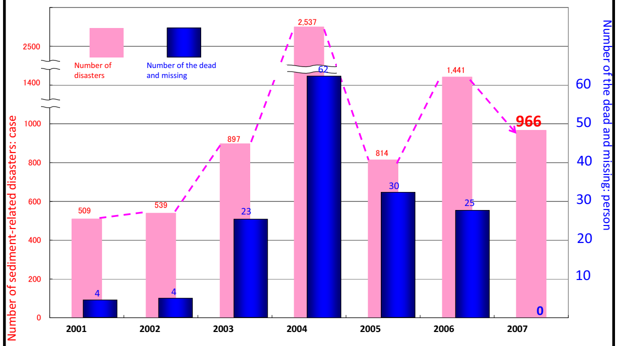
Photographed around 12:00 pm on June 21st 2008

View upstream in vicinity of Numakuraurasawa District (Sanhasamagawa River), Kurihara City, Miyagi Prefecture

Photos: Ministry of Land, Infrastructure, Transport and Tourism, National Institute for Land and Infrastructure Management, Research Center for Disaster Risk Management, Erosion Sediment Control Division

19

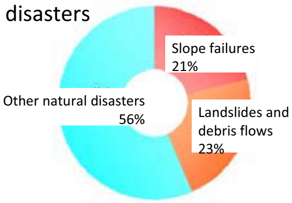
Sediment-related disasters in recent years



20

Sediment-related disasters

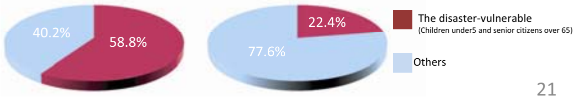
- are likely to kill more people than other natural disasters



44% of natural disaster victims caused by sediment-related disasters in Japan

Except for the death toll by the Hanshin-Awaji Earthquake disaster

The details of victims by sediment-related disasters in 1999 - and proportion of victims throughout the country by age



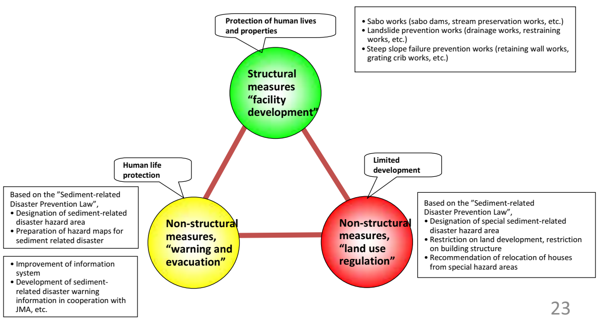
21

Sabo Works for the Prevention of Sediment-related Disasters

22

Three pillars of sediment-related disaster prevention

1) Structural measures protecting human lives and properties, "**facility development**"
2) Non-structural measures protecting human lives through evacuation, "**warning and evacuation**"
3) Non-structural measures limiting new housing development in sediment-related disaster hazard areas, "**land use regulation**"



23

Types of sediment-related disasters

Slope failure

A phenomenon where soil is weakened by the rain, earthquakes, etc. causing a slope to crumble suddenly

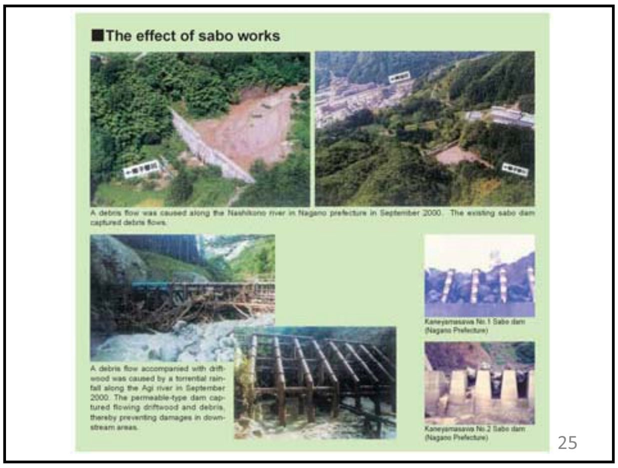
Debris flow

A phenomenon where long or localized torrential rainfall causes mountainside soil, sand, and gravel (debris) from hillsides or stream beds to fall into lower reaches, where they are suddenly washed away downstream at speeds from 20 to 40 km/h

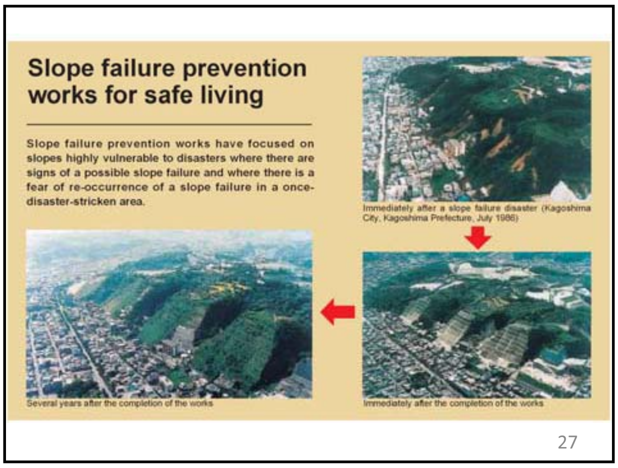
Landslide

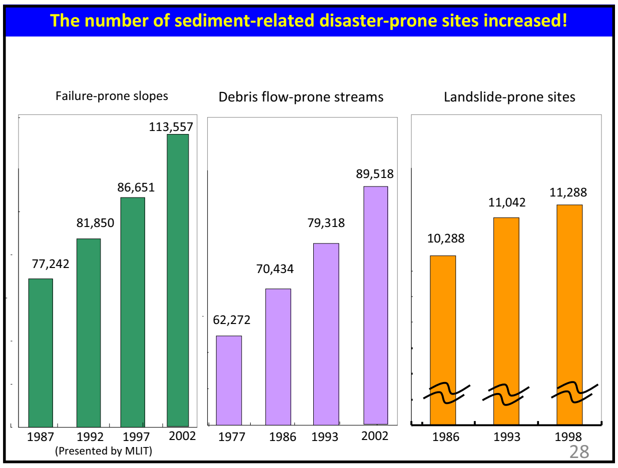
A phenomenon where dirt clods on a slope are slowly moved downward by groundwater, etc., along a landslide surface at speeds from 0.01 to 10 mm/day.

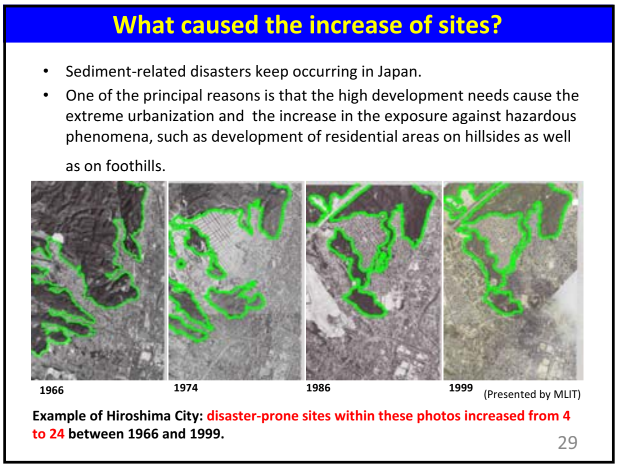
24

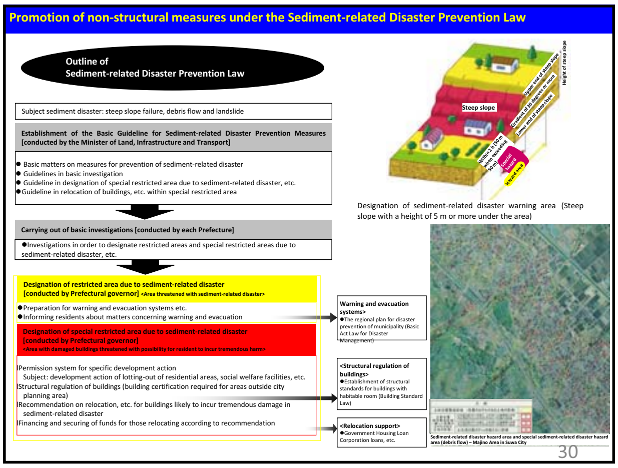

The effect of sabo works
A debris flow was caused along the Nashikono river in Nagano prefecture in September 2000. The existing sabo dam captured debris flows.
A debris flow accompanied with driftwood was caused by a torrential rainfall along the Agi river in September 2000. The permeable-type dam captured flowing driftwood and debris, thereby preventing damages in downstream areas.
Kaneyamasawa No.1 Sabo dam (Nagano Prefecture)
Kaneyamasawa No.2 Sabo dam (Nagano Prefecture)
25

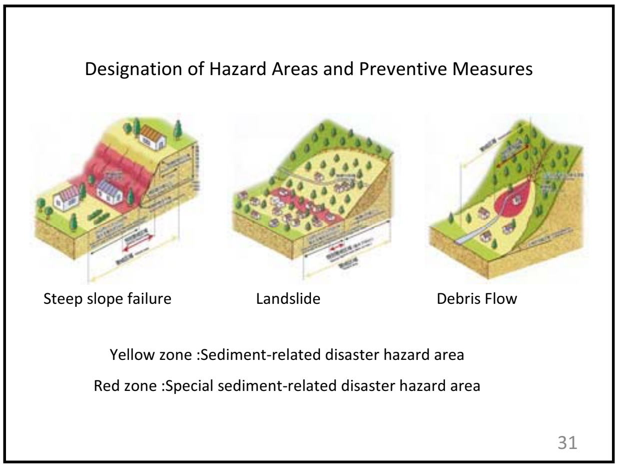

Before and after the landslide counter measure works
Large-scale landslide on Mt. Jizuki (Nagano City, July 1985)
26 killed, 4 injured
Houses completely destroyed: 52, Amount of soil slid: 3.6 million m³
Landslide prevention works have made this area safe. (Photo taken in June 1990)
Anchor works
Drainage well works
Drainage tunnel works
Piling works
26

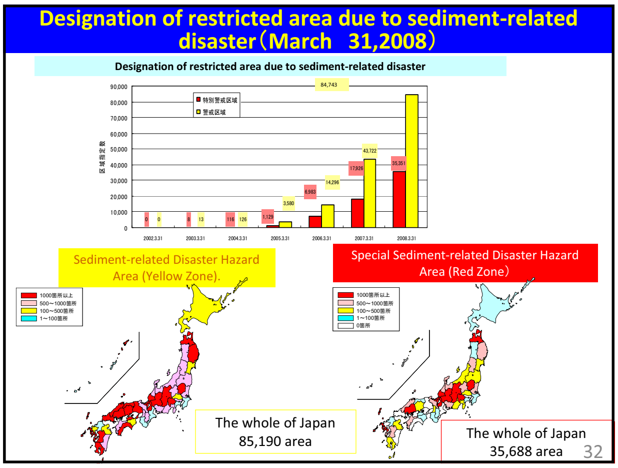

Slope failure prevention works for safe living
Slope failure prevention works have focused on slopes highly vulnerable to disasters where there are signs of a possible slope failure and where there is a fear of re-occurrence of a slope failure in a once-disaster-stricken area.
Immediately after a slope failure disaster (Kagoshima City, Kagoshima Prefecture, July 1986)
Several years after the completion of the works
Immediately after the completion of the works
27

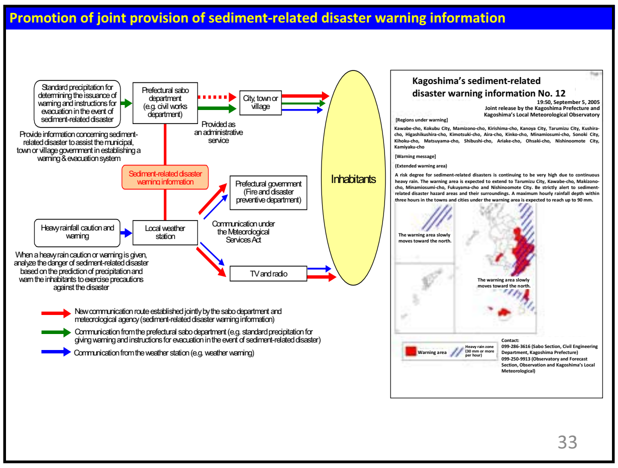

The number of sediment-related disaster-prone sites increased!
Failure-prone slopes
77,242
81,850
86,651
113,557
1987
1992
1997
2002
(Presented by MLIT)
Debris flow-prone streams
62,272
70,434
79,318
89,518
1977
1986
1993
2002
Landslide-prone sites
10,288
11,042
11,288
1986
1993
1998
28

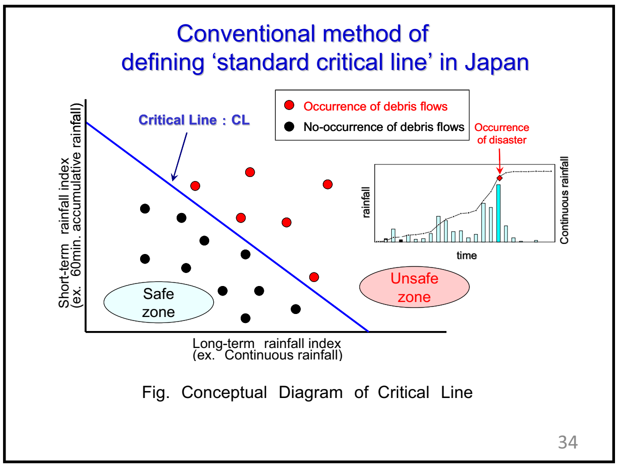

What caused the increase of sites?
• Sediment-related disasters keep occurring in Japan.
• One of the principal reasons is that the high development needs cause the extreme urbanization and the increase in the exposure against hazardous phenomena, such as development of residential areas on hillsides as well as on foothills.
1966
1974
1986
1999
(Presented by MLIT)
Example of Hiroshima City: disaster-prone sites within these photos increased from 4 to 24 between 1966 and 1999.
29

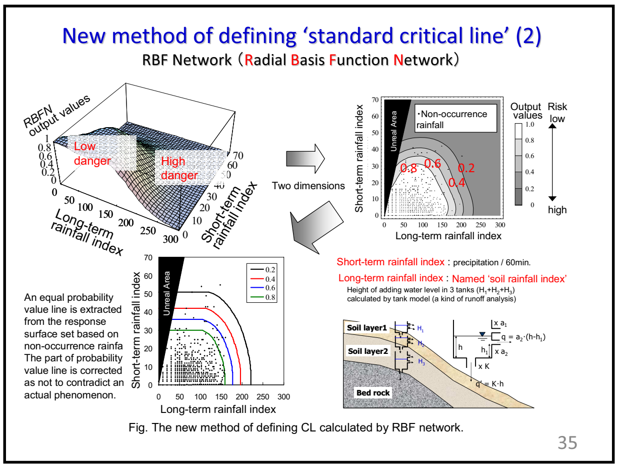

Promotion of non-structural measures under the Sediment-related Disaster Prevention Law
Outline of Sediment-related Disaster Prevention Law
Subject sediment disaster: steep slope failure, debris flow and landslide
Establishment of the Basic Guideline for Sediment-related Disaster Prevention Measures [conducted by the Minister of Land, Infrastructure and Transport]
● Basic matters on measures for prevention of sediment-related disaster
● Guidelines in basic investigation
● Guideline in designation of special restricted area due to sediment-related disaster, etc.
●Guideline in relocation of buildings, etc. within special restricted area
Carrying out of basic investigations [conducted by each Prefecture]
●Investigations in order to designate restricted areas and special restricted areas due to sediment-related disaster, etc.
Designation of restricted area due to sediment-related disaster [conducted by Prefectural governor] <Area threatened with sediment-related disaster>
●Preparation for warning and evacuation systems etc.
●Informing residents about matters concerning warning and evacuation
Designation of special restricted area due to sediment-related disaster [conducted by Prefectural governor]
<Area with damaged buildings threatened with possibility for resident to incur tremendous harm>
Permission system for specific development action
Subject: development action of lotting-out of residential areas, social welfare facilities, etc.
Structural regulation of buildings (building certification required for areas outside city planning area)
Recommendation on relocation, etc. for buildings likely to incur tremendous damage in sediment-related disaster
Financing and securing of funds for those relocating according to recommendation
Warning and evacuation systems>
●The regional plan for disaster prevention of municipality (Basic Act Law for Disaster Management)
<Structural regulation of buildings>
●Establishment of structural standards for buildings with habitable room (Building Standard Law)
<Relocation support>
●Government Housing Loan Corporation loans, etc.
Steep slope
Upper end of steep slope
Gradient of 30 degrees or more
Lower end of steep slope
Height of steep slope
Within 2 h (50 m when exceeding 50 m)
Special hazard
Hazard area
Designation of sediment-related disaster warning area (Steep slope with a height of 5 m or more under the area)
Sediment-related disaster hazard area and special sediment-related disaster hazard area (debris flow) – Majino Area in Suwa City
30

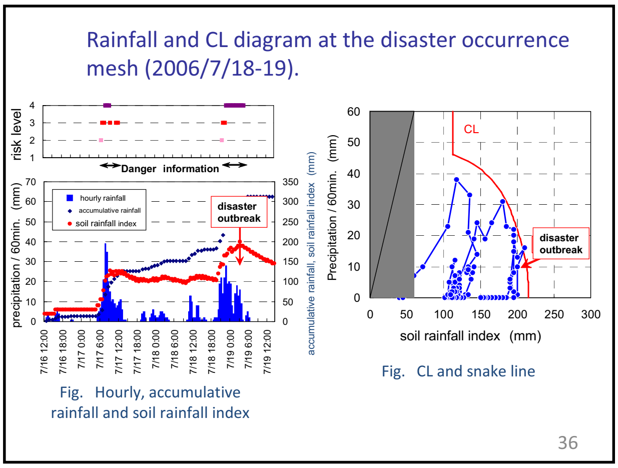

Designation of Hazard Areas and Preventive Measures
Steep slope failure
Landslide
Debris Flow
Yellow zone :Sediment-related disaster hazard area
Red zone :Special sediment-related disaster hazard area
31


Designation of restricted area due to sediment-related disaster（March 31,2008）
Designation of restricted area due to sediment-related disaster
Sediment-related Disaster Hazard Area (Yellow Zone).
Special Sediment-related Disaster Hazard Area (Red Zone)
The whole of Japan
85,190 area
The whole of Japan
35,688 area
32

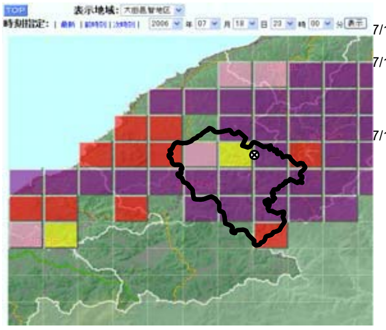

Promotion of joint provision of sediment-related disaster warning information
Inhabitants
Kagoshima's sediment-related disaster warning information No. 12
33


Conventional method of
defining ‘standard critical line’ in Japan
Critical Line : CL
Occurrence of debris flows
No-occurrence of debris flows
Occurrence of disaster
rainfall
time
Continuous rainfall
Short-term rainfall index
(ex. 60min. accumulative rainfall)
Safe zone
Unsafe zone
Long-term rainfall index
(ex. Continuous rainfall)
Fig. Conceptual Diagram of Critical Line
34


New method of defining ‘standard critical line’ (2)
RBF Network（Radial Basis Function Network）
RBFN output values
Low danger
High danger
Long-term rainfall index
Short-term rainfall index
Two dimensions
Non-occurrence rainfall
Output values
Risk low
high
An equal probability value line is extracted from the response surface set based on non-occurrence rainfa
The part of probability value line is corrected as not to contradict an actual phenomenon.
Short-term rainfall index : precipitation / 60min.
Long-term rainfall index : Named ‘soil rainfall index’
Soil layer1
Soil layer2
Bed rock
Fig. The new method of defining CL calculated by RBF network.
35


Rainfall and CL diagram at the disaster occurrence mesh (2006/7/18-19).
risk level
Danger information
hourly rainfall
accumulative rainfall
soil rainfall index
disaster outbreak
precipitation / 60min. (mm)
accumulative rainfall, soil rainfall index (mm)
Fig. Hourly, accumulative rainfall and soil rainfall index
CL
disaster outbreak
Precipitation / 60min. (mm)
soil rainfall index (mm)
Fig. CL and snake line
36

Danger information of sediment disasters in Misato-Town (2006/7/18 23:00) (5km Mesh)



7/17 6:55 announce of precaution information
7/18 21:30 Level 2
22:00 Level 3
23:00 Level 4
7/19 3:30 disaster occurred
10:35 precaution information was canceled

Level 1
Level 2
Level 3
Level 4

37

①Sabo for volcanoes
Protects people from a pyroclastic flow, debris flow and lava flow accompanied with volcanic activities.
②Slope failure prevention works
Protects people from disasters caused by a slope failure.
③Debris flow prevention works
A sabo dam with a sand pool space is built where a debris flow runs down and is deposited so as to directly receive and capture a debris flow.
④Measures against woody debris
Slit type dams are built to effectively check the run-off of trees fallen by wind or other causes.
⑤Avalanche prevention works
Protective fences are installed to protect local communities from snow avalanche.
⑥Landslide prevention works
Ground water is drained and piles are driven into the ground to prevent the ground from starting to move and sliding downward.
⑦Sabo dam
Sabo dams control large amount of sediment outflow like a debris flow without causing damages along the downstream.
⑧Hillside works
Vegetation works, land retainers and drainage systems are given and installed on mountain and hill sides to restore vegetation and prevent slope failure and sediment runoff.
⑨Consolidation works / Revetment works
The works create a space that serves to prevent erosion of river and valley banks and allow people to appreciate waterfront landscape. Streams are provided with fish passes to conserve the ecosystem.

38

Conclusions

- The Japanese Government promotes structural measures.
- The Japanese Government implements nonstructural measures quickly.
  - Inform hazardous area
  - Inform potentioal danger in heavy rainfall
  - Prepare for evacuation

In order to push forward these measures, information should be shared by the national government, prefectural governments, local municipalities, organizations concerned and local residents.

39

Priority Research Subjects of Erosion and Sediment-Control Research Division

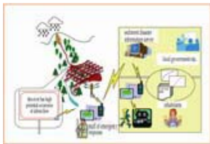
40

Outline of Research of SABO

Support for early warming system

■Study on the sediment disaster warning information system

■Study on the effective communication system for sediment disaster information



Support for sediment control planning

■Study on the comprehensive sediment control management system in sediment river system

■Study on the assessment system for combination of structural and non-structural measures

41

Outline of Research of SABO

Support for rational structure design

■Study on the rational design method for countermeasures against slope failure

Support for quick response against large-scale sediment disaster

■Study on the disaster risk management in case of large-scale sediment disaster

■ Study on the potential risk map for slope failures by large-scale earthquake

Support for environmental conservation and regeneration

■Study on the monitoring method of satellite images usage

■Study on the assessment method of impact on ecology by the Sabo structure

42

Thank you for your Attention!

43

Contents

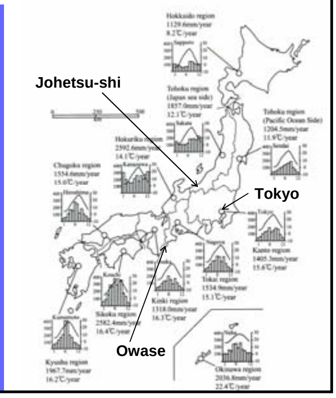
1. Japan and its Nature

Regional temperature and rainfall record

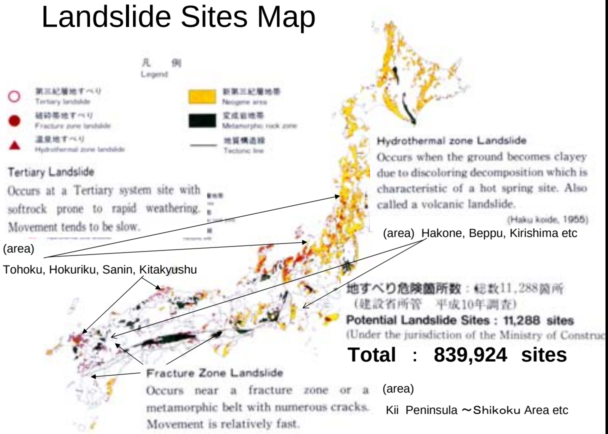
1. Location
North latitude 20°～45°

2. Meteorological condition
typhoons and heavy rains,

3. The annual precipitation
Tokyo : 1,405mm.
Owase, : 4,002mm
Johetsu-shi : 2,880mm
(of which one-half is snow)



Landslide Sites Map



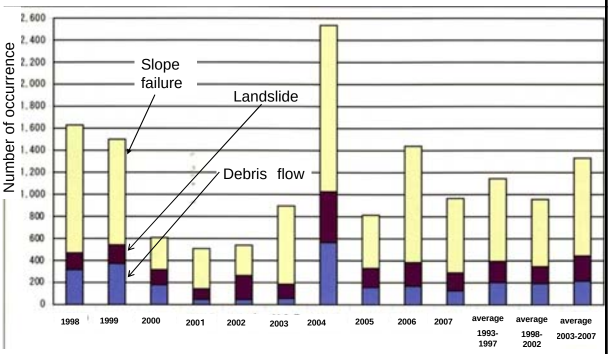
Source: landslide in JapAn (NILIM)

List of Major Landslide Disasters

Landslide can cause extensive damage to such property as houses, roads, railway tracks, tracks, schools and sometimes even claim human lives.

Date		Prefecture	Municipality	District	Scale (unit:ha)	cause	Damage	
Year	Month						killed missing	house
1960		Gunma	Takasaki	Syorinzan	85.34	(Since 23years Meji era)	0	15
1962	4	Niigata	Higashikubiki-gun	Matsunoyama	756.61	Melted Snow	0	371
1964	7	Toyama	Himi	Kurumi	324.2	Seasonal Rain	0	87
1965	9	Fukui	Imadate-gun	Otaki	8.77	Typhoon	10	4
1967	7	Hyogo	Kobe city	Yanagidani	8.0	Raifall	0	5
1975	8	Tokushima	Mima-gun etc.	37 areas (建設省所管)		Typhoon	9	86
		Kochi		6 areas (建設省所管)			0	33
1978	5	Niigata	Nakakubiki-gun	Minamijigoku	900,000(m3) (Debrisflow)	Melted Snow	13	20
1982	7	Nagasaki	Nasaki city etc.	10 areas		Seasonal Rain	0	5
1973	7	Shimane	Hamada city	Nakaba	32.25	Seasonal Rain	15	8
1984	9	Nagno	Kiso-gun	Matsukoshi	4.5	Earthquake	13	20
1985	2	Niigata	Nikubiki-gun	Tamanoki	6.57	Melted Snow	10	5
1985	7	Nagano	Nagano city	Jizukiyama	147.14	Raifall	26	52
1988	7	Shimane	Hamada city	Aioi	34.0	Raifall	0	9
1995	1	Hyogo	Nishinomiya city	Nigawayurino-cho		Earthquake	34	13
2004	7	Niigata	Tochio city	tuchigatani	46.5	Raifall	0	1
2004	10	Niigata	Koshi-gun Yamakoshi	Yuogawa Shimonosawa Koguriyama	45.4 151.1 35.8	Earthquake	0 0 0	3 3 2
2005	9	Ohita	Takeda city	Senokuchi	8.4	Seasonal Rain	0	3
2006	6	Okinawa	Nakagami-gun	Asato	14.2	Seasonal Rain	0	0

Sediment-related Disasters of Recent Year



Source：Realities of Sediment Disaster 2007

2. What is a landslide?

What is landslide?

・Downslope displacement of regolith and rock, such events popularly are called **landslides**.

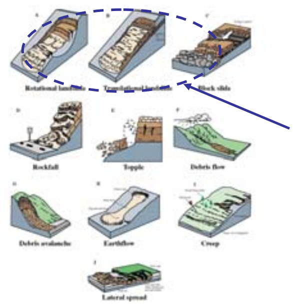
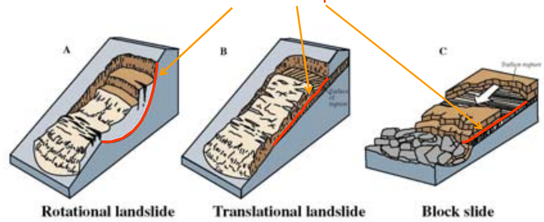


Fig. Type of Landslides（Mass Movement）

Deep seated landslides



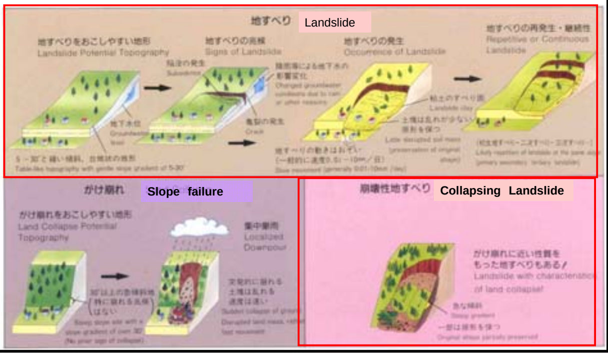
Slides

Mass movements where there is a distinct zone of weakness that separates the slide material from more stable underlying material.

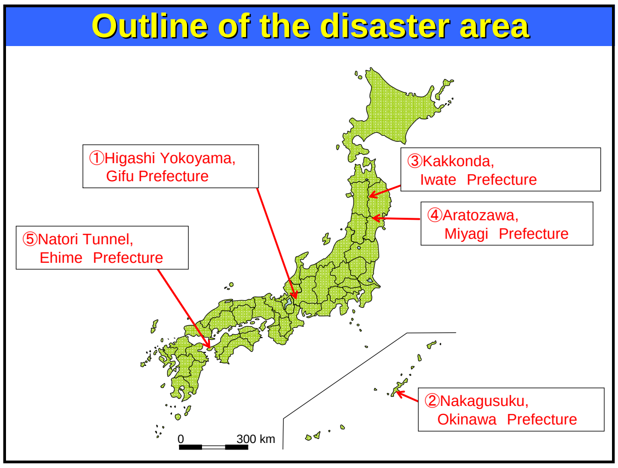
They can be activated by earthquakes, storms, etc…
They can be large/small – can move rapid/slow…

Characteristics of Landslide Movement (Compared to slope failure)

・Gentler slope gradient
・Slow movement of soil mass while retaining original shape
・Repetitive occurrence on slope



3． Recent Landslide Disasters

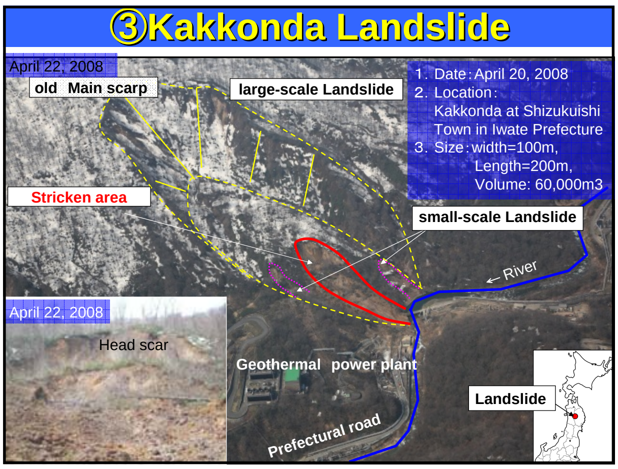

Outline of the disaster area
①Higashi Yokoyama,
Gifu Prefecture
③Kakkonda,
Iwate Prefecture
④Aratozawa,
Miyagi Prefecture
⑤Natori Tunnel,
Ehime Prefecture
②Nakagusuku,
Okinawa Prefecture
0
300 km

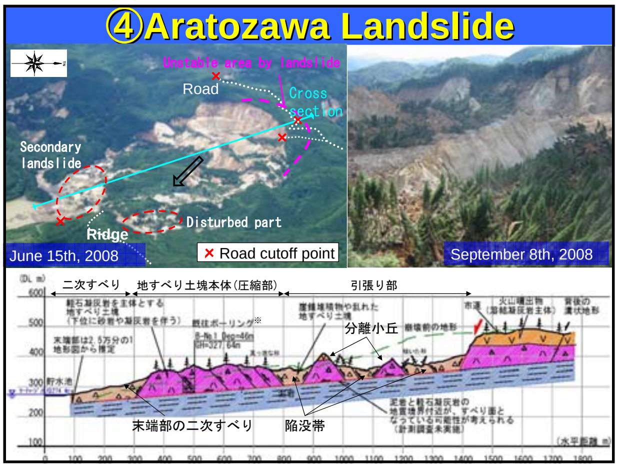

①Higashi-Yokoyama Landslide
1. date :12-13th in May, 2006
2. Location: Higashi-Yokoyama in Ibigawa Town, Gifu Prefecture
3. Size :width=150m, height=90m
Yokoyama Dam
Power station
Landslide
Ibi river
Roadside amenities
Detour Route
Road closed
Video image of collapsing the landslide

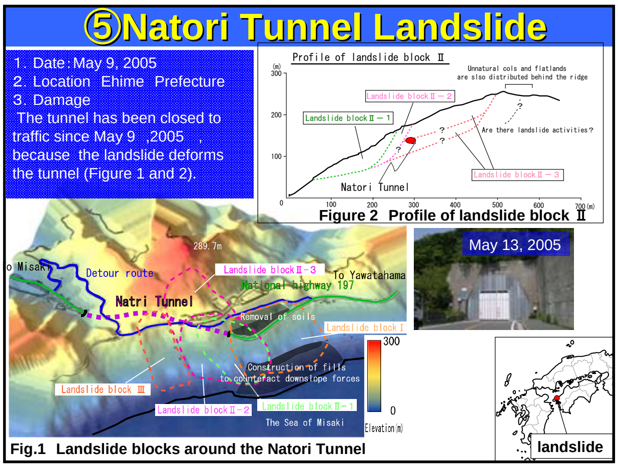

①Higashi-Yokoyama Landslide
12.May 2006
Before
Road
Collapse!
14.May 2006
After
Height: 90m
Width: 150m
Volume: 50,000m³
Remote-controlled removal work of unstable blocks
Operators
Widening river width
landslide
[Setting 1,000 foundation blocks to prevent erosion by the river.]


②Nakagusuku Landslide
1. DATE :10th June 2006.
2. Location: Okinawa Prefecture
3. Size: Height: 50 m, Length: 150 m
Nakagusuku
Landslide
Head scar (15th Jun)

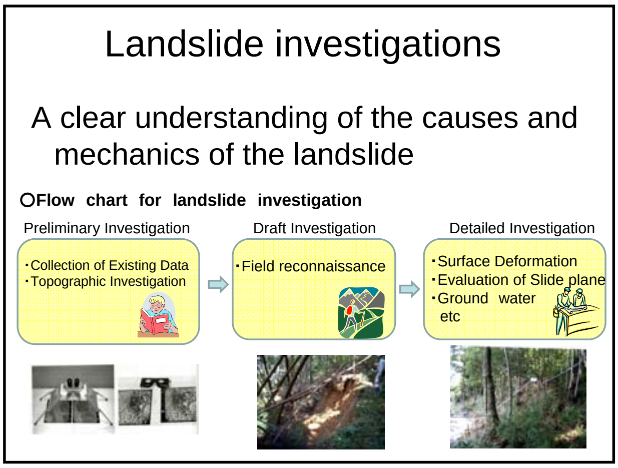

②Nakagusuku Landslide
【Photography】 Okinawa General Bureau
June 12th, 2006 about 10:00
June 15th, 2006 about 10:00
June 14th, 2006 about 10:00
June 15th, 2006 about 12:00


③Kakkonda Landslide
April 22, 2008
old Main scarp
large-scale Landslide
1. Date: April 20, 2008
2. Location: Kakkonda at Shizukuishi Town in Iwate Prefecture
3. Size: width=100m, Length=200m, Volume: 60,000m3
Stricken area
small-scale Landslide
River
April 22, 2008
Head scar
Geothermal power plant
Landslide
Prefectural road





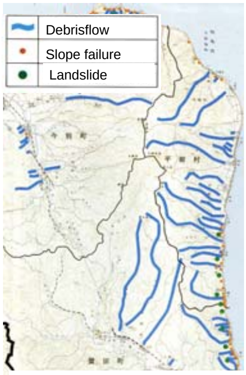
4. Landslide investigations and prediction



Prediction of Landslide

(1) hazard map

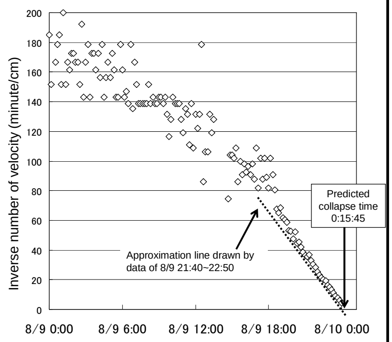
Distribution of a hazard maps have been published.



Distribution of a hazard map on sediment-related disaster

(2) Landslide Prediction

Base on the change in the rate of movement, the timing of landslide failure are predicted.



Application results of inverse number of velocity of extensometer displacement to forecast the time of slope failure

5. landslide Mitigation Measures

Landslides Mitigation Measures

（1）Control measures
（2）Restrain measures

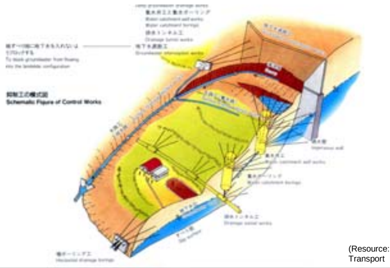
Landslide Control Measures
- Surface Drainage Control
- Groundwater Control
  - Shallow Groundwater Control
    (Interceptor Under Drains, Horizontal Gravity Drains, Interceptor Trench Drains)
  - Deep Groundwater Control
    (Horizontal Gravity Drains, Drainage Wells, Drainage Tunnels)
- Earth Removal
- Buttress Fill
- River Structures

Landslide Restraint Measures
- Piles
- Large Diameter Cast-in-Place Shafts
- Anchors
- Retaining Walls

Landslide mitigation measures

（1）Control measures

The control measures involve modification of the natural conditions of landslides such as topography , geology ,ground water ,and other conditions that indirectly control portions of the entire landslide movement.


(Resource:Ministry of Land, Infrastructure and Transport HP)

- Surface Drainage Control
- Groundwater Control
- Earth removal
- Buttress Fill
- River Structures

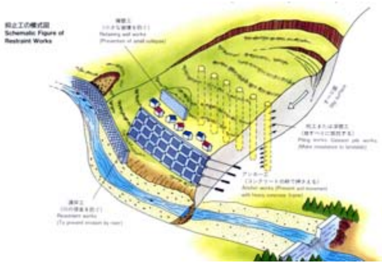

Surface Drainage Control


Horizontal gravity Drains


Soil removal

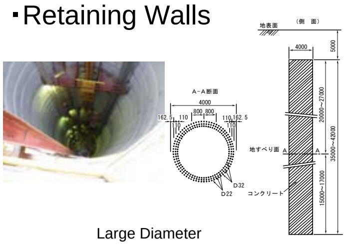
（2）Restraint measures

The restraint measures rely directly on the construction of structural elements.



(Resource:Ministry of Land, Infrastructure and Transport HP)

- ・Piles
- ・Large Diameter cast-in-place Shafts
- ・Anchors
- ・Retaining Walls



Large Diameter cast-in-place Shafts

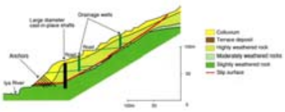
Anchors

①Zentoku Landslide

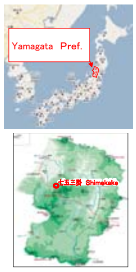
Location :Tokushima Prefecture
Size of Slide :Length 2,000m（Max）
Width 900m（Max）
Threatened Area 221ha
History :1860s:in the early Meiji Period
in 1945,1949,1954,1965,
1987,1992
Damage : Roadways ,Residential structures

Mitigation Measures

The measures were started in 1952.
1952～1981:Tokushima Prefecture
1982～ :Ministry of Construction
(1)Control measures
・Drainage wells , Surface drainage Control
(2)Restraint measures
・Large diameter cast-in place shaft, Anchors ,



②Shimekake Landslide Disaster



- **2009.2 Some cracks were formed at houses and around there in Shimekake area, Tsuruoka city , Yamagata prefecture**
- **After that, the cracks were expanded and many cracks were found.**
- **Size : Length 700m,width 400m**
- **The movement was maximum about 6m form February to June.**

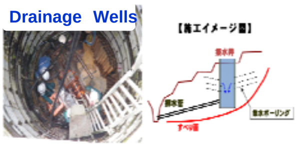
34

Emergency landslide mitigation Measures

Deep well（temporary）

Horizontal Gravity Drains

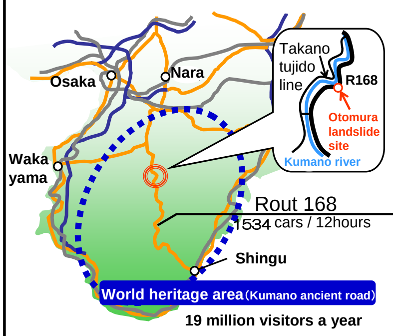
Drainage Wells

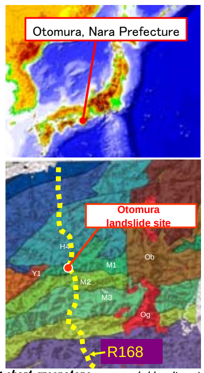


Surface Drainage Control

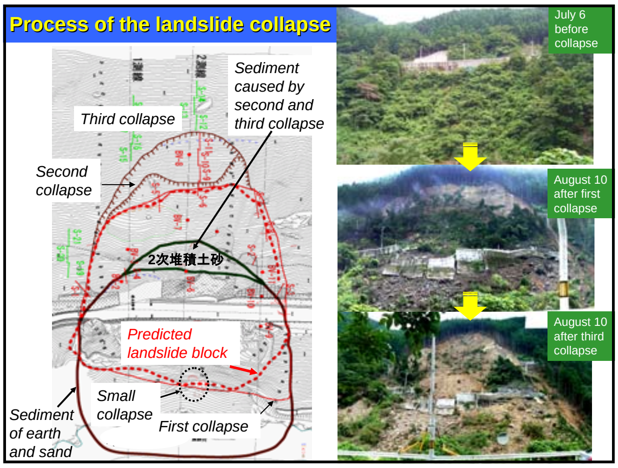
- The movement was reduced by the emergency landslide mitigation measures.

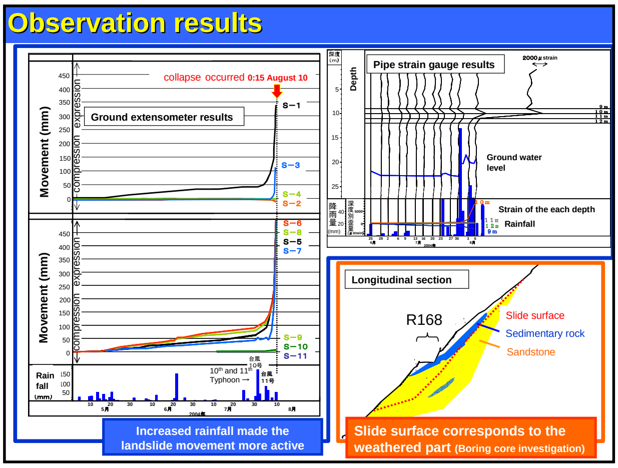
③Otomura Landslide Disaster





Geology: chart greenstone accompanied by alternate layers of sandstone and shale, and layers of sandstone





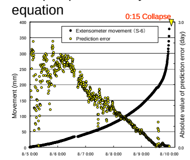
Risk management

Real time monitoring, Automatic alarm distribution system (with cellar phone)

Warning Level : displacement of 2 mm/hr for two continuous hours (by extensometer)

- Reliable prediction
- Effective traffic regulation

Collapse prediction by Saito equation



Both R168 and the detour were stopped an hour before the collapse

Thank you for your attention

1.3.　研究協力の覚書締結について

今般国総研と NIDM で交わされた覚書は、自然災害に対する防災・減災に関する研究協力を目的とし、研究情報の交換、研究者の相互交流やワークショップの共同開催等を内容としている。

これらの覚書の内容は、外務省協議を経て、我が国とインド両国の首相によってなされた「日本とインドとの間の安全保障協力に関する共同宣言」に基づく安全保障アクションプラン(平成 22 年 1 月)の中にも位置付けられている。

国総研と NIDM は、シン首相の本年秋の来日に合わせて、関係する民間企業等も含めた共同ワークショップをインドで開催する方向で検討中である。また、NIDM は、地すべりの研究協力に関して、地すべりなどの土砂災害対策について具体の技術開発を行っている土木研究所とも覚書を締結した。これらの覚書の締結により、インドとの研究協力の推進を通じて両国の良好な関係の維持・発展に寄与することが期待される。

【参考】　締結に関する協議経緯

平成 21 年	12 月 17 日	インドとの事前協議、DRAFT１次案
平成 22 年	1 月 6 日	DRAFT１次案の外務協議終了
		外務修正１次案のインドへの送付
	1 月 7 日	インド側修正案の受領
	1 月 12 日	DRAFT２次案　外務協議終了
	1 月 12 日	日本側の主な修正のインド側への送付
	1 月 12 日	インド側外務省了承（通知受領）
	1 月 13 日	Chakrabarti 所長急遽来日キャンセルの連絡
	1 月 14 日	Surya 氏とのサイン形式の調整、合意
	1 月 14 日	覚書サイン形式、合意手続きのインド側への通知
	1 月 14 日	インド側サイン形式、手続きの了承
		Chakrabarti 所長よりサインし送り返す旨あり

注１）最終覚書文案、サイン形式、手続きについては本省国際建設室に報告済。

注２）今回、地すべりに関する NIDM、PWRI 間覚書も一体的なものとして、NILIM 国際ラインからインド側と協議、締結。

1.3.1. Memorandum of Cooperation（サイン入り）
＜NILIM と NIDM＞

MEMORANDUM OF COOPERATION

Between

NATIONAL INSTITUTE OF DISASTER MANAGEMENT
New Delhi, India

And

NATIONAL INSTITUTE FOR LAND AND INFRASTRUCTURE MANAGEMENT
Tsukuba, Japan

2010

MEMORANDUM OF COOPERATION

Between

NATIONAL INSTITUTE OF DISASTER MANAGEMENT

New Delhi, India

And

NATIONAL INSTITUTE FOR LAND AND INFRASTRUCTURE MANAGEMENT

Tsukuba, Japan

Whereas the National Institute of Disaster Management (NIDM), New Delhi India is a statutory organization under the Ministry of Home Affairs, Government of India for the promotion of training, capacity building, research, documentation and consultancy activities in disaster management;

Whereas the National Institute for Land and Infrastructure Management (NILIM), Tsukuba, Japan functions under the Ministry of Land, Infrastructure, Transport and Tourism of the Government of Japan as a national research and experimental institute that performs technological and policy research on various aspects of natural resources and infrastructure development;

Whereas collaboration between the NIDM and the NILIM (hereinafter referred to as "both Institutes") on landslide risk management has been identified as one of the mechanisms referred to in the Action Plan to Advance Security Cooperation based on the Joint Declaration on Security Cooperation between India and Japan;

Therefore

Both Institutes intend to start the cooperation under this Memorandum to allow them the opportunity and the instrument to develop and implement mutually beneficial and decided programmes and activities.

SCOPE OF COOPERATION

The collaboration between both Institutes will be related to mitigation and management of various types of natural hazards and the counter measures concerning disaster prevention and mitigation.

SPECIFIC AREAS OF COOPERATION

Both Institutes have further identified the following concrete areas of cooperation between them that can be taken up starting from the financial year 2010-11:

(i) Exchange of technical knowledge and information in the fields of prevention and mitigation of natural hazards, with particular focus on critical infrastructure;

(ii) Exchange of faculty members for advanced research and training on disaster risk management;

(iii) Organization of workshops, training programmes and field visits on disaster risk management; and

(iv) Publication of books, journals, pamphlets etc. on subjects of mutual interests.

METHOD OF IMPLEMENTATION

The specific programmes and activities to be taken up under this Memorandum and the methods for their implementation will be determined on the basis of mutual consent between both Institutes.

GENERAL

The specific programmes and activities taken up under this Memorandum will be subject to the applicable laws and regulations of the respective country of both Institutes and the related regulations of the respective Institute.

The cooperation under this Memorandum will continue for five years, after which it will end, unless renewed or modified by both Institutes.

Signed in English on two originals.

Date : 14/01/2010
Place: Tsukuba

K. Nishikawa

Kazuhiro Nishikawa
Director General
National Institute for Land and Infrastructure Management
Tsukuba, Japan

Date : 25. 1. 2010
Place: New Delhi

Chakrabarti

P.G. Dhar-~~Chakrabarti~~
Executive Director
National Institute of Disaster Management
Delhi, India

P. G. DHAR CHAKRABARTI, IAS
Executive Director
National Institute of Disaster Management
(Ministry of Home Affairs)
I.I.P.A. Campus I. P. Estate
New Delhi-110002

＜PWRI と NIDM＞

MEMORANDUM OF UNDERSTANDING

Between

NATIONAL INSTITUTE OF DISASTER MANAGEMENT
New Delhi, India

And

PUBLIC WORKS RESEARCH INSITUTE
Tsukuba, Japan

2010

MEMORANDUM OF UNDERSTANDING

Between

NATIONAL INSTITUTE OF DISASTER MANAGEMENT

New Delhi, India

And

PUBLIC WORKS RESEARCH INSITUTE

Tsukuba, Japan

Whereas the National Institute of Disaster Management (NIDM), New Delhi India is a statutory organization under the Ministry of Home Affairs, Government of India for the promotion of training, capacity building, research, documentation and consultancy activities in disaster management;

Whereas the Public Works research Institute (PWRI), Tsukuba Japan, is a premier institute under the Ministry of Land, Infrastructure and Transport, Government of Japan for the promotion of research on various aspects of construction management with particular focus on mitigation of various natural hazards;

Whereas collaboration between the NIDM and the PWRI on landslide risk management has been identified as one of the action areas under the Action Plan to Advance Security Cooperation between India and Japan;

Therefore

Both the Institutes undertake to enter into this Memorandum of Understanding to allow them the opportunity and the instrument to develop and implement mutually beneficial and agreed upon programmes and activities.

SCOPE OF COOPERATION

The collaboration between the two Institutes shall be related to mitigation and management of various types of natural hazards, with particular focus on landslide risk management.

SPECIFIC AREAS OF COOPERATION

Both parties have further identified the following concrete areas of cooperation between the two organizations that can be taken up starting from the financial year 2010-11:

(i) Exchange of technical knowledge and information in the fields of landslides and avalanche;

(ii) Exchange of faculty members for advanced research and training on landslide and avalanche risk management;

(iii) Conducting joint research programmes on early warning of landslides, slope stability analysis in different geo-environmental conditions and other issues as mutually agreed;

(iv) Conducting training programmes and field visits on geo-hazards, particularly landslides and avalanches;

(v) Organization of Workshop on landslide and avalanche risk management; and

(vi) Publication of books, journals, pamphlets etc on subjects of mutual interests;

METHOD OF IMPLEMENTATION

The specific programmes and activities to be taken up under this collaboration and the methods for their implementation shall be determined on the basis of mutual agreements between the two Institutes.

GENERAL

The specific programmes and activities taken up under this Memorandum of Understanding shall be subject to the applicable laws and regulations of each country and the related regulations of each Institute.

This Memorandum of Understanding shall remain in force for five years, after which it will end, unless renewed or modified by both Institutes.

Signed in English on two originals.

Date : 14/01/2010
Place: Tsukuba

坂本忠彦

Tadahiko Sakamoto
Chief Executive
Public Works Research Institute
Tsukuba, Japan

Date : 25. 1. 2010
Place: New Delhi

P.G. Dhar ~~Chakrabarti~~
Executive Director
National Institute of Disaster Management
Delhi, India

P. G. DHAR CHAKRABARTI, IAS
Executive Director
National Institute of Disaster Management
(Ministry of Home Affairs)
I.I.P.A. Campus I. P. Estate
New Delhi-110002

1.4.　調査報告

国総研はワークショップ開催前に、５つの自然災害に関する研究ニーズ把握のための調査を行なっている。また、今日までにインド国内で発生している自然災害の状況についても調査してとりまとめたので報告する。

調査報告　目次

１．調査の概要

１－１．調査の目的

本調査は、平成 20 年 10 月に「自然災害に対する防災・減災」を会議テーマに開催された第 17 回アジア地域国土整備関係研究所長等会議（以下、「アジア所長会議」という。）において、我が国との研究連携を要望するアジア所長会議参加国であるインドにおける防災減災研究部門の研究ニーズを把握し、今後の国総研とインドとの研究連携を効率的・効果的に推進することを目的とした調査である。

１－２．調査内容

調査内容は、以下のとおりである。

（１）　事前の準備

・関連する研究ニーズの概略を把握のための調査票の整理

（２）　関連研究ニーズの把握

①調査票の送付と結果の整理

②インドの防災・減災に関する研究ニーズの把握（地すべり対策とその状況ヒアリングの実施を含む。）

・インドの災害の詳細と対応体制の課題

・地すべりの現状と課題

・我が国との研究協力の可能性と具体的なニーズの把握

・我が国の地すべり対策工法の適用性に対する NIDM の意見と改善案

③その他参考に必要な事項

（３）　資料の整理

・（２）における関連研究ニーズの資料整理

２．事前準備

事前の準備として、関連する研究ニーズの概略を把握のための調査票の整理を行なった。

＜質問表の基本様式について＞

なお、質問票の基本様式は、以下のとおりである。回答に基づく我が国の支援内容の作成を念頭に、地震、強風、洪水、地すべり、津波など自然災害毎に、防災対策の現状と具体的な日本への支援ニーズについて回答する様式となっている。

表-1　質問票の基本様式

<table>
<tr><td colspan="4">国名（　　　　　　　　　）</td></tr>
<tr><td colspan="4">対象とする自然災害　（　　　　　　　　　　　　）</td></tr>
<tr><td>１．防災対策現状の把握</td><td>現状</td><td>完了のための課題</td><td>優先
順位</td></tr>
<tr><td>①対象とする自然災害の設定</td><td>Ｃ Ａ Ｄ Ｎ</td><td>Ｔ Ｌ Ｏ Ｈ Ｆ 0th</td><td></td></tr>
<tr><td>②自然災害による外力の設定</td><td>Ｃ Ａ Ｄ Ｎ</td><td>Ｔ Ｌ Ｏ Ｈ Ｆ 0th</td><td></td></tr>
<tr><td>③被害想定</td><td>Ｃ Ａ Ｄ Ｎ</td><td>Ｔ Ｌ Ｏ Ｈ Ｆ 0th</td><td></td></tr>
<tr><td>④目標とする防災レベルの設定</td><td>Ｃ Ａ Ｄ Ｎ</td><td>Ｔ Ｌ Ｏ Ｈ Ｆ 0th</td><td></td></tr>
<tr><td>⑤法制度の整備</td><td>Ｃ Ａ Ｄ Ｎ</td><td>Ｔ Ｌ Ｏ Ｈ Ｆ 0th</td><td></td></tr>
<tr><td>⑥ハード対策の実施</td><td>Ｃ Ａ Ｄ Ｎ</td><td>Ｔ Ｌ Ｏ Ｈ Ｆ 0th</td><td></td></tr>
<tr><td>⑦ソフト対策の実施
⑦-1 災害前の予防対策</td><td>－
Ｃ Ａ Ｄ Ｎ</td><td>－
Ｔ Ｌ Ｏ Ｈ Ｆ 0th</td><td>－</td></tr>
<tr><td>⑦-2 災害直後の応急対策
⑦-3 災害後の復旧対策</td><td>Ｃ Ａ Ｄ Ｎ
Ｃ Ａ Ｄ Ｎ</td><td>Ｔ Ｌ Ｏ Ｈ Ｆ 0th
Ｔ Ｌ Ｏ Ｈ Ｆ 0th</td><td></td></tr>
<tr><td>⑧実施状況把握・評価</td><td>Ｃ Ａ Ｄ Ｎ</td><td>Ｔ Ｌ Ｏ Ｈ Ｆ 0th</td><td></td></tr>
<tr><td>回答の説明</td><td>C:完了
A:概成
D:実施中
N:未着手</td><td colspan="2">T: 技術
L: 法制度
O: 組織
H: 人材
F: 資金
0th:その他</td></tr>
<tr><td colspan="4">２．優先順位をつけた項目について、具体的な日本への支援ニーズがあれば、記入下さい。
優先順位①：</td></tr>
<tr><td colspan="4">優先順位②：

優先順位③：</td></tr>
<tr><td colspan="4">３．モニタリングレポート作成のために必要な支援があれば、記入下さい。</td></tr>
</table>

３．関連研究ニーズの把握

３－１．調査票の送付と結果の整理

前述の質問票をインド側へ送付し、対象とする自然災害の対策及び支援ニーズについての回答を得た。

結果を以下に整理する。

①インドの回答結果の総括

インドの災害対策の現状を概括すると、各災害とも対象とする災害の設定は終わっており、自然災害の外力より目的とする防災レベルを設定し、法制度も整えて、ハード及びソフト対策を実施していると考えられる。なお、ソフト対策のうちでも、予防対策と応急対策に力を入れている。

インドでは、防災対策を進めるために、全般的に対策技術の導入が必要とされており、他の災害に比べて地すべりの分野で、人材の育成が必要とされている。一方、大国でもあるためか、資金は自国で対応できる部分が大きいようである。

インドの回答における日本への支援ニーズは比較的具体的なものが多く、人材が育っている分野では技術移転、人材をこれから育成する分野では研修やキャパシティービルディングを通した技術移転が必要とされているとまとめられる。

②インドの災害別の具体的な支援方策の整理

インド側からの質問票の回答をもとに、我が国として支援の検討対象となる具体的な支援策の候補及びアクションについては、以下の通りである。

【地震】

ア）市民に対する家庭等における予防対策、応急対策の普及およびそれらの重要性の認識を向上させるための方策の移転

イ）インドの国情に応じた耐震設計法（建設から維持管理までを含む）の技術移転

ウ）インドの国情に応じた既設構造物に対する耐震補強法の技術移転

【強風】

ア）サイクロンに対する安全なシェルター建設技術の移転（人材育成を含む）

イ）サイクロンの早期警戒警報システム確立の技術支援

ウ）サイクロンから身を守るための市民への啓発活動に関する手法の移転

【洪水】

ア）洪水対策の総合的な計画策定の技術支援および担当者の能力向上支援（研修、キャパシティービルディングなど）

イ）洪水に対する早期警戒警報システム構築のための技術支援

ウ）洪水後の復旧を考慮した豪雨時用排水システムの計画策定のための技術支援

【地すべり】

ア）地すべりに関するハザードマップ、脆弱度などを統合して活用する技術移転
イ）地すべりに対するリスク分類に関する技術移転
ウ）地すべり対策箇所の優先順位付けを行う技術移転
エ）地すべりの早期警戒警報システム開発の技術移転、担当する技術者への研修
オ）地すべりの復旧計画策定のための技術移転、担当する技術者への研修

【津波】

ア）津波対策の有効性、必要性について市民の理解と協力を得るための広報活動に関する技術移転
イ）海岸の植生、津波対策構造物の建設に関する技術移転
ウ）津波に対する早期警戒システムに関する技術移転
エ）津波発生時の緊急伝達、避難対策等の戦略策定のための技術移転

以下に、インドからの質問票の回答結果を列挙する。

表-2　「地震」に関する回答

国名（インド共和国 ）			
対象とする自然災害　（地震 ）			
1．防災対策現状の把握	現状	完了のための課題	優先順位
①対象とする自然災害の設定	$\boxed{C}$ A D N	$\boxed{T}$ L O H F $\boxed{Oth}$	1
②自然災害による外力の設定	C $\boxed{A}$ D N	$\boxed{T}$ L O H F $\boxed{Oth}$	1
③被害想定	C A D $\boxed{N}$	$\boxed{T}$ L O $\boxed{H}$ F $\boxed{Oth}$	1
④目標とする防災レベルの設定	C A $\boxed{D}$ N	$\boxed{T}$ L $\boxed{O}$ H F Oth	2
⑤法制度の整備	C $\boxed{A}$ D N	$\boxed{T}$ $\boxed{L}$ O H F Oth	2
⑥ハード対策の実施	C A $\boxed{D}$ N	$\boxed{T}$ L O $\boxed{H}$ $\boxed{F}$ $\boxed{Oth}$	2
⑦ソフト対策の実施	—	—	—
⑦-1 災害前の予防対策	C A $\boxed{D}$ N	$\boxed{T}$ L O $\boxed{H}$ F $\boxed{Oth}$	1
⑦-2 災害直後の応急対策	C A $\boxed{D}$ N	$\boxed{T}$ L O H F Oth	1
⑦-3 災害後の復旧対策	C A D $\boxed{N}$	$\boxed{T}$ L O H F $\boxed{Oth}$	2
⑧実施状況把握・評価	C A $\boxed{D}$ N	$\boxed{T}$ L O H F Oth	3
回答の説明	C:完了 A:概成 D:実施中 N:未着手	T: 技術 L: 法制度 O: 組織 H: 人材 F: 資金 Oth:その他	

2．優先順位をつけた項目について、具体的な日本への支援ニーズがあれば、記入下さい。

優先順位①：認識の生成：事前に行う予防手段と緊急対策には、予期される地震により生じる結果と、人間の命、財産、建設物、社会基盤、環境への影響を減らす手段であるという、認識が必要である。将来的には、影響を受けたコミュニティは、情報が得られるようになり、人が敏感になり、危険を減らす準備ができるようになる。人々には、予防および緊急時の技術を伝える必要がある。

優先順位②：インドの領域の 58%以上に地震が起きる可能性があり、新設構造物のための耐震性に優れた設計、建設、開発、維持管理手法および既存の弱い構造物のための改良が必要である。我々は、日本からインドに対する、技術と最も良い慣行の移転により人の能力を構築すると共に、地震に抵抗できる、あるいは安全な構造物に関するインド固有の経験を共有する必要がある。

優先順位③：インドは地震時の危機管理のためのガイドラインを準備している。そして、地震に抵抗力のある構造物と風習（社会）とするためのトレーニング、能力形成、人材の発展のためのいくつかのプログラムを作成した。これらのプログラムを評価して、実施の再検討のために標準的なパラメータあるいは指標を用いた結果の分析が必要。

3．モニタリングレポート作成のために必要な支援があれば、記入下さい。

特にないが、提出を求められるモニタリングレポートの記入書式や内容は、この質問に対する包括的な返答が送られる前に知らせていただきたい。

表-3「強風（台風、竜巻、モンスーン、その他)」に関する回答

国名（インド共和国 ）			
対象とする自然災害（強風（台風、竜巻、モンスーン、その他））			
1．防災対策現状の把握	現状	完了のための課題	優先順位
①対象とする自然災害の設定	$\boxed{C}$ A D N	$\boxed{T}$ L O H F $\boxed{Oth}$	1
②自然災害による外力の設定	C $\boxed{A}$ D N	$\boxed{T}$ L O H F $\boxed{Oth}$	1
③被害想定	C A $\boxed{D}$ N	$\boxed{T}$ L O $\boxed{H}$ F $\boxed{Oth}$	2
④目標とする防災レベルの設定	C A $\boxed{D}$ N	$\boxed{T}$ L $\boxed{O}$ H F $\boxed{Oth}$	2
⑤法制度の整備	C $\boxed{A}$ D N	$\boxed{T}$ $\boxed{L}$ O H F Oth	2
⑥ハード対策の実施	C A $\boxed{D}$ N	$\boxed{T}$ L O $\boxed{H}$ F $\boxed{Oth}$	1
⑦ソフト対策の実施	－	－	－
⑦-1 災害前の予防対策	C A $\boxed{D}$ N	$\boxed{T}$ L O $\boxed{H}$ F $\boxed{Oth}$	1
⑦-2 災害直後の応急対策	C A $\boxed{D}$ N	$\boxed{T}$ L O H F Oth	1
⑦-3 災害後の復旧対策	C A D $\boxed{N}$	$\boxed{T}$ L O $\boxed{H}$ F $\boxed{Oth}$	3
⑧実施状況把握・評価	C A $\boxed{D}$ N	$\boxed{T}$ L O H F Oth	3
回答の説明	C:完了 A:概成 D:実施中 N:未着手	T: 技術 L: 法制度 O: 組織 H: 人材 F: 資金 Oth:その他	

2．優先順位をつけた項目について、具体的な日本への支援ニーズがあれば、記入下さい。

優先順位①：私たちは、サイクロンに対して安全なシェルターを建設するための、人材を作りたいと思っている。このようなシェルターの建設のための技術は、サイクロンや他の風災害にしばしば見舞われたコミュニティからの要求である。

優先順位②：早期警戒警報システムを確立することが必要。日本は、インド洋上空での航空機による（気象）観測や、際立って影響のある気候現象のモニタリングを行う技術支援等の分野で技術支援が可能だと考えている。

優先順位③：サイクロンから（住人の）安全性を確保するため、ドキュメントやビデオを作成し、（安全対策）啓発に資する活動を行うこと。

3．モニタリングレポート作成のために必要な支援があれば、記入下さい。

特にないが、提出を求められるモニタリングレポートの記入書式や内容は、この質問に対する包括的な返答が送られる前に知らせていただきたい。

表-4　「洪水」に関する回答

国名（インド共和国 ）			
対象とする自然災害（洪水）			
1．防災対策現状の把握	現状	完了のための課題	優先順位
①対象とする自然災害の設定	$\boxed{C}$ A D N	$\boxed{T}$ L O H F $\boxed{0th}$	1
②自然災害による外力の設定	C $\boxed{A}$ D N	$\boxed{T}$ L O H F 0th	1
③被害想定	C A $\boxed{D}$ N	$\boxed{T}$ $\boxed{L}$ O $\boxed{H}$ F $\boxed{0th}$	1
④目標とする防災レベルの設定	C A $\boxed{D}$ N	$\boxed{T}$ L O H F 0th	2
⑤法制度の整備	C A $\boxed{D}$ N	T $\boxed{L}$ O H F 0th	2
⑥ハード対策の実施	C A $\boxed{D}$ N	$\boxed{T}$ L $\boxed{O}$ H F 0th	1
⑦ソフト対策の実施	―	―	―
⑦-1 災害前の予防対策	C A $\boxed{D}$ N	$\boxed{T}$ L $\boxed{O}$ $\boxed{H}$ $\boxed{F}$ $\boxed{0th}$	1
⑦-2 災害直後の応急対策	C A $\boxed{D}$ N	$\boxed{T}$ L O $\boxed{H}$ F $\boxed{0th}$	1
⑦-3 災害後の復旧対策	C A D $\boxed{N}$	$\boxed{T}$ L O $\boxed{H}$ F $\boxed{0th}$	2
⑧実施状況把握・評価	C A D N	T L $\boxed{O}$ H F 0th	3
回答の説明	C:完了 A:概成 D:実施中 N:未着手	T: 技術 L: 法制度 O: 組織 H: 人材 F: 資金 0th:その他	

２．優先順位をつけた項目について、具体的な日本への支援ニーズがあれば、記入下さい。

優先順位①：洪水リスクの予防、軽減及び管理に資する統合的な計画をつくり前向きに進めてゆくことは、洪水による犠牲者を軽減するのに必要な点である。技術の最適化とインド国内のリソースの有効活用に役立ち得るものとなるであろう。研修活動、キャパシティビルディングや（洪水災害に備えるという）意識を高揚させるようなソフト面において、日本からの技術協力がよい。

優先順位②：堤防や土手、他の排水管理を可能とする構造物の設計や設置、建設は洪水災害の減災に寄与するであろう。現地において、前記の構造物建設（設置）の実際のデモンストレーションを通じてインド側人材のキャパシティビルディングを行ってもらうような考えなどは非常に良いと考える。

優先順位③：早期警戒警報システム、災害後の復旧を考慮に入れた豪雨時向けの排水システム計画を行うことは、洪水が差し迫っている際に的確かつ迅速な（行政の）対応を助けるものとなるであろう。日本の各種組織や協会関係、大学等の研究機関は、この分野でインド側へ技術移転を行えるものと理解している。

３．モニタリングレポート作成のために必要な支援があれば、記入下さい。

特にないが、提出を求められるモニタリングレポートの記入書式や内容は、この質問に対する包括的な返答が送られる前に知らせていただきたい。

表-5 「地すべり」に関する回答

国名（インド共和国 ）			
対象とする自然災害(地すべり)			
1．防災対策現状の把握	現状	完了のための課題	優先順位
①対象とする自然災害の設定	$\boxed{C}$ A D N	$\boxed{T}$ L $\boxed{O}$ $\boxed{H}$ F 0th	1
②自然災害による外力の設定	C $\boxed{A}$ D N	T L O $\boxed{H}$ F 0th	1
③被害想定	C A D $\boxed{N}$	$\boxed{T}$ L O $\boxed{H}$ F $\boxed{0th}$	2
④目標とする防災レベルの設定	C A $\boxed{D}$ N	$\boxed{T}$ L $\boxed{O}$ $\boxed{H}$ F 0th	2
⑤法制度の整備	C $\boxed{A}$ D N	T $\boxed{L}$ O H F 0th	2
⑥ハード対策の実施	C A $\boxed{D}$ N	$\boxed{T}$ L O $\boxed{H}$ F $\boxed{0th}$	1
⑦ソフト対策の実施	―	―	―
⑦-1 災害前の予防対策	C A $\boxed{D}$ N	$\boxed{T}$ L $\boxed{O}$ $\boxed{H}$ F $\boxed{0th}$	1
⑦-2 災害直後の応急対策	C A $\boxed{D}$ N	$\boxed{T}$ L O $\boxed{H}$ F $\boxed{0th}$	1
⑦-3 災害後の復旧対策	C A D $\boxed{N}$	$\boxed{T}$ L $\boxed{O}$ $\boxed{H}$ $\boxed{F}$ $\boxed{0th}$	2
⑧実施状況把握・評価	C A $\boxed{D}$ N	T L $\boxed{O}$ H F 0th	3
回答の説明	C:完了 A:概成 D:実施中 N:未着手	T: 技術 L: 法制度 O: 組織 H: 人材 F: 資金 0th:その他	

2．優先順位をつけた項目について、具体的な日本への支援ニーズがあれば、記入下さい。

優先順位①：:インドでは、地すべり災害に長らく苛まれており（この種の災害では最も被害を蒙った国である)、(地すべり災害に対処する）コミュニティ、管理組織等を急いで整備する必要性がある。体系的な地すべりに関するデータベース、地すべりハザードマップ、脆弱度やリスクアセスメントに関する情報の整備及びそれらをコンパイルしたマップ（の整備）は、地すべり災害に対して積極的に対策を講じるために必要である。日本からの技術的なサポートは、地すべり災害の防災対策に積極的に対応してゆくための基礎づくりのための支援となるであろう。

優先順位②：:地すべりに関するリスク分類と、対策箇所の優先付けを行うプロセス、そして日本の専門家による技術的なサポートを受けて、現場でデモ的に実地調査を行うような活動はとても有効であると考える。

優先順位③：的確かつ権威のある団体（組織）の支援を受け、早期警戒警報システムの開発、地すべり発生メカニズムのモニタリング、復旧計画等を行う諸活動は、地すべり対策として非常に有効と考える。研修活動やキャパシティビルディングも同様。

3．モニタリングレポート作成のために必要な支援があれば、記入下さい。

特にないが、提出を求められるモニタリングレポートの記入書式や内容は、この質問に対する包括的な返答が送られる前に知らせていただきたい。

表-6 「津波」に関する回答

国名（インド共和国 ）			
対象とする自然災害(津波)			
1．防災対策現状の把握	現状	完了のための課題	優先順位
①対象とする自然災害の設定	$\boxed{C}$ A D N	$\boxed{T}$ L O H F $\boxed{0th}$	1
②自然災害による外力の設定	C $\boxed{A}$ D N	$\boxed{T}$ L O H F $\boxed{0th}$	1
③被害想定	C A D $\boxed{N}$	$\boxed{T}$ L O $\boxed{H}$ F $\boxed{0th}$	2
④目標とする防災レベルの設定	C A $\boxed{D}$ N	$\boxed{T}$ L $\boxed{O}$ H F 0th	2
⑤法制度の整備	C $\boxed{A}$ D N	$\boxed{T}$ $\boxed{L}$ O H F 0th	2
⑥ハード対策の実施	C A $\boxed{D}$ N	$\boxed{T}$ L O $\boxed{H}$ $\boxed{F}$ $\boxed{0th}$	1
⑦ソフト対策の実施	—	—	—
⑦-1 災害前の予防対策	C A $\boxed{D}$ N	$\boxed{T}$ L O $\boxed{H}$ F $\boxed{0th}$	1
⑦-2 災害直後の応急対策	C A $\boxed{D}$ N	$\boxed{T}$ L O H F $\boxed{0th}$	1
⑦-3 災害後の復旧対策	C A D $\boxed{N}$	$\boxed{T}$ L O $\boxed{H}$ F $\boxed{0th}$	2
⑧実施状況把握・評価	C A $\boxed{D}$ N	$\boxed{T}$ L O H F 0th	3
回答の説明	C:完了 A:概成 D:実施中 N:未着手	T: 技術 L: 法制度 O: 組織 H: 人材 F: 資金 0th:その他	

2．優先順位をつけた項目について、具体的な日本への支援ニーズがあれば、記入下さい。

優先順位①：: 防災活動や、緊急対応のための手段（を実施するため）には、津波がもたらす惨状や、人命、財産、建物、インフラそして環境に対するインパクトを軽減するための手段に関する（人々の）関心を必要とする。海岸を植生で覆ったり、構造物や非構造物による各種の対策ついては、日本からの技術的な支援により可能となり得る。

優先順位②：: インドは、現在、津波の早期警戒システムに取り組んでいる。日本は過去の経験から学んだ技術、経験及び知見を技術移転することが可能と考える。

優先順位③：緊急の情報伝達や避難のための戦略策定は人命を保護するために必要。日本は、津波対策について効果的な対策を講じるための検討や、適切な場所に津波シェルターを設置する検討などにおいても支援が可能と考える。

3．モニタリングレポート作成のために必要な支援があれば、記入下さい。

特にないが、提出を求められるモニタリングレポートの記入書式や内容は、この質問に対する包括的な返答が送られる前に知らせていただきたい。

３－２．インドの防災・減災に関する研究ニーズの把握
（地すべり対策とその状況ヒアリングの実施を含む。）

（１）インドの災害の詳細と対応体制の課題

①インドの災害の詳細

インドは、地理気候的に自然災害に見舞われやすく、地震、洪水、サイクロン、干ばつ、津波、地すべり、雪崩などさまざまな災害により被害が発生している。

過去の主な災害としては、以下が有名である。

・2004 年 12 月　インド洋津波

2004 年 12 月 26 日に発生したスマトラ島沖地震によって引き起こされた津波により、1 万 6,389 人が死亡、6,913 人が負傷、約 65 万人が被災した。被害総額は約 10 億米ドル。

・2001 年 1 月　グジャラート地震

2001 年 1 月 26 日､インド西部グジャラート州で起きた地震(マグニチュード 7.7)によって 20,005 人が死亡、166,812 人が負傷、およそ 36 万棟の家屋が倒壊し、約 1,500 万人が被災した。被害総額は約 46 億米ドルに及んだ。

・1999 年 10 月　オリッササスーパーサイクロン

1999 年 10 月 29 日､ベンガル湾に面するインド北東部のオリッサに襲来したサイクロンにより、死者 9,887 人、被災者約 1,300 万人、倒壊家屋約 80 万棟の被害が出た。

表-7　インドに関連する 1900 年以降の主な自然災害の概況

資料：平成 21 年度防災白書に基づき作成

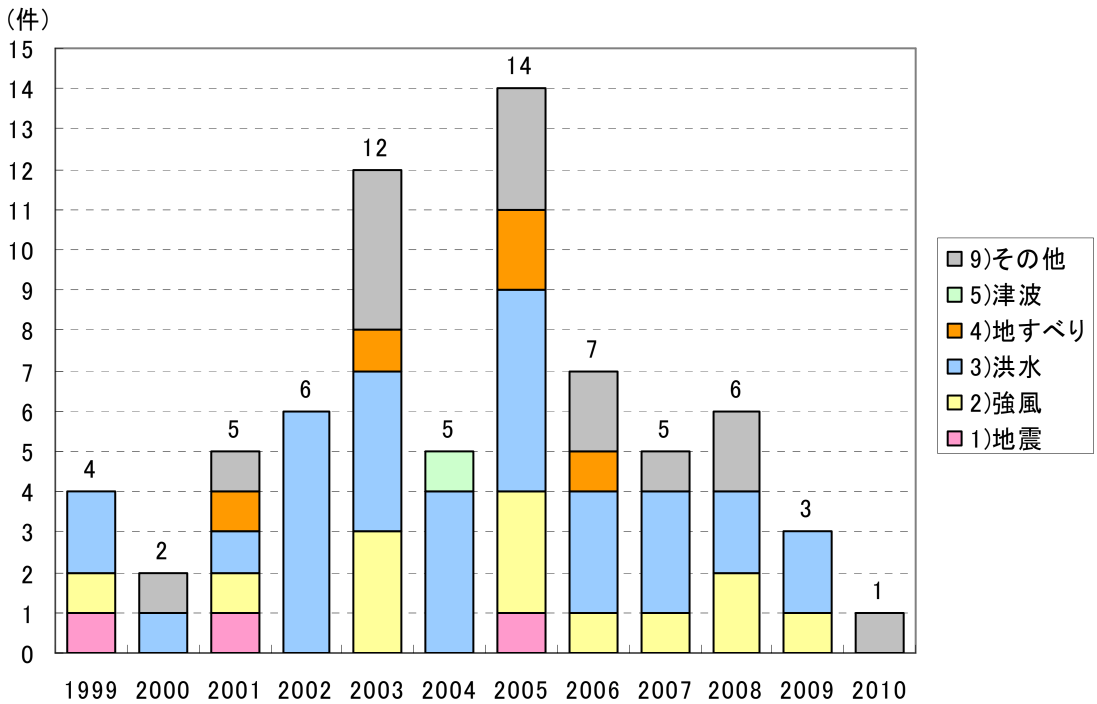
年	災害の種類	国名(地域名)	死者･行方不明者数(概数)
1935	地震	インド、パルチスタン	60,000
1971	サイクロン	インド(オリッサ州)	10,000
1977	サイクロン	インド(アンドラ･ブラデシュ州)	20,000
1988	地震	インド、ネパール	1,000
1989	洪水	インド	1,000
1993	洪水	インド	1,200
1993	地震	インド	9,800
1994	豪雨、洪水	インド	2,000
1997	洪水	インド	1,400
1998	洪水／地すべり	インド	3,000
1998	サイクロン	インド	2,900
1999	サイクロン	インド	9,500
2001	地震	インド	13,805
2004	洪水	インド、バングラディシュ、ネパール	2,000
2004	地震、津波	スリランカ、インドネシア、モルティブ、インド、タイ、マレーシア、ミャンマー、セイシェル、ソマリア、タンザニア、バングラディシュ、ケニア	229,652
2005	洪水／地すべり	インド	1,503
2005	暴雨風	インド、バングラディシュ	4,049
2005	地震	パキスタン、インド、アフガニスタン	74,651
2007	大雨、洪水	インド	1,752
2008	洪水	インド	2,744

インドの近年の災害の詳細は、次頁以降に示す災害概要一覧表のとおりである。

これを年別災害種類別にみると、下図のように、洪水が発生件数としては最も多く、次いで、強風（サイクロン等）、地すべり、地震となっている。

図-1　インドにおける災害の災害種類別発生件数の推移（1999 年以降）

資料：「災害管理サポートシステム」((独)宇宙航空研究開発機構(JAXA) の情報に基づき作成
注：同システムの情報は、アジア防災センター（ＡＤＲＣ）から提供されている情報に基づく



年	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	合計
1)地震	1		1				1						3
2)強風	1		1		3		3	1	1	2	1		13
3)洪水	2	1	1	6	4	4	5	3	3	2	2		33
4)地すべり			1		1		2	1					5
5)津波						1							1
9)その他		1	1		4		3	2	1	2		1	15
総計	4	2	5	6	12	5	14	7	5	6	3	1	70

1)地震　　：地震
2)強風　　：サイクロン、竜巻、モンスーン雨、嵐　等
3)洪水　　：洪水、鉄砲水、豪雨　等
4)地すべり　：地すべり
5)津波　　：津波
9)その他　：干ばつ、熱波、寒波、雪崩、落雷　等

表-8　インドにおける災害概要一覧表（1999 年以降）

資料 :「災害管理サポートシステム」((独)宇宙航空研究開発機構(JAXA))の情報に基づき作成
注：同システムの情報は、アジア防災センター（ＡＤＲＣ）から提供されている情報に基づく

年	No	発生期間	区分	災害の種類		概　要
1999	1	1999/03/29	1)地震	地震	Earthquake	3 月 28 日深夜 12 時 35 分、リヒタースケール 6.8 の強い地震がインド北部の Uttar Pradesh 州(ニューデリーの 190km 北東に位置)を襲った。(4 月 12 日現在:死者 105 人、負傷者 395 人)156 の家屋が倒壊し、余震も続いている。
	2	1999/07-	3)洪水	洪水	Flood	モンスーンは Assam 州、Bihar 州、Kerala 州、Tripura 州、West Bengal 州に深刻な被害をもたらした。35 地区における 3,212 の村が被災し、15,058 戸の家が被害を受けた。豪雨による死亡者の数はインド全体で 367 名にのぼっており、うち 250 名がインド東部の Bihar 州である。
	3	1999/10/28-	2)強風	サイクロン	Cyclone	ベンガル湾で発生した巨大なサイクロンが東部インド地方を襲う。死者数は数千人に上る恐れ。Orissa 州都の Bhubaneswar では風速毎時 240～250 キロを記録
	4	1999/9/21-	3)洪水	洪水	Flood	7 月末の雨期の始まり以来、インド南部では約 2400 万人の人々が洪水の深刻な被害を受けている。500 万人以上の人々が住む West Bengal の 15 地区を飲み込むという前例のない洪水の危険にさらされていると報告されている。9 月最終週には West Bengal 州、Bihar 州、Madhya Pradesh 州は豪雨に見舞われ、多くの地区で洪水が発生している。
2000	5	2000/05	9)その他	干ばつ	Drought	インドは南アジアや西アジア諸国など広範囲に急速に拡大しつつある深刻な干ばつの被害に見舞われている。特に被害が目立つのは Rajasthan と Gujarat である。Rajasthan には 9000 万人以上の人々がおり、Rajasthan、Gujarat ともに深刻な干ばつの状態下におかれている。
	6	2000/08-	3)洪水	洪水	Flood	インドは今年のモンスーンによる悲惨な結果に悩まされている。6 月中旬からの洪水により 850 万人以上の国民が被害を受けており、11 州で 780 名以上の命が奪われたと報告されている。7 月の終わりからの洪水により、特に Assam 州、Bihar 州、West Bengal 州、Himachal Pradesh 州で被害が大きく、家屋やインフラ、作物に多大な損害が出ている。また、水汚染による病気も洪水の被災地で現れている。
2001	7	2001/01/26	1)地震	地震	Earthquake	26 日現地時間午前 8 時 50 分ごろ、インドのニューデリー南西 580 マイルのBhuj近郊でマグニチュード 6.9 の地震が発生。今現在、死亡者数は 16,487 人、負傷者数は 146,713 人、倒壊家屋数は 269,382 戸、被災家屋数は 544,532 戸である。
	8	2001/05～	9)その他	干ばつ	Drought	2000 年の南西モンスーン期の少雨により、Chhattisgarh 州、Gujarat 州、Madhya Pradesh 州、Orissa 州、Rajasthan 州で干ばつの危険性が増加している。
	9	2001/07	3)洪水	洪水	Flood	2001 年は大雨の影響で大規模な洪水が多数発生し、24 の地方で約 7,648,000 人が被害を受け、70 人が死亡。作物被害額は、710,000 ヘクタールに及び、その被害額は 700 万ドル。
	10	2001/10/17	2)強風	サイクロン	Cyclone	インドでは南東部の海岸を台風が通過し、その影響による死者は 31 人、数千人が家を失った。
	11	2001/11/09	4)地すべり	地すべり	Land Slide	インド南部で9日夜、豪雨の影響による地すべりが発生し、少なくとも40人が死亡、10人が行方不明となっている。
2002	12	2002/06/17	3)洪水	洪水	Flood	数日間続いたモンスーンによりインド北東部 Assam で洪水が発生。死亡者の報告はなされていないが 50,000 人が家屋を失っている。
	13	2002/	3)洪水	洪水	Flood	インド北部ではモンスーンの影響による豪雨により数箇

年	No	発生期間	区分	災害の種類		概　要
		08/11				所の村が流され、少なくとも 49 人の死者が出たとされる
	14	2002/ 08/22	3)洪水	豪雨	Heavy rain	モンスーンによる豪雨により、インド中央部でダムが決壊した。少なくとも 75 人が行方不明、25 人が死亡した可能性がある。
	15	2002/ 09/05	3)洪水	洪水	Flood	インドのグアラジャート州 Narmada 川で洪水が発生し、少なくとも 5 人が流された模様。Narmada 川沿岸の 17 の村の約 400 家族が救助キャンプに避難している。
	16	2002/ 09/05	3)洪水	鉄砲水	Flash Flood	インド北部で鉄砲水が発生し、2 つの地域が被害にあった。少なくとも 16 人が死亡し、4,000 人が家屋を失った。モンスーンの季節になって最初の深刻な被害をもたらした洪水である。なお同地域は最近まで干ばつ被害にあっていた。
	17	2002/ 11/20	3)洪水	洪水	Flood	インド東部とバングラデシュでモンスーンにより洪水が発生している。洪水は堤防を破壊し、25 人の死亡者を出した。しかし今月だけで約 550 人が死亡している。また 1,700 万人が被害を受けており、伝染病が発生する可能性もある。
2003	18	2003/ 01/02	9)その他	寒波	Cold Wave	寒さによりインド北部とバングラデシュではここ数週間で 250 人以上が死亡していると伝えられている。
	19	2003/ 03/07	9)その他	雪崩	Avalanche	インドとパキスタンの間のカシミール停戦区域で豪雪による雪崩が発生、少なくとも 17 人が死亡
	20	2003/ 03/13	3)洪水	豪雨	Heavy Rain	2003 年 3 月 13 日、猛烈な雹をともなう嵐によりインドの West Bengal 州で死者 15 名、負傷者 500 名以上におよぶ被害が出ている。
	21	2003/ 03/19	2)強風	雹を伴う嵐	Hailstorm	暴風を伴う予期せぬ雹嵐がインドの West Bengal 地方の Bankura, Hooghly、Howrah で発生した。死者は 30 人にのぼり、負傷者は 500 人以上である。
	22	2003/ 04/23	2)強風	嵐	Storm	インド北東地域にて、雷嵐が発生し、少なくとも 34 人が死亡、300 人が負傷した。
	23	2003/ 05/23	9)その他	熱波	Heat Wave	ここ 8 日間で南部インドでは熱波のために少なくとも 198 人が死亡したと伝えられた。
	24	2003/ 06/18	3)洪水	洪水	Flood	絶え間なく降り続いた豪雨によりインドの Assam 州で洪水が発生した。400,000 人が家屋を失い避難を余儀なくされている。インド政府の情報によると、western Nalbari, southern Karimganj、southern Hailakandi 、eastern Dhemaji の地域もひどい被害を受けている。
	25	2003/ 07/16	3)洪水	鉄砲水	Flash Flood	インドの Himachal Pradesh 州の北部の建設現場で大雨による鉄砲水が発生し、少なくとも 19 人が死亡、生存者の救出に難航している。
	26	2003/ 08/05	4)地すべり	洪水、地すべり	Flood, Land Slide	インドのヒマラヤ地方北東部の小さな町ダージリンでは 6 週間続いたモンスーンの影響による豪雨のために、地すべりや洪水が発生し、26 人以上が死亡、400 世帯が家を失った。
	27	2003/ 08/31	3)洪水	鉄砲水	Flash Flood	インド北部で鉄砲水が発生し、20 人が溺れたおそれがある。
	28	2003/ 12/11	2)強風	サイクロン	Cyclone	インド南東部の海岸地域で台風により少なくとも 45 人が死亡した。この台風は激しい雨と洪水をもたらし、Andhra Pradesh 州の海岸沿いの村々では家屋が倒壊するなどの被害を受けた。
	29	2003/ 12/25 ―	9)その他	寒波	Cold Wave	バングラデシュとインド北部を襲った寒波により、さらに 92 人が死亡した。クリスマス以降のこの厳寒気候による被害者は 574 人に上る。
2004	30	2004/ 06/08	3)洪水	鉄砲水	Flash Flood	2004 年 6 月 8 日、インド東部で急激な川の増水により、川を横断しようとしていた人々が 30 人あまり亡くなった。
	31	2004/ 08/26	3)洪水	洪水	Flood	インド Bihar 州では北部を中心に洪水による被害が出ており、30 人が死亡、125,000 人が家を失った。被害地域は Madhubani、Sitamarhi、Banka、Bhagalpur、Muzzaffarpur、Sheohar などに及んでいる。
	32	2004/ 09/22	3)洪水	鉄砲水	Flash Flood	インド北部の Uttar Pradesh 州シタプール地区で鉄砲水が発生し、家屋が破壊され、44 人あまりが死亡した。

