

タイ国首都圏都市交通計画 事前調査報告書

昭和53年 8 月

国際協力事業団

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序 文

タイ国政府は日本国政府に対し、バンコック市郊外部における大量輸送機関に関する調査、
鉄道の定期旅客輸送に関する調査、及びバンコック市々街地における鉄道の高架化に関する調査
の3件の交通関係調査を要請した。

これに対し、日本国政府は同要請の重要性に鑑み、政府ベースの技術協力の一環として実施することとし、国際協力事業団にその実施を指示した。当事業団は、運輸省鉄道監督局電気技術官福田安孝氏を団長とする事前調査団を昭和53年7月12日より7月26日まで現地へ派遣し、タイ国政府関係機関との協議及び調査を行った。調査団の目的は、これら計画の意義及び内容を確認するとともに、可能ならばこれら三条件を調整することであったが、幸にしてタイDTEC、内務省、ETAを初めとする関係者の協力もあって、無事調査を終了することが出来た。

今般、ここに調査の検討を終え、成果をとりまとめ報告書を提出するはこびとなった。この報告書が、タイ国の社会、経済の発展に寄与し、かつ、日・タイ両国の友好親善の一助として役立つならば、これにまさる喜びはない。

おわりに、本調査に協力されたタイ国政府関係者及び在タイ日本側関係者に対し心から感謝するとともに、今後の調査が順調に実施されることを期待するものである。

昭和53年8月

国際協力事業団
社会開発協力部
部長 廣田孝夫

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I. 調査日程及び団員構成

1. 調査日程

1	7月12日(水)	東京 — Bangkok (JL 717便)
2	13日(木)	大使館、JICA事務所訪問、ETA調査打合せ
3	14日(金)	ETA、SRTと打合せ、DTECにて関係機関と打合せ
4	15日(土)	Bangkok駅視察、Nopburiまで郊外部視察(鉄道)
5	16日(日)	資料整理
6	17日(月)	NESDBと打合せ、ETA、SRTと打合せ
7	18日(火)	内務省都市計画局と打合せ(SRT、ESCAP、BMTA同席)
8	19日(水)	市内バスターミナル視察
9	20日(木)	調査団打合せ
10	21日(金)	内務省、Bangkok市、BMTAと打合せ
11	22日(土)	市内バスターミナル視察、市内道路事情視察
12	23日(日)	資料整理、Summary of Discussions 準備
13	24日(月)	ETAと打合せ
14	25日(火)	ヘリコプターにてBangkok市及び郊外部視察 DTECにて関係機関とSummary of Discussions 討議、署名
15	26日(水)	Bangkok — 東京 (AZ 778便)

2. 調査団員

団長	福田安孝	運輸省	鉄道監督局土木電気課電気技術官
団員	下田公一	建設省	都市局都市計画課々長補佐
"	浅野光行	建設省	建築研究所都市施設研究室長
"	大森寿明	運輸省	鉄道監督局総務課補佐官
"	阿部英樹	国際協力事業団	社会開発協力部開発調査課々長代理

3. 関係機関名

DTEC	: Department of Technical and Economic Cooperation
ETA	: Expressway and Rapid Transit Authority of Thailand
SRT	: State Railway of Thailand
DTCP	: Department of Town and Country, Ministry of Interior
UTPO	: Urban Transportation Planning Office
NESDB	: National Economic and Social Development Board
BMTA	: Bangkok Mass Transit Authority

II. 調査概要

1 背景

バンコック市はタイ国の首都でありチャオプラヤ川に沿って開け、市の西側及び南側は川により分断されている。市の面積は約3,000平方キロメートルあり、人口は約450万といわれ、その約4分の3は市の中央部（半径10キロメートル以内）に居住しているといわれている。

主要道路及び鉄道は添付地図（資料1）に見られる如くであり、幹線道路は、総じて四～六車線であり広く取っている感を受けた。鉄道は、北及び東からほぼ中央に入り、西からは川の西岸まで入っているが、都市間輸送を目的としているので列車回数も少なく、一部近距離輸送としてジーゼル車（6両編成程度）を走らせているが、一時間に1本程度であり都市内交通機関としての利用価値は低い。

したがって都市内交通として大量輸送機関の役割をはたしているのはBMTA（資料2）によるバス輸送のみである。市内バスは105系統あり、1日約300万人を輸送している（資料1および2）。その他BMTAではミニバス（地域的な不定期バス）を運行している。料金は市内一円（約10キロメートル程度）1パーツ（日本円換算10円）と安いので利用が多いが、ホワイトカラーの通勤の足としては、自家用車指向が強く、道路混雑の元凶となっている。

BMTAでは約5年程前に大量にバスを投入し、自家用車からの乗客移入を計ったが、かえって道路混雑を増したと云われており、BMTAの調査によれば、中央部では交通混雑のため10km/H程度の速度であるとされている。

その他の交通機関としては小型貨物車を改造し、荷台に乗客10人～20人を乗せているもの（法的には貨物車として扱われている）、小型3輪車のサムロ（乗客2～3人）及びタクシーがある。

また、市内には多くの水路があり、水上生活者も多く、水上バス、水上タクシー、自家用船と水上交通も活発である。市をはずれると、水路のまわりに数軒の家があつまり、水路を生活の基本としているようすが見られる。

交通信号機系は、英国式を採用しており、交通信号は交差点中央低位置に表示され、現在英国の協力により交通信号体系の近代化をはかっている。比較的歩道と車道がよく区分されており、交通渋滞と交通事故防止のため歩道橋の建設も積極的に実施されつつある。道路の立体交差（四～六車線のうち中央の2車線を立体化）も各所に見られる。幹線街路は上述した如く立派に完成しているが、補助幹線街路の整備及び、信号処理が不十分であり、かつ交差点が非常に多いため交通混雑が著しい。

以上のような交通状況に鑑み、タイ政府は道路混雑の解消のため貨物車の市内通行の時間制限等交通規制を行うとともに、根本的な都市交通対策を立案するため総合的な都市

交通計画の立案を西ドイツ政府の援助により市中心部（中心より半径約10キロメートル以内）の調査を実施する一方、その実施機関としてE T A（資料3）を設立、都市交通の分野を担当させることとした。

西ドイツレポートにより Rapid Transit System 3路線、Express Way 3路線のマスタープランをたて、Express Way の建設を開始するとともに Rapid Transit System の詳細設計を今年より1年間の予定で西ドイツ、スイス及びタイの合同コンサルタントに依頼（資料4）、7月19日その調印が行なわれた。西ドイツレポートによれば、当初道路を立体化したバス専用道を作り、のちにこれを Rapid Transit System に使うとの案が示されたが、タイ国政府としては、需要及び移行時の問題等から直ちに Rapid Transit System を導入したいとしている。Rapid Transit System の方式としては展示写真等からモノレール又はいわゆる新交通システムの如きものが推察される。

既成市街地については上記の方策により交通問題解決の一助とするがバンコック市としては、市街地内の道路網及び道路施設の整備、市街地における道路と鉄道の平面交差の解消、市街化されつつある郊外部の交通網の整備等々まだまだ解決しなければならない交通問題は多い。

そこでタイ国政府は、我国政府に対し、バンコック市郊外部における公共輸送機関網に関する調査（資料5）、鉄道による定期旅客輸送に関する調査（資料6）及び市街地における鉄道の高架化に関する調査（資料7）の実施を要請した。

2. バンコック市郊外部における大量輸送機関網に関する調査

バンコック首都圏の人口は、急速に増加する傾向にあるとともに、郊外部においては、住宅の郊外への発展が急激に進んでいる。バンコック市としては、これら郊外地区から中心街までの通勤輸送を含む交通網の整備が必要となっている。そこでタイ国政府は、郊外地区における交通計画をE T Aを中心として調査を実施しようとしている。

E T Aは、創立以来5年と日が浅く、Dr. Tongchat 総裁以下若いスタッフが多いが、市の交通問題解決に積極的に取組んでおり、本件調査についてもE T Aの当初計画より約1年遅れていることもあって出来るだけ早く実施して欲しいと積極的な態度を持っていた。

これを支援するS R T、D T C P、U T P O等もS R Tがやや消極的ではあったが全て本件調査につき理解を示していた。また、政策決定及び事業実施承認機関であるNESDBにあってもこれを承知していた。

我々とタイ国関係機関との討議の内容はSummary of Discussionsとして確認してあるのでこれにより承知願いたい。調査範囲は中心から40～50キロメートル以内（ほぼバンコック市全域）とし、郊外部と都心部（Central Area）との交通及び郊外部内での交通について、既存交通施設 — 中心街におけるものも含む — の若干の改良等を含め、郊外部における大量輸送機関網（鉄道、バス及びそのための幹線道路網の整備問題）の総合

計画を立案するための調査である。

我々は、鉄道及び高速道路による視察並びにヘリコプターによる空からの視察を行ったが郊外部はまだ湿地、田地が多く、開発の余地は十分あると認められる。市の住宅開発も東北部地区において10万人単位で50ヶ所の計画があるが本格的な実施は未だ行われていないようであるが、視察の途中、東部地区において、アパート群（1階部空洞で、2階から居住区となる高床式で5階建て）の建設が見られた。

3 鉄道の定期旅客輸送に関する調査

本件は、SRT（資料8）により要請されたものであるが、バンコック中心部より約100～130キロメートル圏にある都市からの定期旅客輸送に関するものであるがSRTに具体的な案の腹づもりがなく、我々との討議においても明確化し得なかった。そこで、検討・協議の結果、SRTの鉄道の有効利用は、郊外部の大量輸送機関網を検討するにあたって当然検討すべきであり、その際SRTの都市間輸送に関する需要として50～130キロメートル以内（Lop Buriあたりまで）の都市からの旅客数についても考慮することとし、郊外部の大量輸送機関網の調査と切離す必要はないと結論した。

4 バンコック市々街地における鉄道の高架化に関する調査

先にも述べた如く、鉄道は、北及び東からNorthern Line及びEastern Lineが市街中心部のバンコック中央駅まで入っている。また、Eastern Line途中から港への分岐線がある。これら各線は市街地において主要道路と14ヶ所で平面交差しており、モータリゼーションの波は主要道路の混雑を増すとともに、これら踏切道における安全をも低下させることとなっている。

1975年、ESCAPのJoint Roving Teamは、バンコック市々街地における鉄道の高架化をタイ政府に勧告した。

そこでSRT及びDTCPは、鉄道を高架化し、踏切道を除去するとの意図をもって本件調査を要請したものである。

SRT及びDTCPは高架化の推進につき十分な熱意があり、将来のバンコック市の発展、道路の有効利用、踏切道の保安等（踏切道の交通量についてはEastern Lineの一部について実施した結果は、いずれも片道最高3,000～4,000台/時であったと云われていた。）を考えると鉄道を高架化することは最適であると思われ、その必要性もあると思われる。

我々は、到着直後、関係機関との総合会議を行ったがその席上、NESDBよりESCAP（オブザーバーとして出席）に対し、鉄道の高架化の便益につき疑問が出されたこともあり、日をあらためてNESDBと意見交換を行ったところ、NESDBより「約5年前に鉄道の高架化については経済的な便益がないとのことで計画の検討を取り止めており、現在でも当時と情勢が変わったとは思えないし、SRTよりこの件についてその後も何の説明を

