8.4 施工計画

1) 準備工

工事発注後，直ちにプロジェクトサイトへの資機材の搬入を行うとともに，工事に必要な事務所・宿舎・試験室・倉庫等の仮建物や各種プラント・資材置場の仮設物を建設する。工事に必要とされる仮設物とその位置をＦｉｇ８－２.，Ｔａｂｌｅ８－２に示す。現地にて入手不可能な材料や施工機械は諸外国から，タンザニアへ搬入される。一方，プロジェクトサイトでは，測量を行い，実施設計の照査を行うとともに，仮ベンチ・マークや控え杭等の基準点，施工のためのやり形を設置する。資機材搬入に３ケ月及び仮設工に１～２ケ月を要する。

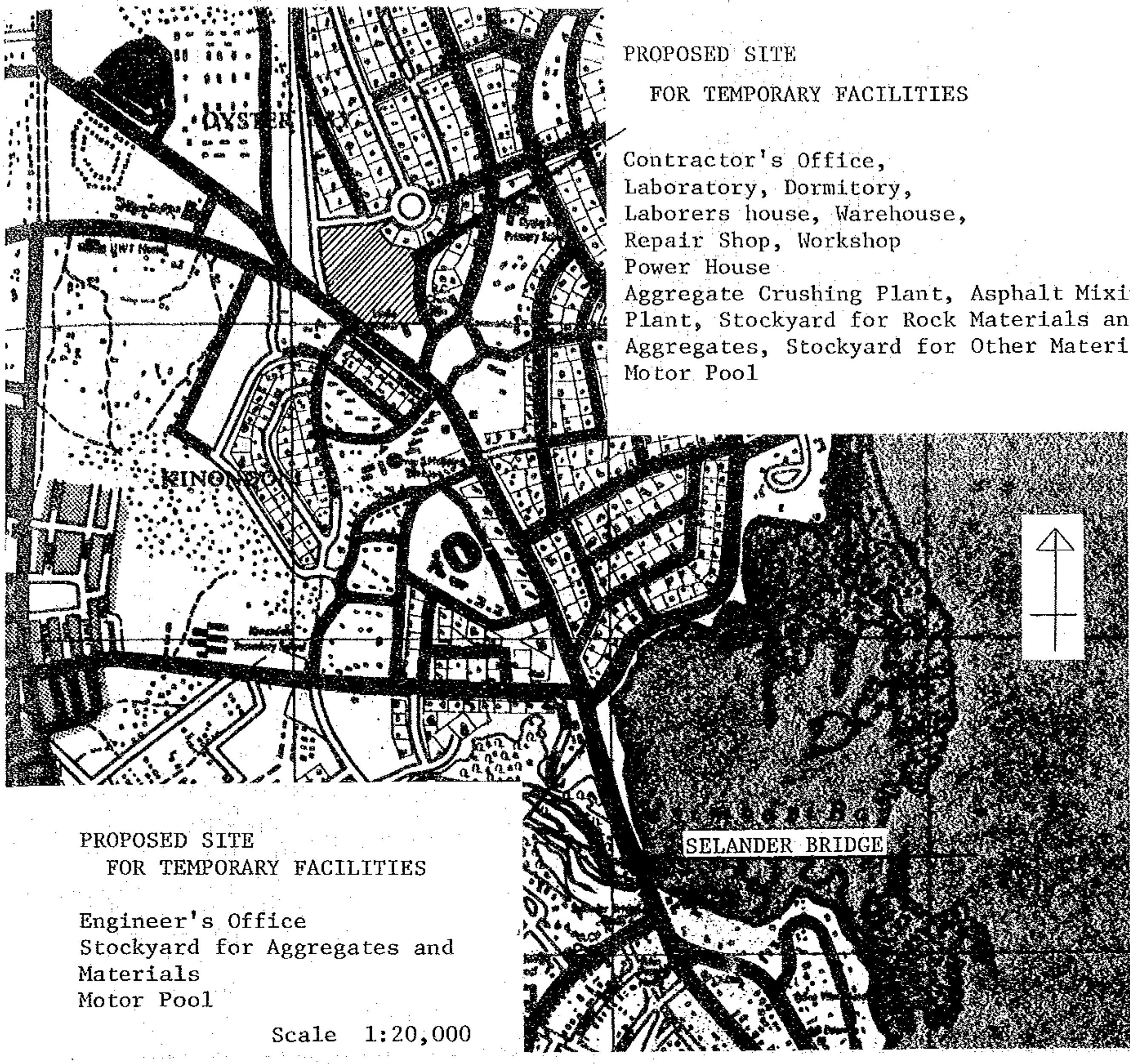
Table 8-2 Temporary Facilities

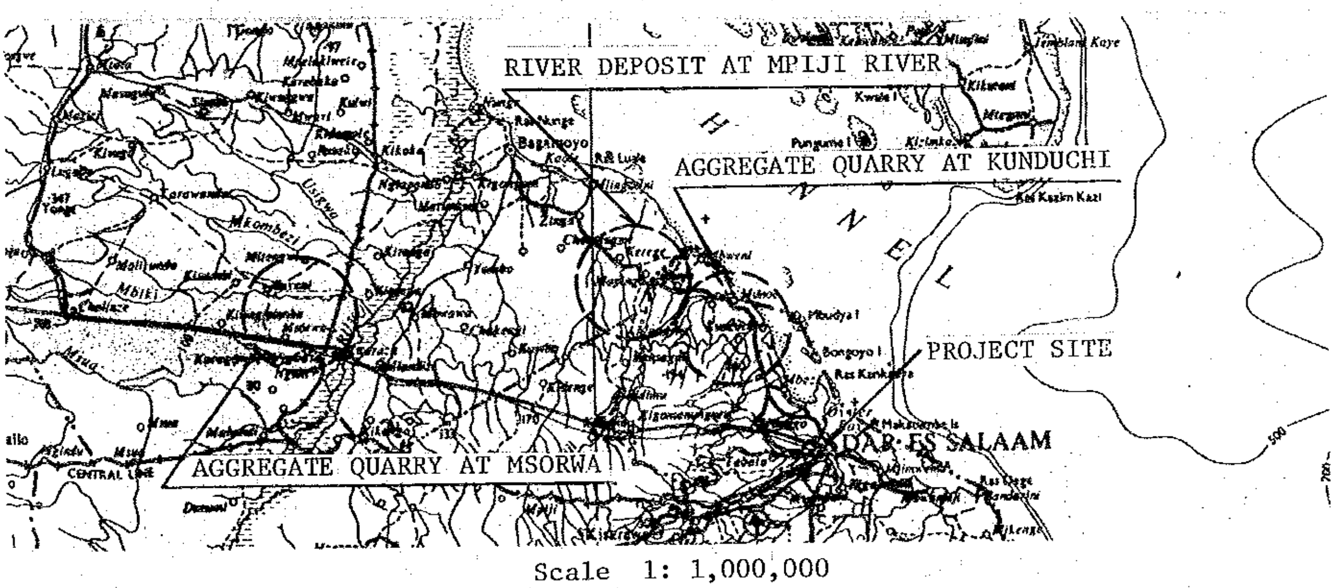
	Building(Sq.m)	Area of land (sq.m)
Office (contractor)	110	220
Domitory	80	160
Laborers house	140	280
Laboratory	30	60
Warehouse (Cement)	140	210
Warehouse	80	120
Repair shop, Workshop	300	450
Stock yards for materials		2,000
Motor pool		800
Crushing plant		7,000
Asphalt plant		
Stockyards for aggregates and rock materials		
Total	880	11,300

Aggregate Quarry MSORWA

" KUNDUCHI

River Deposit MPIJI





Scale 1: 1,000,000

Fig. 8-2 Map of Temporary Facilities and Quarry Sites

2) 橋　梁

橋梁工事着手以前に既設の自歩道橋を撤去しなければならない。この自歩道橋には現在も供用中である水道管，通信ケーブルが添架されておりこれらの施設は自歩道橋撤去に先行して行わなければならない。海上部の撤去には上部工の搬出及び杭の引抜き撤去のための足場が必要である。この自歩道橋の撤去，施設の移設は仮歩道を確保をしたのち行われる。

橋梁の作業フローをFig 8－3に示す。橋台A_2 橋脚P_2 P_3 P_4 は海上にあるが，埋土し，橋梁幅と工事用道路幅合計約30 *m* の上面幅を持つ土堰堤を構築する。作業は陸上での施工となり，施工性はおおいに向上する。橋梁下の水の流れはほとんどなく，潮の干満により水位が上下するのみであるので，橋脚P_3 とP_4 間に水路を設け，工事用道路部分には仮桟橋を設ける。

鋼管杭の打設はディゼルハンマーをクレーン式くい打ち櫓に取り付け行う。掘削は高潮位EL＋2.50 *m* であり水位が高いことから，矢板による仮締切を施工後，人力及びクラムシェルを用いて施工する。掘削された地盤面からの浸水は水中ポンプを用いて排除する。コンクリートの打設は可搬式ポータブルミキサーとシュートを用いて行う。

埋め戻し後，床版の支保工型枠を施工し，鉄筋を組立てる。コンクリート打設にあたっては，打設順序を検討し，支保工基礎の沈下，たわみが過大にならずひび割れが生ぜぬ様，充分な配慮を行う。

BRIDGE WORK

Bridge Work Procedure

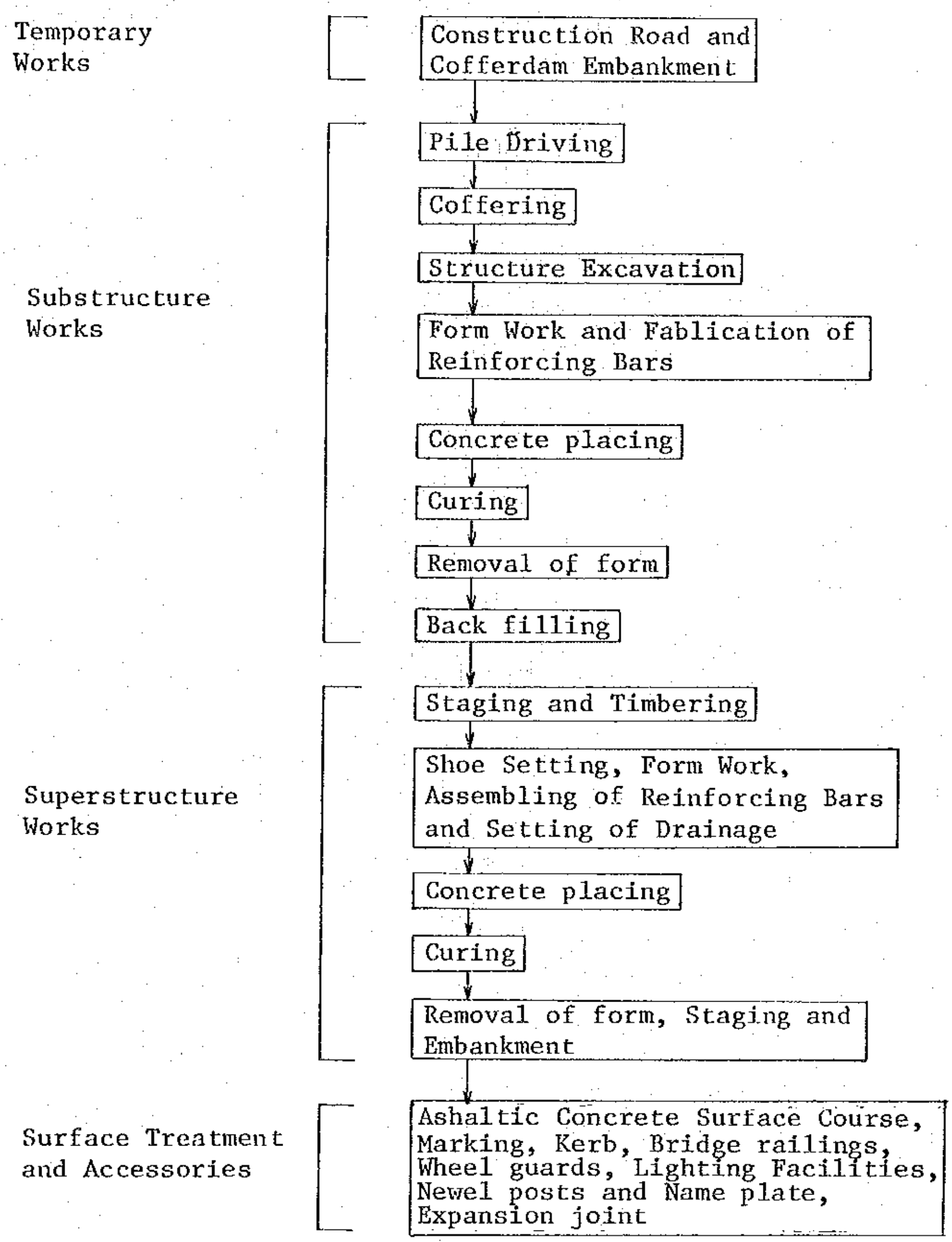


Fig. 8-3 Working Diagram of Bridge Work

3）道　路

a）段階施工と交通車両の安全対策

工事中においても，現在の交通を止めることはできず，ケニヤッタ道路を除いては他に適当な迂回路も無いことから，道路の施工にあたっては，常に現在交通の車道幅を確保するため，工事実施範囲を分け，段階的に施工せざるを得ない。工事手順，範囲をFig 8－4に示す。

工事期間中に一般交通に供用する部分と工事範囲の区別はマーキングや防護柵，保安灯などを用いて行い，通行車両等に危険がない様，配慮する。又，各交差点での交通処理はタンザニア警察と十分な協議の上，助力を得，交通整理員等を配置して，車両の円滑で安全な走行が保たれる様にする。

b）土　工

ブルドーザにより伐開除根し，やり形に基づき，切土工，盛土工を行う。掘削はブルドーザで行い，搬土距離により，トラクタショベル（ホイールタイプ）とダンプトラックを併用する。不良土は土捨場を設け排土する。盛土材の敷均しは，ブルドーザとモーターグレーダーで行ない，タイヤローラで締固めを行なう。

c）舗装工

① 下層路盤，上層路盤工，路盤工の材料は，骨材のストックヤードから，作業現場まで小運搬し，モーターグレーダー，ブルドーザで敷均し，マカダムローラ，タイヤローラにて締固める。自転車道や構造物の隅角部等の転圧は，小型のバイブレーションローラ及びソイルコンパクターで締固めを行う。締固め時，撒水車を準備し，常に最適含水比附近に保つ様にする。転圧後，プライムコートをエンジンスプレイヤーで撒布する。

② 基層，表層に用いられる瀝青材混合物はアスファルトミキシングプラントで製造し，現場へ運搬し，アスファルトフィニッシャーで舗設する。プラントは能力45t／hrのものを用いる。転圧は初転圧と仕上げ転圧をマカダムローラで，2次転圧をタイヤローラで行う。交差点部の舗設高さは排水上に問題を生じ易いので，慎重な施工が必要である。

d）コンクリート工

コンクリートミキサーは可搬式のポータブルミキサー0.3 m^3を使用する。コンクリート水路及びフタ，縁石等規格化できるものについては，現場での施工は避け，骨材のストックヤードに隣接して，ヤードを設け，製品化して，布設する計画である。

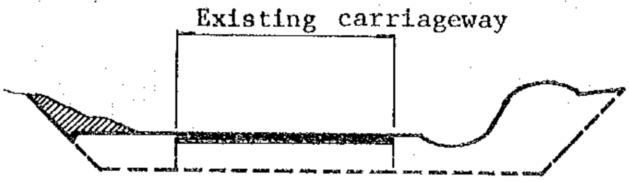
e）交通安全，管理施設，その他

交通安全，管理施設工事は基礎工や配管工の土木工事と器具の取り付け，設置等に大別される。

ROAD WORK

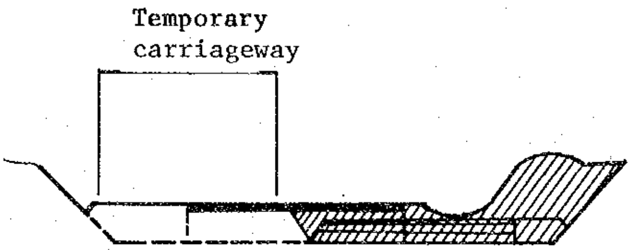
1st Stage

Expand width of
existing carriageway



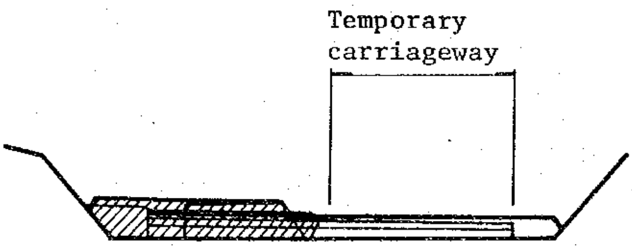
2nd Stage

Earth work is excuted
to the required level.
Following completion
of it, sub-base course
and base course are
carried out



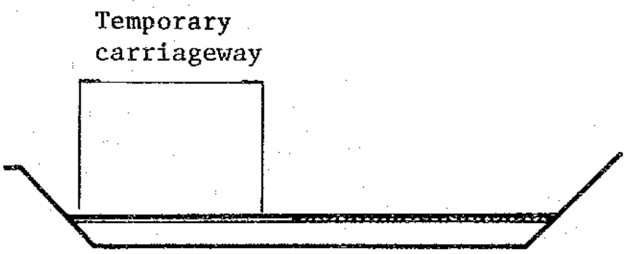
3rd Stage

Earth work and pavement
work are carried out
including some asphaltic
concrete surface course.



4th Stage

The remaining asphaltic
concrete surface course is
excuted



5th Stage

The work at junctions and
around traffic islands
is executed.

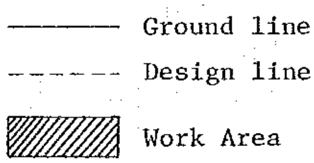


Fig. 8-4 Work Diagram of Half Width staged Construction
for Road Works

基礎工，配管工は路床工終了後，掘削し，布設又は設置し，十分な締固めを行なう。

器具，柱等の設置は原則として舗装工終了後行う。

4) 骨材の生産と採取

工事用粗骨材はプロジェクトエリアより北方約2Kmの仮設用地にクラシャングプラント30t／hrを設けて，生産する。

粗骨材の全必要数量は約15,750t(25,200m^3)である。

Table 8-3 Quantity of Coarse Aggregate

Crusher-run subbase course	4,350 tons
Grading controlled base course	4,560 tons
Asphaltic concrete binder course	1,010 tons
Asphaltic concrete surface course	1,670 tons
Concrete	2,930 tons

路盤用骨材の原石はダルエスサラム北方約14Kmのクンドチ地方産を用いる。又アスファルト表層工及びコンクリート用骨材は西方約130Km離れたムソルワ産の原石を用いる。

原石の推定採取量はそれぞれ約18,600t，約7,700tである。

原石の採取方法は発破工法によるが，粗骨材の最大粒径が小さい事もあり，極力小割りになる様計画する。破砕され適度の大きさに粉砕された原石はダンプトラックにより，プロジェクトサイト近くのクラッシングプラント又は原石のストックヤードまで運搬する。クラッシングプラントで，各サイズに振い分けられた骨材は板囲い等により区別されたストックヤードに小運搬され，工種に応じて搬出する。

コンクリート用骨材，アスファルト表層工骨材は水洗いが必要である。

8.5 主要建設機械

主要建設機械をTable 8－4に示す。

Table 8-4　Construction Equipments

Equipment	Model	Number	Remarks
Bulldozer	11 tons	2	
"	21 tons	1	Riper
Tractor shovel	1.3 m^3	1	Wheel type
"	1.0 m^3	1	〃
"	1.4 m^3	2	Crawler type
Crane	35 HP	1	Crawler type
Clam shell	0.3 m^3	1	Attachment only
Diesel pile hammer	ram = 3.5 tons	1	
Vibrating hammer	22 KW	1	
Leader	ℓ = 20m	1	piling
Welding machine	13 KW	1	
Motor grader	3.1 m	1	
Macadam roller	10 ∿ 15 ton	1	
Tire roller	25 ∿ 28 ton	1	
Vibrating roller	2.5 ton	1	
Asphalt finisher	2.5 m	1	
Engine sprayer	200 ℓ	1	
Soil compactor	1.6 t	1	
Concrete mixer	0.3 m^3	3	Portable type
Asphalt plant	45 t/hr	1	
Aggregate crushing plant	30 t/hr	1	
Jack hammer	3 m^3/min	10	
Hand breaker	15 kg	2	

Table 8-4 (continued 2)

Equipment	Model	Number	Remarks
Diesel generator	25 KVA	2	
	100 KVA	1	
Air compressor	37 KW	2	
	100 KW	1	
Vibrator	φ 60mm	3	Engine
Water pump	13 KW	6	
Water tank	1 m^3	6	
Water truck	1,600 ℓ	1	
Dump truck	8 tons	4	
〃	11 tons	7	
Truck	2 tons	2	

8.6 品質管理

品質管理とは，工事が所要の品質を満足する様，施工の過程において管理するもので，①使用資材，②加工，製造，③施工方法の各段階で行なわれ，最終的には仕上ったものの品質検査を行う。アスファルト，セメント，鋼管杭，施設器具等の材料の規格規準は第３章に記述されている通りであるが，その材料の品質は試験合格証を提出するか，又は監督員立会いのもとで検査を行なう。又，使用骨材，アスファルト混合物，コンクリートの材料試験，品質試験は業者により設置される試験室において，監督員の立会いのもとで実施される。試験室にて行なわれる主な試験をTable 8－5に示す。又，施工時点では，管理試験記録を作成する。

Table 8-5 List of Testing for Construction

Test for Slump of Concrete	JIS A.1101
Grain size Analysis by Screening	1102
Grain size Analysis by Sedimentation	1103
Test for Unit Weight of Aggregates	1104
Test for Organic Impurity of Sand	1105
Test for Flexural Strength of Concrete	1106
Test for Compressive Strength of Concrete	1108
Test for Specific Gravity and Absorption of Fine Aggregate	1109
Test for Specific Gravity and Absorption of Coarse Aggregate	1110
Test for Surface Moisture Content of Fine Aggregate	1111
Test for Air Content of Flesh Concrete by the Volumetric Method	1118
Los Angele's Abraision Test	JIS A 1121
Test for Stability of Aggregate	1122
Method of Making and Curing Concrete Specimens	1132
Test for Moisture Content of Soils	1203
Grain size Analysis of Soils	1204
Test for Liquid Limit of Soils	1205
Test for Plastic Limit of Soils	1206
Test for Moisture-Density Relation of Soils Using Rammer	1210
Test for the California Bearing Ratio of Soils	1211
Test for Density of Soil in Place by the Sand-Cone Method	1214
Bulk Specific Gravity of Compacted Bituminous Mixtures Using Paraffin-Coated Specimens	ASTM-D1188
Resistance to Plastic Flow of Bituminous Mixtures Using Marshall Apparatus	ASTM-D1559
Quantitative Extraction of Bitumen from Bituminous Paving Mixtures	ASTM-D2172

第9章　建設費積算方法

第9章　建設費積算方法

9.1　積算に対する基本思想

1）建設費の積算方法

我国の建設省の請負金額に対する見積の基本思想は，次のとおりである。

- 請負予定工事費
  - 工事原価
    - 直接工事費
      - 材料費
      - 労務費
      - 直接経費
    - 間接工事費
      - 共通仮設費
      - 現場管理費
  - 一般管理費等
    - 一般管理費
    - 利潤

ここで，直接経費は，工事のため直接発生する作業で，機械器具損料を言う。機械器具損料には償却費，定期整備費，現場修理費，機械管理費，労務費，燃料費，消耗品部品費を含むものとする。

共通仮設費は運搬費，準備費，仮設費，安全費，役務費，技術管理費，営繕費を含むものとする。

現場管理費は，通常の現場管理の他，工事に必要な測量費，試験費，設計変更補助事務費，労務員提供費を含むものである。

一般管理費は，建設業者の本店経費，金利，利潤を含むものである。

2）本プロジェクトの積算方法

本プロジェクトにおいては，我国の建設省の見積方法を基盤とし，一般的に海外工事で行なわれている単価契約に適合するように，次のような見積方法をもって，建設費を算出するものとする。

- 予定請負工事費
  - 直接工事費
    - 材　料　費（運搬費込み）
    - 労　務　費
    - 直 接 経 費（運搬費込み）
    - 共通仮設費
    - 現場管理費
    - 一般管理費
    - 利　　　潤
  - 施工管理費
    - 現場事務所建設費（コンサルタント用）
    - 現場事務所維持費
    - 車両購入，維持費（コンサルタント用）

したがって，直接工事費の各工種には，図に示す材料費（運搬費込み），労務費，直接経費（運搬費込み），共通仮設費，現場管理費，一般管理費，利潤の全ての項目を含むものである。この各工種の単価が，予定単価となるものである。

施工管理費は，本プロジェクトの実施のために雇用されるコンサルタントの現場事務所建設費，及びコンサルタントが業務遂行のために必要な設備一式，更に事務所の補修，及び維持管理を行ない，常にその機能を保つために必要な費用を，全て含むものである。又，コンサルタントが施工管理に必要な車両の提供，及び常にその機能が発揮出来るように，維持管理を行なう。それに要する全ての費用を含むものである。

本プロジェクトは，工事期間が１８カ月と短かく，かつその資機材の大半は，タンザニア国外から持ち込まれるため，インフレーションによる予定単価のエスカレーションは想定しない。予定単価の内には，すでにインフレーションによる単価上昇を折込んで積算されている。