年	No	発生期間	区分	災害の種類		概　要
	33	2004/10/09	3)洪水	鉄砲水	Flash Flood	インド北部、バングラデシュ、ネパールでは季節外れの豪雨による土砂崩れにみまわれ、ここ 3 日間で広範囲において浸水の被害にあい、少なくとも 144 人が死亡したと伝えられた。インドでは死者が 100 人に上った。
	34	2004/12/26	5)津波	津波	Tsunami	スマトラ沖で起きたここ 40 年で最大規模のマグニチュード 9.0 の地震により、大津波が発生し、南インドで 9,479 人が死亡し、3,000 人が行方不明となっている。
2005	35	2005/02/19	9)その他	雪崩	Avalanche	インド管轄下のカシミールで、最近 20 年で最も多い降雪があり、100 人以上が死亡、さらに 100 人以上が行方不明になっている。
	36	2005/04/30	2)強風	嵐	Storm	インドの West Bengal 州が嵐に襲われ、13 人が死亡、2,000 棟以上の家屋が倒壊したと地方当局が伝えた。
	37	2005/04/30	2)強風	嵐	Storm	土曜日にインドの Andhra Pradesh 州を嵐が襲い、少なくとも 18 人が死亡、多くの負傷者が出たと当局が伝えた。
	38	2005/05/17	9)その他	熱波	Heat Wave	夏の気温が 50 度近くになるインドの Andhra Pradesh 及び Orissa の両州で、熱波により少なくとも 25 人が死亡したと政府当局が伝えた。
	39	2005/05/26	4)地すべり	地すべり	Land Slide	インド北東部のナガランド Nagaland 州で、地すべりにより少なくとも 12 人が死亡、数百棟の家屋が被害を受けたと当局が伝えた。
	40	2005/06/30	3)洪水	洪水	Flood	モンスーンの雨が絶え間なく続き、西部インドでは洪水が発生、少なくとも 127 人が死亡、25,000 人が家を失った。
	41	2005/07/27	4)地すべり	洪水、地すべり	Land Slide, Flood	インド西部の Maharashtra 州で地すべりと洪水が発生した。インド当局によると、これにより少なくとも 850 人が死亡、数 10 人が行方不明となり、国の経済的中心地であるムンバイが無力化したと伝えられた。
	42	2005/08/27	3)洪水	鉄砲水	Flash Flood	インド北部の商業都市 Uttar Pradesh 州で鉄砲水が発生、24 人が溺死し、家屋数百棟が浸水した。
	43	2005/09/20	2)強風	嵐	Storm	激しい嵐がインド東部の沿岸地域を襲い、少なくとも 34 人が死亡、5 万人以上が避難している。
	44	2005/10/08	1)地震	地震	Earthquake	パキスタンで 38,000 人の犠牲者を出している強い地震により、インド統治下のカシミール地方でも、死者数はおよそ 1,300 人、負傷者数は 6,200 人以上に達した。
	45	2005/10/23	3)洪水	洪水	Flood	インド東部では、3日間豪雨が続き、これにより少なくとも 10 人が死亡、そして何万もの人々が洪水により孤立状態となっている。
	46	2005/11/25	3)洪水	洪水	Flood	2005 年 11 月 25 日、インド南部の Tamil Nadu 州で洪水が発生し、混雑した 2 台のバスが増水に飲み込まれた。これにより少なくとも 75 人が死亡、53 人が負傷した。
	47	2005/12/05	3)洪水	集中豪雨	Torrential rains	2005 年 12 月 5 日、インド南部の Andhra Pradesh 州で集中豪雨により 21 人が死亡、数千人が家を失ったと報告された。
	48	2006/01/08	9)その他	寒波	Cold Wave	インド北部では、この 70 年間で最低の気温を記録し、この寒波により 130 人以上が死亡した。
2006	49	2006/05/10	9)その他	熱波	Heat Wave	インドで焼け付くような熱波により少なくとも 27 人が死亡した。これを受けてインド首都の行政は、熱波から子供達を守るために夏休みを早めに始めるように指示した。
	50	2006/05/20	9)その他	落雷	Lightning	2006 年 5 月 20 日、モンスーン期に入る前に上陸した台風がインドの2州を襲い、落雷により樹木が倒壊し 20 人が死亡した。インド南部の Andhra Pradesh 州では少なくとも 12 人が死亡、West Bengal 州では 8 人が死亡した。
	51	2006/06/11	3)洪水	鉄砲水	Flash Flood	2006 年 6 月 9 日インド北東部のアッサム州で鉄砲水が発生し、眠りに付いた人々を濁流が襲い、130 人が死亡した。最も被害が酷かったのは Goalpara 地域であり、村民が少なくとも 80 人が犠牲になり、今でも行方不明者がいる。
	52	2006/07/04	4)地すべり	洪水、地すべり	Flood, Land Slide	インドのムンバイ市が豪雨にみまわれ、これにより洪水と土砂崩れが発生、32 人が死亡し、金融界の中枢地域に住む人々の生活に支障をもたらした。

年	No	発生期間	区分	災害の種類		概 要
	53	2006/07/08	2)強風	モンスーン雨	Monsoon Rains	モンスーン雨によりインドのUttar Pradesh州の大部分が浸水し、週末にかけて溺死、家屋の倒壊や雷により21人が死亡した。
	54	2006/08/04	3)洪水	洪水	Flood	熱帯性低気圧による豪雨と洪水により、インド南部、東部では42人が死亡、数万人が避難した。
	55	2006/08/27	3)洪水	洪水	Flood	モンスーン雨、洪水により、インド西部のRajasthan州では少なくとも130人が死亡、広範囲の砂漠地域が浸水した。
2007	56	2007/01/05	9)その他	寒波	Cold Wave	寒波が北部および東部インドを襲い、少なくともここ1週間で80人が死亡した。学校や大学は休校を余儀なくされ、家のない人たちに薪の供給を行った。
	57	2007/06/17	3)洪水	鉄砲水、雷	Flash Flood, Lightning	2007年6月18日、インド東部を襲った豪雨による鉄砲水と雷により少なくとも16人が死亡した。
	58	2007/06/23	2)強風	嵐	Storm	2007年6月23日、猛烈な嵐がインド南部のAndhra Pradesh州を襲い、少なくとも45人が死亡、数千人が家を失った。
	59	2007/07/06	3)洪水	豪雨	Heavy rain	インド東部では4日間におよぶ豪雨により数千人が孤立状態であり、激しい雨で救助作業が難航している。一方で隣国であるバングラデシュでは土砂崩れにより2人が死亡した。
	60	2007/10/30	3)洪水	洪水	Flood	インドで5日間降り続いた豪雨による洪水のため、Tamil Nadu州では少なくとも13人が死亡した。
2008	61	2008/02/09	9)その他	雪崩	Avalanches	インドのカシミール地方では豪雪により雪崩が発生、20人が死亡、15人が行方不明となっている。
	62	2008/04/02	9)その他	熱波	Heat Wave	数週間にわたりインド北東部では、気温摂氏40度半ば(華氏110度)もの熱波により、少なくとも17人が死亡している。
	63	2008/05/14	2)強風	嵐	Storm	インド政府担当官によると、2008年5月14日、Uttar Pradesh州で発生した暴雨風の死者数が94人になった。
	64	2008/05/18	2)強風	嵐	Storm	2008年5月18日、インド北部で暴風により13人が死亡し、13人が負傷した。
	65	2008/06/16	3)洪水	洪水	Flood	2008年6月16日、インド当局によると、北東部でモンスーン期の大雨により鉄砲水、地すべりが発生し、25人が死亡、200,000人が避難した。
	66	2008/08/20	3)洪水	洪水	Floods	モンスーン雨に由来する豪雨により洪水が発生し、インドの北東部では5万人が家を失った。
2009	67	2009/04/01	2)強風	竜巻	Tornado	2009年4月1日インド当局の発表によると、東海岸部60以上の村を竜巻が襲い、10人が死亡、約100人が負傷したと。
	68	2009/07/20	3)洪水	洪水	Floods	インド東部Orrisa州では1週間続いた強いモンスーン雨により洪水が発生し、少なくとも36人が死亡し、家屋50万棟が浸水した。
	69	2009/09/30～2009/10/04	3)洪水	洪水	Floods	豪雨による洪水で、インド南部ではここ5日間で少なくとも200人が死亡した。これにより、植物はなぎ倒され、何万人もの人々が家を失った。
2010	70	2010/01/04	9)その他	寒波	Cold Wave	インド北部では寒波のため数十人が死亡している

②対応体制の課題

インドの防災体制は、以下のようになっている。

○法制度

2004 年に国家レベルの防災枠組みを策定したほか、2005 年には防災法（The Disaster Management Act, 2005- DM ACT, 2005)を制定した。

○防災組織

防災政策、計画、ガイドラインを策定し、それらの実施を調整する機関として首相を議長とする国家防災委員会（National Disaster Management Authority (NDMA)）が設置されている。各州には、州防災委員会（State Disaster Management Authorities (SDMAs)）が設置されている。

また NDMA のもと、災害軽減および緊急対応のための人材育成を促進する機関として、国家防災協会（National Institute of Disaster Management (NIDM)）、迅速な災害対応を行う機関として、国家災害対応部隊（National Disaster Response Force (NDRF)）が設置されている。

○防災計画

防災分野に特化した計画はないが、第 11 期国家 5 ヶ年計画（2007-2012）の中の「環境と気候変動」の章に防災に関する記述があり、防災に配慮した開発計画への配慮の必要性などが述べられている。

また、防災法において州ごとに防災計画の策定が求められており、州防災計画作成のガイドラインが 2007 年 7 月に発行されている。

（２）地すべりの現状と課題

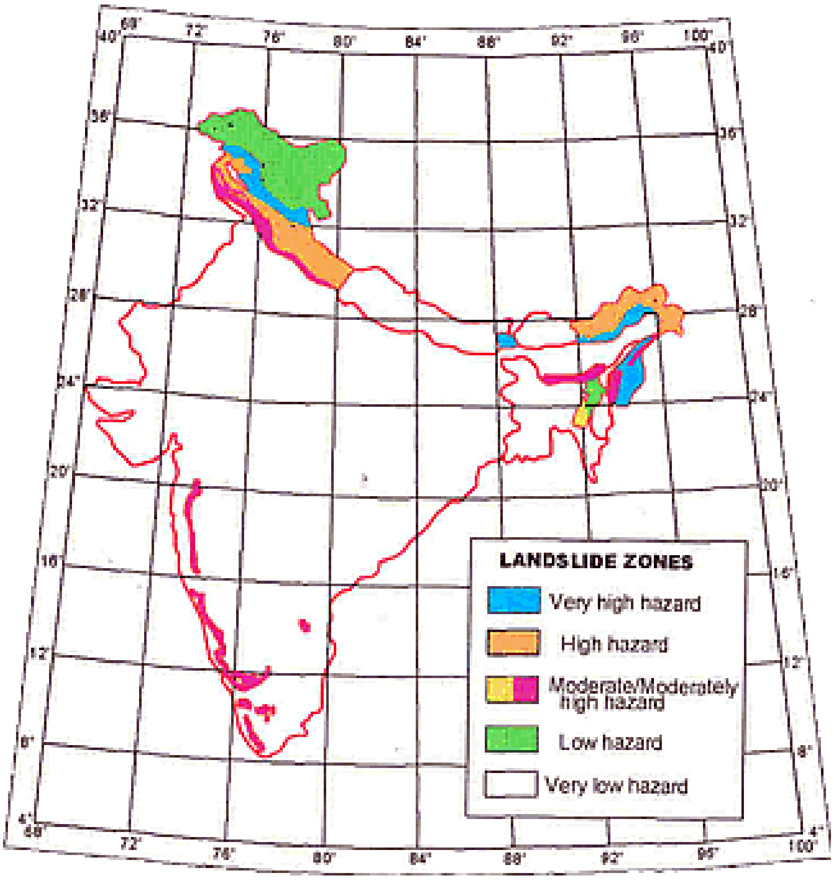
①インド国内における地すべりの危険性について

　インドの地すべりは、ヒマラヤ山脈と北東の丘陵地域及び西部の高地において数多く発生している。また、ヒマラヤの地震活動も地すべりに大きな影響を及ぼすとともに、モンスーンによる大雨も地すべりの要因となっている。

　概算ではインドの国土面積（約 330 万 km^2）のおよそ 15%にあたる 49 万 km^2 は、地すべりの危険がある。（北東地域の 9 万 8000km^2 や、ヒマラヤ山脈、ニルギリ、ラーンチー高原、および東部と西部の一部のアラカンヨーマの範囲、および 39 万 2000km^2 の部分を含む。）

　インドの最大 20 州で様々な地すべりの危険がある。これらのうち、Sikkim 州と Mizoram 州は、非常に危険度の高いクラスに評価されている（（下図水色：Very high hazard)。また、Jammu and Kashmir 州、Himachal Pradesh 州、Uttarakhand 州、Arunachal Pradesh 州、Nagaland 州、および Manipur 州の地区の大部分は、次いで危険度の高い地域に該当する（下図オレンジ色：High hazard)。 半島地域では、Karnataka 州、Andhra Pradesh 州、Tamil Nadu 州、Maharashtra 州、Goa 州、Madhya Pradesh 州、および Kerala 州といった広大な丘陵地帯に中適度の危険性のあるゾーンが広がっている（下図黄・ピンク色：moderate/moderately high hazard)。

図-2　インドの地形における地すべりの危険度マップ



出典：Geological Survey of India(GSI)ホームページより

インドにおける近年の地すべり災害の概要は、以下のとおりである

表-9　インドにおける近年の地すべり災害

資料：「災害管理サポートシステム」（(独)宇宙航空研究開発機構(JAXA)）の情報に基づき作成
注：同システムの情報は、アジア防災センター（ＡＤＲＣ）から提供されている情報に基づく

年	NO	発生期間	災害の種類		概要	死者・行方不明者数
2001	1	2001/11/09	地すべり	Land Slide	インド南部で9日夜、豪雨の影響による地すべりが発生し、少なくとも40人が死亡、10人が行方不明となっている。	死者 40 人、行方不明 10 人
2003	2	2003/08/05	洪水、地すべり	Flood, Land Slide	インドのヒマラヤ地方北東部の小さな町ダージリンでは6週間続いたモンスーンの影響による豪雨のために、地すべりや洪水が発生し、26 人以上が死亡、400 世帯が家を失った。	死者 26 人以上
2005	3	2005/05/26	地すべり	Land Slide	インド北東部の Nagaland 州で、地すべりにより少なくとも 12 人が死亡、数百棟の家屋が被害を受けたと当局が伝えた。	死者 12 人
	4	2005/07/27	洪水、地すべり	Land Slide, Flood	インド西部の Maharashtra 州で地すべりと洪水が発生した。インド当局によると、これにより少なくとも 850 人が死亡、数 10 人が行方不明となり、国の経済的中心地であるムンバイが無力化したと伝えられた。	死者 850 人、行方不明 10 人
2006	5	2006/07/04	洪水、地すべり	Flood, Land Slide	インドのムンバイ市が豪雨にみまわれ、これにより洪水と土砂崩れが発生、32 人が死亡し、金融界の中枢地域に住む人々の生活に支障をもたらした。	死者 32 人

②インドの地すべりに関する課題

インドからの質問票の回答結果を踏まえると、インドの地すべりに関する課題は、以下の通りである。

○インドでは、地すべり災害に長らく苛まれており、この種の災害では最も被害を蒙った国である。地すべり災害に対処するコミュニティ、管理組織等を急いで整備する必要性がある。体系的な地すべりに関するデータベース、地すべりハザードマップ、脆弱度やリスクアセスメントに関する情報の整備及びそれらをコンパイルしたマップの整備は、地すべり災害に対して積極的に対策を講じるために必要である。

○地すべりに関するリスク分類と、対策箇所の優先付けを行うプロセス、現場でデモ的に実地調査を行うような活動はとても有効である。

○的確かつ権威のある団体の支援を受け、早期警戒警報システムの開発、地すべり発生メカニズムのモニタリング、復旧計画等を行う諸活動は、地すべり対策として非常に有効である。また、研修活動やキャパシティビルディングも同様に非常に有効である。

（３）我が国との研究協力の可能性と具体的なニーズの把握

インドからの質問票の回答結果を踏まえると、各災害における研究協力の可能性と具体的な支援ニーズは、以下の通りである。

表-10　インドによる研究協力の可能性とニーズ

	研究協力の可能性	具体的な支援ニーズ
地震	各対策について実施中であり、その中で技術支援を必要とする右記の項目について、支援が望まれる。また、費用がもっとも必要なハード対策のみ資金を必要としている。	・予防対策と緊急対策技術の技術移転、その中で必要な部分の一般の市民への周知に関する支援。 ・インドの実情にあった、耐震設計法と既存構造物の耐震補強法構築に関する技術支援 ・実施した地震対策の評価に関する技術支援 ・各種対策等を実行しているが、まだ不足している技術があり、支援が必要である。
強風		・建築物の耐風設計に関する人材育成の支援 ・早期警戒警報システム確立のための技術支援 ・国民へサイクロンの危険性についての啓発活動支援 ・各種対策等を実行しているが、まだ不足している技術があり、支援が必要である。また、ハード、ソフト対策等で、人材育成も必要
洪水	各対策について実施中であるが、右記の支援ニーズは具体的なものであるため、それらについて対応可能か検討する。	・洪水対策の総合的な計画策定および研修などソフト面の支援。 ・洪水対策構造物の現地施工を通したキャパシティービルディング ・洪水の早期警戒警報システム及び豪雨時向けの排水システム計画作成支援 ・各種対策等を実行にあたり、組織の改善、人材育成も必要。
地すべり	支援ニーズの記述が広範囲で、具体化しにくいが、総合的に見て、どの斜面が危ないか評価し、優先順位を付けた上で、ハード･ソフト対策が実施できるように、支援内容を調整する。	・地すべりに対する包括的な情報の整備、活用体制づくりの支援 ・地すべり対策実施の優先付け技術と現地調査法の技術移転 ・早期警戒警報システム、斜面モニタリング、復旧計画等広範囲な対策技術支援 ・多くの段階で、まだ技術支援、組織の改善、人材育成を必要としている。
津波	津波被害の経験が少ないためか、全ての項目に対し技術支援のニーズがある。右記の支援ニーズは、「津波の早期警戒システムに関する技術移転」など具体的なものがあるので、ここから選択することでよい。	・津波被害に対する啓発活動の支援と具体的な対策に対する支援 ・津波の早期警戒システムに関する技術移転 ・避難体制・避難場所確保などの戦略策定支援 ・全般にわたり技術的支援が必要。その他、被害想定、対策実施のための人材育成、ハード対策の実施のための資金調達も必要。

（４）我が国の地すべり対策工法の適用性に対するNIDMの意見と改善案

我が国の地すべり対策工法の適用性等に対して、ワークショップの結果より、NIDMからは以下のような意見と改善案が出されている。

○自然環境と調和した建設事業手法について

インドは、例えば自然環境と調和した建設事業、山の環境を破壊しないような建設事業、環境と調和した建設事業、それをどういうふうに行うのかということに関しても興味がある。

○土砂災害の地図データベースについて

インドからは、日本の土砂災害の地図に対して高い評価が寄せられた。

インドでは、土砂災害の起きやすい場所のゾーンのマッピングに関するデータベース開発について、どのエリアをデータ化するか、実際の状況と地図がマッチしているかなどの点に関して、日本からの協力を期待している。

○災害管理軽減、気候変動によるリスク軽減分野について

インドから、災害管理軽減、気候の変動によって増加しているリスクの軽減に関しても、大変重要な分野であるため共同でこれらの分野にも焦点を置きたいとの意見があった。

○試験技術について

インドからは、橋や建物の構造を試験する技術が大変有用であるとの意見があった。

○能力開発について

インドからは、能力開発（研修活動やキャパシティビルディング）について、共同的作業が行えればとの意見があった。

４．資料の整理

４－１．インド側から国総研への提供資料

提供された資料は、以下の通りである。

＜Briefing paper＞

・NDM Guidelines on Management of Landslides and Avalanches in India (No.1)
(Writing by Mr. Surya Parkash, Ph.D.)

・NDM Guidelines on Management of Landslides and Avalanches in India (No.1)
(Writing by Mr. Surya Parkash, Ph.D.)

＜Book＞

・Micro-finance and disaster risk reduction
(Edited by P.G. Dhar Chacrabarti Mihir R.Bhat)

・Disaster & Development (Volume 2, Number 1, May 2008)
(Edited by Journal of the National Institute of Disaster Management, New Delhi)

・Manual for Drought Management (November 2009)
(Department of Agriculture and Cooperation Ministry of Agriculture, Government of India New Delhi)

・Disaster risk reduction for safe development A Study of Corporate Practices in India
(Edited by ISDR, NIDM)

・The kutch earthquake 2001 Recollections, Lessons and Insights
(Edited by NIDM)

・Trainer's Guide for Training in Hazard Resistant Construction To ensure effective training of artisans for vulnerability reduction
(Edited by National Disaster management Division Ministry of Home Affairs Government of India)

・Women as equal partners Gender dimension of disaster risk management programme Compilation of good practices
(Edited by GOI-UNDP DRM PROGRAMME)

・Training of trainers manual on gender mainstreaming in disaster risk management
(Edited by GOI-UNDP DRM PROGRAMME)

・Manual on Hazard Resistant Construction in India For reducing vulnerability in buildings built without engineers
(Edited by National Disaster management Division Ministry of Home Affairs Government of India)

・Good practices in community based disaster risk management

(Edited by Government of India)
・Training Calendar 2009-10
(Edited by National Institute of Disaster Management)
・Hazards, disasters and your community Ver.1.0
(Edited by National Disaster Management division, Ministry of Home Affairs, Government of India)
・National disaster management guidelines　Management of landslides and snow avalanches (June 2009)
(Edited by National Disaster Management Authority, Government of India)
・National disaster management guidelines　Management of earthquakes (April 2007)
(Edited by National Disaster Management Authority, Government of India)
・Training module for non-governmental organisations on disaster risk management
(Edited by An initiative under the GOI-UNDP disaster risk management programme)

＜Pamphlet＞
・Disaster risk management-document series　Cyclone resistant building architecture
(Prepared under GOI-UNDP disaster risk management programme)
・Disaster risk management-document series　Detailed seismic assessment of masonry buildings in seismic zone Ⅳ
(Prepared under GOI-UNDP disaster risk management programme New Delhi)
・Earthquake safe construction of masonry buildings　Simplified Guideline for All New Buildings in Seismic Zone Ⅴ of India
(Prepared by Professor Anand S. Arya assisted by Jananjan Panda)
・NIDM Newsletter Vol.Ⅲ, No.4, October-December 2008
(Edited by National Institute of Disaster Management)
・NIDM Newsletter Vol.Ⅳ, No.1, January-March 2009
(Edited by National Institute of Disaster Management)

＜CD＞
・National disaster management guidelines　Management of earthquakes (April 2007)
(Edited by National Disaster Management Authority, Government of India)
・National disaster management guidelines　Management of landslides and snow avalanches
(Edited by National Disaster Management Authority, Government of India)

※ 提供資料は図書館にて保存。

４－２．インドにおける防災ガイドライン（地震・地すべり）の概要

提供された資料の中から、インドにおける地震および地すべりに関する災害マネジメントガイドラインにつき、概要を以下に示す。

【地震災害に関するマネジメントガイドラインの概要】

原題：National disaster management guidelines
Management of earthquakes

発行：National Disaster Management Authority, Government of India

インドでは、地震に関する災害マネジメントのガイドラインを策定するにあたり、産学官の知見を集約し、防災、減災、被災時の緊急対応能力に注力した包括的なアプローチを検討した。それを受けて策定された災害マネジメントガイドラインは、以下に挙げる６つが柱となっている。

・新設構造物には耐震構造を組み込むことを義務化することで、地震時の防災に貢献

・地震多発地域におけるインフラおよび建造物の耐震、免震化を促進

・適正な規制強化によるコンプライアンス制度の徹底

・地方自治体も含めた行政等の災害マネジメント関係者における意識改革

・地震災害のマネジメントにおける人材育成と能力開発の多岐にわたる指導プログラムの導入

・地震多発地域における被災時の緊急対応能力の強化

【地すべり災害に関するマネジメントガイドラインの概要】

原題：National disaster management guidelines
Management of landslides

発行：National Disaster Management Authority, Government of India

インド政府は、これまでの地すべり災害により多大な被害を繰り返し受けてきたことを踏まえ、従前の被災後対応に注力するアプローチから平時に取り組む防災へと災害マネジメントの方針をシフトしている。それに伴い、地形の特徴や地すべり危険度の測定等を研究するタスクフォースを設け、地すべりリスクの明確化を図っているところである。

ガイドラインは、地すべり災害マネジメントにおける重点領域を次の９つに絞っている。

- 地すべりの危険性や国土の脆弱性を加味したリスクアセスメント
- 多様なリスクの概念化
- 地すべり発生地域の復旧活動
- 研究開発およびモニタリング、早期警戒の発信
- 災害マネジメントに関する知識のネットワーク化、知識マネジメント
- 能力構築および人材育成
- 地すべりリスクに対する市民の意識啓発
- 危機対策および復旧対応能力の強化
- 規制の執行

４－３．上記ガイドラインの原文

【地震災害に関するマネジメントガイドラインの概要：原文】

National Disaster management guidelines (Management of Earthquakes)

Executive Summary

Background

The Disaster Management Act, 2005 (DM Act, 2005) lays down institutional and coordination mechanisms for effective disaster management (DM) at the national, state, and district levels. As mandated by this Act, the Government of India (GoI) created a multi-tiered institutional system consisting of the National Disaster Management Authority (NDMA), headed by the Prime Minister, the State Disaster Management Authorities (SDMAs) by the Chief Ministers and the District Disaster Management Authorities (DDMAs) by the District Collectors and co-chaired by elected representatives of the local authorities of the respective districts. These bodies have been set up to facilitate the paradigm shift from the hitherto relief-centric approach to a more proactive, holistic and integrated approach of strengthening disaster preparedness, mitigation and emergency response.

Soon after the NDMA was set up, a series of consultations were initiated with various stakeholders to facilitate the development of guidelines for strengthening earthquake management. Senior representatives from government departments and agencies, academics, professionals, multilateral and humanitarian agencies and corporate sector representatives participated in these meetings. These meetings acknowledged that several initiatives taken up by government agencies in the recent past have been significant and far-reaching, but they also highlighted the need for a holistic and integrated strategy. On the basis of these deliberations, the NDMA has prepared these Guidelines for the Management of Earthquakes, (hereinafter referred to as the Guidelines), to assist the ministries and departments of the GoI, state governments and other agencies to prepare DM plans.

Earthquake Risk in India

India's high earthquake risk and vulnerability is evident from the fact that about 59 per cent of India's land area could face moderate to severe earthquakes. During the period 1990 to 2006, more than 23,000 lives were lost due to 6 major earthquakes in India, which also caused enormous damage to property and public infrastructure. The occurrence of several devastating earthquakes in areas hitherto considered safe from earthquakes indicates that the built environment in the country is extremely fragile and our ability to prepare ourselves and effectively respond to earthquakes is inadequate. During the International Decade for Natural Disaster Reduction (IDNDR) observed by the United Nations (UN) in the 1990s, India witnessed several earthquakes like the Uttarkashi earthquake of 1991, the Latur earthquake of 1993, the Jabalpur earthquake of 1997, and the Chamoli earthquake of 1999. These were followed by the Bhuj earthquake of 26 January 2001 and the Jammu & Kashmir earthquake of 8 October 2005.

All these major earthquakes established that the casualties were caused primarily due to the collapse of buildings. However, similar high intensity earthquakes in the United States, Japan, etc., do not lead to such enormous loss of lives, as the structures in these countries are built with structural mitigation measures and earthquake-resistant features. This emphasises the need for strict compliance of town planning bye-laws and earthquake-resistant building codes in India. These Guidelines have been prepared, taking into account an analysis of the critical gaps responsible for accentuating the seismic risk and of factors that would contribute towards seismic risk reduction, to enable various stakeholder agencies to address the critical areas for improving seismic safety in India.

Overview

Long-term and sustained efforts are required to address the problem of earthquake risk in India. These Guidelines have been prepared to reduce the impact of earthquakes in the short term and the earthquake risk in the medium and long term. They recognise the enormous challenge in improving seismic safety because of the inadequate numbers of trained and qualified civil engineers, structural engineers, architects and masons proficient in earthquake-resistant design and construction of structures. They also acknowledge the need for imparting training in earthquake-resistant design and construction to faculty members in professional colleges, for revising the curriculum in professional courses, and for creating public awareness on seismic risk reduction features in non-engineered construction in earthquake-prone areas.

Guidelines for the Preparation of DM Plans

The National Executive Committee (NEC) will prepare the National Disaster Management Plan which will be approved by the NDMA. The Ministry of Earth Sciences (MoES), as the nodal ministry will prepare the Earthquake Management Plan covering all aspects like earthquake preparedness, mitigation, public awareness, capacity building, training, education, Research and Development (R&D), documentation, earthquake response, rehabilitation and recovery. The Indian Meteorological Department (IMD) will be the nodal agency for the monitoring of seismic activity while the Bureau of Indian Standards (BIS) will be the nodal agency for preparing earthquake-resistant building codes and other safety codes. All such key stakeholders, including central ministries and departments and state governments/SDMAs will develop detailed DM plans, recognising the seismic risk in their respective jurisdictions, based on these Guidelines. Similarly, the SDMAs will lay down appropriate Guidelines for the preparation of DM plans by Urban Local Bodies (ULBs), Panchayati Raj Institutions (PRIs) and district administration, keeping in view the seismic risk considerations in their respective areas. These Guidelines are drawn up in the context of a rigorous Risk Management (RM) framework to ensure the effectiveness of DM plans that are developed by various agencies. Communities and other stakeholders will ensure compliance to the town planning bye-laws, earthquake-resistant building codes and other safety regulations, as well as their effective enforcement. The state governments/SDMAs will be responsible for reviewing and monitoring the implementation of the DM plans.

Structure of the Guidelines

These Guidelines consist of three broad sections: *(a)* the context and approach to the management of earthquakes in India; *(b)* an outline of the specific Guidelines; and *(c)* a broad overview of the DM plans to be prepared by the central ministries and departments, state governments, other stakeholders and nodal agencies.

(a) The first section covers the following:

- an overview of the earthquake risk and vulnerability in India;
- a brief review of the status of earthquake management efforts;
- an overview of the recent initiatives of the government for ensuring earthquake risk reduction;
- an identification of the critical areas which require special attention to ensure that the

overall strategy for the management of earthquakes in India is holistic, integrated and supportive to the development aspirations of building a modern nation;

- an outline of a rational RM framework to institutionalise systems and processes to make earthquake safety in India a sustainable strategy;
- an introduction to the six pillars of earthquake management, with prescribed time lines for the effective implementation of the various activities; and
- an overview of the issues which need to be addressed to ensure the effective implementation of the plans formulated based on these Guidelines.

(b) The second section outlines each of the six pillars for effective earthquake management in India.

(c) The third section provides an overview of the DM plans to be prepared by the central ministries and departments, state governments, other stakeholders and nodal agencies.

Special attention needs to be given to ensure the earthquake safety of non-engineered construction in rural areas, as more than 61 per cent of the buildings in rural areas are built with mud and clay, stone, brick and/or concrete, compared to 26.7 per cent of similar buildings in urban areas. The large number of fatalities due to earthquakes in rural areas during the period 1990 to 2006 also makes it imperative to pay special attention to the earthquake safety of buildings being constructed in these areas.

The Six Pillars of Earthquake Management

These Guidelines envisage the institutionalisation of stakeholder initiatives, by involving communities and other key stakeholders, covering pre-disaster components of mitigation and preparedness based on scientific and technical principles, as well as on indigenous technical knowledge and building techniques. They simultaneously address the incorporation of multi-hazard resistant features in the reconstruction of damaged buildings and outline the strategy for strengthening the post-disaster components of emergency response, rehabilitation and recovery.

Even though earthquake-resistant building codes and town planning bye-laws and regulations exist, these are not strictly enforced.

Given the high seismic risk and earthquake vulnerability in India, these Guidelines require all stakeholders to ensure that, hereafter, all new structures are built in compliance of earthquake-resistant building codes and town planning bye-laws. This will be taken up as a national resolve.

This is in recognition of the seriousness of the high seismic risk in India and the increasing trends of urbanisation and modernisation that demand the construction of flyovers, multi-storied buildings, super malls, techno parks, etc., in metropolitan cities thereby multiplying the risks manifold.

The fragile built environment in India, especially in moderate and high seismic risk zones, is a matter of serious concern. It is neither practical nor financially viable to implement strengthening and retrofitting of all existing structures in moderate and high seismic risk zones in India.

These Guidelines emphasise the need for carrying out the structural safety audit of existing lifeline structures and other critical structures in earthquake-prone areas, and carrying out selective seismic strengthening and retrofitting.

Apart from these two sets of initiatives which are aimed at improving the seismic safety of the built environment, these Guidelines also emphasise the need for strengthening enforcement and regulation, awareness and preparedness, capacity development (including education, training, R&D, and documentation) and earthquake response.

As mentioned earlier, these Guidelines have been prepared through a series of consultations with key stakeholder groups in New Delhi, Kanpur and Mumbai. These consultations identified the critical factors responsible for the high seismic risk in India and prioritised six sets of critical interventions, which have been presented in these Guidelines as the six pillars of earthquake management. They will help to:

1. Ensure the incorporation of earthquake-resistant design features for the construction of new structures.
2. Facilitate selective strengthening and seismic retrofitting of existing priority and lifeline structures in earthquake-prone areas.
3. Improve the compliance regime through appropriate regulation and enforcement.
4. Improve the awareness and preparedness of all stakeholders.
5. Introduce appropriate capacity development interventions for effective earthquake management (including education, training, R&D, and documentation).
6. Strengthen the emergency response capability in earthquake-prone areas.

Milestones for Implementing the Guidelines

These Guidelines envisage two phases for ensuring seismic safety. During Phase I, which is scheduled to commence with immediate effect and conclude by 31 December 2008, the various stakeholders will prepare their DM plans and carry out specific activities aimed at seismic risk reduction. These activities are the most challenging ones, as the stakeholders not only clearly articulate the earthquake safety issues during this phase, but also put in place institutions and processes for moving towards systematic seismic risk reduction. The activities to be carried out during Phase I include the following:

- Preparing DM plans; revising town planning bye-laws and adopting model bye-laws; disseminating earthquake-resistant building codes, the National Building Code 2005 and other safety codes.
- Training trainers in professional and technical institutions; training professionals like engineers, architects, and masons in earthquake-resistant construction.
- Launching demonstration projects and public awareness campaigns to disseminate earthquake-resistant techniques, seismic safety and seismic risk reduction.
- Enforcing and monitoring compliance of earthquake-resistant building codes, town planning bye-laws and other safety regulations; establishing an appropriate mechanism for compliance review of all construction designs submitted to ULBs; undertaking mandatory technical audit of structural designs of major projects by the respective competent authorities.
- Developing an inventory of the existing built environment; assessing its seismic risk and vulnerability by carrying out a structural safety audit of all critical lifeline structures.
- Developing and undertaking seismic strengthening and retrofitting standards for existing critical lifeline structures, initially as pilot projects and for other critical lifeline structures in a phased manner.
- Increasing the awareness of earthquake risk and vulnerability and seismic risk reduction measures to various stakeholders through sensitisation workshops, seminars and public awareness campaigns.

- Preparing DM plans by schools, hospitals, super malls, entertainment multiplexes, etc. and carrying out mock drills for creating greater public awareness.
- Strengthening the Emergency Operations Centre (EOC) network.
- Streamlining the mobilisation of communities, civil society partners, the corporate sector and other stakeholders.
- Preparing national, state and district DM plans, with specific reference to the management of earthquakes.
- Preparing community and village level DM plans, with specific reference to management of earthquakes.
- Carrying out the vulnerability mapping of earthquake-prone areas and creating inventory of resources for effective response.
- Carrying out earthquake safety education in educational institutions and conducting mock drills.
- Strengthening earthquake safety R&D in professional technical institutions.
- Preparing documentation on lessons from previous earthquakes and ensuring their wide dissemination.
- Developing an appropriate mechanism for licensing and certification of professionals in earthquake-resistant construction techniques by collaborating with professional bodies.
- Developing appropriate risk transfer instruments by collaborating with insurance companies and financial institutions.
- Setting up National Disaster Response Force (NDRF) battalions, training and equipping them.
- Setting up State Disaster Response Force (SDRF) battalions in high seismic risk states, training and equipping them.
- Strengthening the medical preparedness for effective earthquake response.

These activities will be initiated by the central ministries and departments and state governments, other key stakeholders and nodal agencies concerned as parallel processes. A review of the DM plans and activities carried out during Phase I will be undertaken, from January to June 2009. Thereafter, the plans will be revised and updated, with special emphasis on areas that need greater attention to achieve the objective of institutionalising seismic risk reduction. The activities of Phase I will continue during this period and be further intensified in Phase II. The implementation of Phase II will commence from 1 January 2010.

Table 1: Important Milestones for the Implementation of the Guidelines

S. No.	Item	Commencement	Action and Date of Completion
	Phase I Implementation of the Guidelines		
1	Development of detailed action plans for each Phase I activity	With immediate effect	Complete by 30 June 2007
2	All activities of Phase I	With immediate effect	Underway by 1 July 2007
3	Mid-term monitoring and correction of implementation plans of all Phase I activities	With immediate effect	Complete by 31 December 2007
4	Completion of Phase I activities	With immediate effect	Complete by 31 December 2008
5	Major review of all action plans of all activities of Phase I	With effect from 1 January 2009	Complete by 30 June 2009
	Phase II Implementation of the Guidelines		
6	Identification of activities to be undertaken in Phase II, and development of detailed action plans for the same	Initiate by 1 July 2009	Complete by 31 December 2009
7	Implementation of all Phase II activities		Underway by 1 January 2010

【地すべり災害に関するマネジメントガイドラインの概要：原文】

National disaster management guidelines (Management of landslides)

Background

The prevention of loss to life and property due to natural calamities is being viewed very seriously by the Government of India. In the past, the main role played by the Government in the case of various disasters was confined mainly to post-disaster activities that included providing relief and organising rehabilitation. The Uttarkashi Earthquake of 1991, Killari Earthquake of 1993 and the devastating Malpa landslide along the Kailash-Mansarovar route in 1998 acted as an eye-opener for the Government. The need was felt for a proactive approach rather than waiting for a disaster to occur. As a part of this strategy, the Government decided to institute task forces for landslide hazard zonation, geotechnical investigations, and land use zonation and regulation. It was however the Kutch Earthquake of 26 January 2001 that led to a paradigm shift in the policies of the Government.

A review of the disaster management mechanism was carried out by the Government in June 2002 and the subject of disaster management was shifted from the Ministry of Agriculture to the Ministry of Home Affairs. The latter was declared as the nodal ministry for coordination of relief and response and overall disaster management. Subsequently, the Geological Survey of India was declared the nodal agency for landslides by the Government in January 2004. The responsibilities of the Ministry of Mines/Geological Survey of India as the nodal ministry/agency include coordinating all the activities related to landslide hazard mitigation, and monitoring the occurrence of landslides in the country.

The Disaster Management Act, 2005, was enacted on 23 December 2005 and the National Disaster Management Authority, a statutory body under the chairmanship of the Prime Minister as provided for in this Act, was set up. As per the Disaster Management Act, the responsibility to cope with natural disasters is essentially that of state governments and the role of the central government is a supportive one in terms of supplementing physical and financial resources. At the state level, each state government is to set up a state disaster management authority under the chairpersonship of the chief minister. At the district level, the collector/district magistrate/ deputy commissioner is the chairperson of the district disaster management authority and directs, coordinates and supervises disaster management activities.

Landslide Risk

Landslides are one of the natural hazards that affect at least 15 per cent of the land area of our country—an area which exceeds 0.49 million km2. Landslides of different types are frequent in geodynamically active domains in the Himalayan and Arakan-Yoma belt of the North-Eastern parts of the country as well as in the relatively stable domains of the Meghalaya Plateau, Western Ghats and Nilgiri Hills. In all, 22 states and parts of the Union Territory of Pudducherry and Andaman & Nicobar Islands are affected by this hazard. The phenomenon of landslides is pronounced during the monsoon period.

For a long time landslides have had disastrous consequences causing enormous economic losses and affecting the social fabric. In 2005 alone, more than 500 human lives were lost due to this hazard in our country.

Approach to the Guidelines

In order to reduce the enormous destructive potential of landslides and to minimise the consequential losses, it is necessary that the hazard must first be recognised, the risk analysed and an appropriate strategy developed at the national level to mitigate its impact. To achieve this objective, the National Disaster Management Authority initiated a series of consultations for drafting the National Guidelines on Landslides and Snow Avalanches to guide the activities envisaged for mitigating the risk emanating from landslides at all levels. The main objectives of these Guidelines are to institutionalise the landslide hazard mitigation efforts, to make our society aware of the various aspects of landslide hazard in the country and to prepare the society to take suitable action to reduce both risks and costs associated with this hazard. The Guidelines include regulatory and non-regulatory frameworks with defined time schedules for all activities. It is envisioned that all national and state disaster management plans and policies for landslides will be formulated and implemented keeping in view the overall framework of the Guidelines.

Structure of the Guidelines

The following nine major areas have been identified for systematic and coordinated management of landslide hazards:

i) Landslide hazard, vulnerability, and risk assessment.

ii) Multi-hazard conceptualisation.

iii) Landslide remediation practice.

iv) Research and development; monitoring and early warning.

v) Knowledge network and management.

vi) Capacity building and training.

vii) Public awareness and education.

viii) Emergency preparedness and response.

ix) Regulation and enforcement.

Landslide Hazard Zonation

The above areas would need to be addressed for minimising the impact of landslides. Landslide hazard and risk assessment will be done through landslide hazard zonation mapping and geological and geotechnical investigation of vulnerable slopes and existing landslides. Building inventory databases has been considered an integral part of this exercise. Hazard zonation mapping involves:

i) Creation of landslide inventory.

ii) Selecting scales for mapping depending upon end-user requirements.

iii) Selecting landslide hazard zonation methodologies for different scales.

iv) Multi-hazard integration especially integrating seismic hazard.

v) Prioritisation of areas for landslide hazard zonation mapping.

vi) Landslide risk zonation.

Investigations for Landslide Risk Assessment

Geological and geotechnical investigations of landslide risk assessment involve a multidisciplinary approach where engineering geologists and geotechnical engineers are an integral part of the investigating team. The investigations include preliminary stage geological investigations, detailed geological investigations and geotechnical investigations. As an aid to the development of a systematic method and development of standard codes, and planning and capacity building for geological and geotechnical investigations, a few major disastrous landslides will be identified for creating pace setter examples of detailed investigations. These pace setting investigations will be carried out by assigning tasks to the identified organisations having necessary expertise and experience. The state geology and mining directorates will be made an integral part of these pilot projects as a part of capacity development.

Strategies for Landslide Risk Treatment

Landslide risk treatment is the ultimate objective of the risk management process which aims to mitigate the effects of the hazard. This encompasses a five-pronged strategy comprising:

i) Treating vulnerable slopes and existing hazardous landslides.

ii) Restricting development in landslide-prone areas.

iii) Preparing codes for excavation, construction and grading.

iv) Protecting existing developments.

v) Monitoring and warning systems.

vi) Putting in place arrangements for landslide insurance and compensation for losses.

Risk treatment of already distressed slopes includes the four broad types of landslide remediation practices for slope stabilisation, namely: control works, restraint works, slope protection works and mass improvement techniques. Mitigation measures for landslide dams have been given special attention as a large portion of the hazard prone area in the Himalayas is susceptible to the formation of such dams with disastrous possibilities. Protecting heritage structures from landslide damage has also been given due attention.

Monitoring and Forecasting of Landslides

The monitoring and forecasting of landslides, which are two of the least developed fields of landslide management practice will be given special attention as a part of mitigating the risk arising from landslide hazard. Monitoring of landslides includes:

i) Surface measurements of landslide activity.

ii) Sub-surface measurements of landslide activity.

iii) Total regime measurements.

These methods are very useful in comprehending slope movement. However, only real-time monitoring of landslides can pick up minor changes from minute to minute and helps in understanding the dynamic behaviour of a landslide. Real-time monitoring can give a sound technological basis for issuing warning signals.

Another important aspect is the development of early warning systems for landslides. Early warning is a process which involves three components:

i) Scientific and technical communities.

ii) Government authorities and civil agencies.

iii) Local communities.

In addition to the first two, the third one, i.e., involvement of local communities in the process of early warning is crucially important. An aware and vigilant community sensitised to the warning signs of impending landslides is the vital pillar for implementation of an effective early warning system.

Early warning systems also comprise a scientific and technological base, mechanisms of dissemination and transmission of information, and response capability on receipt of warning information. It is imperative to execute a few pilot projects as pace setters of early warning systems which will also promote confidence in their operational capabilities.

Research and Development on Landslides

Landslide studies are a developing field of science. Extensive and intensive research and development activities are required to be taken up by institutions and individual experts to attain the goals set by the Guidelines. A few vitally important topics of research identified are:

i) Standardisation of landslide hazard zonation mapping and site specific studies.

ii) Understanding earthquake induced landslides and the required remedial measures.

iii) Design of surface and sub-surface drainage systems for stabilisation of slopes.

iv) Inst rumentation for geotechnical investigation to conduct a detailed study of landslides.

v) Development of early warning systems.

vi) Facets of landslide dams.

vii) Run out and return period modelling of landslides.

viii) Simulation and modelling of snow avalanches.

ix) Landslides and snow avalanches in relation to global warming and climate change.

Success of research and development efforts will depend on institutionalisation of a system with streamlined procedures for speedy funding of priority/fast track projects. The mechanism for evaluation of project proposals, periodic reviews and final reviews should be an integral part of the system.

Awareness and Preparedness

The issues related to awareness and preparedness are considered to be of crucial importance in both the pre- and post-disaster management processes. Mechanisms will be initiated for creating awareness among various stakeholders including government officials, local communities and non-governmental organisations on a sustained basis in landslide affected regions so that all the stakeholders are empowered by information and knowledge and mentally prepared to face the hazard.

Capacity Building

Capacity building is an important component of the disaster management process and is a field which needs attention. The requirement and importance of introducing appropriate capacity development interventions including capacity upgradation of institutions and organisations, education and training of stakeholders and responders, and proper documentation is included in the Guidelines. The identified institutions/organisations will be entrusted with the development of high-quality education material, textbooks, films, technical documentation, training courses, etc.

Post-disaster emergency response has been considered an integral component of mitigation efforts. The requirement of strengthening emergency response capability in landslide prone areas has been given emphasis. A coordinated response mechanism will involve emergency search and rescue, and relief; maintaining an operational incident command system; nurturing a community level disaster response mechanism; defining the involvement, role and responsibilities of all the stakeholders including the corporate sector; delineating the role of specialised paramilitary rescue teams; structuring emergency logistics; and institutionalising a loss assessment mechanism.

Adherence to Legal-Regulatory Regime

Improving the compliance regime through appropriate regulation and enforcement is vital. State governments/state disaster management authorities of landslide affected areas in consultation with the Ministry of Mines/Geological Survey of India and National Disaster Management Authority will establish the necessary techno-legal and techno-financial mechanisms to address the problem of landslide hazard in their respective states. The existing landslide related codes will be updated by review and suitable modifications. The process has to be initiated for preparation of codes on landslide risk evaluation and detailed geological investigations of landslides. The compliance regime has to be monitored and enforced for establishing model planning for towns and villages, thus ensuring safety in hazardous areas.

Development of State and District Disaster Management Plans

The Guidelines include the preparation of disaster management plans of central ministries and departments, state governments and the nodal agency in tune with the stated aims and objectives. Implementation of the Guidelines at the national level will begin with the preparation of a detailed action plan (involving programmes and activities) by the Ministry of Mines.

The National Plan will lay special emphasis on the most vulnerable groups/communities to enable and empower them to respond and recover from the impact of landslide disasters. The National Executive Committee will coordinate preparation of the national disaster management plan incorporating the disaster management plans prepared by the central ministries/departments and state governments for landslide affected states and districts, which will be approved by the National Disaster Management Authority. The plan will be in consonance with the schedule of activities in the Guidelines designed for effective landslide hazard mitigation in the country. The Ministry of Mines will keep the National Authority apprised of the progress on a regular basis. Similarly, concerned state authorities/departments will develop their state level disaster management plans and dovetail them with the national plan and keep the National Authority informed.

These activities will be initiated by the central ministries, departments and state governments, other stakeholders, and the nodal agency as parallel processes. These will be reviewed and updated by a group of experts/advisory committee to be constituted by the Ministry of Mines/nodal agency in consultation with the National Disaster Management Authority. This high level scientific and technical committee will not only serve as a think tank but also provide continuity in thought and ideas to the national landslide mitigation initiative.

Organisations Associated with Landslide Hazard Management

There is a need to set up a central organisation that will deal exclusively with all the fields of landslide management in a comprehensive manner. The central government through the Ministry of Mines will, therefore, set up a centre for landslide research, studies and management in one of the landslide prone states to ensure a wider view of landslides as a component of the environment and bring the existing pool of expertise in earth sciences (coastal stability, seismology and meteorology included) to bear upon this new initiative.

Financial Allocation for Landslide Hazard Management

The scheme of financial allocations for landslide hazard management has also been delineated. In the Five-Year and Annual Plans, the central and state ministries/departments will make specific allocations for landslide disaster management related activities. In addition 10 per cent of the Calamity Relief Fund will also be made available for the purchase of equipment for landslide preparedness and mitigation, and for rescue and relief operations. Besides these, the National Disaster Management Authority has also proposed to take up a national landslide mitigation project in the Eleventh Five-Year Plan which will aim to comprehensively deal with basic issues of landslide hazard management in the country.

Highlights of Important Recommendations

Although management of landslides requires coordinated and multi-faceted activities among many stakeholders in the total disaster management cycle,

a few of the important recommendations made are listed below:

i) Developing and continuously updating the inventory of landslide incidences affecting the country.

ii) Landslide hazard zonation mapping in macro and meso scales after identification and prioritisation of the areas in consultation with the Border Roads Organisation, state governments and local communities.

iii) Taking up pilot projects in different regions of the country with a view to carry out detailed studies and monitoring of selected landslides to assess their stability status and estimate risk.

iv) Set t ing pace set ter examples for stabilisation of slides and also setting up early warning systems depending on the risk evaluation and cost-benefit ratio.

v) Complete site specific studies of major landslides and plan treatment measures, and encourage state governments to continue these measures.

vi) Setting up of institutional mechanisms for generating awareness and preparedness about landslide hazard among various stakeholders.

vii) Enhancing landslide education, training of professionals and capacity development of organisations working in the field of landslide management.

viii) Capacity development and training to make the response regime more effective.

ix) Development of new codes and guidelines on landslide studies and revision of existing ones.

x) Establishment of an autonomous national centre for landslide research, studies and management

Efficacy in managing landslides and avalanches in the country is expected to improve substantially after all these action points have been addressed on a priority basis with a sense of urgency and duly backed by requisite operational, legal, institutional, and financial support.

Schedule for Completion of Action Points

The time lines proposed for the implementation of various activities in the Guidelines are considered both important and desirable, especially in the case of those non-structural measures for which no clearances are required from central or other agencies. Precise schedules for structural measures will, however, be evolved in the landslide management plans that will follow at the central ministries/state level duly taking into account the availability of financial, technical and managerial resources. In case of compelling circumstances warranting a change, consultation with the National Disaster Management Authority will be undertaken, well in advance, for any adjustment, on a case to case basis.

2.　インドネシアとの研究協力について

2. インドネシア共和国との研究協力について

2.1. 背景

インドネシア共和国との研究協力の覚書締結に至った背景には、「第 18 回アジア所長会議（平成 21 年 11 月 10 日～17 日開催、会議テーマ：地域の実情や課題に応じた独創的な道路政策)」のプレ調査として、インドネシア共和国公共事業省研究総局及び同局の 3 研究機関（道路・橋梁研究所(RDCRB)、社会経済文化地域研究所、居住研究所）を訪問し、研究ニーズ等の調査を行なったことがある。

その際、RDCRB との会合の中で、継続的な研究交流を進めるためには覚書の締結を検討すべきとの提案がなされた。それを受けて国総研は、関係部局との調整の結果、第 18 回アジア所長会議において、RDCRB 所長（Agus Bali Silendra 氏）をお招きし、研究協力の覚書締結に至ったものである。

次ページ以降に、覚書締結について及び共同ワークショップ開催について、並びに共同ワークショップ終了後に行なったアンケート調査の結果についてとりまとめを行なったので報告する。

覚書締結の準備にあたり、国総研はインドネシア共和国を訪問している。下記に訪問に関する目的及び会合内容についての詳細を記載する。(海外出張調書)

海外出張調書

出 張 者 ：国際研究推進室長　寺元博昭
出張件名：国際研究連携推進のための専門家会合
出 張 先 ：インドネシア国　ジャカルタ市、バンドン市
出張期間：平成２１年６月１日～平成２１年６月５日（５日間）

出張の目的：本出張の目的は、インドネシア国公共事業省研究開発総局 Agency for Research and Development, Ministry of Public Works、同道路総局 Directorate of Highways, MPW、同社会経済文化地域役割研究所 R&D Center for Social Economic, Cultural and Community Role, ARD, MPW、同道路橋梁研究所 R&D Center for Road and Bridges, ARD, MPW の研究担当幹部及び実務担当専門家と、両国における国土整備関係の研究に関する現状と課題を共有するとともに、共同研究テーマの発掘に向けた研究ニーズを明らかにすること、研究協力と支援の意志を伝えること、より具体的な国際研究の推進に向けた人的つながりや足がかりを作ることである。

（当日の発表と質疑等）

会合では、国総研が取り組むプロジェクト研究の状況や研究の枠組み（大枠による PDCA）等をプレゼンする一方、インドネシア国からは、研究体制（予算、人員、研究評価、本省と研究所との関係等）について紹介いただいたのち、関連事項等を質疑し、国際研究協力の推進に向けた認識の共有を図った。

今回、研究開発総局長（研究開発庁トップ）の勧めで、当初の行程には入れていなかった居住研究所も訪問した。また本会合に合わせて PPP 手法による Tanjun Priok Access Road の現地視察を行った。個別には下記の通りである。

（１）研究開発総局との会合（会合の様子　写真-1、2）

対応相手：研究開発総局長（研究開発庁トップ）、社会経済文化地域役割研究所長、道路・橋梁研究所国際担当官ほか

- Ir. Hendrianto Notosoegondo, Director General, ARD, MPW 公共事業省研究開発総局長
- Drs. Pradino, Director, R&D Center for Social Economic, Cultural and Community Role, ARD, MPW　社会経済文化地域役割研究所長　他

・本会合は公共事業省研究開発総局会議室で実施された、各研究所との会合に先立つ全体会議である。
・研究体制；公共事業省の研究体制は、全体の方針、予算付け等を研究開発総局が総括し

ているが、実質的な研究は４つの研究所で担っているとのことである。技術的な規制は個々の州が行っていて、研究開発総局は SGM（Standard, Guideline, Manual）を通して技術指導を行っている。また州では技術開発も困難であり国が行っている。

・予算と人員；H21 年度研究予算は 300billion ルピア（約 30 億円）であり、国総研予算の３分の１程度の規模。人員は研究官が 200 名、行政官が 500 名で計、700 名。国総研は研究官が 252 名、行政官が 119 名であり、これに比して、研究補助を外注するわけではないので行政官が多くなっているとのことである。

・会合の結果、JICA プロジェクトの伸びが期待できない中、研究領域での協力関係の構築、課題、人的交流の重要性について、認識を共有できた。

・研究総局のトップである総局長と情報交換、認識の共有を得られたことは大きな成果（現在の総局長ヘンドリアント氏は、道路総局長を長年務めた人物で、大臣に昇格（公共事業大臣は、伝統的に、５つある総局長の中から選ばれたテクノクラートが努めている）する可能性もある大物）である。

・人的交流の促進；当方が研究所の窓口（AccessPoint）として調整するので、日本学術振興会（Japan Society for the Promotion of Science(JSPS)）等の制度を利用して、積極的に研究者の派遣をいただきたい旨を伝えた。

・技術的な課題；基準作成に関しては、インドネシアは大きな多様性の中にある国であるので、力学的な共通基盤以外は、地域の特性（構築物の形状や素材など）について極力反映させようとしていること、日本が取り組む柔軟な道路構造基準に大きな興味があるとのことであった。本年のアジア地域研究所長など会議のテーマでもこの規範性と柔軟性を両立させる基準のあり方等についてテーマに入れていること等を伝えた。

写真-1

写真-2

※　写真-1：研究開発総局との会合、筆者右側、奥に研究開発総局長

※　写真-2：研究開発総局長 Hendrianto 氏と寺元国際研究推進室長

<u>（２）道路総局との会合</u>

対応相手：道路総局長、道路技術課長、道路ファイナンス担当課長

- Dr. Ir. A. Hermanto, Director General, DGH, MPW　公共事業省道路総局長
- Ir. Danis H. Sumadilaga, Director of Technical Affairs, DGH, MPW 公共事業省道路

総局技術課長
- Ir. Nur Fizili Kifli, MT. Financial Affairs, DGH, MPW 公共事業省道路総局総務財政担当　他
・本会合は道路行政関係の研究プライオリティについて、道路総局長、技術課長ほかと議論したものである。
・その結果、アセットマネジメント、Toll･Road、調達契約関係に優先度を高くおいて行きたい旨、先方のニーズを把握できた。
・アセットマネジメントについては概念がわかりにくいので困っていること
・Toll･Road については、約 700km の運用状況であるが、日本の取り組み、特にプール制の仕組み（先行した路線の益を後発に回したいという意向を持っているとのこと）や料金と交通管理の関係について日本の先進事例を学びたいとのことであった。日本の民営化のスキームと平日・休日料金社会実験の状況等について概要も説明し、今後とも喜んで協力する旨伝えた。
・調達契約については、インドネシアと日本とで商習慣が異なるので比較は難しいが技術と経営の両面から関連企業を評価する日本の取り組み等を紹介できる旨伝えた。
・研究総局長、道路総局長以下、大変歓迎いただいた。本会合の結果、研究領域でのネットワークを先方も望んでいることがわかった。

（３）社会経済文化地域役割研究所との会合（写真-3、4）
対応相手：社会経済文化地域役割研究所長、国際担当窓口課長ほか
- Drs. Pradino, Director, R&D Center for Social Economic, Cultural and Community Role, ARD, MPW　社会経済文化地域役割研究所長　他
・本研究所は設立から９年しかたっておらず４つの研究所ではもっとも新しい組織で、日本にはストレートに対応できる研究センターはない。
・名称や役割については日本の組織としても時代の先を行っている感じがしてとても挑戦的ですばらしい。
・研究ニーズとしては、用地の円滑な取得に向けた仕組みやプロジェクトの経済的、社会的影響の把握、事業への住民の参加（Involve）やインフラ施設の地域への多様性を踏まえた定着、地球環境関係では植林などに地域とともに積極的に取り組んでいる。
・会合の結果、Public Acceptance 関係の研究というくくりで国総研の活動との接点があると思われる。また、以下の認識を共有した。
○Public Acceptance を得るためにプロジェクトの社会的、経済的インパクトを調査する必要があること
○それらをプロジェクトの前後で行うこと
○Negative な情報や影響も公開することで透明性を確保し、バランスの取れた、信頼性の高い合意が得られること
○関係者のコミュニケーション能力を高めることが重要であること
○インドネシアと日本とは社会の多様性のレベルが異なるが、法的な手続き等は比較し、応用できる部分もあると考えられること

・直接対応した組織は日本にはないが、まず当方にアクセスしてもらえれば適宜、適切なセクターにつないでいくことや、研究者の交流に必要な調整も積極的に行っていきたい旨伝えた

写真-3

写真-4

※　写真-3：社会経済文化地域役割研究所での会合

奥左がPradino所長、奥右が寺元国際研究推進室長

※　写真-4：Pradino所長と寺元国際研究推進室長

（4）道路・橋梁研究所との会合（写真-5、6）

対応相手：道路・橋梁研究所長、国際課長ほか

- Ir. Agus Bari Sailendra, Director, R&D Center for Road and Bridges, ARD, MPW　道路・橋梁研究所長

- Ir. GW SAMSI GUNARTA, Chief of Division, Programming & International Collaboration, R&D Center for Road and Bridges, ARD, MPW　道路・橋梁研究所,計画・国際担当課長　他

- Dra. IPAH SARIPAH, MA, Head of Sub Division of Cooperation Depertment, R&D Center for Road and Bridges, ARD, MPW　道路・橋梁研究所、協力部副課・課長　他

・本会合は、研究開発総局との全体会議を受けた、道路関係の研究所との研究協力に関する会合である。

・先方より研究テーマについて紹介いただき、道路総局と同様、アセットマネジメント関係に大きな関心があることがわかった。

・また先方より、是非、MOU（研究協力に関する総括的な覚書）を結んで研究力を進めていきたい旨、提案があった。当方より、これまでインドネシアと日本とはJICAを通したやや一方的な関係であったが、インドネシアの整備状況も進んできており、今後は更に一方進んだ関係になっていくべき旨を伝え、先方研究所長より、同様の認識を持っていること、人的な交流が重要であるとの発言があった。

・本日の会合を契機として、国際担当を窓口に、更に具体に研究協力について検討していくことを確認した。

写真-5

写真-6

※　写真-5：道路・橋梁研究所での会合、奥左が Agus 所長、奥右が寺元国際研究推進室長
※　写真-6：Agus 所長と寺元国際研究推進室長（記念の公共事業省モニュメントを贈呈いただいた）

（参考）居住研究所の視察

対応相手：居住研究所所長ほか

- Dr. Ir. ANITA FIRMANTI, MT, Director, R&D Center for Settlement, ARD, MPW　居住研究所長ほか

・研究開発総局との会合において、多様性と研究開発との調和などの議論の中で、総局長のヘンドリアント氏より、是非、居住研究所も視察いただきたい旨の話があり、急遽、同研究所を視察し、実験施設や研究方針などの説明を受けた。

・研究開発総局の下部組織であるが、他の研究所同様、本省の担当局との一体的な活動を行っていること、具体には空間総局の領域の研究も行っている。

（５）Tanjun Priok Access Road の現地視察（写真-7、8、9、10）

ジャカルタの環状道路の整備をＰＰＰで進める上記のプロジェクトを視察した。インドネシアは 1978 年に最初の有料道路が整備され、現在約 700ｋｍの高速道路をもつが、採算の問題等から、本プロジェクトは初めて、ヨウカン切りで公共事業が一部入っていること、またその区間も含めて管理をコンセッションで行うことなどが特徴的である。

労務単価は、日本円で１日約 100 円程度とのこと。ちなみに中央省庁課長は月額約２万円（ただし、種々の手当等で２倍程度になるとのこと）。視察の最中に写真のとおり、後方の確認不足で場内の看板が大破（写真-7、8）。インドネシアの工程管理、安全面などの難しさを目の当たりにした。

ジャワ島は、いわゆるラダー構造で高速ネットを計画しており、開発の進む北側海岸（日本で云えば、太平洋側？）の高速道路整備を進めたいとの意向で、そのためにもプール制のような先発の高速の益を吸収するファンドを立ち上げたいとのことであった（財務当局と公共事業省の間での綱引きがあるとのこと）。

写真-7

写真-8

写真-9

写真-10

TANJUNG PRIOK ACCESS ROAD

The Tanjung Priok Access Road (**TgPA**) will provide direct access to/from the Tanjung Priok International Port which is 24th ranking of container handling volume in the world. It is a part of JABODETABEK toll road network connected to JORR (Jakarta Outer Ring Road) and its radial toll roads.

(TgPA and Toll Road Network in JABODETABEK)

TgPA is going to be constructed along the existing arterial roads (i.e. Jl. Cakung-Cilincing-Jl. Jampea, Jl. Laks RE Martadinata, Jl. Yos Sudarso) which are sole existing access roads of the Tanjung Priok International Port to/from eastern, western and southern region. Currently serious traffic jam is frequently observed due to massive traffic demand and obstructing logistic activities of the port.

(Traffic Jam along Jl. Jampea)

FUNCTION OF TgPA

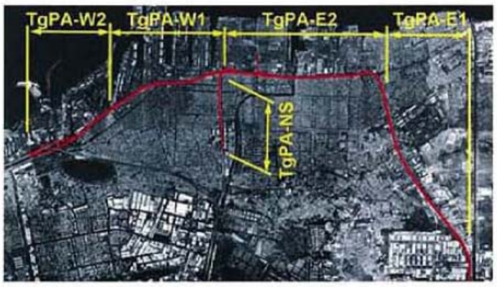
TgPA is expected to contribute the following essential functions.

- to avoid serious traffic congestion, thereby contributing to sustainable urban activities;
- to supplement the function of radial toll roads, and the Cengkareng Access;
- to enhance physical distribution originating from Tanjung Priok International Port; and
- to support land use improvement in the JABOTABEK area.

CONTRACT PACKAGE OF TgPA

TgPA consist of 5 sections.

E-1	**Rorotan - Cilincing (3.4 km)**
E-2	Cilincing - Jampea (4.2 km)
W-1	Jampea - Kampung Bahari (2.8 km)
W-2	Kampung Bahari - Harbor Toll Road (2.9 km)
NS	Jampea – Kubong Bawang (1.7 km)



(Contract Package of TgPA)

THE PROJECT SECTION E-1 : ROROTAN - CILINCING

Section E-1 is the first section to start the construction.

Location	: Rorotan - Cilincing
Length	: 3.4 km At-grade Section (Pile Slab Structure) : 2.1 km Elevated Section (2 nos of flyovers) : 1.3 km
Cross Section	: 6 lanes (3.5 m @ 6 lanes) carriageway Outer Shoulder Width : 2.5 m Inner Shoulder Width : 0.5 m
Interchanges	: Half Diamond Type IC (Semper IC)

写真−11

※　写真−7：Tanjun Priok Access Road の工事（群杭の施工）の状況

※　写真−8：視察中に場内の移動で看板を大破の様子

※　写真−9：土質はラテライト

※　写真−10：作業員８人ごと１人（黄色のヘルメット）の世話役

国内では考えられないが写真左側の崩れを木柱のみで仮止め

※　写真−11：Tanjun Priok Access Road　プロジェクト全体概要

※　道路交通関係データ（会合での聞き取り等）

①Toll･Road の延長

・Operation 688km(内、Jasa Marga 529km、Private Sector 158km)

・Concession Agreement Signed　802km

・Concession Agreement Preparation 169km

・Tender Preparation 475km

②Toll･Road の料金　５円～７円/km 程度

③Toll･Road の建設コスト

850Rp.B(10 億円/km 程度)

④自動車保有台数　約 750 万台

内、半数がジャカルタでの保有、この他にバイク約 2,500 万台

⑤交通事故死者数　１２千人、２４千人、３６千人の３つの数字

（２４千名は保険会社のクレームデータであり３６千人が実際？）

（その他）

今回、ジャカルタ市から研究所のあるバンドン市まで、大使館に車の手配の便宜供与を受けることができたのは幸いであった。この間の高速道路は 2005 年に約１年の突貫工事で行ったとのことで、まだ５年弱しか経過していないにもかかわらず、舗装の状態は極めて悪く、日本で云えば、舗装の悪い県道を 120ｋｍ程度で走行するような感じであった。雨期にもかかわらず工事を強行したため、各所で Slide が発生したとのことであった。橋梁横断部も衝撃が激しく、踏みかけ板が入っていない？場合もあるようであった。

またジャカルタ市内の道路交通状況で特徴的なのは、多くの交差点が右折禁止になっていることがある。ただ、左折してＵターンしている車も見られたので、右折車線をつくるなどのオーソドックスな対策の方が無用の台キロの発生を抑制できるようにも感じた。交通マナーはまだまだであり、Hard-Shoulder（路肩）を平気で走行している、というより、１車線と認識しているに近く、ジャカルタ・バンドン間の 140km の間に、３台も路肩から転倒している車がいたのには驚いた。ジャカルタ市内も同様。当方が赴任経験のあるイングランド(英国道路庁 HA)では Active Management と称して、渋滞時に正式に Hard-Shoulder を通行させているが、こちらの場合は違法。

事前に英字新聞の記事で、Jockey という職業？が発生しているとの記事を読んでいたので、注意深く、車中から見ていると、赤ちゃんを抱いた母親らしき人が２本の指を立てて、ヒッチハイクのような仕草をしているのを発見した。道路・橋梁研究所で聞くとやはり、それは Jockey とのことで、ビジネスタイムに市内に入る車両は３人載らなければ追加料金となるとのことであった。

以上、現地でないと発見できないこと、感じ取れないことも含め、今回の会合は極めて有意義であった。研究開発総局長、道路総局長、各研究所長とも直接情報交換できたことや、彼ら関係者が新たな関係つくりに前向きなことを確認できたことは今後の国際研究の推進にとって大きな成果となった。今回、予想を大きく上回る対応をしていただけたのは、対等な立場で協力関係を作り上げていきたいという、こちらからの提案が今回初めてのことであったこととも無縁ではないと思われる。支援する側、される側を超えた関係づくりこそ、アジア各国との間で進められるべきとの感を強くした。

（以下、当日資料の抜粋）

Mission of This Meeting;

1. About us;

NILIM – National Institute of land and Infrastructure Management, a technical branch of the Ministry of Land, Infrastructure, Transport and Tourism in Japan

2. Mission of this meeting;

1) Pre-research for the 18th Asian Conference of Public Works Research and Development – Roads and Vital regions (draft theme), which will be held in Japan this autumn under the collaboration between Japan International and Corporation Agency(JICA) and NILIM, in order to be as fruitful as possible.

2) Find out the actual needs for the roads of Indonesia in the scope of international research cooperation between Japan and Indonesia.

3. When the needs for research cooperation in respect of the roads are identified, we will try to consider the possibility of the research cooperation and technical information exchanges between the related research organization in Indonesia and us.

(Meeting contents)

i) Presentation from NILIM (Research scheme, Budget, Evaluation system….)

ii) Answer/Presentation from Indonesia

iii) Questions & Discussions

(AppendixⅠ) Questionnaire for Research and Development Agency, Director General of Highway, Research and Develop Center for Roads and Bridge, and Socio-Economic-Culture & Public’s Center　　（中略）

(AppendixⅡ) Questionnaire for Director General of Highway, Research and Develop Center for Roads and Bridge, regarding to the Priority of co-research between NILIM and Related Research Centre in INDONESIA　　（中略）

Contents of This Meeting;

1. Presentation from Japanese side (NILIM)　　(about 20 minutes)

- Mission, Budget, Human-resources, Organization in NILIM
- Strategic Project Research and Evaluation-system in NILIM
- International Research Cooperation in NILIM

2. Presentation from Indonesia /Answer to the Questionnaire

- Answer referencing to Appendix I and/or Appendix II
- Others

3. Question and Discussion

ADDRESS

Directorate General of Highways

Jl. Pattimura No. 20

Kebayoran Baru

South Jakarta 12110、Tel: +62 21 7279 7849

Agency for Research and Development

Jl. Pattimura No. 20

Kebayoran Baru

South Jakarta 12110、Tel: +62 21 724 5083

Research and Development Center for Social Culture, Economic, and Community Participation

Jl. Sapta Taruna Raya No.26

Ministry of Public Works Complex

Pasar Minggu

South Jakarta 12310、Tel: +62 21 751 1081

Research and Development Center for Road and Bridges

Jl. A.H. Nasution No. 264

Bandung 40294

West Java、Tel: +62 22 780 2251

Research Institute for Human Settlments

Jln. Panyaungan Cileunyi Wetan Kab.

Bandung 40393

West Java、Tel: +62 22 779 8393

Mission of This Meeting;

1.About us;

NILIM - National Institute of land and Infrastructure Management, a technical branch of the Ministry of Land, Infrastructure, Transport and Tourism in Japan

2.Mission of this meeting;

1) Pre-research for the 18th Asian Conference of Public Works Research and Development – Roads and Vital regions (draft theme), which will be held in Japan this autumn under the collaboration between Japan International and Corporation Agency(JICA) and NILIM, in order to be as fruitful as possible.
2) Find out the actual needs for the roads of Indonesia in the scope of international research cooperation between Japan and Indonesia.

3.When the needs for research cooperation in respect of the roads are identified, we will try to consider the possibility of the research cooperation and technical information exchanges between the related research organization in Indonesia and us.

(Meeting contents)

i) Presentation from NILIM (Research scheme, Budget, Evaluation system….)
ii) Answer/Presentation from Indonesia
iii) Questions & Discussions

(Appendix Ⅰ) Questionnaire for Research and Development Agency, Director General of Highway, Research and Develop Center for Roads and Bridge, and Socio-Economic-Culture & Public's Center

(Appendix Ⅱ) Questionnaire for Director General of Highway, Research and Develop Center for Roads and Bridge, regarding to the Priority of co-research between NILIM and Related Research Centre in INDONESIA

Contents of This Meeting;

1. Presentation from Japanese side (NILIM) (about 20 minutes)

    ･Mission, Budget, Human-resources, Organization in NILIM
    ･Strategic Project Research and Evaluation-system in NILIM
    ･International Research Cooperation in NILIM

2. Presentation from Indonesia /Answer to the Questionnaire

    ･Answer referencing to Appendix Ⅰ and/or Appendix Ⅱ
    ･Others

3. Question and Discussion

＜Appendix Ⅰ＞

Questionnaire

Objective of this pre-research for “the meeting”;

The objective of this study is to collect the information on the research management of the related research institutes in INDONESIA , with a view to clarifying the overall research direction of the institute, the grand challenge of the research project to which the institute as a whole address, and the individual research themes as to how they manage, plan, implement them and how they publish the results. This survey is consisted of the following:

1. Organization, staffing, and funding of the research institute
2. Research management system
3. Individual research management cases
   (research needs, Plan-Do-See-Check cycle, result…)

1. Organization, staffing, and funding of the research institute

Ⅰ. Staffing and employment

- Please describe the procedures for staff employment.
- Please indicate whether or not there is staff exchange with Universities and other research institutes.

Ⅱ. Management and allocation of research budget and its criteria

- Please describe the procedures and criteria for allocating research budget to each research unit, research theme, or researcher.
- Please explain how the allocated budget is used (proportion of labor cost, in-house facility improvement cost, and outsourcing cost, etc.).

Ⅲ. Establishment and dissolution of the research unit (laboratory, team...)

- Please indicate whether establishment of the research unit comes first and then the research follows, or the research theme comes first and then establishment (and eventual dissolution) of the research unit follows.

Ⅳ. Performance assessment of researchers

- Please indicate whether or not performance assessment of researchers is implemented.

- If implemented, please describe the criteria and weighting factor of the assessment.

2. Research management system

Ⅰ. Determination of the overall research policy

- Please describe the procedures to determine the overall research policy of the institute and whether or not there is any involvement of an advisory committee or alike.
- Please describe the procedures to prepare a strategic plan etc. which explains the overall research policy.

Ⅱ. Determination of the research themes (i.e. planning method)

- Please describe the procedures to identify research needs and to determine research themes; for instance, whether or not researchers opinions and/or requests from superior institutes are taken into consideration, or if the public is consulted.

Ⅲ. Methods to evaluate and publicize the research results

- Please describe the procedures to evaluate the research results.
- Please describe the procedures to publicize and disseminate the research results.
- Please indicate how much effect is gained by the publication and whether or not assessment of such effect is implemented.

3. Individual research management cases

Ⅰ. Flow of procedures of an actual research project

- By way of example, please describe an actual research project along the course from planning to research reporting.

Reference materials related to above matters would be appreciated. If possible, please give a description of the system with its advantages and disadvantages, current issues and so on.

<Appendix Ⅱ>

Questionnaire

Objective of this sheet for "the meeting";

The objective of this sheet is to collect the information on the priority for co-research needs in the area of roads and related administrations in INDONESIA.

With a view to clarifying the overall research needs, it should be delivered to try to research the possibility of co-research between NILIM and the related Research Centre in INDONESIA gov. , for example ,at the opportunity of the 18^{th} Asian Conference for Public works research and development which will be held in JAPAN this autumn under the cooperation between NILIM and JICA.

Which sort of needs bellows do you have a highest priority in the area of roads and related administrations in your country?

Q1. Please check top-three priorities；

(1) Actual New Public Management for roads administrations
(2) New services in the field of toll roads and traffic information
(3) Cost-reduction methods in roads construction and related procurement
(4) Global warning challenge in roads and networks
(5) Roads Planning to improve the town amenity
(6) Asset management technology for roads
(7) Flexible technical standards for best roads in each region
(8) Prevention and mitigation for natural disasters in roads
(9) Others

Q2. Why did you select them for the top-three priorities in Q1 ?

Reasons;

（ ）

2.2.　研究協力の覚書締結について

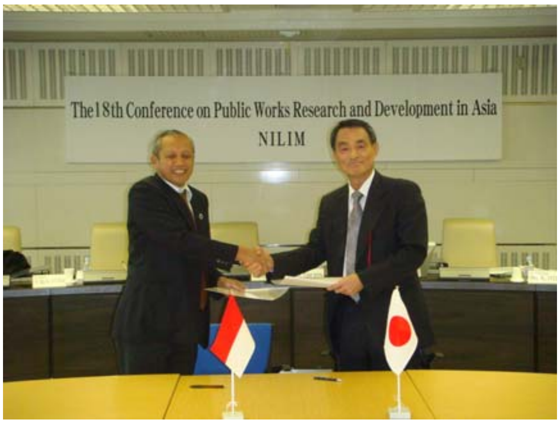
RDCRB との覚書の締結は第 18 回アジア所長会議開催時に行なった。本会議には RDCRB 所長の Agus Bali SAILENDRA 氏が参加して、西川所長とともに覚書に調印を行なった。

覚書の記者発表資料及びの全文を掲載する。

2.2.1.　覚書締結の内容について（記者発表資料）

国土技術政策総合研究所とインドネシア国公共事業省道路・橋梁研究所の
研究協力に関する覚書の締結について

国土交通省国土技術政策総合研究所（以下、NILIM という。）は、11 月 10 日から 13 日にかけて開催した「第 18 回アジア地域国土整備関係研究所長等会議」において、インドネシア国公共事業省道路・橋梁研究所(Research and Development Center for Roads and Bridges, Research and Development Agency, Ministry of Public Works, Indonesia)（以下、RDCRB という。）との研究協力に関する覚書を締結しました。



覚書締結式の写真

＜覚書締結の概要＞

締結日：平成 21 年 11 月 11 日（水）
場　所：国土交通省国土技術政策総合研究所
署名者：国土交通省国土技術政策総合研究所
　　所長　　西川　和廣
　公共事業省道路・橋梁研究所
　　所長　　Agus Bari SAILENDRA

＜研究協力の目的＞

（１）RDCRB と NILIM の研究協力関係の促進及び保持
（２）道路の制度システム、建設、維持運営の分野における情報交換の実施及び促進

＜交流活動の実施＞

（１）会議、出版物等を通じた技術情報の交換
（２）RDCRB と NILIM の職員の可能な範囲での研修交流等

＜本覚書の意義と今後の展開について＞

近年、アジア各国においては、効率的な物流の確立、都市における道路建設と環境の調和が必要とされています。また、道路や橋梁の建設及び維持管理に関する新たな取り組みも進みつつあり、このような諸システムについての最近の状況について国際的に情報交換を行うことは大変有益なことです。

そこで RDCRB と NILIM は、「第 18 回アジア地域国土整備関係研究所長等会議」においてこれらの課題について幅広く議論を行い、今後の相互利益のために引き続き討議し緊密な関係を保つことで一致したものです。

今後は、本覚書の締結に基づき、当所とアジア地域との連携強化や国際的な人的ネットワーク形成の観点から、共同で技術セミナーを開催するなど両研究所の継続的な研究情報の交換や研究者の交流等を積極的に行い、アジア地域の成長を技術面からサポートしていく予定です。

2.2.2. 覚書（サイン入り）

Memorandum
Concerning the Cooperation Activities

Between

Research and Development Center for Roads and Bridges, Research and Development Agency, Ministry of Public Works, Indonesia

And

National Institute of Land and Infrastructure Management, Ministry of Land, Infrastructure, Transport and Tourism, Japan

Road networks are indispensable to the national economies and the wealthy life of the people. Currently, in each country of Asia, the establishment of the efficient physical distribution and the harmonization between road investment and environment in the city are needed, and in addition, new schemes for construction and maintenance of roads and bridges are being introduced, so that it is very beneficial to exchange the current knowledge of such systems internationally.

Research and Development Center for Roads and Bridges, Ministry of public Works, Indonesia (hereinafter referred to as "RDCRB") and National Institute of Land and Infrastructure Management, Ministry of land, Infrastructure, Transport and Tourism, Japan (hereinafter referred to as "NILIM") have discussed a wide range of these roads issues at the 18th Conference on Public Works Research and Development in Asia and decided as follows to have further talks and contacts for mutual benefits.

1. Objective of the cooperation activities:
(1) To promote and maintain close relationship between RDCRB and NILIM; and
(2) To carry out and facilitate exchange of information in the field of road institutional system, construction, operations and maintenance.

2. Exchange activities:
Exchange activities will be carried out by a number of means, including
(1) Exchange of technical information through meetings, publications etc; and
(2) Exchange of trainees from among the staff members of RDCRB and NILIM according to availability.

3. Methods of implementation:
Most appropriate methods for implementing the above activities will be developed as decided between RDCRB and NILIM and will be carried out in accordance with their respective national laws and regulations.

The cooperation under this Memorandom may be modified by mutual consent, and may be terminated at any time by either side with a simple written notice to the other side.

4. Contact points:

The contact points for the implementation of this Memorandum will be the Programming and Institutional Collaboration Division of RDCRB, and the International Research Division of NILIM.

Sighed in TSUKUBA on November 11, 2009 by

(Signature)	(Signature)
Agus Bari Sailendra	Kazuhiro Nishikawa
Director Research and Development Center for roads and Bridges, Research and Development Agency, Ministry of Public Works, Indonesia	Director general National Institute of Land and Infrastructure Management, Ministry of Land, Infrastructure, Transport and Tourism, Japan

2.3. 第１回ワークショップの開催について

第１回共同ワークショップは平成 22 年 3 月 1 日～3 日まで RDCRB 所内（バンドン市内）において開催された。

2.3.1.　プログラム

JOINT WORKSHOP (IRE and NILIM&PWRI) AGENDA
Bandung-Indonesia, February 28 to March 4, 2010

01 March 2010

09.00 – 12.00	Courtesy Call to DG of The Agency for Research and Development and DG of Highways. RSVP: Mulya (+62 818 135 1390)
16.00	Arrive at Hotel Novotel, Jl. Cihampelas Bandung
19.00 – 21.00	Dinner with Head of RDCRB (IRE) and selected Staff (Hosted by IRE); Location: Sindang Reret Restaurant, Jalan Surapati 35 Bandung; RSVP: Hindun Hasanah (+62 817 929 0002)

02 March 2010 Roads and Bridges Workshop

Opening Ceremony

08.30 – 09.00	Registration
09.00 – 09.15	Welcoming Address by DG The Agency for Research and Development MPW (DR. Ir. Moch. Amron,MSc)
09.15 – 09.30	Opening Speech by Vice Ministry of Public Works (DR. Ir. Hermanto Dardak, MSc)
09.30 – 09.45	Message from DG of NILIM on behalf of Japanese side
09.45 – 09.50	Souvenier Exchanges between -IRE and NILIM -IRE and PWRI

Presentation (General Session)

09.50 – 10.05	Research Strategy of NILIM and PWRI including International Collaboration for Infrastructure Policy and Technology in Asia (Mr. Akira TERAKAWA, Executive Director of NILIM)
10.05 – 10.20	The Direction of Highways and Transportation Research of Indonesia (Ir. Agus Bari Sailendra, M. Sc, Director of IRE)
10.20 – 10.30	Q&A Discussions

10.30 – 10.45 Coffee Break

Presentation	**(Technical Session)**
Section I	**Pavement (Room A);**
Moderator:	**DR. Ir. Sjahdanulirwan, M. Sc-IRE**
10.45 – 11.05	Pavement Strategy in Japan(Mr. Kubo, MSc – PWRI)
11.05 – 11.25	Indonesian Pavement Research Strategy (DR. Ir. Furqon Affandi, M. Sc-IRE)
11.25 – 11.45	Pavement Condition on Post Disaster (Ir. Nyoman Suaryana, M. Sc-IRE)
11.45 – 12.05	Utilisation of Buton Natural Asphalt, Problem and Solution (Ir. Nono Sunaryono, M. EngSc / Ir. Kurniadjie, M.Sc-IRE)

Section II	**Disaster and Bridges (Room E);**
Moderator:	**DR. Ir. Maulidya I Junica, M. Sc-IRE**
Presentation	
10.45 – 11.05	Prioritization of Bridge – Works in Network (Mr. Nakao,MSc – NILIM)
11.05 – 11.25	Seismic Design and Seismic Retrofit for Highway Bridges in Japan (Dr. Zhang -PWRI)
11.25 – 11.45	Report on Bridges Infrastructure Investigation on Post Disaster (Nandang Syamsudin-IRE)
11.45 – 12.05	The Need and Development for Bridges Srengthening Technology in Indonesia (Redrik Irawan-IRE)

Section III	**Traffic and Technology (Room C);**
Moderator:	**DR. Ir. Hikmat Iskandar, M. Sc**
Presentation	
10.45 – 11.05	Local ITS Strategy (Mr. Hamada, M. Sc – NILIM)
11.05 – 11.25	Maintenance System of Toll-roads including against Overload (Dr. Konishi)
11.25 – 11.45	Strategy on ITS Development in Indonesia (Ir. Pantja Dharma Oetojo, M. Appl. Sc-IRE)
11.45 – 12.05	The Policy and Evaluation of Electronic Toll Collection System Application in Indonesia (DR. Ir. Rudy Hermawan Karsaman, M. Sc-Indonesia Tollroad Authority; ITA)

12.05 – 13.00 Lunch Break

Discussion

13.00 – 15.30	Section I/Pavement (Room A) Section II/Bridges (Room E) Section III/Traffic (Room C)

15.30 – 15.45 **Coffee Break**

Plenary

15.45 – 16.00	**Conclusion and Recommendation (Room A)**
Moderator	Ir. IGW Samsi Gunarta, M.Appl. Sc, Head of Division / Program and Cooperation-IRE Mr. Hiroaki Teramoto, M Sc, Divisional Director / International Affairs and Promotion-NILIM
16.00 – 16.15	Closing by Ir. Agus bari Silendra, Director of RDCRB (IRE).
19.00 –	Dinner hosted by NILIM/PWRI at the Valley Restaurant, Jalan Pakar Timur no 28, Dago-pakar, attended by NILIM-PWRI delegations, VIP of ARD, IRE/ITA presents, moderators, and contact person for Research Collaboration (estimated 17 people)

03 March 2010 Wrap Up Meeting and Program Development

09.00 – 11.00	Meeting on Joint Research Program Development; the program will be compiled on the basis of workshops recommendation (Pavement/Bridge/Traffic&Technology)

(Members of Japan side)

Mr.Terakawa,MSc
(Execuctive Director for research affairs, No2 of Civil Engineering of NILIM)

Mr.Teramoto,MSc
(Divisional Director of International Affairs and Promotion,NILIM)

Mr.Matsushita
(Researcher of Evaluation Division,NILIM)

Mr.Hamada,MSc
(Research Coodinater of Advanced Information Technology,NILIM)

Mr.Nakao,MSc
(Seneir Researcher of Earthquake prevention Divission,NILIM)

Dr.Zhang
(Rsearcher of Bridge and Structure Technology Research Group,PWRI)

Mr.Kubo,MSc
(Leader of Pavement Team,PWRI)

Dr.Konishi
(Head of Technology and Development for Steel Strucure,Technology Center of Metropolitan Expressway)

2.3.2. 所長の挨拶文

開催当日、寺川研究総務官が代読を行なった。

1 March 2010

NILIM

OPENING MESSAGE for JOINT-WORKSHOP at BANDUNG
Held by DRCRB in Indonesia and NILIM&PWRI in JAPAN

To Ladies and Gentlemen, and Excellencies.

It is our great honor to have "JOINT-WORKSHOP" today with IRE(DRCRB).

As well known internationally, there is the best cooperation being between Indonesia and Japan both in economy and foreign affairs including industrial technology. Therefore in line with this stream there should be added by us, a new step for promotion of research collaboration sphere, which I believe is really strategic to the ability of improving infrastructure to vitalize the economy, as well as to mitigate and prevent natural disasters, as you think being essential to mutual benefits and welfare of the two countries. And I am sure, beside with Japanese economy, that is really true to Indonesia where is emerging rapid growth of its economy as a great leader of South-East Asia.

Today's workshop is themed with road networks and bridges, and related technology and systems. I am convinced Japan has lots of experience and technology in this field accumulated all through the miracle era of growth in Japanese economy between 1960's to 70's, and also until present stage. We are very willing to share the needed information and lessons with you great Indonesia and relating researchers, to the extent that you make most use of them with the harmonization of conservation of nature and heritages, and with growing economy.

I am sending today our special delegation, a head of which I ask Executive Director of NILIM, Mr.TERAKAWA and Mr.TERAMOTO for this international new challenge, and Mr.HAMADA, research coordinator for local ITS, Mr.NAKAO for Prioritization of Bridge Investments, and Mr.MATSUSHITA for Research Strategy. And Public Work Research Institute as you know our sister institute, is a Co-host organization of this workshop, from which Dr.Zhang will provide Seismic Proof Technology and Mr. KUBO ,Pavement Strategy in Japan. In addition, we send Dr.KONISHI for Bridge Maintenance Reality of Metropolitan Expressway TOKYO, as I guess Indonesia will need much of Expressway networks provided in its future, and to tackle matters due to the overloads issues and deteriorations in your networks.

Finally I would like to imform, this opportunity has been successfully facilitated by Director Ir. Mr.AGUS of IRE, who agreed Memorandum of Research Cooperation with us NILIM last year in TSUKUBA, Japan. Many thanks to Mr.AGUS, there is to be held today's JOINT-WORKSHOP and in accordance with this recognition, to make Memorandum go into its actions actually. So I hope, this challenge will provide lots of useful information and productive knowledge for all participants getting with this opportunity and will be also spread to the next steps in the near future.

Again I say many thanks to all participants and with my apology not being there today. Thank you for your kind attention.

Truly yours,

K. Nishikawa

Kazuhiro NISHIKAWA
Director General
National Institute of Land and Infrastructure Management
Ministry of Land, Infrastructure, Transport and Tourism in Japan.

