ミャンマー連邦共和国
建設省公共事業庁(PW)

ミャンマー国
災害多発地域における
道路技術改善プロジェクト

プロジェクト業務完了報告書

平成 27 年 7 月
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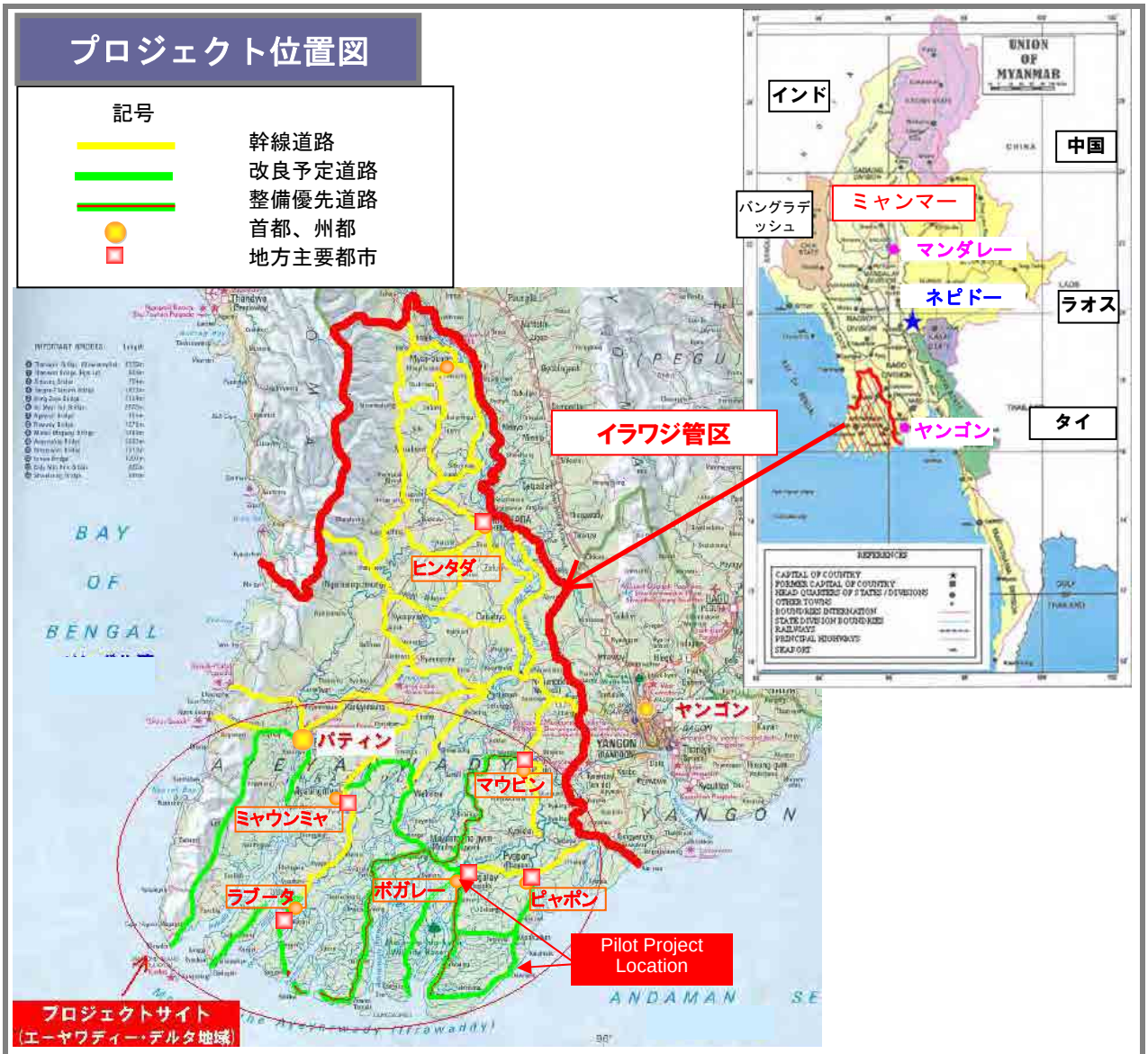
独立行政法人
国際協力機構（JICA）

ペガサスエンジニアリング株式会社
株式会社オリエンタルコンサルタンツグローバル

基盤
JR
15-150

プロジェクト位置図



ミャンマー連邦共和国 及び イラワジ管区 概要

基本データ	ミャンマー国	イラワジ管区
■ 面積	68 万 km^2	3.5 万 km^2
■ 人口	624 万（2011, IMF）	618 万（2014）
■ 首都	ネピート	パテイン
■ 民族	ビルマ族（70 %）	
■ 言語	ビルマ語	
■ 宗教	仏教徒(90 %)，キリスト教徒，イスラム教徒	
■ 通貨	Kyat (1$=818 Kyat, 2012 年 4 月)	
■ 主要産業	農業	
■ GNP 一人当たり	702 $ (200~1400 by CIA)	9 $ (2011)
■ 経済成長率	5.5 %	10.2 % (2011)
■ 物価上昇率	7.3 %	

略語表

AASHTO	American Association of State Highways and Transport Officials
AE	Assistant Engineer　技師補
AH	Asian Highway
ASAL	Average Standard Axle Load　平均標準軸荷重
BIMETEC	Bay of Bengal Initiative for Multi-Sect oral Technical & Economic Cooperation
BOT	Built, Operation & Transfer
CE	Chief Engineer　技師長
CTC	Central Training Center　中央訓練センター
DD	Deputy Director
DDA	Department of Development Affairs of MOBA　国境省開発局
DMD	Deputy Managing Director　副総裁
DSE	Deputy Superintending Engineer　副監督技師
EE	Executive Engineer　上級技師
Furlong	1/8 mile　約200m
GMS	Greater Mekong Sub- region
GOM	the Government of the Republic of the Union of Myanmar　ミャンマー政府
JPSC	JICA Project Supporting Committee　JICA支援委員会
LBT	Labor Based Technique　労働集約型技術
MOBA	Ministry of Boarder Affairs (Myanmar)　国境省
MOC	Ministry of Construction (Myanmar)　建設省
MES	Myanmar Engineering Society　ミャンマー技術協会
MLIT	Ministry of Land, Infrastructure and Transportation (Japan)　国交省
MM	Minutes of Meeting　議事録
MTC	Mechanical Training Center (Myanmar)　機材訓練センター
NPT	Nay Pyi Taw
ORN	Oversea Road Notes　海外道路基準
PD	Project Director　プロジェクトダイレクター
PM	Project Manager　プロジェクトマネージャー
PP	Pilot Project　パイロットプロジェクト
PW	Public Works　公共事業庁
RCSU	Regional Construction Special Unit　特定地域建設特別部
RD	Record of Discussion　討議録
RRL	Road Research Laboratory　道路研究所
SRL	Soil Research Laboratory　土質研究所
TCP	Technical Cooperation Project　技術協力プロジェクト
WP	Work Plan　実施計画
YGN	Yangon

換算レート (2015 年 3 月)
US$1.00=Japanese Yen 119.03
MMK1.00=Japanese Yen 0.117

目次

第１章 プロジェクトの概要 （背景・経緯・目的）

1.1 プロジェクの背景と目的

エーヤワディ管区は、ミャンマー連邦共和国の14の行政区の一つであり、面積約35,000 km2、総人 618 万（2014 年現在）パテイン、ヒンタダ、ミャンミャ、マウビン、ピャポン、ラプラタの 6 つの県からなる。各管区は、中央政府とは別個に知事を筆頭とする独立した地方政府をもつ。

エーヤワディ管区のおよそ南半分[1]がエーヤワディ河口デルタの軟弱地盤地帯となっており、潮汐の影響を受ける地域であるがその干満差が最大で数 m におよぶ。

エーヤワディ河口デルタの軟弱地盤地帯は、19 世紀半ばまでは、ほとんど人の入らない地域であったが、現在は大水田地帯となっていて、ミャンマー全体の 5 割をしめる生産高（600 万トン/年）をあげており、人口は急増してきている。しかし、近年は水田をつぶし、魚の養殖が盛んになってきており、鮮魚の運搬車（総重量 40 トン級）が道路交通の中の最重量車で、将来の道路舗装構造設計上の重要課題となっている。

気候は、5 月半ばから 11 月半ばにかけ、雨季が半年間あり、その間の雨量は半年で 3000 mm を超え、時に時間降雨量 30 mm/h を超えることも稀ではない。雨季の期間、道路工事は、維持補修を除き原則行われず、乾季に使う材料の確保が主体となる。

エーヤワディ・デルタの道路路床は、半年間続く乾季には、一見ソイルセメントのように固結するため、厚さが 10 cm 以下のマカダム舗装のみでも、立派な道路に仕上がる。しかし、5 月から 11 月の半年に及ぶ雨季に入ると、通過車両により路床までこね返され軟弱化し、通行が非常に困難となる。この雨季の降り続く雨の中で、応急的穴埋め等の対策補修は繰り返し行われてきている。本地域では骨材等の材料が入手しにくく、良質材は遠く数百 km 上流のマンダレイ地域等から船で運んでこなければならない点が道路工事遂行上の問題となっている。運搬費が高額となるため、予算が十分とは言えない PW では工事費を節約することが重要課題となっている。

エーヤワディ・デルタ地域は恒常的にモンスーンの通り道となっていて、毎年被害がでている。特に 2008 年には死者 138,000 人以上、損失額 1,300 億円に達する巨大サイクロン「ナルギス」の甚大な被害を受けた。当時、道路事情が悪く、救援活動や復旧作業の大きな障害となったことから、ミャンマー国政府は翌 2009 年から災害時の対策のためデルタ地域において、災害時非常用道路として 11 路線（総延長 888 km）と、多数のエーヤワディ川支流に 50 カ所以上の長大橋梁を建設する道路整備 5 カ年計画をたて、実行してきている。

日本政府は、他の援助機関と協力しこの復旧事業を支援するため、2012 年 2 月の討議議事録（MM）および同年 7 月に署名された討議記録（RD）に基づき、表 1.1 に示す成果目標を達成するため本技術協力プロジェクト（技プロ）を 3 年間の予定で行うことを決定した。

[1] 参考：これは関東平野の全面積 17,000 km2 に相当する。

1.2 プロジェクト目標

本技プロの 2 つの成果目標は、下表に示すように長期専門家の担当部分と短期専門家の担当部分に区分されていた。

表 1.1 プロジェクト目標と成果目標

本プロジェクトの目的	災害多発地域（エーヤーワディ･デルタ地域）に適用可能な道路整備にかかる PW の能力が強化される。	
成果目標	1）道路設計・建設のための基準・マニュアルの改善	（長期専門家が主体）
	2）道路技術者のエーヤワディ地域に適用可能な実用的な技能、知識についての強化	（短期専門家が主体）

パイロット事業の概要を表 1.2 に示す。

5 月から 11 月の雨季の間は、現場に近づくことができなくなるため、パイロット事業は、プロジェクト期間中 2 回ある乾季中（12 月から 4 月）に行われた。(以後 1 期目を PP-1、2 期目を PP-2 と呼ぶ)
なお、PP-2 では、路床・路盤安定処理と高盛土区間の対策の 2 項目を実施した。

表 1.2 パイロット事業の概要

	時期	概要	場所
PP-1 （第 1 回）	2013 年末 ～翌年 4 月	路床・路盤の安定処理工法を中心とした道路整備の能力強化を行った。	エーヤワディ・デルタの新規改良道路 11 路線の中の 7 号線
PP-2 （第 2 回）	2014 年末 ～翌年 4 月	路線・工法を替え、第 1 回の反省を踏まえ再度安定処理工法を中心とした道路整備の能力強化を行った。	10 号線（Kyew Chan Ye Kyaw 橋経由 1 号線への取り付け道路）
		橋梁取り付け高盛土区間で安定性や沈下の問題について高盛土動態観測を実施し対処方法の能力強化を行った。	10 号線 Kyew Chan Ye Kyaw 橋の橋台への取り付け道路

1.3 PDM とその評価指標

PDM はプロジェクトの基本方針である。当初の PDM(Ver. 0.0)は 2012 年 2 月に JICA 事前調査チームによって作成された。

プロジェクト開始当初の 2013 年 5 月 27 日ヤンゴンで PCM ワークショップが開催され約 40 名が出席し PDM の見直し作業を通じプロジェクトの内容の理解を深めた。

プロジェクトの評価指標については、定性目標と定量目標の 2 種類の評価指標の設定が望ましいという同意の上に、参加者から多くの意見が出され、討論の結果が PDM(Ver. 1.0)として取りまとめられた。(Annex 1) この PDM(Ver. 1.0)は、2013 年 9 月 4 日に NPT で開催された JCC において承認を受けている。

しかしその後、PDM(Ver. 1.0)の評価指標は、達成度を正確に把握するためには十分ではないと判断され、2014 年 6 月の中間評価時に指標を改訂するよう提言がなされた。表 1-3 にこの提言された PDM(Ver. 2.0)の評価指標をしめす。TCP チームは、PW に対し、指標変更について JCC での正式承認を要請したが、PW 側は他機関からの援助が多数同時並行しておりその処理に多忙なため JCC を開催することは困難との見解が示されたため、PD(プロジェクトダイレクター)との数回の討議を経て同 2014 年 12 月に PD を通じ MD の署名入り指標の変更内容を示す一覧表を入手した。（参照 Annex 1-5）

表 1.3 PDM および新評価指標

	目標	評価指標 PDM (Ver. 1.0)	新評価指標 (Ver. 2.0)
上位目標	災害多発地域(エーヤーワディ・デルタ地域) の道路が改善される	デルタ地域のPW管轄下における道路施工距離が増加する	定量的目標：パイロットプロジェクトで導入された安定処理技術により建設された道路が 10 ㎞以上となる。
		短縮された運転時間・旅行時間.	定性的目標：運転・旅行時間がプロジェクト実施前に比べ10%減少する。
	指標変更理由：	上位目標はプロジェクト完了後 3 年で評価されるものであるので明確な指標設定が好ましいが、Ver. 1.0 の指標はプロジェクトによる効果を明確に示していない。	
プロジェクト目標	災害多発地域(エーヤーワディ･デルタ地域) に適用可能な道路整備にかかるPWの能力が強化される.	1. パイロットプロジェクトで導入された技術により建設された道路延長	定量目標： プロジェクト完了までに、パイロットプロジェクトを通じ技術移転された工法による道路建設総延長が 2.6 km 以上となる。
		2. デルタ地区での道路の改善状況	定性目標：道路設計および建設についての技術者の技量向上が 30 人以上の職員からのヒアリングを通じ確認される。
	指標変更理由：	Ver. 1.0には定量目標が示されていない. 道路技術者の能力強化程度を示すほうが良い	
成果1	道路設計および施工に関する技術基準･マニュアルが改善される	1-1. PW が開発する道路技術基準･マニュアルの作成数が増加する。	定量目標：新軟弱地盤処理マニュアルが PW 内で討議され承認される
			定性目標：10 名以上の技術者が作成されたマニュアルにより業務を行っている
	指標変更理由：	基準やマニュアルの作成数を示すより、受け入れ状況を示すほうが好ましい	
成果2	道路技術者のエーヤワディ･デルタ地域に適用可能な道路設計･施工にかかる実用的なスキル･知識が向上する.	2-1. 訓練を受けた技術者数 *(セミナーワークショップ OJT).*	定量目標：PW の中の訓練を受けたスタッフ数合計が 300 人以上となる.
			定性目標：参加者の 50%が訓練やセミナーの効果を評価する。
	指標変更理由：	2013 年中にセミナー・ワークショップ･OJT への参加者数は右表のようになったが､プロジェクトとしての最終目標数を示すことが望ましい。	

	参加者数
セミナー	52
ワークショップ1	39
ワークショップ2	40
OJT	15

1.4 プロジェクトの実施体制

a）JICA 専門家チームは、長期専門家チームと短期専門家チームとからなる。

表 1.4 専門家実施体制

JICA 専門家長期チーム

	分担	氏名	着任	離任	
長期専門家	チーフアドバイザー	藤本昭	13 年 2 月	13 年 7 月	2013 年半ば、病気のため任期半ばで帰国
	道路技術基準	三宅将	13 年 7 月	15 年 6 月	
	業務調整員	石田和基	13 年 4 月	15 年 6 月	

JICA 専門家短期チーム（実施体制は、第 1 期と第 2 期で異なる。）

		PP-1	PP-2	
総括／道路計画／評価	兼田	0	0	契約変更で 3.5 MM 追加
副総括／施工技術 1（設計）	小林	0	0	契約変更で 5.0 MM 追加
施工技術 2（施工監理）	藤熊	0		
	Akmar	0	0	契約変更で 3.6 MM 追加
調査・軟弱地盤対策 1	米山 西嶋	0	 0	契約変更で離任（7.0 MM 減） 契約変更で交替（5.0 MM 新規）
道路品質管理 1（土質材料）	宮本	0	0	
道路品質管理 2（機械施工）	高坂	0		
軟弱地盤対策工指針編集	横尾 鈴木		0	契約変更（6.0 MM 新規） 契約変更（2.4 MM 新規）
本邦研修同行	鈴木	0	0	
				変更後の合計 16.4 MM 追加

各専門家別の派遣実績については Annex2-2 に示す。

b）カウンターパート機関は、建設省管轄下の外局である公共事業庁である[2]。

カウンターパートメンバーは、次ページに示すように第 1 期と第 2 期で異なる。
PP-2 では、活動が 3 項目あり、それぞれのカウンターパートメンバーが示されているが、兼務が目立つ。

[2] 2015 年 4 月から制度変更が行われ、公共事業庁 PW は、建設省（MOC）の内局になった。

表 1.5 PW 側カウンターパートメンバー

	氏名	職掌 MD: Managing Director DMD: Deputy MD CE: Chief Engineer DCE: Deputy CE SE: Superintending Engineer DSE: Deputy SE EE: Executive engineer AE: Assistant Engineer JE: Junior Engineer TE: Township Engineer	分担業務 PM: Project Management IP: Implementation Program QC: Quality Control QS: Quantity Survey TS: Topo Survey SI: Soil Investigation CS: Construction Supervision	PP-1	PP-2		
				安定処理に係るパイロット事業		高盛土観測と解析	軟弱地盤対策マニュアル編集委員
1	U Kyaw Linn	Managing Director	Chairman of JCC	O	O	O	O
2	U Win Tint	D M D （Work), PW					O
3	U Khin Maung Kyaw	C E (Road), PW					O
4	U Kyaw Shein	D C E, Planning	Project Director	O			
5	U Aung Myint Oo	D C E, Planning	Project Director		O	O	O
6	U Aung Myint	In-house Consultant, RRL	Adviser	O		O	O
7	Daw Hla Hla Thwe	S E, Road	Project Manager	O		O	O
8	U Myint Kyi	S E, Ayeyarwady Division					O
9	Daw Mya Mya Win	D S E, RRL	Design	O	O	O	O
10	U Aung Myo Oo	D S E, Airfield 2	IP & PM	O		O	O
11	U Khin Zaw	D S E, Special Unit (4)					O
12	U Zaw Naing	D S E, Special Unit (2)					O
13	U Kyi Twin Oo	D S E, Special Unit (15)					O
14	U Thet Zaw Win	E E, Phyapon District	IP & PM		O		O
15	Daw Htar Zin Thin Z	E E, RRL/Yangon	Material QC		O	O	O
16	Daw Zin Zin Htike	E E, ADB project, PW	QS		O		
17	U Nyi Nyi Zaw	E E,	Ditto		O		
18	Daw Aye Aye Thwin	E E, Road Design /NPT-HQ	TS & drawing		O	O	
19	U Kyaw Tun Lin	E E, Maubin District					O
20	U Thet Zaw Win	E E, Pyapon District					O
21	U Than Htoo Aung	E E, Latputta District					O
22	U Toe Toe	E E, Myaung Mya District					O
23	U Yan Naing Zaw	E E, Hintharda District					O
24	U Tint Lwin	E E, Pathein District					O
25	U Nay Lin Tun	AE (RRL)					O
26	U Tint Lwin Oo	AE (RRL)					O
27	U Nyi Nyi Kyaw	A E, RRL/Yangon	SI (material)	O	O	O	O
28	U Aung Kyi	A E Airfield -2	Ditto			O	
29	Daw Ei Ei Mon	A E, Road	Documentation	O			
30	U Win Naing	A E, PW/Bogalay Township	Ditto		O		
31	U Than Naing	A E, Airfield -2	Ditto	O		O	
32	U Nyi Nyi Win	A E, PW/Mechanical Dept.	Soil plant		O	O	
33	U Tun Min Oo	A E, Design /NPT-HQ	Dimension control		O		
34	Daw Su Mon Kyaw	T E, Pyapon	CS	O			
35	Daw Khin Aye Myint	J E (1), Airfield -2	QS			O	
36	U Hlaing Min Zaw	J E (2), PW/Mechanical Dept.	Machinery work		O	O	
37	U Tun Tun Naing	J E (2) Phyapon District	Work progress control		O		
38	U Win Khaing	J E (2), Airfield -2	Work progress control &			O	
39	U Tun Tun Naing	J E (2) PW/Phyapon District	Ditto		O		
40	U Tin Ko		CS			O	
41	Aung So Oo		Observation survey			O	
42	Myo Min Aung		Computer analyze			O	
43		SRL					O
44		Yangon technological Univ					O

1.5 PW 側からの便宜供与

2012年2月1日付け討議議事録（MM）および2012年7月付け議事記録（RD）に基づきPWから本技プロ（TCP）に対して投入された項目を表1-6に示す。

表 1.6 ミャンマー側からの便宜供与

PW 投入項目	内容説明
事務所	PW は、ヤンゴン市内に所有する建物内に 2 か所の事務室を供与（旧 MOC ビル、中央研修センター）
データ/情報	TCP 実施に際して必要なデータや情報を、TCP に対して供与
セミナー・WS 開催費用の一部	会場の提供、出席者用茶菓子費用の負担
パイロットプロジェクト工事費	安定処理試験工事費は PW 予算 （高盛土建設工事費はイラワジ州政府予算）

第 2 章 活動内容

概要

技プロで実施した主なイベントを表 2.1 に記す。

表 2.1 過去の主なイベント

2013 年 2 月 11 日	キックオフミーティングでプロジェクトの趣旨と概要説明を行い、プロジェクトが正式承認された。	この期間の主な活動は準備作業である
2013 年 5 月 27 日	第 1 回ワークショップ　(PCM 手法による PDM の見直し)	
2013 年 6 月 13 - 14 日	第 1 回セミナー　(活動 2.7 参照)	
2013 年 9 月 5 日	第 1 回 JCC　(ワークプランの承認/幾何構造の見直し、軟弱地盤対策工指針翻訳作業の承認)	
2013 年 9 月～10 月	第 1 回本邦研修　11 日間	
2013 年 12 月 14 日	第 2 回ワークショップ　(PP-1 の施工計画の討論、高盛土観測説明)	
2014 年 2 月より	PP-1 の安定処理工法の準備を開始し、2 月 19 日集中研修を実施。	下記の実際活動 ➢ PP1 の安定処理 ➢ 高盛土動態観測 ➢ 軟弱地盤対策工マニュアル準備作成
2014 年 3 月より	3 月から施工を開始　(注 1)。3 月 13-14 日に安定処理施工方法の集中研修を実施。 Kyew Chan Ye Kyaw 橋取り付け道路の高盛土が開始 同時に動態観測用機器を現場に設置し、観測を開始	
2014 年 5 月 25 日	NPT で安定処理工法､高盛土動態観測の施工報告会を開催	
2014 年 6 月	高盛土動態観測に伴う初期解析方法の WS を開始	
2014 年 7 月	軟弱地盤対策工指針の翻訳と編集作業を開始	
2014 年 8 月	中間評価実施、NPT で結果報告会	
2014 年 9 月	プロジェクトダイレクター (PD) が交代し Aung Mint Oo 氏となる。	
2014 年 9 月～10 月	第 2 回本邦研修　13 日間	下記の実際活動 ➢ PP2 の安定処理 ➢ 高盛土動態観測 ➢ 軟弱地盤対策工マニュアル作成
2014 年 10 月	PP-2 の準備　(注 2)	
2014 年 10 月	第 3 回本邦研修　国交省支援	
2014 年 11 月	PP-2 の方針決定　現場準備作業	
2014 年 12 月	PP-2 高盛土区間の土工事再開	
2015 年 2 月	10 号線での安定処理工事を開始 (2 月 15 日) 高盛土動態観測方法およびソイルプラントを用いた安定処理の内容説明 WS 開催 PP-2 の安定処理計画書を作成・提出	
2015 年 4 月	4 月 4 日ソイルプラント設置完了、4 月 29 日 PP2 安定処理 WS 開催	
2015 年 5 月	ソイルプラントを用いた安定処理の実施	
2015 年 6 月 16 日	技プロの成果総括セミナー	

(注 1) 2014 年 2 月から安定処理のパイロット事業 PP-1 が開始された。その詳細は、2014 年 8 月に提出したパイロット事業結果報告書 (第一期) を参照のこと。

(注 2) PP-2 での安定処理施工現場の位置は、PP-1 の経験から、資機材・スタッフのアクセスが良いことが必要条件と考え、2014 年に完成したボガレー橋をわたってすぐの 10 号線上での実施するよう、2014 年に交代した新任の PD との協議を行い、10 号線上の 800 m 区間 (マイルポスト 1/4 mile～2 mile) で実施の方向で準備をすすめた。安定処理用ソイルプラントの現場への搬入は 4 月以降に遅れたため PP-2 の完了が遅れた。

(注 3) 高盛土区間の対策工事指導は、本 TCP の活動項目の 1 つであったが、対象として想定された Kyew Chan Ye Kyaw 橋取り付け道路の工事を担当する PW 側から、工期と予算不足のため、具体的対策工事を行う意向がない旨連絡があったため、工事中の動態観測方法の指導のみを実施する内容に変更となった。

短期専門家の担当する活動項目は、Annex1 の PDM に記載の項目のうち、成果 2 に係るものであったが、活動 1-5 が変更契約で追加になった。

本報告書では表 2.2 に示す活動番号 0 と活動 1-5、および活動番号 2 について新フローチャート（Annex 2-1）に基づき説明を行う[3]。

表 2.2 短期専門家の活動項目

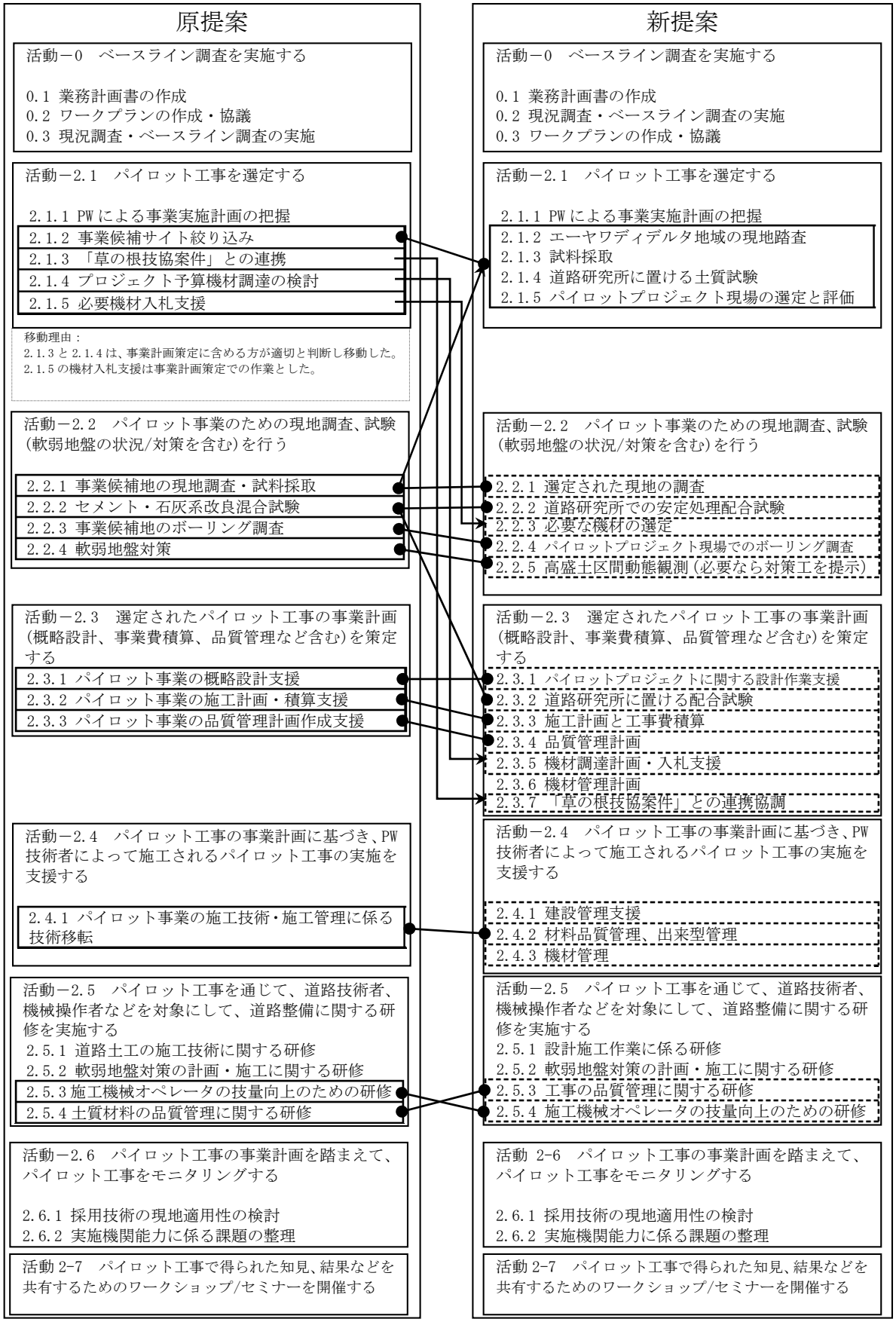
活動番号	
0:	ベースライン調査を実施する
1-5:	道路技術基準･マニュアルを作成するとともに、パイロット工事の結果に基づいて必要な修正を行う。 変更特記仕様書に記載された本活動は以下の 2 項目からなる。
	1.「道路幾何構造基準（修正）」 2013 年 9 月に開催された第 1 回 JCC において、現行の幾何構造基準改訂の提案は承認された。しかし後日、PW が KOICA と協同により同基準改定案作成を実施するとの情報を入手したことから、本 TCP では、作業の重複や、それに伴う関連機関間における混乱を回避するため、活動内容を以下の通り変更することを、PW と合意した。 ◆ 高速道路および一般国道を調査対象道路として、車両踏査により調査を実施する。 ◆ 調査の際は、安全面で問題のある幾何構造や、道路付帯施設を課題箇所として抽出することに留意する。 ◆ 抽出した課題箇所に対して、改善のための方策・提言を「Technical Note on National Road & Expressway (Geometric Feature & Traffic Safety Device)」に取りまとめ、MOC に提出した（2015/06/10）。（本提言集は別途提出。）
	2.「軟弱地盤対策工指針（作成）」 「道路土工　軟弱地盤対策工指針」（日本道路協会発行、平成 24 年版）を翻訳（英語）し、地盤・地質調査やパイロットプロジェクトの結果等を反映させ、指針（案）の作成と提案を行う。指針（案）の作成にあたっては、長期専門家及び国内支援委員会で協議・調整して決定する。
2-1:	パイロット工事を選定する
2-2:	パイロット事業のための現地調査・試験（軟弱地盤の状況/対策を含む）を行う
2-3:	選定されたパイロット工事の事業計画（概略設計、事業費積算、品質管理など含む）を策定する
2-4:	同計画に基づき、PW によって施工されるパイロット工事の実施を支援する
2-5:	パイロット工事を通じて、道路技術者、機械操作者などを対象にして、道路整備に関する研修を実施する
2-6:	パイロット工事の計画を踏まえて、パイロット工事をモニタリングする
2-7:	パイロット工事で得られた知見、結果などを共有するためのワークショップ/セミナーを開催する

新フローチャートは、現地業務をより効率的に実施するため原フローチャートの各活動の細項目について見直したものであるが、原提案の提案細項目は、新フローチャートでもすべて網羅している。次ページ表 2.3 に成果 2 についての原提案と新提案の細項目の比較表を示す。

[3] 特記仕様書第 7 条（10）、及び同第 10 条（1）イ）に従い、Annex2-1 に示す契約変更を反映した新フローチャートに沿って、各活動の細項目毎の進捗状況（概略推定達成度を付記）とそのポイントを記す。

表 2.3 原提案と新提案における成果 2 の活動細項目の関連一覧

無印は変化なしを示す



活動番号 0: ベースライン調査を実施する

細目番号	活動細目名	実施内容	備考
0.1	業務計画書の作成	2013 年 1 月、プロジェクトの実施方針について業務計画書が JICA に提出された。	
0.2	現況調査	ワークプラン作成のため、現況調査をプロジェクト契約に先行して実施した。	
	ベースライン調査	プロジェクト実施前のレベルを確認するための PDM Ver. 1.0 用のベースライン・データ収集作業を実施した。 収集したベースライン・データを Annex5 に示す。[4] ただし、PDM Ver. 2.0 での評価指標の変更に伴い、ベースライン・データも変わってきている。（詳細は Annex5 を参照）	12 種類の既存の道路技術基準とマニュアルを示したが実態は確認できない。
0.3	ワークプランの作成と PW との協議	ワークプランは、日本側の支援委員会へ説明し、その助言結果に基づき修正されたものが 2013 年 9 月 4 日首都ネピドーで開催された JCC で承認された。 「修正された内容」 沈下、滑り、浸食等の盛土の問題は、道路施工前に考慮すべき重大な項目である。これら諸問題解決は、ミャンマー国の道路技術発展に不可欠と判断され、現場で発生している盛土の動態観測を追加項目としてワークプランに書き加えた。	

活動番号 1.5: 道路技術基準･マニュアルを作成するとともに、パイロット工事の結果に基づいて必要な修正を行う

細目番号	活動細目名	実施内容	備考
1.5.1	既存基準の照査･課題の抽出	道路幾何構造基準 レビューの結果、既存の幾何構造基準の内容は非常に簡易であり、本来規定されるべき項目が、多く欠落していることを確認した。	詳細な規定が必要と判断した。しかし、表 2.2 に記載した事由により、成果品を「幾何構造基準改定版」から「TECHNICAL NOTE」へ、変更した。
		軟弱地盤対策工指針（案） 2013 年 9 月 JCC での PW との協議時にミャンマー側には軟弱地盤対策についての指針等は存在しないことが確認された。	
1.5.2	現地調査対象箇所絞り込み･重点調査箇所確認	道路幾何構造基準 高速道路全線（ヤンゴン～ネピドー～マンダレー）、および一般国道シャン州 4 号線（ロイレム～タコー）間を調査対象区間とした。	安全上問題のある道路幾何構造や付帯施設に対して、特に留意して調査を実施することとした。
		軟弱地盤対策工指針（案） 軟弱地盤地域はイラワジ、ラカイン、モンに存在するが主な対象はイラワジとし、特に PP-2 の実施箇所であるピャポン、ボガレー地域を重点調査対象とする。	
1.5.3	現地調査	道路幾何構造基準 計８回の現地調査を、上述した高速道路及び一般国道で実施した	現地調査は 2015 年 12 月を持って完了

[4] 当初、既存の道路技術基準とマニュアルは合わせて 12 あり、うち 2 つはミャンマー語版であるとの説明を受けた。その内のミャンマー語版 2 つについて、RRL へ英訳を依頼した。2014 年 11 月末、2 つのうちの 1 つ「道路維持修繕マニュアル」の英訳を受領した。残り 1 つ「表面処理マニュアル」については、RRL 側から多忙を理由に翻訳打ち切りが通告された。

		軟弱地盤対策工指針（案） 横尾・西嶋両専門家により 2014 年 2～3 月に乾季の状況調査を、同 5～6 月に雨季の状況調査を行った	
1.5.4	改定案作成・提出	道路幾何構造基準（案） 下記の作業内容・結果を TECHNICAL NOTE に取りまとめた。 - 高速道路および一般国道を調査し、問題点を抽出した。 - 問題点の分析・検討を実施した。 - 改善のための提言集を作成した。	TECHNICAL NOTE を以下の仕様で、MOC に提出した。 - 印刷・製本版：30 部 - 電子データ（CD-R）：1 枚
		軟弱地盤対策工指針（案） 2014 年 8 月以降、道路協会発行『軟弱地盤対策工指針』英訳を翻訳会社に依頼した。同英訳原稿を元に図版の差し替え・変更作業を行い、約 400 ページのミャンマー用指針ドラフトを作成した。11 月に PW 側と協議のうえ、同ドラフトを印刷し合計 36 部を関係者に配布した。 2014 年 12 月に入り、本ミャンマー用指針の編集委員会メンバー23 名が決定した、SRL 及び大学からのメンバーが追加。	結果を整理し仮最終版を同年 6 月に提出し、同時にセミナーで重要点について PW の関係者に説明を行った。 そのセミナーでの討論結果に基づき最終版を印刷製本しミャンマー側に提出した。

活動番号 2.1: パイロット工事を選定する

細目番号	活動細目名	実施内容	備考
2.1.1	PW の事業実施計画の把握	PW 側から、2013 年 2 月～3 月に、現在実施または計画段階の事業実施計画の提示・説明があった。その後も継続的に PW の事業計画の把握に努力してきた。結果、以下のような事実が確認されている 1）年 2 回予算会議で実施計画が議論される 2）数年先を見通した計画は実質的にはない 3）実施計画は、政治的配慮から頻繁に変更がなされる	説明された事業実施計画の内容は、2 年程度の短期的なものに限定されていて、当初の上位目標の評価指標を判定するには不十分。
2.1.2	エーヤワディ・デルタ地域の現地踏査	デルタ地域の概要調査は、競争入札を経て地質調査業務経験のある現地業者への再委託により実施した。 当該調査を実施した位置図を次ページの図 2.1 に示す。 洪水時の水位に関する住民聞き取り調査結果は、業務進捗報告書 1 の添付 7 の表 7.2 参照。 現地調査報告書は再委託業者が作成。	
2.1.3	土質材料試料採取	土質性状を把握するため、7 路線、16 か所において、試料を採取し、RRL へ搬入した。（2 号線、3 号線、4 号線、5 号線、6 号線、7 号線、10 号線）	
		PP-1 7 号線の安定処理対象区間の材料試験結果についてはプロジェクト業務進捗報告書(第一期添付-B を参照。	
		PP-2 での道路安定処理区間のサイトは 10 号線上の高盛土観測区間と隣接する区間 （1 mile-4 furlong - 2 mile: 800 m）に決定。 下層路盤安定処理は現地採取土と砂の混合土、上層路盤安定処理は砂とエーヤワディ地域（Labuuta）で大量に採取可能な川砂利を用いた混合土の安定処理施工を行なった。 RRL での配合試験結果に従い、バックホウによる混合方法およびソイルプラントによるセメント安定処理方法の現地研修をパイロット工事として実施した。 （次ページに続く）	

		PP-2 での橋梁取り付け道路高盛土区間の安定性・圧密沈下検討のための SPT による既存盛土強度の確認をした[5]。このデータをもとに周辺の既存ボーリング調査結果も参考とし、対象区間の地質構成の把握、解析用基本数値の設定のための勉強会を WS という形で実施した。	道路路体の状況は既存のボーリングデータから推定したものを使用

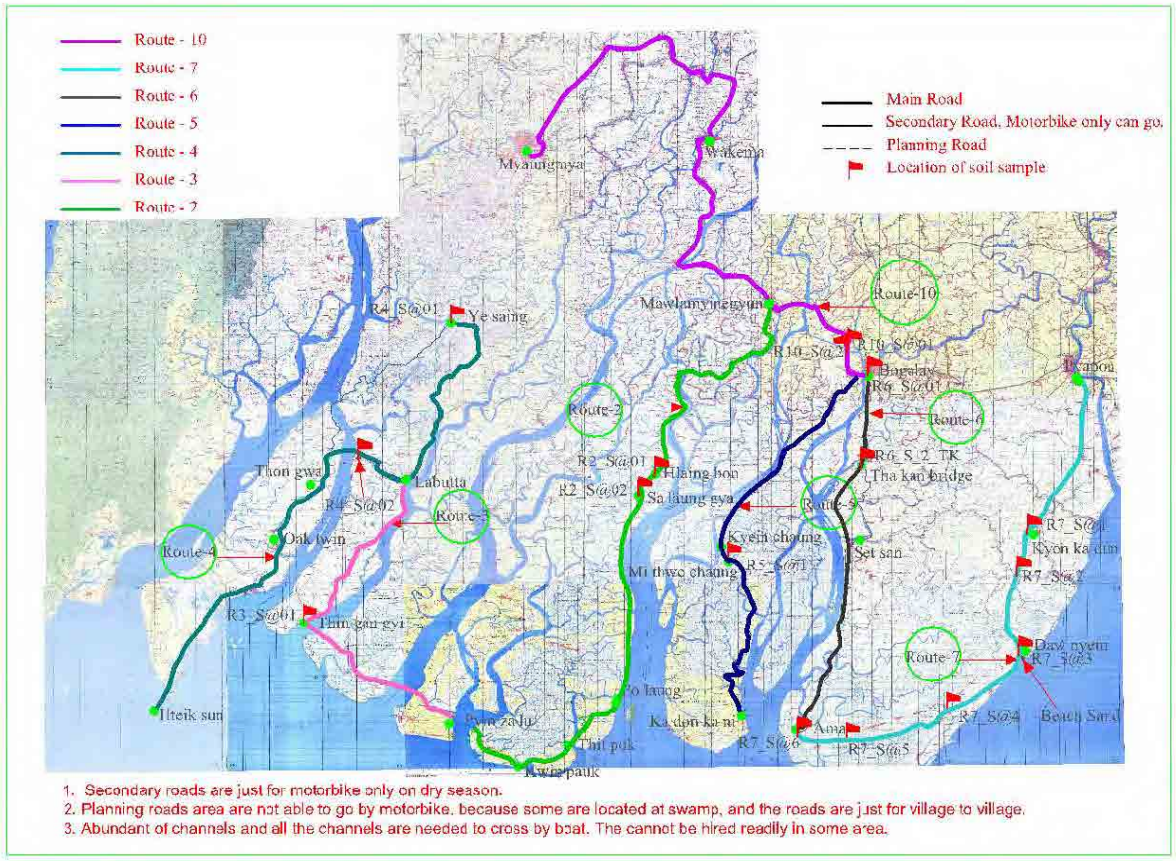


図 2.1 現場状況確認調査位置図

細目番号	活動細目名	実施内容	備考
2.1.4	道路研究所における土質試験	採取した現地の材料の試験を、PW の道路研究所（RRL）において実施した。	
	PP-1	7 号線については既設路床土の CBR 試験を同時に実施した。結果、既存の路床 CBR は 2%と前後推定された。	安定処理材料の配合試験結果は別途提出済みの PP1 道路安定処理進捗報告書の添付書類 B「The Report on Stabilized Material Test」を参照。
	PP-2	現場で採取したサンプルを室内試験した結果、以下の CBR 値が得られた。 既存路床： CBR=2% 土取場試料： CBR=3% 土取場試料+砂（II）： CBR=6% 土取場試料+砂（III）： CBR=4%	安定処理材料の配合試験結果は別途提出の PP2 道路安定処理報告書の添付書類 B「The Report on Stabilized Material Test」を参照。

[5] 結果については　“別途提出の PP2 高盛土動態観測結果報告書の図 6 及び図 7 を参照

室内試験状況（計量）

CBR テストピースの養生

細目番号	活動細目名	実施内容
2.1.5	パイロットプロジェクトサイトの選定と評価 PP-1	パイロット工事 1 期（PP-1）実施個所は、複数の評価指標の比較に基づき、ピャポン行政区内の 7 号線に決定した。 引き続き、7 号線内における PP-1 実施区間の決定作業を行った。 その結果、プロジェクト実施による裨益効果および「ミ」国政府の同管区開発計画を考慮し優先区間の 1.6 km に決定した。
	安定処理区間の選定と評価 PP-2	PP-1 実施から得た知見や反省を踏まえ、以下の事項に留意して、実施区間を 10 号線に決定した。 ● 宿舎～現場間が近距離であること ● 資機材搬入の利便性の観点から市街地近郊が望ましい ● 淡水が入手できること ● マラリア汚染地域で無いこと 試験施工区間は当初 800m を予定していたが、PW の予算の都合で 600m に変更された
	高盛土対策区間の選定と評価 PP-2	橋梁取り付け道路部の高盛土沈下対策は、10 号線の Kyew Chan Ye Kyaw 橋取り付け道路で予定したが、PW 側の予算が付かず実施不可能となった。 対策工無しの場合、安定度は約 1.3 前後、総沈下量は 60 cm 程度と推定されたため、盛土材料として現地発生土に内部摩擦角を上げる目的で川砂(細砂)30%を混合すること、やや広めの犬走りを設置することにし、2014 年 3 月から、工事を開始した。 動態観測を同時に開始し、その解析結果、安定性に問題がでる兆候が見られた時点で改めて対策工の検討を行うことにした。

PP-1 実施箇所（Pyapon District, Myo Kone）

材料混合・仮置用ヤード候補地（PP-1 道路脇）

PP-2 実施箇所現況(Pyapon District, Bogale)

材料混合・仮置用ヤード候補地(ボガレー橋脇)

PP-2 Kyew Chan Ye Kyaw 橋取り付け高盛土道路予定地

高盛土材料採取土取場の潅水状況(12 月初旬)

高盛土区間盛土完了　2015 年 4 月 29 日

高盛土区間盛土完了　2015 年 4 月 29 日

活動番号 2.2: パイロット事業のための現地調査・試験を行う（軟弱地盤の状況/対策を含む）

細目番号	活動細目名	実施内容	備考
2.2.1	選択された現地の調査 PP-1	7 号線現地調査時、現地担当所長と下記の件について意見交換した。 ・起点付近の浸食された法面補修対策 ・機械置き場と安定処理用混合ヤードの確保 ・近隣住民との問題の有無 ・終点付近にある病院への影響 ・途中の小橋梁の重量制限が 8 トンのため、工事用機材、特に総重量 24 トンのスタビライザーの現場への搬入方法	7 号線での法面保護処理は、PW 側が実施しないことに決定。路肩排水は、当初計画した砕石層設置ではなく塩ビパイプの設置に変更となった。
	PP-2	安定処理施工区間の現地調査・資料採取・路線測量は 2014 年内に完了した。	
2.2.2	安定処理配合試験 PP-1	安定処理配合試験結果を表 2.4 に示す。	
	同上　PP-2	安定処理材料の配合試験は 2015 年 4 月完了。 セメント・石灰安定処理材料の配合試験結果は別途提出の PP2 報告書の添付書類の「The Report on Stabilized Material Test」を参照。	

表 2.4 配合試験結果

対象	検討項目	目標	添加剤と添加量
PP-1 路床安定処理用 消石灰量の検討試験		修正 CBR 20 %を目標	消石灰 3.6 %（外割り）
PP-1 路盤安定処理用 セメント量の検討試験		下層路盤用	土:砂 =70% : 30%を採用 セメント 6.3 %（外割り）
		上層路盤用	土：砂：川砂利=15%:15%:70%を採用 セメント 6.8 %（外割り）
PP-2 路床構築の 検討試験	締固め試験､CBR 試験 （4 日水浸 + 7 日水浸）	目標修正 CBR 5 %	土:砂 = 50 % : 50 %を採用 セメント
PP-2 路盤安定処理用 材料の検討試験	粒度分布に応じた土､砂などの配合検討 土質特性（PI）による添加材の選定	下層路盤用 UCS = 1.125 MPa	土:砂 =50% : 50%を採用 セメント 7.0% （外割り）
	川砂利利用によるコスト縮減の検討	上層路盤用 UCS = 3.0 MPa	川砂利:砂 =70% : 30%を採用 セメント 4.6%（外割り）

細目番号	活動細目名	実施内容	備考
2.2.3	プロジェクト実施に必要とされる機材の選択	PP-1 での安定処理による道路改良は、（i）現位置混合転圧および（ii）道路脇の混合用ヤードでの混合後現場への運搬、転圧する 2 種類の工法を実施した。 検討結果 PP-2 も含め表 2.5 のような機材が必要と判断され、技プロでの供与が決定した。	
		PP-2 では、ソイルプラントを用いて、セメント安定処理土の生産を実施した。工事の際は、仮設ヤード内に設置したプラントで生産した上層路盤、下層路盤材料を、道路改良区間に運搬して、敷設・転圧作業を実施した。 また、プラント設置用 RC 基礎工の設計を 2015/01 に完了し、その後、ヤードでの建設作業を実施し、2015/03 作業を完了した。	

本技プロで当初予定されていた本邦調達、携行機材の投入については、プロジェクト開始後の状況変化に対応するため、下記の表 2.5 に示すような理由により、最終的に表 2.6 に示す機材を選択した。

表 2.5 投入機材の選定経緯

	機材名	投入の判断	理由
本邦調達	自走式 安定処理機	中止	ノンプロ無償により、類似の機械が、エーヤワディ管区に供与されることが判明したため、その機械を PP-1 で使用することとなった。
	ソイル プラント	新規要請	デルタ地域内では、大粒径（10 cm 程度）の砕石を用いたマカダム舗装が、広く施工されている。現位置混合の際、安定処理機の破砕・撹拌能力を超えると判断される場合は、いったん既設マカダム舗装を撤去した上で、作業を実施する必要がある。本来、このような場合、施工効率、材料の品質管理の点から、固定プラントを使用し混合、改良した材料を敷設することが望ましく、その結果強固な道路構造の構築が可能となる。このような状況を鑑み、PP-2 では、ソイルプラントと安定処理機を併用した道路改良工事の実施を検討していくこととした。

	機材名	投入の判断	理由
携行機材	バケット型ミキサー	中止	機材を PW 所有バックホーに取り付ける場合は、別途 200 万円の改造費が必要になり、また、故障した場合のメーカー保証も、受けられないことが判明した。 当初、路盤安定処理機の PP-1 への導入が間に合わない場合の代用機材として導入を検討していたが、ノンプロ無償により、類似の機械が使用可能となったため不要となった。
	RI 密度試験機	中止	ノンプロ無償で、電気式密度試験器が供与されることが判明したことから、本機材の導入を中止した。
	現場 CBR 試験機	中止	現場 CBR 値は、PW 所有のコーン式貫入器で換算することが可能である。また PP-1 施工時のトラフィカビリティの確認は、ノンプロ無償で供与される平板載荷試験機でできるため、本機材の導入を中止した。
	トータルステーション	新規要請（2014/01 導入済）	PP-1 施工管理時の出来形計測の他、盛土動態観測に必要な機材であるが、PW ピャポン事務所やその他近隣の管理事務所でも所有していないことが判明したため、本機材の導入を決定した。
	斜面安定解析ソフト	新規要請（2015/06 導入済）	斜面安定解析については無料の解析ソフトウェアを使用しての WS を通じて実施したが、RRL は、機能制限のない解析ソフトを望んで来たもの

表 2.6 必要な機材台数リスト

分類	機材名	PP-1	PP-2	主な使用目的	供与機材
道路改良/現場計測/試験用	ロードスタビライザー（写真 1）	1		道路現位置での安定処理	（ノンプロ）
	ソイル混合プラント（写真 2）		1	混合ヤードにおける安定処理材料生産	○本邦調達
	ブルドーザー	2	2	土工、敷均し	
	バックホー	1	2	土工、積込み	
	ホイールローダー		1	積込み	
	グレーダー	1	1	マカダム層撤去、路面均し	
	タイヤローラー	1	1	締固め	
	ローラー（鉄輪）	1	1	締固め	
	散水車	1	1	散水	
	ダンプトラック	3	3	土・材料運搬	
	瀝青剤散布車	1	1	表層施工	
	コーンペネトロメーター	1	1	現場 CBR 計測	
	電気式密度計測器	1		現場密度計測	（ノンプロ）
高盛土対策土質調査 動態観測用	ボーリング機		1	掘削・試料採取	○本邦調達
	トータルステーション（写真 3）		1	盛土区間の垂直・水平移動量の計測用	○携行機材
	データロッガ（写真 4）		1	上記計器のデータ読取保管用	○携行機材
	沈下計測板（写真 5）		4	盛土基盤面の圧密沈下計測用	○携行機材
	間隙水圧計（写真 6）		3	盛土基盤の地下間隙水圧変動測定用	○携行機材
	傾斜計（挿入型）　（写真 7）		1	盛土基盤の地下での移動傾斜測定用	○携行機材
	地下水位計（写真 8）		1	盛土基盤の地下水位変動測定用	○携行機材
	プラスティック測量杭 1.2 m		16 箱	測量用杭	○携行機材
	盛土安定解析ソフト		1	盛土安定解析	○携行機材

備考：○は本技プロでの供与、（ノンプロ）はノンプロ無償での供与済機材、
無印は現地での PW による調達を示す

写真 1:ロードスタビライザー

写真 2:ソイルプラント

写真 3:トータルステーション

写真 4:データロッガ

写真 5:沈下計測板

写真 6:間隙水圧計

写真 7:挿入式傾斜計

写真 8:地下水位計

細目番号	活動細目名	実施内容	備考
2.2.4	パイロットプロジェクト現場でのボーリング調査	PP-1 では既存盛土の沈下予測のため、現場の地質調査を再委託により深さ 30 m まで実施した。　詳細は、別途提出の Pre-Survey Report of Road に示してある。 各ボーリングで得られた土質柱状図を図 2.2.a 及び図 2.2.b 示す（深度の単位はm）。 その結果、軟弱層の厚さが予想以上に厚いことが判明した。	
		PP-2 の高盛土区間でのボーリング調査は 2014 年 3 月に 2 本実施。その結果をもとに解析方法の WS を実施してきている。	路線両側の既存ボーリング調査結果より、地層変化は小さいと予想され、低い盛土で当工区の圧密沈下は小さいことから、ボーリング調査は省略した。