受けていない。NESDBとしては鉄道の高架化よりも金がかからないこともあり道路を上げる方針である（2車線の立体化を考慮しており、たとえ4車線あげるとしてもこの結論は変わらない）。本年も世銀資金（道路改良に対し借款したもの）を使って2ヶ所の立体化（Eastern Lineに係るもの。UTPOは承知していた。）を行うつもりである。高架化について調査を行うことについてはこれを妨げるつもりはないが、その実施については考えていない。ETAの新しいSystemとの関係においても道路を上げることは問題はないと思うし、その他にも何ら問題はないと思っている。」との意見が出された。

そこで我々は、再度SRT、DTCP等関連機関と話し合った結果、先方より政府内の意見を早急に統一し、再度日本側へ要請するとの提案があり討議を終えた。

調査団の視察によれば、踏切道における自動車の通行方法は、日本のように自動車の踏切前一時停止がなく、そのまま通行しており、列車の運行回数も少なく、速度も低いので、あまり気にも止めずに通行しているようで踏切道内で停車しているものも見られた。また地方部においては、遮断機が降下しているにもかかわらずS字型に通行しているものも見受けられる仕末であった。短時間ではあるが列車の踏切道通過時には、渋滞がないわけではないが大きな不満があるとは見受けられず、総じて踏切道の保安に対する意識は低いように見受けられた。

また現在Northern Lineの中央駅を出た近くに、道路を鉄道上に立体交差化した箇所がある（仮設と聞いていたが出来上がった時は永久構造物になっていたと言あり）が、4車線中2車線を立体化したのみで踏切道は除去されておらず道路混雑の解消を目的にしていると思われる。NESDB等との議論においても、西独の検討したcomprehensive studyであるとの表現があり、したがって鉄道高架化問題は既成市街地におけるSRTの果すべき役割りを都市交通の観点から（現在は幹線都市間輸送のみ）総合的に検討することが必要と思われる。

Ⅲ. 調査結果

1. 結論

今回調査の討議及び調査の結果は、別添 Summary of Discussions（資料9）のとおりである。

郊外部における大量輸送機関網に関する調査については、バンコック市の抱える人口問題は、市街地のみで解決出来ることではなく、郊外部のあり方に大きく係りを有し、郊外部を含めてその解決を計らなければならない。したがって郊外部は必然的に開発され、また開発されねばならないと判断され、大量輸送機関の必要性が認められる。現在、郊外部は十分に開発された状況ではなく、開発の方向をも含めて先ず人口配置とマッチした総合的な交通の基本計画の策定から始めねばならないが、単に基本計画にとどまらずさらに詳細

な調査に発展させ、長期的に調査を行い、バンコック市全体の交通問題として、これをとらえて行く方向が望ましい。さらに附言すれば E T A、S R T 等に長期の専門家を調査とは別に派遣することも有効であると考えられる。(注：E T A より正式に 3 名の長期派遣専門家の要請があった。)

また、本件調査に対するタイ国政府の認識も高く、E T A を初めとする受入態勢も整っているためタイ側の希望する調査 (comprehensive study) を実施する方向で検討することが妥当である。

鉄道の commuter traffic に関する調査は、郊外部の交通サービスのあり方とも十分の係りを有するので上記郊外部大量輸送機関の調査に含め、郊外部の交通調査の一環として処理することとした。その結果、E T A 及び S R T より、両者をまとめた T/R が提出された (資料 1 0) 。

鉄道の高架化に関する調査については、高架化することが最適であることは E S C A P 勧告等より見て肯定出来るが、調査を実施しても鉄道を高架にすることが政策的に取入れられない恐れがあると判断されるので、タイ政府内部での意見統一を待って再検討すべきと考えられる。

2. 所 感

今後の調査の参考として我々が今回の調査を通じ感ぜられたところを列挙する。

(1) 郊外部における大量輸送機関について

- (イ) 郊外部は未だ開発されていない段階であるので開発されたところのみ取らわれず、今後開発し得るところを含め判断する必要がある。
- (ロ) 開発される地域については関係機関より政策的な要求が多く出されると考えられるので関係機関の意見を集約出来る方策を取る必要がある。
- (ハ) 政策的な要求にとらわれず開発効果の面から十分検討する必要があるとともに、策定された計画を関係機関に十分説明出来るようにする必要がある。
- (ニ) 鉄道等既存施設の改良等により投資効果を高めることは勿論であるが、交通機関毎に個々のイメージもあるので、改良、新設等による利用開発を含めて考える必要がある。
- (ホ) 現在のところ市街地における大量輸送機関が明確ではないので市街地内でのスプロールについても十分配慮し、整合する必要がある。
- (ヘ) 航空写真等の入手が困難と思われるので实地踏査等が必要と思われる。
- (ロ) バンコック市の人口、産業構造等の将来についても十分な配慮をしないと、発生原単位、交通特性、利用交通機関が現在と大巾に変る可能性があり、土地利用計画は現在従覧中との事であるが、単なる土地利用よりもう少し詳細なチェックをしておく必要があると思われる。

例えば西独のパーソントリップ調査によると、平均 1.15 Trip/日となっているが、わが国では 2.5～3.0 Trip/日である。

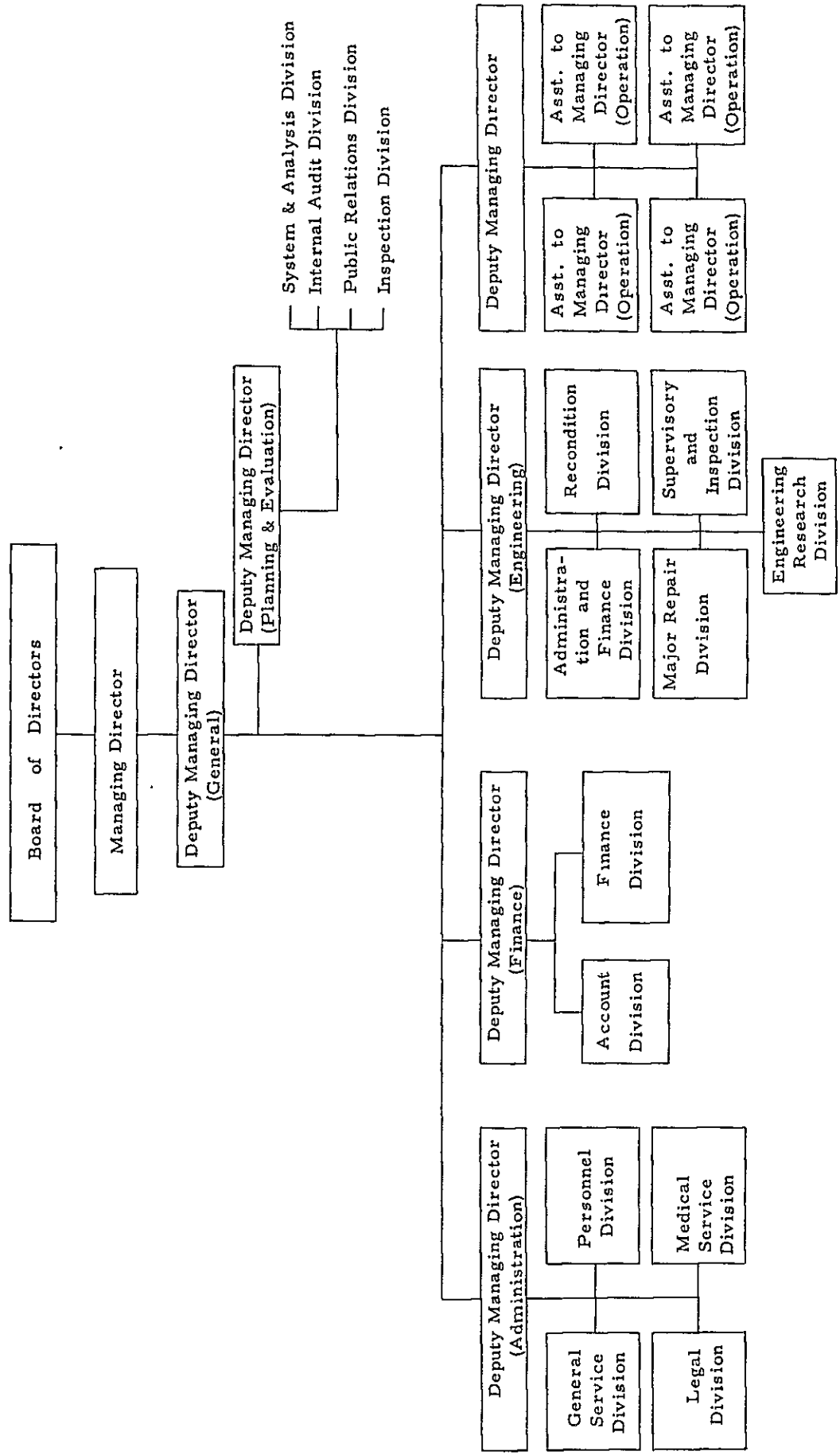
(2) 鉄道の高架化に関する調査について

- (イ) 単に鉄道と道路の交差点解消との狭い観点よりも S R T 鉄道の都市交通としての位置付けを含めて総合的に検討する必要がある。
- (ロ) 鉄道及び道路サイドにおいて高架化による社会的、経済的便益を如何に吸い上げ利用して行くかの見通しをたてるとともに、計画をさらに積上げて、政策的に有効なものとするべきと思われる。
- (ハ) S R T は新しいことに消極的であるが、列車増発、旅客の利便増加等につき確たる見通しを持って大量輸送機関として市民にその必要性を認識させる努力が必要と思われる。
- (ニ) 踏切道の解消はいずれにしても行わなければならない事柄であり、大量輸送機関としての改良、増設を検討しつつ合せ考えて行くことも必要であろう。

