

5-8 計測計器の仕様と設置位置

本試験水路に用いる計測計器の仕様は表5.8.1に示す通りである。

計測計器の設置位置は図5.8.1～図5.8.3に示す粘弾塑性モデルを用いた解析結果に基づいて決定した。

各断面の計測計器の配置計画は図5.8.4～図5.8.7に示す通りである。

表5.8.1 計測計器の仕様

Equipment Name		Item	Specification
Inclinometer	Casing	Material	Alluminium with plastic coating
		Diameter	Inner 47mm Outer 50mm
		Length	3.0m
		Installation	Install into borehole and grouting outside
		Joint	Fix by rivet and cover by sealing tape
	Probe	Range of Meas.	$\pm 30^\circ$
		Linearity	0.05%
		Resolution	Less than 10 sec
		Dimension	Dia 30mm Length of wheel 500mm
	Recorder	Display	Depth and displacement
		Recording	5 $\frac{1}{2}$ inch floppy disk
		Print	Paper with 58mm wideness
		Auto Calculation	Displacement, summary displacement
Measuring		Manual measuring using recorder	
Settlement Gauge	Magnet Ring	Material	P.V.C. with magnet rod
		Dimension	Inner 40mm Outer 70mm Length 100mm
		Arm	3 Numbers, each 20cm length
	Indicator	Probe	22mm diameter and 150mm length
		Cable	with measure tape
		Accuracy	$\pm 2mm$
		Indicator	buzzer
	Measuring		Manual measuring
Piezometer	Piezometer	Material	Stainless steel with filter ring
		Range	Approx. 2 times of static water pressure
		Linearity	1% FS
		Temperature	0 - 60°C
		Mechanism	Strain gauge
Extensometer	Sensor	Material	Steel
		Range	2000mm in displacement
		Linearity	0.5% FS
		Sensitivity	$2.5 \times 10^{-6}/mm$
		Temperature	0 - 40°C
		Mechanism	Strain gauge
Recorder	Data Logger	Numbers of Channels	500
		Measuring Speed	0.08 sec/channel with 1 sec - 60min
		Power Source	AC 220V
	Disk Recorder	Disket	3.5 inch
		Interface	GP - IB
	Switch Box	Number of Channels	More than 50

PORE PRESSURE

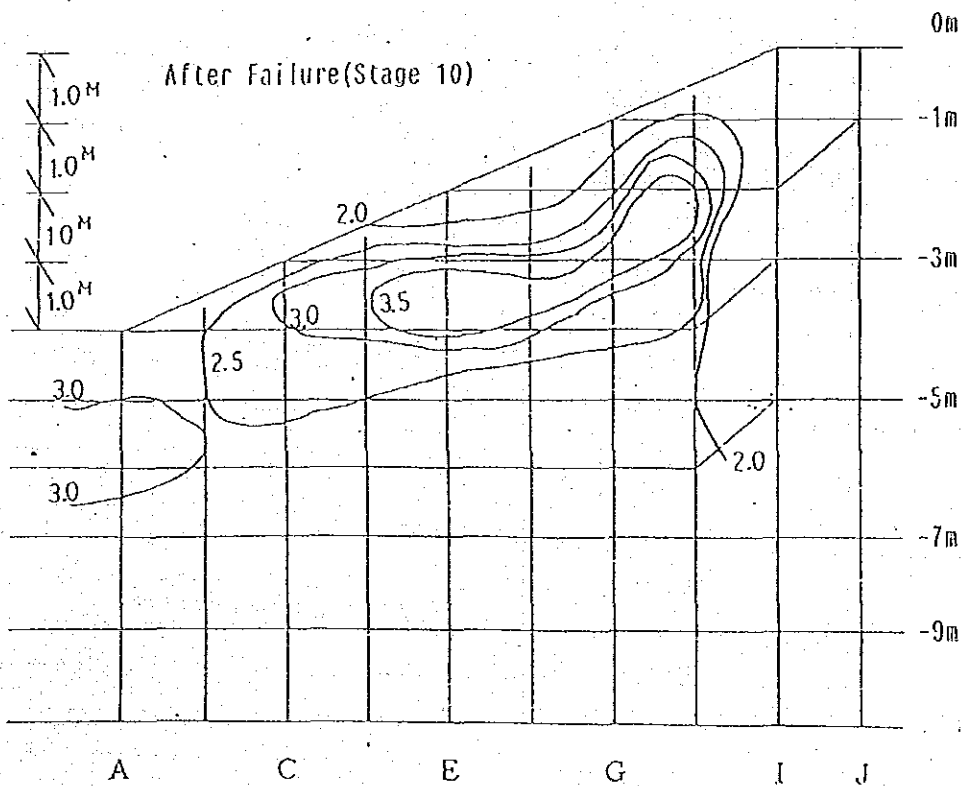
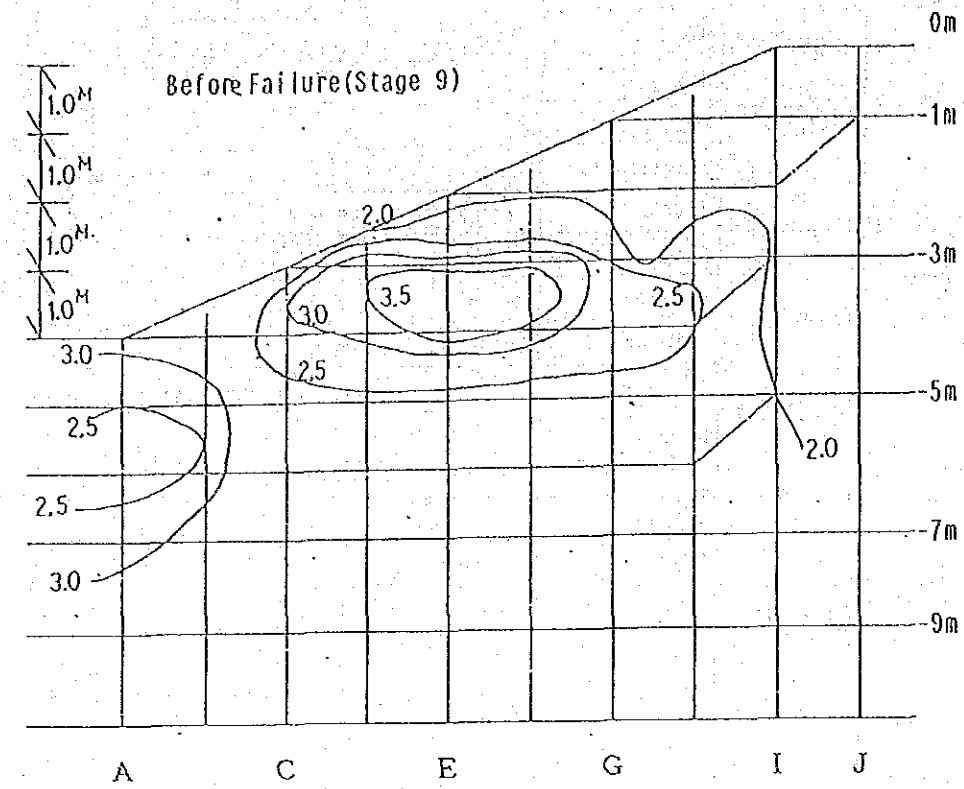


図5.8.1 間隙水圧の変化

Horizontal Displacement

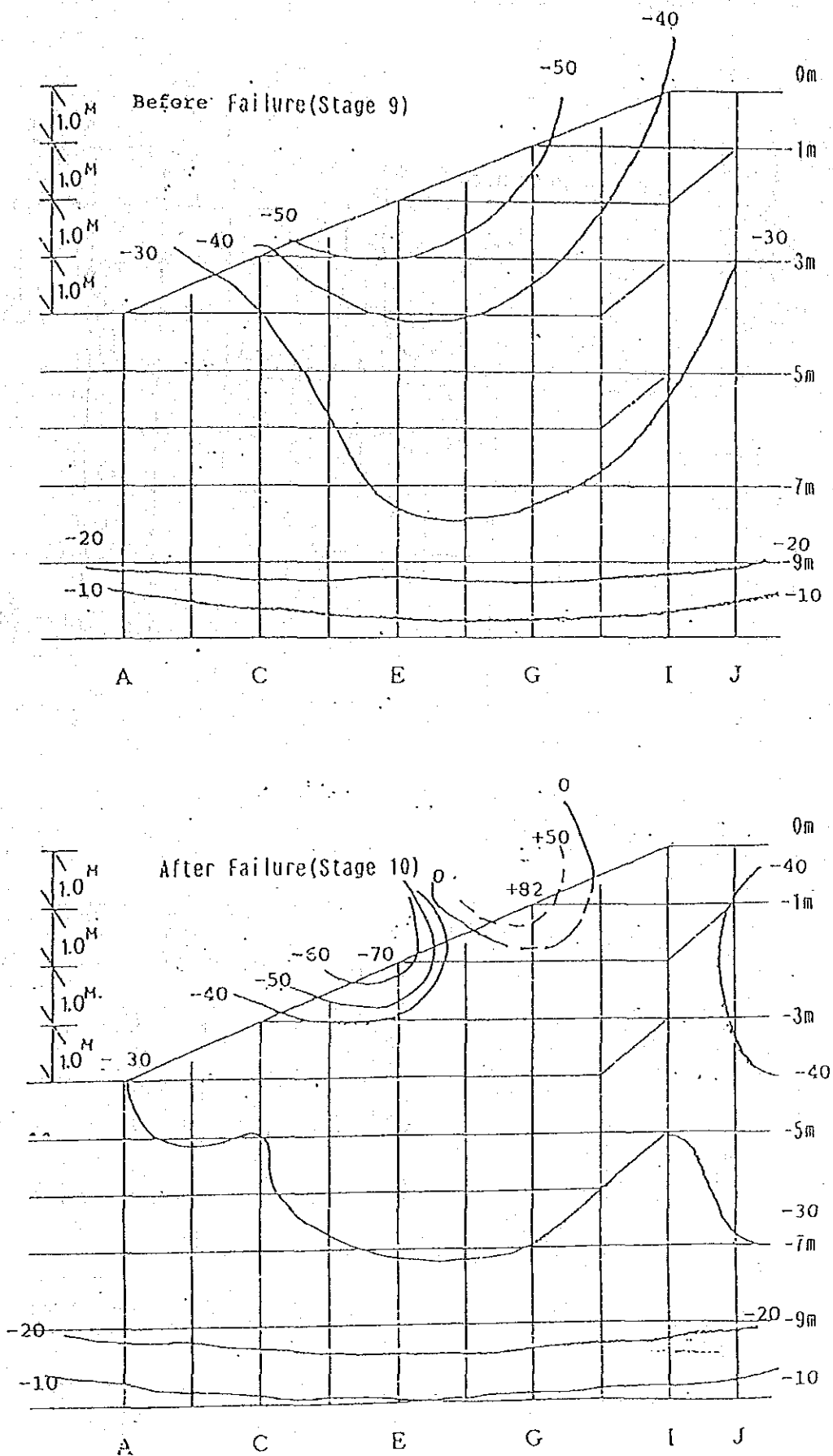


図5. 8. 2 鉛直変位の変化

Vertical Displacement

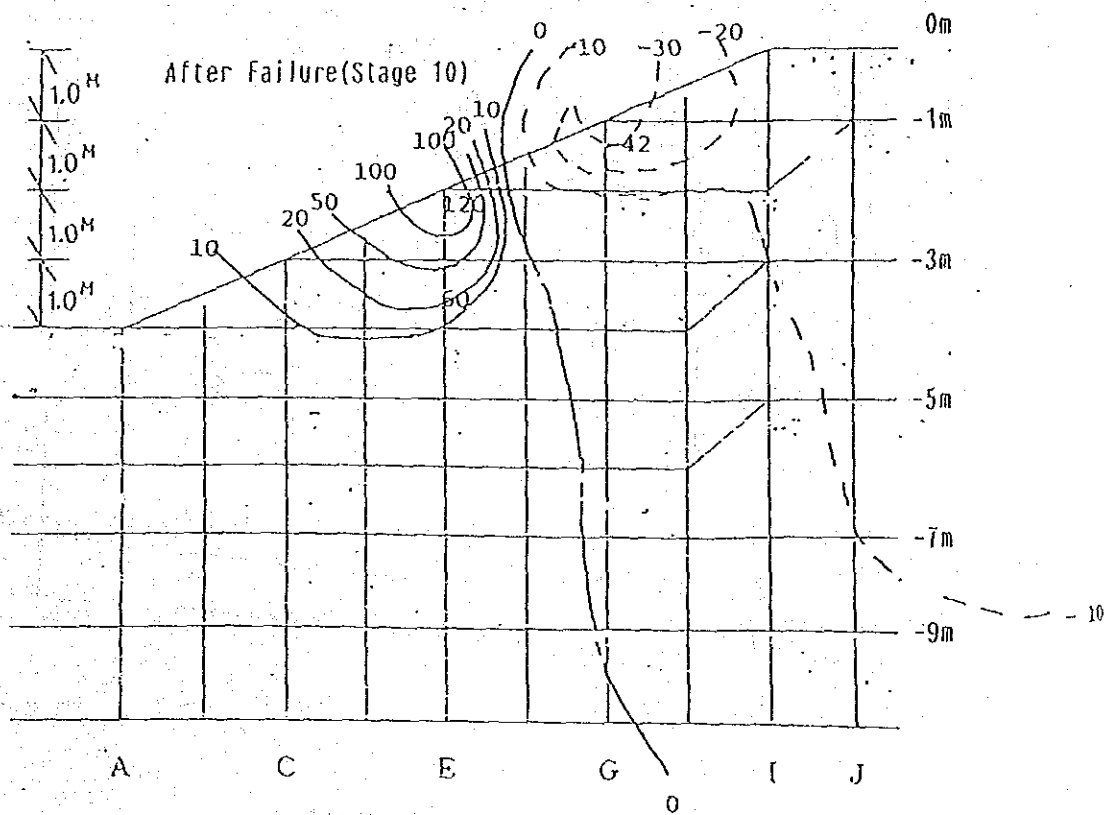
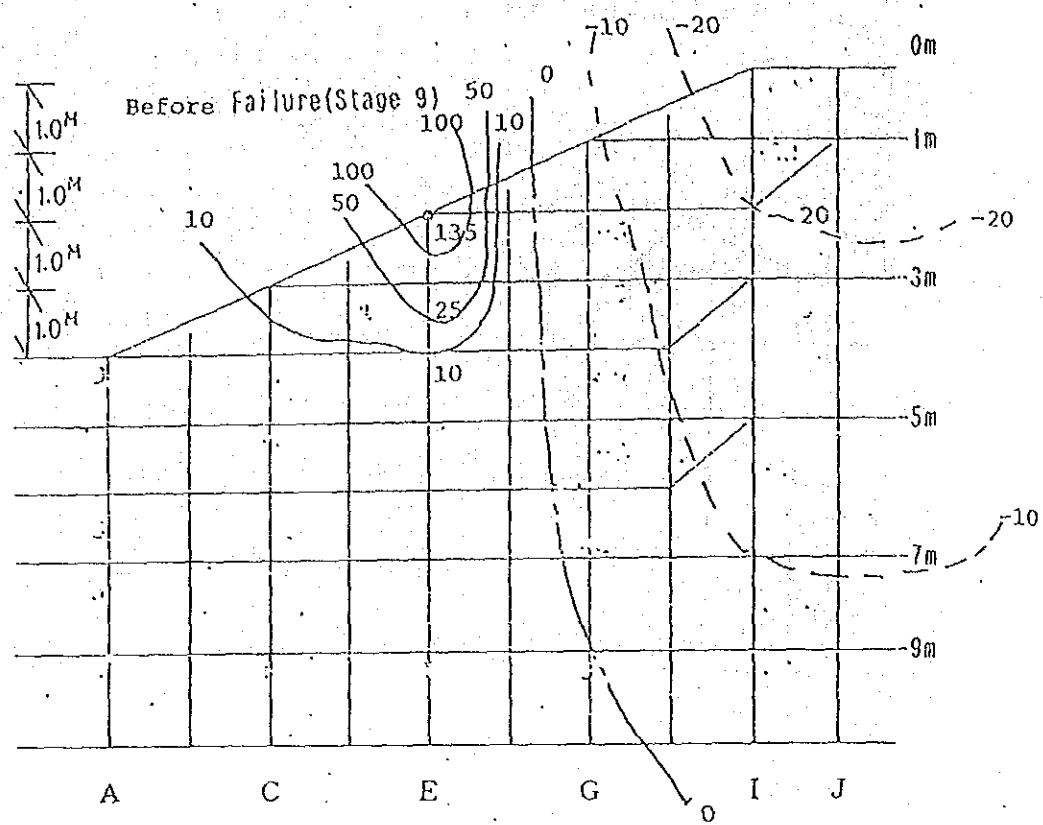