9.2 数量及び積算項目

数量及び積算項目，すなわち支払項目は次の通りである。この各項目について入札を行なう。これらに含まれる工事は，仕様書に詳細に記述してある。

Table 9-1 Bill of Quantities

Pay Item No.	Description	Unit	Quantities	Remarks
101	Safe Measure to Traffic on Existing Road	L.S.	1	
102	Safe Measure to Existing Public Utilities	L.S.	1	
103	Safe Measure to Demolition of Existing Pedestrians Bridge	L.S.	1	
201	False work	LS	1	
202	Structure Excavation	m^3	1,570	
203	Structure Back fill	m^3	450	
204	Foundation cobble stone	m^3	70	
205	Concrete (class-A)	m^3	990	
206	Concrete (Class-B)	m^3	625	
207	Concrete (Class-D)	m^3	40	
208	Reinforcing Bar-A	kg	47,790	
209	Reinforcing Bar-B	kg	126,970	
210	Piling (ϕ600 Steel Pipe)	m	1,536	
211	Asphaltic Concrete Pavement	m^2	1,423	

Table 9-1 (continued 2)

Pay Item No.	Description	Unit	Quantities	Remarks
212	Elastic Bearing	m^2	60	
213	Hand Railing	m	303	
214	Newel Post	each	4	
215	Expansion Joint	m	19	
216	Drainage	each	8	
301	Clearing and Grubbing	m^2	27,250	
302	Waste Excavation	m^3	230	
303	Side borrow Embankment	m^3	3,340	
304	Borrow Pit Embankment	m^3	7,600	
305	Improved Subgrade	m^3	920	
306	Slope Protection Sodding	m^2	2,360	
307	Slope Protection Rock Rip rap	m^2	220	
401	Kerb Stone	m	2,270	
402	Side Ditch-A	m	1,210	
403	Side Ditch-B	m	1,380	
404	Side Ditch Cover (G)	each	53	
405	Culvert	m	180	
406	Catch Basin	each	39	
407	Out let	each	5	
501	Crusher run Subbase Course (t = 15cm)	m^2	18,490	
502	Grading Controlled Base Course (t = 15 cm)	m^2	19,380	

Table 9-1 (Continued 3)

Pay Item No.	Description	Unit	Quantities	Remarks
503	Asphaltic Concrete Binder Course (t = 5 cm)	m^2	19,620	
504	Asphaltic Concrete Surface Course (t = 5 cm)	m^2	20,800	
505	Sidewalk Pavement	m^2	7,700	
601	Street Lighting Pole -I	set	55	
602	" Pole -II	set	28	
603	" Pole -III	set	11	
604	Traffic Signal - I	set	10	
605	" -II	set	16	
606	" -III	set	4	
607	Cable laying and wiring for Lightings	m	3,000	
608	Cable laying and wiring for Traffic Signals	m	640	
609	Distribution Pannel for Lightings	each	2	
610	Control Pannel for Traffic Signals	each	3	
611	Road sign - A	each	10	
612	" B	each	6	
613	" C	each	14	
614	Delineator	each	20	
615	Road Marking	each	830	
616	Hand Rail	m	28	
701	Bus Stop Shelter	each	1	
702	Median Strip	m^2	2,850	
703	Planting	each	550	
704	Office for Engineer's Use	LS	1	
705	Vehicles for Engineer's Use	LS	1	

9.3 現地購入材，建設機械及び労務単価

本建設費積算に用いた主要現地購入材，主要建設機械及び主要労務単価は，次のとおりである。これらの単価は，1980年10月から1982年3月までの工事期間における平均的予想単価である。

1) 主要現地購入材

Table 9-2 Unit Prices of Major Locally Procured Materials

Description	Unit	Unit Price (Yen)
Cobblestones for riprap	m^3	6,400
Sand for Concrete	m^3	8,100
Gravel	m^3	7,000
Wooden form	m^3	3,100
Turf (Sod)	m^3	170
Petrol	ℓ	240
Diesel oil	ℓ	130
Light oil	ℓ	115
Lubricating oil	ℓ	2,200
Cement 50 kg bag	bag	230
Timber for trenches	m^3	1,700

2) 主要建設機械

Table 9-3 Major Construction Equipments

Description	Classification	Hourly, operating cost (YEN/hour)
Bulldozer	11 t	9,820
Tractor shovel	1.3 m^3	14,940
Cramshell	0.3 m^3	37,430
Back hoe	0.35	74,240
Macadam roller	10 ∿ 12 t	12,200
Tire roller	8 ∿ 20 t	16,390
Motor grader	3.1 m class	74,770
Asphalt finisher	2.4 ∿ 5.0 m class	24,800
Engine sprayer	200 ℓ	1,730
Crawler Crane	35 t	15,170
Diesel hammer	ram = 3.5	-
Compressor	Portable 27 kw	24,320
Diesel generater	100/125 KVA	-
Dump truck	11 t	9,440
" "	8 t	3,440
Truck crane	2 t	8,610
Lift car	11 ∿ 12 m	4,640
Trailer	20 t class	-
Water tank	3 m^3	-
Station wagon	2,000 cc	-
Asphalt plant	45t/hr	105,760
Crushing plant	30 t/hour	1,070
Concrete mixer	0.2 m^3	1,250

3) 労務単価

Table 9-4 Unit Prices of Major Types of Laborers

Description	Classification	Unit	Price (Yen)
Forman		hour	600
Mechanician		"	500
Operator		"	430
Driver		"	380
Skilled Labor	Plumber	"	300
	Carpenter	"	300
	Painter	"	300
	Mason	"	300
Semi-skilled labor		"	220
Unskilled labor		"	170

第10章　施工における留意点

第１０章　施工における留意点

10.1　橋梁工

1）仮締切及び掘削

橋台，橋脚の基礎掘削は，海上部は矢板掘削とする。仮締切工（山留工）は，掘削の進行に伴なう土圧，及び水圧の変化に注意し，施工期間中，安全な強度を有するよう設計されなければならない。特に，既設橋の橋台，及び橋脚に接近して施工する箇所は，ボイリング及びパイピング現象により，既設構造物が変化を起こしていないか，常時観察しておく必要がある。

2）鋼管杭及び打設

杭長は設計図の寸法にこだわらず，杭先端支持層を確認しながら，決定するものとする。

単管は比較的長尺ものを用意し，現場溶接箇所数を少なくするよう，配慮すべきである。

3）床付

橋台，橋脚フーチングの床付面が，非常に軟弱土層であるため，基礎敷均石工の厚さの寸法は，設計図にこだわらず善処し，打設されたフーチングコンクリートに，割れを生じさせないように注意を要する。

4）橋台裏込め工

橋台の裏込め材は，砕石を用い，十分な転圧を施して締固める。橋台パラペット背後は，特に注意を払い，転圧不足となるのを避けなければならず，仕上げは，責任監督官の承認を得るものとする。

5）支保工

支保工支持地盤面は，あらかじめ十分な転圧を施し，表層を良質土砂におき換える等して，コンクリート打設後不同沈下が起きない様にしておかなければならない。

支保工は堅牢な材料を用いるものとし，施工中のあらゆる荷重に対し安定した構造でなければならない。

6）型わく工

外型わくは，耐水性にとみ表面が平滑な材料を用いるものとし，角材等を密に配置した上にセットして，コンクリート打設後のたわみを最小限に押えなければならない。

円筒型わくは，施工中凹みや破損を生じない様慎重に取扱うものとする。浮上り防止バンドを

所定の間隔でセットし，コンクリート打設中の型わくの浮上りを防ぐ。又，円筒型わく内部に水が溜らない様，あらかじめ型枠底部に排水パイプをとりつけておく。

7） コンクリート工

本橋は，連続形式であるので，支間部分からコンクリートの打設を行ない，型わく，支保工の沈下がおさまったことを確認してから，支点部コンクリートを打設する。コンクリート打設中は，円筒型わくが移動しない様注意しなければならない。又，円筒型わくの下は，コンクリートが回りにくいので，バイブレーターにより十分な締固めを行ない，有害な空隙の発生を防がなければならない。

10.2 道 路

道路建設の際，留意すべき事項としては以下のような項目が挙げられる。

1） 工事中の現道交通に対する配慮

当プロジェクトは幹線道路であるため，工事中に現道交通をストップするわけにはいかないので，常に2車線分の通行幅を確保しながら工事を進めなければならない。又，現道交通に対する安全確保の立場から，安全施設，工事灯の設置等，特に注意を払う。

工事車両と現道交通のさくそうを極力少なくするような搬入路の計画，資機械置場の位置選定を行なわなければならない。

2） 標定点の設置と測量誤差の補正

詳細設計に用いている地形図は，タンザニア政府から貸与された地形図を基本設計調査団が補測修正したものであるが，局座標による補測であり，現地に標定点は設置されていない。従って，工事着手に当っては，現地に標定点を設置し誤差の補正を行なう必要がある。

3） 採石場，土取場等現地材料の入手

採石場，土取場等現地材料入手のために必要な行政措置を工事に支障がないように行なわなければならない。そのために正確な工程，材料の種類，量について十分な余裕期間をもってタンザニア政府に便宜供与を申し入れる必要がある。

5） 現道拡幅部分の舗装

現道拡幅部分については，盛土の締固めを十分に行なうとともに，路体の沈下を促進し，舗装布設後に現道部分と拡幅部分の舗装に段差等生じないよう施工を入念に行なわなければならない。又，現道の舗装端にはカッターを入れ，タックコートを散布し現道と新設部分の舗装のなじみをよくする。

ANNEX

A MINUTES OF DISCUSSIONS
B DATA FOR BRIDGE DESIGN
C DATA FOR ROAD DESIGN
D DATA FOR PAVEMENT DESIGN
E DATA FOR DESIGN OF TRAFFIC CONTROL FACILITIES

CONTENTS

A-I MINUTES OF DISCUSSION

of

The Preliminary Survey on the Selander Bridge
Expansion Project in Dar es Salaam, Tanzania

The Japanese Government, on the request of the Tanzanian Government, dispatched the team from 22nd September, 1979, to 5th October, 1979, through the Japan International Cooperation Agency to carry out the Preliminary survey in the Selander Bridge Expansion Project in Dar es Salaam, Tanzania.

The team had a series of discussions with various government agencies concerned during their stay in Tanzania. The main items which were understood by both sides were as follows:-

1. The team confirmed that the Tanzanian side understood the system of Japan's grant aid programme to be extended by the Government of Japan.

2. It was confirmed that the Project covers the road section between the Kinondoni Road/Bagamoyo Road junction and the Ocean Road/Upanga Road junction.

3. It was clarified that the capacity of the proposed four-lane bridge and approach road would cope with the traffic volume in 1990 estimated in the reports obtainable.

4. The team recommended that the width of the carriageway from curb to curb should be around 16.25m.

5. It was confirmed that the design ratio of the turning - right volume to the total south-bound one at the United Nations Road junction could be presumably fixed at the present ratio, approximately 30%.

6. It was suggested by the team that the basic design of the Junctions based on a traffic-light system to be conducted by the basic design survey team.

7. It was suggested by the team that, in case the traffic demand exceeds the capacity of the proposed four-lane bridge and approach road, the proposed Inner Link Road should be constructed in relation to traffic conditions.

8. It was confirmed that bridge loads for designing should be based on the British Standards HA loadings and checked for HB loadings.

9. It was confirmed that the effect of corrosion should be fully considered in the selection of the type of structure and materials of the proposed new bridge.

10. The superstructure design should be decided taking into consideration the availability of local materials, ease in construction and maintenance problems.

11. The existing road bridge should continue to be used for light loadings for pedestrians and cyclists. The new road bridge shall be constructed on the ocean side of the existing road bridge.

12. The Tanzanian Government agreed to provide the land and its relevent facilities necessary for the implementation of the Project (inclusive of an additional right of way for widening).

13. The team was requested by the Tanzanian Government that the Government of Japan would dispatch the basic design survey team at latest by the end of November, 1979.

14. The team was requested by the Tanzanian Government to advise the Government of Japan to initiate the prompt implementation of construction work at the earliest time within the framework of the Japanese budgetary mechanism.

N. Narita

(NOBUYUKI NARITA)
Leader
of
Japanese Preliminary Survey Team
2nd October, 1979

I.N. Kimambo

(I.N. KIMAMBO)
Director of Roads &
Aerodromes Division
Ministry of Works

A-II MINUTES OF THE MEETING

ON

THE SELANDER BRIDGE EXTENSION PROJECT

DAR ES SALAAM, TANZANIA

At the request of the Government of the United Republic of Tanzania for the Selander Bridge Extension Project, the Government of Japan, through the Japan International Cooperation Agency, dispatched the basic design survey team, (hereinafter referred to as the Team) from 1st December 1979 to 21st December 1979 to conduct the basic design survey of the Project.

The Team had a series of discussions as well as field reconnaissance and exchanged views with various government agencies concerned during their stay in Tanzania.

As a result of the survey and discussions, both parties have agreed to recommend to their Government respectively to take necessary measures towards establishing the Project as stated in the Minutes of Discussion attached herewith.

December 8, 1979
Dar es Salaam, Tanzania

N. Narita

(NOBUYUKI NARITA)
Team Leader of the Japanese
Basic Design Survey Team

(I.N. KIMAMBO)
Director of Roads and
Aerodromes Division
Ministry of Works

MINUTES OF DISCUSSION

1. It is confirmed that the Project shall cover:
   - Construction of the new Selander Bridge.
   - Modification/Improvement of Bagamoyo Road to 4 lanes divided highway between Kinondoni Road and Ocean Road including all the junctions.

2. The proposed Bridge shall be designed in accordance with the following conditions.
   - Design load: Type HA loading and thereafter to be checked by Type HB loading (45 Units)
   - Seismic load: KH = 0.05
   - Bridge type : Reinforced concrete
   - Span: 15.00m x 5 - span
   - Lighting facilities: to be provided
   - Clearance: not narrower than the existing bridge
   - Other design criteria than the above and design calculation method shall follow the Japanese standard.
   - General plan, profile and cross section shall be as shown in Exhibit - 1.

3. The proposed road and intersections shall be designed in accordance with the following conditions.
   - Design traffic : 3,000 pcus for south bound traffic
   - Typical cross section shall be as shown in Exhibit-2.
   - Approximate layout of the intersections shall be as shown in Exhibit-3 and Exhibit-4.
   - Pavement shall be of asphalt concrete surface.
   - Other design criteria than the above and design calculation method shall be in accordance with Japanese standard.

4. As stipulated in Japan's Grant Aid Program,

   1) The Tanzanian Government is required to clear the site and to remove/demolish the obstructive matters in advance of the actual commencement of the construction work.

   2) The anticipated obstructive matter will include the building, the foot bridge, the water pipe and other miscellaneous facilities. The detailed specification of these obstructive matters will be clarified in the design report to be prepared by the Japanese Government.

5. It was understood that the Japanese Government has taken note of importance of this project to the Tanzanian Government and will take utmost efforts to accelerate its implementation of the proposed Project to practically possible extent within the framework of Japanese budgetary mechanism.

6. Other items on the MINUTES of the Preliminary Survey Team, unless otherwise mentioned, remain unchanged.

A-III GIST OF DISCUSSIONS

ON

THE DETAILED DESIGN OF THE SELANDER BRIDGE EXPANSION PROJECT

The Japanese Detailed Design Survey Team for the Selander Bridge Expansion Project, headed by Dr. N. Narita, was dispatched by the Japan International Cooperation Agency to the United Republic of Tanzania from the 1st June, 1980 to the 12th June, 1980 to reach to the mutual consent on the detailed design, the scope of site clearance and the procedure and schedule necessary for tendering.

During its stay in the United Republic of Tanzania, the Survey Team exchanged views and had a series of discussions with the Tanzanian Ministries concerned in respect to necessary measures to be taken for the smooth implementation of the above mentioned Project.

As a result of discussions, both parties agreed to recommend to their respective Governments the matters referred to in the gist of discussions attached herewith.

Dar es Salaam, Tanzania June 6, 1980

N. Narita

Nobuyuki Narita
Team Leader
The Japanese Detailed Design Survey Team for the Selander Bridge Expansion Project

F. Barozi
Director of Roads
Ministry of Works
Government of the United Republic of Tanzania

GIST OF DISCUSSIONS

ON

The Detailed Design of the Selander Bridge Expansion Project

I. Detailed Design

It was confirmed that the contents of detailed design discussed by both parties were mutually agreed unless otherwise described below.

1) Access to the existing police station from the proposed road.

2) Alteration of the sidewalk adjacent to the New African Building near Upanga Road - United Nation Road Junction.

3) Arrangements by Tanzanian Government for possible inconvenience caused to Soviet Embassy and British Embassy.

II. Site Clearance

Regarding the measures to be done for obstructions, both parties agreed to be responsible for carrying out their roles respectively. (See attached list)

A-III (continued 3)

LIST OF OBSTRUCTIONS FOR SELANDER BRIDGE EXPANSION PROJECT

Item	Obstruction	Location	Measures to be done	Time of Clearing
1.	Hedge/Fence	At the sea side of Ocean Road	Demolition	During main construction
2.	ditto	At both sides of United Nations Road	ditto	ditto
3.	Fence	At the north side of Kinondoni Road	ditto	ditto
4.	Concrete block wall	At the north side of United Nations Road	ditto	ditto
5.	Handrail	In front of the police box	ditto	ditto
6.	Police box including traffic signal controller	In and around the junction of Upanga Road and United Nations Road	Shift	ditto
7.	Underground communication cable and accessories (Tanzania Posts & Tele-communications Corp)	In the project area	Shift (if necessary)	By the end of November, 1980
8.	ditto (Ministry of Foreign Affairs)	A part of under the foot bridge	Shift	During preparation work for main construction
9.	Water mains and fittings	ditto	ditto	Before demolishing of the foot bridge
10.	Foot bridge	Along the Selander Bridge	Demolition	During main construction period

A-III (continued 4) No. 2

Item	Obstruction	Location	Measures to be done	Time of clearing
11.	Street lighting facilities	In the Project area excluding the part of Selander Bridge	Removal	ditto
12.	11 KV overhead distribution line	In and around each junction	shift	The end of November 1980
13.	Traffic signal facilities	In the junction of Upanga Rd. and United Nations Rd.	Removal	During main construction

A-III (continued 5) The divided table of the clearing work

Item	Cost	Construction	Compensation
1	Japanese side	Japanese side	Tanzanian side
2	ditto	ditto	ditto
3	ditto	ditto	ditto
4	ditto	ditto	ditto
5	ditto	ditto	ditto
6	Tanzanian side	ditto	-
7	ditto	Tanzanian side	-
8	ditto	Japanese side	-
9	ditto	Tanzanian side	-
10	Japanese side	Japanese side	-
11	Tanzanian side	Tanzanian side	-
12	ditto	ditto	-
13	ditto	Japanese side	-

III. Tender Procedure and Tender Schedule

As a result of the discussions by both parties, the tender procedure and its schedule are to be conducted as follows.

1) Tender documents and pre-qualifications for tenderers shall be prepared by the Consultant.

2) Tenderers to be invited shall be selected by Tanzanian side

3) The invitation letters shall be sent to tenderers by the Consultant.

4) The tender opening shall be carried out by the authorized agency to be named by both Governments.

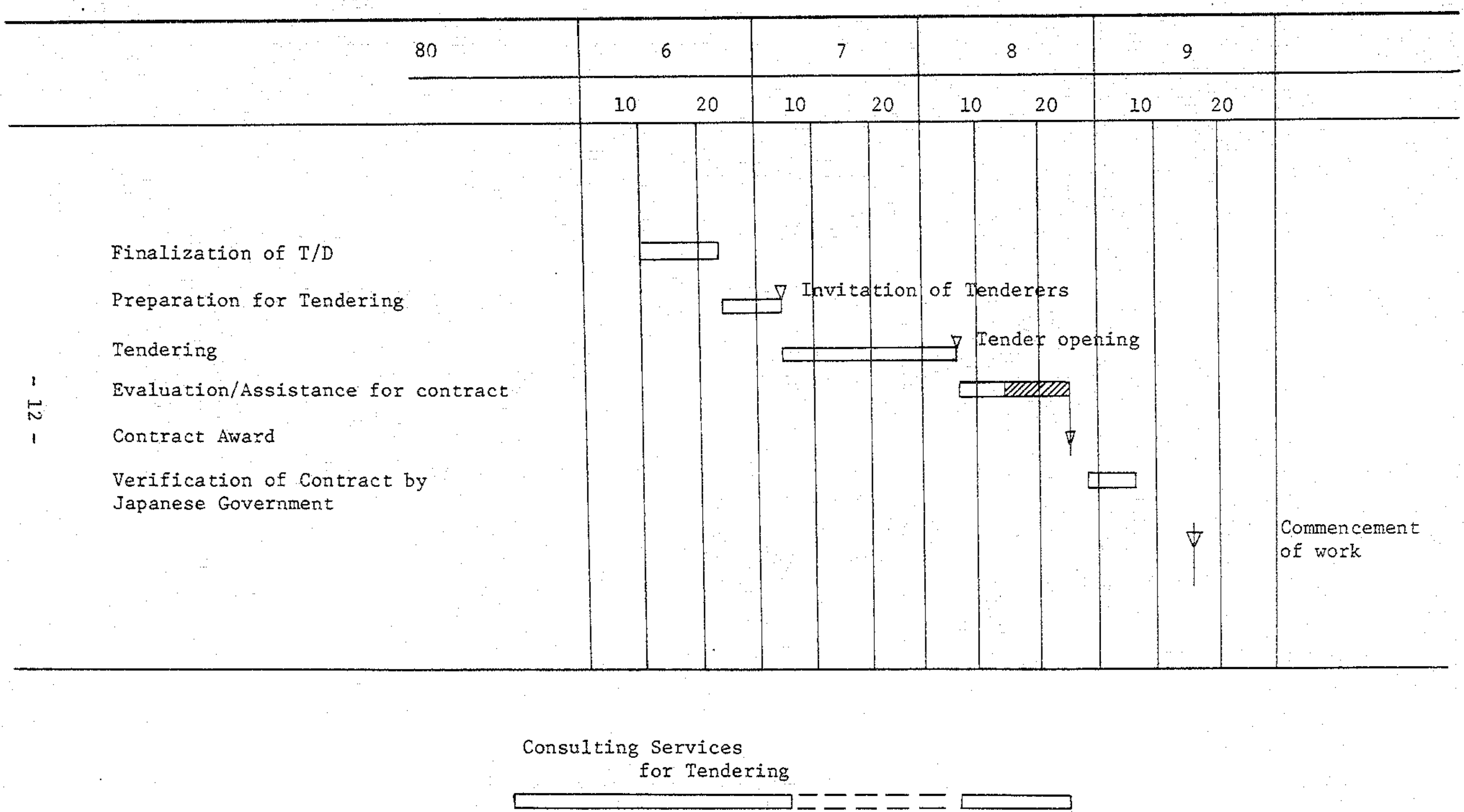
5) Evaluation for tenders shall be carried out by the Consultant.

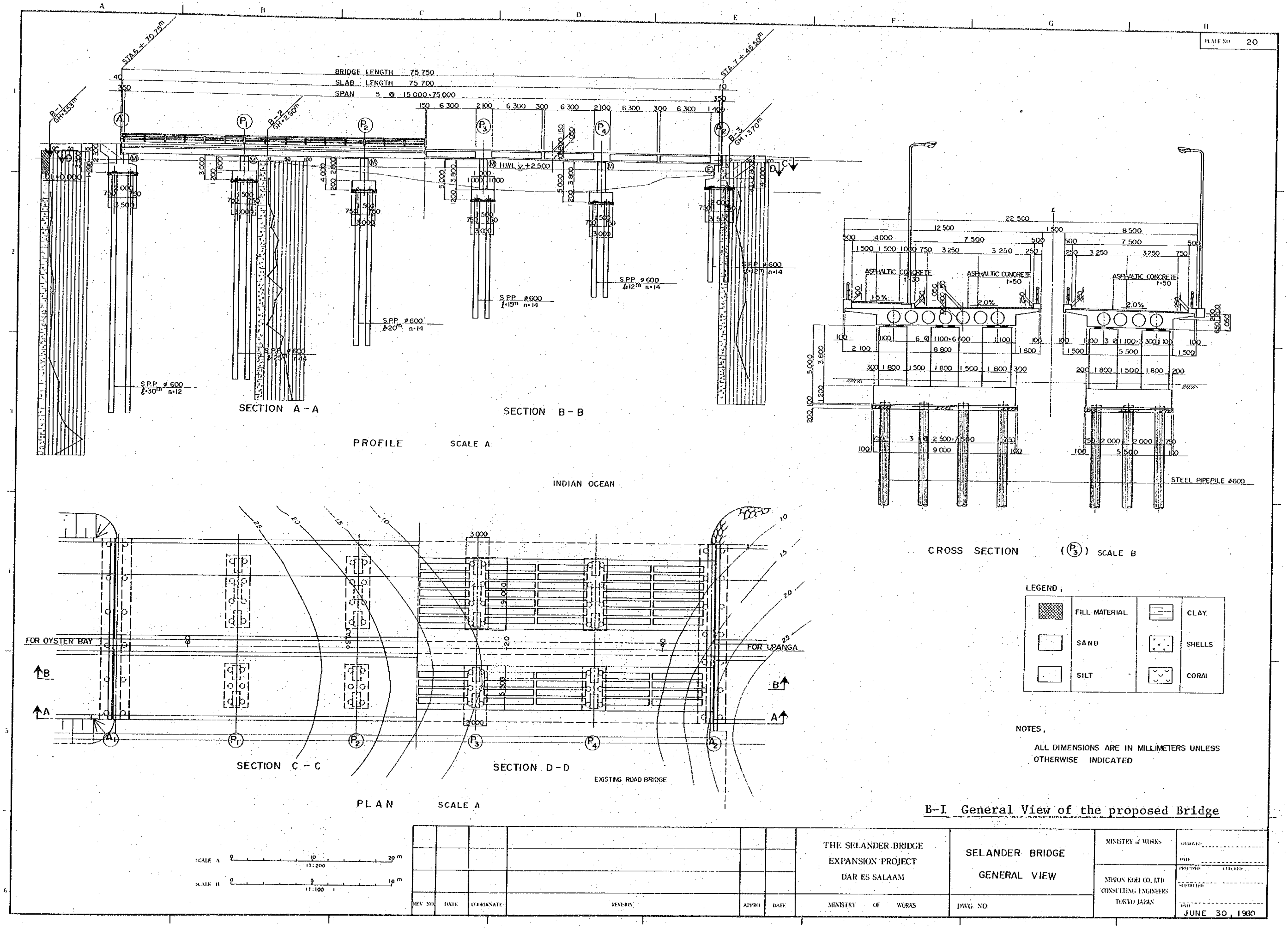
6) The Contract shall be awarded by Japanese Government and signed by Tanzanian Government.