2.3.3.　記者発表資料

資料配付の場所 １．国土交通記者会 ２．国土交通省建設専門紙記者会 ３．国土交通省交通運輸記者会 ４．筑波研究学園都市記者会 平成２２年２月２５日　同時配付

NILIM
National Institute for Land and Infrastructure Management

PUSJATAN

平 成 22年 2月 25日
国土交通省国土技術政策総合研究所
独 立 行 政 法 人 土 木 研 究 所

インドネシア公共事業省道路橋梁研究所との共同ワークショップ開催について

国土技術政策総合研究所及び土木研究所は、平成 22 年 3 月 1 日から 3 月 3 日までの 3 日間の日程で、インドネシア公共事業省道路橋梁研究所と道路及び橋梁に関する共同ワークショップを開催することとなりましたので、お知らせします。

≪開催の経緯と概要≫

国土技術政策総合研究所は、昨年１１月につくばで開催した「アジア地域国土整備関係研究所長等会議」において、インドネシア公共事業省道路橋梁研究所との間で道路や橋梁の建設及び維持管理の新たな取組等に関する研究協力の覚書を締結しました。

この度、この覚書に基づく活動の一環として、国土技術政策総合研究所及び土木研究所では、インドネシア公共事業省道路橋梁研究所と下記のとおり共同ワークショップを開催することとなりました。この共同ワークショップでは、舗装関係・橋梁関係・道路交通関係のセッションに分かれて，それぞれの研究所からの研究発表と討議等を行います。

記

1.　開 催 日:　平成 22 年 3 月 1 日（月）～3 日（水）
2.　場　　所:　インドネシア国バンドン市
3.　内　　容:　セッションⅠ　舗装関係（日本とインドネシア両国の舗装戦略等）
セッションⅡ　橋梁関係（耐震基準と補強、保全戦略その他の対応策）
セッションⅢ　道路交通関係（地方におけるITS等）

資料配付の場所
１．国土交通記者会
２．国土交通省建設専門紙記者会
３．国土交通省交通運輸記者会
４．筑波研究学園都市記者会
平成２２年３月５日　同時配付

National Institute for Land and Infrastructure Management

平 成 ２２年 ３月 ５日
国土交通省国土技術政策総合研究所
独 立 行 政 法 人 土 木 研 究 所

インドネシア公共事業省道路橋梁研究所との共同ワークショップの結果概要について

このたび、国土技術政策総合研究所及び土木研究所がインドネシア公共事業省道路橋梁研究所と開催した共同ワークショップ（平成22年3月1日から3月3日までインドネシア国バンドン市内の道路橋梁研究所で開催）の結果概要について、お知らせします。

本共同ワークショップでは、インドネシア公共事業省Hermanto Dardak副大臣をはじめインドネシア政府関係者及びバンドン大学関係者を含む約200人の研究者の方々が参加されました。共同ワークショップの結果概要につきましては、次のとおりです。

セッション1（舗装関係）
日本の舗装の保全戦略、インドネシア現地材料によるBUTON舗装等について発表、討議が行われ、今後、BUTON舗装の改良と活用等について研究所間での情報交換と協力を進めることを確認しました。

セッション2（橋梁関係）
わが国の耐震技術体系、インドネシアの地震後の橋梁被災状況等について発表、討議が行われ、地震後のリスク管理や耐震設計・補強等に両国とも関心が高く本分野での情報交換等を進めることを確認しました。

セッション3（道路交通関係）
わが国の地域ITS戦略や構造物の劣化データの取得の役割、インドネシアにおける有料道路政策等について発表、討議が行われ、交通の管理と監視の技術分野に関する情報交換等を進めることを確認しました。

※　BUTON 舗装　…　インドネシアで産出される廉価な天然アスファルト材料

公共事業省のホームページに、共同ワークショップ開催の記事が掲載された。

3 Penyelenggaraan Asia Pasific Ministerial Conference on Housing and Urban Development, Tgl. 22-24 Juni 2010 di S

PU-net
REPUBLIK INDONESIA
KEMENTERIAN PEKERJAAN UMUM

Home | Buku Tamu | Forum | Kontak | Site Map

Minggu, 11 April 2010

Saran dan Pengaduan

Profil Kementerian

Organisasi Kementerian

Produk Kementerian

Telaahan Issu Strategis
Kebijakan/Peraturan
Standar Nasional
Hasil Kajian
Makalah / Seminar
Info Prasarana

Info Kegiatan (Proyek)

Petunjuk Penggunaan
Registrasi Penyedia Jasa
Satuan Kerja (Info Umum)
Paket Kegiatan
Lelang (CTI)
Lelang (Semi E-Proc)
Lelang (Semi E-proc Plus)
Dana Stimulus
Anggaran Non Dep.PU
Dinas PU (APBD)
E-Monitoring

Info Media

Guntingan Berita
Tanggapan Berita
Media Cetak PU

Info Lain

Pengumuman
Pustaka
Info Peta
Info Statistik
Info Bencana
Jaringan Eksternal
Forum Kerjasama

S e r a m b i

Gallery Foto
B u k u
O p i n i
Glossary

D u k u n g a n

Network Monitoring

Berita PU

Selasa, 2 Maret 2010 18:15

INDONESIA - JEPANG BAHAS TEKNOLOGI JALAN DAN JEMBATAN

Pusat Penelitian dan Pengembangan Jalan dan Jembatan (pusjatan) bekerjasama dengan *National Instutude for Lands and Infrastructure Management* (NILIM) dan *Public Works Research Institude* (PWRI) dari Jepang menyelenggarakan *Joint Workshop on Road and Bridge* di Bandung, Selasa (2/3).

Dalam sambutannya, Wakil Menteri Pekerjaan Umum Hermanto Dardak mengatakan Kementerian Pekerjaan Umum bertanggung jawab dalam penyediaan dan peningkatan kualitas jalan nasional di Indonesia. Untuk itu, dalam mendukung pertumbuhan ekonomi dan kesejahteraan, Kementerian PU memiliki program Rencana Jangka Menengah Nasional (RPJMN) tahun 2010 - 2014 dalam pembangunan infrastruktur.

Program RPJMN Kementerian PU di bidang jalan dan jembatanan yakni meningkatkan kualitas jalan dan jembatan sepanjang 171.700 km, meningkatkan kapasitas serta kualitas jalan nasional sepanjang 19.400 km dan 27.000 m jembatan. Kementerian PU dalam meningkatkan hidup masyarakat menggunakan standar teknologi dan menerapkan teknologi untuk meningkatkan kualitas inrfrastruktur dalam pembangunan masyarakat di masa depan.

Menurut Hermanto Dardak, dengan kondisi demografi dan geologi Indonesia yang rawan bencana dan gempa bumi sangat diperlukan peningkatan penggunaan teknologi dalam bidang konstruksi. Acara tersebut bertujuan untuk saling tukar menukar informasi dan berbagi pengalaman antara Indonesia - Jepang di bidang kontruksi jalan dan jembatan. Jepang juga memiliki pengalaman dalam manajemen jalan tol di Asia dan manajemen operasional lalu lintas. Dengan tukar informasi dan berbagi pengalaman, diharapkan Indonesia mampu melakukan pembangunan dan peningkatan infrastruktur yang handal di daerah rawan bencana.

"Kondisi alam Indonesia yang rawan gempa tidak jauh berbeda dengan Jepang. Melihat pengalaman Jepang dalam penanganan gempa bumi di Kobe di tahun 90-an, akan sangat membantu kita dalam melakukan pembangunan infrastruktur jalan dan jembatan di Indonesia. Jepang telah melakukan penelitian dan menggunakan teknologi " ujar Hermanto.

Sementara itu, Kepala Badan Penelitian dan Pengembangan Kementerian PU Moch. Amron mengatakan, dengan kekayaan sumber alam yang dimiliki Indonesia, hendaknya penelitian juga difokuskan pada penggunaan material lokal dalam pembangunan infrastruktur. Material lokal dan pengembangan spesifikasi tehnik dapat mengefisiensikan pendanaan. Material lokal seperti aspal buton telah dibuktikan penggunaannya dengan bahan dasar minyak aspal dan peningkatan permukaan jalan sebesar 25 persen.

Materi dibahas dalam worshop tersebut yakni kondisi permukaan Jalan pasca bencana; standar jembatan tahan gempa; serta kebutuhan dan pengembangan perkuatan jembatan di Indonesia. Ke depan, Badan litbang akan secara aktif melakukan penelitian, produksi, penggunaan dan evaluasi teknologi, khususnya dibidang jalan dan jembatan, (ind)

Pusat Komunikasi Publik
020310

2.3.4.　海外出張調書

海外出張調書

出　張　者：研究総務官　　寺川　陽
企画部国際研究推進室　室長　　寺元博昭
企画部国際研究推進室　研究員　　松下智祥
高度情報化研究センター　情報研究官　　濱田俊一
危機管理技術研究センター地震防災研究室　　主任研究官　中尾吉宏

出張件名：国際研究連携推進のための専門家会合
（昨年締結した RDCRB との研究協力覚書に基づく共同セミナー開催の主催・出席）

出　張　先：インドネシア国　ジャカルタ市、バンドン市、ジョグジャカルタ市

出張期間：
平成 22 年 2 月 28 日～平成 22 年 3 月 4 日　（5 日間）（寺川、中尾）
平成 22 年 2 月 28 日～平成 22 年 3 月 5 日　（6 日間）（寺元、松下、濱田）

出張の目的：

インドネシア国の公共事業省研究総局 Agency for Research and Development, Ministry of Public Works、同道路総局 Directorate of Highways, MPW、同道路橋梁研究所(RDCRB)R&D Center for Road and Bridges, ARD, MPW の研究担当幹部及び実務担当専門家と、両国における国土整備関係の共同研究テーマの発掘や研究支援、特に舗装、ITS、耐震関係の研究分野の現状と課題、並びに今後の方向性について、両国の研究成果を発表し討論を行うため開催する別紙の共同ワークショップ会合「Joint-Workshop In Bandung (RDCRB/NILIM/PWRI 共催)」に出席するものである。

また、第１７回アジア地域国土整備関係研究所長等会議（以下、アジア所長会議という。）及び昨年の国際研究推進のための専門家会合（H21.5)、並びに第１８回同会議開催を契機として「昨年 11 月に当研究所 NILIM とインドネシアの研究所 RDCRB とが締結した研究協力の覚書」を実行する具体的な共同事業として取り組むものであり、また本年 10 月～11 月に開催を計画されている「アジア太平洋道路関係共同セミナー(仮称 Next-Plan)」のプレ開催と必要な調整を意図するものである。

出張内容及び成果：

わが国からは、国総研が取り組むプロジェクト研究の概要（予算や研究評価の枠組み等）や道路関係の研究の具体について発表を行なった。インドネシア国からは、研究の重点事項や課題、わが国への技術支援ニーズ等について発表いただいた。ワークショップは、別

紙のとおり、全体会議とテーマ毎のセッションに分けて実施し、関連研究分野における連携のあり方とアジア・太平洋地域における両国の連携の下でのイニシアティブ発揮についての意見交換を公共事業省の幹部等と行ない、また国土整備と環境との調和等に関する視察を合わせて行なった。

本出張の成果としては、科学技術基本計画及び国土交通省技術基本計画においても「アジアとの研究協力の強化」が必要とされていることから、国総研において、アジア地域国土整備関係研究所長等会議を開催するなど、国際的な技術協力の推進のための土台になるものと考える。なお、本会合において上記の情報交換や方策等の討議行うことは、今後の研究活動におけるアジアの連携強化に資するものであると考える。

以下に、本出張の詳細について述べる。

＜3 月 1 日（月）＞

<u>○インドネシア共和国公共事業省(The Agency for Research and Development and, Ministry of Public Works)表敬訪問</u>

・対応相手：公共事業省研究開発総局長　DR.Ir. Moch. Amron 氏
RDCRB 所長　DR.Ir. Agus Bali Sailendra 氏
RDCRB 研究員５名

訪問先では、研究開発総局長 DR.Ir. Moch. Amron 氏を交えて、３研究機関の共同ワークショップ開催への経緯や目的等、今後の研究協力について再確認を行なった。また、研究開発総局長からは昨年の JICA を通じて DR.Ir. Agus Bali Sailendra 氏がアジア所長会議に参加し、国総研及び土研の研究内容及び現地視察が行なえたことに対して御礼の言葉をいただいた。

今後の両国の関係についても話し合い、研究開発総局長も今回のワークショップをきっかけに、より RDCRB が国総研及び土研と親密な関係になることを望まれていた。

写真-1

写真-2

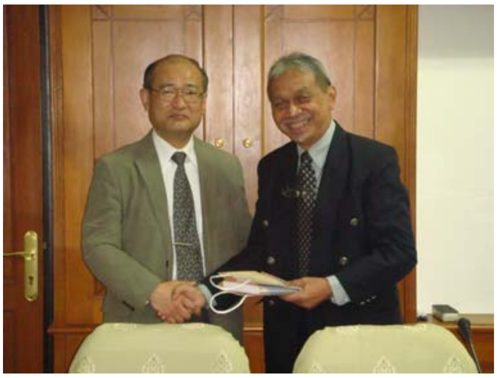


写真-3

写真-4

※　写真-1：公共事業省入口

※　写真-2：表敬訪問時の様子

※　写真-3：記念品贈呈（左:寺川研究総務官、右: Mr. Moch Amron 研究開発総局長）

※　写真-4：日本側訪問団集合写真（公共事業省前にて）

＜3月2日（火）＞

○日本・インドネシア共同ワークショップ開催

【RDCRB内(Jalan Raya Timur(AH Nasution 264)Ujungberung-Bandung)にて】

(1)Registration

開会式直前に、公共事業省副大臣 DR.Ir.Hermanto Dardak 氏と面会を行なった。

写真-5

写真-6

※　写真-5：Registration 風景（中央：DR.Ir.Hermanto Dardak 公共事業省副大臣）

※　写真-6：Registration 風景

(2)開会式

・DR. Ir. Hermanto Dardak 公共事業省副大臣、DR. Ir. Moch. Amron 研究開発総局長、寺川研究総務官より開会の挨拶を述べた。

・国総研及び土研から RDCRB への記念品を贈呈した。

写真-7

写真-8

写真-9

写真-10

写真-11

※　写真-7：開会の挨拶（インドネシア）、西川所長のメッセージ紹介（日本）

※　写真-8：ワークショップ会場の風景（左：受付、右：会場、おおよそ200名の参加者）

※　写真-9：DR.Ir. Agus Bali Sailendra所長に記念品を贈呈する寺川総務官

※　写真-10：地元のテレビ取材を受ける寺川総務官とDR.Ir.Hermanto Dardak公共事業省副大臣

※　写真-11：共同ワークショップ集合写真

(3)General Session

まず初めに、日本側は寺川研究総務官より、国総研と土研についての説明を行なった（研究所の組織体制や現在のプロジェクト研究、研究協力の体制について）。また、インドネシア側からはRDCRBのMr. I GW SAMSI GUNARTA氏より、RDCRBの組織、現在の研究内容及びインドネシア国内の道路整備状況についての説明を受けた。

両研究機関の説明を受けて、互いの研究組織体制や両国の研究内容を把握できたことは、今後の研究協力体制の強化につなげるために重要なことであり、Minutesの取りまとめに反映させた。

写真-12

※　写真-12：General Session（左：寺川研究総務官、右：Mr. I GW SAMSI GUNARTA氏）

(4)Technical Session

Technical Session は３分野に分かれて行なわれた。SessionⅠでは舗装関係を、SessionⅡでは橋梁関係（耐震を含む）を、SessionⅢでは道路・交通関係（ITS を含む）にそれぞれ分かれ発表と討議を行なった（表-1）。

表-1　各セッションの内容

No.	Session	内容
Ⅰ	舗装関係	日本の舗装の保全戦略、インドネシア現地材料によるＢＵＴＯＮ舗装等について発表、討議が行われ、今後、ＢＵＴＯＮ舗装の改良と活用等について研究所間での情報交換と協力を進める。
Ⅱ	橋梁関係	わが国の耐震技術体系、インドネシアの地震後の橋梁被災状況等について発表、討議が行われ、地震後のリスク管理や耐震設計・補強等に両国とも関心が高く本分野での情報交換等を進める。
Ⅲ	道路交通関係	わが国の地域 ITS 戦略や構造物の劣化データの取得の役割、インドネシアにおける有料道路政策等について発表、討議が行われ、交通の管理と監視の技術分野に関する情報交換等を進める。

【SessionⅠ】

SessionⅠでは、土研の久保舗装チーム上席研究員が発表を行なった。久保上席は、「日本における舗装技術について」と題し、現況の舗装整備率や管理手法のあり方及び維持管理に関する技術を中心に発表を行なった。RDCRB からは３名の発表が行なわれた（写真-13）。


写真-13

本セッションを通じて、インドネシア側は以下の点について問題点や関心を抱いていた。

①舗装メンテナンス技術に対する関心が高い

②Buton Natural Asphalt の有効利用のあり方

③効率的な舗装整備の研究

※　写真-13：SessionⅠ（発表中の久保上席）

【SessionⅡ】

SessionⅡでは、中尾地震防災研究室主任研究官と土研の張橋梁構造研究グループ研究員が発表を行なった。中尾主研は、地震災害に伴う評価法や耐震補強プロジェクトの概要等の説明を行ない、インドネシア側がかかえる問題点等を話し合うきっかけを作り、盛んな議論が行なわれた。張研究員からは、現行の耐震設計基準の設計地震動や耐震性能の設計における考え方、橋脚の耐震補強工法及び落橋

防止システムについて説明した。

本セッションを通じて、インドネシア側は以下の点について問題点や関心を抱いていた。

①橋梁の耐震設計基準改定に関する問題

②橋梁被害の原因についての問題

③長大橋に対する関心が高い

写真-14

※　写真-14：SessionⅡ（発表中の中尾主研(上段)と張任期付研究員(下段)）

【SessionⅢ】

SessionⅢでは、濱田高度情報化研究センター情報研究官と（財）首都高速道路技術センターの小西氏が発表を行なった。濱田情報研究官は、現在の日本のITS技術の紹介及び高知県における実証実験の概要についての発表を行ない、RDCRB研究者から大きな関心を集めた。また小西氏からは、道路橋のメンテナンス手法の紹介や損傷（クラック・変位・振動等）におけるモニタリング技術の説明、取得データの解析手法についての説明を行なった。ITS技術においては、RDCRB研究者内でも関心は高く、現在のインドネシア国内の道路状況を踏まえても重要視されている研究分野であると感じた。

本セッションを通じて、インドネシア側は以下の点について問題点や関心を抱いていた。

①ローカルITSの導入に対して関心が高い

②交通安全及び過密交通の解消策について

※　写真15：SessionⅢ（発表中の濱田情報研究官(上段)と小西氏(下段)）

写真-15

(5)Discussion

各セッション終了後、司会進行役からセッション発表内容及び議事内容を報告し合い、共同ワークセッションは無事に終了した。今回、セッションを３つもうけたことで、先方との研究官同士のパイプがより太いものとなった。この会議の成果を日本側から「３本の矢」の話（１本だと簡単におれるが３本になると丈夫になるとの、毛利元就の言葉）を結びで紹介したところ、インドネシアにも糸をいっぱい集めれば大きな木になるとの話があるとの紹介があり、文化的な近しさも感じられ、会議は成功裏に終了した。

写真-16　　　　写真-17　　　　写真-18

※　写真-16：Discussion の司会進行役を務める寺元室長

※　写真-17：セッションの報告を行なう久保上席研究員

※　写真-18：ワークショップ終了後、日本側訪問団全員に記念品を贈るアグス所長

＜3 月 3 日（水）＞

<u>○Meeting in Joint Research Program Development</u>

３日は、昨日の共同ワークショップの全体の取りまとめ作業、今後の研究連携に関する協議及び次回の共同セミナー開催における事項についての討議を行なった。事前にＭＩＮＵＴＥＳ（議事録）について調整していたが、実際、まとめるとなると細部に渡り双方から意見が出て大変であったが、何とかまとめ上げることができ、参加者のサインを行った。言いっぱなしになりがちな国際会議もあるが、今回、覚書をさらに具体化する MINUTES を整理できたので、次回以降、さらに具体の研究や支援テーマの特定、現地での状況の確認等に進んでいくことが可能となった。

写真-19

※　写真 19：討議風景

そ　の　他：

<u>○今後の展開について</u>

今後の展開としては、今回の共同ワークショップの内容を十二分に踏まえ、次回の共同ワークショップ開催に向けての調整を行なう予定である。

2.3.5. Minutes of Session（サイン入り）

INSTITUTE OF ROAD ENGINEERING (IRE/RDCRB)-INDONESIA

NATIONAL INSTITUTE FOR LAND AND INFRASTRUCTURE MANAGEMENT (NILIM)-JAPAN

PUBLIC WORKS RESEARCH INSTITUTE (PWRI)-JAPAN

JOINT WORKSHOPS ON ROADS AND BRIDGES

2-3 MARCH 2010

MINUTES OF SESSIONS

VENUE:

DEVELOPMENT BUILDING-RDCRB

Jalan Raya Timur (AH Nasution 264) Ujungberung-Bandung, Indonesia

In line with the MOC agreed in Tsukuba in 11th November 2009 between RDCRB and NILIM, NILIM & PWRI and RDCRB discussed in Bandung to decide this minutes into action according to the need of respected issues on session 1, 2 and 3.

SESSION I Minutes

1. Date :	Mar. 2nd, 2010
2. Place :	Room A,Development Building-IRE; Jalan ,Nasution 264 Ujungberung Bandung,Indonesia
3. Participants for Presentation:	
Japan	Mr.Kazuyuki Kubo, MSc (sign) (Leader of Pavement Team, PWRI)
Indonesia	Dr. Ir. Siegfried (sign) (Program Director, Low Cost and Low Volume Road, IRE)
	(sign) Ir. Nyoman Suaryana M.Sc (Head of Pavement and Materials Laboratory, IRE)
	Ir. Sunaryono Nono, M.Sc, (sign) (Program Manager, Buton Nat Asphalt Research, IRE)
4. Memorandum of Technical Session	Pavement
a. Presentation 1	"Pavement Maintenance Strategy in Japan" (Kazuyuki Kubo)
(abstract)	In Japan, the length of national highways controlled directly by the Ministry, is close to 20,000km. And the whole pavement conditions are monitored every 3 years. In this presentation, present status of pavement management system is introduced. Then research topics on pavement management would be shown such as required service level of road surface, new materials for maintenance, and so on.
b. Presentation 2	"Indonesian pavement Research Strategy" (Siegfried)
(abstract)	The Ministry of Public Works of Indonesia has to ensure 40.000 km of national highways and around 800 km of expressways keep in service. The utilisation of AC/WC technology for flexible pavement and concrete based technology for rigid pavement seems unable to sufficiently accommodate traffic load and climatic situation of Indonesia. The Directorate general of Highways (Bina Marga) has introduced a number of approach in pavement management, including preservation system and Performance based contract. This opened greater opportunity for innovation in pavement technology to ensure the efficient construction, availability of stronger, and longer last pavement. The presentation will discuss the direction of pavement research in Indonesia, which constist of the development of Buton Natural Asphalt Utilisation, the development of flexible and rigid pavement specification, and low-cost low-volume roads.

c. Presentation 3 "Pavement Condition on Post Disaster": (Nyoman Suaryana)

(abstract)

With the complex geological structure, Indonesia is prone to serious disasters, such as : earthquakes and volcanic eruption which damage infrastructures in a short period of time and, moreover, the second phenomena, such as tsunamis and land slide. In recent years disaster caused by earthquake were occured in many place of Indonesia, such as Tsunamis in Aceh on the morning of December 26, 2004, and Indian Ocean earthquake near Padang on September 30, 2009, which measured 7,6 on the Richter scale.
Typical damages on the road pavement such as landslide, settlement and craks. Measures should be taken to repaired roads and bridges. Damages road pavement was repaired such as remove soil and install caution signs, crack shall be sealed immediately, sand bags or gabion installment, and divert water flow and construct temporary drains. There was a great danger that heavy rain would result in secondary disaster such as landslides. The next steps is rehabilitation and reconstruction. In this step it is needed to select the construction with the most effective and economical treatment, other factors must be considered, including safety, construction scheduling, availability of materials, site accessibility, equipment availability, aesthetics, budget for design and construction, and environmental impact.

d. Presentation 4 "Utilization of Buton Natural Asphalt, Problems and Solutions" Nono/Kurniadjie

(abstract)

One way to reduce the use of oil based bitumens and improve the performance of asphalt mixtures is adding Buton natural asphalt (Asbuton) in the mixture. The deposit of natural asphalt in the island of Buton, South Sulawesi Province, is estimated to be the largest deposits in the world of containing around 677 million tones of Asphaltic Rocks/soil, which is equivalent to approximately 170 million tones of asphalt.

Prior to early 2000s, Asbuton experiences some difficulties attributed to the quality of Asbuton products, inappropriate use of modifiers, and inappropriate method of application. In 2005 the granular type of asbuton products and pre-blended asbuton that serves as a substitute for oil and asphalt additives were introduced. The substantial issues in the application of Asbuton then were solved.

From laboratory studies, it was known that asphalt mix plus Asbuton demonstrated several advantages such as increasing the value of Marshall stability of up to 19%, value of resilient modulus of up to 36% (25oC) and dynamic stability up to 71%, in comparation to mixture of asphalt mix without asbuton.

These were also proven in IRE's field trials. The hot mix and cold mix Asbuton were tried in some locations such as in Pasuruan, East Java Province, the City of Palangkaraya in Central Kalimantan Province, Gorontalo, Kolaka, Muna (Southeast Sulawesi) and the District Bandung of West Java Province. After several years of observations the asbuton mix demonstrated satisfactory performance.

In 2008, the extraction of asbuton using solvent of organic materials was initiated. This would make the price of asphalt in Indonesia free from the influence of crude-oil prices. The results of laboratory studies showed that asphalt mixtures using pure asbuton has significant effects to performance of road pavement.

e. Result of Discussion	1. It is confirmed that there is a great difference between two countries in asphalt property and construction methods, especially in quality control. However, Indonesian own technologies such as Buton natural asphalt was regarded to be expensive and be used only pavements on bridge deck to assure the water proof in Japan, Japan would expect the refined Indonesian technologies. Japan has an advantage in new technologies such as porous asphalt pavement and pavement monitoring system, and these technologies could be utilized in Indonesia for their efficient pavement management. 2. Similar to Indonesia, Japan also developed several types of asphalt mixture. 3. Japan use cracking ratio and rutting depth to as important indices for judgement of repair pavement. Originally, the formula was from AASHTO (PSI). 4. Porous asphalt is used mainly in expressway in Japan for safety. Advance technology has been established to avoid clogging of the asphalt porous surface. 5. Daily patrol is conducted of about 50-100 km/day to collect road condition data visually. Road Surface Measuring Device is used every three years. 6. Asbuton should be evaluated in full life cycle costs not only initial (construction cost). Besides high transportation cost, the high cost of Asbuton also due to the effort to extract the bitumen from the mineral. Japan side will support Indonesian side regarding the Asbuton under the cooperation including related industrial sectors. 7. Japan uses natural asphalt (Trinidad Lake Asphalt) is used in bridge decks not in roads to assure water does not penetrate into decks (to avoid corrosion). 8. Current solution for flooded roads in Indonesia is simply to raise the road level or use rigid pavement. Japan however, never experience the flooded roads and hence the experiences for this problems is still limited. Japan is now developing permeable pavement to quickly drain the water from the road surface to avoid water pounding on the roads. According to Japan's experience the use of rigid pavement would not be recommended because the maintenance is more complicated than flexible pavement. 9. Asphalt stabilized base is more popular than cement treated base because CTB is too rigid and the maintenance is also difficult. 10. In Road Surface Measuring Device, crack ratio (ratio of cracking area to section area) is automatically obtained using camera and image analyzer. 11. Pavement problems should be solved not only in table but also in the field. For that, Japan expert would like to come back to Indonesia for further discussion. 12. Indonesia manage about 52% unpaved road. The road map on Low Cost and Low Volume Road has been established in RDCRB, which 2010 is focusing on unpaved road and the following years will be focused on low cost and low volume road. Japan has been developing low cost road. For that, the cooperation on low cost and low volume road is needed.
Themes of research cooperation	Following themes are recommended to cooperate between two countries; i. Pavement Management System, including materials for maintenance and monitoring method ii. Advance technology in pavement construction such as in-situ recycling method, additional pavement performance, such as higher rutting resistance (eg Stone Mastic Asphalt, SMA), low-noise pavement and permeable pavement iii. Development of Buton natural asphalt technology iv. Low cost and low volume road technology

Method of cooperation	i.	Information would be requested or provided through the contact person named below according to need.
	ii.	Holding workshops and personnel exchanges would be considered according to need.

Contact persons :

Japan : Leader of Pavement Team, PWRI

Mr. Kazuyuki Kubo, M.sc

(k-kubo@pwri.go.jp)

Indonesia:

i. Senior Researcher on Pavement and materials Division,IRE

DR. Ir. Sjahdanulirwan, M.Sc

(msjahdanulirwan@yahoo.co.id)

ii. Leader, Low Volume Road Working Group, IRE

DR. Ir. Anwar Yamin, M.Sc

(ayplg@yahoo.com)

SESSION Ⅱ Minutes

1. **Date :** Mar. 2nd, 2010

2. **Place :** Room E , Development Building-IRE; Jalan ,Nasution 264 Ujungberung Bandung,Indonesia

3. **Participants for Presentation:**

Japan

i. Mr.Yoshihiro Nakao (Senior Researcher of Earthquake Disaster Prevention Division, NILIM , nakao-y92rr@nilim.go.jp) (sign) 中尾吉宏

ii. Dr.Guangfeng Zhang (Researcher of Bridge and Structural Technology Research Group, PWRI, tyou44@pwri.go.jp) (sign) 張広鋒

iii.

Indonesia

i. Ir. Nandang Syamsudin, MT (Head of Bridges and Structures Laboratory, nandangesye@yahoo.com) (sign)

ii. Redrick Irawan, ST, MT (Program Director, Long Span Bridge Research, redskin175@yahoo.com) (sign)

4. **Memorandum of Technical Session** **Disaster and Bridges**

a. **Presentation 1** "Philosophies in Earthquake Disaster Mitigation - Multiple Perspectives" (Yoshihiro Nakao)

(abstract) Earthquake disaster mitigation is classified into in-advance measurements and crisis managements. The speaker will introduce the philosophies of in-advance measurements in Japan with focus on seismic design specifications- and seismic retrofitting of highway bridges. In the presentation, philosophy of crisis management will be also illustrated by briefing a strategy planning for post-earthquake quick restoration of road networks.

b. **Presentation 2** "Seismic Design and Seismic Retrofit for Highway Bridges in Japan" (Guangfeng Zhang)

(abstract) Seismic design methods for highway bridges in Japan has been developed and improved based on the lessons learned from the various past bitter experiences after the Great Kanto Earthquake (M7.9) in 1923. The current version was revised based on the performance-based design concept in 2002 with the propose to enhance the durability of bridge structures for a long-term use, as well as the inclusion of the improved knowledges on the bridge design and construction methods. In this presentation, basic concepts of the current seismic design and seismic retrofit are introduced.

c. **Presentation 3** "Report on Bridges Infrastructure Investigation on Post Disaster" (Nandang Syamsudin)

(abstract)

The geological features the Indonesian archipelago is characterized by the collision between large tectonic plates. The collision of Eurasia and India-Australia plates influences the western part of Indonesia, while on the eastern part of Indonesia these two plates collide again with the Pacific plate from eastern direction. These movements cause high seismic risks and active volcanic in Sumatra, Java, Flores, Maluku, Sulawesi and Irian Jaya islands. This report describes the investigation results of post earthquake damage on the bridge infrastructure during the last five years, with a magnitude over six on the Richter scale in several regions of Indonesia, like Nabire, Aceh, Nias, Yogyakarta, Bengkulu, West Java and West Sumatra. The earthquake impacts on bridges generally characterized by :

- Movement of superstructures in lateral direction
- Increases in lateral dilatation between old bridges and new widened bridges
- Slumping of the approach embankment to the bridge
- Cracking/ splitting of wing walls at abutments

d. **Presentation 4** "The Need and Development for Bridges Strengthening Technology in Indonesia" (Redrik Irawan)

(abstract)

Factors causing the structural damage of bridges mainly relate to the decrease of load carrying capacity and/or increase of load factors. Maintenance is a decisive factor influencing the bridge resistance and durability. Inadequate routine maintenance influences the degradation rate of the bridge even if the structure is well constructed with the use of materials and elements of high quality.

Bridge damages can be also attributed to structural model of the bridge. Failures can happen due inappropriate structures that leads to fatigue of concrete and steel of structural components. Bridge strengthening focuses on repairing the structural damage and deterioration. The capacity and durability of bridges can be restored when causes of damages and deteriorations of the concrete and steel bridges is counteracted by the strengthening method. Cases of bridge damages and their remedial actions for concrete and steel bridges are described more detail in this paper. The case study of the Sei-Kedang Pahu bridge strengthening is incorporated to show wider scope of an actual remedial action.

e. **Results of Discussion**

Common research interests were found in the fields of seismic design and retrofit of highway bridges and post-earthquake crisis management. Following items were discussed:

1. The method how to repair the structure post - earthquake depend on the level of damages and condition of bridges.
2. Three philosophies in earthquake disaster mitigation were introduced from the following aspects by NILIM (Japan) .
   a. Seismic design specification for highway bridges
   b. Seismic retrofitting of highway bridges
   c. Post-earthquake quick restoration of road networks
3. The IRE mentioned there are four causes factors of bridge damage after the earthquake:

a. Lateral movement of bridge superstructure
b. Lateral dilatation between main superstructure and added structure
c. Settlement of bridge approach bridge embankment
d. Crack on retaining wall and abutment

4. Overloading is the one of factors has made the failed of bridge. It is a common problem of Indonesia.
5. The technological information exchange regarding to long span bridges in Japan will be supplied by NILIM under the cooperation with related organization.

Themes of Research Information Exchange

Technical information exchange related to the mutual interests including the following topics would be beneficial.

i. Seismic hazard evaluation (Deterministic- & probabilistic ground motion estimation)
ii. Earthquake disaster information including tsunami disaster
iii. Information and communicative technologies for immediate information- collection and sharing
iv. Earthquake damage estimation for urgent response and notification
v. Seismic design technologies for highway bridges
vi. Seismic retrofit technologies for highway bridges
vii. Seismic evaluation of highway bridges after earthquake
viii. Emergency function recovery of highway bridges damaged in earthquake
ix. Prevention of collapse of highway bridges due to tsunami attack

Contact persons

Japan :

i. Head of Earthquake Disaster Prevention Division, NILIM

Takamiya Susumu (takamiya-s92tc@nilim.go.jp)

ii. Leader for Rehabilitation and Earthquake Engineering, PWRI

Jun-ichi Hoshikuma (hosikuma@pwri.go.jp)

Indonesia:

Leader, Long Span Bridge Technology Development

Redrik Irawan

(redskin175@yahoo.com)

SESSION Ⅲ Minutes

1. **Date :** Mar. 2nd, 2010

2. **Place :** Room C , Development Building-IRE; Jalan ,Nasution 264 Ujungberung Bandung,Indonesia

3. **Participants for Presentation:**

Japan

i. Mr.Shunichi hamada, MSc (sign) 濱田俊一.

(Research Coordinator for Advanced Information Technology,NILIM)

ii. Dr.Takuyo konishi (sign) Takuyo Konishi

(Technology Center of Metropolitan Expressway)

Indonesia

i. Ir. Pantja Dharma Oetojo (sign)

(Head of Traffic and Environmental Laboratory)

ii. DR. Rudy Hermawan Karsaman (sign)

(Board Member of Indonesia Toll Road Authority)

4. **Memorandum of Technical Session** **Traffic and Technology**

a. **Presentation 1** "Local ITS Strategy " (Shunichi HAMADA)

(abstract) Assisting safety driving systems using vehicle-infrastructure cooperative systems are developed in Japan. On the other hand, low-cost and easy-installed Intelligent Transport Systems (ITS) are developed as the feasible system to be easily installed in the local area. For example, systems warning of cars from opposite direction at narrow road have been developed and deployed in mountainous roads in Kochi prefecture, so called "grass-roots ITS". In this presentation, low-cost and high-feasible ITS in Japan are introduced.

b. **Presentation 2** "Role of structure condition data acquisition on bridge maintenance activities" (Takuyo KONISHI)

(abstract) Acquisition of information data concerning bridge condition began to be applied in expressway maintenance field. Effective use of self-inform structure (i.e. Smart Structure) is strongly desired in maintenance field especially in busy network expressway. Inspection of their structures is mostly dependent on human visual inspection but it requires many labors and special equipment for human safety. Important point of the smart structure is how to find out symptoms of deterioration or results of accidental damage from limited information obtained from small number of low cost sensors. Application of data acquisition and wireless transportation of damage information will be presented in the presentation. Contents of presentation are 1) maintenance of bridge 2) identification of damage from ordinary condition data, 2) weigh in motion, 3) monitoring of damage (crack, displacement, vibration) 4) strategy of alarming, etc.

c. Presentation 3 "Strategy on ITS Development in Indonesia" (Pantja D. Oetojo)

(abstract) In general, road traffic is growing rapidly in Indonesia. In major cities like Jakarta, it is figured growing by 11 % annually. In2007, jakarta was estimated occupied by 6.3 million vehicles, around 700 new private vehicles are dragged into the road network per day which requires 3 km new road lane. Such condition can lead to significant increase in vehicle operating costs, loss in travel time, and also physical losses due to decreases in average operating speed. The utilisation of ITS in Indonesia to anticipate such situation was started in early 1990s bey the establishment of Area Traffic ontrol System in Bandung. This system has widely introduced in Indonesia, however, due to lack in maintenance most of systems have failed to operate. This paper will cover state of the art of ITS in Indonesia and set forth the idea about the strategy of local/municipal government in Indonesia to implement ITS technology. It may contain prioritisation of ITS program, rol sharing among parties, as well as possible form of cooperation between stakeholders in yhe operation of ITS.

d. Presentation 4 " The Policy and Evaluation of Electronic Toll Collection System Application in Indonesia" (Rudy Hermawan)

(abstract) In order to smoothly support traffic flows in toll road safely, comfortable and efficient, one of its aspect related to toll collection system adopted. Toll Collection System is activities chain related with toll transaction service to the user, transaction control, administration of revenue collection and other supporting procces. In principle, toll collection system must be rely on quick, precise, secure and comfortable service for the user, ensuring guarantee for the user and operator that transaction has been done in accordance with tarif applied, compatible and integrated with existing or future system and considering technology development and human resources management.

To increase toll road service in Indonesia, the toll collection system or payment transaction aspect at toll gates need to be accelerated. One of the choice to acceleration is to apply toll collection electronically or Electronic Toll Collection (ETC) System.

The advantage of this system adoption are :

i. Accelarate transaction time and increase service capacity
ii. Decrease cash moneyneed to be handled and increase security
iii. Increase transaction accuracy level and avoid human errors
iv. Increase the efficency of human resource number for toll gates servicing

In ETC adoption implementation, some of the operators made joint operation in procurement process and operation by pointing one of the Bank as transactio and card manager to ensure the system interoperability in every roads managed by those operators.

In accordance with the system implementation schedule throught out all toll roads in Indonesia, as first the step and transistion period, this system has been adopted at Jabodetabek area.

This paper discuss the result of implementation so far such as trend of usage, problem encountered etc, including recommendation to develop the system further in the future.

e. Result of Discussion

Japan has an advantage in local ITS technologies such as systems warning of cars from opposite direction at narrow road, and these technologies could be utilized in Indonesia.

1st Paper: Local ITS Strategy, by Mr Shunichi HAMADA.

The paper introduces a whole ITS technology developed recently, and explained in more detail application of ITS technology in local narrow roads, particularly in rural areas. ITS devices used is claim simple and relatively cheap. It managed alternate priority given to vehicles entering a narrow lane. It warrants the driver either he/ she should enter the lane or wait until the road lane clear.

This type of ITS technology may be introduced in typical residential areas with narrow lane of streets, to overcome interlock traffic because of vehicles entering narrow street without knowing that other opposing vehicle entering in the same time.

Further, ITS technology and application are requested to introduce in more detail for Indonesian engineers and researchers.

2nd Paper: Role of structure condition data acquisition on bridge maintenance activities, by DR Takuyo KONISHI.

The paper explain inside ITS technology applied in monitoring structural bridges damages using strain gauges connected to transmitter for sending information to the computer in offices. Similar technique may be applied to obtain vehicle weights, so characteristic of traffic loads may be detected. This type of ITS technology is suitable to be developed in Indonesia, particularly in monitoring the distribution of vehicles weight. Study such as easiness, applicability, economic, and durability of any element of devices under Indonesian condition need to be carried out. The simplicity and easy operation of application of the system seem to be suitable for case of overloading in national highway network.

3rd Paper: The policy and evaluation of electronic toll collection system application in Indonesia, by DR Rudy Hermawan.

The paper explain application of electronic toll collector (ETC) in Toll road system. The system use "smart card" to pay the toll by tagging or touching the card to the "card reader" and then go. The system in a part of the payment system in toll booth. The ETC up to now has been achieved up to about 10% of the total transaction, the rest still use manual system. In the future, this type of collector system need to be upgraded to the free system, i.e. the payment system that is not required for car driver pass through the gate by toughing the card to the reader. Culture condition and education to the traveler about free system may be studied in order to introduce the more efficient free system for transaction of toll payment.

4th Paper: Strategy on ITS development in Indonesia, by Mr. Pantja Dharma Oetojo.

The paper discussed situation recently in Indonesia, e.g. coordinated Traffic control system which has been used in urban areas such as in Jakarta and Bandung, but due to some reasons the most of the system works only partially or even back to conventional method, i.e. isolated single phase traffic light. In IRE office, traffic researchers have been developing several traffic management devices such as automatic traffic counter-classifier capable to weigh axle loading using telemetry technology to send data from field to office. Others are system information on traffic and other road data which is designed accessible by any stake holders, mobile wireless stand-alone traffic light to manage traffic pass through area under construction. All the works by IRE are still under development. IRE face luck of expert for developing electronic devices. Urgent problem in traffic situation mostly in urban areas are domination of motorcycles in traffic flows. It needs special management to overcome the problem which may use ITS.

Themes of research cooperation:

Following themes are recommended to cooperate between two countries;

i. Local ITS, such as low-cost, easy-installed and high feasible ITS
ii. Highway Traffic Control, Monitoring Technology and Electronic Toll Collector.
iii. Traffic safety and reduction of traffic congestion.

Method of cooperation:

i. Information would be requested or provided through the contact person named below according to need.
ii. Holding workshops and personnel exchanges would be considered according to need

Contact persons :

Japan

i. Head of Intelligent Transport System Division, NILIM

Hideto hatakenaka hatakenaka-h2q7@nilim.go.jp

ii. Head of Technology and Development for Steel Structure, Technology Center of Metropolitan Expressway

Takuyokonishi

konishi@tecmex.or.jp

Indonesia

Head of Planning and Technical Services, Traffic Laboratory

Mohamad Idris Lubis (idrisloebis@gmail.com)

General

Regarding to not being included in Session 1, 2, 3, there are access points on respective side as below:

Indonesian Side	Head of Division, Progrram and Institutional Collaboration-RDCRB IGW Samsi Gunarta samsi.gunarta@gmail.com samsi@pusjatan.pu.go.id	Sign
Japan Side	Director, International Research and Promotion Division-NILIM Hiroaki Teramoto teramoto-h92tb@nilim.go.jp	Sign

(Reference information)

Questionnaire from Japan side to RDCRB for the JOINT-WORKSHOP being fruitful

○SESSION I

Q1. Summary of BUTON pavement including its technology and history of its works

Q2. Achievements of monitoring surveillance

○SESSION II

Q3. Budgets of maintenance for bridges and its strategy of investment in Indonesia

Q4. Seismic design standard for bridges in Indonesia

○SESSION III

Q5. Status of installation of ITS(Intelligent Transport System) in Road network in Indonesia

Q6. Interests and concerns of your side in ITS

Q7. Interests and concerns of your side in the matter of overloads against roads and related countermeasures

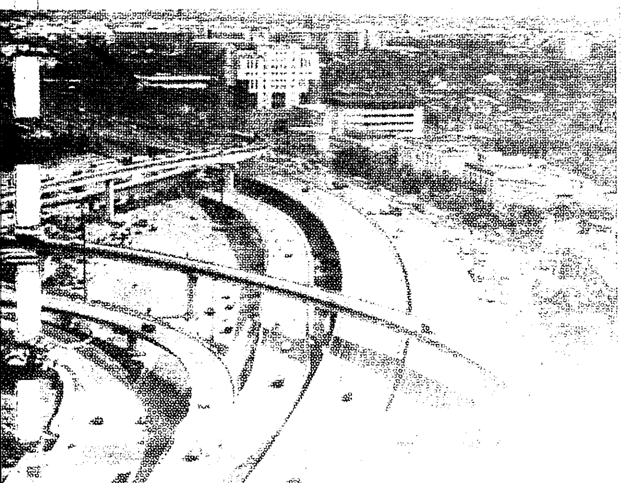
2.3.6. 当日の配布資料一式

ISBN: 987-602-8256-15-5

JOINT WORKSHOP ON ROAD AND BRIDGE

Bandung, March 02, 2010

PROCEEDING



RDCRB

RESEARCH AND DEVELOPMENT CENTRE FOR ROAD AND BRIDGE

NILIM

NATIONAL INSTITUTE OF LAND AND INFRASTRUCTURE MANAGEMENT - JAPAN

PWRI

PUBLIC WORKS RESEARCH INSTITUTE - JAPAN

PROCEEDING

JOINT WORKSHOP ON ROAD AND BRIDGE

RDCRB
Prof. DR. Ir. Furqon Affandi, M.Sc
Ir. Nyoman Suaryana, M.Sc
Ir. Nono, M.Eng.Sc
Ir. Kurniadjie, M.Sc
Ir. Roestaman, M.Sc
Ir. Imam Murtosidi
Ir. Nandang Syamsudin, MT
Rulli Rinastra, ST, MT
Prof. Lanneke T.
Redrik Irawan, ST, MT
Akuinto
Ir. Pantja Dharma Oetojo, M.Sc
Taufik S Sumardi, ST

PWRI
Kazuyuki Kubo, M.Sc
DR. Guangfeng Zhang

NILIM
DR. Yoshihiro Nakao
Shunichi Hamada, M.Sc
DR. Takuyo Konishi

BPJT
Ir. Rudi Hermawan

ISBN : 978-602-8256-15-5

PWRI

N I L I M

Research and Development Center for Road and Bridge (RDCRB)
The National of land and Infrastucture Management (NILIM) Japan
The Public Works Research Institute (PWRI) Japan

FOREWARD

FOREWORD

Challenges and problems in the field of road infrastructure increasingly requires treatment through the use of applied technology. R & D institutions in the field of roads and bridges, as well as Research and Development Center for Roads and Bridges (RDCRB) became central to the search for invention and innovation in these problems. Ministry of Public Works Republic of Indonesia, as an institution managing road, has golas in the National Medium – term Development Plan (RPJMN) 2010 – 2014. Those goals are: improve the quality of roads and bridges along 171,695 km, and increase capacity and quality of 19,407.27 km of national roads and 26,957.83 m of bridges.

Objectives set in the RPJMN were put in detail in the respective goals of the Ministry of Public Works Strategic Plan 2010 - 2014. To bridge the research and development activities in RDCRB with the Strategic Plan, the institution had prepared R & D focus and sub focus that have relevance to the achievement of the goals of Ministry of Public Works. To strengthen the implementation of the focus and sub focus, RDCRB prepared future research that pours into technology roadmap.

Meanwhile, R & D capacity owned by RDCRB can be assessed are not sufficient to achieve the target of research in the roadmap. There are limited resources which institution has to operationalize the plan that allow the targets achievement. RDCRB Strategic Plan 2010 - 2014 implements a policy that directs cooperation with other institutions, both domestic and international. Through this cooperation, RDCRB is projected to work more optimally in achieving national development goals, through transferring technology, strengthening R & D capacity, as well as R & D result information axchange by all parties working together. Workshop involving three R & D institutions came from Indonesia and Japan which is conducted at the moment, can be indicated as an attempt to implement the policy mentioned above.

In substance, there are two papers presented in these proceedings describes topics that can be shared in reference to a future research program. Pavement and Expressway session put for papers that map strategies in research and development of the two countries. Mr. Kazuyuki Kubo (Public Work Research Institute Japan/ PWRI) expresses paving strategy in Japan in the paper entitled **Pavement Strategy in Japan**, while research strategy in Indonesia delivered by Prof. Furqon Affandi (RDCRB).

Related to the problems often faced by both countries, Ir. Nyoman Suaryana (RDCRB) told the paper entitled **Pavement Condition Post Disaster**. This paper is considered important because the two countries frequently hit by disasters, particularly earthquakes that also influence the condition of pavement. Located on the Pacific plate which is still active, disaster mitigation efforts in paving should always be improved. In particular, the bridge and the disaster session presents a four papers from three parties: PWRI, National Institute for Land and Infrastructure Management (NILIM), and RDCRB. Dr. Guangfeng Zhang (PWRI) present a paper titled **Earthquake - Proof Standard of Bridges**. Bridge investigation report after disaster, especially for Indonesian condition is delivered by Ir. Nandang Syamsudin (RDCRB). As support for the handling of this disaster issues, Ir. Redrik Irawan delivered a paper titled **The Need and Development for Bridges Strengthening Technology in Indonesia**. This paper describes position of bridge strengthening technological development in Indonesia, which is important for bridge maintenance and also in bridges disaster mitigation.

In Traffic and Technology Session, research strategies in the field of Intelligent Transportation System (ITS) in Indonesia presented by Ir. Pantja Dharma Oetojo, M.Eng.Sc (RDCRB). Mr. Sunuichi Hamada, M.Sc (NILIM) completes the contribution of the research strategy in the session through a paper entitled **Local ITS Strategy**. In the context of highway maintenance policies and overloading countermeasures, Indonesian Toll Road Authority (ITRA) make an important presentation to the strategies and policies that can be an valuable input for the next research programs.

The papers presented in this proceeding can be considered as valuable inputs regarding technological achievement of two countries. The workshop is expected to move further to technological exchange, capacity building R & D resources, and to solve road development problems. Associated with R & D strategy in the future, this event is a leap forward for RDCRB to make himself more "open" to the external environment than this moment. In the future, RDCRB leads to the fifth R & D generation that works across – boundary alliances, which means the institution has actively involving all parties concerning on the production, use, and technological evaluation, especially in roads and bridges.

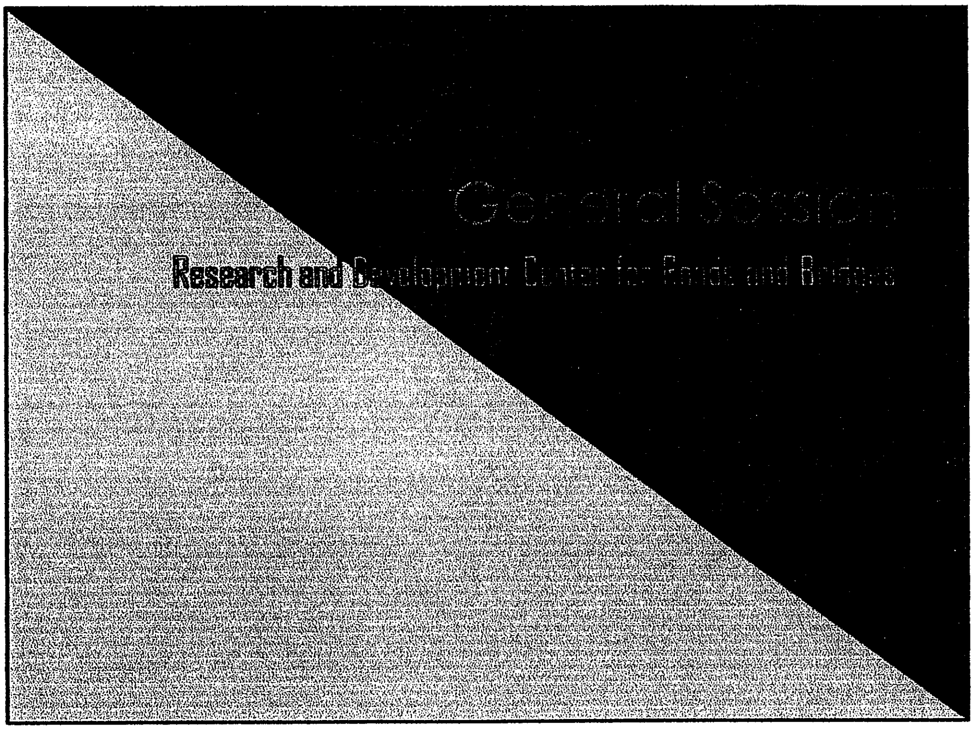
Bandung, March 2nd, 2010
Head of Research and Development Centre for Road and Bridge

Ir. Agus Bari Sailendra, M.Sc

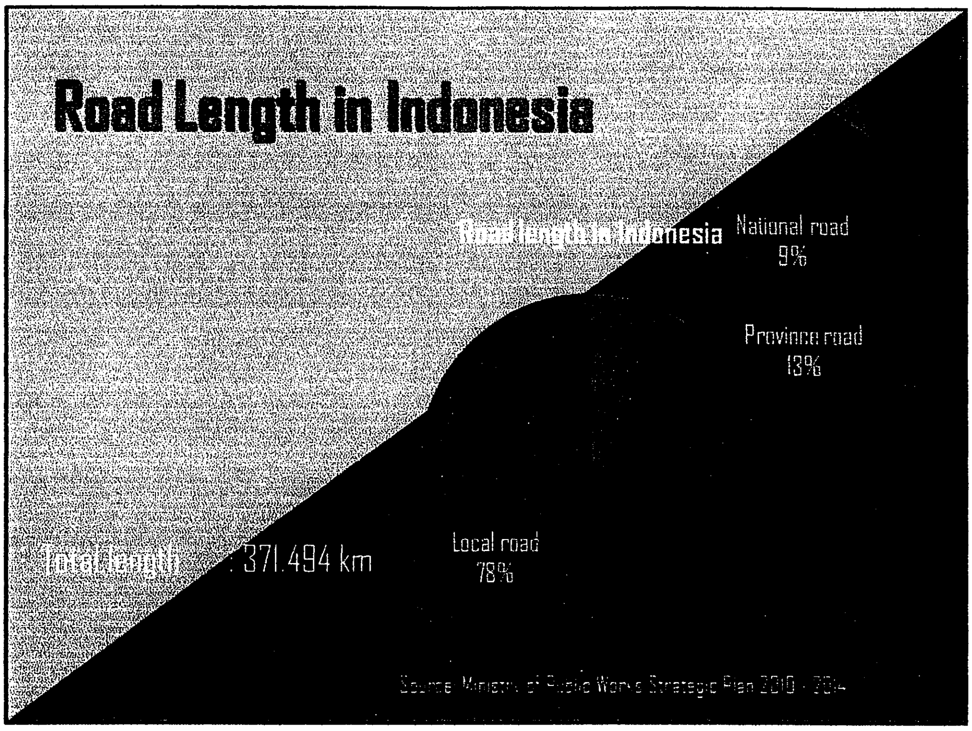
LIST OF CONTENTS

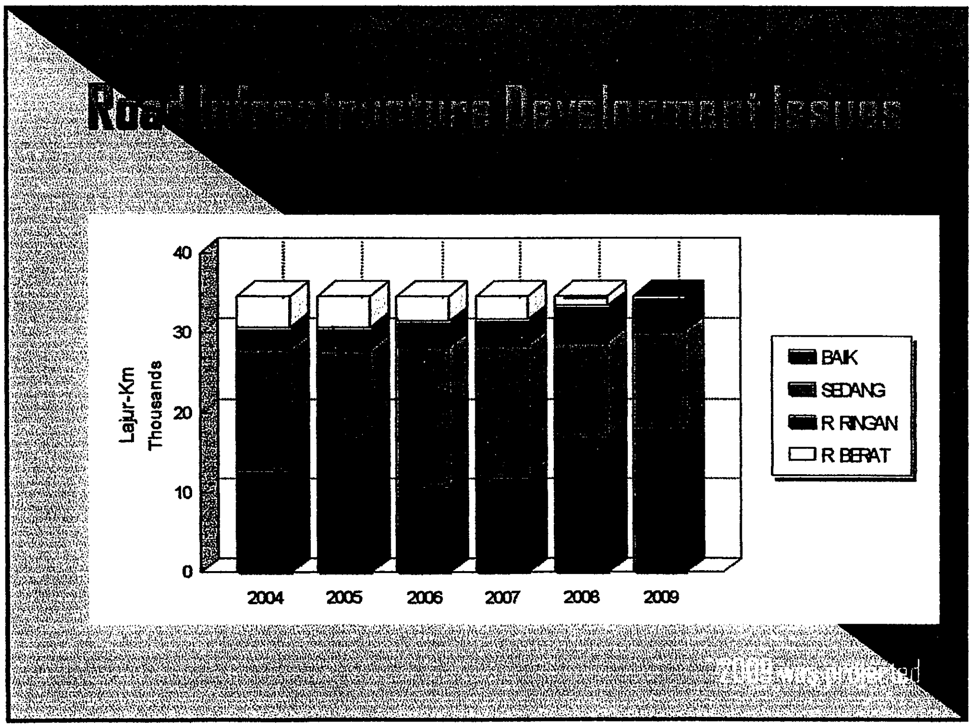
LIST OF CONTENTS

GENERAL SESSION


General Session
Research and Development Center for Roads and Bridges

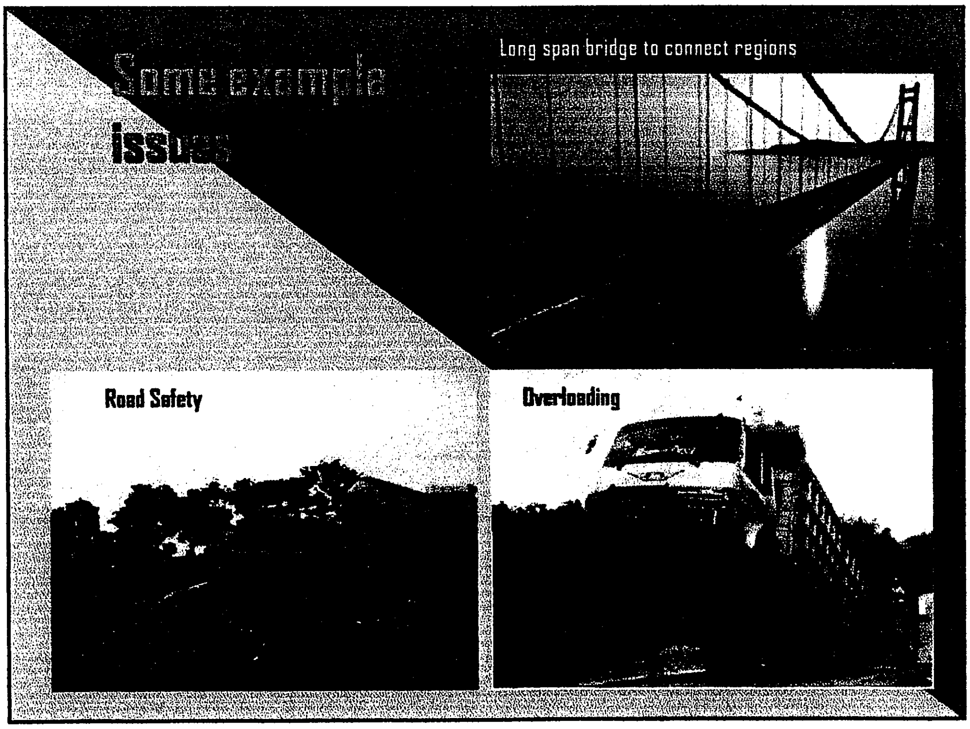

Road in Indonesia
CONDITION AND ISSUES

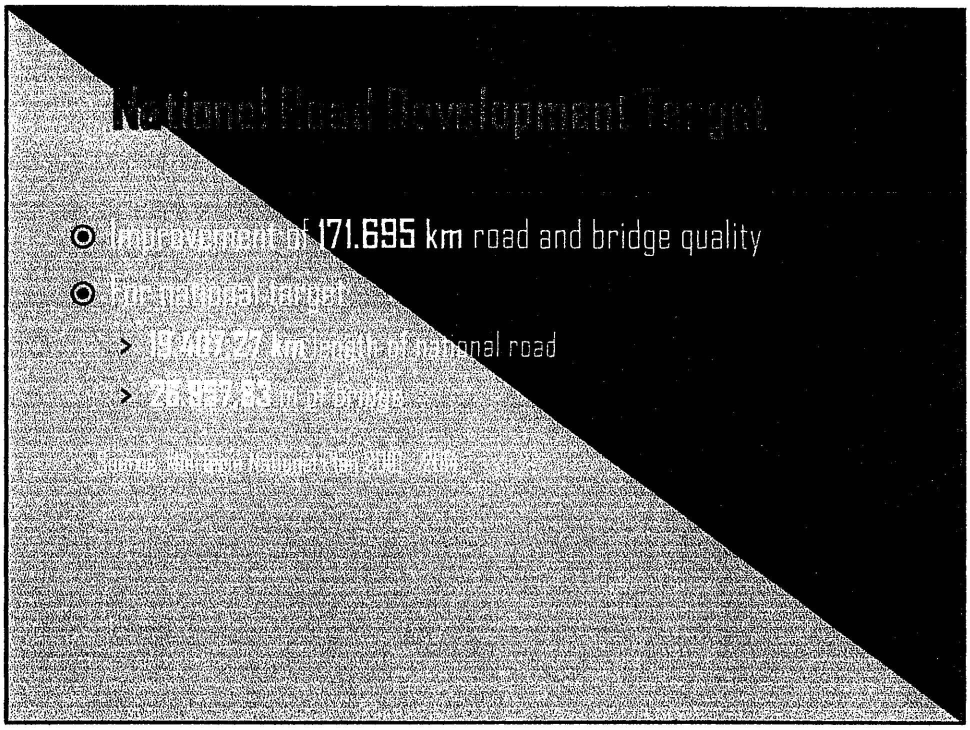

Road Length in Indonesia
Road length in Indonesia
National road
9%
Province road
13%
Local road
78%
Total Length : 371.494 km

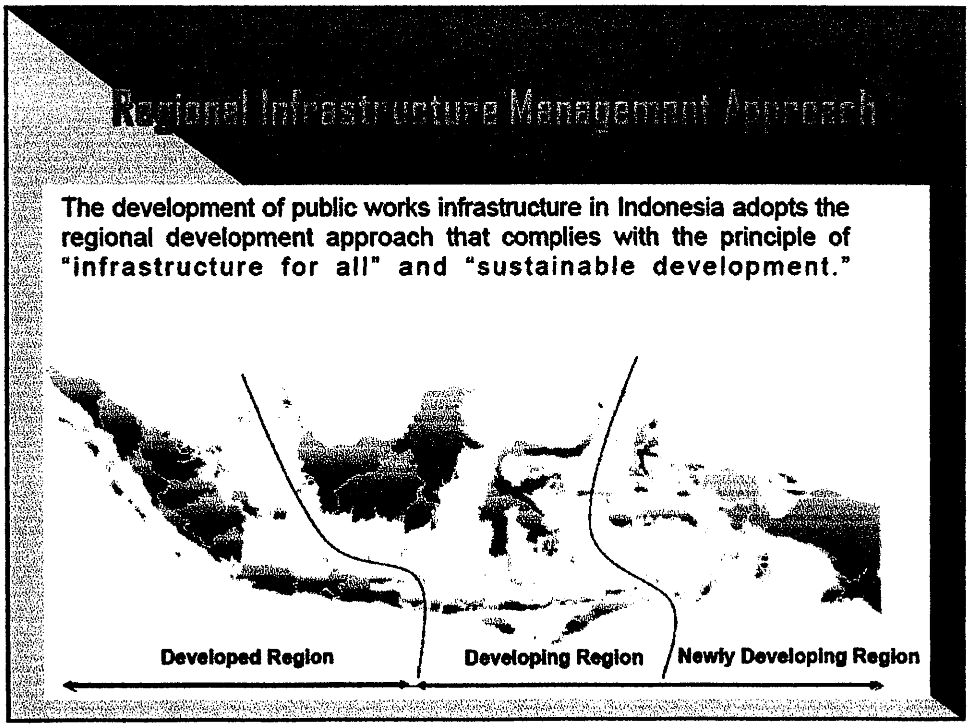

Road Infrastructure Development Issues
40
30
20
10
0
Lajur-Km
Thousands
2004
2005
2006
2007
2008
2009
BAIK
SEDANG
R RINGAN
R BERAT
2009 was projected

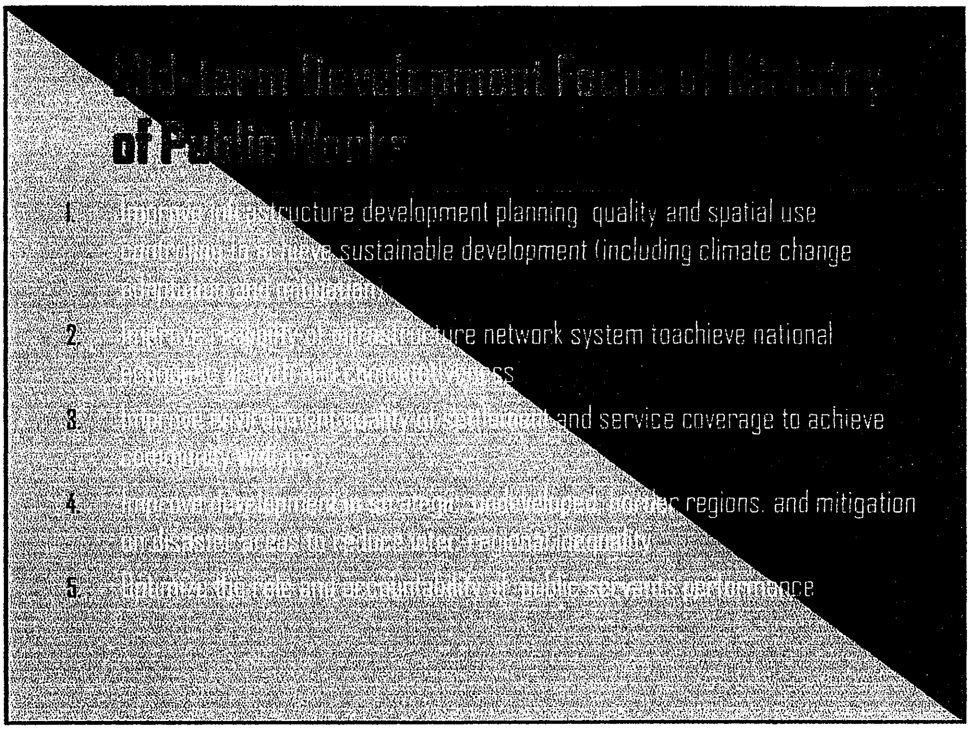
Road Infrastructure Strategic Issues

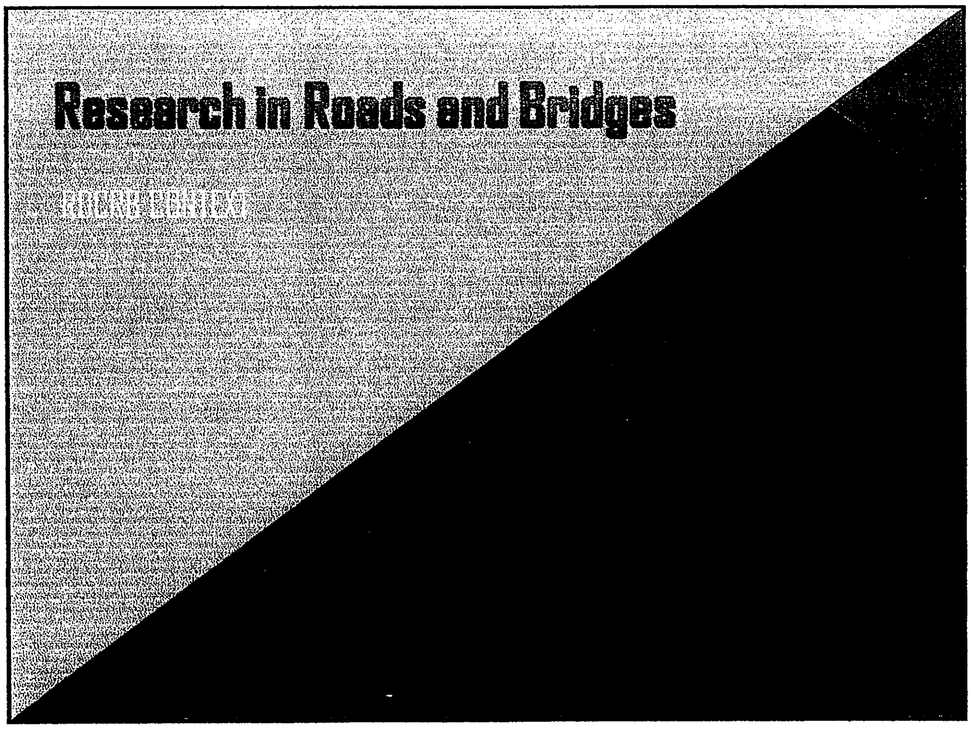
- Expansion of road networks in 4 main islands: East Sumatera Network, North Java Bay, South Kalimantan Network, and West Sulawesi Network
- Toll road connection of Trans-Java (Jakarta – Surabaya corridor)
- Overloading in North Bay Java and East Sumatera Network
- Improve road accessibility in isolated and remote areas
- Improve and optimize road comformment in the case of induquate fund
- Institution coordination in road management between Central, Province, and Local Government




National Road Development Target
Improvement of 171.695 km road and bridge quality
For national target


Regional Infrastructure Management Approach
The development of public works infrastructure in Indonesia adopts the regional development approach that complies with the principle of "infrastructure for all" and "sustainable development."
Developed Region
Developing Region
Newly Developing Region


1.
ucture development planning quality and spatial use
sustainable development (including climate change
2.
re network system toachieve national
3.
and service coverage to achieve
4.
regions. and mitigation
5.


Research in Roads and Bridges

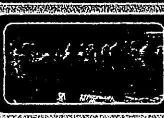
RDCRB Focus to Support National Development


To establish and promote the use of sustainable technology which adapt to global climate change


To establish applicable infrastructure technology to support national economic growth


To establish road and bridge technology involving community participation


To establish technology which suitable with local environment condition and local wisdom


Institution capacity building

GOALS	TARGETS	POLICIES
To establish and promote the use of sustainable technology which adapt to global climate change	Environmentally friendly road consists of recycled & reused materials, and engineered pavement materials	The activity is focused to reusable materials and tailing with large production, negatively impact to the environment and potentially be used as road materials. Integrating environmentally friendly road concept into design and construction guidelines to improve road environment Integrating the effort for adaptation and mitigation to global climate change into
	To establish tunnel technology to increase land use effectiveness and to reduce environmental impact	Based on strong literature study and observational method on tunnel construction projects in DG of Highway or DG of Water Resources to develop manuals and to utilize researcher exchange
	Urban road network system technology	Focused to system planning and technology to accommodate the most weak road users including road furniture.

GOAL	TARGETS	POLICIES
To establish applicable infrastructure technology to support national economic growth	Pavement technology which fit with climate characteristics and specific Indonesian condition	1. To optimize research collaboration between research institutions 2. Full scale test may only be carried out through a more selective procedure 3. To build exclusive road test facility 4. Besides technical aspects, economic feasibility of the technology shall be completely scrutinized
	To develop ground improvement technology to assure a stable road foundation	Based on strong literature study and observational method on construction projects in DG of Highway to develop manuals and to utilize researcher exchange
	Long span bridge technology which integrating regional economic growth	Based on strong literature study and observational method on construction projects in DG of Highway to develop manuals and to utilize researcher exchange
	To establish technology to reduce traffic congestion so as to reduce gas emission	To develop traffic monitoring center (TMC) prototype as a reference for TMC in urban
	Road safety technology	Focused to road safety along Trans Asia and ASEAN Highway route
	To develop manuals on road serviceability level and geometric design parameters	Updating Indonesian Road Capacity Manual 1998 with modification to traffic planning and geometric design

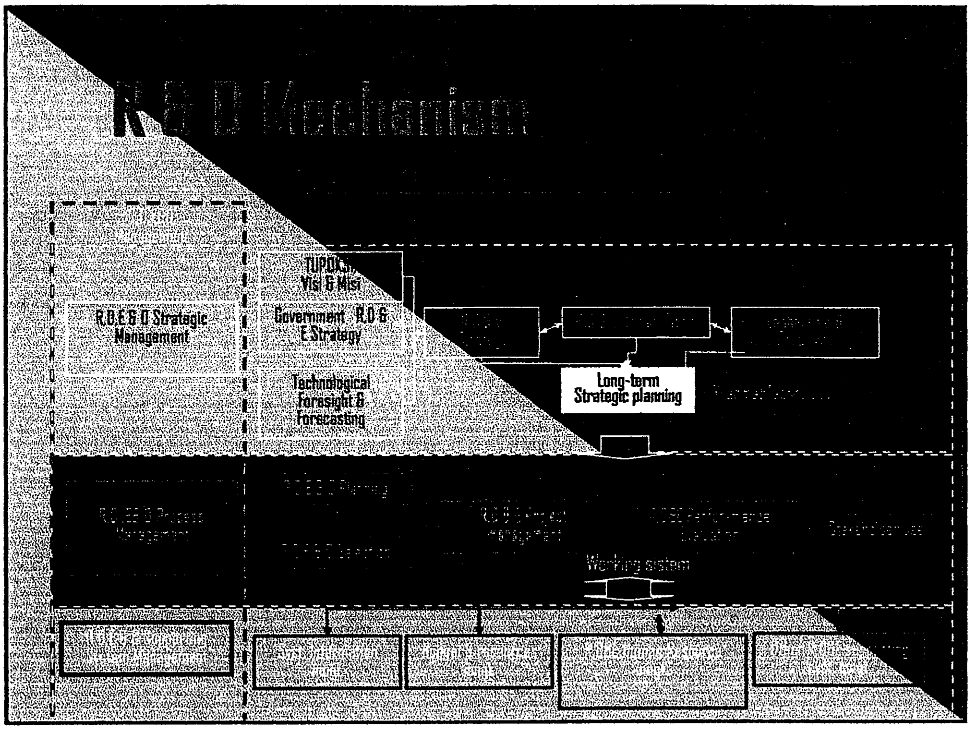
GOAL	TARGETS	POLICIES
To establish road and bridge technology involving community participation	To develop applicable road technology which involve local community participation	Focused to area with low accessibility to road technology and low regional accessibility Simple technology which can be applied to districts community with minimum training
To establish technology which suitable with local environment condition and local wisdom	Road technology using local materials and disaster prevention and mitigation	Based on strong literature study and observational method on construction projects in DG of Highway to develop manuals and to utilize researcher exchange
Institution Capacity Building	To conduct beurocational reform	To perform performance based remuneration
	To provide research infrastructure and laboratories	Based on research road map and master plan
	To make IRE as center for technology transfer	IRE as a center for technology verification institution
	To increase local research and laboratory institution	To cooperate with local research and laboratory institution

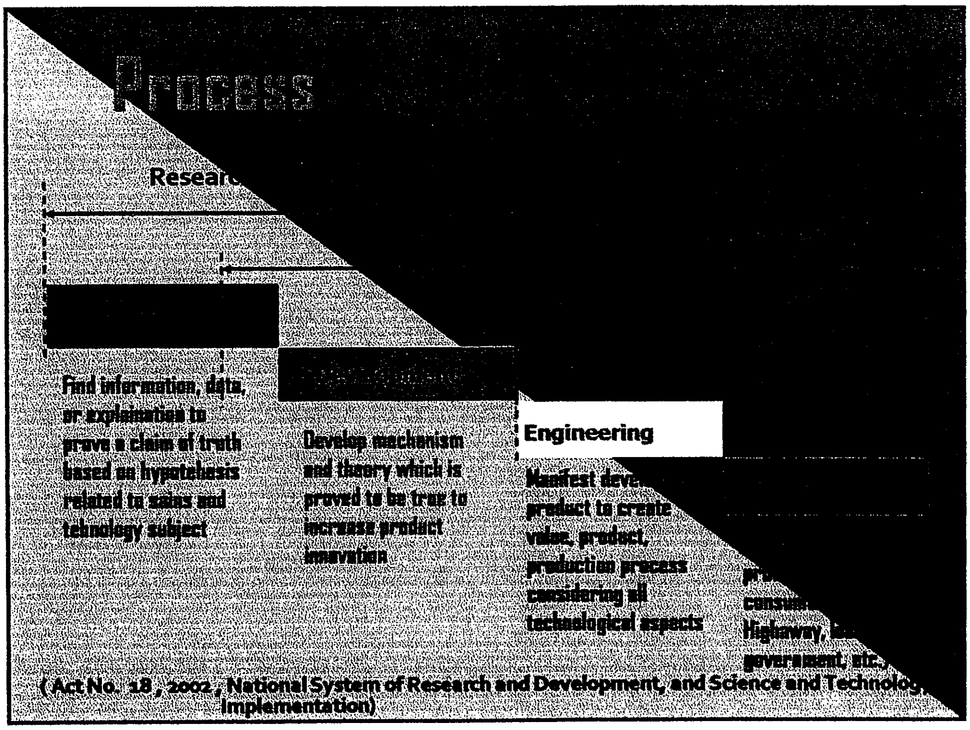
Mid-term R & D Projected Funding..(1)

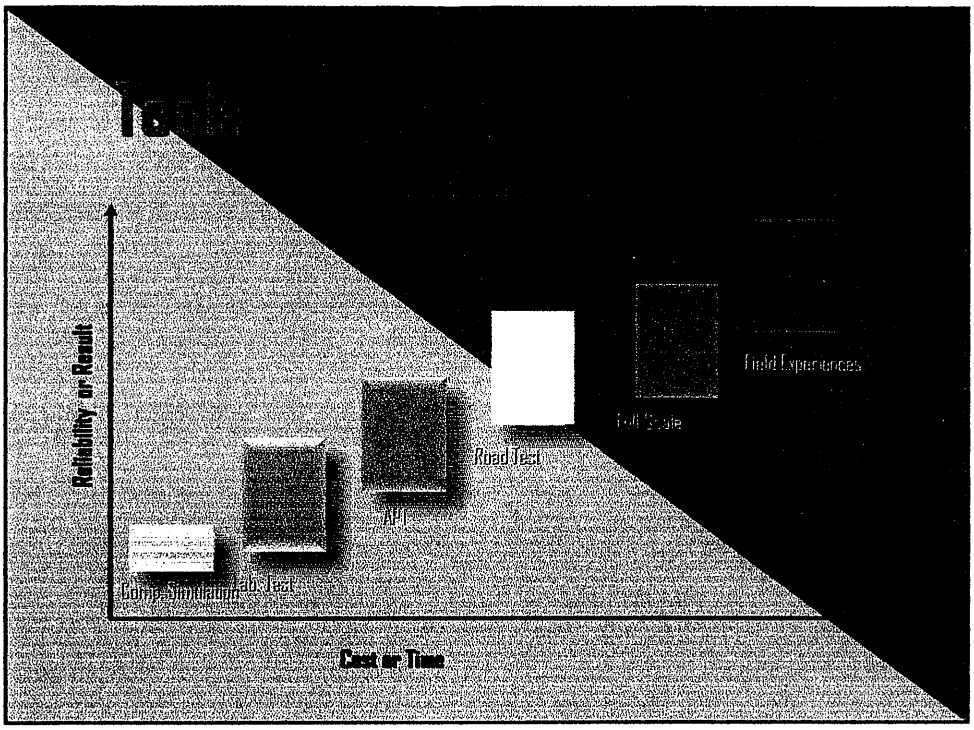
No.	R & D Focus	Funds (in milion rupiahs)
1.	Environmental friendly road	10.700
2.	Tunnel	33.106
3.	Urban road	11.236
4.	Mitigation and adaption on climate change	1.675
5.	Strategic pavement (natural Buton asphalt, flexible pavement, rigid pavement)	62.167
6.	Soil stabilization	41.011
7.	Long-span bridge	7.586
8.	Bridge maintenance	23.820
9.	ITS	4.403

Mid-term R & D Projected Funding..(2)

No.	R & D Focus	Funds (in milion rupiahs)
1.	Road safety	8.896
2.	Trans ASEAN and Asia Highway	2.517
3.	Indonesia Highaway Capacity Manual	2.548
4.	Low volume road	3.986
5.	Local material	25.000
6.	Mitigation on slope disaster	17.081

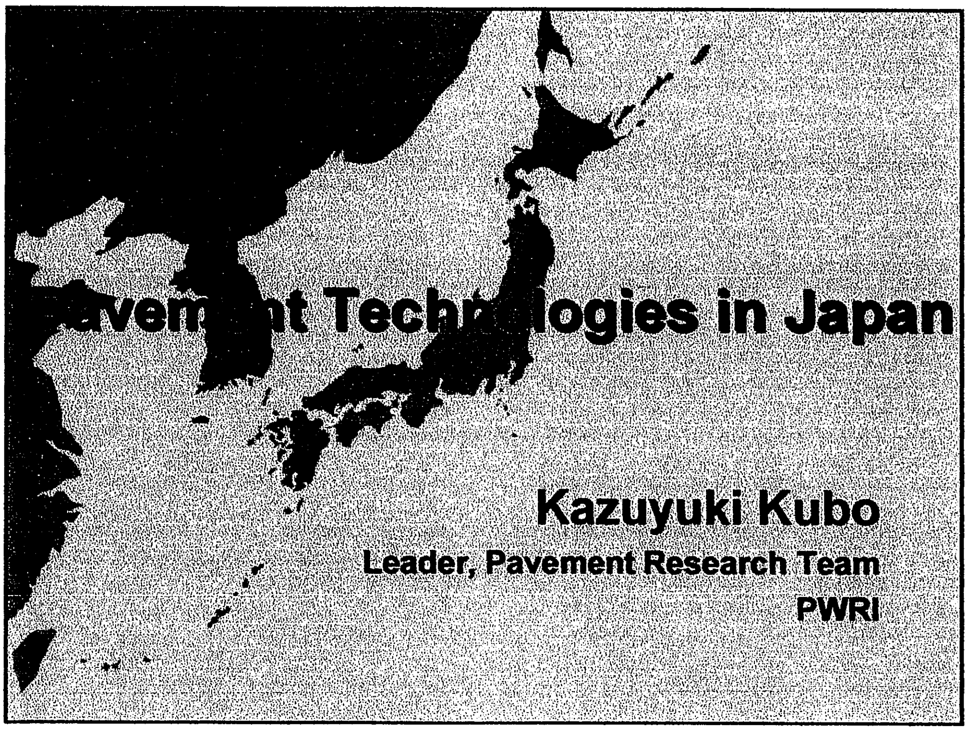

R & D
R,D,E & O Strategic Management
Government R,D & E Strategy
Technological Foresight & Forecasting
Long-term Strategic planning
Working system

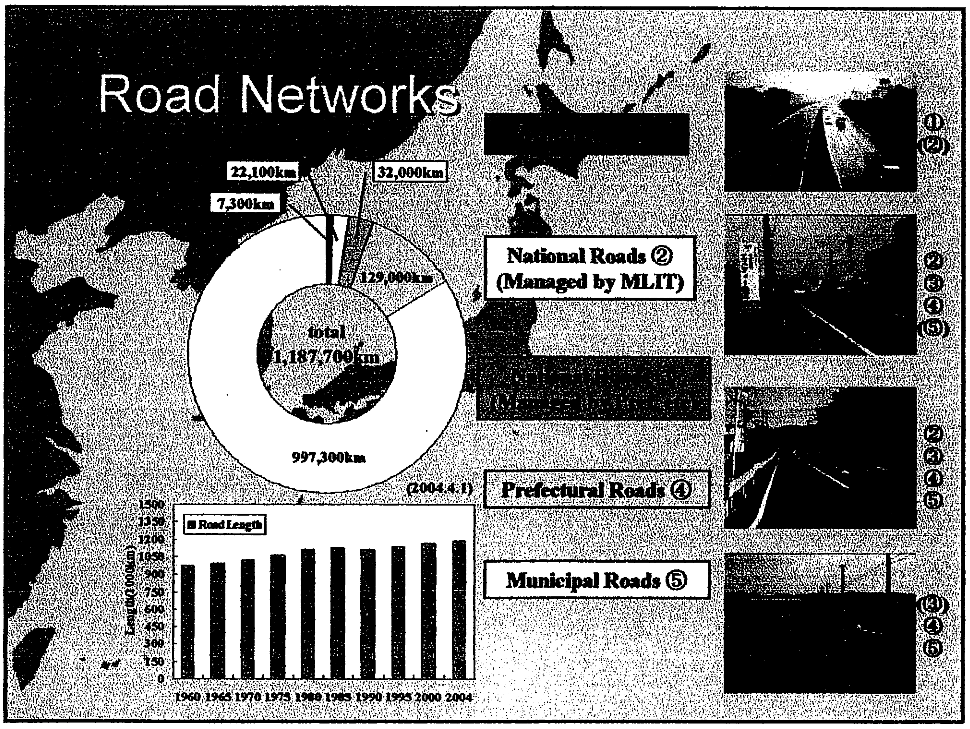

Process
Engineering
Find information, data, or explaination to prove a claim of truth based on hypothesis related to sains and tehnology subject
Develop mechanism and theory which is proved to be true to increase product innovation
product to create value, product, production process considering all technological aspects
(Act No. 18, 2002, National System of Research and Development, and Science and
Implementation)

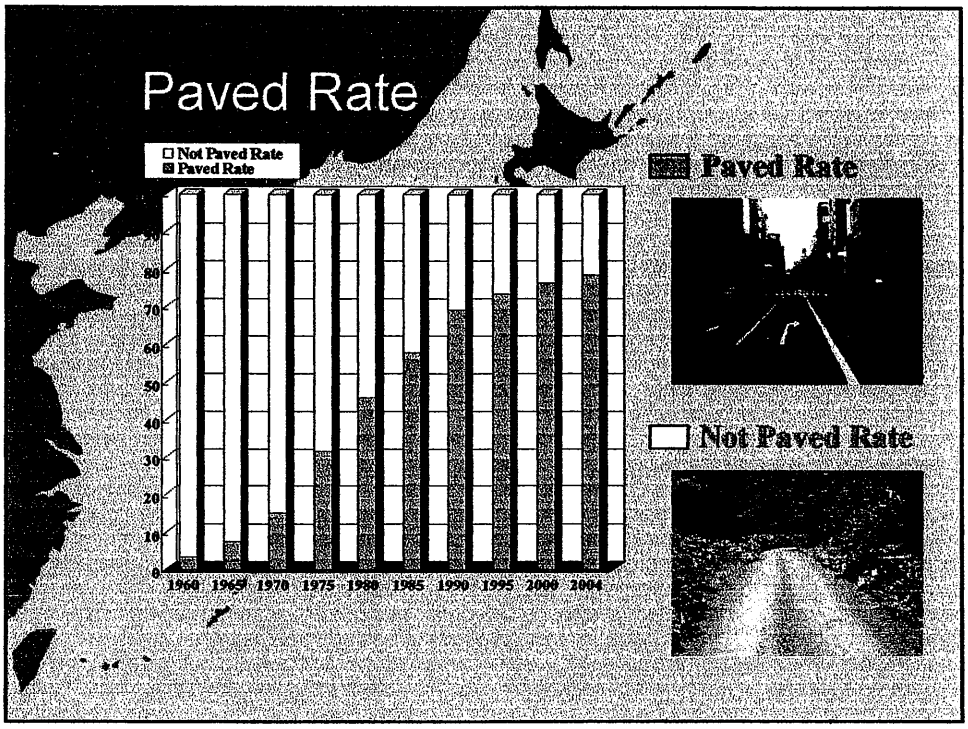

Reliability or Result
Cost or Time
Comp. Simulation
Lab. Test
APT
Road Test
Full Scale
Field Experiences

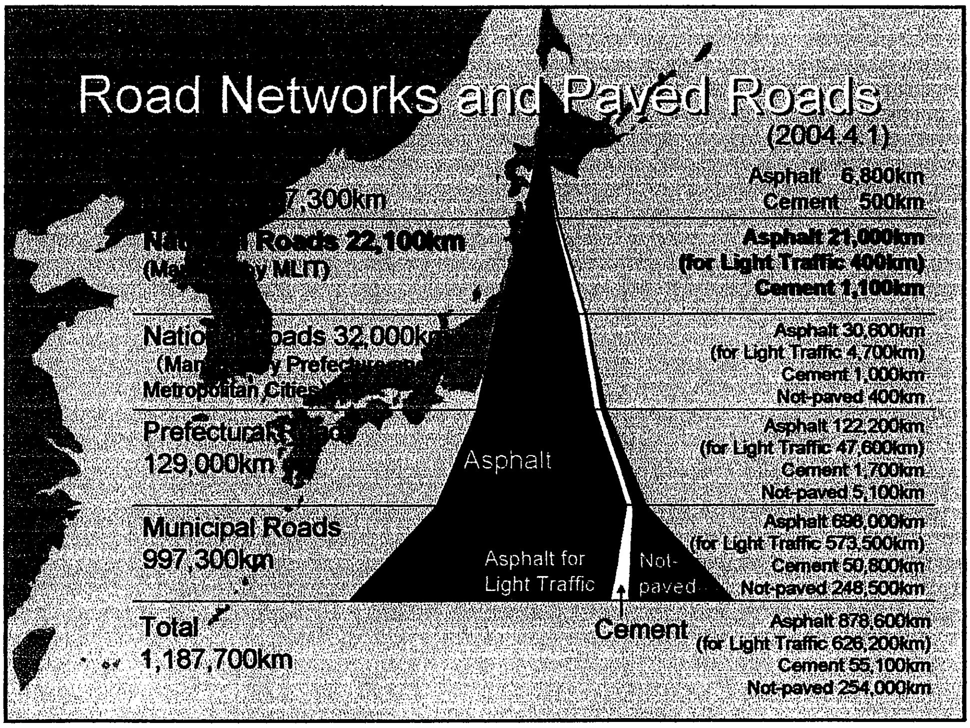

THANK YOU

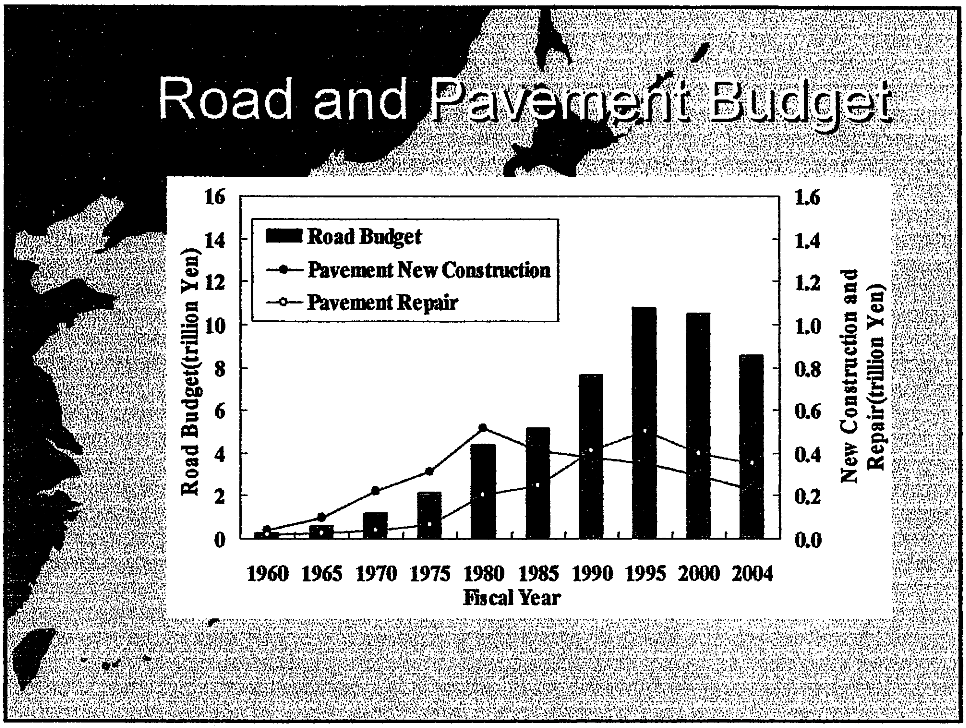
Technical Session I
PAVEMENT AND EXPRESSWAY