図5. 8. 3 水平変位の変化

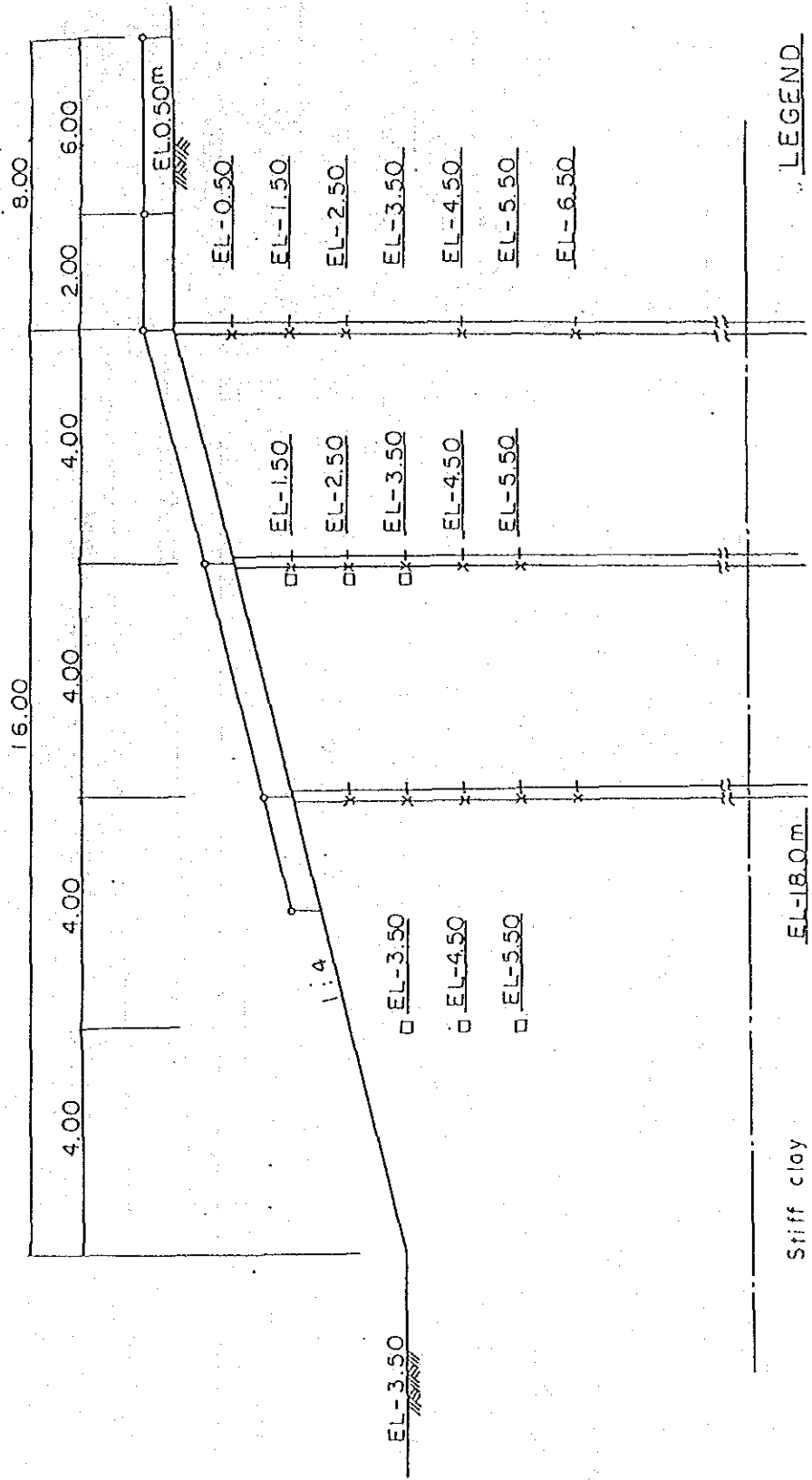


図 5. 8. 4 無処理断面 (1 : 4) の計測計器配置計画

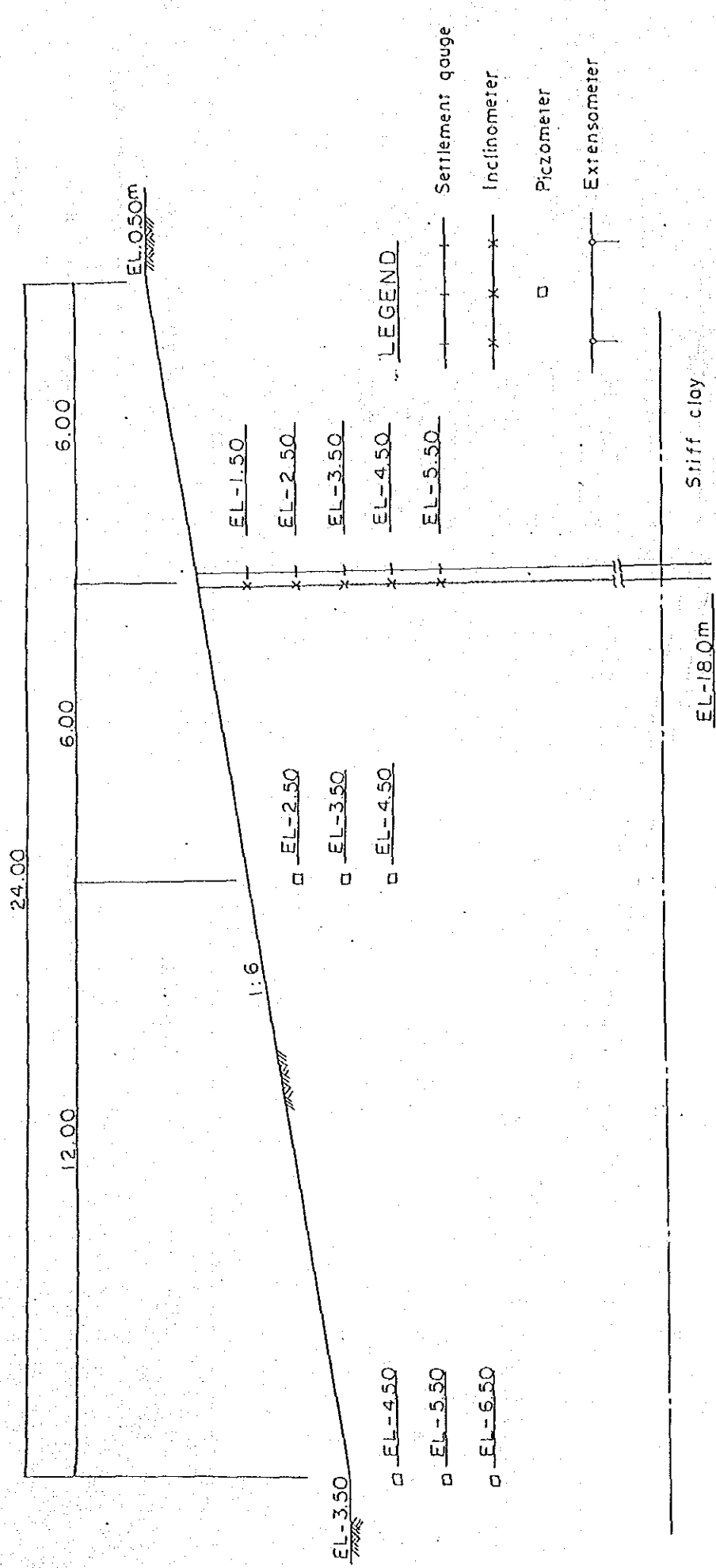


図5.8.5 無処理断面(1:6)の計測計器配置計画

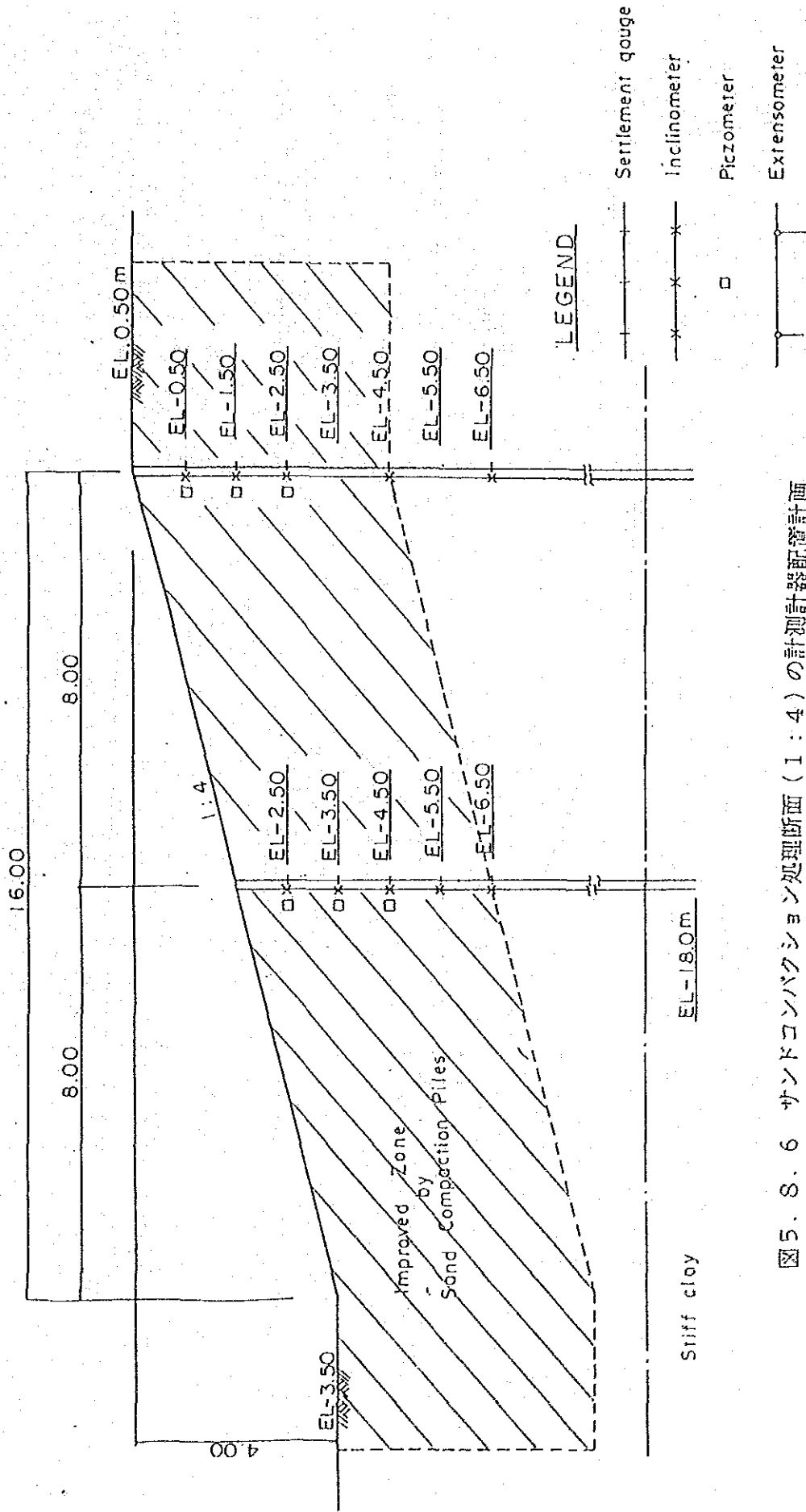
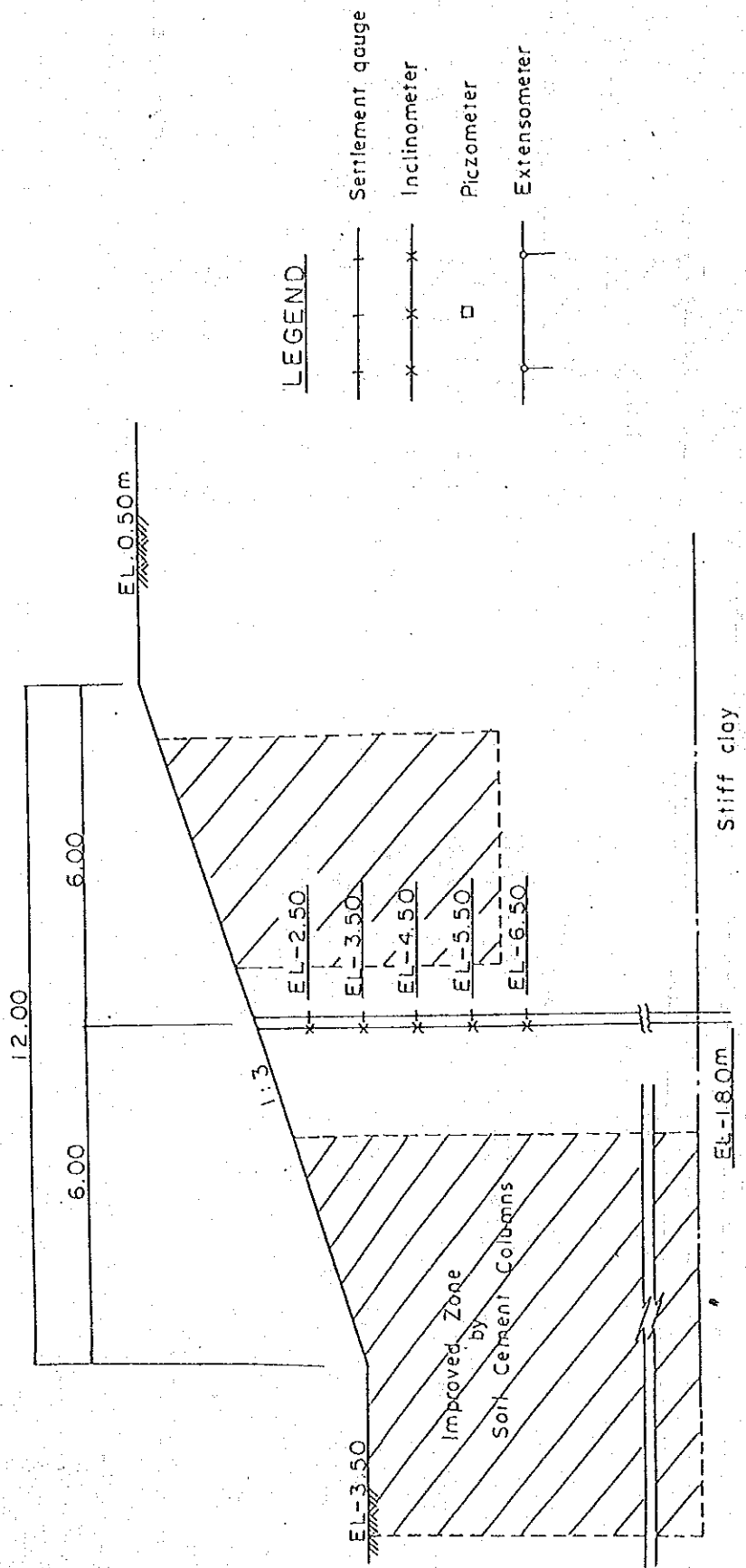