資 料 編

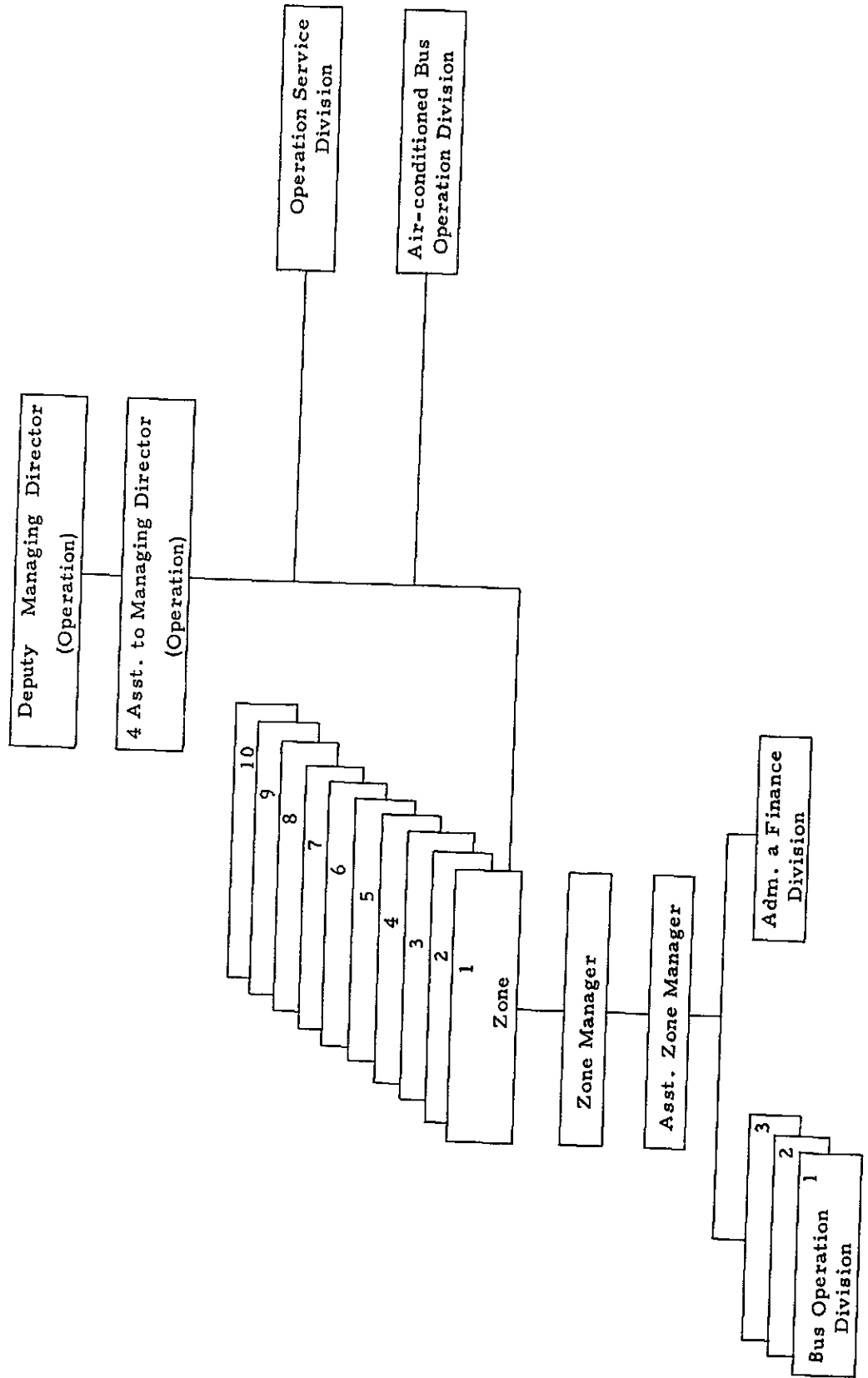
資料 1 - (1) Bangkok の市地図





BANGKOK MASS TRANSIT AUTHORITY

OPERATION CHART



BANGKOK MASS TRANSIT AUTHORITY

Zones and Bus Routes

Ordinary Bus

Zone	Route No.	Name of Routes	Route Distance (Km)
<u>ZONE 1</u> (Phaholyothin)	3	Ban Pak Rod Fai km. 11 - Klong San	17
	24	Pracha Nives 2 - Victory Monument	20
	29	Rangsit - Phaholyothin - Hua Lam Pong	32
	34	Rangsit - Super Highway - Hua Lam Pong	33
	39	Don Muang - Sanam Luang	32
	44	Morchit - Tha Tien	13
	59	Don Muang - Sanam Luang	30
	Total	7 routes	
<u>ZONE 2</u> (Bangkapi)	8	Latphao - Sapan Phuthayodfar	20
	11	Dindang - Sapan Phuthayudfar	14
	26	Minburi - Sapan Knao	28
	27	Klong Koom - Klong Tuey Port	30
	58	Ramkhamhaeng University - Bangkoknoi	28
	60	Klong Chan - Pak Klong Talad	24
	61	Ramkahaeng University - Victory Monument	12
	71	Klong Chan - Wat Pho	25
	92	Ramkhamhaeng University - Victory Monument	29
	93	SEAP Games Village Sipraya	17
	94	Miburi - Sanam Luang	31
	96	Kong Chan - Nang Loeng	18
	95	Don Muang - Klong Tuey Port	13
	118	Minburi - Nong-Chok	20
			(Express)Ramkhamhaeng University - Sisaon Theves
Total	15 routes		309

Zone	Route No.	Name of Routes	Route Distance (Km.)
<u>ZONE 3</u>			
(Sukumvit)	2	Samrong - Pak Klong Talad	24
	23	On Nuch - Sisao Theves	16
	25	Pak Nam Thachang Wang Luang	31
	38	Morchit - Ekamai	14
	46	Bang Chak - Hua Lom Pong	16
	48	Samrong - Wat Pho	19
	72	Tharue - Sisao Theves	25
Total	7 routes		145
<u>ZONE 4</u>			
(Tharue-Thanon Tok)	1	Thanon Tok - Tha Tien	12
	4	Thanam Pasi Charoen - Klong Tuey Port	22
	22	Thanon Tok - Ramkhahaeng University	20
	35	Sathu Pradit - Sao Ching Cha	12
	45	Banglampoo - Suan Lumpini	10
	47	Klong Tuey Port - Dept. of Land	14
	62	Sathu Pradit - Victory Monument	15
	89	Sanam Luang - Technical College	16
	205	Pak Tho (Km.1) - Technical College	16
Total	9 routes		142
<u>ZONE 5</u>			
(Charoen Nakorn-Bangpakok)	6	Bookkalo - Sisao Theves	14
	10	Wat Sing - Nang Loeng	14
	20	Pom Prachun - Thanom Dindang	28
	21	Suan Thonburirom - Chula	12
	32	Pak Kred - Bangpakok (Also included in Zone 8)	31
	37	Bangpakok - Nang Loeng	16
	68	Bangkok - Banglumpoo	12
	75	Suan Tonburirom - Tha Tien	21
	82	Prapradang - Sapan Phuthayodfar	14
	85	Wat Changron - Sanam Luang	19

	86	Prapradang - Banglampoo	19
	87	Suan Thonburirom - Nang Loeng	16
	88	Thung Karu - Klong San	15
Total	13 routes		231
<u>ZONE 6</u>			
(Bangkae)	7	Klong Kwang - Nopawong	25
	19	Circle Line Bangkoknoi - Sisaó Theves	16
	41	Muban Sethakit - Sao Ching Cha	22
	42	Circle Line Siriraj - Sao Ching Cha	15
	43	Wat Sing - Banglampoo	16
	57	Circle Line Thonburi	15
	79	Tali gchan - Sao Ching Cha	8
	80	Nong Kam - Sanam Luang	23
	81	Bangkae - Siirraj	12
	83	Talingchan - Bangkoknoi	6
	84	Om Noi - Klong San	28
	91	Muban Sethakit - Sanam Luang	22
	1124	Nong Kam - Bang Kae	10
Total	13 routes		218
<u>ZONE 7</u>			
(Charan Sanitwong)	9	Thanam Pasi Charoen - Siyan	11
	14	Siyan - Klong Tuey Port	22
	15	Sapan Krungthep - Banglampoo	14
	17	Sapan Krungthep - Banglampoo	24
	28	Morchit - Sai Tai	14
	40	Ekamai - Sai Tai	16
	53	Circle Line Theves	13
	56	Circle Line Sapan Krungthon	17
	76	Wat Lao - Suan Lumpini	15
	78	Sathorn - Banglampoo	12
	202	Chula - Sanam Luang	9
Total	11 routes		175

<u>ZONE 8</u>			
(Nontaburi)	18	Rama 6 - Sipraya	17
	30	Nontaburi - Sai Tai	16
	31	Pathum Thani - Thachang Wang Luang	35
	32	Pak Kred - Bangpakok (also include in Zone	31
	33	Pathum Thani - Sanam Luang	43
	51	Pak Kred - Sanam Luang	26
	52	Pak Kred - Victory Monument	26
	63	Nontaburi - Victory Monument	11
	64	Nontaburi - Sanam Luang	13
	69	Sanam Binnam - Morchit	20
	90	Bangpoon - Sanam Luang	48
	203	Nontaburi - Sanam Luang	14
	1130	Kong Bin - Victory Monument	20
Total	13 routes		320
<u>ZONE 9</u>			
(Bangsue - Bangsorn)	5	Thanum Kaikay - Chakawat	21
	16	Tao Poon - Surawong	17
	49	Bangsorn - Samyak	12
	50	Rama 4 - Suan Lumpini	17
	55	Circle Line Amnuay Songkram	19
	65	Rama 6 - Tha Tien	18
	66	Pracha Nives 1 - Thanam Pasi Charoen	27
	67	Pracha Nives 1 - Technical College	23
	70	Pracha Nives 2 - Sanam Luang	16
Total	9 routes		170
<u>ZONE 10</u>			
(Huay Kwang)	12	Huay Kwang - Ministry of Commerce	13
	13	Huay Kwang - Klong Tuey Port	13
	36	Sapan Kwai - Sipraya	10
	54	Huay Kwang - Rob Muang	19
	73	Dindang - Sapan Phuthayudfar	12
	74	Huay Kwang - Klong Tuey Port	14
	77	Victory Monument - Silom	7

Total	201	Sanam Luang - Victory Monument	8
	204	Thanam Rajawong - Victory Monument	8
	9 routes		104

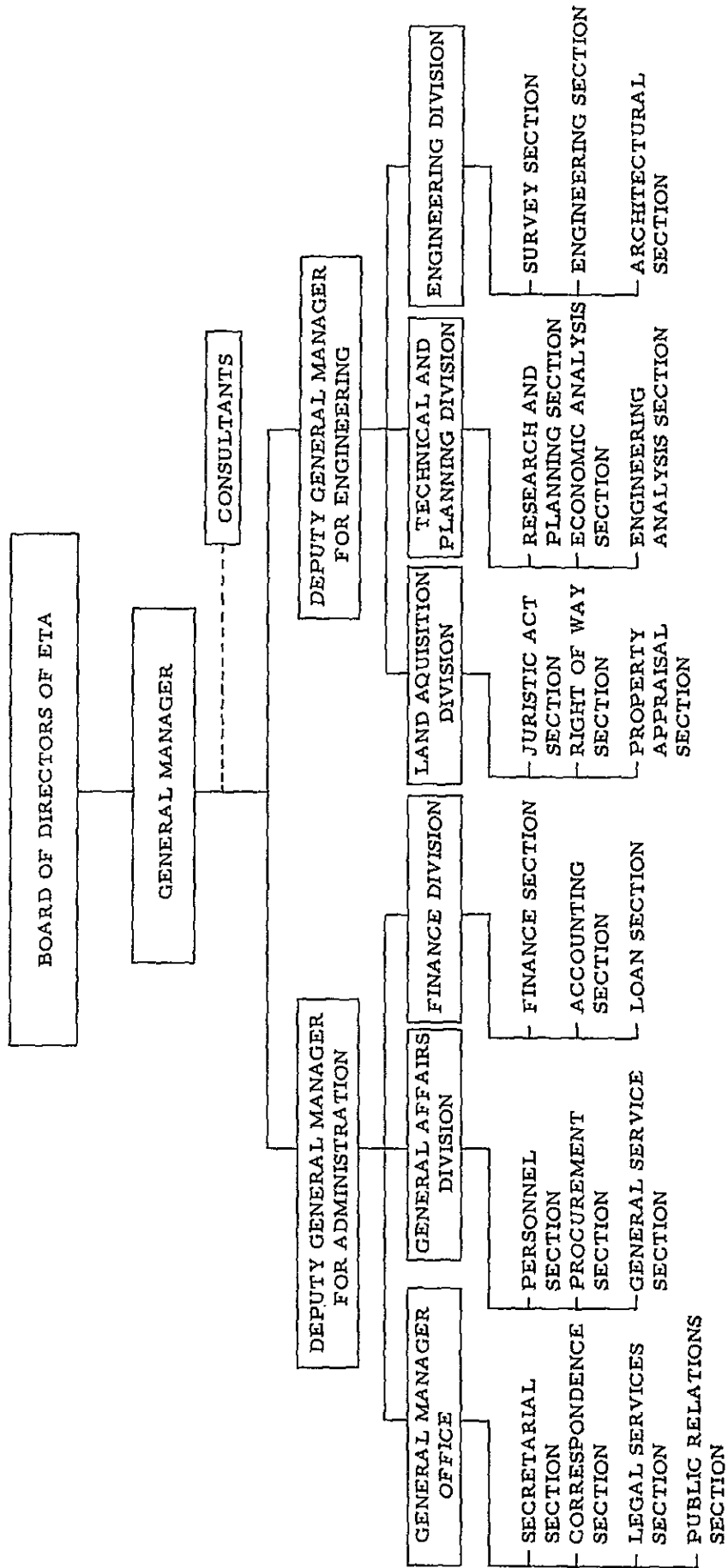
(The net-work of ordinary bus routes is comprised of 105 routes which are about 1,961 kms. in length).