7) The Contract shall be verified by Japanese Government. The time schedule for tendering is shown in the following figure.

A-III (continued 7)

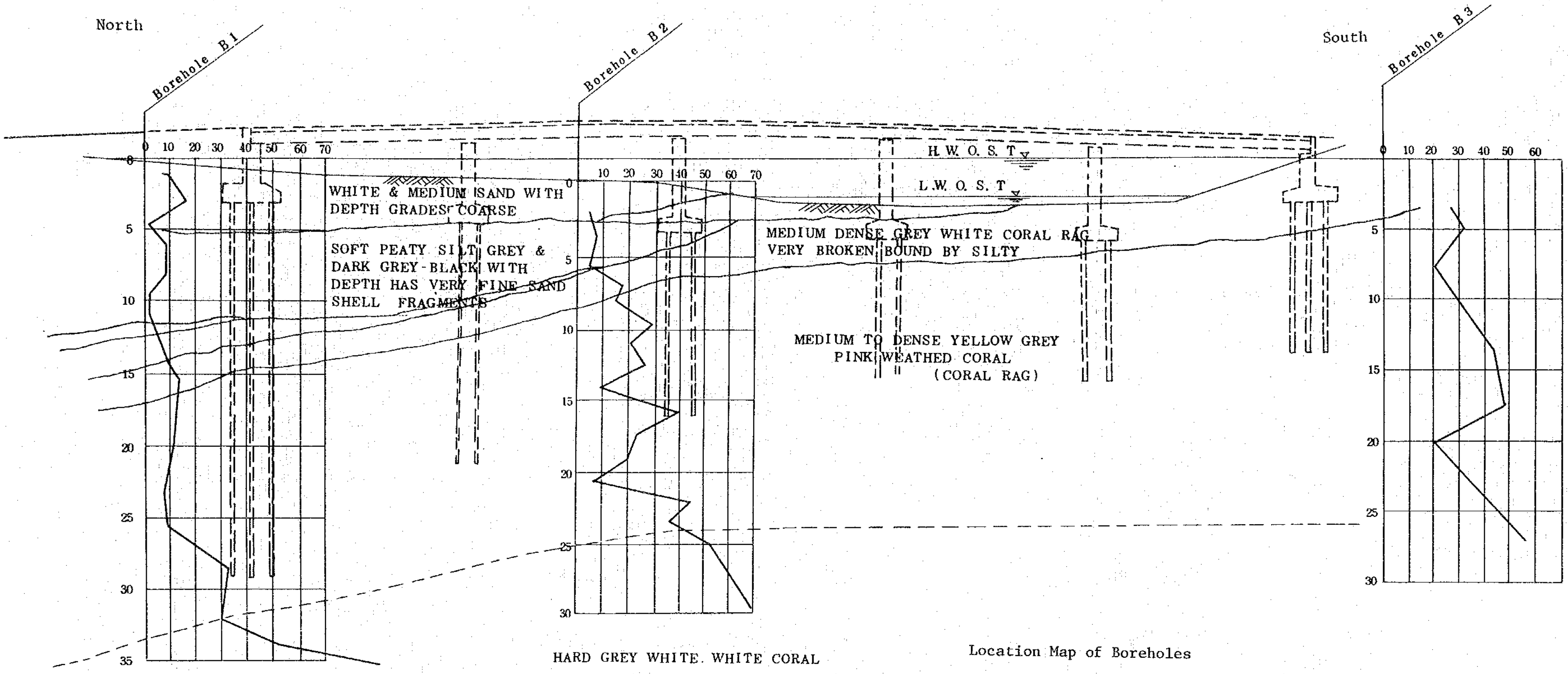
Time Schedule for Tendering



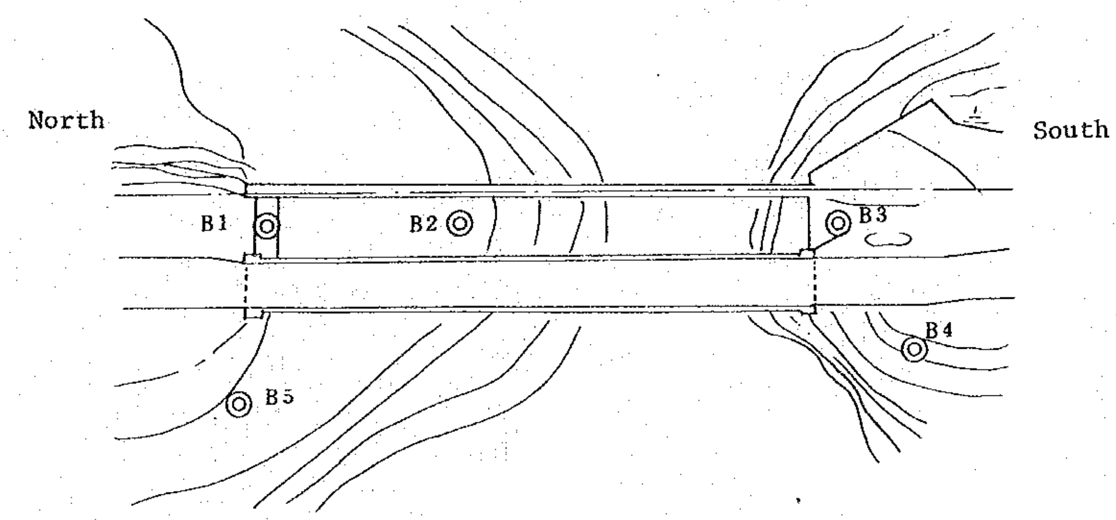


B-I General View of the proposed Bridge

B-II Geological Profile



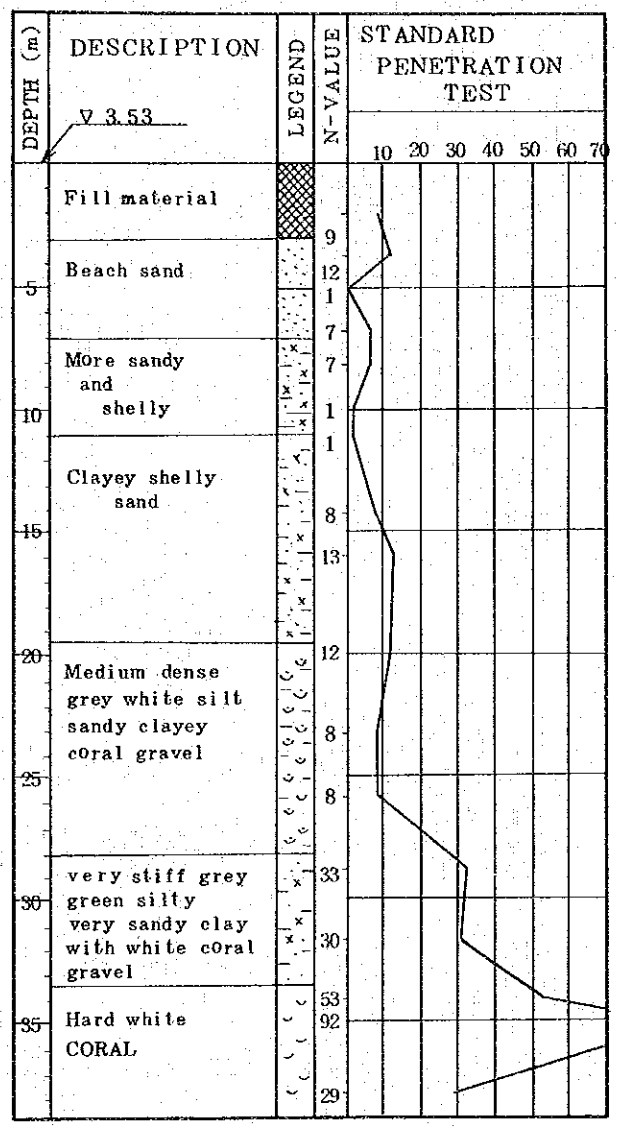
Location Map of Boreholes



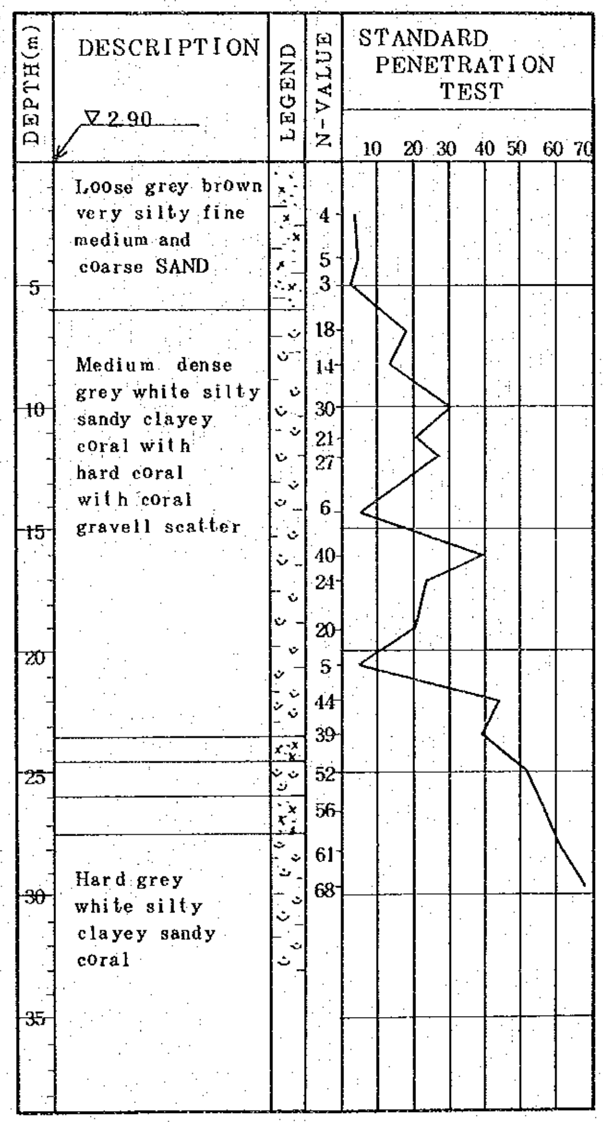
Source : Selander Bridge Extension. Construction of Bridges
COWI Consult, July 1978

B-III Boreholes Record

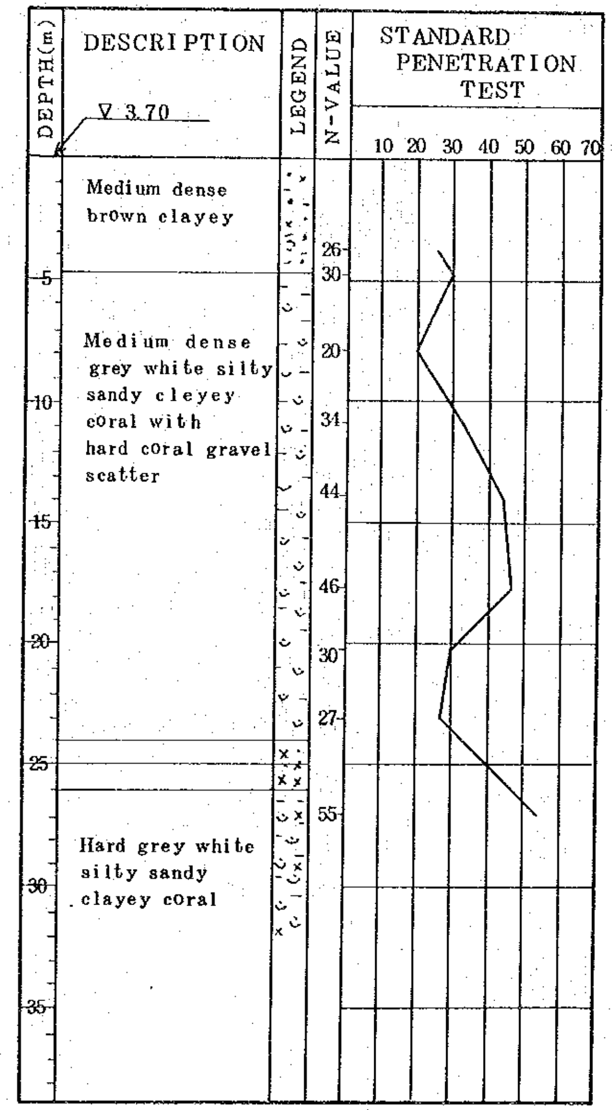
B 1



B 2



B 3

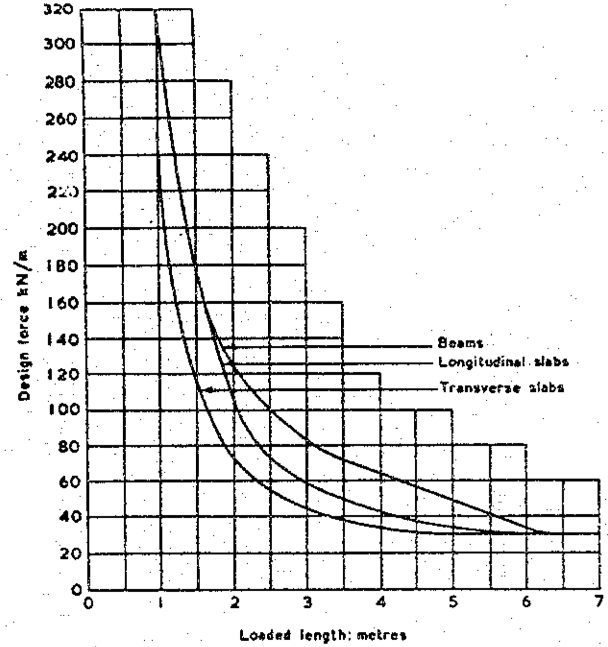


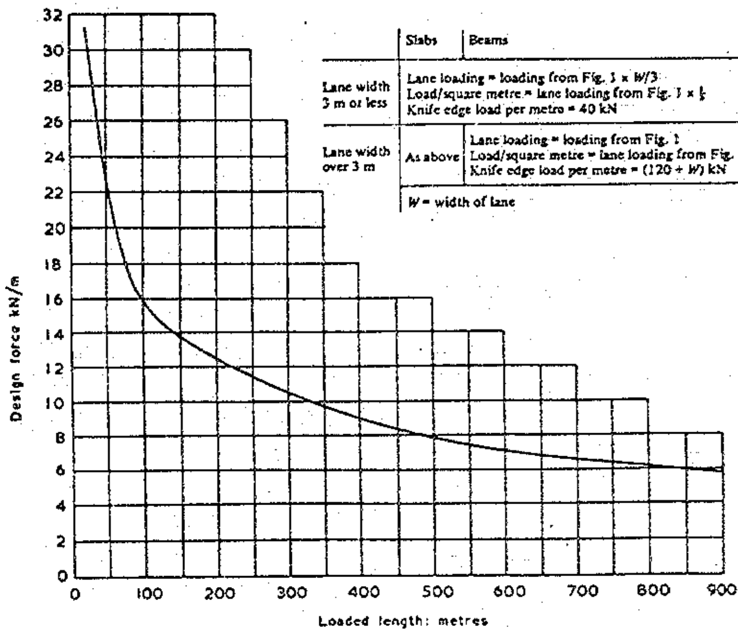
Source: Selander Bridge Extension, Construction of Bridges
COWI Consult, July 1978

Equivalent uniformly distributed load (U.D.L.) to be used in conjunction with the knife edge load (see Fig. 1)

Loaded length	U.D.L. for beams per metre of lane	U.D.L. for longitudinal slabs per metre of lane	U.D.L. for transverse slabs and cross girders per metre of lane	Loaded length	U.D.L. for beams per metre of lane	U.D.L. for longitudinal slabs per metre of lane	U.D.L. for transverse slabs and cross girders per metre of lane
m	kN	kN	kN	m	kN	kN	kN
1.00	318.6	318.6	282.0	4.00	64.8	42.0	34.2
1.25	233.7	233.7	153.6	4.25	60.9	39.0	33.0
1.50	179.4	179.4	113.4	4.50	57.0	36.3	31.8
1.75	146.4	139.5	89.4	4.75	52.8	35.1	31.5
2.00	126.6	107.1	72.6	5.00	49.2	33.9	31.5
2.25	112.8	85.5	62.7	5.50	41.1	32.1	31.5
2.50	101.7	72.0	55.2	6.00	33.0	31.5	31.5
2.75	92.4	64.5	48.6	6.50-23.0	31.5	31.5	31.5
3.00	84.6	58.5	45.0				
3.25	77.4	53.4	41.7				
3.50	72.3	49.2	38.7				
3.75	68.4	45.3	36.3				

Loaded length	Force	Loaded length	Force	Loaded length	Force	Loaded length	Force
m	kN/m	m	kN/m	m	kN/m	m	kN/m
24.0	31.2	52.0	22.3	80.0	17.7	220	12.2
25.0	30.8	53.0	22.0	82.0	17.4	240	11.7
26.0	30.4	54.0	21.8	84.0	17.2	260	11.3
27.0	30.0	55.0	21.5	86.0	17.0	280	10.9
28.0	29.7	56.0	21.3	88.0	16.8	300	10.6
29.0	29.3	57.0	21.1	90.0	16.6	325	10.1
30.0	28.9	58.0	20.9	92.0	16.4	350	9.8
31.0	28.5	59.0	20.7	94.0	16.2	375	9.5
32.0	28.2	60.0	20.6	96.0	16.1	400	9.0
33.0	27.8	61.0	20.4	98.0	16.0	425	8.6
34.0	27.4	62.0	20.2	100	15.9	450	8.4
35.0	27.0	63.0	20.0	105	15.6	475	8.2
36.0	26.8	64.0	19.8	110	15.3	500	7.9
37.0	26.6	65.0	19.7	115	15.1	525	7.7
38.0	26.2	66.0	19.6	120	14.9	550	7.4
39.0	26.0	67.0	19.4	125	14.7	575	7.3
40.0	25.7	68.0	19.3	130	14.5	600	7.1
41.0	25.4	69.0	19.1	135	14.3	625	7.0
42.0	25.2	70.0	19.0	140	14.1	650	6.8
43.0	24.9	71.0	18.9	145	14.0	675	6.7
44.0	24.6	72.0	18.7	150	13.8	700	6.6
45.0	24.3	73.0	18.6	155	13.7	725	6.5
46.0	24.0	74.0	18.5	160	13.6	750	6.4
47.0	23.8	75.0	18.3	165	13.5	775	6.3
48.0	23.5	76.0	18.2	170	13.4	800	6.1
49.0	23.2	77.0	18.1	180	13.1	850	5.9
50.0	22.9	78.0	17.9	190	12.9	900	5.8
51.0	22.6	79.0	17.8	200	12.7		





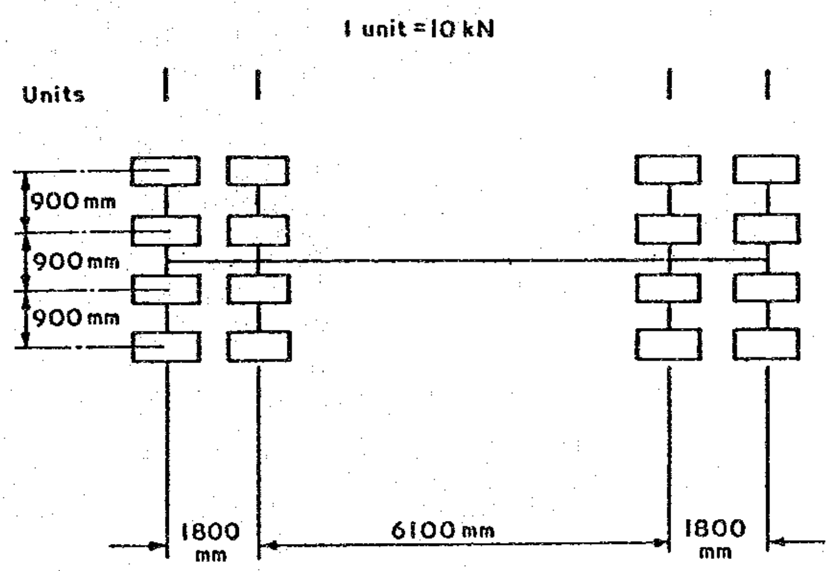
	Slabs	Beams
Lane width 3 m or less	Lane loading = loading from Fig. 1 × W/3 Load/square metre = lane loading from Fig. 1 × ⅓ Knife edge load per metre = 40 kN	
Lane width over 3 m	As above	Lane loading = loading from Fig. 1 Load/square metre = lane loading from Fig. 1 ÷ W Knife edge load per metre = (120 ÷ W) kN

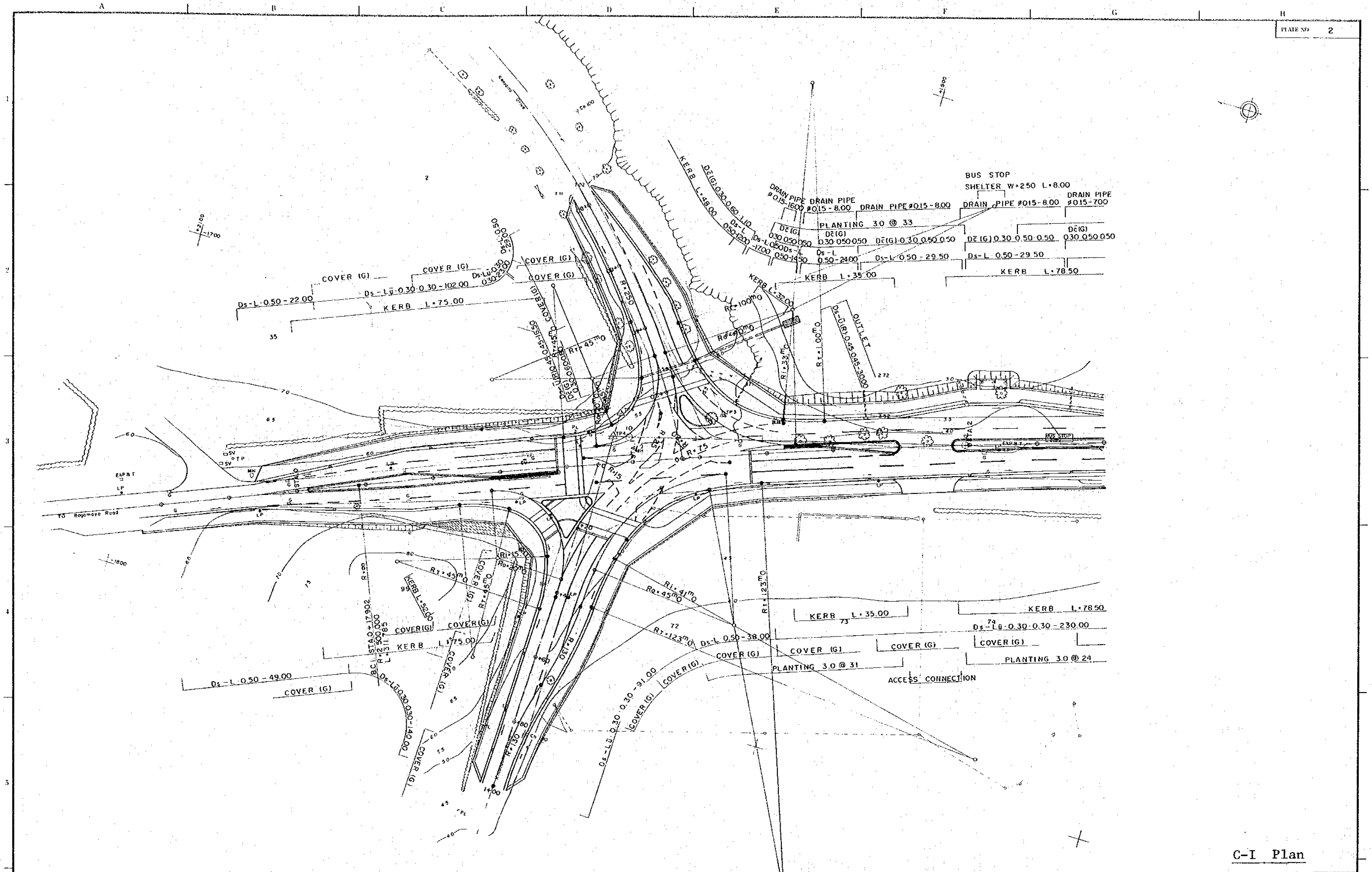
W = width of lane

B-V Relation between the Carriageway Width and Number of Traffic Lanes.

Carriageway width (m)	No. of lanes
4.60 up to and including 7.40	2
7.40 up to and including 11.1	3
11.1 up to and including 14.8	4
14.8 up to and including 18.5	5

B-VI Highway bridges Type HB unit loading.





C-I Plan

REV. NO	DATE	COORDINATE	REVISION	APPRD.	DATE

THE SELANDER BRIDGE EXPANSION PROJECT DAR ES SALAAM

MINISTRY OF WORKS

PLAN (1)

DWG. NO.