図 5. 8. 6 サンドコンパクション処理断面 (1 : 4) の計測計器配置計画



LEGEND

- |—|—| Settlement gauge
- x—x—x— Inclinator
- Piezometer
- |—|—| Extensometer

図 5. 8. 7 ソイルセメントコラム処理断面 (1 : 3) の計測計器配置計画

第6章 施工計画

6-1 施工条件及び施工順序

本工事は試験水路の建設である為、施工には種々の制約を受ける。本工事に対する施工計画の立案に当っては次の条件を考慮しなくてはならない。

- i) 軟弱地盤上の施工なので、施工時に建設機械による影響を極力避けなくてはならない。
- ii) 特に掘削時に於ては、斜面の法肩にはいかなる荷重も乗せてはならない。
- iii) 動態観測用の計測機器及びそのケーブルの設置時期を考慮する必要があり、工事中にこれらの計器、ケーブルにダメージを与えてはならない。
- iv) 掘削工事は、地盤改良工事が終了してから開始しなくてはならない。
- v) モデルインフラプロジェクトとして性格上、工期及び工事費に制限がある。

全体的な工事工程のフローチャートは図6. 1. 1に示す通りである。

6-2 締切堤及び水替工事

1) 締切堤工事

本試験水路サイトの南側と東側に接しているエビの養殖場は海の干満を利用し運営されている。養殖場のサイトに接している部分は、標高1.60~1.70mの小堤防で囲まれてる。

サイトの海側に約20mの低位部があり、サイトに溜まっている海水は、この地点より流入している。

従って締切堤は、この低位部に設け、海水の影響を防ぐものとする。

締切堤は下図の標準断面にて施工する。

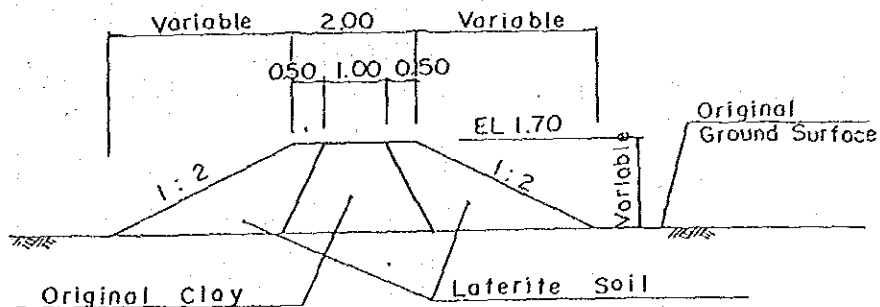


図6. 2. 1 締切堤標準断面図

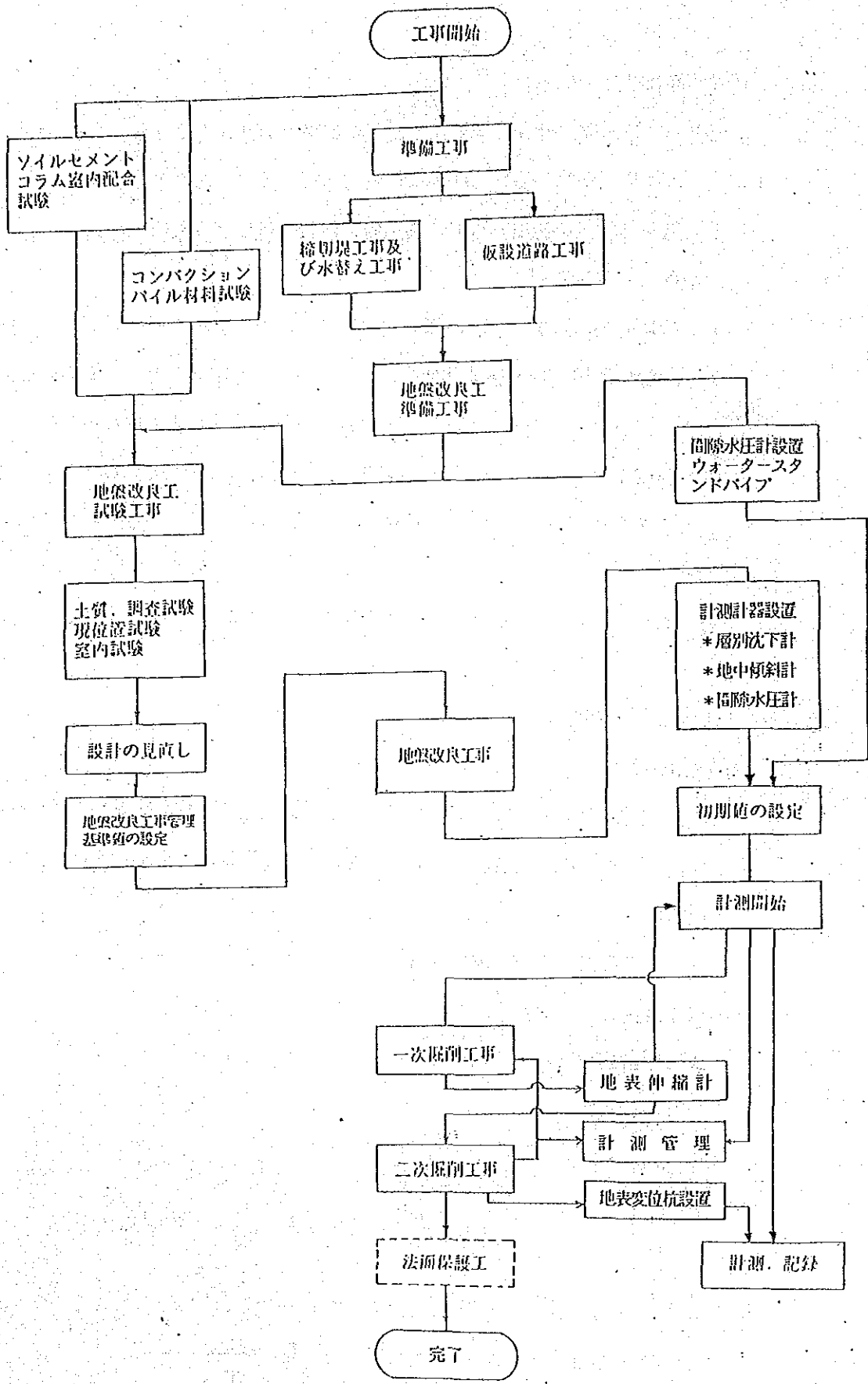


図6. 1. 1 工事工程のフローチャート

施工はブルドーザーによる押土，人力による転圧とする。

- 工事数量：95 m³
ラテライト：61 m³
粘土：34 m³
- ブルドーザー(11ton) 作業能力：

$$Q = \frac{60 \times q \times f \times E}{C_m} \quad \text{----- (6.1)}$$

ここに、Q : ブルドーザー運転1時間当りの作業能力

q : 1サイクル当りの掘削，押土量 (m³)

f : 土量換算係数

E : 作業効率

C_m : 1サイクル当りの所要時間(分)で

次式による

$$C_m = 0.034 \times L + 0.25 \quad L : \text{運土距離}$$

$$C_m = 0.034 \times 50 + 0.25 = 1.95 \text{ (分)}$$

$$Q = \frac{60 \times 1.34 \times 1.0 \times 0.40}{1.95} = 16.5 \text{ m}^3 / \text{hr}$$

- 人力盛土の作業能力：

人力タコにより締固めることとする。

$$q = \frac{10.0 \text{ m}^3 / \text{d}}{1.9 \text{ 人}} = 5.2 \text{ m}^3 / \text{d} / \text{人}$$

- 必要工事日数

作業員を10人配置する。

$$95.0 \text{ m}^3 \div (5.2 \text{ m}^3 / \text{d} / \text{人} \times 10 \text{ 人}) = 1.8 \approx 2 \text{ 日間}$$

2) 水 替 工

プロジェクトサイトの水位がEL1.0mとすると、サイト内の水量は約3,600m³である。

4インチポンプ2台で排水すると、

$$3,600 \text{ m}^3 \div (0.33 \text{ m}^3 / \text{分} \times 60 \times 24 \times 2 \text{ 台}) = 3.7 \approx 4 \text{ 日間}$$

土捨場貯留量は約2,000m³と見積られた。

4インチポンプ1台で排水すると、

$$2,000 \div (0.33 \times 60 \times 24) = 4.2 \approx 5 \text{ 日間}$$

工事中の試験水路内の排水は4インチポンプ1台を配置し行うこととし、プロジェクトサイト低位部の排水には小水路を設けた上、釜場より2インチポンプで適宜排水を行うこととする。

6-3 仮設道路及び地盤改良工仮設工事

1) 仮設道路計画

プロジェクトサイトでの地盤改良工事及び掘削工事の為に図6.3.1.に示す通りの仮設道路を計画する。

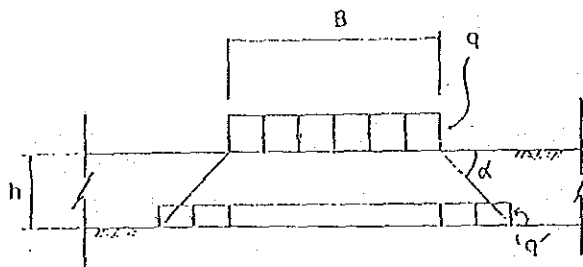
仮設道路を計画する原地盤表土のコーン支持力 q_c は、既ね $q_c = 4 \sim 5 \text{ kg/cm}^2$ である。従って、施工機械の走行の為、砂とラテライトソイルにて仮設道路を設ける。又、砂が粘土地盤内に消失するのを避ける為、土木シートを施工する。