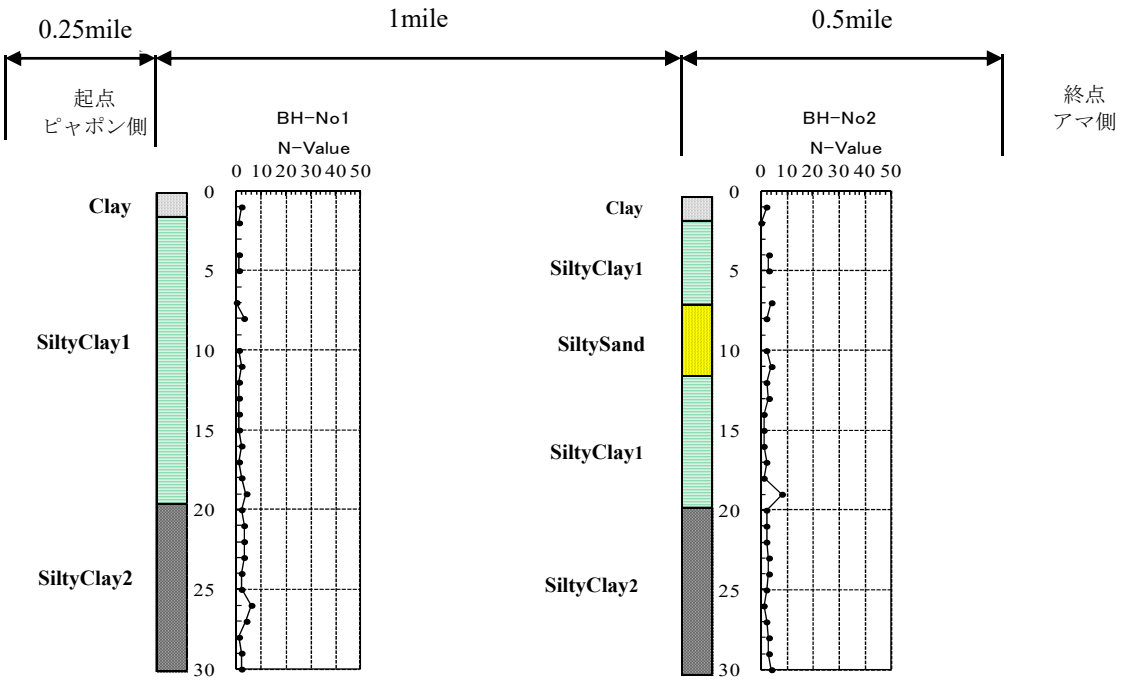


図 2.2.a PP-1 区間の土質柱状図

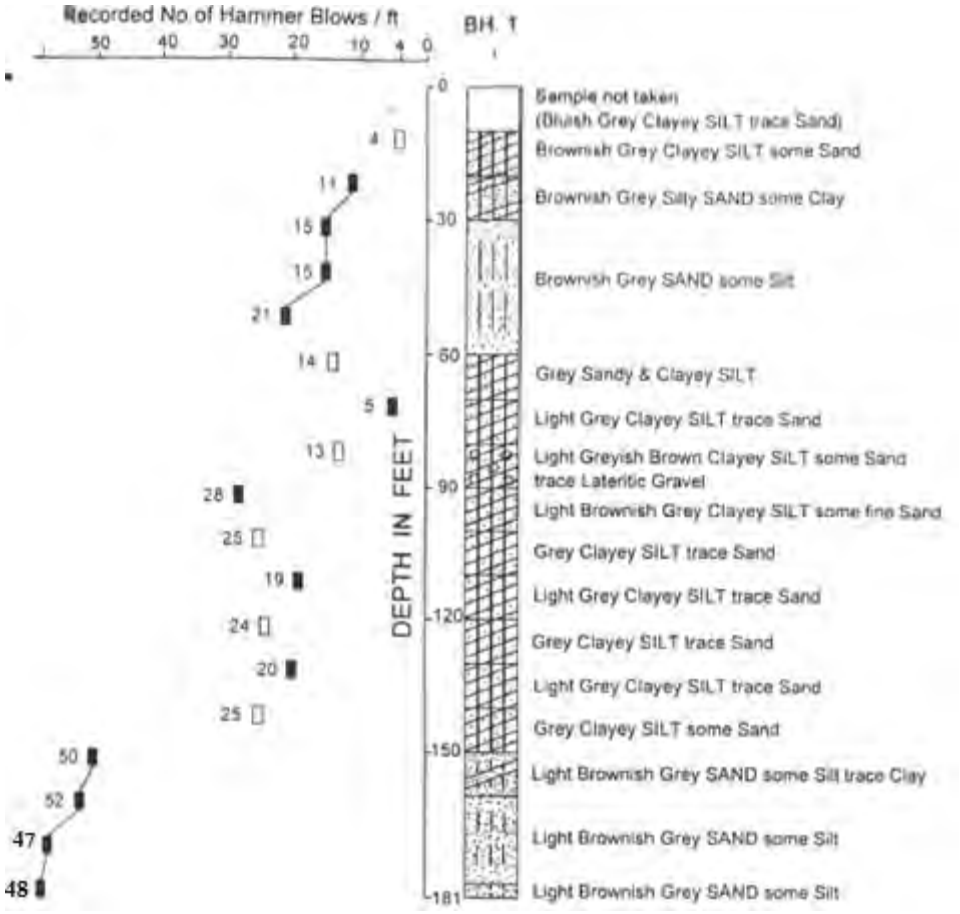


図 2.2.b 高盛土区間の土質柱状図

細目番号	活動細目名	実施内容	備考
2.2.5	盛土の動態観測[6] （下記注参照）	PP-1 デルタ地域道路整備5カ年計画では、50橋を超える新橋建設が予定され、2014年度が最終年度とされていた。従い、サンドパイルのような沈下対策工を実施することは、残り工期と予算の制約から実質的に無理がある。そこで、動態観測の結果を解析し、その結果、安全が確保されない可能性のある場合には、あらためて対策工の協議を行うことになった。	日本側は、PP-1実施にあたり、既存盛土の初期状態を再現し、動態観測をするため、現状道路の脇に、高さ3-4 m、面積100-200 m^2の試験盛土を新規構築することを提言したが、PW側からは、「低盛土部の土工は、860 km全線について既に完成後数年を経ており、その圧密沈下は収束しつつある。また、2009年から雨期の中を突貫工事で盛土をした状況の再現は困難」との説明があり、新規盛土による動態観測は行わず、既存盛土上のPP-1区間において、竣工後から動態観測を実施することとした。 しかし、雨期に入り、途中経路の道路が損傷を受け、観測作業のために現場に入れない事態となってしまったため、同作業は実施できなかった。
		PP-2 高盛土区間の動態観測は2014年3月の盛土開始と同時に開始したが3層到達時点（盛土高で0.9 m）で雨季に入り中断し2014年12月から再開。2015年4月末盛土工事は完了。 2015年6月時点で0.6ｍの沈下が生じている。	安定処理区間は、盛土高さも低く、沈下量は道路構造に影響を及ぼさない程度に収まると推測されるため、動態観測は実施しない。 高盛土区間では本格的盛土の進行に合わせ、動態観測（沈下量、間隙水圧、地下水位、地中変位、地表変位計測）を行った。 2015年6月時点で0.6 mの沈下、30ｍｍの地中変位、が生じており、間隙水圧は、雨季の地下水位とほぼ同等、地表面変位データはバラツキが多く一義的に傾向を述べる事は難しいが、傾向としては当初内側（盛り立て断面の中心に向き）に移動し、その後外側に向かって7~8 cm移動している。　これらの計測結果は「パイロット事業結果報告書2-2」に示す。

活動番号 2.3: 選定されたパイロット工事の事業計画を策定する（概略設計、事業費積算、品質管理を含む）

細目番号	活動細目名	実施内容
2.3.1	パイロットプロジェクトに関する設計作業支援	PP-1 PWの中小規模工事では通常なされていない縦横断測量を実施し、その結果をCADにより図面化、数量計算を行う方法を支援した。 舗装設計については、PWはOverseas Road Note 31による従来の方法を用いているが、下記項目の設計条件の適切な決定方法について、PWと協議し、日本の基準（TA法）やAASHTO(SN法)を用いた場合の比較検討内容を提示した。結果としてRRLは下記のデータを用いORN 31による従来の設計方法を採用した。

[6] 動態観測の対象は下記のようなものである

	対象	懸念された問題点
PP-1	低盛土：盛土高さ約2mの通常道路	道路表面の小さな欠陥および道路脇法面の侵食が部分的に見られるが、盛土自体の大きな変形や沈下は見られなかった
PP-2	低盛土：盛土高さ約2mの通常道路	公示前には特に問題がなかった
	高盛土：盛土高さ約10mの橋梁取り付け道路	盛土の大きな沈下および斜面すべりが懸念された

		(1) 現在日当り交通量（AADT） (2) 重車両のダメージ係数 (3) 将来交通量伸び率 (4) 路床の設計 CBR の評価方法	
		MOC 測量チームにより、路線測量および図面作成（縦平面図、横断図）が実施された。さらに、その後同図面は、設計作業に用いられた。 MOC 設計チームにより、AASHTO を採用した舗装設計を実施された。 設計成果を含む PP-2 実施計画書を、2015 年 2 月 MOC に提出した。（別途提出の”PP2 Implementation Program”参照）	2015 年 1 月以降、RRL の要望に従い、材料配合設計、およびコスト縮減を目指して、多層弾性理論解析による舗装厚さ低減の検討を行ったが、実際に採用するには、さらなる検証が必要、という MOC 判断により、最終的には採用されなかった
2.3.2	道路研究所に置ける 配合試験支援	PP-1 では、主に Assistant Eng 以下の実務者レベルを対象に安定処理路床・路盤に関する試験訓練を行った。（締め固め試験や CBR 試験は BS 基準）結果内容を、下記の表 2.7 にまとめる。	
		PP-2 では、PP-1 と同様に試験および試験結果の整理方法を支援した。	

表 2.7 技術移転に関する取り組み結果

項目	取り組み内容
試験方法と試験目的の理解	RRL で日常行っている各種試験方法について BS、AASHTO の対比を行いながら、試験方法に違いによる結果の解釈について話し合いを実施し、系統立てた試験計画、試験結果の処理について技術移転を実施した。
石灰･セメント安定処理路盤の理解	日本国内の事例紹介 石灰・セメント安定処理路盤設計における下記のような留意事項の説明 a. 現地土質特性（PI）と安定処理材の関係 b. 安定処理材の強度発現特性 コスト縮減に対する現地材料の利用方法について話し合いをした。
室内配合試験	試験計画書の作成と工程表による作業進捗の管理方法を支援した。 試験状況の管理方法を指導した。 各段階における試験結果の照査方法を指導（上級 Eng を交えた協議）
試験結果の処理	エクセル等を用いた試験結果の整理方法を指導 グラフを用いた各試験結果の対比と試験結果の妥当性評価方法を指導
現場での品質管理	締め固め度を変化させた強度試験の実施を通じた技術指導 現場試験管理方法の検討を指導 現地安定処理土を用いた現地締め固め試験など、室内配合試験との相違の確認方法について指導した。
路床安定処理の設計方法の理解	日本の道路舗装設計基準に従った、安定処理路床の平均 CBR の評価方法について討議

コーン式貫入器動作確認

安定処理用材料練り混ぜ作業

現地における担当者指導

締め固め度確認試験（砂置換法）

現地配合土の締め固め試験

現場 CBR 試験（平板載荷試験）

細目番号	活動細目名	実施内容	備考
2.3.3	施工計画と工事費積算支援	PP-1 PW は、工事費積算に必要な材料・労務単価および施工歩掛をすでに有しており、各地区（District）事務所がそれらのデータ、および既往実施工事の経験則を用いて、PW 独自の方法で積算業務を実施している。 しかし、事業費の積算内容は丸秘扱いで MD の許可なく外部に出すことはできない。なお、事務所へは定期的に内部監査も入る。 本 TCP では、「ミ」国にとっての新工種（路床・路盤安定処理工）については、今後、PW が歩掛作成のための基礎資料として活用することを目的として、PP-1 における実作業への投入量を PW に提示できるよう、PP-1 記録調書（労務、材料、機材）の整理・集計を行った。集計結果をパイロット事業結果報告書（第 1 期）Appendix C に示している。 また、安定処理等の工事費検討結果を Annex6-2 安定処理の積算方法に示す。	MOC およびチームは、PP-2 実施内容の詳細を、情報共有が一部で不十分であったため、迅速な事業実施の面で、支障が生じた。

		PP-1 全体工程の中で、施工順序、使用する機材、および施工日数の観点から、クリティカル・パスとなる工種を設定し、その工程を軸として、他工種の工程を設定する手法を、PW に提示し、施工計画を作成した。 図 2.3 に路床安定処理工の作業行程イメージを示す。
		PP-2 プラントは、新規でミャンマーに導入される機械であるため、図・写真を用いた工事実施手順を、MOC に示した（図 2.4 参照）。

図 2.3　PP-1 施工イメージ

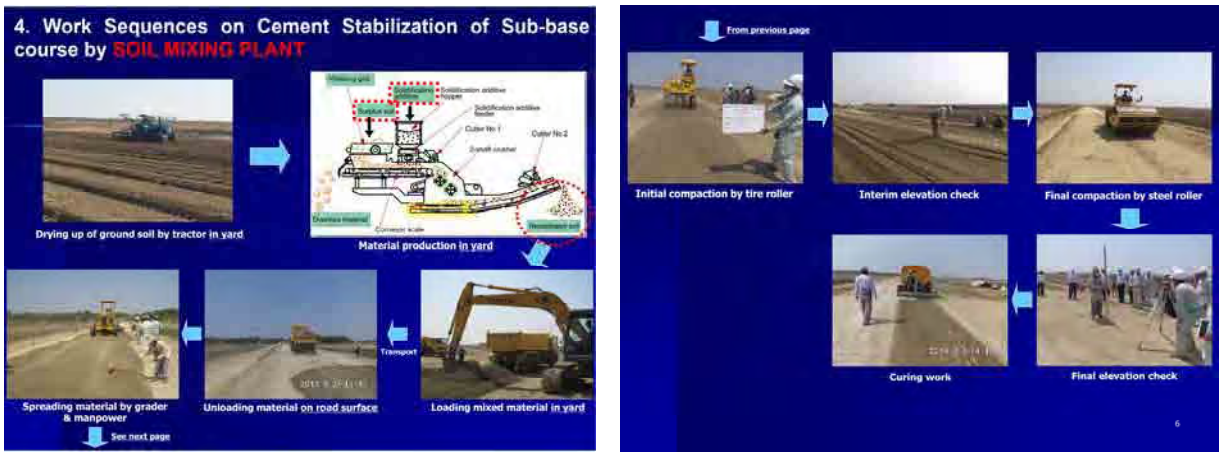


図 2.4　PP-2 施工手順イメージ

安定処理工法のコスト検討結果を下記に示す。(詳細は Annex6-2)(墨の入った項が安定処理を示す) 比較のため骨材による従来の路盤工法のコストも示す。PP1 のコストはやや高めとなっているが、日本の標準積算方法を適用した場合他工種と比較し低めであると言える。

表 2.8 安定処理工法のコスト検討結果

	Conventional Road Base construction			Road Stabilization	
Subgrade	PW basic methods	ADB	Japan standard Methods	PP1budget (modified)	Stabilization
		Soil & sand	Soil	Lime stabilization	Lime stabilization
Output area					180-250m2/day
Thickness (inch)		16	8	16	16
Total cost $			286	56035	
$/m3		**18**	**14**	**27**	**17**
$/m2		**4.5**	**2.9**	**6.3**	**6.9**

Subbase	PW basic methods	ADB	Japan standard	PP1 budget (stabi)	Stabilization
	Laterite	Shingle / soil	Laterite/sand	Cement stabilization	
Output area					500-1400 m3/day
(Volume)	100sud				
Thickness (inch)	6”	8	8	8	8
Total cost $	9,048		574	60134	
$/m3	**32**	**44**	**29**	**40**	**32**
$/m2	**4.8**	**9.0**	**5.7**	**8.0**	**6.5**

Base course	PW basic methods	ADB	Japan standard	PP1budget	Stabilization
	Aggregate	Crushed rock	Aggregate	Aggregate	
Output area					
(Volume)	100sud				
Thickness (inch)	6”	6	6	7	6”
Total cost $	14,653		1122	97323	
$/m3	**52**	**102**	**75**	**80**	**64**
$/m2	**7.8**	**15.0**	**11.2**	**14.0**	**9.6**

細目番号	活動細目名	実施内容
2.3.4	品質管理計画支援	安定処理材を含む土質材料および工事の品質管理に必要な調査・確認方法についてRRLとの協議と室内研修をした。 PP-2での取り組み済み項目を表2.9に記す。

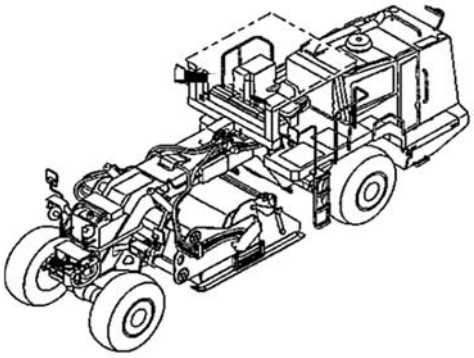
表 2.9 品質管理関係の検討結果

項目	内容	状況
1.既存盛土の品質	(1)既存盛土材料評価	・RRLでは、現場密度試験の経験はあるが、熟練度などは個人差が大きい。 ・粒度分布、締め固め特性、CBR試験方法、盛土締め固め度の室内試験研修を実施
	(2)盛土沈下特性の評価	地盤強度試験、圧密試験を実施 試験結果を用いての圧密沈下計算等の研修を実施
2.品質管理基準	(1)品質管理基準（一般材料）	RRLの品質管理基準を確認。各舗装材料の規格、締め固め度、現場試験頻度が規定されている。 室内材料試験は実施されている。実際の現場での品質管理責任者を明確にした。
	(2)安定処理路床、路盤	1）RRL技術者による石灰の品質判断は可能。 2）ORN31に従った規定を使用しているので日本の試験方法を紹介。 3）セメント安定処理に対する六価クロム試験方法を紹介した。 4）日本へサンプルを持ち帰り確認 5) 石灰の製造規格なし。
3.現場試験機の有無確認	(1)現場測定器具	1）　砂置換法による密度試験器あり。 電気式の密度測定器（ノンプロ無償で供与済み）が使用できない。 2）強度測定は簡易動的貫入試験、現場CBR試験（平板載荷試験）器があり、RRL担当者は実施可能である。
	(2)試験記録	紙ベースでの現場試験記録結果を保有 エクセルなど電子媒体による試験結果の整理と保存方法を研修した
4.現場研修方法の確認事項	(1)研修日程計画	1）RRLアシスタントエンジニアレベルは工程に従って現場滞在し、体系的な現場品質管理に関する研修を行なった。またアシスタントエンジニアは定期的に現場を訪れ以下について、サイトエンジニアを加えて以下を協議した。 ・現地混合土と室内配合試験土との対比 ・相違を踏まえた現地確認方法 ・現地試験結果の施工への反映方法
	(2)現場での実施内容	1）安定処理路盤施工に必要な調査の仕様規定計画を立案（材料撹拌、ローラー締め固め時間等） 2）材料、締め固め度確認などの品質試験内容は協議済み。
	(3）実施体制	1）直営工事方式における、現場技術者と品質管理技術者（RRL）の役割と実態把握。

細目番号	活動細目名	実施内容
2.3.5	機材調達計画支援･入札支援	路床安定処理用機材等の調達支援のため、下記の表 2.10 に示す機種の入札仕様書の作成、参考見積書の入手を実施。 並行して、PW 機材部所有の機材、借上げ機材の手続きを進めた

表 2.10　入札仕様書の準備を実施した機材

	機種	検討結果
①	ミキシングバケットおよび装着のための改造キット（PW 保有のエキスカベータ改造用）	2013 年 11 月にノンプロ無償でロードスタビライザー（路盤処理用）（写真 1）が納入されたため、左記①～③の本プロジェクトでの調達は、中止となった。
②	ミキシングバケット付きエキスカベータ	
③	ロードスタビライザー（写真 1）	
④	土質調査用ボーリングマシン	2014 年 2 月には現着
⑤	小型固定式ソイルプラント（写真 2）	P-2 工事開始前までに調達の予定。ソイルプラントの調達工程を図 2.5 に示す。



（写真 1）ロードスタビライザー（路盤用）

（写真 2）　ソイルプラント

内　　容	時　期	2013年度 3月	2014年度 4月	5月	6月	7月	8月	9月	10月	11月	12月	2015年 1月	2月	3月	4月
A4フォーム手続き	1ヶ月														
機材購入・輸送請求書の送付															
本部原価／調達部にて内容を審査	1ヶ月														
公示準備／公示	1ヶ月														
入札会／審査	1.5ヶ月														
契約締結															
機材製作準備・組立・検収	4ヶ月														
機材納品															
輸送準備／輸送（本邦出発）	1ヶ月														
緬国到着／輸送手続	3週間														
据付技師派遣／据付作業／検収	2週間														
据付完了／現地引渡し															

図 2.5 固定式ソイルプラント調達工程表

図 2.6 プラント設置予定箇所

細目番号	活動細目名	実施内容	備考
2.3.6	機材管理計画作成支援	現場の機材管理組織、現場で使用中の機材管理帳票を調査し、安定処理用機材オペレータの能力・技量向上研修方法を検討し PP-1 では現場で各種機材の OJT を実施した。	プラント組立・設置および初期操作訓練を、PP-2 仮設ヤード内で実施した(4/3 - 4/10)。
2.3.7	″草の根プロジェクト″との協調	コンサルタント契約書に規定[7]されている JIP との連携方法について数回の打合せをおこなった。 その結果、次のような合意がなされた。 ➢ 調査・試験舗装等を通じて得た情報は JIP と TCP の間で共有する。 ➢ JIP の用意する簡易舗装マニュアル案に対し必要に応じ提案する。	

活動番号 2.4: パイロット工事の事業計画にもとづき、PW 技術者によって施工されるパイロット工事の実施を支援する

細目番号	活動細目名	実施内容	備考
2.4.1	建設管理	PP-1 は 2014 年当初から実施し、5 月の雨季入りで、路側排水施設、法面保護を残し終了し、11 月に入り PW 側で再開。 石灰・セメント道路安定処理の工事参考用として、Reference Paper for Road Stabilization を準備した。 (Annex -6-1-1) パイロット事業の工事費は、原則 PW 側の負担であるが、その予算が変動するため、PP-1 では工事規模が変動し、工事実施内容に影響してきた。	PP-1 同様に PP-2 においても工事開始が遅れ、3 月から 4 月の予算年度をまたぐことになるため、この間の予算の継続性について PW 側に配慮を要請し、承認された。
2.4.2	材料品質管理、出来型管理	現場での品質管理基準を準備し技術移転してきた。 PP-2 でも PP-1 同様の管理体制で実施。	

[7]特記仕様書第 7 条 (3) パイロット工事の選定の項

2.4.3	機材管理	現場の費用負担が実行予算に明示されていない PW 機材部からの借用の場合は、総裁へ申請する。一方、民間業者からの借上げの場合は、現場事務所が直接に手配するので、事前の機材選択・調達先の検討が重要。	2015 年 4 月のソイルプラントの設置時にメーカー側の初期研修が実施された。

活動番号 2.5: パイロット工事を通じて、道路技術者、機械操作者などを対象にして、道路整備に関する研修を実施する

細目番号	活動細目名	実施内容	備考
2.5.1	設計施工作業に係る研修	安定性を考慮した盛土の設計方法、法面処理、路面排水設計等を WS、OJT を通じ技術支援した。 既往の PW ﾏﾆｭｱﾙ（ORN 31 ﾍﾞｰｽ）に順じて、作業を実施しながらも、草の根の作成マニュアルや AASHTO マニュアルの考え方についても、PW が理解を深めるよう支援を行った。 幾何構造設計については、高速道路・一般国道の調査を経て、問題点の改善方法の提言を行った。	PP-2 の設計施工に関わる研修をワークショップや OJT 形式を通して実施 sita（2015/02-05）。 高速道路・一般国道への提言を取りまとた。（2015/06）
2.5.2	軟弱地盤対策の計画・施工に関する研修	橋梁取り付け高盛土部の動態観測・解析を行うための機材調達を 2014 年 2 月に実施し、10 号線の Kyew Chan Ye Kyaw 橋の工事直前に OJT を兼ねて現地に設置した。 安定性、沈下量の推定については、現地のボーリング調査結果をもとに 15 回の WS 形式の OJT を継続実施した。	
2.5.3	工事の品質管理に関する研修	現場職員の出来形管理・品質管理能力向上につながる研修計画を立案し、実施した。	
2.5.4	施工機械・オペレータの技量向上のための研修	技能向上結果を、指標をもちいて評価してきた。詳細は PP-1 結果報告書に記載。 PP-2 ではソイルプラントの技能講習を実施した	

活動番号 2.6: パイロット工事の事業計画を踏まえて、パイロット工事をモニタリングする

細目番号	活動細目名	実施内容	備考
2.6.1	採用技術の現地適用性の検討	動態観測とその解析方法について大嶺教授からの助言を受け、ワークショップを開き、PW 側と方針を打ち合わせ、必要観測機材を現地に設置し、雨季の間の工事中断中も観測を継続的に実施した。	乾季に入り 12 月から盛土工事が再開され、観測も再開されたが、盛土高さが 5m を超える 3 月以降に本格的監視を実施、完成後も 1 年程度は観測を継続するよう PW 側に要望。
2.6.2	実施機関能力に係る課題の整理	盛土の動態観測は、PW では最初の試みなので、若手技術者にマニュアルを配布しノウハウを身につけるよう指導してきた	PW の工事形態は、直営が主体であり、工事仕様書的なものはなく、予算不足もあり、品質管理は行われているとは言い難い。 週末になると大臣、副大臣が現場視察に頻繁に訪れ、政治的配慮から、現場に様々な指示を出して行くが、予算の裏付けは当面なく、現場は、不足気味の他のプロジェクト予算から捻出することになる。結果として、地区工事全体としての道路品質はさらに低下するという状況にある。
			PP-1 区間の安定処理材料の劣化度を計測するために、コア抜きによる試料採取および室内試験を実施した。 コア抜き器は、RRL 予算にて購入済み。

活動番号 2.7: パイロット工事で得られた知見、結果などを共有するためのワークショップ/セミナーを開催する

<table>
<tr><td>細目番号</td><td>活動細目名</td><td>実施内容</td></tr>
<tr><td rowspan="5">2.7.1</td><td>セミナー

2013 年 6 月 13・14 日</td><td>第 1 回セミナーは参加者約 52 名により実施。
下記に日本側の講演者と演題を示す。
<table><tr><td>講演者</td><td>演題</td></tr><tr><td>古木委員長</td><td>熱帯での舗装</td></tr><tr><td>曽根室長</td><td>日本の道路基準</td></tr><tr><td>宮武上席</td><td>軟弱地盤対策</td></tr><tr><td>久保上席</td><td>舗装</td></tr><tr><td>大嶺教授</td><td>軟弱地盤対策</td></tr></table></td></tr>
<tr><td>2014 年 5 月 22 日</td><td>道路材料と改良についてラカインの橋梁塩害調査後 NPT　PW 本部でプレゼンテーションを開催
出席者　曽根室長　渡辺主席（土研コンクリート室）</td></tr>
<tr><td>2014 年 5 月 28 日</td><td>PP-1 報告会　NPT
<table><tr><td>講演者</td><td>演題</td></tr><tr><td>U Kyaw Linn</td><td>開会挨拶</td></tr><tr><td>U Kyaw Shein</td><td>PP-1 の概要紹介</td></tr><tr><td>U Aung Myo Oo</td><td>PP-1 の内容説明</td></tr><tr><td>Daw Kyi Kyi Thwe</td><td>高盛土動態観測紹介</td></tr><tr><td>大嶺教授</td><td>軟弱地盤上の高盛土施工上の注意</td></tr></table></td></tr>
<tr><td colspan="2"> 
セミナー風景</td><td> 
セミナー講師写真</td></tr>
<tr><td>2015 年 6 月 16 日</td><td>最終セミナーが、日本から3名の専門家を招聘して実施した
講演者と演目は下記の通り
✓ JICA TCP の目的・活動・今後の課題（三宅専門家）
✓ PP2 の舗装設計法（ニン・ユ・アウン女史）
✓ PP2 での工事監理（テット・ゾー・ウィン氏）
✓ 軟弱地盤上での高盛土の動態観測（ター・ジン・ティン・ゾー女史）
✓ ミャンマーにおける道路建設改良の実情と将来計画（アウン・ミン・ウ氏）
✓ 日本における軟弱地盤への適応事例と最新情報（宮武上席）
✓ 軟弱地盤での高盛土の安定性についての提言（大嶺教授）
✓ 技術協力と将来の方向（古木委員長）</td></tr>
</table>

細目番号	活動細目名	実施内容
2.7.2	ワークショップ	現在までに通常のワークショップを 3 回、他に OJT 的な WS として高盛土の安定と沈下解析計算を訓練する目的の小 WS を計 15 回開催した。 各回の「ワークショップ報告書」を作成し、PW 側にも提出済みである。

表 2.11　ワークショップの概要

	テーマ	日時	会場	出席者数	
第 1 回	PCM 手法導入に関する講義、本 TCP の PDM の目的分析と評価指標の改訂	2013 年 5 月 27 日	中央研修センター（CTC）、ヤンゴン	約 50 名	
第 2 回	-舗装設計の実施アプローチ -スタビライザーの操作手法 -土質材料の品質管理手法 -現場での施工実施手順 -地盤の挙動に関する解析手法（大嶺教授による講義）	2013 年 12 月 13 日	中央研修センター（CTC）、ヤンゴン	約 30 名	
第 3 回	Kyew Chan Ye Kyaw 橋取り付け道路高盛り土区間の動態観測 動態観測の必要理由 使用する観測機器 観測機器の設置方法 データ収集・整理・解析方法	2014 年 3 月 28 日 2:00 -4:00	SRL (Soil Test & Research Laboratory) 会議室	23 名	
第 4 回	PD との協議の結果、SRL と RRL の若手技術者を対象にした高盛土区間盛り土工事中の動態観測から得られるデータ解析の実習	2014 年 4 月 3 日 – 12 月 10 日	SRL 会議室	10 名 x 15 回	6 月、8 月、11 月 12 月に毎週 1 回の割合で開催
第 5 回	高盛土作業実施箇所視察	2015 年 2 月 23 日	ボガレー工事事務所	60 名	高盛土動態観測の概要説明 観測機器設置箇所の見学
第 6 回	ソイル混合プラントを用いた材料安定処理に関するワークショップ	2015 年 4 月 29 日	ボガレー橋管理事務所	53 名	下記の項目に関して、MOC 側担当者による、発表が実施された。 - 舗装設計 - 材料配合設計 - 材料品質管理 - プラント操作手法 - 現場実習

PDM の目的分析実施状況

大嶺教授による高盛土観測の講義

第 3 回 WS 「高盛土動態観測の必要性」参加者

第 4 回のうち 9 番目及び 10 番目の WS

細目番号	活動細目名	実施内容	備考
2.7.3	OJT	材料配合試験 路床の設計 CBR の決定や、現地発生土から舗装材料を生成するために必要な材料の配合試験を、共同で実施し、PW はこれらの手法を会得した。	試験計画、結果の評価については所長を始めとする上級技術者を交えて協議した。 アシスタントエンジニアをリーダに安定処理土配合試験の OJT を行った。
		PP-1 施工監理業務 施工監理業務（施工手順、出来形管理、材料・機械施工の品質管理）に関する OJT を施工期間中（2014 年 1 月～4 月）実施した。	PP-2 の施工監理業務の OJT を、工事期間（2015 年 2～5 月）を通じて実施した。
		PP-2 高盛土動態観測用機器設置 OJT	
		PP-2 高盛土動態観測方法の OJT	動態観測要員は、測定期間中に 2 回要員交替があり、その都度、業務引継ぎ状況の確認と補足 OJT を実施したが、現場観測要員には測定データの解析判断が難しいと考え、道路研究所の若手職員を解析要員に育成する OJT を実施した

		PP-2 プラント操作に関する OJT	プラント製造メーカーから日本人技術者を招へいして実施した訓練を受講した MOC 技術者が、その後は、マニュアル等の自主学習に取り組み、さらなる技術向上に努めた。また、技プロチームも、その取り組みを支援した。
2.7.4	本邦研修 第 1 回	2013 年 9 月 30 日～2013 年 10 月 11 日の期間に、研修員 5 名に対し、日本の現状と取り組みを伝え知識を向上させることを目標に本邦研修が実施された。 研修先では有明海岸道路の視察が好評であったが、カリキュラム全体も有益との反応を得た。 研修内容の詳細は「研修員受入業務完了報告書（平成 25 年）」に示している。	
	本邦研修 第 2 回	2014 年 9 月 28 日（日）から 2014 年 10 月 11 日（土）に、研修員 5 名に対し軟弱地盤対策や再生舗装工事に関する我が国の取り組みを伝え、将来的な「ミ」国における技術力向上に寄与する目的で実施された。 日本の道路維持管理・組織体制や研究所・企業がもつ技術についての知見を深められたという報告が研修員から寄せられている。 研修内容の詳細は「研修員受入業務完了報告書（平成 26 年）」に示している。	
	本邦研修 第 3 回	2014 年 10 月国交省補助で RRL の 3 名が 1 週間本邦研修を受けた。担当は三宅長期専門家で、短期専門家の契約項目外の活動である。	
	本邦研修 第 4 回	2015 年 1 月 24 日～2 月 5 日の間、海外産業人材育成協会（HIDA）の費用で本邦研修に 10 人の技術者が招かれた。担当は三宅長期専門家で、短期専門家の契約項目外の活動である。	

有明海岸道路現場

参加者（JICA 九州において）

2014 年度参加者

2014 年長崎アスファルト合材工場見学

細目番号	活動細目名	実施内容	備考
2.7.5	国内支援委員会	支援委員会としての活動は下記のように実施された	
	第1回 （国内） 2013.04.02	1. 技術支援プロジェクトの概要と現況報告および国内支援委員会概要説明 2. デルタ地域の道路概況 3. 現地セミナー（第1回）および本邦研修（第1回）のテーマ、日程について 4. 草の根事業の概況と現況報告（小室委員）	
	セミナー （現地） 2013.06.09 -06.16	1. 講演 （内容は、活動細目番号2.7.1に記述） 2. 現場訪問	
	第2回 （国内） 2013.07.31	長期専門家（藤本氏）の業務従事中止についての報告 現地セミナー報告（古木委員長） 近況報告（三宅専門家） ワークプラン案の説明（兼田） 草の根プロジェクトによる舗装マニュアル 盛土動態観測	
	TV会議 2013.09.18	草の根プロジェクトとTCPの協調について 各チームの取りまとめるマニュアル基準の範囲調整（舗装の技術基準作成・改定はTCPの対象外）	
	JICAでの打合せ 2013.12.27	舗装設計について実際の計算例を示す講習会開催が要望された 評価指標についての検討がなされているかという質疑があった	
	第3回 国総研での打合せ 2014.04.14	塩害橋梁現地調査について 軟弱地盤試験施工の報告会を5～6月に開催する件 TCP実施上の問題点 技術移転方法（写真付き工事内容説明書配布） PP-1進捗報告 記録必要項目の提言	
	JICAでの打合せ 2014.11.20	1. PP-1安定処理工の工費の妥当性について 2. PP-2舗装設計への多層弾性理論導入に際しての留意事項	
	JICAでの打合せ 2015.07.28	JICAおよび支援委員会への報告会	

第 3 章プロジェクト実施上の課題 ・工夫 ・教訓 （業務実施方法、運営体制等）

3.1 プロジェクト実施上生じた問題点

下記にプロジェクト実施上生じた問題点、その対策、今後の提言を示す。

表 3.1 プロジェクト実施上生じた問題点、その対策、今後の提言

	問題点	実施した活動	提言
1. PW 側の全体事業計画	初期段階では、PW 側の事業計画の内容が不明瞭であり、更新されていない情報が含まれていた。	PW 側のできるだけ多数の担当者・関係者から情報を入手してきた。	全体事業計画は、定期的に中央の部署で一元管理・更新し、情報集約・管理に関する作業手順の確立も必要である。
2. 配合試験	安定処理土の締め固め度を変化させ強度試験を実施したが、実際の現場工事では、締め固め度のバラ付きに加えて添加材撹拌の不確実性による強度変化も生じている。	現地で入手容易な土質材料の組み合わせ配合比の検討。セメント、石灰を用いた室内配合試験と現場での材料配合方法の指導。 現地配合土や試験結果を確認するために必要な試験の指導および、試験結果の施工への反映等について技術移転した。	パイロット工事で、材料撹拌回数や締め固め時間についてのデータを蓄積し、使用機材や作業環境などによる設計配合における割増係数や、品質管理基準の整備を行う必要がある。
3. 機材調達方法	予定していた機材が他プロジェクトで調達されることになり、調達のための仕様書、入札書等の準備を行ったものの、調達が中止になる機材が続出した。	調達情報が遅れることがあったが、変化に対応するよう努力してきた。	他案件の入札情報、機材の納期等の情報収集に努め、効率的に進める必要がある。
4. 他のプロジェクトとの作業調整	わが国の複数の他プロジェクト[8]および ADB のプロジェクトが同時並行で実施され、そのいずれもが道路研究所（RRL）に配合試験を委嘱する事態となったため、研究所の作業が多忙となり、本技プロの PP-1 に関する配合試験の結果が遅れる事態を招いた。	個別に各プロジェクトに接触し情報を入手してきた。	日本側内部におけるプロジェクト調整が必要である。また、PW も RRL の実施能力を越えると想定される場合には、試験の外注などの方策を講じる必要がある。
5. 新規盛土及び盛土の動態観測	50 を超える新規長大橋梁工事の大部分は完了しつつあり、圧密沈下対策や動態観測が行える新規の盛土区間は残り施工箇所が限定されてきていた。いずれの対象箇所もサンドパイルのような圧密対策を行うための時間的余裕も予算も PW にはなかった。	2014 年 3 月から開始された Kyew Chan Ye Kyaw 橋取り付け道路区間の高盛土の施工計画にあわせ動態観測を始めたが雨季に入り同年 5 月から中断。12 月から再開、2015 年 4 月末完工した。	現地の盛土施工の状況を観測し解析結果を現場にフィードバックする情報化施工の具体例として技術移転を進めてきたが、測量技術者の未熟さ、データ取りまとめを含む監理者を明確にするという 2 点の解決に努力した。

[8] 草の根プロジェクト、ノンプロ無償による安定処理機の供与、国交省支援の安定処理試験舗装、貧困削減道路プロジェクト等。

	問題点	実施した活動	提言
6. セミナー	セミナー後のアンケート結果によると、総じて理解の程度はまあまあであるが関心はそれほどないという結果を示している。	セミナーでは、受入国側の要望を取り入れるようにしてきたが、具体的要望は少なかった。	PW という組織を通じての要望は MD を通さねばならないが、若手の要望を直接拾い上げる方策を考慮する必要がある。
7. ワークショップ 1（PCM 及び PDM）	ワークショップ前後の理解度の比較アンケート調査回答に有意差はなかった。 その理由としては 1） PW のスタッフは、専門家が（PW の協力の下に）プロジェクトを実施していくものだという誤解を有している。	ミーティング毎に技プロの趣旨を説明し理解を求めてきている。	PW スタッフには、自主性や積極性を持ってもらうため、十分な準備の時間が必要である。
	2）昼食と茶菓以外の配布資料等の準備作業は、JICA 専門家により行われた。	参考資料の準備と説明を事前に実施。	実施にあたり資料の準備作業が重要と言う意識改革を図る。
	3） ワークショップの時間は 1 日（5 時間）であり、新システムや手法を学習するには十分な時間とは言えない。	時間延長を要望してきたが、C/P 側多忙という理由から時間拡大は実現できていない。	ワークショップの時間を拡大する。 OJT として実施する （しかし、OJT の場合、主要メンバーの参加が困難）。
	4） PW のスタッフは主業務を持っているため、技術協力プロジェクトのカウンターパートとして十分な時間参画することができない。	1 週間のうち数日はプロジェクトに専念するように要望してきた。	（余裕のあるときだけ参画するのでは成果が得られない）。
ワークショップ 2（PP-1 の実施検討及び高盛土動態観測方法）	第 2 回ワークショップは、約 2 ヶ月前から計画され、長崎大学大嶺教授の招聘を含め、準備されていたものであるが、2 日前になり PW 側の都合で、PP-1 の実施主体である現地工事事務所から誰も出席できないことになった。	道路研究所、土質研究所、ヤンゴン工科大学、地方工事事務所の出席者で、行われた。	PW 側の突然の計画変更はしないという約束を取り付ける。
ワークショップ 3	高盛土の安定性と圧密沈下解析を習得するためにはある程度の講習期間が必要であるが、PW の 上級エンジニアは、本来業務が多忙で時間のかかる解析業務のないよう習得は困難	まず概要のみの説明のための第 3 回ワークショップを実施した	高盛土の安定性・圧密沈下の解析方法の習得には、基礎知識と語学能力双方が必要であるが、該当する若手技術者の数は未だ少ない
ワークショップ 4		若手技術者を対象とした解析講習会として 15 回実施	
ワークショップ 5		わずか半日ではあるが上級技術者を含めた 60 人を高盛土の施工現場に招き動態観測の実施状況の説明を行った	

ワークショップ 6	PP1 での安定処理工法がハイコストであるとの指摘を受けた。 また、イラワジの道路舗装は、径 10ｃｍ以上の砕石材料が路盤に使用されている箇所が多く、スタビライザーの能力の限界が感じられた	MOC および技プロチームは、プラントを用いた、より効率的かつ経済的な安定処理工法の実施を提言した。 従来工法との比較コスト分析を実施。	MOC は、下記に示すように、各工種の特性（実施場所や材料)に応じた機材選定を実施することを推奨した。 - バックホーを用いた混合 - スタビライザーを用いた現位置安定処理混合 - 仮設ヤード内でプラントを用いた安定処理混合 実施内容は、PP-2 完了報告書に記載（工事継続中につき、提出は 2015/07/31 までとすることで、JICA と合意）。
8. 本邦研修	2013 年度本邦研修実施時点では PP-1 が未実施であり、PP-1 の結果からの課題抽出と同課題解決に向けた研修カリキュラム作成はできなかった。		実施後のアンケートのコメントにみられるように、軟弱地盤の盛土対策、浅層安定処理手法の習得はミ国エンジニアにとって重要度の高い課題である。 将来的な技術導入を鑑み、引き続き先進的技術の紹介も含める必要がある。
9. パイロット工事で可能な工種・内容	日本側からの各種提案について、ミ国側からは、予算措置が困難なため、実施出来ないとの対応が多々見られた。	ミ国側事業者の予算に基づき工事内容、規模を変更してきている。	先方の実施する工事に立会い、問題点の解決のための支援をする仕組みを作る必要がある。
10. パイロット工事の品質保証	品質管理マニュアルが整備されていないため、工事管理が十分になされていない。	現地品質試験のスキル向上を図った。 施工担当者と品質試験担当者の協議をその都度設けて、品質保証のための現場作業手順を訓練した。	高盛土での土工と安定処理用の品質管理基準や工事管理マニュアルのようなものを準備する。
11. 技術協力プロジェクトの実施者（カウンターパート）	本技プロのカウンターパートは、多数の援助プロジェクトを同時並行して担当しているため、実質上、自らが実施していくには、無理がある。	カウンターパートが実施する業務において、その実施上、技術上の問題点を探り、解決方法を模索し提言してきた。	外国援助が続出している現在のミャンマーでは、落ち着いて一つのプロジェクトに専念して実務を行いながら技術の向上を図るには、援助側も含め、方針、組織について見直しが必要である。
12. 軟弱地盤対策工マニュアルの作成	ミャンマー国には軟弱地盤の多いデルタ地域がエーヤーワディ地域のほか、西部ラカイン州、東部州に分布する。圧密沈下対策、盛土安定性の検討、盛土側面のり面崩壊対策の具体的対策は取られてこなかった	軟弱地盤地域内での対策指針として、我が国の道路協会の発行する「軟弱地盤対策工指針」を英訳し、さらにミャンマー国の状況に適合するように改訂した。	現場のエンジニアでも使えるように、ミャンマー語版を公共事業省で作る。 内容に理論的なところが多く高度すぎる。現場のエンジニアが使えるような実務的なもの（ハンドブック）が必要である。日本側のフォローが必要である。

3.2 教訓

本プロジェクトを通じて得られた教訓は次のようなものである。:

技術協力プロジェクトは、無償・有償支援プロジェクトに先駆け、先方政府の職員の能力向上を目的として実施されるものであるが、その前提として、先方政府の職員の積極的参画が望まれる。しかし、2013 年頃からミャンマーの社会体制が開国に向かい、海外の支援機関からの各種援助プロジェクトが一挙に集中して行われたため、本技プロ開始早々から、先方政府の職員は、多忙を極め、腰を落ち着けて、能力向上のための行事に参画する時間的余裕がなくなってしまった。一方、多数の職員を集めての短時間のセミナーには、知的好奇心が満たされるためもあり、多くの参加者が集まり、大部分の参加者は、有益であった、今後も継続して欲しいという感想をよこしている。また、日本国内での研修旅行も同様に非常に好評であった。

問題は次のような点の解決方法にあると考える。

表 3.2 プロジェクト実施上生じた問題点と解決策案

問題点	解決案
1) ひとつのポジションにとどまることが 3 年程度である公務員に、3 年程度の期間の技プロを実施した場合、途中でのメンバー交替を前提として考えざるを得ない。	自発的引継ぎのほかに、TOT（Training of Teacher）や技能向上マニュアルの早い段階での準備等、技プロとして対応が必要である。
2) 短時間でのセミナーは、概要を紹介するのに向いているが、専門的内容の実務の習得には、長時間が必要となる。	技プロ開始前に、概要紹介セミナーと実務知識習得講習会の内容・必要時間・できれば必要な基礎知識を受入国側に紹介し、TCP にふさわしい人物の事前選択をお願いしておく。
3) ワークショップ・OJT での能力強化には、専門用語を理解できる語学力が必要である。今回の技プロでは PW 側から参加スタッフに技プロの機会を利用して英語能力の向上を期待する旨の発言があった。	当初から専門用語を理解できる通訳を確保しておくか、受入国側の参加者が専門英語の能力を有したものであることが望まれる。
4) 直接セミナー、WS、OJT に参加することは難しいが、将来の能力強化の手段の一つとしてマニュアル等の参考書の希望が多かった	日本の基準、指針等の英語版を強く要請されたが、国情が異なることを考えると、単純に翻訳したものを手渡すだけでは不十分で相手国に見合ったものに改善しなければ意味がない また受領したものをミャンマー側で消化、改善する継続的努力が可能となる体制作りが望まれるが、予算・時間的余裕がない状況でどのように対処できるか詳細計画策定調査時点での議論が必要である

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5) 各地区事務所は、乾期内（通常 12 月～翌年 4 月）に、数多くの道路関連工事（改修、補修、拡幅など）を、限られたリソース（機材、人員、予算など）を用いて同時並行で実施する責務を抱えている。このため、PP-2 の工期初期の段階（2～3 月）では、現場への機材搬入の段取りが付かず、遅れたことにより、当初計画時よりも工事の進捗が遅れる事態となった。	技プロチームは、地区事務所の準備作業を支援するために、PP-2 実施概要を 2014 年 12 月に発表・説明した。しかし、詳細内容（舗装構成・厚さ、安定処理材料の混合比率など）が、室内試験実施・検討の遅れにより、翌年 2 月まで最終決定できなかった。これが、準備作業遅延の一因となったことも、認めざるを得ない。 今後、試験担当部署である RRL は、現況のキャパを考慮した上で、適正な試験計画・スケジュール策定を実施するべきである。さらに、それを実施することで、地区事務所の事業費積算・材料調達業務の迅速化を支援することに繋がると考える
6) 技プロチームは、現地調査を通じて、道路幾何構造および交通安全施設の観点から、安全上脅威となる、多くの課題点を確認した。チームは、それらを主要な原因別に 6 つに分類し、それぞれに対する改善のための提言を、取りまとめた。ここでは、提言も実施に向けた実現性（=難易度）に応じて、3 つのレベルに分類した。	チームは、例え軽微な変更作業でも、多大な改善（安全の向上）が期待できる課題箇所が数多く存在することを確認している。MOC による、これらの箇所の迅速な改善作業を期待する。

第 4 章プロジェクトの達成度

4.1 中間評価の実施

2014 年 8 月 10 日から 2 週間、中間評価が実施された。

メンバーは次の通りである。

総括	三宅繁樹	JICA 社会基盤・平和構築部、運輸交通・情報通信 G、第二チーム課長
協力企画	土橋徹	JICA 社会基盤・平和構築部、運輸交通・情報通信 G
評価分析	白井和子	（株）かいはつマネジメント・コンサルタント
PW 側	U Aung Myint Oo	New Project director of this TCP, Deputy Chief Engineer, Planning Dept., PW-HQ
	Daw Hla Hla Thwe	Project Manager, Superintending Engineer, Road Dept., PW-HQ
	Daw Mya Mya Win	Assistant Project Manager, RRRL, Deputy Superintending Engineer

当初予定した PW 側との JCC を含めた日程は、PW 側の半期毎の予算策定会議と重なったため，下記のように変更となった。

当初予定した主要日程	実際の日程	備考
August 20 議事録案と評価報告書案の説明協議	August 19、PW 側 PM と APM に説明後、同日午後、MD に説明	
August 21 議事録のまとめと JCC による承認	August 20、MM に MD の署名取り付け	JCC が開催されず、MD からの単独署名となった。

合意した議事録については、Annex 4-2 を参照

中間評価結果の要約は下記のとおりである

妥当性	やや高い	BS, AASHTO 及び日本の基準の相違点を分析しミャンマーの道路に適合する基準を作成したいという PW の意向は強い
有効性	中位	PW の技術者の能力強化度合いを評価するものとして、道路状況の改善度合いを評価する指標はなじまない 道路技術職員の実務上の技能や知識の強化が、PW の能力強化に直結するものである
効率性	やや低い	C/P はプロジェクト活動に全面的に従事できない状況にある。 活動の一部は PW 側の予算の不足により変更を余儀なくされている.
インパクト		旅行時間や病院・買い物へのアクセス面からみれば PP-1 の沿線住民の日常生活に改善が見られた。
自立発展性	中位	従来のマカダム工法に比較し安定処理工法のコストが倍に近いということは、予算的にみて、安定処理による道路延伸に対し重要な問題といえる 土質試験や建設作業での新技能・知識については全技術者が評価している.

重要なコメントを下記に記載する

評価チームコメント	双方のコミュニケーション不足を改善する必要がある。 プロジェクト完了後も安定処理工法を継続するため、JICA ローンプロジェクトのなかで実施することを JICA として検討する。
MD のコメント	（安定処理も含め）TCP で導入した工法を今後ミャンマーで普及していく為には、マニュアルと合わせて必要予算額別に工事代替案を 3 つ以上作成し添付する必要がある。 TCP の成果は、共同で実施の工事を通じた技術移転より、後に残るマニュアルが重要と考えている

なお、評価チームから、PDM について数値目標を明記したものが望ましいとの助言があった。このため、2013 年 9 月第 1 回 JCC で承認された Ver. 1.0 を修正した Ver. 2.0 案が提議され、2014 年 12 月 17 日、JCC の議長である MD の承認が得られた。その経緯を以下にまとめた。なお、Ver. 2.0 案は、Annex 1-1 に示す。

新指標承認の経緯

年月日	内容
2013 年 5 月 27 日	PCM-WS を開催し、PDM Ver. 1.0 を作成
2013 年 9 月 5 日	JCC で PDM Ver. 1.0 が正式承認される。
2013 年 12 月	業務進捗報告書 1 をまとめるにあたり、指標がプロジェクトの成果を表現するのに、不十分なため、新指標についての提言を行う（業務進捗報告書 4 章）。
2014 年 8 月	中間評価調査団からも指標改定の必要性が指摘され、合同で PDM Ver. 2.0 案を作成し、PW 側に承認の必要性を説明した。
2014 年 10 月 16 日	TCP チームが PDM Ver. 2.0 案について、カウンターパート内で協議することを提案し、その結果、変更内容について協議するとの申し入れがあった。
2014 年 11 月 29 日	PD と新指標についての PW 側の承認手続きについて再協議した結果、 PD が MD に確認することになった。
2014 年 12 月 17 日	MD の署名の入った新 PDM 用評価指標一覧が送付されてきた。 JCC は開催されないままであるが、JCC の議長が承認したという解釈をとることにした。

4.2 終了時評価の結果

終了時評価は 2015 年 3 月 8 日から 2 週間の日程で行われた.

終了時合同評価チームの構成は下記のようになっている:

総括	垣下　禎裕	ＪＩＣＡ本部　社会基盤・平和構築部　参事役
協力企画	土橋　徹	ICA社会基盤・平和構築部、運輸交通・情報通信G
評価分析	小野澤　雅人	IC ネット　コンサルタント
PW側	Mr. Aung Myint Oo	Project Director, Public Works, Ministry of Construction, PW
	Ms. Hla Hla Thwe	Project Manager, PW
	Ms. Mya Mya Win	Deputy Superintendent Engineer, RRL, PW

討議議事録を Annex 4-3. に添付する

評価結果の要約を下記に示す

妥当性	高い	ミャンマー側の道路整備方針と日本側の援助方針はおおむね一致している
有効性	中位	成果 2（道路技術者のエーヤーワディ･デルタ地域に適用可能な道路設計･施工にかかる実用的なスキル･知識が向上する.）は達成途上にあるが、すべての成果およびプロジェクト目標が達成される見込みは明白である
効率性	中位	投入は当初の合意と計画どおりほぼ達成されている 健康上の理由によるチーフアドバイザーの途中帰国は業務進捗面でマイナスとなった
インパクト	比較的高い	軟弱地盤処理、圧密、圧縮、土質安定処理等の課題と対策をプロジェクトでは紹介した
自立発展性	全体としては中位	道路網拡大と維持管理の最近の傾向は、地方レベルに対しての最小限の予算の下で継続される見込みである
技術面の自立発展性	条件付で高いといえる	(i) PW スタッフの知識・技能の内容向上のため、継続的な努力がなされることが条件 (ii) PW が知識・技能を組織として整備・確立するため、全技術者に対しマニュアルの内容を教育するプログラムを整備することが条件 (iii) PW が組織的に知識・技能を強化するための人材開発(HRD)をすすめるため、全職員に対し職員の行動改善と HRD の総合基本計画の訓練の機会を与えることが条件

下記に評価チームと総裁からのコメントを示す.