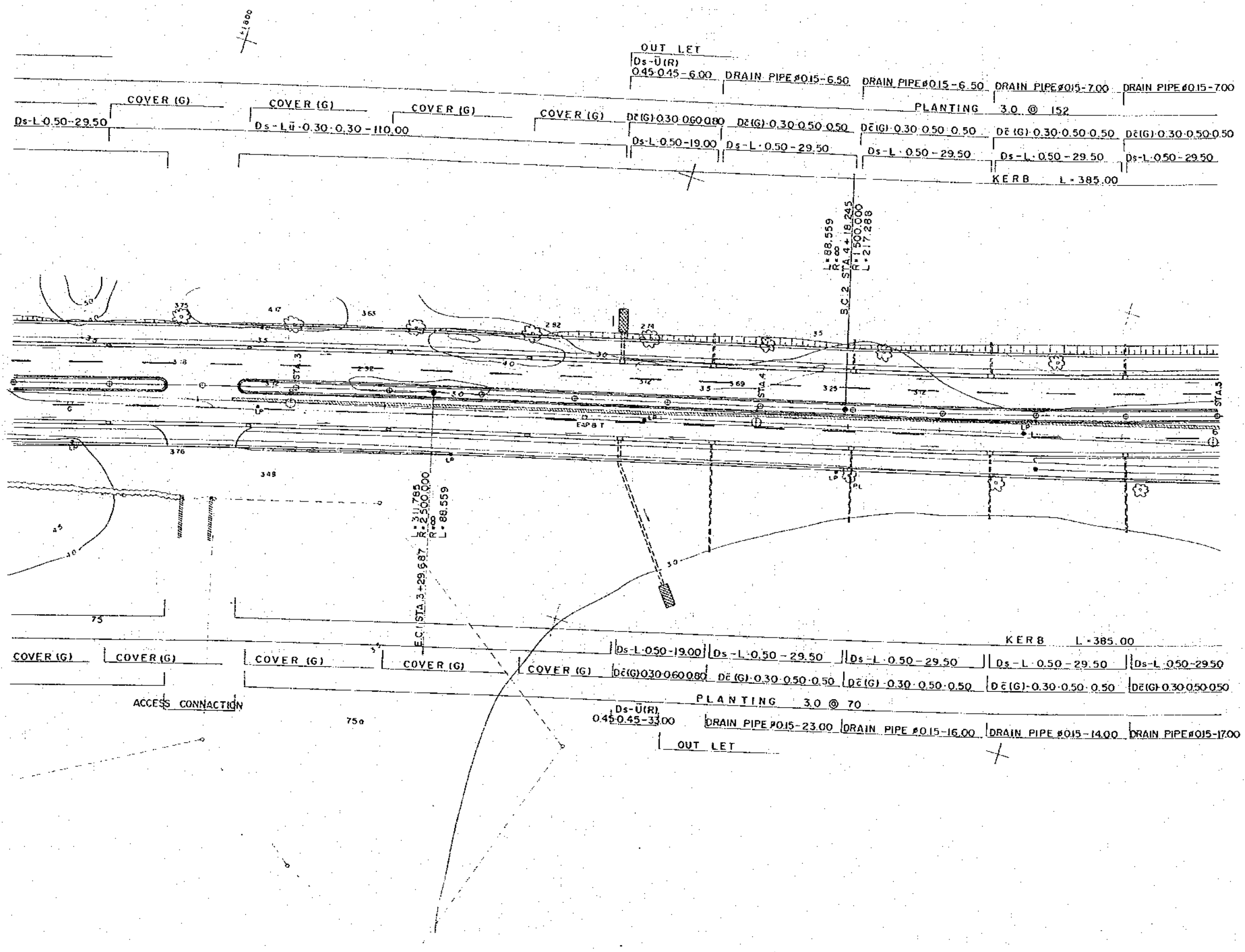
MINISTRY of WORKS

NIPPON KOEI CO. LTD. CONSULTING ENGINEERS TOKYO JAPAN

APPROVED / DATE / PREPARED / CHECKED / SUBMITTED / DATE

JUNE 30, 1980

PLATE NO. 3



C-I (continued 2)

SCALE A 0 25 50M 1:500

SCALE B 1:

REV. NO	DATE	COORDINATE	REVISION	APPRO	DATE

THE SELANDER BRIDGE
EXPANSION PROJECT
DAR ES SALAAM

MINISTRY OF WORKS

PLAN (2)

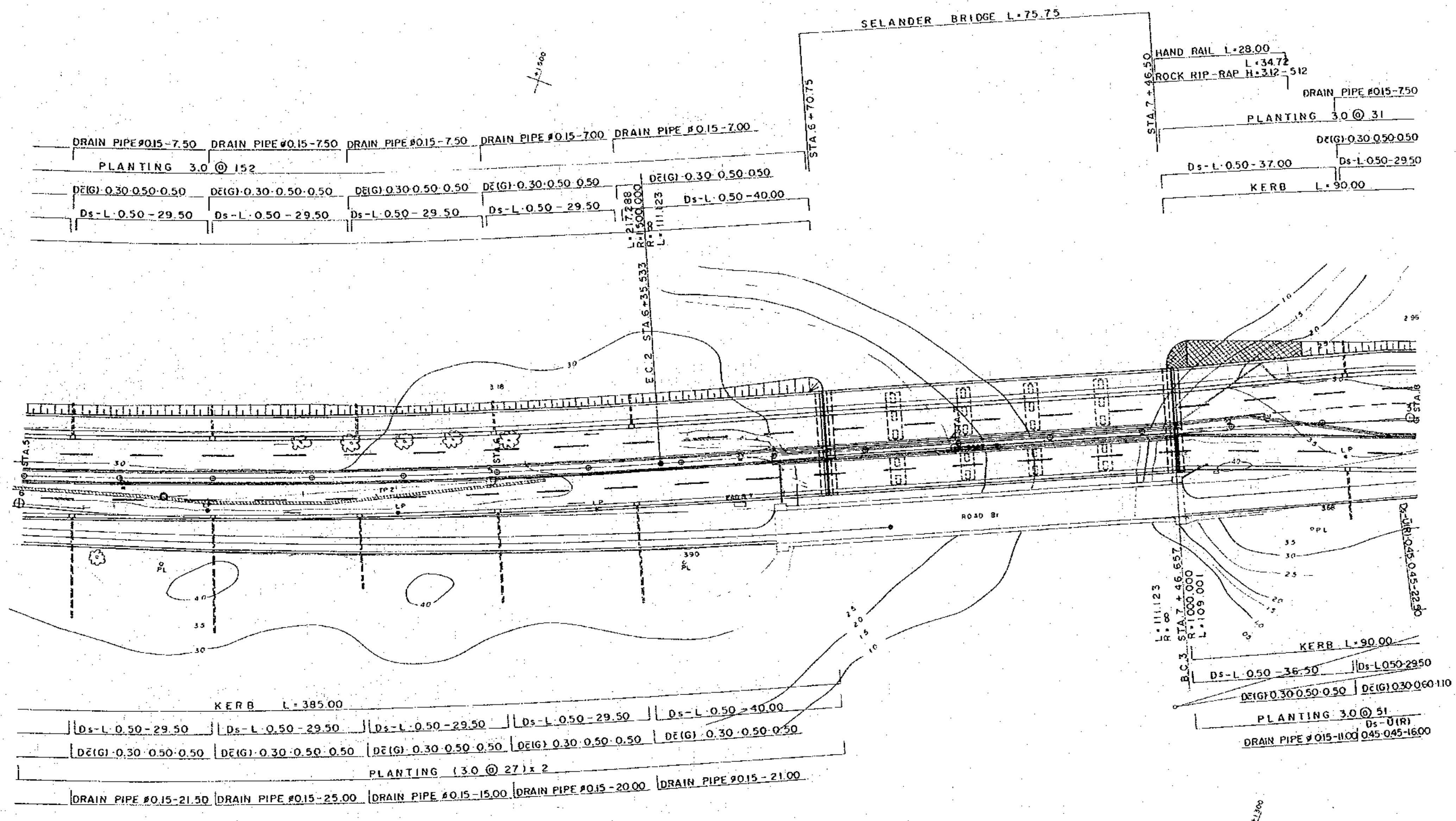
DWG. NO.

MINISTRY of WORKS

NIPPON KOEI CO., LTD.
CONSULTING ENGINEERS
TOKYO JAPAN

APPROVED
DATE
PREPARED CHECKED
SUBMITTED
DATE JUNE 30, 1980

PLATE NO. 4



C-I (continued 3)

SCALE A 0 25 50M (1:500)

SCALE B (1:)

REV NO.	DATE	COORDINATE	REVISION	APPRO	DATE

THE SELANDER BRIDGE EXPANSION PROJECT
DAR ES SALAAM

MINISTRY OF WORKS

PLAN (3)

DWG NO.

MINISTRY of WORKS

NIPPON KOEI CO. LTD.
CONSULTING ENGINEERS
TOKYO JAPAN

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DATE
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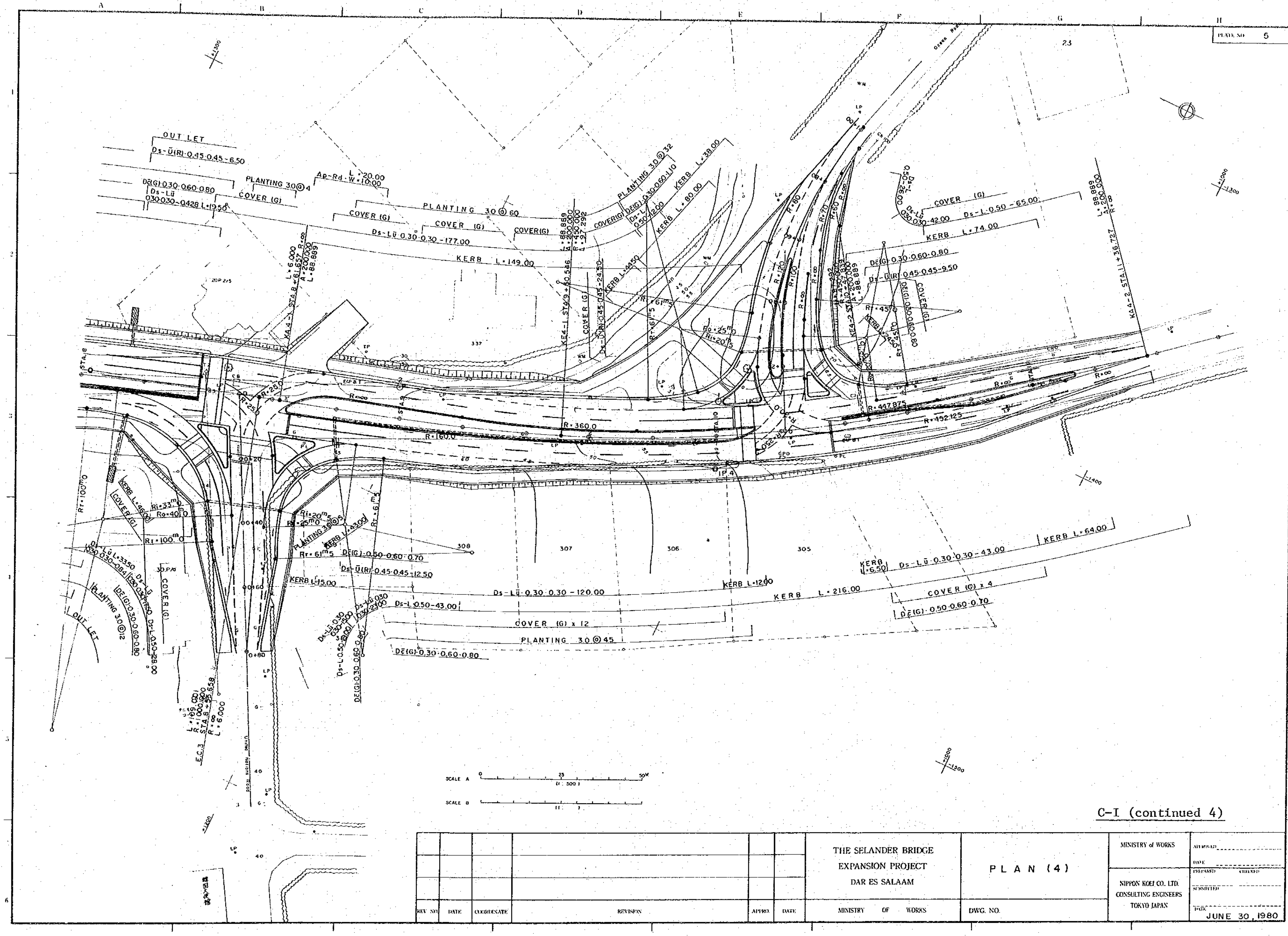
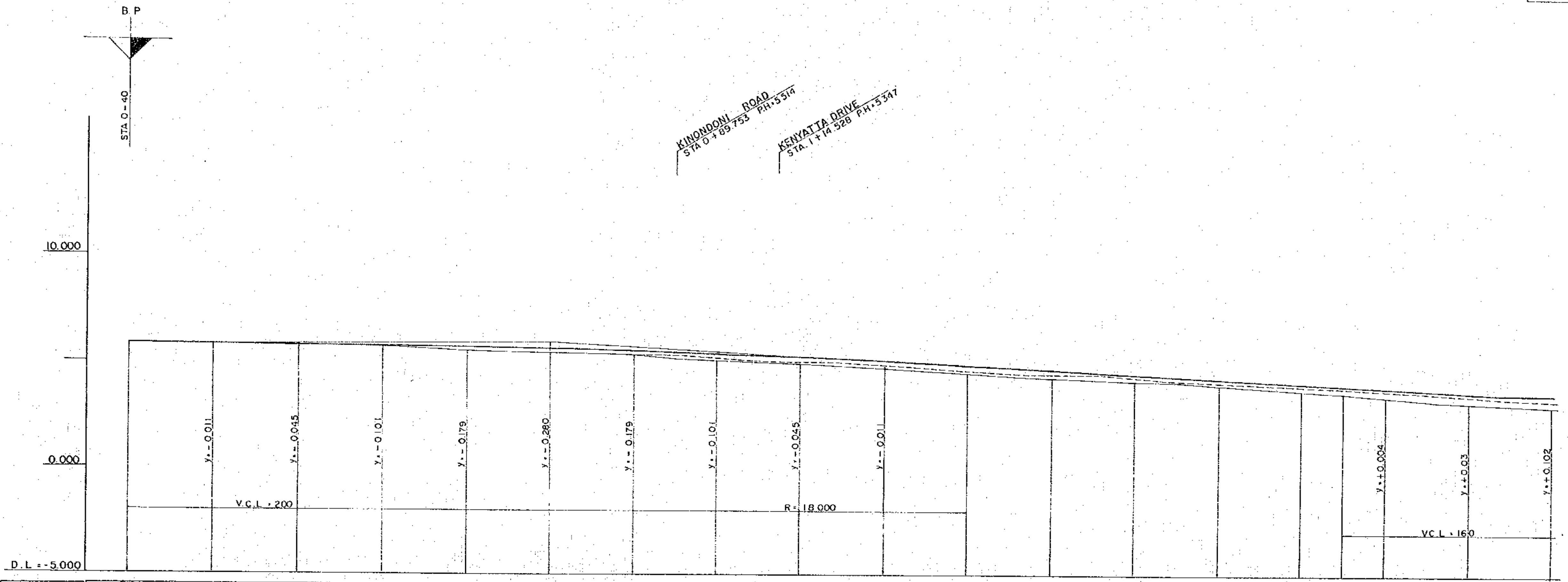
DATE JUNE 30.1980



C-I (continued 4)

PLATE NO. 9



GRADIENT	5.830		i = 0.120% L = 100.000			5.950			
EMBANKMENT HEIGHT		0.023	0.043	0.061	0.047	0.140	0.161	0.349	0.305
CUT HEIGHT									
PROPOSED HEIGHT	5.830	5.843	5.833	5.801	5.747	5.670	5.571	5.449	5.305
GROUND HEIGHT	5.83	5.82	5.79	5.74	5.70	5.53	5.41	5.10	5.00
CUMULATED DISTANCE	-40.00	-20.00	0.00	20.00	40.00	60.00	80.00	100.00	120.00
DISTANCE	20.00	20.00	0.00	20.00	20.00	20.00	20.00	20.00	20.00
STATION NO.	-40	-20	0+00	+20	+40	+60	+80	1+00	+20

GRADIENT				i = 1.000% L = 270.000					
EMBANKMENT HEIGHT	0.154	0.250	0.290	0.270	0.200	0.300	0.334	0.487	0.462
CUT HEIGHT									
PROPOSED HEIGHT	5.139	4.950	4.750	4.550	4.350	4.150	3.954	3.787	3.652
GROUND HEIGHT	4.985	4.70	4.46	4.28	4.15	3.85	3.62	3.35	3.19
CUMULATED DISTANCE	140.00	160.00	180.00	200.00	220.00	240.00	260.00	280.00	300.00
DISTANCE	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00
STATION NO.	+40	+60	+80	2+00	+20	+40	+60	+80	3+00

SUPERELEVATION: -2.000% ... -2.000%

CURVE BAND: R = ∞

I.P.I IA = 7°-8'-44.1" R = 2500.000, TL = 156.095, CL = 311.785, SL = 4.868

Scale Horizontal = A
Vertical = B

SCALE A 0 25 50M (1 : 500)
SCALE B 0 5 10M (1 : 100)

C-II Profile

REV NO	DATE	COORDINATE	REVISION	APPRO	DATE

THE SELANDER BRIDGE EXPANSION PROJECT
DAR ES SALAAM

MINISTRY OF WORKS

PROFILE
MAIN ROAD (I)
BAGAMOYO ROAD

DWG. NO

MINISTRY of WORKS

NIPPON KOEI CO. LTD.
CONSULTING ENGINEERS
TOKYO JAPAN

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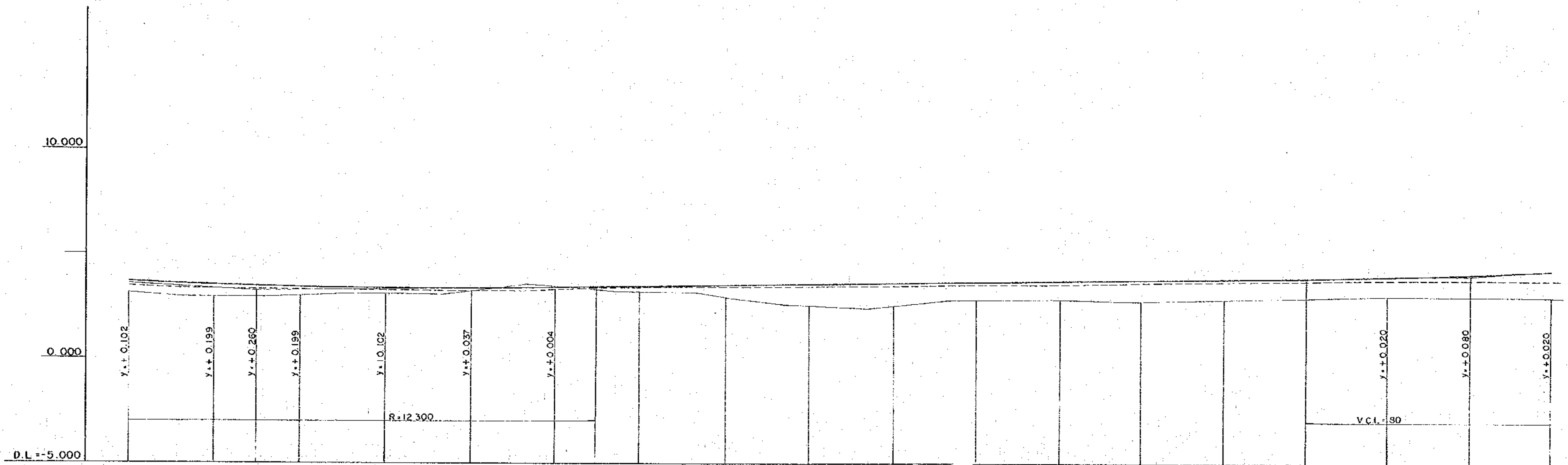
DATE JUNE 30, 1980

PLATE NO. 10



GRADIENT: 3.250 — i = 0.300% L = 290000 — 4.120

	3+00	+20	+40	+60	+80	4+00	+20	+40	+60
EMBANKMENT HEIGHT	0.462	0.630	0.479	0.302	0.177		0.260	0.500	0.590
CUT HEIGHT						0.076			
PROPOSED HEIGHT	3.652	3.610	3.479	3.442	3.437	3.464	3.520	3.580	3.640
GROUND HEIGHT	3.19	2.98	3.00	3.14	3.26	3.54	3.26	3.08	3.05
CUMULATED DISTANCE	300.00	320.00	340.00	360.00	380.00	400.00	42000	44000	460.00
DISTANCE	20.00	20.00	20.00	20.00	2000	20.00	20.00	20.00	20.00
STATION NO.	3+00	+20	+40	+60	+80	4+00	+20	+40	+60

	+80	5+00	+20	+40	+60	+80	6+00	+20	+40
EMBANKMENT HEIGHT	0.120	0.260	0.670	0.780	0.860	0.730	0.760	0.800	0.810
CUT HEIGHT									
PROPOSED HEIGHT	3.700	8.760	3.820	3.880	3.940	4.000	4.080	4.200	4.360
GROUND HEIGHT	3.82	3.50	3.15	3.10	3.08	3.27	3.32	3.40	3.55
CUMULATED DISTANCE	480.00	50000	52000	540.00	560.00	58000	60000	620.00	640.00
DISTANCE	20.00	2000	2000	20.00	2000	20.00	20.00	20.00	20.00
STATION NO.	+80	5+00	+20	+40	+60	+80	6+00	+20	+40

SUPERELEVATION: 2.000%

CURVE BAND: R = ∞ L = 88.559 — I.P. 2 I.A = 8°-17'-59.3" R = 1500.000 T.L = 108.835 C.L = 217.288 S.L = 3.943

Scale Horizontal = A
Vertical = B

C-II (continued 2)

SCALE A 0 25 50M (1:500)
SCALE B 0 5 10M (1:100)

REV. NO.	DATE	COORDINATE	REVISION	APPRD.	DATE

THE SELANDER BRIDGE EXPANSION PROJECT
DAR ES SALAAM
MINISTRY OF WORKS

PROFILE
MAIN ROAD (2)
BAGAMOYO ROAD
DWG. NO.

MINISTRY of WORKS
NIPPON KOEI CO., LTD.
CONSULTING ENGINEERS
TOKYO JAPAN

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DATE
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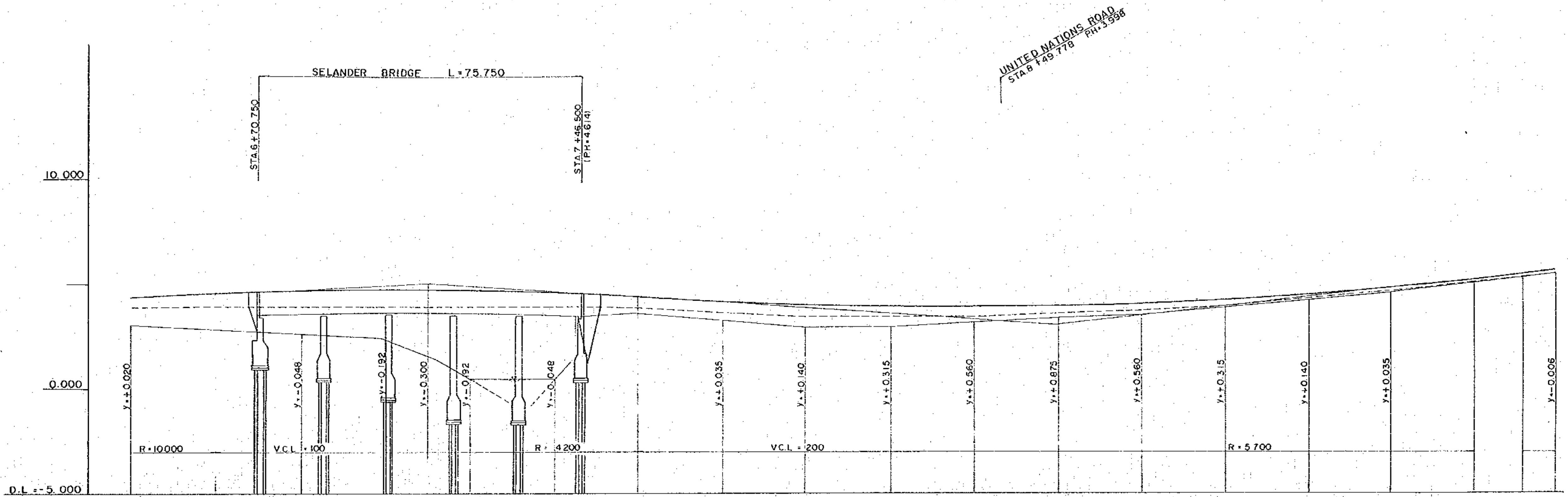
SUBMITTED
DATE JUNE 30, 1980

PLATE NO. 11



GRADIENT	i=1.100 % L=90.000				5.110			i=1.300 % L=150.000				3.160				i=2.200 % L=176.000		
EMBANKMENT HEIGHT	1.810	1.060	2.102	1.948			0.760	0.885	1.010	0.635	0.500	0.485	0.390	0.305	0.270	0.195	0.180	0.254
CUT HEIGHT																		
PROPOSED HEIGHT	4.360	4.560	4.732	4.808	4.788	4.672	4.460	4.235	4.080	3.995	3.980	4.035	4.160	4.355	4.620	4.955	5.360	5.794
GROUND HEIGHT	3.55	3.50	2.63	2.86			3.70	3.38	3.07	3.36	3.48	3.55	3.77	4.05	4.35	4.76	5.18	5.54
CUMULATED DISTANCE	640.00	660.00	680.00	700.00	720.00	740.00	760.00	780.00	800.00	820.00	840.00	860.00	880.00	900.00	920.00	940.00	960.00	980.00
DISTANCE	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00	13.580	20.00	20.00	20.00
STATION NO.	6+40	+60	+90	7+00	+20	+40	+60	+80	8+00	+20	+40	+60	+80	9+00	+20	+40	+60	+80
SUPERELEVATION	-2.00 %											2.00 % 40.000 1/154		2.00 %				+2.00 %
CURVE BAND	R=∞ L=111.123						I.P.3 IA=6°-14'-43.1" R=1000.000 T.L=54.555 C.L=109.001 S.L=1.487					R=∞ L=6.000	A=200.000 L=88.889				R=450.000	

Scale Horizontal = A
Vertical = B

SCALE A 0 25 50M (1:500)
SCALE B 0 5 10M (1:100)