2) 仮設道路断面

盛土厚は施工機械により生ずる地盤内の応力が原地盤表土の非排水せん断強さを越えない様に計画する。

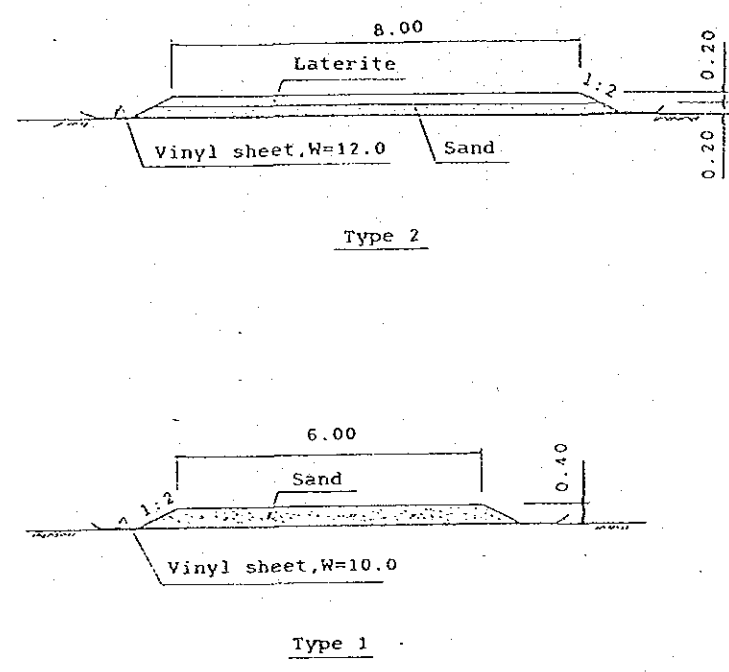
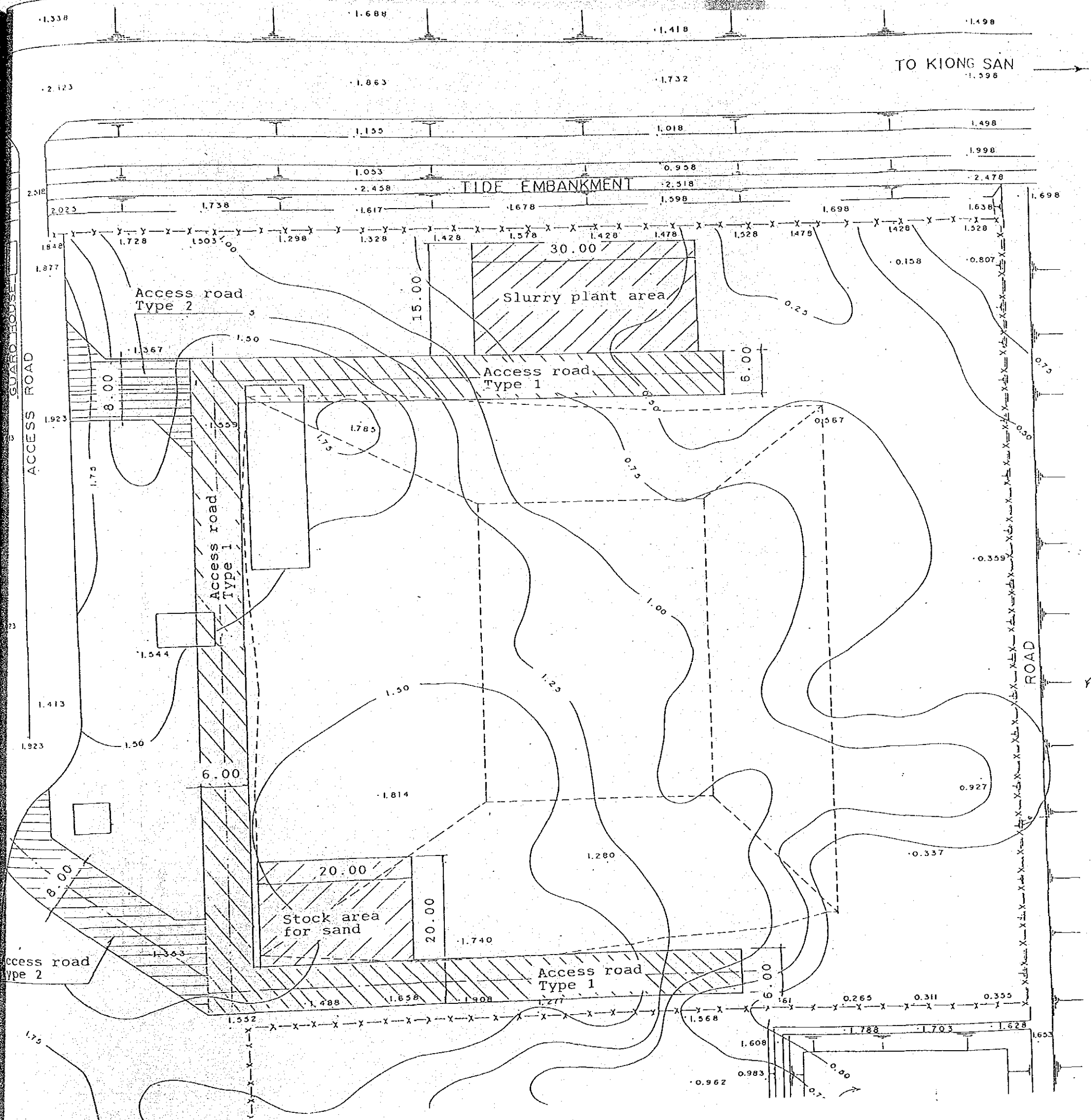
仮設道路上の荷重が原地盤に直接分散すると仮定すると、koglerの式より原地盤の応力は次式で表わされる。

$$q' = \frac{q \cdot B}{B + 2 \times h \times \cot \alpha} \quad (6.2)$$



ここに、 $\alpha = 45^\circ$ とすると

$$q' = \frac{q \cdot B}{B + 2h} \quad (6.3)$$



Typical Section of Access Road

图6.3.1 仮設計画図

ここに、 q' : 原地盤表土のせん断強度 (t/m^2)

q : 仮設道路上に作用する荷重 (t/m^2)

B : 荷重の載荷巾 (m)

h : 盛土厚さ (m)

コーン支持力 (q_c) とせん断強度 (C_u) との間に近似的に次式が成り立つと言われている。今、 $q_c = 4.0 kg/cm^2$ とすれば、

$$C_u = q_c / 10 = 4.0 / 10 = 0.4 kg/cm^2 = 4.0 t/m^2$$

また、トラック荷重を見込むと、11tトラックによる接地圧 q は $12 t/m^2$ と言われている。

従って、 $C_u = q'$ として必要盛土高 h は次の様に求まる。

(6.3) 式より

$$h = \frac{1}{2} \times \left[\frac{qB}{q'} - B \right] \quad \text{----- (6.4)}$$

より

$$h = \frac{1}{2} \times \left[\frac{12.0 \times 0.5}{4.0} - 0.5 \right] = 0.50m$$

従って、土木シート施工を考え次の断面を計画する。

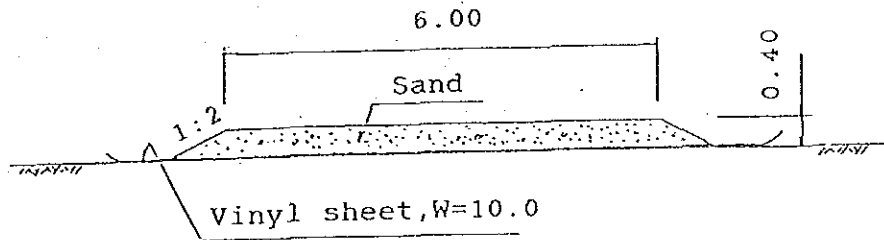


図6.3.2. (A) 仮設道路標準断面図 (タイプ1)

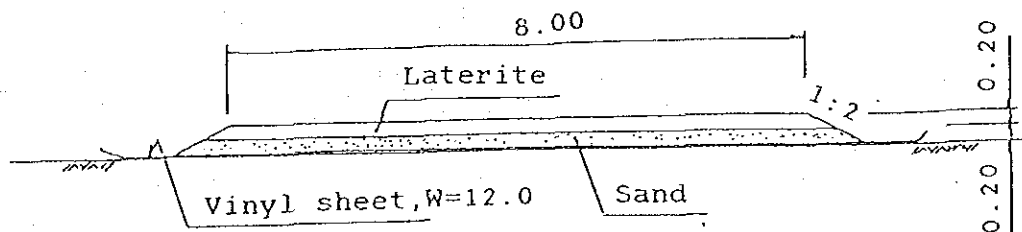


図6.3.2. (A) 仮設道路標準断面図 (タイプ2)

3) 仮設道路工事数量

i) 延長

プロジェクトサイト内:	230m
土捨場:	40m
計	270m

ii) 土工数量

ラテライト:	160m ³
サンド:	815m ³
計	975m ³

iii) 施工日数

ブルドーザー(11ton)にて敷均し転圧する。

ブルドーザーによる敷均し、転圧の能力は次式で求める。

$$Q = \frac{Q_1 \times Q_2}{Q_1 + Q_2}$$

ここに、Q :ブルドーザーによる1時間当り敷均し、転圧の作業量

Q₁ :ブルドーザーによる1時間当り敷均し作業量

$$Q_1 = 10E_1 \times (11D + 8)$$

E₁ :作業効率 (=0.65)

D :仕上り厚さ (=0.20m)

$$\therefore Q_1 = 10 \times 0.65 \times (11 \times 0.2 + 8) = 66.3 \text{ m}^3 / \text{hr}$$

Q₂ :ブルドーザーによる1時間当り転圧作業量

$$Q_2 = \frac{V \times W \times D \times E_2}{N}$$

V :締固め速度 (=3,500m/hr)

W :1回の有効締固め巾 (=0.7m)

D :仕上り厚さ (=0.20m)

E₂ :作業効率 (=0.75)

N :締固め回数 (=4)

$$\therefore Q_2 = 3,500 \times 0.7 \times 0.2 \times 0.75 / 4 = 91.9 \text{ m}^3 / \text{hr}$$

$$\text{従って、} Q = \frac{66.3 \times 91.9}{66.3 + 91.9} = 38.5 \text{ m}^3 / \text{hr}$$

1日当り作業量は

$$\Sigma Q = 38.5 \times 8 = 308.0 \text{ m}^3 / \text{日}$$

従って、施工日数は

$$N = 975 \text{ m}^3 \div 308.0 \text{ m}^3 / \text{日} = 3.1 \text{ 日}$$

従って、3日とする。

4) 地盤改良工仮設工事

地盤改良工事の為のベースマシーンを水平に保つ為、図6.3.3.に示す如く、サンドマットを適宜施すものとし、さらにベースマシーンの接地圧を減じ、安定性を確保する様、鉄板敷を行うこととする。

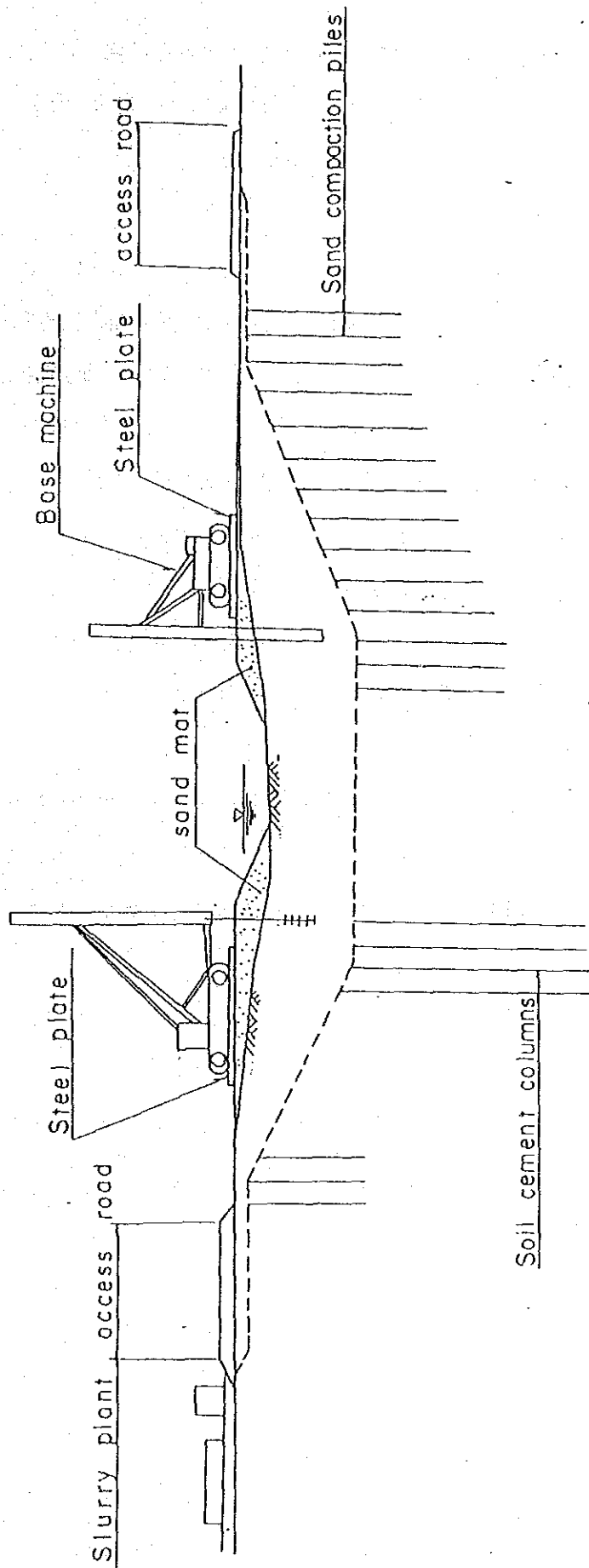


Fig. 6.3.3 Temporary Work for Foundation Improvement Work

圖 6.3.3 地盤改良工仮設工事

6-4 地盤改良工試験工事

試験水路内斜面に施工する地盤改良工事に先立ち、次の地盤改良工の試験工事を行う。

- ① サンドコンパクションパイル
- ② グラベルコンパクションパイル
- ③ ソイルセメントコラム

サンドコンパクションパイルとグラベルコンパクションパイルは同じ施工機械を用いて行うもので、本工事の施工に当って、どちらの材料を用いるのが安定性と経済性にすぐれているか検討する資料にするものである。

本試験工事の主目的としては、次の様なことが掲げられる。

- ① 完成したサンドコンパクションパイルとグラベルコンパクションパイルの内
部摩擦角を標準貫入試験にて推定する。
- ② 完成したソイルセメントコラムのせん断強度を確認する。
- ③ サンドコンパクションパイルとグラベルコンパクションパイルの仕上り径を
確認する。
- ④ サンドコンパクションパイルとグラベルコンパクションパイルによる周辺地
盤の強度への影響をチェックする。
- ⑤ 地盤改良工による周辺地盤への影響（側方流動，盛り上がり）に対してチェ
ックする。

試験工事では次の作業を行う。

- ① ソイルセメントコラム室内配合試験
- ② サンドコンパクションパイル及びグラベルコンパクションパイル材料物理試
験
- ③ 試験工事実施
- ④ 効果確認試験（土質調査，試験による）
- ⑤ 試験結果取まとめ

1) ソイルセメントコラム室内配合試験

6-5章, 2), vii) 参照

2) サンドコンパクションパイル及びグラベルコンパクションパイル材料の物理試験

本工事に用いるサンドとグラベル材料について、次の各試験を行う。

試料：各採取場

サンド及びグラベル材をそれぞれ最低1試料

試験項目：・粒度分析

・単位体積重量

・含水比

3) 試験工事の実施

i) 試験工事の位置と数量

試験工事の位置は図6.4.1に示す通りである。

試験工事数量は、それぞれの改良工法について、表6.4.1に示す通りとする。又、パイル配置は図6.4.2に示す通りである。

表6.4.1 試験工事数量

工 法	本 数	杭 長	杭 総 延 長	備 考
サンドコンパクションパイル	3	5.00 m	15.00 m	
グラベルコンパクションパイル	3	5.00	15.00	
ソイルメントコラム	2	6.00	12.00	本工事に含む