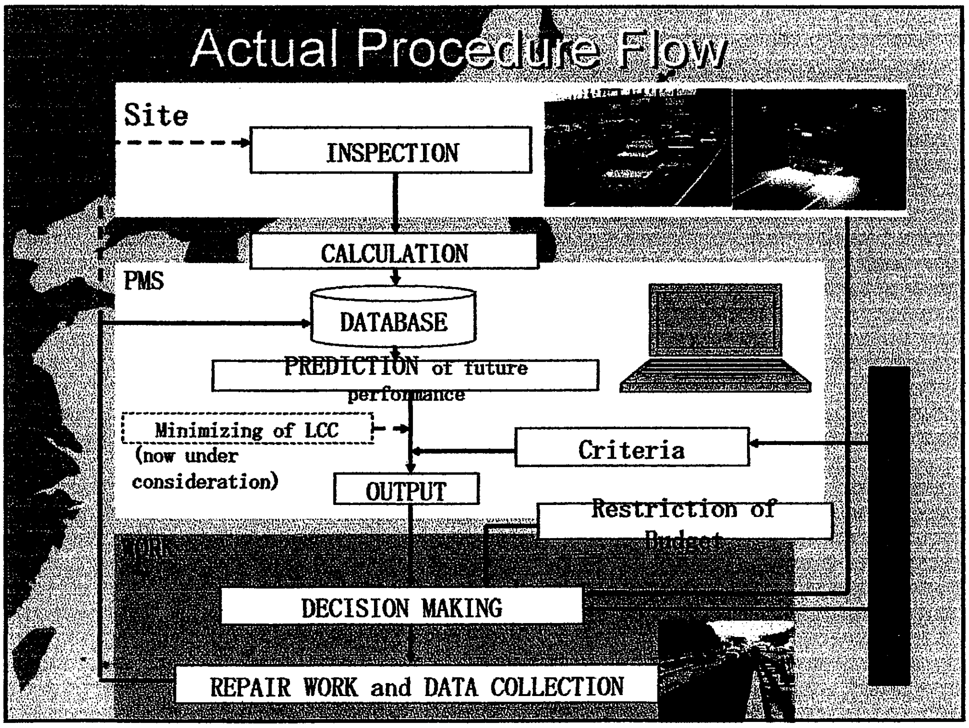

Kazuyuki Kubo
Leader, Pavement Research Team
PWRI

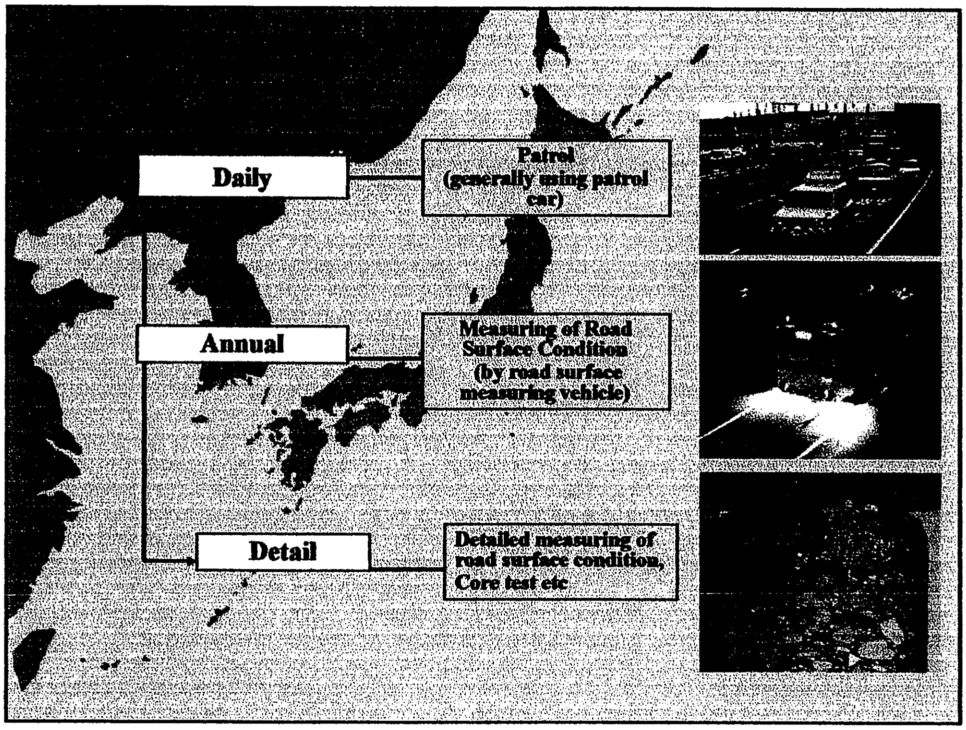

Road Networks
22,100km
32,000km
7,300km
129,000km
total
1,187,700km
997,300km
(2004.4.1)
Road Length
1960 1965 1970 1975 1980 1985 1990 1995 2000 2004
National Roads ②
(Managed by MLIT)
Prefectural Roads ④
Municipal Roads ⑤

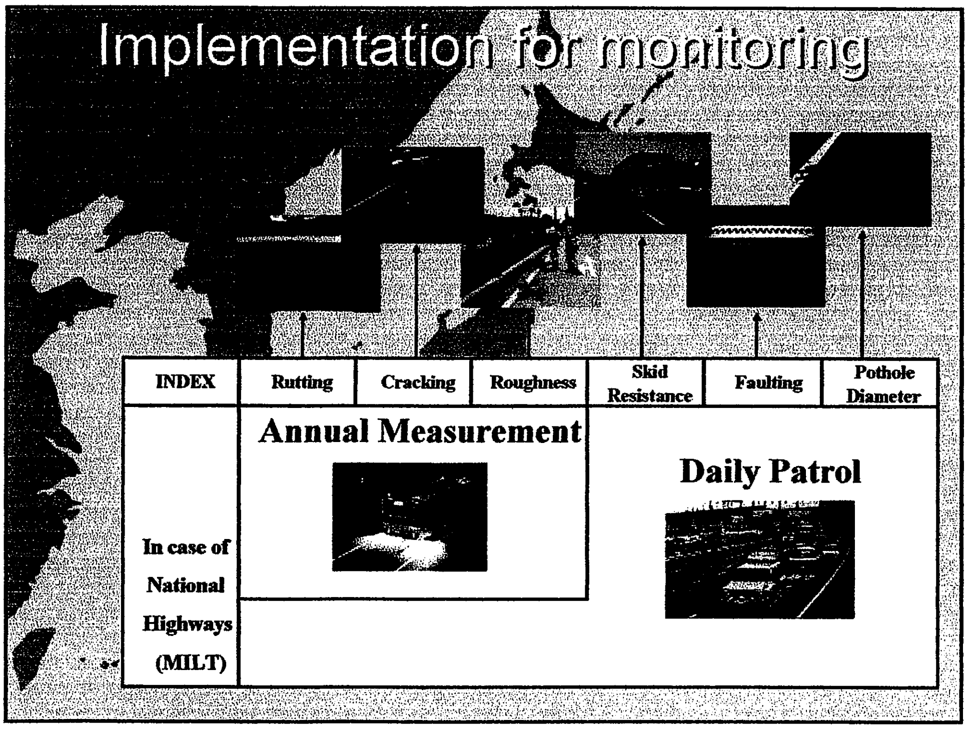

Paved Rate
Not Paved Rate
Paved Rate
0
10
20
30
40
50
60
70
80
1960 1965 1970 1975 1980 1985 1990 1995 2000 2004
Paved Rate
Not Paved Rate

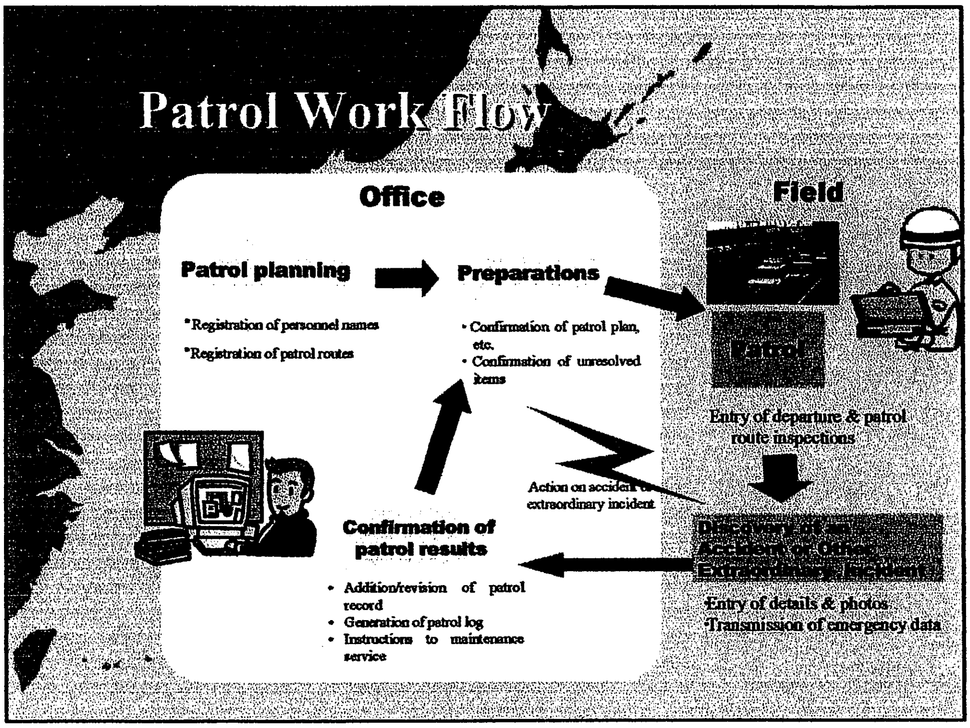

Road Networks and Paved Roads
(2004.4.1)
7,300km
Asphalt 6,800km
Cement 500km
Roads 22,100km
Asphalt 21,000km
(for Light Traffic 400km)
Cement 1,100km
Asphalt 30,600km
(for Light Traffic 4,700km)
Cement 1,000km
Not-paved 400km
Metropolitan Cities
Asphalt 122,200km
(for Light Traffic 47,600km)
Cement 1,700km
Not-paved 5,100km
129,000km
Asphalt
Municipal Roads
997,300km
Asphalt for Light Traffic
Not-paved
Asphalt 698,000km
(for Light Traffic 573,500km)
Cement 50,800km
Not-paved 248,500km
Total
1,187,700km
Cement
Asphalt 878,600km
(for Light Traffic 626,200km)
Cement 55,100km
Not-paved 254,000km

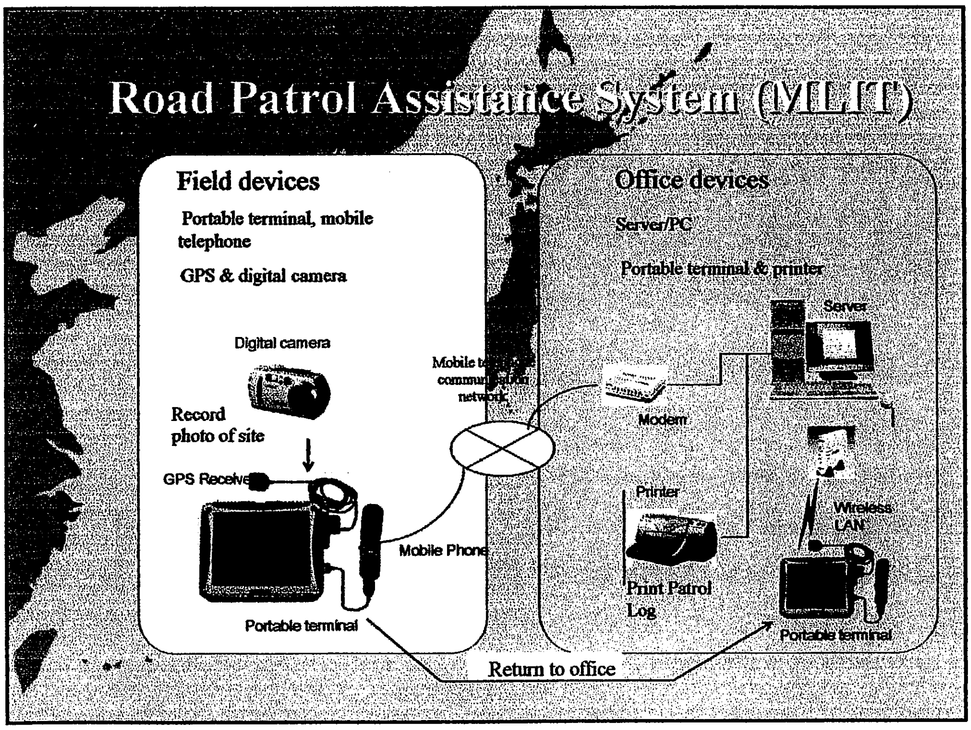

Road and Pavement Budget
Road Budget
Pavement New Construction
Pavement Repair
Road Budget(trillion Yen)
New Construction and Repair(trillion Yen)
16
14
12
10
8
6
4
2
0
1.6
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
1960 1965 1970 1975 1980 1985 1990 1995 2000 2004
Fiscal Year

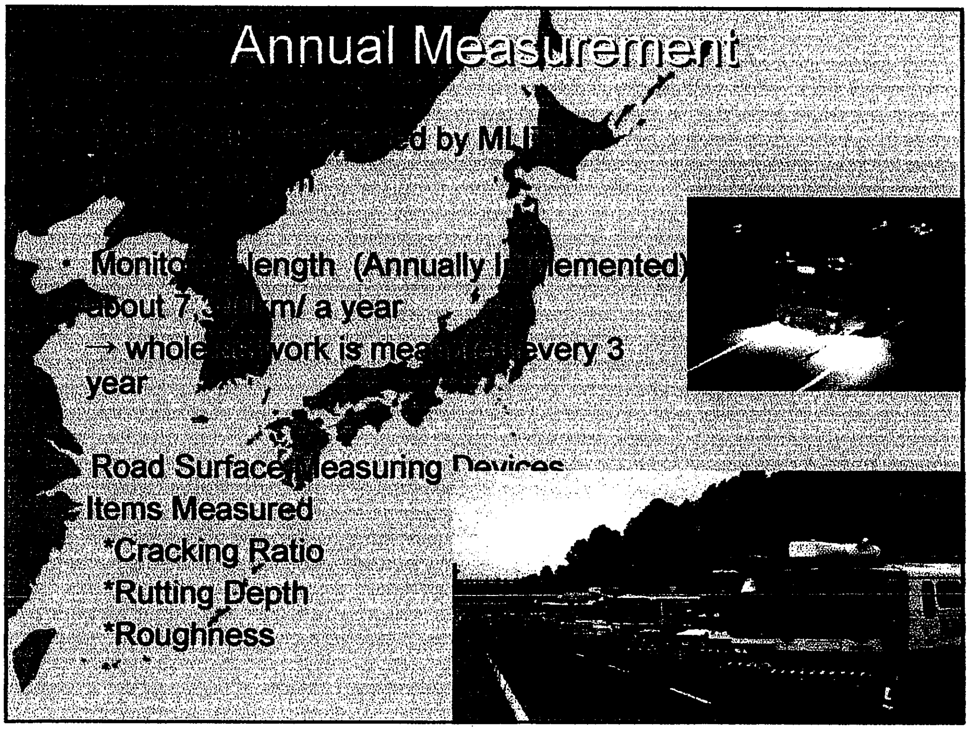

Actual Procedure Flow
Site
INSPECTION
CALCULATION
PMS
DATABASE
PREDICTION of future performance
Minimizing of LCC
(now under consideration)
Criteria
OUTPUT
Restriction of Budget
DECISION MAKING
REPAIR WORK and DATA COLLECTION

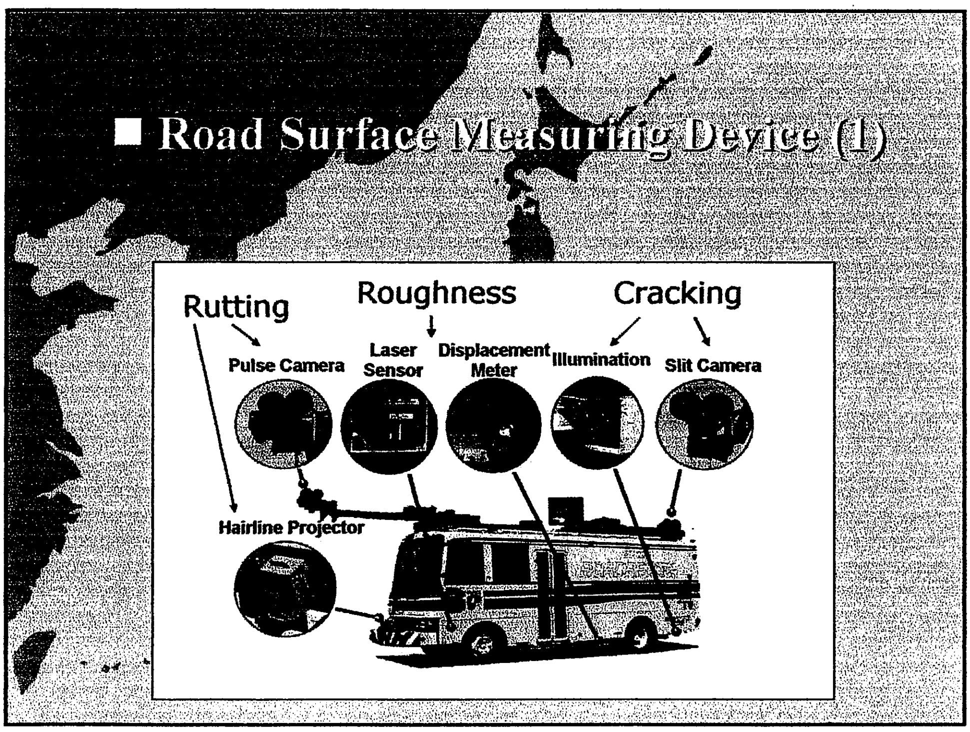

Daily
Patrol (generally using patrol car)
Annual
Measuring of Road Surface Condition (by road surface measuring vehicle)
Detail
Detailed measuring of road surface condition, Core test etc

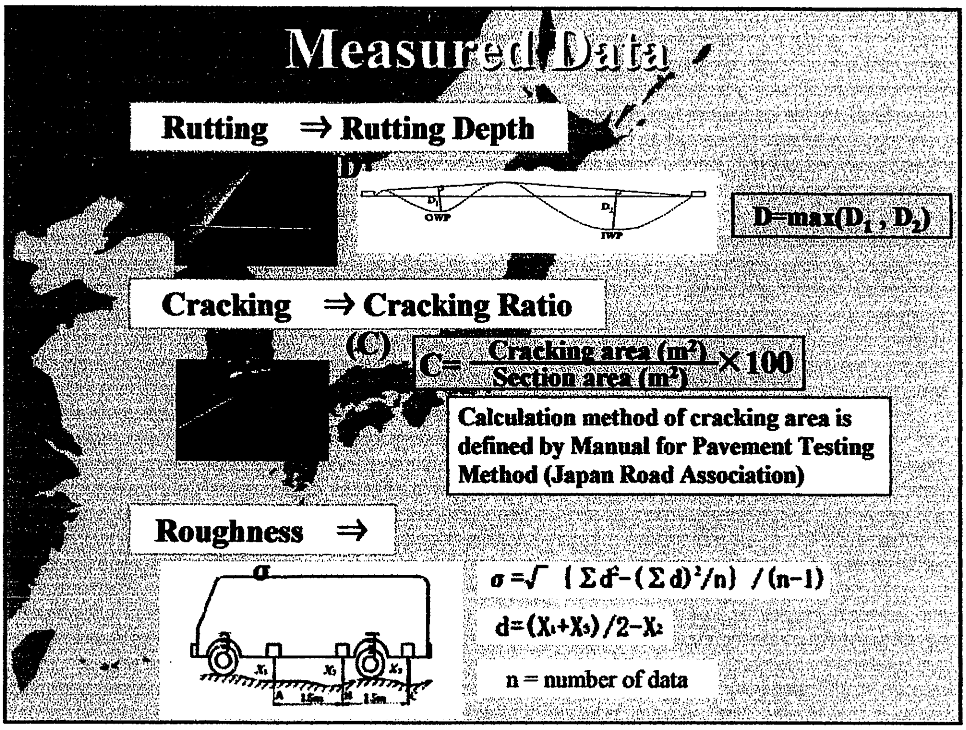

Implementation for monitoring
INDEX
Rutting
Cracking
Roughness
Skid Resistance
Faulting
Pothole Diameter
Annual Measurement
Daily Patrol
In case of National Highways (MILT)

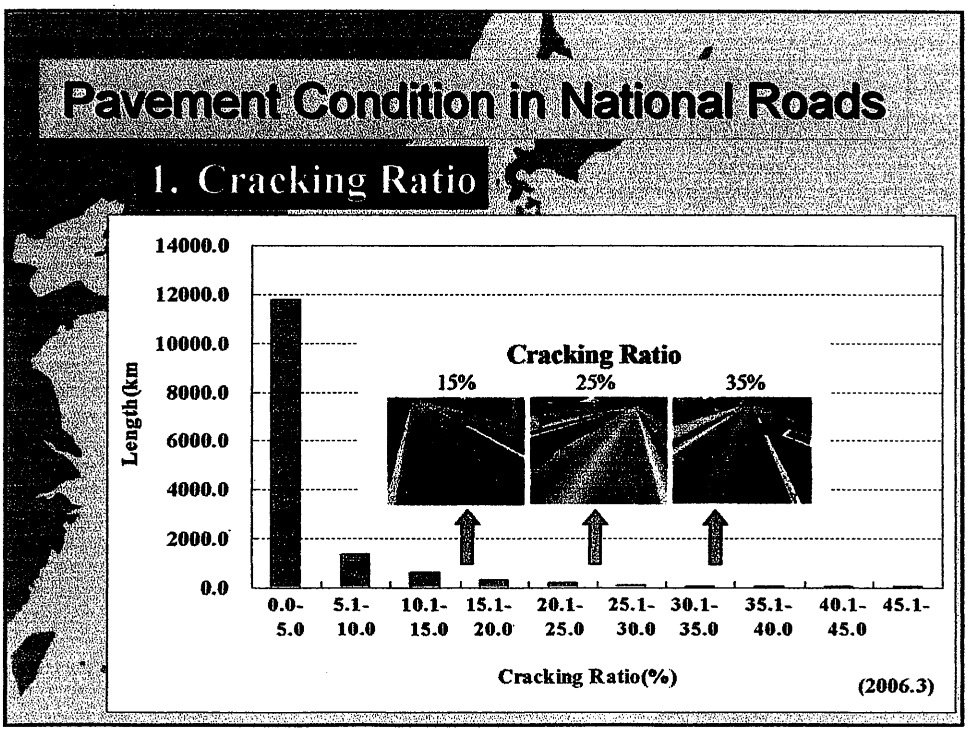

Patrol Work Flow
Office
Field
Patrol planning
Preparations
•Registration of personnel names
•Registration of patrol routes
• Confirmation of patrol plan, etc.
• Confirmation of unresolved items
Patrol
Entry of departure & patrol route inspections
extraordinary incident
Confirmation of patrol results
• Addition/revision of patrol record
• Generation of patrol log
• Instructions to maintenance service
Entry of details & photos
Transmission of emergency data

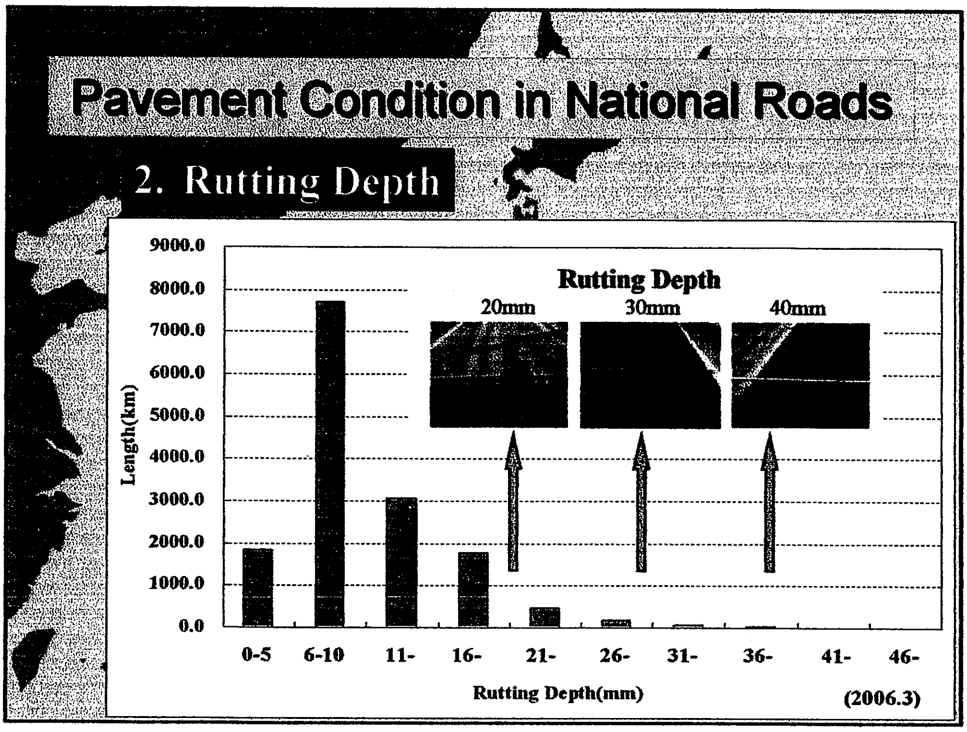

Road Patrol Assistance System (MLIT)
Field devices
Portable terminal, mobile telephone
GPS & digital camera
Digital camera
Record photo of site
Portable terminal
Office devices
Server/PC
Portable terminal & printer
Server
Modem
Printer
Print Patrol Log
Wireless LAN
Portable terminal
Return to office

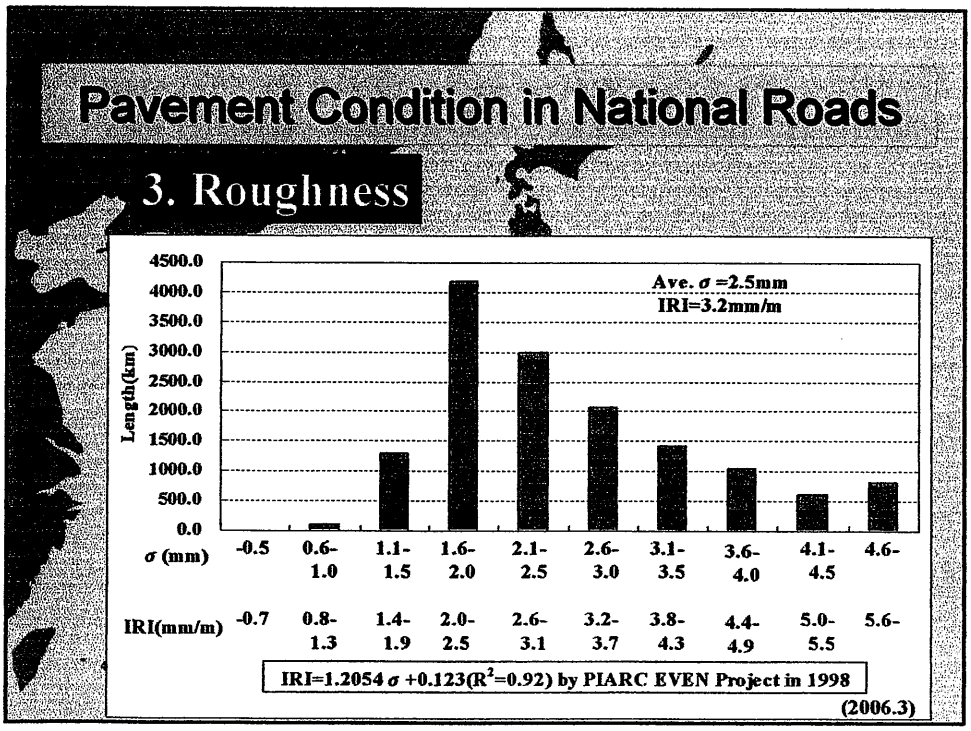

Annual Measurement
Items Measured
*Cracking Ratio
*Rutting Depth
*Roughness

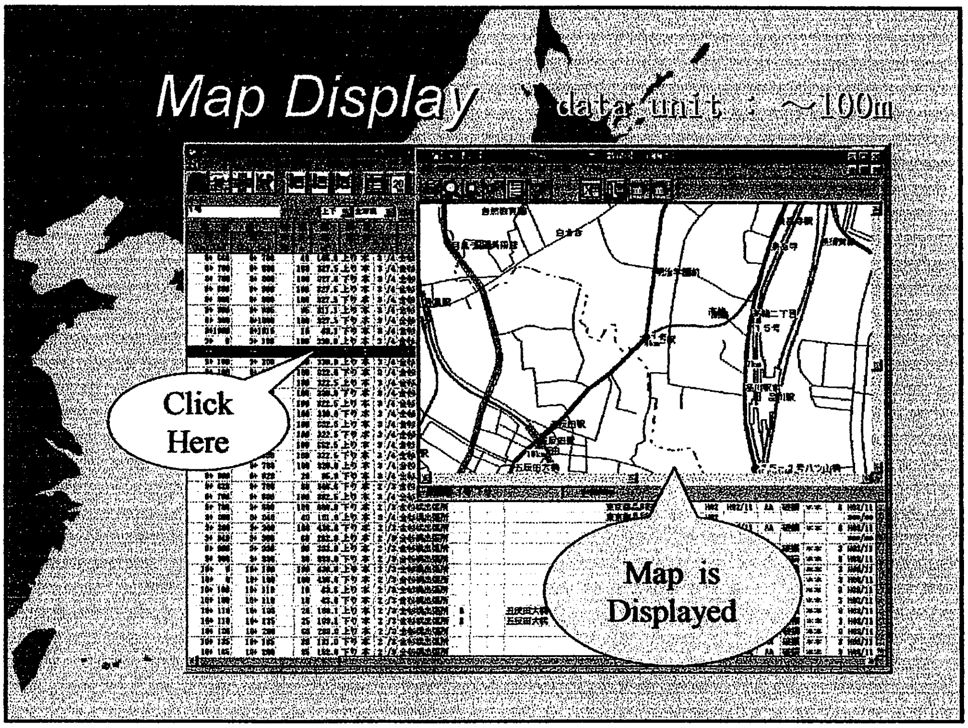

Road Surface Measuring Device (1)
Rutting
Roughness
Cracking
Pulse Camera
Laser Sensor
Displacement Meter
Illumination
Slit Camera
Hairline Projector

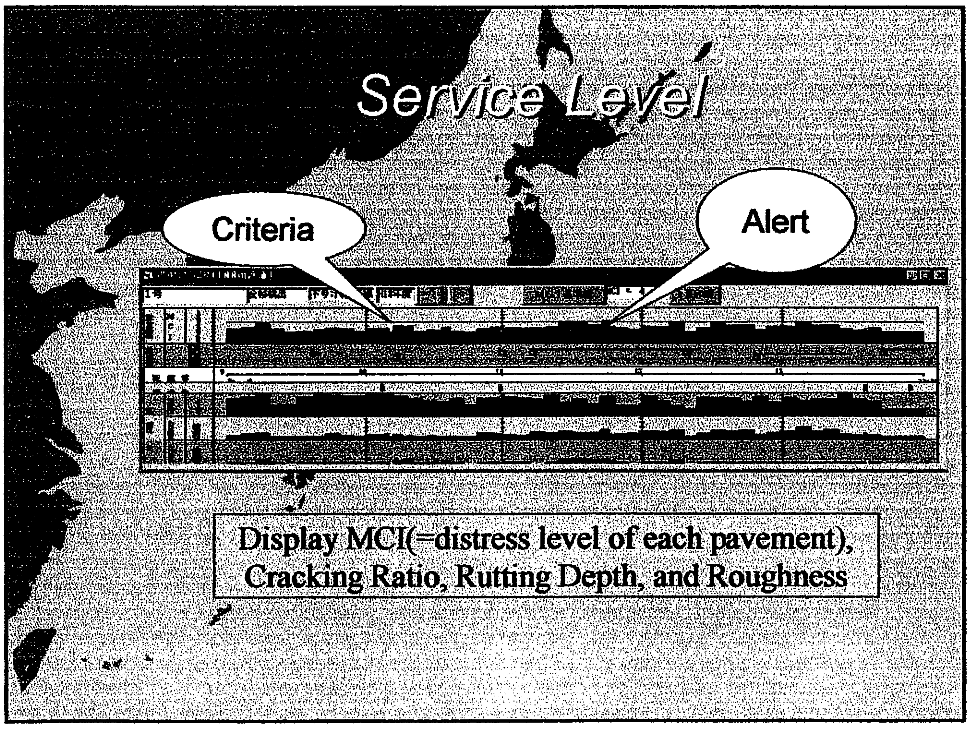

Measured Data
Rutting ⇒ Rutting Depth
D
OWP
IWP
D=max(D1 , D2)
Cracking ⇒ Cracking Ratio
(C)
C= Cracking area (m²) / Section area (m²) ×100
Calculation method of cracking area is defined by Manual for Pavement Testing Method (Japan Road Association)
Roughness ⇒
σ
σ=√ {Σd²-(Σd)²/n} /(n-1)
d=(X1+X3)/2-X2
n = number of data

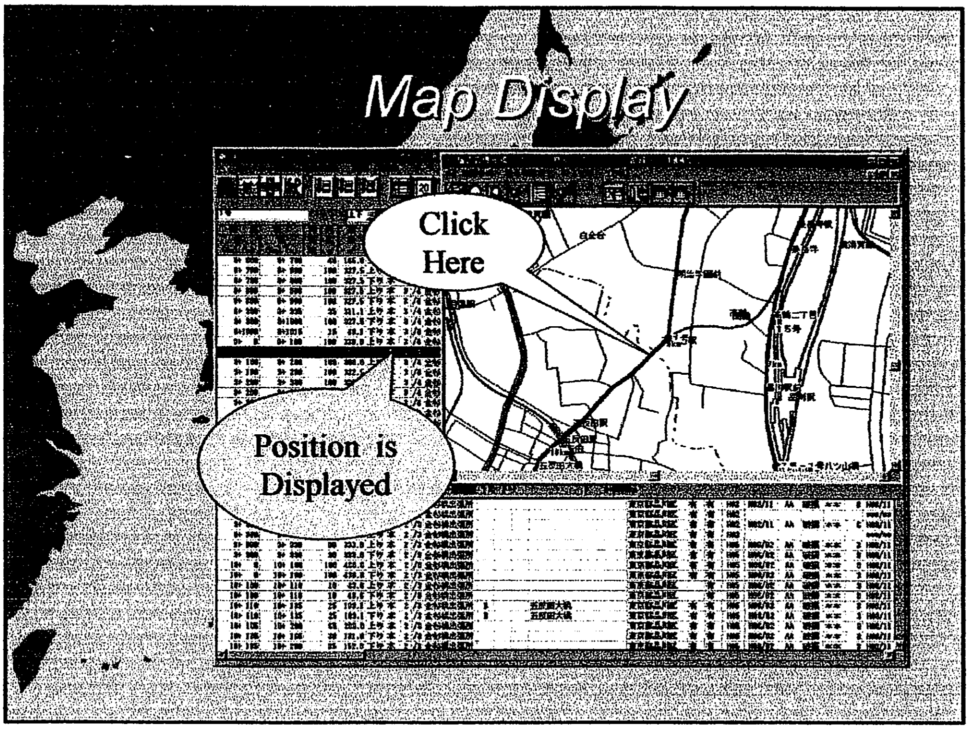

Pavement Condition in National Roads
1. Cracking Ratio
Length(km
14000.0
12000.0
10000.0
8000.0
6000.0
4000.0
2000.0
0.0
Cracking Ratio
15%
25%
35%
0.0-5.0
5.1-10.0
10.1-15.0
15.1-20.0
20.1-25.0
25.1-30.0
30.1-35.0
35.1-40.0
40.1-45.0
45.1-
Cracking Ratio(%)
(2006.3)

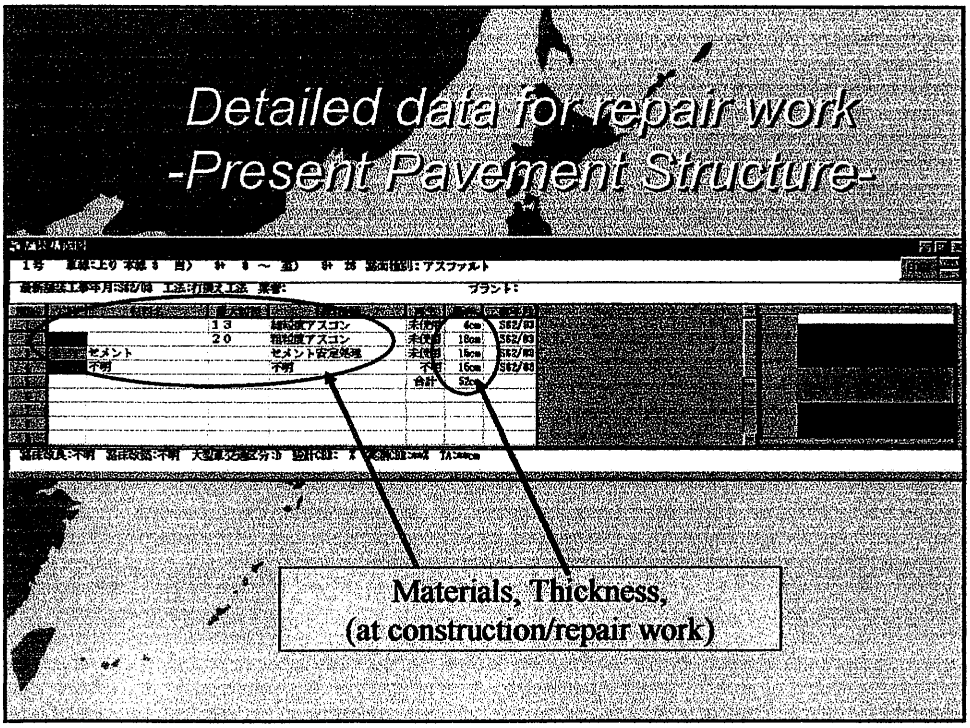

Pavement Condition in National Roads
2. Rutting Depth
Rutting Depth
20mm
30mm
40mm
Length(km)
9000.0
8000.0
7000.0
6000.0
5000.0
4000.0
3000.0
2000.0
1000.0
0.0
0-5
6-10
11-
16-
21-
26-
31-
36-
41-
46-
Rutting Depth(mm)
(2006.3)

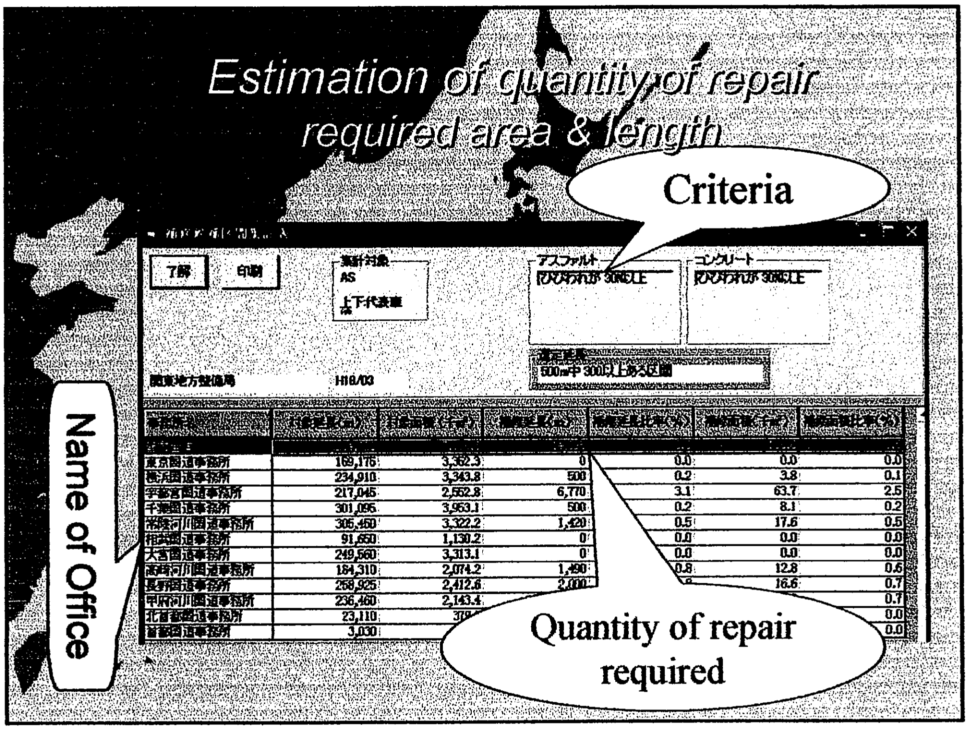

Pavement Condition in National Roads
3. Roughness
Ave. σ =2.5mm
IRI=3.2mm/m
Length(km)
4500.0
4000.0
3500.0
3000.0
2500.0
2000.0
1500.0
1000.0
500.0
0.0
σ (mm) -0.5 0.6-1.0 1.1-1.5 1.6-2.0 2.1-2.5 2.6-3.0 3.1-3.5 3.6-4.0 4.1-4.5 4.6-
IRI(mm/m) -0.7 0.8-1.3 1.4-1.9 2.0-2.5 2.6-3.1 3.2-3.7 3.8-4.3 4.4-4.9 5.0-5.5 5.6-
IRI=1.2054σ+0.123(R2=0.92) by PIARC EVEN Project in 1998
(2006.3)

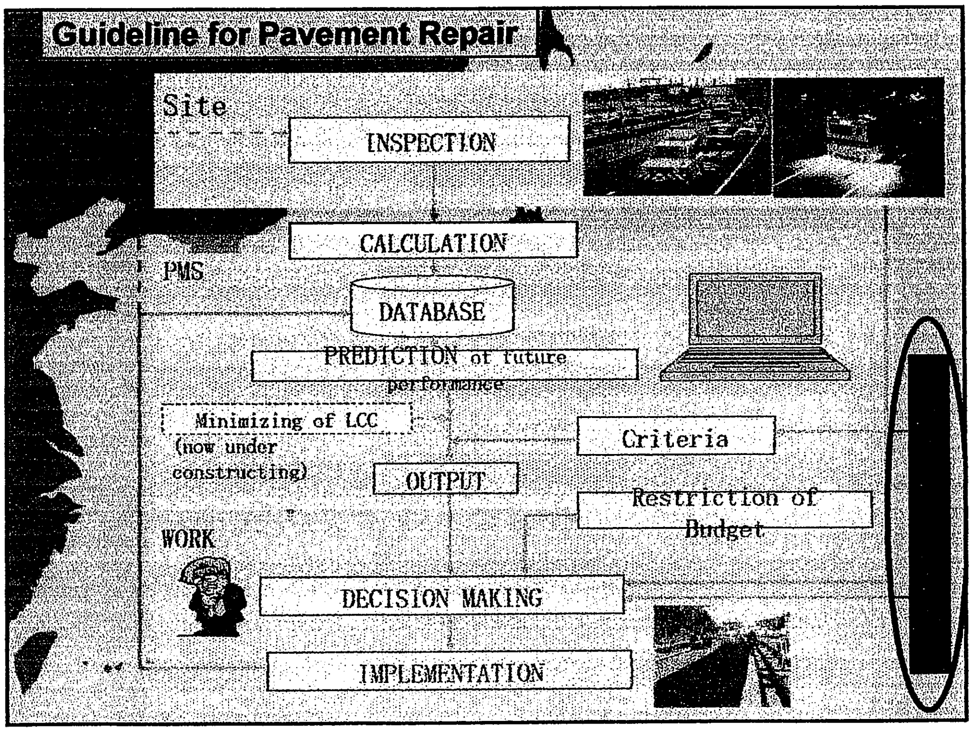

Map Display
data unit : ~100m
Click Here
Map is Displayed

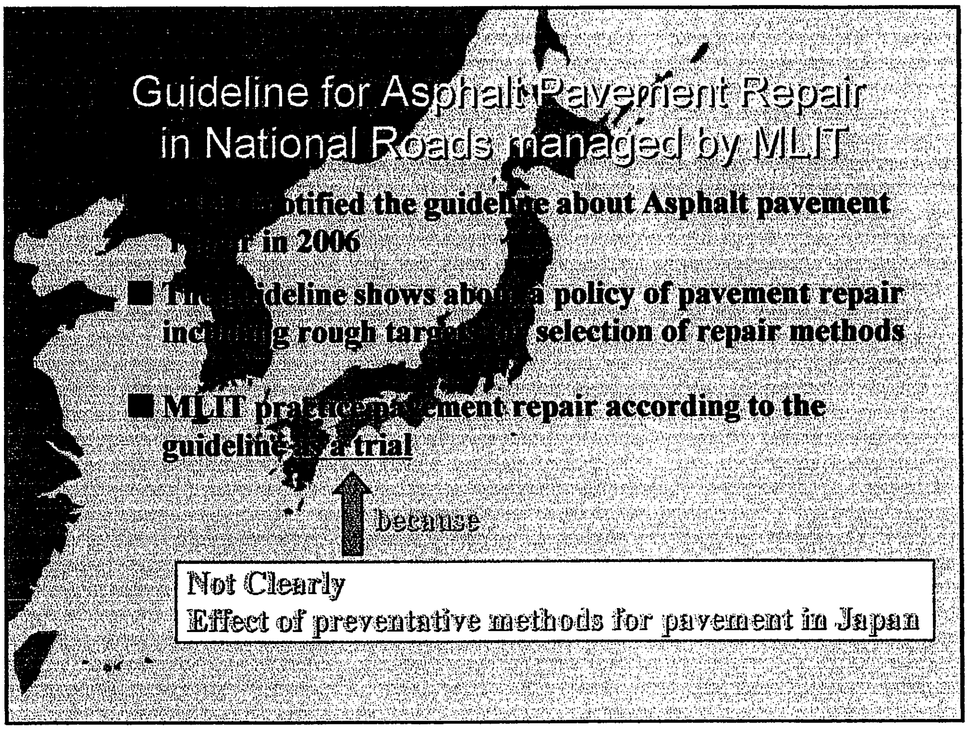

Service Level
Criteria
Alert
Display MCI(=distress level of each pavement),
Cracking Ratio, Rutting Depth, and Roughness

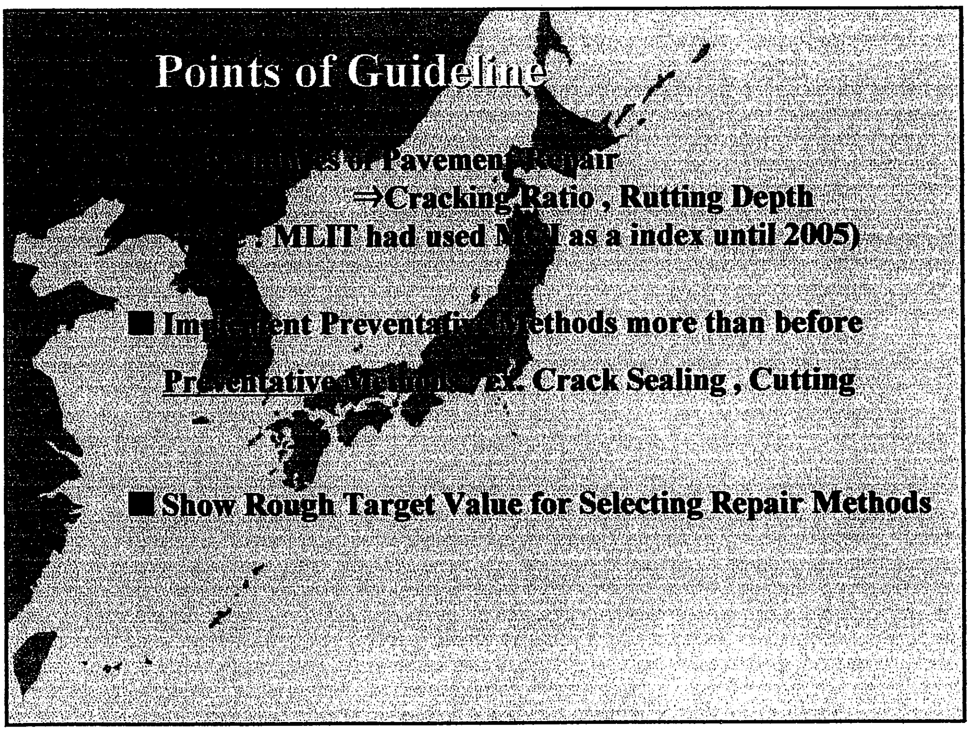

Map Display
Click Here
Position is Displayed

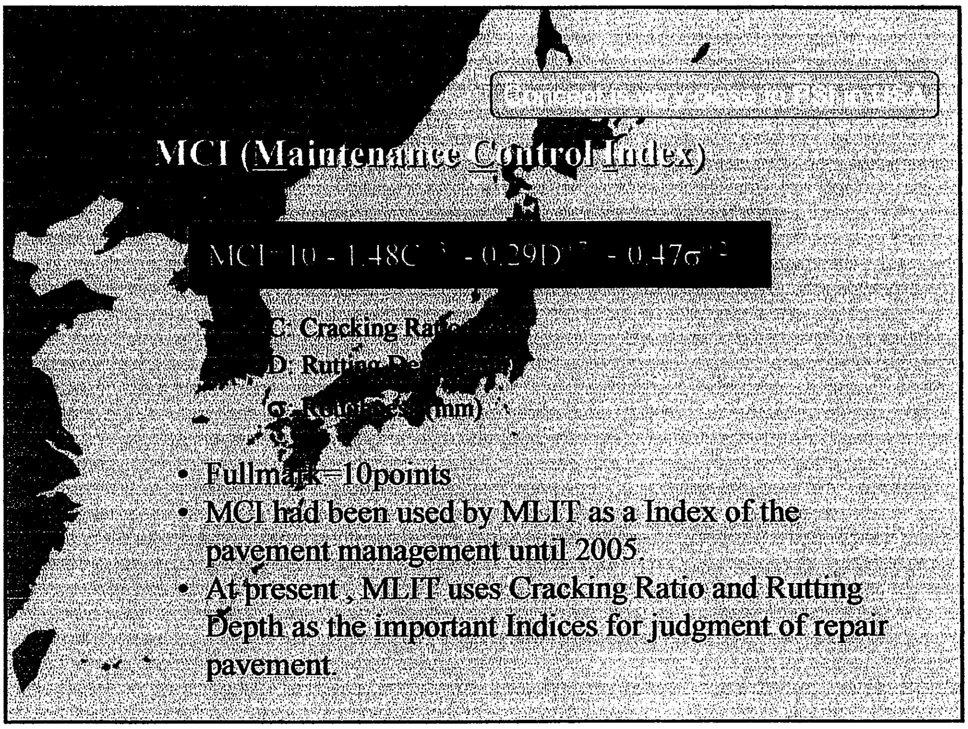

Detailed data for repair work
-Present Pavement Structure-
Materials, Thickness,
(at construction/repair work)

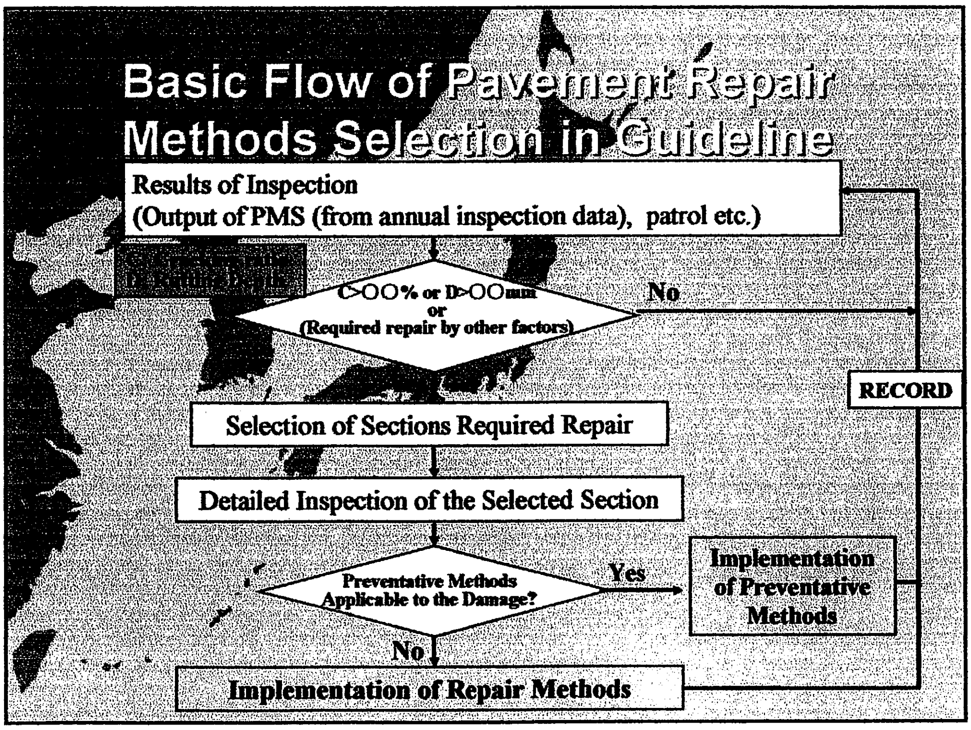

Estimation of quantity of repair required area & length
Criteria
Name of Office
Quantity of repair required
了解
印刷
AS
H16/03
500m中 300以上ある区間

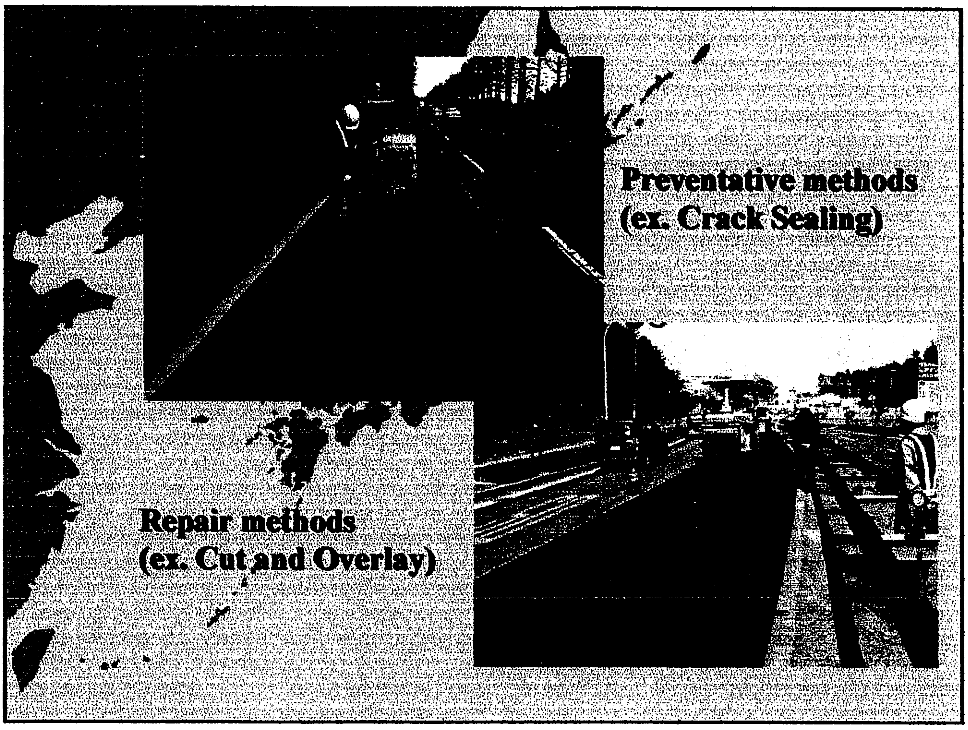

Guideline for Pavement Repair
Site
INSPECTION
CALCULATION
PMS
DATABASE
PREDICTION of future performance
Minimizing of LCC
(now under constructing)
Criteria
OUTPUT
Restriction of Budget
WORK
DECISION MAKING
IMPLEMENTATION


Guideline for Asphalt Pavement Repair
in National Roads managed by MLIT
otified the guideline about Asphalt pavement
in 2006
■ The guideline shows about a policy of pavement repair
selection of repair methods
■ MLIT pavement repair according to the
a trial
because
Not Clearly
Effect of preventative methods for pavement in Japan


Points of Guideline
⇒Cracking Ratio , Rutting Depth
MLIT had used as a index until 2005)
■ Preventative Methods more than before
Preventative ex. Crack Sealing , Cutting
■ Show Rough Target Value for Selecting Repair Methods


MCI (Maintenance Control Index)
MCI=10 - 1.48C - 0.29D - 0.47σ
C: Cracking Ra
D: Rutting
σ (mm)
• Fullmark=10points
• MCI had been used by MLIT as a Index of the pavement management until 2005.
• At present , MLIT uses Cracking Ratio and Rutting Depth as the important Indices for judgment of repair pavement.


Basic Flow of Pavement Repair Methods Selection in Guideline
Results of Inspection
(Output of PMS (from annual inspection data), patrol etc.)
C>OO% or D>OOmm
or
(Required repair by other factors)
No
RECORD
Selection of Sections Required Repair
Detailed Inspection of the Selected Section
Preventative Methods Applicable to the Damage?
Yes
Implementation of Preventative Methods
No
Implementation of Repair Methods

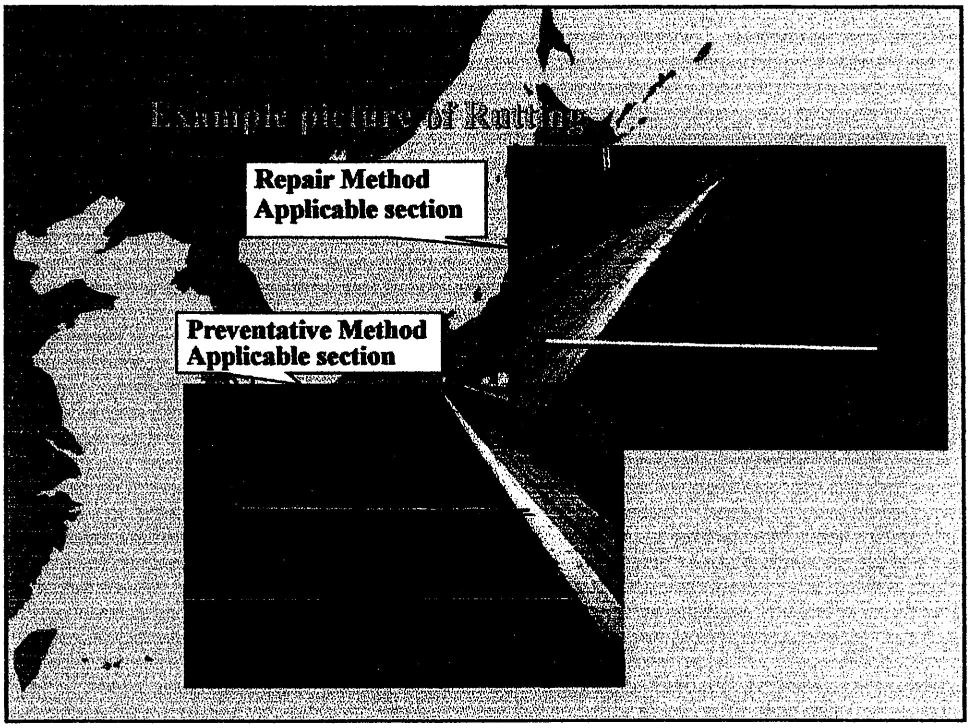


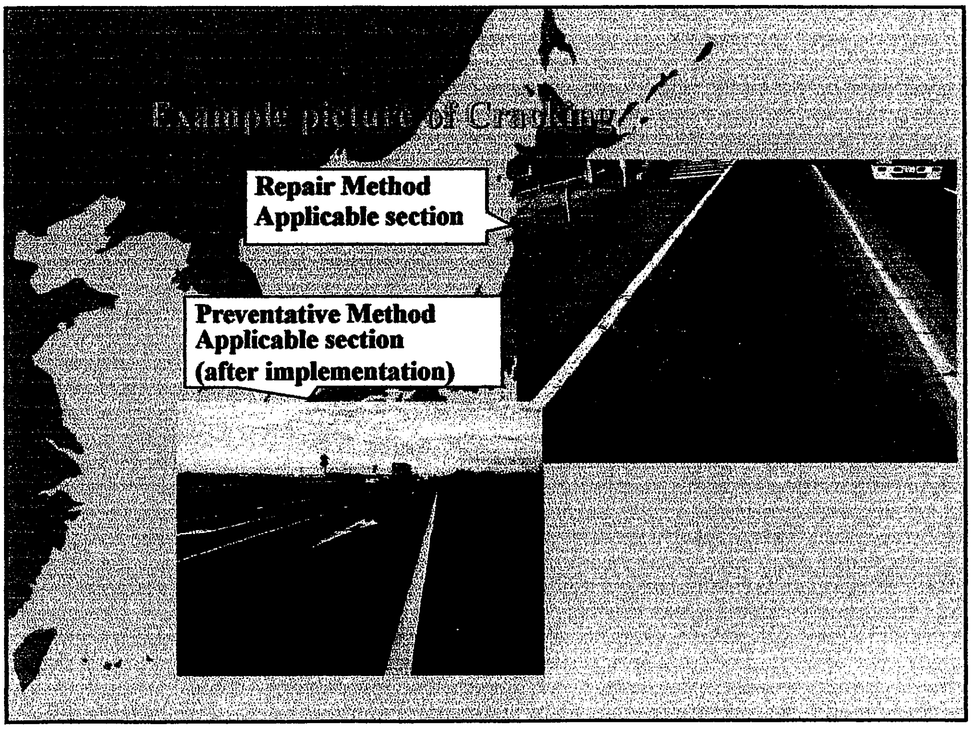
Rough Target (Selection of Method)

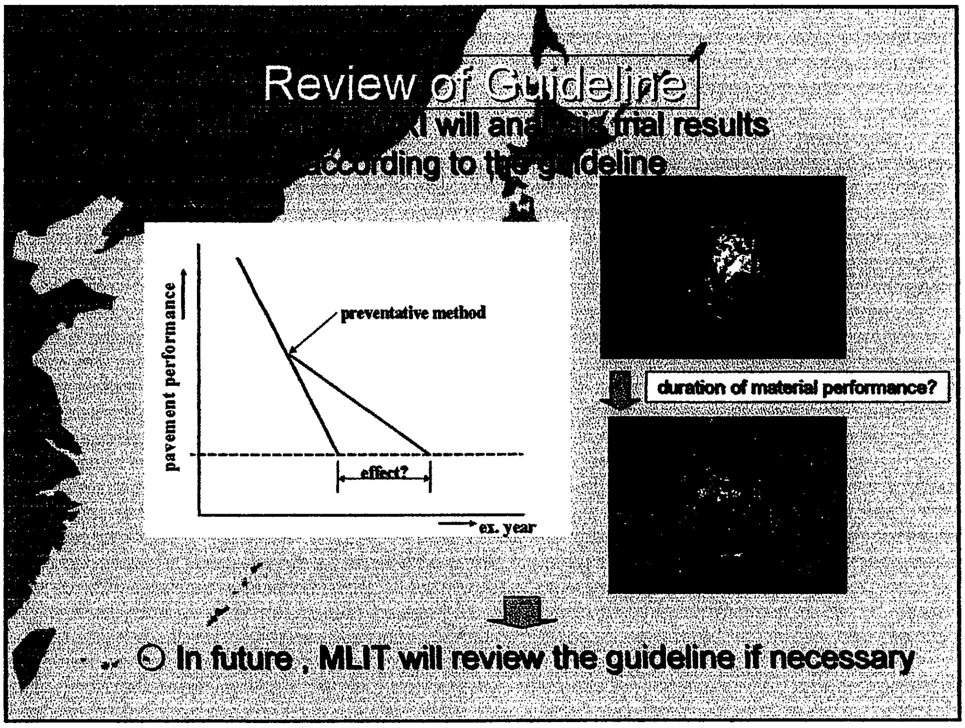
Rutting Depth / Craking Ratio	0mm-10mm	10mm-20mm	20mm-30mm	30mm-40mm	35mm-40mm	40mm-
0%-10%				cutting		
10%-20%						
20%-30%						
30%-35%	Crack sealing		Crack sealing + cutting			
35%-40%						
40%-					repair method(cut and overlay,etc)	

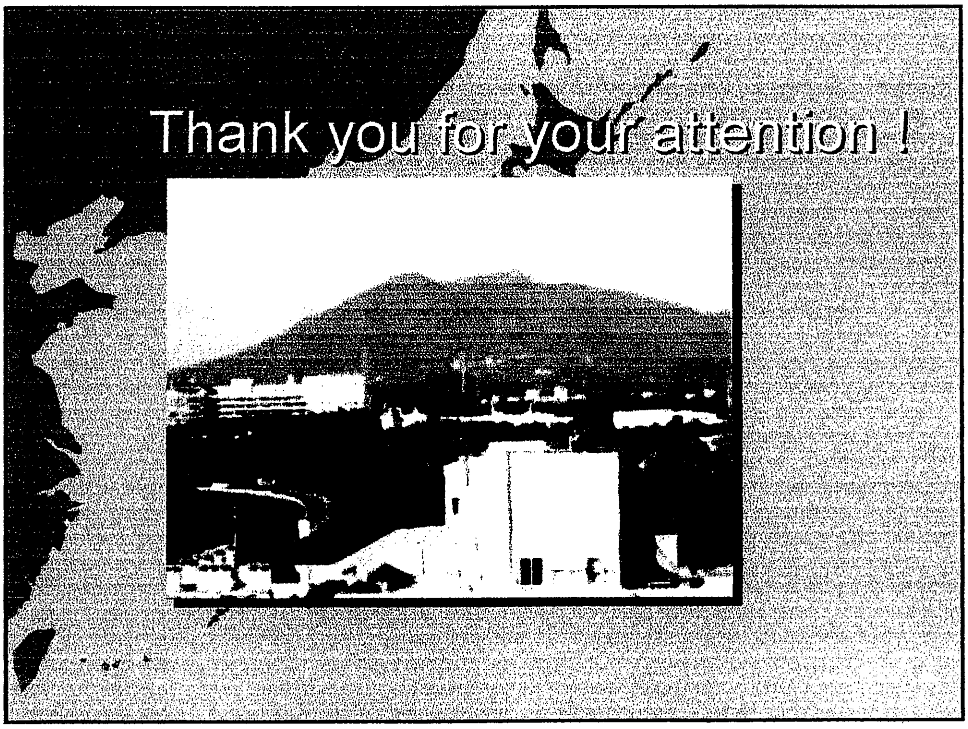
Preventative methods

Notice : The guideline shows these rough targets
but the guideline also says "technical judgment of engineer is important for selecting repair method properly".


Example picture of Rutting
Repair Method
Applicable section
Preventative Method
Applicable section


Example picture of Cracking
Repair Method
Applicable section
Preventative Method
Applicable section
(after implementation)


Review of Guideline
...will analysis final results
according to the guideline
pavement performance
preventative method
effect?
ex. year
duration of material performance?
In future , MLIT will review the guideline if necessary


Thank you for your attention !

Indonesian Pavement Research Strategy

Furqon Affandi
Research and Development Centre for Roads and Bridge
Jl. A.H. Nasution 264, Bandung 40294, Indonesia
E'mail: furqon_affandi@yahoo.com

Indonesia is the world's largest island group, it comprises over 3,000 islands situated below the equator which passes the center of Sumatera , Kalimantan and through the central Sulawesi. Therefore, it has a tropical climate which is greatly influenced by mountains and the sea. The total length of Indonesian roads is 372.173 km consisting of national, provincial, toll and district roads with the length of 34.629 km, 48.681 km, 688 km and 288.185 km respectively. While the length of country road is 240.000 km spreaded in the whole country.

The type of pavement used , 47% of the total length is asphalt and concrete pavements and the rest (53%) is unpaved road. From all paved roads, 98% is asphalt pavement while concrete road is only 2%. The reason is that asphalt pavement has been applied for a long time, while concrete road was just applied in 1985 and continuously developing. Budget for road construction and maintenance is approximately 1/3 and 1/5 of total needs, as a consequence, most roads are in bad condition. Furthermore, overloading with its load equivalent factor ranges from 2-5 times of permitted loads equivalent factor leads to early damage. In the future, national road is designed to use the maximum axle loads of 10 tonnes, 2 tonnes greater than the present condition (8 tonnes). The performance of pavement, especially asphalt pavement will be much influenced by Indonesian geographic and climate which tends to increase in temperature resulting from global warming. In addition, Indonesia with large areas has different regional characteristics including geographical condition and availability of material types and quality such as aggregate and sand. In certain areas, it is difficult to find aggregate for road pavement, it must be transported from other islands.

Asphalt is the main material for road pavement. Indonesia needs 1,3 million tonnes, however, local asphalt product is approximately 600.000 tonnes, the rest has to be imported from other countries. On the other hand, Indonesia has a large deposit of natural rock asphalt (Asbuton) reaching of 670 m tonnes which has not been optimally utilized. The reasons are Asbuton has different properties and Asbuton production is low in quality.

Cement factories in Indonesia have total production capacity by 44.89 m tonnes/year, however, domestic consumption is 34.17 m tonnes which most consumed by property (housing) sector, so that the rest of cement production capacity can be utilized by road sector. Approximately, 124.000 km of Indonesian roads are unpaved and most of them are low volume roads mainly in Kalimantan, Sulawesi and Papua, up to present there is no standard specification is made. Nowadays, environmental concern is developing therefore, environmental pavement technology is required. The reliability of infrastructure system which can increase competitive economic growth is one of the main goals of Indonesian Ministry of Public Works, therefore, pavement technology

suitable for Indonesian condition is needed. Road Map Research Design has been prepared consisting of four divisions, namely road map technology for Indonesia Natural Rock Asphalt (Asbuton) utilization, Road map technology for rigid pavement, Road map technology for flexible pavement and Road map technology for low volume roads. Road map technology for Indonesia Natural Rock Asphalt (Asbuton) is focused on utilization of Indonesian natural rock asphalt (Asbuton) in order to be utilized to overcome the shortage of asphalt in Indonesia. It is implemented by conducting several studies on database of Asbuton deposit and properties, Asbuton rheological properties, technology of Asbuton mix design, and economic feasibility study of Asbuton and its supply.
Road map for rigid pavement is aimed to provide technology of concrete utilization which is expected to decrease the need of asphalt, utilize the potential of cement production, overcome traffic overloading problem and also participate in nature preservation. The main focus of road map technology for rigid pavement is material technology and concrete mix design, design of concrete pavement for low volume traffic and heavy traffic, maintenance technology for concrete road and concrete pavement construction technology. Road map of Flexible pavement is focused on pavement technology to anticipate the increase of vehicle load, flexible pavement technology suited for Indonesian condition, technology for utilization of local materials and environmental technology to save energy. Road map of flexible pavement is categorized to be four groups ,i.e: material and asphalt mix, thickness design of flexible pavement, method of construction for flexible pavement, maintenance technology for flexible pavement and pavement management.
Road map technology for low volume traffic is aimed to provide relevant of low cost technology for low volume traffic by considering the availability and quality of local materials through several research which producing technical manuals for pavement mix design of low volume traffic, manuals for construction and supervision. Another one is study on sub standard local materials for road pavement materials.
The four road maps above, are expected to realize "the relevant road pavement technology for heavy and low volume traffic suitable for Indonesian condition, by utilizing natural material (mainly natural rock asphalt and cement), which durable, comfortable and safe for environment.

Keywords: flexible pavement, concrete pavement, Indonesian natural rock asphalt, low volume traffic, road map, environmental preservation, over loading.

PAVEMENT CONDITION POST DISASTER

Prepared by
Nyoman Suaryana

Research and Development Center for Road and Bridges (RDCRB)
Jl. A.H. Nasution 264, Ujungberung, Bandung 40294, Indonesia

Abstract

With the complex geological structure, Indonesia is prone to serious disasters, such as : earthquakes and volcanic eruption which damage infrastructures in a short period of time and, moreover, the second phenomena, such as tsunamis and land slide. In recent years disaster caused by earthquake were occured in many place of Indonesia, such as Tsunamis in Aceh on the morning of December 26, 2004, and Indian Ocean earthquake near Padang on September 30, 2009, which measured 7,6 on the Richter scale.

Much of the primary transportation infrastructure of West Sumatera province especially in Padang and Pariaman areas, was damages. Typical damages on the road pavement such as landslide, settlement and craks. Measures should be taken to repaired roads and bridges. Damages road pavement was repaired such as remove soil and install caution signs, crack shall be sealed immediately, sand bags or gabion installment, and divert water flow and construct temporary drains. There was a great danger that heavy rain would result in secondary disaster such as landslides. Measures for prevention to landslide or slope failure : close the areas where there was fear of damage, making temporary drainage to protect the landslides area from water flow, and strengthened inspection.

The next steps is rehabilitation and reconstruction. In this step it is needed to select the construction with the most effective and economical landslide treatment, other factors must be considered, including safety, construction scheduling, availability of materials, site accessibility, equipment availability, aesthetics, budget for design and construction, and environmental impact.

Key words : disaster, pavement

1. INTRODUCTION

Indonesia is the world's largest archipelago (Area : 1,922,570 km2), this country consists of many island for more than 17,000 islands spread from 6°08' north latitude to 11°15' south latitude, and from 94°45' to 141°05' east longitude. Indonesian region lie at the intersection of three major lithospheric plates : Eurasian, Pacific and Indian-Australian plate. Pacific plate has been continuously moving northwest and Indian-Australian plate moving northword, where oceanic crust of the Indian plate underthrusts the asian plate. With the complex geological structure, Indonesia is prone to serious disasters, such as : earthquakes and volcanic eruption which damage infrastructures in a short period of time and, moreover, the second phenomena, such as tsunamis and land slide.

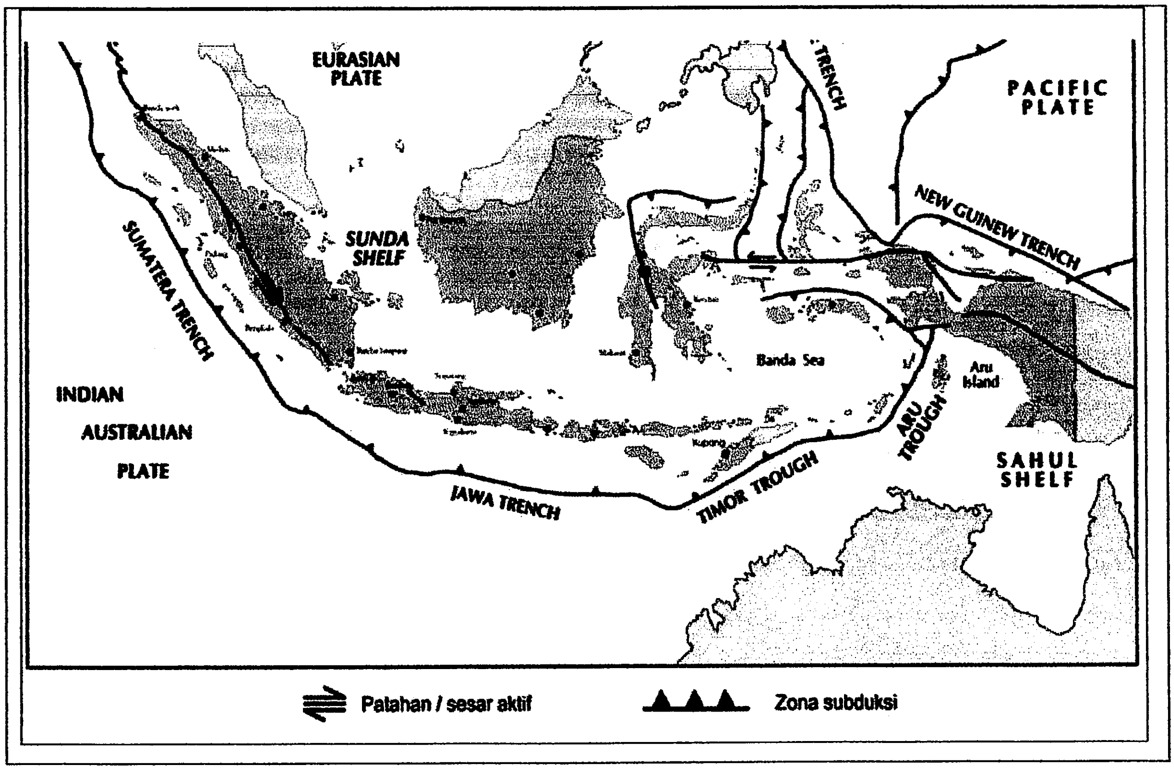


Figure 1. Plates and subduction zone in Indonesia

In recent years disaster caused by earthquake were occured in many place of Indonesia, such as : Flores sea on December 12, 1992 (Magnitudes=7,5), Lampung on February 16, 1994 (Magnitudes=7,2), Banyuwangi on Juny 3, 1994, Bengkulu on Juny 4, 2000, Alor Island on October 24 and November 15 (Magnitudes=7,3), Nabire on February 6 (Ms=6,9) and November 26, 2004 (Ms=6,4) which have caused heavily damaged. Tsunamis in Aceh on the morning of December 26, 2004, and Indian Ocean earthquake near Padang on September 30, 2009, which measured 7,6 on the Richter scale.

2. LITERATURE STUDY

There are four phases of the cycle of disaster management : (i) emergency response, (ii) rehabilitation and reconstruction, (iii) prevention and mitigation and (iv) preparedness. The phases which deals with pre-disaster is referred to as risk management and deals with post-disaster is referred to as crisis management. Figure 2 below presented the schematic of the cycle of disaster management.

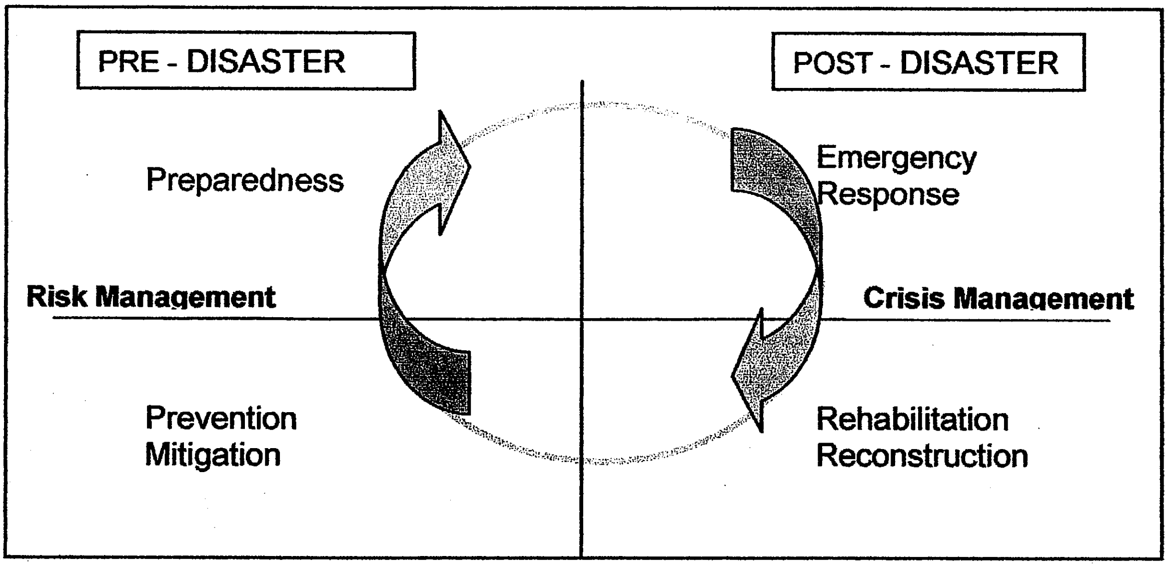


Figure 2. The cycle of disaster management

a. Emergency Response

The emergency response stage is aimed at rescuing the surviving community members and to immediately fulfill their minimum basic needs. The main goal of this response stage is humanitarian rescue and aid. At this response stage, it is also endeavored to complete decent temporary places for refuge, and quick logistic arrangement and distribution that can reach the intended target namely the disaster survivors.

Secondary disasters can be occur caused by heavy rain and aftershock earthquakes. Measures should be taken for the prevention of secondary disaster after a great disaster. There was a great danger that heavy rain would result in secondary disaster where the earth quake had caused sediment blockades of rivers and landslides.

b. Rehabilitation and Reconstruction

The rehabilitation and reconstruction stage is a continuation stage of the emergency response stage with the purpose of restoring public services in a sufficient time and redevelop the community in the context of social, economic, cultural and political life in accordance with the aspiration and the community's demand. Reconstruction of Infrastructure by giving priority to the restoring of basic infrastructure functions such as roads, airports and seaports, telecommunications infrastructure and facilities, the restoring electricity, water supply and housing.

c. Prevention and Preparedness

The basic plan should be taken before the disaster occurred and divided into two preventive measures, ie : structural-meaures (prevention) and non-structural measures (preparedness). The relationship between structural measures and non-structural measures in context of risk management is presented in Figure 5. In terms of structural measures (prevention), the target is to directly minimize disaster damage (reduction or mitigation). There will always be element of probablity indesigning external force. The action shuld be taken such as controlling development in high risk earthquake zones, using building codes that reflect the earthquake risk in the community and so on. In terms of non-structural measures, the key is abundance, meaning strengthening public awareness and preparedness of local government and local communities with the priority on disaster-prone areas, strengthening capabilities in disaster detection and emergency response, strengthening people's capacity through training and education, Issuing procedures and guidelines in disaster management; and so on.

3. PAVEMENT CONDITION POST DISASTER

3.1. Aceh Tsunamis

On the morning of December 26, 2004, earthquake which have magnitude 9.0 on the Ricther scale, caused tsunamis and struck Aceh and part of South Sumatera resulting in heavy damages. The hypocentre of the main earthquake was at 160 km west of Sumatra, at a depth of 30 km below mean sea level (initially reported as 10 km). This is at the extreme western end of the Ring of Fire, an earthquake belt that accounts for 81 percent of the world's largest earthquakes. Numerous aftershocks were reported off the Andaman islands and the region of the original epicentre in the hours and days that followed.

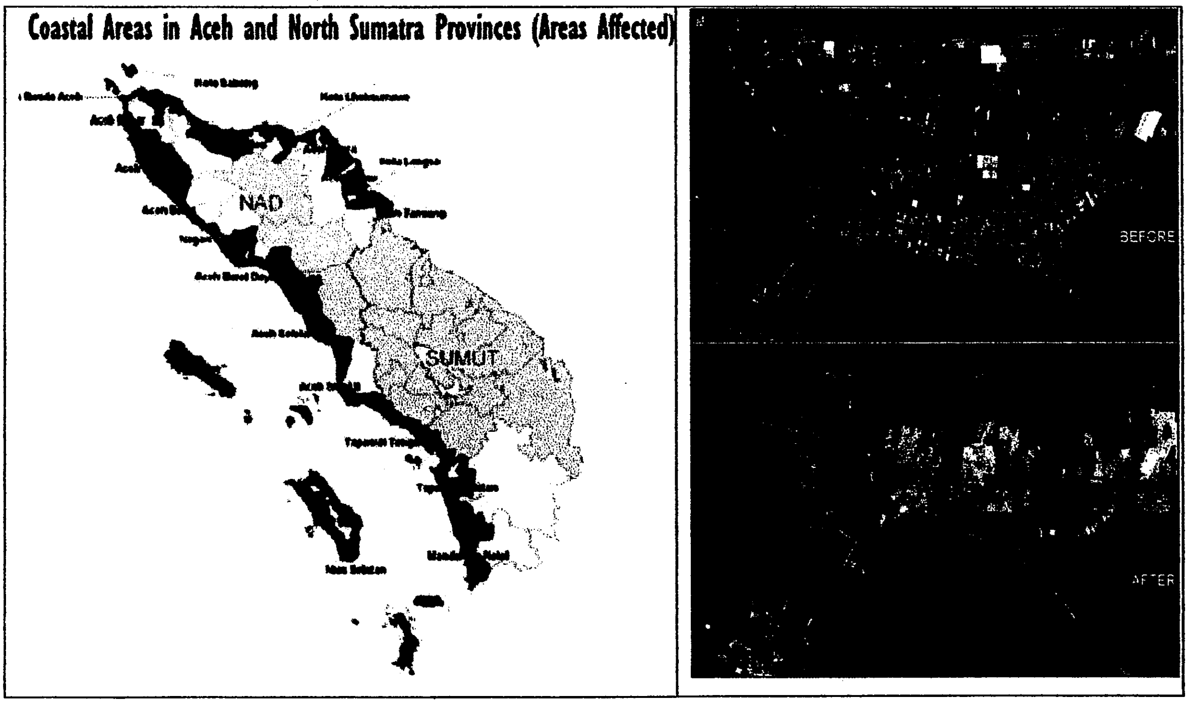


Figure 3. Areas affected, condition before and after tsunami

Based on recent information obtained from the National Coordinating Board for Disaster Management (Bakornas PBP) on March 21, 2005, the fatalities in 20 *kabupatens* in the Province of Nanggroe Aceh Darussalam (NAD) are estimated to reach 126,602 people killed and interned, and 93,638 people missing. Estimated length of primary roads damages :

a. Total damaged arterial roads: **654** km (27.5% destroyed, 45.5% sustained major damage)
b. Total damaged neighborhood roads: **1,361**km (33.7% destroyed, 21% sustained major damage)
c. Total damaged provincial highways: **603** km (38% destroyed,14% sustained major damage)
d. Total damaged bridges: **2,267** units (66.5% destroyed, 18% sustained major damage)
e. Total damaged aqueducts: **9,122** units (83% destroyed, 6% sustained major damage)

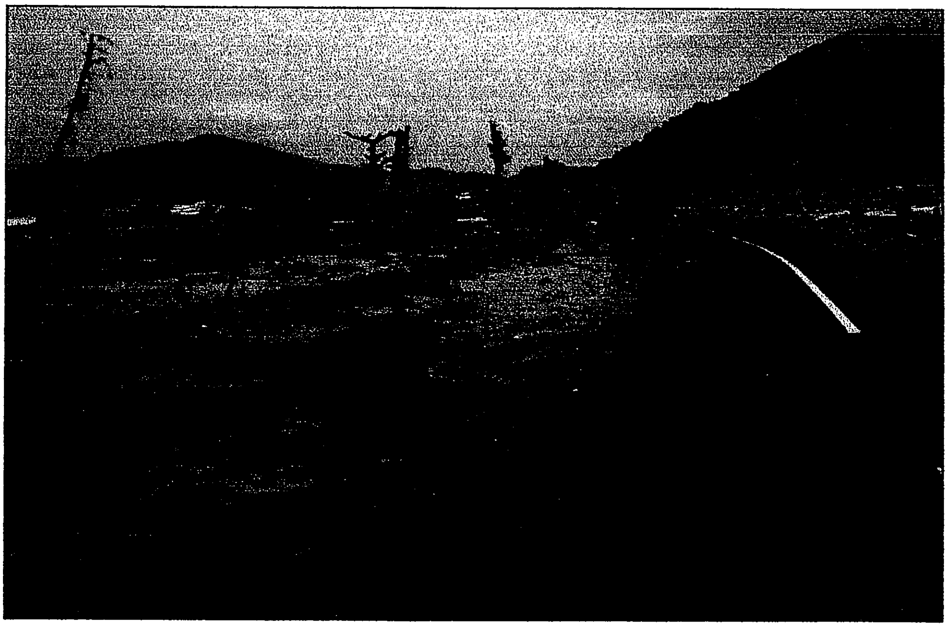


Figure 3. Typical road damages after Tsunami

3.2. Padang Earthquakes

Indian Ocean earthquake near Padang on September 30, 2009, which measured 7,6 on the Richter scale resulting the infrastructure in West Sumatera (Padang) damaged and more then 100 people death. Epicenter located about 45 km from Padang City, and infrastructures damages mostly happen in Padang and Pariaman area.

Typical damages in infrastructure, especially in road pavement are craks, settlement and landslide. Figure 4 – 7 shown the condition of pavement post disaster.