AIR-CONDITIONED BUS ROUTES

PO. 1	Klong Chan - Pak Klong Talad (via Sukumvit)	25
PO. 2	Klong Chan - Silom	25
PO. 3	Rang Sit - Prapinklao Bridge	40
PO. 4	Rangsit - Prapradang	40
PO. 5	Pak Kred Silom	30
PO. 6	Pak Kred - Prapradang	39
PO. 7	Nong Kam - Muban Tungsattee	49
PO. 8	Pak Nam - Tha-Rajvordit	28
PO. 9	Huay - Kwang - Bangbon	29
PO. 10	Rang Sit - Klong San	47
PO. 11	Pak Nam - Banglampoo	31
PO. 12	Ramintha - Pak Klong Talad	37
PO. 13	Poe-Chaosamingply - Rang Sit	43
PO. 14	Minburi - Hua Lam Pong	35
		507

(The net-work of air-conditioned bus routes is comprised of 14 routes which are about 507 kms. in length).

ORGANIZATION CHART OF ETA



Terms of Reference (May, 1977)
for
Engineering and Economic Investigations
of
The First Stage Mass Transit System in Bangkok

I. INTRODUCTION

1. During the past 5 years the Royal Government of Thailand has been assisted by an advisory team from Germany, provided under bilateral assistance from the Federal Republic of Germany, in carrying out a transportation study of the Metropolitan Bangkok Area. Part of the advisory team's report covers recommendations for the First Stage Mass Transit System in Bangkok, of which divided into three sections, approximately 50 kilometers in length, and a large section of which would be elevated. The report also provides preliminary justification for the above mass transport' track.

2. The Royal Government of Thailand has decided to construct the whole of the Mass Transit System recommended. It has instructed the Expressway and Rapid Transit Authority of Thailand (ETA) to engage consultants to carry out further Comprehensive Study within the limited frame of engineering and economic investigations and preliminary design.

3. The original Terms of Reference (February 1976) engages the consultants to carry out further preliminary engineering and limited economic investigations and detail designs of the three section.

(1) The objectives as described in Part II, Paragraph 4.

(a) Engineering and Economic Investigations are superseded with the new Terms of Reference dated May 1977.

(b) Detailed Design will be subject to alterations corresponding to the selection of the system as well as the proposed engineering requirements and execution procedure for the detailed design.

4. The sections of the First Stage Mass Transit System are identified for reference purposes as follow:

- (1) Pra Kanong - Hua Lum Pong - Bangsue Section.
- (2) Wong Wian Yai - Sathorn - Lard Prao Section.
- (3) Dao Kanong - Phan Fah - Makkasan Section.

These corridors were shown in the attached map.

II. OBJECTIVES

5. The objectives of the Comprehensive Study required work are as follow:

(a) Engineering and Economic Investigations:

- Examination of alternative alignments, the need and possibility of the extension of the sections and recommendation of the best alignments.
- Selection of system
- Evaluation management and operational cost and recommended fare.
- Economic and Financial Analysis.
- Recommendation for the most economic implementation plan and investment.
- Recommendation of Feeder system.

(b) Preliminary Design

Preliminary design of the selected alignments, stations and equipments and estimation of construction and equipment costs.

III. SCOPE OF CONSULTING SERVICES

A. General

6. The Consultants shall be responsible for all economic and financial studies, engineering services, passenger volume forecasts and related works required to carry out the investigations, analysis and services herein described. Execution of the studies and engineering services shall be in close cooperation with the ETA, which shall be responsible for providing all necessary criteria, available data and supporting services, as outlined in Section IV hereof.

7. The Consultants shall review and make use of all available data, but shall be responsible, however, for the collection of any supplementary data, the analysis and interpretation of data, and for the findings, conclusion and recommendations contained in their reports.

8. The Consultants shall review and carefully sort and index all data, maps and reports that are made available in the course of the study by the ETA and others, as well as the records of data collected by the Consultants and, upon completion of their work, the Consultants shall submit these materials to the ETA.

9. The Consultants shall use the metric system in their studies, designs, and reports.

10. All Computer programs used in the work shall be left with the ETA, in a form that would enable (a) the checking of results obtained through their use, and (b) use of the programs by the ETA and its consultants for further work on the Mass Transit System. The programs and all computer tapes used in the study shall be submitted to the ETA in a form that will be durable in Bangkok for at least five years, together with manuals explaining their use.

B. Engineering and Economic Investigations Passenger Volume Forecasts

11. The Consultants shall review and revise the calculations of the passenger volume forecasts in the OMTP report. The recommended parameter that should be updated are Land-Use, Operating costs and Speed Flow Relationship.

12. The Royal Government of Thailand intends to construct the three sections of the First Stage Expressway System in Bangkok. The Consultants shall consider the influence of this expressway project in the study of passenger movements along the lines.

Selection of System

13. The Consultants shall evaluate alternative modes of transport for the system and give the recommendation for the most economic and effective mode for Mass Transit System in Bangkok. The evaluation procedures for the selection of system should include economic viability, financial feasibility,

operation effectiveness, technical assessment, and environmental impacts.

The systems which should be considered are:

- Convertible System Bus/Rail (BRT)
- Light Rail Rapid Transit System (LRT)
- Rail Rapid Transit System (RRT)

or any other system recommended by the Consultants.

Engineering Requirements

14. The Consultants shall consider alternative alignments within these corridors and examine the possibility of the extension of

- (1) Pra Kanong - Hua Lum Pong - Bangsue Section, - to Samrong and - to Donmuang.
- (2) Wong Wian Yai - Sathorn - Lard Prao Section, - to Phetkasem Road and - to Phahonyothin Road - Bangkhen
- (3) Dao Kanong - Phan Fah - Makkasan Section, to Hua Mak and Bang Kapi Area.

15. The Consultants shall consider alignment and stations as proposed by the ETA, and compare the costs and merits for different designs. The Consultants shall recommend, signalling and telecommunication system, electrification system, fare collection system as well as type and location of yards and workshops. These criterias have to be derived from economic justification. The Consultants shall prepare plans and preliminary design in sufficient detail to enable preliminary costs to be estimated with an accuracy of $\pm 20\%$.

16. The Consultants shall prepare a realistic time schedule for the design, construction and equipment of the mass transit sections. This shall include, among other things, the time needed for land acquisition, detailed design, solicitation of bids, construction and equipment, this will involve:

(I) Investigation of alternative locations and designs where necessary, and recommendations of alignments, taking full account of technical feasibility, costs and impact on the environment.

(II) Preparation of plans of the geometric layout and preliminary drawings of cross sections and longitudinal sections and drawings showing types of structures and stations, taking account of environmental factors.

Description of probable methods of construction for special engineering works

such as tunnels, large bridges, if any.

(III) Undertaking soil investigations as required to confirm the technical feasibility of recommended structures and engineering works.

(IV) Preparation of cost estimates including design, construction and equipment costs for the proposed construction.

(V) Recommend priorities in an implementation program taking account of expected land acquisition and/or resettlement problems and prepare preliminary time schedules for implementation, as well as for the direct capital costs and benefits.

17. The Consultants are informed that:

(I) On Pra Kanong - Hua Lum Pong - Bangsue Section, the Consultants shall consider scrutinizingly the environmental effects of the alignment in the vicinity of the Marble Temple and Chitlada Palace.

(II) On Wong Wian Yai - Sathorn - Lard Prao Section, the mass transit bridge across Chao Phraya River is being designed by the other consultants.

(III) On Dao Kanong - Phan Fah - Makkasan Section, the bridge across Chao Phraya River is being designed by the other consultants, and the Consultants shall consider scrutinizingly the environmental effects of the alignment in the vicinity of Wong Wian Yai Circle.

18. The Consultants' final report shall include preliminary design for the selected system, plans, profiles and typical cross sections of the proposed works at appropriate scale and a realistic program and time schedule for detailed design, staff training program, construction, manufacture and installation of equipment.

Economic Evaluation

19. Where reasonable alternative alignments or extension sections or phasing of investments can be identified, the Consultants shall, as required by the ETA, formulate alternatives that might involve different concepts, designs, alignments and/or investment scheduled; they shall then evaluate the alternatives and recommend the design, alignments and phasing considered most economic.

20. The optimal phasing of investments shall be considered such that the sum of the discounted investment, operating, management and time costs measured in terms of opportunity costs associated with the proposals, shall be minimized over a period of 20 years. For the recommended solutions, full technical and economic explanations of the reasons for selection over reasonable alternatives shall be given.

IV. PROVISION OF DATA AND FACILITIES TO BE PROVIDED BY THE ETA

A. Data Provision

21. The Government shall provide the Consultants with all available data and reports relevant to their work, including:

- (a) Reports and data of the Bangkok Transportation Study Project.
- (b) Engineering and Economic Investigation of the First Stage Expressway System in Bangkok.
- (c) Maps, plans, aerial photographs, etc. and other relevant data concerning the area. Provision of these will not necessarily be free of cost.
- (d) Demographic and economic data of the country and particular areas, as available.
- (e) Information and data on traffic and transportation regulations.
- (f) Information and data on land use and its regulation.
- (g) Government plans for major investments.
- (h) Cost experience on recent construction projects.
- (i) The results of other relevant studies.

B. Facilities to be provided by the ETA

22. The ETA will designate one representative as project Director and delegate to that representative authority and responsibility to approve and administer this contract on behalf of the ETA.