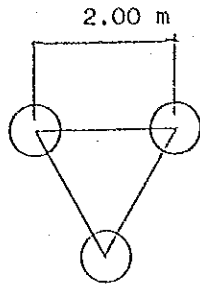


図6.4.2 (a)
サンドコンパクションパイル

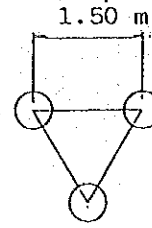


図6.4.2 (b)
グラベルコンパクションパイル

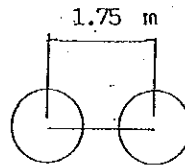


図6.4.2 (c)
ソイルセメントコラム

図6.4.2 試験工事パイル配置図

ii) 土質調査, 試験

試験工事終了後、次の土質調査, 試験を行う。

a) 現位置試験

現位置試験の項目は次の通りである。

表6. 4. 2 試験工事現位置験項目及び数量

試験項目	砂コンパクションパイル	グラベルコンパクションパイル	ソイルメントコラム
標準貫入試験 (パイル内)	<ul style="list-style-type: none"> 位置：パイル中央1孔 ボーリング深度：7m 試験回数：7回 (深度1.0m毎) 	同 左	—
コアボーリング (パイル内)	—	—	<ul style="list-style-type: none"> 位置：パイル中央1孔 ボーリング深度：6m コア採取：6ヶ所 (深度1m毎)
シンウォール サンプリング (原地盤粘土)	<ul style="list-style-type: none"> 位置：パイル中央1孔 ボーリング深度：7m コア採取：4ヶ所 採取深度：-1.0, -3.0, -5.0 & -7.0 	同 左	—
現場密度試験	<ul style="list-style-type: none"> 位置：パイル中央2孔 試験数：2回 	同 左	—

b) 室内試験

室内試験項目と数量は表6. 4. 3に示す。

表6. 4. 3 試験工事室内試験項目及び数量

試験項目	砂コンパクションパイル	グラベルコンパクションパイル	ソイルメントコラム
1. 物理試験 <ul style="list-style-type: none"> 自然含水比 湿潤密度 	<ul style="list-style-type: none"> パイル材：2試料 粘土：7試料 粘土：4試料 	<ul style="list-style-type: none"> パイル材：2試料 粘土：7試料 粘土：4試料 	
2. 力学試験 <ul style="list-style-type: none"> 一軸圧縮試験 	<ul style="list-style-type: none"> 粘土：4ヶ所 	<ul style="list-style-type: none"> 粘土：4ヶ所 	<ul style="list-style-type: none"> パイル：6ヶ所

6-5 地盤改良工事

1) サンドコンパクションパイル及びグラベルコンパクションパイル

i) 工事位置

工事位置は図6.5.1に示す通り、国道と反対側、海側の試験斜面とする。

ii) 工事数量

表6.5.1 (a) 工事数量 (サンドコンパクションパイルの場合)

貫入長	改良長	改良径	本数	改良総延長
7.88 m	5.0 m	0.70 m	217 本	1,085 m

表6.5.1 (b) 工事数量 (グラベルコンパクションパイルの場合)

貫入長	改良長	改良径	本数	改良総延長
7.88 m	5.0 m	0.50 m	385 本	1,921 m

注) 改良径は試験工事により確認される。

iii) 工事仕様

a) 改良径

改良径の目標値はサンドコンパクションパイルで70cm ($A=0.385\text{m}^2$)、グラベルコンパクションパイルで50cm ($A=0.196\text{m}^2$)とする。

b) 改良材

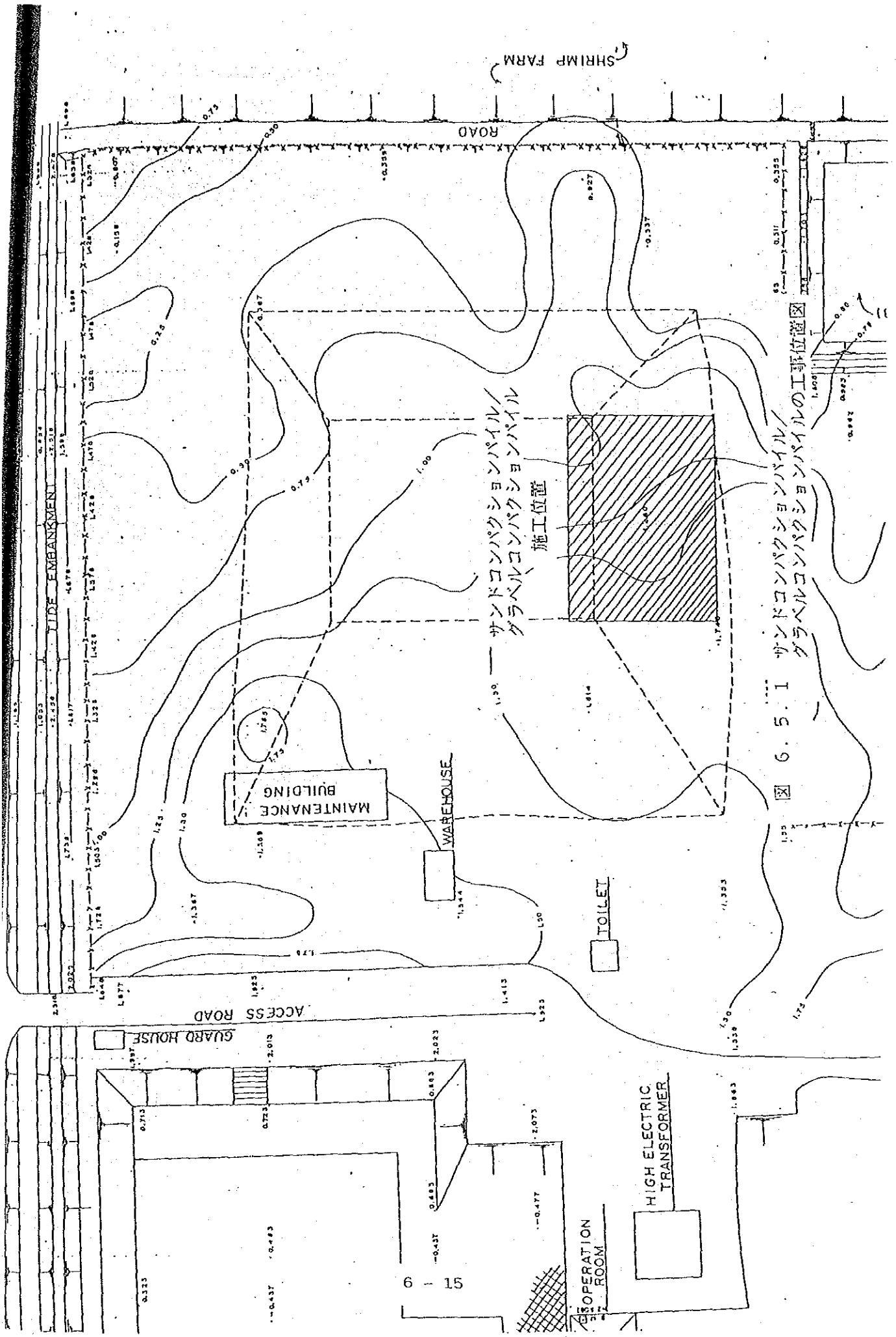
改良材として日本での実績の粒度範囲は図6.5.2に示す通りであり、日本道路公団では、サンドコンパクションパイルに用いる砂は、

有効径 $D_{10} > 0.1\text{mm}$

均等係数 $D_{60}/D_{10} = U > 5$

が望ましいとされている。

本工事の砂の入手先の候補地として Mae Klong川と Chao Phya川で採取



SHRIMP FARM

ROAD

TIDE EMBANKMENT

MAINTENANCE BUILDING

WAREHOUSE

TOILET

OPERATION ROOM

HIGH ELECTRIC TRANSFORMER

サンドコンパクションパイル
グラベルコンパクションパイル

施工位置

図 6.5.1 サンドコンパクションパイル
グラベルコンパクションパイルの工事位置図

6 - 15

した砂の粒度分布を図6. 5. 2に示す。この粒度分布によると、

$$D_{10} = 0.2 \sim 0.3 \text{mm}$$

$$U = 3$$

であり、粒度分布がやや悪いと言えるが、適用に当っては問題はないと考えられる。

iv) 施工機械

標準的な施工機械の仕様を示せば、表6. 5. 2に示す通りである。

表6. 5. 2 施工機械一覧

名 称	標準仕様, 規格
打設機	クローラクレーン25t~27t
ガイドリーダー	L=15m
門けんハンマー	3tクラス
緩衝器	
ホッパー	
バケット	0.3m ³ クラス
ケーシング	φ40cm, L=12m 鋼製
コンプレッサー	75HP
レシーバータンク	3m ³ , 7KVA
発電機	75KVA

上記施工機械の配置図を図6. 5. 3に示す。

また、図6. 5. 4にケーシングの構造詳細を示す。

図 6. 5. 2 コンパクションパイルの日本での実績粒度範囲
 Mae Klong 川とChao phya 川の砂の粒度分布

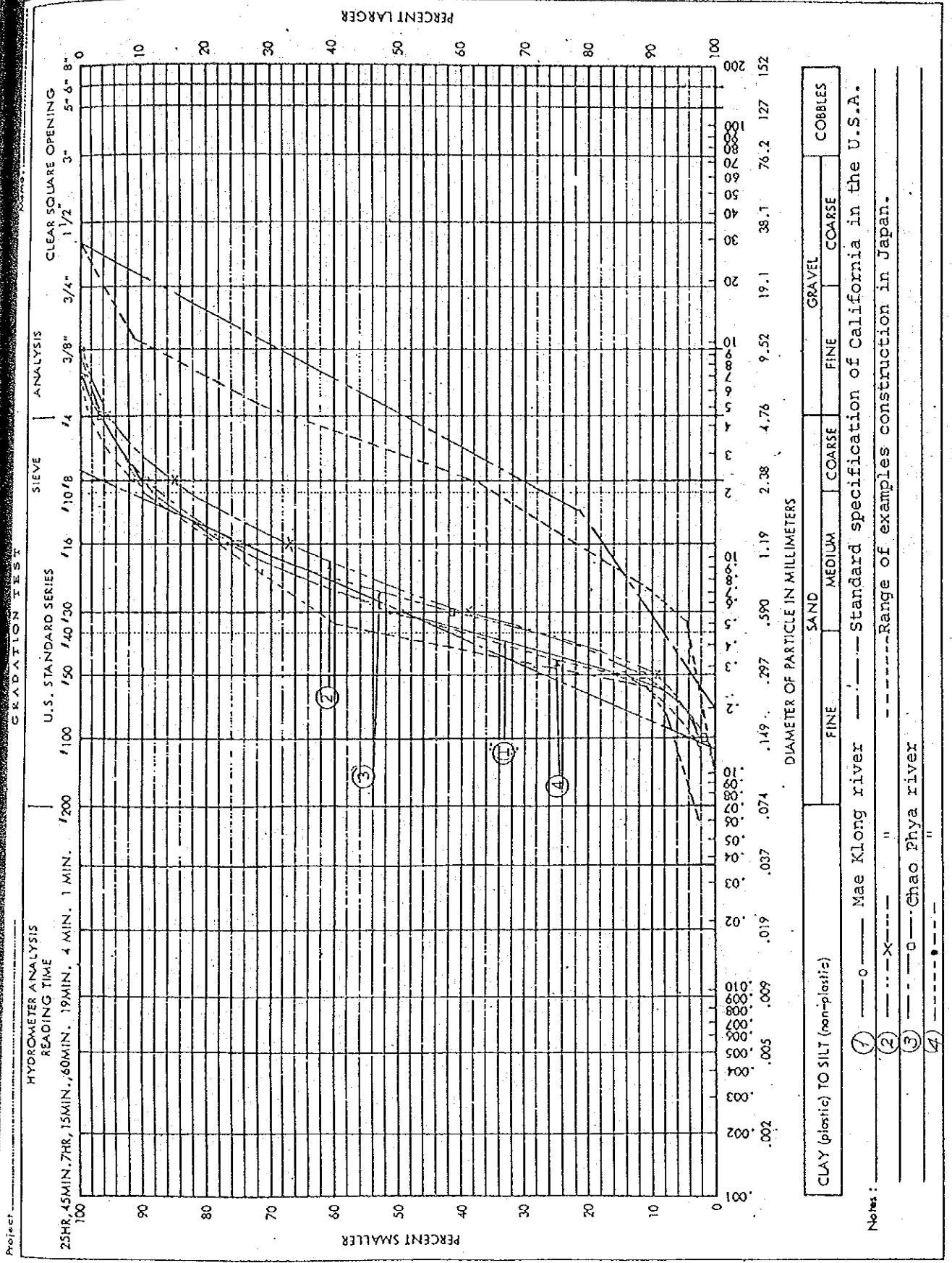
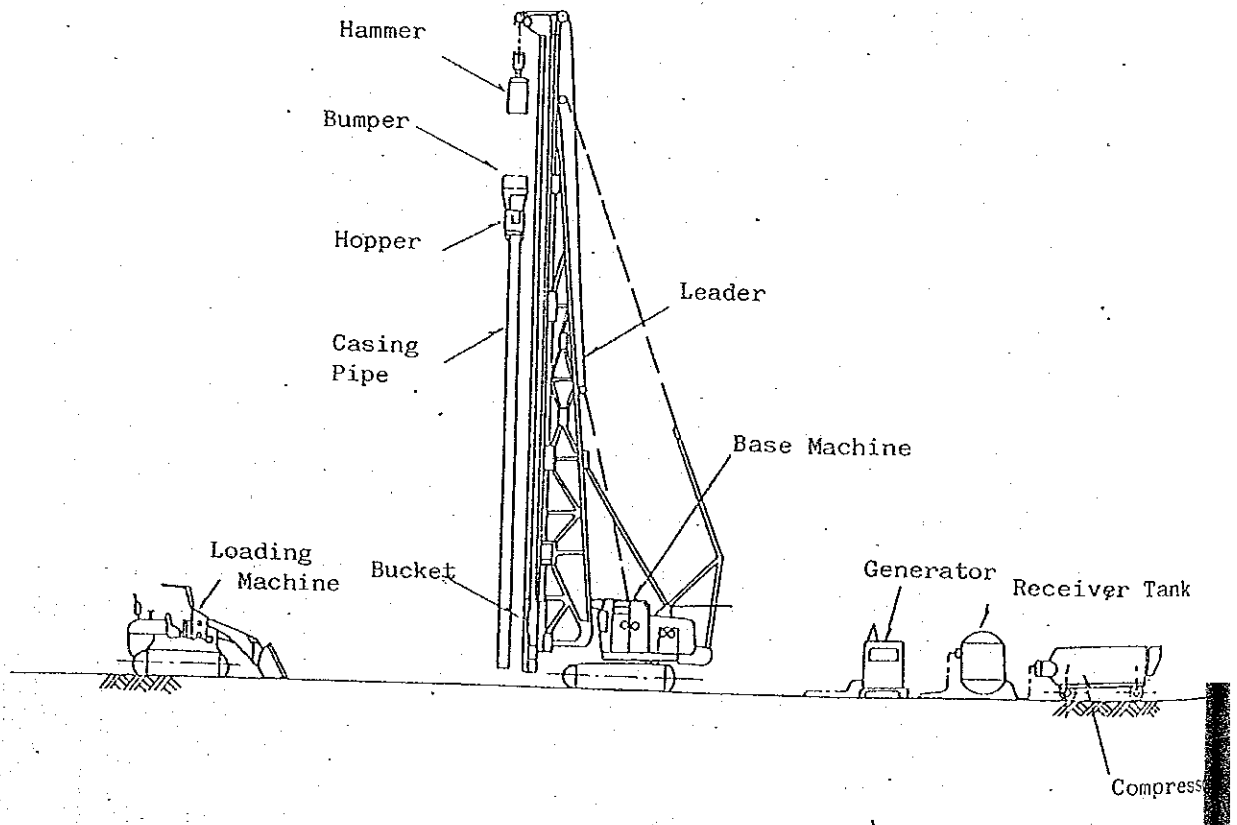