C-II (continued 3)

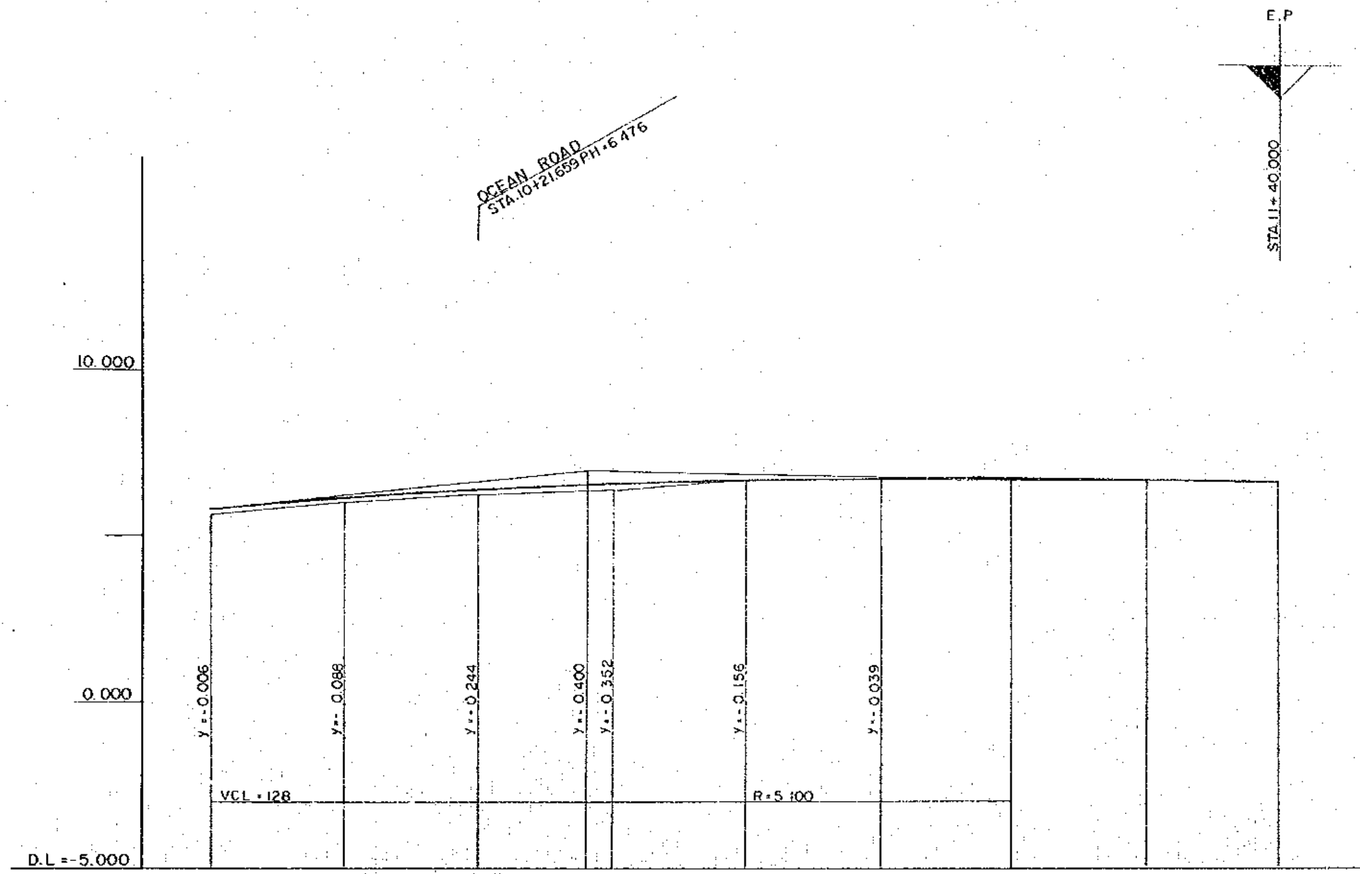
REV. NO.	DATE	COORDINATE	REVISION	APPRD.	DATE

THE SELANDER BRIDGE EXPANSION PROJECT
DAR ES SALAAM
MINISTRY OF WORKS

PROFILE
MAIN ROAD (3)
BAGAMOYO - UPANGA ROAD
DWG. NO.

MINISTRY of WORKS
NIPPON KOEI CO. LTD.
CONSULTING ENGINEERS
TOKYO JAPAN

APPROVED
DATE
PREPARED CHECKED
SUBMITTED
DATE JUNE 30, 1980



GRADIENT				7.032			I=0.300 % L=104.000		6.720
EMBANKMENT HEIGHT	0.254	0.172	0.216	0.168	0.014	0.041	0.020	0.020	0.000
CUT HEIGHT									
PROPOSED HEIGHT	5.794	6.152	6.436	6.668	6.804	6.861	6.840	6.780	6.720
GROUND HEIGHT	5.54	5.97	6.22	6.50	6.79	6.82	6.82	6.76	6.72
CUMULATED DISTANCE	980.00	1000.00	1020.00	1040.00	1060.00	1080.00	1100.00	1120.00	1140.00
DISTANCE	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00
STATION NO.	+80	10+00	+20	+40	+60	+80	11+00	+20	+40
SUPERELEVATION	+2.000 %						2.000 %	40.000 1/153	2.000 %
CURVE BAND	I.P.4 IA=23°-42'-19.1" R=450.000 C.L=97.292					A=200.000 L=88.889			

Scale Horizontal = A
Vertical = B

C-II (continued 4)

SCALE A 0 — 25 — 50M (1:500)
SCALE B 0 — 5 — 10M (1:100)

REV. NO.	DATE	COORDINATE	REVISION	APPRD	DATE

THE SELANDER BRIDGE EXPANSION PROJECT
DAR ES SALAAM
MINISTRY OF WORKS

PROFILE
MAIN ROAD (4)
UPANGA ROAD
DWG. NO.

MINISTRY of WORKS
NIPPON KOEI CO. LTD
CONSULTING ENGINEERS
TOKYO JAPAN

APPROVED
DATE
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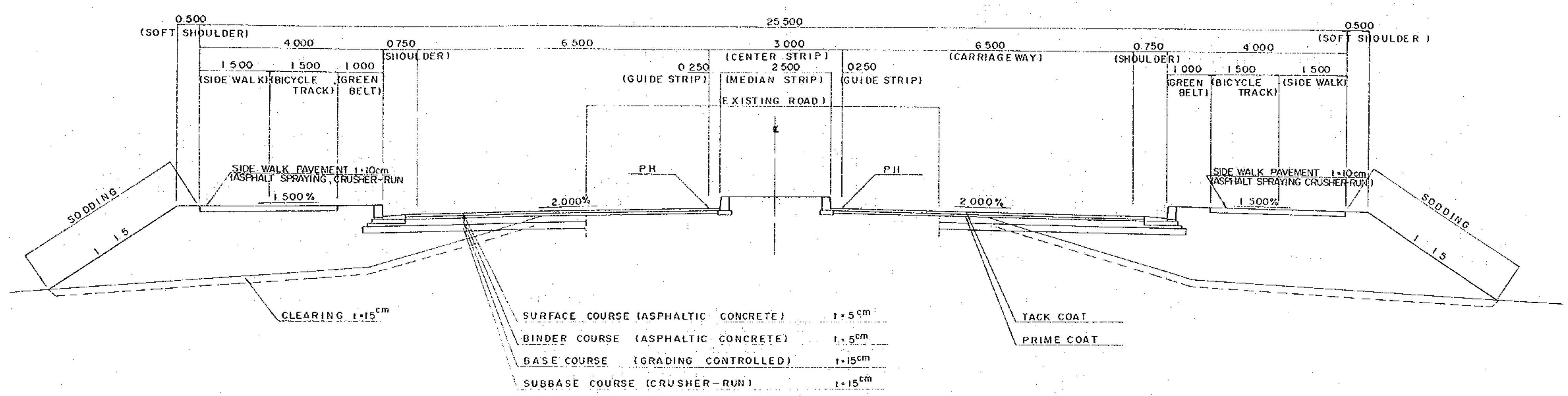
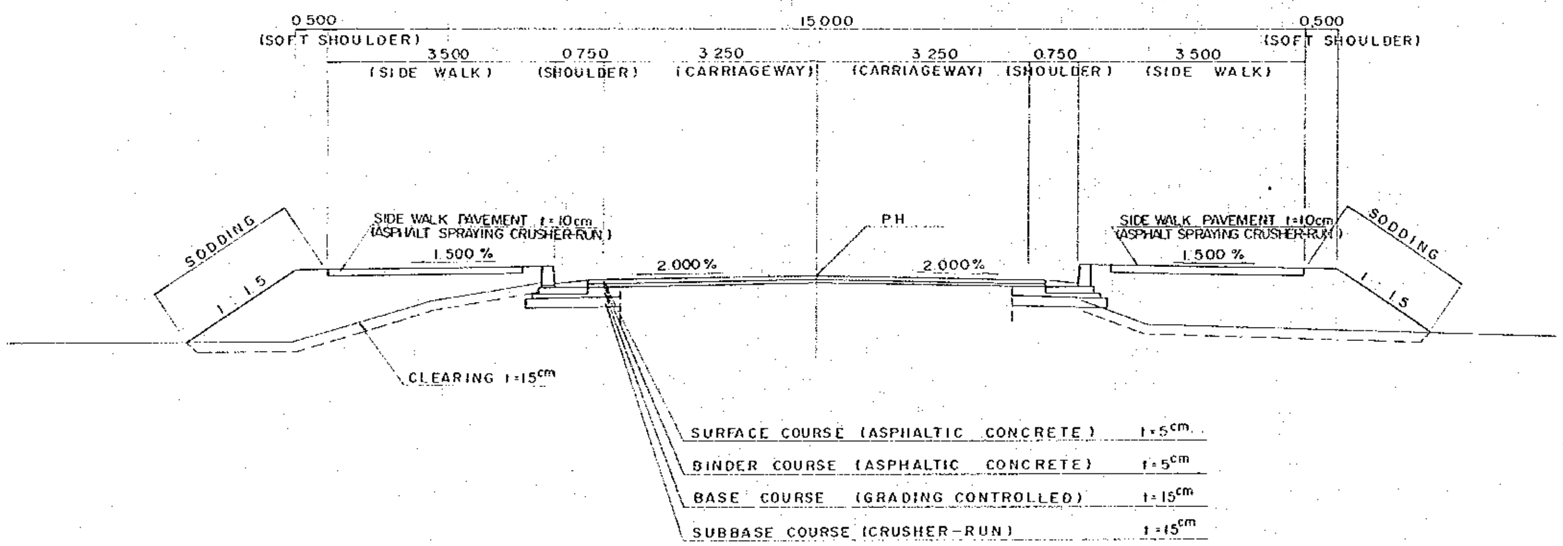
SUBMITTED
DATE JUNE 30, 1980

PLATE NO. 12



MAIN ROAD



ACCESS ROAD

C-III Typical Cross Section

THE SELANDER BRIDGE EXPANSION PROJECT
DAR ES SALAAM

MINISTRY OF WORKS

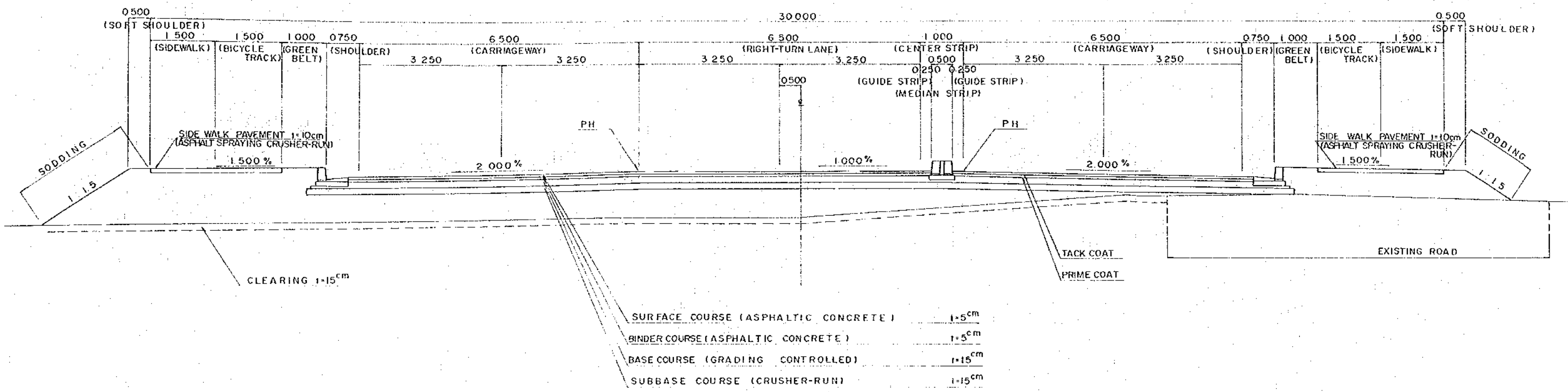
TYPICAL CROSS SECTION(1)

MINISTRY of WORKS

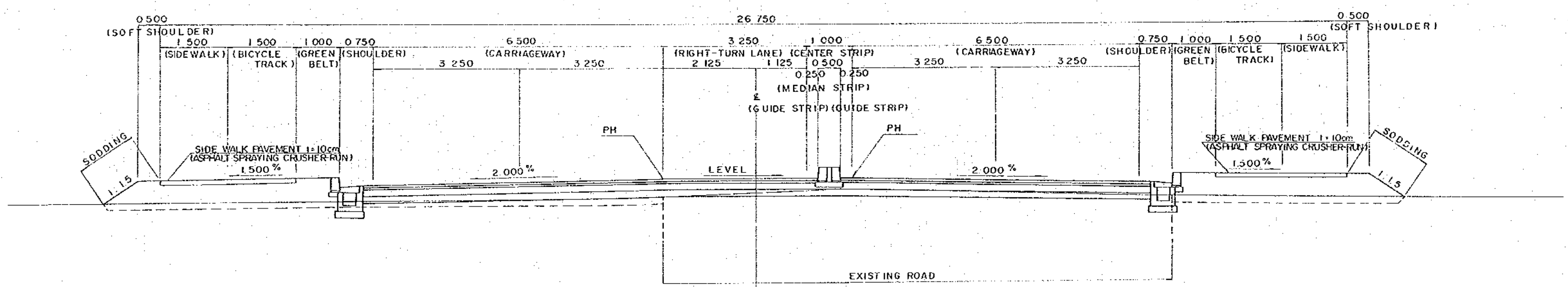
NIPPON KOEI CO. LTD
CONSULTING ENGINEERS
TOKYO JAPAN

DATE: JUNE 30, 1980

PLATE NO. 18



JUNCTION
(RIGHT - TURN TWO LANE)



JUNCTION
(RIGHT - TURN ONE LANE)

C-III (continued 2)

SCALE A 0 2.5 5.0M (1:50)
SCALE B (1:)

REV. NO.	DATE	COORDINATE	REVISION	APPRD.	DATE

THE SELANDER BRIDGE EXPANSION PROJECT
DAR ES SALAAM
MINISTRY OF WORKS

TYPICAL CROSS SECTION (2)

DWG. NO.

MINISTRY of WORKS
NIPPON KOEI CO. LTD.
CONSULTING ENGINEERS
TOKYO JAPAN

APPROVED
DATE
DESIGNED
CHECKED
SUBMITTED
DATE
JUNE 30, 1980

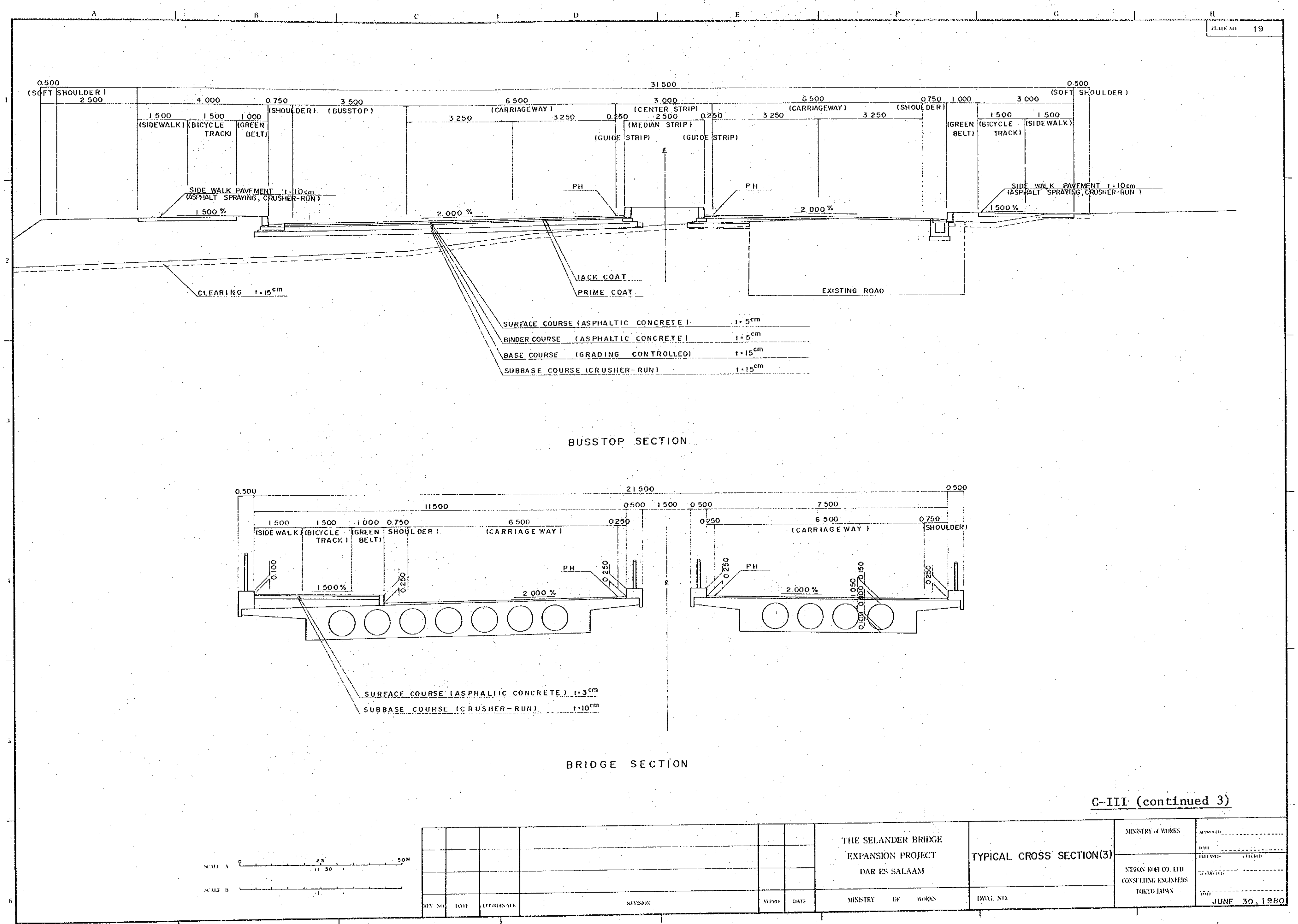


PLATE NO. 19
31 500
0.500 (SOFT SHOULDER)
2 500
4 000
0.750 (SHOULDER)
3 500 (BUSSTOP)
1 500 (SIDEWALK)
1 500 (BICYCLE TRACK)
1 000 (GREEN BELT)
6 500 (CARRIAGEWAY)
3 250
3 000 (CENTER STRIP)
2 500 (MEDIAN STRIP)
0.250 (GUIDE STRIP)
PH
SIDE WALK PAVEMENT t=10cm (ASPHALT SPRAYING, CRUSHER-RUN)
1 500 %
2.000 %
CLEARING t=15cm
TACK COAT
PRIME COAT
EXISTING ROAD
SURFACE COURSE (ASPHALTIC CONCRETE) t=5cm
BINDER COURSE (ASPHALTIC CONCRETE) t=5cm
BASE COURSE (GRADING CONTROLLED) t=15cm
SUBBASE COURSE (CRUSHER-RUN) t=15cm
BUSSTOP SECTION
21 500
11500
0.500
1 500
7 500
6 500 (CARRIAGE WAY)
0.750 (SHOULDER)
0.250
0.100
0.150
2.000 %
1.500 %
SURFACE COURSE (ASPHALTIC CONCRETE) t=3cm
SUBBASE COURSE (CRUSHER-RUN) t=10cm
BRIDGE SECTION
C-III (continued 3)
SCALE A 0 25 50M
SCALE B
REV. NO. DATE COORDINATE REVISION APPRO. DATE
THE SELANDER BRIDGE EXPANSION PROJECT
DAR ES SALAAM
MINISTRY OF WORKS
TYPICAL CROSS SECTION(3)
DWG. NO.
MINISTRY of WORKS
NIPPON KOEI CO. LTD CONSULTING ENGINEERS TOKYO JAPAN
JUNE 30, 1980

C-IV Calculation of Future Traffic Volume

a) Growth rate

Year	Morning peak hourly traffic of sough direction (7:00 - 8:00 a.m.)	Annual growth	Remarks
1970	*1) 1,277	-	
1971	1,340	5.0	
1972	1,410	5.0	
1973	1,450	2.8	
1974	1,490	"	
1975	1,530	"	
1976	1,620	"	
1977	1,620	"	
1978	1,660	"	
1979	1,700	" *)	
1980	1,800	5.3	*) 1700 vehicles/hr Investigation of JICA Mission
1981	1,890	"	
1982	1,990	"	← Opening year
1983	2,100	"	
1984	2,210	"	
1985	2,330	"	
1986	2,450	"	
1987	2,580	"	← 5 years after opening
1988	2,720	"	
1989	2,860	"	
1990	3,000	"	← Target year

£1) "Traffic Study and Traffic Design data" Sept. 1970 Fig. 12
COWI Consult

b) Annual average of deaily traffic

$$\alpha = \frac{\text{24 hours traffic volume}}{\text{12 hours traffic volume}} = 1.29$$

Heavy direction traffic = 60%

7:00 - 19:00	Daytime traffic volume	*1	13870 vehicles/12 hr
7:00 - 8:00	Peak traffic volume	*2	1277 vehicles/day

therefore Daily traffic volume is 13870 x 1.29 = 17890 vehicles/day

$$\text{Peak rate} = \frac{1277}{17890 \times 0.60} \times 100 = 12\ \%$$

Designing daily traffic volume in target year for pavement design

1987; 2580/(0.60 x 0.12) = 35800 vehicles/day (P.C.U.)

Designing daily traffic volume in target year for junction plan

1990; 3000/(0.60 x 0.12) = 41700 vehicles/day (P.C.U.)

*1)*2) "Traffic Study and Traffic Data" Sep. 1970
COWI Consult.

c) Large vehicle and design traffic volume

Each equivalent rate of passenger car	Large vehicle	3.0
	Motor cycle	0.8
Sharing rate of the total of buses and trucks in ADT		5%
Sharing rate of the motor cycle in ADT		11%

Daily traffic volume in 1987, 1990 is shown below.

Daily Traffic Volume

	Traffic Volume			
Year	Passenger Car	Large Vehicle	Motor cycle and other	Total
1987	27,890	1,660	3,650	33,200
1990	32,500	1,940	4,260	38,700

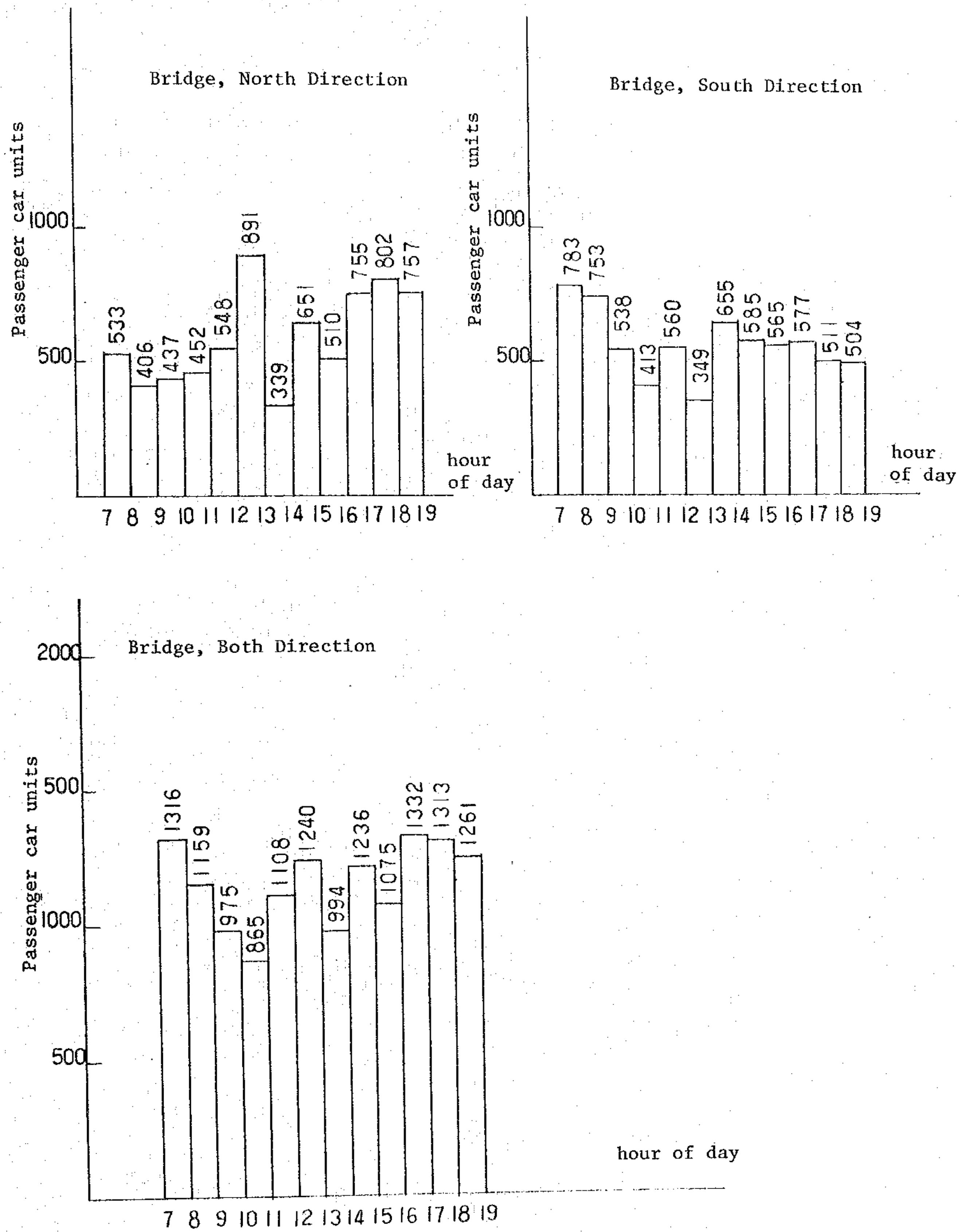


Fig. C-IV.1 HOURLY VARIATIONS IN TRAFFIC VOLUMES ON SELANDER BRIDGE

TRAFFIC COUNT 9TH JULY 1970

Formula for Analysis

For the selection of the analysis a method for by hydrological analysis applicable to the project area, various formulas were reviewed comparatively and the gumbel method was applied.