23. The ETA will assign senior qualified engineers to work with the Consultants and to be responsible for liaison between the Consultants and concerned Government Agencies.

V. TIME SCHEDULE FOR CONSULTING SERVICES AND REPORTS

24. The Consultants shall commence field work on the "Starting Date," defined as being no more than 30 Calendar days after the date on which the contract has become effective. The Consultants shall prepare and submit to the ETA the following reports (in English) within the time period indicated.

(a) An Inception Report (50 copies) giving the Consultants' proposed work program in further depth, as may be required by the ETA, the methodology and schedule for the project and describing the key procedures to be followed, to be submitted within one month after the Starting Date.

(b) Progress Reports (35 copies) at the end of each month after commencing field work giving a summary of the work performed during the reporting period, and indicating the percentage of completion of the work under each major subheading under part III of the Terms of Reference.

(c) A Recommendation Report (50 copies) presenting the analysis of the various systems investigated and the corresponding recommendation, within a period of about four (4) months of the Starting Date.

(d) A Draft Final Report (50 copies) presenting the findings resulting from the work performed under Part III, within nine (9) months of the Starting Date.

(e) A Final Report and preliminary design (100 copies) incorporating all revisions deemed appropriate by the Consultants after the comments received on the Draft Final Report by ETA as well as the corresponding Summary (200 copies) after 45 days of receipt of all comments.

25. The submission of the Comprehensive Study shall be completed within twelve (12) months of the Starting Date.

Terms of Reference for Comprehensive Study
of
Suburban Mass Transport System for Bangkok

I. INTRODUCTION

1. During the past 5 years the Government of Thailand has been assisted by an advisory team from Germany, provided under bilateral assistance from the Federal Republic of Germany, in carrying out a transportation study of the Metropolitan Bangkok Area. Part of the advisory team's report covers recommendations for the First Stage Mass Transit System in Bangkok, of which divided into three sections, approximately 50 kilometers in length, and a large section of which would be elevated. The report also provides preliminary justification for the above mass transport track.

2. The Government of Thailand intends to construct the Mass Transit System as recommended, and the Expressway and Rapid Transit Authority of Thailand (ETA) is in the process of employing consultants to carry out engineering and economic investigations and detailed designs of those three sections of the First Stage Mass Transit System which concentrated in the Central Area.

The sections of the First Stage Mass Transit System are as follow:

- (1) Pra Kanong - Hua Lum Pong - Bangsue Section
- (2) Wong Wian Yai - Sathorn - Lard Prao Section
- (3) Dao Kanong - Phan Fah - Makkasan Section

These corridors where shown in the attached map No.1.

3. In order to improve the public transportation in the suburban region and between inter - regions (Central Area and Sub-urban Area) by means of systematic rationalization, therefore the ETA desires to carry out Comprehensive Study for the Suburban Mass Transport System, particularly in connection with the service of the aforementioned Urban Mass Transit System.

II. OBJECTIVES

4. The objectives of the Comprehensive Study are as follow:

(a) Engineering and Economic Investigations:

- Study and propose an appropriate suburban-mass-transport networks for Bangkok, which focuses on the future urbanized and socio-economic developments, as well as the Urban Mass Transit System.
- Selection of transit system
- Evaluation the management and operational cost and recommendation the suitable fare rates for the System.
- Economic and financial analysis.
- Recommendation the most economic implementation plan and investment for the System, with the consideration for the implementation of the Urban Mass Transit System.

(b) Preliminary Engineering Design

Preliminary engineering design for

- The selected alignments, and/or stations if required (For construction or improvement).
- Transit System if necessary
- Estimation of construction and equipment costs.

III. SCOPE OF CONSULTING SERVICES

A. General

5. The Consultants shall be responsible for all economic and financial studies, engineering services, passenger volume forecasts and related works required to carry out the investigations, analysis and services herein described. Execution of the studies and engineering services shall be in close cooperation with the ETA, which shall be responsible for providing all necessary criteria, available data and supporting services, as outlined in Section IV hereof.

6. The study area of the Suburban Mass Transport System for Bangkok is recommended (but not limited to) in the attached map No. 2.

7. The Consultants shall review and make use of all available data, but shall be responsible, however, for the collection of any supplementary data,

the analysis and interpretation of data, and for the findings, conclusion and recommendations contained in their reports.

8. The Consultants shall review and carefully sort and index all data, maps and reports that are made available in the course of the study by the ETA and others, as well as the records of data collected by the Consultants and, upon completion of their work, the Consultants shall submit these materials to the ETA.

9. The Consultants shall use the metric system in their studies, designs, and reports.

10. All Computer programs used in the work shall be left with the ETA, in a form that would enable (a) the checking of results obtained through their use, and (b) use of the programs by the ETA and its consultants for further work on the Mass Transit System. The programs and all computer tapes used in the study shall be submitted to the ETA in a form that will be durable in Bangkok for at least five years, together with manuals explaining their use.

B. Engineering and Economic Investigations

Passenger Volume Forecasts

11. The Consultants shall review the calculations of the passenger volume forecasts in the Bangkok Transportation Study and the recent reports.

12. The Consultants shall update the suburban data base for planning such as: land-use, population, income, motorization, characteristics of transportation system used, socio-economic characteristics of trip-makers and etc. and carry out origin-destination survey. The Consultants shall consider scrutinizingly the forecasting parameters for forecasting the future urban and suburban developments.

13. The Consultants shall use the forecasting and modechoice models which are suitable for suburban in the study area, and the results from such models could be checked with the existing data.

14. The Government of Thailand intends to construct the three sections of

the First Stage Mass Transit System in Bangkok and also plans to implement the Long-Term Mass Transit Network (as indicated in Long-Term Strategies of Bangkok Transportation Study.) The Consultants shall consider the passenger movements along the suburban mass transit lines as a feeder to the three trunk lines of the First Stage Urban Mass Transit System.

Selection of Transit System

15. The Consultants shall evaluate alternative modes of transport for the system and give the recommendation for the most economic and effective mode for Suburban Mass Transport System in the study area of Bangkok. The evaluation procedures for the selection of system should include economic viability, financial feasibility, operational effectiveness, technical assessment, and environmental impacts. The systems which should be considered (but not limited to) are:

- Combined System, micro bus and standard bus
- Bus System (BUS)
- Combined System, bus and Light Rail Transit
- Combined System, bus and Commuter train.
- Light Rail Transit System (LRT)

16. The Consultants shall prepare the alternative alignments for the Suburban Mass Transport System and form a network, the Consultants shall consider alignments and stations as proposed by the ETA, and compare the costs and merits for different designs. The Consultants shall recommend, signalling and telecommunication system, electrification system, where necessary, as well as type and location of yards and workshops. The Consultants shall recommend the suitable fare rates for the System. These criteria have to be derived from economic justifications. The Consultants shall prepare plans and preliminary design in sufficient detail to enable preliminary costs to be estimated with an accuracy of $\pm 20\%$.

17. The Consultants shall prepare a realistic time schedule for the design, construction and equipment of the Suburban Mass Transport System to coordinate with the time schedule for implementation of the First Stage Mass Transit System. This shall include, among other things, the time needed for land acquisition, detailed design, solicitation of bids, construction and equipment, this will involve:

(I) Investigation of alternative locations and designs where necessary, and recommendations of alignments, taking full account of technical feasibility, costs and impact on the environments.

(II) Preparation of plans of the geometric layout and preliminary drawings of cross sections and longitudinal sections, and drawings showing types of structures and stations, taking account of environmental factors. Description of probable methods of construction for special engineering works such as tunnels, large bridges, if any.

(III) Undertaking soil investigations as required to confirm the technical feasibility of recommended structures and engineering works.

(IV) Preparation of cost estimates including design, construction and equipment costs for the proposed recommendation.

(V) Recommend priorities in an implementation program taking account of expected land acquisition and/or resettlement problems and prepare preliminary time schedules for implementation, as well as for the direct capital costs and benefits.

18. The Consultants' final report shall include preliminary engineering design for, the selected alignments, and/or stations if required, Construction or improvement, and selected transit system, plans, profiles and typical cross sections of the proposed works at a appropriate scale and a realistic program and time schedule for final engineering, staff training program, construction, manufacture and installation of equipment.

Economic Evaluation

19. Where reasonable alternative alignments or extension sections or phasing of investments can be identified, the Consultants shall, as required by the ETA, formulate alternatives that might involve different concepts, designs, alignments and/or investment schedules; they shall their evaluate the alternatives and recommend the design, alignments and phasing considered most economic.

20. The optimum phasing of investments shall be considered such that the sum of the discounted investment, operating, management and time costs measured in terms of opportunity costs associated with the proposals, shall be minimized over a period of 20 years. For the recommended solutions, full technical and economic explanations of the reasons for selection over reasonable

alternatives shall be given.

IV. PROVISION OF DATA AND FACILITIES TO BE PROVIDED BY THE ETA

A. Data Provision

21. The Government shall provide the Consultants with all available data and reports relevant to their work, including:

- (a) Reports and data of the Bangkok Transportation Study.
- (b) Engineering and Economic Investigation of the First Stage Expressway System in Bangkok.
- (c) Maps, plans, aerial photographs, etc. and other relevant data concerning the area. Provision of these will not necessarily be free of cost.
- (d) Demographic and economic data of the country and particular areas, as available.
- (e) Information and data on land use and its regulation.
- (f) Government plans for major investments.
- (g) Cost experience on recent construction projects.
- (h) The results of other relevant studies.

B. Facilities to be provided by the ETA.

22. The ETA. will provide a counterpart staff to work with the Consultants and the supporting staff and to be responsible for liaison between the Consultants and concerned government agencies.

V. TIME SCHEDULE FOR CONSULTING SERVICES AND REPORTS

23.

(a) An inception Report (50 copies) giving the Consultants proposed work program in further depth, as may be required by the ETA, the methodology and schedule for the project and describing the key procedures to be followed, to be submitted within one month after the Starting Date.

(b) A Draft Final Report (50 copies) presenting the findings and recommendations resulting from work performed under part III.

(c) A Final Report and preliminary engineering design (300 copies)

incorporating all revisions deemed appropriate by the Consultants after the comments received off the Draft Final Report within 60 days of receipt of all comments.

24. The period of the Comprehensive Study will be discussed later on.

Technical and Planning Division
Expressway and Rapid Transit Authority of
Thailand
November 24, 1977.

資料 6 Study on Rail Commuter Service for Bangkok

1. PROJECT: Study on rail commuter service for Bangkok
2. IMPLEMENTING AGENCY: State Railway of Thailand (RSR)
3. DURATION 1978
4. BRIEF DESCRIPTION: Study on rail commuter service for Bangkok
objective of determining the role of the railway in
providing train service to meet the requirement from the
growing commuter traffic of the Metropolis in conjunction
with the proposed Mass Transit the Rapid Transit System
of Bangkok.
5. STUDIES REQUIRED FOR THE PROJECT:
 - Traffic study and projection of commuter traffic
 - Existing capacity of RSR for rail commuter traffic
 - Type of operation and equipment required for future traffic
 - Coordination with the proposed Mass Transit and Rapid
Transit System of Bangkok
 - Investment required for the expanded capacity
 - Financial analysis and economic feasibility of the rail
commuter service project

6. ESTIMATED COST:

FOREIGN CURRENCY.....
LOCAL CURRENCY
TOTAL

DISBURSEMENT SCHEDULE

Unit: Million US. \$

<u>YEAR</u>	<u>FC</u>	<u>LC</u>	<u>TT</u>
1978			
1979			
1980			
1981			
1982			
1983			
TOTAL			

7. STATUS OF THE PROJECT:

The project for this study is only in a proposal stage which has already been approved by the Ministry of Communications.