図 6.5.3 コンパクションパイル施工機械の配置図



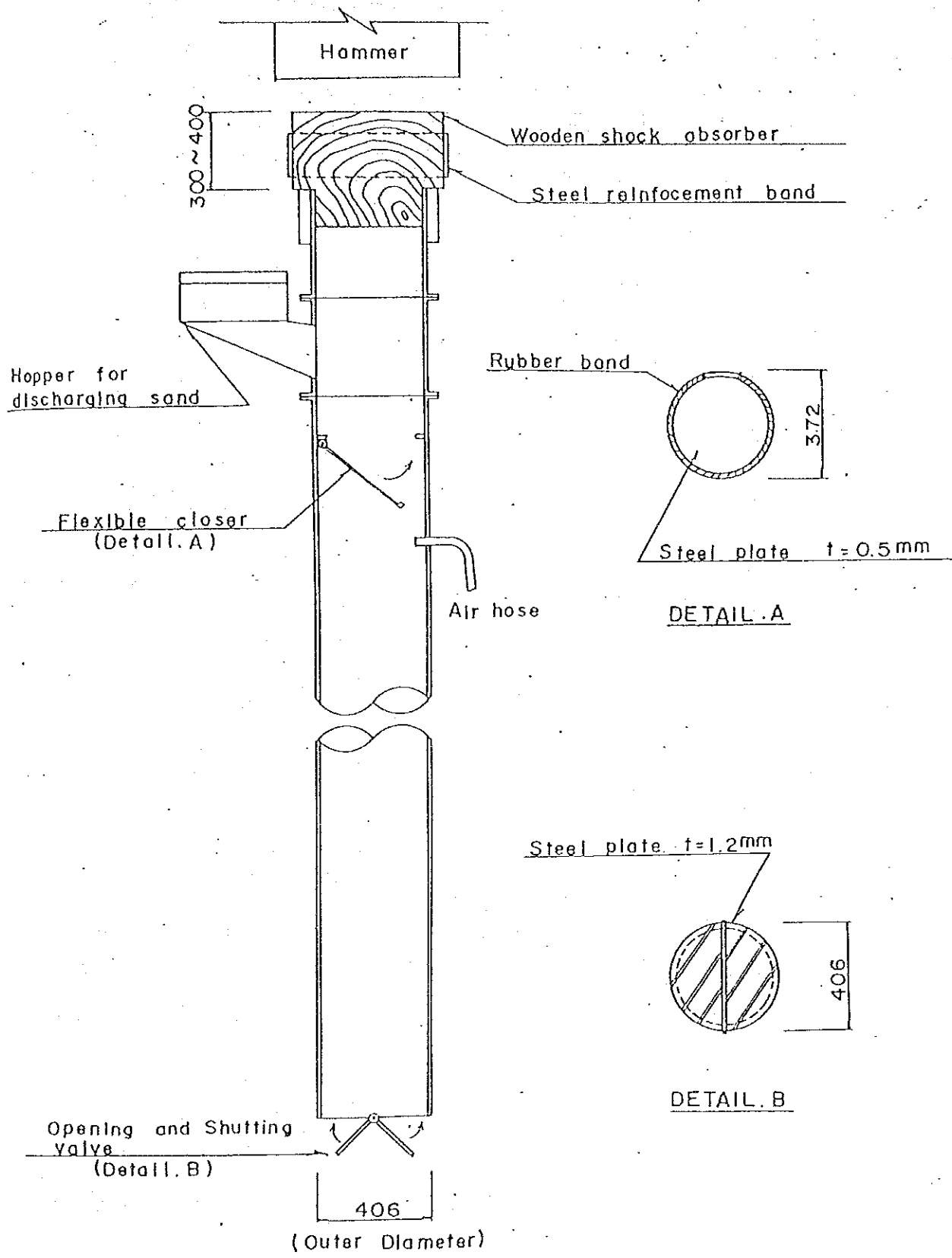
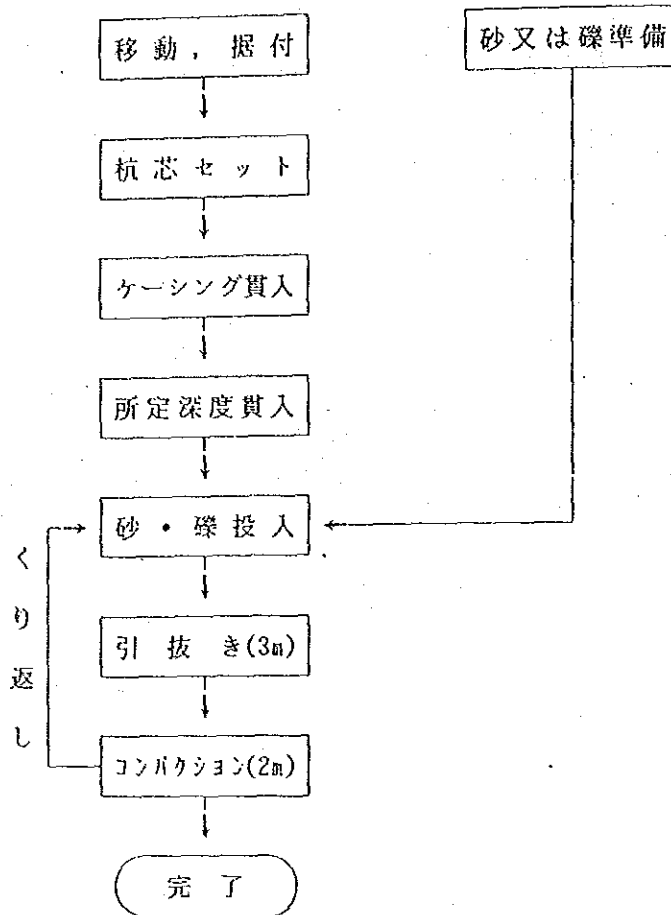


図 6.5.4 コンパクションパイルのケーシングの詳細

v) 施工手順

施工のフローチャートを示せば下図の通りである。



施工手順の概要を示せば、図6. 5. 5の通りである。

また、本工法により地盤改良効果をも高める為、原地盤粘土に対する拘束圧を増加させ、せん断強度大きくする様による事が望ましい。従って、パイルの打設は図6. 5. 6に示す通り、外周より開始し、順次内側へ移動することとする。

vi) 施工管理

施工管理に必要な品質管理と概略の管理頻度は表6. 5. 3に示す通りである。

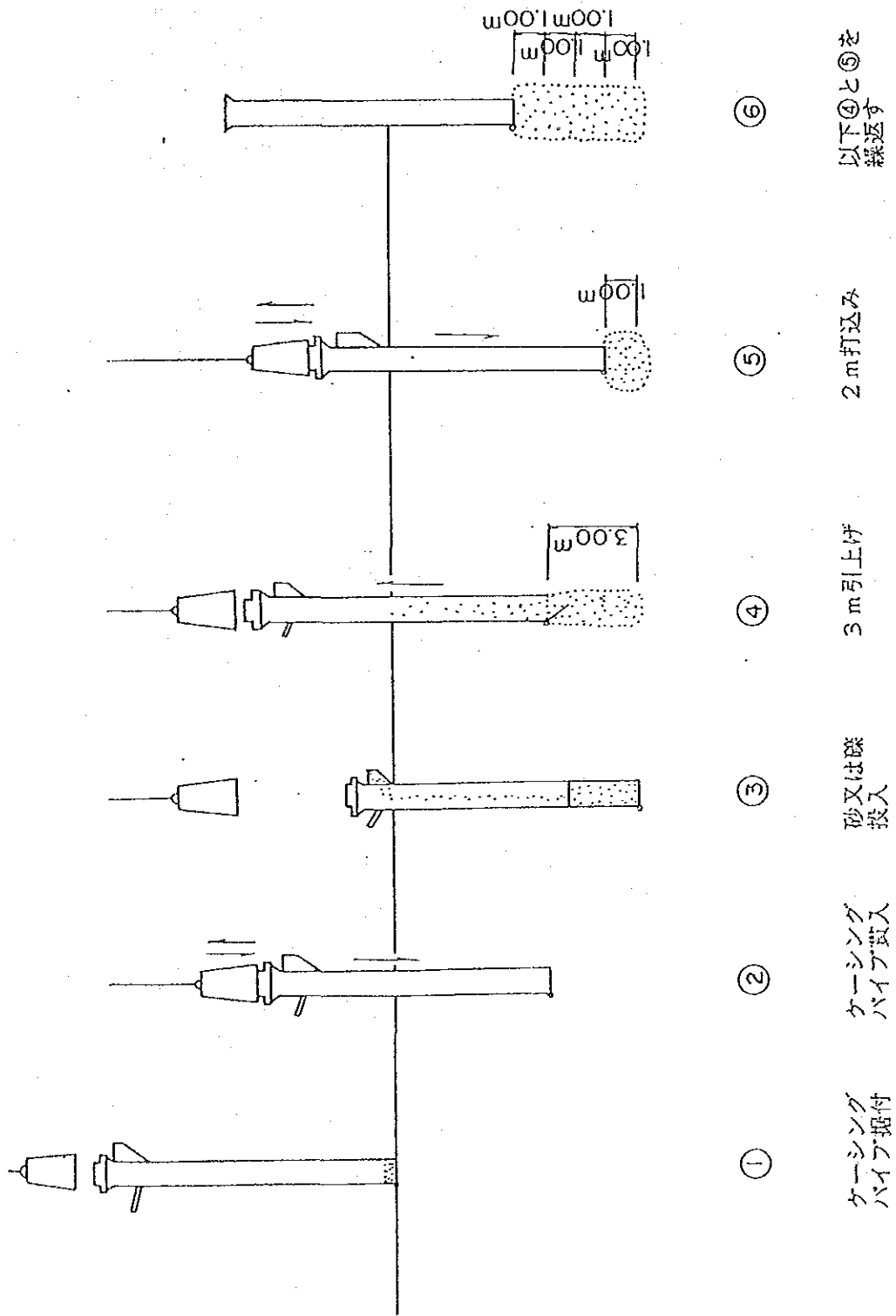


図 6. 5. 5 コンパクションパイルの施工手順

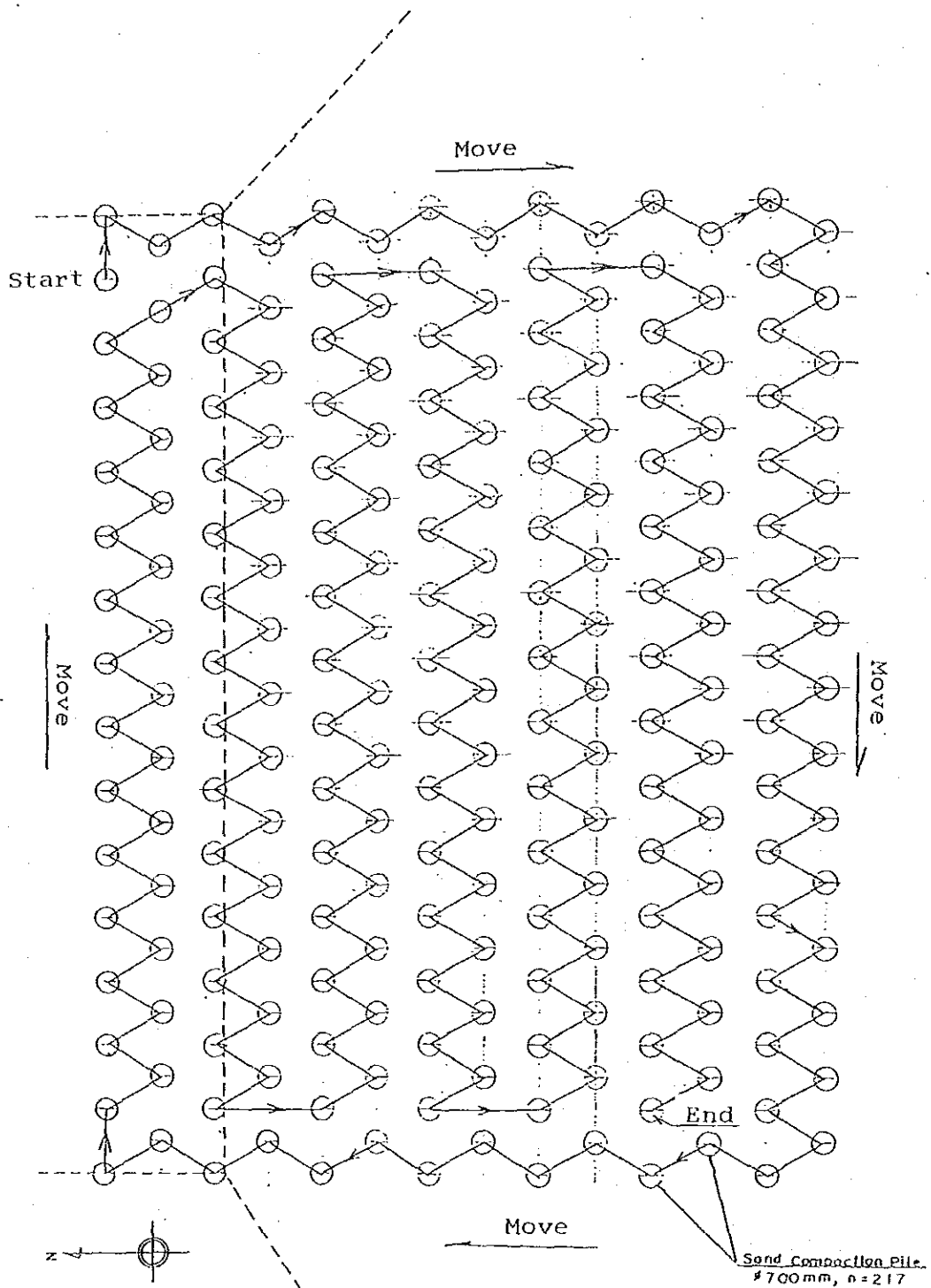


図 6. 5. 6 コンパクションパイルの打設順序

表6.5.3 サンドコンパクションパイル及び
グラベルコンパクションパイルの施工管理

管理項目	管理方法	管理頻度
パイル材料	粒度試験	1回/50 m ³
打設位置	測量(杭の設置)	パイル毎
打設深さ	ケーシングに付した印	パイル毎
投入材料量	バケット	コンパクション毎
パイル強度	標準貫入試験	1回/30本, 1m深度毎
原地盤強度	一軸圧縮試験	1回/30本, シンウォールサンプリング

vii) 施工能力

施工能力算定に用いるサンドコンパクション及びグラベルコンパクション
パイルの施工機械の作業工程所要時間を次の様に想定する。

ケーシング径：40cm

パイル空打ち：0.47min/m

パイル締固め：2.90min/回

材料投入：1.20min/回

移動・据付：12min/回

作業時間：8hr/day

viii) 施工日数

$$1 \text{ 本当りの施工時間} : C_m = 12.0 + 0.47 \times 7.88 + 2.9 \times 5.0 + 1.2 \\ \times 5.0$$

$$\text{総施工時間} : 36.2 \text{ 分/本} \times 217 \text{ 本} = 7,855.4 \text{ 分}$$

$$\text{施工日数} : 7,855.4 \text{ 分} \div 60 \text{ 分} \times 8 \text{ 時間} = 16.4 \text{ 日}$$