評価チームのコメント	マニュアルの継続的な改訂	軟弱地盤対策マニュアルについては、プロジェクト完了後も編集委員会により改善改定されるべきものである
	建設計画と建設方法についての合理的選択	PWがより合理的な判断・決定を行い、建設計画と建設方法についての合理的選択を促進することが望まれる
	プロジェクトの成果の採用・普及	プロジェクトで得た結果をPWで実施される他のプロジェクトに適用・拡大することが望まれる.
	技能の実際的活用	プロジェクトを通じ移転された技術を使用・応用することが望ましい。たとえば石灰セメント安定処理工法をこれからの外国資金援助プロジェクトに適用することである。高盛土の新設計方法は次の橋梁建設プロジェクトで採用されるべきものと考える
総裁のコメント	プロジェクト完了時、軟弱地盤対策マニュアルはPWで討議され承認される予定である。高盛土の挙動や安定処理による道路建設でのPW技術者の技術的知識や技能もまた改善されると考えている。 PW 側は、安定処理による道路建設での土質調査、設計、品質管理、品質保証、建設管理、維持管理のための新しいマニュアルができることを希望しているが、プロジェクトからの成果はない。プロジェクトの結果は、PWの期待とは異なるものである。投入に見合うどのような大きな成果が得られたかでプロジェクトを評価すべきと考えている。	

終了時評価チームは、PP2 でのソイル混合プラントを用いた安定処理以外のほとんどの活動が完了したことを述べた

4.3 プロジェクトの達成率

PDM の評価指標に基ずく 2015 年 6 月現在のプロジェクトの達成率を下記にまとめた:

<table>
<tr><th>プロジェクト要約</th><th>評価指標</th><th>入手手段</th><th>達成結果</th></tr>
<tr><td rowspan="2">プロジェクト目標
災害多発地域（エーヤーワディ・デルタ地域）に適用可能な道路整備にかかる公共事業局の能力が強化される</td><td>1. 道路設計・建設に係る技術者の技能・知識が強化されたことが 30 人以上の職員からのヒアリング結果から確認される</td><td>プロジェクトでは 50 名の職員に、道路設計・建設に係る技術者の技能・知識が強化されたかをアンケート調査した</td><td>17 名が強化されたと回答。
24 名が有用な知識技能をある程度得たと回答。
9 名が否定的な回答。
結果として 41 名の職員から技能・知識の強化につながったという確認を得た。</td></tr>
<tr><td>2. プロジェクト完了時までにパイロットプロジェクトを通じ紹介された技術により建設された道路延長が 2.6km 以上になる</td><td>PW 側から下記のような確認を得ている<table><tr><td>PP1</td><td>1.6 km</td></tr><tr><td>PP2</td><td>0.6 km</td></tr><tr><td>Others</td><td>0.0 km</td></tr><tr><td>Total</td><td>2.2 km</td></tr></table></td><td>PW 側の予算の都合もあり、総合出来高は目標の 92%でとまった。しかし本プロジェクトに継続して行われる ADB ローンによるマウビンーピャポン間の道路改良工事で安定処理が採用されると聞き及んでいる。</td></tr>
<tr><td rowspan="2">成果 1
道路設計および施工に関する技術基準・マニュアルが改善される</td><td>1-1.
軟弱地盤対策マニュアルが PW により討論され認められる</td><td>2015 年 6 月 22 日に計 80 部のマニュアルを公共事業省 RRL、BRL およびヤンゴン工科大学に配布したが、ミャンマー側への説明会はこの前後に累計 4 回実施された。
MOC 側は、本マニュアルが公式に承認されると表明した。</td><td>2015 年 6 月 10 日のマニュアル発表会では、大臣、PS はじめ公共事業省の幹部・エンジニアが参加し、議論を行った。
ミャンマー側からは、内容を平易にする、ページ数を減らす、事例集を追加する、という要望が寄せられた。</td></tr>
<tr><td>1-2.
0 名以上の技術者が新マニュアルを使用して業務を実施している</td><td>プロジェクト期間中、4 種類のマニュアル・教科書を 50 部程度ずつ配布したが、2015 年 4 月 29 日の WS の参加者 50 名中 10 名のみが受領したと回答している</td><td>2015 年 4 月 29 日の WS でのアンケートに対し受領したと回答した 10 名中 7 名がマニュアルを参照していると回答</td></tr>
<tr><td rowspan="2">成果 2
道路技術者のエーヤーワディ・デルタ地域に適用可能な道路設計・施工にかかる実用的なスキル・知識が向上する</td><td>2.1
訓練を受けた PW の全職員数が 300 名以上となる.</td><td>活動番号 2.7 に示すように各種のセミナー・WS が開催された</td><td>セミナー・WS・OJT の類型参加者数は 400 に達しているので、指標 2-1 は達成している</td></tr>
<tr><td>2.2
訓練やセミナーについて参加者の 50% が良かったと評価している</td><td>4 月 29 日実施の WS でのアンケートでは出席者の 72%は過去のセミナー・WS・OJT に参加する機会がなかったと回答
15%は無回答
12%が良かったと評価
残り 1%が評価していない</td><td>何らかのセミナー・WS・OJT に参加した職員の 90%が良かったと回答している</td></tr>
</table>

結論として、プロジェクトでは、成果 1-2 “10 名以上の技術者が新マニュアルを使用して業務を実施している”を除き、ほとんどのプロジェクト目標を達成した。

しかし、多くの技術者が、機会があれば、将来のプロジェクトでマニュアルを使用していきたいと回答している。

第 5 章 上位目標達成のための提言

上位目標: 災害多発地域（エーヤーワディ・デルタ地域）の道路が改善される。
定量的目標 : パイロットプロジェクトで導入された安定処理技術により建設された道路が 10 ㎞以上となる。
定性的目標 : 運転・旅行時間がプロジェクト実施前に比べ 10%減少する。

上位目標達成のための提言としては、下記のようなものが考えられる。

必要な要素	内容	備考
1 : 十分な耐久性を有する道路構造物の構築	道路基盤となる地質特性の確認分析	技プロ期間中に強化できたと考えている。
	改善・対策作業の計画と実施	予算と工期の不足が問題
	道路建設に用いる土質材料の検討	現場周辺から採取・利用する土質材料のばらつきが大きくその CBR は 3 以下が多い
	配合試験に基づく土質材料の改良	現場の不良材料は石灰、セメント、砂混合により改良することが必要。その混合割合は試験室での配合試験で決定されるべきもの
	適切な設計条件に基づく設計作業	舗装設計に当っては次のような要素を検討する; 1. 標準軸荷重換算の将来累計交通量 2. 路床CBR (最低限 3) 3. 舗装各層の構造指数（SN）
	建設工事中におこなうべき適切な品質管理の実施	舗装の施工に当っては下記の項目を遵守する: 1. 材料品質の確保 2. 規定密度を確保できる転圧 3. 各層毎の設計厚と幅員の管理 軟弱地盤上の高盛土施工に当っては下記の項目を遵守する: 1. 粘性土層の性状把握のための事前地質調査の実施 2. 安定性、圧密沈下量・時間の事前検討 3. 対策工の検討と実施 4. 沈下板、地表面変位用測量杭による変位観測

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2：適切な維持管理作業の実施	維持管理マニュアルの作成	MOC は、保有するリソース（人材、図書など）を活用して、マニュアル編集委員会を立ち上げるべきである。作成するべきマニュアルの種類の例を以下に示す。 1. 道路維持管理マニュアル 2. 法面維持管理マニュアル 3. 橋梁維持管理マニュアル
	維持管理担当部局の設立	MOC は、維持管理業務を実施する部局を設立するべきである。また、業務に関する訓練やワークショップを継続的に実施することが、能力向上のために不可欠である。
	業務実施サイクルの確立	MOC は、維持管理に関する一連の作業（点検～評価～補修作業計画策定～補修作業実施）に関する実施サイクルを策定し、それに準じて業務を実施するべきである。
	道路インベントリーシステムの開発	MOC は、所管する道路に関するデータ・情報を保存した、インベントリーを開発するべきである。保存が必要なデータ・情報を以下に示す。 1. 位置情報および道路延長 2. 幾何構造 3. 舗装構造 4. 交通量 5. 補修・改修工事の実施履歴 MOC は、これらのデータを参照して、業務実施計画を策定するべきである。また、これらのデータは定期的に更新しなければならない。

添付資料

PDM V2.0

Project Title: Project for Improvement of Road Technology in Disaster-affected Areas in Myanmar	Version. 2.0
Target Areas: Delta areas of Ayeyarwady Region	Date December, 2014
Target Group (Beneficiaries): Road Technical Staff of the Public Works	Project Period Jul 2012 – Jul 2015

Narrative Summary	Objectively Verifiable Indicators	Means of Verification	Important Assumptions
Overall Goal Roads in the delta areas of Ayeyarwady Region are improved.	1. The road improved by the stabilization technique is more than 10 km. 2. Driving hour or travelling time is reduced 10% comparing before execution of project.	1. Hearing from PW 2. Report by actual measurement by district office	
Project Purpose The capacity of the Public Works (PW) for road construction adaptive to the delta areas of Ayeyarwady Region is enhanced.	1. The enhancement of skill and knowledge of the engineer for road design and construction is confirmed by the hearing from more than 30 staff. 2. By the end of the project, road length constructed by the technology introduced from Pilot Project is extended longer than 2.6 km.	1. Questionnaire to C/P. 2. Pilot Project Report.	Budgetary and human resources necessary for road construction are continuously allocated by the Government of Myanmar.
Outputs 1. Road technology standards and manuals for designing and construction works are improved. 2. The practical skills and knowledge of the road technical staff are enhanced.	1-1. New soft soil treatment manual is discussed and accepted by P.W. 1-2. More than 10 engineers are executing the work by using the manual. 2.1 Total number of trained staff of PW is more than 300 numbers. 2.2 50% of participants evaluate training/seminars favorably.	1-1 Hearing from PW. 1-2. Hearing from PW. (Interview from site engineer) 2-1. Records of the pilot project(s) and training programs 2-2 Questionnaire for trainees.	P.W approves the manuals.

PDM V2.0

Activities	**Inputs**		**Important Assumptions**
0 Conduct the baseline. 0-1. Number of the road technology standards and manuals adaptive to Delta area 1-1. Review Myanmar standards and manuals of road technologies for designing and construction works 1-2. Analyze the issues and challenges on the road technologies for designing and construction works in Myanmar. 1-3. Conduct research on construction conditions including soft ground. 1-4. Specify the road technologies for designing and construction works necessary to be developed. 1-5. Develop the road technology standards and manuals, and revise them based on the outcomes of the pilot project(s) as necessary. 1-6. Convene the workshops/seminars to share the contents of the road technology standards and manuals with the road technical staff across the country. 2-1. Select pilot project(s). 2-2. Conduct the research activities on construction conditions including soft ground. 2-3. Formulate the work plans, including outline design, cost calculation, quality control, etc., of the selected pilot project(s). 2-4. Assist the road technical staff of the PW to implement the pilot project(s) based on the work plans-Conduct training on road construction for technical staff, operators, etc. through the pilot project(s). 2-5. Monitor the pilot project(s) based on the plans. 2-6. Convene the workshops/seminars to share the experiences, outcomes, etc. of the pilot project(s)	Japanese side 1. Experts [Long term Experts] ・Chief Advisor/ Road Technology ・Road Technical Standards ・Project Coordinator [Short term Expert] ・Road planning and Assessment ・Road Survey and Design ・Construction technology ・Quality Control ・Others as necessary 2. Training of counterpart personnel in Japan and/or the Third Countries 3. Provision of machinery and equipment 4. Local expenses for the project activities ・Teaching materials for training/ workshops/seminars ・Others	Myanmar's side 1. Personnel ・Chairperson ・Project Director ・Project Manager ・Counterpart personnel 2. Provision of the project offices and facilities necessary for the project implementation 3. Expenses for implementing pilot projects in the delta areas of Ayeyarwady River 4. Administrative and operational expenses ・Electricity, water, communication, etc. ・Local traveling costs and daily subsistence allowance (DSA) for counterpart personnel ・Others as necessary	Natural disasters do not give a profound effect to the project activities. **Pre-condition** Understanding and cooperation on road construction are obtained from the local people residing in the target areas.

PDM V1.0-1.(for Reference to compare with V2.0)

Project Title: Project for Improvement of Road Technology in Disaster-affected Areas in Myanmar	Version . ~~0~~ *1.0*
Target Areas: Delta areas of Ayeyarwady Region	Date ~~February 1, 2012~~, *June 2013*
Target Group (Beneficiaries): Road Technical Staff of the Public Works	Project Period Jul 2012 – (36 Months)

Narrative Summary	Objectively Verifiable Indicators	Means of Verification	Important Assumptions
Overall Goal Roads in the delta areas of Ayeyarwady Region are improved.	1. The length (km) of road construction under the control of the PW is increased in the delta areas. ~~2. The road conditions (Good, Fair, and Poor) are improved in the delta areas. **Note1**~~ 2. *Reduced driving hour or traveling time.*	1. ~~Monthly~~ Report on Development of Road Network in Ayeyarwady Delta Area ~~("Monthly Report")~~ ~~2. The Monthly Report~~ *2.Report by actual measurement by district office*	
Project Purpose The capacity of the Public Works (PW) for road construction adaptive to the delta areas of Ayeyarwady Region is enhanced.	~~1. The number of construction plans/ works adaptive to the delta areas conducted by PW is increased. **Note2**~~ *1. Road length constructed by the technology introduced from Pilot project* 2. *Improved road conditions in delta area*	~~1. The Monthly Report~~ ~~2. Annual Report on Training Program prepared by the Central Training Center~~ 2. *Report by actual measurement by district office*	Budgetary and human resources necessary for road construction are continuously allocated by the Government of Myanmar.
Outputs 1. Road technology standards and manuals for designing and construction works are improved. 2. The practical skills and knowledge of the road technical staff are enhanced.	1-1. The number of the road technology standards and manuals ~~adaptive to the delta areas~~ developed by the PW is increased. ~~2-1. Level of understanding of road technical staff is improved after the pilot project(s) and training in comparison with before~~ 2.1 *Number of trained engineers (Seminar WS OJT).*	1-1. Road technology standards and manuals 2-1. Results of the comprehension tests 2-2. Records of the pilot project(s) and training programs	The road technical staff capacitated by the Project continues working for their respective positions.

Note1: Deleted sentences are shown by cancel line from V 0 and new added sentences are shown by italic

PDM V1.0-1 (for Reference to compare with V2.0)

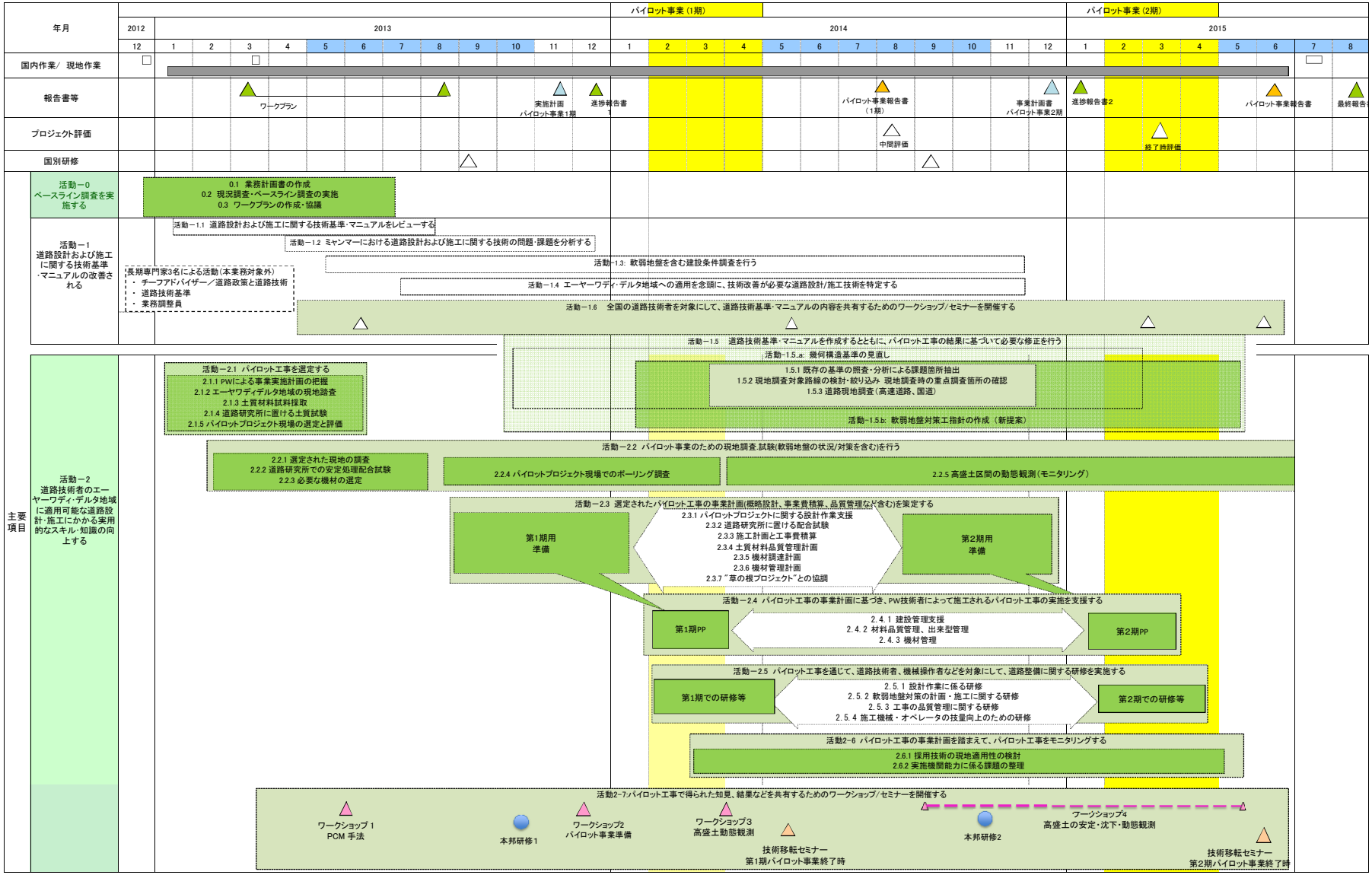
Activities	**Inputs**		**Important Assumptions**
0 Conduct the baseline. ~~0-1 Construction plans/ works adaptive to Delta area.~~ 0-2 Number of the road technology standards and manuals adaptive to Delta area ~~0-3 Understanding level of road technical staff.~~ 1-1. Review *Myanmar* standards and manuals of road technologies for designing and construction works ~~in Myanmar.~~ 1-2. Analyze the issues and challenges on the road technologies for designing and construction works in Myanmar. *1-3. Conduct research on construction conditions including soft ground.* 1-4. Specify the road technologies for designing and construction works necessary to be developed. 1-5. Develop the road technology standards and manuals, and revise them based on the outcomes of the pilot project(s) as necessary. 1-6. Convene the workshops/seminars to share the contents of the road technology standards and manuals with the road technical staff across the country. 2-1. Select pilot project(s). 2-2. Conduct the research activities on construction conditions including soft ground. 2-3. Formulate the work plans, including outline design, cost calculation, quality control, etc., of the selected pilot project(s). 2-4. Assist the road technical staff of the PW to implement the pilot project(s) based on the work plans ~~with teaching materials for training /workshops/seminars.~~ 2-5. Conduct training on road construction for technical staff, operators, etc. through the pilot project(s). 2-6. Monitor the pilot project(s) based on the plans. 2-7. Convene the workshops/seminars to share the experiences, outcomes, etc. of the pilot project(s) ~~and to reflect the results to the development of standards and manuals~~	Japanese side 1. Experts [Long term Experts] ・Chief Advisor/ Road Technology ・Road Technical Standards ・Project Coordinator [Short term Expert] ・Road planning and Assessment ・Road Survey and Design ・Construction technology ・Quality Control ・Others as necessary 2. Training of counterpart personnel in Japan and/or the Third Countries 3. Provision of machinery and equipment 4. Local expenses for the project activities ・Teaching materials for training/ workshops/seminars ・Others	Myanmar's side 1. Personnel ・Chairperson ・Project Director ・Project Manager ・Counterpart personnel 2. Provision of the project offices and facilities necessary for the project implementation 3. Expenses for implementing pilot projects in the delta areas of Ayeyarwady River 4. Administrative and operational expenses ・Electricity, water, communication, etc. ・Local traveling costs and daily subsistence allowance (DSA) for counterpart personnel ・Others as necessary	Natural disasters do not give a profound effect to the project activities. **Pre-condition** Understanding and cooperation on road construction are obtained from the local people residing in the target areas.

Modification of PDM (Ver.01 → Ver.02)

PDM (Ver. 01)	PDM (Ver. 02)
Overall Goal *Roads in the delta areas of Ayeyarwady Region are improved.*	
<Objectively Verifiable Indicators>	
1. The length (km) of road construction under the control of the PW is increased in the delta areas. ⇨	1. The road improved by the stabilization technique is more than 10 km.
2. Reduced driving hour or traveling time. ⇨	2. Driving hour or traveling time is reduced 10% comparing before execution of Project.
Project Purpose *The capacity of the Public Works (PW) for road construction adaptive to the delta areas of Ayeyawardy Region is enhanced.*	
<Objectively Verifiable Indicators>	
1. Road length constructed by the technology introduced from Pilot Project. ⇨	1. The enhancement of skill and knowledge of the engineer for road design and construction is confirmed by the hearing from more than 30 staff.
2. Improved road conditions in delta area. ⇨	2. By the end of the Project, road length constructed by the technology introduced from Pilot Project is extended longer than 2.6 km.
<Means of Verification>	
1.&2. Report by actual measurement by District Office. ⇨	1. Questionnaire to C/P . 2. Project report.
Outputs *1. Road technology standards and manuals for designing and construction works are improved.* *2. The practical skills and knowledge of the road technical staff are enhanced.*	
1. The number of the road technology standards and manuals developed by the PW is increased. ⇨	1-1. New soft soil treatment manual is accepted by PW. 1-2. More than 10 engineers are executing the work by using the manual.
2. Number of trained engineers (Seminar, Workshop and On-job training (OJT)). ⇨	2-1. Total number of trained staff of PW is more than 300 numbers. 2-2. 50% of participants evaluate training / seminars favorably.
<Means of Verification>	
1. Road technology standards and manuals. ⇨	1-1. Soft soil treatment manual accepted 1-2. Interview from site engineer
2-1. Results of the comprehension tests. 2-2. Records of the pilot projects and training programs. ⇨	2-1. Records of the pilot project(s) and training programs 2-2. Questionnaire for training 2-3. Hearing from engineers
<Important Assumptions>	
	(Additional)
	PW approves the manuals.

(Kyaw Linn)
Managing Director
Public Works

ワークフローチャート　（新提案）



業務従事者の従事計画・実績表

契約件名：ミャンマー国災害多発地域における道路技術改善プロジェクト

監督職員確認印：　経済基盤開発部運輸交通・情報通信第1 課長　竹内　博史　印

	氏名 担当業務	格付	計画／実績	渡航回数	2013年 1月〜12月	2014年 1月〜12月	2015年 1月〜8月	日数合計	人月合計
現地調査	兼田 公揮 総括／道路計画・評価	3号	計画	10	(27日) (45日) (45日)	(45日) (30日) (27日) (45日) (30日)	(45日) (45日)	384	12.80
			実績	11	2/9 3/5 (25日) 4/28 6/20 (54日) 8/20 9/20 (32日) 11/20 (32日)	12/21 2/16 3/29 (42日) 5/18 6/21 (35日) 8/3-31 (29日) 9/1-6 (6日) 10/26-12/13 (49日)	1/30-2/28 (30日) 3/15-19 (5日) 4/21-5/14 (24日) 6/4-6/24 (21日)	**384**	**12.80**
	小林 宏昭 副総括／施工技術1（設計）	4号	計画	9	(30日) (30日) (30日) (30日) (30日) (30日) (60日)	(58日) (45日)		343	11.43
			実績	9	4/28 5/31 (34日) 6/9 7/6 (28日) 9/9 10/13 (33日) 12/1-18 (18日)	1/7-31 (25日) 2/10 3/18 (37日) 4/21 6/4 (45日) 7/14-26 (13日) 8/16-29 (14日) 9/25-11/08 (45日) 11/27-12/26 (30日)	2/12-4/12 (60日) 4/23-5/3 6/1-6/19 (39日) (19日)	**440**	**14.67**
	藤熊 昌孝 施工技術2（施工監理）	4号	計画	5	(29日)	(42日) (18日)	30(1.00) 30(1.00)	149	4.97
			実績	2	9/10 9/24 10/19 (14日) (15日)	1/22 2/28 3/12〜3/15 (38日) (4日)		**71**	**2.37**
	Noor Akmar 施工技術3（舗装施工監理）	4号	計画	1	(47日)			47	1.57
			実績	2	1/14 3/1 (47日)		2/11-4/12 (61日)	**108**	**3.60**
	米山 秀樹 調査・軟弱地盤対策	4号	計画	3	(29日) (32日) (40日)			101	3.37
			実績	3	1/23 2/20 (29日) 4/7 5/8 (31日) 6/24 8/2 (40日)			**100**	**3.33**
	宮本 宏一 道路品質管理1（土質材料）	4号	計画	4	(45日)	(45日) (45日) (45日)	(45日)	180	6.00
			実績	4	9/16 11/6 (52日)	1/20 3/1 3/11〜3/15 (41日) (5日)	11/1〜11/10 (10日) 12/6〜12/15 (10日) 3/8-4/11 (35日) 4/23-5/19 (27日)	**180**	**6.00**
	高坂 幸夫 道路品質管理2（機械施工）	4号	計画	3	(60日)	(60日) 12/6〜12/15	(60日)	180	6.00
			実績	2	4/22 6/20 (60日)	1/14 2/23 (41日)		**101**	**3.37**
	西嶋 國昭 調査・軟弱地盤対策2	4号	計画	4	(45日) (45日) (30日)	(30日)		150	5.00
			実績	4	2/16 3/29 (42日) 5/18 6/21 (35日) 11/01-12/13 (43日)	4/21-5/20 (30日)		**150**	**5.00**
	横尾 文彦 軟弱地盤対策工指針整備1	4号	計画	5	(30日) (30日) (45日) (30日)	(45日)		180	6.00
			実績	5	2/16 3/29 (42日) 5/18 6/21 (35日)	2/12-3/3 (20日) 4/22-5/21 6/4-6/26 (30日) (23日)		**150**	**5.00**
	鈴木 飛鳥 軟弱地盤対策工指針整備2	5号	計画	2	(30日)	(30日)		60	2.00
			実績	2	5/25 6/21 (28日)	4/21-5/21 (31日)		**59**	**1.97**
							現地業務小計 計画	1774	59.13
							現地業務小計 実績	**1743**	**58.10**
国内作業	兼田 公揮 総括／道路計画・評価	3号	計画		(6日) (6日)		(14日)	26	0.87
			実績		6/21-6/30 (10日) 10/3 (1日)	1/20-1/30 (10日) 6/23-6/27 (5日)		**26**	**0.87**
	横尾 文彦 軟弱地盤対策工指針整備1	4号	計画					0	0.00
			実績			7/1-7/18 (14日) 9/1-24 (16日)		**30**	**1.00**
	鈴木 飛鳥 軟弱地盤対策工指針整備2	5号	計画			(13日)		13	0.43
			実績			7/1-7/17 (13日)	2/18 (1日)	**14**	**0.47**
	鈴木 飛鳥 本邦研修同行	5号	計画		(17日)	(17日)		34	1.13
			実績		9/29-10/15 (17日)	9/29-10/15 (17日)		**34**	**1.13**
							国内業務小計 計画	73	2.43
							国内業務小計 実績	**104**	**3.47**
							合計 計画	61.57	
							合計 **実績**	**61.57**	

凡例：　業務従事実績　　業務従事計画（変更契約時）

報告書		
		プロジェクト業務進捗報告書の提出 △ ／ パイロット事業結果報告書の提出：2014年8月1日 ▲
		プロジェクト業務進捗報告書の提出 △ ／ パイロット事業結果報告書の提出 △▲ ／ プロジェクト業務完了報告書の提出：2015年8月19日

Annex 2-2

ANNEX 3 Prepared Reports List

	Plan and Reports	Date
1	Project Implementation Plan	Nov 2013
2	Inception Report	Feb 2013
3	Work Plan	Sep 2013
4	Seminar Report 1	Jun 9-16, 2013
5	Workshop 1 Report	May 27, 2013
6	Workshop 2 Report	Dec 13, 2013
7	Workshop 3 Report	Mar 28, 2014
8	Workshop 4 Report (Total 13 times)	Jun 2014-Dec 2014
9	Progress Report 1	Dec 27, 2014
10	Soil Property Test and Stabilization Mixing Test Report	Mar 2014
11	Pilot Project Implementation Plan	Feb 2014
12	Pilot Project Report 1	July 2014
13	Mid Term Evaluation Report	
14	Soft Ground Treatment Manual (Draft)	Nov 2014
15	Progress Report 2	Jan 2015
16	Terminal Evaluation Report	May 2015
17	Pilot Project Report 2	June 2015

	Monthly Report	Date
	Monthly Report	January 2013-Jun 2015

	Training in Japan	Date
1	Implementation Report 2013[1]	Nov 2013
2	Implementation Report 2014	Dec 2014

[1] with Lecture fee and travel expenses detailed statement

打合簿リスト

No.	表題	Date
1	分任監督職員について	21-Jan-13
2	再委託先選定経緯報告書及び現地再委託契約書（写し）の提出	18-Feb-13
3	ワークプラン提出時期（Jul. 2013）	18-Feb-13
4	分任監督職員の変更	30-Jul-13
5	総括・兼田の現地作業計画の変更について	12-Aug-13
6	民間法人化された特殊法人の講師謝金単価の変更について	28-Jun-13
7	本邦研修担当の選任	26-Aug-13
8	研修員受入れに係る研修内容の確定について	09-Sep-13
9	「施設技術/施工管理」担当の渡航経路及び現地作業日程の変更	18-Sep-13
10	経路変更：小林、帰国日変更：藤熊	03-Oct-13
11	土質調査（現地再委託業務）の実施について	15-Oct-13
12	現地再委託選定経緯報告書の提出について	15-Oct-13
13	副総括の渡航経路及び現地作業日程の変更	18-Nov-13
14	研修員受入業務完了の確認及び支出金額の報告について	26-Nov-13
15	追加専門家（舗装管理）の配置	21-Dec-13
16	携行機材の変更	17-Jan-14
17	追加専門家（調査・軟弱地盤対策 2）の配置	25-Jan-14
18	追加専門家（軟弱地盤対策工指針整備）の配置	06-Feb-14
19	盛土観測用機材購入	26-Feb-14
20	施工技術短期専門家の現地アサインへの渡航経路の変更	27-Feb-14
21	携行機材（動態観測用機材）の変更	05-Mar-14
22	副総括施工技術担当の渡航経路および現地作業日程の変更	05-Mar-14
23	道路品質管理１（土質材料）担当の旅費（航空賃）および現地作業日程の変更	07-May-14
24	追加専門家（軟弱地盤対策工指針整備）の配置	07-May-14
25	「パイロット事業結果報告書（第一期）」提出締切延期 8 月 8 日まで	07-Jun-14
26	「軟弱地盤対策工指針整備 1」の一部現地作業の国内作業への振り替え	26-Sep-14
27	研修員受入れに係る研修内容の確定について	26-Sep-14
28	本邦研修の講師謝金の変更	28-Oct-14
29	業務進捗報告書提出時期（1 月下旬へ）	18-Nov-14
30	機材調達支援について	08-Dec-14
31	監督職員を社会基盤・平和構築部運輸交通・情報通信グループ第一チーム課長へ変更	24-Dec-14
32	研修員受入業務完了の確認及び支出金額の報告	24-Dec-14
33	機材調達支援について(ソイルプラント立会検査員)	16-Feb-14
34	総括の渡航回数追加	23-Feb-15
35	施工技術 3（舗装施工監理）の渡航回数追加	09-Feb-15
36	成果品の作成費	23-Apr-15
37	土壌解析用ソフトウェアの購入	13-May-15
38	成果品提出締切の延期(PP2 報告)	23-Jun-15

打ち合せ記録　リスト

	Date	場所	Agenda
キックオフミーティング(一般事項)	2013.02.11	PW Nay Pyi Taw	Project開始日、開催頻度、事務担当者名、PW側担当者名 事務所、免税処置、ビザ
キックオフミーティング(詳細項目)	2013.02.13	RRL YGN	成果１と成果2の説明、機材供与、プロジェクト参加組織 連絡方法、PWの専従スタッフ
団内打合せ	2013.02.14	Hotel Pyapon	法面植生・土嚢工法、安定処理の施工方法・配合試験 本邦研修・セミナー・ワークショップ
PWとの打合せ	2013.02.16	RRL YGN	ベースラインデータ調査、関係者名確認、WP準備 試料サンプリング
PWとの打合せ	2013.02.18	RRL YGN	採取試料の試験方法、道路建設基準
SRLとの打合せ	2013.02.21	SRL YGN	協調関係維持方法、必要機材
大使館打合せ	2013.02.22	EOJ　YGN	Project概要説明・担当者紹介、米山専門家事前乗込み理由、他の関連プロジェクトとの協調、ノンプロ無償供与機材の活用
PWとの打合せ	2013.02.23	RRL YGN	ベースラインデータ、基準・マニュアルの改訂の優先順位、ノンプロ無償供与機材の維持管理担当者
MTCとの打合せ	2013.02.25	MTC　YGN	ノンプロ無償供与機材の種類と維持管理 バケットタイプの仕様
現地調査結果	2013.02.26	Maubin	Maubin橋A2が傾きスラブが橋台方向にずれを生じている
団内打合せ	2013.02.26	Trader HTL	WP、ベースライン調査、
PWとの打合せ	2013.02.27	RRL YGN	試料サンプリング、道路維持管理マニュアル・表面処理マニュアル英語化
MOC大臣昼食会	2013.02.27	JH東	本邦研修　都市間高速道路
月例報告会	2013.03.01	JICAミャンマー	月次報告書、機材関係、協調プロジェクト、WS
チーム内打合せ	2013.06.03	My Hotel	WP、ベースライン調査、WS、本邦研修、プロジェクト開始日、バケット型ミキサー
PWとの打合せ	2013.03.04	RRL YGN	ベースラインデータ調査、ワークショップ開催日、セミナー議題、ワークプラン　高盛土対策　7号線での安定処理
第4回合同打ち合わせ会 帰国報告会	2013.03.08	JICA本部	草の根との協調、支援委員会発足、ワークプラン、本邦研修
三宅帰国報告 JICA打合せ PW 打合せ PW打合せ PW 打合せ	2013.03.17 2013.03.12 2013.03.12 2013.03.13 2013.03.15	 JICAミャンマー RRL　YGN PW　NPT RRL　YGN	 セミナー、本邦研修 セミナー、本邦研修 本邦研修
大使館打合せ	2013.03.27	EOJ　YGN	道路マスタープラン作成（OC） 日本企業に有利になるような活動
JICA打合せ	2013.03.28	JICA本部	JICSの機材供与 ビザ・国別研修・支援委員会予定
PWとの打合せ （英文・和文）	2013.03.28	RRL YGN	道路建設材料、MOC技術者数・セミナー・
支援委員会メモ	2013.04.02	JICA本部	ProjectのSOW：パイロット事業・マニュアル改訂 セミナー、ワークプラン作成工程
チーム内打合せ	2013.04.02	OC 本社	WS、セミナー、国内研修、ビザ、支援委員会、ボーリング調査、追加機材
現地調査メモ	2013.04.04	Ayeyarwadi	6号線。7号線視察結果
現地調査メモ	2013.04.20	Ayeyarwadi	Labutta、Ywae River Bridge、
PWとの打合せ	2013.04.22	RRL YGN	セミナー
PWとの打合せ	2013.05.02	RRL YGN	室内試験と追加試料採取 ワークプラン　・　情報交換方法
Weekly Meeting	2013.05.03	CTC事務所	WP、JCC、セミナー、WS、
PWとの打合せ	2013.05.06	RRL YGN	パイロットプロジェクト候補箇所 試料採取箇所位置図・必要試験器具

			ワークショップ準備、C/P氏名
大使館打合せ	2013.05.07	EOJ　YGN	ワークショップとセミナーの予定 ノンプロ機材無償、今後の関係プロジェクト
PWとの打合せ	2013.05.09	RRL YGN	セミナー　・ワークショップ・C/P氏名 パイロットプロジェクト候補箇所 試料採取箇所位置図・必要試験器具
MTCとの打合せ	2013.05.10	MTC　YGN	納入機材仕様
Weekly Meeting	2013.05.13	JICAミャンマー	プロジェクト事務所、JCC、セミナー、WS、必要機材、
PWとの打合せ	2013.05.14	RRL YGN	ワークプラン原稿、基準の見直し方法・日本のものを要求
PWとの打合せ	2013.05.15	PW NPT	セミナー準備、事務所移動
PWとの打合せ	2013.05.16	Pyapon	材料調達・機材調達・仮ヤード取得・工法・公定単価
PWとの打合せ	2013.05.17	RRL YGN	セミナー　・ワークショップ・道路基準の作成方法
PWとの打合せ	2013.05.17	RRL YGN	セミナー　・ワークショップの内容と参加費用 本邦研修
Weekly Meeting	2013.05.28	MOC事務所	JCC、セミナー、WS、機材リスト準備、CP
MTCとの打合せ	2013.05.30	MTC　YGN	機材訓練予算　外部からの訓練生
CTC打合せ	2013.05.31	CTC YGN	機材訓練計画
PWとの打合せ	2013.06.03	RRL YGN	セミナー、C・Pスタッフ、石灰、CBRモールド
PWとの打合せ	2013.06.06	RRL YGN	セミナー
			Project実施方法
CTCとの打合せ	2013.06.12	CTC　YGN	機材訓練予算　訓練教官費用負担
PWとの打合せ	2013.07.03	PW NPT	セミナー・　ワークプラン案・　JCC・ スタビライザーの使用・　PP予算
PWとの打合せ	2013.07.04	PW NPT	ワークプラン案　・PDMの変更、機材の変更、TCP期間 スタビライザーの使用許可・将来の道路計画・舗装種類・ 現地測量・現地調査・盛土動態調査・PP予算・公定単価・ PWマニュアル翻訳・SRLの参加
草の根小室PMとの協議メモ	2013.07.12	JIP	ワークプラン（第1稿）提出・概要説明 両プロジェクトの連携に関する確認事項
支援委員会	2013.07.31	JICA本部	簡易舗装要綱とRN・草の根との連携・現地盤改良方法・ 道路基準・技術移転に重点・仮説-計測が重要・
草の根技術協力との技術的連携を検討	2013.08.07	JICA本部	草の根と技プロの区別について 草の根の対象は舗装：TCPは安定処理 草の根は日本の舗装要項、TA法を提案：TCPはBS/ASSHTO 路体に対する要望があるがどちらが担当するのか 道路基準の共同作成とサポート体制
三宅課長との打合	2013.09.04	ティンガハHTL	藤本氏後任、舗装マニュアル、支援委員会対応、新規盛土動態観測
JCC議事録	2013.09.05	PW Nay Pyi Taw	WPの説明と承認。PDM変更承認 ・要望基準・舗装マニュアル・軟弱地盤対策マニュアル ・藤本氏退任・短期専門家増加で補強 ・日本の舗装方法の導入要望。
PWとの打合せ	2013.09.13	MOC YGN	新規盛土の観測（費用見積もり・負担先） 室内配合試験経過・サカイによる安定処理設計 現場測量・
サカイとの打合せ	2013.09.13	MOC YGN	予定講習：配合設定、機材取扱い、OJT（３カ所の現場） 路盤乳剤安定処理＋表層のDBSTまで施工
草の根との打合せ	2013.09.18	TV会議	GRPは、簡易舗装マニュアルの作成＋100mの試験舗装 技プロは、舗装より下に主眼、相互の連携方法
大林道路打合せ	2013.09.27	Trader HTL	試験施工延長1.6km・路盤再生マニュアルを作成
PWとの打合せ	2013.09.27	MOC YGN	PP1での新規盛土はなし。工程計画案、PP2の候補箇所 D-Boxの試行、軟弱地盤対策マニュアル サカイと大林によるリサイクル試験施工
草の根と技プロの協調	2013.10.01	（小室氏の電話メモ）	経費を共同化する提案 報告書等の最終責任をどちらがとるのか JIPとの直接打ち合せの自粛

ADB打合せ	2013.10.10	MOC YGN	2014-2015の工事の入札図書を2014初めまでに作成 舗装はセメント安定処理＋DBST
PWとの打合せ	2013.10.11	MOC YGN	draft implementation programのPW側担当 RN7測量、トータルステーション、D-Box保証 舗装設計にはORN31を採用する、事務所移転
チーム内打合せ	2013.10.16	Shibuya TYO	GRPとの協調方法、舗装設計方法、軟弱地盤対策マニュアル、長崎大学の共同研究、PP2でのボーリングとモニタリング、D-Box, PP1実施計画、安定処理の配合設定
D-Box打合せ	2013.10.21	Site	本部承諾、瑕疵責任、 Danyubyu視察　RN5視察　RN10視察　RN6視察
チーム内打合せ	2013.10.22	OC TYO	MM管理方法、軟弱地盤対策マニュアル翻訳方法
PWとの打合せ	2013.10.23	RRL YGN	12月と２月のセミナー準備、本邦研修報告会依頼 品質管理、六価クロム試験
Boring 位置確認	2013.10.24	Pyapon	ボーリング位置、舗装工事積算方法
JICA打合せ	2013.10.28	JICA本部	D-Box, 高盛土施工、軟弱地盤対策マニュアル、短期専門家増員、サカイ大林との協力、PP1実施計画
チーム内打合せ	2013.10.31	Shibuya TYO	軟弱地盤対策担当、施工管理担当、機械施工担当、 圧密解析ソフト、WS準備、追加資機材、沈下対策
JICAとの打合せ	2013.11.15	JICA本部　229 会議室	外務省委託案件D-Box工法の取扱いについての合意形成
JICAとの打合せ	2013.12.17	YGN　CTC事務所	進捗上の問題点の打合せ　（契約変更内容、軟弱地盤対策、幾何構造マニュアル、古木委員長から要望の舗装、機材調達、ソイルプラント）
JICAとの打合せ	2014.01.10	ペガサス事務所	進捗報告書の手直し、契約変更準備、軟弱地盤対策、幾何構造マニュアル、動態観測機器、OJT報告書）
Preparation work of PP1	2014.01.17	RRL, Yangon	訓練生指名、機材の手配、PP2盛土施工工程
Preparation work of PP1	2014.01.25	RRL, Yangon	機材の準備、BM手配、PP2盛土施工工程
RRLとの打合せ	2014.02.03	RRL	沈下板設置方法、対策工案討議、
SRLとの打合せ		SRL	ボーリング、圧密試験実施計画
団内打合せ	2014.02.05	ペガサス事務所	契約変更進捗状況、業務進捗状報告書の経過報告、プロジェクト１月の進捗状況の報告、高盛土観測計画の方針、軟弱地盤対策工指針の方針と翻訳状況
JICAとの打合せ	2014.02.06	JICA本部　216 会議室	新短期専門家の経歴紹介、機材調達および供与、ソイルプラント、PP-1の施工計画、進捗報告書、高盛土施工方針、機材現地調達、品質管理、
RRLとの打合せ	2014.02.17	RRL	軟弱地盤対策マニュアルのCP、Kywe Chan Ye Kya橋アプローチ盛土土質、プログレスレポート説明
Kywe Chan Ye Kya 橋施工計画	2014.02.19	PW District Office at Bogaly	施工業者であるSHWE War Linnを交えて、現場視察、工程、工事計画、
PWとの打合せ	2014.02.24	RRL	新スタッフ紹介、PP1進捗状況報告、軟弱地盤対策マニュアル進捗状況、高盛土工事進捗、2013年の技プロ進捗報告書
RRLとの打合せ	2014.02.26	RRL	軟弱地盤対策マニュアル進捗、高盛土動態観測、
SRLとの打合せ		SRL	ボーリング作業、盛土材料採取と運搬
RRLとの打合せ	2014.03.05	RRL	軟弱地盤対策マニュアル進捗、高盛土動態観測、
SRLとの打合せ		SRL	ボーリング作業、
RRLとの打合せ	2014.03.19	RRL	WS計画、動態観測計画、盛土安定計算、軟弱地盤対策マニュアル
RRLとの打合せ	2014.03.20		軟弱地盤対策マニュアル
SRLとの打合せ	2014.03.21	SRL	動態観測機器設置計画、WS、土質データ
ソイルプラント	2014.04.02	TV会議	プロジェクト運営管理に係る打ち合わせ,ソイルプラント
JICAとの打合せ	2014.04.07	JICA本部　217	ソイルプラント、高盛土計器設置、英文事業進捗報告書、

		会議室	変更契約、支援委員会
団内打合せ	2014.04.10	ペガサス事務所	ソイルプラント、支援委員会、変更契約、2014年度本邦研修、舗装設計、大使館渡部書記官、5月～6月の予定、PP1完了報告書
支援委員会	2014.04.14	筑波土研	橋梁破損における海水使用コンクリート 軟弱地盤試験施工
PWとの打合せ	2014.04.24	RRL	道路材料セミナー、ＰＰ報告会
PDとの打合せ	2014.08.04	ADBプロジェクト事務所	PD退任、中間評価、ダニュブでのPW実施の工事
JICAとの打合せ	2014.08.08	TV会議	中間評価対処方針
新PDとの打ち合せ	2014.9.5	ADB 事務所	アウンミンウー氏に今後の活動予定内容を説明
RRLとの打合せ	2014.9.19	RRL	工費算出打合せ
PP2の概要計画	2014.10.21	RRL	位置、設計基準、プラント
方針打ち合せ	2014.10.24	JICA本部	積算、安定処理工法普及、工事費、指針委員会、機材
同上	2014.10.28	PW本部	幾何構造・安全、PP2測量、軟弱地盤マニュアル
同上	2014.10.28	PW本部	ソイルプラント
同上	2014.10.28	PW本部	高速道路安全対策調査
同上	2014.10.28	PW本部	幾何構造
同上	2014.10.29	PW本部	PP2現地測量
RRLとの打合せ	2014.03.19	RRL	PP2予算、軟弱地盤マニュアルおよび編集委員会
PWとの打ち合せ	2014.11.7	ボガレー	安定処理現地調査
PWとの打ち合せ	2014.11.7	ボガレー	高盛土動態観測打ち合せ
現地調査	2014.11.15	Murak Oo	市内コンクリート道路建設現場調査
古木委員長打合せ	2014.11.20	JICA本部	中間評価結果、PP1コスト、舗装設計
Wとの打ち合せ	2014.11.21	ボガレー	高盛土動態観測打ち合せ
PWとの打ち合せ	2014.11.29	RRL	安定処理計画、動態観測、PDM指標、軟弱地盤マニュアル、安定処理コスト、道路幾何構造、10号線交通量調査
PWとの打ち合せ	2014.12.2	ボガレー	高盛土動態観測打ち合せ、プロベース、D-BOX
PWとの打ち合せ	2014.12.5	ピャポン	10号線交通量調査、舗装設計
RRLとの打ち合せ	2014.12.9	RRL	土質試験、路床設計
PWとの打ち合せ	2014.12.11	MOC building, Nawaday St	道路幾何構造マニュアル、PP2道路構造
PWとの打ち合せ	2014.12.11	RRL	PDM指標、道路幾何構造マニュアル、安定処理コスト、軟弱地盤マニュアル、動態観測、WSの議題、セミナー
PWとの打ち合せ	2014.12.18	RRL	PP2の土質試験計画
RRLとの打ち合わせ	2014.12.21	RRL	PP2安定処理打ち合わせ:施工位置、安定処理施工は１層、室内配合試験、WS
JICA本部打ち合わせ	2015.01.21	東京	第2回進捗報告書提出と説明、ほかに２月のセミナー、マニュアル関係
第2期進捗報告	2015.02.02	RRL	第2回進捗報告書および今後の作業内容を説明、ソイルプラント到着時期、軟弱地盤対策マニュアル、高盛土動態観測、道路安全施設検討、６月のセミナー等
第2期進捗報告	2015.02.13	RRL	
JICA本部打ち合わせ	2015.02.15	東京	ソイルプラント調達状況、最終評価日程、国内委員会の招聘、
YTUとの打ち合わせ	2015.02.19	ヤンゴン工科大学	軟弱地盤対策マニュアル案の説明、対策実例、章ごとのサマリー等要望あり、４月末日までにコメントを要望
高盛土動態観測WS	2015.02.23	Kyaw Chan Ye Kyaw 橋事務所	約５０名出席、高盛土施工や動態観測についての発表
TV会議	2015.03.06	東京-YGN	最終評価事前打ち合わせ、軟弱地盤対策マニュアル、安定処理マニュアル、幾何構造マニュアル、
PDとの打ち合わせ	2015.03.07	ADB事務所	高速道路研修資料、最終評価日程、安定処理工事費、安定処理実施上の要望
動態観測打ち合わせ	2015.04.23	Bogale 事務所	高盛土現場の進捗状況および盛り土動態観測状況確認
チーム内打ち合わせ	2015.04.24	Sule事務所	0429予定のPW主催ワークショップ、軟弱地盤対策施工指針、６月のセミナー、QC報告書

軟弱地盤マニュアルのコメント対応	2015.04.29	BRL	軟弱地盤マニュアルのコメント対応、高盛土動態観測データ提供、
地質調査	2015.04.29	BRL	地質調査計画書　(案)
表敬	2015.04.29	RRL	解析Soft (Geo Slope) の手配状況、アンケート依頼、
YTU	2015.05.04	ヤンゴン工科大学	軟弱地盤対策マニュアル案の説明、コメント依頼、
マニュアル準備	2015.05.06	RRL	軟弱地盤対策マニュアル案の説明、コメント依頼、 事例紹介を増やすよう要望あり、
PDとの打ち合わせ	2015.05.07	ADB事務所	６月のセミナーの内容、 高盛土動態観測経過報告
軟弱地盤マニュアルのコメント収集	2015.05.12	MOC NPT	編集内容・体裁、事例紹介が望まれた、ソフトコピーの要望あり、編集委員会メンバーについて、正式承認方法
安定処理作業	2015.05.14	PP-2 Project Office in Bogale	工事作業の詳細討議、機材、材料安全管理
本部での打ち合わせ	2015.05.17	東京	近況報告（安定処理、動態観測）・プロジェクト完了のための準備状況報告（最終セミナー。完了報告書）

Minutes of Meeting

The 1st Joint Coordinated Committee Meeting on Improvement of Road Technology in Disaster Affected Area

Date : September 5, 2013 between 10:30am and 11:30am
Venue : Conference Room of MOC, Nay Pyi Taw
Participants : (Please referred to the attendant List)
Agenda :

1) Approval of Work Plan prepared by TCP (Technical Cooperation Program) members
2) Approval of revision of PDM (Project Design Matrix) for TCP
3) Others

1. Process:

U Kyaw Linn, Managing Director of Public Works, has made opening speech, and U Kyaw Shein, Deputy Chief Engineer of Planning in Public Works, has explained the draft work plan.
Mr. Kaneda, chief of short-term experts, has explained about the necessary revision of PDM, which was proposed at PCM (Project Cycle Management) Workshop held on May 7, 2013.
All of above agenda was approved without any modification.
During above process, various kinds of Q&A were held as shown in below:

2. Discussions:

(1) U Kyaw Linn asked JICA officers about questions and opinions for the work plan.

Mr. Miyake, director of JICA headquarter, explained that macadam would be suitable for Myanmar based on his inspection results of roads in Rakhine state. JICA experts and Seminar lecturers have recommended them also after the survey of soft soil in the Ayeyarwady area. He said that he would also like to introduce Japanese pavement method. He also explained about Dr. Fujimoto situation. JICA doctor decided his health condition is not suitable for working abroad. As for the absence of the chief advisor, number of man-month of short term experts will be increased and dispatch of technical support team from MLIT will be conducted.

Mr. Morikawa explained that standard and manual developed in this project should be suitable for whole Myanmar. In addition, support and arrangement from PW side is quite important to realize smooth acquisition of machinery and equipment.
U Kyaw Linn said road standards and manuals are very important for whole country. And he said that road No. 7 is selected for the Pilot Project because this road is also very important in this region. Stabilizer is provided from Embassy of Japan and it will be utilized effectively.
He also said that macadam method is still used all over Myanmar. However, now it is starting in southern region to upgrade from macadam to well grade base coarse with asphalt concrete overlaying.

Mr. Miyake pointed two problems;

First, macadam is constructed in labor base and quite difficult to use equipment. Secondly, stabilizer is not suitable for the improvement of current macadam layer in Myanmar. If used, the machine can be broken by big stones.

U Kyaw Linn explained that crush rock is difficult to produce in Rakhine state due to the shortage of quarry site with good quality. Good ones can be getting only in far place, and their supply is not easy. Therefore, instead of crush rock layer, we consider concrete pavement or granular base there. On the other hand, crush rock is rather easy to obtain at the Ayeyarwady Delta.

(2) U Kyaw Linn asked opinions from U Aung Myint about pavement design and U Khin Maung about geometric design.

U Aung Myint said that macadam method was used due to qualified materials and economic point of view. And there are now only 2 stabilizers for the project and some tools are still being needed for macadam base projects. He commented about the past working methods on minimum CBR. For the trial section in Delta area, PW should reconstruct existing sub grade to get specified compaction.
He asked what the kinds of pavement layer shall be applied, if the existing sub grade was stabilized?
Is it needed to change pavement layer to verified design method or Japanese method or traditional method compare to stabilize?

U Khin Maung Aye explained that Geometric Design was introduced in MOC since 1969. During Geometric Design review on Asian highway and ASEAN Highway, it has almost same standard as MOC class 3.
According to ASEAN Highway standard agreement, MOC should follow the Asian and ASEAN Highway standard. Review on road research in 1986-88, standard no 5 was not so agreeable, for 2 lane highway with 16 feet road lane which is not used now in other countries.
It should be minimum 18 feet (5.5 meter). It is a standard which is not so different with Myanmar. He suggested reviewing result of Tech section in Yamethin, different kind of tech result done by road researchers sponsored by UNDP.

U Kyaw Linn said they have to do asphalt concrete for ASEAN 2 lane road. And they have to upgrade existing roads to asphalt concrete road before 2015 AEC. Among 5000km roads in country, 3000km has been completed as 2-lane asphalt road. Some of the rest of 2000km are one-lane asphalt road and some are earthen road. Therefore which is preferable upgrading to 24 ft or 18 ft?

U Khin Maung Aye said that 24 ft is enough and satisfied the ASEAN standard.

U Kyaw Linn said they have estimated for 2 years budget and already submitted for government, but approved amount was too less. Therefore they will submit to minister for national planning,

and minister will divide for budget. Dr. Kanzaw (national planning minister) will decide to propose to ADB, JICA or EU for the projects loan.

U Khin Mg Aye proposed to consider for prioritize of beneficial roads. This time, road and bridges should be upgraded to clear missing link.

U Kyaw Linn said there is no missing links but bridges should be upgraded, because some of them are temporary one and not durable.
AH 1 (Tamu-Myawaddy) is important and first priority and have to be finished.
AH2 (Taunggyi-Kyaing tone –Tachililake) is 2nd priority, but Loi Lin-Hsipaw, Than byu zayat-Myeik –Dawei-Kawtthaung are not so important. AEC, all vehicles will be using AH1.

(3) Mr. Kaneda said JICA experts are planning to support modifying geometrical standard.

Furthermore, JICA experts are considering supporting modifying standards of drainage, soft ground treatment, or road maintenance. Maintenance might be studied in next project. He asked the priority of development of manuals as Public Works.

U Kyaw Linn answered pavement including shoulder is the first priority. Soft ground treatment is the second, and third one will be drainage.

Mr. Miyake told that pavement manual (including stabilization) would be prepared by grass root project. Therefore, this area is not treated by this project. This project would like to consider assisting to prepare soft-ground treatment manual or drainage manual.

U Kyaw Linn and U Aung Myint agreed to prepare soft-ground treatment manual or drainage manual in this technical project.

(4) Mr. Sanjo asked about the possibility of privatization reform of MOC, because the technical cooperation is executed by Government to Government base.

U Kyaw Linn answered that Public Works is not only for the regularity body for MOC, but also for government contractor.
It is true that reforming is considered as two parts, one is regulatory body and another will be in regional institutions. Regional offices and regional engineers are under consideration to reform and to resign by compromising.
However most of engineers don't want to resign from government sectors.
It's become big issue to reform. Because of Myanmar geographical situation, nobody wants to go highlands due to difficult access, and that will affect for the works. Therefore, government is planning to reform gradually as privatization by teaching knowledge about privatization like reforming conducted in the New Zealand.

3. Conclusion:

It was acknowledged by the JCC members as follows:

(1) Draft of Work Plan

(2) Revision of Project Design Matrix (PDM)

(3) The priority of development of manuals

(1^{st} priority) Pavement including shoulder

(2^{nd} priority) Soft Ground Treatment

(3^{rd} priority) Drainage

The meeting was adjourned at approx. 11:30 a.m.