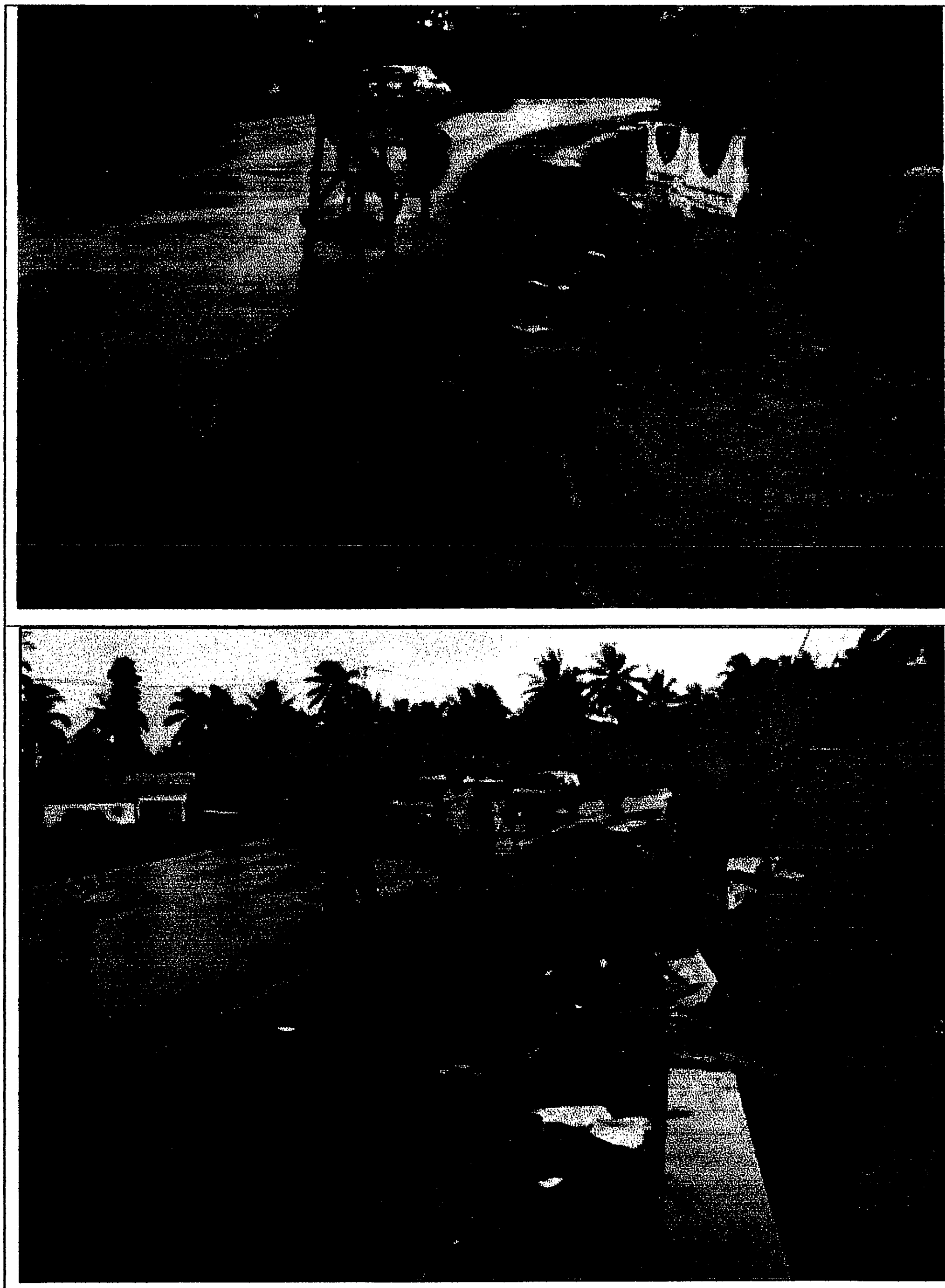


Figure 4. Craks and Settlement in KM 44.5 LUBUK SELASIH-SOLOK

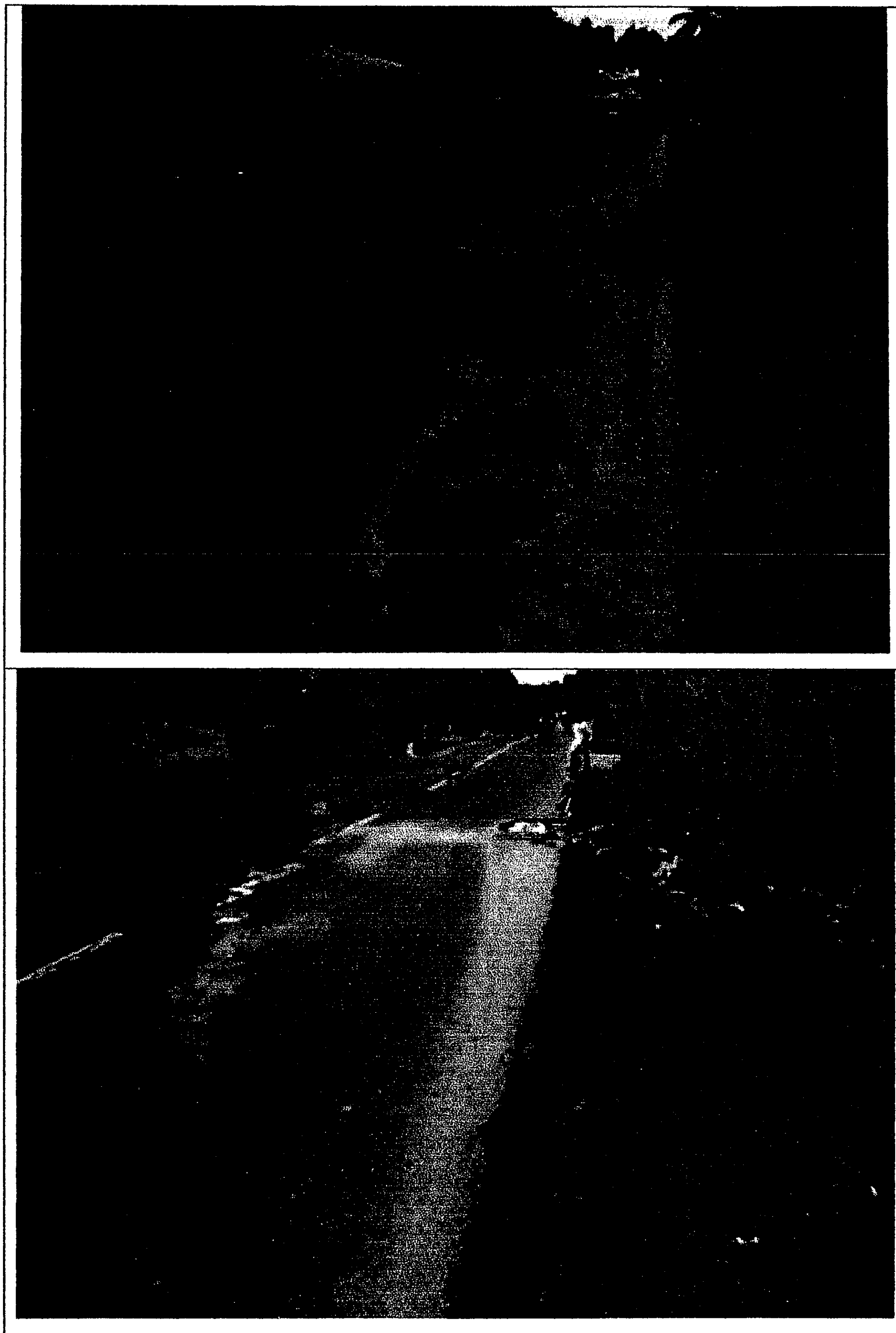


Figure 5. Craks and Settlement in PARIAMAN MANGGOPOH-PADANG

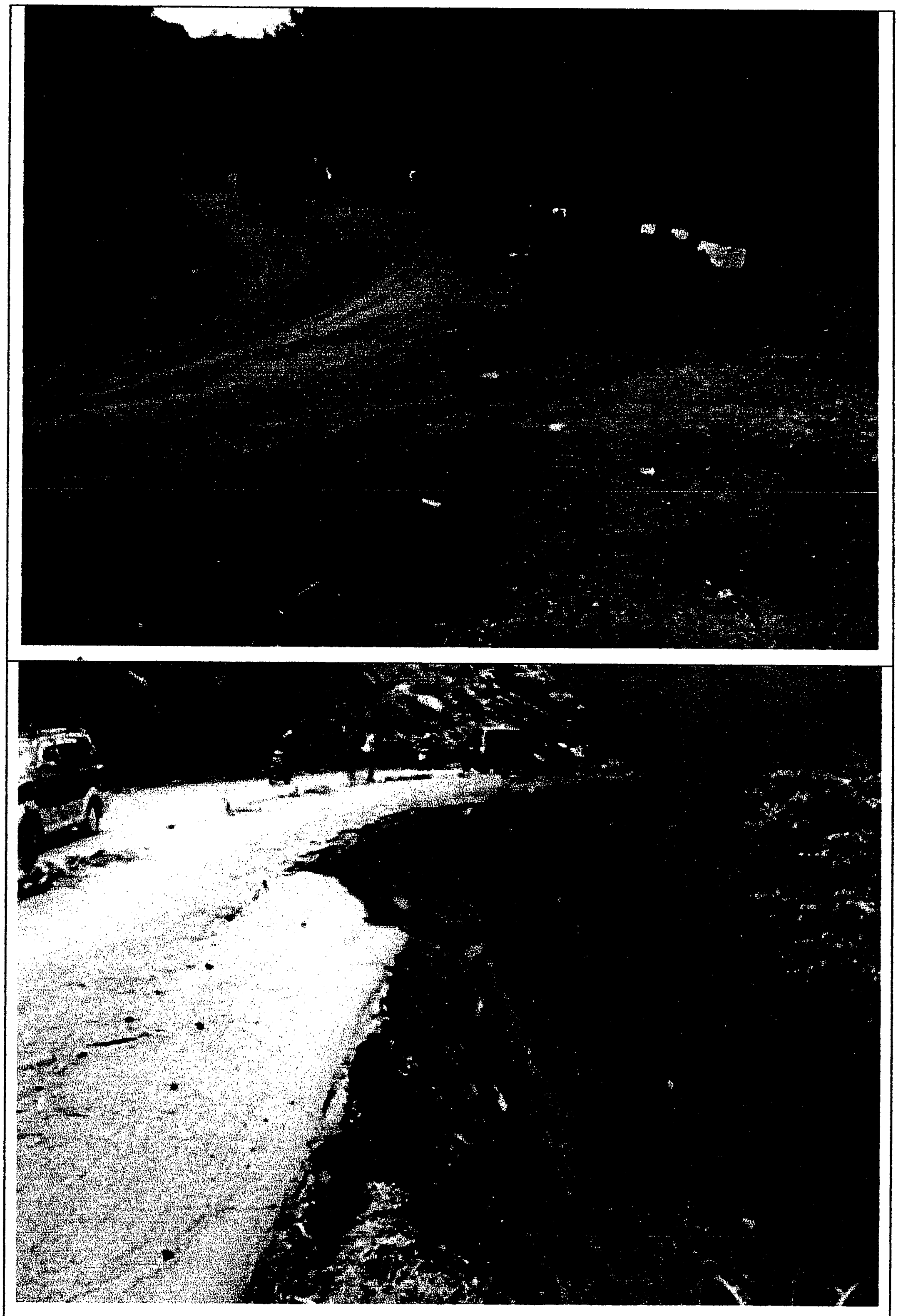


Figure 6. Landslide in Km. 17.9 KOTA PADANG – LUBUK SELASIH

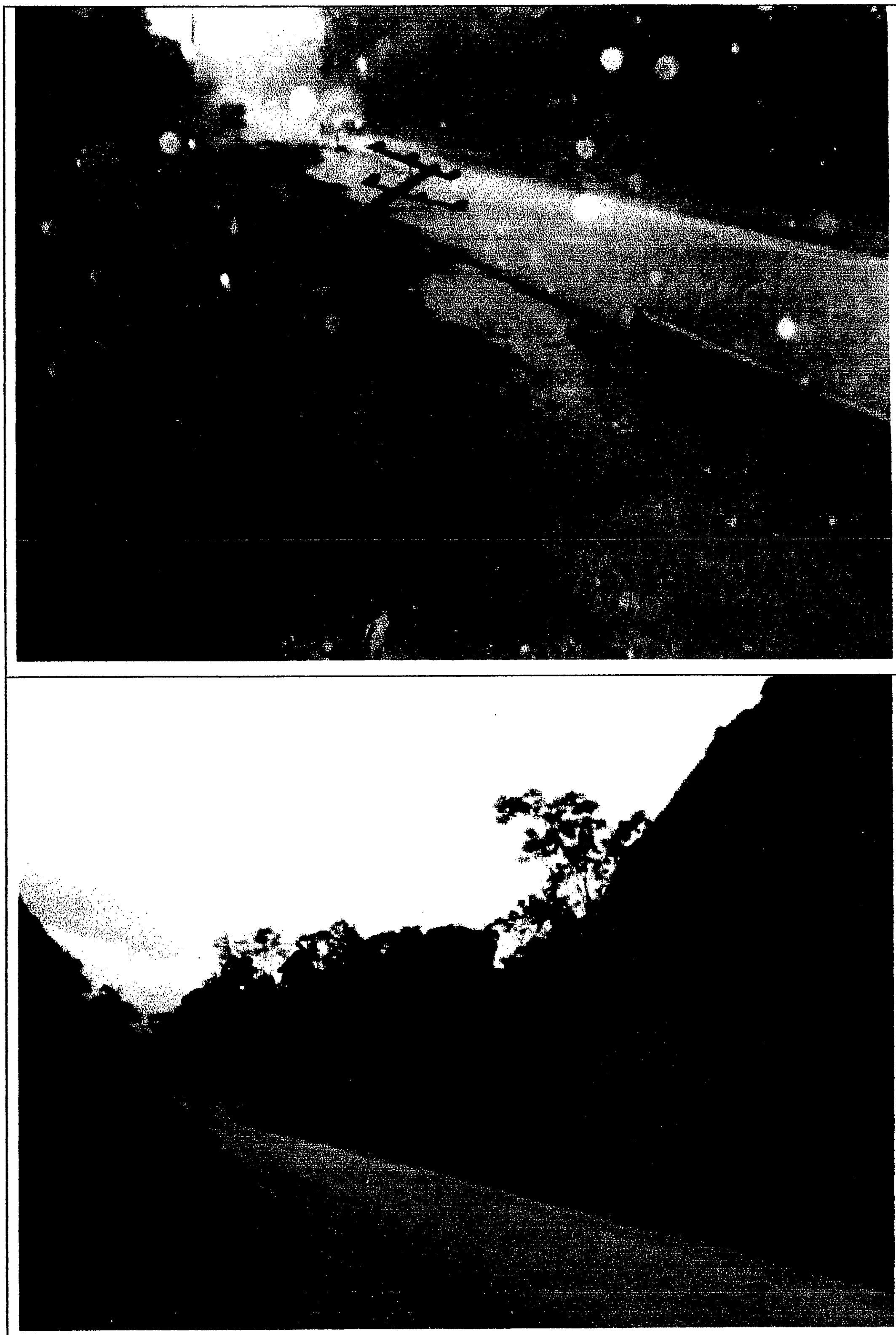


Figure 7. Landslide in roadway and in slope (PARIAMAN MANGGOPOH-PADANG (Simpang Empat Direction)

4. EMERGENCY RESPONSE (Padang Earthquakes)

The Stage of Emergency Response was set for 3 months since the disaster. At the stage of emergency response, the Board has coordinated these following emergency efforts:

a. Preliminary countermeasure

After the disaster, the government first estimates the damages such as death, injured, collapsed infrastructures, water supply, electrical and communication damages. The first estimation is needed in order to set up a system of disaster management.

b. Emergency countermeasure

- Mobilization of search and rescue teams (army, police, red cross, government official and volunteers)
- Immediately helping the disaster survivors
- Temporary restoration of the basic infrastructure that support life, such as temporary dwelling, sanitation, water supply, electricity, communications and transport facilities.

Taken measures for transportation

Much of the primary transportation infrastructure of West Sumatera province especially in Padang and Pariaman areas, was damages. Typical damages such as landslide, settlement and craks. Measures should be taken to repaired roads and bridges. Damages roads are repaired using minimum pavement structure, such as :

a. Remove soil and install caution signs

At the landslide area, soil should be remove from the road pavement to allow traffic flow, and install caution sign.

b. Crack shall be sealed immediately

Cracks is caused by settlement associated with an underground movement or landslide. Considering the rainy season, the craks in the pavement should be sealed imemediatly to protect the pavement structure from infiltrate water and secondary landslide.

c. Sand bags or gabion installment

   Temporary treatment for landslide should be taken, such as sand bags or gabion installment.

d. Divert water flow and construct temporary drains

   Secondary disasters can be occur caused by heavy rain and aftershock earthquakes. To prevent the landslide it need to construct temporary drain and divert water flow.

Prevention of secondary disasters

There was a great danger that heavy rain would result in secondary disaster such as landslides. Measures for prevention to landslide or slope failure :

a. Close the areas where there was fear of damage
b. Making temporary drainage to protect the landslides area from water flow
c. Strengthened inspection

5. RECONSTRUCTION & REHABILITATION (Padang Earthquakes)

In conjunction with selecting the most effective and economical landslide treatment, other factors must be considered, including safety, construction scheduling, availability of materials, site accessibility, equipment availability, aesthetics, budget for design and construction, and environmental impact. Some datas is needed to used in design ie. soil investigation, mapping and geology survey. There are many technique for strengthened, ie :

Treatment for strengthened slope :

a. Restoration with planting

   Restoration with planting is used on the slopes that does not collapse under normal condition (standard slope gradient). Some specific technique are : lined turfing, lined planting, sodding, vegetation matting (covering with mats containing seeds and fertilizer), seed spraying, spraying vegetation substrate (soil dressing, thick-layer substrate spraying), vegetation sand bags (use of sand bags containing seeds and fertile soil).

b. Restoration by facing structures

This technique is used when planting is not practical such as with bedrock slopes. Some specific techniques are : mortar or concrete spraying, stone or block pitching, concrete block pitching, cribbing with concrete block, cribbing by mortar and gabions.

c. Restoration with structures

This method is applied when slopes length would be too long and not enough space to make standard slope gradient. Some specific techniques are : retaining wall made of piled stone or concrete block, concrete retaining walls, lattice walls, anchoring and reinforced earth walls.

d. Other techniques

Other techniques of slope restoration include soil improvement and drainage works. Soil improvement is done to improve stability, using chemical injection or lime soil stabilization.

Treatments for strengthening pavement :

a. SAMI

A strain alleviating membrane interlayer (SAMI) is a sprayed seal surfacing, which is covered with a thin layer of asphalt as part of the surfacing treatment. The sprayed treatment acts as a membrane interlayer, which is designed to eliminate or minimize reflection cracking in a pavement by the use of either :

- a higly modified polymer modified binder
- a geotextile with an unmodified binder

b. Asphalt Overlay

An asphalt overlay is an application of a layer asphalt to an existing pavement surface. Overlay are used to strengthened pavement, they are also placed to remedy surface deficiencies such as shape and roughness.

c. Reconstruction of pavement

Resources :

1. RDCRB, 2009, "Survey for emergency response post earthquake in West Sumatera", RDCRB Bandung, 2009
2. Nyoman Suaryana, 2005, " Report of training in Disaster Mitimigation and Restoration System for Infrastructure (for Civil Engineer), Japan 2005", RDCRB Bandung 2005

UTILIZATION OF BUTTON NATURAL ASPHALT (ASBUTON) PROBLEM AND SOLUTION

Ir. Nono, M.Eng.Sc[1], Ir. Kurniadjie, M.Sc[2]

Research and Development Center for Road and Bridges (RDCRB)
Jl. A.H. Nasution 264, Ujungberung, Bandung 40294, Indonesia

Abstract

In recent years there are two main issue that occurred on an pavement constraction work in Indonesia, the first issue is the need for national asphalt can not be met so that the domestic suppliers need to import. The second issue is not achieved due to the age of the plan indicated early damage because the asphalt was softer or the asphalt was harder of asphalt used.
One way to reduce imports and improve the performance of asphalt mixtures is the use of domestic products is the use of natural asphalt found in Southeast Sulawesi, Buton Island, called Asbuton (Buton Rock Asphalt) was the region with the largest deposits of natural asphalt in the world at around 677 million tonnes or equivalent with approximately 170 million tons of asphalt.
In its use for construction pavement, Asbuton experiencing some constraints in terms of quality Asbuton produced, the use of modifiers is not appropriate and the technology used to make asphalt mixtures with Asbuton. This happened before the year two thousand, but after the year 2005 produced grain asbuton and pre-blended asbuton that serves as a substitute for oil and asphalt additives, these constraints can be more or less been solved.
From studies in the laboratory that had conducted showed that asphalt mix plus Asbuton has several advantages such as increasing the value of Marshall stability of up to 19%, value of resilient modulus of up to 36% (25°C) and dynamic stability up to 71%, compared with a mixture of asphalt mix without asbuton.

Keywords:

Asbuton, National Asphalt, Age of the Plan, Construction Pavement, Modifiers, Grain Asbuton.

1. INTRODUCTION

There are two major issue for asphalt work in Indonesia, the first issue is the need for national asphalt maintenance, improvement, accessibility and development of road transport is estimated at 1.2 to 2 million tons and will continue to increase with the growth of development can not be supplied by Pertamina.

Pertamina as the main supplier of asphalt supply in the country is only able to provide for about 600,000 tons/year, so to meet the shortage of supply of asphalt is done by way of diminishing the import of foreign exchange. The second issue, Indonesia with high rainfall and the heat of the sun throughout the year coupled with heavy traffic which will encourage uncontrolled early damage in the form of cracking or deformation.

One alternative that can be considered to reduce imports and improve the performance of asphalt mixtures is the use of asphalt domestic product is the use of natural asphalt found in Southeast Sulawesi, Buton Island, commonly called Asbuton (Buton Rock Asphalt), which is the region's largest deposit of natural asphalt in the world which is about 677 million tons. Asbuton was found by Dutch East Indies government in 1924 and managed by NV Mijnbouw en Cultuur Maatschapij Boeton (1924-1954), then managed by Indonesia government through mining concessions until now.

Most of these deposits have been explored in the area Lawele, of ± 210 million tons, equivalent to ± 63 million tons of asphalt cements. During this Asbuton exploited in the mining area and surrounding Kabungka, whereas relatively low amount of deposit, which is about 60 million tons, equivalent to ± 12 million tons of asphalt cement.

2. ASBUTON DEPOSIT

There are two types of natural asphalt, natural asphalt lake (lake asphalt) and natural rock asphalt. When compared with a deposit of natural asphalt in other countries, the island of Buton smoothly largest deposit of natural asphalt in the world as shown in Table 2.1.

Table 2.1 Deposits of natural asphalt in the world

No.	Country	Estimates deposits of natural asphalt (tons)
1.	Indonesia	677.000.000
2.	Asiatic	35.000.000
3.	Canada (Trinidad Lake Asphalt)	30.000.000
4.	Switzerland	10.000.000
5.	France	7.000.000
6.	Bosnian	7.000.000

Asbuton is natural rock asphalt found on the Buton Island, southeast Sulawesi, formed naturally by geological processes since thousands or even millions of years ago, asbuton formation derived from crude oil that pushed the surface slip out the porous rock. Generally rock type impregnated crude oil were lime stone, clay stone or sand stone.

Natural asphalt is available on Buton Island has a very large reserves, with asphalt levels varied between 10% and 50% with spread from the bay location Sampolawa up to Lawele bay along 75 km with a width of 27 km, as an illustration, the location of natural bitumen deposits in the island of Buton, shown in Figure 2.1.

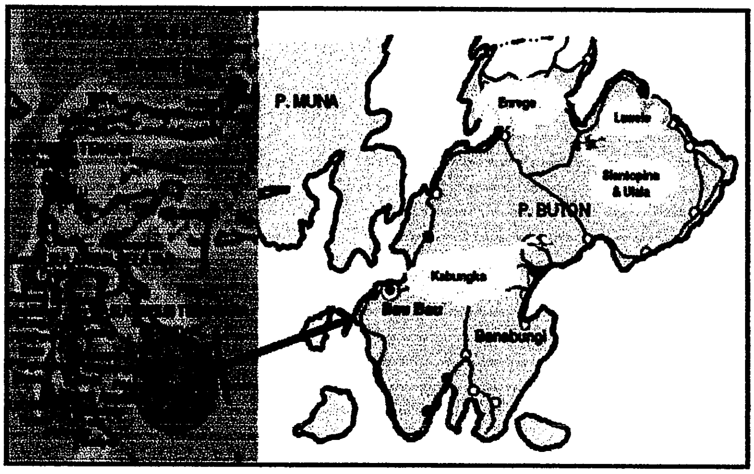


Figure 2.1 Location of Buton Island deposits

Exploration undertaken Alberta (1989) at 132 points Lawele on drilling Asbuton thick obtained ranged from 9 meters to 45 meters or an average of 29.88 meters thick. Witch is a thick ground cover from 0 to 17 meters or an average of 3.0 meters thick ground cover, 47 meters in the distribution area of the deposit Asbuton 1527343.5 m^2.

The data is equipped with advanced studies conducted by KPN Dharma Bhumi, mining fields and energy Southeast Sulawesi province, 1997 and satellite data that shows total reserves of natural asphalt in the entire island of Buton is about 677.247 million tons of scattered area, Waesiu 0.100 million tons; Kabungka 60 million tons; Winto 3.2 million tons, 0.600 million tons Winil; Lawele 210.283 million tons, 181.25 million tons Siantopina, Olala 47,089, Enreko (Coolie Milk) 174.725 million tones.

Table 2.1 Estimated Deposit Asbuton in Lawele and surrounding areas

No.	Location	area,m^2	Thick (m)	bitumen content,%	Deposit (tones)
1.	Batuawu	550.000	76.1	20 – 40	60.69
2.	Mempenga	280.000	72	20 – 30	29.232
3.	Lagunturu	420.000	61	20 – 25	37.149
4.	Kabukubuku	570.000	50	20 – 35	41.325
5.	Wangkaburu	460.000	62.8	20 - 35	41.888
6.	Siantopina	5000.000	25	Unknown	181.25
7.	Ulala	1.500.000	21.65	Unknown	47.089

Source: Report Estimation Geolistrik and core drilling Lawele village Asbuton, KPN Dharma Bhumi, mining fields and energy Southeast Sulawesi province, 1997

Of the many Asbuton deposit locations, only locations are Kabungka deposit has been mined and exploited, other areas such as the deposit location Lawele, new in the exploration stage and little use. Therefore, so far engineered paving roads in Indonesia are only known natural asphalt Asbuton characteristics of Kabungka. In general can be distinguished two types of Asbuton with different characteristics that are hard as the Kabungka and are relatively soft from Lawele.

From the results of exploration, the area has a kind Lawele soft Asbuton covered with a layer of soil (overburden) on average between 0 to 4.9 meters. Further exploration of the results was also mentioned that there have been some obstacles to carrying out drilling, one of which is sticky with asbuton drill, and it's likely due to very soft under layer asbuton.

3. CHARACTERISTICS OF ASBUTON

As already known, in the Asbuton there are two types of main element, namely bitumen (asphalt) and minerals. In the utilization of asphalt work, the two types of elements of a dominant will affect the performance of the designed asphalt mixtures.

The results of physical and chemical analysis of bitumen Asbuton from Kabungka and Lawele locations are shown in Table 3.1 and Table 3.2.

Table 3.1 The results of physical testing of bitumen Asbuton from Kabungka and Lawele

Type of physical testing	Result of test	
	Asbuton from Kabungka	Asbuton from Lawele
Bitumen content,%	20	30.08
Penetration, 25°C,100 gr, 5 sec, 0,1 mm	4	36
Softening point, °C	101	59
Ductility, 25°C, 5cm/minute, cm	< 140	>140

Solubility in C_2HCL_3, %	-	99.6
Flash point, °C	-	198
Specific gravity	1.046	1.037
LOH (TFOT), 163°C, 5 hours	-	0.31
Penetration after TFOT, % fresh	-	94
Softening point after TFOT, °C	-	62
Ductility after TFOT, cm	-	>140

Table 3.2 The result of chemistry testing of bitumen Asbuton from Kabungka and Lawele

Type of chemistry testing	Result of test	
	Asbuton from Kabungka	Asbuton from Lawele
Nitrogen (N),%	29.04	30.08
Acidafins (A1), %	9.33	6.60
Acidafins (A2), %	12.98	8.43
Parafin (P), %	11.23	8.86
Maltene	1.50	2.06
Nitrogen/Parafin, N/P	2.41	3.28
Asphaltene content, %	39.45	46.92

Judging from their chemical composition, bitumen of Asbuton from both regions has deposits of nitrogen compounds and high base maltene good parameters.
This indicates that Asbuton can serve as a good adhesive to aggregate and sufficient durability. But viewed from the other characteristics, penetration value of Asbuton Kabungka has a relatively low penetration compared to Asbuton from Lawele. In order Asbuton from Kabungka can be utilized in asphalt mixed, Asbuton be undertaken in such a way that has characteristics approaching the characteristics of the asphalt cement.

From the description shows that the largest deposits Asbuton in Buton island located in Lawele with high quality asphalt, which needs to be done is an appropriate technology so that the nature of Lawele asphalt can be used in asphalt road paving work.

Minerals of Asbuton dominated by "Globigerines limestone 'limestone is a very fine micro-organism is formed from ancient animal micro-foraminifera have very fine qualities, hard-yield relatively high calcium and good as a filler in asphalt mixtures.

Gradation test results and chemical analysis mineral extraction results from the location Kabungka and Lawele shown in Table 3.3 and Table 3.4.

Table 3.3 Mineral gradation of Asbuton from Kabungka and Lawele

Sieve Size		passing (%)	
ASTM	mm	Asbuton from kabungka	Asbuton from Lawele
No.8	2.38	100	100
No.30	0.595	100	99.1
No.50	0.297	100	89.1
No.100	0.148	95.6	49.3
No.200	0.074	4.5	32.2

Table 3.4 Mineral composition of Asbuton from Kabungka and Lawele

Compounds	mineral chemist analysis	
	Asbuton from kabungka	Asbuton from Lawele
$CaCO_3$	86.66	72.90
$MgCO_3$	1.43	1.28
$CaSO_4$	1.11	1.94
CaS	0.36	0.52
H_2O	0.99	2.94
SiO2	5.64	17.06
$Al_2O_3 + Fe_2O_3$	1.52	2.31
Residu	0.96	1.05

4. BARRIERS TO USE ASBUTON

In the decade of the eighties to the nineties, asbuton, usually used for cold mix asphalt, which is used conventional asbuton, but a failure caused by:

- bitumen content vary widely, the levels of conventional asphalt Asbuton can vary up to 10%
- grain size is relatively large, the specifications required for Asbuton layer aggregate mixture has maximum grain size is passed sieve No. 4 (4.76 mm), the reality on the ground asbuton grains found in above 1 inch (2.54 mm), where this will affects asbuton asphalt activate by modifier material.
- modifier material not suitable to activate the bitumen asbuton
- Asbuton contamination between the clay and the other materials at accumulation and transport.
- asbuton water content is high, the water content conventional asbuton can occur up to above 20%.

Mixed failure due to cold, tried Asbuton used in asphalt mixtures in a warm but experienced several problems, namely:

- modifications must be made in mixer,
- modifier kind of inappropriate,
- the use of cold mix in locations with heavy traffic and

- Asbuton water content is high.

The next effort is to make an asbuton hot mixing, but although the results are relatively good, there are still obstacles include:

- must make modifications mixer,
- modifier types of inappropriate and
- Water levels are relatively high.

5. IMPROVING PERFORMANCE MIXTTURE DONE USING ASBUTON

The work done to improve the performance of asphalt mixtures using asbuton are:

- Uniform bitumen content and grain products generated asbuton fabrication, such as Butonite Granular Asphalt (BGA), Butonite Rock Asphalt (BRA), Lawele Granular Asphalt (LGA) and refined Asbuton bitumen (Refine Buton Asphalt, Retona).
- Minimizing water content resulting asbuton while protecting the addition of water content, for example by packaging
- Producing asbuton that can be used directly, without making any modifications to the equipment used for mixing, for example BGA supplied through feeder filler.
- Conduct pre blended between the asphalt asbuton hard grains with a specific process that occurs mixture homogeneity, for example refined Asbuton bitumen (Refine Buton Asphalt, Retona) mixed with asphalt cement before inserted into the mixer.
- Conduct barring the placement of asphalt mixtures using asbuton, for example for low traffic use cold mix Lasbutag, for traffic being able to use a asbuton warm mixture and asbuton for heavy traffic can be used asbuton hot mixture.
- If the asbuton modifier must be used, choose the appropriate modifier, for example to asbuton warm mixture can be used PH-1000 which has a viscosity modifier that between 1000 to 1200 cSt.
- Making modifications mixer that can be used for hot asphalt mixtures using hard asphalt and can be used to mix the mixture using asbuton.
- An activity is already done and has given satisfactory results. The last attempt was done LGA mixes are hot without modifying the asphalt mixing plant (AMP).

6. TYPE ASBUTON THAT HAVE BEEN PRODUCED

Asbuton types that have been produced in fabrication and manual in recent years that have been recommended are granular type, refined Asbuton bitumen (refine Buton asphalt, Retona) and pure refined Asbuton bitumen (full extraction results).

Of the three types that have been recommended asbuton, only two types have been produced which has done manufacturers and full scale test by IRE and used for projects that use the type asbuton granular and (refine Buton asphalt, Retona).

6.1. Granular Asbuton

Granular Asbuton is the result of processing solid Asbuton which broke with a stone-breaker (crusher) or other appropriate solvers that have a certain grain size.

Since 2005 there are four types of grain produced asbuton, classification of type asbuton basis points based on class penetration and bitumen content. Terms asbuton into four types of granular are shown in Table 6.1 Granular Asbuton are generally used in cold mix asphalt, a mixture of hot and warm the mixture as a binder or added ingredients (additives).

Table 6.1 Granular Asbuton requirements

Properties of Asbuton	Test method	Type 5/20	Type 15/20	Type 15/25	Type 20/25
Bitumen content of asbuton; %	SNI 03-3640-1994	18-22	18 - 22	23-27	23 - 27
Grain size of asbuton					
- Passing No 8 (2,36 mm); %	SNI 03-1968-1990	100	100	100	100
- Passing No 16 (1,18 mm); %	SNI 03-1968-1990	Min 95	Min 95	Min 95	Min 95
Water content, %	SNI 06-2490-1991	Max 2	Max 2	Max 2	Max 2
Penetration of bitumen: 25 °C, 100 g, 5 sec; 0,1 mm	SNI 06-2456-1991	≤10	10 - 18	10 - 18	19 - 22

Note:
1. Type 5/20 : penetration grade of 5 (0.1 mm) and bitumen content of 20 %.
2. Type 15/20 : penetration grade of 15 (0.1 mm) and bitumen content of 20 %.
3. Type 15/25 : penetration grade of 15 (0.1 mm) and bitumen content of 25 %.
4. Type 20/25 : penetration grade of 20 (0.1 mm) and bitumen content of 25 %.

6.2. Asphalt cement modified by Refined Asbuton bitumen

There are several products extracted (Refine) Asbuton bitumen content of between 60 to 100%. To harness the power of the asbuton mineral filler, made extraction asbuton only reached a certain content of bitumen, typically between 50 to 60% the way to making a modified asphalt asbuton or commonly called pre-mixed asbuton. To be used as a binder or modifier softener needed, generally using asphalt cement, Asphalt cement requirements were modified with Asbuton shown in Table 6.2.

Table 6.2 Requirements of Asphalt cement modified by Refined Asbuton Bitumen (Refine Buton Asphalt, Retona)

No.	Test	Test Method	Requirements
1.	Penetration, 25°C,100 g, 5 sec, 0,1 mm	SNI 06-2456-1991	40 - 60
2.	Softening point, °C	SNI 06-2434-1991	Min. 55
3.	Flash point, °C	SNI 06-2433-1991	Min. 225
4.	Ductility, 25°C, 5cm/minute, cm	SNI 06-2432-1991	Min. 50

5.	Specific gravity	SNI 06-2441-1991	Min. 1,0
6.	Solubility in C_2HCL_3, % by weight	RSNI M-04-2004	Min. 90
7.	LOH (TFOT), % by weight	SNI 06-2440-1991	Max. 1
8.	Penetration after LOH, % by fresh	SNI 06-2456-1991	Min. 55
9.	Ductility after TFOT, cm	SNI 06-2432-1991	Min. 25
10	Mineral passing No. 100, %	SNI 03-1968-1990	Min. 90

Asphalt cement modified with Refined Asbuton Bitumen or pre-mixed asbuton can be obtained by mixing grain that has asbuton in extraction part with asphalt cement pen 60 or 80 pen, whose creation is done with the fabrication process flow chart as shown in Figure 6.1.

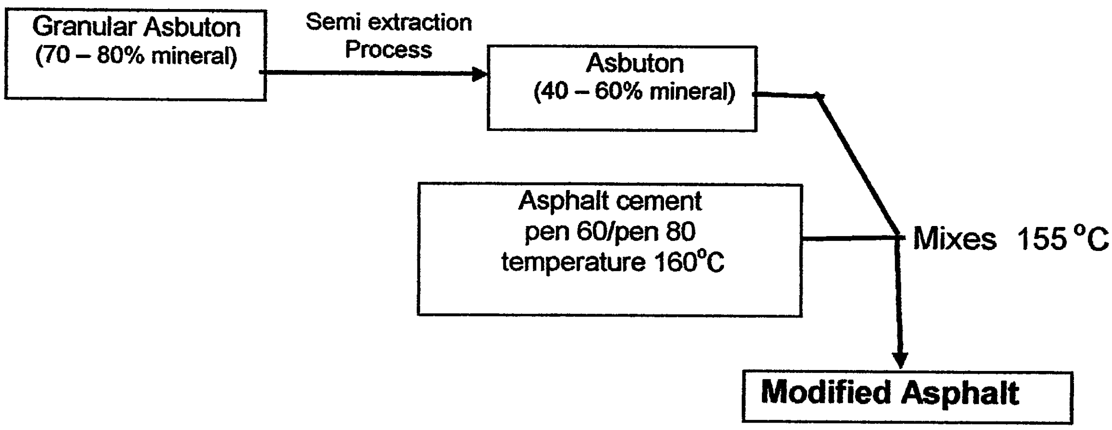


Figure 6.1 Process of modified asphalt cement by granular asbuton
Source: Retona blend 55, 2008

6.3. Pure Refined Asbuton Bitumen (Full extraction)

Pure refined asbuton bitumen is asbuton types obtained from the total extraction of asbuton with 100% bitumen content.

Pure refined asbuton bitumen in a mixture of asphalt can be added as an ingredient asphalt or as a binder as well as ready-made standard asphalt or asphalt cement equivalent.

If the extracted bitumen has a low penetration, to create the equivalent asphalt cement grade with certain characteristics may be tempered by the added material in this case asphalt pen 60, pen 80 or pen 120 at a particular composition.

7. STUDY IN THE USE OF HOT MIXED GRANULAR ASBUTON

7.1. Test characteristics and performance of asphalt mixtures

To analyze the characteristics and performance of asphalt mixtures without and with Asbuton, as the sample used Asbuton from Lawele shaped grains, among other test results to obtain the characteristics of asphalt mixtures using the Marshall method, the performance of mixed use Wheel Tracking Machine tools, test equipment fatigue using Dartec and stiffness modulus test using a UMMATA.

7.1.1. Marshall Test

For the analysis of the characteristics of hot asphalt mixture with and without granular Asbuton, Marshall test performed, test results are shown in Table 7.1.

Table 7.1 Marshall Test result

No.	Test	Test result with % granular Asbuton			Requirement
		0 %	5%	10%	
1	Optimum bitumen content,%	6.00	6.40	7.20	-
2	Density, gr/cm3	2.304	2.280	2.242	-
3	Voids in Mineral Aggregate, %	17.42	18.30	20.20	Min.15
4	Voids filled bitumen, %	70.80	71.60	74.00	65
5	Voids in Mixes (VIM). %	5.09	5.12	5.30	4.9-5.9
6	VIM on absolute density, %	3.31	3.80	2.70	Min.2.50
7	Stability , kg	953	956	960	Min.800
8	Flow, mm	2.03	3.01	3.10	Min.2
9.	Retain Stability, %	93	87	86	Min 85
10	Marshall Quotient, kg/mm	336	295	320	Min 200

With the addition Asbuton in hot mixture asphalt have a tendency to raise the value of stability and optimum bitumen content in the mixture, this phenomenon occurs because the assumption of asphalt serves from Asbuton as direct asphalt cement. This was also followed by the rise in the voids in mineral aggregate, voids filled bitumen, the voids in a mixture with equal value. This volumetric balance value makes the mixture easier to work in the field.

7.1.2. Test with a groove depth of Wheel Tracking Machine

To know the effect of the addition Asbuton in hot mixture asphalt to deformation, the test conducted using the wheel tracking machine tools. Test results are shown in Table 7.2. and graph the relationship with the depth of the track deformation happens in Figure 7.1.

Table 7.2 Wheel Tracking Machine test result

Number of passing	% Asbuton grains in mixture		
	0%	5%	10%
0	0	0	0
21	1.39	1.25	1
105	2.01	1.85	1.52
210	2.37	2.17	1.79
315	2.64	2.39	1.97
630	3.22	2.85	2.29
945	3.67	3.16	2.52
1260	4.09	3.4	2.71
Do (mm)	2.44	2.44	1.95
DS(T/mm)	1536.6	2625	3315
R (mm/m)	0.0273	0.016	0.0127

Additions Asbuton in the mix to give permanent deformation decreasing trend indicates that a hot mixture of asphalt more resistant to deformation.

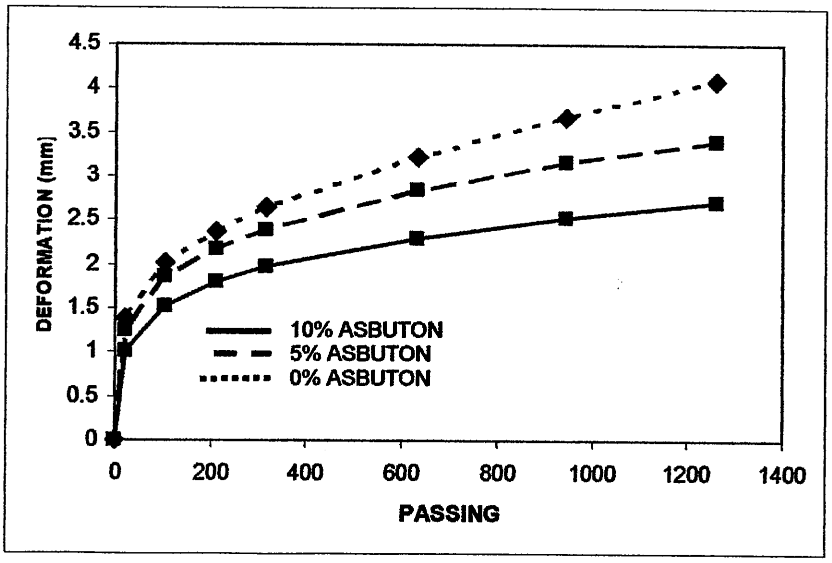


Figure7.1 Graph showing the relationship deformation with passing

7.1.3. Test the resistance to Fatigue

To determine the influence of resistance fatigue addition Asbuton in hot mixed asphalt, fatigue testing using Dartec, test results are shown in Figure 7.2.

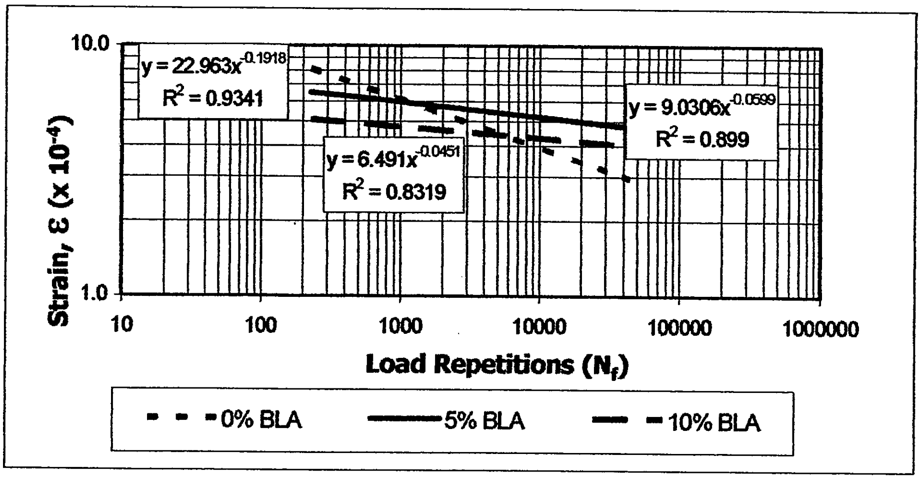


Figure 7.2 Graph showing the relationship between load repetitions with tensile strain (ε)

7.1.4. The Stiffness Modulus Test

To find out the value modulus of asphalt mixtures produced with the addition of Asbuton, using the Universal Machine Testing Apparatus (UMATA), test results are shown in Table 7.3. Stiffness Modulus of Bituminous Mixes depend on temperature time of loading and the stiffness modulus of the bitumen, therefore, the modulus test carried out with temperature variation.

Table 7.3 Test result

Test temperature °C	Stiffness Modulus, MPa		
	0% Asbuton	5% Asbuton	10% Asbuton
25°C	3488	4466	4729
35°C	1472	2181	2432
45°C	681.3	1281	1332

From data on Table 7.3 shows the addition of more Asbuton in the mix, the higher the modulus value. Besides the addition Asbuton looked in the mix will cause more resilient to temperature increases.

7.2. Simulation calculations determining the thick overlay

Test results with the data that has been done, to know the effect of the use of granular Asbuton Lawele in hot mixed asphalt simulation calculations performed overlay determination, field data are used as the simulation is data on roads Padalarang - Purwakarta.

- Existing road:
  - Surface layer (asphaltic concrete), thickness : 5 cm,
  - Base layer (crushstone base), thickness : 13 cm
  - Subase layer (gravel) thickness : 20 cm
  - Subgrade
- Data traffic:
  - ADT : 21,586 vehicles per day for two-way and heavy vehicles ± 30%.
  - ESA :3,914,000 per year
- Overlay for design life : 5 years

  With a variety of Asbuton addition Lawele 0%, 5% and 10% of the total mixture, in this case, obtained a thick overlay:
  - hot mixed asphalt concrete without Asbuton: 10 cm
  - hot mix asphalt concrete with 5% Asbuton: 8 cm
  - hot mix asphalt concrete with 10% Asbuton: 7.75 cm

The calculations above show that the addition of the mixture Asbuton can reduce the required thick overlay.

8. CONCLUSION

Based on the above description can be concluded matters as follows:

1. Bitumen Asbuton has deposits of nitrogen compounds and high base maltene good parameters, so good adhesive to aggregate and sufficient durability.
2. To reduce the failure rate and reduce the cost of construction, the recommended granular Asbuton with the grain size is very small (1.18 mm), with appropriate quality control
3. Asbuton mixing can be carried out by heat, by considering Asbuton type, type and location of placement modifier mixture.
4. Asbuton functions in the mixture, as well as additives that improve the characteristics of the mixture can also substitute the use of asphalt cement.
5. Can substitute with asphalt cement in the mix and have a level higher reliability, the use Asbuton can save foreign exchange, in addition to other benefits such as tax revenue.
6. At the design life and the same location, a thickness layer of asphalt concrete overlay is needed mix asphalt asbuton with 5% is 20% thinner than the asphalt cement asphalt mixtures.
7. To get better quality Asbuton product, research and development has been on going

Bibliography

1. ADB Road Rehabilitation Project, Section 6.3 Hot Mix Asphalt (2006) Department Kimpraswil

2. DGH Lasbutag, 1983 Department of Public Works

3. Dharma Bhumi KPN, 1997, Report Geolistrik Estimation and core drilling Lawele village Asbuton, Division of Mines and Energy area of Southeast Sulawesi province.

4. Kurniadji, 2002 research report Asbuton as road paving materials, Center for Transportation Infrastructure, Department of Kimpraswil.

5. Kurniadji, 2003 research report on utilization of Buton Lake Asphalt as a paving roads, Transportation Research Facility, Department Kimpraswil.

6. Zamhari, 2000, recommended Asbuton Technology.

Technical Session II
DISASTER AND BRIDGE

PUBLIC WORKS RESEARCH INSTITUTE

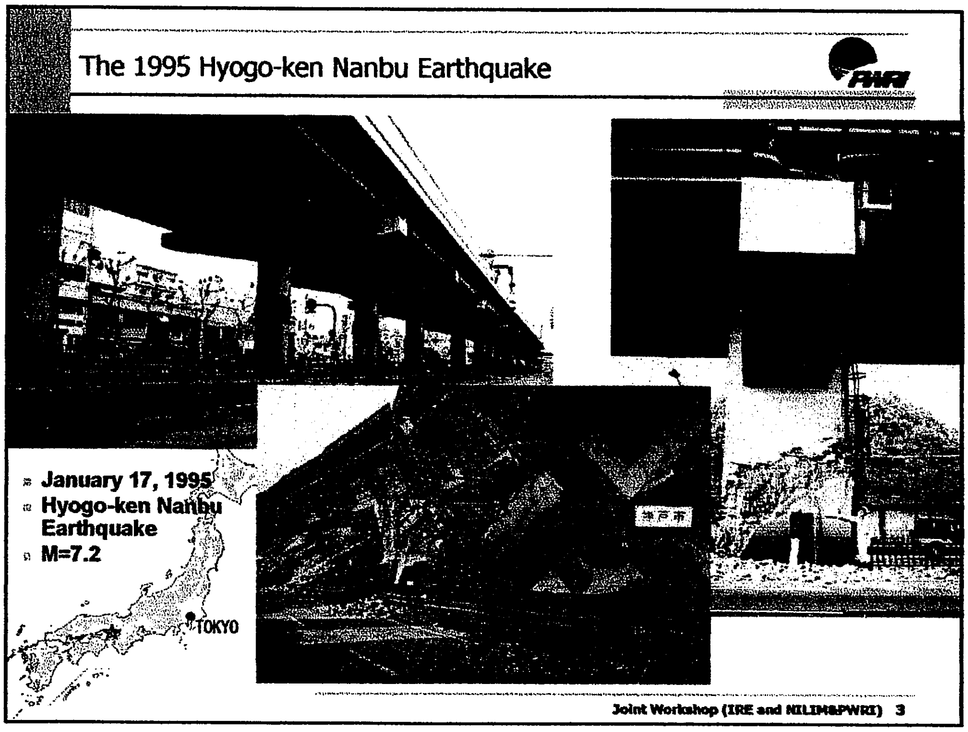
SEISMIC DESIGN AND SEISMIC RETROFIT FOR HIGHWAY BRIDGES IN JAPAN

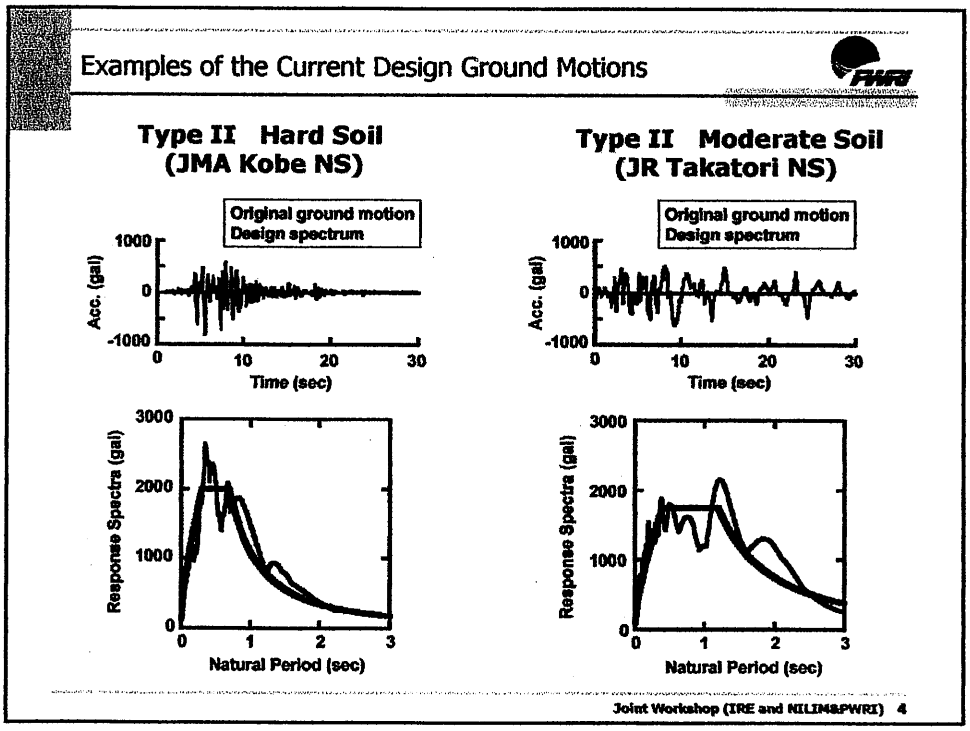
Guangfeng ZHANG
Public Works Research Institute, Japan
March 1-4, 2010

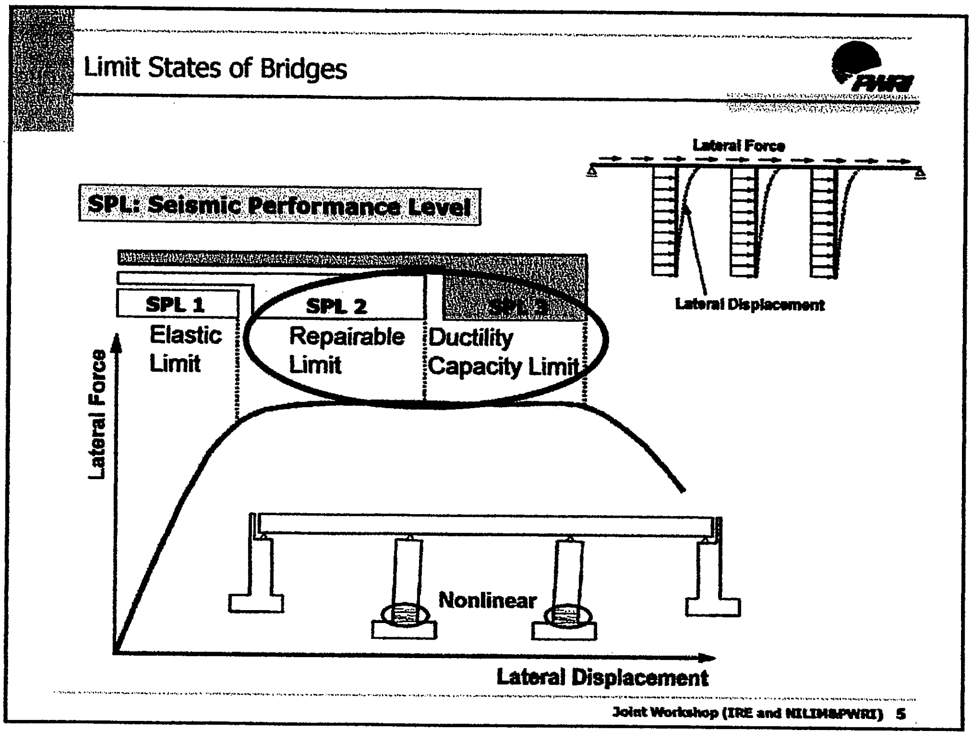
Improvement of Seismic Design Specifications for Highway Bridges

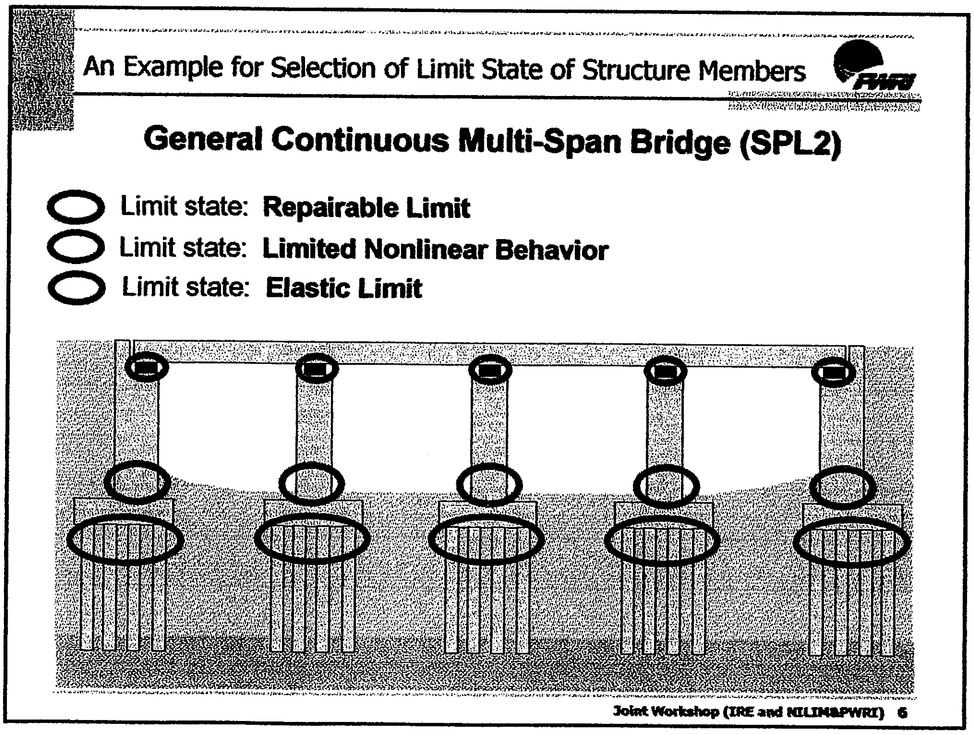
Earthquakes	Seismic Design Specifications
1923 Great Kanto E.Q. (M7.9)	1926 Design Specifications of Road Structure Introduction of seismic design
1964 Niigata E.Q. (M7.5)	1971 Seismic Design Specifications
1978 Miyagi-ken Oki E.Q. (M7.1)	1980 Design Specifications for Bridges
1995 Hyogo-ken Nanbu (Kobe) E.Q. (M7.2)	1996 Design Specifications for Bridges
	2002 Design Specifications for Bridges (Current version)

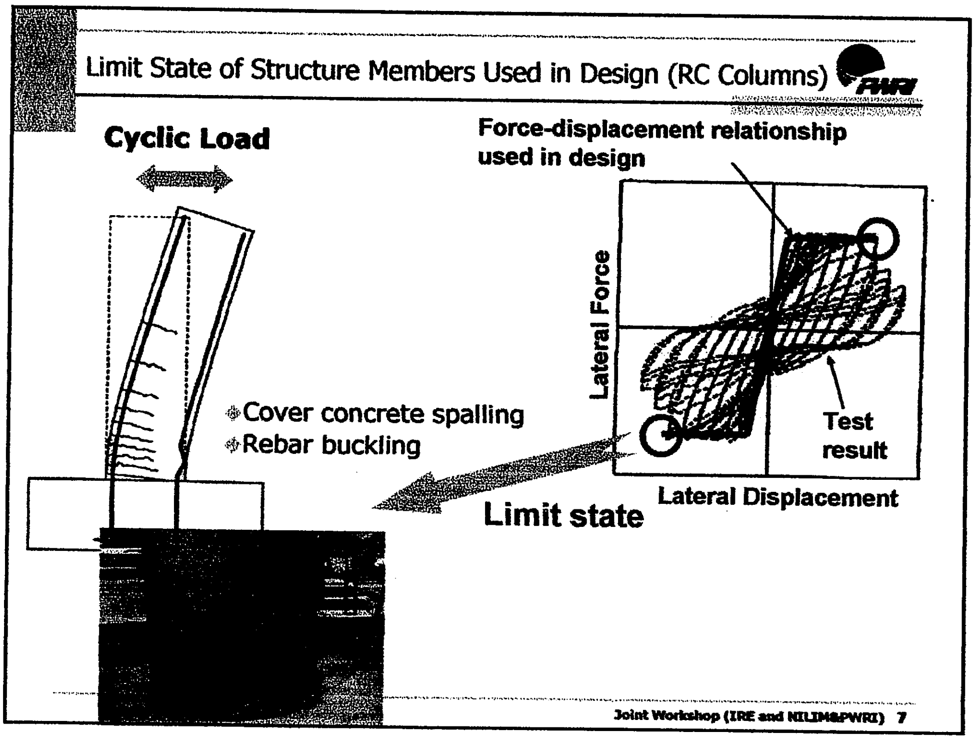
Joint Workshop (IRE and NILIM&PWRI) 2

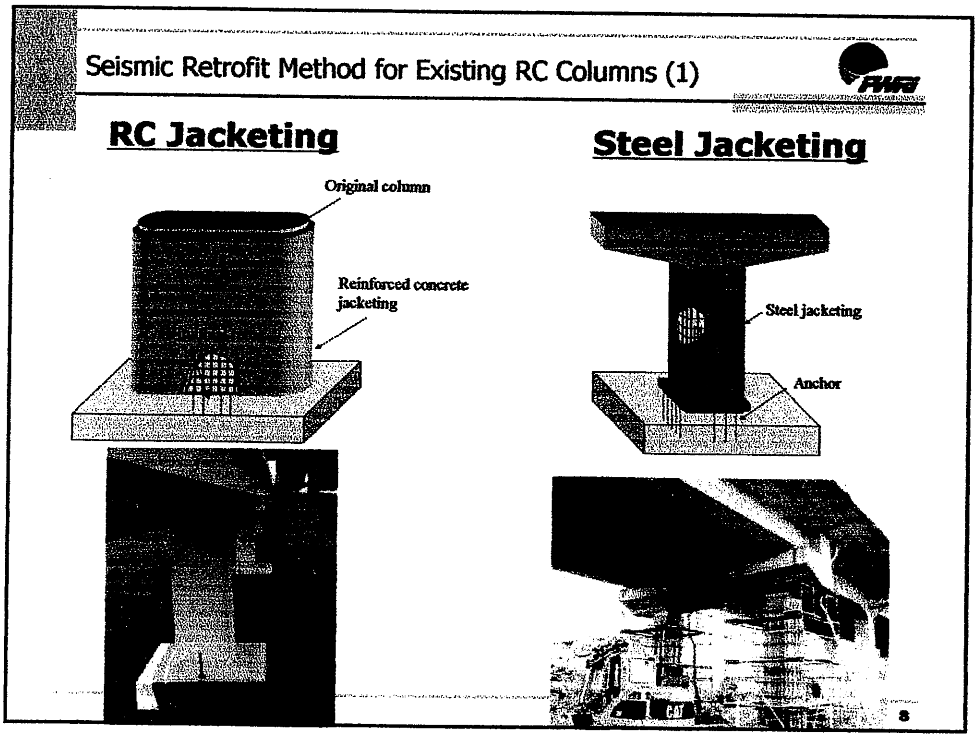

The 1995 Hyogo-ken Nanbu Earthquake
PWRI
January 17, 1995
Hyogo-ken Nanbu Earthquake
M=7.2
TOKYO
Joint Workshop (IRE and NILIM&PWRI) 3


Examples of the Current Design Ground Motions
PWRI
Type II Hard Soil
(JMA Kobe NS)
Type II Moderate Soil
(JR Takatori NS)
Original ground motion
Design spectrum
Acc. (gal)
1000
0
-1000
0
10
20
30
Time (sec)
Response Spectra (gal)
3000
2000
1000
0
1
2
3
Natural Period (sec)
Joint Workshop (IRE and NILIM&PWRI) 4


Limit States of Bridges
PWRI
SPL: Seismic Performance Level
SPL 1
Elastic Limit
SPL 2
Repairable Limit
SPL 3
Ductility Capacity Limit
Lateral Force
Lateral Displacement
Nonlinear
Lateral Force
Lateral Displacement
Joint Workshop (IRE and NILIM&PWRI) 5


An Example for Selection of Limit State of Structure Members
PWRI
General Continuous Multi-Span Bridge (SPL2)
Limit state: Repairable Limit
Limit state: Limited Nonlinear Behavior
Limit state: Elastic Limit
Joint Workshop (IRE and NILIM&PWRI) 6

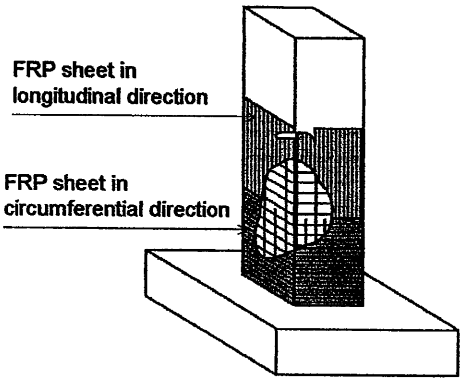

Limit State of Structure Members Used in Design (RC Columns)
Cyclic Load
Force-displacement relationship
used in design
Lateral Force
Cover concrete spalling
Rebar buckling
Test
result
Lateral Displacement
Limit state
Joint Workshop (IRE and NILIM&PWRI) 7


Seismic Retrofit Method for Existing RC Columns (1)
RC Jacketing
Steel Jacketing
Original column
Reinforced concrete
jacketing
Steel jacketing
Anchor
8

Seismic Retrofit Method for Existing RC Columns (2)

FRP Jacketing

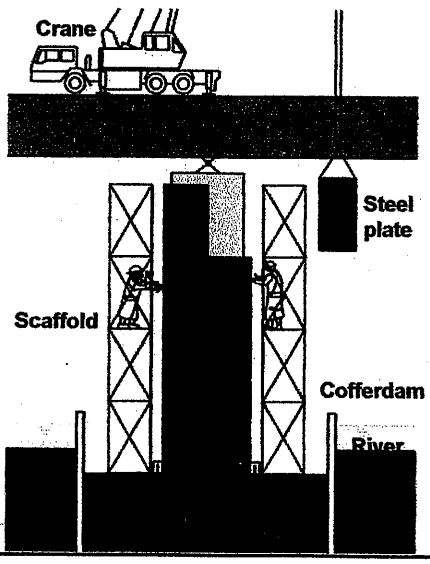
FRP: Fiber Reinforced Polymer



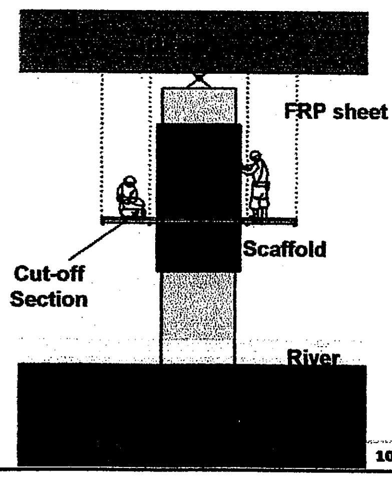
9

Schematic of Constructions of Steel Jacketing and FRP Jacketing

Steel Jacketing



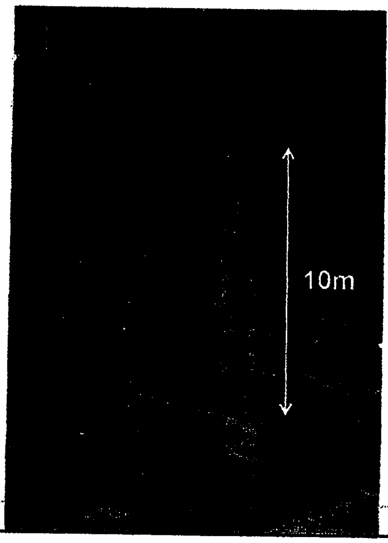
FRP Jacketing

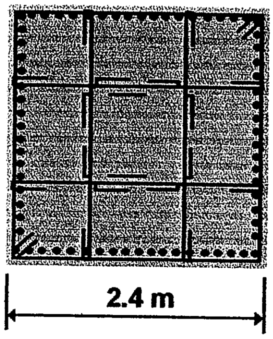


10

Experimental Verification (1)

Quasi-static cyclic loading tests of full scale RC column

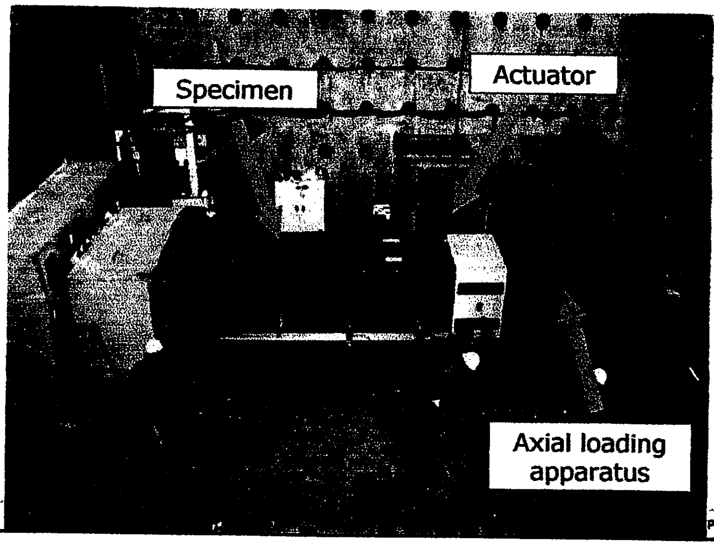




Joint Workshop (IRE and NILIM&PWRI) 11

Experimental Verification (2)

Quasi-static cyclic loading test of RC column specimen retrofitted with steel jacketing



PWRI) 12

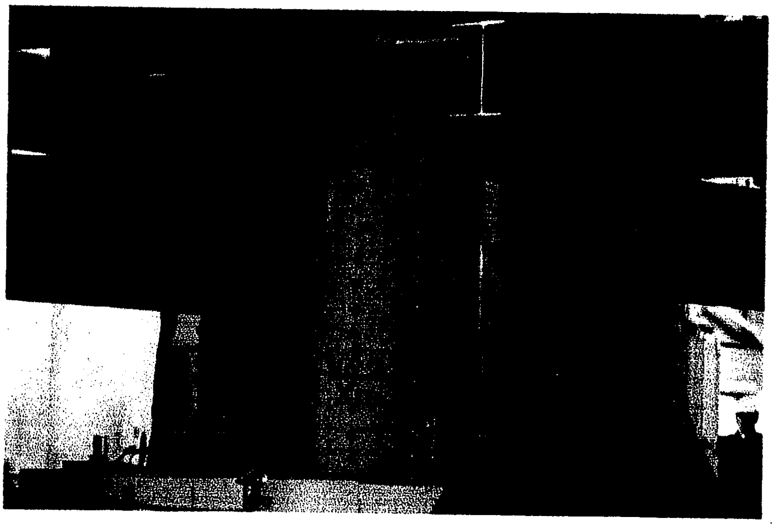
Experimental Verification (3)

Dynamic loading test of RC column specimen

Joint Workshop (IRE and NILIM&PWRI) 13

Experimental Verification (4)

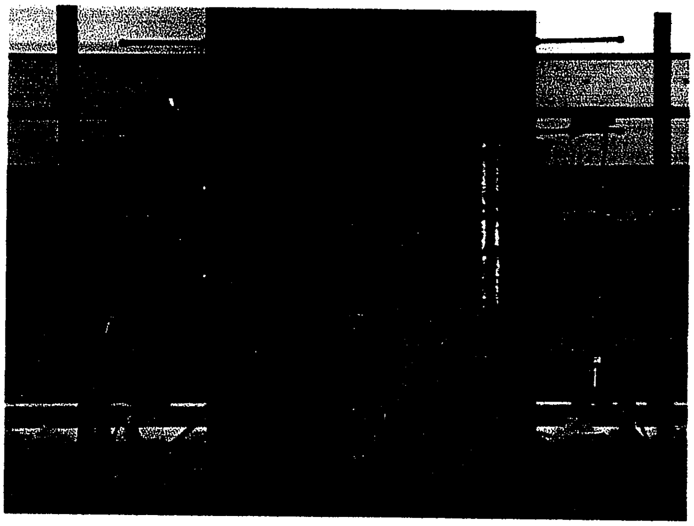
RC column specimen failed in shear



Joint Workshop (IRE and NILIM&PWRI) 14

Experimental Verification (5)

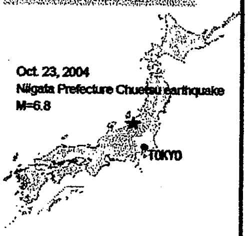
RC column specimen failed in flexure

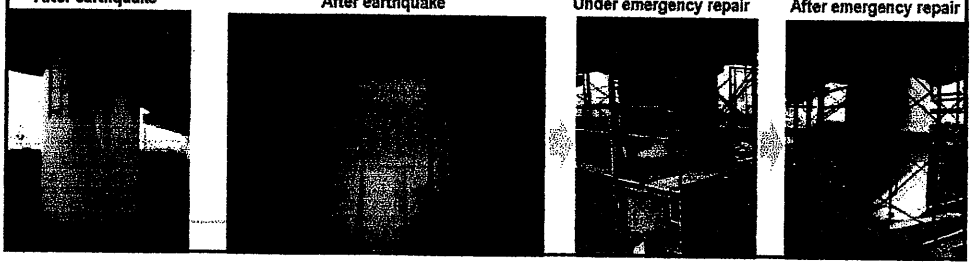


Joint Workshop (IRE and NILIM&PWRI) 15

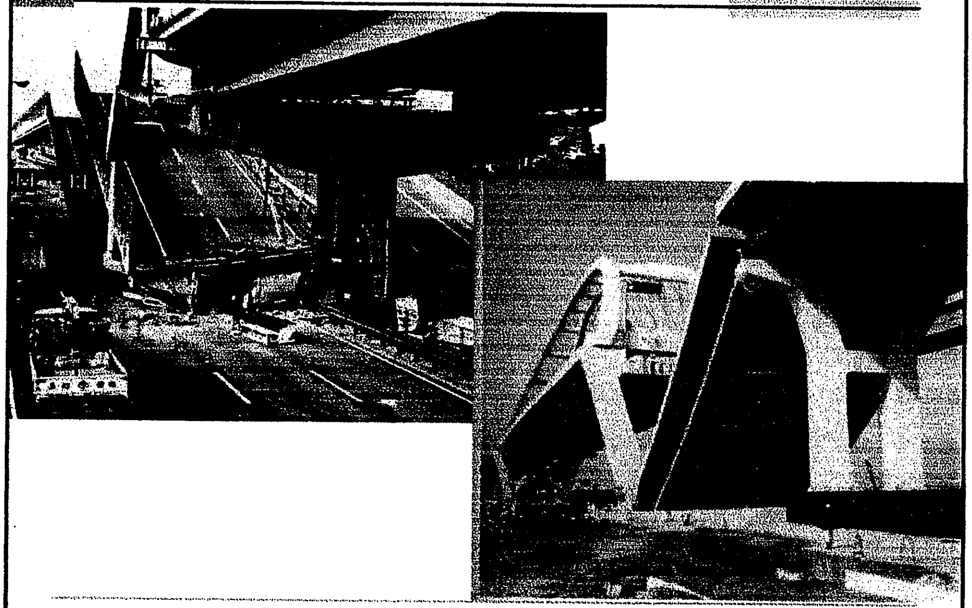
A Case That Effectiveness of Seismic Retrofit was Verified in Earthquake

Shinkumi Kosen Bridge





Unseating Cases in the 1995 Hyogo-ken Nanbu Earthquake

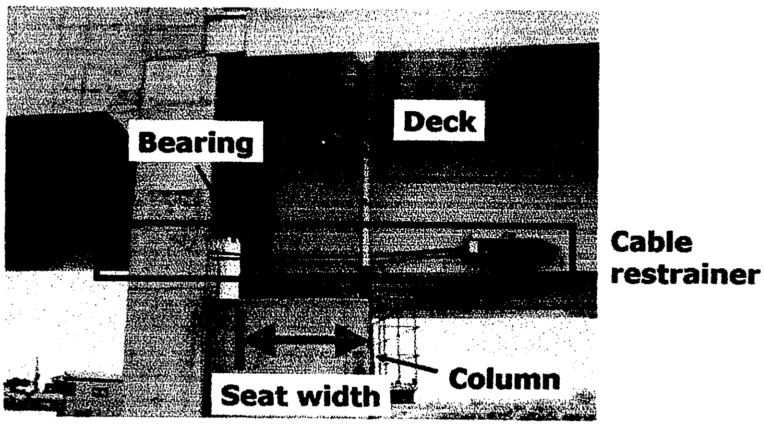


Joint Workshop (IRE and NILIM&PWRI) 17

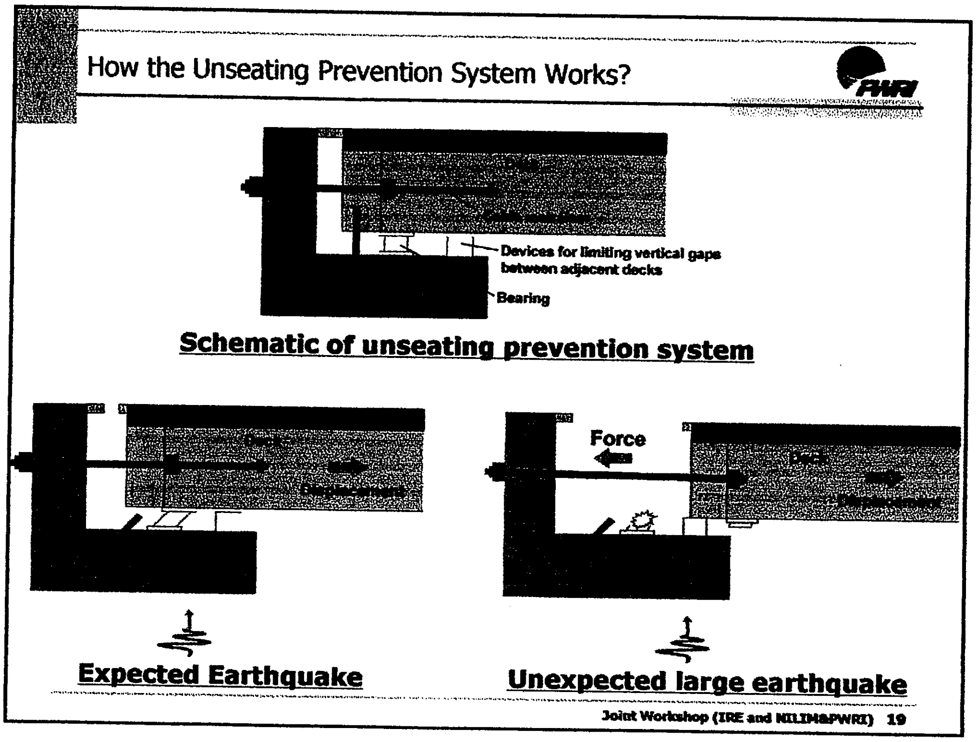
An Example of Unseating Prevention System

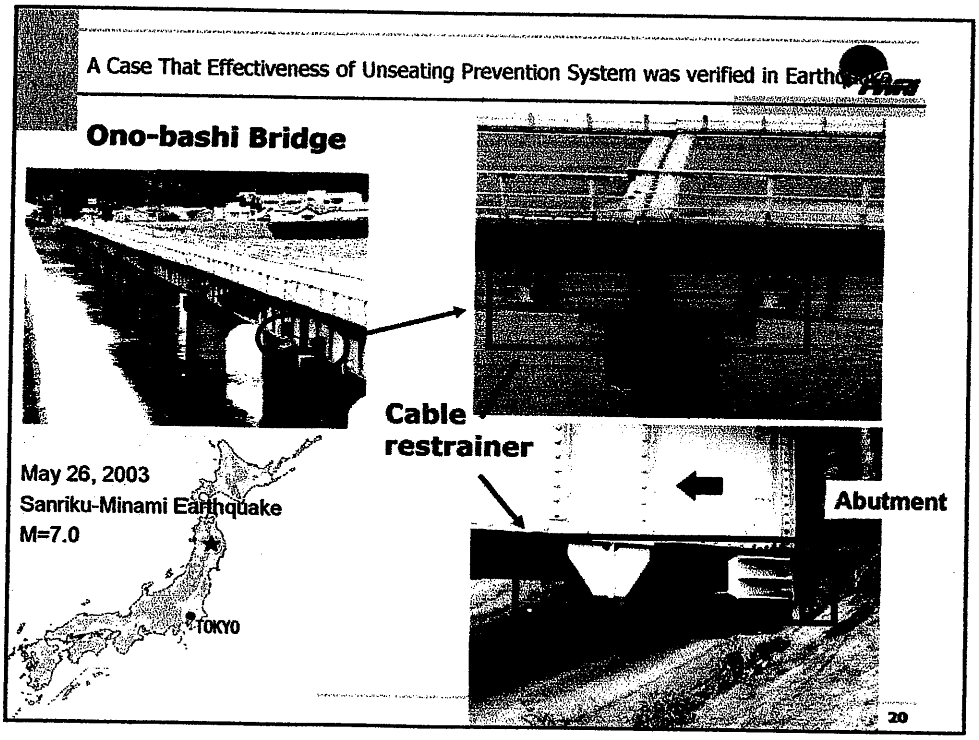
Multiple Fail-safe System

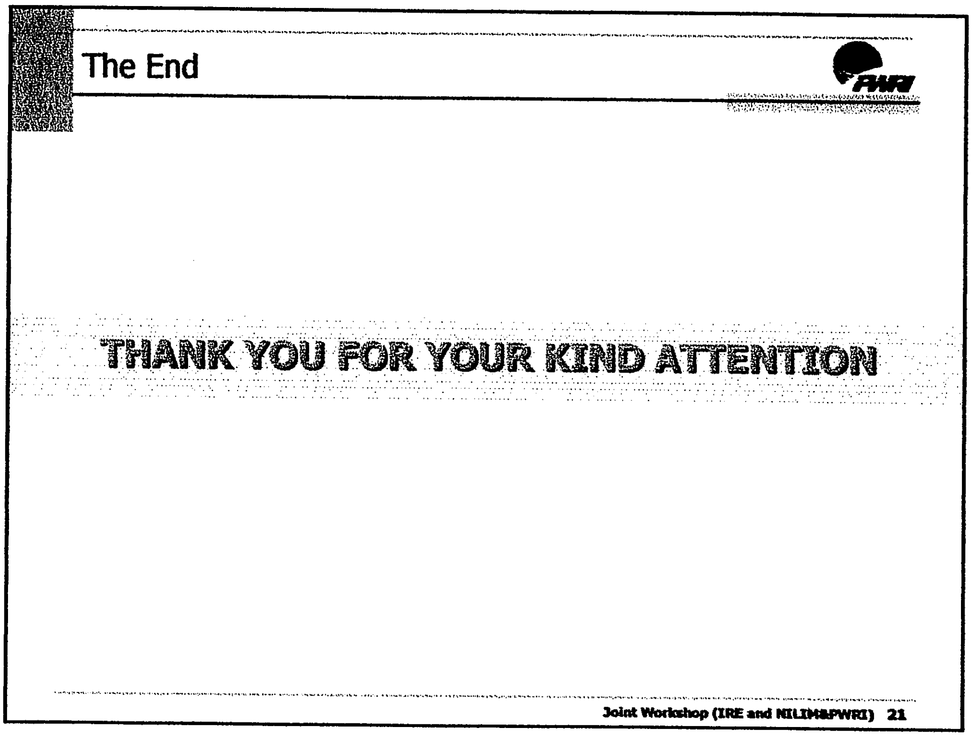
- Seat width
- Restrainers



Joint Workshop (IRE and NILIM&PWRI) 18


How the Unseating Prevention System Works?
PWRI
Devices for limiting vertical gaps between adjacent decks
Bearing
Schematic of unseating prevention system
Force
Expected Earthquake
Unexpected large earthquake
Joint Workshop (IRE and NILIM&PWRI) 19


A Case That Effectiveness of Unseating Prevention System was verified in Earth
PWRI
Ono-bashi Bridge
Cable restrainer
Abutment
May 26, 2003
Sanriku-Minami Earthquake
M=7.0
TOKYO
20


The End
PWRI
THANK YOU FOR YOUR KIND ATTENTION
Joint Workshop (IRE and NILIM&PWRI) 21

REVIEW OF BRIDGE CONDITION POST EARTQUAKE DISASTER

Ir. Roestaman, M.Sc[1], Ir. Imam Murtosidi[2], Ir. Nandang Syamsudin, MT[3]
Rulli Ranastra Irawan, ST, MT[4]

Institute of Road Engineering
Jl. A.H. Nasution 264, Bandung 40294

Abstract

From geological aspects the Indonesian archipelago is formed by collision between large tectonic plates. Collision of Eurasia and India-Australia plates influence the western part of Indonesia, while on the eastern part of Indonesia these two plates collide again with the Pacific plate from eastern direction. These movements cause the seismic risk and volcanic conditions in Sumatra, Java, Flores, Maluku, Sulawesi and Irian Jaya islands.

This report describes the investigation results of post earthquake damage on the bridge infrastructure during the last five years, with a magnitude of more than six on the Richter scale in several regions of Indonesia, like Nabire, Aceh, Nias, Yogyakarta, Bengkulu, West Java and West Sumatra.

The earthquake damage in bridges is generally comprising of :

- *Movement of superstructures in lateral direction*
- *Increase of lateral dilatation between old bridge and new widened bridge*
- *Slumping of the approach embankment to the bridge*
- *Cracking/splitting of wing walls at abutments*

I. INTRODUCTION

Earthquake is one of the natural phenomena that frequently occurs, and anytime earthquakes could hit even with or without prediction. Earthquakes always cause damage regardless of their great or small magnitudes. Damage is also caused by other natural disasters that are triggered by the earthquake, like earth sliding, damage of buildings, and even loss of human life.

If an earthquake damages infrastructure facilities like roads and bridges, then the economical activities in that region are disturbed due to transportation obstructions. This is another aspect of post earthquake loss.

Based on geological aspects, some regions in Indonesia have a high risk for the occurrence of great/massive quakes. During the last five years several earthquake disasters with magnitudes above six on the Richter scale caused damage to bridge structures in following regions :

1.Nabire (7 February 2004, 6,8 SR)
2.Aceh (26 December 2004, 9,3 SR, Tsunami)
3.Nias (28 March 2005, 8,7 SR)
4.Yogyakarta (27 June 2006, 6,2 SR)
5.Bengkulu (12 September 2007, 7,9 SR)
6.West Java - Southern part (2 September 2009, 7,3 SR)
7. West Sumatera (30 September 2009, 7,6 SR)

Based on investigation studies on several bridges, the type and extent of post earthquake damage on bridges in Indonesia can be revealed.

Generally, there are several post earthquake typical damage on bridge as follow :

- Lateral movement of bridge superstructure.
- Lateral dilatation between main superstructure and added superstructure.
- Settlement of bridge approach road embankment.
- Cracks on retaining wall and abutments.

II. GEOLOGICAL CONDITION OF INDONESIA

The Indonesian archipelago is one attractive region by the geological conditions. Attractive because of the formation of the group of islands by collision of large tectonic plates. Collision of Eurasia and India-Australia plates influences the western part of Indonesia, while on the eastern part of Indonesia these two plates collide again with the Pacific plate from eastern direction.

Figure 1 Tectonic condition of Indonesian archipelago

The red, orange and green lines show the borders of tectonic plates. The red line shows the widening of the oceanic floor. The orange line shows the relatively horizontal faulting, while the green line shows collision between tectonic plates. These moving condition as shown in Figure 1 has an impact on life and nature on these plates. Sulawesi island has one of the worst conditions by the collision between three plates.

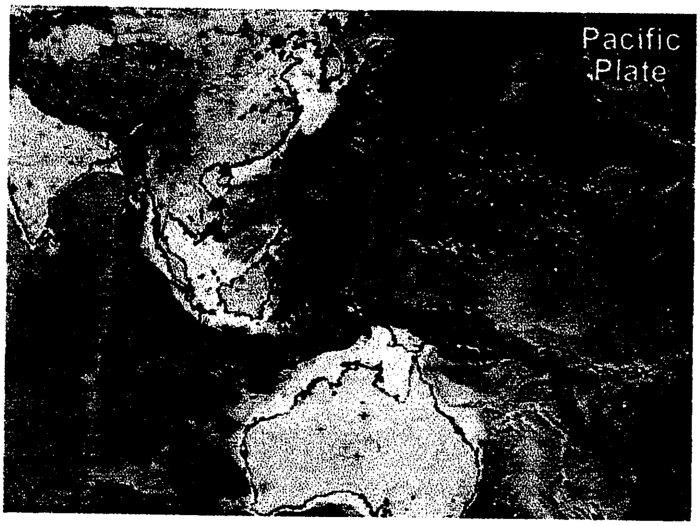


Figure 2 The ring of volcanoes and epicenter locations in the Indonesian archipelago.

The red line on Figure 2 shows the ring of fire/volcanoes, the purple points are earthquake centers, and yellow stars are hot spots. These tectonic activities cause the seismic risk and volcanic conditions in Sumatra, Java, Flores, Maluku, Sulawesi and Irian Jaya islands. Only Kalimantan island is relatively free from earthquake risks.

III. REVIEW OF SEVERAL POST EARTHQUAKE DAMAGE OF BRIDGES IN INDONESIA

The bridge damage pattern is in general as follows :

- Movement of bridge superstructures in lateral direction
- Increase of lateral dilatation between old bridge and new widened bridge
- Slumping of the approach embankment to the bridge
- Cracking/splitting of wing walls at abutments

Typical earthquake damage in some regions of Indonesia is described as follows :

A. Aceh Earthquake

On December 26th 2004, a massive earthquake in the Indian ocean occurred, near the west coast of Aceh. The earthquake was at 7:58:53 WIB (West Indonesian Time). The epicenter was at 3.316° N 95.854° E about 160 km from western Aceh with a hypocenter depth of 10 kilometer. The magnitude was 9,3 according Richter Scale and it was the most massive earthquake of the past 40 years. This quake also caused tsunami, spreading to 8 countries and about 230.000 persons died.

In general the national road was damaged along the coast where the tsunami passed the coast line by about 2-3 km into land. Damage locations in some places were so severe that road and bridge segments could not be identified.

The following figures show that for locations far from the coast, roads and bridges are undamaged. While in some locations the damage is caused by falling of the superstructure from the substructure, that was still existing, scouring of the approach embankment to the bridge, and widening of the river on both sides.