従って、施工日数を17日とする。

2) ソイルセメントコラム

i) 工事位置

工事位置は図6.5.7に示す通り、国道側斜面とする。

ii) 工事数量

表6.5.4 ソイルセメントコラムの工事数量

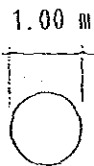
位置	掘削長	杭長	本数	総掘削長	総杭延長
上部	6.89 ^m	5.50 ^m	53 ^本	365.17 ^m	291.50 ^m
下部	17.92	13.79	70	1,254.40	965.30
計	(13.16) ^m	(10.22) ^m	123 ^本	1,619.57 ^m	1,256.80 ^m

() は平均長を示す。

iii) 工事仕様

a) 攪拌仕様

攪拌径は下図の如くφ1,000^mとする。



b) 改良材仕様

改良材は普通ポルトランドセメント（比重3.15）を用いたセメントスラリーとする。

水セメント比は重量比で 100%とする。

SHRIMP FARM

ROAD

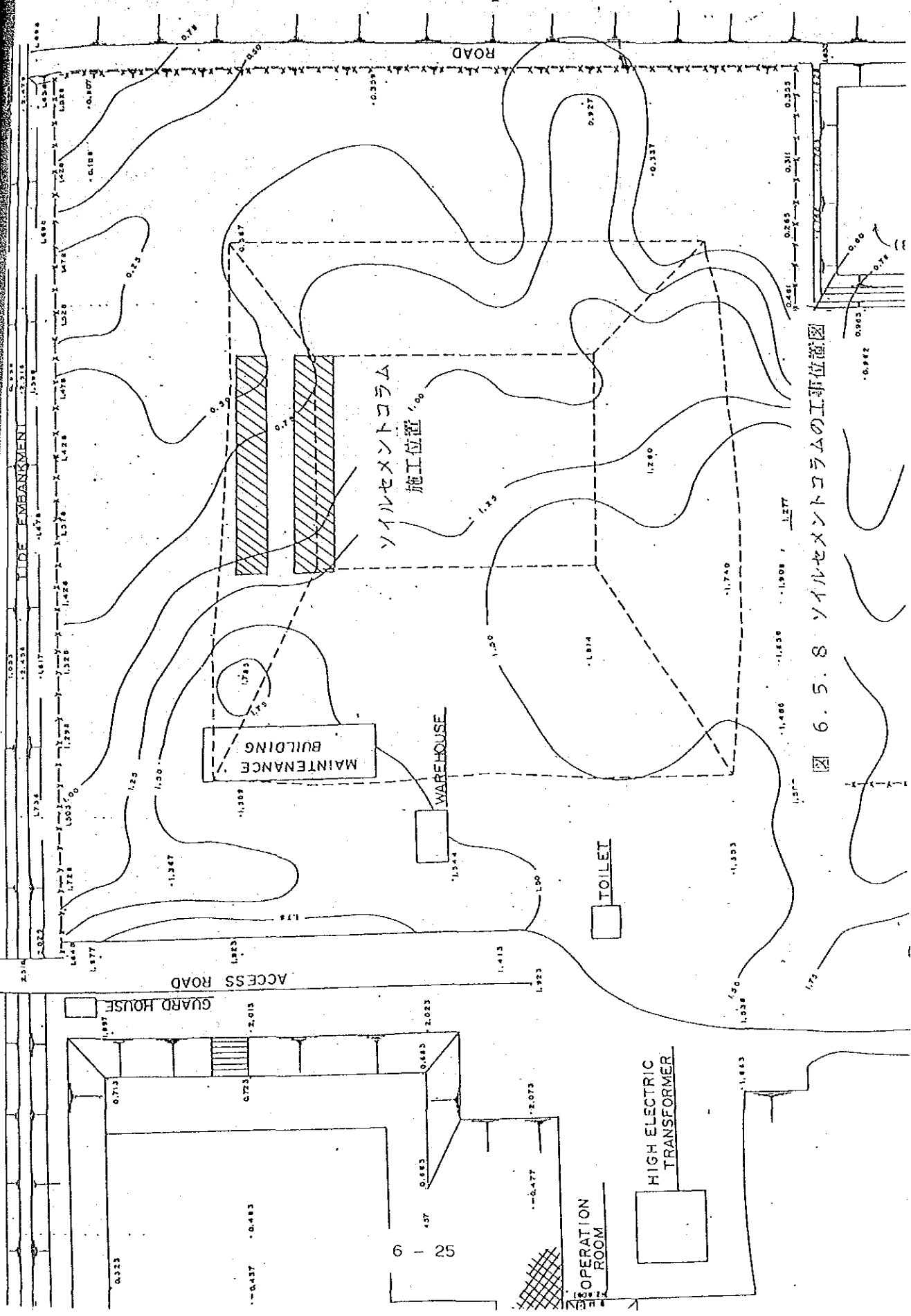


図 6.5.8 ソイルセメントコラムの工事位置図

0 25

c) 改良材添加量

原地盤粘土1.00 m³ 当り改良材 198ℓ (セメント量で 150kg) の添加量とするが、施工前に行う室内配合試験に基づき決定する。

iv) 施工機械

標準的な施工機械の仕様を示せば、表6.5.5に示す通りである。

表6.5.5 施工機械一覧

名 称	標準仕様, 規格	単 位	台 数	備 考
打設機	クローラークレーン 35t クラス	台	1	
リーダー		組	1	攪拌機ガイド
アースオーガー	D-60K クラス	台	1	
アタッチメント		式	1	アースオーガー
攪拌ロッド	φ200m/m	式	1	L _{max} = 25m
攪拌翼	φ1,000m/m, 2段	セット	1	
オーガーヘッド	φ600m/m	式	1	
発電機	125KVA クラス	台	1	アースオーガー用
ミキサー	750 ℓ×2 クラス	台	1	
グラウトポンプ	150 ℓ/min	台	1	
水 槽	2m ³	台	1	
水中ポンプ	2インチ	台	1	

施工機械の標準的な配置図を示せば、図6.5.8の通りである。

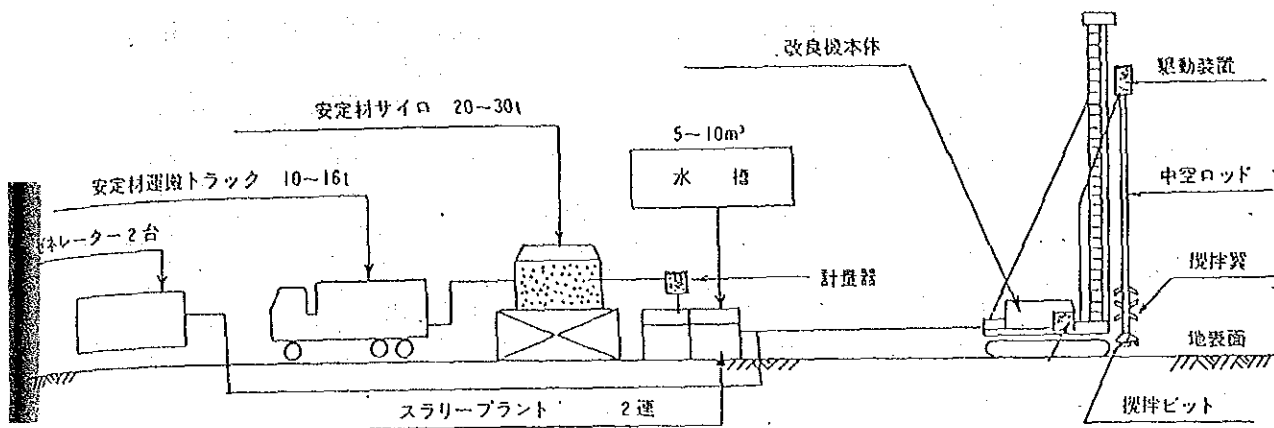


図 6.5.8 ソイルセメントコラム施工機械の標準配置図

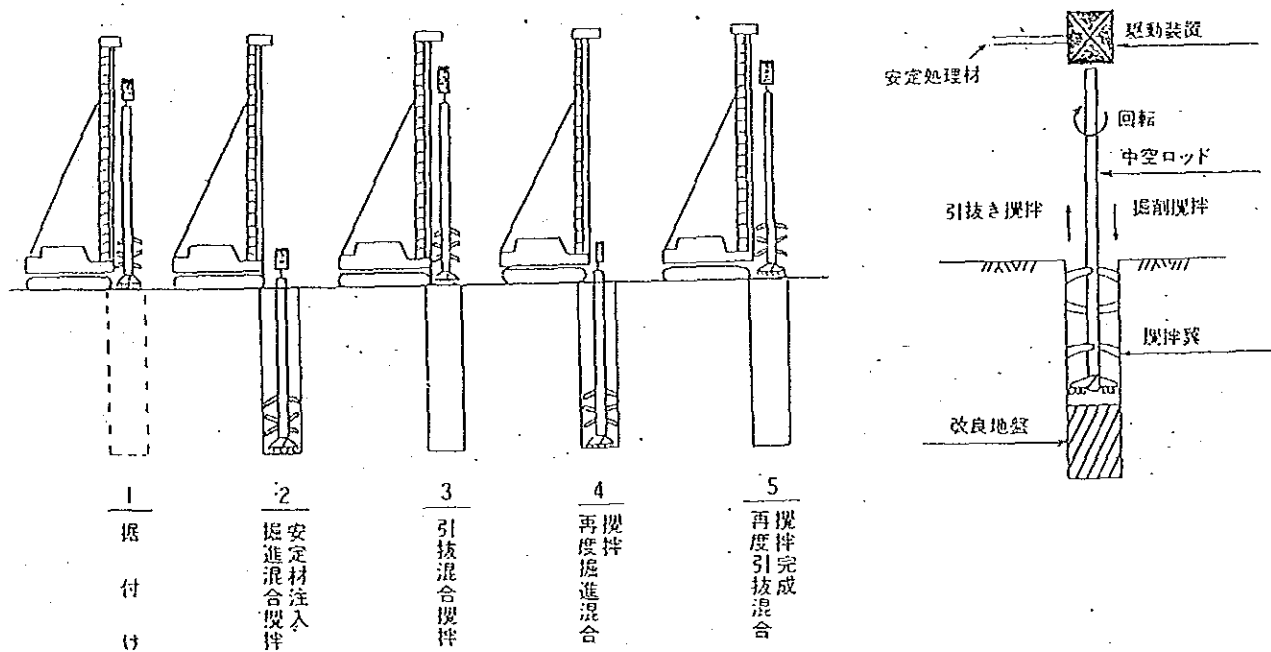
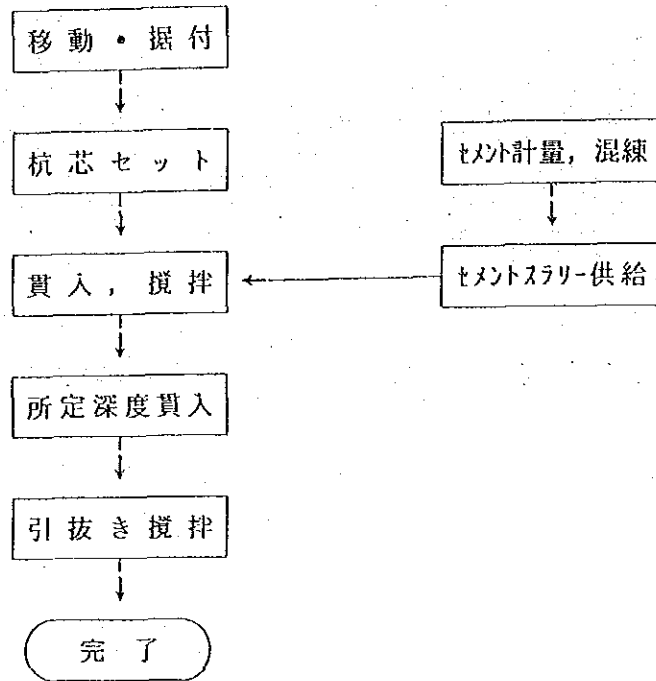


図 6.5.9 ソイルセメントコラムの施工手順

v) 施工手順

ソイルセメントコラム施工のフローチャートを示せば、下図の通りである。



施工手順の概要を示せば、図6. 5. 9の通りである。

又、セメントスラリー供給のフローチャートは図6. 5. 10に示す。

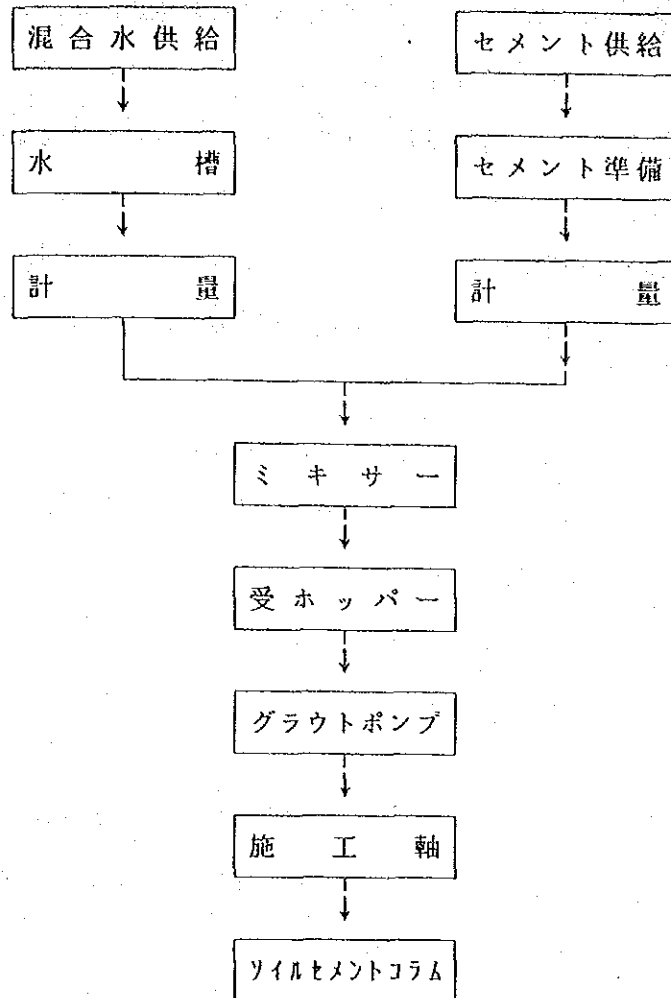


図6. 5. 10 セメントスラリー供給フローチャート

vi) 施工管理

ソイルセメントコラムの施工に当って特に留意しなければならない点は次の通りである。

- ① 深度毎にスラリーを正確に供給する為に、スラリーの供給量，施工装置の貫入，引抜き速度を厳密に管理する。
- ② 施工装置の鉛直性を正確に保つ。
- ③ 攪拌混合機の性能を把握し、回転数，攪拌トルク，攪拌昇降速度等の管理基準を設定する。
- ④ 軟弱地盤上で施工する為、ベースマシンの安全性を充分に考慮し、施工能率が低下しない様にしなければならない。