Approved by

U Kyaw Linn	Mr. Masaru Miyake
Managing Director	JICA Expert
Public Works, MOC	

Annex 4

<Participant List>

1. Chairman		
U Kyaw Linn	Managing Director	PW

2. Members from Myanmar side			
(1)	U Win Tint	Deputy Managing Director	Work
(2)	U Win Pe	Deputy Managing Director	Planning
(3)	U Khin Maung Kyaw	Chief Engineer	Road Department
(4)	U Ohn Lwin	Chief Engineer	Road Department
(5)	U Thein Zaw	Chief Engineer	Airfield
(6)	U Khin Maung Thein	Chief Engineer	Building
(7)	U Saw Win Naing	Deputy Chief Engineer	Road Department
(8)	U Sai Kyaw Moe	Deputy Chief Engineer	Road Department
(9)	U Win Lwin	Deputy Chief Engineer	Bridge
(10)	U Khin Thet	Deputy Chief Engineer	Airfield
(11)	U San Wai	Deputy Chief Engineer	Airfield
(12)	U Myint Kyi	Superintending Engineer	Ayeyarwady Division
(13)	Daw Khin Than Win	Deputy Superintending Engineer	Road Department

3. **Members from Japan side**			
(1)	Mr. Miyake Shigeki	Director	JICA Headquarter
(2)	Mr. Sanjo Akihito	Deputy Chief representative	JICA Myanmar Office
(3)	Dr. Morikawa Maki	Project Formulation Advisor	JICA Myanmar Office

4. Counterpart			
(1)	U Kyaw Shein	Project Director DCE	Planning
(2)	Daw Hla Hla Thwe	Project Manager SE	Road Department
(3)	Daw Mya Mya Win	Assistant Project Manager DSE	RRL
(4)	U Aung Myo Oo	Assistant Project Manager EE	Phyapon District
(5)	U Thet Zaw Win	Assistant Project Manager EE	Road Department
(6)	Daw Yin Yin Swe	Assistant Project Manager EE	Soil Research Laboratory
(7)	Daw Htar Zin Thinn Zaw	Executive Engineer	RRL
(8)	U Nyi Nyi Zaw	Executive Engineer	Quantity Survey
(9)	Daw Zin Zin Htike	Executive Engineer	Quantity Survey
(10)	Daw Su Mon Kyaw	Township Engineer	Phyapon District
(11)	Daw Ei Ei Mon	Assistant Engineer	Road Department
(12)	U Aung Myint	Consultant	RRL

5. JICA Expert			
(1)	Mr. Miyake Masaru	Long Term Expert	JICA Expert
(2)	Mr. Ishida Kazuki	Long Term Expert	JICA Expert
(3)	Mr. Kaneda Koki	Short Term Expert	JICA Expert

6. Other Attendants			
(1)	Daw Lwin Lwin Mi	Executive Engineer	Road Department
(2)	U Aung Kyaw Han	Executive Engineer	Road Department
(3)	U Myint Oo	Executive Engineer	Road Department
(4)	Daw Myint Myint Sein	Executive Engineer	Yangon Division

Meeting Memo in July 4-2013

Main subject	(1) Submission of draft Work (2) Arrangement of JCC (3) Discussion and confirmation of the contents of Pilot Project		
Date/Time	3/Jul (Wed): 17:30 – 18:00 4/Jul (Thu): 13:00 – 14:30		
Place	MOC/HQ		
Attendance	**(3/Jul)** MD U Kyaw Linn CE(Planning) U Kyaw Shein PD PM Daw Hla Hla EE U Nyi Nyi Zaw U Thet Zaw Win **(4/Jul)** DMD U Win Tint CE (Road) U Khin Maung Kyaw CE (Planning) U Kyaw Shein PD PM Daw Hla Hla Dr. Zin Zin Htike Dr. Hlaing Moe DSE U Thet Zaw Win	(Long Term Expert) Mr. Miyake Mr. Ishida	(Short Term Expert) Mr. Kobayashi Dr. Yoneyama
(1) Submission of draft work plan	JICA Expert team submitted the draft work plan to PW on 3/Jul (Wed). The plan will be finalized in accordance with the comments and suggestion from JICA/HQ and PW. Currently submission date of the final version will be at the beginning of August.		
(2) Signing of Minutes of Meeting	Signing of Minutes of Meeting for "revision of PDM" and "procurement of equipment" was completed by U Kyaw Shein and Mr. Miyake. 2 sets of the original Minutes was made and each party keeps 1 original.		
(3) Revision of the period for the Technical Cooperation project	JICA Expert team just explained about current condition.		
(4) Date of Joint Coordinating Committee (JCC)	JICA requested PW to implement JCC during 1st week of September. PW will decide the date and attendants. The date and attendants will be announced from Daw Hla Hla Thwe to Mr. Ishida. Currently, approximately 20 members from Myanmar side including Minister, Vice-minister, CE will attend the JCC.		
(5) Disposition of road stabilizer during Pilot Project	JICA requested PW for exclusive application of the road stabilizer during the Pilot Project period (Jan – Mar, 2014). PW answered that the stabilizer will arrive at Myanmar in October, 2013. Subsequently, PW will have the training for operation work conducted by the manufacturer (SAKAI). PW will provide the information of the training to JICA as listed below. - Date and period - Location (classwork and field training) - Curriculum and training schedule - Number of the trainees their organizations - Textbook - etc. The above information will be through Daw Hla Hla to Mr. Ishida. Furthermore, PW promised the arrangement of the stabilizer for the project after the training.		
(6) Future road improvement program in Ayeyarwady Region	JICA requested PW to provide future road improvement program in Ayeyarwady Region. PW responded the program till Mar/2016 exists. But, Planned road construction length varies every year. Furthermore, currently PW and local government share the construction length of almost 50% each. However, PW length will be decreasing and local government length/BOT		

	length will be increasing in the future due to the government policy. Dr. Yoneyama will send the form of the program as attached in Table A.2-2 in page 3, Appendix-A of draft work plan. PW will fill the form and send to Mr. Ishida by e-mail within 2 weeks. Furthermore, PW will collect the data of the current driving hour in Ayeyarwady Region. This Collected data will be filled in Figure 1-2 in page 4, chapter-1 of draft work plan and send to Mr. Ishida by e-mail. PW said that it will take more than one month to measure the driving time and some routes are impassable because some bridges are not constructed yet on the routes. JICA suggested that PW will mark "impassable" on the figure in such a case.
(7) Pavement type and work execution method for the Pilot Project	PW and JICA confirmed to apply DBST by equipment based method for the surface course in the Pilot Project.
(8) Topographic survey work in the Pilot Project section	PW will conduct the topographic survey work in 3 candidate sections of the Pilot Project. Output drawings such as cross sections (25m interval) and profile will be prepared into Auto-CAD format before JCC.
(9) (10) Site investigation for the Pilot Project section	JICA Experts (Mr. Ishida, Mr. Miyake, and Dr. Yoneyama) will visit the site on Road No.7 with Executive Engineer in Phyapon District Office at 9 am on 10/Jul. Purpose of the visit is for the identification of the deteriorated location caused by ground movement (e.g. settlement, landslide). The result of the investigation will be utilized to consider the countermeasure work. JICA requested PW to dispatch the staffs to the investigation for the training. PW answered that they will dispatch one engineer from RRL and one geometric division engineer, Daw Ei Ei Mon.
(11) Capability of the PW for monitoring work of ground movement	JICA proposed to conduct monitoring work of the ground movement during the Pilot Project. The work content is described in page 66 – 70, chapter-3 of draft work plan. PW will carefully examine the content by considering their capability including tool and manpower. Furthermore, involvement of SRL is necessary for boring work and core sampling work. PW will have internal discussion for the involvement of SRL. The content will be finalized in accordance with the result of the above examination and the discussion. Moreover, PW suggested using piezometer to measure vertical settlement instead of settlement measurement board. JICA responded the measurement method and the instrument should be simplified for the broadly application in other region. Furthermore, the risk of stolen and broken of the instrument should be minimized. Therefore, JICA preferred to use the board. Note training of the measurement and analysis method will be conducted before the commencement of the Pilot Project.
(12) Budget preparation for the Pilot Project	JICA requested PW for the allocation of the sufficient budget for the Pilot Project. PW responded to make an effort as much as possible. Application of the supplemental budget also will be considered.
(13) Official unit rate of construction work	JICA requested to confirm the existence of the official unit rate of construction work in PW. PW responded to confirm "cost estimate department". PW will send the answer before JCC.
(14) Current status of the translation work of the 2 sets of the manuals	JICA requested to confirm the current status of the translation work of the manuals requested in April. PW responded to complete the work before JCC.
(15) Member of Project Implementation Body	JICA requested to include SRL into the Project Implementation Body (PIB) indicated in Figure 1-8, page 11, chapter-1 of draft work plan. PW will have internal discussion for this matter. Furthermore, "Consultant" will be placed on the another line of PW members.

MINUTES OF MEETING
BETWEEN
JAPAN INTERNATIONAL COOPERATION AGENCY,
AND
PUBLIC WORKS, MINISTRY OF CONSTRUCTION,
THE GOVERNMENT OF THE REPUBLIC OF THE UNION OF MYANMAR
ON
JAPANESE TECHNICAL COOPERATION
FOR
THE PROJECT FOR IMPROVEMENT OF ROAD TECHNOLOGY
IN DISASTER AFFECTED AREA

The Japanese Mid-term Review Team (hereinafter referred to as “the Team”) organized by Japan International Cooperation Agency (hereinafter referred to as “JICA”) headed by Mr. Shigeki Miyake visited the Republic of the Union of Myanmar (hereinafter referred to as “Myanmar”) from 11 to 22 August, 2014 for the purpose of conducting a Mid-term Review of “the Project for Improvement of Road Technology in Disaster Affected Area” (hereinafter referred to as “the Project”).

During its stay in Myanmar, the Team joined by the Myanmar side evaluator had a series of discussions and exchanged views with authorities concerned of the Government of Myanmar (hereinafter referred to as “Myanmar side”) in order to jointly evaluate the achievements of the Project.

As a result of the discussions, the Team and Myanmar side agreed to the matters in the documents attached hereto.

Nay Pyi Taw, 20 August 2014

_____	_____
Mr. Shigeki Miyake	U Kyaw Linn
Team Leader	Managing Director
Japanese Mid-term Review Team	Public Woks
Japan International Cooperation Agency	Ministry of Construction
Japan	The Republic of the Union of Myanmar

Attachment-1

The Team presented the Joint Mid-tem Review Report and explained the results including recommendations. The Team and Myanmar side discussed the contents of the Joint Mid-term Review Report and adopted the Report as Attachment 1.

JOINT MID-TERM REVIEW REPORT

ON

THE PROJECT

FOR

IMPROVEMENT OF ROAD TECHNOLOGY

IN DISASTER AFFECTED AREA

IN

THE REPUBLIC OF THE UNION OF MYANMAR

AUGUST 2014

TABLES OF CONTENTS

ANNEX LIST

LIST OF ABBREVIATIONS

AASHTO	American Association of State Highway and Transportation Officials
ADB	Asian Development Bank
BOT	Built, Operation & Transfer
BS	British Standards
CAD	Computer Aided Design
CE	Chief Engineer
C/P	Counterpart
CTC	Central Training Center
DD	Deputy Director
DDA	Department of Development Affairs of Ministry of Border Affairs
DMD	Deputy Managing Director
DSE	Deputy Superintending Engineer
ED	Executive Director
EE	Executive Engineer
GOM	The Government of the Republic of the Union of Myanmar
JCC	Joint Coordination Committee
JICA	Japan International Cooperation Agency
MLIT	Ministry of Land, Infrastructure, Transportation and Tourism (Japan)
MOC	Ministry of Construction
M/M	Minutes of Meeting
PDM	Project Design Matrix
PO	Plan of Operations
PP	Pilot Project
R/D	Record of Discussions
RRL	Road Research Laboratory
SRL	Soil Research Laboratory

1. INTRODUCTION

1.1 Objectives of the Mid-term Review

The Objectives of the Mid-term Review are as follows:
(1) To review the accomplishments of the Project in terms of inputs, activities, and outputs;
(2) To examine the process of project implementation;
(3) To identify obstacles and/or enabling factors that affect project implementation; and
(4) To provide recommendations regarding the measures to be taken for the remaining period of the project.

1.2 Methodology

The Team reviewed related documents and information collected through questionnaires and interviews with Japanese experts, Myanmar C/Ps, pilot famers and relevant stakeholders. The Team analyzed the Project from the viewpoints of 1) achievements of the Project, 2) implementation process, and 3) the five evaluation criteria.

(1) Achievements of the Project
Achievements of the Project were measured in terms of Inputs, Outputs, Project Purpose, and Overall Goal in the light of the Objectively Verifiable Indicators of the PDM version 1.0 (attached in ANNEX 2).

(2) Implementation Process
Implementation process of the Project was reviewed to see if the activities have been implemented according to the schedule shown in the PO, and to see if the Project has been managed properly, identifying contributing/hindering factors that have affected the implementation process.

(3) Evaluation based on the Five Evaluation Criteria
The Project is evaluated against the Five Evaluation Criteria (see the following table) of the OECD Development Assistance Committee (DAC), which is the standard measurement applied by JICA.

Five Evaluation Criteria

1. Relevance	Degree of compatibility between the development assistance and priority of policies of the target group, the recipient, and the donor.
2. Effectiveness	A measure of the extent to which an aid activity attains its objectives.
3. Efficiency	Efficiency measures the outputs -- qualitative and quantitative – in relation to the inputs. It is an economic term which is used to assess the extent to which aid uses the least costly resources possible in order to achieve the desired results. This generally requires comparing alternative approaches to achieving the same outputs, to see whether the most efficient process has been adopted.
4. Impact	The positive and negative changes produced by a development intervention, directly or indirectly, intended or unintended. This involves the main impacts and effects resulting from the activity on the local, social, economic, environmental and other development indicators.
5. Sustainability	Sustainability is concerned with measuring whether the benefits of an activity are likely to continue after donor funding has been withdrawn. Projects need to be environmentally as well as financially sustainable.

Source: New JICA Guideline for Project Evaluation First edition (June, 2010) P.23

1.3 Members of the Team

The members of the Team are as follows:
(1) Japanese Side

Name	Role in the Team	Position, Organization
Mr. Shigeki Miyake	Leader	Director Team 2, Transportation and ICT Group, Infrastructure and Peacebuilding Dept., JICA
Mr. Toru Tsuchihashi	Cooperation Planning	Highway Engineer (Road & Bridge), Planning and Coordination Div. Infrastructure and Peacebuilding Dept., JICA
Ms. Kazuko Shirai	Evaluation Analysis	Consultant Kaihatsu Management Consulting, Inc.

(2) Myanmar Side

Name	Role in the Team	Position, Organization
U Aung Myint Oo	Leader	Project Director, Deputy Chief Engineer, Planning Dept., PW-HQ
Daw Hla Hla Thwe	Team member	Project Manager, Superintending Engineer, Road Dept., PW-HQ
Daw Mya Mya Win	Team member	Assistant Project Manager, Deputy Superintending Engineer, RRL

1.4 Schedule of the Review

The review was conducted from 11 to 22 Aug 2014 in Myanmar. The detailed schedule is attached in Annex 3.

2. OUTLINE OF THE PROJECT

2.1 Background

Road structure in the Government of the Republic of the Union of Myanmar (hereinafter referred to "GOM") is very vulnerable to inundation. Especially in Ayeyarwady Division, as that area is located in coastal area, they have huge risk of suffering the damage from disasters. When Cyclone "Nargis" hit these areas, inadequate road condition hindered relief operation and recovery effort. These risks are seriously considered by Public Works responsible for road construction and maintenance. However, they cannot take enough actions and road network available for all-year round has not yet established. Uniform technical standard of road is applied for all areas, but proper road technique is different in other respective areas. To secure the availability of roads through all year round, it is essential to develop the standard with consideration of area characteristic, long-term maintenance and proper technique for target area. In addition, some engineers' technical level is also low because training center gives training on road technology but that training is only general one and isn't advanced one for road construction and maintenance under special condition such as soft-ground, Vulnerability of roads in Myanmar is caused by the lack of budget and road technology mentioned above. To secure the availability of roads for life and security of local people, upgrade of technical standard and enhancement of capacity of engineers are indispensable.

Under such circumstances, GOM requested to the Government of Japan in August 2011 for a “Technical Cooperation Project for Improvement of Road Technology in Disaster Affected Area”. In response to the request, JICA carried out the preparatory study in February 2012 to determine the details of the project components. The Record of Discussions (hereinafter referred to as “R/D”) about the framework of the Project was signed in July 2012.

2.2 Project Overview

2.2.1 Overall Goal

Roads in the delta areas of Ayeyawardy Region are improved.

2.2.2. Project Purpose

The capacity of the Public Works (PW) for road construction adaptive to the delta areas of Ayeyawardy Region is enhanced.

2.2.3. Outputs

There are two outputs;

(1) Road technology standards and manuals for designing and construction works are improved.

(2) The practical skills and knowledge of the road technical staff are enhanced.

2.2.4 Implementing Organization

The implementation organization is PW.

2.2.5 Target Group

The target group of the Project is Road Technical Staff of PW.

3. INPUTS PROVIDED TO THE PROJECT

3.1 Japanese side

Items	Actual Inputs
Dispatch of Experts	1) Long-term Experts: initially three (3) experts (Chief Advisor, Road Technology Standards, Project Coordination), two (2) experts (Road Technology Standards, Project Coordination) at present 2) Short-term Experts: seven (7) experts, total 15.66MM
Provision of Equipment	- Boring machine, testing equipment, etc. (total cost: US$ 127,9555)
Training in Japan	- Training in Japan was conducted from September to October in 2013 for five (5) participants from PW.
Project Expenses	- The Project bored US$ 117,588 for holding seminars / workshops

3-2. Myanmar side

Items	Actual Inputs
Assignment of Counterparts	- JCC Chairman (MD of PW) - Project Director (D.C.E-Planning), Project Manager (S.E.-Road) , Assistant Project Manager (D.S.E-RRL) - C/P (RRL, SRL, CTC)
Working Environment Preparation	- Office space at MOC building and CTC
Project Budget	- 400 million kyat for PP-1

4. ACHIEVEMENT OF THE PROJECT

4.1 Achievement of Activities

The activities for PP-1 of Output 2 have been completed mostly before rainy season of 2014 in spite of the delay on the beginning. As the preparation work of guideline/manual (activity 1-5), the Soft Soil Treatment Manual (Myanmar version – by English) is now on going. Those manual and recommendations will be submitted to PW by the end of the Project.

Several road projects are simultaneously on-going in Ayeyawardy delta area at present. In such circumstances, pre mixing test, transportation of machineries and material were delayed, which hindered smooth implementation of PP-1 for Output 2.

The Project also sifted its plan from behavior observation by building new embankment to behavior observation of existing embankment due to lack of PW's budget.

Details of achievement of activities are described as follows:

0-1 Make a project planning paper	The Project completed the Implementation Plan soon after the project commencement
0-2 Conduct baseline and impact survey	# The Project conducted the base line data survey # Numbers of standards and manuals were identified to be ten. # Translation of two manuals from Myanmar language to English has not been completed.
0-3 Make a Work Plan	The Work Plan was completed.
Activities for Output 1: Road technology standards and manuals for designing and construction works are improved	
1-1 Review the standards and manuals of road technologies for designing and construction	The Project reviewed 10 kinds of manuals, and accumulated comments.
1-2 Analyze the issues and challenges on the road construction works in Myanmar	#The Project exchanged views on the plan with PW engineers. (PW engineers agreed with the plan and already solved some problems.)
1-3 Conduct research on construction conditions including soft ground	# The Project conducted a field survey of national road in Ayeyawardy delta area to grasp present condition of road design and construction works. # Based on the result of survey, the short-term experts are

	preparing the Soft Soil Treatment Manual with approval of the JCC.
1-4. Specify the road technologies for designing and construction necessary to be developed	# The pavement manual has already been formulated by the Japan Infrastructure Partners (JIP) under the Grass Root Project supported by JICA. The Project decided to discuss issues of formulate the Soft Soil Treatment Manual under the acceptance of JCC.
1-5 Develop road standards and manuals, and revise them based on the outcomes of the pilot project(s) as necessary	# The Project will revise necessary part of the Soft Soil Treatment Manual based on the Pilot Projects.
1-6 Conduct workshop/seminars to share the contents of the road technology standards and manuals with the road technical staff across the country	# The Project has conducted the following seminars on Japanese road technology standards: - Seminar on soft ground and pavement (June 2013) - Seminar on soft soil ground (December 2013) - Seminar on geometric design and road safety facility, salt damaged bridge and soft soil ground (May 2014) # The Project will conduct seminars on the Soft Soil Treatment Manual
Activities for Output2: **The practical skills and knowledge of the road technical staff are enhanced.**	
2-1 Select pilot project(s)	# The Project identified PW's road development plan, conducted a field survey in Ayeyawardy delta area, and collected soil materials for test use at RRL. # Based on results of these activities, the Project selected and evaluated the project site for PP-1. # The site for high embankment is decided.
2-2 Conduct research activities on construction conditions including soft ground	# The Project discussed with the manager of Pyapon District Office on countermeasure of shoulder repair works near the road starting section, and possibilities of negative impact for local residents. # The Project also conducted stabilization treatment mixing test, selected machineries for PP-1, and conducted a boring test by out-sourcing company.
2-3 Formulate the work plan, including outline design, cost calculation, quality control, etc., of the selected pilot project(s)	# The Project conducted a topographic survey to draft drawing with CAD including quantity calculation # The Project implemented mixing test at RRL. # The Project developed construction plan by making construction work sequences, in which kind of the inputs and key points needed in construction site are illustrated.
2-4 Assist the road technical staff of the PW to implement the pilot project(s) based on the work plans	# The Project executed capacity enhancement for construction management, quality control, progress control, and machinery management in PP-1.
2-5 Conduct training on road construction for technical staff, operators, etc. through the pilot project(s)	# The Project conducted intensive training on design, construction management, quality control, and machineries management in PP-1.
2-6 Monitor the pilot project(s) based on the plans	The Project monitored work progress of PP-1 through the weekly meeting
2-7 Convene the workshops/seminars to share the experiences, outcomes of the pilot project(s)	# The 1st seminar (13, 14 June 2013) on pavement in tropic area, introduction of Japanese road standards, countermeasures against soft soil ground, and pavement for 52 participants # The 2nd WS (14, December 2013) on construction plan of PP-1 and high embankment observation for 39 participants from RRL, SRL, YTU, and district offices # The Project held completion report seminar of PP-1 (May 28, 2014) in Nay Pyi Taw for 40 participants.

4.2 Achievement of Outputs

The following are the achievements of the two Outputs based on the Objectively Verifiable Indicators (herein after OVI) in the PDM version 1.0.

Preparation works of standards/manuals are on-going as planned in Output1.Capacity enhancement works for the engineers of RRL, SRL and district office is now on going well through the On the Job Training on trial stabilization, behavior observation and analysis of high embankment by utilizing stabilizer donated by non-project grant and boring machine procured in this project.

The seminar, work shop and training also contributed for the capacity enhancement, in which practical engineering subject were covered.

Output1. Road technology standards and manuals for designing and construction works are improved	Indicators: 1) The number of the road technology standards and manuals is increased. Result: # The Project is preparing the Soft Soil Treatment Manual.

Output2: The practical skills and knowledge of the road technical staff are enhanced.	Indicators: 2) The number of trained engineers (Seminar, Workshop and On-the job training (OJT) Result: # PCMWS-1（May 2013）: 39 participants # Introduction of advanced technology in Japan for road Sector(June 2013）: 52 participants # 2nd PCMWS (December 2013）:40 participants # Road material & Bridge inspection seminar:15 participants from PW # Pilot Project Reporting meeting: 29 participants from PW-HQ 29 （total 131 participants）

4.3 Achievement of the Project Purpose (prospect)

The Project Purpose:

The capacity of the Public Works (PW) for road construction adaptive to the delta areas of Ayeyawardy Region is enhanced.

The achievement of each indicator of the Project Purpose is described as follows:

Indicator 1) Road length constructed by the technology introduced from Pilot project	1.6km of road was constructed by the technology introduced from PP-1 so far.
Indicator 2) Improved road conditions in delta area	The indicator is not appropriate to measure the project purpose.

4.4 Achievement of Overall Goal

Overall goal:

Roads in the delta areas of Ayeyawardy Region are improved.

In order to achieve Overall goal, it is necessary to 1) construct durable paved roads, and 2) conduct appropriate maintenance. The Project identifies soil characteristics, plans and implements countermeasure works, and searches for appropriate soil materials for construction of durable roads during the project period. Maintenance is indispensable for long lasting roads even though it is not covered by the Project scope.

The prediction of achievement of Overall goal is described as follows:

Indicator 1) The length (km) of road construction under the control of the PW is increased in the delta areas	It is expected 10 km to be extended with introduced technologies by the Project after 3 to 5 years of the project end
Indicator 2) Driving time and travel time are shortened	10 % is expected to be shortened

5. IMPLEMENTATION PROCESS

5.1 Implementation process of Activities

PP-1 stabilization trial work has completed in June 2014 on the delay as mentioned in 4-1. The earthwork at the target project about high embankment treatment has started since February 2014, and suspended in May 2014 due to entering to rainy season. Preparation work for behavior observation, such as installation of equipment as PP-2 works has completed in March 2014. The phase 2 trial stabilization works scheduled in PP-2 will be finalized in May 2015. Issue is the possible delay of procurement of Soil plant up to February 2015.

5.2 Methodology/Skill Transfer

New technology, testing skills and new knowledge, such as stabilization method, methods of high embankment on soft ground were transferred through domestic training and C/P training in Japan, seminars, workshop and OJT during implementation of PP-1 and PP-2. Engineers participated actively in practical training in the field. At the time of training in SRL for boring machine, all the engineers gathered to learn how to operate the machine, sharing new knowledge and skill for future use.

5.3 Project Monitoring System

5.3.1 Reporting System

The Project is reported to JICA HQ and JICA Myanmar Office as follows:

1) The Project submitted the 1st Progress Report
2) The Project submitted the Completion Report of PP -1
3) Long-term expert submitted the 1st Interim Report (Japanese)

The JICA HQ and JICA Myanmar Office monitor the Project through above reports, discussion with Japanese experts and C/P, and provide necessary support to the Project.

5.3.2 Joint Coordination Committee (JCC)

The JCC as the highest decision making mechanism, was held in February 2012 to discuss and approve the following subjects of approval of PDM and PO.

Although the Project does not have a regular meeting on working level gathering all the working level of C/P, Japanese experts visit C/P for consultation as needed.

6. REVIEW BY FIVE EVALUATION CRITERIA

6.1 Relevance

Relevance of this project is relatively high as evidenced by the following factors;

6.1.1 Policy priority

The GOM has prioritized in road construction in the 3rd Five Year Road Development Plan (2011/12 ～ 2015/16) in the 30 years Road and Bridge Development Plan (2001/02～2030/31).

The technical standards have not been largely changed since the time of Detailed Planning Survey for this project conducted in 2012.

The Project objective is in line with the national plans at present as well.

6.1.2 Needs of Target Group

1) PW

- The Project is preparing recommendations for modification of the existing standard, of which already contributed improvement of some roads in Myanmar.
- Considering Myanmar society, economic status and environment, PW has a strong will to analyze a variety of standards such as BS, AASHTO and Japanese one, modifying the standard to apply for roads in Myanmar.
- PW also recognizes that the new skills and knowledge for soft soil stabilizing countermeasures transferred from PP-1 and PP2 have benefitted especially for younger engineers of PW.

2) RRL & SRL

In RRL, technical transfer on soil testing method for soft soil countermeasure work is particularly in line with the need of the engineers. The boring machine procured by the Project was another example of fulfilment of SRL's needs for improvement of soil testing.

3) Pyapon District Office

The engineers at Pyapon District Office of PW had an opportunity to learn how to conduct survey, soft

soil treatment, to supervise construction works, and to operate the stabilizer through the implementation of PP-1.

6-1-3 Relevance of the Project Plan

The Team identified that indicators in the present PDM version 1 are needed to be modified since they are not clear with target figures, and a logical relation between the indicators of Project purpose and Output is not clear.

6.2 Effectiveness

Effectiveness of this project is as middle evidenced by the as following factors;

6.2.1 Achievement of Project purpose

- The indicator-1 of the Project purpose is not measurable due to lack of target figure set. Although in the circumstance of limited budget of PW, and in which the stabilization methods are not approved yet, it is expected that road length constructed by the technology introduced from PP-1 and PP-2 will exceed its covering length in Road no.7 in Pyapon district by the end of the Project.
- The indicator to measure improvement of road condition is not appropriate to measure the capacity enhancement of PW engineers.

6.2.2 Logicality and contribution of Outputs

- Some of recommendations for modification of Myanmar road standards have been accepted and applied for improvement of road in Myanmar. However, C/P side regards these recommendations as a source for comparison among other ones' standards for future development of Myanmar road standards.
- The enhancement of practical skills and knowledge of the road technical staff are directly contributing capacity enhancement of PW.

6.3 Efficiency

Efficiency of this project is relatively low as evidenced by the following factors;

6.3.1 Achievement of Outputs

- As for the achievement of Output1, the Project is preparing the Soft Soil Treatment Manual. Some of the recommendations for modification of standards have been adopted by PW, and applied for improvement of roads.
- The practical skills and knowledge of PW engineers at RRL, SRL, and Pyapon District office were enhanced through OJT, Intensive Training Program of PP-1.

6.3.2 Inputs

(1) Japanese side

- Six (6) months of delay in dispatching long-term experts due to delay of issue of Visa hampered the smooth commencement of the Project activities with close discussion of testing works in the 1st project year.
- Expertise and instruction of Japanese experts for C/P are effective to ensure the quality of activities.
- Provision of boring machine was effective to upgrade SRL engineers' capacity to conduct soil test.

(2) Myanmar side

- Although some C/P s are not able to fully engaged in the project activities due to simultaneously on-going projects, they are very eager and active to absorb new skills and knowledge from the Project.
- Some of activities, such as drainage layer construction work and sodding work for slope, were changed due to lack of PW's budget.

6.4. Impact

6.4.1 Prospect of Achievement of the Overall Goal

Cost of stabilizing method is twice higher than that of ordinary Macadam method. Even though it is costly, using stabilizer is effective in Ayeyawardy delta area. It depends on PW's budget

And the result of examination of effectiveness of the method whether they can extend the length with such method.

As for the indicator-2, the Team identified that travel hour for students already decreased near the PP-1 site. However, the target figure of hour is still needed for appropriate evaluation.

6.4.2 Impact to Environment and Society

Pyapon district office received some reference from surrounding district office on implementation of PP-1 and some non-targeted engineers participated in training. These factors show some impacts to non-targeted area in Ayeyawardy delta area.

As above mentioned, daily life of local residents near PP-1 site improved in terms of traveling time, access to hospital and market.

6.4.3 Negative Impact

There was no negative impact identified in this review survey.

6.5 Sustainability

Sustainability of this project is middle as evidenced by the following factors;

6.5.1 Institution

PW owns the Center for Training for Construction (CTC) to train engineers on design, testing, and construction works. The collaboration between the Project and CTC was not identified during the survey, however, RRL showed their will to continue capacity enhancement of engineers with CTC after the Project period.

SRL assured appropriate operation and maintenance of the boring machine. They appointed a high level engineer to handle the machine for evading possible troubles by multiple users.

6.5.2 Finance / budget

Stated as above, shortage of budget caused delay and change of project activities. In future, budget issue might be critical for extension of road with stabilizing methods, since the construction cost is nearly twice higher than the ordinary Macadam method.

6.5.3 Ownership of the Target Groups

PW has strong ownership in establishing the appropriate standards by themselves. Establishment of road standards requires a long period of analysis with consideration of all the conditions of society, economy and budget.

6.5.4 Skills and Knowledge

All the interviewed C/Ps at PW, RRL, SRL and Pyapon district appreciated new skills and knowledge of soil testing and construction work. Administrative know-hows such as report writing and conducting periodical meeting were also appreciated among Pyapon district engineers. They showed strong will to maintain these new skills and techniques after the end of the Project, however, it depends on budget and approval whether they can continue to construct roads with stabilizing method or not in future.

7. CONCLUSIONS AND RECOMMENDATIONS

7.1 Conclusions

- The Project has implemented its activities to recover the delayed schedule by extending construction period and changed the contents of construction works. Monitoring of the entire management of the Project is not done by either side of Japanese or Myanmar side. Closer communication between C/P and Japanese experts on working level is needed for smooth implementation of the Project activities.
- The achievement of Project Purpose (Effectiveness) depends on how far PW can improve the road in delta area. However, it is not allowed for Pyapon district to extend the road with stabilizing method before the recommended standards are approved.
- Considering Efficiency of the Project, management aspect of PP-1 and PP-2 such as transportation of machineries and materials, largely affects progress of the Project.
- While C/P has strong will to maintain the transferred skills and knowledge, it depends on budget and approval from PW-HQ whether they can use those skills and knowledge after the Project end. Contrary, according to the study by Japanese experts, maintenance cost and durability of stabilized road is much less than that of ordinary one. Without clear and continuous explanation of cost benefit and actual results of experiments, it would be difficult for PW to maintain stabilizing method in longer term.

7.2 Recommendations

- Increase the frequency of meetings and continuous revision of technical manuals.
  Because of the scattered office and busy schedule of PW members and Japanese experts, it is difficult to have prompt discussion an agreement among them The Team recommends to have JCCs more frequently or establish technical committees in specific fields for the close communications, as soon as possible.
  For example, the technical committees could have a function to revise and update the manuals continuously so as to fully apply for Myanmar's economic and social conditions.

- Revision of the Project Design Matrix (PDM)
  PDM 1.0 was drafted in the first JCC in September 2013. However the Team found some ambiguities in the PDM. Therefore the Team suggests revision of the present PDM by referring the attached PDM (See ANNEX 7) by the next JCC.

- Monitoring of the outputs of the Project by PW
  The outputs of the Project, e.g. construction manuals for soft soil condition and practical knowledge obtained by pilot projects, will be shared among the Project participants. The Team suggests that PW monitors the competitiveness of pilot projects among the existing methods and proceed to approve them appropriately.

- Secure the budget for the road construction
  It is important to secure the appropriate road construction budget for rural areas. The Team suggests that PW monitor the result of pilot projects after the Project period and compare with the existing methods from the perspective of lifecycle cost.

MINUTES OF MEETING
BETWEEN
JAPAN INTERNATIONAL COOPERATION AGENCY,
AND
PUBLIC WORKS, MINISTRY OF CONSTRUCTION,
THE GOVERNMENT OF THE REPUBLIC OF THE UNION OF MYANMAR
ON
JAPANESE TECHNICAL COOPERATION
FOR
THE PROJECT FOR IMPROVEMENT OF ROAD TECHNOLOGY
IN DISASTER AFFECTED AREA

The Japanese Terminal evaluation Team organized by Japan International Cooperation Agency (hereinafter referred to as "JICA") headed by Mr. Yoshihiro Kakishita visited Myanmar from 9 to 20 March, 2015 for the purpose of conducting a Terminal Evaluation of "the Project for Improvement of Road Technology in Disaster Affected Area" (hereinafter referred to as "the Project").

During its stay in Myanmar, the Japanese Team joined by the Myanmar side Evaluator had a series of discussions and exchanged views with authorities concerned of the Government of Myanmar (hereinafter referred to as "Myanmar side concerned authorities") in order to jointly evaluate the achievements of the Project.

As a result of the discussions, the Evaluation Team and Myanmar side concerned authorities agreed to the Joint Terminal Evaluation Report attached hereto.

Nay Pyi Taw, 19 March 2015

Mr. Yoshihiro Kakishita	U Kyaw Linn
Team Leader	Managing Director
Japanese Terminal Evaluation Team	Public Woks
Japan International Cooperation Agency	Ministry of Construction
Japan	The Republic of the Union of Myanmar

ATTACHED DOCUMENT

I. The Terminal Evaluation of the Project

The Evaluation Team presented the Joint Terminal Evaluation Report and explained the results including recommendations. The Evaluation Team and Myanmar side concerned authorities discussed the contents of the Joint Terminal Evaluation Report and other related point.

ATTACHMENTS:

1 Joint Terminal Evaluation Report
2. Other related point

Attachment 1

JOINT TERMINAL EVALUATION REPORT

ON

THE PROJECT

FOR

THE PROJECT FOR IMPROVEMENT OF ROAD TECHNOLOGY IN DISASTER AFFECTED AREA

IN

THE REPUBLIC OF THE UNION OF MYANMAR

MARCH 2015

Abbreviation

AASHTO	American Association of State Highway and Transportation Officials
ADB	Asian Development Bank
ASEAN	Association of South - East Asian Nations
BOT	Build, Operate and Transfer
BS	British Standards
C/P	Counterpart
CAD	Computer Aided Design
CE	Chief Engineer
CTC	Central Training Center
DAC	Development Assistance Committee
DD	Deputy Director
DDA	Department of Development Affairs of Ministry or Border Affairs
DMD	Deputy Managing Director
DSE	Deputy Superintending Engineer
ED	Executive Director
EE	Executive Engineer
GDP	Gross National Product
GOJ	Government of Japan
GOM	The Government of the Republic of the Union of Myanmar
HRD	Human Resources Development
JCC	Joint Coordination Committee
JICA	Japan International Cooperation Agency
LLC	Life Cycle Cost
M/M	Minutes of Meeting
MLIT	Ministry of Land, Infrastructure, Transport and Tourism (Japan)
MOC	Ministry of Construction
OECD	Organization of Economic Cooperation and Development
OJT	On-the-Job Trainings
PDCA	Plan Do Check and Action
PDM	Project Design Matrix
PO	Plan of Operations
PP	Pilot Project
R/D	Record of Discussions
RRL	Road Research Laboratory

SRL	Soil Research Laboratory
TCP	Technical Cooperation Project
TOT	Training of Trainers
UNDP	United Nations Development Program
USAID	United States Agency for International Development
WTO	World Trade Organization
YTU	Yangon Technical University

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LIST of ANNEX

1 Introduction

1.1 Objectives of the Terminal Evaluation

The Japan International Cooperation Agency (JICA) has been cooperating with the Department of Public Works, (PW) of the Ministry of Construction (MOC) of the Republic of the Union of Myanmar in the implementation of the "Project for the Improvement of Road Technology in Disaster Affected Area in the Republic of the Union of Myanmar" (The Project) since July 2012. The objectives of the Terminal Evaluation are to assess the performance of the project at the three month prior to the end of the duration to make sure the achievement of the Outputs and the Project Purpose, and their indicators. Based on the result of the analysis, the direction of the project implementation as well as the issues to be resolved would be addressed among the parties concerned.

1.2 Methodology

The Terminal Evaluation shall be carried out in accordance with the JICA Guideline for Project Evaluation. The guiding principles of the evaluation are as follows:

(1) The Project Design Matrix (PDM) (attached in Table-1) is to be agreed upon by both sides and utilized as a basis of the evaluation process,

(2) The achievement of the Project is to be confirmed by collecting data defined in the objectively verifiable indicators of the PDM;

(3) Achievements of the Project were measured in terms of Inputs, Outputs, Project Purpose, and Overall Goal in the light of the Objectively Verifiable Indicators of the PDM, and

(4) The Project is evaluated against the five evaluation criteria defined by the Development Assistance Committee (DAC) Evaluation Quality Standard of the Organizational for Economic Cooperation and Development (OECD) which is the standard measurement applied by JICA (Explained in the Table-1).

In addition, more holistic perspective in assessing the overall achievements of the PW-JICA collaboration since the launch of the Project shall be employed. More specifically, what and to what extent the road construction in the Ayeyarwady Region of Myanmar has and has been changing through the interventions by the Project.

1.3 Key Terms of the DAC Principles for Evaluation of Development Assistance

JICA applies the following five (5) criteria for value judgment of the Project review and evaluation as a standard measurement defined in the DAC Principles for Evaluation of Development Assistance and the Glossary of Key Terms in Evaluation and Results Based Management[1] explains the description of the five evaluation criteria (Table-1).

[1] The DAC Principles for the Evaluation of Development Assistance, OECD (1991), Glossary of Terms Used in Evaluation, in 'Methods and Procedures in Aid Evaluation', OECD (1986), and the Glossary of Evaluation and Results Based Management (RBM) Terms, OECD (2000).

Table-1 General Description of the Five Evaluation Criteria

Criteria	General Description
Relevance	Degree of compatibility between the development assistance and priority of policy of the target group, the recipient, and the donor.
Effectiveness	A measure of the extent to which an aid activity attains its objectives.
Efficiency	Efficiency measures the outputs – qualitative and quantitative – in relation to the inputs. It is an economic term which is used to assess the extent to which aid uses the least costly resources possible in order to achieve the desired results. This generally requires comparing alternative approaches to achieving the same outputs, to see whether the most efficient process has been adopted.
Impact	The positive and negative changes produced by a development intervention, directly or indirectly, intended or unintended. This involves the main impacts and effects resulting from the activity on the local social, economic, environmental and other development indicators.
Sustainability	Sustainability is concerned with measuring whether the benefits of an activity are likely to continue after donor funding has been withdrawn. Projects need to be environmentally as well as financially sustainable.

Source: New JICA Guideline for Project Evaluation First edition (June, 2010) P.23

1.4 Members of the Joint Terminal Evaluation Team

(1) Myanmar Side

Name	Title and Affiliation
U Aung Myint Oo	Project Director, Public Works, Ministry of Construction, PW
Daw Hla Hla Thwe	Project Manager, PW
Daw Mya Mya Win	Deputy Superintendent Engineer, RRL, PW

(2) JICA Side

Designation	Name	Title and Affiliation
Team Leader	Mr. Yoshihiro Kakishita	Senior Advisor to the Director General, Infrastructure and Peacebuilding Department, JICA
Cooperation Planning	Mr. Toru Tsuchihashi	Highway Engineer (Road and Bridge), Planning and Coordination Division, Team 1 Transportation and ICT Group, Infrastructure and Peacebuilding Department, JICA
Evaluation Analysis	Mr. Masato Onozawa	Consultant, IC Net Inc.

1.5 Schedule of the Terminal Evaluation

The terminal evaluation was conducted from 8 to 21 March 2015 in Myanmar. The detailed schedule is shown in the Annex 3.

2 Outline of the Project

2.1 Background

The road construction and maintenance in the Republic of the Union of Myanmar faces a variety of challenges and difficulties. In Ayeyarwady Division, as the area is located in the coastal zone of the country, they are prone to face significant risks damages from disasters. When Cyclone "Nargis" hit these areas in 2008, inadequate road condition hindered relief operations and recovery efforts. Such risks have been seriously considered by GOM. The Public Works (PW), a agency responsible for road construction and maintenance in Myanmar, however, is not able to ensure full access to its road network all year round under any weather conditions due to lack of adequate road construction technologies are not fully developed and applied by meeting a variety of parameters, PW is in need of developing the standards take into the consideration of natural conditions, the need of long-term maintenance and proper road technologies matching the respective region.

In addition, some engineers' technical level has much room for improvement because its training center gives training on road technology but the training provided are limited to general one and isn't advanced one for road construction and maintenance under special condition such as soft-ground, Such challenges of roads in Myanmar is caused by the lack of budget and road technology mentioned above. To secure the availability of roads for life and security of local people, upgrade of technical standard and enhancement of capacity of engineers are indispensable.

Under such circumstances, GOM requested to the Government of Japan (GOJ) in August 2011 for a "Technical Cooperation Project for Improvement of Road Technology in Disaster Affected Area". In response to the request, JICA carried out the preparatory study in February 2012 to determine the details of the project components. The Record of Discussions (R/D) on the framework of the Project was signed in July 2012.

2.2 The Project Overview

2.2.1 Overall Goal

Roads in the delta areas of Ayeyarwady Region are improved.

2.2.2 Project Purpose

The capacity of the Public Works (PW) for road construction adaptive to the delta areas of Ayeyarwady Region is enhanced.

2.2.3 Outputs of the Project

(1) Road technology standards and manuals for designing and construction works are improved.

(2) The practical skills and knowledge of the road technical staff are enhanced.

2.2.4 Implementing Organization

The implementation organization is PW of MOC

2.2.5 Target Group

The target group of the Project is Road Technical Staff of PW.

3 Project Performance and Inputs

3.1 Implementation of the Activities

3.1.1 Inputs from the Japanese Side

Inputs includes dispatch of experts, trainings in Japan, trainings, seminars and workshops in Myanmar, the Project cost, provision of equipment. Basically the inputs have been arranged as initially agreed.

(1) Dispatch of Experts

Long-term experts and short-term experts are dispatched as shown in ANNEX 5.

(2) Local Cost

The local cost borne by the Japanese side is shown in Table-2. The detailed breakdown of the local cost borne by the Japanese side is shown in ANNEX 8.

Table-2 Local Cost Borne by the Japanese Side

Year	JFY 2012	JFY 2013	JFY 2014	JFY 2015 (Planned)	Total
Local Cost	6,080	62,890	53,527	15,000	123,997

Unit: in US Dollar

(3) Equipment Provided

The list of equipment provided from the Project is shown in ANNEX 7. The soil mixing plant is scheduled to be installed in April 2015.

3.1.2 Inputs from the Myanmar Side

(1) Appointment of Counterpart Personnel

The Managing Director (MD) of PW has served as the Project Director whilst a Deputy Chief Engineer (DCE) has been appointed as the Project Manager to oversee the overall implementation of the Project. Engineers of various departments of PW are assigned to the Project as counterparts and involved a variety of activities in the course of the implementation (See ANNEX 4).

(2) In-kind Contribution of Office and Facilities

The Myanmar side provided the Project the office space for JICA experts. PW has allowed the Project for use of rooms for meetings and training activities in its premises.

(3) Cost for the Pilot Projects

The Myanmar side provided the cost necessary for carrying out the two pilot projects. The total cost borne by the Myanmar side is 772.0 million Kyats.

(4) Local Expenses

Administrative and operational costs for electricity, water supply are borne by the Myanmar side.

3.2 Achievement of the Activities

The Project so far has made significant progresses since the beginning of the Project. The adverse impacts of the assignment change were minimal and the gap to the original one was negligible.

Except the PP-2 and tasks related to the final seminar, the activities have been completed mostly at the time of the evaluation. Remaining tasks include finalization of the guideline/manual (activity 1-5), the Soft Soil Treatment Manual and the final seminar for dissemination of the analytical results of the PP-2.

Those manual and recommendations derived from the Activities will be compiled and to be submitted to PW by the end of the Project. The current status of the Activates is summarized in the Table-3.

Table-3 Achievement of Activities

Activities	Achievement
Activities for Output 0: Conduct the baseline	
0-1. Number of the road technology standards and manuals adaptive to Delta area	[Completed] • Total of 10 technical standards and manuals on the road construction technologies were identified. • The standards for road technologies on British Standards (BS) and those of the American Association of State Highway and Transportation Officials (AASHTO) are utilized mainly for material analyses and pavement structure design.
Activities for Output 1: Road technology standards and manuals for designing and construction works are improved.	
1-1. Review Myanmar standards and manuals of road technologies for designing and construction works	[Completed] • The Project has reviewed the standards and manuals utilized by PW. List of • The Project prepared a note on geometric structures and traffic safety of expressways and highways in Myanmar for further discussion and improvement.
1-2. Analyze the issues and challenges on the road technologies for designing and construction works in Myanmar.	[Completed] • Based on the analysis and observation from site visits and survey, the Project exchanged views with the C/P on a variety of issues related to the road technologies in Myanmar. • The Project submitted a work plan for review and the plan were accepted by the Myanmar side. • The issues on geometric structure and the traffic safety of the expressways were reviewed with PW engineers. 147 items were identified unsafe or not appropriate between the Yangon - Naypyitaw section in light of the existing standards. So far, 33

Activities	Achievement
	items listed were fixed or resolved by PW.
1-3. Conduct research on construction conditions including soft ground.	[Completed] • The Project conducted field surveys of the union roads in the Ayeyarwardy delta to understand the present condition of the road design and the construction works. • Based on the result of survey, issues on analysis of high embankment and soft soil treatment needs to be discussed as the priority area among the road construction technologies. • The Project excluded the development of the pavement manual since it was already completed by the Japan Infrastructure Partners (JIP) funded by the JICA Partnership Program.
1-4. Specify the road technologies for designing and construction works necessary to be developed.	[Completed] • The short-term experts are newly assigned to prepare the Soft Soil Treatment Manual covering such issues as analysis of soil consolidation, soil compaction.
1-5. Develop the road technology standards and manuals, and revise them based on the outcomes of the pilot project(s) as necessary.	• The first draft manual of soft soil treatment has been prepared and submitted to PW for review. • The submission of the review by PW will be by the end of April 2015. The Project is to finalize the draft by middle of coming June... • Upon completion of the PP-2, the manual will be revised based on the results of PP-2
1-6. Convene the workshops/seminars to share the contents of the road technology standards and manuals with the road technical staff across the country.	• The Project has organized seminars covering a variety of topics in the road technologies. Date, topics and number of participants are shown in ANNEX 9. • Final seminar is planned upon the completion of the PP-2. The prospective topics on the final seminar will be soft soil treatment manual and the analysis of the PP-2.
Activities for Output 2: The practical skills and knowledge of the road technical staff are enhanced.	
2-1.Select pilot project(s).	• The Project identified and reviewed the PW's road development plan, conducted a field survey in Ayeyarwady delta area, and collected soil materials for soil testing at the RRL. • Based on the results of these studies, the Project identified and assessed the sites for PP-1 and PP-2. The suitable site for high embankment was identified.
2-2. Conduct the research activities on construction conditions including soft ground.	• The Project discussed with the engineers of PW (both central and district levels) on a variety of issues associated to the pilot projects for detailed design and construction plan for implementation of the projects. • Based on the plan the Project consult with the Executive Engineer of the Pyapon District Office on implementation and supervision of the projects. • The Project also conducted stabilization treatment mixing test, and selected machinery for pilot projects. • The Project carries out monitoring activities of the pilot projects (movement of embankment, core boring, etc.)
2-3. Formulate the work plans, including outline design, cost calculation, quality control, etc., of the selected pilot project(s).	• The Project demonstrated typical procedures for construction management throughout implementation of the pilot projects. • This includes preparation of construction plan, survey, soil testing, temporary facilities, etc. to ensure the quality control over the process.
2-4. Assist the road technical staff of the PW to implement the pilot project(s) based on the work plans Conduct	• The Project executed capacity enhancement covering a variety of technologies and technique on construction management, quality control, progress control, etc. in PP-1. • The Project conducted practical training on design, construction

Activities	Achievement
training on road construction for technical staff, operators, etc. through the pilot project(s).	management, quality control, etc. in PP-1.
2-5. Monitor the pilot project(s) based on the plans.	• The Project monitored the work progress of PP-1 by undertaking regular weekly meeting.
2-6. Convene the workshops/seminars to share the experiences, outcomes, etc. of the pilot project(s).	• The first seminar (13 to 14 June, 2013): selected topic on pavement in tropical zone, introduction of Japanese road standards, countermeasures against soft soil ground, and pavement. The Number of participants was 52. • The second seminar (14 December 2013): selected topic on construction plan of PP-1 and high embankment observation for 39 participants from RRL, SRL, YTU, and district offices. • The Project held a seminar for reporting the completion of PP-1 (May 28, 2014) in Nay Pyi Taw for 40 participants.

3.3 Achievement of Outputs

As the result of the activities, the following achievements of the Outputs are observed.

Table- 4 Achievement of Outputs

Narrative Summary	Objectively Verifiable Indicators	Method of Measurements	Result
Outputs: 1. Road technology standards and manuals for designing and construction works are improved.	1-1. New soft soil treatment manual is discussed and accepted by P.W.	1-1 Hearing from PW.	• The first draft of the soft soil treatment manual has been submitted to PW for review. The comments and feedback will be compiled by mid May. • The finalization of the draft will be completed by the May.
	1-2. More than 10 engineers are executing the work by using the manual.	1-2. Hearing from PW. (Interview from site engineer)	• A various practices have been observed on the operational procedures for each step on the construction cycle throughout the pilot projects (e.g. survey, research, design, supervision, inspection, operation and maintenance). C/Ps have attained and improved these skills of the works (e.g. geographic survey, quality control, soil research, soft soil treatment method, construction management, etc.) • The casebook on the stabilization methodology based on the two pilot projects has been prepared and scheduled to complete upon completion of PP-2 expected in June 2015. • Many technique and approaches taught through seminars and workshops are being adopted by the counterpart gradually. The adoption process is still in progress. Many sign of full adoption and behavioral changes are observed.
2. The practical skills and knowledge of the road technical staff are	2-1 2.1 Total number of trained staff of PW is more than 300 numbers.	2-1. Records of the pilot project(s) and training programs	• A series of seminars and workshops held since 2012. The calmative total of staff members of PW trained was 318 and summarized as following

Narrative Summary	Objectively Verifiable Indicators	Method of Measurements	Result

enhanced.

Year	Seminar Title	No of total participants
C/P Training in Japan		
2013	Workshop for Enhancing Road Engineering (14 days)	5
2014	Workshop for Enhancing Road Engineering (14 days)	5
2014	Pre-workshop b/w NILIM & RRL (8 days)	3
2014	Japanese Expressway Technologies (10 days)	10
	Total	23
Seminars		
2013	Road engineering	53
2014	Road materials and road improvement	15
	Total	68
Workshops		
2013	Project Design Management	50
2013	Chemical Stabilization for PP-1	9
2013	Stabilized Material Test Results in Pavement Design	5
2013	Implementation of PP-1	30
2014	Stabilized Road Improvement Work	7
2014	Reporting on PP-1	29
2014	Study on High Embankment on Soft Ground (1)	11
2014	Analysis of High Embankment on Soft Ground (2)	10
2014	Analysis of High Embankment on Soft Ground (3)	10
2014	Analysis of High Embankment on Soft Ground (4)	9
2014	Analysis of High Embankment on Soft Ground (5) (6)	9
2014	Summary of the workshops on the new manual (7)	5
2014	Preparation of Laboratory Test (8)	6
2014	Preparation of Laboratory Test (9)	6
2014	Preparation of Laboratory Test (10)	6
2014	Settlement Analysis Using the Textbook	9
2015	High Embankment Behavior Observation and Analysis	51
	Total	171
Training in the PP-1		
2014	Operation of Machinery	13
2014	Control of Stabilization Materials	37

Narrative Summary	Objectively Verifiable Indicators	Method of Measurements	Result
			2014 | Field Density Test at PP-1 | 6 Total | 56 Calmative Total of the C/P Trained | 318
	2.2 50% of participants evaluate Training/seminars favorably.	2-2 Question-naire for trainees.	• During the workshops attainment and comprehension of the topics covered were monitored by the experts by a variety of assessment tools for attainment (e. g. question and answer, discussion, paper & pencil mini-test, practices-based examination, practice using computer, etc) instead of collecting approval rating.

3.4 Achievement of Project Purpose

The achievement of the Project Purpose is explained in Table- 5.

Table- 5 Achievement of the Project Purpose

Narrative Summary	Objectively Verifiable Indicators	Method of Measurements	Result
Project Purpose:	1. The enhancement of skill and knowledge of the engineer for road design and construction is confirmed by the hearing from more than 30 staff.	1. Questionnaire to C/P.	Signs of adoption are observed. Some examples: (1) Discussion throughout the process of the preparation of the Soft Soil Treatment Manual (2) Deepen and enhanced the understanding of analysis of soil consolidation by integrating the theories and data collected from the observation/ monitoring at the site. (3) Advantages of lime/ cement stabilization methods fully understood for further adoption to section next to the PP-2 when funding is secured. (4) Quality control throughout the construction process adopted by engineers involves (e.g. district office, RRL, etc.) (5) Adoption of the new calculation methods for high embankment have been trained through WS
	2. By the end of the project, road length constructed by the technology introduced from Pilot Project is extended longer than 2.6 km.	2. Pilot Project Report.	• Total length of the sections applied the lime stabilization method are as shown in the following: PP-1: 1.6 km, Donated stabilizer used PP-2: 0.6 km, In progress. Soil plant will be used. Total: 2.2 • The length of PP-2 was changed from 1.0km originally planned to 0.6km due to the restriction of budget allocation for this year. • The length of the PP-2 was changed from 1.0km originally panned to 0.6 km due to the procurement and budget disbursement procedures of the both sides. The Myanmar side plans to continue the remaining section in the next fiscal year.

Narrative Summary	Objectively Verifiable Indicators	Method of Measurements	Result
			• Despite above change in length, the technical contents for PP-1 and PP-2 has been unchanged and taught to C/P as planned through OJT.

3.5 Achievement of Overall Goal

The achievement of Overall Goal is summarized in Table- 6.

Table- 6 Achievement of Overall Goal

Narrative Summary	Objectively Verifiable Indicators	Method of Measurements	Result
Overall Goal: Roads in the delta areas of Ayeyarwady Region are improved.	1. The road improved by the stabilization technique is more than 10 km. 2. Driving hour or travelling time is reduced 10% comparing before execution of project.	1. Hearing from PW 2. Report by actual measurement by district office	1. Total length of the road improvement is projected 10 km. • PW explained that the total length of the road improved by the stabilization technique is planned more than10 km. PW believes the new technology shall be retained and strengthened within the organization by practicing and applying continuously every year. • Improvement of the road conditions of the entire road section of PP-1 and PP-2 will be completed. It contributes better access to the market. It will benefit to the well being and social and economic activities of the local residents and will contribute to poverty alleviation in the region. 2. Upon the completion of the Route 10 (which the PP-2 is part of) the access between Bogale and Mawgyun will be secured (expected as early as April 2017). As the result, more than 30 thousand people will benefit from a reduced travel time to Yangon by at least 1.5 to 2.0 hours by automobile. The above route will be accessible throughout a year.

4 Project Implementation Process

4.1 Project Implementation

(1) Activities Planned in the PDM

Overall, the Team observed that the Project has been carried out according to the schedule and the planned activities will be completed by the end of June, 2015.

(2) Favorable Factors

Under the leadership of the Managing Director of PW, positive disciplines for improving road technologies have been established; for example, engineers of PW has shown strong interest on soft soil treatment and stabilization technologies presented in the seminars/workshops; PW has borne the construction cost for PP-1 and PP-2 which is 471 million Kyat and ? Kyat respectively.

(3) Non-favorable factors:

Due to the current policy changes of Myanmar, un-expected in-flow of donor assistances has been experienced at PW. Most senior-level counterparts are occupied with many different commitments. The availability of C/P personnel and securing close consultation and collaborating in many circumstances has been a challenge for implantation of the Project.

5 Evaluation Results

5.1 Relevance: [High]

The Team concluded that the relevance of the project remains high. Policies of the Myanmar and Japanese sides are largely consistent since the detailed planning study of the Project.

5.1.1 Myanmar Policies Perspective

The Project is aligned with the current "3rd Five Year Road Development Plan (2011/12-2015/16)" under the 30-years Road and Bridge Development Plan (2001/02-2030/31). The GOM has prioritized in road construction for supporting economic and social activities. The current Five Year plan stipulates that construction and improvement of 10 road sections, total of 888.8km with minimum pavement width of 3.66m (12 feet) in the Ayeyarwady Region. The above road development plan remains unchanged largely since the time of the Detailed Planning Survey for this technical cooperation project (TCP) carried out in 2012. In addition, PW holds above policy for expanding and maintaining the Union Road network and requires dealing with soft soil conditions in the Ayeyarwady Region. The project's objective is in line with the national plans as well as PW's responsibilities.