8. FULL DETAILS OF THE PROJECT:

There has been for some ten years a small number of commuter traffic who travel into Bangkok in the morning and return in the afternoon to their homes in the outlying areas within the radius around 50-100 km of Bangkok on the main lines i.e. North, East and South. The number of this traffic, though not growing in any alarming rate, is expected to increase rapidly within the next 5 years.

This is due firstly to the fact that the outskirts of Bangkok is fast expanding: housing projects both of the Government and private builders are coming up in a great number and further away from the city, as distant as 45 km. Rail and bus will be the modes of moving those commuters into the city or at least to the city outer limits where they can change from train or bus to the Mass Transit or Rapid Transit System. Secondly, people who live in the outer areas of Bangkok itself recently have been turning to using the existing commuter trains to go into the city centre because of road congestion and time loss during the rush hours. The present capacity of RSR cannot meet the demand of this type of traffic. The proposed equipment to be acquisitioned during the present 5-year Investment Programme are not geared specifically for this traffic. A study on rail commuter traffic for both short term and long term projects is therefore urgently needed to ascertain the role which the railway can take in commuter transport for Bangkok, by itself as well as in coordination with the proposed Mass Transit and Rapid Transit System of Bangkok. The study will assist the Government in making a decision as to what extent it will require the Railway to participate in the

planned commuter transport.

The study is to analyse the present traffic, project future traffic, analyse economic, financial and engineering aspects of the rail commuter service needed. It will advise, in particular, how the service can be operated and its financial burden will not deteriorate the current deficit sustained by RSR.

1. Background Information

As a major goal of the Thai Government, the Department of Town and Country Planning has carried out the planning for the Greater Bangkok Metropolis to cope with the existing urban problems as well as the future ones. The traffic problems are, however, very obvious and most serious. The seriousness of the traffic problems is caused by many factors; and one of the main factors is existing at-grade crossings between railways and major urban roads. According to the plan the number of crossings will be increased as more urban roads are constructed. Consequently, one of the solutions recommended in the plan is to elevate railway tracks to eliminate those crossings in the congested area.

During the months of February and March 1975, the ESCAP Joint Roving Team of Railway Research Experts came to assist the State Railway to Thailand in identifying areas of research as well as problems meriting detailed investigations. Based on the preliminary study the team suggested that the only effective solution for such traffic problems is to elevate railway tracks leading into the Bangkok metropolis. More precisely, the track sections from Bangkok Station to Bang Sue and from Yomarat and Jitlada to Makkasan should be elevated during the first stage of this development, and subsequently extended to as far as the Port of Bangkok. In the subsequent stages of the introduction of elevated railway track, another line from Bangkok Station should be elevated above the canal along Krung Kasem Road from which it crosses Chao Phraya River, follows along Charoen Rat Road in Thonburi, and joins the existing Mae Klong Line which should be extended to meet the main Southern Line at Pak Tho Station. This will form a loop to serve as the suburban line for Greater Bangkok Area. The new team of experts is requested to carry out a feasibility

study and survey in detail for the introduction of elevated railway tracks along the proposed routes as mentioned above.

Counterpart national engineers with Bachelor Degrees in Civil, Electrical and Mechanical Engineering from the Department of Town and Country Planning and the State Railway of Thailand will be assigned to work with the experts. They will be available throughout the course of this study.

The Government of Japan will provide budget on all expenses for the experts. Thus there is no need for counterpart funds.

The construction of the elevated railway track is to be included as an integral part of Bangkok city's urban and suburban planning, and incorporated in the National Development plan, if the project's feasibility is established by the study.

2. (a) Post Titles of Members of the Team Conducting the:

Preliminary Survey:

Chief of the survey team	1
Civil engineer who will play the principal role in the survey	1
Transportation economist	1
Highway engineer	1
Others	1

Main survey:

Chief of the survey team	1
Civil engineer	2
Bridge engineer	1
Architect	1
Electrical engineer	1
Geologist	1

2. (b) Job Description and Responsibilities of Expert Team.

The outline of work to be carried out by the experts requested is as follows:-

- 1) Study/survey for the construction of elevated railway in the Bangkok metropolitan area.
- 2) Study/survey for connection Bangkok Station to the Mae Klong line

to join the main Southern Line at Pak Tho to form loops for urban and suburban traffic around Bangkok.

- 3) Study the influence of the elevated railways on other urban transportation systems as related to the plan of the Bangkok Metropolitan Area.
2. (c) Division of Engineering, Department of Town and Country Planning, Ministry of Interior.
2. (d) Experts are expected to have experience in planning, designing and constructing elevated railway systems for more than 7 years and should be 35-50 years of age.
2. (e) For preliminary survey and study, the number of personnel required is 7. For main survey and study, 7 experts are also required. For detailed qualification, please see above attachment 2(a).

4. (a) Duration of the Study on Elevated Railway in Bangkok

Survey should be carried out in three stages:

First stage: Preliminary survey (two weeks, 5 experts)

Detailed discussions with the Thai Government

Collection of basic data essential for the study

Determination of existing traffic volumes

Forecast of future traffic volumes

Outline of the design and structure

Decision on how to carry out the investigations, the kinds of experts, their number and what kinds of machineries or materials are necessary for the Team.

Second stage: Main survey (1 - 1-1/2 months, 6 - 7 experts)

Detailed survey based on the preliminary survey on returning to Japan, the Team will ascertain the opinions of experts in the various fields, consult data on the construction required and prepare a draft report.

Third stage: Explanation of the report (one week, 3 experts)

Explanation of the report to the Thai Government

Incorporation of the views of the Thai Government in the

final report

Submission of the final report

4. (b) The Bangkok Metropolitan Area and its surroundings
4. (c) Yes, for one expert, furnished apartment suitable for a family is allowed, provided that its rent is not more than 4,000 bahts a month.
5. (e) Compensation of 200 bahts per day will be paid for the first 15 days and after that it will be paid according to the actual rent but not more than 4,000 bahts a month.

The presence of railway level crossings in the metropolitan area is regarded as one among the others causing the deteriorating situation.

In February 1975, the ESCAP Joint Roving Team of Railway Research Experts came to assist the State Railway of Thailand in identifying areas of research study as well as problems meriting detailed investigations. One of the items studied by the team on a preliminary basis was the construction of an elevated railway track in Bangkok Metropolitan area. The team suggested that the only effective solution for such congested traffic problem was to have elevated tracks for the railways leading to the metropolitan area, and that the track sections from Bangkok to Bang Sue and from Yomarat and Jitlada to Makkasan should be elevated at the first stage, and subsequently extended as far as the Port of Bangkok. In the subsequent stages of development, another line from Bangkok station should be elevated above the canal by the side of Krung Kasem Road and laid across the river Chao Phraya to follow along Charoen Rat Road in Thonburi to join the existing Mae Klong line which should be extended to meet the Southern main line at Pak Tho station. This could form an outer loop to serve as the suburban line for the Greater Bangkok area. Relation of the elevated railways to the other urban transportation systems in view of Bangkok Metropolis planning should also be considered.

The report of the roving team as mentioned above had been considered and discussed during the Railway Group Meeting Conference of ESCAP which was held in Bangkok in June 1976. It was recommended that action on this problem should be taken up jointly by RSR and the City & Town Planning Bureau and the service of the Experts from the advanced country for the detailed study of the project should be sought.

State Railway of Thailand
BOARD OF COMMISSIONERS
GENERAL MANAGER

資料 8

DEPUTY GENERAL MANAGER (OPERATIONS)	DEPUTY GENERAL MANAGER (ADMINISTRATION)
<ul style="list-style-type: none"> - TRAFFIC DEPT. (TRAFFIC MANAGER & DEPUTY) - TRANSPORTATION DIV. - CAR CONTROL DIV. - GOODS & LAND DIV. - PASSENGER DIV. - HOTEL DIV. - 5 DISTRICT TRAFFIC DIVS. MECHANICAL ENGINEERING DEPT. (CH F, MECHANICAL ENGINEER & DEPUTIES) - MECHANICAL DIV. - MOTIVE POWER DIV. - 4 DISTRICT MECHANICAL ENGINEERING - ROLLING STOCK CONSTRUCTION DIV. - LOCOMOTIVE REPAIR DIV. - ROLLING STOCK REPAIR DIV. - PRODUCTION DIV. CIVIL ENGINEERING DEPT. (CHIEF, CIVIL ENGINEER & DEPUTIES) - PROJECTS AND PLANNING DIV. - TECHNICAL DIV. - CONSTRUCTION DIV. - CIVIL ENGINEERING DEPOT. - MAINTENANCE OF WAY DIV. - MAINTENANCE OF BRIDGE & BUILDING DIV. - SIGNALLING & TELECOMMUNICATION DIV. - TIMBER & STONE DIV. - 11 DISTRICT ENGINEER'S OFFICES STORES BUREAU (STORES SUPERINTENDENT) - PURCHASING DIV. - STORES DIV. RAILWAY POLICE DIV. (COMMANDER OF RAILWAY POLICE DIV.) 	<p style="text-align: center;">ATTACHED TO THE GENERAL MANAGER</p> <ul style="list-style-type: none"> - ADMINISTRATION DEPT. (CHIEF, ADMINISTRATION DEPT.) - CENTRAL DIV. - WELFARE AND LABOUR DIV. - EMPLOYMENT DIV. - PUBLIC RELATIONS & FOREIGN DIV. ACCOUNTING & FINANCE DEPT. (COMPTROLLER & DEPUTY) - GENERAL ACCOUNTS DIV. - INTERNAL AUDITING DIV. - TREASURY DIV. - REVENUE AUDITING DIV. - INVESTMENT PROJECT & BUDGET DIV. - DISBURSEMENT AUDITING DIV. - DATA PROCESSING DIV. - MISCELLANEOUS AUDITING DIV. MARKETING DEPT. (MARKETING MANAGER) - PASSENGER MARKETING DIV. - FREIGHT MARKETING DIV. LEGAL BUREAU (CHIEF, LEGAL BUREAU) - LEGAL PROCEEDING DIV. - LEGAL INVESTIGATION DIV. RAILWAY TRAINING CENTRE (RAILWAY TRAINING CENTRE SUPERINTENDENT) MEDICAL BUREAU (CHIEF, MEDICAL BUREAU) - 12 DISTRICT MEDICAL OFFICES - RAILWAY HOSPITAL DEVELOPMENT COORDINATING BUREAU (CHIEF, DEVELOPMENT COORDINATING BUREAU) 3 PROJECT EVALUATION AND COORDINATION DIVS.