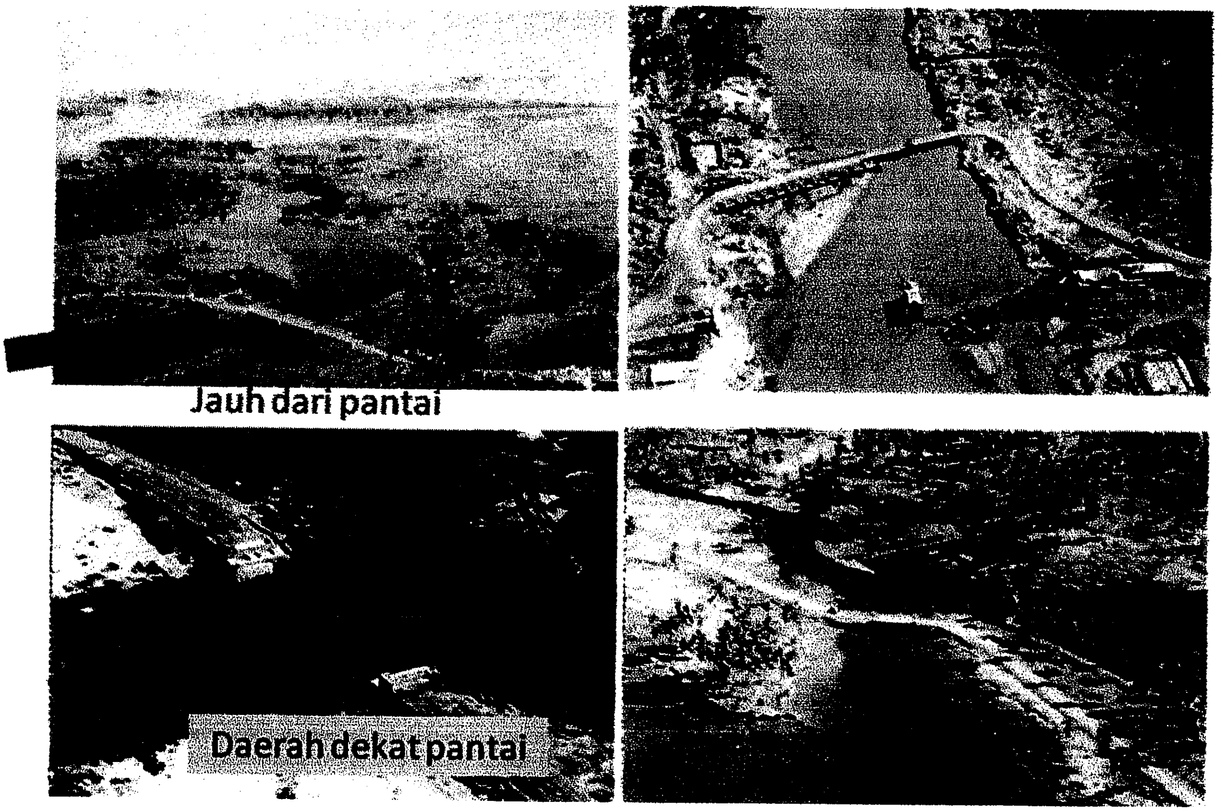


Figure 3. General road and bridge conditions after tsunami

Some bridges were swept away by the sea waves :

a. Sua Ujong Kalak Bridge

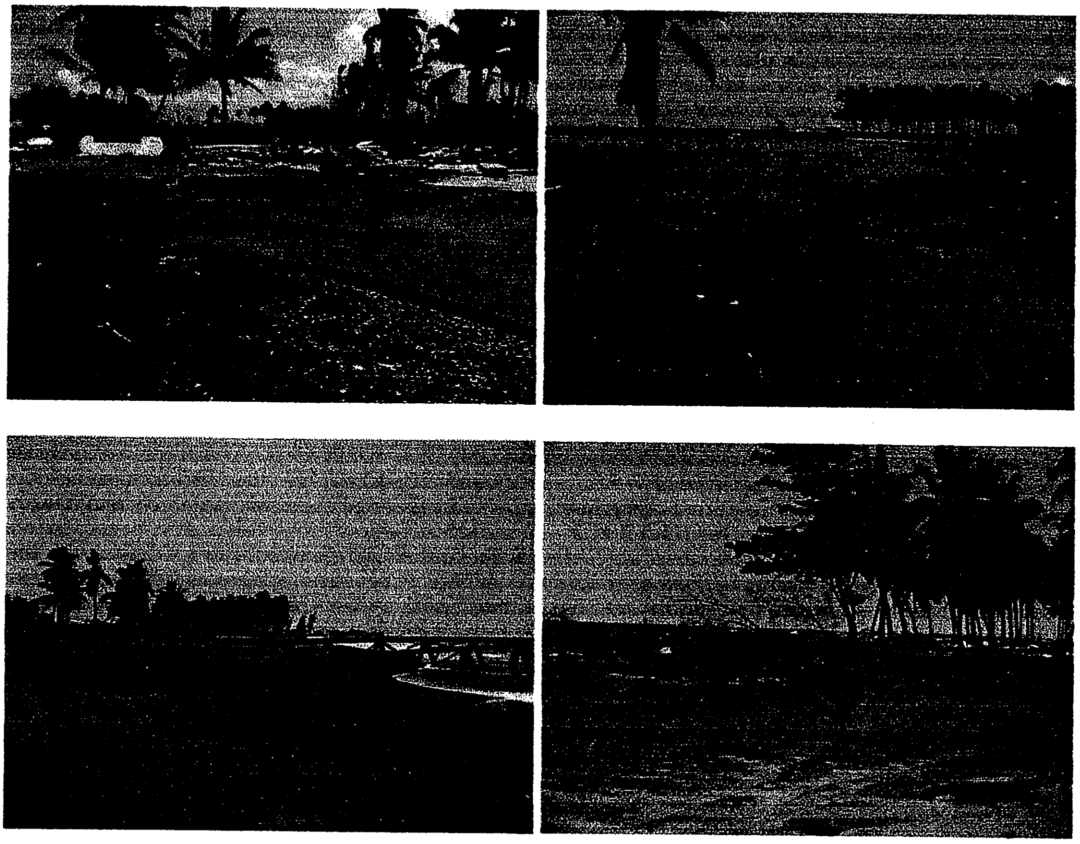


Figure 4. Sua Ujong Kalak bridge condition , link Banda Aceh-Meulaboh, KM 241,9

b. Kuala Bubon Bridge

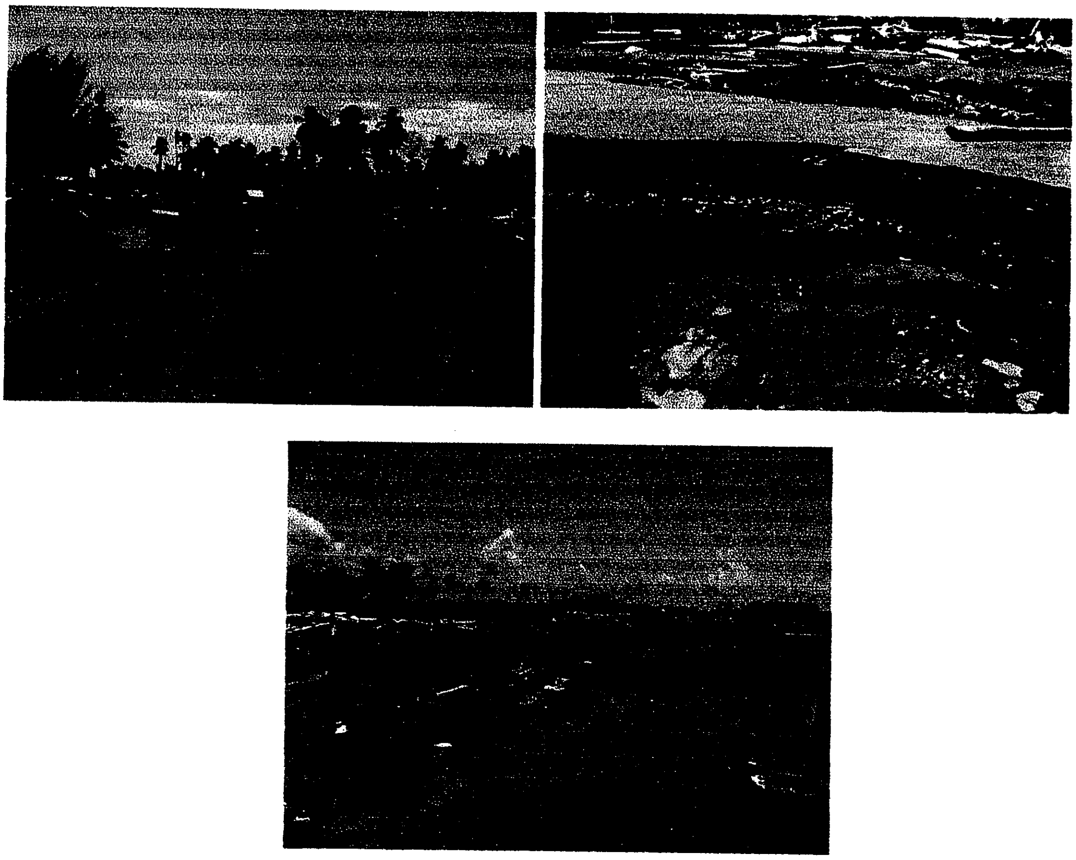


Figure 5. Kuala Bubon bridge condition, link Banda Aceh-Meulaboh, KM 235,7

Some bridges were destroyed :

Suak Ujong Kala II bridge

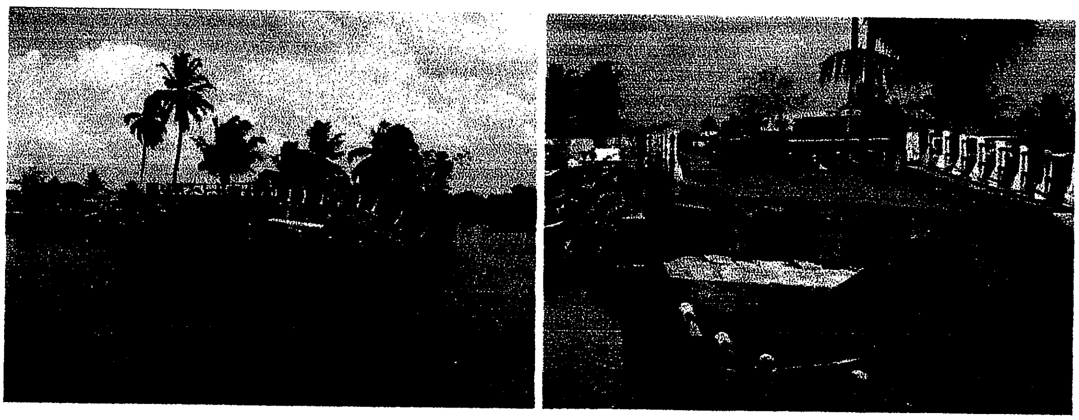


Figure 6. Suak Ujong Kala II bridge condition , link Meulaboh-Sumbar

B. Bengkulu Earthquake

Bengkulu earthquake 2007 was a series of quakes in the Java sea near the coast of Bengkulu and Sumatra. This quake caused a tsunami warning along the coasts of the Indian ocean, that was later dismissed.

The initial earthquake had a magnitude of 7.9 SR, occurred on 12 September 2007 at 18.10 WIB (West Indonesian time). The hypocenter depth was about 10 km, about 105 km from the coast of Sumatra, or about 600 km from the capital Jakarta.

The bridge conditions after earthquake were in general as follows :

- lateral bridge movement due to lateral earthquake forces
- Slumping of the approach embankment because there was no retaining wall at the bridge abutment.

1. Lais Besar Bridge

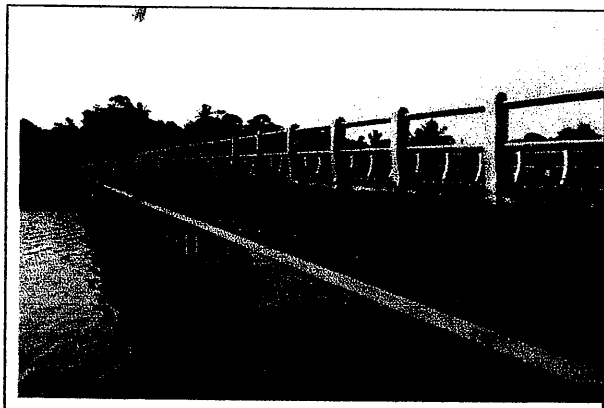
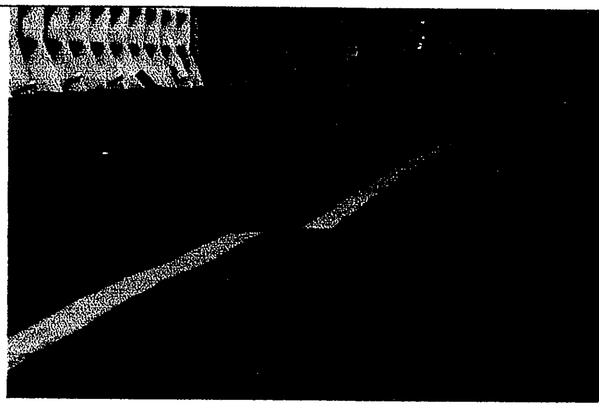
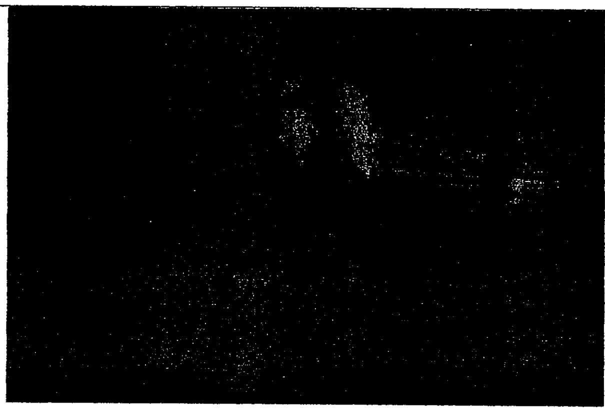
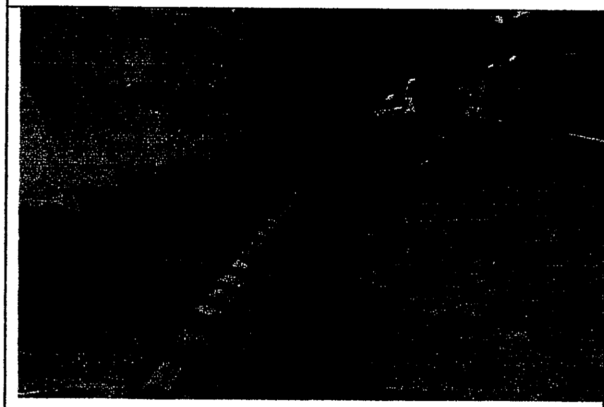
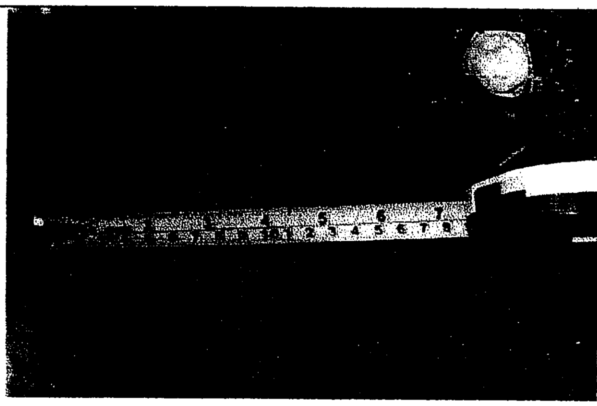
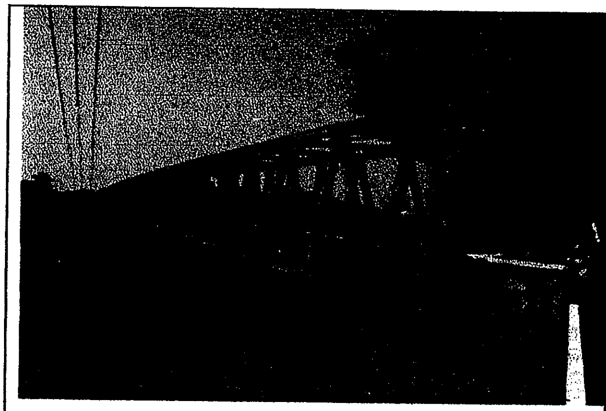
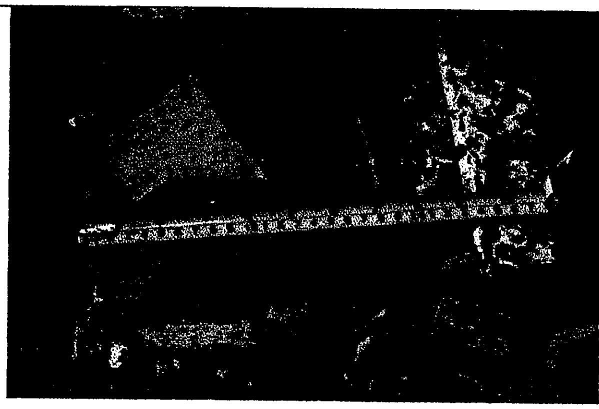
	
Segmental Prestressed Concrete Girder	Lateral movement of superstructure
	
Broken Lateral Stopper	Broken connection of segmental girder I
	
Lateral movement of superstructure	Measurement of sidewalk movement

Figure 7. Damage of Lais Besar bridge

2. Sebelat bridge



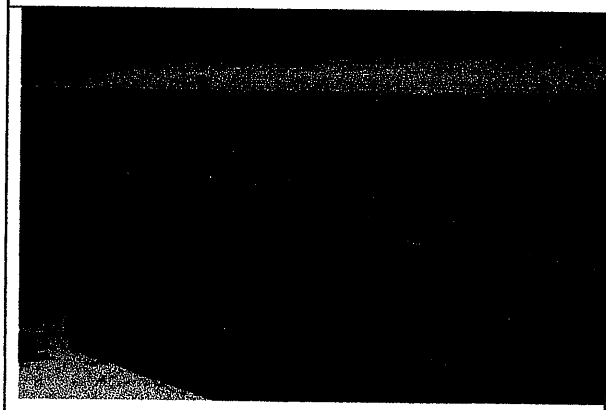
Sebelat bridge (steel truss type)



Lateral movement of superstructure

Truss movement from bearing seat

No lateral stopper was provided

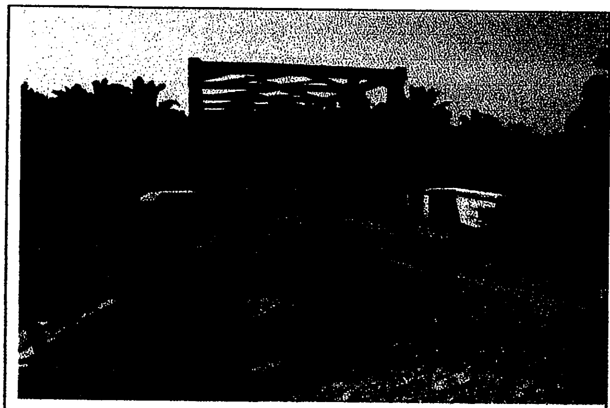


Broken Bridge Bearing

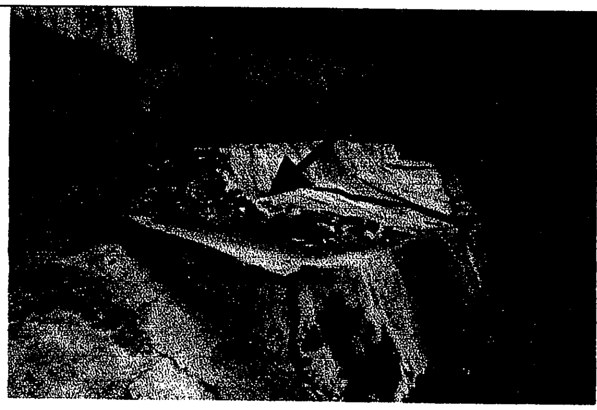
Bending of Hold down anchorage

Figure 8. Damages of Sebelat Bridge

3. Kalikut Bridge

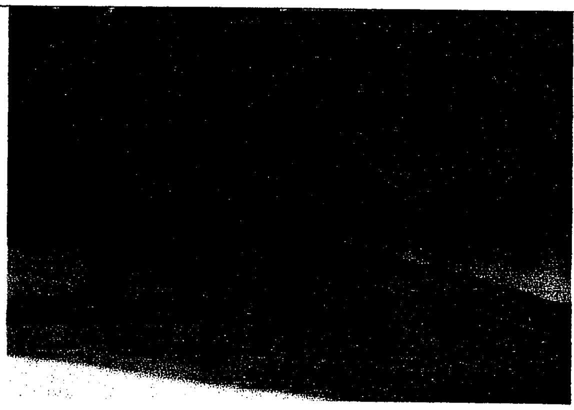


Kalikut bridge(slump of approach road)

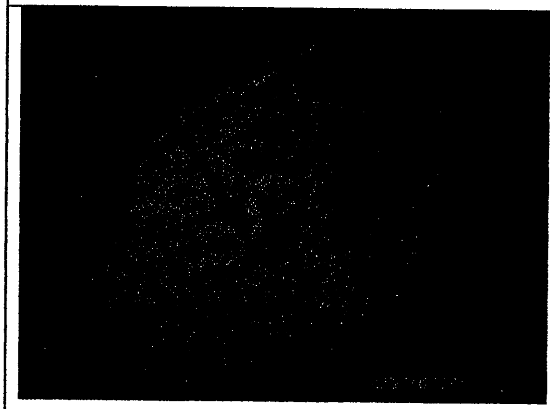


Retaining wall sag

Slumping of approach road



Lateral stopper has no bolt



Retaining wall cracking damage

Exposed foundation due to slumping of soil

Figure 9 Damages of Kalikut Bridge

3.3 West Sumatera Earthquake

West Sumatera Earthquake on 2009 occurred with a magnitude of 7,6 Richter Scale near the coast of West Sumatra on 30 September 2009 at 17:16:10 WIB (west Indonesian time). The earthquake location was near the coast of Sumatera, about 50 km from Padang City. The quake caused serious damage in several regions of West Sumatra like Kabupaten Padang Pariaman, Padang city, Kabupaten South Pesisir, Pariaman city, Bukittinggi city, Padangpanjang city, Kabupaten Agam, Solok city, and Kabupaten West Pasaman. According to the data of local authorities (Satkorlak PB), at least 1.117 persons died by this quake involving 3 cities & 4 kabupaten in West Sumatera, heavy injured people achieve 1.214 persons, light injured 1.688 persons, 1 person was not found. Besides that 135.448 houses were heavily damaged, 65.380 houses fairly damaged, & 78.604 houses lightly damaged[(3)].

The general bridge condition after the West Sumatra earthquake is as follows :

- Lateral dilatation occurred between the old bridge and the new widened bridge structure a **Titian panjang bridge**
- The soil of the approch road slumped because there was no retaining wall at the abutment

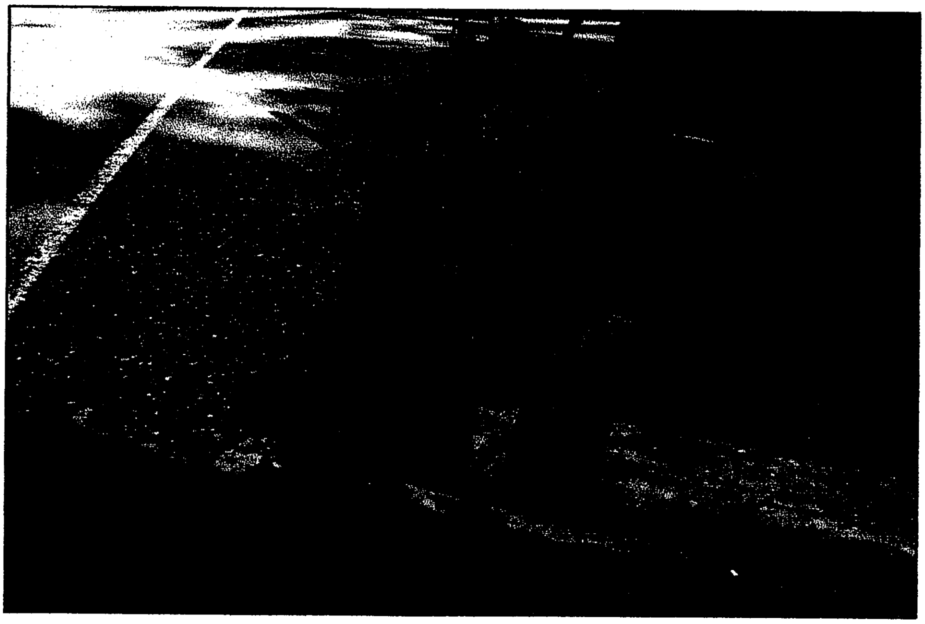


Figure 10. Gap between old and new widened structure at Titian Panjang bridge

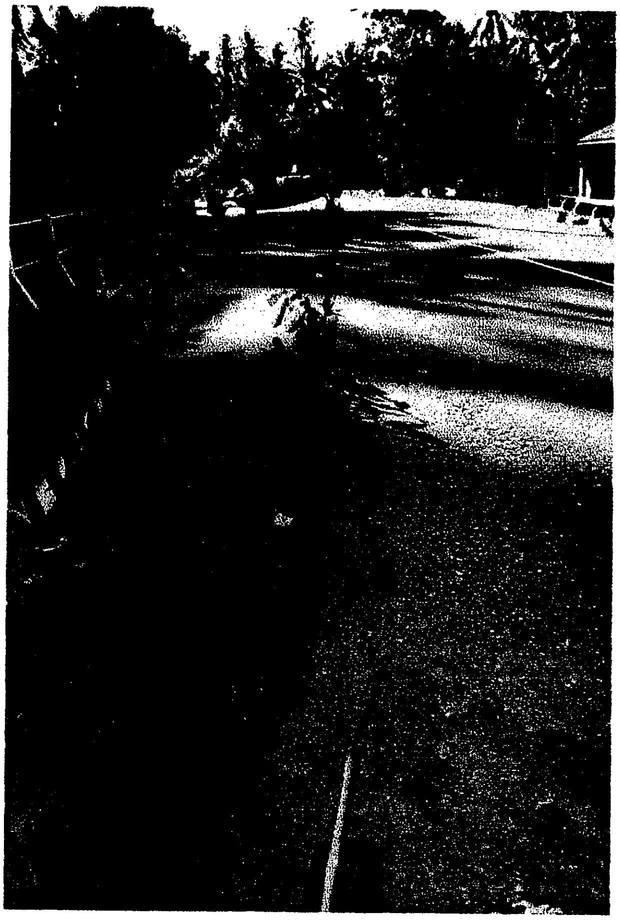


Figure 11. Hole at bridge approach embankment

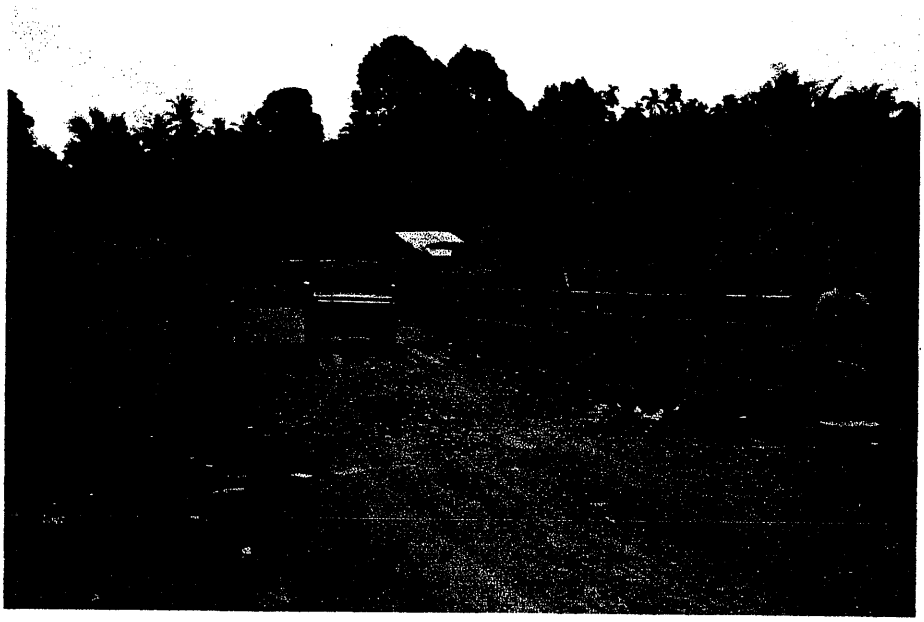


Figure 12. Tingkok bridge

Figure 13. Hole at the approach embankment

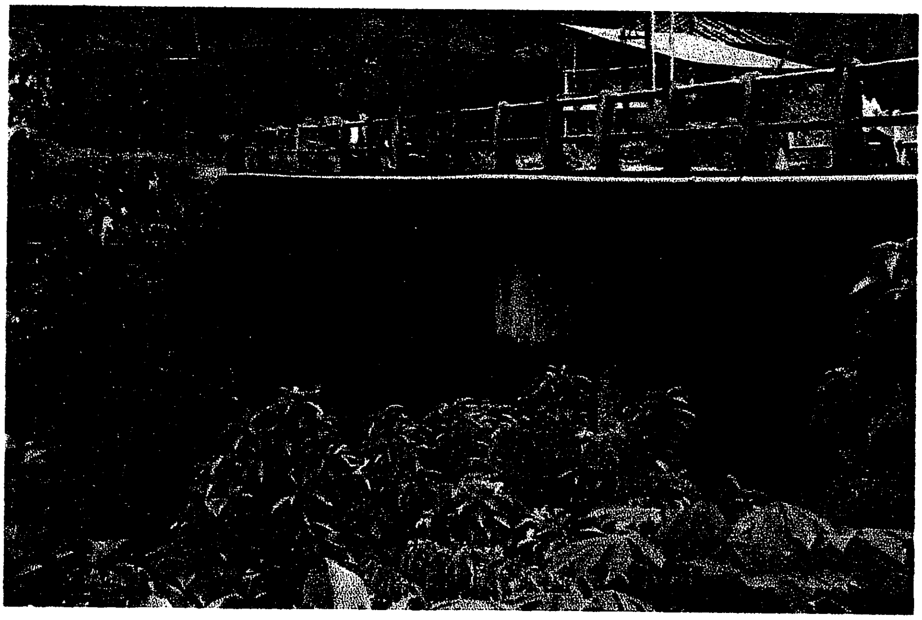


Figure14. Abutment condition of Tingkok Bridge

IV. DISCUSSION

4.1. Steel Truss Bridge

Steel truss bridge in Indonesia is designed to accommodate earthquake and builts with elements to resist lateral force (stopper), vertical force (anchorage bar) and longitudinal force (buffer), however there are several of bridges which is not installed with those elements.
Another example, steel truss bridge which only install one earthquake element on its pierheads / abutments, after an earthquake occurs, the suprastructure moved ± 20 cm laterally and causing damage to other elements. (stripped anchorage, broken/slide bearing, broken sidewalk)
(see fig. 8).

4.2. Girder Bridge

Girder bridge in Indonesia is generally use anchorage to accommodate vertical force and lateral stopper to accommodate lateral force. On Lais Besar bridge there are no lateral stopper installed on bridge abutments,, causing the superstructures to moved ± 13 cm horizontally, crack on the concrete diaphragm and crack on wingwall (see fig. 7).
The following figures showing bridge damages caused by lack of lateral stopper.

3. Research, development and dissemination related to design of earthquake resistance.

V. REFERENCES

1. IRE, 2004, *Post Earthquake Survey Report on Damage of Bridge Structures (Aceh)*
2. IRE, 2007, *Post Earthquake Survey Report on Damage of Bridge Structures (Bengkulu)*
3. IRE, 2009, *Post Earthquake Survey Report on Damage of Bridge Structures (West Sumatra)*

THE NEED AND DEVELOPMENT FOR BRIDGE STRENGTHENING TECHNOLOGY IN INDONESIA

Lanneke Tristanto[1], Redrik Irawan[2], Akuntino[3]

Institute of Road Engineering, MPW
Jl. A.H. Nasution 264, Ujungberung, Bandung 40294, Indonesia

ABSTRACT

The reasons leading to structural damage of existing bridges are mainly the decrease of load carrying capacity and/or increase of load factors. Bridge strengthening is focussed on repair of structural damage and deterioration. Therefore knowledge and knowhow are important as capacity and durability can only be achieved if the cause of damage and deterioration of the concrete and steel bridges is counteracted by the strengthening process.

Maintenance is the decisive factor influencing the bridge resistance and durability. Inadequate routine maintenance influences the degradation rate of the bridge even if the structure is well constructed with the use of materials and elements of high quality.

Besides above reasons, damage can be caused by the structural model. Failures like fatique of concrete and steel are frequently assessed and simplified by implying load factors in the ultimate limit state design. By using load factors, the possibility of reasonable deviations in design and construction is considered.

Typical damage cases with their remedial actions for concrete and steel bridges are described in more detail in this paper. The case study of the Sei Kedang Pahu bridge strengthening is incorporated to show the wide scope of an actual remedial action.

I. INTRODUCTION

1.1 Background

Roads and bridges furnish the land transportation network. A bridge connects two points on dry land by crossing a river or sea. Bridges are feasible in becoming damaged like other structures. Damage cases are caused by :

1. Lack of maintenance
2. Insufficient construction quality
3. Environmental effects
4. Overloading / non-standardized dimension

5. Change of road function

Structural damage of existing bridges is mainly caused by the decrease of load carrying capacity and/or increase of load factors. Bridge strengthening is one repair method to counteract structural damage. Therefore knowledge and knowhow are important as capacity and durability of the bridge strengthening process can only be achieved if the cause of damage of the concrete and steel bridges is made invalid. Besides above reasons, damage can also be induced by the structural model design. Fatique of concrete and steel is assessed in the ultimate limit state design by the implementation of load factors. Ultimate limit state is a simplified fatique design. Therefore a failure proofed design is rarely achieved.

1.2 Case problems

Based on the facts of the above background, some case problems are as follows:

1. Various typical damage in bridges structures
2. Various types of structural bridge strengthening methods
3. Fatique effects on concrete and steel bridge structures

1.3 Aim of the program

1. Various typical damage in bridge structures with their appropriate strengthening methods
2. More information about the fatique effect on the bridge structure, in particular for concrete structures

1.4 Research Methodology

Based on the expected achievement, the research method is performed in stages as follows :

1. Literature study of reference material in connection with various typical structural damage in bridges and their appropriate strengthening methods. Besides this, the fatique of concrete with the influence of different concrete grades on the Young's modulus is studied from reference sources. Fatique of steel with consistent Young's modulus for all steel grades is already well known and established according to the Miner's Theory.

2. A case study of Sei Kedang Pahu bridge is described to evaluate the structural damage and the appropriate strengthening method.

2. Reference Overview

2.1 Typical damage in bridge structures

Each bridge structure is effected by the load types dan other effects from vehicle live load besides exposure to weather and environmental conditions like natural phenomena.

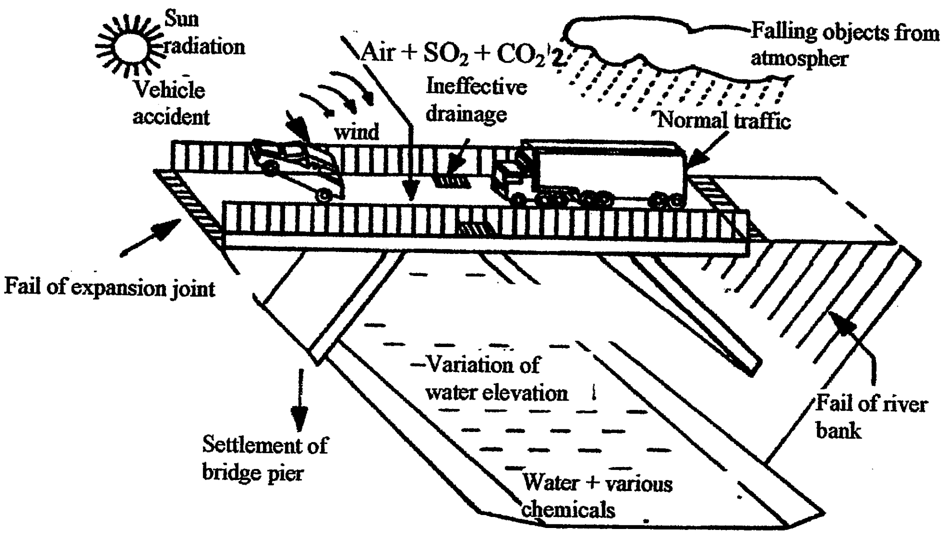


Figure 2.1 Factors effecting the bridge in service

The factors that cause bridge damage are classified in four basic groups as follows :

1. Inner factors,
2. Traffic load factors,
3. Weather and environmental factors,
4. Maintenance factors.

Inner factors are inherent with the structure itself. This means that the structure can contain some factors that cause degradation or particular sensitivity to damage, for example design errors including structural system, quality of materials, aging factor etc.

Traffic load factors. It is a fact that intensity and speed of traffic as well as heavy vehicle load concentration and dynamic effects are increasing and developing since the last few decades. Many existing bridges are not upgraded and become insufficient in capacity to support these conditions. It must also be notified, if static axle loads do not increase, then the axle distances are nearer. The resulting concentrated loads can overstress certain bridge elements. Usage conditions can also change the live load to an other type, that is different from the previous design assumptions.

Weather and environmental factors are part of the climate and atmospherical nature. Some examples like seasons and change in daily temperatures, rain fall or wind pressure, may be classified as objective ones. These factors are directly independent of human activities in the field of bridge engineering, while others. (for example : atmospheric pollution, aggressive chemicals in ground water or in the river) are dependent on human activity in the field of bridge engineering. It should be emphasized that bridges are not covered by roofing and therefore they are exposed to weather and environmental attack. These effects are more important for durability of the bridge structure than traffic load effects. Thereby only certain factors are included in design, such as temperature differentials and wind pressure are standard design parameters. A majority of climatic and environmental factors are not considered in design and it is very difficult to predict their development in time and influence on the structural damage (for example , atmospheric pollutions or aggressive chemicals in rivers).

Maintenance factors are entirely related to quality and intensity of protective measures, such as anti-corrosive protection, current conservation works, cleaning etc. Maintenance is the decisive factor influencing the bridge resistance and durability. Inadequate routine maintenance influences the degradation rate of the bridge even if the structure is well constructed with the use of materials and elements of high quality. Therefore, the maintenance factor is part of the human activity in bridge engineering itself.

2.1.1. Typical damage of concrete structures

Damage of concrete structures is mainly revealed by visual inspection of crack types. Damage of concrete can be caused by :

- Inadequte design and/or construction
- Structural cracking/ excessive deflection in structural components
- Inadequate material quality
- Degradation in structural capacity
- Weathering and aging, chemical attack
- Fire attack, earthquake or floods.

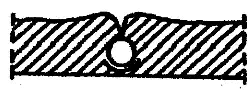
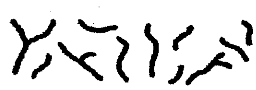
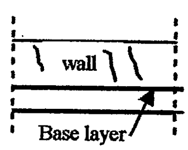
In the evaluation of cracking influence on the bridge resistance and safety, it is important to investigate the cause of cracking. Cracking is mainly caused by the following factors :

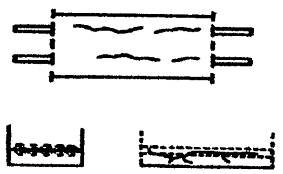
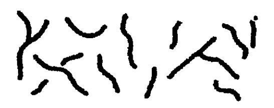
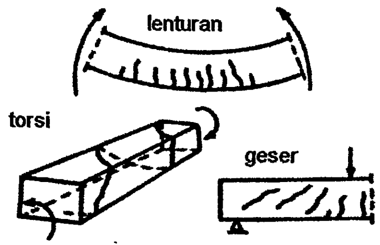
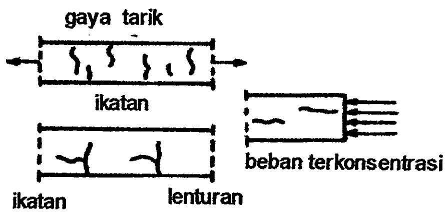
(i) Initial crack formation after casting the concrete or construction of the structure

(ii) External crack appearance or pattern

(iii) Crack width, number and location

Tabel 2.1 Cause and appearance of cracks in concrete structures

No.	Cause	Time of formation	External appearance	Illustration	Comment (crack width w)
1	Plastic settlement (slump cracking	First few hours after casting of concrete	Cracks along reinforcing bars. Cracks at changes in shape/section		Cracks can be large ($w > 1$ mm)
2	Plastic shrinkage	First few hours after casting of concrete	Cracking pattern or long cracks on surface of elements cast in drying conditions		Cracks can be large ($w = 2\text{-}4$ mm)
3	Early thermal cracks	First few days after casting of concrete	Large cracks at construction joints in walls. Other cracks depending on restraint condition		Can be controlled by reinforcement ($w < 0{,}4$ mm) , by limiting pour sizes or temperature control
4	Shrinkage	Several months after construction	Similar to bending or tension cracks	See below (7 or 8)	Usually small if reinforcement is sufficient ($w < 0{,}4$ mm)

5	Corrosion	Several months or years after construction	Cracking along reinforcement bars developing into spalling		Initially small (w < 0,2 mm) increasing with time, rust staining may be visible on concrete surface in wet conditions .
6	Alkali silica aggregate reaction	Several years after construction	occurrence in wet conditions, frequently as a map of cracks, only with alkali reactive aggregates		Cracks can be large (even w > 1,0 mm)
7	Service loading	Depending on usage of structure			Small in general (w < 0,2 mm), if design for strength is satisfactory. Larger cracks indicate in general design errors
8	Restraint	Depending on external influence			Small in general (w < 0,2 mm), if reinforcement is sufficient

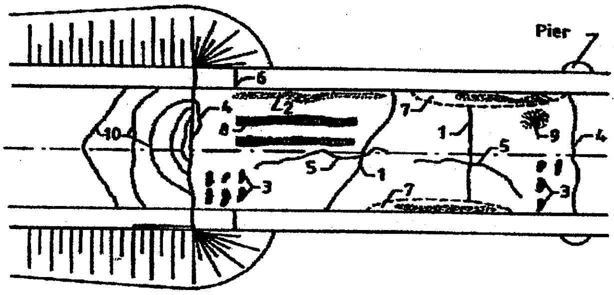


Figure 2.2 Damage in paved roadway on concrete/composite bridges

1. transversal cracks in pavement, 2. contaminations along curbs, 3. losses/defects in pavement, 4. cracks in expantion joints, 5. longitudinal cracks in pavement, 6. deterioration and leakage near curbs, 7. pavement defomation, 8. 'wheel tracks' pavement deformation, 9. pavement deterioration, 10. pavement roughness in approach zones due to settlement of embankment or lack of intermediate slab between span and abutment

2.1.2 Corrosion of steel structures

Corrosion is damage or degradation of metal caused by reaction between metal and some ions from environmental conditions resulting into corrosion products ($Fe_2O_3.nH_2O$).

Corrosion is the most common factor leading to deterioration of structural members and their joints. There are five forms of corrosion observed in steel bridges :

(a) Surface corrosion, causing uniform destruction of relatively large surface of structural steel and leading to reduction of cross sections or material losses

(b) Pitting (fatique) corrosion, occurring on very small surfaces and therefore difficult to detect. , developing deeply inside the steel and leading to local stress concentration.

(c) Crevice (fatique) corrosion, occurring in the contact layer between two elements of the same type of steel (e.g., in bolted plates, splice plates, gusset plates etc) and leading to destruction by tear forces resulting from swelling of corrosion products. This type of corrosion is difficult to detect its harmful effects as it occurs in not easily accessible places in the bridge structure.

(d) Galvanic corrosion, in general occurring in the joint of two different types of steel or metals (e.g., in welded, screw, bolt or riveted joints where the so called galvanic cell can be formed) and leading to local material destruction, in general difficult to detect.

(e) Stress (fatique) corrosion, occurrring mostly in cables of suspension or cable-stayed bridges, relatively seldom in bridges elements of carbon steeel.

Deterioration by corrosion is leading to increase of stresses in the structural members caused by loss of material and reduction of section. Reduction in structural stiffness will increase deflection and deformation, effecting the dynamic characteristicts of the bridge. Other effects of corrosion can be observed in damage of bridge bearings leading to locked bearing movement and causing local structural instability.

2.2 Strengthening of bridge structures

Bridge strengthening is in general classified into two principle criterias : (A) passive method dan (B) active method. The passive method can be defined as a strengthening method causing the redistribution of internal forces in the structure, but redistribution itself is not the main principal of this method. While the active method can be defined as a strengthening method based on redistribution that is induced on the structural forces, and the required strengthening is achieved by this redistribution method.

Both methods are described for steel bridging, according to (1) principle of the strengthening method, (2) construction time, and (3) construction costs as shown in Table 2.2.

Tabel 2.2 General classification of strengthening methods for steel bridges

	Passive method				Active method		
	Principle	Time	Costs		Principle	Time	Costs
P1	Enlargement of cross section of structural members	Long	Low	A1	Installation of additional strengthening members	mean	high
P2	Replacement of weak members with new ones to achieve the required load carrying capacity	Short	high	A2	External post tensioning	mean	mean
P3	External bonding of CFRP strips	Short	mean	A3	Change in supporting system	mean	low
P4	Strengthening of joints of any type, including gusset plates, by adding new plates	Short	Low	A4	Replacement of deck by a lighter system (e.g. orthotropic plate)	long	high
P5	Other methods			A5	Other methods		

To achieve optimal results of the strengthening of steel and concrete bridges, some additional repair has to be carried out as described in Table 2.3 (steel bridges) and 2.4. (concrete bridges).

Tabel 2.3 General classification for technical repair and material application of steel bridge structures

No	Type of work	Structural element	Applied repair	Applied material
1	Corrosion removal and surface cleaning	Any	Cleaning by hand brushing, sand blasting, thermal or chemical cleaning	-
2	Repair of deformed elements	Any	Mechanical method by jacking or heating method	
3	Removal of part of structural elements and structural joints, e.g. welds, rivets with defects, cracked gusset plates	Any, if necessary	By using hand methods , mechanical or thermal cutting methods	
4	Strengthening of structural element with reduced cross section by corrosion or fatigue cracks	Any, if necessary	Reinforcement by steel plates or angle profiles welded or bolted to existing profile	Steel, welding, bolts in material conformity with existing steel structure
5	Strengthening of structure after repair	Mostly main structural elements	Additional steel plates/profiles jointed to existing elements by welding/bolting	Steel, welding, bolts in material conformity with existing steel structure to avoid forming the corrosion cell
6	Installation of new elements after removal of existing ones	Any, if necessary	By welding, bolting	Steel, welding, bolts in material conformity with existing steel structure
7	Anti-corrosion protection	Any	Mostly painting, brush/spray painting	Paint systems of various types, one or more coating layers

Tabel 2.4 General classification for technical repair and material application of concrete bridge structures

No	Type of work	Structural elements	Applied repair	Applied material
1	Removal of deteriorated concrete	All structural elements	Hand chipping, pneumatic hammer saw cutting, water jet	-
2	Corrosion removal	Reinforcing steel, strands, steel bearings	Hand removal, using brush, grinding. Sand blasting	
3	Surface cleaning	Concrete and steel	Hand technique by washing, jet blast of air or water	
4	Crack repair	concrete	Depending crack width : surface coating, injection using gravitation or pressure.	Cement grout, epoxy grout
5	Bonding of repair material	concrete	Wetting repair area & applying rich mortar layer, or applying epoxy bonding coat (mostly by hand), dowelling by drilling	cement mortar or modified polymer mortar, epoxy bonding agent, steel dowels
6	Patching/ penambalan	Beton	Hand techniques	cement mortar or modified polymer mortar, concrete
7	Replacement or addition of reinforcement	Reinforcing steel	Hand techniques or welding	Reinforcement ,stirrups, laps
8	Reinforcement protection	Reinforcing steel	Hand techniques or spraying	Epoxy coats
9	Applying repair materials	concrete	Hand application , trowelling, cast by gravitational method, shotcrete, pumping	cement mortar or modified polymer mortar, concrete fibrous mortar or concrete , epoxy mortar , resin based polymer concrete
10	Surface coating and sealing	Beton	Hand techniques	For surface coating: polymer modified cement, cement modified polymer For sealing: polymer impregnation, silicates, epoxy based sealants, rubber and silicon resins, linseed oil
11	Perbaikan kerusakan akibat tumbukan	RC and PC beams or box girders	External prestressing	Prestressing tendons and sleeves

Other repair works that are carried out simultaneously with the strengthening work are as follows :

1. Repair of expantion joints to improve bridge movement
2. Repair of drainage to reduce rain water load at time of flooding
3. Repair of asphalt surface layer to reduce impact on the bridge
4. Repair of railings and utility lighting to improve safety of the main truss structure against collision with passing vehicles.

2.3 Selection of repair methods

2.3.1 Strengthening of steel truss structures by increasing cross section and replacement of weak elements

Purpose : By increasing/repair of the cross section, the inertia moment of the section will increase and finally improves the static and dynamic stiffness.

1) Pre-Stage :
   a) Measurements of dimensional cross sections in detail, where probably the distances between nodal points may differ due to change of camber in time and passing of vehicle loads.
   b) Measurement of dimension and location of existing bolts
   c) It is necessary to provide the detailing of new bolt holes to connect the old structure with the new one
   d) Providing surface corrosion protection between the inter surface of old and new structure
   e) Providing bolts with the same class/or higher class and larger lengths
   f) Providing additional equipment to resist the forces in truss chords that lock the bolt movement, by adding a structural truss replacement, with a symmetrical prestressing force to replace the compression chord, or symmetrical compressive force to replace the tension chord.
   g) Providing coating of bolts with paint or galvanic method.
   h) If it is possible, the working forces are removed (e.g. excessive overlay load, or even concrete slab) or temporairily detoured (e.g. traffic loads)
   i) Providing scaffolding and equipment to transport steel profiles.

2) Construction stage :
   a) Cleaning of existing structural surface
   b) Loosening of bolts by using appropriate wedges and pins

c) Inserting the new bolt simultaneously with the removal of the old one.

d) Attaching the additional profile on the existing structure

3) Maintenance stage

a) Providing routine bolt fastening

b) Providing periodical corrosion inspection in particular on interface surfaces.

c) Providing routine painting schedule

2.3.2 CFRP strip addition (*Carbon Fibre Reinforced Polymer*) / *steel plate bonding*

Purpose : Adding strength to resist axial forces and bending forces in the steel/concrete element section, by bonding an additional plate of steel or polymer plastic sheet

1) Pre stage :

a) Providing steel sheet or polymer plastic sheet and appropriate bonding material.

b) Providing scaffolding and equipment for transportation of steel profiles.

c) Providing bolts and other bonding materials.

d) Painting to protect the steel plates to be bonded against corrosion

2) Construction stage :

a) Surface cleaning

b) Steel members require shielding to avoid excessive heat that will influence the physical properties of the bonding agent.

c) Scaffolding to hold the plates during bonding process

d) Placing dowels/bolts and bonding layer

e) Placing steel plates/ CFRP

3) Maintenance stage :

a) Providing periodical corrosion inspection in particular on interfaces

b) Providing routine painting schedule

2.3.3 Strengthening of connections/splices

Purpose : To anticipate cracking tendency caused by overload and fatique phenomena (achievement of lower cracking stresses in steel than yield stress by cyclic repetition at certain level)

1) Pre stage : similar to strengthening by increasing cross section / replacement of weak elements
2) Construction stage : similar to strengthening by increasing cross section / replacement of weak elements
3) Maintenance stage : similar to strengthening by increasing cross section / replacement of weak elements

2.3.4 Placing additional elements such as additional truss chords

Purpose : Distributing chord forces of the existing structure to additional truss chords, reducing the buckling length

1) Pre stage :
   a) Detailed structural analysis in particular if the connection point with the new truss causes significant change in internal force distribution
   b) Measurement of the available clearance for placing the new truss chords. Thereby determining the profile types that can be placed.
   c) Measurement of the exact length of the additional truss.
   d) Providing additional equipment for loosening and placing back of the bolts.
   e) Providing bolts with greater length and steel grade that confirms to existing bolts.
   f) Protecting the new truss profiles with an anti-corrosive layer
   g) Providing scaffolding and equipment for transportation of steel profiles.
   h) Providing equipment to enlarge bolt holes if case bolts do not fit.
2) Construction stage :
   a) Reducing loads on the structure or removal of working loads
   b) Bolt loosening

c) Fixing and placing new steel profiles in such a way that the bolts can accurately be placed

d) Placing the bolts back and fastening

3) Maintenance stage:

a) Routine bolt fastening programme

b) Providing a protective coating layer as soon as some corrosion can be detected

2.3.5 External prestressing on steel truss bridges

Purpose : Prestressing tendons induce stress with a sign opposite to those in the original structure on the bridge, therefore the load carrying capacity and camber of the structure is improved.

1) Pre stage :

a) Alignment is determined by accurate design considering the dilatation gap at the abutment wall, clearance underneath the bridge, the chords that are crossed by the cable, and critical chords that will be reduced in stress, anchorage and deviator locations in connection with the prestressing force to be applied.

b) Providing ducts and prestressing tendons

c) Providing hydraulic pump that has been calibrated and is not leaking.

d) Providing scaffolding and equipment to transport the hydraulic pump

e) Design and construction of anchorage assemblies and deviator.

2) Construction stage :

a) Placing anchorage assemblies and deviators including boring new bolt holes.

b) Placing cable ducts and prestressing tendons

c) Reduction and removal of working loads during prestressing process

d) Repair of bearing system to hinge-roller function when stressing is applied, in achieving optimal compression results.

e) Reduction of floor stiffness that obstructs the force in providing additional camber, if possible but not recommended if the cross girder has shear connectors.

f) Stressing is applied gradually and simetrically between truss sides until the required stressing is achieved. An interval of 25% is applicable for the stressing process in stages.

g) Loosening bolts up to 50% of the minimum torsion value to optimize the effect on additional camber during removal of bridge slab.

h) Fastening bolts up to 100% minimum torsion value to increase stiffening of connections in the truss frame during cable stressing

i) Monitoring camber and section shape during stressing to control excessive stressing

j) Grout injection in cable sleeves.

3) Maintenance stage :

a) Monitoring of cables if sleeves are not filled wth cement grout, to observe fatique indication of the cables.

b) Monitoring the anchorage ends to make sure that grout filling is correctly carried out, to prevent ingress of corrosion on the cables

c) Monitoring steel elements that have been bored and bolt holes to prevent corrosion

d) Routine painting of new bolt holes or steel profiles that had to be bored for inserting/placing the cables, anchorages and deviators

e) Filling/sealing of empty gaps that have potency to induce corrosion at anchorage assemblies and deviators.

2.3.6 Strengthening by adding a supporting system on the steel truss bridges

Purpose : reducing of the bridge span by providing additional supporting or changing the internal force distribution through the changed structural system.

1) Pre stage :

   a) Detailed structural analysis is required regarding the change of forces in the steel truss chords in particular the axial forces that change from tension to compression or reversely. This change will also influence change of forces in the floor structure. The floor structure may be subjected to a change of moment forces that are not resisted by the existing reinforcement and finally causing cracking in the deck slab.

b) Determine the location of additional supporting in connection with placing a new pier

2) Construction stage :

a) Determine location of the supporting pier

b) Foundation for the new pier

c) Construction of the supporting system

d) Placement of bearings on the new support

3) Maintenance stage :

a) Monitoring the bearings on the new support

b) Monitoring cracking of the deck slab

c) Monitoring deformation of the steel truss

2.3.7 Replacement of deck structure by a lighter system on steel truss bridges

Purpose : Reducing the deck load leading to reduction of element forces in the steel truss and thereby improving the deck performance to a higher load capacity .

1) Pre stage :

a) Design of the new deck structure, including the connections at the cross girders

b) Equipment to remove the concrete deck slab

c) Equipment to transport the crushed deck slab parts

d) Measurement of the distance between segments of the steel truss after concrete deck removal, to enable the placement of the new plate as accurate as possible

2) Construction stage :

1. Removal of the existing asphalt layer and concrete deck
2. Placing of wing assembly for supporting the new plate
3. Boring new bolt holes for the supporting assembly of the new plate

4. Fastening bolts to 100 % minimum torsion value
5. Constructing new shear connectors
6. Transporting the new plate
7. Placing the new plate into position on the steel truss
8. Casting the connection at cross girders

3) Maintenance stage :

a) Monitoring cable stressing for precast concrete deck slab system
b) Monitoring transverse cracks at cross girders for precast concrete deck slab system
c) Monitoring transverse cracks at bottom side of precast concrete deck slab system

or

d) Monitoring cracks of the orthotropic steel deck plate
e) Monitoring corrosion of the orthotropic steel deck plate
f) Monitoring debonding/spalling of the asphalt layer on the steel deck plate

2.4 Application of bridge strengthening methods

2.4.1 Strengthening by enlarging of concrete sections

Strengthening by enlarging the section of concrete beams and adding reinforcement is commonly used. This method can be used at the top or bottom sides of the concrete elements. The main task is to perform sufficient bonding of new to old concrete. The difference in shrinkage of the two concrete types may cause lack of bond. This is overcome by using shear connectors and/or non-shrink concrete.

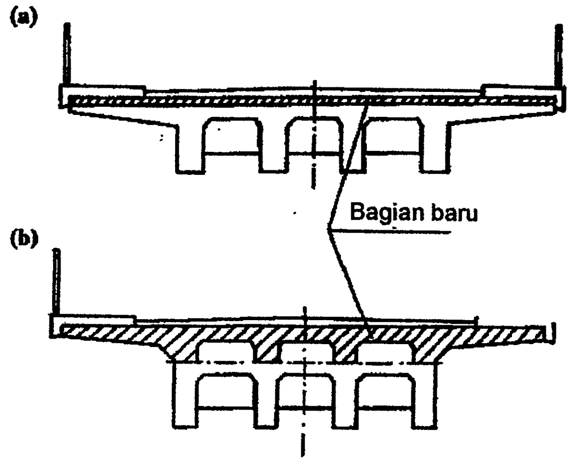
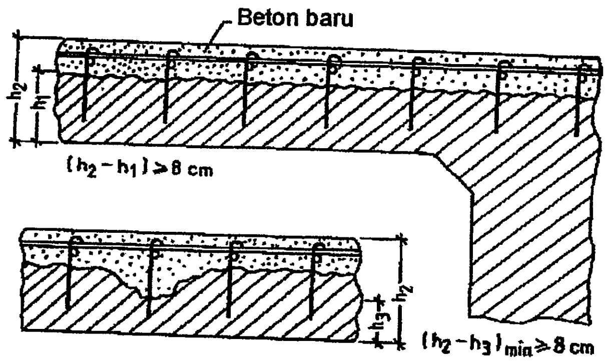
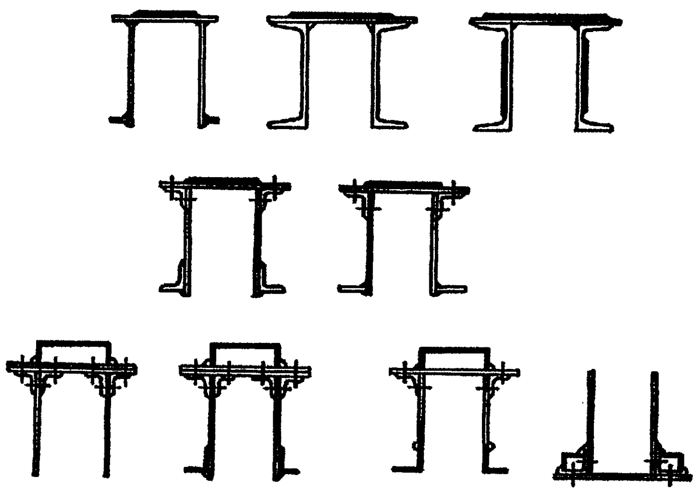


Figure 2.3 Strengthening by enlarging slab and beam sections

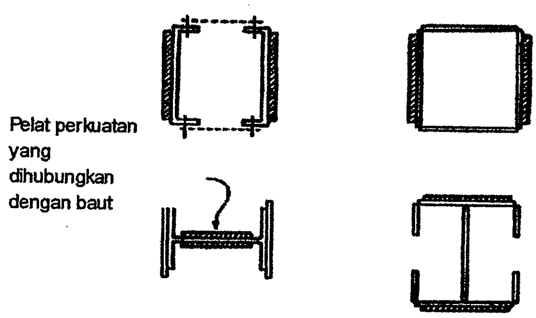


Gambar 2.4 Stengthening by enlarging deck slab section

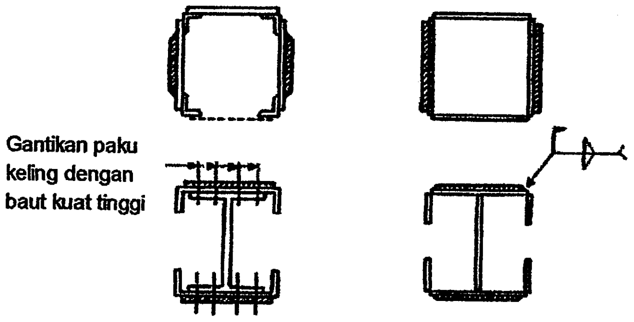
The strengthening by enlarging sections can also be applied to steel bridges (Figure 2.5)



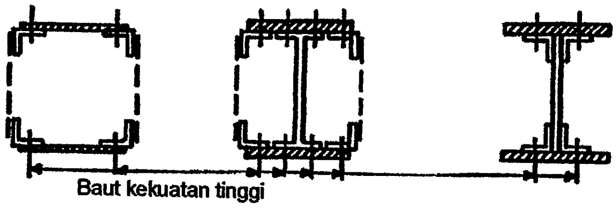
(a)


Pelat perkuatan
yang
dihubungkan
dengan baut

(b)

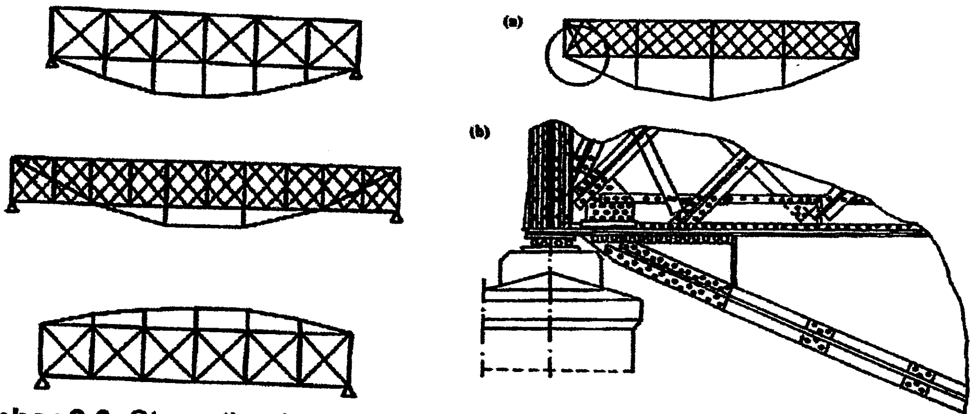

Gantikan paku
keling dengan
baut kuat tinggi

(c)



(d)

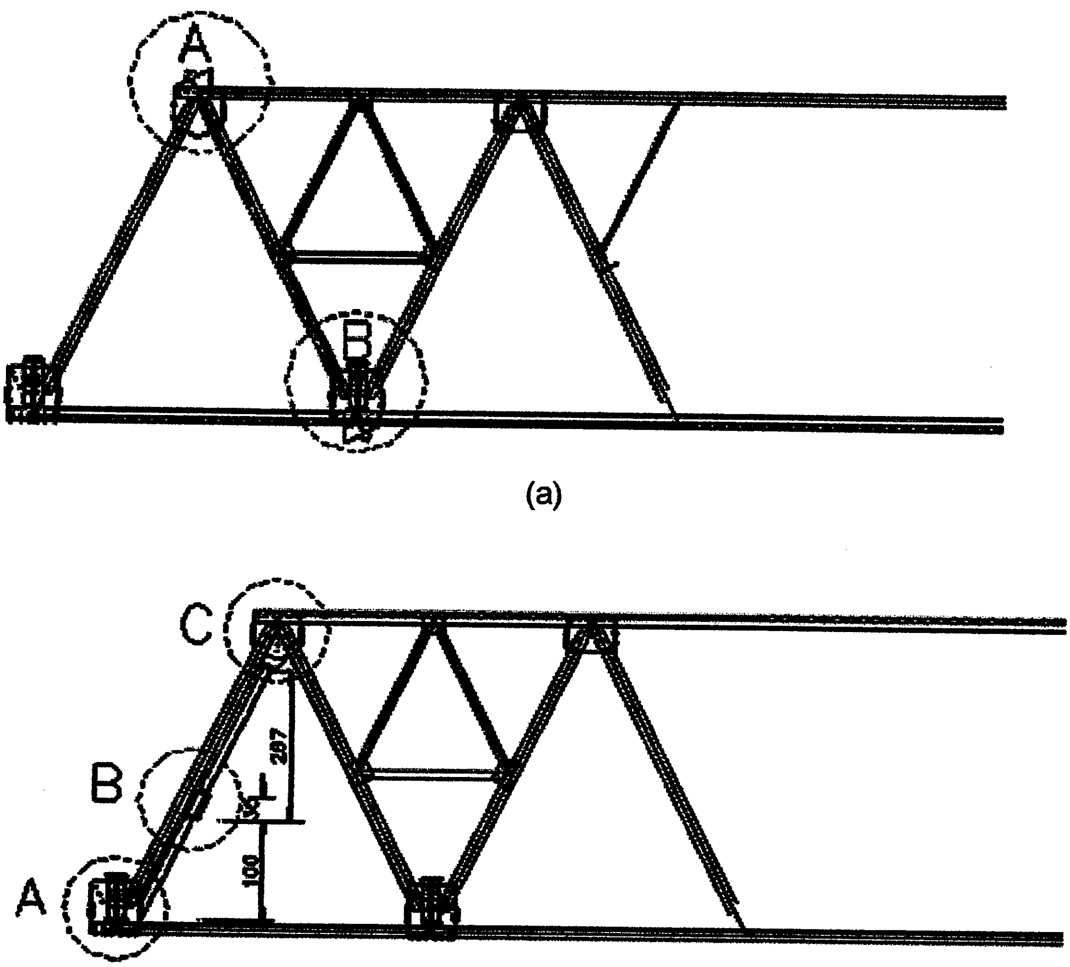
Figure 2.5 Strengthening by enlarging the section using additional steel plates on steel trusses (a) additional plates/profiles (b) additional plates for tension chords (c) additional plates for compression chords (d) additional plates for vertical chords



Gambar 2.6 Strengthening by adding additional chords on steel truss bridges

2.4.2 Replacing weak elements

The replacement of tension or compression chords is initialized by a method to carry out chord removal in a safe way. This method needs care and traffic on the bridge has to be reduced or stopped during the removal process. Replacing of tension chords need a temporair prestressed bar to counteract tension, and a temporair jack to counteract compression (Figure 2.7). Another method is by using a temporair frame besides the existing truss.



(a)

(b)

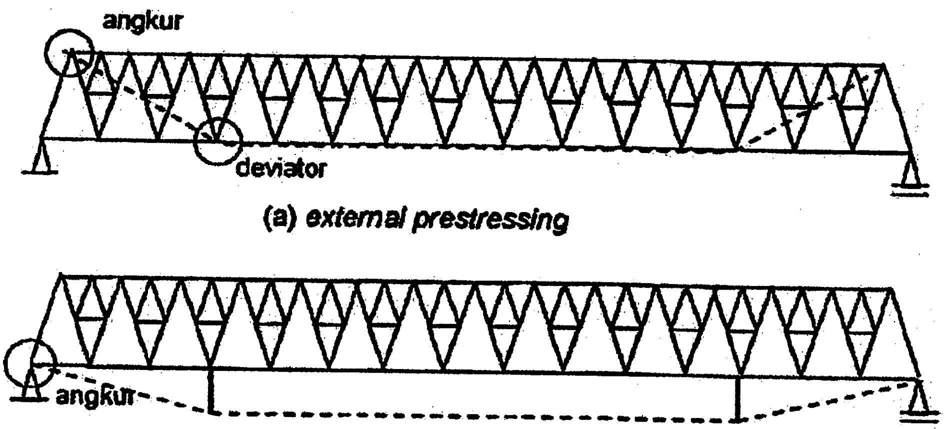
Gambar 2.7 Replacing of tension chord and compression chord (A) placing external prestressed bar in replacing tension chord (B) placing jack supported by additional frame in replacing compression chord

2.4.3 External prestressing

This strengthening method is most universal because it can be applied to different structural types. Besides for concrete structures it can be applied to steel structures. The main elements for this strengthening method are prestressing cables, anchorages and deviators.

Strengthening by external prestressing simplifies the application of axial loads that are combined with uplift loads leading to increase bending and shear capacity of the structure. Capacity and serviceability of the bridge will also increase. As an example, the stiffness increase by external prestressing can reduce defection and vibration in service life of the bridge. Critical locations can be reduced in stress to improve performance against fatique besides reducing the existing deflection..

The principals of external prestressing are similar to prestressed concrete bridging, that is the application of a compressive force combined with the moment eccentricity that increase the bending capacity and controls the cracking of a concrete girder.



(b) *external prestressing* dengan batang penyokong

Gambar 2.8 External prestressing on steel truss bridges

The anchorage system is similar to the one used in prestressed concrete. Nowadays producers provide special anchorages for external prestressing including facilities for corrosion protection and replacing of strands in future maintenance work. Anchorages in steel trusses can be placed at upper or lower sides of the truss. Tendons can be straight or trapesoidal according to design requirement. The advantages of external prestyressing are as follows :

a) Restriction of traffic is not required
b) Construction is quite simple
c) Inspection of externally placed cables and anchorages is quite simple
d) Cables can be re-tensioned periodically.
e) Cables can be replaced if necessary in future

Some disadvantages are as follows :

a) Detailed analysis is required to ensure that no overstressing occurs in the deck, girder and truss chords. This may result is strengthening of some chords in truss bridges due to external prestressing influence.
b) Externally placed cables are vulnerable to vandalism and corrosion
c) During external prestressing procedures some movement occurs in vertical and horizontal directions, causing secondary stresses in deck slab and truss chords.
d) In steel trusses, the axial force application can disturb the local stability , and therefore local strengthening of anchorage assemblies or additional profiles/plates are required at anchorage locations

2.4.4 Steel Plate Bonding

Strengthening by using steel plate bonding is similar to adding reinforcement (steel plate) that is compositely bonded to the concrete by using epoxy resins. Steel plate bonding strengthening improves bending and shear capacities.

A disadvantage of this method is that temperatures higher than 60° C will reduce the epoxy resin strength and thereby reduce the bonding of steel plates to existing concrete.

The shear strength of epoxy resin is minimal similar to high strength concrete 8 MPa and the shear strength of existing concrete should be minimal 4 MPa. This is in practice very difficult to obtain, as existing concrete structures have frequently a lower quality.

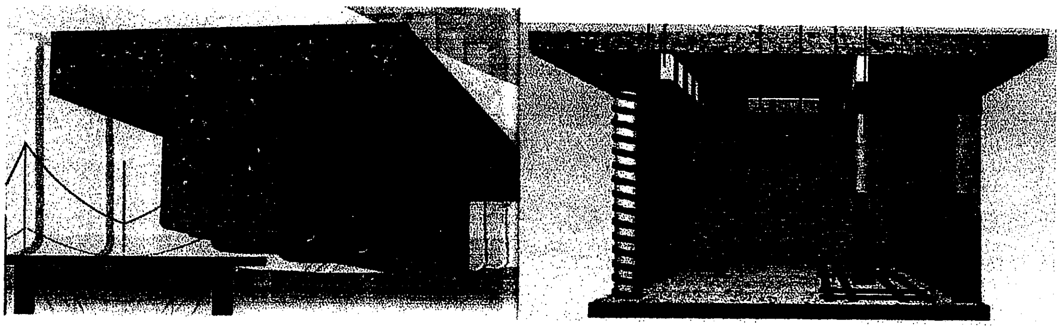
The epoxy resin must have a bending modulus strength of 2 - 8 GPa and to ensure durability (30 years service life) the temperature of the structure have to be between -20°C to +40°C.

The design procedure for this strengthening method is by the assumption that the steel plate is compositely integrated to the concrete, using elastic and plastic limit state calculations.

2.4.5 Carbon Fiber Reinforced Polymer sheets (CFRP)

This method use *Carbon Fiber Reinforced Polymer* (CFRP) and is similar to the steel plate bonding method. The CFRP carbon fibre sheet is compositely bonded to the concrete by using epoxy resins. CFRP strengthening increase bending and shear capacities.

The advantage of CFRP is the high strength and light weight, enabling simple construction compared to the steel plate bonding.



Gambar 2.9 Strengthening by using CFRP

Tabel 2.4 Comparison between Steel Plate Bonding and CFRP sheet

	Steel plate bonding		CFRP sheet
		Advantages	
1.	Economical	1.	Corrosion is no problem
2.	Commonly used	2.	Light weight
3.	Sufficient strength and fatigue resistant	3.	High strength and fatigue resistant
4.	Forces in any direction	4.	Simple construction and maintenance
5.	Can use dowels/anchors if necessary	5.	No splicings
		Disadvantage	
1.	Sensitive to corrosion	1.	Costs relative high
2.	Relative heavy	2.	Not commonly used
3.	Construction relatively difficult	3.	Forces only in one direction.
4.	Need splicings		
5.	Higher scaffolding costs		

Strengthening by CFRP on reinforced concrete structures considers the following :

1. Bending strength of the section to be strengthened
2. Allowable shear strength
3. Capacity of the epoxy connection
4. Bonding strength or dowelling
5. Safety factor of the concrete without strengthening

The design procedure of strengthening using CFRP sheet is different from conventional concrete design. The performance of CFRP sheet at time of carrying load is linear-elastic and has no plastic deformation. The maximum bending strength of the section is when the CFRP sheet fails together with the yield of reinforcing steel, before compression failure in concrete occurs.

2.4.6 Fiber Reinforced Polymer (FRP)

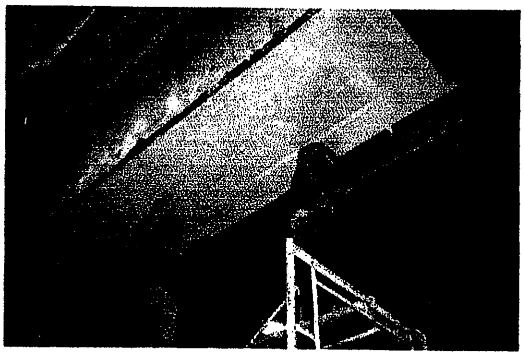
Strengthening of concrete structures by using Fiber Reinforced Polymer (FRP) is a new method. FRP is a material using fibers of carbon, aramid and glass with epoxy resin bonding. This method is very flexible and can be used for strengthening several structural shapes.

(a) (b) (c)

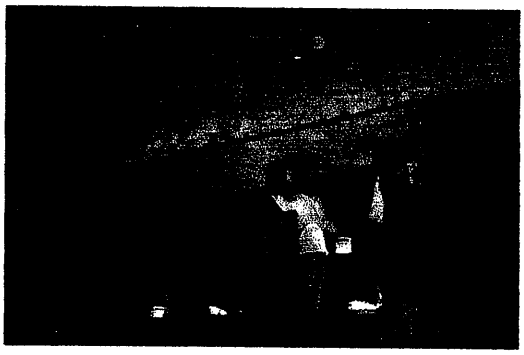
Gambar 2.10 Fibers for strengthening material (a) carbon (b) aramid (c) glass

The design procedure for strengthening using FRP is so far not standardized, therefore designers use assumptions based on laboratory testing results. Technical data for calculations depends on the information from producers. The construction of this strengthening method is as follows :

1. Placing an epoxy resin layer on the existing concrete surface and also on the fiber surface to be bonded
2. Bonding the fiber material to the concrete surface
3. Fiber is again painted with epoxy resin by using roller
4. After initial setting of the epoxy, a protective layer is placed against UV influence and environment



(a)



(b)

(c)

Gambar 2.11 Strengthening by using FRP on U type concrete box girder a) placing of fiber (b) painting of fiber with epoxy (c) sealing by anti-UV layer

2.4.7 Changing structural system

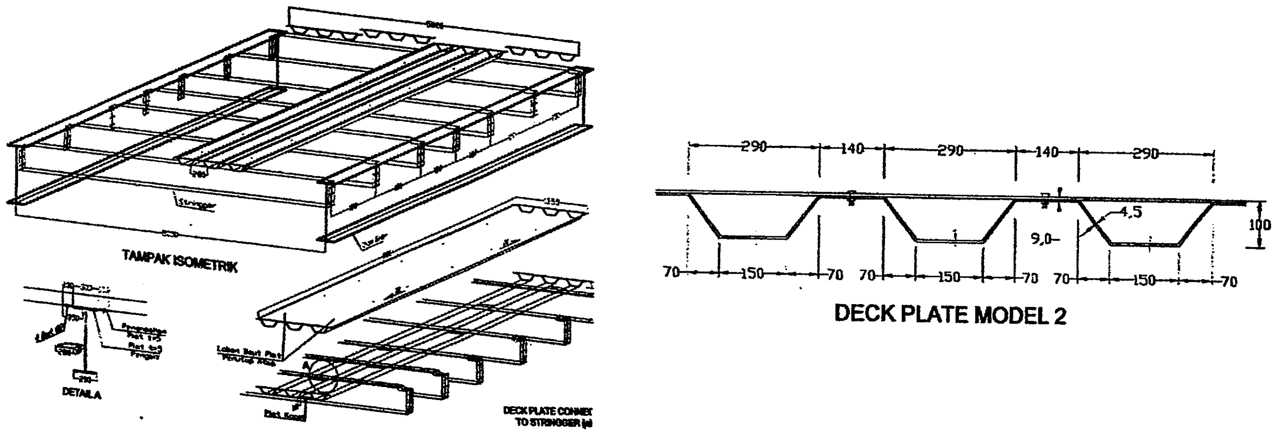
This method changes the structural system without strengthening of components, some examples are as follows :

1. Changing the system of minimal 2 simple spans to a continuous span. In this method the deck slab is made continuous for carrying live loads only. The dead loads are carried by each span acting as a simple beam.on two supports.
2. Changing the structural system by adding a new system such as cable stayed , arch or truss

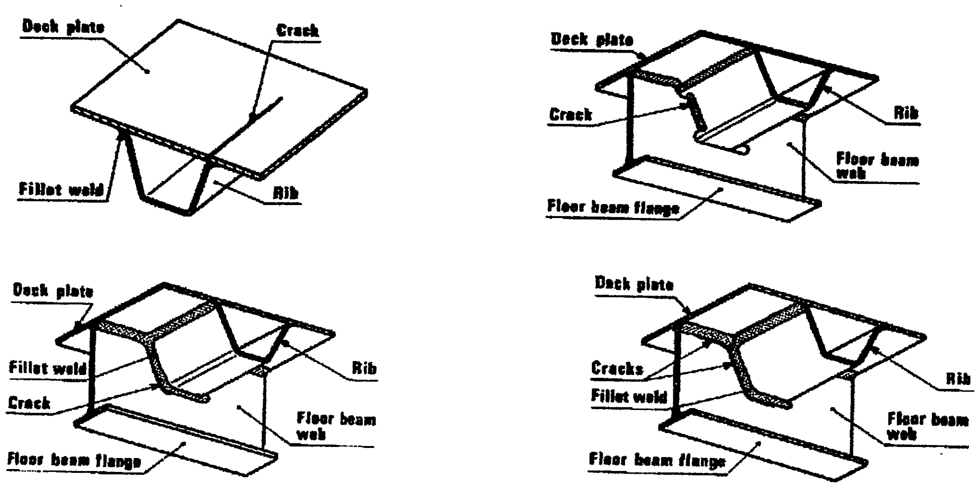
2.4.8 Deck slab modification

The deck slab can be modified by using several methods for replacing the existing deck as follows :

1. Replacing the concrete deck with orthotropic steel deck. The connection strength of the deck plate with the cross girder has to be calculated against fatigue cracking, as the steel truss bridge moves dynamically at connection points or lower gusset plates. Therby the bond of the asphalt layer to the orthotropic deck has to be improved by using epoxy coat bonding.

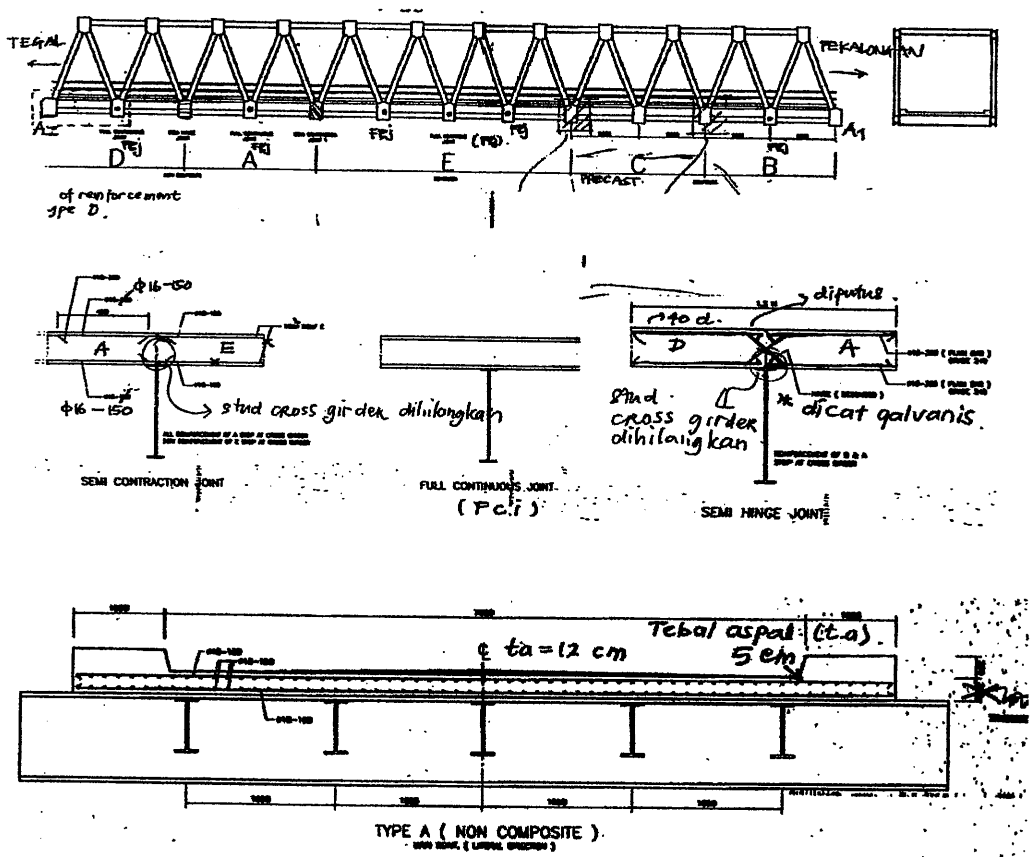


Gambar 2.12 Construction of orthotropic steel plate deck



Gambar 2.13 Cracking in connections between cross girder and orthotropic steel plate

2. Additional reinforcement by considering the actions on the bridge deck that have not been calculated in the previous design, including localizing measures for cracking formations.



Gambar 2.14 An example of a full scale experiment to compare several types of concrete deck systems separated by construction joints at 10m interval

3. Reinforced concrete deck replacement can be carried out by using precast concrete slab elements or corrugated steel plate system that is compositely connected with shear connectors into the concrete slab. These alternatives have been included in the full scale experiment (Figure 2.14)

III. CASE STUDY OF KEDANG PAHU BRIDGE

3.1 Background

Sei Kedang Pahu Bridge is located in a mine area belonging to PT. Trubaindo Coal Mining (TCM), West Kutai Regency, East Kalimantan Province. Bridge construction phase was already finished on April 2005 although there were additional works still to be done for instance: finishing work on bridge curb on 12 m extended span and additional bridge embankment until first loading test in the same month. Some of the design and construction revision has also been done to fit the condition by PT. TCM Advisor teams.

There is crack occurrence over the bridge slab which is indicated in first loading test in 2005. To forecast the effect of that crack in bridge performances, the specific bridge load test & condition monitoring is carried out.

3.2 Changing in Bridge Condition

Bridge condition before the first loading test visually seemed a good condition. No structural crack has been found before loading test started. But the camber was not formed good enough, thats why the sidewalk and railing seem not straight enough at certain section, see Figure 3-1 and 3-2.

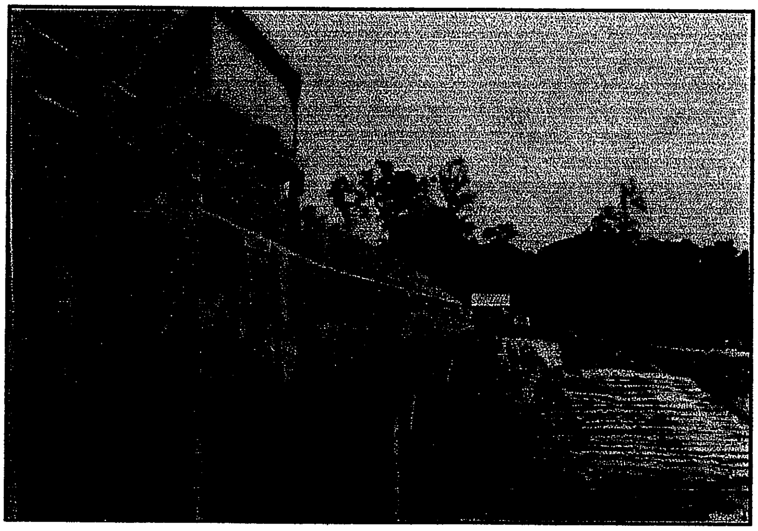


Figure 3-1 Uneven bridge soffit in first loading test

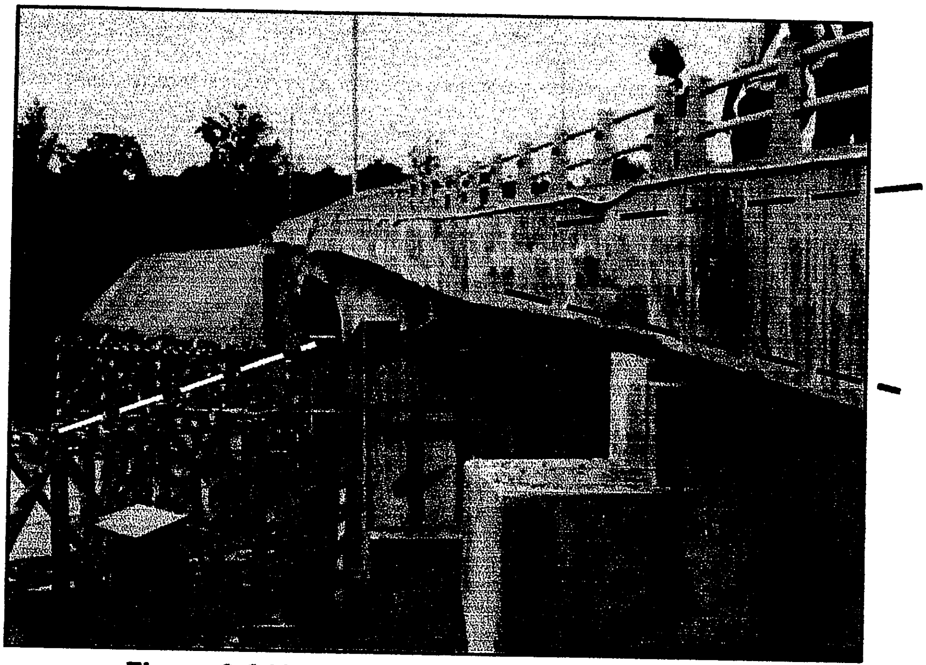


Figure 3-2 Uneven bridge soffit in second loading test

Bridge expantion joint is equipped with two angle covering plates after first loading test above the concrete slab which has been designed as in the as-built-drawing, see Figure 3-3 for condition in first loading test and Figure 3-4 for condition in second loading test.