5.1.2 ODA Policy of Japan Perspective

The project is aligned with ODA policy of the government of Japan as well as that of JICA. The Ayeyarwady Region is located in the costal state of Myanmar where the risks associated to major disasters, cyclones and heavy rains are high. Japanese Assistant Policy (April, 2012) and JICA's assistant program to Myanmar is designated to improve the quality of life and safety of residents in the disaster prone areas in Myanmar.

5.1.3 The Project Approach Perspective

The approach adopted by the Project meets the needs and context of PW. One of the most critical challenges for PW is capacity development at both the organizational and individual levels. The past situation was as follows;

PW, an agency under MOC responsible for plan develops and maintain the Union Road Network endeavors every effort to maintain the quality of road construction despite of restricted resources (e.g. budget, machine power, choice of technology, etc.). For example, securing high quality road construction materials such as sand, gravels and soil with reasonable cost is extremely difficult in

Ayeyarwady Region due to geological and geographic conditions. In addition, technical capacity of designing earth work in the soft soil conditions is limited because the design procedures and the technical guidelines ensuring the safe and stable embankment have not been established in Myanmar. The TCP to support development of such capacity contributes the safety and the quality of any structures built on soft grounds. Therefore the relevancy of the Project remains high as initially planned.

The Project introduced the practical methods on (i) how to carry out the analysis of soil consolidation of soft soil, (ii) understanding through the experiment and analysis, the actual behavior of high embankment on the soft soil site, and (iii) how to integrate lab analysis and actual planning, designing and management the construction projects. In addition, the Project introduced a mechanism to maintain quality employing PDCA cycle for the construction management by practical on-the-job training. To enhance the learning of the engineers of PW, practical examples in Myanmar and Japan were introduced and compared during the study visits to Japan.

Further, the Project has dealt with geometric and safety structure of expressways to improve drivability and the safety. Based on the site survey, potential high risk items have been identified and personated to division concerned for improvement and repair. The items in the recommendation were put in action for immediate repair. It has provided the basis of understanding necessary clearance for high-standard road design.

5.2 Effectiveness : [Medium]

The Project is now on the right track toward achieving the Project Purpose. Given one of the major activities, namely the PP-2, is still in the process of the preparation, the Output 2 is not yet fulfilled. Tangible signs of fulfilling the all Outputs and achieving the Project Purpose are observed. These examples are explained in the following:

5.2.1 Improvement of the Road Technology Standards and the Manuals for Designing and Construction Works

The progress of the Output 1 shows that the preparation is judged by the revised indicators "1-1.New soft soil treatment manual is discussed and accepted by PW." and "1-2. More than 10 engineers are executing the work by using the manual". The first draft of the manual for soft soil treatment has been prepared and the draft manual has been submitted to PW for review. The experts will finalize and revise the manual as necessary upon the receipt of the feedback from PW and the completion of the PP-2.

More than 10 engineers use the manual for their work. Along with the each step of the project cycle (i.e. plan, research and survey, design, supervision, inspection and monitoring), many engineers of respective divisions involves. The manual and the guidelines as well as contents of the training provided are given to those engineers for reference of their work. According to the Myanmar side, the translation of these manuals into the Myanmar language is scheduled within six

months. The official approval of the documents by the administration of PW is expected after one month after the translation. Especially, the new calculation methods in the manual will be applied in the analysis of high embankment in the approach roads to the Htee Chant Bridge construction project in the Sageing Region.

5.2.2 Enhancement of the Practical Skills and Knowledge of the Road Technical Staff

The revised indicators of Output 2 "The practical skills and knowledge of the road technical staff are enhanced" include "2.1 Total number of trained staff of PW is more than 300 numbers" and "2.2 50% of participants evaluate training/seminars favorably". The calmative total of the participants of the training and seminar carried out by the Project has been 318, exceeding the indicator of 300. The final number will be confirmed by the end of the Project.

5.2.3 Adoption and Localization of the Technology Suitable for Myanmar

Some items listed in the recommendations of on geometric and safety structure of expressway has been immediately adopted and put into repair and modification. There are 147 items listed in the both side of the Yangon – Naypyitaw section of the express way and 33 items have been repaired. Those items not adopted, however, are either, technically and financially unable to repair. The recommendation has introduced the fundamental knowledge of necessary clearance and its application for securing traffic safety. The team acknowledges that MOC has been preparing the regulatory frameworks on road and transportation with technical assistance from other donor. The practical knowledge, such as implication of the clearance for safety works help the Myanmar side accelerates the preparation of the regulatory framework.

5.2.4 Adoption and Further Use of New Technology

It is rather difficult to list any particular revisions of procedures regarding the analysis of high embankment on the soft soil ground at the time of evaluation. According to the PW, full adoption of the new calculation methodology needs some time because PW needs to ensure the stability and safety of the high embankment site over the time. PW would like to utilize the monitoring facility of the PP-2. PW would also like to see if no serious effects caused by soil consolidation occurred at PP-2.

The district office of PW, in the other hand, indicates that the lime/cement stabilization method shall be fully adopted in the Ayeyarwady Region. The initial cost of the new method is relatively high under the current circumstances. This is one of obstacle for full adoption in the region because the funding for road construction is limited. The office is carefully conducting monitoring of the surface condition at PP-1 and PP-2 (when completed) to get concrete evidence of advantages over conventional pavement methods. The office would like to ensure the total cost over design period would be lower than those of the conventional one. If the durability and the cost effectiveness (life cycle cost) exceed those of the conventional one, they well be encouraged to allocate funding to adopt the stabilization method fully in the region.

5.3 Efficiency : [Medium]

Overall efficiency of the Project is considered "Medium". The inputs are delivered as almost initially agreed and scheduled. Unexpected departure of the Chief Advisor due to his health created an adverse impact on the process. The activities, however, have been catching up with the original implementation plan, according to the experts.

5.3.1 Input and Activities

The overall operation, which includes schedule and timing of the Project Activities and the Inputs, the quality and the quantity of the resources to be utilized, are determined and provided according to the mutual consultation processes by two sides. According to the interview, the quality, the quantity and the scheduling of provision of the resources have been generally satisfactory. The issue on securing good communication among the members of the Project, however, has been a challenge for everyone in the Project. After the assignment change, more meetings for coordination, more supports with a personal-touch in the workshops have created more open work relationship. Better communication and close consultation have encouraged, as the result, the overall communication problems have been improved. At the same time, the situation however has been somehow persistent due to the physical setting of the Project locations, delegation of the power and duties over different offices, unavailability of C/P due to other commitments and their routing work.

5.3.2 Adoption and Application of the New Technologies in PW

On the other hands, JICA side pointed out that PW seems to have no clear plan to disseminate and fully adopt the new technology to civil engineers of PW. The technical contents introduced in the manual shall be fully adopted in planning, designing, construction management and monitoring since they are very fundamental one. To do so, use of technical contents through training is advised.

5.3.3 Obstacles and challenges for Full Adoption

The Japanese experts have observed many positive signs of adopting the technology despite the existence of some barriers and obstacles. These obstacles need to be cleared. For example, lime-based (or cement-based) stabilization technology the Project introduced is one of the promising technical alternatives because of its strength, durability, effective use of materials on-site and ease of maintenance. The team have introduced and provided precise analysis of Life-cycle cost to justify full adoption of the technology.

5.3.4 Consideration for Improved Efficiency

Overall, the Project pays specific attention to ensure efficiency throughout the process. For example, the topics for preparation of technical manuals and guidelines were decided to avoid

duplication by reviewing manuals and guideline PW have used. Improvement of geometric and safety structures were selected by its practicality, importance and urgency. The recommendation such as issues on clearance and the safety facilities, etc provide technical frameworks and the foundation of other donor activities.

In the course of the implementation of the pilot projects, the specific attentions are paid in the followings:

(1) The road sections selected were one of 10 priority road sections to be upgraded and were of importance due to heavy traffic. The both sites are suitable for testing and experimenting the effectiveness of soft soil stabilization methodology,
(2) The sites selection were appropriate for collecting on-site soil for earth work, and
(3) The locations of the sites were decided from the view of securing the on-site soil collection, the stock yard, the detour route and labor recruitment from nearby villages.

5.4 Impact : [Relatively High]

5.4.1 Possibility of Achieving the Project Overall Goal

To see the achievement of the Overall Goal, "Roads in the delta areas of Ayeyarwady Region are improved", the Team agreed to use the two indicators in the evaluation. They are: (i) The road improved by the stabilization technique is more than 10 km; and (ii) Driving hour or travelling time is reduced 10% comparing before execution of project.

At the timing of the Evaluation, the length of the road improved in the Ayeyarwady Region, the Team estimates additional 10 km will be extended after 5 years from the termination of the Project. The second indicator will be fulfilled as early as April 2017. Upon the completion of the Route 10 (which the PP-2 is part of) the access between Bogale and Mawgyun will be completed. As the result, more than 30 thousand people will benefit from a reduced travel time to Yangon by at least 1.5 to 2.0 hours by automobile. Currently estimated travel time is 5-6 hours from the area. The above route will be accessible throughout a year.

Since the road connection contribute overall quality of life of the nearby community, the completion of the entire section of the pilot projects will have the following positive impacts:

(1) The travel time to large markets such as Yangon improved,
(2) Social and economic activities in the region facilitated, and
(3) Access to social services (e.g. education, health care, etc.) improved.

5.4.2 Technical Impacts

In terms of integrating theories and practices, the topics covered and introduced are mostly the first time in Myanmar. Topics covered in the new manual, such as treatment of soft soil, soil consolidation, compression, soil stabilization etc. are important subject within the whole area of road technology. Prior to the Project, the manuals and guidelines on soil, however, had not been

available in Myanmar and the capacity of understanding and utilizing the subject area has not been fully developed at PW. The Project introduced these subjects and it was technologically significant since soil engineering is one of the fundamental subjects for able civil engineers. .

5.5 Sustainability : [Overall medium, technical sustainability is high with some reservations]

5.5.1 Policy Sustainability

GOM is supposed to continue the current policy of extending the Union Road Network in order to support social and economic activities of Myanmar. The current trend of expanding and maintaining the road net work will continue. Therefore, the technology acquired will be utilized because the construction and upgrading of road in the Ayeyarwady Region will continue.

5.5.2 Fiscal Sustainability

Fiscal sustainability is defined as follows in the context of the Project: whether or not activities arranged and funded under the Project will be financed by PW's own budget after JICA withdraws. It is also important for road engineers of PW to engage themselves in services under the favorable financial environment.

In the course of the TCP the experts observed and encountered problems caused by shortage of resources, in particular funding. PW generally does not have its own sufficient budget to sustain such necessary activities. In order to meet the demand of upgrading and maintaining the level of road conditions and access to the network, PW compromises the quality of pavement and facility due to the funding limitation. Such situation causes adoption of low quality standard. To upgrade the level of fiscal sustainability, sufficient funding shall be provided to activities. At the same time, PW should rationalize its decision for selection of technology taking cost and benefit into account for better funding allocation. In any cases, minimal funding shall be allocated to the local level if PW considers such construction and maintenance activities are important.

5.5.3 Institutional Sustainability

Institutional sustainability is defined as follows in the context of the Project: (i) whether or not some institutional settings are backed with laws and regulations in PW, and (ii) whether or not the relevant technologies and procedures introduced by the Project, namely, new method/procedure for analysis, lime stabilization etc. are adopted and continued in accordance with solid plans.

For the first part, Project has utilized the existing institutional and organizational setting of PW. Although, some are totally new, tasks and approaches were introduced based on the duties and responsibilities of the existing organizational/ institutional setting of PW under the leadership of the Managing Director of PW.

As for the second part, the Team recognizes it is the time of transition for PW since the opening of the market. The roles and responsibilities of PW and the officers of PW will be changing in the

foreseeable future. More road projects may be relied on the services provided by consultants and contractors in the form of BOT supported by foreign funding. The staff engineers of PW will need to assume the role of administrator with technical capabilities. In light of such trend, the staff training and the future scope of the work of technical cooperation projects shall be aligned to the role change. To achieve the satisfactory level of institutional sustainability, PW need to develop its own plan for adopting such trend.

5.5.4 Technical Sustainability

Technical sustainability is defined as follows in the context of the Project: (i) to what extent PW staff understand knowledge and skills introduced under the Project (ii) to what extent PW establishes institutional arrangements (e.g. the procedures for analysis, quality control, etc.) for knowledge and skills accumulated through OJT and the pilot projects, and (iii) to what extent efforts of HRD is continued systematically (e.g. OJT and career development) to extend the knowledge to other engineers in accordance with overarching HRD strategy, if any.

As for the first element, this is long process. But the Team observed the fundamental methodology, techniques and principles of road technologies, such as soft soil treatment, soil stabilization and construction management, have been transferred to PW though the series of seminars and workshop as well as day-to-day interaction with the experts. They seem to be being adopted gradually among many core staff members of PW. A continued effort to practice and review such technical subjects and tasks will enhance the acquired capacity and extended to all counterparts gradually.

As for the second element, the Project submitted the Soft Soil Treatment Manual (due finalization based on the feedback provided from C/P). The Project proposed PW to translate the Manual into the Myanmar language and to acknowledge officially for wider utilization across the organization. The contents of the manual is foundation of the soil engineering which is useful to all civil engineer and is a subject that shall be understood by all engineers of PW. It is further expected to develop training program to cover the subject of the manual for all engineers.

As for the third element, PW has not yet developed overarching HRD plan by expertise of its staff. It is important for PW to provide training opportunities to its all staff particularly engineers as much as possible. However, the current ability of the school is still limited because of lack of staffing and comprehensive master plan for HRD, and inadequate human resources capable for providing appropriate training to staff of all levels.

6 Conclusion

The Team concludes that the Project has been implemented on track and is showing good results. The C/Ps is now on the way of acquiring knowledge and knowhow for soft road technologies through the Project Activities.

7 Recommendations

7.1 Toward the End of the Project Duration

Both sides agreed that the Project will be terminated in July 2015 as the result of the Terminal Evaluation. It is suggested that the Project outputs (e.g. the manual for soft soil treatment and the casebook on soil stabilization), which is now processing, will be finalized toward the termination in accordance with the schedule, June, 2014.

7.2 Recommendations

7.2.1 Continuous Improvement and Updating of the Manual

The Team recommends the manual for soft soil treatment shall be improved and revised continuously after completion of the Project by the Editing Committee shown in ANNEX 10. The committee members were nominated after the Mid-Term Review for editing the Manual for Soft Soil Treatment. The intention of the formation of the committee was to help PW to institutionalize the technical capacity of soft soil treatment through collective activities and to retain the advanced knowledge among the members nominated. The Team recommends the mission of the committee shall be re-defined to continue updating and reviewing technical information on soft soil treatment technologies and revising the manual periodically. To do so, the purpose, activities, and frequency of regular meeting shall be clarified prior to the end of the TCP

7.2.2 Rational Choice for Construction Planning and Methodologies

The Team acknowledges PW's endeavors to fulfill its mandate for improve and maintain the Union Road Network. Understanding al the current situations of PW, the Team recommends PW to facilitate road construction projects employing more rational decision-making and selection of construction planning and methodologies. The planning and selection of construction technologies shall be carried out based on scientific evidence such as the result of survey and testing. The choice shall be made carefully by taking a various factors (e.g. life span cost, durability, reasonable duration of construction period necessary, etc.) into account.

7.2.3 Adoption and Dissemination of the Outcomes from the Project

The Team recommends PW to apply and extend the outcomes from the Project to other projects carried out by PW. The Team expects PW to adopt technical capacity covered through the Project. The Project has been implemented at the midst of transition at the rapid reform in Myanmar. The role and the responsibilities of the engineers of PW are changing accordingly. To meet such situation, the Team further recommends PW to adopt and acknowledge not only the technical aspects of the Project but also managerial and administrative aspects. In the course of the TCP, the experts have carefully designed to carry out the Activities aiming at enhancing PW's capacity in overseeing, supervising and administering not just as an engineer but administrator of the public sector. The experts have demonstrated to C/P such approaches suitable for government engineers. Such knowledge and skills can be adoptable either PW implement projects by its own or entrust contractors to do the jobs. To do so, the outputs prepared by the experts shall be used for PW to train young engineers to enhance their capacity and to further transfer the C/P's

knowledge and experiences attained through the Project.

7.2.4 Use of Technologies

As the principle of the TCP, JICA expects to use and apply the technologies transferred through the Project. By doing so, the capacity of PW will be much enhanced. During the evaluation, PW's prospective plan to use lime/cement stabilization methodology in coming foreign funded projects was encouraging. Application of new design method for high embanking shall be adopted in the next bridge construction projects. The stabilization technologies may be used in future poverty alleviation projects. If additional training aiming at any particular projects is necessary, the Japanese expert will assist PW to carry out such workshop.

7.3 Lesson Learned

In the course of the Project, the related needs such as geotechnical investigation, design, quality control and assurance, construction management and maintenance of road construction with stabilization has been arisen in spite of not being described in the PDM. The lessons derived from the experience was that mutual and close consultation between both sides were essential to discuss such matter both at the initial and midtime stage of the cooperation project. And with such addressing, the design of the projects can be more flexible and practical when the situation changes significantly in the cooperation projects onward.

[END]

PDM V2.0

Project Title: Project for Improvement of Road Technology in Disaster-affected Areas in Myanmar	Version. 2.0		
Target Areas: Delta areas of Ayeyarwady Region	Date December. 2014		
Target Group (Beneficiaries): Road Technical Staff of the Public Works	Project Period Jul 2012 – Jul 2015		
Narrative Summary	**Objectively Verifiable Indicators**	**Means of Verification**	**Important Assumptions**
Overall Goal Roads in the delta areas of Ayeyarwady Region are improved.	1. The road improved by the stabilization technique is more than 10 km. 2. Driving hour or travelling time is reduced 10% comparing before execution of project.	1. Hearing from PW 2. Report by actual measurement by district office	
Project Purpose The capacity of the Public Works (PW) for road construction adaptive to the delta areas of Ayeyarwady Region is enhanced.	1. The enhancement of skill and knowledge of the engineer for road design and construction is confirmed by the hearing from more than 30 staff. 2. By the end of the project, road length constructed by the technology introduced from Pilot Project is extended longer than 2.6 km.	1. Questionnaire to C/P. 2. Pilot Project Report.	Budgetary and human resources necessary for road construction are continuously allocated by the Government of Myanmar.
Outputs 1. Road technology standards and manuals for designing and construction works are improved. 2. The practical skills and knowledge of the road technical staff are enhanced.	1-1. New soft soil treatment manual is discussed and accepted by P.W. 1-2. More than 10 engineers are executing the work by using the manual. 2.1 Total number of trained staff of PW is more than 300 numbers. 2.2 50% of participants evaluate training/seminars favorably.	1-1 Hearing from PW. 1-2. Hearing from PW. (Interview from site engineer) 2-1. Records of the pilot project(s) and training programs 2-2 Questionnaire for trainees.	P.W approves the manuals.

PDM V2.0

(2/2)

Activities	Inputs		Important Assumptions
0 Conduct the baseline. 0-1. Number of the road technology standards and manuals adaptive to Delta area 1-1. Review Myanmar standards and manuals of road technologies for designing and construction works 1-2. Analyze the issues and challenges on the road technologies for designing and construction works in Myanmar. 1-3. Conduct research on construction conditions including soft ground. 1-4. Specify the road technologies for designing and construction works necessary to be developed. 1-5. Develop the road technology standards and manuals, and revise them based on the outcomes of the pilot project(s) as necessary. 1-6. Convene the workshops/seminars to share the contents of the road technology standards and manuals with the road technical staff across the country. 2-1. Select pilot project(s). 2-2. Conduct the research activities on construction conditions including soft ground. 2-3. Formulate the work plans, including outline design, cost calculation, quality control, etc., of the selected pilot project(s). 2-4. Assist the road technical staff of the PW to implement the pilot project(s) based on the work plans-Conduct training on road construction for technical staff, operators, etc. through the pilot project(s). 2-5. Monitor the pilot project(s) based on the plans. 2-6. Convene the workshops/seminars to share the experiences, outcomes, etc. of the pilot project(s)	Japanese side 1. Experts [Long term Experts] ・Chief Adviser/ Road Technology ・Road Technical Standards ・Project Coordinator [Short term Expert] ・Road planning and Assessment ・Road Survey and Design ・Construction technology ・Quality Control ・Others as necessary 2. Training of counterpart personnel in Japan and/or the Third Countries 3. Provision of machinery and equipment 4. Local expenses for the project activities ・Teaching materials for training/ workshops/seminars ・Others	Myanmar's side 1. Personnel ・Chairperson ・Project Director ・Project Manager ・Counterpart personnel 2. Provision of the project offices and facilities necessary for the project implementation 3. Expenses for implementing pilot projects in the delta areas of Ayeyarwady River 4. Administrative and operational expenses ・Electricity, water, communication, etc. ・Local traveling costs and daily subsistence allowance (DSA) for counterpart personnel ・Others as necessary	Natural disasters do not give a profound effect to the project activities. **Pre-condition** Understanding and cooperation on road construction are obtained from the local people residing in the target areas.

Plan of Operation (1)

ANNEX 2

Project Title: The Project for the Improvement of Road Technology in Disaster Affected Area in Myanmar

Inputs	Year	1st Year (JFY2012)				2nd Year (JFY2013)				3rd Year (JFY2014)				4th Year (JFY2015)				Remarks
	Quarter	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	
Expert																		
Chief Adviser/ Road Technology	Plan																	Dr. Akira Fujimoto
	Actual																	
Project Coordinator	Plan																	Mr. Kazuki Ishida
	Actual																	
Road Technical Standards	Plan																	Mr. Masaru Miyake
	Actual																	
Leader/ Road Planning and Assessment	Plan																	Mr. Koki Kaneda
	Actual																	
Sub-Leader/ Design	Plan																	Mr. Hiroaki Kobayashi
	Actual																	
Supervision I	Plan																	Mr. Masataka Fujikuma
	Actual																	
Supervision II	Plan																	Mr. Noor Akmar
	Actual																	
Research/ Soft Ground Countermeasure	Plan																	Dr. Hideki Yoneyama
	Actual																	
Material Quality Control	Plan																	Mr. Hirokazu Miyamoto
	Actual																	
Mechanical Work Quality Control	Plan																	Mr. Yukio Kosaka
	Actual																	
Soft Soil Embankment Study	Plan																	Mr. Kuniaki Nishijima
	Actual																	
Soft Soil Treatment Manual I	Plan																	Mr. Fumihiko Yokoo
	Actual																	
Soft Soil Treatment Manual II	Plan																	Mr. Asuaka Suzuki
	Actual																	
Equipment																		
Boring Machine (JFY2013 Donation Equipment)	Plan																	
	Actual																	
Total Station (JFY2013 Hand-Carry Equipment)	Plan																	
	Actual																	
Equipment for Observation of High Embankment (JFY2013 Hand-Carry Equipment)	Plan																	
	Actual																	
Soil Plant Equipment (JFY2014 Donation Equipment)	Plan																	
	Actual																	
Training in Japan																		(JFY2013) Five (5) Counterparts (JFY2014) Five (5) Counterparts
JFY2013 (Workshop on Enhancing Road Engineering)	Plan																	
	Actual																	
JFY2014 (Workshop on Enhancing Road Engineering)	Plan																	
	Actual																	
In-country/Third country Training																		
	Plan																	
	Actual																	

Plan of Operation (2)

ANNEX 2

Activities / Sub-Activities		Year	1st Year (JFY2012)				2nd Year (JFY2013)				3rd Year (JFY2014)				4th Year (JFY2015)				Responsible Organization	
		Quarte	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	Japan	Myanmar
Output 0: Preparation for the project																				
0	Conduct the baseline.	Plan																	JICA	PW-MOC
		Actual																		
0	Number of the road technology standards and manuals adaptive to Delta area.	Plan																	JICA	PW-MOC
		Actual																		
Output 1: Road technology standards and manuals for designing and construction works are improved.																				
1	Review Myanmar standards and manuals of road technologies for designing and construction works.	Plan																	JICA	PW-MOC
		Actual																		
1	Analyze the issues and challenges on the road technologies for designing and construction works in Myanmar.	Plan																	JICA	PW-MOC
		Actual																		
1	Conduct research on construction conditions including soft ground.	Plan																	JICA	PW-MOC
		Actual																		
1	Specify the road technologies for designing and construction works necessary to be developed.	Plan																	JICA	PW-MOC
		Actual																		
2	Develop the road technology standards and manuals, and revise them based on the outcomes of the pilot project(s) as	Plan																	JICA	PW-MOC
		Actual																		
2	Convene the workshops/seminars to share the contents of the road technology standards and manuals with the road	Plan																	JICA	PW-MOC
		Actual																		
Output 2: The practical skills and knowledge of the road technical staff are enhanced.																				
2	Select pilot project(s).	Plan																	JICA	PW-MOC
		Actual																		
2	Conduct the research activities on construction conditions including soft ground.	Plan																	JICA	PW-MOC
		Actual																		
2	Formulate the work plans, including outline design, cost calculation, quality control, etc., of the selected pilot	Plan																	JICA	PW-MOC
		Actual																		
2	Assist the road technical staff of the PW to implement the pilot project(s) based on the work plans Conduct training on road	Plan																	JICA	PW-MOC
		Actual																		
3	Monitor the pilot project(s) based on the plans.	Plan																	JICA	PW-MOC
		Actual																		
3	Convene OJT for Road Engineers and Mechanical Engineers through Pilot Project.	Plan																	JICA	PW-MOC
		Actual																		
3	Convene the workshops/seminars to share the experiences, outcomes, etc. of the pilot project(s)	Plan																	JICA	PW-MOC
		Actual																		

Plan of Operation (3)

ANNEX 2

Activities / Sub-Activities	Year	1st Year (JFY2012)				2nd Year (JFY2013)				3rd Year (JFY2014)				4th Year (JFY2015)				Responsible Organization	
	Quarter	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	Japan	Myanmar
Duration / Phasing	Plan																	July 25, 2012	
	Actual																	~ June 30, 2015	
Monitoring																			
Joint Coordination Committee	Plan																	Conducting of at least 1 time per year.	
	Actual			Kick-off															
Set-up the Detailed Plan of Operation	Plan																		
	Actual																		
Submission of Monitoring Sheet	Plan																		
	Actual																		
Monitoring Mission from Japan	Plan																	(Mid-term) Aug 11 ~25, 2014	
	Actual																		
Joint Monitoring	Plan																		
	Actual																		
Post Monitoring	Plan																		
	Actual																		
Reports/Documents																			
Quarterly Report/ Monthly Report (for Long-term Experts)	Plan																		
	Actual																		
Work Plan/ Progress Report (for Short-term Experts)	Plan																		
	Actual																		
Project Completion Report	Plan																		
	Actual																		
Public Relations																			
Establishment and Operation of Web Site	Plan																		
	Actual																		
Update of Web Site	Plan																		
	Actual																		

Outline Schedule for Terminal Evaluation
on Project for Improvement of Road Technology in Disaster Affected Area

No.	Date	Evaluator of Japanese Side			Evaluator of Myanmar Side	Participants (JICA Staff, Experts)	Place
		Mr. Yoshihiro KAKISHITA [Leader]	Mr. Toru TUCHIHASHI [Plan & Coord.]	Mr. Masato ONOZAWA [Evaluation]	U Aung Myint Oo (PW) Daw Hla Hla Thwe (PW) Daw Mya Mya Win (RRL)		
1	Mar 08			Arr. At YGN			
2	Mar 09 Mon			1000 Meeting w/ JICA Office			
				1400 Meeting w/ JP Experts		Mr. Miyake Mr. Ishida Mr. Kobayashi Mr. Miyamoto	
3	Mar 10 Tue			1000 Interview to C/Ps		U Aung Myo Oo	MOC Project Office
				1100 Interview to JP Experts		Mr. Miyake Mr. Ishida	
4	Mar 11 Wed			move (YGN to NPT)			
				1030 Interview to C/Ps		Daw Yin Yin Swe	PW-HQ
				1100 Meeting w/ Myanmar Side Evaluator		U Aung Myint Oo Daw Hla Hla Thwe	
				1400 Interview to C/Ps		U Aung Myint Oo Daw Hla Hla Thwe U Khin Maung Kyaw U Kyaw Phone Lwin	
5	Mar 12 Thu			(AM) Interview to Counterparts (Spare)			
				move (NPT to YGN)			
6	Mar 13 Fri			0600 move (YGN to Pyapon)			
				1000 Interview to District Office		U Thet Zaw Win	
				1400 move (Pyapon to Bogale)		U Win Naing	
				1500 Observation -PP-2 Site -High Embankment Site			
				1600- Interview to JP Experts		Mr. Kobayashi Mr. Miyamoto	
7	Mar 14 Sat			0700 move (Bogale to YGN)			
				PM Interview to C/Ps (RRL&BRL)		Daw Mya Mya Win U Aung Myint Daw Htar Zin Thin Zaw U Nyi Nyi Kyaw	
8	Mar 15 Sun	Arr. at YGN	Arr. at YGN				
		1300 Internal Meeting					
9	Mar 16 Mon	0930 Meeting w/ JICA Office					JICA Office
		1400 Meeting w/ JP Experts				Mr. Miyake Mr. Ishida Mr. Kaneda Mr. Kobayashi	MOC Project Office
10	Mar 17 Tue	move (YGN to NPT)					
		1430-1530 Explanation of Evaluation report				U Aung Myint Oo Daw Mya Mya Win Mr. Miyake Mr. Ishida Mr. Kaneda Mr. Kobayashi	PW-HQ
11	Mar 18 Wed	1000 Explanation & Discussion of Evaluation report with PW-MD				U Kyaw Linn U Aung Myint Oo Daw Hla Hla Thwe Daw Mya Mya Win Mr. Morikawa Mr. Miyake Mr. Ishida Mr. Kaneda Mr. Kobayashi	PW-HQ
12	Mar 19 Thu	AM/PM Signing of MM					PW-HQ
		move (NPT to YGN)					
13	Mar 20 Fri						
		13:30 TV conference w/ JICA-HQ					JICA Office
		1500 Report to JICA Myanmar Office & EOJ				Mr. Watanabe (EOJ)	
		1600 Feedback meeting w/ JP Expert				Mr. Miyake	
14	Mar 21 Sat					Mr. Miyake Mr. Kobayashi	MOC Project Office
		Leave YGN	Leave YGN	Documentation			

LIST OF PROJECT COUNTERPART PERSONNEL

ANNEX 4

(as of February 28, 2015)

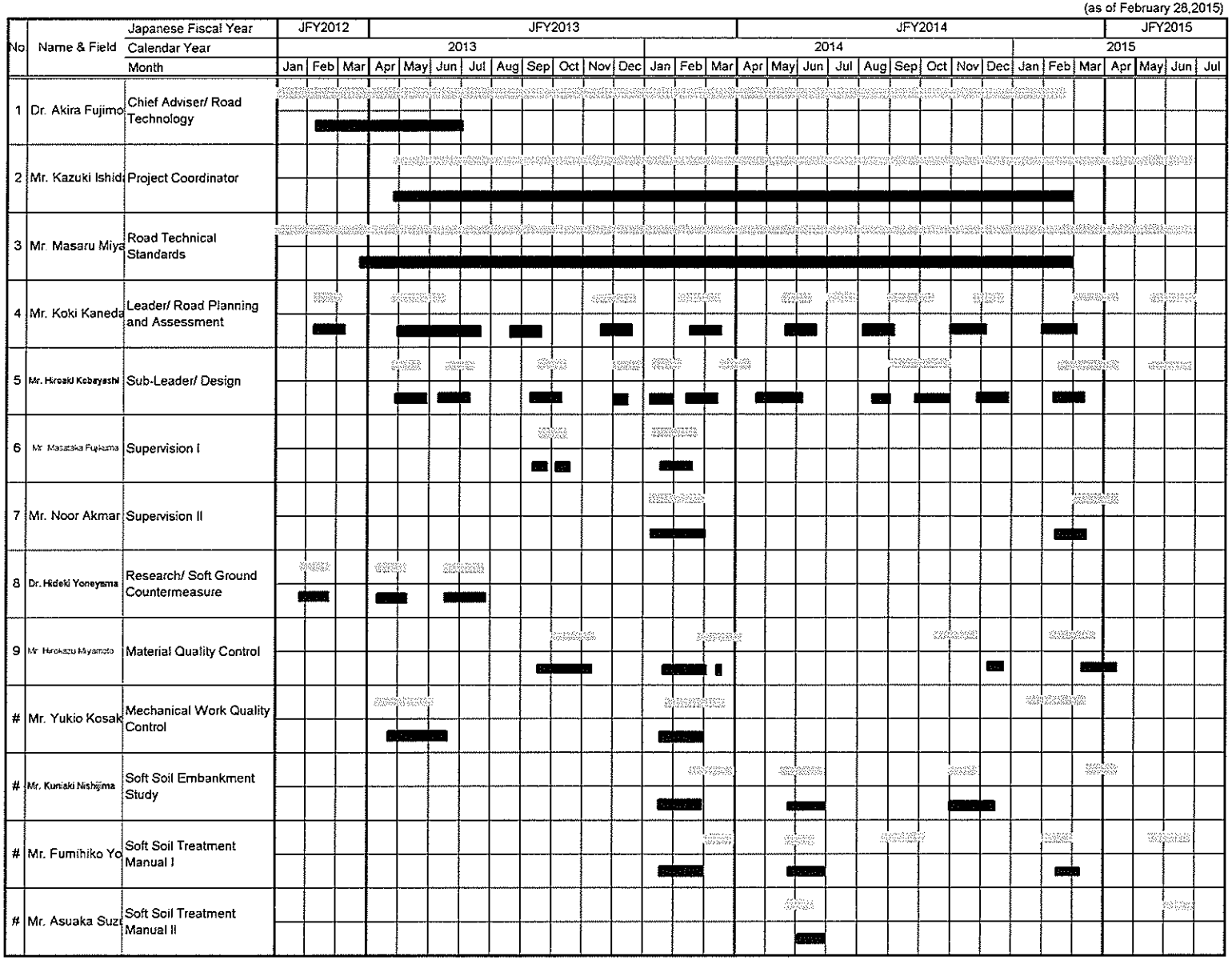
No.	Cooperation Field	Name of Expert	Counterparts Information		
			Name	Department	Position
1	Chief Adviser/ Road Technology	-	U Aung Myint Oo	PW-HQ (Planning Dept.)	Deputy Chief Engineer
			Daw Hla Hla Thwe	PW-HQ (Road Dept.)	Superintending Engineer
			Daw Mya Mya Win	Road Research Laboratory (R	Deputy Superintending Engineer
			U Aung Myint	Road Research Laboratory (R	Adviser
2	Project Coordinator	Mr. Kazuki Ishida	U Aung Myint Oo	PW-HQ (Planning Dept.)	Deputy Chief Engineer
			Daw Hla Hla Thwe	PW-HQ (Road Dept.)	Superintending Engineer
			Daw Mya Mya Win	Road Research Laboratory (R	Deputy Superintending Engineer
			Daw Htar Zinn Thin	Road Research Laboratory (R	Executive Engineer
3	Road Technical Standards	Mr. Masaru Miyake	U Khin Maung	MOC Adviser	Adviser
			U Khin Maung Kyaw	PW-HQ (Road)	Chief Engineer
			U Kyi Zaw Myint	Expressway Unit	Superintending Engineer
			Daw Thein Nu	PW-HQ	Deputy Superintending Engineer
			U Htet Zaw Win	Pyapon District Office	Executive Engineer
			U Aung Myo Oo	PW-HQ (Airfield)	Deputy Superintending Engineer
			U Nyi Nyi Zaw	PW-HQ (Quantity Survey)	Executive Engineer
4	Leader/ Road Planning and Assessment	Mr. Koki Kaneda	U Aung Myint Oo	PW-HQ (Planning Dept.)	Deputy Chief Engineer
			Daw Mya Mya Win	Road Research Laboratory (R	Deputy Superintending Engineer
			Daw Yin Yin Swe	Soil Research Laboratory (SR	Executive Engineer
5	Sub-Leader/ Design	Mr. Hiroaki Kobayashi	U Aung Myo Oo	PW-HQ (Airfield)	Deputy Superintending Engineer
			Daw Su Mon Kyaw	Pyapon District Office	Assistant Engineer
6	Supervision I	Mr. Masataka Fujikuma	U Aung Myo Oo	PW-HQ (Airfield)	Deputy Superintending Engineer
			Daw Su Mon Kyaw	Pyapon District Office	Assistant Engineer
7	Supervision II	Mr. Noor Akmar	U Tun Tun Hlaing	Pyapon District Office	Junior Engineer (2)
			U Myo Min Min	Pyapon District Office	Junior Engineer (2)

No.	Cooperation Field	Name of Expert	Counterparts Information		
			Name	Department	Position
8	Research/ Soft Ground Countermeasure	Dr. Hideki Yoneyama	Daw Mya Mya Win	Road Research Laboratory (R	Deputy Superintending Engineer
			U Nyi Nyi Kyaw	Road Research Laboratory (R	Assistant Engineer
9	Material Quality Control	Mr. Hirokazu Miyamoto	Daw Mya Mya Win	Road Research Laboratory (R	Deputy Superintending Engineer
			U Nyi Nyi Kyaw	Road Research Laboratory (R	Assistant Engineer
10	Mechanical Work Quality Control	Mr. Yukio Kosaka	Daw Mya Mya Win	Road Research Laboratory (R	Deputy Superintending Engineer
			U Nyi Nyi Win	PW-HQ (Mechanical Section)	Assistant Engineer
11	Soft Soil Embankment Study	Mr. Kuniaki Nishijima	Daw Mya Mya Win	Road Research Laboratory (R	Deputy Superintending Engineer
			Daw Kyi Kyi Thwe	PW-HQ	Superintending Engineer
			Daw Yin Yin Swe	Soil Research Laboratory (SR	Executive Engineer
			Daw Phyu Phyu	Soil Research Laboratory (SR	Assistant Engineer
			Daw Hnin Hnin Soe	Soil Research Laboratory (SR	Assistant Engineer
			U Nay Lin Tun	Road Research Laboratory (R	Assistant Engineer
			U Than Naign	Special Airfield Construction U	Assistant Engineer
			U Aung Kyi	Special Airfield Construction U	Engineer
12	Soft Soil Treatment Manual I	Mr. Fumihiko Yokoo	Daw Mya Mya Win	Road Research Laboratory (R	Deputy Superintending Engineer
			U Nay Lin Tun	Road Research Laboratory (R	Assistant Engineer
13	Soft Soil Treatment Manual II	Mr. Asuka Suzuki	Daw Mya Mya Win	Road Research Laboratory (R	Deputy Superintending Engineer
			U Nay Lin Tun	Road Research Laboratory (R	Assistant Engineer

ANNEX 5

LIST OF DISPATCHED JAPANESE EXPERTS

(as of February 28,2015)



ANNEX 6

LIST OF EXISTING MANUALS, STANDARDS and RELATED MATERIALS

(as of February 28,2015)

<Manuals & Standards>

No	Title	Language	Content	Date of Publication	Model	Form	Pages	Original/Copy	Author	Publisher	Received	Remarks
1	Overseas Road Note 31, A guide to the structural design of bitumen-surfaced roads in tropical and sub-tropical countries	English	Standards for Pavement Design in UK	1993	A4	Binding	42	Copy	Overseas Centre Transport Research Laboratory, Crowthorne, Berkshire, United Kingdom	RRL	2013/2/13	
2	Road Construction Specification	English	Road Construction Specification	2004	A4	Binding	166	Copy		RRL	2013/2/16	
3	Road Maintenance Manual	Myanmar	Road Maintenance Manual		A4	CD-R		Copy			2013/2/16	
4	Surface Dressing Manual	Myanmar	Dressing Manual		A4	CD-R		Copy				
5	Road Research and Development Project BUR/81/021; Pavement surfacing; Their Properties &Applications to Roads in Burma	English	Selection of Pavement Surfacing	1981	A4	Binding	14	Copy	Prepared by L. S. Hitch, Highway Engineer(Design), N. D. LEA ASSOCIATION LTD.	RRL		For GOM and RR & DP by UNDP T/C
6	Road Research and Development Project BUR/81/021; Axle Load Survey Demonstration, January, 1987	English	Report of Axle Load Survey	1987	A4	Binding	28	Copy	Prepared by D. R. Saunders, Highway Engineer (Planning), N. D. LEA ASSOCIATES LTD.	RRL		For GOM and RR & DP by UNDP T/C
7	Highway Construction Specifications, April, 1989	English	Highway Construction Specifications	1989	A4	Binding	77	Copy	Prepared by C. A. Koch, Highway Engineer (Construction) and U ManSan Thaung, Executive Engineer	RRL	2013/2/23	For GOM and RR & DP by UNDP T/C
8	Road Research and Development Project BUR/81/021; General Specifications for Highway Bridge Construction in Burma, March, 1989 No. 40, Golden Valley Road, Rangoon	English	General Specifications for Highway Bridge Construction in Burma	1989	A4	Binding	86	Copy		RRL	2013/2/23	
9	Road Research and Development Project BUR/81/021; Inventory of Construction Corporation Roads April, 1988	English	Inventory of Construction Corporation Roads	1988	A4	Binding	35	Copy	Prepared by D. R. Saunders, Highway Engineer (Planning), N. D. LEA ASSOCIATES LTD.	RRL		For GOM and RR & DP by UNDP T/C
10	Road Research and Development Project BUR/81/021; Road Roughness Surveys, May, 1988	English	Report of Road Roughness Surveys	1988	A4	Binding	28	Copy	Prepared by D. R. Saunders, Highway Engineer (Planning), N. D. LEA ASSOCIATES LTD.	RRL		For GOM and RR & DP by UNDP T/C
11	Design Standards for Highways											

ANNEX 6

<Related Materials>

No	Title	Language	Content	Date of Publication	Model	Form	Pages	Original/Copy	Author	Publisher	Received	Remarks
1	Road Research Laboratory(Public Works)	English	Outline of RRL (Road Research Laboratory)		A4	Binding	15	Copy		RRL		GOM / MOC PW
2	Report on Soil Testing on Research Laboratories (S.T.R.L) Kamakyi Road, Thuwunna, Yangon.	English	Outline of SRL (Soil Research Laboratory)	2012	A4	Binding	18	Copy		SRL	2013/2/8	GOM / MOC PW
3	Soil Testing on Research Laboratories (S.T.R.L) Kamakyi Road, Thuwunna, Yangon.	English	Outline of SRL (Soil Research Laboratory) <Revised Edition>	2012	A4	Binding	19	Copy		SRL	2013/2/21	GOM / MOC PW
4	An Information Booklet on Training Activities and Training Centers of The Ministry of Construction	English	Information on Training Activities and Training Centers of The Ministry of Construction		A4	Binding	23	Copy		SRL	2013/2/5	GOM / MOC PW, CTC
5	Base Workshop (South) Ywa Ma, Insein Yangon	English	Information of MTC (Mechanical Training Center)		A4	Paper	9	Copy	GOM / MOC, PW, MD	MTC	2013/1/25	PowerPoint
6	Practical Guide to Pavement Design for Tropical Countries (AASHTO methods, Design of shoulders slopes & drainage)	English	Guideline for Pavement Design	1984	A4	Binding	71	Copy	France. Ministère de la coopération, Centre expérimental de recherches et d'études du bâtiment et des travaux publics	RRL		
7	Road Condition(kilometer) of Ayeyarwardy Region, Pathein	Myanmar	Report of Road condition(kilometer) of Ayeyarwardy Region		A4	Binding	150	Copy		RRL	2013/2/23	
8	Road Research and Development Project BUR/81/021; Bitumen Emulsions; A Report on Their Production & Use in Burma	English	Report of Bitumen Emulsions	1988	A4	Binding	30	Copy	Prepared by L. S. Hitch, Highway Engineer(Design), N. D. LEA ASSOCIATION LTD.	RRL		For GOM and RR & DP by UNDP T/C
9	Ayawardy Delta District, Delta Region Route No. 11, Inventory	English	Inventory of Route. 11	2013	A4	Binding	152	Copy		RRL		GOM / MOC PW
10	After Construction (1) Maubin-Yelagale-Shwedaungmaw-Kyaikpi-Mawlamyinegtun Road	English	Outline of Road Construction		A4	Paper	1	Copy		RRL		
11	After Construction (2) Mawlamyinegyun-Hlaingbone-Thitpoak-Kwinpouk-Pyinzalu Road	English	Outline of Road Construction		A4	Paper	1	Copy		RRL		
12	After Construction (3) Labutta-Tingangyi-Pyinzalu Road	English	Outline of Road Construction		A4	Paper	1	Copy		RRL		
13	After Construction (4) Labutta-Thongwa-Oaktwin-Hteiksun Road	English	Outline of Road Construction		A4	Paper	1	Copy		RRL		
14	After Construction (5) Bogale-Kyeinchaung-Katonkani Road	English	Outline of Road Construction		A4	Paper	1	Copy		RRL		
15	After Construction (6) Bogale-Setsan-Htawpine-Ama Road	English	Outline of Road Construction		A4	Paper	1	Copy		RRL		
16	After Construction (7) Pyapon-Kyaonkadun-Dawnyein-Ama-Road	English	Outline of Road Construction		A4	Paper	1	Copy		RRL		

ANNEX 6

No	Title	Language	Content	Date of Publication	Model	Form	Pages	Original/Copy	Author	Publisher	Received	Remarks
17	After Construction (8) Kyaonkadun-Setsan Road	English	Outline of Road Construction		A4	Paper	1	Copy		RRL		
18	After Construction (9) Pathein-Talatkhwa-Mawtinsun Road	English	Outline of Road Construction		A4	Paper	1	Copy		RRL		
19	After Construction (10) Bogalae-Mawlamyinegyun-Wakema-Myaungmya Road	English	Outline of Road Construction		A4	Paper	1	Copy		RRL		
20	After Construction (11) Pathein-Ngapudaw Road	English	Outline of Road Construction		A4	Paper	1	Copy		RRL		
21	Pyapon(Final)_Route No. 7	Myanmar	Road Map (Route 7)		A4	CD-R/ Map	1	Copy		Pharpone PW	2013/2/1	Translation into English
22	Route No. 7	Myanmar	Road Map (Route 7)	2012	A4	CD-R/ Map	1	Copy		Pharpone PW	2013/2/1	Translation into English
23	Pharpone-Kyunkadone-Dawnyein-Amar Road(51 miles 5Pharlone)_Road Map	Myanmar	Pavement Classification Map (Route 7)	2012	A4	Paper	1	Copy		Pharpone PW	2013/2/1	Translation into English
24	Route No. 2 Mawlamyaing Kyun-Hlaing Bone-Thit Pote-Kwin Paunt-Pyin Salu, Road Construction Plan	Myanmar	Road Construction Plan (Route 2)	2012	A4	Paper	1	Copy		Pharpone PW	2013/2/1	Translation into English
25	Ayeyarwady District, Connection Road Construction Plan The Map of Connection Road from Route No. 10, Bogalay-Mawkyun-Warkhae Ma Road to Route No. 2, Mawkyun-Pyin Salu	Myanmar	The Map of Connection Road from Route No. 10, Bogalay-Mawkyun-Warkhae Ma Road to Route No. 2	2012	A4	Paper	1	Copy		Pharpone PW	2013/2/1	Translation into English
26	Pharpone-Kyunkadone-Dawnyein-Amar Road(51 miles 5Pharlone)	Myanmar	Budget Allocation of the Past Road Construction	2012	A4	Paper	1	Copy		Pharpone PW	2013/2/1	Translation into English
27	Report on Subsurface Soil Investigation of Maubin River Bridge Site, Maubin Township, Ayeyarwady Division, April, 1996	English	Report on Subsurface Soil Investigation of Maubin River Bridge Site	1996	A4	Binding	27	Copy	Soil Testing & Research Laboratories, Kamakyi Road, Thuwunna, Yangon	SRL	2013/2/5	GOM / MOC PW
28	Report on Subsurface Soil Investigation Bokalay River Bridge, Bokalay-Kyein Chaung-Ka Don Ka Ni Road, Ayeyarwady Division, May, 2010	English	Report on Subsurface Soil Investigation Bokalay River Bridge	2010	A4	Binding	56	Copy	Soil Testing & Research Laboratories, Kamakyi Road, Thuwunna, Yangon	SRL	2013/2/5	GOM / MOC PW
29	Report on Subsurface Soil Investigation, Kywe Chan Ye Kyaw Bridge, Mawgyun-Wakema Road, November, 2010	English	Report on Subsurface Soil Investigation, Kywe Chan Ye Kyaw Bridge	2010	A4	Binding	68	Copy	Soil Testing & Research Laboratories, Kamakyi Road, Thuwunna, Yangon,	SRL	2013/2/5	GOM / MOC PW
30	Report on Subsurface Soil Investigation The Kan Chaung Bridge, Bogalay-Satsun-Ahmar Road, Ayeyarwady Region, December, 2010	English	Report on Subsurface Soil Investigation Tha Kan Chaung Bridge	2010	A4	Binding	30	Copy	Soil Testing & Research Laboratories, Kamakyi Road, Thuwunna, Yangon,	SRL	2013/2/5	GOM / MOC PW

ANNEX 7

LIST OF THE PROVISION EQUIPMENT

(as of February 28, 2015)

NO	ITEM	QTY.	MODEL	MANUFACTURER	Amount		Installation Place	Purchased Date	Condition (*1)	Frequency of Use
					US$	Kyat				
<JFY 2013>										
(Donation Equipment)										
1.	Boring Machine	1 set	D2-K92-P2	TOHO	101,500.00	-	SRL	02/03/201	1	b
2.	Soil Mixing Plant	1 set	NVG1801	NAKAYAMA	65,838,950 Yen	-	PW-MOC	03/28/201	-	-
(Hand-Carry Equipment: Local Purchase)										
1. Total Station		1 set	R-425VN	PENTAX	-	6,500,000	RRL	2/24/2014	1	b
2. Equipment for Observation of High Embankment										
1)	Settlement Board	4 set	400 x 400 x 9	GEOTECH	758.40	-	Bogale MOC	03/25/201	1	a
2)	Pore Water Pressure	3 pcs	KPC-200KPA	Tokyo Sokki	3,255.45	-	Bogale MOC	03/25/201	1	a
3)	Water Level	1 pc	Type 2-50	Alfa Kougaku	760.40	-	Bogale MOC	03/25/201	1	a
4)	Inclination Gauge	1 set	KB-10GC	Tokyo Sokki	5,336.63	-	Bogale MOC	03/25/201	1	a
-1.	Guide Pipe	24 pcs	KBF-51-2 (2m)	Tokyo Sokki	1,877.28	-	Bogale MOC	03/25/201	1	a
-2.	Guide Pipe Socket	20 pcs	KBF-52	Tokyo Sokki	534.60	-	Bogale MOC	03/25/201	1	a
-3.	Guide Pipe Top Cap	4 pcs	KBF-54-1	Tokyo Sokki	102.96	-	Bogale MOC	03/25/201	1	a
-4.	Guide Pipe Bottom Cap	4 pcs	KBF-54-2	Tokyo Sokki	301.00	-	Bogale MOC	03/25/201	1	a
-5.	Tapping Screw	2 packs	KBF-58 (100pcs/pack)	Tokyo Sokki	35.64	-	Bogale MOC	03/25/201	1	a
3.	Data Logger	1 set	TC-32K	Tokyo Sokki	3,009.90	-	Bogale MOC	03/25/201	1	a
4.	Plastic Survey Stick	2 set	KS-120 (120pcs/set)	Tokyo Sokki	3,768.32	-	Bogale MOC	03/25/201	1	a

(*1) Condition

Rank	Statement
1	Good
2	Moderate
3	Repair
4	Unable to Use
5	Lost

(*2) Classification of the Frequency of Use of the each Equipment

Rank	Statement	Frequently
a	Used Frequently	Almost daily
b	Used Well	1-3 times per week
c	Not so much used	1-3 time per year
d	Not used	-

ANNEX 8

OVERSEAS ACTIVITIES COST

(as of February 28, 2015)

	JFY 2012									
	1st Quarter		2nd Quarter		3rd Quarter		4th Quarter		TOTAL	
	US$	Kyat	US$	Kyat	US$	Kyat	US$	Kyat	US$	Kyat
Miscellaneous	0.00	0	0.00	0	0.00	0	325.00	1,319,580	325.00	1,319,580
Rent/ Car Hiring	0.00	0	0.00	0	0.00	0	4,170.00	0	4,170.00	0
Communication Cost	0.00	0	0.00	0	0.00	0	50.00	20,000	50.00	20,000
Airfare	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0
Travel Allowance	0.00	0	0.00	0	0.00	0	895.00	0	895.00	0
Refreshment/ Conference Fee	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0
Fee and Honorarium	0.00	0	0.00	0	0.00	0	640.00	45,000	640.00	45,000
Commission Contract (Others)	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0
TOTAL	**0.00**	**0**	**0.00**	**0**	**0.00**	**0**	**6,080.00**	**1,384,580**	**6,080.00**	**1,384,580**

	JFY 2013									
	1st Quarter		2nd Quarter		3rd Quarter		4th Quarter		TOTAL	
	US$	Kyat	US$	Kyat	US$	Kyat	US$	Kyat	US$	Kyat
Miscellaneous	8,185.00	8,139,380	2,640.00	5,777,570	1,950.00	4,388,800	3.00	1,929,225	12,778.00	20,234,975
Rent/ Car Hiring	9,158.00	0	10,760.00	0	6,620.00	2,660,000	12,082.00	14,901,000	38,620.00	17,561,000
Communication Cost	100.00	1,210,250	0.00	1,167,600	0.00	613,550	0.00	954,550	100.00	3,945,950
Airfare	1,850.00	0	880.00	0	0.00	0	0.00	129,000	2,730.00	129,000
Travel Allowance	1,330.00	0	995.00	0	663.00	0	694.00	1,168,000	3,682.00	1,168,000
Refreshment/ Conference Fee	0.00	0	0.00	0	0.00	98,200	0.00	0	0.00	98,200
Fee and Honorarium	1,133.00	14,000	2,070.00	164,000	1,050.00	352,000	727.00	600,000	4,980.00	1,130,000
Commission Contract (Others)	0.00	0	0.00	1,411,000	0.00	0	0.00	0	0.00	1,411,000
TOTAL	**21,756.00**	**9,363,630**	**17,345.00**	**8,520,170**	**10,283.00**	**8,112,550**	**13,506.00**	**19,681,775**	**62,890.00**	**45,678,125**

ANNEX 8

	JFY 2014									
	1st Quarter		2nd Quarter		3rd Quarter		4th Quarter (as of Feb)		TOTAL	
	US$	Kyat	US$	Kyat	US$	Kyat	US$	Kyat	US$	Kyat
Miscellaneous	696.00	705,600	2,605.00	1,067,950	3,619.00	2,014,370	386.00	952,490	7,306.00	4,740,410
Rent/ Car Hiring	5,395.00	5,889,000	9,448.00	6,334,000	12,873.00	6,930,000	3,032.00	462,500	30,748.00	19,615,500
Communication Cost	0.00	825,950	0.00	1,707,850	214.00	2,652,728	0.00	517,900	214.00	5,704,428
Airfare	2,507.00	150,000	2,667.00	142,000	4,461.00	303,700	802.00	0	10,437.00	595,700
Travel Allowance	515.00	0	945.00	8,000	1,689.00	217,665	373.00	86,449	3,522.00	312,114
Refreshment/ Conference Fee	0.00	300,000	0.00	0	0.00	0	0.00	323,550	0.00	623,550
Fee and Honorarium	400.00	600,000	400.00	1,833,000	500.00	2,789,000	0.00	854,275	1,300.00	6,076,275
Commission Contract (Others)	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0
TOTAL	**9,513.00**	**8,470,550**	**16,065.00**	**11,092,800**	**23,356.00**	**14,907,463**	**4,593.00**	**3,197,164**	**53,527.00**	**37,667,977**

LIST OF TRAINING COURSES IN THE PROJECT

ANNEX 9

(as of February 28, 2015)