The result of analysis will be shown below:

1) Calculation for Probability daily rainfall

Order	Daily Rainfall Xi	Xi^2	Date
1	100.1	10,020.01	Jan. 1974
2	94.9	9,006.01	Jan. 1978
3	92.2	8,500.84	Mar. 1976
4	87.5	7,656.25	Nov. 1978
5	86.0	7,396.00	Feb. 1978
6	82.3	6,773.29	Sep. 1977
7	80.1	6,416.01	Sep. 1075
8	75.4	5,685.16	Dec. 1978
9	74.8	5,595.04	Mar. 1971
10	71.0	5,041.00	Jun. 1976
Total	844.3	72,089.61	
Mean	$\bar{X}i=84.43$	$\bar{X}i^2=7,208.96$	

$$\sigma x = \sqrt{\bar{X}_i^{\,2} - (\bar{x}_i)^2} = \sqrt{7208.96 - (84.43)^2} = 8.9741$$

$$\frac{1}{\sigma} = \frac{\sigma x}{\sigma y}$$

$$b = \bar{X}_i - \left(\frac{1}{\alpha}\right) \bar{y}$$

Where $\sigma y = 0.9496$ statistical value determined by sampling number

$\bar{y} = 0.4952$ statistical value determined by sampling number

C-V (continued 2)

$$\frac{1}{\alpha} = \frac{8.9741}{0.9496} = 9.450$$

$$b = 84.43 - 9.450 \times 0.4952 = 79.750$$

$$X_T = b + \frac{1}{\alpha} y_T = 79.75 + 9.45 y_T$$

where X_T : T-years probability daily rainfall

y_T : hereunder

T (year)	y_T	X_T (mm/day)
2	0.3665	83.21
3	0.9027	88.28
5	1.4999	93.92
10	2.2504	101.02

The probability daily rainfall of Side ditches and Culverts in the roadway is generally applied the 3 years probability daily rainfall.

2) Calculation of hourly rainfall

$$Y = \frac{X3}{24} \left(\frac{24}{t}\right)^{2/3} \quad \text{(mm/hr)}$$

where Y : Hourly rainfall

X3 : 3 years probability daily rainfall (mm/day)

t : Consecutive rainfall hour (hour)

$$Y_1 = \frac{88.23}{24} \times \left(\frac{24}{1}\right)^{2/3} = 30.6 \quad \text{mm/hr}$$

3) Calculation of Design rainfall

The design rainfall is decided by the hourly rainfall and the consecution time.

C-V (continued 3)

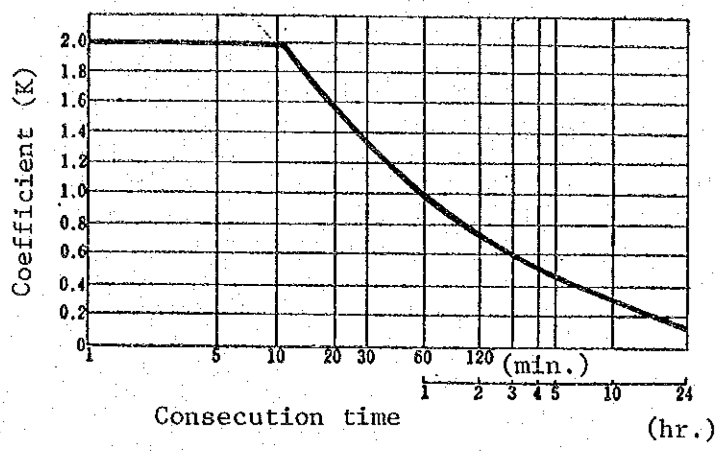


Fig. C-V-1 Coefficient determined according to consecution time.

The consecution time was calculated less than ten minutes.

Vd = 30.6 x 2 = 61.2 → (rounded to 65mm/hr)

Data for : 1971 to 1978
Station : Dar Es Salaam Air Port

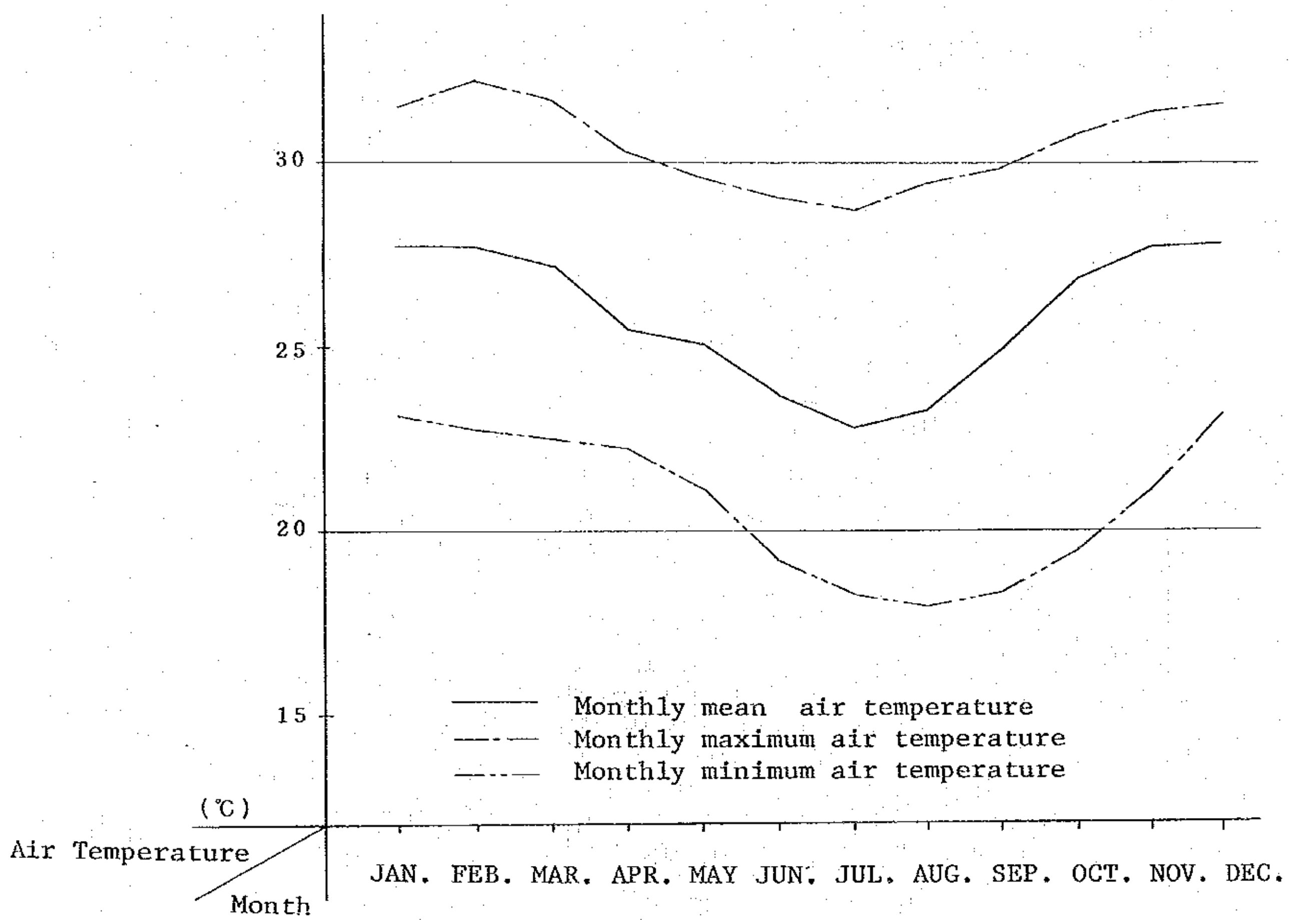


Fig. C-V-2 Variation of Monthly Mean Air Temperature

Data for : 1971 to 1977
Station : Dar Es Salaam Air Port

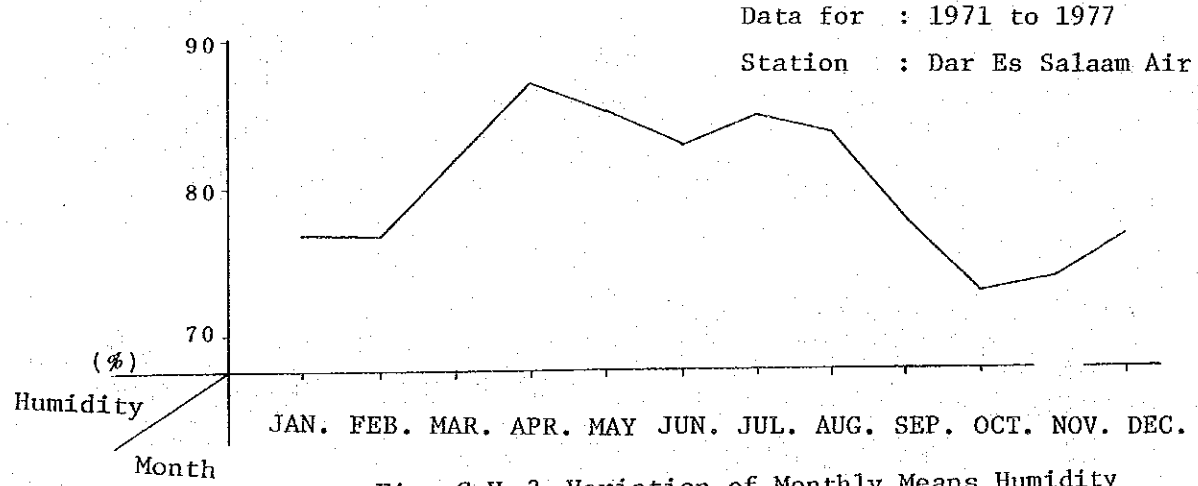


Fig. C-V-3 Variation of Monthly Means Humidity

Data for : 1971 to 1978
Station : Dar Es Salaam Signal Station

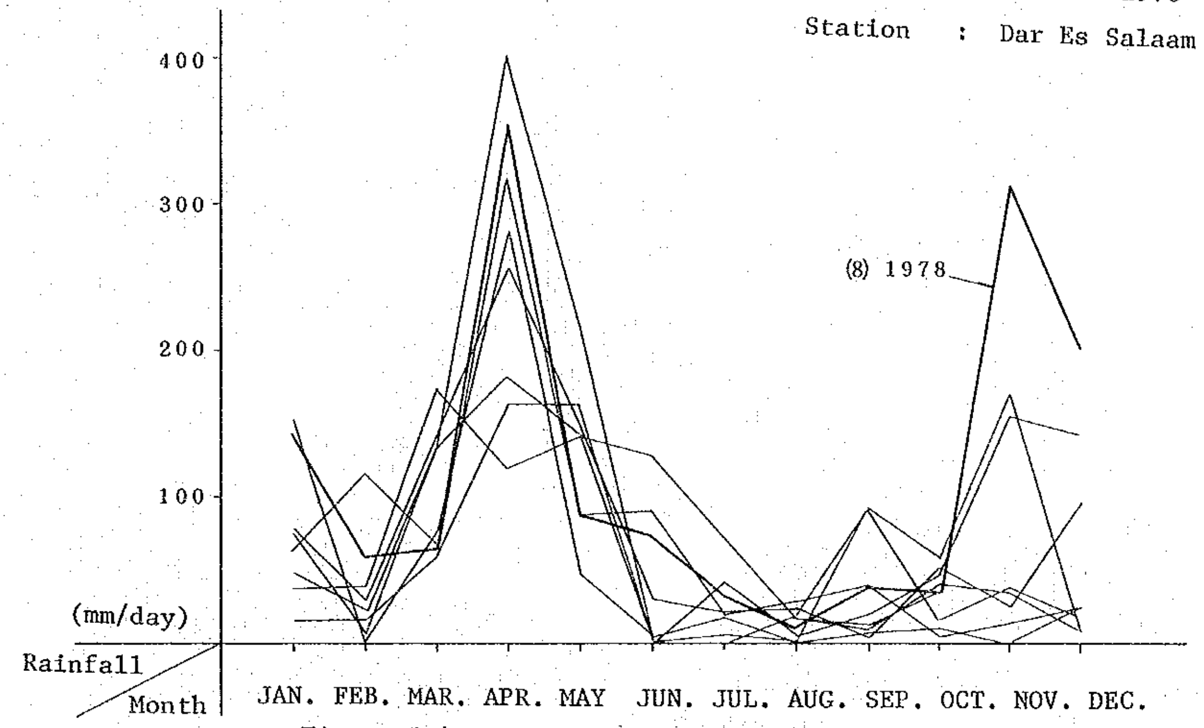


Fig. C-V-4 Variation of Monthly Rainfall of Each Year

Data : 1978 Station : Dar es Salaam Signal Station

Month	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
Rainfall Days	3	3	6	15	6	7	4	2	2	1	14	5	68

Data for : 1971 to 1978

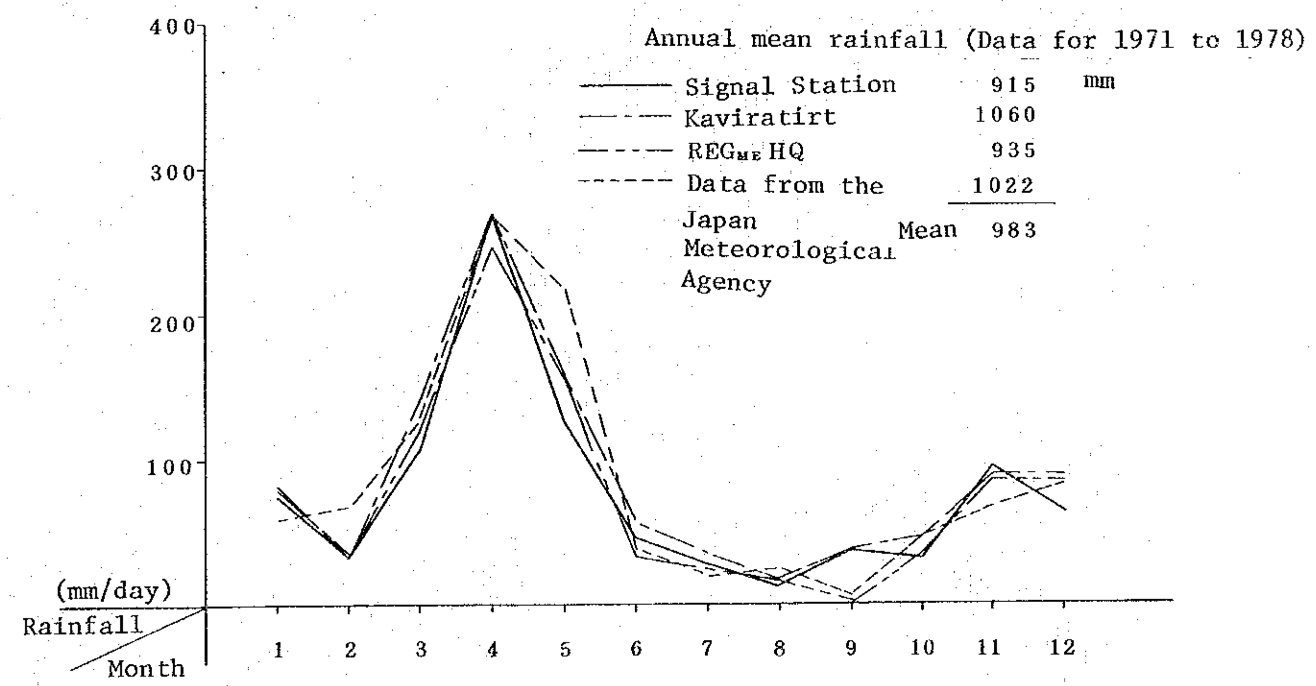


Fig. C-V-5 Variation of Monthly Rainfall of Each Station in Dar Es Salaam

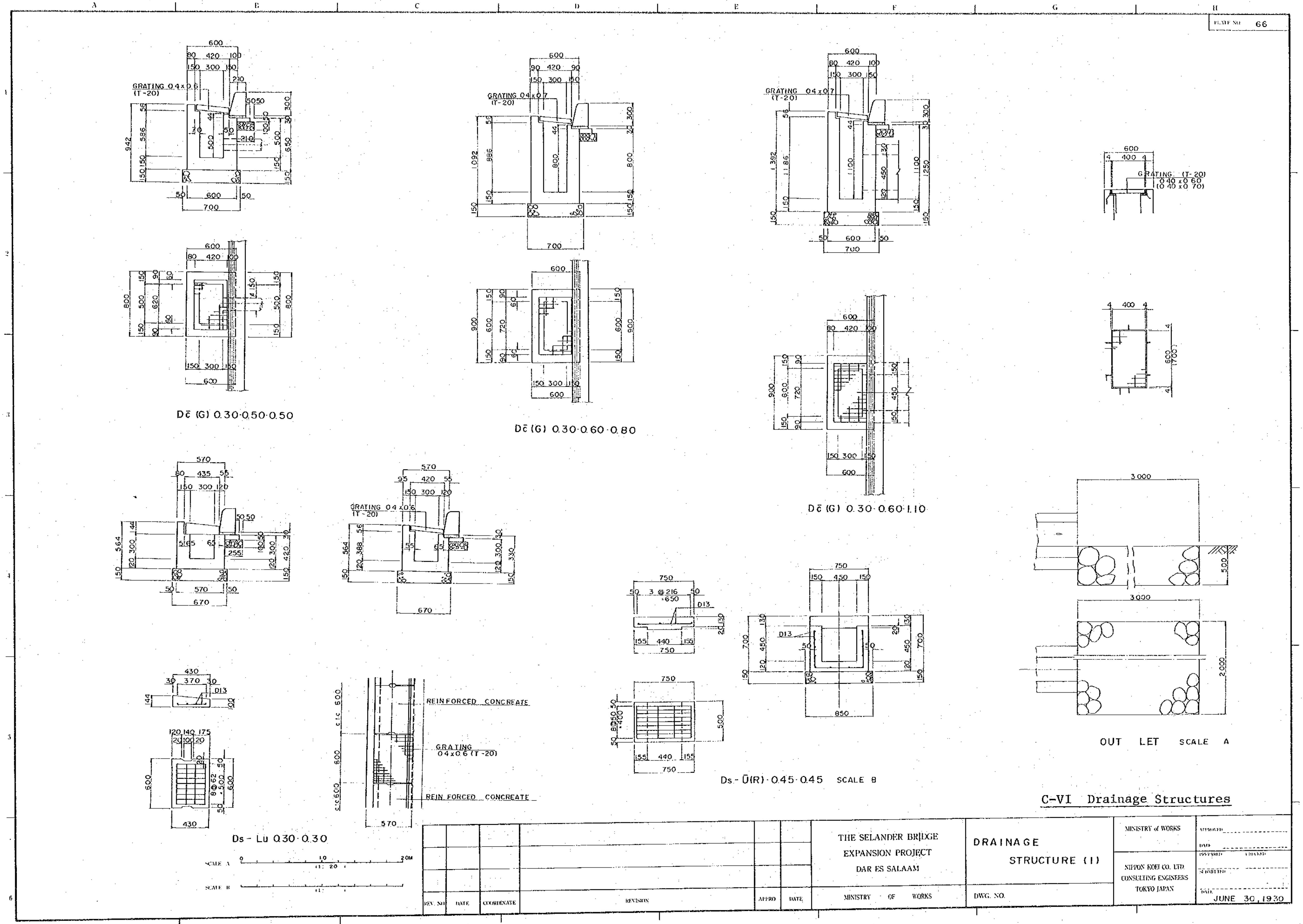
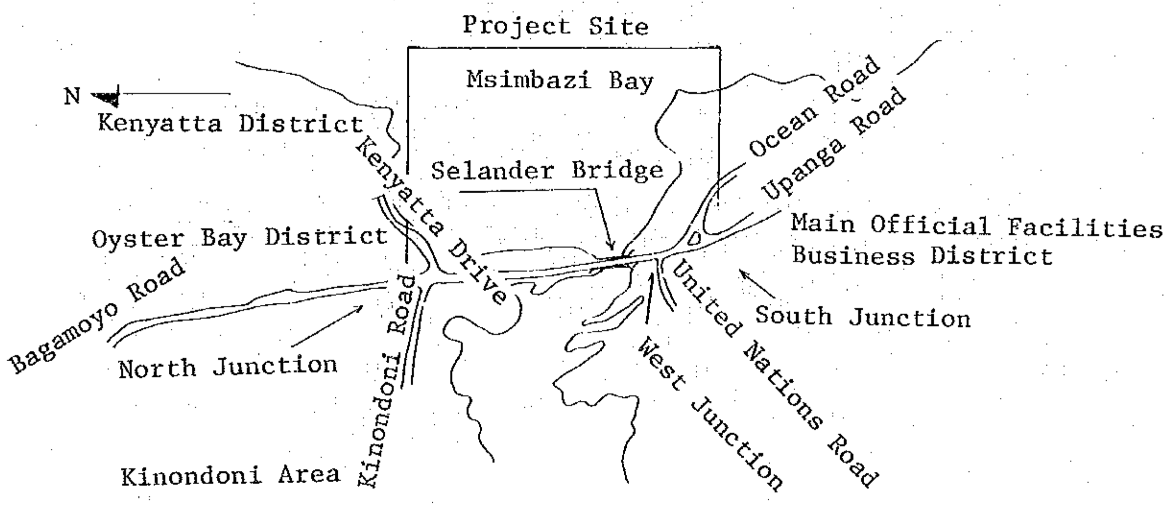
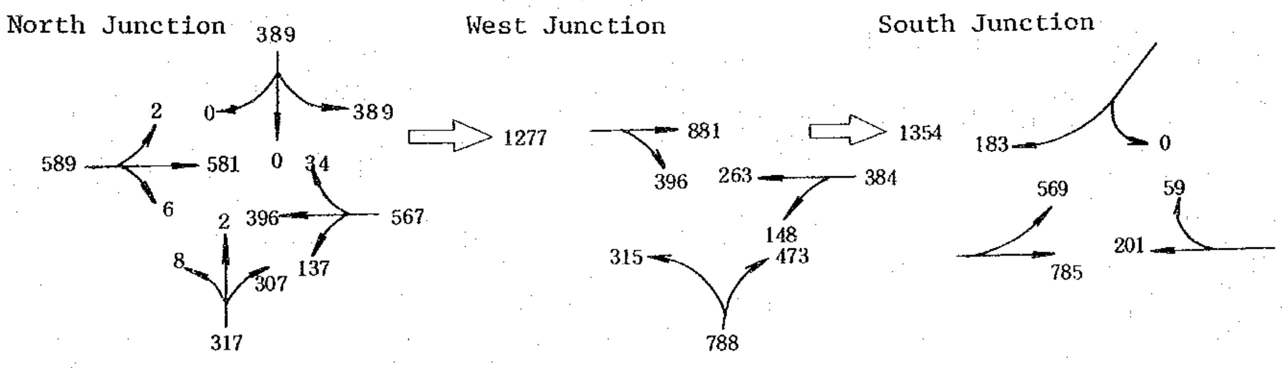


PLATE NO 66
GRATING 0.4x0.6 (T-20)
Dc̄ (G) 0.30·0.50·0.50
GRATING 0.4x0.7 (T-20)
Dc̄ (G) 0.30·0.60·0.80
Dc̄ (G) 0.30·0.60·1.10
GRATING (T-20) 0.40x0.60 (0.40x0.70)
GRATING 0.4x0.6 (T-20)
REINFORCED CONCREATE
GRATING 0.4x0.6 (T-20)
REIN FORCED CONCREATE
Ds - Lu 0.30·0.30
Ds - Ū(R)·0.45·0.45 SCALE B
OUT LET SCALE A
C-VI Drainage Structures
SCALE A
SCALE B
THE SELANDER BRIDGE EXPANSION PROJECT
DAR ES SALAAM
MINISTRY OF WORKS
DRAINAGE STRUCTURE (1)
DWG. NO.
MINISTRY of WORKS
NIPPON KOEI CO. LTD. CONSULTING ENGINEERS TOKYO JAPAN
REV. NO. DATE COORDINATE REVISION APPRO DATE
JUNE 30, 1930