GENERAL DESCRIPTION

The State Railway of Thailand, henceforth referred to as RSR, is the government owned enterprise. It came into being as a department of the government in 1890, until it was made an autonomous organization on July 1, 1951 by the State Railway of Thailand Act B.E. 2494 (1951). The first line was commenced in 1892 and reached Nakhon Ratchasima in 1900, a distance of 264 kms. All the earlier line was 4 ft. 8 1/2 in. gauge, but the construction of southern main line, from 1900 onwards, brought into being a metre gauge system for it was intended that this line should eventually be linked with Malaysia and Burma. Conversion of other line to metre gauge was decided upon in 1919, and completed by April 1930. At the close of the fiscal year 1976 (September 30, 1976) RSR had a total of 3,765 route kilometres (excluding Mae Klong line) open to traffic. The system radiates from Bangkok, and connects with the Malayan Railway at Padang Besar and at Sungai Kolok in the South.

The formulation of policies and the supervision of the general affairs of RSR are entrusted to the Board of Commissioners consisting of a chairman and other four to six members appointed by the Council of Ministers. The General Manager, chief executive of RSR, is also in his capacity a member of a Board. The Minister of Communications has general supervisory power and may call upon RSR to give statement or opinion or to submit report or suspend RSR's actions.

資料 9 Summary of Discussions

Summary of Discussions between the Japanese Contact Mission and the Department of Technical and Economic Cooperation of the Government of Thailand on the Japanese Technical Cooperation for the comprehensive studies of Suburban Mass Transit System of Bangkok, Rail Commuter Services and Elevated Railway Track for Bangkok.

July 25, 1978

The Japanese Contact Mission (hereinafter referred to as "the Mission") organized by the Japan International Cooperation Agency (hereinafter referred to as "JICA") and headed by Mr. Yasutaka Fukuda, visited Thailand from July 12 to 25 for the purpose of working out the details of the studies of Suburban Mass Transit System of Bangkok, Rail Commuter Services and Elevated Rail Track for Bangkok.

During its stay in Thailand, the Mission had a series of discussions and exchanged views with representatives of the various Thai authorities concerned (hereinafter referred to as "the authorities") as to the contents and direction of the above-mentioned studies. As a result of the discussions, the Mission and the authorities agreed as follows:

I. Comprehensive study of Suburban Mass Transit System of Bangkok

1. Background of the study

In Bangkok, traffic conditions are getting deteriorated due to many factors, main factors being the fast growing population and the tremendously increasing demand of trips.

So the Government of Thailand have recognized the necessity to cope with the transportation problems in the future as well as at present.

Furthermore urbanized areas are and will be expanding.

Whereas job opportunities and the centers of education, health, commercial, recreational activities are still in the central area of Bangkok.

Therefore demand to make trips from the suburban areas to the central

is increasing directly according to the growth of the outlying suburbs . This implies that traffic congestion and transportation problems in suburban areas can be obviously foreseen in the near future, as well as in the core area .

As a result, the Government of Thailand has decided it necessary to conduct a comprehensive study of the Suburban Mass Transit System for the suburban areas , as well as central area of Bangkok, and asked the Government of Japan to accept the task.

Moreover in the original request, the Government of Japan was also asked to study the Rail Commuter Service for Bangkok, commuters being the passengers riding on the train between Bangkok and nearby communities out of suburban areas of the Greater Bangkok. And an agreement was made between two (2) parties that the Rail Commuter Service was not necessary to be studied separately from the Suburban Mass Transit System.

2. The Objective of the Study

The objective of this study is to have a comprehensive study of the efficient and economical mode of transportation for those who travel between the central area and the suburban area, and for those who travel between the communities in suburban area of the Bangkok metropolis .

The objective of this study shall follow those items as shown in Attachment No. 1 and following:

- (a) Forecast of travel demand
 - (1) between central area and suburban area
 - (2) among central area of Bangkok and surrounding cities
- (b) Analysis and estimation of operating capacity of the existing railway system of SRT
- (c) Study of other development plans

3. Area of the Study

3-1 Summary

Geographic Study Area	Within the radius of 40-50 KM of Bangkok Central Business District
Modes of transportation to be considered and the role of each mode to be played in this scheme	<ol style="list-style-type: none"> 1. Improvement of existing facilities of SRT 2. Extension of Mass Transit System in the Central Area of Bangkok by ETA 3. Bus service improvement including new construction and/or improvement of roads 4. Others
Travel Demand to be considered	<ol style="list-style-type: none"> 1. Suburban Areas to/from Central Area of Bangkok 2. Among Suburban Areas <p>Note: Travel demand between Central Areas of within the radius of 50-130 KM of Bangkok will be taken into consideration in figuring out the capacity required for the Mass Transit System.</p>

3-2

- (1) In this study, much attention should be given to the central area transport system, because central area and suburban area have a close relation to each others.
- (2) Possibility should be reserved for this study to suggest (an) additional line (s) and/or minor change (s) in the Urban Mass Transit System, if necessary.
- (3) Planning to construct new facilities should be considered after the idea of the effective utilization of existing facilities is introduced.
- (4) The Target Year of the suburban mass transit system of this study will be 2000 A.D.

4. Proceedings to be followed

The Mission, based upon the study done during its stay in Bangkok will prepare draft of the "Scope of Work" of the study containing the following items:

- (1) a. Introduction
- b. Background of the study
- c. Objective and scope of the study
- d. Area of the study
- e. Time schedule of the study
- f. Participations by the Government of Japan
- g. Participations by the Government of Thailand
- h. Reports to be prepared

This draft will be formalized by JICA and the Government of Japan and will be submitted to the Government of Thailand.

- (2) The Government of Thailand, based upon the proposed scope of work, will request the Government of Japan to undertake the study under technical cooperation scheme.

II. Comprehensive Study of Elevated Railway Track for Bangkok

1. Background of the Proposed Study

The Ministry of Interior and the Royal State Railway of Thailand (hereinafter referred to as "SRT") have carried out the planning for Greater Bangkok Metropolis to cope with the existing urban problems as well as those in the future. The traffic problems in the central area of Bangkok are very serious. The seriousness of the traffic problems is caused by several factors, and one of the main factors is the existing at-grade crossings between railways and major streets. According to the plan, the number of crossings will be increased as more streets are constructed. Consequently, one of the solutions recommended in the plan is to elevate railway tracks to eliminate those crossing in the congested area.

In 1975, the ESCAP Joint Roving Team of Railway Research Experts came to assist the State Railway of Thailand as to identifying areas of research as well as problems worth detailed investigations. Based on the preliminary study, the team suggested that the only effective solutions for such traffic problems be to elevate railway tracks leading into the Bangkok Metropolis. The Thai Government to carry out a feasibility study which includes survey in detail of the introduction of

elevated railway tracks as mentioned above.

2. Summary of the Meetings

The Mission had a series of discussions and exchanged views with representatives of the National Economic and Social Development Board, Department of Town and Country Planning of Ministry of Interior, SRT, Bangkok Mass Transit Authority and Urban Transportation Planning Office as to the contents and direction of the project. During the course of the discussions, it was proposed that the Government of Thailand will notify the Embassy of Japan in due course as to the latest decision regarding this project.

Bangkok, July 25, 1978

Leader of Japanese Contact Mission

Deputy Director-General of Department of Technical and Economic Cooperation

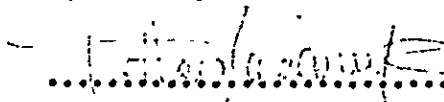

.....

(Mr. Yasutaka Fukuda)


.....


(Mr. Wanchai Sirirattna)

Expressway and Rapid Transit Authority of Thailand


..... Witness


(Dr. Tongchat Hongladaromp)

State Railway of Thailand


..... Witness

(Mr. Aphai Phadoemchitt)

Department of Town and Country Planning


..... Witness

(Dr. Prapon Vongvichien)

Urban Transportation Planning Office

Sarit Santimataneedol Witness
(Dr. Sarit Santimataneedol)

National Economic and Social Development Board

Supanras Sirihong Witness
(Mrs. Supanras Sirihong)

ATTACHMENT NO. 1

The objectives of this Study are as follow:

(a) Engineering and Economic Investigations:

- Study and propose an appropriate Suburban Mass Transport networks for Bangkok, which focuses on the future urbanized and socio-economic developments, as well as the Urban Mass Transit System.
- Evaluate existing capacity of State Railway of Thailand in the limited area of Rail Commuter Service.
- Projection of commuter traffic.
- Selection of the transit system, with recommendation (if any) for improvement/expansion of rail and bus services.
- Evaluation the management and operational cost and recommendation the suitable fare rates for the system.
- Economic analysis, and financial analysis separately for Suburban Mass Transport System Project and Rail Commuter Service Project.
- Recommendation the most economic implementation plan and investment for the System with the consideration for the implementation of the Urban Mass Transit System.

(b) Preliminary Engineering Design

Preliminary engineering design for

- The selected alignments, and/or stations if required (For construction or improvement).
- Transit System if necessary
- Estimation of construction and equipment costs.

I. INTRODUCTION

1. During the past 5 years the Government of Thailand has been assisted by an advisory team from Germany, provided under bilateral assistance from the Federal Republic of Germany, in carrying out a transportation study of the Metropolitan Bangkok Area. Part of the advisory teams report covers recommendations for the First Stage Mass Transit System in Bangkok, of which divided into three sections, approximately 50 kilometers in length, and a large section of which would be elevated. The report also provides preliminary justification for the above mass transport track.

2. The Government of Thailand intends to construct the Mass Transit System as recommended, and the Expressway and Rapid Transit Authority of Thailand (ETA) is in the process of employing consultants to carry out engineering and economic investigations and detailed designs of those three sections of the First Stage Mass Transit System which concentrated in the Central Area.

The sections of the First Stage Mass Transit System are as follow:

- (1) Pra Kanong - Hua Lum Peng - Bangsue Section.
- (2) Wong Wisn Yai - Sathorn - Lard Prao Section.
- (3) Dao Kanong - Phan Fah - Makkasan Section.

These corridors were shown in the attached map No. 1.

3. It is also considered that: there has been for some ten years a small number of commuter traffic who travel into Bangkok in the morning and return in the afternoon to their homes in the outlying areas within the radius of 50 - 130 km. of Bangkok on the main lines i. e. North, East and South. The number of this traffic, though not growing in any alarming rate, is expected to increase rapidly within the next 5 years.

This is due firstly to the fact that the outskirts of Bangkok is fast expanding: housing projects both of the Government and private builders are coming up in a great number and further away from the city, as distance as

45 km. Rail and bus will be the modes of moving these commuters into the city or at least to the city outer limits where they can change from train or bus to the Mass Transit or Rapid Transit System. Secondly people who live in the outer areas of Bangkok itself recently have been turning to using the existing commuter train to go into the city center because of road congestion and time loss during the rush hours. The present capacity of SRT cannot meet the demand of this type of traffic. The proposed equipment to be acquisitioned during the present 5 - year Investment Program are not geared specifically for this traffic. A Study on rail commuter traffic for both short term and long term project is therefore urgently needed to ascertain the role which the railway can take in commuter transport for Bangkok, by itself as well as in coordination with the proposed Mass Transit and Rapid Transit System of Bangkok. The Study will assist the Government in making a decision as to what extent it will require the railway to participate in the planned commuter transport.