1. Project Counterpart Training in Japan

No.	Name	Department	Position
		<JFY 2013>	
	(Title) Workshop on Enhancing Road Engineering		
	(Term) September 29 ~ October 12, 2013 (14 days)		
1	U Ohn Lwin	Building	Chief Engineer
2	U Win Lwin	Airfield	Superintending Engineer
3	U Aung Myo Oo	Pyapon District Office	Executive Engineer
4	Daw Htar Zin Thin Zaw	RRL (Road Research Laboratory)	Executive Engineer
5	U Than Naing	Airfield Special Construction Unit-2	Assistant Engineer
		<JFY 2014>	
	(Title) Workshop on Enhancing Road Engineering		
	(Term) September 28 ~ October 11, 2014 (14 days)		
1	U Sai Kyaw Moe	Road	Deputy Chief Engineer
2	Daw Kyi Kyi Thwe	MOC	Superintending Engineer
3	U Kyaw Tun Linn	Maubin District Office	Executive Engineer
4	Daw Su Mon Kyaw	Pyapon District Office	Assistant Engineer
5	U Nyi Nyi Kyaw	RRL (Road Research Laboratory)	Assistant Engineer

No.	Name	Department	Position
	(Title) Pre-Workshop between National Institute of Land and Infrastructure Management (NILIM) and Road Research Laboratory (RRL)		
	(Term) November 15 ~ 22, 2014 (8 days)		
1	Daw Khine Nyein Soe	RRL (Road Research Laboratory)	Senior Assistant Engineer
2	Daw Hnin Yu Aung	RRL (Road Research Laboratory)	Senior Assistant Engineer
3	Daw Nay Chi Oo	RRL (Road Research Laboratory)	Senior Assistant Engineer

No.	Name	Department	Position
(Title) The Training Program on Comprehensive Japanese Expressway Technologies related to Yangon Urban Expressway Project for Republic of the Union of Myanmar			
(Term) January 26 ~ February 4, 2015 (10 days)			
1	Mr. Aung Myint Oo	Planning (Road and Bridge), Publics Works, Ministry of Construction (MOC)	Deputy Chief Engineer
2	U Win Htay	Bridge Department, Publics Works, MOC	Deputy Superintending Engineer
3	U Kyaw Naing	Expressway Maintenance and Repair Unit, Public Works, MOC	Executive Engineer
4	U Nyi Nyi Aung	Expressway Maintenance and Repair Unit, Public Works, MOC	Assistant Engineer
5	U Yan Naung	Expressway Maintenance and Repair Unit, Public Works, MOC	Assistant Engineer
6	U Aung Ko Oo	Bridge Construction Special Unit No.3, Public Works, MOC	Assistant Engineer
7	U Thein Tun Oo	Road Planning Department, Public Works, MOC	Assistant Engineer
8	U Aye Ko	Road & Bridge Department, YCDC (Yangon City Development Committee)	Deputy Head
9	U Kyaw Min Oo	Road & Bridge Department, YCDC	Assistant Engineer
10	U Win Maung	Myanmar Engineering Society	Joint General Secretary

2. Seminar

No.	Date	Title	Lecturer	No. of Participants	Content	Expenses by the Project
1	June 9 ~ 16, 2013	The 1st Myanmar-Japan Joint Seminar ~ Road Engineering ~	<Myanmar Side> 1) U Win Tint (DMD, PW) 2) U Aung Myint (RRL Consultant) 3) Daw Mya Mya Win (DSE, RRL) 4) U Thet Zaw Win (EE, Road Design Sec) 5) U Htay Win (Associate Professor, Civil Dept., YIU) <Japanese Side> 1) Mr. Moriyasu Furuki	53 participants	* Current road construction and maintenance of all over in Myanmar * Current road construction and maintenance at Ayeyawady Region * Introduce RRL's work and ideas, challenges for road problems at Ayeyawady Region * Soft Soil Treatment * Review on Road design and soil stabilization researches * Soft Soil Treatment Practice in	USD 11,700.00 Kyat 3,722,590 = USD 4,015.74 (USD1.00 = Kyat927) <TOTAL> USD 15,715.74

No.	Date	Title	Lecturer	No. of Participants	Content	Expenses by the Project
			2) Dr. Shinri Sone 3) Mr. Kazuyuki Kubo 4) Mr. Hiroaki Miyatake 5) Prof. Kiyoshi Omine		Ariake Gulf * Pavement construction practices in tropical countries * Brief Explanation of Japanese Road Policy * Road Standards, Road Engineering , Research, History in Japan	
2	May 22, 2014	The 2nd Myanmar-Japan Joint Seminar ~ Road material and road improvement ~	<Myanmar Side> 1) U Aung Myo Oo <Japanese Side> 1) Dr. Shinri Sone 2) Dr. Hiroshi Watanabe	15 participants	* Road construction and Improvement Quality control and inspection * Road material and necessary technologies and standards * Causes, countermeasures of Concrete structures' deterioration	<TOTAL> USD 2,280.00

3. Workshop

No.	Date	Title	Lecturer	No. of Participants	Content	Expenses by the Project
1	May 27, 2013	Methodology of Project Cycle Management (PCM)	1) Mr. Koki Kaneda	50 participants	Presentation of approach of the PCM method and discussion of revising evaluation indicators in the Project Design Matrix (PDM).	USD 120.00 Kyat 176,100 = USD 201.49 (USD1.00 = Kyat874) <TOTAL> USD 321.49

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No.	Date	Title	Lecturer	No. of Participants	Content	Expenses by the Project
2	July 25, 2013	Key points in case of applying chemical stabilization method in the PP-1	1) Dr. Hideki Yoneyama	9 participants in RRL	* Selection of additives (lime or cement?) * Determination of material mix ratio * Determination of target strength of stabilized material * Approach of cost reduction	<TOTAL> USD 0.00
3	Oct 4, 2013	How to use the stabilized material testing results in improved pavement design	1) Mr. Hirokazu Miyamoto	5 participants in RRL	* Evaluation of existing test result i) * How to use testing result in improved subgrade * Detail testing plan according to testing results so far.	<TOTAL> USD 0.00
4	Oct 29, 2014	Introduction on stabilized road improvement work	1) Mr. Hirokazu Miyamoto	7 participants in RRL	* Procedure of road stabilized road work * The role of mixing test in laboratory for stabilized road work * Quality control test	<TOTAL> USD 0.00
5	Dec 13, 2013	Implementation Program of Pilot Project-1	<Myanmar Side> 1) Daw Mya Mya Win 2) U Nyi Nyi Kyaw <Japanese Side> 1) Mr. Koki Kaneda 2) Mr. Hiroaki Kobayashi 3) Prof. Kiyoshi Omine	30 participants	* Pavement design approach * Operation method of the stabilizer * Quality control method of soil material * Construction procedure on site * Analysis method of ground behavior	<TOTAL> USD 0.00
6	May 28, 2014	Report about Pilot Project-1 ~ Conditions & Issues	<Myanmar Side> 1) U Kyaw Shein 2) U Aung Myao Oo 3) Daw Kyi Kyi Thwe <Japanese Side> 1) Prof. Kiyoshi Omine	29 participants	* Brief Presentation of the Pilot Project -1 in Ayeyarwady Region * Pilot Project-1 Reporting * High Embankment Behavior, Study in Delta Area * Importance of monitoring of high embankment on soft ground	USD 120.00 Kyat 360,000 = USD 380.15 (USD1.00 = Kyat947) <TOTAL>

No.	Date	Title	Lecturer	No. of Participants	Content	Expenses by the Project
						USD 500.15
7	June 6, 2014	Study about Analysis methods of high embankment on soft ground at Kywe Chan ye Kyaw Bridge approach road (1)	1) Mr. Koki Kaneda 2) Mr. Kuniaki Nishijima	11 participants	* Consolidation, Phenomenon and Theory * How to conduct consolidation test and how to summarize the results * Example of countermeasures * Slope stability * Slope failure, Phenomenon and Theory * How to calculate the safety factor of embankment * Critical embankment height * Drill: Stability chart by Tayler * Drill: Slip circular methods * Analysis methods of the observation equipment installed at site	<TOTAL> USD 0.00
8	June 12, 2014	Study about Analysis methods of high embankment on soft ground at Kywe Chan ye Kyaw Bridge approach road (2)	1) Mr. Koki Kaneda 2) Mr. Kuniaki Nishijima	10 participants	* Analysis of Soil Boring Data * Consolidation settlement * How to calculate the underground stress due to overburden load * Drill of underground stress calculation and settlement * How to estimate Consolidation settlement and its time * Drill of estimation of Consolidation settlement and its time	<TOTAL> USD 0.00
9	June 19, 2014	Study about Analysis methods of high embankment on soft ground at Kywe Chan ye Kyaw Bridge approach road	1) Mr. Koki Kaneda 2) Mr. Kuniaki Nishijima	10 participants	* Consolidation settlement * Consolidation, Phenomenon and Theory * How to conduct consolidation test and	<TOTAL> USD 0.00

No.	Date	Title	Lecturer	No. of Participants	Content	Expenses by the Project
		(3)			how to summarize the results * How to calculate the underground stress due to overburden load * Drill of underground stress calculation and settlement * How to estimate Consolidation settlement and its time * Drill of estimation of Consolidation settlement and its time	
10	August 6, 2014	Study about Analysis methods of high embankment on soft ground at Kywe Chan ye Kyaw Bridge approach road (4)	1) Mr. Koki Kaneda	9 Participants	* Supplementary explanation about basic knowledge of soil * Questionnaire about basic knowledge * Explanation of calculation methods for stability * Coming time schedule	
11	August 27, 2014	Study about Analysis methods of high embankment on soft ground at Kywe Chan ye Kyaw Bridge approach road (5) (6)	1) Mr. Koki Kaneda	9 Participants	* Review of calculation methods for stability by Geo Studio * Group discussion about the understanding methods of original data * Group discussion about the correctness of converted or calculated data * Classification of soil striatum and definition of soil stratum characteristic data * No tests, but score by the presentation and comments number	
12	November 5, 2014	Summarization of the work shop process based on new	1) Mr. Koki Kaneda 2) Mr. Kuniaki Nishijima	5 participants	* Manual Vol.1 Stability factor analysis * Manual Vol.2 Consolidation	

No.	Date	Title	Lecturer	No. of Participants	Content	Expenses by the Project
		manual (7)			settlement	
13	November 19, 2014	Preparation of Data sheets about Lab test in JIS format sheets by practical data (8)	1) Mr. Koki Kaneda 2) Mr. Kuniaki Nishijima	6 participants	* Kyawe chan yak yaw bridge approach slope's soil investigation results as a sample excise of data processing and arranging necessary graphs	
14	November 24, 2014	Preparation of Data sheets about Lab test in JIS format sheets by practical data (9)	1) Mr. Koki Kaneda 2) Mr. Kuniaki Nishijima	6 participants	* Explained and discussed about how to put data and draw in the format sheets of d-vt curve and d-long curve	
15	November 26, 2014	Preparation of Data sheets about Lab test in JIS format sheets by practical data (10)	1) Mr. Koki Kaneda 2) Mr. Kuniaki Nishijima	6 participants	* Calculating sheet and preparation of e-log p curve	
16	December 3, 2014	Explanation of Settelement Analysis method using textbook (11)	1) Mr. Koki Kaneda 2) Mr. Kuniaki Nishijima	9 participants	* Process of soil investing * Preparation of several curve for analysis * Consolidation test process * Preparation of characteristic graph for consolidation analysis * How to get Cv value from log Cv-log P vurve * Ground and loading condition * Calculation of effective stress * Calculation of settlement by e-log p curve and by Cc method * Calculation of settlement time * Settlement curve modification during construction * Countermeasures (example, preloading, sand pipe) *	

No.	Date	Title	Lecturer	No. of Participants	Content	Expenses by the Project
17	February 23, 2015	1) High Embankment Behavior Observation & Analysis 2) Stabilization work	3) U Aung Myo Oo 4) U Aung Chi 5) U Aung Soe oo 6) Daw K Khaing Nyein Soe 7) Mr. Koki Kaneda 8) Mr. Hiroaki Kobayashi	51 participants	* Installed equipment and Installing method * Observation method and current results * Necessary of observation and work specification countermeasure work * Explanation of PP-2 work plan	USD 300.00 + Kyat 323,550 = USD 320.03 (USD1.00 =Kyat 1,011) <TOTAL> USD 620.03

4. Training in the PP-1

No.	Date	Title	Trainer	No. of Participants	Content	Expenses by the Project
1	Feb 19, 2014	Intensive training of operation skill of machinery work	1) Mr. Yukio Kohsaka 2) U Nyi Nyi Win 3) U Tin Aung 4) U Hlaing Min Zaw 5) U Myint Than	13 participants	Classroom: * Role of Operator * Daily Operation and Inspection Report by Operators * Review of Operation & Maintenance Manual * Skill test Field training: * Construction of Road Stabilizer * Functions of Control equipment, Switches and Monitor * Work Operation (start the engine->stabilizing work->stop the engine) * To cope with Emergency	Kyat 15,600 = USD 16.12 (USD1.00 = Kyat968) <TOTAL> USD 16.12

2	Mar 13-14, 2014	Intensive training of control of stabilization material	1) Mr. Hiroaki Kobayashi 2) U Aung Myo Oo 3) Mr. Masataka Fujikuma 4) U Nyi Nyi Kyaw 5) Mr. Hirokazu Miyamoto	37 participants	Classroom: * Investigation & Design * Supervision of stabilization works * Quality control of stabilized materials * Analysis & Monitoring of ground behavior Field training: * Lime stabilization work of sub-grade * Cement stabilization work of sub-base course	Kyat 871,600 = USD 900.41 (USD1.00 = Kyat968 <TOTAL> USD 900.41
3	Jan 30, 2014	Training in field density test at PP-1 site	<Myanmar Side> 1) U Nyi Nyi Kyaw <Japanese Side> 1) Mr. Hirokazu Miyamoto	6 participants QC technician from RRL, Site engineer	Field pre- training * Field density test by sand replacement method * Confirmation the degree of compaction on existing subgrade	

Member List of "Soft Soil Treatment Manual" Editing Committee

	Name	Title	Role in TC
1	U Kyaw Linn	Managing Director	Chairman of JCC
2	U Win Tint	D M D (Work), PW	
3	U Khin Maung Kyaw	C E (Road), PW	
4	U Aung Myint Oo	D C E, Planning	Project Director
5	U Aung Myint	In-house Consultant, RRL	Adviser
6	Daw Hla Hla Thwe	S E, Road	Project Manager
7	U Myint Kyi	S E, Ayeyarwady Division	
8	Daw Mya Mya Win	D S E, RRL	Design
9	U Aung Myo Oo	D S E, Airfield 2	Implementation Program & Project Management
10	U Khin Zaw	D S E, Special Unit (4)	
11	U Zaw Naing	D S E, Special Unit (2)	
12	U Kyi Twin Oo	D S E, Special Unit (15)	
13	U Thet Zaw Win	E E, Phyapon District	Implementation Program & Project Management
14	Daw Htar Zin Thin Zaw	E E, RRL/Yangon	Material QC
15	U Kyaw Tun Lin	E E, Maubin District	
16	U Thet Zaw Win	E E, Pyapon District	
17	U Than Htoo Aung	E E, Latputta District	
18	U Toe Toe	E E, Myaung Mya District	
19	U Yan Naing Zaw	E E, Hintharda District	
20	U Tint Lwin	E E, Pathein District	
21	U Nay Lin Tun	AE (RRL)	
22	U Tint Lwin Oo	AE (RRL)	
23	U Nyi Nyi Kyaw	A E, RRL/Yangon	Soil Investigation (material)
24		SRL	
25		Yangon technological Univ	

MD	Managing Director
DMD	Deputy MD
CE	Chief Engineer
DCE	Deputy CE
SE	Superintending Engineer
DSE	Deputy SE
EE	Executive engineer
AE	Assistant Engineer
JE	Junior Engineer
TE	Township Engineer

Member List of JCC

1. Chairman			
U Kyaw Linn		Managing Director	PW
2. Members from Myanmar side			
1	U Win Tint	Deputy Managing Director	Work
2	U Win Pe	Deputy Managing Director	Planning
3	U Khin Maung Kyaw	Chief Engineer	Road Department
4	U Ohn Lwin	Chief Engineer	Road Department
5	U Thein Zaw	Chief Engineer	Airfield
6	U Khin Maung Thein	Chief Engineer	Building
7	U Saw Win Naing	Deputy Chief Engineer	Road Department
8	U Sai Kyaw Moe	Deputy Chief Engineer	Road Department
9	U Win Lwin	Deputy Chief Engineer	Bridge
10	U Khin Thet	Deputy Chief Engineer	Airfield
11	U San Wai	Deputy Chief Engineer	Airfield
12	U Myint Kyi	Superintending Engineer	Ayeyarwaddy Division
13	Daw Khin Than Win	Deputy Superintending Engineer	Road Department
3. Counterpart			
1	U Aung Myint Oo	Project Director Deputy Chief Engineer	Planning
2	Daw Hla Hla Thwe	Project Manager Superintending Engineer	Road Department
3	Daw Mya Mya Win	Assistant Project Manager Deputy Superintending Engineer	Road Research Laboratory
4	U Aung Myo Oo	Assistant Project Manager Executive Engineer	Phyapon District
5	U Thet Zaw Win	Assistant Project Manager Executive Engineer	Road Department
6	Daw Yin Yin Swe	Assistant Project Manager Executive Engineer	Soil Research Laboratory
7	Daw Htar Zin Thinn Zaw	Executive Engineer	Road Research Laboratory
8	U Nyi Nyi Zaw	Executive Engineer	Quantity Survey
9	Daw Zin Zin Htike	Executive Engineer	Quantity Survey
10	Daw Su Mon Kyaw	Township Engineer	Phyapon District
11	Daw Ei Ei Mon	Assistant	Road Department
12	U Aung Myint	Consultant	Road Research Laboratory

4. Other Attendants			
1	Daw Lwin Lwin Mi	Executive Engineer	Road Department
2	U Aung Kyaw Han	Executive Engineer	Road Department
3	U Myint Oo	Executive Engineer	Road Department
4	Daw Myint Myint Sein	Executive Engineer	Yangon Division

OTHER POINT DISCUSSED

The Myanmar side expressed their comment as following;
At the end of project the soft soil treatment manual will be discussed and accepted by Public Works. The technological knowledge and skill of PW engineers will also be improved in behavior of high embankment and road construction with stabilization.
PW expected to achieve new manual for geotechnical investigation, design, quality control, quality assurance, construction management and maintenance for the road constructions with stabilization. But PW didn't achieve it from the Project. Outcome of the Project didn't meet PW's expectations. We should evaluate the input and how big the output is achieved by PW.

The Japanese side explained their understanding as following:
In the course of the Project, the related needs such as geotechnical investigation, design, quality control and assurance, construction management and maintenance of road construction with stabilization has been arisen in spite of not being described in the PDM. The lessons derived from the experience was that mutual and close consultation between both sides were essential to discuss such matter both at the initial and mid-time stage of the cooperation project. And with such addressing, the design of the projects can be more flexible and practical when the situation changes significantly in the cooperation projects onward.

ANNEX 5

The indicators are stipulated in the Project Design Matrix (PDM).
Achievement level of the project activities will be examined by applying verifiable indicators at designated timing.

Indicators for PDM V1.0 was collected in 2013 as shown on Table 5.2 – 5.6 on following pages.

Table 5.1.1 Verifiable Indicators for PDM Version 1

Narrative Summary	Objectively Verifiable Indicators	Baseline Data
Overall Goal Roads in the delta areas of Ayeyarwady Region are improved. (To be examined 3 years after the Project)	1. The length (km) of road construction under the control of the PW is increased in the delta areas. 2. Reducing driving hour or travel time.	Annex 5 Table 5.2 Annex 5 Table 5.3
Project Purpose The capacity of the Public Works (PW) for road construction adaptive to the delta areas of Ayeyarwady Region is enhanced. (To examined at the completion of the Project)	1 Road length constructed by the technology introduced from Pilot Project. 2 Improved road conditions in delta area	Annex 5 Table 5.4
Outputs 1. Road technology standards and manuals for designing and construction works are improved.	1-1. The number of the road technology standards and manuals developed by the PW is increased.	Annex 5 Table 5.5
2. The practical skills and knowledge of the road technical staff are enhanced.	2-1. Number of trained engineers (Seminar, WS, OJT)	Annex 5 Table 5.6

However, all indicators was revised by the suggestion of Mid Term Evaluation Team, and the base line data were changed as shown below:

Table 5.1.2 Verifiable Indicators for PDM Version 2

Narrative Summary	Objectively Verifiable Indicators	Baseline Data
Overall Goal Roads in the delta areas of Ayeyarwady Region are improved. (To be examined 3 years after the Project)	1. The road improved by the stabilization technique is more than 10 km 2. Driving hour or travelling time is reduced 10% comparing before execution of project.	No work as the Baseline in the past Annex 5 Table 5.3
Project Purpose The capacity of the Public Works (PW) for road construction adaptive to the delta areas of Ayeyarwady Region is enhanced. (To examined at the completion of the Project)	1. The enhancement of skill and knowledge of the engineer for road design and construction is confirmed by the hearing from more than 30 staff. 2 By the end of the project, road length constructed by the technology introduced from Pilot Project is extended longer than 2.6 km.	No baseline data, because this is a newly introduced technology
Outputs 1. Road technology standards and manuals for designing and construction works are improved.	1 New soft soil treatment manual is discussed and accepted by P.W. 2 More than 10 engineers are executing the work by using the manual.	No baseline data, because this is a newly introduced technology
2. The practical skills and knowledge of the road technical staff are enhanced.	1 Total number of trained staff of PW is more than 300 numbers. 2. 50% of participants evaluate training/seminars favorably.	No baseline data, because this is a newly introduced technology

ANNEX 5

Table 5.2 Length of Road Construction (Past Record and Future Plan)

No.	Name of Road	Km	Construction Group	2009 km	2010 km	2011 km	2012 km	2013 km
1	Pathein - Monywa	218	Districts, Special Construction Group + Company	223.69	223.69	218.86	219.27	217.86
2	Yangon - Pathein	99.6	B.O.T (Asia World)	149.26	149.26	100.58	100.58	100.58
3	Pathein - Ngwesaung	47.4	B.O.T (Asia World)	0.00	0.00	47.47	47.47	47.47
4	Ngathainggyaung - Gwa	35.6	RCSU (2)	45.87	45.87	35.81	35.81	35.81
5	Maubin - Kyaiklat	32.2	Maubin District + Pyapon District	32.39	32.39	32.39	32.39	32.39
6	Kyaiklat - Pyapon	17.6	Pyapon District	17.70	17.70	17.70	17.70	17.70
7	Pyapon - Bogale	30.8	Pyapon District	30.98	30.98	30.98	30.98	30.98
8	Kyeinpinse - Setkawt - Danubyu - Zalun	43.8	RCSU (4)	44.05	44.05	44.05	57.73	57.73
9	Hinthada - Duya - Dauntgyi - Zalun - Danubyu	33.2	B.O.T	53.11	53.11	53.11	19.71	19.71
10	Approach Road of Bo Myat Htun Bridge	6.4	B.O.T (Asia World)	0.00	0.00	6.44	6.44	6.44
11	Hinthada - Songon - Myan-aung	104.4	Companies	105.01	105.01	105.01	105.01	105.01
12	Myan-aung - Kyangin	7	Hinthada District	7.04	7.04	7.04	7.04	7.04
13	Kyangin - Phatye	13.8	Hinthada District	13.68	13.68	13.68	13.88	13.88
14	Danubyu - Thaunggyi	38.8	Maubin District + Pathein District	39.03	39.03	39.03	39.03	39.03
15	Hinthada - Athok - Kyaunggon	16.8	Hinthada District + Pathein District + B.O.T	16.90	16.90	16.90	16.90	16.90
16	Approach Road of Kebaung Bridge	4.4	Pathein District + B.O.T	4.43	4.43	4.43	4.43	4.43
17	Maubin - Sarmalauk	34.2	Maubin District + B.O.T (Asia World)	36.41	36.41	34.80	34.80	34.80
18	Twante - Maubin	24.2	Maubin District	21.12	21.12	24.34	24.34	24.34
19	Dedaye - Pyapon	25.2	Pyapon District	26.35	26.35	25.35	25.35	25.35
20	Labutta - Myaungmya - Einme - Kyaunggon - Kyonpyaw	74	Myaungmya District + Pathein District + RCSU (15) + RCSU (16)	171.79	171.79	171.19	146.65	163.14
	Total	907.4						

No.	Name of Road	Km	Construction Group	2009 km	2010 km	2011 km	2012 km	2013 km
21(1)	Maubin - Yelagale - Shwedaungmaw -Kyaikpi - Mawlamyinegyun	82.8	RCSU (4)	72.02	72.02	72.02	72.02	72.02
22(2)	Mawlamyinegyun - Hlaingbone- Thitpoak - Kwinpouk- Pyinzalu	115.8	RCSU (4)	108.43	108.43	116.47	116.47	116.47
23(3)	Labutta- Tingangyi – Pyinzalu	56.4	Labutta District	56.73	56.73	56.73	56.73	56.73
24(4)	Labutta- Thongwa- Oaktwin- Hteiksun	99.8	RCSU (2) + Labutta District	60.55	60.55	40.03	100.38	100.38
25(5)	Bogale-Kyeinchaung- Katonkani	66	RCSU (16)	66.38	66.38	66.38	66.38	66.38
26(6)	Bogale- Setsan- Htawpine- Ama	61.8	Maubin District	62.16	62.16	62.16	62.16	62.16
27(7)	Pyapon - Kyaonkadun - Dawyein - Ama	82.6	Pyapon District	48.68	48.68	83.08	83.08	83.08
28(8)	Kyaonkadun- Setsan	30.8	Pyapon District	30.78	30.78	30.78	30.78	30.78
29(9)	Pathein- Thalaikhwa- Mawtinsun	153.6	Pathein District + Labutta District	154.49	154.49	154.49	154.49	154.49
30(10)	Bogalae- Mawlamyinegyun- Wakema - Myaungmya	105.6	Myaungmya District + Pyapon District	0.00	0.00	0.00	98.77	98.77
31(11)	Pathein- Napudaw	33.6	Pathein District	33.80	33.80	33.80	32.59	32.59
	Total	888.8						

Table 5.3 Driving Hours or Travel Time in the Delta Area

No.	Name Of Road	Km	Construction Group	Driving Hour (hr:min)		Remark
				Rainy Season	Drying Season	
1	Pathein -Monywa	216.6	Districts+Special Construction	4:22	4:02	Group+Company(BOT) 52.8km
2	Yangon-Pathein	100.0	B.O.T (Asia World)	3:10	3:10	(152.8km)
3	Pathein - Ngwesaung	47.2	B.O.T (Asia World)	1:30	1:15	
4	Ngathainggyaung-Gwa	35.6	RCSU (2)	1:45	1:15	
5	Maubin-Kyalklat	32.2	Maubin District + Pyapon District	1:10	0:55	
6	Kyaiklat-Pyapon	17.6	Pyapon District	0:30	0:30	
7	Pyapon-Bogale	30.8	Pyapon District	0:35	0:35	
8	Kyeinpinse-Setkawt-Danubyu-Zalun	57.4	RCSU (4)	2:00	1:30	
9	Hinthada-Duya-Dauntgyi-Zalun-Danubyu	19.6	Hinthada District	0:25	0:25	
10	Approach Road of Nyaungdon Bridge	6.4	RCSU (4)	0:12	0:10	
11	Hinthada-Songon-Myanaung	104.4	Companies	2:45	2:30	
12	Myanaung-Kyangin	7.0	Hinthada District	0:10	0:10	
13	Kyangin-Phatye	13.8	Hinthada District	0:25	0:20	
14	Danubyu-Thaunggyi	38.8	Maubin District + Pathein District	1:30	1:00	
15	Hinthada-Athokg-Kyaunggon	16.8	Pathein Districts	0:57	0:40	
16	Approach Road of Kebaung Bridge	4.4	Pathein District	0:10	0:05	
17	Maubin-Sarmalauk	34.6	Maubin District+B.O.T (Asia World)	2:30	2:00	
18	Twante-Maubin	24.2	Maubin District	0:35	0:30	
19	Dedaye-Pyapon	25.2	Pyapon District	0:25	0:25	
20	Labutta-Myaungmya-Einme-Kyaunggon-Kyonpyaw	74.0	Myaungmya District +Pathein District + RCSU(15)+RCSU(16)	3:00	2:15	
21	Maubin-Yelagale -Shwedaungmaw-Kyaikpi-Mawlamyinegyun	71.6	RCSU(4)	3:30	2:00	
22	Mawlamyinegyun-Hlaingbone-Thitpoak-Kwinpouk-Pyinzalu	115.8	RCSU(4)	-	-	Connot drive because of earth toad
23	Labutta- Tingangyi-Pyinzalu	56.4	Labutta District + RCSU(15)	1:15	1:00	From Labatta to Tinganyyi
24	Labutta-KyaukPhyarlay-Thongwa-	99.8	RCSU(2)+Labutta District	-	-	Connot drive from M 0/0-M 20/7
	Oaktwin-Hteiksun			-	2:00	M 20/7-55/1
				0:40	0:20	M 30/0-40/0
				0:30	0:20	M 47/0-55/1
				0:30	0:15	M 6/3-7/2 (Old)
				0:30	0:20	M 0/0-4/7
25	Bogale -Kyeinchaung-Katonkani	66.0	AFSU (2)	-	1:30	In raining season, car can drive only up to M 10/2
26	Bogale-Seisan -Htawpine-Ama	61.8	AFSU (2)	-	-	Cannot drive because 5 nos of bridges are under construction
27	Pyapon-Kyaokadun-Dawnyein-Ama	82.6	Pyapon District	5:00	3:30	
28	Kyaonkadon-Satsan	30.6	Pyapon District	1:10	1:00	M (0/7-20/0)
29	Pathein-Thalaikhwa-Mawteinsun	153.6	Pathein District	4:40	3:30	
30	Bogalae-Mawlamyinegyun-Wakama-Myaungmya	98.2	Pyapon+Labutta+Myaungmay District	6:40	4:00	
31	Pathein-Napudaw	32.4	Pathein District	0:58	0:40	
	Total	**1143.8**				

Table 5.4 Road Condition by Road in Delta Area

			Good		Fair		Bad		Total
No.	Name of Road	Km	km	%	km	%	km	%	km
1	Pathein - Monywa	216.6	216.60	100%	-	-	-	-	216.60
2	Yangon - Pathein	99.6	99.60	100%	-	-	-	-	99.60
3	Pathein - Ngwesaung	47.2	40.40	86%	6.80	14%	-	-	47.20
4	Ngathainggyaung - Gwa	35.6	1.60	5%	13.80	39%	20.20	56%	35.60
5	Maubin - Kyaiklat	32.2	4.60	14%	18.20	57%	9.40	29%	32.20
6	Kyaiklat - Pyapon	17.6	-	-	17.60	100%	-	-	17.60
7	Pyapon - Bogale	30.8	30.80	100%	-	-	-	-	30.80
8	Kyeinpinse - Setkawt - Danubyu - Zalun	57.4	4.80	8%	6.40	11%	46.20	81%	57.40
9	Hinthada - Duya - Dauntgyi - Zalun - Danubyu	19.6	2.00	10%	15.80	81%	1.80	9%	19.60
10	Approach Road of Bo Myat Htun Bridge	6.4	6.40	100%	-	-	-	-	6.40
11	Hinthada - Songon - Myan-aung	104.4	37.60	36%	55.90	54%	10.90	10%	104.40
12	Myan-aung - Kyangin	7	3.80	54%	2.60	37%	0.60	9%	7.00
13	Kyangin - Phatye	13.8	1.80	13%	4.80	35%	7.20	52%	13.80
14	Danubyu - Thaunggyi	38.8	3.90	10%	9.40	24%	25.50	66%	38.80
15	Hinthada - Athok - Kyaunggon	16.8	6.00	36%	6.40	38%	4.40	26%	16.80
16	Approach Road of Kebaung Bridge	4.4	0.40	9%	0.40	9%	3.60	82%	4.40
17	Maubin - Sarmalauk	34.2	21.00	61%	13.20	39%	-	-	34.20
18	Twante - Maubin	24.2	24.20	100%	-	-	-	-	24.20
19	Dedaye - Pyapon	25.2	-	-	25.20	100%	-	-	25.20
20	Labutta - Myaungmya - Einme - Kyaunggon - Kyonpyaw	74	19.55	26%	49.45	67%	5.00	7%	74.00
	Total	**905.8**	**525.05**	**58%**	**245.95**	**27%**	**134.80**	**15%**	**905.80**

			Good		Fair		Bad		Total
No.	Name of Road	Km	km	%	km	%	km	%	km
21(1)	Maubin - Yelagale - Shwedaungmaw -Kyaikpi - Mawlamyinegyun	82.8	9.0	11%	65.8	79%	8.0	10%	82.80
22(2)	Mawlamyinegyun - Hlaingbone- Thitpoak - Kwinpouk- Pyinzalu	115.8	-	-	-	-	115.8	100%	115.8
23(3)	Labutta- Tingangyi – Pyinzalu	56.4	0.8	1%	-	-	55.6	99%	56.4
24(4)	Labutta- Kyaukphyarlay- Thongwa- Oaktwin- Hteiksun	99.8	16.6	17%	4.6	5%	78.6	78%	99.80
25(5)	Bogale-Kyeinchaung- Katonkani	66	-	-	-	-	66.0	100%	66.0
26(6)	Bogale- Setsan- Htawpine- Ama	61.8	-	-	-	-	61.8	100%	61.8
27(7)	Pyapon - Kyaonkadun - Dawyein - Ama	82.6	-	-	43.4	53%	39.2	47%	82.6
28(8)	Kyaonkadun- Setsan	30.6	-	-	7.2	24%	23.4	76%	30.6
29(9)	Pathein- Thalaikhwa- Mawtinsun	153.6	21.6	14%	132.0	86%	-	-	153.6
30(10)	Bogalae- Mawlamyinegyun- Wakema - Myaungmya	105.6	16.0	15%	47.4	45%	42.2	40%	105.60
31(11)	Pathein- Napudaw	32.4	29.6	91%	1.0	3%	1.8	6%	32.40
	Total	**887.4**	**93.6**	**11%**	**301.4**	**34%**	**492.4**	**55%**	**887.40**

Table 5.5 List of Existing Manuals and Standards

No.	Title
1.	Road Construction Specification (Public Works, Ministry of Construction)
2.	Road Maintenance Manual (Public Works, Ministry of Construction)
3.	Surface Dressing Manual (Public Works, Ministry of Construction)
4.	Pavement Surfacing; their properties and applications to Roads in Burma (Road Research and Development Project, United Nations Development Program)
5.	Axle Load Survey Demonstration (Road Research and Development Project, United Nations Development Program)
6.	Highway Construction Specifications (Road Research and Development Project, United Nations Development Program)
7.	General Specifications for Highway Bridge Construction in Burma (Road Research and Development Project, United Nations Development Program)
8.	Inventory of Construction Corporation Roads (Road Research and Development Project, United Nations Development Program)
9.	Road Roughness Surveys (Road Research and Development Project, United Nations Development Program)
10.	Design Standards for Highways (Ministry of Construction, Public Works)

Table 5.6 List of Training and Workshop (as of Dec/2013)

No.	Date	Theme	Number of attendance from PW
1.	Feb. 11, 2013	(at the time of Kick Off Meeting)	0
2.	May. 27, 2013	Project Cycle Management (PCM) workshop (The 1st Workshop at Yangon)	39
3.	Jun. 13 and 14, 2013	The 1st Seminar at Yangon (Introduction of advanced technology in Japan for road sector)	52
4.	December 13, 2013	Workshop prior to PP-1	40
5.			
6.			
7.			
8.			
9.			

Republic of the Union of Myanmar
Public Works, Ministry of Construction

Japan International Cooperation Agency

Reference Paper for Road Stabilization

April 2015

PW, MOC, JICA
The Project for Implement of Road Technology
in Disaster Affected Area in Myanmar

Abbreviations

Premium rate	Additional additive rate to the rate decided by Laboratory test considering the allowance for site mixture conditions
Additive rate	Mixture rate including premium rate

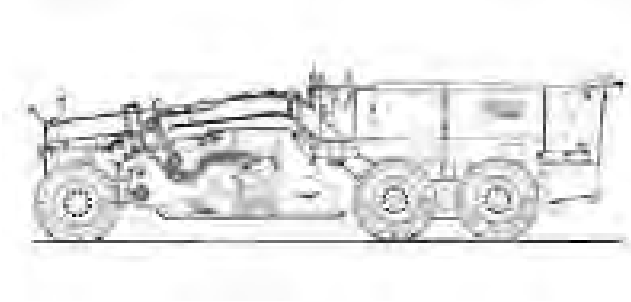
Table of contents

Stabilizer Equipment

Stabilization is the work to improve the site soil mainly by mixing. One of the features of stabilization work is to be mechanical work. It needs minimum backhoe. Many kinds of specific equipment were developed to execute the work efficiently. Followings are example of equipment to be used in stabilization work.

Subgrade Stabilizer

Mud Stabilizer

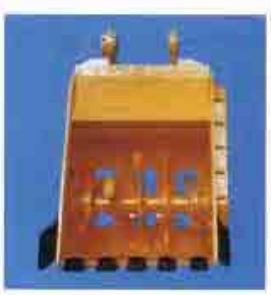


Base course Stabilizer

Subgrade stabilizer

Movable Soil Plant

Movable Soil Plant



Bucket Type Stabilizer

Lime/Cement Spreader

1. Outline of Stabilization

Stabilization is a kind of soft ground treatment. Stabilization methods should be adopted when the cost is economical comparing other methods.

1.1. in what case Road Stabilization is required?

Road stabilization could be adopted in case of Table 1-1:

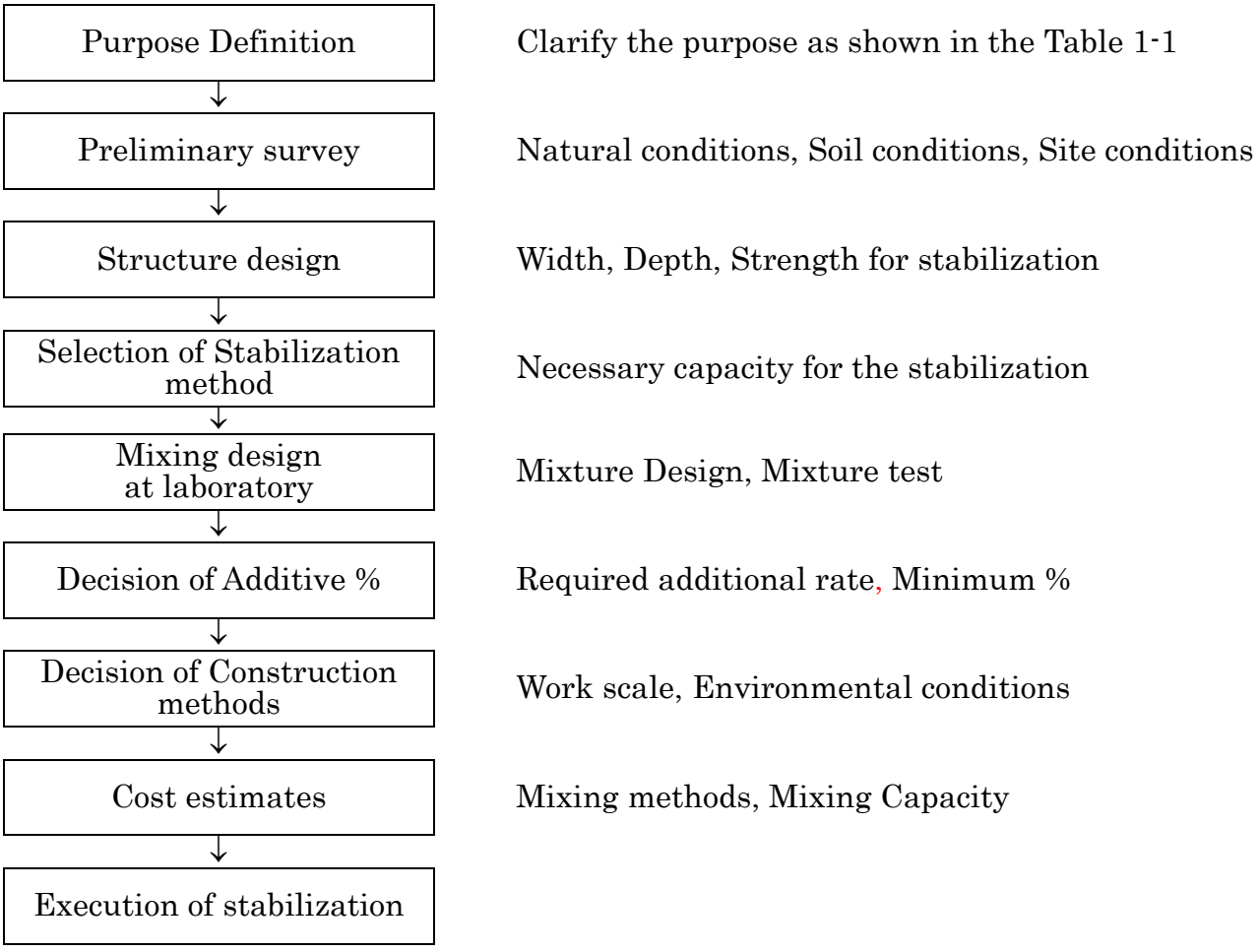
Table 1-1 Purpose of Stability Work

a) to ensure the traffic for the construction equipment
b) to improve the strength or bearing capacity of road-bed, subgrade, base-course and structure foundations
c) to reduce the compressibility of soil to be used refilling or backfilling
d) to re-use the construction generated soil by improving
e) others

1.2. Process for Road stabilization

Road stabilization process is shown in bellow: Fig1-1

Fig 1-1 Procedures for Stabilization Work



1.3. Preliminary survey

Three kinds of survey are expected

Fig 1-2 Necessary items for Preliminary Survey

Natural condition	Topographical, geological, weather, environmental conditions
↓	
Soil condition	Pat survey report, if available Should follow the testing standards of the execution agency Physical test except water contents should be done, if necessary
↓	
Site condition	Construction site's earth ground, obstacles, temporary roads Procurement methods (route, package or bulk) Period, Work volume, seasons Surrounding conditions

1.4 Classification of Site Soil or generated soil from the site

Site soil or Generated soil from the site is classified as follows in Japan:

This manual will treat for 3rd class and 4th class soil, and not described others

Table 1-2 Generated Soil and Applicable Place

		Cone index	Backfill	Re-fill	Sub-grade	Road-bed	Dike	Land develop-ment
1st class	Stone soil, Sandy soil		◎	◎	◎	◎	◎	◎
2nd class	Stone soil, Sandy soil	>800	◎	◎	◎	◎	◎	◎
3rd class	Sandy soil Clay soil Organic soil	>400	○	◎	○	◎	◎	◎
4th class	Sandy soil Clay soil	>200	○	○	○	○	○	○
Mud	Sandy soil Clay soil	200>	○ △ ×	△ △ ×	△ △ ×	○ △ △	○ △ ×	○ △ △

◎: usable without treatment
○: usable by applying stabilization
△: needs cost and time for the improvement
×: not appropriate to use generally

1.5. Kinds of Road stabilization

Road stabilization will be categorized into 2 kinds

Table 1-3 Kinds of Road Stabilization

1) Mechanical stabilization	✓ Mixing with good material such as sand or gravel soil ✓ Freezing of soil ✓ Dehydration such as Vacuum etc
2) Chemical stabilization	✓ Lime stabilization ✓ Cement stabilization ✓ Stabilization by artificial solidification materials ✓ Mixing of above solidification materials

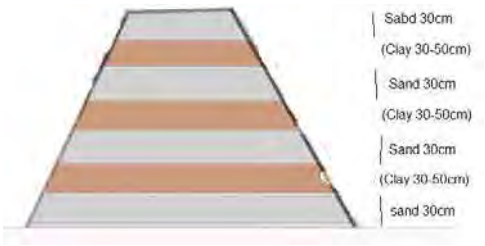
Note1: Mixing of above methods is effective according to the site soil conditions

Note2: Mixing by blast furnace slag has a effect of mechanical stabilization and chemical stabilization due to its CaO components.

1.5.1. Mechanical stabilization

This method is applied to improve the soil properties or drain the water inside of clayey layer and mainly for road-bed (embankment) improvement.

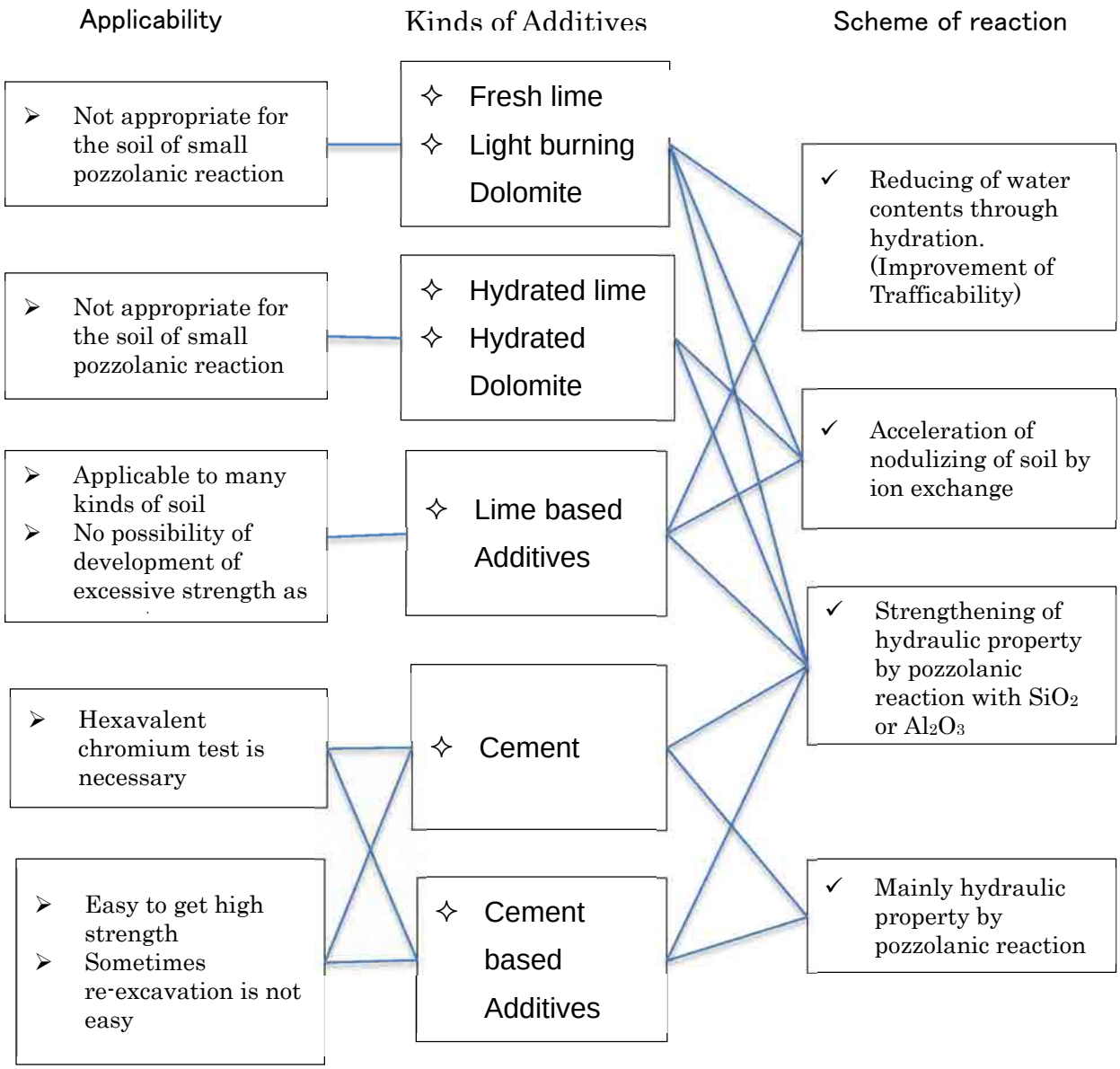
Table 1-4 Kinds of Mechanical Stabilization

Mechanical stabilization	Mixing	mixing sand (30% or more) without solidification additives
	Alternation of strata	

1.5.2 Chemical Stabilization

There are many kinds of chemical additives. They are categorized as shown in Figure below:

Fig 1 Comparison of Chemical Additives



This manual will describes only Lime and Cement.

Figure 2 Applicability of additives for Subgrade according to Soil Properties

					Issues on using as subgrade			Stabilization Additives				Remarks
					Increase CBR	Traffic ability	Stability	Cement	Hydrated Lime	Fresh lime	Others	
Course Soil Course parts> 50%	Gravel Soil G>S	FP<15%	Gravel S<15%	G				Δ	◎			
			Sand Gravel S>15%	GS	Δ			Δ	◎			
		FP>15%	Gravel with fine parts	GF	X			◎	◎			
	Sandy Soil S<G	FP<15%	Sand	S	Δ	Δ	Δ		Δ			
			Gravel sand	SG			Δ		Δ			
		FP>15%	Sand with fine parts	SF	X	X	Δ	◎	◎			
Fine Soil Fine parts>50%	Cohesive Soil		Silt	M	X	X			◎	○		Disturbed Fine Soil is not appropriate as Subgrade
			Clay	C	X	X			◎	○		
	Organic soil			O	Difficult to use as subgrade materials							
	Volcanic Clay			V	X	X			○	◎		
High Organic soil				Pt	Difficult to use as subgrade materials							

Remarks

Issues on using as subgrade			Effectiveness as stabilizing additives			
X	Δ		◎	○	Δ	
Has issues	Maybe issues		Highly	Good	Not always	

1.5.3 Lime stabilization

Lime stabilization has following effects:

Table 1-5 Purpose of Lime stabilization

a) reducing of water contents ratio
b) reducing of plastic index
c) improving trafficability
d) improving compaction degree
e) increasing strength value

There are many kinds of Limes to be used as shown bellow. It should be selected considering the cost, availability and effect by the laboratory test

Table 1-6 Kinds of Lime to be used for lime stabilization

Lime stabilization	Fresh lime	✓ Burning lime stone with 900℃ or more ✓ Powder type or particle type
	Hydrated lime-dry	✓ Reacted fresh lime with water ✓ Powder type
	Hydrated lime-wet	✓ Added 20-25% water to Hydrated lime
	Light burning Dolomite	✓ Burning dolomite with 900C or more ✓ Powder type or particle type
	Hydrated Dolomite	✓ Reacted fresh lime with water ✓ Powder type
	Solidification lime	✓ Added talc, slag powder, alumina, fly ash

1.5.4. Cement stabilization

Cement stabilization is generally effective for sandy soil.

Table 1-7 Kinds of Cement for stabilization

Cement stabilization	Portland cement	✓ Available in almost area ✓ Strength will be developed in short time comparing other additives
	Furnace cement	✓ Low cost comparing with portal cement ✓ Strength development is slow comparing with portal cement

Table 1-8 Applicability of Cement Stabilization

	Kinds of soil		Cone index	Fc	Water contents	
3rd class	Sandy soil	SF	>400	25–50%	30–50%	
	Silt Soil Clay soil	M C			<40%	
	Volcanic soil	V			–	
4th class	Sandy soil	SF	>200	25–50%	–	
	Silt Soil Clay soil	M C			40–80%	
	Volcanic soil	V			–	
	Organic soil	O			40–80%	

Notice 1: Followings should be taken care in case of cement stabilization

a) Possibility of reflection crack to the surface layer
b) Possibility of hexavalent chromium

Notice 2: Followings are important on the execution of Cement stabilization

a) Mixed materials should be compacted immediately
(should not store temporally in case of Soil Mixing Plant methods
b) Compaction degree should be more than 90%
(one layer thickness should be less than 20-30 cm)

2. Stabilization methods

2.1. Mixing methods

There are many kinds of methods for the stabilization.

This manual target treatment volume is around 1000m3 or less per one project.

Table 2-1 Recommendable Mixing Methods by Works

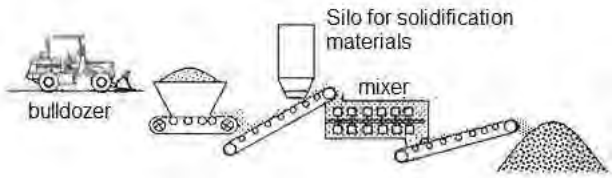
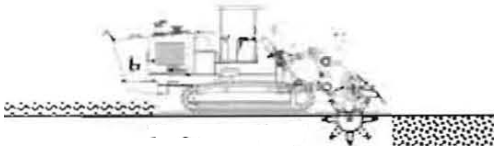
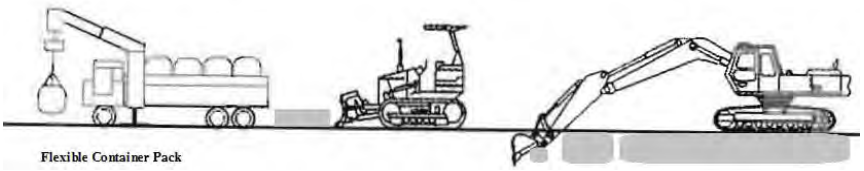
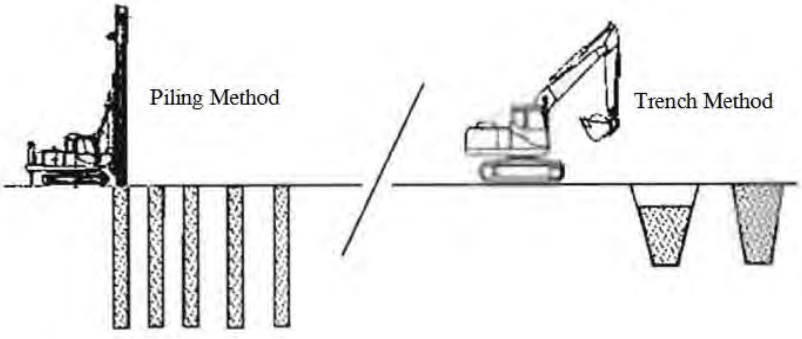
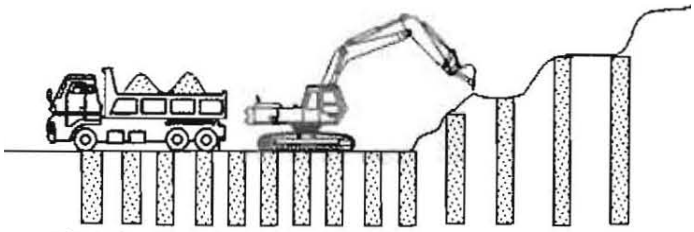
	Soil plant mixing		In-situ mixing			Borrow pit mixing
			Mixing on road		Shallow mixing	
			Depth 1m or less		Depth 1~3m	
Mixing methods	Fixed soil plant	Movable soil plant	Stabilizer	Back-hoe	Stabilizer Bach-hoe Movable plant	Bach-hoe Bulldozer Stabilizer Movable plant
Work scale	Large (30,000m3 or more)	Middle or Small	Large, Middle, Small	Small (300m3 or less)	Large, Middle, Small	Large, Middle, Small
Smoking	None	Less	Possible by methods and kinds of mixture			
Mixing degree	◎	◎	○	○	○	○
Embankment	◎	◎	○	○		◎
Subgrade	◎	◎	◎	○		△
Base-course	◎	○	○	△		
Gravel soil	◎	◎	○			
Sandy soil	◎	◎	◎	○	○	○
Clay	○	○	◎	○	◎	◎
Production Capacity (m3/h)	○	○	(100~300)	(20~40)	Stabilizer (Max 100) Backhoe (10~30) Movable plant (40~150)	(Variable)

◎: usable without treatment
○: usable by applying stabilization
△: needs cost and time for the improvement

2.2. Construction process

There are various kinds of mixing methods for stabilization as shown below:

Table 2-2 Mixing Methods for Stabilization

Plant mix	Fixed soil plant	
	Movable soil plant	
In-situ mixing plant	Mixing on road	
	Shallow mixing	
Borrow pit mixing		 

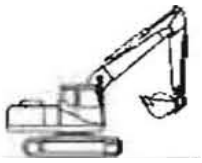
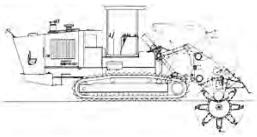
2.3. Construction equipment

Necessary equipment are shown in Table 2-3, and comparison of mixing equipment is summarized in Table 2-4.