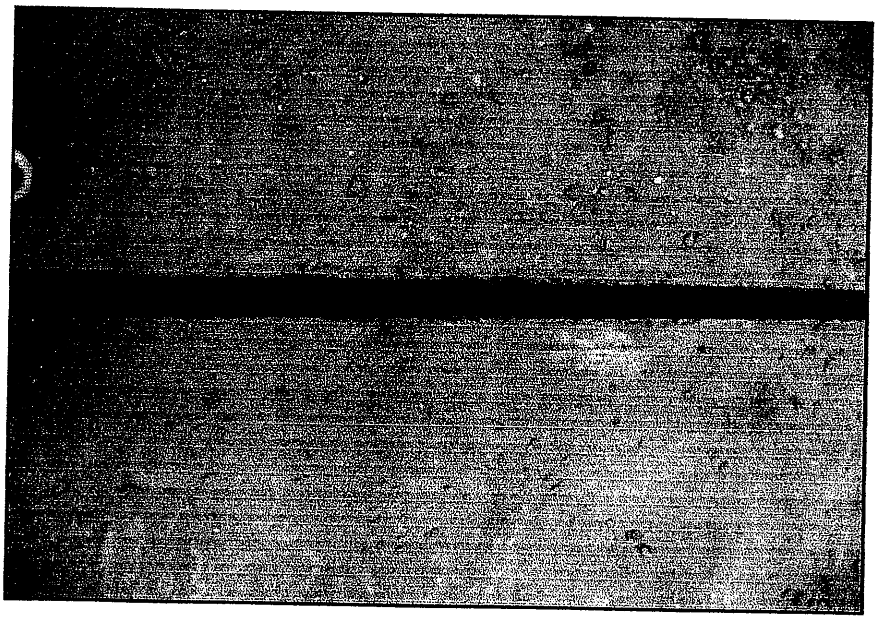


Figure 3-3 Double angle expansion joint without covering plate in fist loading test

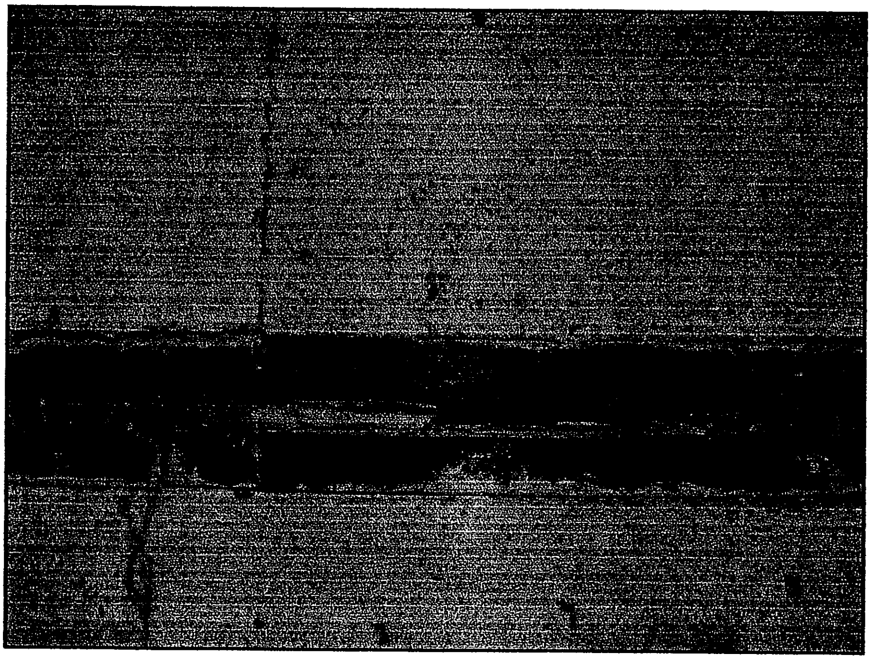


Figure 3-4 Double angle covering plate with broken rubber filler in second loading test

To stabilize bridge lateral movement, the owner constructed driven pile bracing between driven steel piles on the pier section. Also pier protection/ bridge fender construction work has been done properly so no wood or timber hooks onto the bridge driven piles. To protect against corrosion, which occurred in first loading test, coating protection with paint has been implemented onto piles, see Figure 3-5 and Figure 3-6 for condition in first loading test and Figure 3-7 for recent condition.

Figure 3-5 Driven pile bracing below pier section and bridge fender system in first loading test

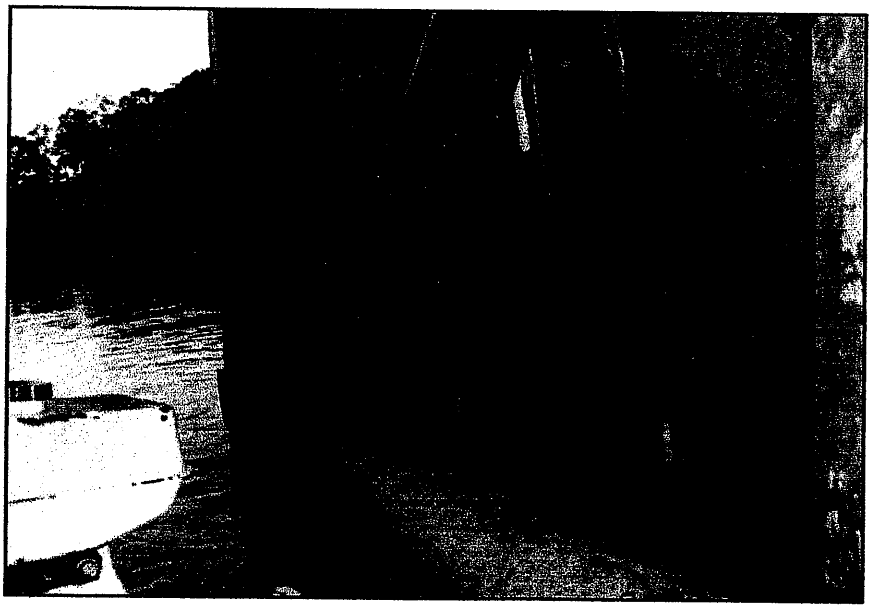


Figure 3-6 Corrosion on steel driven pile in first loading test

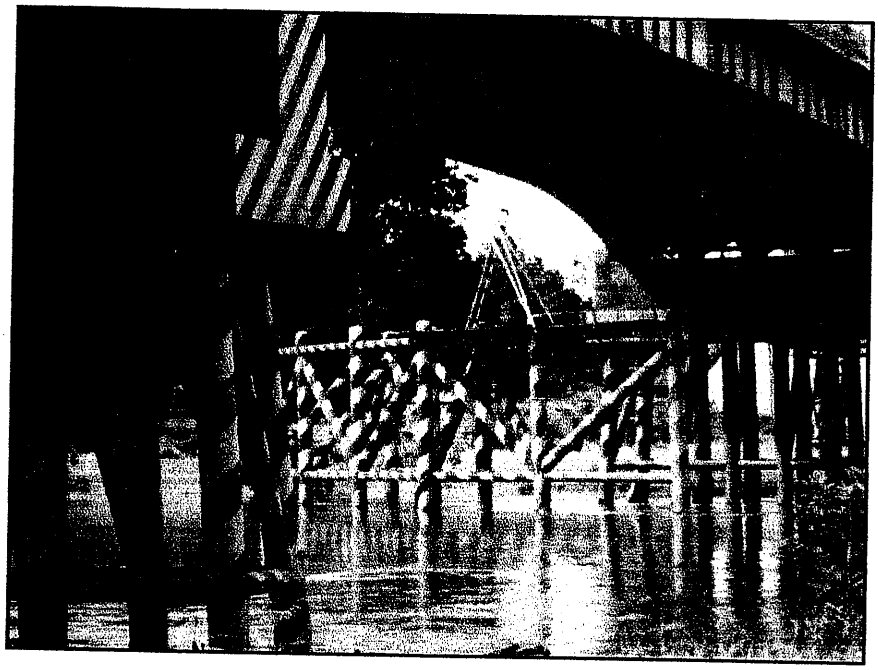


Figure 3-7 Paint coating for corrosion protection on bridge pile and fender

Although it seems that corrosion still occurs in joints between pile and pier footing and lower part of corrugated steel plate near bridge deck sewer pipe, see Figure 3-8 and Figure 3-9.

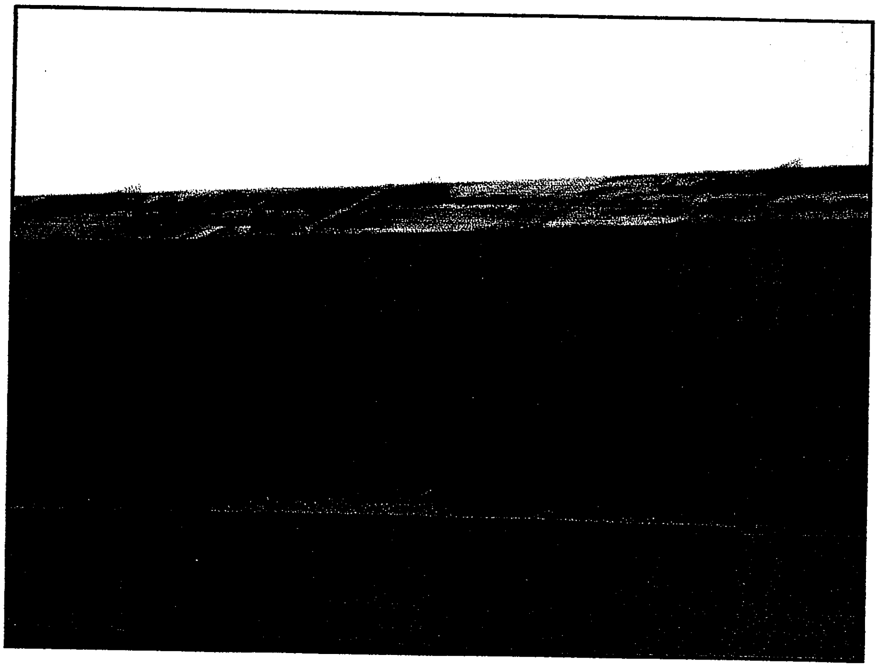


Figure 3-8 Corrosion in lower part of bridge deck

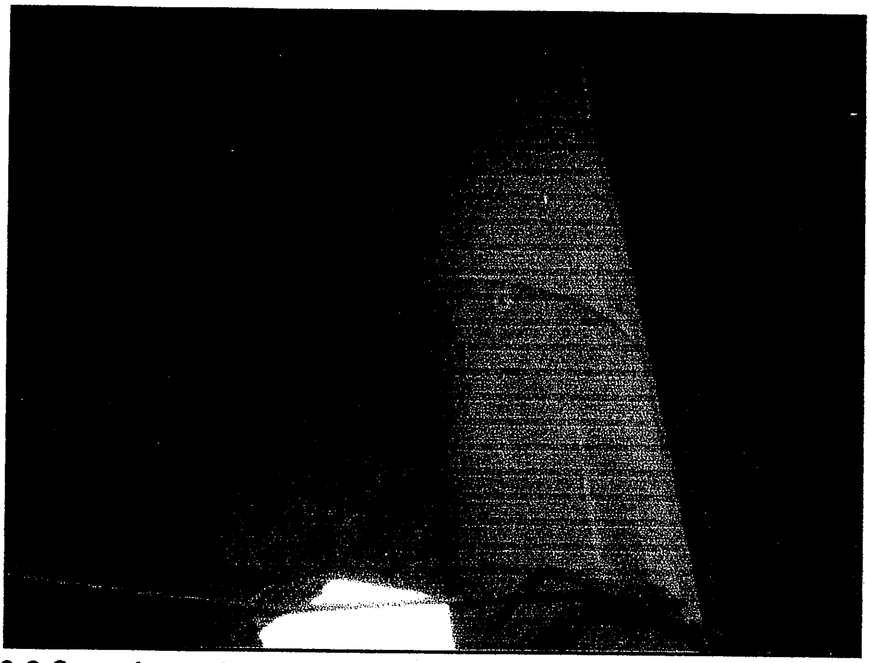


Figure 3-9 Corrosion on interface between pier footing and the tip of pile foundation

At the soffit of second pier from Adong side, a large gap under the corrugated steel plate surface has been found and is still not repaired yet, see Figure 3-10 and Figure 3-11.

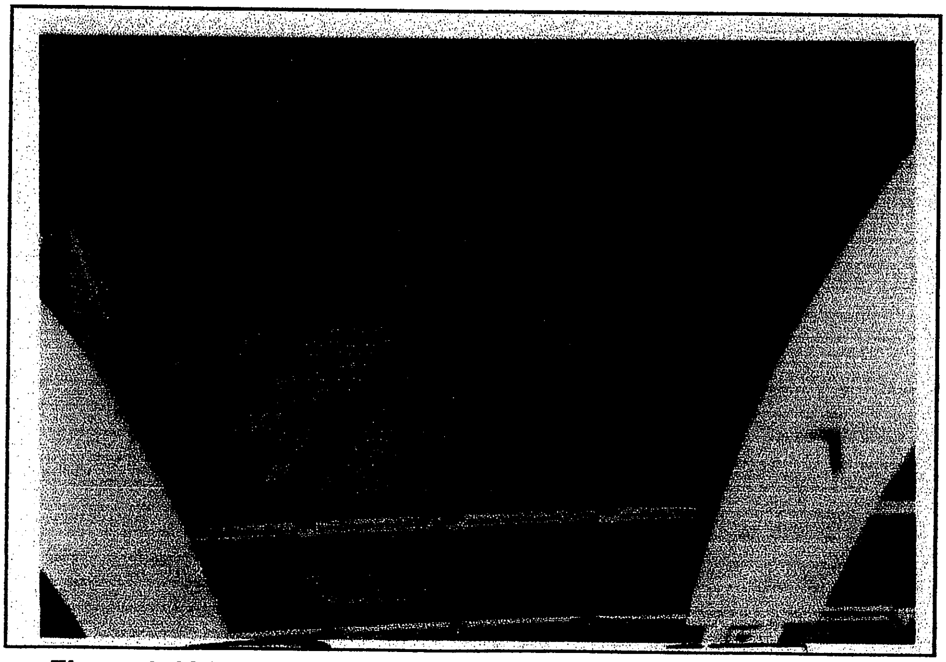


Figure 3-10 Large gap on the corrugated steel plate in first loading

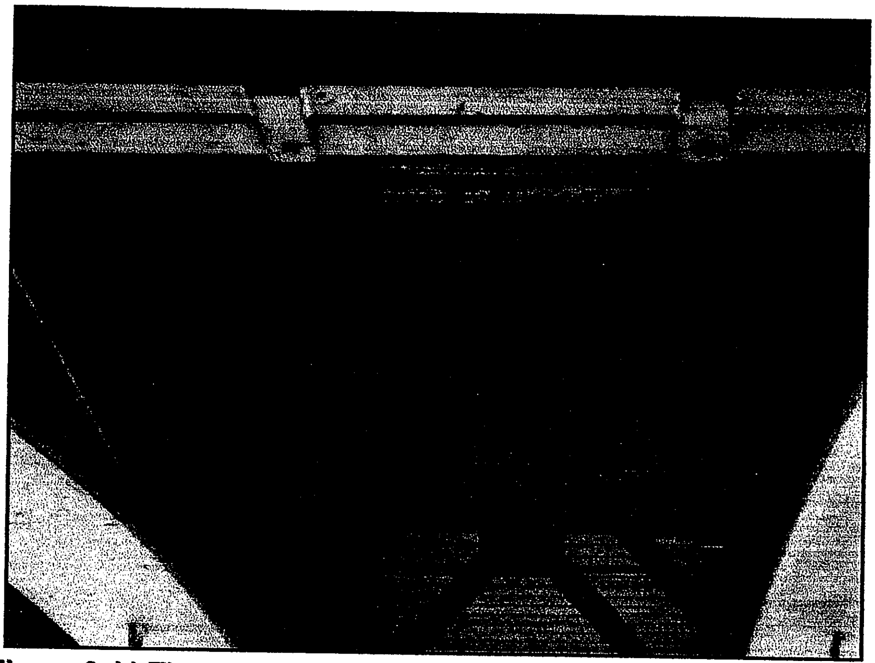


Figure 3-11 The gap have still remain in same position after two years

Uncompleted bolt component has been installed and also tightened, see Figure 3-12.

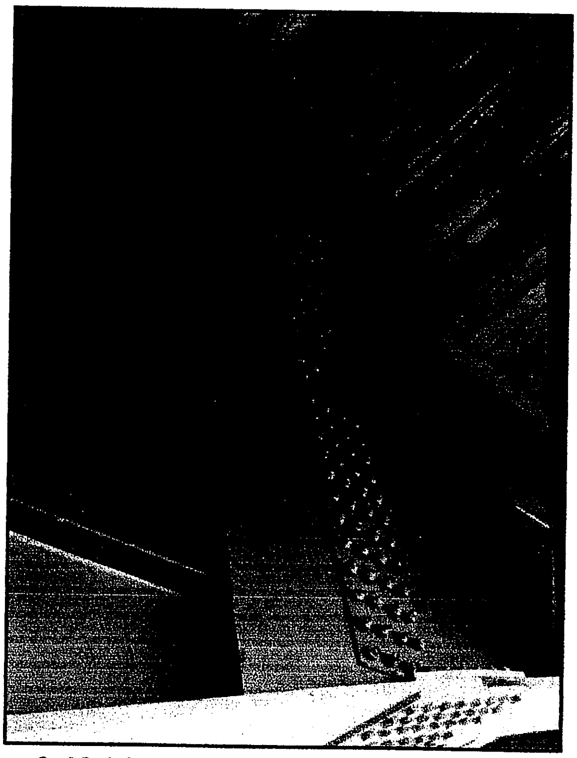


Figure 3-12 All bolts have been tightened and marked

Bridge bearing pad and lateral stopper also work properly without outranged deformation.

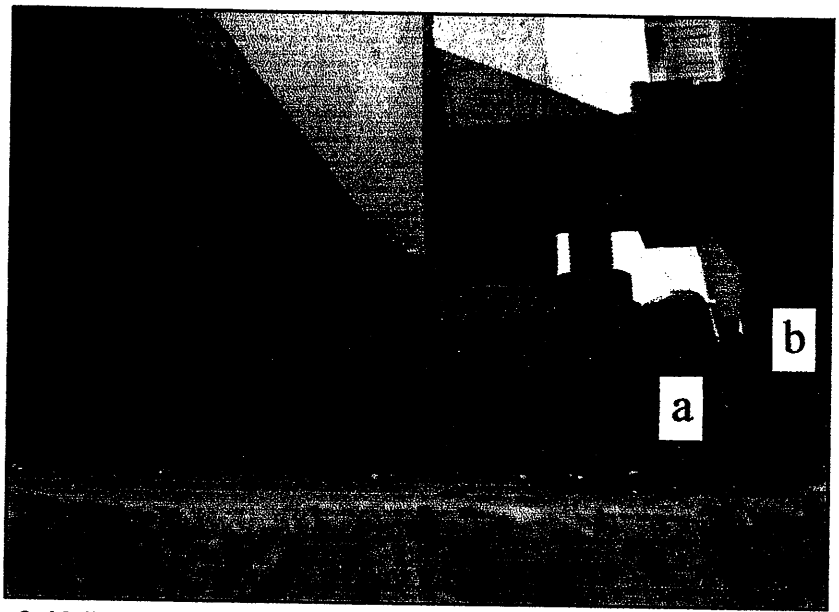


Figure 3-13 Bridge bearing pads (a) and lateral stopper (b) in recent condition

The embankment slope stabilization has also been improved by laying geotextile, which has been done in first loading test, reinforced with combination of stone masonry and concrete filler, see Figure 3-14 for condition in first condition and Figure 3-15 for recent condition.

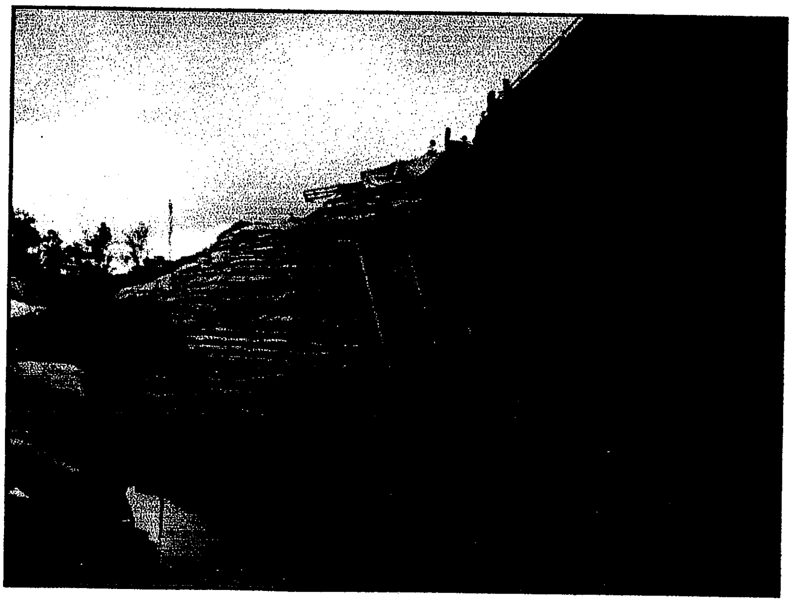


Figure 3-14 Slope protection with geotextile in first loading test

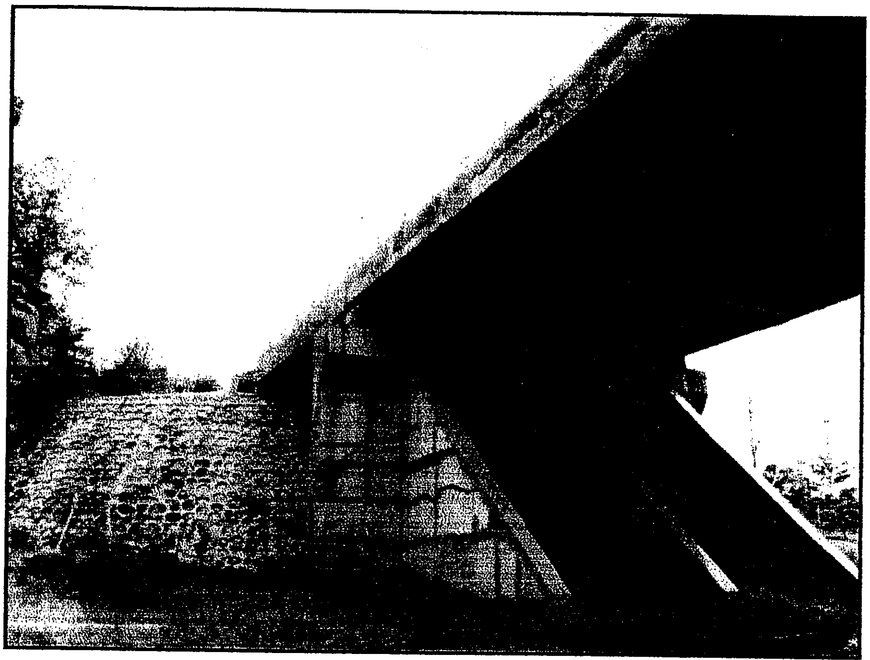


Figure 3-15 Slope protection which is reinforced with stone masonry

IV. CONCLUSIONS AND RECOMMENDATIONS

1. Bridge inspection and repair techniques are becoming special engineering fields
2. Some repair methods can only prolong the service years until a new bridge can be bulit
3. Durable repair is still the main target of bridge strengthening
4. More investigation and study on fatigue of concrete structures has to be carried out
5. Early deterioration of concrete structures is mainly caused by insufficient concrete quality

V. REFERENCES

1. Radomski Wojciech, 2002, *Bridge Rehabilitation*, Imperial College Press, London, UK

2. IRE, 2008, *Final Report Kedang Pahu Bridge Load Testing and Condition Monitoring*

3. IRE, 2010,*Workshop and Training Course onHighways Development and Technology*

Technical Session III
TRAFFIC AND TECHNOLOGY

Local ITS Strategy

- Grass-Roots ITS in Kochi -

Shunichi HAMADA
Research Center for Advanced Information Technology,
National Institute for Land and Infrastructure Management (NILIM)

1

Local ITS in Japan

- Solutions for local traffic problems
- Local specification
- In general, simple and easy functions using mainly road units
- Niche Market

2

What's Grass-Roots ITS ?

- Local ITS proposed and developed by Kochi University of Technology (KUT) & Kochi prefecture
- Cooperative movement by Public, Private, Academia and Local people (PPA&L)
- Deployed by Grass-Roots movement

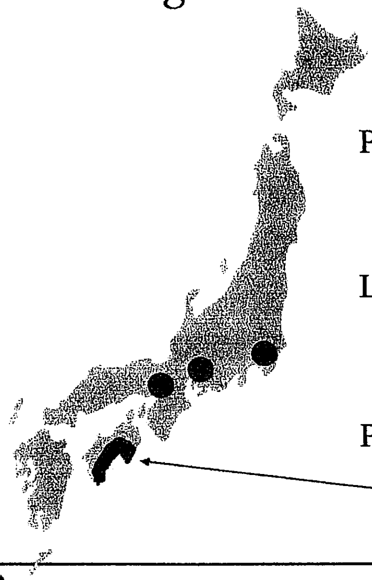
3

Three Features of Grass-Roots ITS

- Needs are from the fields
- Products are by local companies
- Maintenances are with local residences

4

Three Mega Areas and Many Micro Towns



Population rate

$$\frac{\text{Three Metropolitan Areas}}{\text{Whole Country}} = 0.49$$

Land rate

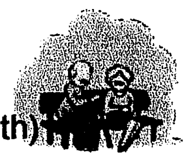
$$\frac{\text{Three Metropolitan Areas}}{\text{Whole Country}} = 0.10$$

Population desnsity(/Km^2)

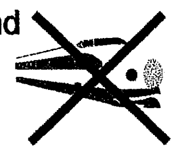
$$\frac{\text{Kochi Prefecture}}{\text{Average of Whole Nation}} = \frac{115}{336}$$

5

Local disparities in Kochi !



1. Aging society & Depopulation
   - Elderly rate 24.1% (ranked 3rd)
   - Population growth rate -0.15% (ranked 38th)
   - Death rate (10.3 /1000) (ranked 1st)
2. Undeveloped social infrastructure
   - Poor public transportation such as trains and buses
   - Road reform rate 41.6% (ranked 44th)



3. Severe natural disaster
   - 83.3% covered by mountains and forest area (ranked 1st)
   - Frequent typhoon and heavy rainfall

6

Then, what's happing in Kochi !

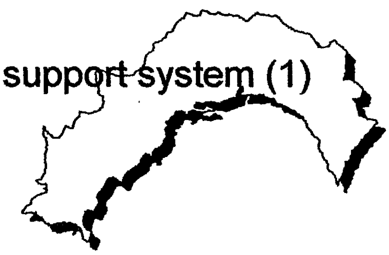
- High rate of aged persons' fatal accidents
- Uncomfortable road traffic circumstances
- Frequent unexpected road damage by disaster

Therefore, Grass Roots ITS !

7

Deployed Systems in Kochi

- Driving Support Systems for Narrow Road (44)
- Safety Support System at "Stops without No safety barriers" (7)
- Pedestrian Safety Support System (1)
- Simplified VMS (23)
- Tunnel pedestrian safety support system (1)

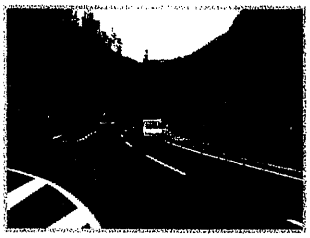


8

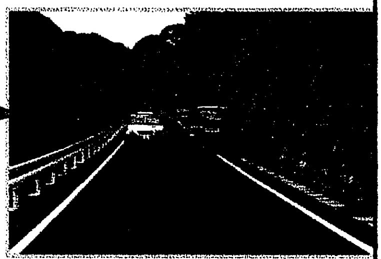
Construction of Quasi-2 lane road

Before

Conventional method



New method



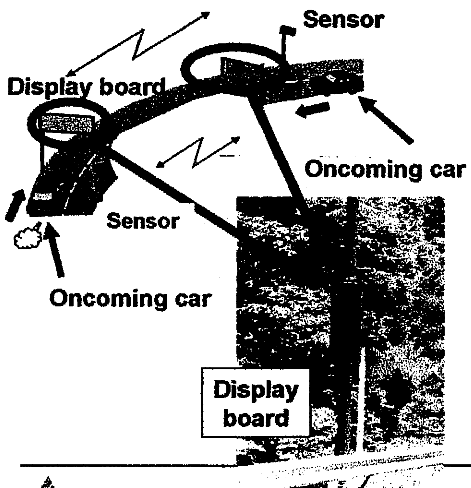
After

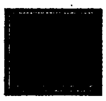
Benefits

- Cheaper construction price
- Shorter construction time

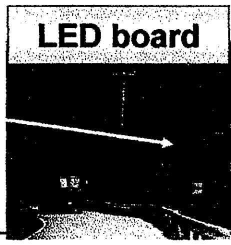
9

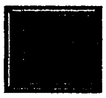
Driving Support System for Narrow Road





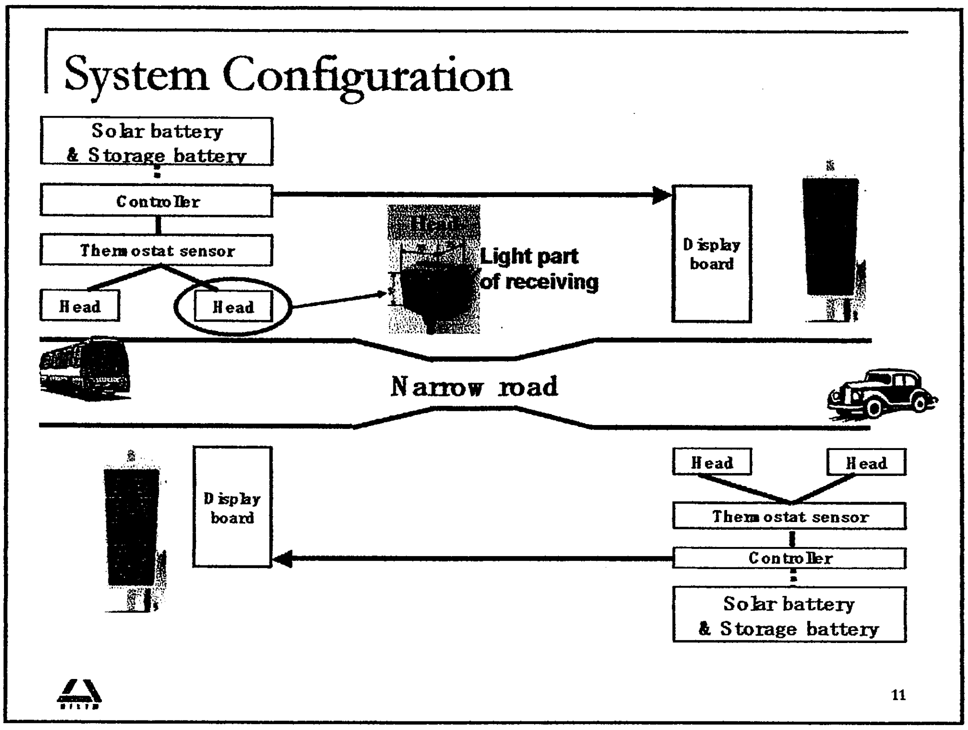
MOVIE 1

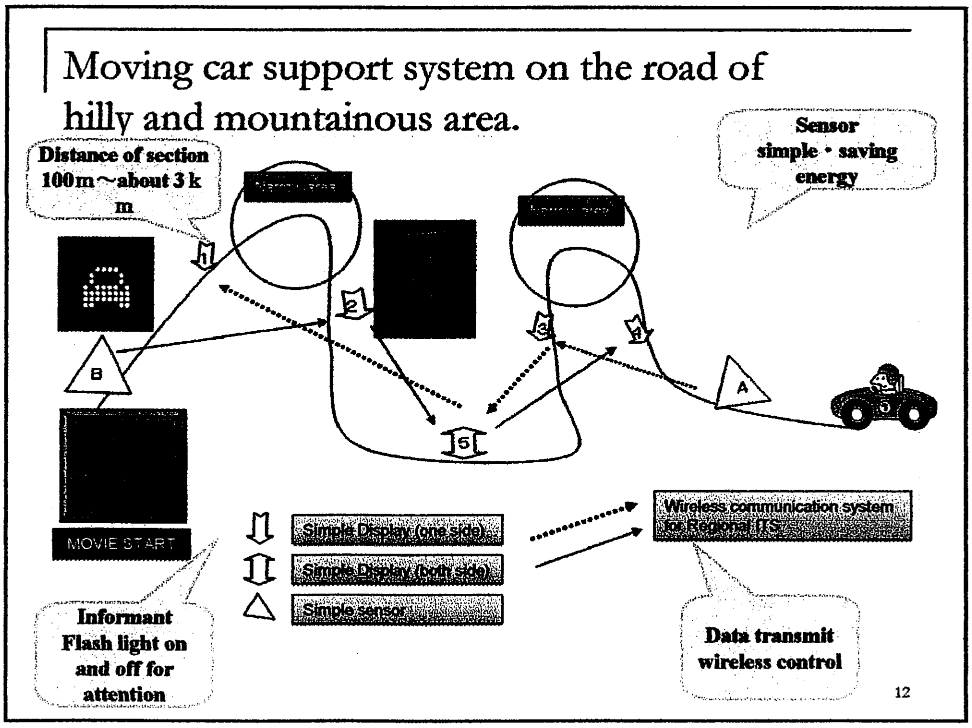




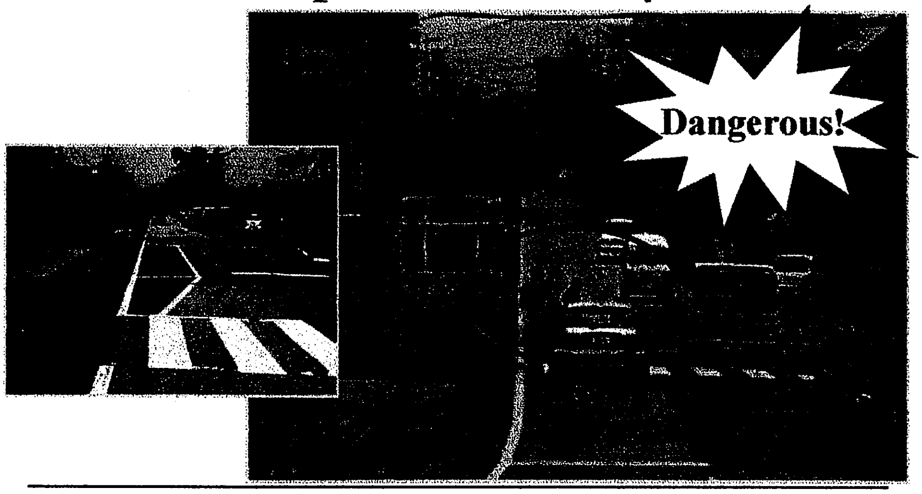
MOVIE 2

10


System Configuration
Solar battery & Storage battery
Controller
Thermostat sensor
Head
Head
Head
Light part of receiving
Display board
Narrow road
Display board
Head
Head
Thermostat sensor
Controller
Solar battery & Storage battery
11

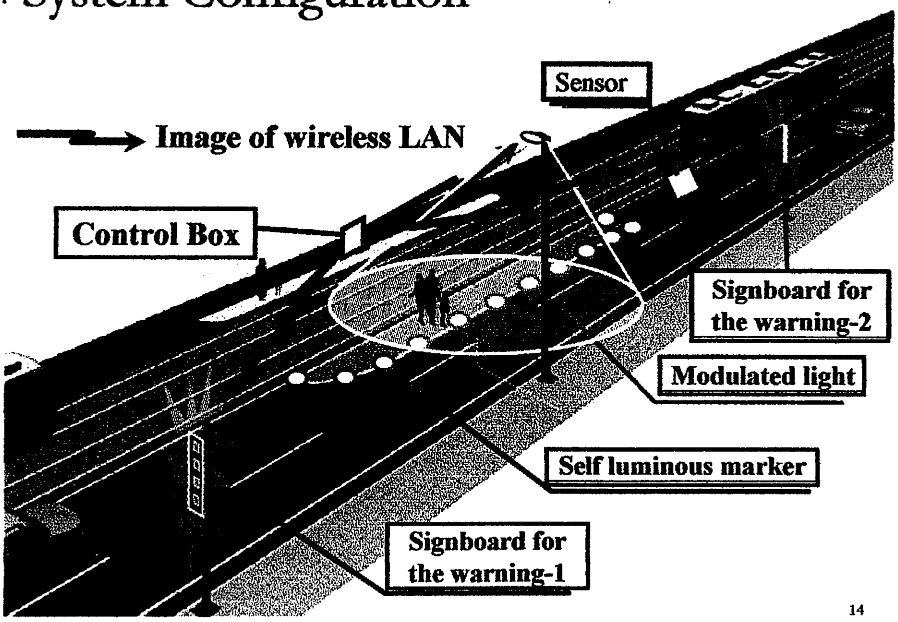

Moving car support system on the road of hilly and mountainous area.
Distance of section 100m～about 3 km
Sensor simple・saving energy
1
2
3
4
5
A
B
MOVIE START
Simple Display (one side)
Simple Display (both side)
Simple sensor
Wireless communication system for Regional ITS
Informant Flash light on and off for attention
Data transmit wireless control
12

Safety Support System at "Stops without Safety Barriers"



13

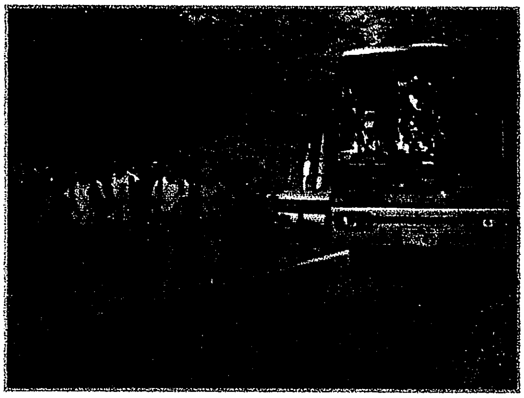
System Configuration



14

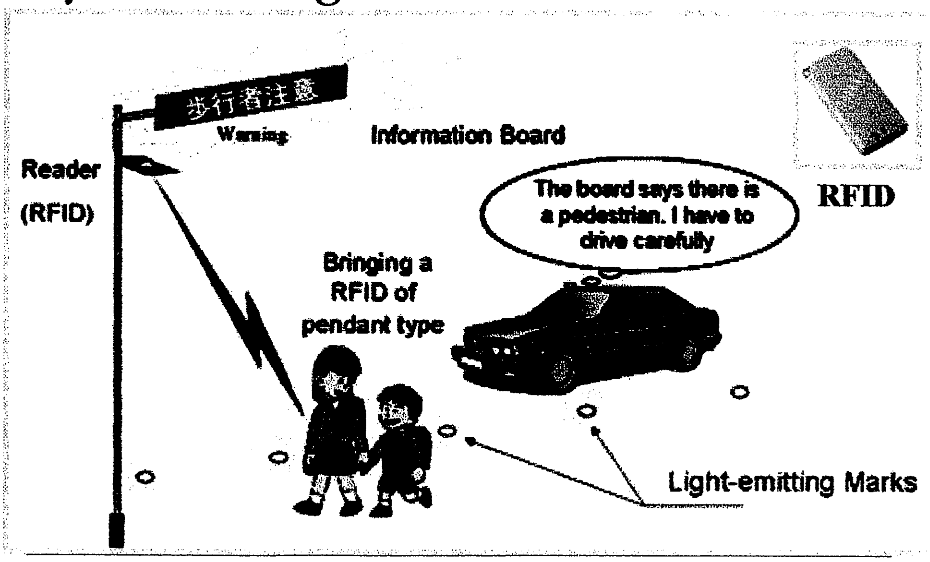
Pedestrians Safety Support System in the Rural Area

Development of the Pedestrian Information System to Improve the Safety in the Intermediate and Mountainous Area



15

System Configuration



16

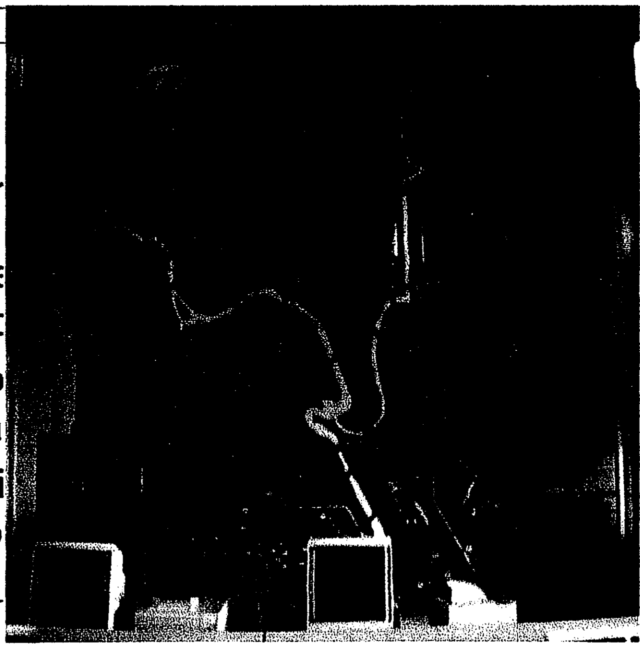
Characteristics of Grass-Roots ITS

Those systems introduced have the common characteristics as follows

- Second best method
  - ✓It is not the best method and the best method is hard to realize due to high cost and long term construction.
- Cheap cost
  - ✓Operating cost is very important
- Not Seeds but Needs oriented
  - ✓Needs need Seeds

17

4th I



ir are

- Fie the loc
- Fo ent by na
- Wi dose no

18

5th Lesson learned

19

6th Lesson learned

1960	1970	1980	1990

ERGS (1967)
CAGS (1973-1978)
Keiyo Road Travel Time system
RACS Committee (1984)
Pilot Test (1987-1990)
RACS Promotion Council (1989)
VICS Committee (3/1990)
Pilot Test at Expo (1990)
AMTICS Promotion Council (1987)

1991	1992	1993	1994	1995	1996	1997	1998	1999

VICS Promotion Council (10/1991)
WG/SWG Activities
International Activities (Visit Europe 8/1992)
Grand Seminar (5/1993)
Open Demonstration (11/1993)
VICS Preparation Office (9/1994)
VICS Center (7/1995)
WG/SWG Activities
VICS Demonstration (11/1995 at WC Yokohama)
VICS Commenced Service (4/1996)
Extend Service Areas
One Million Shipped (3/1999)

20

7th Lesson learned

Grass-Roots ITS may work effectively
not only in Kochi,
but also in many Asian countries

21

Summary

- ITS is classified into two types, the Nation wide ITS and the Local ITS
- Grass-Roots ITS is the local ITS proposed and developed by Kochi
- Several Grass-Roots ITS are already deployed and work effectively
- Grass-Roots ITS is sometimes not the best but the second best method, but useful for local cities like Kochi

22

Summary (continued)

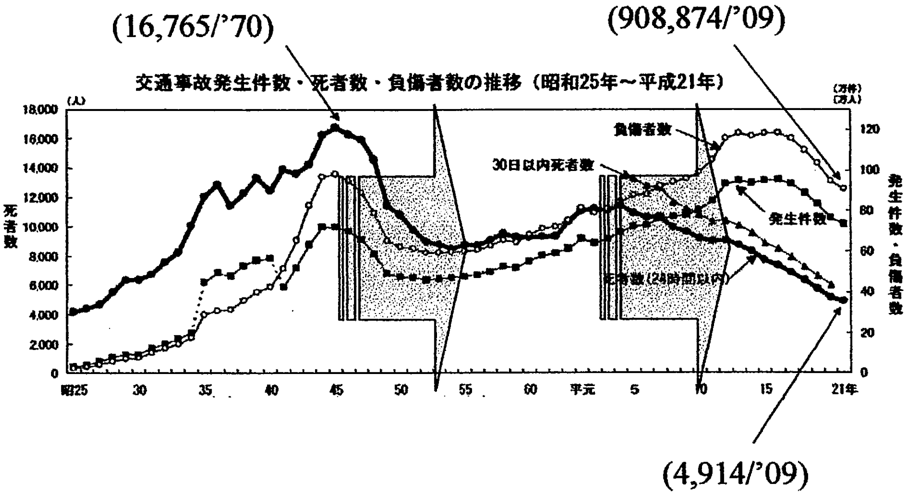
- Many Asian countries have traffic problems caused by rapid economic growth and delayed infrastructure deployment
- ITS is expected as the tool for improving those traffic problems
- Especially, Grass-Roots ITS is thought as the tool for traffic solution in Asian countries

23

Thank you for your attention

24

Traffic accidents in Japan



From the Home Page of the National Police Agency

25

STRATEGY ON ITS DEVELOPMENT IN INDONESIA

Pantja Dharma Oetojo[1], Taufik S Sumardi[2]

Research and Development Center for Roads and Bridges,
Ministry of Public Works Indonesia

2010

ABSTRACT

In generally road traffic is growing rapidly in Indonesia, weather in urban or interurban road. In major city such as Jakarta, in 2008 it has 6.3 million vehicles with a growth of 11% per annum. This is the same as 700 private vehicles addition every day which require 3 km more of road length per day, while the road growth is currently only 0.1% (Sinaga, Elly 2008). Such conditions will lead to decline the average speed of vehicles that would cause high operating costs of vehicles, value of time loss, and also psychic losses.

Engineers have many ways to reduce the impact of traffic congestion, one of which is to make components of transportation can communicate with each other. Technologies that integrate the transportation component is ITS. ITS technology has evolved over the last 2 decades, and Indonesia began to implement ITS during 1990's with the application of ATCS (Area Traffic Control System) in Bandung.

This paper will cover state of the art of ITS in Indonesia and set forth the ideas about Indonesian strategies for developing ITS. It may contains prioritization of ITS program, role sharing among parties as well as a possible form of cooperation between stakeholders in running ITS

Keyword: Indonesian ITS, Technology, Road Transport

1. Introduction

1.1 Present Status in Indonesia

In 2008, Jakarta has 6.3 million vehicles with a growth of 11% per annum. This is the same as 700 private vehicles addition every day which require 3 km more of road length per day, while the road growth is currently only 0.1% (Sinaga, Elly 2008). Such conditions will lead to decline the average speed of vehicles that would cause high operating costs of vehicles, value of time loss, and also psychic losses.

Total number of loss due to traffic congestion in major cities in Indonesia is estimated at 25.2 trillion rupiah per year. (Widiantono)

Today Indonesian are confronted by a number of changes in social conditions, such as :

1. Over 23,000 traffic accidents per year
2. Traffic congestion
3. Overloading
4. Bad road conditions
5. High cost commercial vehicle operations
6. Growing concern about environment
7. Rapid spread of mobile telephones and broadband Internet

Engineers have many ways to reduce the impact of traffic congestion, one of which is to make components of transportation can communicate with each other. Technologies that integrate the transportation component is ITS

1.2 Basic Philosophy of ITS

Intelligent Transport Systems is an umbrella term for a number of electronic, information processing, communication, and control technologies that may be combined and applied to the transport domain. There is no clear definition of what is ITS and what isn't. However, intuitively any ITS must show at least some form of information processing, computing, or vehicular or road network control to be considered intelligent. ITS may refer to a single technology, an integrated system, or a network of systems. As noted by Mitretek (1999), ITS is not a monolithic system, nor the integration of systems.

Rather "ITS is a multi-faceted approach for addressing transportation needs"

ERTICO (1997, cited in Rumar, et al., 1999) reported a vision for the future of ITS in which the following predictions were made:

- ITS will significantly contribute to a 50% in road fatalities.
- 25% reductions in travel times due to ITS.
- 50% reductions in city centers due to traffic management systems
- Automatic Crash Notification will result in a 15% reduction in fatalities.
- 40 hours per road user saved due to automated tolling systems.
- 50% delay reductions due to public transport priority systems.
- 25% reductions in commercial vehicle operations cost due to fleet management systems.

1.3 State of The Art of ITS in Indonesia

- In 1997, in Bandung, West Java, Indonesia has begun a new technology breakthrough by installing ATCS (Area Traffic Control Systems) for 60 intersections, cooperated with AWA (Australia). (www.beritajakarta.com)
- 2005, PT. Jasa Marga implemented smart card for Padaleunyi toll roads
- 2006, RDCRB built a prototype of smart card paying systems for toll Gate (touch and go systems)
- 2006, RDCRB developed ATC (Automatic Traffic Counter) and installed 4 units on the links of the national highway in West Java
- 2006, RDCRB developed "Sisjatan" (Roads and Bridges Information Systems) which contains any information about pavement, bridges conditions, traffic volume, etc on national highway in Indonesia.
- 2007, in Solo, Central Java, Indonesia, installed ATCS for 15 intersections (www.tempointeraktif.com)
- 2008, RDCRB developed "Wireless portable traffic signal" for road works
- 2009, e-toll (electronic payment for toll roads) implemented on Jakarta's intercity toll roads (www.jasamarga.com)

2. Strategy on ITS Development in Indonesia

2.1 Ultimate Goal

Safer, smoother, continuous, integrated and environmentally friendly Indonesian Transportation System

2.2 Targets

a. More effective and efficient use of infrastructure;
b. Enhance the flow of traffic;
c. Better public transport services;
d. Improve safety;
e. Cheaper freight costs; and
f. Reducing the impact on the environment.

2.3 Role Sharing

Role of private-sector operators

Capitalization of ITS on vehicle technology assets and support systems for pedestrian navigation

Role of RDCRB

Research and development on ITS technology

Provide actual data on road traffic

Publish the cost benefits associated with a policy based on traffic estimates.

Role of Ministry of Transportation

Issues regulations on traffic management system

Role of Automotive Manufacturer

Provide "on vehicles instrument" to support ITS technology

Role of Ministry of Public Work

Adjustment of the smart cities concept with local needs

2.4 Prioritization of ITS in RDCRB

Medium term of Indonesian ITS development are:

a. Optimization of Automatic Traffic Counter and axle load detector that have been installed in sections of national roads, and integrate them.
b. Updating *Sisjatan* as part of Traffic Monitoring Systems
c. Establish TMC (Traffic Monitoring Center) for public interest.

3. Discussion

RDCRB is an Institute under the government ministries responsible for road infrastructure. Together with the Directorate General of Bina Marga doing activities such regulate, coached, develop, and supervise of road infrastructure, which covers:

1. The inventory level of service roads and problems.
2. Formulation of plans and its programs implementation as well as determining the level of service for desired roads.
3. Planning, development, and optimizing the utilization of road space.
4. Improving the link roads geometric and or road intersections.
5. Test the feasibility of roads function in accordance with safety standards and traffic safety.
6. Development of information and communication systems of road infrastructure.

Research and Development Center of Roads and Bridges, in accordance with its duties and functions, has conducted several activities related to information and communication about the road infrastructure such as:

1. Develop the road information system (Sisjatan), which explains about the conditions inside the road infrastructure, road paving, such as data, geotechnical, bridges, and traffic.
2. Develop equipment to measure the elements of roads and bridges condition, and traffic.

Such activities above, prepared as data and road infrastructure conditions for input data of ITS

Bibliography

Bayly, Megan; Fildes, Brian; Regan, Michael; Young, Kristie, Review of crash effectiveness of Intelligent Transport Systems, 2007

http://www.tempointeractive.com/hg/nasional/2010/01/19/brk,20100119-220000,uk.html, 19 January, 2010

ITS Strategy Committee, Report of the ITS Strategy Committee ITS Japan Summary version, July 2003

Road Map of Indonesian ITS, Research and Development Center for Roads and Bridges,
Ministry of Public Works Indonesia, 2009

Sinaga, Elly Adriani, Environmentally Sustainable Transport in Indonesia, Directorate General of Land Transportation, Ministry of Transportation, March 2008

The Cluster Competitiveness Group, Intelligent Traffic /Transport systems, Turin Euro-Latin American Forum for the promotion of knowledge-based regional development, 2007

Widiantono, Doni J, Kebijakan dan Strategi Penanganan Kemacetan Lalulintas di Perkotaan, Ditjen Penataan Ruang

Ministry of Public Work of Indonesia
Research and Development Center for Roads and Bridges
Traffic Engineering and Environment Experimental Station

Joint Workshop on Road and Bridge
RDCRB, NILIM Japan, and PWRI Japan
Bandung, March 2, 2010

Presented By : Pantja Dharma Oetojo, M.Eng. Sc

STRATEGY ON ITS DEVELOPMENT IN INDONESIA

INTRODUCTION

- In 2008, Jakarta has 6.3 million vehicles with a growth of 11% per annum
- 700 private vehicles addition every day which require 3 km more of road length per day, while the road growth is currently only 0.1%
- Total number of loss due to traffic congestion in major cities in Indonesia is estimated at 25.2 trillion rupiah per year

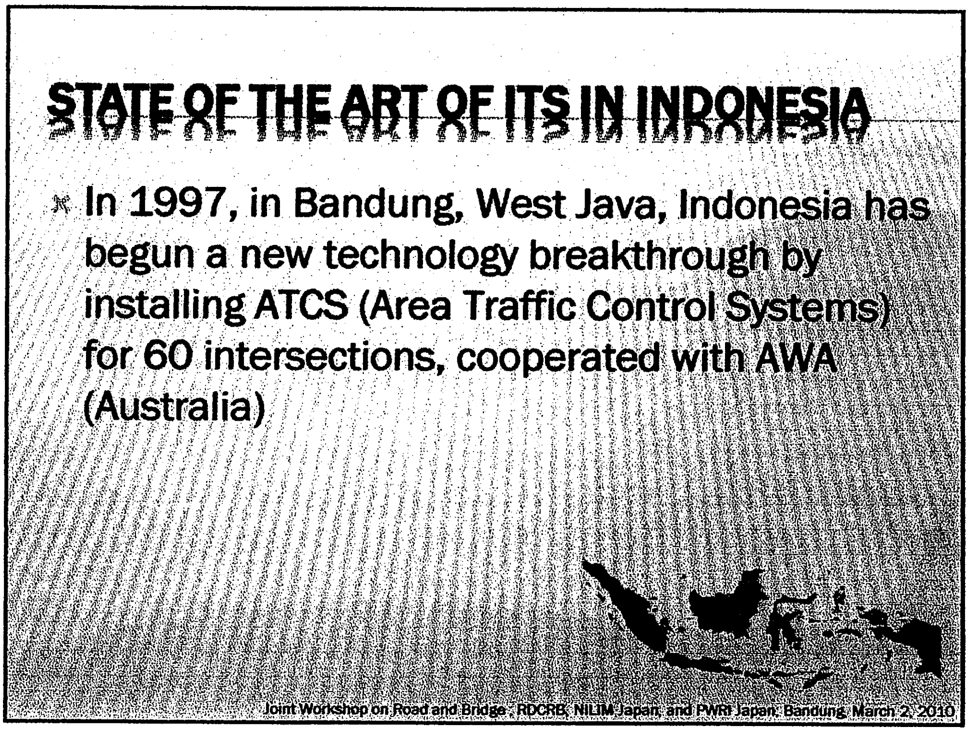
Joint Workshop on Road and Bridge : RDCRB, NILIM Japan, and PWRI Japan, Bandung, March 2, 2010

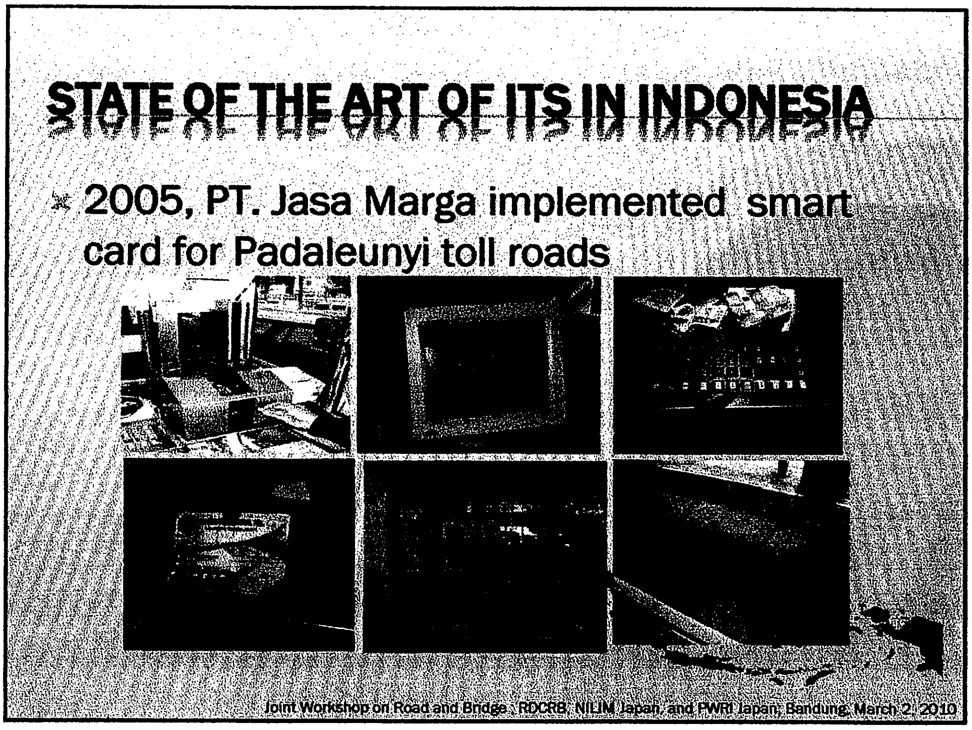
INTRODUCTION

- Over 23,000 road traffic accidents per year
- Traffic congestion
- Overloading
- Bad road conditions
- High cost commercial vehicle operations
- Growing concern about environment
- Rapid spread of mobile telephones and broadband Internet

BASIC PHILOSOPHY OF ITS

- Intelligent Transport Systems is an umbrella term for a number of electronic, information processing, communication, and control technologies that may be combined and applied to the transport domain
- ITS must show at least some form of information processing, computing, or vehicular or road network control to be considered intelligent
- ITS is not a monolithic system, nor the integration of systems


STATE OF THE ART OF ITS IN INDONESIA
In 1997, in Bandung, West Java, Indonesia has begun a new technology breakthrough by installing ATCS (Area Traffic Control Systems) for 60 intersections, cooperated with AWA (Australia)
Joint Workshop on Road and Bridge : RDCRB, NILIM Japan, and PWRI Japan; Bandung, March 2, 2010

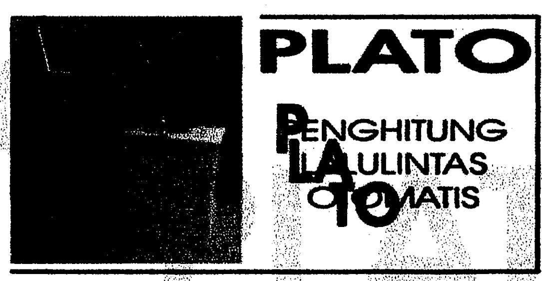

STATE OF THE ART OF ITS IN INDONESIA
2005, PT. Jasa Marga implemented smart card for Padaleunyi toll roads
Joint Workshop on Road and Bridge : RDCRB, NILIM Japan, and PWRI Japan; Bandung, March 2, 2010

STATE OF THE ART OF ITS IN INDONESIA

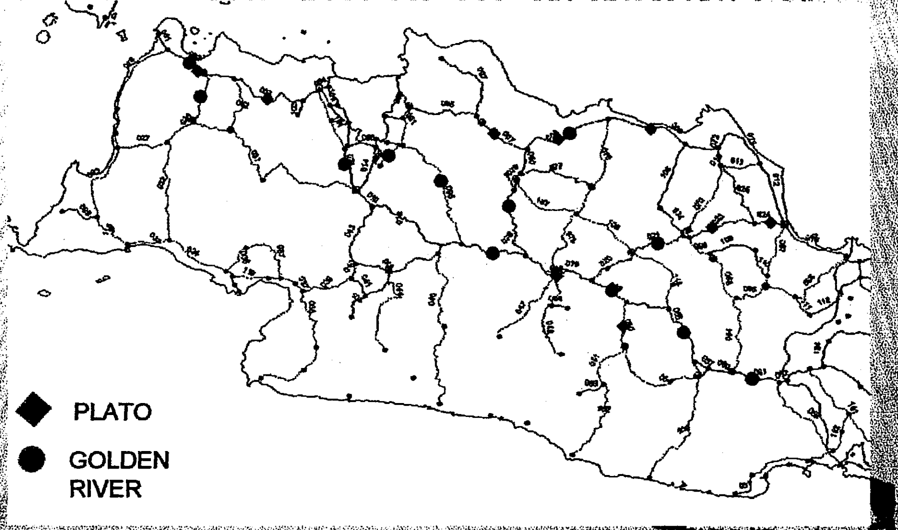
- 2006, RDCRB built a prototype of smart card paying systems for toll Gate (touch and go systems)

STATE OF THE ART OF ITS IN INDONESIA

- 2006, RDCRB developed ATC (Automatic Traffic Counter) and installed 4 units on the links of the national highway in West Java



STATE OF THE ART OF ITS IN INDONESIA

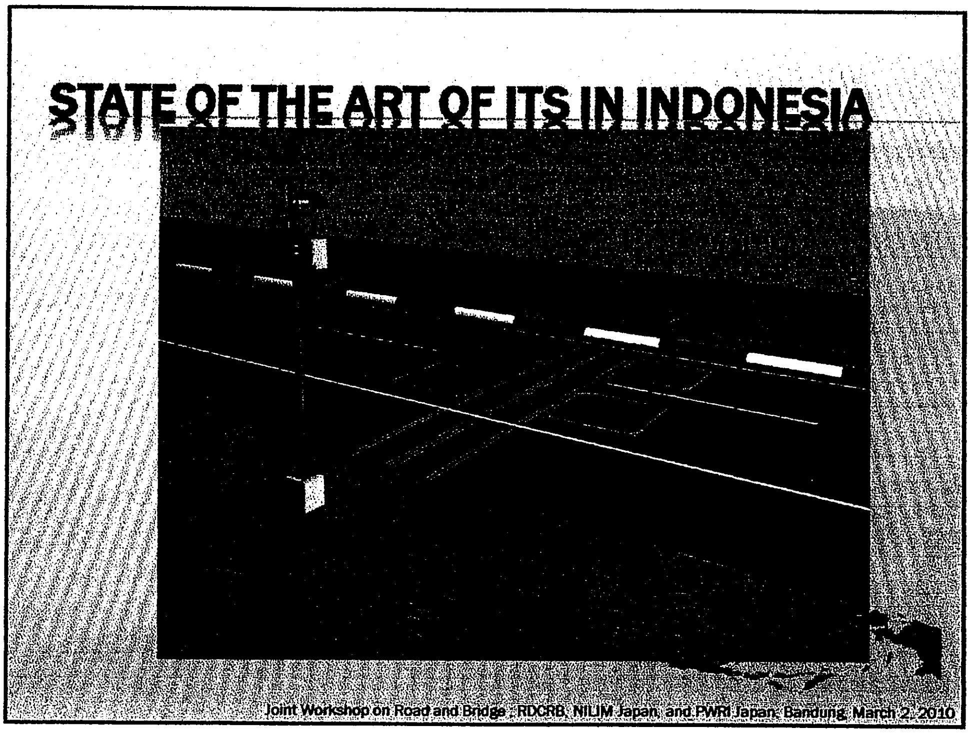


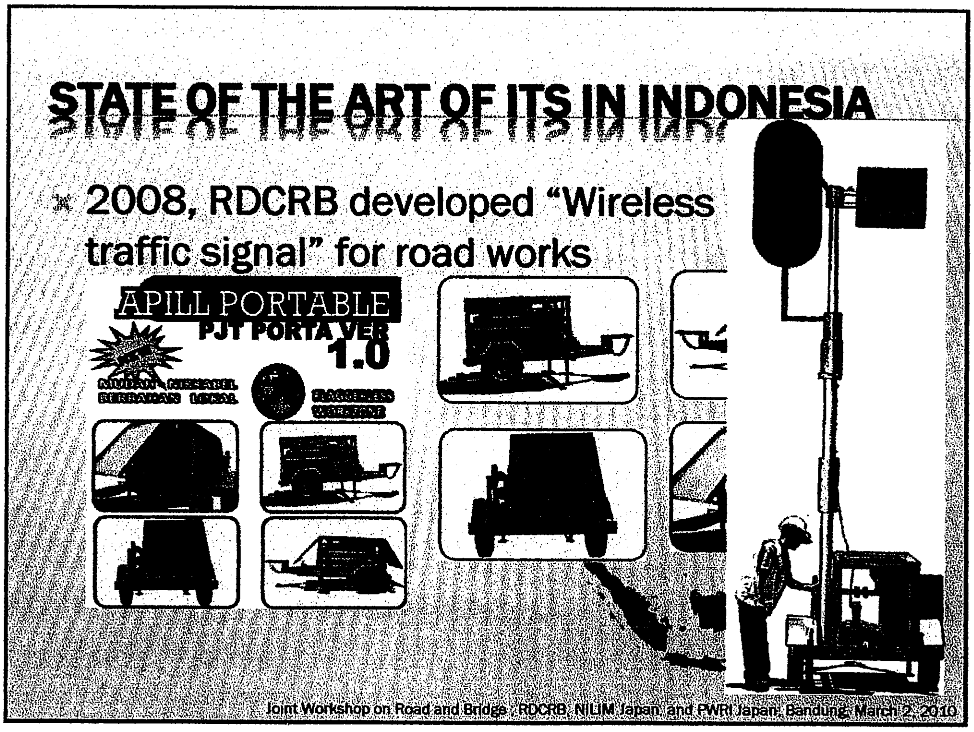
Joint Workshop on Road and Bridge : RDCRB, NILIM Japan, and PWRI Japan. Bandung, March 2, 2010

STATE OF THE ART OF ITS IN INDONESIA

- 2006, RDCRB developed "Sisjatan" (Roads and Bridges Information Systems) which contains any information about pavement, bridges conditions, traffic volume, etc on national highway in Indonesia.

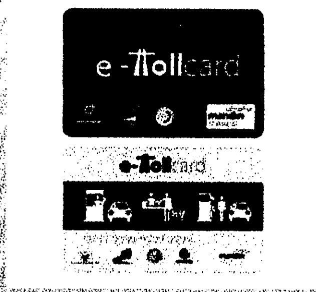
Joint Workshop on Road and Bridge : RDCRB, NILIM Japan, and PWRI Japan. Bandung, March 2, 2010


STATE OF THE ART OF ITS IN INDONESIA
Joint Workshop on Road and Bridge : RDCRB, NILIM Japan, and PWRI Japan, Bandung, March 2, 2010


STATE OF THE ART OF ITS IN INDONESIA
2008, RDCRB developed "Wireless traffic signal" for road works
APILL PORTABLE
PJT PORTA VER 1.0
Joint Workshop on Road and Bridge : RDCRB, NILIM Japan, and PWRI Japan, Bandung, March 2, 2010

STATE OF THE ART OF ITS IN INDONESIA

- 2009, e-toll (electronic payment for toll roads) implemented on Jakarta's intercity toll roads (www.jasamarga.com)



Joint Workshop on Road and Bridge : RDCRB, NILIM Japan, and PWRI Japan, Bandung, March 2, 2010

STRATEGY ON ITS DEVELOPMENT IN INDONESIA

Ultimate Goal

Safer, smoother, continuous, integrated and environmentally friendly Indonesian Transportation System

Joint Workshop on Road and Bridge : RDCRB, NILIM Japan, and PWRI Japan, Bandung, March 2, 2010

STRATEGY ON ITS DEVELOPMENT IN INDONESIA

Targets

a. More effective and efficient use of infrastructure;
b. Enhance the flow of traffic;
c. Better public transport services;
d. Improve safety;
e. Cheaper freight costs; and
f. Reducing the impact on the environment.

Joint Workshop on Road and Bridge ; RDCRB, NILIM Japan, and PWRI Japan; Bandung, March 2, 2010

STRATEGY ON ITS DEVELOPMENT IN INDONESIA

Prioritization of ITS in RDCRB

Medium term of Indonesian ITS development are:

a. Optimization of Automatic Traffic Counter and axle load detector that have been installed in sections of national roads, and integrate them.

b. Updating Sisjatan as part of Traffic Monitoring Systems

c. Establish TMC (Traffic Monitoring Center) for public interest.

Joint Workshop on Road and Bridge ; RDCRB, NILIM Japan, and PWRI Japan; Bandung, March 2, 2010

DISCUSSION

Research and Development Center of Roads and Bridges, in accordance with its duties and functions, has conducted several activities related to information and communication about the road infrastructure such as:

1. Develop the road information system (Sisjatan), which explains about the conditions inside the road infrastructure, road paving, such as data, geotechnical, bridges, and traffic.
2. Develop equipment to measure the elements of roads and bridges condition, and traffic.

Such activities above, prepared as data and road infrastructure conditions for input data of ITS

Joint Workshop on Road and Bridge : RDCRB, NILIM Japan, and PWRI Japan, Bandung, March 2, 2010

TERIMA KASIH

NILIM PWRI

ありがとうございました

Joint Workshop on Road and Bridge : RDCRB, NILIM Japan, and PWRI Japan, Bandung, March 2, 2010

THE POLICY AND STRATEGY OF ELECTRONIC TOLL COLLECTION SYSTEM APPLICATION IN INDONESIA

Rudy Hermawan Karsaman
Lecture at Bandung Institute of Technology
And Board Member of Indonesian Toll Road Authority

Abstract

In order to smoothly support traffic flows in toll road safely, comfortable and efficient, one of its aspect related to toll collection system adopted. Toll Collection System is activities chain related with toll transaction service to the user, transaction control, administration of revenue collection and other supporting procces. In principle, toll collection system must be rely on quick, precise, secure and comfortable service for the user, ensuring guarantee for the user and operator that transaction has been done in accordance with tarif applied, compatible and integrated with existing or future system and considering technology development and human resources management.

To increase toll road service in Indonesia, the toll collection system or payment transaction aspect at toll gates need to be accelerated. One of the choice to acceleration is to apply toll collection electronically or Electronic Toll Collection (ETC) System.

The advantage of this system adoption are :

1. *Accelarate transaction time and increase service capacity*
2. *Decrease cash moneyneed to be handled and increase security*
3. *Increase transaction accuracy level and avoid human errors*
4. *Increase the efficency of human resource number for toll gates servicing*

In ETC adoption implementation, some of the operators made joint operation in procurement process and operation by pointing one of the Bank as transaction and card manager to ensure the system interoperability in every roads managed by those operatori.

In accordance with the system implementation schedule throught out all toll roads in Indonesia, as first the step and transistion period, this system has been adopted at Jabodetabek area.

This paper discuss the result of implementation so far such as trend of usage, time schedule instalation etc, including recommendation to develop the system further in the future.

Keywords : Toll road, ETC.

I. Introduction

Toll Road as part of National Road has to be maintained operationally to function optimum in accomodating traffic flows secure, efficient and comfortable. One of its aspect related to toll collection system adopted.

Toll Collection System is activities chain related with toll transaction service to the user, transaction control, administration of revenue collection and other supporting procces. In principle, toll collection system must be rely on quick, precise, secure and comfortable service for the user, ensuring guarantee for the user and operator that transaction has been done in accordance with tarif applied, compatible and integrated with existing or future system and considering technology development and human resources management.

To increase toll road service in Indonesia, the toll collection system or payment transaction aspect at toll gates need to be accelerated. One of the choice to acceleration is to apply toll collection electronically or Electronic Toll Collection (ETC) System.

The advantage of this system adoption are :
1. Accelarate transaction time and increase service capacity
2. Decrease cash moneyneed to be handled and increase security
3. Increase transaction accuracy level and avoid human errors
4. Increase the efficency of human resource number for toll gates servicing

In ETC adoption implementation, some of the operators made joint operation in procurement process and operation by pointing one of the Bank as transaction and card manager to ensure the system interoperability in every roads managed by those operator.

II. System Architecture

System is operated in fully or semi automatic system and designed in modular to ease migration from manual system to fully automatic system. In general this system consists of :

A. Head Quater Central System
B. Communication Network System
C. Toll Plaza Computer System
D. Toll Gate Automatic System
E. Electronic Payment Transaction System.
F. Prepaid Card Payment System.
G. Payment Settlement System

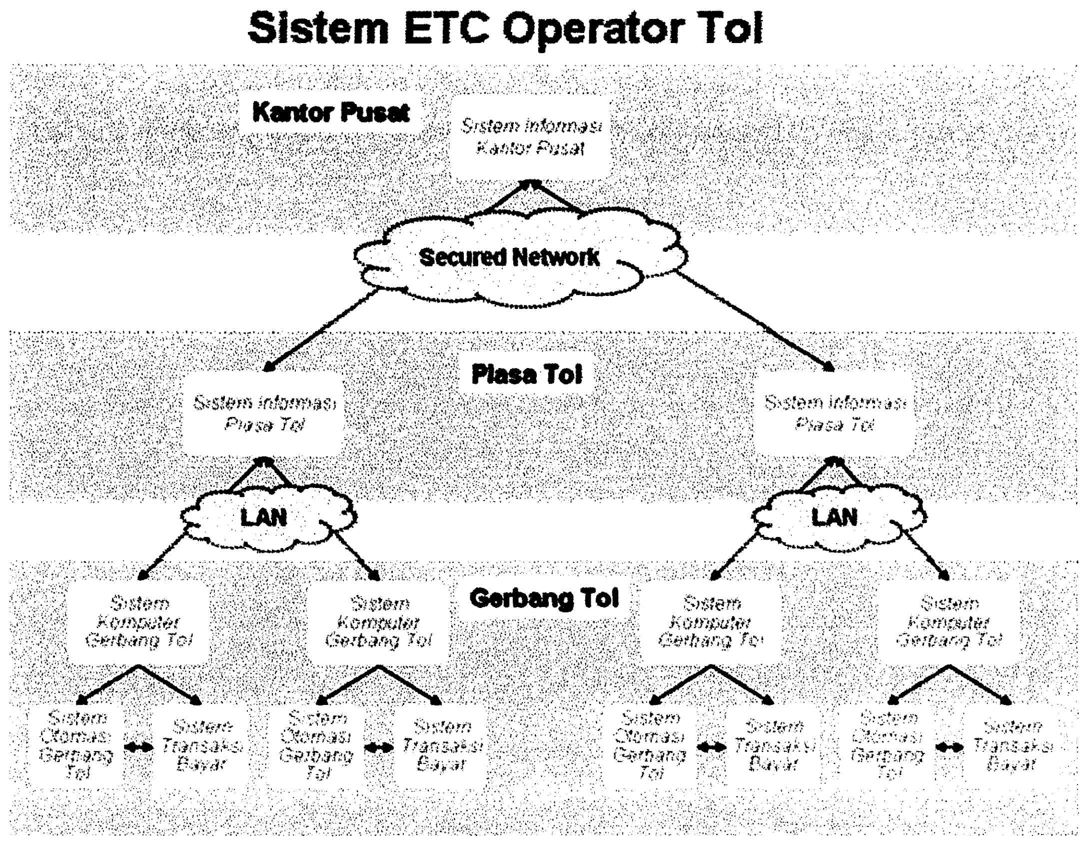


Figure 1. Architecture System

A. *Head Quater Central System*

Information and data analysis system in central office that collect all transaction data for data base, reporting and administering all data. This system consists of *server, peripheral, workstation, router, switch, database* and application software for monitoring and reconsiliation both for internal and external requirement.

B. Communication Network System

Communication Network System that connect Head Quarter and Toll Plaza computer system wich make data communication on-line real-time or on-line batch.

C. Sistem Komputer Plasa Tol

Information and data analysis system at Toll Plaza that can collect transaction data from all toll gates in that plaza for storing, reporting and administering. This system is connected with automatic system and payment transaction system through Local Area Network (LAN).

D. Toll Gate Automatisation System

This system control all transaction process from vehicle identification and classification, payment transaction and problem handling (if any).

E. Electronic Payment Transaction System

This system execute payment process by deducting money value stored in the card and transfer it to operator account.

F. Electronic Card Reloading System

Electronic Card reloading system is issued in accordance with Indonesian Central Bank (BI) regulation. System should be completed by reload-station and easy inter bank transfer and other facilities/features (e.g ATM, EDC or SMS banking).

G. Payment *Settlement System*

Settlement system is required in reconsiliation process amongs toll operator and other user (merchant). This system is developed based on agreement between all parties involved.

The Bank/Clearing house for settlement system is recommended to have characteristic as follows :

- Have large network in Indonesia
- Have corporate and custumor service
- Have electronic banking system.
- Proven as issuer of other electronic card (credit/debit card).

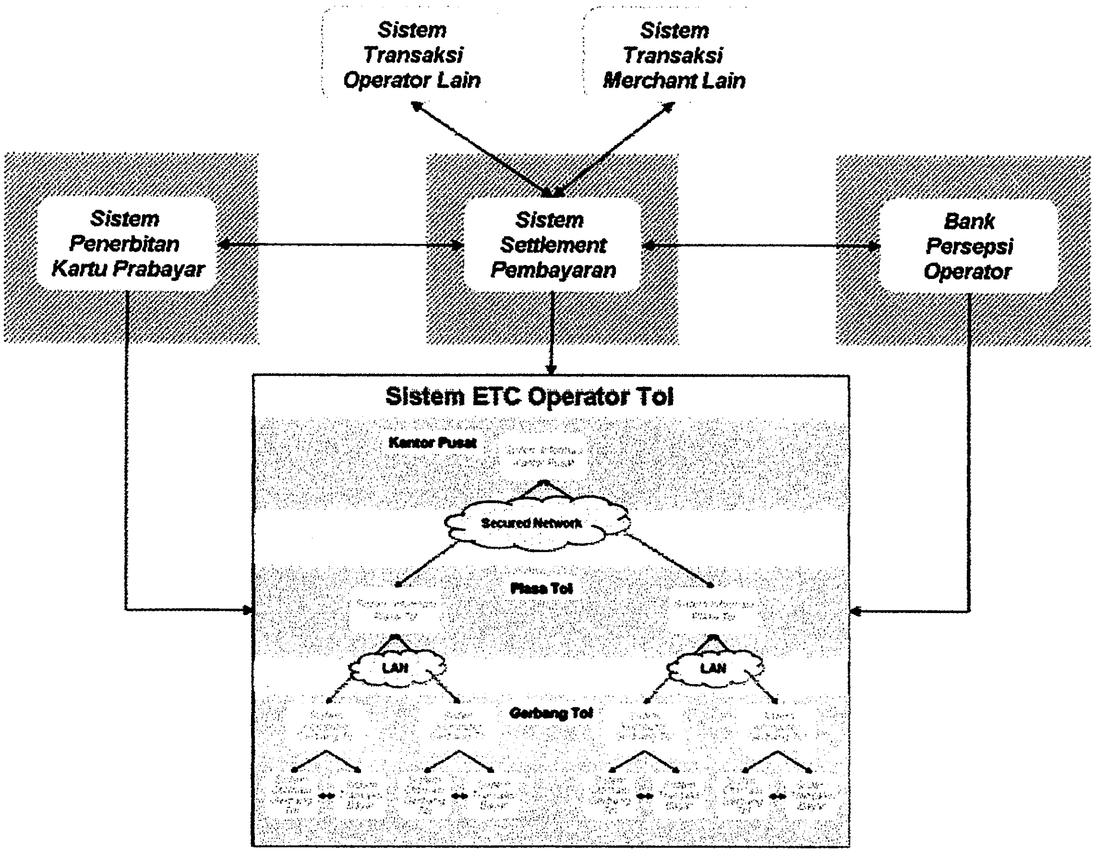


Figure 2 Transaction and Settlement System

III. Operational Arrangement

3.1. Transaction

Transaction coud be done by tap and go and/or free flow (in the future). In certain condition, toll gate could be operated both manual system and electronically.

3.2. Transaction

1. Vehicle enter/exit toll gate and identified its type.
2. *Read card for authentification*
3. If OK, system write related information (gate code, transaction time, vehicle type, tariff, "money" value left etc) and vehicle go through.
4. If not OK, (less "money" value left, card in the black list etc), system activating camera to get vehicle picture, store information on data base

and sending signal or activate alarm for officer to act). Further process can be done manually (vehicle is processed in other place so not to disturb other vehicle or service system). If neccessary, due to high level of system violation, driver could be charged with penalty.

3.3. Card Usage

Card could be used in all toll roads (inter operability) and valid for either close or open systems. Card is specially published and transaction payment is done by deducting money value stored in the card or through periodic billing. For prepaid system, money value could be reload.

IV. Bussiness Management and Payment System

4.1. Basis of Bussiness and Payment

In toll transaction, there is no additional payment, out of toll tariff. Policy of system procurement is given to every operator as long as its meets technical standard and regulation.

4.2. Bussiness Management

Management of ETC is handled by operator consortium with other party that could meet all regulation, including banking and payment system. In this case, this handled by Mandiri Bank. Billing and payment mechanism amongst Mandiri Bank and Operators is based on each toll road transaction through verification and validation proccesses agreed before hand.

4.3. Related Parties and Their Role

The parties involved in this system can be seen in Figure 3. However, their role could be done by same institution :

- *Service Provider / Merchant*
- *Card Holder*
- *Purse Provider / Clearing House*
- *Card Issuers, Load Agents and* Acquirers

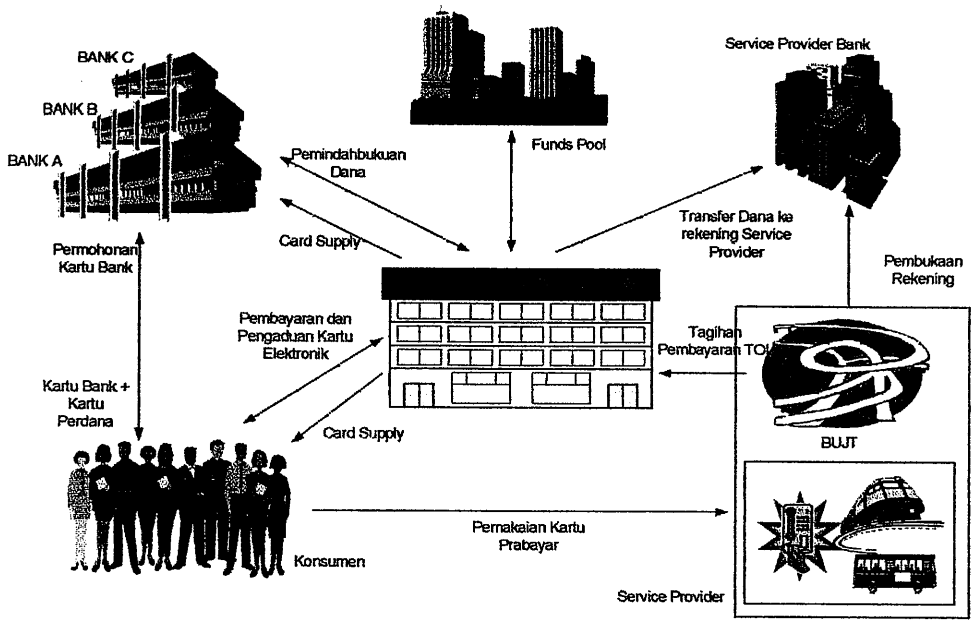


Figure 3 Parties Involved

4.4. Bussiness Process

Based on transaction notes and data, service provider (toll road operator) sending invoice to card issuer and after validated the money is transfered to operator bank. This process is done everyday (or even several time a day) in certain time agreed by all parties.

V. Implementaion Schedule and Transition Period

The application of ETC is scheduled in 2009 – 2010 gradually. This implementation is considering traffic flow, financial and toll gates condition. For future condition, the card could be used for other purpose as well (many merchant) and its stage is illustrated in Figure 4.

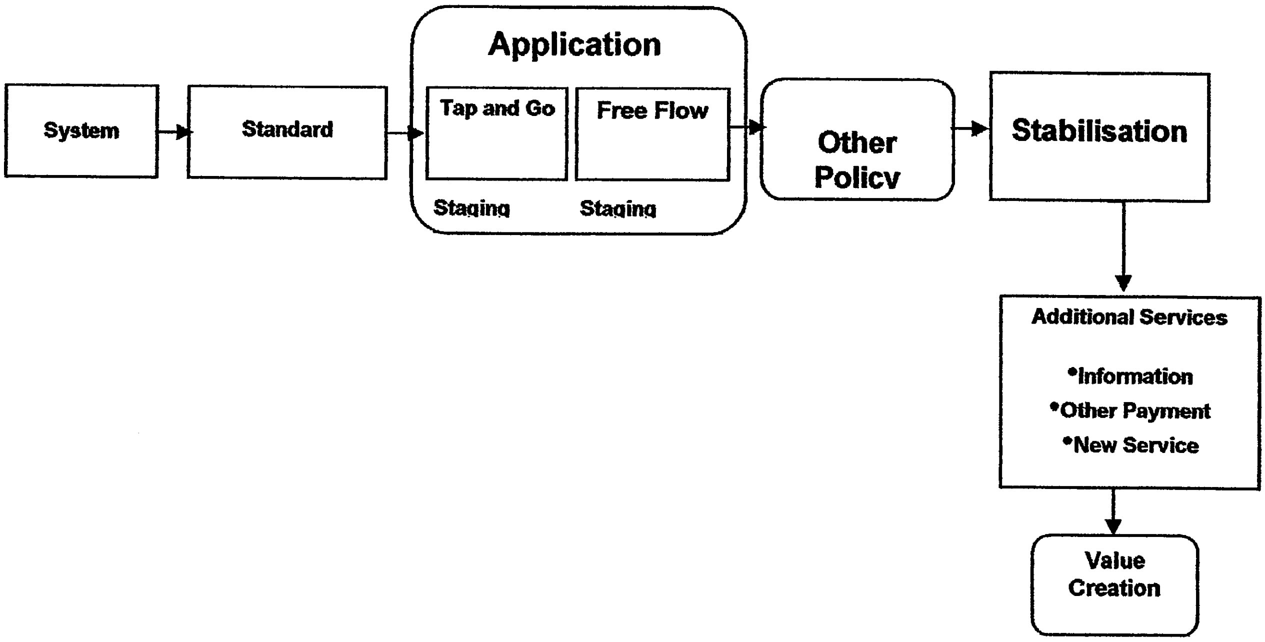


Figure 4 Implementation and Transition Period

In the mean time, the card sold continuosly increase as well as transaction volume. However, there are some issues need to be resolved, i.e transaction failure in some toll gates, transaction data reconsiliation and double debit transaction. In this case, the toll operator and card management continuosly improve the system for better service. To get full advantage of this system, it should be installed in all toll roads as well as give some incentives to the toll road user to use this system.

VI. Acknowledgement

Part of this paper is based on work of ETC implementation team. Therefore I thanks to all member of the team and all toll operators involved. However, any missed interpretation of the content of this paper is on the author

References :

1. Guide line of Electronic Toll Collection System (draft, 2007)
2. Minister of Public Work Decree (2005) : Minimum Service Standar of Toll Road
3. Report of Jasa Marga
4. Report of Mandiri Bank

THE WORKSHOP COMMITEE

D E P A R T E M E N P E K E R J A A N U M U M
BADAN PENELITIAN DAN PENGEMBANGAN
PUSAT PENELITIAN DAN PENGEMBANGAN JALAN DAN JEMBATAN
JL.A.H. Nasution No.264 Kotak Pos 2 Ujung Berung Tlp.(022) 7802251 Fax : (022)7802726 Bdg. 40294 e-mail pusjal@melsa.net..id

SURAT KEPUTUSAN
KEPALA PUSAT PENELITIAN DAN PENGEMBANGAN
JALAN DAN JEMBATAN
NOMOR : 16 /KPTS/LJ/2010

TENTANG
PENUNJUKAN PANITIA PELAKSANA, PENYAJI
MODERATOR, PADA KEGIATAN JOINT WORKSHOP
ANTARA RDCRB DAN NILIM

PUSLITBANG JALAN DAN JEMBATAN

KEPALA PUSAT PENELITIAN DAN PENGEMBANGAN JALAN DAN JEMBATAN

MENIMBANG :
a. Bahwa dalam rangka Meningkatkan Optimalisasi Hubungan Antara RDCRB dan NILIM serta untuk melaksanakan pertukaran Informasi yang akan diselenggaraan dalam bentuk Joint Workshop dengan Tema "**Roads dan Bridges Workshop**";
b. bahwa nama-nama yang tercantum dalam kolom 4 (empat) lampiran Surat Perintah ini, dipandang cakap dan mampu untuk melaksanakan tugas sebagai Panitia Pelaksana, Pembicara, Moderator, pada kegiatan Joint Workshop;
c. bahwa untuk maksud tersebut di atas perlu ditetapkan dengan Surat Keputusan.

MENGINGAT
1. Peraturan Menteri Pekerjaan Umum Nomor : 286/PRT/M/2005 tentang Organisasi dan Tata Kerja Departemen Pekerjaan Umum;
2. Keputusan Menteri Pekerjaan Umum Nomor : 324/KPTS/M/2007 tanggal 1 Agustus 2008 tentang Pembebasan dan Pengangkatan Pejabat Pimpinan Eselon II.a di lingkungan Departemen PU;

MEMPERHATIKAN
Memorandum Concerning the Cooperation Activities Between Research and Development Centre for Roads and Bridges, Research and Development Agency, Ministry of Public Works, Indonesia and National Institute of Land and Infrastructure Management, Ministry of Land, Infrastructure, Transport and Tourism, Japan tanggal 11 November 2009.

M E M U T U S K A N

Menetapkan : **KEPUTUSAN KEPALA PUSAT PENELITIAN DAN PENGEMBANGAN JALAN DAN JEMBATAN TENTANG PENUNJUKAN PANITIA PELAKSANA, PENYAJI, MODERATOR, PADA KEGIATAN JOINT WORKSHOP**

Pertama : Menunjuk nama – nama yang tercantum dalam lampiran Surat

Keputusan ini, selain melaksanakan tugas pokok juga melaksanakan tugas sebagai berikut :

1. Panitia Pelaksana :
   a. Mempersiapkan pelaksanaan Joint Workshop RDCRB dan NILIM.
   b. Melaksanakan Joint Workshop yang akan diselenggarakan selama 2 (Dua) secara tepat waktu dan tepat mutu.
   c. Membuat laporan akhir kemudian diserahkan kepada Kepala Pusat Litbang Jalan dan Jembatan.
2. Moderator :
   a. Memimpin persidangan.
   b. Membuat resume persidangan.
3. Penyaji :
   Menyajikan dan Mempresentasikan makalah.

Kedua : Segala biaya yang diakibatkan dengan terbitnya Surat Keputusan ini, dibebankan kepada RDCRB dan NILIM ;

Surat Keputusan ini mulai berlaku sejak tanggal ditetapkan dan berakhir setelah pelaksanaan Joint Workshop selesai dengan ketentuan akan dilakukan perbaikan atau perubahan sebagaimana mestinya.apabila dikemudian hari terdapat kekeliruan dalam penetapan Surat keputusan ini.

Tembusan Surat Keputusan ini disampaikan kepada Yth.:

1. Bapak Kepala Badan Litbang PU, sebagai laporan;
2. Sekretaris Badan Litbang PU;
3. Pejabat Komitmen di lingkungan Puslitbang Jalan dan Jembatan;
4. Kepala Bagian/Bidang/Balai Pusat Litbang Jalan dan Jembatan;
5. Yang bersangkutan untuk dilaksanakan.