4. In order to improve the public transportation in the suburban region and between inter - regions (Central Area and Suburban Area) by means of systematic rationalization and provide adequate rail commuter service for those commuter traffic mentioned previously, therefore the ETA desires to engage consultants to carry out Comprehensive Study for the Suburban Mass Transport System and Rail Commuter Service, particularly in connection with the service of the aforementioned Urban Mass Transit System.

II. Objectives

5. The objectives of the Comprehensive Study are as follow:

(a) Engineering and Economic Investigations:

- Study and propose an appropriats suburban-mass-transport networks for Bangkok, which focuses on the future urbanized and socio-economic developments, as well as the Urban Mass Transit System.
- Evaluate existing capacity of State Railway of Thailand and Bangkok Mass Transit Authority for respective rail and bus services.
- Projection of commuter traffic.

- Selection of the transit system, with recommendation (if any) for improvement/expansion of rail and bus services.
- Evaluation the management and operational cost and recommendation the suitable fare rates for the System.
- Economic and financial analysis.
- Recommendation the most economic implementation plan and investment for the System, with the consideration for the implementation of the Urban Mass Transit System.

(b) Preliminary Engineering Design

Preliminary engineering design for

- The selected alignments, and/or stations if required (For construction or improvement).
- Transit System if necessary
- Estimation of construction and equipment costs.

III. SCOPE OF CONSULTING SERVICES

A. General

6. The Consultants shall be responsible for all economic and financial studies, engineering services, passenger volume forecasts and related works required to carry out the investigations, analysis and services herein described. Execution of the studies and engineering services shall be in close cooperation with the ETA, which shall be responsible for providing all necessary criteria, available data and supporting services, as outlined in Section IV hereof.

7. The study area of the Suburban Mass Transport System for Bangkok is recommended (but not limited to) in the attached map No. 2, which is approximately the area within radius of 40 - 50 km. from Bangkok city center.

8. The Consultants shall review and make use of all available data, but shall be responsible, however, for the collection of any supplementary data, the analysis and interpretation of data, and for the findings, conclusion and recommendations contained in their reports.

9. The Consultants shall review and carefully sort and index all data,

maps and reports that are made available in the course of the study by the ETA and others, as well as the records of data collected by the Consultants and, upon completion of their work, the Consultants shall submit these materials to the ETA.

10. The Consultants shall use the metric system in their studies, designs, and reports.

11. All Computer programs used in the work shall be left with the ETA, in a form that would enable (a) the checking of results obtained through their use, and (b) use of the programs by the ETA and its consultants for further work on the Mass Transit System. The programs and all computer tapes used in the study shall be submitted to the ETA in a form that will be durable in Bangkok for at least five years, together with manuals explaining their use.

B. Engineering and Economic Investigations
Passenger Volume Forecasts

12. The Consultants shall review the calculations of the passenger volume forecasts in the Bangkok Transportation Study and the recent reports.

13. The Consultants shall update the suburban data base for planning such as: land-use, population, income, motorization, characteristics of transportation system used, socio-economic characteristics of trip-makers and etc. and carry out origin-destination survey. The Consultants shall consider scrutinizingly the forecasting parameters for forecasting the future urban and suburban developments.

14. The Consultants shall use the forecasting and mode choice models which are suitable for suburban in the study area, and the results from such models could be checked with the existing data.

15. The Consultant shall also use appropriate forecasting model for anticipation of rail commuters in the future.

16. The Government of Thailand intends to construct the three sections of the First Stage Mass Transit System in Bangkok and also plans to implement the Long-Term Mass Transit Net-work (as indicated in Long-Term Strategies of Bangkok Transportations Study.) The Consultants shall consider the passenger movements along the suburban mass transit lines as a feeder to the

three trunk lines of the First Stage Urban Mass Transit System.

Recommendations & Selection of Transit System

17. The Consultants shall evaluate alternative modes of transport for the system and give the recommendation for the most economic and effective mode (or combination of modes) for Suburban Mass Transport System in the study area of Bangkok. The evaluation procedures for the selection of system should include economic viability, financial feasibility, operational effectiveness, and environmental impacts. The systems for Suburban Mass Transport, which should be considered (but not limited to) are:

- Combined System, micro bus and standard bus
- Bus System (BUS)
- Combined System, bus and Light Rail Transit
- Combined System, bus and Commuter train.
- Light Rail Transit System (LRT)

The recommendation for Rail Commuter Service should include:

- Type of operation and equipment required for future traffic.

18. The Consultants shall prepare the alternative alignments for the Suburban Mass Transport System and form a network, the Consultants shall consider alignments and stations as proposed by the ETA, and compare the costs and merits for different designs. The Consultants shall recommend, signalling and telecommunication system, electrification system, where necessary, as well as type and location of yards and workshops. The Consultants shall recommend the suitable fare rates for the System. These criteria have to be derived from economic justification. The Consultants shall prepare plans and preliminary design in sufficient detail to enable preliminary costs to be estimated with an accuracy of $\pm 20\%$.

19. The Consultants shall prepare a realistic time schedule for the design, construction and equipment of the Suburban Mass Transport System to coordinate with the time schedule for implementation of the First Stage Mass Transit System. This shall include, among other things, the time needed for land acquisition, detailed design, solicitation of bids, construction and equipment, this will involve:

(I) Investigation of alternative locations and designs where necessary, and recommendations of alignments, taking full account of technical feasibility,

costs and impact on the environments .

(II) Preparation of plans of the geometric layout and preliminary drawings of cross sections and longitudinal sections, and drawings showing types of structures and stations, taking account of environmental factors .

Description of probable methods of construction for special engineering works such as tunnels, large bridges, if any .

(III) Undertaking soil investigations as required to confirm the technical feasibility of recommended structures and engineering works .

(IV) Preparation of cost estimates including design, construction and equipment costs for the proposed recommendation .

(V) Recommend priorities in an implementation program taking account of expected land acquisition and/or resettlement problems and prepare preliminary time schedules for implementation, as well as for the direct capital costs and benefits .

20. The Consultants' final report shall include preliminary engineering design for, the selected alignments, and/or stations if required, Construction or improvement, and selected transit system, plans, profiles and typical cross sections of the proposed works at appropriate scale and a realistic program and time schedule for final engineering, staff training program, construction, manufacture and installation of equipment .

Economic Evaluation

21. Where reasonable alternative alignments or extension sections or phasing of investments can be identified, the Consultants shall, as required by the ETA, formulate alternatives that might involve different concepts, designs, alignments and/or investment schedules; they shall then evaluate the alternatives and recommend the design, alignments and phasing considered most economic .

22. The optimal phasing of investments shall be considered such that the sum of the discounted investment, operating, management and time costs measured in terms of opportunity costs associated with the proposals, shall be minimized over a period of 20 years . For the recommended solutions, full technical and economic explanations of the reasons for selection over reasonable alternatives shall be given .

IV. PROVISION OF DATA AND FACILITIES TO BE PROVIDED BY THE ETA

A. Data Provision

23. The Government shall provide the Consultants with all available data and reports relevant to their work, including:

- (a) Reports and data of the Bangkok Transportation Study
- (b) Engineering and Economic Investigation of the First Stage Expressway System in Bangkok.
- (c) Maps, plans, aerial photographs, etc. and other relevant data concerning the area. Provision of these will not necessarily be free of cost.
- (d) Demographic and economic data of the country and particular areas, as available.
- (f) Information and data on land use and its regulation.
- (g) Government plans for major investments.
- (h) Cost experience on recent construction projects.
- (i) Records of SRT passenger volume and frequency of service.
- (j) The results of other relevant studies.

B. Facilities to be provided by the ETA.

24. The ETA will provide a counterpart staff to work with the Consultant and the supporting staff and to be responsible for liaison between the Consultant and concerned government agencies.

V. TIME SCHEDULE FOR CONSULTING SERVICES AND REPORTS

25.

(a) An Inception Report (50 copies) giving the Consultants' proposed work program in further depth, as may be required by the ETA, the methodology and schedule for the project and describing the key procedures to be followed, to be submitted within one month after the Starting Date.

(b) A Draft Final Report (50 copies) presenting the findings and recommendations resulting from work performed under part III.

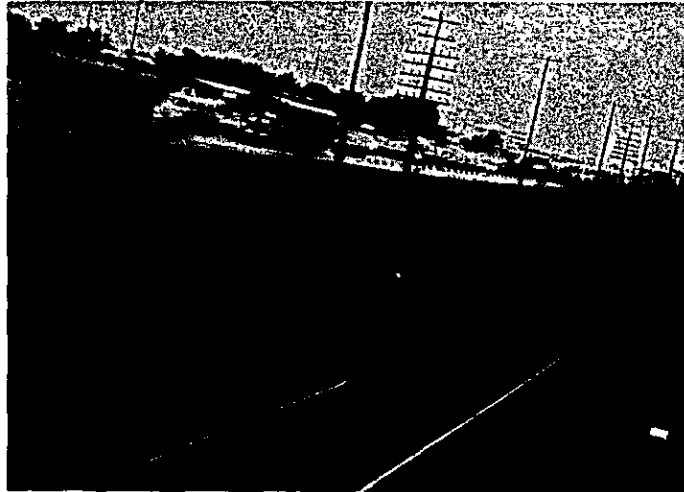
(c) A Final Report and preliminary engineering design (300 copies) incorporating all revisions deemed appropriate by the Consultants after the comments received on the Draft Final Report within 60 days of receipt of all

comments .

24. The period of the Comprehensive Study will be discussed later on.

Technical and Planning Division
Expressway and Rapid Transit Authority
of Thailand

July 21, 1978.



(写真1) 空港に至る Highway の混雑及びタイ国鉄既設軌道



(写真2) 整備中のタイ環状道路(日本の提案による)及び沿線開発状況(中層ゲタバキアパート)



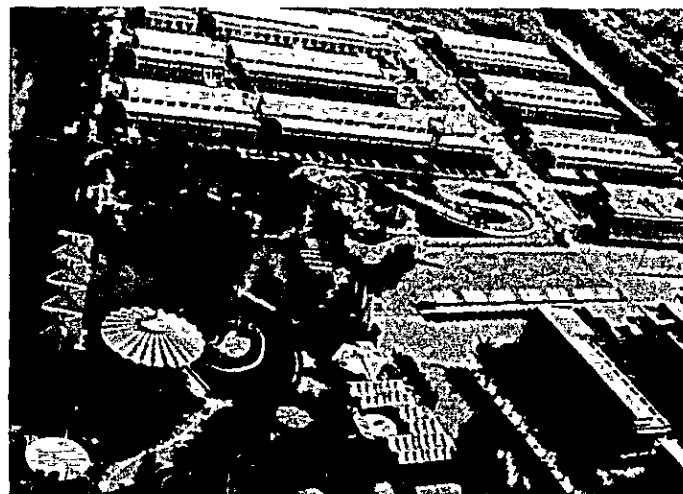
(写真3) 郊外開発状況(低層アパート)



(写真4) 郊外開発状況及び郊外の水田集落分布



(写真5) 郊外開発の例(中層高密アパート)



(写真6) 郊外開発の例(低層高密アパート)

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