Table 2-3 Necessary equipment for stabilization

	Scarify & shaping	Spreading	Crushing & mixing	Target Soil	Placing	Compaction
Plant mix	Bulldozer (Back-hoe) (Grader)	Man-power Track crane Dump truck (Dozer shovel) Spreader	Fixed soil plant Movable soil plant	Clay Sandy-soil Gravel-soil Base-course	Bulldozer Motor-grader	Tire-roller Macadam-roller Vibration-roller Tamper-plate
Mixing on road			Stabilizer (Max depth 100cm)			
Shallow mixing			Back-hoe (Max depth 100cm)	Clay Sandy soil Gravel soil		
			Stabilizer (Max depth 120cm)			
			Back-hoe (Max depth 150cm)			
			Movable soil plant			
Borrow pit mixing			Stabilizer (Max depth 120cm)	Clay Sandy soil	No work at mixing yard	No work at mixing yard
			Back-hoe (Max depth 150cm)			
			Movable soil plant	Clay Sandy soil Gravel soil	Back-hoe for loading	

Table 2-4 Mixing Equipment Comparisons

	Backhoe	Rotary built-in Backhoe	Stabilizer for base-course	Stabilizer for subgrade
Outline				
Mix depth[1]	60-70cm (0.7m3 bucket)	60-70cm (0.7m3 bucket)	43cm	100cm
Capacity	25~50m3/h			70~120m3
✓ Feature	✓ General purpose machine ✓ Applicable for removal of big obstacle	✓ Mixing degree is good	✓	✓ Qc>300kN/m2 ✓ Qc>5kN/m2 is possible in case of soft ground crawler type

[1] Mixing Depth is recommended to be Maximum around 30cm in spite of possible mixing depth of each equipment in order to ensure the sufficient compaction.

3. Road-bed (embankment) stabilization

3.1. Purpose

Road-bed (embankment) stabilization will be adopted in case of following case:

Table 3-1 Purpose of Stabilization for Road-bed

a) to improve trafficability for the construction equipment
b) to reduce the compressibility of soil to be used refilling or backfilling
c) to improve the stability of embankment

Note1: Required additional rate for additives % is not considered in case of the improving of trafficability. Because above required value including safety allowance.

3.2. Mixture design

Mixture design of Road bed is done by Cone-Index or Unconfined strength.

Table 3-2 Necessary Design strength of Roadbed Stabilization

Purpose	Indicator	Design strength
trafficability	Cone index	Qc=400kN/m2
compressibility	Unconsolidated strength	Same value with backfill material
stability		Decided by the designer

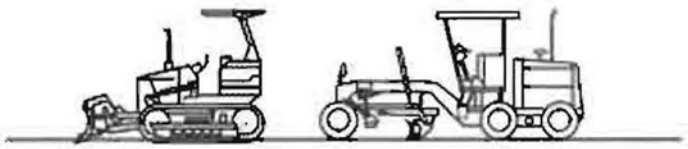
Table 3-3 Mixture Design Methods

Preparation of specimen	Material	Passed one of sieve of 4.75mm (9.5mm for improved soil)
	Mold	D 100mm V 1000cm3
	Rammer	W 2.5kg
	Compaction	3 layer compaction 25 times from H 30cm
Measurement	Cone penetrometer	Area of bottom 3.24cm2 Top angle 30˚C
	Penetration speed	1 cm/s
	Methods	Penetrate to specimen with mold
Calculation	Penetration resistance	Average of value at 5cm, 7.5cm and 10 cm depth
	Cone index Qc (kN/m2)	Average value should be divide by 3.24cm2

3.3. Construction process

Construction process for Road-bed is shown in below:

Shaping of ground

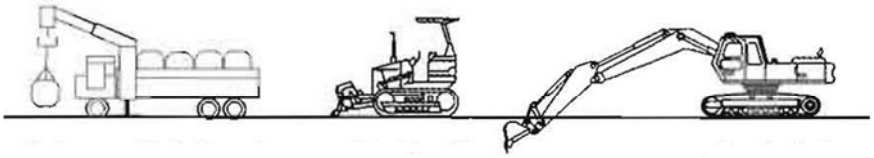


⇩

Spreading lime

⇩

Mixing



⇩

Leaves for Curing

⇩

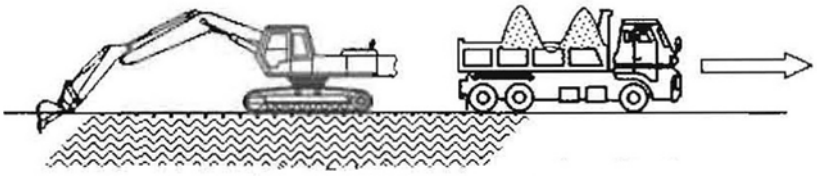
Excavation/Loading

⇩

Transportation

⇩

Placing/Leveling

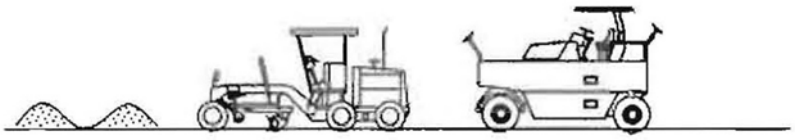


⇩

Compaction

⇩

Curing

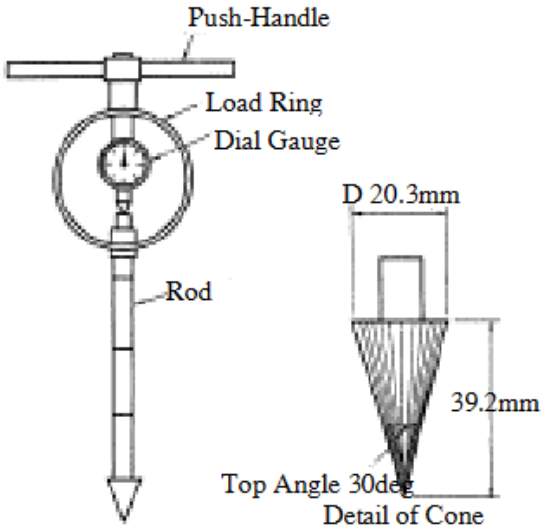


3.4. Quality control

Quality Control on Road-bed construction is shown in below:

Table 3-4 Q/C method

Item and Method				Test Frequency
Base test	Soil test		Water contents etc	Representative materials
	Mixture test			
Site quality control	Used quantity	Bag	Used bag number	Each section
		Soil plant	Weight on receipt	1 time/day
	Site density			1 time/1000m2
	Cone index			1 time/day or 1 time/1000m2



Cone-Penetro-meter

4. Subgrade stabilization

4.1 Purpose

Subgrade stabilization is most popular methods in case of following case:

Table 4-1 Purpose of Stabilization for subgrade

a) if subgrade CBR<3
b) to improve subgrade bearing strength where finished height is limited
c) if subgrade bearing strength is not constant
d) if the total cost become small by subgrade stabilization

4.2 Mixture design

Mixture design of subgrade is by CBR test.

Design CBR is determined by following three step:

Table 4-2 Mixture Design methods for subgrade stabilization

CBRm at each point	Each layer of each point CBR should be checked by laboratory data	Composite CBR of the place should be calculated
↓		
CBR of the section	Decide the section where the pavement thickness should be same	CBR of the section should be calculated from average and standard deviation
↓		
Design CBR	Decide from CBR of the section	Round down after the decimal point

CBR test should be followed by AASHTO T193

Required additional rate will be around 15-50% as shown in Table 4-4.

Minimum mixture rate should be 30kg/m3 considering mixing condition and workability

Mixing test indicator is by CBR test

Table 4-3 CBR Test method

Preparation of specimen	Material	Passed one of sieve of 37.5mm
	Mold	D 150mm V 2209cm3
	Rammer	W 4.5kg
	Compaction	3 layer compaction 67 times compaction from H 45cm
Curing		6 days air curing plus 4 days submerged curing
		20±3 cent degree
Measurement	Penetration piston	D 50mm
	Penetration speed	1 mm/min
	Methods	Penetrate to specimen with mold Prepare graph from the load at 0.5, 1.0, 1.5, 2.0, 2.5, 3.0, 4.0, 5.0, 7.5, 10.0, 12.5mm
Calculation	CBR (%)	Read out the penetration load at 2.5mm
		Adopt load at 5.0mm if the load at 5mm is bigger than 2.5mm

Mixing ratio

Mixing ratio of the additives should be decided at Laboratory trial test based on necessary design CBR. It is normally 2~20 % for lime and for cement.

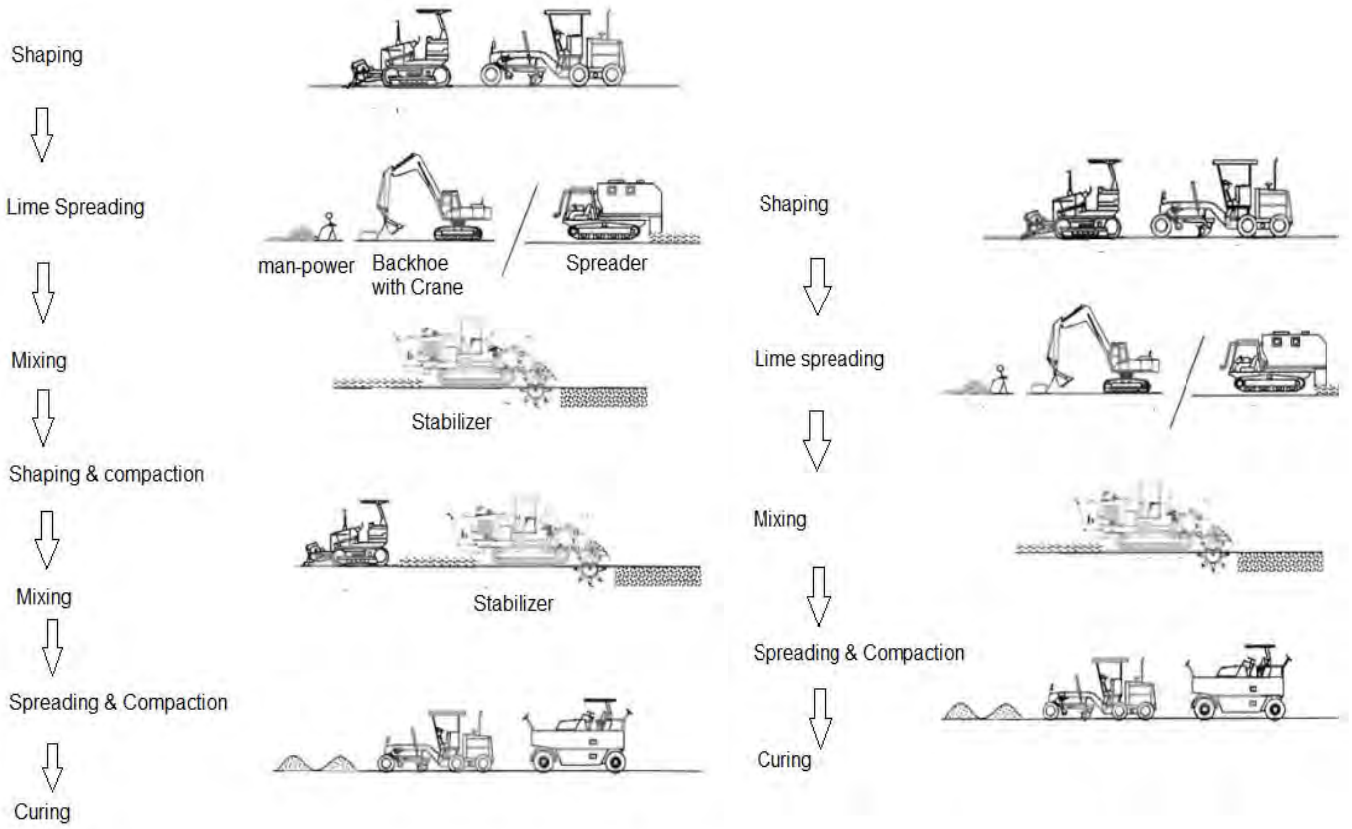
And required additional rate for the additive should be considered by the site conditions as shown in bellow:

Table 4-4 Required additional rate

Thickness	%
50cm or less	15~20%
More than 50 cm (sandy soil)	20~40%
More than 50 cm (clayey soil)	30~50%

4.3 Construction process

There are two kinds of Construction process according to the additive materials for the stabilization to use particle one or powder one. In case of using particles, mixing will be done two times normally.



Particle shape additives powder type additives

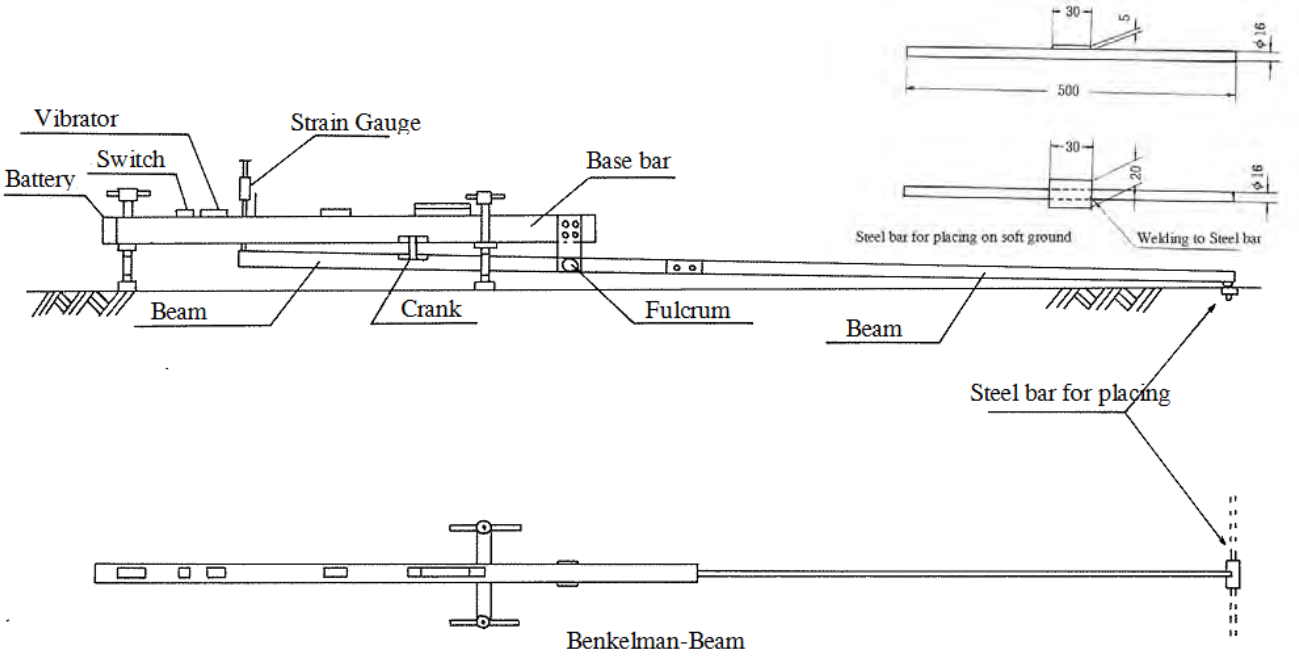
On spreading the additives, it is necessary to use them equally or evenly. Following photo shows the example of using of bag type additives.

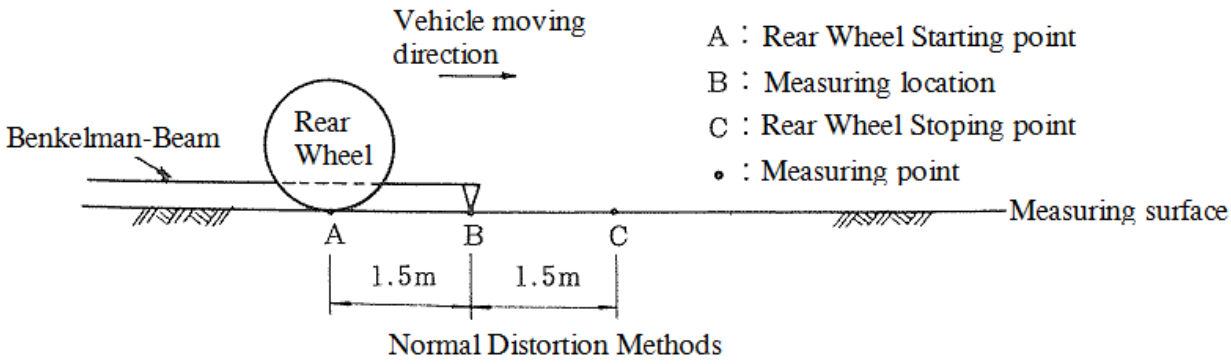
4.4. Quality control

Quality control is done by the method shown in Table 4-5.

Table 4-5 Q/C Methods

	Item and Method			Test Frequency
Base test	Soil test	Water contents etc		Representative materials
	Mixture test			
Site quality control	Used quantity	Bag	Used bag number	Each section
		Soil plant	Weight on receipt	1 time/day
	Site density			1 time/1000m2
	Proof rolling			All area Any time on demand





Normal Distortion Methods

5. Base course stabilization

5.1 Purpose

Base-course Stabilization will be adopted in case of following case:

Table 5-1 Purpose of stabilization for base-course

a) if local materials near the site is out of quality specification
b) recycling of site generated material
c) to reduce the total pavement thickness
d) if the total cost of stabilization methods become economical

5.2 Mixture design

Table 5-2 Necessary Quality for base-course

	Unconfined compression strength (curing 10 days) Mpa	
	Subbase-course	Base-course
Asphalt pavement	0.7	0.98
Cement concrete pavement	0.5	0.98

Table 5-3 Desirable aggregate quality to be used for stabilization

		Materials quality	
		Subbase-course	Base-course
Sieve passing %	53mm	-	100
	37.5mm	-	95~100
	19mm	-	50~100
	2.36mm	-	20~60
	0.075mm	-	2~20
95% modified CBR (%)		More than 10	More than 20
Ip		6~18	6~18
Max size (mm)		Less than 50	Less than 40

1 Mpa=1000KN/m2=1/9.8kgf/mm2

Mixing test indicator is by unconfined compression test (JIS ??)

Table 5-4 Mixture Design Procedures

Preparation of specimen	Material	Passed one of sieve of 26.5mm
	Mold	D 100mm V 1000 cm3
	Rammer	W 2.5kg
	Compaction	3 layer compaction 25 times compaction from H 30 cm
Curing		9 days air curing plus 1 days submerged curing
		20±3 cent degree
Measurement	Penetration piston	D 50mm
	Penetration speed	1 %/min
	Methods	Penetrate to specimen with mold Prepare graph from the stress and strain
Calculation	unconfined compression test Qu(kN/m2)	Maximum stress is Qu within the rage up to stress of 15% Stress at Qu is called as breaking stress

Mixture ratio

As shown in Fig 5-1, additive % should be decided based on necessary unconfined compression strength.

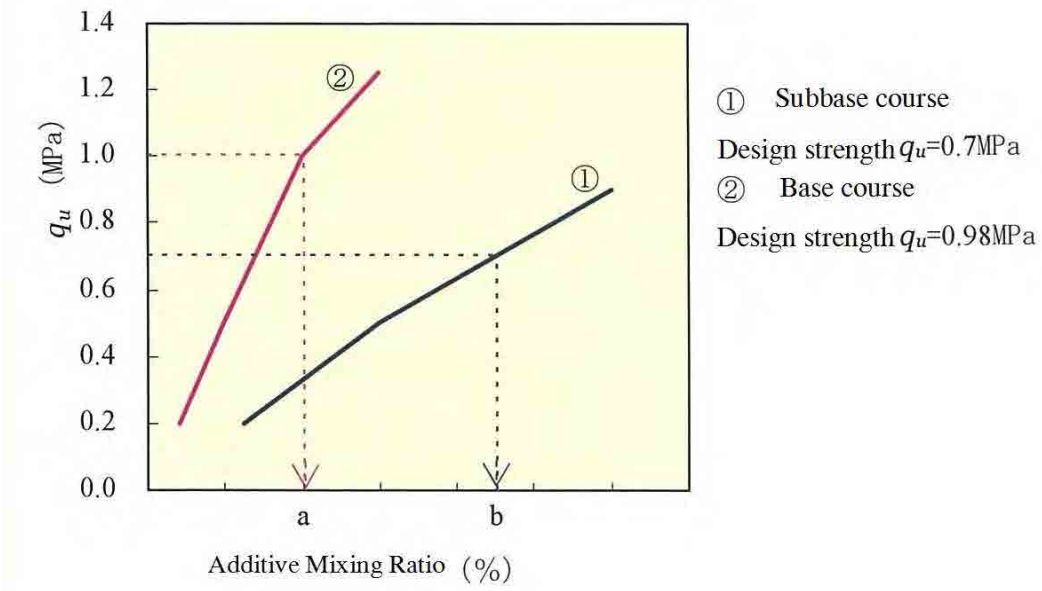


Figure 5-1 Methods to seek % of additives

5.3 Construction process

Table 5-5 Construction Process for Base Course

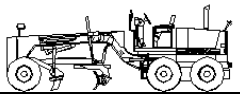
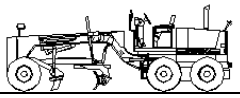
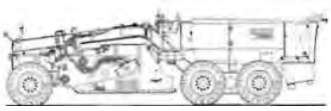
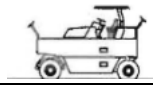
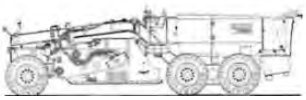
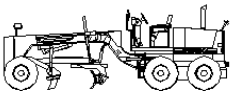
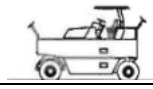
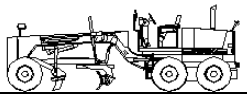
Stage	Explanation	equipment
Preparation	Plow existing layer & Water spray	
	Placing Additional materials	
Pacing & Mixing of mixture materials	Placing lime or cement	
	Mixing up to designed depth	
	Preliminary compaction	
	Re-mixing after 4~12 hours	
Compaction	Shaping by grader: One layer 15~30cm for subbase; One layer 10~20cm for base-course	
	Light Compaction by tire roller	
	Shaping by grader	
	Compaction by macadam roller and tire roller	 
Curing	May open to traffic immediately after the work	
	As-emulsion may sprayed, if necessary	
Traverse joint	End of base-course of the Previous day should be disturbed and connect to new materials	
Longitudinal joint	Form should be used and placed opposite side materials in early occasion to avoid the crack	

Table 5-4 Q/C methods

Item and Method				Test Frequency
Base test	Soil test	Water contents etc.		Representative materials
		Grading		
		PI		
	Mixture test			
Site quality control	Used quantity	Bag	Used bag number	Each section
		Soil plant	Weight on receipt	1 time/day
	Site density			1 time/1000m2
	Grading			1 time/day
	Proof rolling + Benkelman-Beam			All area Any time on demand

6. Stabilization for structure foundation (not described in this manual)

7. Stabilization of Site generated soil

7.1. Purpose

Stabilized site-generated soil will be used following case:

Table 7-1 Purpose of Stabilization for Site generated Soil

a) re-filling for under-ground facility work
b) road embankment
c) backfilling of structures
d) construction of dike
e) land development

Table 7-2 Applicability for the location

	Cone index (kN/m2)	Backfill	Re-fill	Subgrade	Road bed	Dike	Land development
1st grades	Similar to sand or rock	◎	◎	◎	◎	◎	◎
2nd grade	>800	◎	◎	◎	◎	◎	◎
3rd grade	>400	○	◎	○	◎	◎	◎
4th grade	>200	○	○	○	○	○	○
Mud	200>	△	○	△	○	○	○

◎: usable without treatment
○: usable by applying stabilization
△: needs cost and time for the improvement

7.2. Mixture design

Table 7-3 Desirable quality of stabilization for site generated soil

	Re-fill	Backfill	Subgrade	Road bed	Dike	Land development
Max size	50㎜	100㎜			150mm	100mm
Grading	Fc<25%	Fc<25%				
Consistency		PI<10				
Strength	CBR	CBR				
Compaction	Dc>90%	Dc>90~95%		Dc>90%		Dc>85%
1 layer	20~30cm	20cm		30cm		30~50cm

Fc: Fine particle contents

Appendix

Appendix 1 Standard Additive Quantity (Silt) (for reference)

			Dike Road-bed	Refill Backfill	Subgrade					Remarks
Target strength	Qc(kN/m2)		400	800	900	1350	1800	2700	4550	Qc=227xCBR
	CBR(%)		1.8	3.5	4	6	8	12	20	
	Qu(kN/m2)		18	35	40	60	80	120	200	Qu=10xCBR
	Original soil	Qc in Lab	Mixing ratio of Cement (% for γd)							
Water contents w (%)	W<40		Non	3	3	5	6	7	9	Almost belongs to 4th class soil
	40<W<42	300~400	1	3	4	5	6	8	9	
	42<W<44		1	4	4	6	7	8	10	
	44<W<46	200~300	2	4	5	6	7	8	10	
	46<W<48	150~200	2	5	6	7	8	9	11	Almost belongs to Mud
	48<W<50	100~150	3	6	7	8	9	10	11	
	50<W<52	<100	3	6	7	9	9	10	12	
	52<W<54		4	7	7	9	9	10	12	
	54<W<56		4	7	8	9	9	10	12	
	56<W<58		5	8	8	9	9	11	13	
	58<W<60		5	8	8	9	10	11	13	
	60<W<62		6	8	8	9	10	11	14	
	62<W<64		6	8	9	9	10	12	15	
	64<W<66		7	9	9	10	11	12	15	
	66<W<68		8	9	9	10	11	13	16	
	70<W		8	9	9	11	12	14	18	
	40<W<42		-	-	-	-	-	-	-	

Appendix 2 Standard Additive Quantity (Clay) (for reference)

			Dike Road-bed	Refill Backfill	Subgrade					Remarks
Target strength	Qc(kN/m2)		400	800	600	850	1150	1750	2900	Qc=145xCBR
	CBR(%)		2.8	5.5	4	6	8	12	20	
	Qu(kN/m2)		28	55	40	60	80	120	200	Qu=10xCBR
	Original soil	Qc in Lab	Mixing ratio of Cement (% for γd)							
Water contents w (%)	W<40	200~300	1	2	1	2	3	5	7	Almost belongs to 4th class soil
	40<W<42		1	2	2	3	4	6	7	
	42<W<44		1	3	2	3	4	6	8	
	44<W<46	150~200	2	3	2	4	5	7	9	
	46<W<48		2	4	3	5	6	8	10	
	48<W<50	100~150	3	6	4	6	8	9	11	
	50<W<52		3	6	4	7	8	9	12	
	52<W<54		3	7	5	7	8	10	12	
	54<W<56	<100	3	7	5	8	8	10	13	Almost belongs to Mud
	56<W<58		4	8	6	8	9	11	13	
	58<W<60		4	8	6	8	9	11	14	
	60<W<62		5	8	7	9	10	12	15	
	62<W<64		5	9	7	10	11	13	16	
	64<W<65		5	10	8	10	11	13	16	
	65<W		-	-	-	-	-	-	-	

Appendix 3 Standard Additive Quantity (Volcanic Soil) (for reference)

			Dike Road-bed	Refill Backfill	Subgrade					Remarks
Target strength	Qc(kN/m2)		400	800	500	750	1000	1500	2500	Qc=124xCBR
	CBR(%)		3.2	6.5	4	6	8	12	20	
	Qu(kN/m2)		32	65	40	60	80	120	200	Qu=10xCBR
	Original soil	Qc in Lab	Mixing ratio of Cement (% for γd)							
Water contents w (%)	W<50	200~300	1	3	2	3	5	7	9	Almost belongs to 4th class soil
	50<W<52		2	4	2	3	5	7	9	
	52<W<54		2	4	2	4	5	7	10	
	54<W<56	150~200	2	5	3	4	6	8	11	Almost belongs to Mud
	56<W<58		2	5	3	5	7	9	12	
	58<W<60	100~150	3	6	3	6	7	9	13	
	60<W<62		3	7	4	6	8	10	14	
	62<W<64	<100	4	8	5	7	9	11	16	
	64<W<66		4	9	5	8	10	12	17	
	66<W<68		5	9	6	9	10	12	17	
	68<W<70		5	9	6	9	10	13	17	
	70<W<72		6	10	7	9	11	13	17	
	72<W<74		6	10	8	10	11	14	18	
	74<W<76		7	11	8	10	12	14	18	
	76<W<78		8	11	9	11	12	15	18	
	78<W<80		9	12	9	11	13	15	19	
	80<W<82		9	12	10	12	13	16	19	
	82<W<84		10	13	11	12	14	16	20	
	84<W<86		11	13	11	13	14	17	21	
	86<W<88		11	14	12	13	15	17	21	
	88<W<90		12	14	12	14	15	18	22	
	90<W		-	-	-	-	-	-	-	

ミャンマーにおける道路舗装安定処理の積算方法について

ミャンマーで試験施工した安定処理のコストについーでの技術協力プロジェクト（技プロ）で道路路床路盤の安定処理を実施したが、ミャンマーMOC のコスト積算方法に基づいた安定処理のコストについての検討結果を以下に記述する。

目次

近隣工事の工事費

まず、PP-1 の試験工事箇所（Daw Nyein）を含めた近隣の工事費[1]（舗装面積あたり）を比較した結果を下記に示す。

Example in Past Project

	Pyapon	Daw Nyein	Daw Nyein	Daw Nyein	Danubyu	Danubyu	Yelegale
		Other site near PP1		PP1			
	Standard repair			JICA TCP	PW work	Sakai/Ohbayashi	JIP
Surface	-	DBSTx2	DBSTx2	DBSTx2	DBST	DBST 25mm	PM:4
Base Course	Crush Stone 10cm	Graded Crush Stone 15cm CBR=100	Graded Crush Stone 51cm CBR=100	Graded Crush Stone 17.5cm CBR=100	?	Cement stabilization 30cm 2.9Mpa Cement 4.3%	Graded Crush Stone 15-20cm
Subbase	-	Cement stabilization 15cm 0.75Mpa Sand 70% Cement 7.8%	-	Cement stabilization 15cm 0.75Mpa Sand 70% Cement 6.8%		Cement stabilization 15cm 0.98Mpa Cement 2.3%	-
Subgrade	Sand mix 45cm	Capping layer 30cm CBR15%	-	Lime stabilization 40cm CBR 20%		-	-
CBR			2.5%	2%	4%	4%	20%?
Total thickness	55cm	60cm	51cm	72.5cm		45cm	20cm
Unit rate $ of each layer	-	9.6 14.2 5.5 10.9	9.6 48.0 - -	9.6 16.6 7.3 13.2		-	-
Total Unit rate $/m2	30.0	40.1	57.6	46.6	22.7	62.1	27.1
Cost/Year $	15	8	11	5	17	6	3
Source etc		No improvement of subgrade	No improvement of subgrade	Pyapon Office	Repair / 3 year Maintenance / year by 1/3 cost	Maubin office	JIP Report (Material cost is only for transportation)

>Stability cost>12comparison

上記は、条件も異なり並列で比較しにくいものである。

PW が実施した Pyapon、Danubyu の舗装は、構造が不明で、極力コストが抑えられたものに見える。また、JIP が実施した Yelegale での試験舗装費は、材料費が明確でないせいか、非常に安い。その他の平均は $50-60/m2 である。

[1] 情報源：現地事務所および大林道路報告書

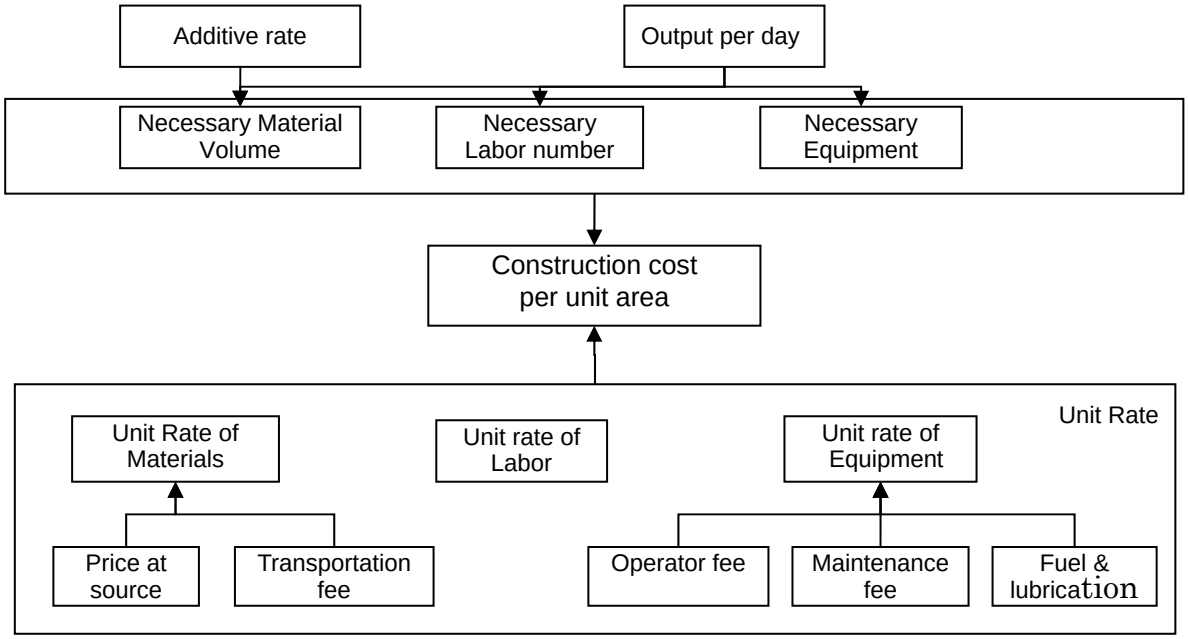
ミャンマーの積算方法[2]

ミャンマー建設省の積算方法を以下に示す。ミャンマー建設省では、工事に先立ち、予算確保のため、現場事務所で実行予算書を作成する。この工事積算方法は公開されていない。なお、工事完了後、この実行予算書は見直されることはなく、監査が入った場合、実行予算書に基づき説明がなされるとのことである。

PW の積算は次の３つの指針を基本としている。

1.PW Work Basic Standard for Cost Estimates	2004	主として歩係りを示している
2.Material Rate of PW/Irrigation Dept./CDC	2014-2015	毎年の３機関共通単価表
3.機械損料通達	Every year	機械部が毎年発出する単価表

積算のフローは下記のようになる



以下、工事歩掛り、材料単価、労務費単価、機材費単価についてそれぞれの説明を行う。

なお、ミャンマー建設省の積算の特徴として、材料費の単価とは別に現場までの運搬費、機材の燃料に加え各種油脂代、の詳細な検討項目があるが、根拠が今ひとつ明白でない。

現場経費、本部経費等の諸係りについては、直営工事が多いこともあり、計上されていない場合が多い。

[2] 情報源：PW 現地事務所

工事歩掛り

2004 年に作成された Work Basic Standard は、主として工事歩掛りを示すもので、目次構成は次のように２区分からなっている。

No	Title	Category	Page
1	Clearing of jungle/bushes		1
2	Earth work or grubbing work		2
3	Transporting with Tipper	Road bed	5
4	Leveling ground surface by Grader	embankment	9
5	Spreading of transported soil		10
6	Spreading and Compaction of embankment		12
7	Leveling, Grading, shaping, and compaction of ground		14
8	Transporting of soil, crushed stone, gravel, sand, laterite etc.	Subgrade	16
9	Laying, crushing and compaction laterite subgrade		17
10	Construction of subgrade, sub base, base by soil-gravel mixture	Subbase	19
11	Construction of sub base with crushed stones	Base course	23
12	Construction of base course with hard crushed stone		26
13	Compacting 1"-2" and below 1" stones for spraying bitumen		28
14	Spraying Bitumen prime coat		29
15	Grinding crushed stone and pouring asphalt (0.55 gal)		31
16	Laying and grinding small crushed stone and spraying layer of bitumen	Surface	34
17	Construction of cement concrete subbase, base surface		38
18	Applying asphalt concrete surface		51
19	Construction of unlined surface drains of 2'-6"x 2'-6" by 3"below road subbase and 40'between road shoulders.	Drainage	57

	General		
1	Material requirements for optimum mix of Asphalt concrete (5.0% Asphalt)	Component rate of As Mixture	58
2	Estimation of fuel consumption for heavy machines;	Formula to seek fuel rate from PH	59
3	Stone crushing	Loss rate on crushing aggregate	61
4	Water requirement	Water spray rate on compaction	61
5	Compaction to get designed density	Compaction number, maximum thickness	62
6	Lubricant consumption (gal/hr)	Necessary lubricant volume	63
7	Hourly fuel consumption (per hr consumption)	Fuel consumption rate, Output/hr	64
8	Maintenance cost for machinery, vehicle	Necessary equipment maintenance cost	70
	(As per memo dated 22.4.2004 of Mechanic dept. memo no.142/yasa 114/2004),		

>PW Work Basic Standard>TOC

材料単価

毎年発行される Material Rate は、工事資機材の標準単価を示すもので、目次構成は次のようになっている

No	Particulars	Pages number
1	Price of Local Product Materials	1-5
2	Price of Building Materials	6-51
	Labor Price	52
3	Lump Sum Labor Rate (Building)	1-25
	Lump Sum Labor Rate (Road/Bridge)	25-59
4	Handling charges / Labor Charges	60-64
5	Mobilization rate within work site	65-68
6	General Rental Charges	69-70
7	Transportation Rates	71-75
8	Undertaking soil works (Road) by using Machines/Vehicles	76-77

>Material Rate>Fig5

Material Rate of PW に記載されている Pyapon 地区の材料単価表、油脂類単価表、人件費単価の内、関係する項目を下記に示す（2014–2015 単価）

体積単位では gallon のほか Sudrine（約 2.8m3）を通常用いている

Unit Rate

	Pyapon District	Pyapon, Bogelay, Kyaik Lat, Daydaye 共通			Japan
No.	Particulars	Unit	Price (Unit Ks)	Remarks	(参考比較)
1	Rock (Nghat Pauk/Mway Hauk)	Sud	70000	Landing port	
2	Granite Rock	Sud	84000		$40/m3
11	Granite (Mhaw bi/ Tite Kyi)	Sud	84000	Stock in land	=$112/sud
3	Htone bo Rock	Sud	80000	Landing port	
4	Nyaung Chay Htauk Rock	Sud	101000	Landing port	
5	River Shingle (Myan Aung / Kyan Khin) for using in concrete work	Sud	135000	Stock in port	$30/m3
6	River Shingle (Using for construction road mixim with soil)	Sud	125000	Stock in port	=$84/sud
7	River Sand	Sud	26000	Stock in port	$12-28/m3
8	Sand	Sud	17000	Stock in port	=$34-78/sud
9	Brick	No.	125	Landing port	
10	Broken Brick	Sud	47000	Landing port	
12	2"-4" Crush Stone (Mandalay)	Sud	136500	Stock in land	$30-45/m3 =84-126/sud
13	1"-1" Crush stone / 1"-2" Crush stone (Mandalay)	Sud	178500	Stock in land	
14	½"- ¾" Chipping (Mandalay)	Sud	180000	Stock in port	
15	3/8" Chipping (mandalay)	Sud	182000	Stock in port	
16	2"-4" Crush Stone (Mote Pa Lin)	Sud	164500	Stock in port	
17	1"-2" Crush Stone (Mote Pa Lin)	Sud	194000	Stock in port	
18	½"- ¾" Chipping (Mote Pa Lin)	Sud	201000	Stock in port	
19	3/8" Chipping (Mote Pa Lin)	Sud	209000		
46	cement 50kg	bag	8000	160/kg	$5/25kg=$10/50kg
47	colour cement	lb	1600	3500/kg	
48	white cement	lb	700	1500/kg	
49	wet lime (small bag 25 pcs)	basket	3700		
50	lime powder	basket	1100		
51	lime powder (8 galons) 30lit=30kg	bag	3700	123/kg	$210/ton=$0.2 /kg
52	lime powder (small bag) 17kg	bag	2100	124/kg	
	Lubricants				
151	Diesel oil	gallon	4400		$1.13/l=$5.9/gallon
152	Engine oil (Multi Grade)	gallon	26500		
153	Engine oil (normal)	gallon	18000		$3/l=$14/gallon
154	Gear oil	gallon	13000		$4/l=$18/gallon
155	Hydraulic (normal)	gallon	17000		$2.5/l=$11/gallon
156	Hydraulic (multi grade) (5 L)	gallon	21000		
157	Grease oil	1lb bottle	3200		$4/l=$1.8/lb
158	Brake oil	1/8Gl bottle	4800		
	Labor				$120
1	Group (A)				
	Skill Technician	Day	5500		
	Sill helper	Day	3500		
	Forman	Day	4500		
2	Group (B)				
	Special Skill Technician	Day	6000		$200
	Special Skill helper	Day	4500		
3	Group(C)				
	Micro-art skill Technician	Day	8500		
	Assistant Technician	Day	4500		
	Operator	Day	4500		

Source: >Material Rate local material 建設物価

Sudrine=2.8m3, Gallon=4.55l

機材単価

機材の時間当り料金（維持管理費）は毎年機械部が出す通達による[3]。その関係する個所を下記に示す[4]。

（単位：Ks）

8 Machineries and vehicles maintenance cost per hour

		2004	2010	2014	2015	Applicable type	Fuel Rate Per hour[5]
1	Dozer Large	2810	6740	13500	15000	1A,1B	
	Dozer Medium	2190	5260	10500	10520	1C	5.5
	Dozer Small	810	1940	4000	6000	1D	
2	Grader komatsu 2m			14200	16000	japan grant	
	Grader liugong clg414			8750	10000	new	3.75
	Grader	1000	2400	4800	8750	1F	
3	Excavator MI E290			15000	18000	new	
	ditto Kobelco			10000	16000	japan grant	
5	Wheel Loader/Shovel kawasaki 80z5			14500	15000	japan grant	
		1310	3140	6300	8000	1G	3
6	Back Hoe Loader JCB			7000	6950	1g-210	
6	High speed Compactor	1875	4500	9000	10000	2bt	
7	Road Roller	300	720	2000	4000	2B	1.75
	ditto SAKAI 3 wheel			10200	11000	japan grant	
	Tyre Roller	290	700	1400	4000	507-512,CIP 2B1 6YPR 01,02UNDP 007/ JG 88-010,JG 88	2
	ditto SAKAI			10000	11000	japan grant	
11	Vibrating Roller	1045	2500	5000	5000	All	2.25
	MI2 C-14			5000	5000	new	5
	SAKAI SV520 sheep foot			13000	12650	japan grant	4
	Hand Guide Roller			1400	1360	japan grant	0.5
	Tandem Roller SAKAI		2000	6750	6740	japan grant	
	Plate Compactor			450	460		2.25
54	Water Bowzer	375	900	1800	4000		1
	Road stabilizer			-	89650	japan grant	9
	Soil mixing plant			-		japan grant	
45	Asphalt plant	5190	12546	25000	25000	2R042,045,052,055	50
48	Bitumen Decanter	475	1140	2300	3500	up to 2000 litre	24.3
	Bitumen Decanter	1125	2700	5400	7000	above 2000 litre	
49	Asphalt paver	1875	4500	9000	12000		5
50	Bitumen Distributor	1500	3600	7200	7500		10
	Burning						0.625
	Driving						0.4
62	Water pump	56	135	260	260		0.5
53	Tipper	300	720	1450	2500	up to 5 tons	1
	Tipper	600	1440	3000	4000	6-8 tons vehicles	
	Tipper	1250	3000	6000	7500	Vehicles numbers	
	Dump Truck (10 Wheel)		2640	7500	8000		1
52	Truck	240	576	1200	2000	up to 5 tons	0.4
	Truck	550	1320	2650	3500	6 ton & above	
4	Excavator	325	780	1600	4000	till 1FO46	
		1810	4340	9000	9000	1FO47 & up	
40	Electric generating sets	410	984	2000	2500	up to 75KVA	
	Electric generating sets	625	1500	3000	4500	75-150KVA	20
	Electric generating sets	1000	2400	4800	6000	Above 150KVA	

PW Work Basic Standard-General 8 & 7

上記の時間単価には燃料・油脂代、およびオペレータの人件費は含まれていない

[3] Mechanical dept. repair unit letter no.256/Mechanical (repair)/ NaPaTa/2015, 137/Mechanical (repair)/ NaPaTa/2014

[4] Material Rate の機材費賃料表(p69-70)には、コンクリート構造物関係、河川船舶関係の 27 機種が計上されている[4]が、舗装に関係する機材が載せられていない。

[5] 燃料消費量は、PW の歩掛り例からピックアップしたもの

上記とは別に 2014 年に民間からの借上げ料の通達がでているが、今回のコスト分析に必要な機材は記載がないもの多い。（赤字のもの）

Local Rental Price (ks)

SUBJECT : RESEARCH OF CONSTRUCTION BASIC PRICES OF EQUIPMENT **DATE : Nov 2014**

LOCATION : YANGON, MYANMAR

Note: -Daily Rate shall include operator, fuel, maintenance and other cost.
-Monthly Rate shall include operator, maintenance and other cost except for fuel.
-Registration and permit of equipment shall be considered in the equipment rate as required by laws and regulations.
-Insurance of the equipment shall be included in the equipment rate.
-If you have another capacity of equipment, please add in the list.

Code	Name	Capacity/ Specs	Maker/ Brand	Country Origin	Mob/Demob Cost in Yangon Area (2ways)	Rate in Myanmar Kyat: Daily (8hrs/day working)	Monthly (26days/month working)	Overtime Rate per hour	Remarks (fuel rate/h)
	Equipment								
e1	Backhoe	0.4 m3				388,000	6,760,000	72,750	
e2	Backhoe	0.7 m3				542,000	9,100,000	101,625	
e3	Vibratory Compactor	15 t				351,000	5,798,000	65,813	5.5
e4	Vibratory Compactor	10 t				296,000	5,200,000	55,500	4
e5	Vibratory Compactor	1 t				92,000	1,560,000	17,250	0.5
e6	Bulldozer D2					246,000	3,900,000	46,125	
e7	Bulldozer D4					281,000	4,810,000	52,688	
	Dozer D6					320,000		60,000	5.5
e8	Motor Grader					351,000	5,798,000	65,813	3.75
e9	Wheel Loader 1m3	1.0 m3				383,000	5,798,000	71,813	
e46	Wheel Loader	2.7 m3				492,000	7,800,000	92,250	
e48	3-Wheel roller								1.75
	Pneumatic roller								2
	Tandem Roller								2.25
	Vibrating Roller								2.25
	Paver								5
	Truck								0.4
e28	Dump Truck (10 Wheel)	10-15 t				248,000	3,120,000	46,500	1
e29	Water Truck (10 Wheel)	10-15 t				218,000	2,340,000	40,875	
	Water bowzer								1
	Water Pump								0.5
	bitumen burner TK2000								20
	bitumen distributor								10
	burning								0.625
	driving								0.4
	AC Plant (40ton/hr)								50
	Decanter (4000 liter)								24.3
e35	Generator	40-50 kVA				176,000	2,080,000	33,000	
e36	Generator	150 kVA				310,000	3,900,000	58,125	20

>Analysis of Rates for Road works>rental Price

上記の機材単価を日本の機械損料算定表に基づくものと比較すると次のように異なる。

Equipment		(1) PW Price/hour	(2) PW Price/day	(3) Rental/day	(4) Japanese Rate/day
Backhoe	0.4 m3	$7	$56	$388	$109
Dozer D6		$10	$80	$320	$106
Motor Grader		$10	$80	$351	$143
Loader 966C		$8	$64	$492	$68
3-Wheel roller		$4	$32	$210	$105
Vibrating Roller		$11	$88	$197	$197
Truck		$2	$16	$154	$77
Dump Truck (10 Wheel)	10-15 t	$8	$64	$248	$122
Crawler type Stabilize	D0.6m w1.6m	$40*	$320*	-	$806
Tire type Stabilizer	D0.5m w2.4m	$90	$720	-	$3247
Movable soil plant	20ton	$60*	$480*	-	$674
		Excluding Operator, Fuel etc.		Including Operator, Fuel etc.	