DITETAPKAN DI : BANDUNG
PADA TANGGAL : 12 Februari 2010

KEPALA,

DEPARTEMEN PEKERJAAN UMUM ★ BADAN PENELITIAN DAN PENGEMBANGAN ★ PUSAT PENELITIAN DAN PENGEMBANGAN JALAN DAN JEMBATAN

Ir. Agus Bari Sailendra, MT.
NIP. 19510811 198003 1 002

File:D/PKSK/Kepegawaian/B-Statuter/SPRIN/SPRINKolokium1 2010

Lampiran : Surat Keputusan
Kepala Pusat Litbang Jalan dan Jembatan
Nomor : 16 /KPTS/LJ/2010
Tanggal : 12 Februari 2010

SUSUNAN KEPANITIAAN
JOINT WORKSHOP RDCRB DAN NILIM
TAHUN 2010

NO	KEDUDUKAN	JABATAN	NAMA
1	2	3	4
A.	PENGARAH	Kepala Pusat Litbang Jalan	1. Ir. Agus Bari Sailendra, MT
B.	PENANGGUNG JAWAB	Kepala Bidang Program dan Kerjasama	1. Ir. IGW. Samsi Gunarta, M.AppL,Sc
C.	KETUA		1. Hindun Hasanah, SE
D.	WAKIL KETUA		2. Rakhman Taufik, ST, M.Sc
E.	SEKRETARIS		3. Drs. Endang Fauly, Dipl. TEFL
F.	ANGGOTA		
a.	Kesekretariatan		
			1. Ati Dwiyanti
			2. Tika Mustikasari, SE
			3. Ani Mulyani, S. Sos
b.	Persidangan		
			1. Nana Sumarna, ST, MM
			2. Iman Santosa, ST
			3. Dimas Sigit Dewandaru, S.Kom
			4. Dadi Muljadi
			5. Arief Bachtiar
c.	Notulen		
			1. Andi Sata, ST, MT
			2. Gede Budi Suprayoga, ST, MT
d.	Ruangan dan Acara		
			1. Dra. Loida Dasuha
			2. Dewi Siti Baiduri, ST
			3. Didin Sarifudin, SH
			4. Diah Rumdiani, A.Md
			5. Nana Rohandi
h.	Umum		
			1. Heri Sarifudin
			2. Enjang Wikusnadi
			3. Epih Rodiansyah
			4. Nurdiansyah
			5. J. Mihardja
			6. Ana Permana
G.	MODERATOR		1. Dr. Ir. M.Sjahdanulirwan, M.Sc

+

File:D/PKSK/Kepegawaian/B-Statuter/SPRIN/SPRINKolokium1 2010

H.	PAKAR/ PRAKTISI/ PEMBICARA KHUSUS	
a.	Penyaji	
		1. Prof (R) Dr. Furqon Affandi, M.Sc
		2. Ir. Nyoman Suaryana, M.Sc
		3. Ir. Nono, M.Sc
		4. Ir. Kurniadjie, M.Sc
		5. Ir. Nandang Sjamsudin, MT
		6. Ir. Pantja Dharma O, M. Eng.Sc
		7. Redrik Irawan, ST, MT
		8. Badan Pengatur Jalan Toll.

DITETAPKAN DI : BANDUNG
PADA TANGGAL : 12 Februari 2010

KEPALA,

DEPARTEMEN PEKERJAAN UMUM

Ir. Agus Bari Sailendra, MT.
NIP. 19510811 198003 1 002

File:D/PKSK/Kepegawaian/B-Statuter/SPRIN/SPRINKolokium1 2010

RESEARCH AND DEVELOPMENT CENTRE FOR ROAD AND BRIDGE
Jln. A.H. Nasution No.264 Bandung 40294
Phone : 022-7802251-53 Fax : 022-7802726
E-Mail : Info@pusjatan.pu.go.id
www.pusjatan.pu.go.id

ISBN: 987-602-8256-15-5

2.4.　調査報告

国総研は共同ワークショップ開催時に、研究ニーズの具体的な内容について把握のためにアンケート調査を行ない、とりまとめを行なったので報告する。

調査報告　目次

１．アンケートの作成

１－１．インドネシアの研究ニーズを把握する質問の作成

インドネシアの関係機関における舗装、橋梁、ITS 等、関連分野の研究ニーズを把握するための調査方法として、3 月に開催した「INDONESIA /JAPAN-JOINTWORKSHOP in BANDUNG Held by RDCRB and NILIM/PWRI」においてアンケート調査を実施することとした。

アンケートは、次回の開催テーマに関して、現在関心を持っているテーマを選定していただく形式とするともに、その中で特に重要と考えている２題について、その具体的な内容を求めることとした。

アンケートの作成にあたっては、舗装、橋梁、ITS に関する項目をいれることはもちろんであるが、ＷＳが幅広の内容を対象としているため、それらを踏まえて質問には計画段階から、維持管理まで幅広く 12 の項目を設定することとした。

作成したアンケートを次節に示す。

１－２．アンケートの内容

アンケートの質問部分について、実際に用いた英文を表－１に、参考として和文を表－２に示す。

表－１　WS に用いたアンケート（英文）

○ What sort of theme and issue would you like to cover in the next JOINT-WORKSHOPs ?

When you hit upon some ideas, please check on the blanks(☑) shown below. And, could you write down specific contents as much as possible.

☐Planning of Act and Regulation ☐Investment and Prioritization including Evaluation
☐Construction Technology for Road and Bridge (including earthquake resistant construction technology).
☐Maintenance and related issues ☐ITS (Intelligent Transport Systems) technology.
☐Execution and maintenance of the pavement（including high-performance pavement)
☐Capacity Building including Civil Engineering Judgment ☐Procurement Systems
☐Disaster Management ☐Safety in Road ☐Environment issues including Climate Change
☐Relevance between Economy and Road Projects ☐Others

You can select upper-mentioned items as much as possible. Detailed description on your selected items one by one in the blank below will be highly appreciated.

【Example】
Selected Topic: Disaster Management
Content : Due to the lack of information communication system between road users & road administration bodies especially in the mountain areas, in the east JAWA area, normally, it takes 3 days for initiation of road recovery works at site. It leads to great loss for regional economy and social activities etc.

Selected Topic:
Content :

Selected Topic:
Content :

表－２　WS に用いたアンケート（和文：参考）

〇次回のワークショップでどのようなテーマを扱ってもらいたいと思いますか？ご意見がある場合は、下記の☐にチェックを入れて頂くとともにできるだけ具体的にご意見の内容を記載してください。

☐実施計画と規制　☐評価を含む、投資と優先順位
☐道路と橋（耐震補強技術を含む）の建設技術
☐維持補修と関連した問題　☐ITS（高度道路交通システム）技術
☐舗装の施工と維持補修（高機能舗装を含む）
☐土木技術における判断を含む能力開発　☐調達システム
☐災害のマネージメント　☐道路の安全性　☐気候変動を含む環境問題
☐経済と道路プロジェクトとの関連　☐その他

上記の項目は複数選択可能です。選択項目については、個々について下欄に具体的に記載いただけますと幸いです。

【例】
選択項目：災害管理
内　　容：東部ジャワ地域の山間部で道路災害が発生した際に、道路管理者と道路利用者間のコミュニケーションシステムが整備されていないため、通常の場合、復旧工事着手まで３日を要し、地域の社会・経済活動に多大な損失を与えている、など。

選択項目：
内　　容：

選択項目：
内　　容：

２．アンケートの集計

アンケートは、ワークショップの参加者全員に配布し、19 人より回答をいただいた。アンケートの回答結果を整理し、以下に示す。整理は、作成した質問も含めて、全ての設問とした。なお、回答のうち、4 人はインドネシア語での回答であった。

回答原文は、参考資料として巻末に示す。また、各意見の丸付き数字は回答原文の番号を示している。

２－１．アンケートの集計結果

（1）ワークショップの評価

表－３　ワークショップの評価の整理

	5 (Excellent)	4	3	2	1 (Not Good)	合計
(1)全体セッション	4	10	3	0	0	17
(2)-1 専門セッション1 (舗装と道路)	2	3	1	0	0	6
(2)-2 専門セッション2 (災害と橋梁)	2	2	1	0	0	5
(2)-3 専門セッション3 (交通と技術)	2	9	0	0	0	11
(3) 専門セッションの討議	5	7	3	0	0	15

（2）最も興味深かったこと

1）特定の発表あるいはセッションを回答したもの

・専門セッション 1(舗装と道路)の”Pavement Maintenance Strategy in Japan” と回答　１名

・専門セッション 2(災害と橋梁)の”The Need and Development for Bridges Strengthening Technology in Indonesia” と回答　１名

・専門セッション 3(交通と技術)　と回答　２名

・専門セッション 3(交通と技術)の ITS　と回答　１名

・専門セッション 3(交通と技術)の”Local ITS Strategy” と回答　３名

・専門セッション 3(交通と技術)の”Role of structure condition data acquisition on bridge maintenance activities” と回答　２名

・専門セッション 3(交通と技術)の” Strategy on ITS Development in Indonesia” と回答　１名

2）自由に回答いただいたもの

①日本には MCI（メインテナンス管理指数）というメンテナンス管理目標値がありますが、我々は、その日本の指標を得ることが可能ですか。どのような方法で、例えばインターネットでダウンロードできるのですか。

②インドネシアにおける橋梁の構造の健全性、交通スマートシステムに関するモニタリングシステムついて（ただし、実地についてはどうか？）

④今回のワークショップはとても良かったです。しかし、国総研は多くのアスペクトを網羅するため、総合的に行う方がよいと考えます。各研究開発センターがこのようなワークショップに参加できる機会を与えられたらさらに良かったと考えます。

⑦基本的な ITS：・狭隘道路での運転サポートシステム

・“バリアが無い停止地点”での安全サポートシステム

⑬ITS は車両の動きと道路状況に充分な注意を払うべき

⑮技術は進歩しているが、弱点と欠点も絶えずついて回るものである。人的資源はどうか？技術が発展するにつれ雇用が失われる。最も大事なことは、運転者の運転態度である。

⑲2003 年の地震時に確認された脱座席防御のために効果を発揮する多目的安全システム

（3）次回のワークショップのテーマ

表－４　次回のワークショップのテーマの整理

項目	人数				備考
	全体	TS Ⅰ	TS Ⅱ	TS Ⅲ	
アンケート回答者数	19	6	5	11	
項目3の回答者数	12	3	3	7	
・実施計画と規制	4	1	0	3	
・評価を含む、投資と優先順位	2	1	0	1	
・道路と橋（耐震補強技術を含む）の建設技術	5	2	2	0	
・維持補修と関連した問題	3	1	2	0	
・ITS（高度道路交通システム）技術	7	3	1	4	
・舗装の施工と維持補修（高機能舗装を含む）	1	1	0	0	
・土木技術における判断を含む能力開発	3	1	2	0	
・プロキュアメントシステム	1	0	0	1	
・災害のマネージメント	2	1	1	0	
・道路の安全性	7	1	0	5	
・気候変動を含む環境問題	4	1	0	3	
・経済と道路プロジェクトとの関連	3	1	0	2	
・その他	1	0	0	1	・都市部の道路

注：「項目３の回答者数」は項目３で１項目以上選択した方をカウントした。
参加者には複数の専門セッション(TS)に参加した方や TS に参加しなかった方いるため、TS の合計と全体の数は一致しない場合がある。

各項目に対する具体的な内容等のコメント

ａ）実施計画と規制

⑬道路状態は運転時の安全性を決める要因となるので道路は充分に整備されるべきである。

ｂ）評価を含む、投資と優先順位

①質の高いプロジェクトにおける成果要因からみて、いろいろな異なる地域でのプロジェクトに関する研究

ｃ）道路と橋（耐震補強技術を含む）の建設技術。

⑲長大橋の設計及び建設技術、地震の断層の影響への抵抗(スンダ海峡)、耐風安定性の試験方法。

ｄ）維持補修と関連した問題

①補修の寿命、過負荷、使用される補修資材に関する研究

⑲地震などの災害後の道路、橋梁ネットワークを迅速かつ効率的にリハビリするための復旧プログラム

ｅ）ITS（高度道路交通システム）技術

②国や県レベルの道路の交通システムのプログラム計画手法について.

④道路開発者によってもたらされる交通渋滞や将来における課題。解決のためには技術を伴う新たなアプローチを必要とするが、一方で利用者側の（課題解決へ向けた）アプローチも必要。

⑧インドネシアに独特な状況に対して適切なITSを知るために良いワークショップの機会だった。

⑮幾つかの箇所での交通混雑による問題を解決するために人的資源と共に進んだITSシステムの導入が必要である。交通混雑は多くの問題を引き起こす原因となっている。現場での活動に着手するよりもシステム確立を優先すべきである。良いシステム構築には時間を要すると思うが。

ｆ）舗装の施工と維持補修（高機能舗装を含む）

コメント無し

ｇ）土木技術における判断を含む能力開発

コメント無し

ｈ）調達システム

コメント無し

ｉ）プロキュアメントシステム

コメント無し

ｊ）災害のマネージメント

コメント無し

ｋ）道路の安全性

⑨道路標識と利用者の間の管理システムの欠如(バイクを含むあらゆる種類の車両について)

⑪幅が狭い道における通行者の発見。

⑪夜に道を渡る通行者の発見。

⑭インドネシアの道路における事故の最小化。

⑮依然として無駄に命を落とす人々が大勢いる。この問題は早急に解決されるべきである。

ｌ）気候変動を含む環境問題

⑧道路事業における環境問題を支援するためにどのような努力を払うべきか？このワークショップではエコな道（Green road）や排水システムなどの環境関連事項に対処するための詳細について知見を与えてくれるであろう。

⑭環境面に基づいた交通手段の構築。

ｍ）経済と道路プロジェクトとの関連

コメント無し

n）その他

②道路利用者へ良いサービスを提供するための官側の課題（規則、道路の運営や道路利用者)如何に管理を行うか？

２－２．アンケート結果の分析

ここでは、２－１で集計したアンケート結果のうち、本業務に関係する、「次のワークショップのテーマ」についてアンケート結果から分析する。

「次のワークショップのテーマ」については、回答のあった 19 人の中で、12 人が項目を選択し、その他を含んだ 13 項目に 43 の選択が行われた。その中で、最も多くの人から選択されたのが「ITS（高度道路交通システム）技術」と「道路の安全性」であり、項目選択をした 12 人のうち、半数以上の 7 人により選択された。なお、既に検討テーマと決定している３件の選定数と順位は以下のとおりである。

・舗装「舗装の施工と維持補修（高機能舗装を含む)」　１人（11 位／12 件）

・橋梁「道路と橋（耐震補強技術を含む）の建設技術」 5 人（3 位／12 件）

・ITS「ITS（高度道路交通システム）技術」　7 人（1 位／12 件）

注：順位付けには「その他」は含んでいない。

また、上記を表－４に示すセッションごとの参加者に分けて整理すると、特徴的な点は以下のとおりである。

・選択数１位の「ITS 技術」は「舗装と道路」のセッション参加者全員が選択しており、「交通と技術」のセッション参加者からの選択も多い。一方、「災害と橋梁」のセッション参加者は選択していない。

・同様に選択数１位の「道路の安全性」は、主に「交通と技術」のセッション参加者が選択している。

今回のアンケートは回収数が少なく、一部から全体を類推するのは困難であるが、１つの見方として、

・各セッションの重みは同程度である。

・一部の回答者は、セッション参加者の総意を代表している。

という前提条件だと仮定すると、表－４に示す各項目の評価は表－５のようになり、上位３項目は以下のようになる。

１位：ITS（高度道路交通システム）技術　63%

２位：道路と橋（耐震補強技術を含む）の建設技術　44%

３位：道路の安全性　35%

表－５　次回のワークショップのテーマの整理（その２）

項目	TSⅠ	TSⅡ	TSⅢ	平均
・実施計画と規制	33%	0%	43%	25%
・評価を含む、投資と優先順位	33%	0%	14%	16%
・道路と橋（耐震補強技術を含む）の建設技術	67%	67%	0%	44%
・維持補修と関連した問題	33%	67%	0%	33%
・ITS（高度道路交通システム）技術	100%	33%	57%	63%
・舗装の施工と維持補修（高機能舗装を含む）	33%	0%	0%	11%
・土木技術における判断を含む能力開発	33%	67%	0%	33%
・プロキュアメントシステム	0%	0%	14%	5%
・災害のマネージメント	33%	33%	0%	22%
・道路の安全性	33%	0%	71%	35%
・気候変動を含む環境問題	33%	0%	43%	25%
・経済と道路プロジェクトとの関連	33%	0%	29%	21%

なお、主要な項目に対する意見の中には、具体的な研究ニーズもいくつか含まれているため、それらについては、研究ニーズに取りまとめる。また、別の設問である「最も興味深かったこと」からもニーズと考えられるものは、幅広に取り上げ、研究ニーズとして記載するようにする。

３．ＷＳのとりまとめ

ワークショップでは､表－３に示す３つの技術セッションで､各セッションのとりまとめが行われた。このとりまとめにも、インドネシアのニーズが含まれるため、研究ニーズの参考になると考えられる部分については和訳を以下に示す。

３－１．専門セッション１（舗装と道路）

（１）討論、検討の結果

① 日本とインドネシアの間では、アスファルトの性状および施工の方法について、特に品質管理の点で大きな違いがあることが確認されている。また、「Asbuton(ブトン天然アスファルト)」のようなインドネシア固有の技術は日本では高価であると考えられており、日本では橋梁の防水工事に使われる程度である。日本は洗練されたインドネシアの技術に期待する。
日本は多孔質アスファルト舗装や舗装道路のモニターシステムのような新鋭技術に優位性を持っており、こういった技術をインドネシアで利用することで、効率的な舗装道路の管理を行うことが可能となる。

② インドネシア同様、日本も種々のタイプのアスファルトミックスを開発している。

③ 舗装道路の修理を行う際、日本は「ひび割れ率」と「わだち割れ深さ」を重要な指標として使っているが、これはもともと AASHTO(American Association of State Highway and Transportation Officials) (PSI)から来たものである。

④ 日本では多孔質アスファルトは主として高速道路で使用され、排水を良くし、水しぶきや水はねを減少させ、安全を確保するために使用されている。また、多孔質のアスファルト表面に目詰まりが出来るのを防止するため、最先端の技術が開発されている。

⑤ 日本では、道路の状況を示すデータを採集するため、毎日 50～100km の区間に渡って目視でパトロールを行っている。また、3 年毎に道路表面測定装置を用いた測定を行う。

⑥ Asbuton（ブトン天然アスファルト）の評価をする際、初期の建設コストのみならず、ライフサイクルコストをも加味して評価する必要がある。Asbuton が高価な理由は、輸送費がかかることに加えて、採掘した原鉱からアスファルト留分を抽出する手間がかかることによる。
Asbuton（ブトン天然アスファルト）の件に関して日本側としては、関連する業界の協力を得てインドネシア側を援助する用意がある。

⑦ 日本はトリニダードにあるピッチレイク（アスファルト沼）で取れる天然アスファルトを使用しているが、これは道路舗装用ではなく橋梁の鋼製デッキ部の防水用であり、これにより水の浸入による腐食から鋼製デッキ部を守っている。

⑧ 降雨で浸水する道路については、インドネシアでは単にかさ上げをするか剛性の高い舗装にするだけである。日本では常に洪水状態になるような道路はないので、この問題に関する助言は限られたものとなる。日本は現在、道路の表面からすぐに滲みこむ透水性のある舗装を開発中

である。また日本の経験によれば剛性の高い舗装は推薦できない。その理由は柔軟性のある舗装に比べるとメンテナンスが非常に複雑になるからである。

⑨ 日本ではアスファルトによる安定処理路盤はセメント処理路盤よりも広く一般的に使われている。その理由は、セメント安定化処理路盤（CTB）は剛性が高いためメンテナンスが難しいことによる。

⑩ 道路表面測定装置を使うと、カメラと画像アナライザーを用いて、「ひび割れ率」（クラック面積と全面積との比）が自動的に測定できる。

⑪ 舗装に関する問題は、討議をおこなうこともさることながら、現場を見て解決することも必要である。このため日本側の専門家はさらにインドネシアに行って協議を行いたい。

⑫ インドネシアには約52%の未舗装道路がある。今後建設予定の簡易舗装とLow Volume Roadについての計画はRDCRBが作成している。それによると2010年は未舗装道路に焦点を当て、翌年以降は簡易舗装とLow Volume Roadに焦点を当てることになっている。日本は簡易舗装の開発も行っている。このため今後簡易舗装と低交通量道路についての協力も必要となる。

（2）共同研究のテーマ

共同研究のテーマとして以下の事項が挙げられた。

① 舗装管理システム、メンテナンス用資材とモニターの方法を含む

② 現場リサイクル法などの最新技術や、高いわだち割れ抵抗（例えばStone Mastic Asphalt）、低騒音舗装や透水性舗装。

③ Asbuton（ブトン天然アスファルト）に関する技術開発

④ 簡易舗装と低交通量道路に関連する技術

３－２．専門セッション２（災害と橋梁）

（1）討論、検討の結果

日本とインドネシア双方が興味を持っている共通のテーマが既にある。それは耐震設計、道路橋の補強、地震後の危機管理であり、以下の点が議論された。

① 地震後の構造物補修の方法は、被害の程度と橋梁の劣化度合いに左右される

② 地震災害を軽減するため、以下の３つの基本方針が、日本の国総研によって紹介された

a. 橋梁に対する耐震設計の仕様

b. 橋梁の耐震補強

c. 地震後の速やかな道路ネットワークの復旧

③ 地震による橋梁被害の４つの要因をRDCRBが指摘した

ａ． 橋梁上部工の横方向の動き

ｂ． 橋梁上部工主要部と追加構造物との間の横方向の膨張

ｃ． 橋梁の沈下による、橋梁盛土への接近

ｄ． 擁壁および橋台に発生した亀裂

④ 過荷重は橋梁破壊の原因であるが、インドネシアではよく見られる

⑤ 長大橋梁に関する日本の技術情報は、日本の国総研によって提供される

（2）研究情報交換のテーマ

相互に興味のある下記のような情報を交換することが有意義であろう

① 地震災害の評価（決定論的な、あるいは確率論的な地盤振動の予測）

② 津波情報をも含む地震災害情報

③ 情報伝達に関わる技術、特に、即座に情報収集をするとともに関係者間で情報を共有できるような形の技術

④ 緊急に対応、周知できるような地震被害予測

⑤ 道路橋の耐震設計技術

⑥ 道路橋の耐震補強技術

⑦ 地震後の道路橋の耐震性評価

⑧ 地震で被害を受けた道路橋の緊急復旧方法

⑨ 道路橋の崩落防止法

３－３．専門セッション３（交通と技術）

（1）討論、検討の結果

日本は ITS 技術も進んでいる。狭い道路で逆方向から来る車があると警告したりするものであるが、インドネシアでも使える技術である。

① 地方の ITS 戦略：濱田俊一氏の内容

最近開発された ITS 技術の全容と、特に地方における狭い道路での ITS 技術の応用について発表があった。この ITS の装置は簡易で比較的安価であり、狭い道路に進入する車両に対して指示を与えドライバーが道路に進入すべきか道路が空くまで待つべきかを教えるものである。

このタイプの ITS 技術は住宅地域の狭い道路での導入が適切であり、反対方向から車両が来ていることを知らずに双方から進入して、どちらにも動けなくなる状態を避けることができる。

この ITS 技術とその応用に関しては、更に詳細にインドネシア側の技術者、研究者に紹介していただきたい内容である。

② 橋梁のメンテナンスのための構造データの取得について：小西拓洋氏の内容

橋梁の劣化度合いをモニターするための ITS 技術について発表があった。これはストレーンゲージを用いて、トランスミッターに接続して、事務所のコンピュータに情報を転送するものである。同じような技術で車両の重量を測ることができるため、交通に対する負荷を探知することも可能になる。このタイプの ITS 技術は車両の重量分布をモニターする点で、インドネシアにふさわしい。この装置の簡便性、適用性、経済性、耐久性等がインドネシアの現状にふさわしいか、評価されるべきである。インドネシアの道路網における過積載の問題からは、このシステムが簡便で操作が容易であることがふさわしいと思われる。

③ 電子料金徴収システムをインドネシアに導入するための政策と評価：Rudy Hennawan 博士の内容

ETC による料金徴収システムについて発表があった。このシステムはスマートカードを用いてカードリーダーにタッチすることで料金を支払うものである。これは料金支払いブースに代わるものであり、現在の ETC の取扱量は約 10%程度である。残りは人の手で徴収する。将来このシステムは更に改良さ

れて、タッチしなくても良いようになる。このようなシステムを将来導入するためには、ドライバーに対する教育等が必要になる。

④　インドネシアにおけるITS発展戦略：Pantja Dharma Oetojo氏の内容

連動した交通管制システムについて発表があった。これはジャカルタやバンドンのような都市部で用いられているものであるが、ある事情で多くのシステムが、一部のみ用いられるか、使われないで独立型の従来型信号に逆戻りしているとのことである。

また、RDCRBの事務所では、交通の研究者は軸負荷を計測して遠隔通信システムで事務所にデータ転送できる「自動交通量分類計測器」などの交通管理機器の開発に従事している。そのほかにも交通情報、あるいは他の道路データを関係者がアクセスできるシステムがある。移動式の無線スタンドアロン交通信号は工事現場の交通整理に使用される。しかしRDCRBの行うこれらの研究は未だ開発途上にあるとのことである。RDCRBでは、電子機器の開発が出来る専門家が不足している。

緊急の都市交通の問題点は、大量の二輪車の問題である。ITSを使ってこの問題を解決するには格段の配慮を要すると考えられる。

（2）共同研究のテーマ

以下のテーマが望ましい。

①　低コストで、設置が容易で、実現可能性のある地方のITS

②　高速道路の交通管制、モニター技術、ETCの採用

③　交通安全と渋滞緩和

４．インドネシアの状況

研究ニーズの把握にあたり、認識しておくべきインドネシアの道路に関係する情報として、車両の保有台数、道路延長を調べるとともに、WS 参加者の意見として多かった交通事故に関係する数値を以下に示す。

数値情報はインドネシア政府より公表されていた情報を整理し以下の表に示す。インドネシアでは、表－６に示すように、特に2003年から2008年にかけて車両保有台数が約2.5倍になっているのに対し、表－７に示すように道路延長はさほど増えていない。そのような中で、交通事故の数値も増減はあるが（表－８）、事故車両数等は急増しており、オートバイの数が急増している（表－９）。このような交通事故に関する状況が、「ITS（高度道路交通システム）技術」と並んで「道路の安全性」が次回のワークショップのテーマ選択の１位となった意見に現れたのではないかと推測される。

①インドネシアの車両台数

表－６　インドネシアの車両保有台数（台）

西暦	乗用車	バス	トラック	オートバイ	合計	５年間増加率
1988	1,073,106	385,731	892,651	5,419,531	7,771,019	－
1993	1,700,454	568,490	1,160,539	7,355,114	10,784,597	139%
1998	2,769,375	626,680	1,586,721	12,628,991	17,611,767	163%
2003	3,885,228	798,079	2,047,022	19,976,376	26,706,705	152%
2008	9,859,926	2,583,170	5,146,674	47,683,681	65,273,451	244%

＊インドネシア中央統計庁 HP より

②道路延長

表－７　インドネシアの道路延長（km）

西暦	国道	県道	地方道	市街地道路	有料道路	合計	前年比増加率
2004	34,629	46,498	229,080	21,863	660	332,730	－
2005	34,318	46,771	229,208	21,934	772	333,033	100%
2006	34,318	46,771	229,208	21,934	772	333,033	100%
2007	36,318	50,044	245,253	23,469	772	355,856	107%
2008	36,318	50,044	245,253	23,469	772	355,856	100%

＊インドネシア運輸省 HP データより

③交通事故数

表－８　交通事故関係数

西暦	事故数（件）	事故車両（台）	死傷者数（人）	死者数（人）	死者数（人/日）	重傷（人）	軽傷（人）	損失額（BR）
2004	17,732	26,187	32,271	11,204	30.6	8,983	12,084	53.05
2005	91,623	28,245	103,323	16,115	44.2	35,891	51,317	51.56
2006	87,020	70,308	101,354	15,762	43.2	33,282	52,310	81.85
2007	48,508	84,090	82,588	16,548	45.3	20,180	45,860	103.29
2008	56,584	130,062	94,921	19,216	52.5	22,364	53,341	123.01

＊インドネシア運輸省 HP データより

＊BR：Billion Rupiah（10 億ルピア）=約 1 千万円（2010 年 3 月時点）

＊表中の死者、重傷、軽傷の定義は、以下のとおりである。

死者；事故発生 30 日以内に事故に起因する負傷が原因で死亡した場合

重傷；事故後病院での治療が 30 日以上の場合

軽傷；事故後病院での治療が 30 日未満の場合

④交通事故車両

表－９　インドネシアの交通事故に関係した車両

西暦	乗用車	バス	トラック	オートバイ	合計
2004	5,442	1,650	4,872	14,223	26,187
2005	6,095	1,607	4,872	15,671	28,245
2006	10,604	2,945	9,168	47,591	70,308
2007	12,726	3,278	11,006	57,080	84,090
2008	16,552	3,973	14,328	95,209	130,062

＊インドネシア運輸省 HP データより

５．研究ニーズの整理

５－１．研究ニーズのとりまとめ

インドネシア側の実務担当者と国総研の実務担当者により共同ワークショップを開催する前に事前の打ち合わせを行なっており、その際インドネシア側から優先順位の高い研究ニーズとして以下の３つが選定された。

①道路のためのアセットマネージメント技術

②各地域における最適な道のための柔軟な技術規格

（インドネシアでは国土が広大で、諸条件の違いが大きいため、画一的な基準では各地域に最適な道路は建設できない。）

③道路に関する自然災害に対する防災と減災

（インドネシアでは、気候・地形・地質条件により地すべり災害の危険性が高い。）

なお、選定されなかった項目は以下のとおりである。

④道路管理のための、実際の新しい公共管理手法

⑤有料道路と交通情報の分野の新しいサービス。

⑥道路建設と関連した調達におけるコスト削減方法。

⑦道路ネットワークにおける広域的な警報体制への挑戦。

⑧町の快適さを向上するための道路計画。

選定された項目が、アンケートの項目と必ずしも対になっているわけではないが、概ね以下のアンケート項目で参加者に研究ニーズを聞いていると考えられる。

①「維持補修と関連した問題」と「舗装の施工と維持補修（高機能舗装を含む)」の合計

（両方を選択した場合人は１人とカウント）　3 人（5 位／12 件）

②「道路と橋（耐震補強技術を含む）の建設技術」　4 人（3 位／12 件）

③「災害のマネージメント」　2 人（9 位／12 件）

一方、２に示すように、アンケートで最も多くの方に選択された項目は、7 人に選択された「道路の安全性」であった。アンケートの意見からは、交通事故、特に人と車両の事故を課題と見ていると推測される。４に示すように最近のインドネシアの交通事故についての調査結果では、特に近年死者数が増加している。日本とインドネシアの交通事故に関する比較を表－１０に示す。事故件数では、日本の方が多いが、死者数ではインドネシアのほうが多い。

表－１０　日本とインドネシアの交通事故の比較

国（対象年）	事故数（件）	死者数（人）	重傷（人）	軽傷（人）
日本(2009)	736,688	4,914	53,690	856,425
インドネシア(2008)	56,584	19,216	22,364	53,341

出典：日本のデータは警視庁 HP より

日本の死者、重傷、軽傷について

死者：交通事故発生から 24 時間以内に死亡した人数（別途 30 日死者も統計を取っているが通常 24 時間が用いられる。）

. 重傷者：交通事故によって負傷し、1 ヶ月（30 日）以上の治療を要する場合。

軽傷者：交通事故によって負傷し、1 ヶ月（30 日）未満の治療を要する場合。

ただし、インドネシアの交通事故の数字については、公表元のインドネシア運輸省より、「交通事故の過少報告の場合」と題して、

・ 警察による報告がない場合に、様々な管轄権（管轄外であること）が大きな一因となっている。
・ 警察は報告された場合だけを記録する。
・ 保険会社は被害者が請求を申し立てた時のみ記録する。
・ 病院は DUA(到着後すぐに死亡)犠牲者も記録しないし、治療を受けた後死亡した犠牲者も記録しない。

過少報告を避けるために、私たちは Road Safety Information System（道路安全情報システム）を Indonesia Police（インドネシア警察）、Ministry of Transportation（運輸省）、Ministry of Public Works（公共事業省）、Ministry of Health（保健省）、そして調整者としての National Planning Board（国家計画委員会）と共に確立しようとしている。

という資料を公表している。

また、両国では、人口、車両の保有台数等、その他にも違いが有り、表－１０をそのまま比較することはできないが、インドネシアでは最低でも 2 万人近い交通事故死者数があることから、社会問題として認識されているものと推測される。

以上より、事前の打合せでは、比較的道路管理者的な視点が強く反映されて研究ニーズが選定されていたが、アンケート結果は、道路利用者に近い視点からの研究ニーズが選定されたのではないかと推測される。

５－２．研究ニーズ

研究ニーズについては、共同研究のニーズを把握することが目的であるため、せん別することなく、幅広く全ての意見を列挙した。

（１）舗装

１）舗装管理システム（メンテナンス用資材とモニターの方法を含む）

２）現場リサイクル法などの最新技術や、高いわだち割れ抵抗（例えば Stone Mastic Asphalt）、低騒音舗装や透水性舗装。

３）Asbuton（ブトン天然アスファルト）に関する技術開発

４）簡易舗装と低交通量道路に関連する技術

５）補修の寿命、過負荷、使用される補修資材に関する研究

６）MCI（メインテナンス管理指数）のインドネシアへの導入

７）各地域における最適な舗装のための柔軟な技術規格

（２）橋梁（耐震関連を含む）

１）緊急に対応、周知できるような地震被害予測

２）道路橋の耐震設計技術

３）道路橋の耐震補強技術

４）地震後の道路橋の耐震性評価

５）地震で被害を受けた道路橋の緊急復旧方法

６）道路橋の崩落防止法

７）長大橋の設計及び建設技術

８）地震断層の影響への対策(スンダ海峡)

９）耐風安定性の試験方法

10）各地域における最適な橋梁のための柔軟な技術規格

（３）ＩＴＳ

１）低コストで、設置が容易で、実現可能性のある地方の ITS

２）高速道路の交通管制、モニター技術、ETC の採用

３）渋滞緩和（交通混雑解消）のための ITS システムの導入

（４）道路の安全性

１）交通安全技術

２）道路標識と利用者の間の管理システムの構築

３）幅が狭い道における通行者の発見技術

４）夜に道を渡る通行者の発見技術

５）インドネシアの道路における事故の最小化の研究

６．まとめ

インドネシア側の協力により、アンケート結果に基づき、回答者が次回のワークショップのテーマにすべきと考えている課題の項目、その具体的な内容を把握した。

また、共同ワークショップ会議中には、インドネシアの公共事業省副大臣(Mr. Hermanto Dardak)の挨拶において長大橋とトンネルの技術について重要性が指摘された。長大橋はアンケート結果にも含まれており、またそれら両技術については、日本は世界有数の技術を有していることから、この分野における研究協力も可能性が高いものと考えられる。

取りまとめた研究ニーズの多くは、日本で既に研究として取り組まれている項目が多いと判断されるが、インドネシアでの適用を考慮すると、日本の既存の技術を改良する必要があるニーズも含まれると考えられ、それらには共同研究が必要と思われる。

調査報告　概要版

インドネシアの政府関係の研究機関における舗装、橋梁、ITS 等、関連分野の研究ニーズを把握するための基礎的調査を行なった。その方法として、「INDONESIA /JAPAN-JOINTWORKSHOP in BANDUNG Held by RDCRB and NILIM/PWRI」においてアンケート調査を実施した。

また、アンケートを行なった会議では、インドネシアの公共事業省副大臣(Mr. Hermanto Dardak)の挨拶において、長大橋とトンネルの技術について重要性が指摘された。これらの技術については日本は世界有数の技術を有していることから、この分野における研究協力も可能性が高いと考えられる。

それらの情報を整理して、以下の研究ニーズを整理した。

（1）舗装

1）舗装管理システム（メンテナンス用資材とモニターの方法を含む）
2）現場リサイクル法などの最新技術や、高いわだち割れ抵抗（例えば Stone Mastic Asphalt）、低騒音舗装や透水性舗装。
3）Asbuton（ブトン天然アスファルト）に関する技術開発
4）簡易舗装と低交通量道路に関連する技術
5）補修の寿命、過負荷、使用される補修資材に関する研究
6）MCI（メインテナンス管理指数）のインドネシアへの導入
7）各地域における最適な舗装のための柔軟な技術規格

（2）橋梁（耐震関連を含む）

1）緊急に対応、周知できるような地震被害予測
2）道路橋の耐震設計技術
3）道路橋の耐震補強技術
4）地震後の道路橋の耐震性評価
5）地震で被害を受けた道路橋の緊急復旧方法
6）道路橋の崩落防止法
7）長大橋の設計及び建設技術
8）地震断層の影響への対策(スンダ海峡)
9）耐風安定性の試験方法
10）各地域における最適な橋梁のための柔軟な技術規格

（3）ＩＴＳ

1）低コストで、設置が容易で、実現可能性のある地方の ITS
2）高速道路の交通管制、モニター技術、ETC の採用
3）渋滞緩和（交通混雑解消）のための ITS システムの導入

（4）道路の安全性

1）交通安全技術
2）道路標識と利用者の間の管理システムの構築

３）幅が狭い道における通行者の発見技術

４）夜に道を渡る通行者の発見技術

５）インドネシアの道路における事故の最小化の研究

（５）トンネル

１）トンネルの設計及び建設技術

以上のニーズの多くは、日本で既に研究として取り組まれている項目が多いと判断されるが、インドネシアでの適用を考慮すると、日本の既存の技術を改良する必要があるニーズも含まれると考えられ、それらには共同研究が必要と思われる。

参考資料リスト

A．質問表（英語）

B．回答原文（19 人分）

A．質問表（英語）

INDONESIA/JAPAN-JOINTWORKSHOP in BANDUNG
Held by RDCRB and NILIM/PWRI

<Questionnaire to Participants>

Thank you very much four your participation in this international joint workshop.
It would be our pleasure to have your cooperation for this questionnaire in order to promote the collaboration between Indonesia and Japan in the research sphere of Roads and Brides.

1. May we have your overall evaluation on this Workshop by checking charts shown below.

	<Excellent> ←			→	<Not Good>
(1) General Session	5	4	3	2	1
if you participated in; (2)-1 Technical Session I (Pavement and Expressway)	5	4	3	2	1
if you participated in; (2) -2 Technical Session II (Disaster and Bridges)	5	4	3	2	1
if you participated in; (2)-3 Technical Session III (Traffic and Technology)	5	4	3	2	1
(3) Discussion of each of (2)	5	4	3	2	1

2. What kind of issues and topics did you get your strongest interest in this workshop?
Please write down specifically in the blank bellow.

(Ex. New Materials of Pavement proposed from Japan side etc.)

3. What sort of theme and issue would you like to cover in the next JOINT-WORKSHOPs ?
When you hit upon some ideas, please check on the blanks(☑) shown below. And, could you write down specific contents as much as possible.

☐Planning of Act and Regulation ☐Investment and Prioritization including Evaluation
☐Construction Technology for Road and Bridge (including earthquake resistant construction technology).
☐Maintenance and related issues ☐ITS (Intelligent Transport Systems) technology.
☐Execution and maintenance of the pavement (including high-performance pavement)
☐Capacity Building including Civil Engineering Judgment ☐Procurement Systems
☐Disaster Management ☐Safety in Road ☐Environment issues including Climate Change
☐Relevance between Economy and Road Projects ☐Others

You can select upper-mentioned items as much as possible. Detailed description on your selected items one by one in the blank below will be highly appreciated.

【Example】
Selected Topic: Disaster Management
Content : Due to the lack of information communication system between road users & road administration bodies especially in the mountain areas, in the east JAWA area, normally, it takes 3 days for initiation of road recovery works at site. It leads to great loss for regional economy and social activities etc.

Selected Topic:
Content :

Selected Topic:
Content :

4. Your voice and comments for this joint workshop.

Your Name :
Organization :
E-mail address :

Thank you for your cooperation!

B. 回答原文（19 人分）

①

INDONESIA/JAPAN-JOINTWORKSHOP in BANDUNG
Held by RDCRB and NILIM/PWRI

<Questionnaire to Participants>

Thank you very much four your participation in this international joint workshop.
It would be our pleasure to have your cooperation for this questionnaire in order to promote the collaboration between Indonesia and Japan in the research sphere of Roads and Bridges.

1. May we have your overall evaluation on this Workshop by checking charts shown below.

	<Excellent>				<Not Good>
(1) General Session	5	4	3	2	1
if you participated in; (2)-1 Technical Session I (Pavement and Expressway)	5	4	3	2	1
if you participated in; (2) -2 Technical Session II (Disaster and Bridges)	5	4	3	2	1
if you participated in; (2)-3 Technical Session III (Traffic and Technology)	5	4	3	2	1
(3) Discussion of each of (2)	5	4	3	2	1

2. What kind of issues and topics did you get your strongest interest in this workshop?
Please write down specifically in the blank bellow.

(Ex. New Materials of Pavement proposed from Japan side etc.)

Jepang ada Rumus MCI, bagaimana di. kita apa bisa kita adop dari jepang standar2 mereka dan bgm bisa kita dapatkan. apa bisa di down Load di internet misalnya.

* MCI = Maintenance Control Index.

3. What sort of theme and issue would you like to cover in the next JOINT-WORKSHOPs ?
When you hit upon some ideas, please check on the blanks(☑) shown below. And, could you write down specific contents as much as possible.

☑Planning of Act and Registration ☑Investment and Prioritization including Evaluation
☑Construction Technology for Road and Bridge (including earthquake resistant construction technology).
☑Maintenance and related issues ☑ITS (Intelligent Transport Systems) technology.
☑Execution and maintenance of the pavement (including high-performance pavement)
☑Capacity Building including Civil Engineering Judgment ☐Procurement Systems
☑Disaster Management ☑Safety in Road ☐Environment issues including Climate Change
☑Relevance between Economy and Road Projects ☐Others

You can select upper-mentioned items as much as possible. Detailed description on your selected items one by one in the blank below will be highly appreciated.

【Example】
Selected Topic: Disaster Management
Content : Due to the lack of information communication system between road users & road administration bodies especially in the mountain areas, in the east JAWA area, normally, it takes 3 days for initiation of road recovery works at site. It leads to great loss for regional economy and social activities etc.

Selected Topic: PLANNING & APLICATION
Content : Penelitian ttg umur rencana & overload & jenis material yg digunakan.

Selected Topic: PROJECT MANAGEMENT
Content : Penelitian ttg proyek di daerah yg berbeda di tinjau dari berbagai aspek / Faktor keberhasilan Quality suatu proyek.

4. Your voice and comments for this joint workshop.

SANGAT SENANG DAPAT MENERIMA INFO BARU TENTANG PERKERASAN JALAN & PERKEMBANGAN TEKNOLOGI JEPANG & KITA TIDAK TERLALU KETINGGALAN.

Your Name : SOERYADI
Organization : P2JJ ACEH
E-mail address : soeryadi_btj@yahoo.co.id

Thank you for your cooperation!

②

INDONESIA/JAPAN-JOINTWORKSHOP in BANDUNG
Held by RDCRB and NILIM/PWRI

<Questionnaire to Participants>

Thank you very much four your participation in this international joint workshop.
It would be our pleasure to have your cooperation for this questionnaire in order to promote the collaboration between Indonesia and Japan in the research sphere of Roads and Bridges.

1. May we have your overall evaluation on this Workshop by checking charts shown below.

	<Excellent>				<Not Good>
(1) General Session	5	4	3	2	1
if you participated in; (2)-1 Technical Session I (Pavement and Expressway)	5	4	3	2	1
if you participated in; (2) -2 Technical Session II (Disaster and Bridges)	5	4	3	2	1
if you participated in; (2)-3 Technical Session III (Traffic and Technology)	5	4	3	2	1
(3) Discussion of each of (2)	5	4	3	2	1

2. What kind of issues and topics did you get your strongest interest in this workshop?
Please write down specifically in the blank bellow.

(Ex. New Materials of Pavement proposed from Japan side etc.)

About Structural Health Monitoring System
for Bridge
and.
Smart Structures
for Traffic System in Indonesia
(but how about implementation?)

3. What sort of theme and issue would you like to cover in the next JOINT-WORKSHOPs ?
When you hit upon some ideas, please check on the blanks(☑) shown below. And, could you write down specific contents as much as possible.

☑Planning of Act and Registration ☐Investment and Prioritization including Evaluation
☐Construction Technology for Road and Bridge (including earthquake resistant construction technology).
☐Maintenance and related issues ☑ITS (Intelligent Transport Systems) technology.
☐Execution and maintenance of the pavement (including high-performance pavement)
☐Capacity Building including Civil Engineering Judgment ☐Procurement Systems
☐Disaster Management ☐Safety in Road ☐Environment issues including Climate Change
☐Relevance between Economy and Road Projects ☐Others

You can select upper-mentioned items as much as possible. Detailed description on your selected items one by one in the blank below will be highly appreciated.

【Example】
Selected Topic: Disaster Management
Content : Due to the lack of information communication system between road users & road administration bodies especially in the mountain areas, in the east JAWA area, normally, it takes 3 days for initiation of road recovery works at site. It leads to great loss for regional economy and social activities etc.

Selected Topic:
Content : Planning & Programing Transportation System
About development method of Planning Program for System Transportation about status Province and National Road.

Selected Topic: Public Transport.
Content :
Much challenge for public domain (regulator, operator and user) for give the best service for people, how to manage?

4. Your voice and comments for this joint workshop.

Please, in the next Joint-Workshop all presentation materi in this workshop will be the copy from CD/flash disk for all participan
the participant will be a the best service, so we care and want to join again with this workshop. The invitation, why not to aim for all sector in Indonesia?

Your Name : dinihari mulya lestari
Organization : dinas bmtr prov. banten
E-mail address : diniharimulyalestari@yahoo.com

Thank you for your cooperation!

③

INDONESIA/JAPAN-JOINTWORKSHOP in BANDUNG
Held by RDCRB and NILIM/PWRI

<Questionnaire to Participants>

Thank you very much four your participation in this international joint workshop.
It would be our pleasure to have your cooperation for this questionnaire in order to promote the collaboration between Indonesia and Japan in the research sphere of Roads and Bridges.

1. May we have your overall evaluation on this Workshop ~~by checking charts shown below.~~

	<Excellent> ←				→ <Not Good>
(1) General Session	5	4	3	2	1
if you participated in; (2)-1 Technical Session I (Pavement and Expressway)	5	4	3	2	1
if you participated in; (2) -2 Technical Session II (Disaster and Bridges)	5	4	3	2	1
if you participated in; (2)-3 Technical Session III (Traffic and Technology)	5	4	3	2	1
(3) Discussion of each of (2)	5	4	3	2	1

2. What kind of issues and topics did you get your strongest interest in this workshop?
Please write down specifically in the blank bellow.

(Ex. New Materials of Pavement proposed from Japan side etc.)

3. What sort of theme and issue would you like to cover in the next JOINT-WORKSHOPs ?
When you hit upon some ideas, please check on the blanks(☑) shown below. And, could you write down specific contents as much as possible.

☐Planning of Act and Registration ☐Investment and Prioritization including Evaluation
☑Construction Technology for Road and Bridge (including earthquake resistant construction technology).
☑Maintenance and related issues ☐ITS (Intelligent Transport Systems) technology.
☐Execution and maintenance of the pavement (including high-performance pavement)
☑Capacity Building including Civil Engineering Judgment ☐Procurement Systems
☐Disaster Management ☐Safety in Road ☐Environment issues including Climate Change
☐Relevance between Economy and Road Projects ☐Others

You can select upper-mentioned items as much as possible. Detailed description on your selected items one by one in the blank below will be highly appreciated.

【Example】 Selected Topic: Disaster Management Content : Due to the lack of information communication system between road users & road administration bodies especially in the mountain areas, in the east JAWA area, normally, it takes 3 days for initiation of road recovery works at site. It leads to great loss for regional economy and social activities etc.

Selected Topic: Content :

Selected Topic: Content :

4. Your voice and comments for this joint workshop.

Your Name : SAFRIZAL .

Organization : P2JJ NAD .

E-mail address : zalijzal 77@yahoo.co.id .

Thank you for your cooperation!

④

INDONESIA/JAPAN-JOINTWORKSHOP in BANDUNG
Held by RDCRB and NILIM/PWRI

<Questionnaire to Participants>

Thank you very much four your participation in this international joint workshop.
It would be our pleasure to have your cooperation for this questionnaire in order to promote the collaboration between Indonesia and Japan in the research sphere of Roads and Bridges.

1. May we have your overall evaluation on this Workshop by checking charts shown below.

	<Excellent>				<Not Good>
(1) General Session	5	4	3	2	1
if you participated in; (2)-1 Technical Session I (Pavement and Expressway)	5	4	3	2	1
if you participated in; (2) -2 Technical Session II (Disaster and Bridges)	5	4	3	2	1
if you participated in; (2)-3 Technical Session III (Traffic and Technology)	5	4	3	2	1
(3) Discussion of each of (2)	5	4	3	2	1

2. What kind of issues and topics did you get your strongest interest in this workshop? Please write down specifically in the blank bellow.

(Ex. New Materials of Pavement proposed from Japan side etc.)

* Workshop yang bagus. Sip. Namun ada baiknya bila di buat integratif ~~gak~~ karena NILIM kan mencakup banyak aspek. Bila semua pusat Litbang di berikan kesempatan sepertinya bagus.
* Banyaknya peserta juga perlu dijadikan pertimbangan penataan hidangan karena bnyk waktu terbuang untuk antri, akibatnya org2 bosan & menghilang pasca coffee break

3. What sort of theme and issue would you like to cover in the next JOINT-WORKSHOPs ?
When you hit upon some ideas, please check on the blanks(☑) shown below. And, could you write down specific contents as much as possible.

☐Planning of Act and Registration ☐Investment and Prioritization including Evaluation
☑Construction Technology for Road and Bridge (including earthquake resistant construction technology).
☐Maintenance and related issues ☑ITS (Intelligent Transport Systems) technology.
☐Execution and maintenance of the pavement (including high-performance pavement)
☑Capacity Building including Civil Engineering Judgment ☐Procurement Systems
☐Disaster Management ☐Safety in Road ☑Environment issues including Climate Change
☐Relevance between Economy and Road Projects ☐Others

You can select upper-mentioned items as much as possible. Detailed description on your selected items one by one in the blank below will be highly appreciated.

【Example】
Selected Topic: Disaster Management
Content : Due to the lack of information communication system between road users & road administration bodies especially in the mountain areas, in the east JAWA area, normally, it takes 3 days for initiation of road recovery works at site. It leads to great loss for regional economy and social activities etc.

Selected Topic:
Content : ITS
~~A we need~~ Traffic jam & future problem facing by road development body to reduce and manage. We need a new approach with technology to manage the situation and offcourse more user approach.

Selected Topic:
Content :

4. Your voice and comments for this joint workshop.

It is excellent way to improve & share problem & approach manage by each part & and to find new approach to reduce lost cards by

Your Name : Christanto Yudha Saputra
Organization : Research Institute for Human Settlements
E-mail address : christanto_yudha@yahoo.com

Thank you for your cooperation!

⑤

INDONESIA/JAPAN-JOINTWORKSHOP in BANDUNG
Held by RDCRB and NILIM/PWRI

<Questionnaire to Participants>

Thank you very much four your participation in this international joint workshop.
It would be our pleasure to have your cooperation for this questionnaire in order to promote the collaboration between Indonesia and Japan in the research sphere of Roads and Bridges.

1. May we have your overall evaluation on this Workshop by checking charts shown below.

	<Excellent>				<Not Good>
(1) General Session	5	4	3	2	1
if you participated in; (2)-1 Technical Session I (Pavement and Expressway)	5	4	3	2	1
if you participated in; (2) -2 Technical Session II (Disaster and Bridges)	5	4	3	2	1
if you participated in; (2)-3 Technical Session III (Traffic and Technology)	5	4	3	2	1
(3) Discussion of each of (2)	5	4	3	2	1

2. What kind of issues and topics did you get your strongest interest in this workshop?
Please write down specifically in the blank bellow.

(Ex. New Materials of Pavement proposed from Japan side etc.)

Traffic and Technology

3. What sort of theme and issue would you like to cover in the next JOINT-WORKSHOPs ?
When you hit upon some ideas, please check on the blanks(☑) shown below. And, could you write down specific contents as much as possible.

☐Planning of Act and Registration ☐Investment and Prioritization including Evaluation
☐Construction Technology for Road and Bridge (including earthquake resistant construction technology).
☐Maintenance and related issues ☐ITS (Intelligent Transport Systems) technology.
☐Execution and maintenance of the pavement (including high-performance pavement)
☐Capacity Building including Civil Engineering Judgment ☐Procurement Systems
☐Disaster Management ☐Safety in Road ☐Environment issues including Climate Change
☐Relevance between Economy and Road Projects ☐Others

You can select upper-mentioned items as much as possible. Detailed description on your selected items one by one in the blank below will be highly appreciated.

【Example】 Selected Topic: Disaster Management Content : Due to the lack of information communication system between road users & road administration bodies especially in the mountain areas, in the east JAWA area, normally, it takes 3 days for initiation of road recovery works at site. It leads to great loss for regional economy and social activities etc.

Selected Topic: Content :

Selected Topic: Content :

4. Your voice and comments for this joint workshop.

Your Name :

Organization :

E-mail address :

Thank you for your cooperation!

⑥

INDONESIA/JAPAN-JOINTWORKSHOP in BANDUNG
Held by RDCRB and NILIM/PWRI

<Questionnaire to Participants>

Thank you very much four your participation in this international joint workshop.
It would be our pleasure to have your cooperation for this questionnaire in order to promote the collaboration between Indonesia and Japan in the research sphere of Roads and Bridges.

1. May we have your overall evaluation on this Workshop by checking charts shown below.

	<Excellent> ←→ <Not Good>				
(1) General Session	5	4	3	2	1
if you participated in; (2)-1 Technical Session I (Pavement and Expressway)	5	4	3	2	1
if you participated in; (2) -2 Technical Session II (Disaster and Bridges)	5	4	3	2	1
if you participated in; (2)-3 Technical Session III (Traffic and Technology)	5	4	3	2	1
(3) Discussion of each of (2)	5	4	3	2	1

2. What kind of issues and topics did you get your strongest interest in this workshop?
Please write down specifically in the blank bellow.

(Ex. New Materials of Pavement proposed from Japan side etc.)

Traffic & Technology

3. What sort of theme and issue would you like to cover in the next JOINT-WORKSHOPs ?
When you hit upon some ideas, please check on the blanks(☑) shown below. And, could you write down specific contents as much as possible.

☐Planning of Act and Registration ☐Investment and Prioritization including Evaluation
☑Construction Technology for Road and Bridge (including earthquake resistant construction technology).
☐Maintenance and related issues ☑ITS (Intelligent Transport Systems) technology.
☐Execution and maintenance of the pavement (including high-performance pavement)
☐Capacity Building including Civil Engineering Judgment ☐Procurement Systems
☐Disaster Management ☑Safety in Road ☐Environment issues including Climate Change
☐Relevance between Economy and Road Projects ☐Others

You can select upper-mentioned items as much as possible. Detailed description on your selected items one by one in the blank below will be highly appreciated.

【Example】
Selected Topic: Disaster Management
Content : Due to the lack of information communication system between road users & road administration bodies especially in the mountain areas, in the east JAWA area, normally, it takes 3 days for initiation of road recovery works at site. It leads to great loss for regional economy and social activities etc.

Selected Topic: Safety In Road
Content :

Selected Topic: ITS
Content :

4. Your voice and comments for this joint workshop.

Your Name : VERA
Organization : RDCAB
E-mail address : vg_sanoe@yahoo.com

Thank you for your cooperation!

⑦

INDONESIA/JAPAN-JOINTWORKSHOP in BANDUNG
Held by RDCRB and NILIM/PWRI

<Questionnaire to Participants>

Thank you very much four your participation in this international joint workshop.
It would be our pleasure to have your cooperation for this questionnaire in order to promote the collaboration between Indonesia and Japan in the research sphere of Roads and Bridges.

1. May we have your overall evaluation on this Workshop by checking charts shown below.

	<Excellent> ←				→ <Not Good>
(1) General Session	5	4	3	2	1
if you participated in; (2)-1 Technical Session I (Pavement and Expressway)	5	4	3	2	1
if you participated in; (2) -2 Technical Session II (Disaster and Bridges)	5	4	3	2	1
if you participated in; (2)-3 Technical Session III (Traffic and Technology)	5	4	3	2	1
(3) Discussion of each of (2)	5	4	3	2	1

2. What kind of issues and topics did you get your strongest interest in this workshop?
Please write down specifically in the blank bellow.

(Ex. New Materials of Pavement proposed from Japan side etc.)

Grass Roots ITS : - driving support system for narrow road
- Safety support system at "Stop without safety barriers"

3. What sort of theme and issue would you like to cover in the next JOINT-WORKSHOPs ?
When you hit upon some ideas, please check on the blanks(☑) shown below. And, could you write down specific contents as much as possible.

☐Planning of Act and Registration ☐Investment and Prioritization including Evaluation
☐Construction Technology for Road and Bridge (including earthquake resistant construction technology).
☐Maintenance and related issues ☐ITS (Intelligent Transport Systems) technology.
☐Execution and maintenance of the pavement (including high-performance pavement)
☐Capacity Building including Civil Engineering Judgment ☑Procurement Systems
☐Disaster Management ☑Safety in Road ☑Environment issues including Climate Change
☐Relevance between Economy and Road Projects ☑Others ~~Urban road~~

You can select upper-mentioned items as much as possible. Detailed description on your selected items one by one in the blank below will be highly appreciated.

【Example】 Selected Topic: Disaster Management Content : Due to the lack of information communication system between road users & road administration bodies especially in the mountain areas, in the east JAWA area, normally, it takes 3 days for initiation of road recovery works at site. It leads to great loss for regional economy and social activities etc.

Selected Topic: Content :

Selected Topic: Content :

4. Your voice and comments for this joint workshop.

Good, but please be on time :)

Your Name : Natalia Tanan

Organization : RDCRB

E-mail address : natalia.tanan@gmail.com

Thank you for your cooperation!

⑧

INDONESIA/JAPAN-JOINTWORKSHOP in BANDUNG
Held by RDCRB and NILIM/PWRI

<Questionnaire to Participants>

Thank you very much four your participation in this international joint workshop.
It would be our pleasure to have your cooperation for this questionnaire in order to promote the collaboration between Indonesia and Japan in the research sphere of Roads and Bridges.

1. May we have your overall evaluation on this Workshop by checking charts shown below.

	<Excellent> ← → <Not Good>				
(1) General Session	5	4	3	2	1
if you participated in; (2)-1 Technical Session I (Pavement and Expressway)	5	4	3	2	1
if you participated in; (2) -2 Technical Session II (Disaster and Bridges)	5	4	3	2	1
if you participated in; (2)-3 Technical Session III (Traffic and Technology)	5	4	3	2	1
(3) Discussion of each of (2)	5	4	3	2	1

2. What kind of issues and topics did you get your strongest interest in this workshop? Please write down specifically in the blank bellow.

(Ex. New Materials of Pavement proposed from Japan side etc.)

Integent Transportation System.

3. What sort of theme and issue would you like to cover in the next JOINT-WORKSHOPs ?
When you hit upon some ideas, please check on the blanks(☑) shown below. And, could you write down specific contents as much as possible.

☑Planning of Act and Registration ☑Investment and Prioritization including Evaluation
☐Construction Technology for Road and Bridge (including earthquake resistant construction technology).
☐Maintenance and related issues ☑ITS (Intelligent Transport Systems) technology.
☐Execution and maintenance of the pavement (including high-performance pavement)
☐Capacity Building including Civil Engineering Judgment ☐Procurement Systems
☐Disaster Management ☑Safety in Road ☑Environment issues including Climate Change
☑Relevance between Economy and Road Projects ☐Others

You can select uppermentioned items as much as possible. Detailed description on your selected items one by one in the blank below will be highly appreciated.

[Example]
Selected Topic: Disaster Management
Content : Due to the lack of information communication system between road users & road administration bodies especially in the mountain areas, in the east JAWA area, normally, it takes 3 days for initiation of road recovery works at site. It leads to great loss for regional economy and social activities etc.

Selected Topic: ITS
Content :
Deeper ITS workshop to know appropriate ITS to be implemented in Indonesia regarding to our specific condition and behaviour.

Selected Topic: Environment issues including climate change.
Content :
-> What kind of effort to support environment issue in road project activities? This workshop will present more detail about activities to support environment issues : green road drainage system, etc.

4. Your voice and comments for this joint workshop.

This joint workshop is a good moment to digging our partner experiences in road & bridge as well as to exchange our experience.
I hope this kind of workshop can be held frequently.

Your Name : Handiyana.
Organization : IRE
E-mail address : handi_yn@yahoo.com

Thank you for your cooperation!

⑨

INDONESIA/JAPAN-JOINTWORKSHOP in BANDUNG
Held by RDCRB and NILIM/PWRI

<Questionnaire to Participants>

Thank you very much four your participation in this international joint workshop.
It would be our pleasure to have your cooperation for this questionnaire in order to promote the collaboration between Indonesia and Japan in the research sphere of Roads and Bridges.

1. May we have your overall evaluation on this Workshop by checking charts shown below.

	<Excellent> ←				→ <Not Good>
(1) General Session	5	✓4	3	2	1
if you participated in; (2)-1 Technical Session I (Pavement and Expressway)	5	4	3	2	1
if you participated in; (2) -2 Technical Session II (Disaster and Bridges)	5	4	3	2	1
if you participated in; (2)-3 Technical Session III (Traffic and Technology)	5	✓4	3	2	1
(3) Discussion of each of (2)	5	✓4	3	2	1

2. What kind of issues and topics did you get your strongest interest in this workshop?
Please write down specifically in the blank bellow.

(Ex. New Materials of Pavement proposed from Japan side etc.)

Strategy on ITS Dev in Indonesia by . Lancar.

3. What sort of theme and issue would you like to cover in the next JOINT-WORKSHOPs ?
When you hit upon some ideas, please check on the blanks(☑) shown below. And, could you write down specific contents as much as possible.

☐Planning of Act and Registration ☐Investment and Prioritization including Evaluation
☐Construction Technology for Road and Bridge (including earthquake resistant construction technology).
☐Maintenance and related issues ☐ITS (Intelligent Transport Systems) technology.
☐Execution and maintenance of the pavement (including high-performance pavement)
☐Capacity Building including Civil Engineering Judgment ☐Procurement Systems
☐Disaster Management ☑Safety in Road ☐Environment issues including Climate Change
☐Relevance between Economy and Road Projects ☐Others

You can select upper-mentioned items as much as possible. Detailed description on your selected items one by one in the blank below will be highly appreciated.

【Example】
Selected Topic: Disaster Management
Content : Due to the lack of information communication system between road users & road administration bodies especially in the mountain areas, in the east JAWA area, normally, it takes 3 days for initiation of road recovery works at site. It leads to great loss for regional economy and social activities etc.

Selected Topic: Safe & comfort in road.
Content : due to the lack of management system between road design & road users (any kind of vehicle including motorcycle).

Selected Topic:
Content :

4. Your voice and comments for this joint workshop.

Your Name : Budiprastyo D
Organization : Puslitbang Sebranmas
E-mail address : budiprastyo@pu.go.id

Thank you for your cooperation!

⑩

INDONESIA/JAPAN-JOINTWORKSHOP in BANDUNG
Held by RDCRB and NILIM/PWRI

<Questionnaire to Participants>

Thank you very much four your participation in this international joint workshop.
It would be our pleasure to have your cooperation for this questionnaire in order to promote the collaboration between Indonesia and Japan in the research sphere of Roads and Bridges.

1. May we have your overall evaluation on this Workshop by checking charts shown below.

	<Excellent>				<Not Good>
(1) General Session	5	✓4	3	2	1
if you participated in; (2)-1 Technical Session I (Pavement and Expressway)	5	4	3	2	1
if you participated in; (2) -2 Technical Session II (Disaster and Bridges)	5	4	3	2	1
if you participated in; (2)-3 Technical Session III (Traffic and Technology)	5	✓4	3	2	1
(3) Discussion of each of (2)	5	✓4	3	2	1

2. What kind of issues and topics did you get your strongest interest in this workshop?
Please write down specifically in the blank bellow.

(Ex. New Materials of Pavement proposed from Japan side etc.)

3. What sort of theme and issue would you like to cover in the next JOINT-WORKSHOPs ?
When you hit upon some ideas, please check on the blanks(☑) shown below. And, could you write down specific contents as much as possible.

☐Planning of Act and Registration ☐Investment and Prioritization including Evaluation
☐Construction Technology for Road and Bridge (including earthquake resistant construction technology).
☐Maintenance and related issues ☐ITS (Intelligent Transport Systems) technology.
☐Execution and maintenance of the pavement (~~including high-performance pavement)~~
☐Capacity Building including Civil Engineering Judgment ☐Procurement Systems
☐Disaster Management ☐Safety in Road ☐Environment issues including Climate Change
☐Relevance between Economy and Road Projects ☐Others

You can select upper-mentioned items as much as possible. Detailed description on your selected items one by one in the blank below will be highly appreciated.

【Example】
Selected Topic: Disaster Management
Content : Due to the lack of information communication system between road users & road administration bodies especially in the mountain areas, in the east JAWA area, normally, it takes 3 days for initiation of road recovery works at site. It leads to great loss for regional economy and social activities etc.

Selected Topic:
Content :

Selected Topic:
Content :

4. Your voice and comments for this joint workshop.

Your Name :

Organization :

E-mail address :

Thank you for your cooperation!

⑪

INDONESIA/JAPAN-JOINTWORKSHOP in BANDUNG
Held by RDCRB and NILIM/PWRI

<Questionnaire to Participants>

Thank you very much four your participation in this international joint workshop.
It would be our pleasure to have your cooperation for this questionnaire in order to promote the collaboration between Indonesia and Japan in the research sphere of Roads and Bridges.

1. May we have your overall evaluation on this Workshop by checking charts shown below.

	<Excellent>				<Not Good>
(1) General Session	5	4	3	2	1
if you participated in; (2)-1 Technical Session I (Pavement and Expressway)	5	4	3	2	1
if you participated in; (2) -2 Technical Session II (Disaster and Bridges)	5	4	3	2	1
if you participated in; (2)-3 Technical Session III (Traffic and Technology)	5	4	3	2	1
(3) Discussion of each of (2)	5	4	3	2	1

2. What kind of issues and topics did you get your strongest interest in this workshop? Please write down specifically in the blank bellow.

(Ex. New Materials of Pavement proposed from Japan side etc.)

ITC from Japan Technology, WIM for checking bridge durability

3. What sort of theme and issue would you like to cover in the next JOINT-WORKSHOPs ? When you hit upon some ideas, please check on the blanks(☑) shown below. And, could you write down specific contents as much as possible.

☐Planning of Act and Registration ☐Investment and Prioritization including Evaluation
☐Construction Technology for Road and Bridge (including earthquake resistant construction technology).
☐Maintenance and related issues ☑ITS (Intelligent Transport Systems) technology.
☐Execution and maintenance of the pavement (including high-performance pavement)
☐Capacity Building including Civil Engineering Judgment ☐Procurement Systems
☐Disaster Management ☐Safety in Road ☐Environment issues including Climate Change
☐Relevance between Economy and Road Projects ☐Others

You can select upper-mentioned items as much as possible. Detailed description on your selected items one by one in the blank below will be highly appreciated.

【Example】
Selected Topic: Disaster Management
Content : Due to the lack of information communication system between road users & road administration bodies especially in the mountain areas, in the east JAWA area, normally, it takes 3 days for initiation of road recovery works at site. It leads to great loss for regional economy and social activities etc.

Selected Topic:
Content :
Detection people in narrow road

Selected Topic:
Content :
Detection people who cross the road in the night

4. Your voice and comments for this joint workshop.

It have a good material but have a difficult in spoken ~~be~~ better accent language and need a translator

Your Name : DWI BUDI PERMANA, ST
Organization : PUSJATAN
E-mail address : dwibudipermana@gmail.com

Thank you for your cooperation!

12

INDONESIA/JAPAN-JOINTWORKSHOP in BANDUNG
Held by RDCRB and NILIM/PWRI

<Questionnaire to Participants>

Thank you very much four your participation in this international joint workshop.
It would be our pleasure to have your cooperation for this questionnaire in order to promote the collaboration between Indonesia and Japan in the research sphere of Roads and Bridges.

1. May we have your overall evaluation on this Workshop by checking charts shown below.

	<Excellent> ←→ <Not Good>				
(1) General Session	5	4	3	2	1
if you participated in; (2)-1 Technical Session I (Pavement and Expressway)	5	4	3	2	1
if you participated in; (2) -2 Technical Session II (Disaster and Bridges)	5	4	3	2	1
if you participated in; (2)-3 Technical Session III (Traffic and Technology)	5	4	3	2	1
(3) Discussion of each of (2)	5	4	3	2	1

2. What kind of issues and topics did you get your strongest interest in this workshop? Please write down specifically in the blank bellow.

(Ex. New Materials of Pavement proposed from Japan side etc.)

ITS & Smart Structure.

3. What sort of theme and issue would you like to cover in the next JOINT-WORKSHOPs ?
When you hit upon some ideas, please check on the blanks(☑) shown below. And, could you write down specific contents as much as possible.

☐Planning of Act and Registration ☐Investment and Prioritization including Evaluation
☐Construction Technology for Road and Bridge (including earthquake resistant construction technology).
☐Maintenance and related issues ☐ITS (Intelligent Transport Systems) technology.
☐Execution and maintenance of the pavement (including high-performance pavement)
☐Capacity Building including Civil Engineering Judgment ☐Procurement Systems
☐Disaster Management ☑Safety in Road ☐Environment issues including Climate Change
☐Relevance between Economy and Road Projects ☐Others

You can select upper-mentioned items as much as possible. Detailed description on your selected items one by one in the blank below will be highly appreciated.

【Example】 Selected Topic: Disaster Management Content : Due to the lack of information communication system between road users & road administration bodies especially in the mountain areas, in the east JAWA area, normally, it takes 3 days for initiation of road recovery works at site. It leads to great loss for regional economy and social activities etc.

Selected Topic: Content :

Selected Topic: Content :

4. Your voice and comments for this joint workshop.

Your Name : Sandi

Organization : Lalulintas

E-mail address : sandi-pras @ yahoo.com

Thank you for your cooperation!

⑬

INDONESIA/JAPAN-JOINTWORKSHOP in BANDUNG
Held by RDCRB and NILIM/PWRI

<Questionnaire to Participants>

Thank you very much four your participation in this international joint workshop.
It would be our pleasure to have your cooperation for this questionnaire in order to promote the collaboration between Indonesia and Japan in the research sphere of Roads and Bridges.

1. May we have your overall evaluation on this Workshop by checking charts shown below.

	<Excellent>				<Not Good>
(1) General Session	5	4	3	2	1
if you participated in; (2)-1 Technical Session I (Pavement and Expressway)	5	~~4~~	3	2	1
if you participated in; (2) -2 Technical Session II (Disaster and Bridges)	5	4	3	2	1
if you participated in; (2)-3 Technical Session III (Traffic and Technology)	5	4	3	2	1
(3) Discussion of each of (2)	5	4	3	2	1

2. What kind of issues and topics did you get your strongest interest in this workshop? Please write down specifically in the blank bellow.

(Ex. New Materials of Pavement proposed from Japan side etc.)
ITC Should be pay attention about the Motorcycle behaviour and Road Condition.

3. What sort of theme and issue would you like to cover in the next JOINT-WORKSHOPs ?
When you hit upon some ideas, please check on the blanks(☑) shown below. And, could you write down specific contents as much as possible.

☐Planning of Act and Registration ☐Investment and Prioritization including Evaluation
☐Construction Technology for Road and Bridge (including earthquake resistant construction technology).
☐Maintenance and related issues ☐ITS (Intelligent Transport Systems) technology.
☐Execution and maintenance of the pavement (including high-performance pavement)
☐Capacity Building including Civil Engineering Judgment ☐Procurement Systems
☐Disaster Management ☑Safety in Road ☐Environment issues including Climate Change
☐Relevance between Economy and Road Projects ☐Others

You can select upper-mentioned items as much as possible. Detailed description on your selected items one by one in the blank below will be highly appreciated.

【Example】
Selected Topic: Disaster Management
Content : Due to the lack of information communication system between road users & road administration bodies especially in the mountain areas, in the east JAWA area, normally, it takes 3 days for initiation of road recovery works at site. It leads to great loss for regional economy and social activities etc.

Selected Topic: Safety in Road
Content : Road Condition can be determine the Safety of driven so it must be Well Maintenance.

Selected Topic:
Content :

4. Your voice and comments for this joint workshop.

Good Workshop

Your Name : Ivan Hernat H
Organization : Pusjatan
E-mail address : haryantohivar@gmail.com

Thank you for your cooperation!

⑭

INDONESIA/JAPAN-JOINTWORKSHOP in BANDUNG
Held by RDCRB and NILIM/PWRI

<Questionnaire to Participants>

Thank you very much four your participation in this international joint workshop.
It would be our pleasure to have your cooperation for this questionnaire in order to promote the collaboration between Indonesia and Japan in the research sphere of Roads and Bridges.

1. May we have your overall evaluation on this Workshop by checking charts shown below.

	<Excellent>				<Not Good>
(1) General Session	5	4	3	2	1
if you participated in; (2)-1 Technical Session I (Pavement and Expressway)	5	4	3	2	1
if you participated in; (2) -2 Technical Session II (Disaster and Bridges)	5	4	3	2	1
if you participated in; (2)-3 Technical Session III (Traffic and Technology)	5	4	3	2	1
(3) Discussion of each of (2)	5	4	3	2	1

2. What kind of issues and topics did you get your strongest interest in this workshop? Please write down specifically in the blank bellow.

(Ex. New Materials of Pavement proposed from Japan side etc.)

The topic that presentated by Japan side on traffic & Technology (ITS & smart structure)

3. What sort of theme and issue would you like to cover in the next JOINT-WORKSHOPs ? When you hit upon some ideas, please check on the blanks(☑) shown below. And, could you write down specific contents as much as possible.

☑Planning of Act and Registration ☐Investment and Prioritization including Evaluation
☐Construction Technology for Road and Bridge (including earthquake resistant construction technology).
☐Maintenance and related issues ☐ITS (Intelligent Transport Systems) technology.
☐Execution and maintenance of the pavement (including high-performance pavement)
☐Capacity Building including Civil Engineering Judgment ☐Procurement Systems
☐Disaster Management ☑Safety in Road ☑Environment issues including Climate Change
☑Relevance between Economy and Road Projects ☐Others

You can select upper-mentioned items as much as possible. Detailed description on your selected items one by one in the blank below will be highly appreciated.

【Example】
Selected Topic: Disaster Management
Content : Due to the lack of information communication system between road users & road administration bodies especially in the mountain areas, in the east JAWA area, normally, it takes 3 days for initiation of road recovery works at site. It leads to great loss for regional economy and social activities etc.

Selected Topic:
Content :
Make the transportation based on environment aspect

Selected Topic:
Content :
Minimalized the number of accident Indonesia road

4. Your voice and comments for this joint workshop.

A good refference especially the topic from Japan, we can used that system for transportation system in Indonesia

Your Name : Redi Aditya Y. ST,
Organization : Ministry of Public works
E-mail address :

Thank you for your cooperation!

15

INDONESIA/JAPAN-JOINTWORKSHOP in BANDUNG
Held by RDCRB and NILIM/PWRI

<Questionnaire to Participants>

Thank you very much four your participation in this international joint workshop.
It would be our pleasure to have your cooperation for this questionnaire in order to promote the collaboration between Indonesia and Japan in the research sphere of Roads and Bridges.

1. May we have your overall evaluation on this Workshop by checking charts shown below.

	<Excellent> ←→ <Not Good>				
(1) General Session	5	4	3	2	1
if you participated in; (2)-1 Technical Session I (Pavement and Expressway)	5	4 ✓	3	2	1
if you participated in; (2) -2 Technical Session II (Disaster and Bridges)	5	4	3	2	1
if you participated in; (2)-3 Technical Session III (Traffic and Technology)	5	✓	3	2	1
(3) Discussion of each of (2)	5	4	3	2	1

2. What kind of issues and topics did you get your strongest interest in this workshop?
Please write down specifically in the blank bellow.

(Ex. New Materials of Pavement proposed from Japan side etc.)

The technology is high tech. But still have a weakness and disadvantages.
How about the human resources, it will reduce work field become unimployed.
The most important thing is driver attitude in driving

3. What sort of theme and issue would you like to cover in the next JOINT-WORKSHOPs ?
When you hit upon some ideas, please check on the blanks(☑) shown below. And, could you write down specific contents as much as possible.

☐Planning of Act and Registration ☐Investment and Prioritization including Evaluation
☐Construction Technology for Road and Bridge (including earthquake resistant construction technology).
☐Maintenance and related issues ☑ITS (Intelligent Transport Systems) technology.
☐Execution and maintenance of the pavement (including high-performance pavement)
☐Capacity Building including Civil Engineering Judgment ☐Procurement Systems
☐Disaster Management ☑Safety in Road ☐Environment issues including Climate Change
☐Relevance between Economy and Road Projects ☐Others

You can select upper-mentioned items as much as possible. Detailed description on your selected items one by one in the blank below will be highly appreciated.

【Example】
Selected Topic: Disaster Management
Content : Due to the lack of information communication system between road users & road administration bodies especially in the mountain areas, in the east JAWA area, normally, it takes 3 days for initiation of road recovery works at site. It leads to great loss for regional economy and social activities etc.

Selected Topic: ITS (Intelligent Transport Systems) technology.
Content : We need an advance ITS with Human Resources to solve our problem in trafic jam in several location. lots of disadvanteges from abad trafic jam. We can start from the sytems than the work, work with a good system more long last.

Selected Topic: Safety in Road
Content : Theres still alots of people died useless, because safety in road. This need to solve Immidiately

4. Your voice and comments for this joint workshop.

- Very usefull, to get a news things in science.
- The next workshop I hope it will be provide with langgue translator, couse not all the participant capable speak & knowing english well
- The speakers hopefully comunicaten in two ways
- Better than nothing

Your Name : Izumi Muzorrobin
Organization : BPJN VIII Denpasar
E-mail address : obin02@yahoo.com

Thank you for your cooperation!

16

INDONESIA/JAPAN-JOINTWORKSHOP in BANDUNG
Held by RDCRB and NILIM/PWRI

<Questionnaire to Participants>

Thank you very much four your participation in this international joint workshop.
It would be our pleasure to have your cooperation for this questionnaire in order to promote the collaboration between Indonesia and Japan in the research sphere of Roads and Bridges.

1. May we have your overall evaluation on this Workshop by checking charts shown below.

	<Excellent>				<Not Good>
(1) General Session	5	4	3	2	1
if you participated in; (2)-1 Technical Session I (Pavement and Expressway)	5	4	3	2	1
if you participated in; (2) -2 Technical Session II (Disaster and Bridges)	5	4	3	2	1
if you participated in; (2)-3 Technical Session III (Traffic and Technology)	5	4	3	2	1
(3) Discussion of each of (2)	5	4	3	2	1

2. What kind of issues and topics did you get your strongest interest in this workshop? Please write down specifically in the blank bellow.

(Ex. New Materials of Pavement proposed from Japan side etc.)

3. What sort of theme and issue would you like to cover in the next JOINT-WORKSHOPs ?
When you hit upon some ideas, please check on the blanks(☑) shown below. And, could you write down specific contents as much as possible.

☐Planning of Act and Registration ☐Investment and Prioritization including Evaluation
☐Construction Technology for Road and Bridge (including earthquake resistant construction technology).
☐Maintenance and related issues ☐ITS (Intelligent Transport Systems) technology.
☐Execution and maintenance of the pavement (including high-performance pavement)
☐Capacity Building including Civil Engineering Judgment ☐Procurement Systems
☐Disaster Management ☐Safety in Road ☐Environment issues including Climate Change
☐Relevance between Economy and Road Projects ☐Others

You can select upper-mentioned items as much as possible. Detailed description on your selected items one by one in the blank below will be highly appreciated.

【Example】
Selected Topic: Disaster Management
Content : Due to the lack of information communication system between road users & road administration bodies especially in the mountain areas, in the east JAWA area, normally, it takes 3 days for initiation of road recovery works at site. It leads to great loss for regional economy and social activities etc.

Selected Topic:
Content :

Selected Topic:
Content :

4. Your voice and comments for this joint workshop.

Your Name : Ir. AGUS HERI PRIYANTO
Organization : DINAS BINA MARGA, PROV. NAD.
E-mail address : STAF TEKNIK

Thank you for your cooperation!

⑰

INDONESIA/JAPAN-JOINTWORKSHOP in BANDUNG
Held by RDCRB and NILIM/PWRI

<Questionnaire to Participants>

Thank you very much four your participation in this international joint workshop.
It would be our pleasure to have your cooperation for this questionnaire in order to promote the collaboration between Indonesia and Japan in the research sphere of Roads and Bridges.

1. May we have your overall evaluation on this Workshop by checking charts shown below.

	<Excellent>				<Not Good>
(1) General Session	5	4	3	2	1
if you participated in; (2)-1 Technical Session I (Pavement and Expressway)	5	4	3	2	1
if you participated in; (2) -2 Technical Session II (Disaster and Bridges)	5	4	3	2	1
if you participated in; (2)-3 Technical Session III (Traffic and Technology)	5	4	3	2	1
(3) Discussion of each of (2)	5	4	3	2	1

2. What kind of issues and topics did you get your strongest interest in this workshop?
Please write down specifically in the blank bellow.

(Ex. New Materials of Pavement proposed from Japan side etc.)

Between each presentation should be time (5 minute) to let the participant to move from one room to other.

3. What sort of theme and issue would you like to cover in the next JOINT-WORKSHOPs ?
When you hit upon some ideas, please check on the blanks(☑) shown below. And, could you write down specific contents as much as possible.

☐Planning of Act and Registration ☐Investment and Prioritization including Evaluation
☐Construction Technology for Road and Bridge (including earthquake resistant construction technology).
☐Maintenance and related issues ☐ITS (Intelligent Transport Systems) technology
☐Execution and maintenance of the pavement (including high-performance pavement)
☐Capacity Building including Civil Engineering Judgment ☐Procurement Systems
☐Disaster Management ☐Safety in Road ☐Environment issues including Climate Change
☐Relevance between Economy and Road Projects ☐Others

You can select upper-mentioned items as much as possible. Detailed description on your selected items one by one in the blank below will be highly appreciated.

【Example】
Selected Topic: Disaster Management
Content : Due to the lack of information communication system between road users & road administration bodies especially in the mountain areas, in the east JAWA area, normally, it takes 3 days for initiation of road recovery works at site. It leads to great loss for regional economy and social activities etc.

Selected Topic:
Content :

Selected Topic:
Content :

4. Your voice and comments for this joint workshop.

Should [illegible] time (±5 minute) between each presentation to let participan move from one room to other room

Your Name : [illegible]
Organization : PT [illegible]
E-mail address :

Thank you for your cooperation!

INDONESIA/JAPAN-JOINTWORKSHOP in BANDUNG
Held by RDCRB and NILIM/PWRI

18

<Questionnaire to Participants>

Thank you very much four your participation in this international joint workshop.
It would be our pleasure to have your cooperation for this questionnaire in order to promote the collaboration between Indonesia and Japan in the research sphere of Roads and Bridges.

1. May we have your overall evaluation on this Workshop by checking charts shown below.

	<Excellent>				<Not Good>
(1) General Session	5	4	3	2	1
if you participated in; (2)-1 Technical Session I (Pavement and Expressway)	5	4	3	2	1
if you participated in; (2) -2 Technical Session II (Disaster and Bridges)	5	4	3	2	1
if you participated in; (2)-3 Technical Session III (Traffic and Technology)	5	4	3	2	1
(3) Discussion of each of (2)	5	4	3	2	1

2. What kind of issues and topics did you get your strongest interest in this workshop? Please write down specifically in the blank bellow.

(Ex. New Materials of Pavement proposed from Japan side etc.)

Pavement Strategy in Japan by Mr. Kubo, MSc

3. What sort of theme and issue would you like to cover in the next JOINT-WORKSHOPs ? When you hit upon some ideas, please check on the blanks(☑) shown below. And, could you write down specific contents as much as possible.

☐Planning of Act and Registration ☐Investment and Prioritization including Evaluation
☐Construction Technology for Road and Bridge (including earthquake resistant construction technology).
☐Maintenance and related issues ☐ITS (Intelligent Transport Systems) technology.
☐Execution and maintenance of the pavement (including high-performance pavement)
☐Capacity Building including Civil Engineering Judgment ☐Procurement Systems
☐Disaster Management ☐Safety in Road ☐Environment issues including Climate Change
☐Relevance between Economy and Road Projects ☐Others

You can select upper-mentioned items as much as possible. Detailed description on your selected items one by one in the blank below will be highly appreciated.

【Example】 Selected Topic: Disaster Management Content : Due to the lack of information communication system between road users & road administration bodies especially in the mountain areas, in the east JAWA area, normally, it takes 3 days for initiation of road recovery works at site. It leads to great loss for regional economy and social activities etc.
Selected Topic: Content :
Selected Topic: Content :

4. Your voice and comments for this joint workshop.

Cukup baik. Disarankan agar rencana presentasi disusun sedemikian rupa sehingga bisa pudah/menclik setiap topik.

Your Name : SOEDARMANTO D

Organization : TIM TEKNIS

E-mail address : –

Thank you for your cooperation!

19

INDONESIA/JAPAN-JOINTWORKSHOP in BANDUNG
Held by RDCRB and NILIM/PWRI

<Questionnaire to Participants>

Thank you very much four your participation in this international joint workshop.
It would be our pleasure to have your cooperation for this questionnaire in order to promote the collaboration between Indonesia and Japan in the research sphere of Roads and Bridges.

1. May we have your overall evaluation on this Workshop by checking charts shown below.

	<Excellent>				<Not Good>
(1) General Session	5	4	3	2	1
if you participated in; (2)-1 Technical Session I (Pavement and Expressway)	5	4	3	2	1
if you participated in; (2) -2 Technical Session II (Disaster and Bridges)	5	4	3	2	1
if you participated in; (2)-3 Technical Session III (Traffic and Technology)	5	4	3	2	1
(3) Discussion of each of (2)	5	4	3	2	1

2. What kind of issues and topics did you get your strongest interest in this workshop? Please write down specifically in the blank bellow.

(Ex. New Materials of Pavement proposed from Japan side etc.)

Multiple Fail-safe system effectiveness of unseating prevention that was verified in Earthquake (2003)

3. What sort of theme and issue would you like to cover in the next JOINT-WORKSHOPs ? When you hit upon some ideas, please check on the blanks(☑) shown below. And, could you write down specific contents as much as possible.

☐Planning of Act and Registration ☐Investment and Prioritization including Evaluation
☑Construction Technology for Road and Bridge (including earthquake resistant construction technology).
☑Maintenance and related issues ☐ITS (Intelligent Transport Systems) technology.
☐Execution and maintenance of the pavement (including high-performance pavement)
☑Capacity Building including Civil Engineering Judgment ☐Procurement Systems
☑Disaster Management ☐Safety in Road ☐Environment issues including Climate Change
☐Relevance between Economy and Road Projects ☐Others

You can select upper-mentioned items as much as possible. Detailed description on your selected items one by one in the blank below will be highly appreciated.

【Example】
Selected Topic: Disaster Management
Content : Due to the lack of information communication system between road users & road administration bodies especially in the mountain areas, in the east JAWA area, normally, it takes 3 days for initiation of road recovery works at site. It leads to great loss for regional economy and social activities etc.

Selected Topic: Construction Technology for Road & Bridge
Content :
• Long span bridge design & construction techniques & the influence of faulting on the earthquake resistancy (Sunda Strait
& • Testing methods for aerodynamic stability.)

Selected Topic: Maintenance & Related issues
Content : Restoration programs for post disaster Repair in quick efficient Remedial operation. to Rehabilitation of the Road-bridge network. after earthquake.

4. Your voice and comments for this joint workshop.

This workshop brings new ideas & innovations for Research in future & applied technology

Your Name : Lanneke Tristanto Ms.
Organization : RDC RB
E-mail address : lanneketristanto@gmail.com

Thank you for your cooperation!

3.　今後の外交的活動について

3.　今後の外交的活動について

（１）　国総研における外交的活動の目標と領域の再設定

従来の旧建設領域は、
・*「欧米」へは知識や最新情報の取得*
・*「アジア」へは工事受注活動*
・*２国間活動も、本省の枠組みの下での本省業務「請負型（独自マネジメントの弱さ）」*

↓ 問題提起

欧米からは知識を吸収して**研究**成果を国内活用、**アジア**では援助**工事**の単発受注という、「**欧米と研究しアジアで工事**」というパラダイムのままで良いのか？

↓ 視点を変える

＜アジアにおける関連技術市場の創造＞

・**長大橋梁・トンネル技術や保全システム**
・幹線道路に標準装備された**排水性舗装**（雨天時の安全性）
・**交通状況分析**、交通機関分担や渋滞対策の**立案技術**
・洪水、土砂災害**警報システム**、IT 活用（**交通管制等**）
・**環境保全、合意形成等**の**地域施策**　等

→　アジアにはこれらの巨大な市場が潜在する

↓ 従来パターンからの脱却、研究所としてできることは何か？

「**巨大建設市場の創造を視野にアジアとの研究を戦略的に展開**」という新たなパラダイムへ、国総研の外交的活動の**目標と領域の重点をシフト**していくべき。

（２）　アジア建設市場での国総研の外交的活動

＜研究フェーズでこそできること＞

・共同 WS を開催しわが国の優れた技術をアピール
・相手国キーマンの特定と組織的な関係（文書）づくり
・共同研究等による当該技術の適応性の向上
・相手国の計画への当該技術やスペックの書き込み
・高い適応技術を有する、相手国との合併会社で建設する等、アジアにおける当該技術市場を広げていく

＜国総研の現状と今後の外交的戦略に関するまとめ＞

・わが国の国内市場が縮小する中、アジアには巨大な建設需要。アジアの成長の取り込みが不可欠。
・標準化も現状で欧州に有利、世界市場のヘゲモニーを握るためにも、わが国はアジア各国との連携、取り込みが必要。

・「国（国交省）という立場」
・「技術政策を研究するという権能」を有する国総研が、アジアの建設市場の獲得に向けて戦略的に研究連携を展開していくことが大切。」

（重点国）
・２０２０年頃に中国を人口で抜く「インド」
・国際収支プラスの「インドネシア」
・急成長が期待される「ベトナム」

国土技術政策総合研究所資料
TECHNICAL NOTE of NILIM
No.597　　　　　　June 2010

編集･発行　©国土技術政策総合研究所

本資料の転載･複写の問い合わせは
〒305-0804　茨城県つくば市旭 1 番地
企画部研究評価･推進課　TEL:029-864-2675