C-VII Junction Plans and Signal Indications

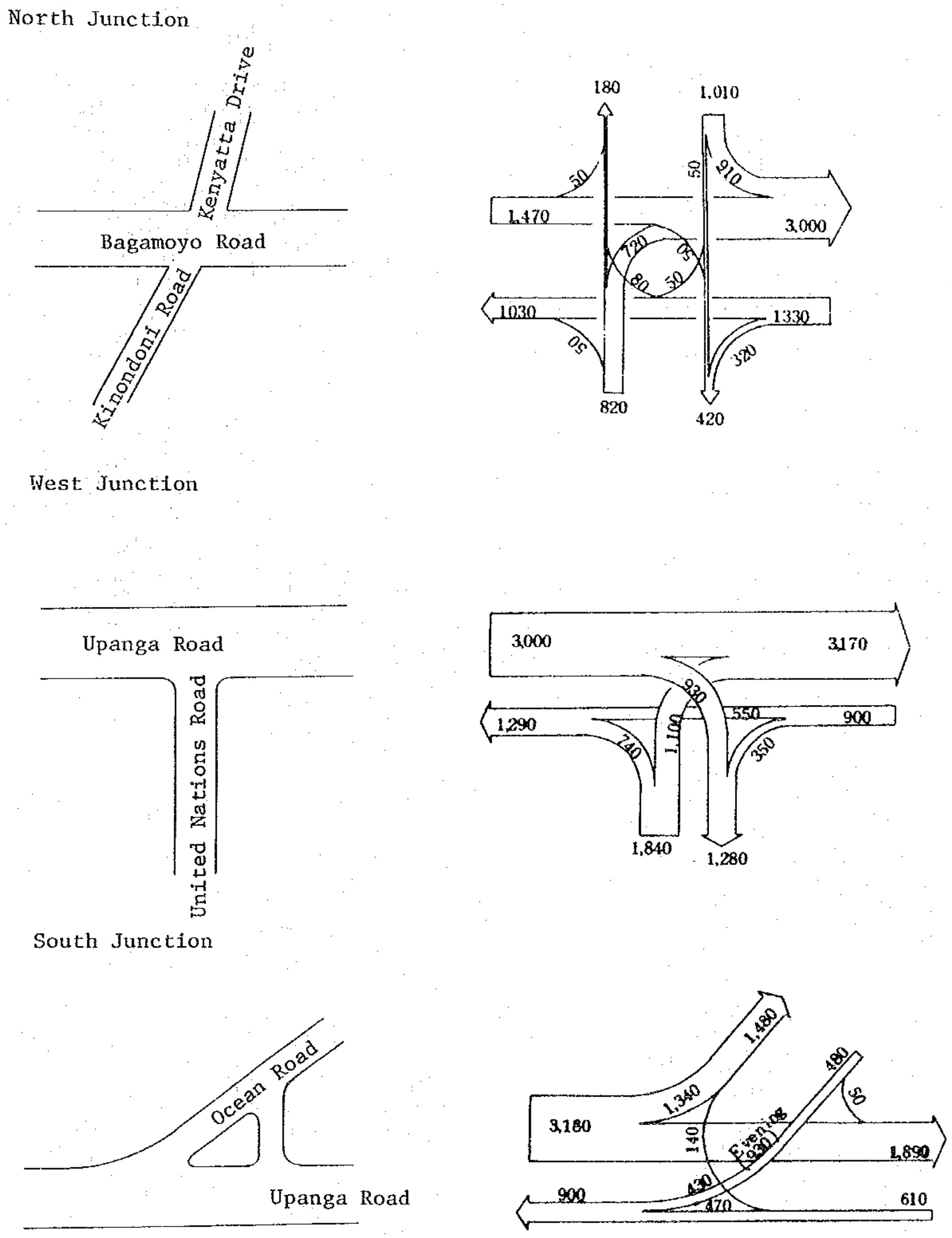
(1) Traffic Distribution by Direction 1970





Source : COWI Consult

(2) Design traffic volume (1 9 9 0)



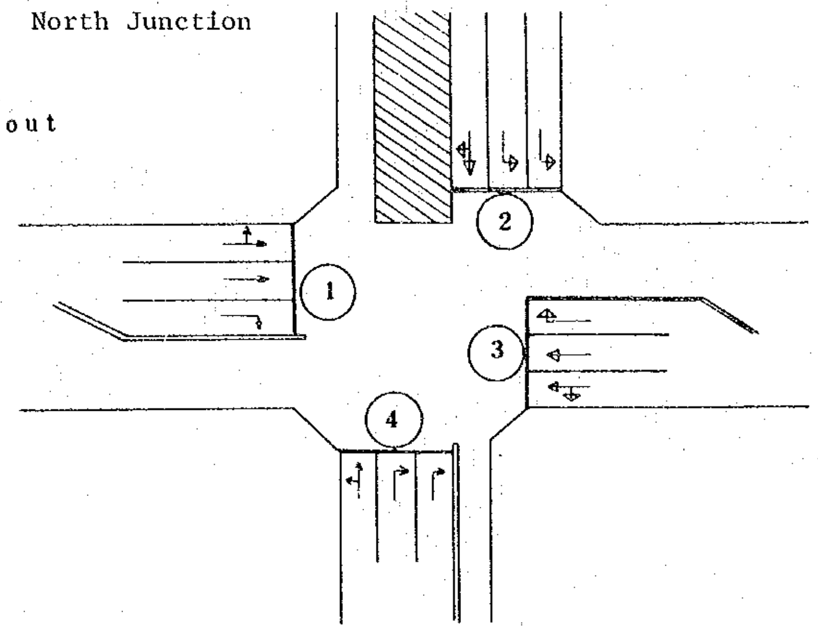
Source : JICA Mission

C-VII (continued 2)

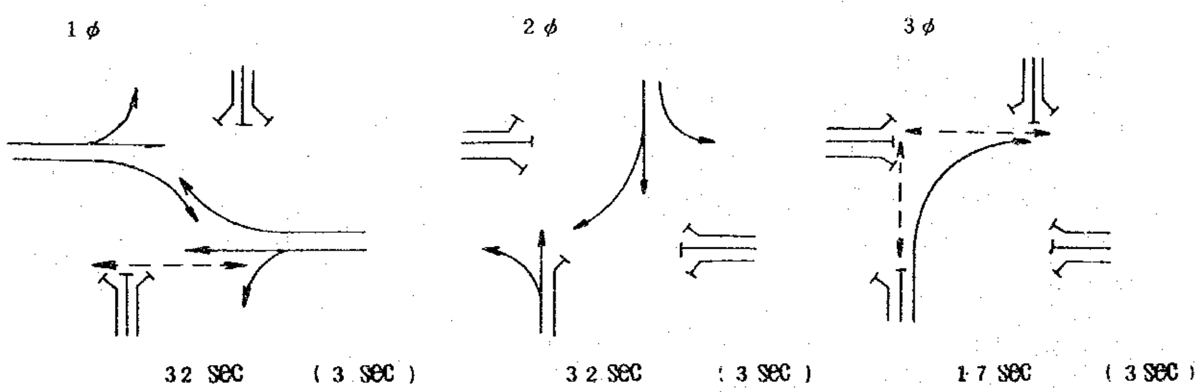
(3) Examination of Traffic Capacity by Traffic Signals

a) North Junction

Layout



Signal Phasing



( ) : Clearance time

Cycle time

$$C = \frac{A}{1-\Sigma y i}$$

$$= \frac{1.5L+5}{1-\lambda}$$

$$= \frac{1.5 \times 3 \times 3 + 5}{1 - 0.827}$$

107 sec > 80 sec

L ; Loss time (sec)

yi ; Max. necessary phase rate

Design Traffic Capacity

Design Traffic Capacity = Basic Capacity x Adjustment Factor for Right turn/ Left turn x 0.9 x $\frac{\text{Green Signal Time}}{\text{Cycle Time}}$

Phase	Entr.	Exit direction	Design hourly volume	Basic capacity	No. of lanes	Possible capacity	Necessary phase rate Y	Modified phase rate Y	Phase rate	Design capacity	Congestion ratio
1φ	①	→ (↑50)	710	2,000	1	※1. 1,900	[0.374]	0.452	0.400	684	1.04
1φ	①	→	710	2,000	1	2,000	0.355		0.400	720	0.99
1φ	①	→ ↓	50	1,800	1	1,800	0.028			※5. 90	0.56
2φ	②	↓ →	910	3,600	2	3,600	[0.253]	0.306	0.275	891	1.02
2φ	②	↓ (←50)	100	2,000	1	※2. 1,550	0.065		0.275	384	0.26
1φ	③	← ↑	80	1,800	1	1,800	0.044			※5. 90	0.89
1φ	③	←	625	2,000	1	2,000	0.313		0.400	720	0.87
1φ	③	← (↓320)	625	2000	1	※3. 1,710	0.365		0.400	616	1.01
3φ	④	↑ →	720	3,600	2	※4 3,600	[0.200]	0.242	0.213	690	1.04
2φ	④	↑ (←50)	100	2,000	1	1,710	0.058		0.275	423	0.24

$\Sigma Y_i = 0.827 < 0.9$

※1. Left turn   50÷710×100= 7 %   2000×095 =1900

※2. Right turn   50÷100×100=50 %   2000×0795=1550

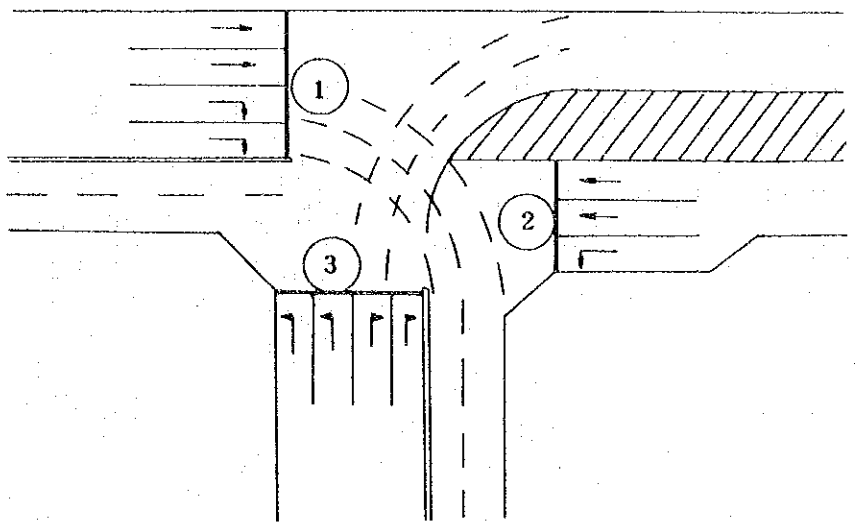
※3. Left turn   320÷625×100=51.2%   2000×0855=1710

※4. Left turn   50÷100×100=50 %   2000×0855=1710

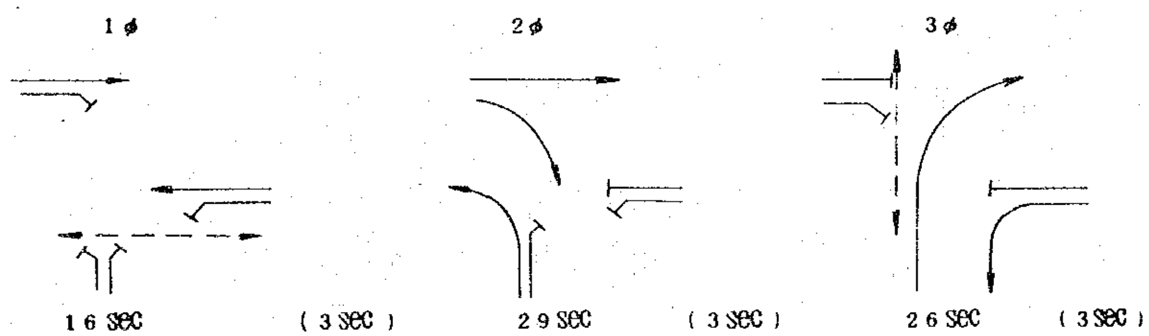
※5. Passing cars during yellow light : $2 \times \frac{3,600}{80} = 90$ vehicles

b) West Junction

Layout



Signal Phasing



Cycle Time ( ): Clearance time

$$C = \frac{A}{1-\Sigma y_i} = \frac{1.5L+5}{1-\lambda} = \frac{1.5\times3\times3+5}{1-0.824} \doteqdot 105\text{sec} > 80\text{sec}$$

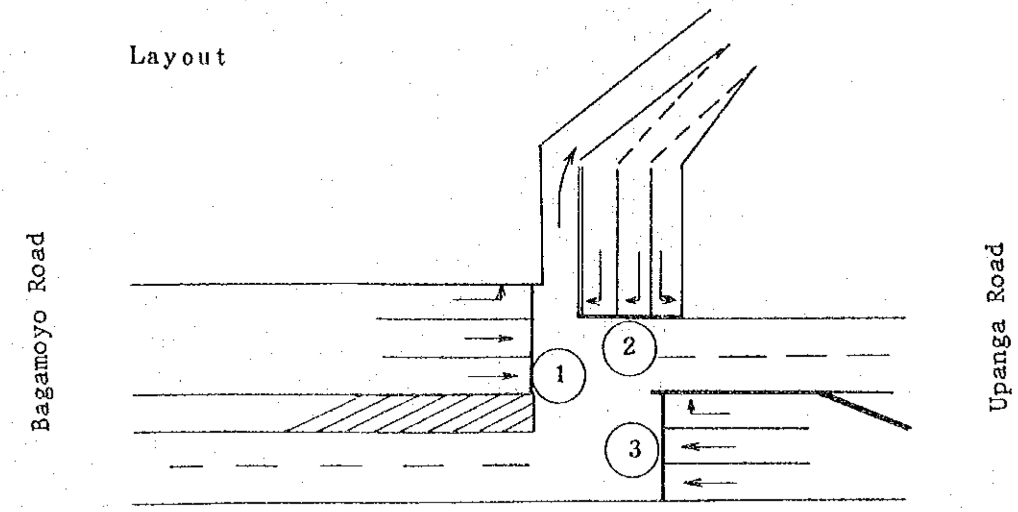
Design Traffic Capacity

Phase	Entr.	Exit direction	Design hourly volume	Basic capacity	No. of lanes	Possible capacity	Necessary phase rate Y	Modified phase rate Y	Phase rate	Design capacity	Congestion ratio
1φ 2φ	①	→	2,070	4,000	2	4,000	0.518	0.629	0.563	2,027	1.02
2φ	①	→↓	930	3,600	2	3,600	0.258	0.313	0.363	1,176	(1.02) 0.79
1φ	②	←	550	4,000	2	4,000	0.138	0.167	0.200	720	0.76
3φ	②	↓	350	1,800	1	1,800,	0.194	–	0.325	527	0.66
2φ	③	↰	740	3,600	2	3,600,	0.206	–	0.363	1,176	0.63
3φ	③	↱	1,100	3,600	2	3,600	0.306	0.371	0.325	1,053	1.04

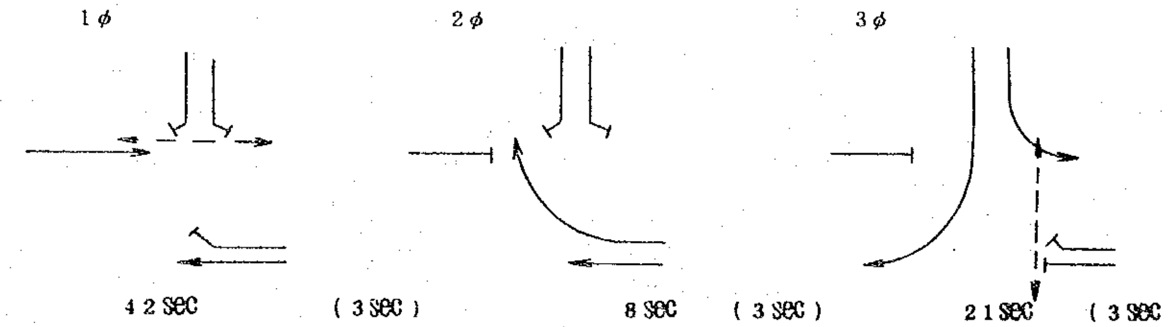
$\Sigma Y_i = 0.824 < 0.9$

c) South Junction

Layout



Signal Phasing



Cycle Time

$$C = \frac{A}{1-\Sigma y_i} = \frac{15L+5}{1-\lambda} = \frac{1.5\times3\times3+5}{1-0.779} \doteqdot 83\text{sec} > 80\text{sec}$$

Design Traffic Capacity

Phase	Entr.	Exit direction	Design hourly volume	Basic capacity	No. of lanes	Possible capacity	Necessary phase rate Y	Modified phase rate Y	Phase rate	Design capacity	Congestion ratio
1φ	①	→	1,840	4,000	2	4,000	0.460	0.590	0525	1,890	097
3φ	②	↳	50	1,800	1	1,800	0.028		0263	426	0.12
3φ	②	↲	430	1,800	1	1,800	0.239	0.307	0263	426	1.00
2φ	③	↑	140	1,800	1	1,800	0.08	0.103	0.100	162	0.86
1φ 2φ	③	←	470	4,000	2	4,000	0.118		0.625	2,250	0.21

$\Sigma Y_i = 0.779 < 0.9$

D-I Summary of Soil Test Results

PROJECT : SELANDER BRIDGE　　　　ORIGINATOR : JAPANESE TEAM.

LABORATORY NO.	7091		
SAMPLE NO.	1	2	3
GRADATION % passing 3 in		Soil	Shore sand
1½ in.	100		
¾ in.	94		
⅜ in.	92		
3/16 in.	91		
B.S. Sieve NO. 7	90	100	100
14	88	99	89
25	75	81	40
36	59	59	8
52	44	40	1
72	36	26	03
100	32	16	0.1
200	26	7	0.1
ATTERBERG LIMITS L. L.	40	NP	NP
P. L.	14	NP	NP
P. I.	26	NP	NP
CLASSIFICATION UNIFIED	SC	SAND	SAND
COMPACTION Sta /Mod. FMC	432	0.72	0004
MDD	112	120	127
OMC	16	11	10
C.B.R. At 95/100% M.D.D (Sta./Mod.) Unsoaked			
1 day soaked			
4 days soaked	3 *	21 *	10 *
Specific Gravity	265	265	267

* Average of two test results.

D-II Pavement Design Calculation

a) Design Standards

"A guide for Asphalt Pavement Design" Japan Highway Institute.

b) Traffic volume of Buses and Trucks

1660 ÷ 2 = 830 cars/day · one direction

Traffic Classification

Traffic Classification	Traffic volume of Buses and Trucks
L Traffic	- 100
A Traffic	100 - 250
B Traffic	250 - 1,000
C Traffic	1,000 - 3,000
D Traffic	3,000 -

c) Design CBR

Design CBR of Improved Subgrade : 12% (See ANNEX D-I)

d) Pavement Design and Pavement Formation

i) Design CBR; 12

ii) Traffic Classification ; B traffic

Thickness TA = 17 Total thickness = 26 cm

CBR	Thickness									
	L Traffic		A Traffic		B Traffic		C Traffic		D Traffic	
	TA	Total Thickness	TA	Total Thickness	TA	Total Thickness	TA	Total Thickness	TA	Total Thickness
2	17	52	21	61	29	74	39	90	51	105
3	15	41	19	48	26	58	35	70	45	83
4	14	35	18	41	24	49	32	59	41	70
6	12	27	16	32	21	38	28	47	37	55
8	11	23	14	27	19	32	26	39	34	46
12	-	-	13	21	17	26	23	31	30	36
20-	-	-	-	-	-	-	20	23	26	27

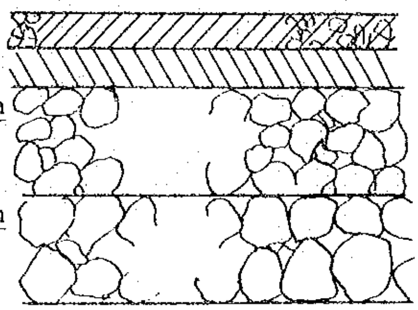
D-II (continued 2)

Assuming the pavement structure illustrated below.

TA = 5 x 1.0 + 5 x 1.0 + 15 x 0.35 + 15 x 0.20 = 18.25 > 17

and total thickness is 5 + 5 + 15 + 15 = 40 > 26

Surface course (Asphaltic concrete) t=5cm
Binder course (Asphaltic concrete) t=5cm
Base course (Grading controlled) t=15cm
Subbase course (Crusher-run) t=15cm



Equivalent Rate used TA Calculation

Used for	Work materials	Condition	Equivalent rate
Surface course & Binder course	Hot mixture asphalt		1.0
Base course	Asphalt treated	Marshall stability value 350 kg min.	0.8
	Grading controlled	CBR 80 min.	0.35
Subbase course	Clusher-run	CRR 20 - 30	0.20

E-I Design Calculation of Lighting

(A)	Kind of road	Trunkroad at town part
(B)	Traffic density on average day	38,700 vehicles/day (1990)
(C)	Construction of road	Width: 6.5m shoulder:0.75W

Design

(D)	Light source used	Fluoresent mercury lamp
(E)	Average horizontal surface illuminance	15ℓx (Average)
(F)	Maintenance facter	0.65
(G)	Deciding the disposition	
	1) Lamp equipment used	H745 (Semi-cut off type)
	2) Position of post erection	0.7 outside from Kerb
	3) Installation height	One side arrangement, 100m (From H≧ 1.2W)
	4) Angle of inclination of installation	5°
	5) Pole used	10-8B
	6) From center of pole to center of lamp equipment	1.3W
	7) Overhang	-0.1(=0.75=0.65+1.3)
	8) Max. installation space	35W (From S≦ 3.5H)
	9) Coefficient of utilization	(On the assumption of using HF400W)

Carriageway side W/H = 6.5 + 0.1/10

= 0.66 --- U_1 = 0.27

(from curve of coefficient of utilization)

Shoulder side W/H = 0.1/10

= 0.01 --- U_2 = 0.01

(from curve of coefficient of utilization)

E-I (continued 2)

$$U = U_1 + U_2$$

$$= 0.26$$

10) Deciding the luminous flux required

$$F = \frac{W.E.S}{U.M}$$

$$= \frac{35 \times 6.5 \times 15}{0.26 \times 0.65}$$

$$= 20.192 \ (\ell m)$$

Accordingly, 20.192 HF400W (luminous flux of lamp: 22.000ℓm)

Therefore, Lamp used is HF 400W

11) Calculation of illumunation

$$E = \frac{F.U.M}{S.W}$$

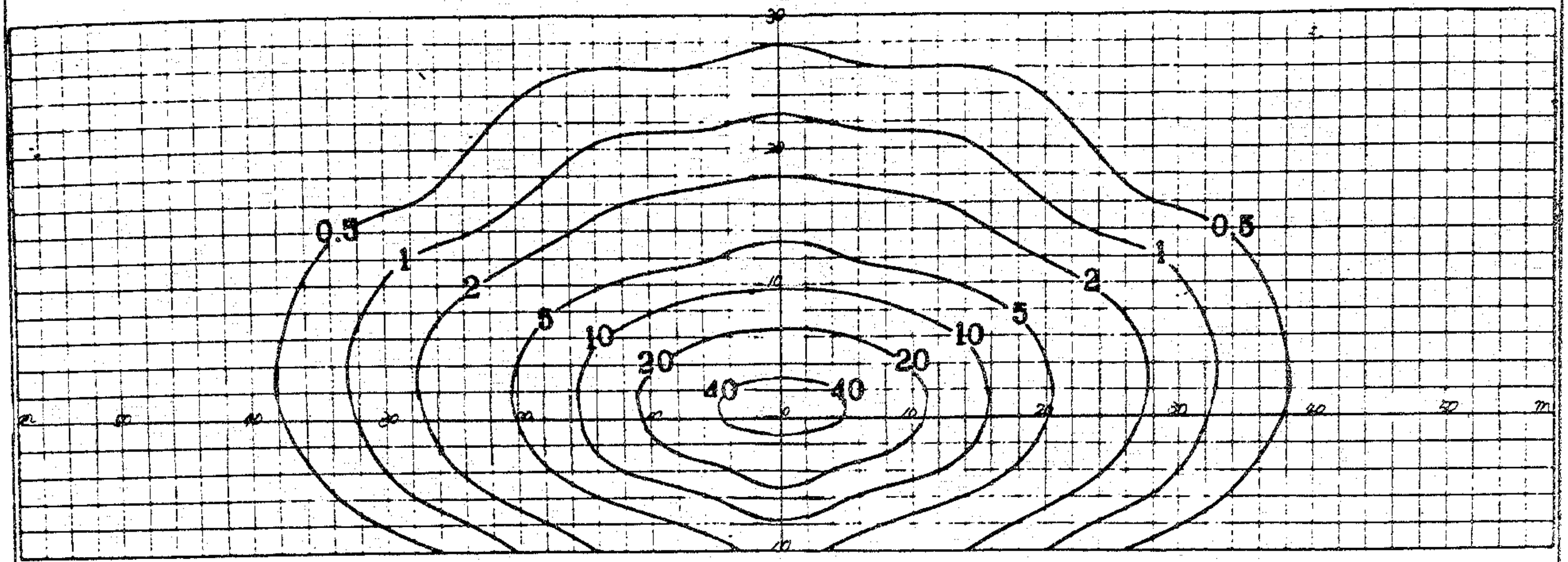
$$= \frac{22.000 \times 0.26 \times 0.65}{35 \times 6.5}$$

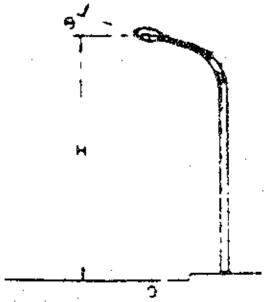
$$= 16.3(\ell x) \ (1.08nt) > 15\ell x(1.0nt)$$