*は推定値、 換算レート Ks1000=$1.0

上記の比較からみて日本機材使用料単価と PW 使用料単価には差があるが、今後工事費算出にあたり機材単価は MOC 算出の時間単価を基本とする。

ミャンマー建設省の工事費積算例

以上の収集した単価を Work Basic Standard に当てはめ、路床・路盤のコストを試算した結果を下記に示す。

1) 現場近くに混合場所を建設し混合運搬した場合

10 ~~9. Subgrade/~~ Sub base~~/ Base course~~ construction with soil-aggregate mixture for 6" (150 mm) compacted thickness.							混合作業箇所面積
Summary of (1)-(6)	For 1 acre=		43560	sud	218	1.25	1 acre= 4047m2
Materials							
Laterite		70%	88	sud	70,000	6,125,000	施工箇所単位面積
Sand		30%	38	sud	26,000	975,000	100sud=280m3
						7,100,000	280/0.15=1873m2
	For 100sud=280m3=1873						
(a) Machineries		m2		sqft	rate	amount	材料割増係数 1.25
Dozer D6	1.mix yard construction		8	hr	10,520	84,160	
	2.dozing		2.63		10,520	27,689	
	3.mixing work		2.63		10,520	27,689	
Loader	3.mixing work		8.58		8,000	68,640	
	4.loarding		2.86		8,000	22,880	
Grader	6.spreading		1.28	hr	10,000	12,820	
Compactor	6.spreading		1.22		10,000	12,200	
3-Wheel roller	6.spreading		4		4,000	16,000	
Pneumatic roller	6.spreading		1.58		4,000	6,312	
Truck	6.spreading		2		3,500	7,000	
Water bowzer	6.spreading		2		4,000	8,000	
Water Pump	6.spreading		2		260	520	
						293,909	
(b) Fuel (Diezel)							
Dozer		5.5	72.95	gal			燃料費は前述の機材単価表の右欄に決められた時間当り消費量から計算する
Loader		3	34.32				
Grader		3.75	4.81				
Compactor		5.5	6.71				
3-Wheel roller		1.75	7.00				
Pneumatic roller		2	3.16				
Truck		0.4	0.80				
Water bowzer		1	2.00				
Water Pump		0.5	1.00				
	total		131.75		4,400	579,680	
Motor Spirit	5.&6		7.946	gal	5,000	39,730	各油脂代は燃料消費量に比例したものが規定されている
Engine Oil		0.67%	0.883	gal	26,500	23,391	
Gear Oil		0.83%	1.093		13,000	14,215	
Hydraulic Oil		0.34%	0.448		21,000	9,407	
Break Oil		0.10%	0.132		38,400	5,059	
Grease		0.50%	0.659	lb	3,200	2,108	
	total		3.21			93,910	
(c) Labor							人件費の歩掛りは、規定のものである
Head Worker			4.43	md	6,000	26,565	
Worker			13.32		4,500	59,955	
Operator			4.10		6,000	24,588	
Hlper Operator			4.10		5,000	20,490	
Watchmen			4.10		5,000	20,490	
Driver			0.75		6,000	4,500	
water pump driver			0.25		5,000	1,250	
						157,838	
(d) Oberhead							$29/m3, $4.4/m2
(a+b+c)*		10.00%				822,534	without OH & Profit
(e) Profit							
(a+b+c+d)*						0	
(f) Total							
(a+b+c+d+e)						9,047,872	$32/m3, $4.8/m2

>Analysis of rates for road works>9

PW の Work Basic Standard では、直工費に機材の維持管理費を割り掛けるようになっているが、PW スタッフからの助言で上記は管理費 10%と利益 10%を割り掛けるように変更している

2) 同様に砕石路盤を施工した場合のコストを算出すると下記のようになる。

11 ~~10.~~ Construction of Maximum compacted thickness 6"(150mm) 1"-2"/ 11/2"-2"/ 2"-4" crushed stone ~~subbase/~~ Base course, construction including choking with sand (30% of crushed rock) including watering and compacting up to required CBR.						
materials				for 100 sud		施工箇所単位面積
Crushed rock (25% compaction)		87.5	sud	136,500	11,943,750	100sud=280m3
Sand (30%)		37.5	sud	26,000	975,000	280/0.15=1873m2
					12,918,750	
(a) Machineries	For 1 acre =43560 sqft			rate	amount	
Grader		2.564		10000	25640	
Compactor					0	
Vibrating roller		8		2,500	5000	
3-Wheel roller		8		720	4000	
Pneumatic roller						
Truck		2		3500	7000	
Water bowzer		2		4000	8000	
Water Pump		4		260	1040	
					113680	
(b) Fuel (Diezel)						
Grader	3.75	9.62				
Compactor	5.5	0.00				
Vibrating roller	2.25	18.00				
3-Wheel roller	1.75	14.00				
Pneumatic roller	2	0.00				
Truck	0.4	0.80				
Water bowzer	1	2.00				
Water Pump	0.5	2.00				
	total	44.42		4,400	195,426	
Motor Spirit		2.18	gal	5,000	10,900	
Engine Oil	0.67%	0.298	gal	26,500	7,886	
Gear Oil	0.83%	0.369		13,000	4,792	
Hydraulic Oil	0.34%	0.151		21,000	3,171	
Break Oil	0.10%	0.044		38,400	1,706	
Grease	0.50%	0.222	lb	3,200	711	
	total				29,166	
(c) Labor						
Head Worker	1	1.4	md	6,000	8,400	
Worker	2	2.8		4,500	12,600	
Operator		2.32		6,000	13,923	
Hlper Operator		2.32		5,000	11,603	
Watchmen		2.32		5,000	11,603	
Driver		0.50		6,000	3,000	
water pump driver		0.50		5,000	2,500	
					63,628	
(d) Oberhead						$47/m3, $7.1/m2
(a+b+c)*	10.00%				1,332,065	without OH & Profit
(e) Profit						
(a+b+c+d)*						
(f) Total						
(a+b+c+d+e)					14,652,715	$52/m3, $7.8/m2

>Analysis of rates for road works>10

PP1 の工事予算書

PW の工事実行予算書[6]は非公開とされているが、何度かの交渉の上 PP1 の実行予算書を入手した。その総括表は次のようなものである。(元本の Ks 表示を $ 表示にしている) (PP2 の予算書は未入手)

SUMMARY OF COST of PP1　　なお、右端の２つの欄は、比較参考用に示すものである。

No	Particulars	Quantity	Unit	Rate$	Amount	Rate $/m2	Rate $/m3
					$		
1	Digging and removing rock of road	158	sud	9	1,422	0.2	3.2
2	**Lime Subgrade (14'width / 16'' thickness)**	1,281	sud	70	89,200	15.4	25.0
3	**Laying Sub-base (second layer) (13' width/8'' thick)**	572	sud	81	46,347	8.0	29.1
4	**Laying base-course (12' width/7'' thick)**	462	sud	211	97,416	16.8	75.8
5	Hot bitumen first sealcoat	31,680	sq/ft	0.3	9,340	1.6	
6	Hot bitumen second sealcoat	31,680	sq/ft	0.2	7,721	1.3	
7	Laying 2'' thick base-course by 1''- 2'' crushed rock	66	sud	233	15,368	2.7	93.0
8	Laying Hot bitumen grouting	31,680	sq/ft	0.5	14,691	2.5	
9	Laying hot bitumen seal coat	31,680	sq/ft	0.3	9,474	1.6	
10	Making hard shoulder by mixing with river shingle, earth, sand (4:2:1) on both sides (4 ft. wide)	660	sud	58	38,179	6.6	20.8
11	Digging cross drain (7 ft. center/center on both side of road)	30	sud	4.5	135	0.0	1.6
12	Fixing Drain Pipe (7ft C/C on both side of road)	10,640	ft	2.2	23,408	4.0	7.3
13	Making Earth embankment on both sides of road	450	sud	9.2	4,129	0.7	3.3
14	Shifting machines, vehicles, heavy machine to work side			Lump Sum	45,969	7.9	
15	Using working yard as requirement			Lump Sum	3,600	0.6	
16	Quality control work from road research laboratory			Lump Sum	4,444	0.8	
17	Undertaking administration and general supporting works			Lump Sum	17,343	3.0	
	Subtotal				428,186	74	
18	Operator fee and maintain fee of machines/vehicle (10%)				42,819	7	
	Total				471,005	81	

>PP1Cost (version2)>Summary

	工事総延長	幅員	工事総額		単価
PP1	1mile(=1.6km)	12'(=3.6m)	4.71 億 Ks（チャット）	5200 万円	9000 円/m2
PP2	600m		3.10 億 Ks（チャット）	3400 万円	15700 円/m2

単純計算では、2 ページに示した平均単価$50-60/m2 と比べ割高にみえる。

上記の積算方法は、日本の積算方法と下記の点が異なる。

- ✧ 単位がヤードポンドであり、さらに Sudrine(=2.84m3)という独自のものを使用。
- ✧ 機材費および労務費計上の歩係りが明確でない。
- ✧ 機材がランプサムで 10%計上。（一部民間からの借上は別計上している）
- ✧ 施工機材の燃料代と、材料運搬用の燃料代が区分されていない。
- ✧ 材料費の項に運搬費が別計上されているが、明解でないところがある。

以下に上記 PP1 の代価表のうち、本安定処理工事に直接関係する路床・路盤関係の代価表を以下に示す。なお。左表はオリジナルであるが、計算間違い、機材費の計上等、修正したものを右表に示す。

[6] Cost Estimates for Pilot Project 1 (PP1) 2014

オリジナル

2. Laying Subgrade (14'width/16"thick) (1281 sud)				$
Earth (100 %)	1,281	sud		0
Lime (4%)	51	sud		0
Lime	15,600	bag	3.5	54,600,
Transporting lime (Pyapon-Myokone)	260	ton	45.5	11,840,
Transporting lime (external vehicle)	260	ton	20.0	5,210
Material cost				71,651
- Road Stabilizer Diesel 3628 m³/75 m³ x 9 gallon	435	gallon	4.2	1,827
- Levelling by Motor Grader Diesel (6867 m²/720 m²) x 8 layers x 3.75 gallon	286	gallon	4.2	1,201
- Tyre Roller Diesel (6867 m²/235 m²) x 8 layers x 3.5 gallon	818	gallon	4.2	3,436
- Vibrating Roller Diesel (6867 m²/230 m²) x 8 layers x 3.5 gallon	836	gallon	4.2	3,511
- Water Bowzer 128100 cu/ft x 5 % x 6.24 gallon	39,967	gallon		0
33 times x 2 x 5 miles 7 miles/gallon	47	gallon	4.2	197,
-(Dump Truck)Diesel oil 1281 sud x 2 x 5 miles 1.75 sud x 5 miles/ gallon	1,464	gallon	4.2	6,148
- Bull Dozer Diesel oil (1281 sud / 36 sud) x 4.5 gallon	160	gallon	4.2	672
Small water pump	20	day	14.0	280
total of equipment fuel cost				17,273
Labor fee	92	no	3.0	276
			Total	89,200

>PP1Cost (version2)>Builders estimates>2

修正したもの

2. Laying Subgrade (14'width/16"thick) (986 sud)				$ $
Earth (100 %)	986	sud		0
Lime (4%)	39	sud		0
Lime	5,819	bag	2.1	12,219
Transporting lime (Pyapon-Myokone)	99	ton	45,5	4,5045
Transporting lime (external vehicle)	99	ton	20,0	1,982
Material cost				18,706
Equipment				
Road Stabilizer	48	hr	89,7	4,333
Motor Grader	76	hr	16,0	1,220
Tyre Rolle	234	hr	11,0	2,571
Vibrating Rolle	239	hr	5,0	1,194
Water Bowzer	47	hr	4,0	188,
Dump Truck	366	hr	8,0	2,928
Bull Doze	36	hr	10,5	374
Small water pump	20	day	2,1	42
				12,850
Diesel fuel				
- Road Stabilizer 3628 m³/75 m³x 9 gallon	435	gallon	4,2	1,827
- Levelling by Motor Grader (6867 m²/720 m²) x 8 layers x 3.75 gallon	286	gallon	4,2	1,201
- Tyre Roller (6867 m²/235 m²) x 8 layers x 3.5 gallon	818	gallon	4,2	3,436
- Vibrating Rolle (6867 m²/230 m²) x 8 layers x 3.5 gallon	836	gallon	4,2	3,511
- Water Bowzer 128100 cu/ft x 5 % x 6.24 gallon	39,967	gallon		0
33 times x 2 x 5 miles 7 miles/gallon	47	gallon	4,2	197
-(Dump Truck) 1281 sud /1.75 x 2 x 5 miles/ 5 miles/ gallon	1,464	gallon	4,2	6,149
- Bull Dozer (1281 sud / 36 sud) x 4.5 gallon	160	gallon	4,2	672
Small water pump	80	gallon	4,2	3360
total of fuel	4,126			17,329
Motor Spirit				
Engine Oil	28	gallon	26,5	732
Gear Oil	34	gallon	13,0	445
Hydraulic Oil	14	gallon	17,0	238
Break Oil	4	gallon	38,4	158,
Grease	21	lb	3,2	66
				1,641
Labor fee	92	no	4,5	414
Overhead				5,094
			Total	56,035
			6.3/m2	27.4/m3

>PP1Cost (version2)>improved>2

PP1 の工事予算書（続き）

3. Sub-base (13'width/8"thick) (572 sud)				$	$
Earth (70 %)	400	sud			
sand (30%)	172	sud			
Cement (7%) 3200 bag=160 ton	3,200	bag			
sand	172	sud	15,0	2,580	
transporting sand (external vehicle)	86	sud	11,3	969,	
transporting sand (internal vehicle)					
Cement	3,200	bag	6,5	20,704	
Cement (transport by boat) (Pyapon- Myokone)	160	ton	37,2	5,949	
Cement (external)	80	ton	11,7	934	
Cement (internal)					
Material cost				31,136,	
Diesel oil 86 sud x 2 x 3 miles / 1.25 sud x 10 miles / gallon	41	gallon	4,2	172,	
loading /unloading fee for sand (internal)	86	sud	1,7	142	
Mixing (earth+sand) with water (4.5%) by Excavator at Mixing yard Diesel oil (572 sud/45 sud) x 4 gallon	51	gallon	4,2	214	
Transporting by vehicle from Mixing yard to work place (within 3 mile)					
Vehicles Diesel 572sud/ 3.5 sud x 2 x 3 miles/4 miles/gallon	245	gallon	4,2	1,029	
- levelling by Motor Grader Diesel 6376 m²/720m² x 2 layers x 3.75 gallon	66	gallon	4,2	277	
- Tyre Roller Diesel 6376 m²/235m² x 2 layers x 3.5 gallon	190	gallon	4,2	798	
- Vibrating Roller Diesel 6376 m²/230m² x 2 layers x 3.5 gallon	194	gallon	4,2	815	
- Water Bowzer 57200 cu/ft x 5% x 6.24 gallon/ cu/ft	17,846	gallon		0	
15 times x 2x 5miles / 7 miles/gallon	21	gallon	4,2	88	
Small water pump	12	days	14,0	168	
Diesel oil 80 ton x 2 x 3 miles / 3 ton x 10 miles/ gallon	16	gallon	4,2	67	
loading fee for cement to vehicle	80	ton	2,2	176	
transporting within 200 ft	160	ton	5,5	880	
- Road Stabilizer diesel 1620 m³/75 m³ x 9 gallon	194	gallon	4,2	815	
- levelling by Motor Grader Diesel 6376m² /720m² x 8 layers x 3.75 gallon	267	gallon	4,2	1,121	
- Tyre Roller Diesel 6376m² / 235m² x 8 layers x 3.5 gallon	760	gallon	4,2	3,192	
-Vibrating Roller Diesel 6376m² / 230m² x 8 layers x 3.5 gallon	776	gallon	4,2	3,259	
Small water pump	20	days	14,0	280	
Distribution labor	572	person	3,0	1,716	
total of equipment fuel cost			Total	15,210	
				46,347	

>PP1Cost (Version2)>Builders estimates>3

3. Sub-base (13'width/8"thick) (343 sud)				$	$
Earth (70 %)	343	sud			
sand (30%)	147	sud	15,0	5,148	
Cement (7%) 3200 bag=160 ton (50kg/bag)	3,075	bag	6,5	19,896	
transporting sand (external vehicle)	86	sud	11,3	969,	
transporting sand (internal vehicle)					
loading /unloading fee for sand (internal)	86	sud	1,70	142	
Cement (transport by boat) (Pyapon- Myokone)	154	ton	37,2	5,717	
Cement (external)	80	ton	11,7	934	
Cement (internal)					
loading fee for cement to vehicle	80	ton	2,2	176	
transporting within 200 ft	160	ton	5,5	880	
Material cost				33,862	
dump truck for sand transportation	41	hr	8,0	328	
Excavator for mixing	17	hr	18,0	305	
Truck from mixing yard to site	245	hr	3,5	858	
Truck for cement	16	hr	2,0	32	
Motro Grader	19	hr	10,0	191	
Tyre Roller	58	hr	11,0	643	
Vibrating Roller	60	hr	12,7	755	
Water bowzer	21	hr	4,0	86	
Small waret pump	32	days	2,1	67	
Equipment cost				3,264	
Dumptruck 86 sud/1.25sud x 2 x 3 miles/10miles /gallon	41	gallon	4,2	172	
Mixing (earth+sand) with water(4.5%) by Excavator at Mixing yard					
Excavator Diesel oil (572 sud/45 sud) x 4 gallon	51	gallon	4,2	213	
Transporting by internal vehicle from Mixing yard to work place (within 3 mile)					
Diesel 572sud /3.5 sud x 2 x 3 miles /4 miles/gallon	245	gallon	4,2	1,0300	
- Motor Grader 6376 m²/720m² x 2 layers x 3.75 gallon	66	gallon	4,2	277	
- Tyre Roller 6376 m²/235m² x 2 layers x 3.5 gallon	190	gallon	4,2	798	
- Vibrating Roller 6376 m²/230m² x 2 layers x 3.5 gallon	194	gallon	4,2	8145	
- Water 57200 cu/ft x 5% x 6.24 gallon/cuft	17,846	gallon		0	
- Water Bowzer 15 times x 2x 5miles / 7 miles/gallon	21	gallon	4,2	90	
Small water pump	48	gallon	4,2	134	
truck for Cement 80 ton x 2 x 3 miles / 3 ton x 10 miles/ gallon	16	gallon	4,2	67	
- Road Stabilizer 1620 m³/75 m³ x 9 gallon	194	gallon	4,2	815	
- levelling by Motor Grader 6376m² /720m² x 8 layers x 3.75 gallon	267	gallon	4,2	1,121	
- Tyre Roller 6376m² / 235m² x 8 layers x 3.5 gallon	760	gallon	4,2	3,192	
-Vibrating Roller 6376m² / 230m² x 8 layers x 3.5 gallon	776	gallon	4,2	3,259	
Small water pump	128	gallon	14,0	1,792	
total of equipment fuel cost	2,997			13,776	
Motor Spirit					
Engine Oil	20	gallon	26,5	532	
Gear Oil	25	gallon	13,00	323	
Hydraulic Oil	10	gallon	17,0	173	
Break Oil	3	gallon	38,40	115	
Grease	15	lb	3,2	48	
				1,192	
Distribution labor	572	person	4.5	2,574	
Overhead	10	%		5,487	
			Total	60,134	
			8.0/m2	39.8/m3	

>PP1Cost (version2)>improved>3

4. Laying Base course (12' width/7'' thick) (462 sud)				$	$
1'' – 1'' crushed rock (20%)	92	sud	170,0		15,708
1/2'' – 3/4'' crushed rock (23%)	106	sud	170,0		18,064
3/8'' crushed rock (45%)	208	sud	170,0		35,343
sand (12%)	55	sud	15,0		832
1''-1'' crushed rock (by boat)	92	sud	41,8		3,862
1''-1'' crushed rock (external)	92	sud	14,2		1,316
1/2'' – 3/4'' crushed rock (by boat)	106	sud	40,7		4,325
1/2'' – 3/4'' crushed rock (external)	53	sud	12,7		676
1/2'' – 3/4'' crushed rock (internal)					
1/2'' – 3/4'' crushed rocks loading fee to car	53	sud	2,5		134
3/8'' crushed rock (by boat)	208	sud	40,7		8,462
3/8'' crushed rock (external)	105	sud	12,7		1,332
3/8'' crushed rock (internal)					
Diesel 103 sud x 2 x 3 miles / 1.25 sud x 10 miles/gallon	49	gallon	4,2		201
loading fee 3/8'' crushed rocks to vehicle	103	sud	2,5		261
sand (external)	55	sud	11,3		625
Material cost					91,145
Diesel 53 sud x 2 x 3 miles / 1.25 sud x 10 miles/gallons	25	gallon	4,2		105
Mixing (crushed rock+sand) with water (4.5%) at Mixing yard					
Excavator Diesel 462 sud/45 sud x 4 gallon	41	gallon	4,2		172
Transporting from Mixing yard to work site by vehicle (within 3miles)					
Diesel 462 sud x 2 x 3 miles / 3.5 sud 4 miles/gallon	198	gallon	4,2		832
Distribution labour	462	No	3,0		1,386
- Levelling with Grader Diesel 5886 m²/720 m² x 4 layers x 3.75 gallon	123	gallon	4,2		517
- Tyre Roller Diesel 5886 m²/235 m²x 4 layers x 3.5 gallon	351	gallon	4,2		1,474
- Vibrating Roller Diesel 5886 m²/230 m² x 4 layers x 3.5 gallon	358	gallon	4,2		1,504
- Water Bowzer 46200 cu/ft x 5% x 6.24 gallon/cuft	14,414	gallon			0
12 times x 2 x 5 miles / 7 miles / gallon	17	gallon	4,2		71.4
small water pump	15	days	14,0		210
total of equipment fuel cost					6,271
				Total	97,416

>PP1Cost (Version2)>Builders estimates>4

4. Laying Base course (12' width/7'' thick) (360 sud)				$	$
1'' – 1'' crushed rock (20%)	79	sud	170,0		13,464
1/2'' – 3/4'' crushed rock (23%)	91	sud	170,0		15,484
3/8'' crushed rock (45%)	178	sud	170,0		30,294
sand (12%)	48	sud	15,0		713
transportation fee					
1''-1'' crushed rock (by boat)	79	sud	41,8		3,311
1''-1'' crushed rock (external)	79	sud	14,2		1,128
1/2'' – 3/4'' crushed rock (by boat)	91	sud	40,7		3,707
1/2'' – 3/4'' crushed rock (external)	46	sud	12,7		578
1/2'' – 3/4'' crushed rock (internal)					
1/2'' – 3/4'' crushed rocks loading fee to car	46	sud	2,5		115
3/8'' crushed rock (by boat)	178	sud	40,7		7,253
3/8'' crushed rock (external)	89	sud	12,7		1,132
3/8'' crushed rock (internal)					
loading fee 3/8'' crushed rocks to vehicle	178	sud	2,5		451
sand (external)	48	sud	11,3		536
Material cost					78,164
truck	107	hr	3.5		374
dumptruck	25	hr	8.0		200
excavator	51	hr	16.0		823
tipper	123	hr	4.0		493
grader	96	hr	10.0		955
Tyre roller	33	hr	11.0		360
water bowzer	17	hr	4.0		68
small water pump	15	days	2.1		31
equipment cost					3,305
truck 89 sud/1.25sud x 2 x 3 miles/10 miles/gallon	43	gallon	4,2		1780
Diesel 53 sud/ 1.25 sud x 2 x 3 miles/10 miles/gallons	25	gallon	4,2		105
Mixing (assorted crushed rock+sand) with water (4.5%)by at Mixing yard					
Excavator 462 sud/45 sud x 4 gallon	32	gallon	4,2		1340
Transporting from Mixing yard to work site by department (within 3miles) vehicle 360 sud/3.5 sud x 2 x 3 miles/ 4 miles/gallon	154	gallon	4,2		648
Grader 6336 m²/720 m² x 4 layers x 3.75 gallon	123	gallon	4,2		517
Tyre Roller 6336 m²/235 m² x 4 layers x 3.5 gallon	351	gallon	3,0		1,052
Vibrating Roller 6336 m²/230 m² x 4 layers x 3.5 gallon	358	gallon	4,2		1,505
Water Bowzer 36000 cu/ft x 5% x 6.24 gallon/cuft	11,232	gallon			
12 times x 2 x 5 miles /(7 miles / gallon)	17	gallon	4,2		71
small water pump	60	gallon	4,2		252
total of equipment fuel cost	1,093				4,465
Motor Spirit					
Engine Oil	7.8	gallon	26,5		207
Gear Oil	9.7	gallon	13,0		126
Hydraulic Oil	4.0	gallon	17,0		67
Break Oil	1.2	gallon	38,4		45
Grease	5.8	lb	3,2		19
					463
Distribution labor	462	M/D	4,		2,079
Overhead	10	%			8,848
				Total	97,232
				14.0/m2	79.8/m3

参考 1：ADB の単価例

ADB Project による Maubin = Phyapon Road Rehabilitation Project の単価は次のように表示されている[7]。内訳は入手していない。

Key Works, Material and Equipment Unit Rates

Item	Description	Unit	Unit Rate (US$)
Clearing and grubbing		M2	0.3
Common Fill (CBR 2 min.)	Silty Clay (cut to Fill)	M3	3.0
Imported Fill	Silty Sand		
Improved Bill (CBR 5%)	Lime modifying local soil and silty sand	M3	16
Subgrade (CBR 5 minimum)	Soil / sand blend	M3	18
Recycle Existing pavement	Penetration and water bound macadam	M3	25.0
Subbase	Shingle/soil	M3	44.0
Base	Crushed Rock(dense graded)	M3	102.0
Primer		M2	1.0
DBST	10mm/20mm	M2	6.8
Water Bound Macadam		M3	115
Penetration Macadam (75mm)		M2	14.7
Asphalt Concrete (50mm)		M2	16.5
Concrete pavement	Fast Setting	M3	200
Misc Concrete		M3	190
Line marking		M	2

Source: Prepared by the ADB Consultant ADBKeyUnit PRice

参考 2：日本の積算方法例

材料費・機材費・労務費にミャンマーの単価を使用した場合の日本の積算方法[8]による路盤の積算結果を右に示す[9]。

Table 7-6 Unit rate of Subgradee (per 100m2) depth=200 Output per day is 500m2

Name	Spec	Unit	Quantity	Rate	Amount	Remarks
Soil	CBR10	m3	24.0	9.2	220.4	
Supervisor	1	m-d	0.2	6.0	1.2	1x100/D
Common labor (site)	3	m-d	0.6	4.5	2.7	0.3*10
BulDozer		day	0.2	125.3	25.1	Table 8-1
Tire roller		day	0.2	116.0	23.2	Table 8-9
Overhead	5%				13.6	
		Total			286.1 $/100m2	14.3 $/m3

Table 7-7 Unit rate of Aggregate SubBase (per 100m2) depth=200 Output per day is 1100m2

Name	Spec	Unit	Quantity	Rate	Amount	Remarks
Laterite 70%	CBR30	m3	16.1	28.3	454.9	
sand 30%			6.9	9.2	63.4	
Supervisor	1	m-d	0.1	6.0	0.5	1x100/D
Common labor (site)	2.4	m-d	0.2	4.5	1.0	0.24*10
Motor grader		day	0.1	121.0	11.0	Table 8-7
Tire roller		day	0.1	61.2	5.6	Table 8-9
Macadam roller		day	0.1	116.0	10.5	Table 8-8
Overhead	5%				27.3	
		Total			574.2 $/100m2	28.7 $/m3

Table 7-8 Unit rate of Aggregate Base Course (per 100m2) depth=150 Output per day is 1100m2

Name	Spec	Unit	Quantity	Rate	Amount	Remarks
Grading adjust Aggregate	CBR80	m3	16.5	63.0	1040.1	
Supervisor	1	m-d	0.1	6.0	0.5	1x100/D
Common labor (site)	2.4	m-d	0.2	4.5	1.0	0.24*10
Motor grader		day	0.1	121.0	11.0	Table 8-7
Tire roller		day	0.1	61.2	5.6	Table 8-9
Macadam roller		day	0.1	116.0	10.5	Table 8-8
Overhead	5%				53.4	
		Total			1122.2 $/100m2	74.8 $/m3

>StabilizationCost>7.WorkUnit rate

ただし労務費については、普通作業員員数を日本の約 3 倍として計算している[10]

[7] Road Engineering Report-Maubin in Phyapon Road Rehabilitation Project. P43 Table 6B.1 –(Key works, Material and Equipment Unit Rate)

[8] 阪神高速 積算基準

[9] ミャンマーの貨幣単位チャット(Ks)は桁が多く見にくいのでドル($)表示にしている（Ks1000=$1.0）

[10] 人件費単価は日本と比較し 1/10-1/20 と低いので、全体コストへの影響は小さい。

工事積算結果の比較

以上の計算をまとめ、比較すると次のようになる。

Subgrade	PW basic methods	PP1budget	Japan standard	ADB
Output area		7728m2	100m2	
(Volume)		552sud	20m3	
Thickness		8”	8”	
Total cost $		56,035	286	
$/m3		27	14	18
$/m2		6.3	2.9	4.5

Subbase	PW basic methods	PP1budget	Japan standard	ADB
	Laterite	Cement stabi	Laterite/sand	Shingle / soil
Output area	1873m2	7020m2	100m2	
(Volume)	100sud	572 sud	20m3	
Thickness	6”	8”	8”	8”
Total cost $	9,048	60,134	574	
$/m3	32	40	29	44
$/m2	4.8	8	6	9

Base course	PW basic methods	PP1budget	Japan standard	ADB
	Aggregate	Aggregate	Aggregate	Crushed rock
Output	1873m2	6480m2	100m2	
(Volume)	100sud	462 sud	15m3	
Thickness	6”	7”	6”	6”
Total Cost $	14,653	97,323	1122	
$/m3	52	80	75	102
$/m2	7.8	14	11	15
Reference	Analysis of Rates for Road works	PP1Cost (Version2)	Stabilization Cost Table 7.7 & 7.8	

Stabilization cost>11comparison

以上から　材料・労務・機材・燃料油脂の単価としてミャンマーのものを使用した場合、積算方法による工事単価差はあまりないことがわかる。

しかし、ミャンマーの積算方式は、以下のような問題がある。

- 積算方法が統一されていない
- 日当りアウトプットの算出にあたり何を根拠に行うのか明確でない
- 機材費の単価算定根拠が明確でない。
- 燃料・油脂の使用料等の扱いに統一性がない。(扱いが統一されていない)
- 人件費単価は非常に低いが個々の作業員の作業効率が低いので割増を考慮する必要がある
- 材料単価は原産地価格に運搬費を加えるものであるが、その積算方式が明解でない
- 安定処理のような新工法用機材については資料がない

道路安定処理の工事費積算

積算方法

ミャンマーでは道路路床・路盤安定処理工法は新しいものであり、既存の歩掛りが存在しないので、工事単価積算は、下記のものを参照し、日本の標準的方法[11]で行うことにした。

１．　石灰による地盤改良マニュアル　H23　日本石灰協会

２．　石灰による地盤改良の手引き（コスト）H23 日本石灰協会

３．　セメント安定処理の手引き　H12　付録１　積算資料　北陸地建

積算対象項目

検討対象とする道路舗装安定処理（路床、下層路盤）は下記の５つの工法とし、各工法での日当り施工量を仮定した。

	Mixing D(m)	Mixing width(B)	Working speed (v)	Daily Output (A)	
				(m3/d)	(m2/d)
1. Subgrade stabilizing by back hoe (0.45m3)	0.4				180
2. Subgrade stabilizing by crawler type stabilizer (b:1.6m,) (Direct mixing at site)	0.4	1.6	300m/hr	1 time mixing	252
				2 times mixing	126
3. Base Course material Mixing yard by base-course stabilizer (tire type) and Hauling to site after mixing	0.3	2.65	700m/hr	1 time mixing	1000
				2 times mixing	500
4. Base Course Mixing by base-course stabilizer (tire type) (Direct mixing at site)	0.2	2.65	1000m/hr	1 time mixing	1400
				2 times mixing	700
5. Base Course Mixing by Soil Mixing Plant and Hauling mixed materials to the site after mixing	(0.2)		Min	54	270
	(0.2)		Max	162	810[12]

>StabilizationCost>2.Output

$A = \frac{b*V*E}{N}$　here: E is working efficiency(=0.6)

b =B-0.2　(0.2m is overlap width loss)

V (working speed) is shown in Table 2-6

機材別安定処理施工速度

Table 2-6 Mixing Speed of Stabilizer (m/hr)

Mixing depth	20cm	30cm	40cm	60cm	Remarks
Crawler Type stabilizer	350	330	300	200	including secondary mixing
Tire Type stabilizer	1000	700	600	400	Estimated from PM550S Manual

P >StabilizationCost>2.Mixing Speed

[11] 各単価はミャンマーのものを使用する

[12] 今後の計算では便宜上、平均 500m2/day とする

添加材量

石灰・セメントの添加量は、試験室で配合設定した結果から下記のように設定した。

Premium rate base course 1.15
Premium rate subgrade 1.2

Table 3-1 Pilot Project 1 Additive mixing ratio

		Site soil	Sand	Gravel	Cement	Lime	CBR	Qu
Base Course	Granular	0%	-	100%	-	-	100%	-
Subbase	Cement stabilization	70%	30%	0%	6.8% 7.8%	-	-	0.75-1.5Mpa
Subgrade	Lime stabilization	100%	0%	0%	-	3.6% 4.3%	20%	-

Premium rate basecourse 1.15
Premium rate subgrade 1.2

Table 3-2 Pilot Project 2 Additive mixing ratio

		Site soil	Sand	Gravel	Cement	Lime	CBR	Qu
Base Course	Granular	0%	-	100%	-	-	80%	-
Subbase	Cement stabilization	50%	50%	0%	4.6% 5.3%	-	-	1.5Mpa
~~Subgrade~~	~~Lime stabilization~~	~~100%~~	~~0%~~	~~0%~~	~~-~~	~~%~~	~~20%~~	-

shows including premium rate >Stabilization Cost>3.Additives

必要労務者数

必要労務者数は下記のように決めている。一般労務者必要数は、日本の３倍を見ている[13]

Table 4-2 Necessary Man-power (Myanmar)

Item	Spec	Unit	Numbers	Rate	Amount	
Supervisor		m-d	1x100/D	6		
Common labor		m-d	10x100/D	4.5		
Operator		m-d	1x100/D			per one equipment

>Stabilization Cost>4.Man power

工種別積算例

下記に工種別単価を示す

Table 7-1 Unit rate for subgrade by backhoe (per 100m2) Ouptput per day is 180m2/day

Name	Spec	Unit	Quantity	Rate	Amount	Remarks
Additives	Lime	ton	3.1	123.3	383.6	4.3%*100*0.4*1.8
diito transportation			3.1	4.4	13.7	
Supervisor	1	m-d	0.6	6.0	3.3	1x100/D
Common labor	10	m-d	5.6	4.5	25.0	10x100/D
Backhoe		day	0.6	125.1	69.5	Table 8-2
Motor grader		day	0.6	121.0	67.2	Table 8-7
Tire roller		day	0.6	61.2	34.0	Table 8-9
Macadam roller		day	0.6	116.0	64.4	Table 8-8
Overhead	5%				33.0	
		total			693.8 $/100m2	17.3 $/m3

4.3% of Additive ratio is based on 3.6% x 1.20 as shown in Table 2.2.3 of Pilot Project 1 Report prepared on Aug, 2014

Table 7-2 Unit rate for subgrade by crawler type stabilizer (per 100m2) Output per day is 252m2

Name	Spec	Unit	Quantity	Rate	Amount	Remarks
Additives	Lime	ton	3.1	123.3	383.6	4.3%*100*0.4*1.8
diito transportation			3.1	4.4	13.7	
Supervisor	1	m-d	0.4	6.0	2.4	1x100/D
Common labor	10	m-d	4.0	4.5	17.9	10x100/D
Ditto for Removal of big stone	5	m-d	2.0	4.5	8.9	5x100/D
Stabilizer		day	0.4	244.3	97.0	Table 8-11
Motor grader		day	0.4	121.0	48.0	Table 8-7
Tire roller		day	0.4	61.2	24.3	Table 8-9
Macadam roller		day	0.4	116.0	46.0	Table 8-8
Overhead	5%				32.1	
		total			673.9 $/100m2	16.8 $/m3

>Stabilization Cost>7.Work Unit Rate

[13] ３倍の根拠：作業員の能力と給与から独自に推定したもの

Table 7-3 Unit rate for subbase by mixing at mixing yard (per 100m2) Output per day is 1000m2

Name	Spec	Unit	Quantity	Rate	Amount	Remarks
Additives	Cement	ton	4.2	160.0	675.6	7.8%*100*0.3*1.8
diito transportation			4.2	4.4	18.6	
Sand	river	m3	9.0	9.2	82.6	30%*100*0.3
diito transportation			9.0	1.2	11.1	
Supervisor	1	m-d	0.1	6.0	0.6	1x100/D
Common labor (site) Removal of big stone	10	m-d	1.0	4.5	4.5	10x100/D
Common labor (plant)	5	m-d	0.5	4.5	2.3	5x100/D
Stabilizer		day	0.1	910.4	91.0	Table 8-12
Motor grader		day	0.1	121.0	12.1	Table 8-7
Wheel Dozer		day	0.1	96.9	9.7	Table 8-3
Dump truck		day	0.3	115.1	34.5	Table 8-4
Tire roller		day	0.1	61.2	6.1	Table 8-9
Macadam roller		day	0.1	116.0	11.6	Table 8-8
Overhead	5%				48.0	
		total			1008.4 $/100m2	33.6 $/m3

Table 7-4 Unit rate for subbase by stabilizer tire type (per 100m2) Output per day is 1400m2

Name	Spec	Unit	Quantity	Rate	Amount	Remarks
Additives	Cement	ton	2.8	160.0	450.4	7.8%*100*0.2*1.8
diito transportation			2.8	4.4	12.4	
Sand	river	m3	6.0	9.2	55.1	30%*100*0.2
diito transportation			6.0	1.2	7.4	
Supervisor	1	m-d	0.1	6.0	0.4	1x100/D
Common labor Removal of big stone	10	m-d	0.7	4.5	3.2	10x100/D
Common labor	5	m-d	0.4	4.5	1.6	5x100/D
Stabilizer		day	0.1	910.4	65.0	Table 8-12
Motor grader		day	0.1	121.0	8.6	Table 8-7
Tire roller		day	0.1	61.2	4.4	Table 8-9
Macadam roller		day	0.1	116.0	8.3	Table 8-8
Overhead	5%				30.8	
		total			647.7 $/100m2	32.4 $/m3

Table 7-5 Unit rate by stabilizer movable plant (per 100m2) depth=200 Output per day is 540m2 (194ton/day)

Name	Spec	Unit	Quantity	Rate	Amount	Remarks
Additives	Cement	ton	1.9	160.0	304.7	5.3%*100*o.2*1.8
diito transportation			1.9	4.4	8.4	
Sand	river	m3	10.0	9.2	91.8	100*0.2*50%
diito transportation			10.0	1.2	12.4	
Supervisor	1	m-d	0.2	6.0	1.1	1x100/D
Common labor (site)	10	m-d	1.9	4.5	8.3	10x100/D
Common labor (plant)	5	M-d	0.9	4.5	4.2	5x100/D
Soil plant		day	0.2	444.9	82.4	Table 8-13
Wheel loader		day	0.2	96.9	17.9	Table 8-3
Dump Truck		day	0.4	115.1	42.6	Table 8-4
Motor grader		day	0.2	121.0	22.4	Table 8-7
Tire roller		day	0.2	61.2	11.3	Table 8-9
Macadam roller		day	0.2	116.0	21.5	Table 8-8
Overhead	5%				31.5	
		Total			660.5 $/100m2	33.0 $/m3

>Stabilization Cost 7.Work Unit Rate

Table 7-9 Unit rate of Stabilized Base Course (per 100m2) d=150 Output/day is 1400m2

Name	Spec	Unit	Quantity	Rate	Amount	Remarks
Grad adjust Aggregate	CBR80	m3	16.5	36.5	602.2	
Additives	Cement	ton	1.4	160.0	229.0	5.3%*100*o.15*1.8
Supervisor	1	m-d	0.1	6.0	0.4	1x100/D
Common labor (site)	2.4	m-d	0.2	4.5	0.8	0.24*10
Motor grader		day	0.1	121.0	8.6	Table 8-7
Tire roller		day	0.1	61.2	4.4	Table 8-9
Macadam roller		day	0.1	116.0	8.3	Table 8-8
Stabilizer		day	0.1	910.4	65.0	Table 8-12
Overhead	5%				42.7	
		Total			961.4	64.1
					$/100m2	$/m3

Table 7-6 Unit rate of Subgradee (per 100m2) depth=200 Output per day is 500m2 P2-18

Name	Spec	Unit	Quantity	Rate	Amount	Remarks
Soil	CBR10	m3	24.0	9.2	220.4	
Supervisor	1	m-d	0.2	6.0	1.2	1x100/D
Common labor (site)	3	m-d	0.6	4.5	2.7	3
BulDozer		day	0.2	125.3	25.1	Table 8-1
Tire roller		day	0.2	116.0	23.2	Table 8-9
Overhead	5%				13.6	
		Total			286.1	14.3
					$/100m2	$/m3

Table 7-7 Unit rate of Aggregate SubBase (per 100m2) d=200 Output per day is 1100m2 P11-9

Name	Spec	Unit	Quantity	Rate	Amount	Remarks
Laterite 70%	CBR30	m3	16.1	28.3	454.9	
sand 30%		m3	6.9	9.2	63.4	
Supervisor	1	m-d	0.1	6.0	0.5	1x100/D
Common labor (site)	2.4	m-d	0.2	4.5	1.0	0.24*10
Motor grader		day	0.1	121.0	11.0	Table 8-7
Tire roller		day	0.1	61.2	5.6	Table 8-9
Macadam roller		day	0.1	116.0	10.5	Table 8-8
Overhead	5%				27.3	
		Total			574.2	28.7
					$/100m2	$/m3

Table 7-8 Unit rate of Aggregate Base Course (per 100m2) d=150 Output/day is 1100m2 P11-10

Name	Spec	Unit	Quantity	Rate	Amount	Remarks
Grad adjust Aggregate	CBR80	m3	16.5	63.0	1040.1	
Supervisor	1	m-d	0.1	6.0	0.5	1x100/D
Common labor (site)	2.4	m-d	0.2	4.5	1.0	0.24*10
Motor grader		day	0.1	121.0	11.0	Table 8-7
Tire roller		day	0.1	61.2	5.6	Table 8-9
Macadam roller		day	0.1	116.0	10.5	Table 8-8
Overhead	5%				53.4	
		Total			1122.2	74.8
					$/100m2	$/m3

安定処理積算結果のまとめ

総括表を下記に示す

Table 6 Summary of Construction Cost with equipment cost

	method	Output	Cost	Cost Breakdown				Rate	Reference
		m2/day	$/100m2	Material	man-power	Equipment	Overhead	$/m3	
Subgrade 40cm Lime	by backhoe	180	694	397	28	235	33	17	Table 7-1
	by stabilizer crawler type	252	674	397	29	215	32	17	Table 7-2
Subbase 20cm Cement	stabilizer at mixing yard	1000	1008	788	7	165	46	34	Table 7-3
	by stabilizer tire type	1400	648	525	5	86	31	32	Table 7-4
	by stabilizer movable plant	540	661	417	14	198	31	33	Table 7-5
Stabilized Base Course d=150	By mortar grader	1400	961	602	1	21	43	64	Table 7-9
Subgrade depth=200	Not stabilization	500	286	220	4	48	14	14	Table 7-6
Aggregate SubBased=200	Ditto	1100	574	465	2	27	27	29	Table 7-7
Aggregate Base Course d=150	Ditto	1100	1122	1040	2	27	63	75	Table 7-8

>Stabilization Cost 6.Summary

従来工法との単価比較

以上の計算結果に基づき安定処理工法コストを従来工法と比較すると次のようになる。

Comparison of Rate of Each Project cost

Subgrade	PW basic methods	Japan standard	ADB	PP1budget(modified)	Stabilization
		Soil	Soil & sand	Lime stabilization	Lime stabilization
Output area					180-250m2/day
Thickness (inch)		8	16	16	16
Total cost $		286		56035	
$/m3		14	18	27	17
$/m2		2.9	4.5	6.3	6.9

Subbase	PW basic methods	Japan standard	ADB	PP1 budget (stabi)	Stabilization
	Laterite	Laterite/sand	Shingle / soil	Cement stabi	
Output area					500-1400 m3/day
(Volume)	100sud				
Thickness (inch)	6"	8	8	8	8
Total cost $	9,048	574		60134	
$/m3	32	29	44	40	32
$/m2	4.8	5.7	9.0	8.0	6.5

Base course	PW basic methods	Japan standard	ADB	PP1budget	Stabilization
	Aggregate	Aggregate	Crushed rock	Aggregate	
Output area					
(Volume)	100sud				
Thickness (inch)	6"	6	6	7	6"
Total cost $	14,653	1122		97323	
$/m3	52	75	102	80	64
$/m2	7.8	11.2	15.0	14.0	9.6
Reference	Analysis of Rates for Road works 9 & 10	StabilizationCost Table 7.6 & 7.7 & 7.8		PP1Cost (Version2) Improved Estimate	StabilizationCost Table 7.1 & 7.4 & 7.9

Stabilization cost 11

上記から比較してみると、路床安定処理は置き換えと同等、下層路盤での安定処理の単価は他の工法に比べ割安であるといえる。耐久性のある高価な砕石を用いた上層路盤にかわりセメント安定処理を用いた場合、ローコスト骨材が活用可能なので施工単価はかなり割安となる。

なお、PW の積算方法は、あいまいな点、間違いが多く、わかる範囲を修正したが、運搬費等不明なものもある

Dear Sirs

Questionnaires

We. JICA TCP team, are appreciating your participation to this Workshop.

This TCP (Technical Cooperation Project) for Improvement of Road Technology in Disaster-affected Areas in Myanmar has following Purpose:

- Improvement of Road technology standards and manuals for designing and construction works.
- Enhancement of the practical skills and knowledge of the road technical staff.
- Enhancement of the capacity of the Public Works (PW) for road construction adaptive to the delta areas of Ayeyarwady Region.

Now you are kindly requested to answer to following questioners:

1. TCP team has carried out following kinds of Seminar, Workshops and Trainings. Please put the mark on the right side as follows: ・: I have participated and got good knowledge for you future works △ : I have participated, but could not get good knowledge ✔ : I have not participated these kinds of Seminar, Workshop, Training	
1. Seminar at Nay Pyi Taw (Jun 13-14, 2013) about TCP outline	
2. Seminar at Nay Pyi Taw (May 22, 2014) about PP1 planning	
3. Workshop at CTC (May 27, 2013) about PCM Workshop	
4. OJT about Soil mix testing work	
5. Training in Japan (Sep 30 to Oct 11, 2013)	
6. Workshop at CTC (Dec 13, 2013) about Stabilization, Soft Ground Behavior	
7. OJT through Construction Supervision Work of PP-1	
8. Workshop at CTC (Mar 28, 2014) about high embankment analysis	
9. OJT for installation of equipment for high-embankment behavior observation work	
10. Training in Japan (Sep 28, to Oct 10, 2014)	
11. Training in Japan (Nov 2014)	
12. Training in Japan (Jan24~Feb 5) by HIDA[1]	
13. Workshop at BRL (Jun 3~Dec 10, 2014) about data analysis for stability and settlement	
14. Workshop at Bogale (Feb 23,2015) for Site Reconnaissance of high embankment work	
15. Workshop at Bogale (Apr 29, 2015) for Pilot Project 2---Today	
16. OJT for Construction Management (Apr~Mar 2015)—not yet	
17. Seminar at Nay Pyi Taw (Jun 18, 2015) about TCP summarization —not yet	

[1] The Overseas Human Resources and Industry Development Association

This is the question for the person who participated to some of above Seminar or Workshop or Training 2. Have you gotten some improvement or progress on your technical or engineering knowledge for the road design and construction through this TCP. Please select one from the followings:	
I received a good knowledge	
I received some reference	
I received some knowledge, but not so much	
Almost nothing	

3. TCP team has prepared and delivered following kinds of Manual or reference books. Please put the mark on the right side as follows: ・ : I have used these reference books on the execution of your project(s) △ : I have just read or looked ✔ : I have not received	
1. Soft Ground Treatment Manual (Draft)	
2. Text Book for Practical Training about Checking Methods for Stability & Settlement of High Embankment on Soft Ground	
3. Comments about Geometric Design and safety facilities of Expressway	
4. Training text at HIDA about Expressway	

Please fill your name and title

Name	
Title and/or position	
Phone Number	
Email Address	

Thanks your Cooperation

Analysis Results of Questionnares for PDM Indicators

Answer Total 50

1. TCP team has carried out following kinds of Seminar, Workshops and Trainings. Please put the mark on the right side as follows: ○: I have participated and got good knowledge for you future works △ : I have participated, but could not get good knowledge ✓ : I have not participated these kinds of Seminar, Workshop, Training		Output 2 ○:	△ :	✔ :	non	total	=○／(○＋△)
1. Seminar at Nay Pyi Taw (Jun 13-14, 2013) about TCP outline		1	2	40	7	50	33%
2. Seminar at Nay Pyi Taw (May 22, 2014) about PP1 planning		2		41	7	50	100%
3. Workshop at CTC (May 27, 2013) about PCM Workshop		4	1	38	7	50	80%
4. OJT about Soil mix testing work		1		43	6	50	100%
5. Training in Japan (Sep 30 to Oct 11, 2013)		2		41	7	50	100%
6. Workshop at CTC (Dec 13, 2013) about Stabilization, Soft Ground Behavior		6	1	36	7	50	86%
7. OJT through Construction Supervision Work of PP-1		9		35	6	50	100%
8. Workshop at CTC (Mar 28, 2014) about high embankment analysis		4	1	38	7	50	80%
9. OJT for installation of equipment for high-embankment behavior observation work		4		40	6	50	100%
10. Training in Japan (Sep 28, to Oct 10, 2014)				43	7	50	
11. Training in Japan (Nov 2014)		3		40	7	50	100%
12. Training in Japan (Jan24~Feb 5) by HIDA[1]				43	7	50	
13. Workshop at BRL (Jun 3~Dec 10, 2014) about data analysis for stability and settlement		9		34	7	50	100%
14. Workshop at Bogale (Feb 23,2015) for Site Reconnaissance of high embankment work		21		15	14	50	100%
15. Workshop at Bogale (Apr 29, 2015) for Pilot Project 2---Today		27	1	14	8	50	96%
16. OJT for Construction Management (Apr~Mar 2015)—not yet							
17. Seminar at Nay Pyi Taw (Jun 18, 2015) about TCP summarization —not yet							
	Total	93	6	541	110	750	
		12%	1%	72%	15%	100%	

Almost of participants on Apr 29, 2015 has not participated to the early stage seminar, and could not get answer.
Therefore TCP team has utilized the answer for the questionare, which was delivered to around 35 participants on the Seminar of Jun 14,2013. Summary of average answer were as folows:
1 Easiness for understanding = Comparatively easy
2. Interesting degree of contents = interesing

Indicatot 2.2 Output 2:
50% of participants evaluate training/seminar favorably

Results: Almost of participants for each training/ seminar answered to be favoravle (got good knowledge) as shwn in right summary Table.

This is the question for the person who participated to some of above Seminar or Workshop or Training 2. Have you gotten some improvement or progress on your technical or engineering knowledge for the road design and construction through this TCP. Please select one from the followings:		Project Purpose				
I received a good knowledge		17				
I received some reference			24			
I received some knowledge, but not so much				6		
Almost nothing					3	50

Indicator 1 for Project Purpose:
The enhancement of Skill and knowledge of the Engineer for road design and construction is confermed by the hearing from moretha 30 staff.

Questionare was delivered to around 50 participants on the Workshop, held on Apr 29 2015. And gtot answers from 36 engineers.
The Workshop is the first occasion for almost 70% of Engineers to participate to TCP trainings.
Alomost of the engineer participated to TCP training evaluated

3. TCP team has prepared and delivered following kinds of Manual or reference books. Please put the mark on the right side as follows: ○ : I have used these reference books on the execution of your project(s) △ : I have just read or looked ✓ : I have not received		Output 1 ○:	△ :	✔ :	no answer		
1. Soft Ground Treatment Manual (Draft)		2	9	31	8	50	18%
2. Text Book for Practical Training about Checking Methods for Stability & Settlement of High Embankment on Soft Ground		5	13	25	7	50	28%
3. Comments about Geometric Design and safety facilities of Expressway			4	38	8	50	0%
4. Training text at HIDA about Expressway			3	39	8	50	0%
		7	29	133	31	200	
		4%	15%	67%	16%		

Indicator 1-2 for Output 1:
More than 10 engineers are executing the work by using the manuals

This achievement ratio is not good
Only 3 engineers used the manuals.

契約変更追加

長期専門家の体制縮小に伴う業務補強のため、短期専門家の契約変更が 2014 年 5 月 28 日付けで行われた。

主な変更内容を下記に記す。

1.原仕様書の第 5 条業務の方針及び留意事項(2)派遣予定の長期専門家との役割分担につき、下記のように変更となった。	
原契約内容	変更後
「現在、本プロジェクトについては長期専門家として「チーフアドバイザー／道路政策・技術」、「道路技術基準」および「業務調整員」が派遣される予定であり、長期専門家は主に成果 1 に関する活動を行うことになる（「チーフアドバイザー／道路政策・技術」が総括をし、「道路技術基準」が主に技術基準・マニュアルの改善を行う）。」	「現在、本プロジェクトについては長期専門家として「道路技術基準」および「業務調整員」が派遣されており、長期専門家とコンサルタントの分業は下記の通りとする。ただし、長期専門家との綿密な協議・調整を行いつつ、業務を進めることとする。 ・長期専門家の活動内容 成果 1 に係る活動について、活動 1-1～1-3、1-5 に関すること。 ・コンサルタントの活動内容 成果 1 に係る活動について、活動 1-4 に関すること。 この活動において作成・修正される技術基準・マニュアルは下記のとおりとする。 「道路幾何構造基準」の修正 「軟弱地盤対策工指針」の作成 成果 2 に係る活動（特に変更はない）
2.原仕様書の第 7 条業務の内容(3)パイロット工事の選定につき、下記のように変更となった。	
「ただし、パイロット事業の選定時点から、第一期事業の開始までの期間は短期間となるため、機材調達スケジュール等も勘案して計画を立てる必要があり、真に必要となる以下の機材については携行機材として用意する。 ア)GPS 機材 イ)ミキシングバケット ウ)標準型 RI 密度水分計 エ)SJ 式現場試験機」	「ただし、パイロット事業の選定時点から、第一期事業の開始までの期間は短期間となるため、機材調達スケジュール等も勘案して計画を立てる必要があり、真に必要となる以下の機材については携行機材として用意する。 ア）トータルステーション イ）盛土沈下量・間隙水圧測定器具
3.原仕様書の第 7 条業務の内容につき、	下記が追加された。
(1)ワーク・プランの作成・協議 (2)パイロット事業候補地の現況調査および実施機関能力のベースライン調査 (3)パイロット工事の選定 (4)パイロット事業のための現地調査・試験の支援 (5)選定されたパイロット事業の事業計画策定支援 (6)パイロット事業の施工(管理)技術および施工監理に係る技術支援 (7)パイロット事業(施工)を通じた道路整備に関する研修の実施 (8)パイロット事業のモニタリング (9)ワークショップ/セミナーの開催 (10)プロジェクト業務進捗報告書の作成 (11)国別研修の実施 (12)国内支援委員会での報告 (13)プロジェクト業務完了報告書の作成	「(14)道路幾何構造基準の見直し ミャンマーに既存の道路幾何構造基準の記載内容の照査と現地道路調査を行い、課題の抽出・提示を行い、改訂（案）の作成と提案を行う。 調査対象の道路・区間の決定及び改訂作業は、C/P・長期専門家及びコンサルタントで協議・調整して協同にて実施する。 (15)「軟弱地盤対策工指針」の導入 「道路土工軟弱地盤対策工指針」（日本道路協会発行、平成 24 年版）を翻訳（英語）し、地盤・地質調査やパイロットプロジェクトの結果等を反映させ、指針（案）の作成と提案を行う。指針（案）の作成にあたっては、長期専門家及び国内支援委員会で協議・調整して決定する。 (16)道路技術基準・マニュアル作成に係るワークショップ／セミナーへの参加・協力 長期専門家の活動 1-5 に関して、道路技術基準・マニュアルの内容を共有するために開催されるワークショップ／セミナー等へ参加・協力する。コンサルタントは上記の(14)および

<table>
<tr><td></td><td>(15)に関する内容について担当する。場所は中央訓練センター（ヤンゴン）または事業サイトとし、参加人数は 50 人程度を想定し、実施回数は 2 回を予定する。</td></tr>
<tr><td>4.原仕様書の第 10 条成果品等(1)報告書等につき、</td><td>下記が追加された。</td></tr>
<tr><td>
<table>
<tr><td>レポート名</td><td>提出時期</td><td>部数</td></tr>
<tr><td>業務計画書</td><td>契約後 10 日以内</td><td>和文 3 部</td></tr>
<tr><td>ワークプラン</td><td>2013 年 5 月下旬</td><td>英文：10 部</td></tr>
<tr><td>プロジェクト業務進捗報告書（第一期/第二期）</td><td>第一期：2013 年 12 月下旬
第二期：2014 年 10 月下旬</td><td>和文 8 部
英文：11 部</td></tr>
<tr><td>パイロット事業結果報告書（第一期/第二期）</td><td>第一期：2014 年 6 月下旬
第二期：2015 年 6 月下旬</td><td>和文 8 部
英文：11 部</td></tr>
<tr><td>プロジェクト業務完了報告書</td><td>2015 年 8 月 19 日</td><td>和文 8 部
英文 11 部
CD-R3 枚</td></tr>
</table>
</td><td>
<table>
<tr><td>レポート名</td><td>提出時期</td><td>部数</td></tr>
<tr><td>道路幾何構造基準（案）</td><td>2015 年 1 月下旬</td><td>英文：11 部</td></tr>
<tr><td>軟弱地盤対策工指針（案）</td><td>2015 年 1 月下旬</td><td>英文：11 部</td></tr>
</table>
</td></tr>
<tr><td>5.原仕様書の第 10 条成果品等(2)技術協力成果品等につき、</td><td>下記が追加された。</td></tr>
<tr><td>1)各種研修資料
2)実習用のマニュアル等</td><td>3)道路技術基準・マニュアル類のレビュー結果及び改訂内容</td></tr>
<tr><td>2 業務量の目途</td><td></td></tr>
<tr><td>原契約内容</td><td>変更後</td></tr>
<tr><td>現地作業：44.63MM
国内作業： 2.00MM
合計：46.63MM</td><td>現地作業：59.14MM
国内作業： 2.43MM
合計：61.57MM</td></tr>
</table>

プロジェクト業務完了報告書として提出する書類一覧
（CD Soft Copy 共）

区分	和文	英文
A	プロジェクト業務完了報告書本文	Project Completion report
A	Annex1-1&2 PDM（改訂版） Annex1-3&4 PDM（原案） Annex1-5 MD の署名入り指標の変更承認	Annex1-1&2 PDM (Ver 2.0) Annex1-3&4 PDM (Ver 1.0) Annex 1-5 Acceptance of Indicator by MD
A	Annex2-1 業務フローチャート（改訂版） Annex2-2 業務フローチャート（原計画）	Annex 2 Work Flow Chart　(Revised version)
A	Annex2-3 専門家要員計画（最新版）	-
A	Annex2-4 専門家派遣実績	-
A	Annex3-1 報告書リスト	Annex3-1 Report List
A	Annex3-2 打ち合せ簿リスト	-
A	Annex3-3 現地打ち合せ記録リスト	-
A	Annex4-1 JCC 議事録 Annex4-1 JCC Meeting Minutes	Annex 4-1 Record of JCC
A	Annex4-2 中間評価時の合意議事録	Annex 4-2 Minute of Agreement on Mid Term Review
A	Annex4-3 終了時評価時の合意議事録	Annex 4-3 Minute of Agreement on Terminal Evaluation
A	Annex5　ベースライン・データ	Annex 5 Baseline Data
A		
A	Annex6　技術協力成果品各種要領最新版ドラフト	Annex 6 Prepared documents (Output of TCP)
I-1	Annex6-1 Reference Paper for Road Stabilization.docx (I-1)	Annex6-1 Reference Paper for Road Stabilization.docx (I-1)
I-2	Annex6-2 安定処理の積算方法 (I-2)	Annex-6-2 Example of Cost Estimation for Stabilization (I-2)
A	Annex7　Enquete to PW staff to confirm the Project Effectiveness	Annex7 Enquete to PW staff to confirm the Project Effectiveness
A	Annex8 2014 年 8 月契約変更の概要総括	Annex8 Monitoring Item (Draft)

以下は別途提出済み　　ソフトを CD に添付

区分	和文	英文
B	業務計画書(和文)	
C		Work Plan
D-1	プロジェクト業務進捗報告書(第一期)（和）	Project Progress Report Term 1 (December 27, 2013)
D-1’		Report on Site Survey for Roads in Ayeyarwady Region （March 2013）
D-2	プロジェクト業務進捗報告書(第二期)（和）	Project Progress Report Term 2 (January 20, 2014)
E-1	パイロット事業結果報告書 (第一期) （和） Vol. 1: Main Text Vol. 2: Appendices A): Pavement design B): Mixing laboratory test Report on Stabilized Material (March, 2014) 活動 2.1.4 C): Quantity Test Results D): Dimension Management Results E): Soil test	Completion Report on Pilot Project (Phase-1) July 2014 Vol. 1: Main Text Vol. 2: Appendices A): Pavement design B): Mixing laboratory test Report on Stabilized Material (March, 2014) 活動 2.1.4 C): Quantity Test Results D): Dimension Management Results E): Soil test

	F): Daily Progress Report (Feb-Jun, 2014) G): Weekly Meeting Memo H): Equipment management I): Summary of Input to PP-1	F): Daily Progress Report (Feb-Jun, 2014) G): Weekly Meeting Memo H): Equipment management I): Summary of Input to PP-1　PP-1 記録調書（労務、材料、機材）の整理・集計

以下の 10 部 は(特記仕様書 10 条の 1 項に記載の報告書等等として)別途製本提出するものであるがソフトを CD に添付

区分	和文	英文
E-1		PP1 Soil Investigation Report
E-21		PP2 implementation program
E-21	パイロット事業結果報告書 (第二期第 1 部 路盤安定処理) （和） Main Text Appendices A): Pavement design Report B): Report on Stabilized Material Test C): Work Quantity D): Drawings of Soil Plant Foundation E) Test Reports on Alkaline Digestion Method	Completion Report on Pilot Project (Phase-2, Part 1, Stabilization of base course) July 2015 Main Text Appendices A): Pavement design Report B): Report on Stabilized Material Test C): Work Quantity D): Drawings of Soil Plant Foundation E) Test Reports on Alkaline Digestion Method
E-22	パイロット事業結果報告書 (第二期) （和） 第 2 部高盛土動態観測 和文報告書本文 Appendix 1 写真集 Appendix 2 Measured Row data	Completion Report on Pilot Project (Phase-2, Part-2, High embankment Behavior Observation Work) July 2015 Main Text Appendix 1 Photo Report Appendix 2 Measured Row Data
E22		Text book for Practical Training for checking methodology of high embankment on soft ground
F		Soft Ground Treatment Manual（ミャンマー用最終盤）
G		道路幾何構造基準（案）名称変更 「Technical Note on National Road & Expressway (Geometric Feature & Traffic Safety Device)」
H		その他技術協力成果品として Pre-Survey Report of Ayeyarwady Road

以下は CD の中に Soft Copy としてのみ添付

F		軟弱地盤対策工指針　英語翻訳原文
J	セミナー資料　20130613-14 PCM	
J	セミナー資料　20140522　橋梁塩害 道路改良	
J	セミナー資料　20140528　PP-1 報告会	
J	セミナー資料　20150614　TCP 完了報告	
K	ワークショップ資料　20130527　PCM	
K	ワークショップ資料　20131213　安定処理 & 高盛土	
K	ワークショップ資料　20140328　高盛土	
K	ワークショップ資料　20150223　高盛土現地見学	
K	ワークショップ資料　20150429　安定処理の集中研修	
L	OJT 資料　201403-201412　高盛土室内研修	
L	OJT 資料　201403-201412　観測用機器設置	
L	OJT 資料　201403-201412　観測用観測方法	
M	収集資料	M-1 Report on Subsurface Soil Investigation of KCYK bridge
M		M-2 ADBEngReport1309