Therefore, lamp equipment space S = 35W

Therefore, height of lamp equipment H = 10m

E-II Isolux Diagram and Illumination Distribution Chart



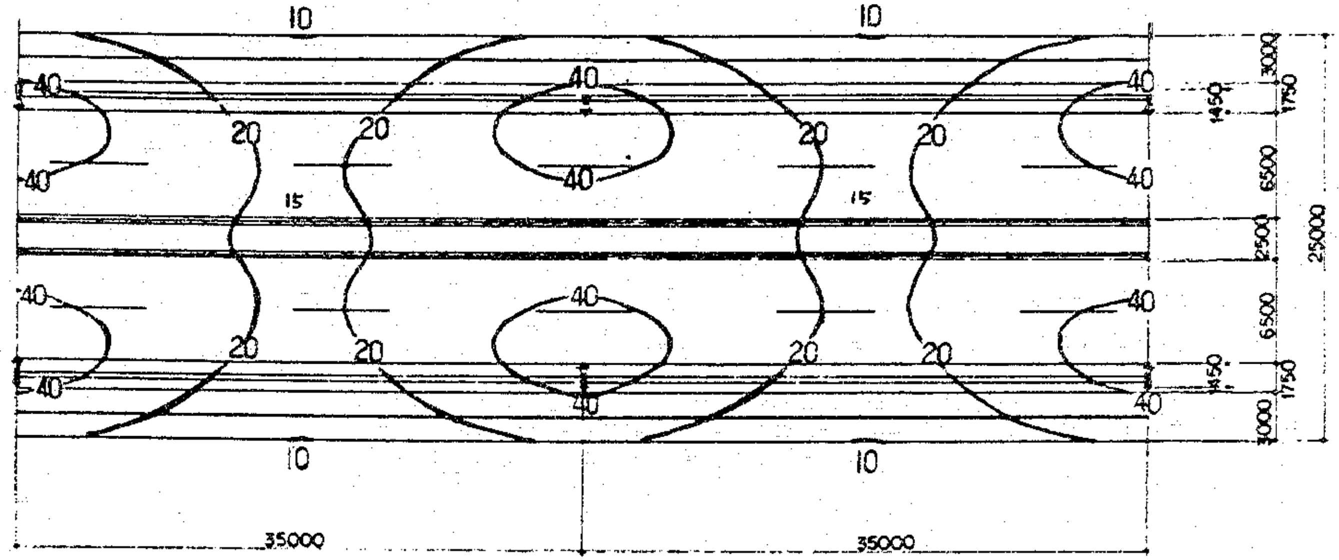


LAMP	400 W
TOTAL LAMP LUMENS	22000 lm
MOUNTING HIGHT (H)	10 m
INCLINATION (θ)	5 °

ISOLUX DIAGRAM
(CARRIAGEWAY)

UNIT : [lx] SCALE : 1/300

E-II (Continued 2)



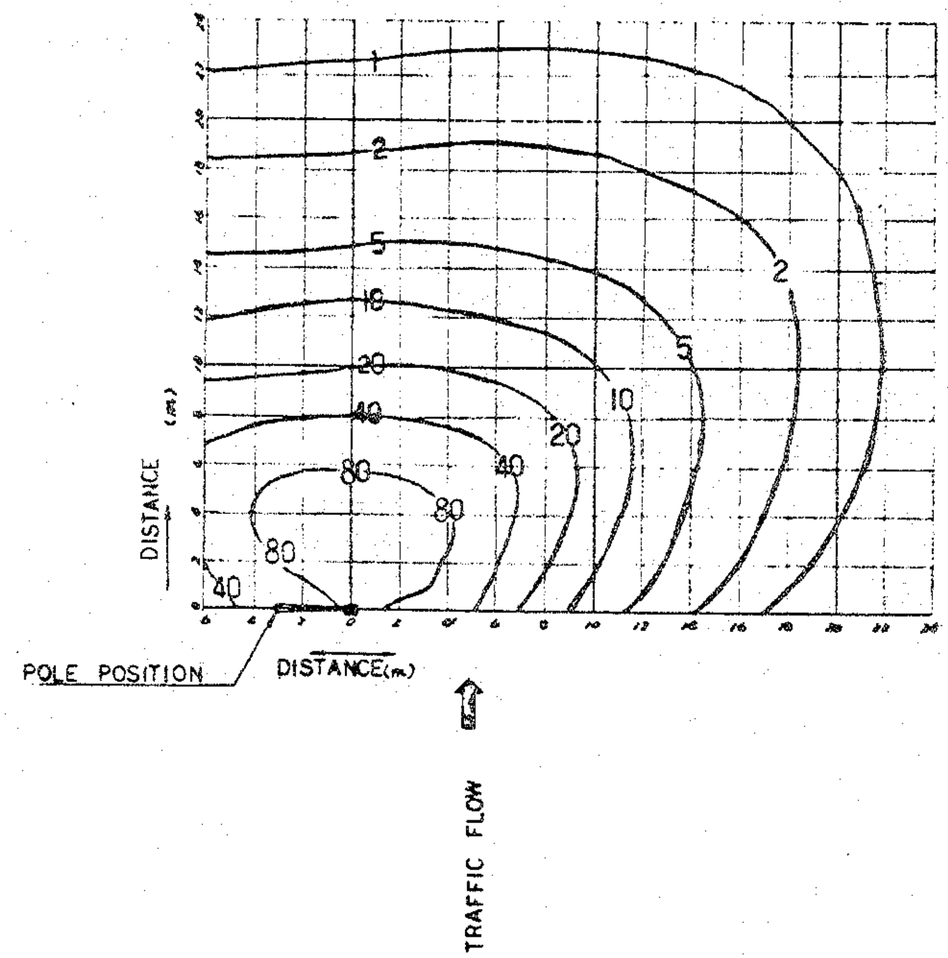
LEGEND

MARK	DESCRIPTION
—o	LAMP : 400W, HIGHT: 10m, 5°POLE [illegible]

NOTE: INITIAL ILLUMINANCE SHALL BE SHOWN THE NUMBER ON THE CURVE UNIT: [lx]

ILLUMINATION DISTRIBUTION CHART (CARRIAGEWAY)	
UNIT : [lx]	SCALE : 1/300

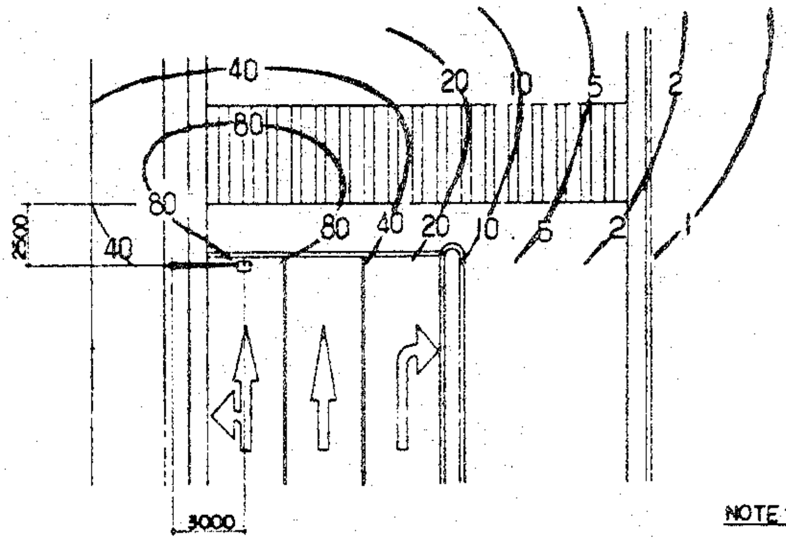
E-II (Continued 3)



NOTE: INITIAL ILLUMINANCE SHALL BE SHOWN
THE NUMBER ON THE CURVE. UNIT: [lx]

ISOLUX DIAGRAM (PEDESTRIAN)	
UNIT : [lx]	SCALE : 1/200

E-II (Continued 4)



LEGEND

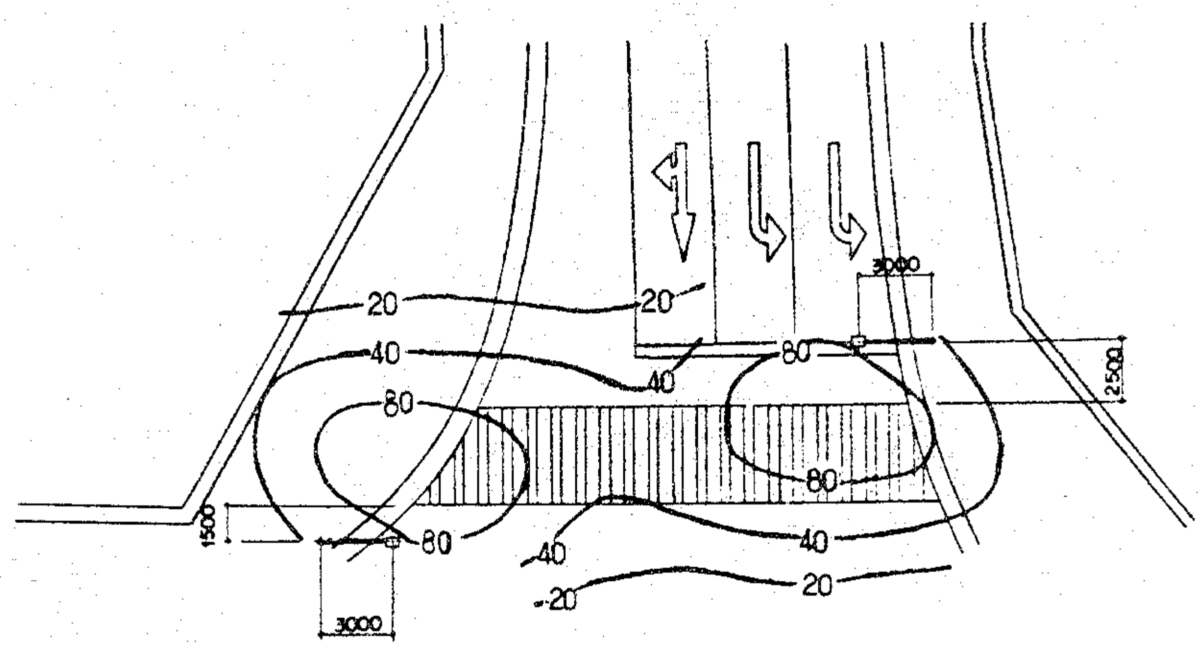
MARK	DESCRIPTION
(lamp symbol)	LAMP : 400 W, HEIGHT H = 6.35m

NOTE: INITIAL ILLUMINANCE SHALL BE SHOWN THE NUMBER ON THE CURVE. UNIT : [lx]

ILLUMINANCE DISTRIBUTION CHART OF ONE LAMP
(PEDESTRIAN)

UNIT : [lx] SCALE : 1/200

E-II (Continued 5)



LEGEND

MARK	DESCRIPTION
——□	LAMP : 400 W, HEIGHT H = 6.35m

NOTE: INITIAL ILLUMINANCE SHALL BE SHOWN THE NUMBER ON THE CURVE.
UNIT : [lx]

ILLUMINANCE DISTRIBUTION CHART OF TWO LAMPS (PEDESTRIAM)	
UNIT : [lx]	SCALE : 1/200

E-III Distribution Panel Load Table and Voltage Drop Calculation

Distribution Panel Load Table

Distribution Panel	Feeder	Connection	Quantity	Phase Amper	Voltage	Load Capacity
A	1	R-N	HF400wx4	9.2(A)	230(V)	2,116 (VA)
		S-N	" x4	"	"	2,116 (VA)
		T-N	" x4	"	"	2,116 (VA)
	2	R-N	HF400wx6	13.8(A)	"	3,174(VA)
		S-N	" x6	"	"	3,174(VA)
		T-N	" x5	11.5(A)	"	2,645(VA)
	3	R-N	HF400wx3	6.9(A)	"	1,587(VA)
		S-N	" x3	"	"	1,587(VA)
		T-N	" x3	"	"	1,587(VA)
	4	R-N	HF400wx4	9.2(A)	"	2,116(VA)
		S-N	" x4	"	"	2,116(VA)
		T-N	" x4	"	"	2,116(VA)
	5	S-N	TRAFFIC SIGNAL			1,800(VA)
TOTAL						28,250(VA)
B	1	R-N	HF400wx4	9.2(A)	230(V)	2,116(VA)
		S-N	" x4	"	"	2,116(VA)
		T-N	" x4	"	"	2,116(VA)
	2	R-N	HF400wx4	9.2(A)	230(V)	2,116(VA)
		S-N	" x4	"	"	2,116(VA)
		T-N	" x4	"	"	2,116(VA)
	3	R-N	HF400wx3	6.9(A)	"	1,587(VA)
		S-N	" x3	"	"	1,587(VA)
		T-N	" x3	"	"	1,587(VA)
	4	R-N	HF400wx4	9.2(A)	230(V)	2,116(VA)
		S-N	" x4	"	"	2,116(VA)
		T-N	" x3	6.9(A)	"	1,587(VA)
	5	S-N	TRAFFIC SIGNAL			3,100(VA)
TOTAL						26,376(VA)

E-III (continued 2)

VOLTAGE DROP CALCULATION

FEEDER NO.	FEEDER		LOAD				LENGTH	CABLE SIZE	VOLTAGE DROP (%)		NOTES
	START	END	MAXIMUM LOAD	VOLTAGE	AMPER	PHASE	(m)	(mm^2)	DESIGN	CALCULA-TION	
			(VA)	(V)	(A)						
B2	9/B2	12/B2	529	230	2.3	1	62.5	8		0.28	
								TOTAL	6	3.08	
B3	Distribution Panel B	MB6	1,587	230	6.9	1	220	14		1.65	
"	MB6	4/B3	1,058	"	4.6	"	27	8		0.44	
"	4/B3	1/B3	529	"	2.3	"	73	"		0.56	
"	MB6	6/B3	1,058	"	4.6	"	33.5	"		0.53	
"	6/B3	9/B3	529	"	2.3	"	104	"		0.81	
								TOTAL	6	3.99	
B4	Distrubtion Panel B	2/B4	2,116	230	9.2	1	83	8		1.46	
"	2/B4	5/B4	1,587	"	6.9	"	85.5	"		1.13	
"	5/B4	8/B4	1,058	"	4.6	"	74.5	"		0.65	
"	8/B4	11/B4	529	"	2.3	"	104	"		0.46	
								TOTAL	6	3.70	

E-III (continued 3)

VOLTAGE DROP CALCULATION

FEEDER NO.	FEEDER START	FEEDER END	LOAD MAXIMUM LOAD (VA)	LOAD VOLTAGE (V)	LOAD AMPER (A)	LOAD PHASE	LENGTH (m)	CABLE SIZE (mm2)	VOLTAGE DROP(%) DESIGN	VOLTAGE DROP(%) CALCULATION	NOTES
B1	Distribution Panel B	MB1	2,116	230	9.2	1	20	8		0.35	
"	MB1	31/B1	529	"	2.3	"	55	"		0.25	
"	MB1	MB2	1,587	"	6.9	"	46	"		0.62	
"	MB2	6/B1	529	"	2.3	"	20.5	"		0.09	
"	MB2	MB3	1,058	"	4.6	"	24	"		0.21	
"	MB3	7/B1	529	"	2.3	"	34.5	"		0.16	
"	MB3	9/B1	1,058	"	4.6	"	26.5	"		0.23	
"	9/B1	12/B1	529	"	2.3	"	130.5	"		1.00	
								TOTAL	6	2.91	
B2	Distribution Panel	MB4	2,116	230	9.2	1	35	8		0.62	
"	MB4	4/B2	1,058	"	4.6	"	37	"		0.33	
"	4/B2	1/B2	529	"	2.3	"	118.5	"		0.53	
"	MB4	6/B2	1,587	"	6.9	"	30	"		0.40	
"	6/B2	9/B2	1,058	"	4.6	"	104.5	"		0.92	

E-III (continued 4)

VOLTAGE DROP CALCULATION

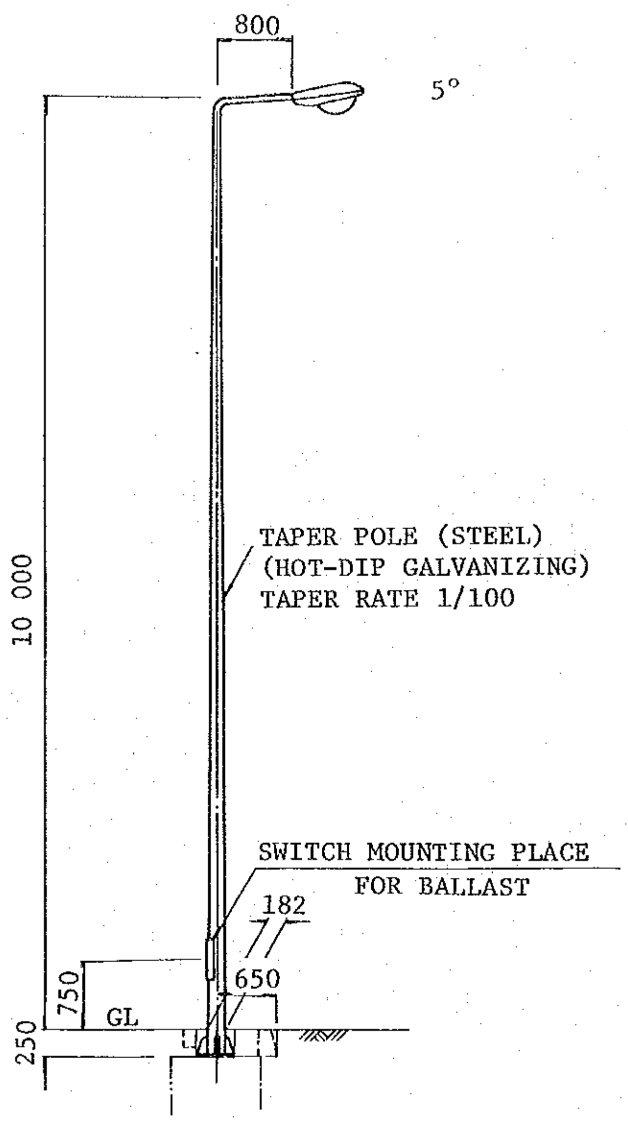
FEEDER NO	FEEDER START	FEEDER END	LOAD MAXIMUM LOAD (VA)	LOAD VOLTAGE (V)	LOAD AMPER (A)	LOAD PHASE	LENGTH (m)	CABLE SIZE (mm^2)	VOLTAGE DROP (%) DESIGN	VOLTAGE DROP (%) CALCULATION	NOTES
A2	MA5	8/A2	529	230	2.3	1	51	8		0.51	
"	MA5	11/A2	1,587	"	6.9	"	27.5	14		0.20	
"	11/A2	14/A2	1,058	"	4.6	"	99.5	14		0.30	
"	14/A2	17/A2	529	"	2.3	"	117.5	14		0.30	
								TOTAL		3.41	
A3	Distribution Panel A	3/A3	1,587	230	6.9	1	439	14		3.30	
"	3/1A3	5/A3	1,058	"	4.6	"	112.5	"		0.57	
"	6/A3	9/A3	529	"	2.3	"	112.5	"		0.28	
								TOTAL	6	4.15	
A4	Distribution Panel A	3/A4	2,116	230	9.2	1	291.5	14		2.91	
"	3/A4	6/A4	1,587	"	6.9	"	112.5	"		0.84	
"	6/A4	9/A4	1,058	"	4.6	"	112.5	"		0.57	
"	9/A4	12/A4	529	"	2.3	"	112.5	"		0.28	
								TOTAL		4.60	

E-III (continued 5)

VOLTAGE DROP CALCULATION

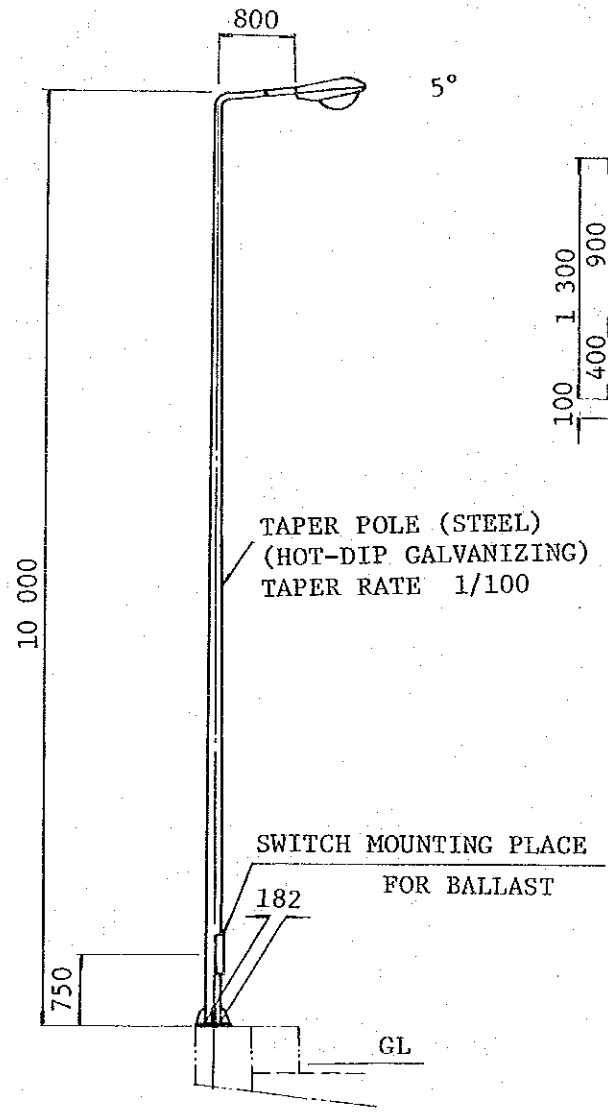
FEEDER NO.	FEEDER		LOAD				LENGTH	CABLE SIZE	VOLTAGE DROP(%)		NOTES
	START	END	MAXIMUM LOAD (VA)	VOLTAGE (V)	AMPER (A)	PHASE	(m)	(mm^2)	DESIGN	CALCULA-TION	
A1	Distribution Panel A	MA1	2,116	230	9.2	1	3.0	8		0.05	
"	MA1	1/A1	529	"	2.3	"	49.0	"		0.21	
"	MA1	5/A1	529	"	2.3	"	69.5	"		0.30	
"	MA1	MA2	1,587	"	6.9	"	30.0	"		0.90	
"	MA2	6/A1	529	"	2.3	"	36.0	"		0.16	
"	MA2	9/A1	1,058	"	4.6	"	46.5	"		0.40	
"	9/A1	12/A1	529	"	2.3	"	107.5	"		0.63	
								TOTAL	6	2.15	
A2	Distribution panel A	MA3	3,174	230	13.8	1	34	14		0.51	
"	MA3	1/A2	529	"	2.3	"	79	8		0.35	
"	MA3	5/A2	2,645	"	11.5	"	40.5	14		0.50	
"	5/A2	MA4	2,116	"	9.2	"	9.5	"		0.10	
"	MA2	7/A2	529	"	2.3	"	54.0	8		0.23	
"	MA4	MA5	2,116	"	9.2	"	21.0	14		0.21	

E-IV Foundation of Lighting Pole and Hand Rails



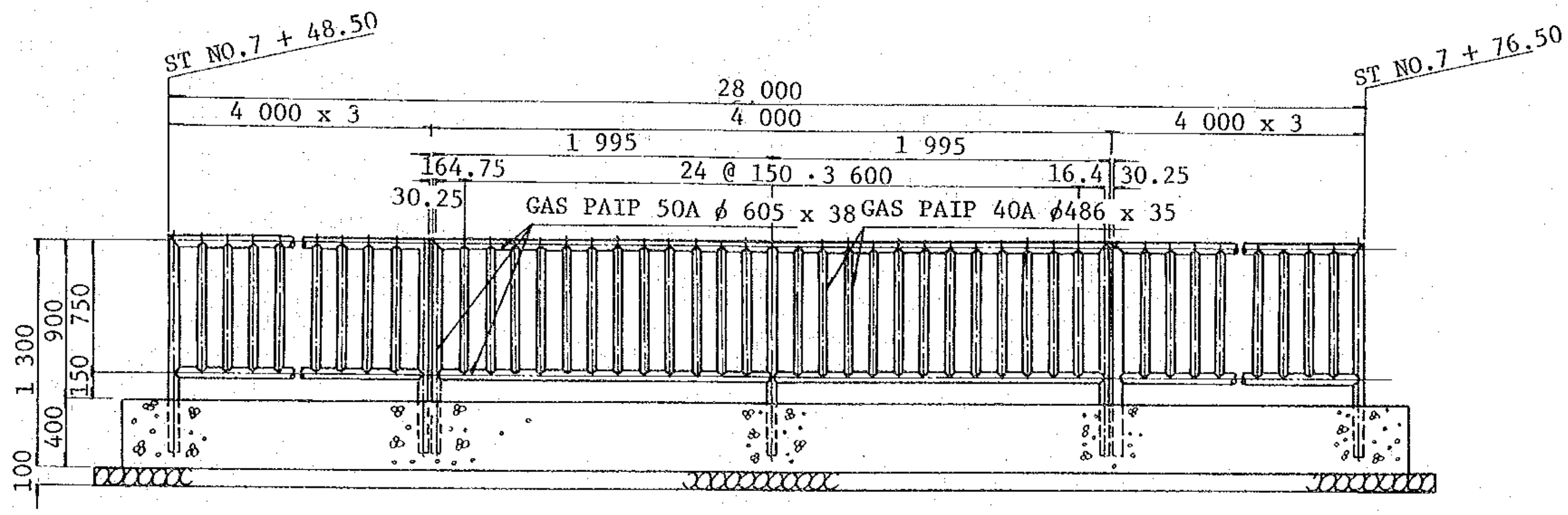
LP-1

ELEVATION OF LIGHTING POLE

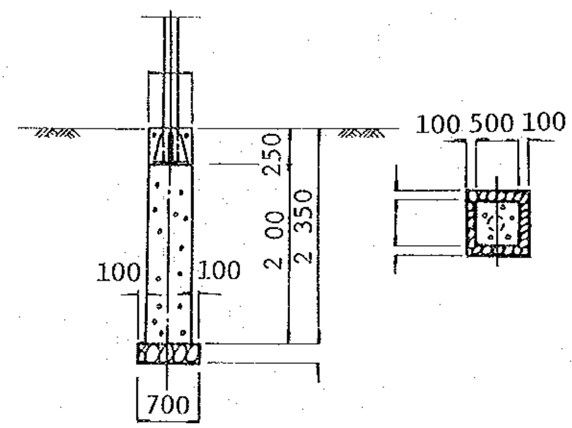


LP-2

ELEVATION OF LIGHTING POLE



HAND RAI?



BASE CONCRETE OF LIGHTING POLE