施工時の管理項目として次の項目が考えられる。

a) セメントスラリーの濃度と注入量

スラリーが計画通り製造されているか、スラリーの比重を測定することによって確認する。

○ スラリー配合計画

ミキサーの1バッチ当りの適正練上り量はミキサー容量が750ℓ/槽とすれば500~600ℓ程度である。

従って、水セメント比は100%であるので、セメントと水の投入量を各々400kgにすると、1バッチの練上り量(V)は次式で計算できる。

$$V = \frac{\text{セメント投入量}}{\text{セメント比重}} + \text{水}$$
$$= \frac{400}{3.15} + 400 = 527 \text{ ℓ}$$

従って、1バッチ当りの練上り量を以下の様に定める。

セメント投入量：400kg (10袋×40kg)

水投入量：400kg

練上り量：527ℓ

従って、スラリー1m³当りのセメントは、

$$\frac{400\text{kg}}{0.527\text{m}^3} = 759 \text{ kg/m}^3$$

配合されていることになる。

○ 比重管理

スラリーの配合計画より、比重は次の様に計算できる。

$$\text{スラリーの比重} = \frac{400 + 400}{400/3.15 + 400} = 1.518$$

比重管理は、管理図を作成し行うもので、測定頻度は午前と午後に各1回行うものとする。

○ スラリー注入量

深度1m当りの改良土量は0.785m³である。

ソイルセメントコラム1m³当りのセメント注入量を150kg/m³とする

と、セメントスラリーの注入量（Q）は次式で求まる。

$$Q = \frac{150}{3.15} + 150 = 198 \text{ } \ell / \text{m}^3$$

又、深度1m当りの改良速度を $V = 1.5 \text{ min/m}$ とすると、ポンプで送る注入量は

$$198 \text{ } \ell / \text{m}^3 \times 0.785 \text{ m}^3 / \text{m} \div 1.5 \text{ min/m} = 104 \text{ } \ell / \text{min}$$

従って、ポンプで送る注入量は 105～115 ℓ / min で管理する必要がある。

スラリーのトータル注入量は、例として以下の様に計算出来る。

改良長	計 算	トータル注入量（ ℓ ）
11.5m	$11.5 \times 0.785 \times 198$	1,787
5.5m	$5.5 \times 0.785 \times 198$	858

b) 施工速度

ソイルセメントコラムの鉛直施工速度は貫入時、引抜時共 1.5 min/m と設定する。この為、ロッドの降下、上昇速度を 1.5 min/m とに設定すると同時に、ロッドに付した印と標尺により施工速度の管理を行う。

c) 回転数の管理

攪拌翼の回転数は、目視により計測する。

d) 鉛直性の管理

トランミットにより縦及び横方向からリーダーの傾斜を測定する。

e) 品質管理

造成したソイルセメントコラムの強度チェックの為、30本に1本の割合でコアボーリングを行い、一軸圧縮試験及び単位体積重量を測定する。

コア採取は1m深度について行う。

vii) 室内配合試験

ソイルセメントコラムの設計強度を確保できるセメント注入量を決定する為、室内配合試験を実施する。

a) 試験フローチャート

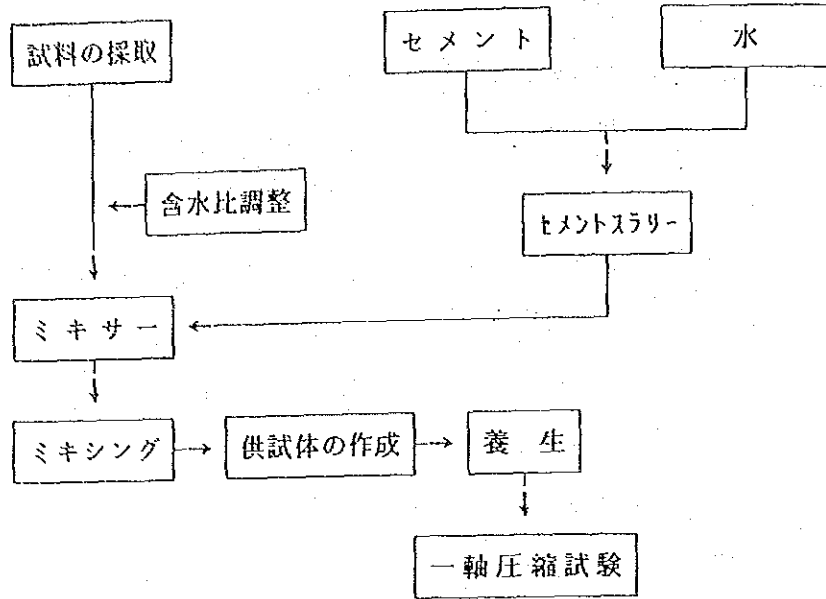


図6. 5. 11 試験フローチャート

b) 試験仕様

室内配合試験の標準仕様は、表6. 5. 6に示す通りである。

表6. 5. 6 室内配合試験標準仕様

項 目	標 準 仕 様
改良材の種類	普通ポルトランドセメント
水セメント比 (%)	100
セメント配合量 (kg/m ³)	100, 150及び200
ミキシング時間 (分)	10
材 令 (日)	7, 14 及び28
モールド寸法	φ5cm 高さ10cm
1試験のモールド数 (ヶ)	2

水セメント比は 100%であるので、セメント配合量による原地盤粘土1m³に投入するスラリー量は、以下の通りである。

表6. 5. 7 スラリー投入量

セメント配合量	スラリー投入量
100 kg/m ³	132 ℓ/m ³
150	198
200	264

c) 試験項目

① 物理試験

- 単位体積重量：各配合量により3試料

② 力学試験

- 一軸圧縮試験：各モールドにより18試料

viii) 施工能力

施工能力算定に用いるソイルセメントコラム施工機械の運転仕様は、次の様に想定する。

攪拌方式：1サイクル

空掘速度：1.0min/m

貫入攪拌速度：1.5min/m

引抜き攪拌速度：1.5min/m

移動，掘付時間：12min

作業時間：8hr/day

(ix) 施工日数

- 1本当り施工時間：上部， $Cm_1 = 12 + 1.39 \times 1.0 \times 2 + 5.5$
 $\times 1.5 \times 2$

$$= 31.3 \text{分/本}$$

下部， $Cm_2 = 12 + 4.13 \times 1.0 \times 2 + 13.79$

$$\times 1.5 \times 2$$

$$= 61.6 \text{分/本}$$

- 総施工時間： $31.3 \text{分/本} \times 53 \text{本} + 61.6 \text{分/本} \times 70 \text{本}$

$$= 5,970.9 \text{分}$$

- 施工日数： $5,445.9 \div 60 \div 8 = 12.3 \text{日}$

従って、施工日数を13日とする。

x) 施工順序

ソイルセメントカラムの施工は図6.5.12に示す様に法尻より行い順次移動する。

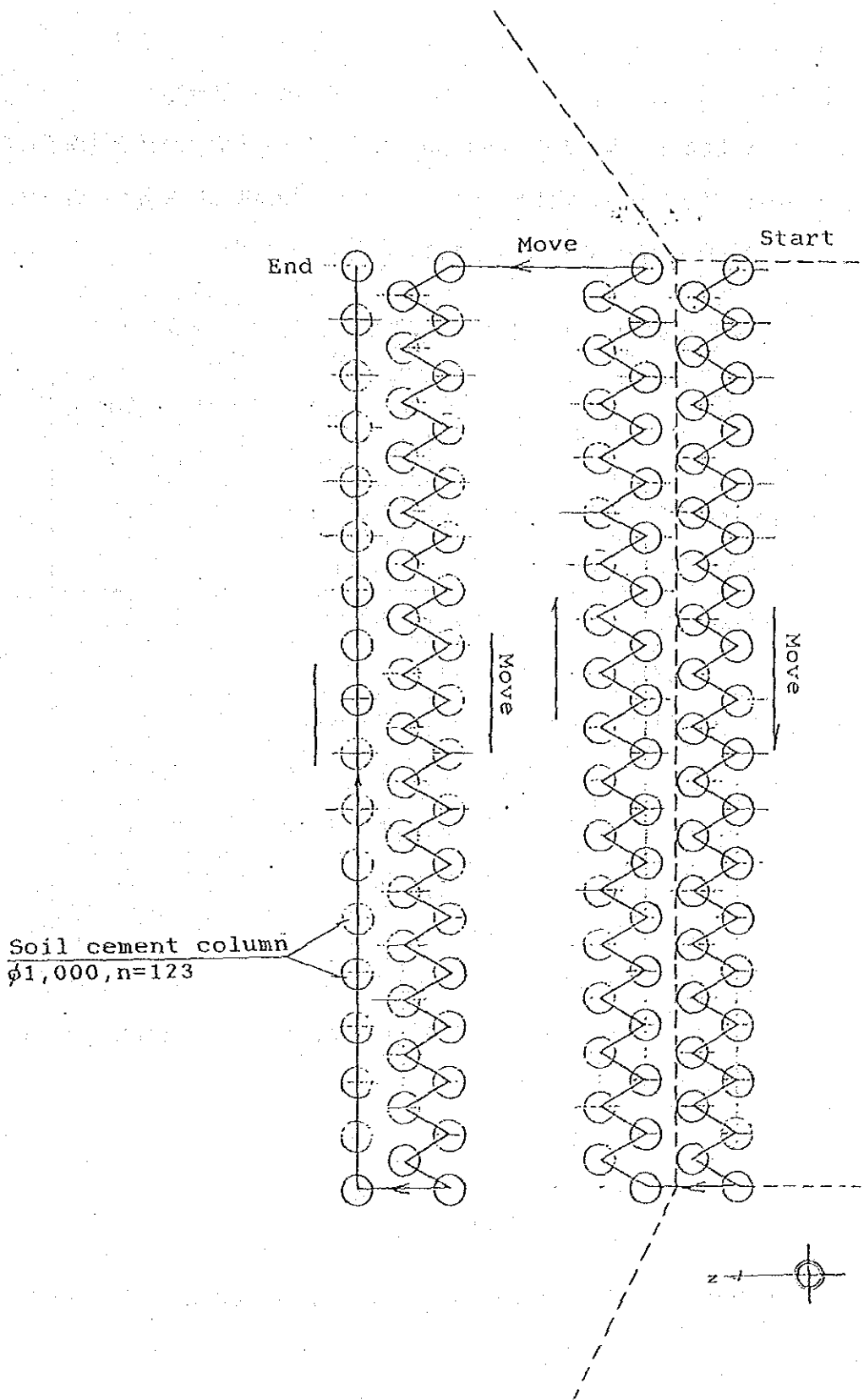


図6. 5. 12 ソイルセメントカラムの施工順序

6-6 掘削工事

1) 施工機械

軟弱地盤上を建設機械が走行する場合のトラフィカビリティを確保する為に必要な地盤のコーン支持力はそれぞれの建設機械の接地圧を考え、表-6.6.1であると云われている。

表-6.6.1 建設機械の接地圧と必要コーン支持力

建設機械	接地圧 (kgf/cm ²)	コーン支持力 (kgf/cm ²)
超湿地ブルドーザー	0.15~0.23	2 以上
湿地ブルドーザー	0.22~0.43	3 以上
ブルドーザー (11t)	0.50~0.60	5.5 以上
〃 (21t)	0.60~1.00	7 以上
バックホウ (0.8m ³)	0.46~0.52	5 以上
〃 (0.4m ³)	0.38~0.39	3.5 以上
クローラクレーン (35t)	0.51~0.68	6 以上
ダンプトラック	3.5 ~ 5.5	12 以上

プロジェクトサイトのダッチコーンテスト結果では $q_c = 0 \sim 5 \text{ kgf/cm}^2$ を示しており、サイト内の一部の高地を除いて、湿地あるいは超湿地型の建設機械以外での走行は不可能である。

また、本工事の試験工事と云う特殊製を考慮して、試験サイト内には出来るだけ荷重を加えることは避けるべきである。

従って、掘削工事では超湿地型のブルドーザー及び台船上に取付けた掘削機械を考慮し、積込み運搬には、試験サイトの地盤を乱さない方策を考える。

2) 施工方法

1) 一次掘削

一次掘削では、超湿地ブルドーザーにて EL-2.50m までドライコンディションで掘削、押土を行う。一次掘削では計画斜面の法肩より 5m までとし、

掘削勾配は無処理斜面側で1:7, 処理斜面側で1:5とする。(図 6.6.1)

一次掘削の掘削, 押土, 集積には2台の超湿地ブルドーザーを配置する。

掘削, 押土された粘土は、無処理断面1:6とソイルセメント処理断面の間のコーナーに集積し、クラムシェル及びクローラーショベルにて8tダンプトラックに積込み、土捨場まで運搬することとする。

a) 工事数量

掘削土量: 8,690m³

b) 機械の作業能力

① 超湿地ブルドーザーによる掘削・押土

ブルドーザーの運転1時間当りの作業量は次式により求める。

$$Q = \frac{60 \times q \times f \times E}{C_m} \quad (6.8)$$

ここに、Q : 運転時間当り作業量 (m³ /hr)

q : 1サイクル当り掘削, 押土量 (m³) で、超湿地ブルの場合、10t クラス、q=0.679(m³)

f : 土量換算係数 (=1.0)

E : 作業効率 (=0.45)

C_m : 1サイクル当りの所要時間 (分)

$$C_m = 0.034L + 0.25$$

L : 運土距離

$$L = 30\text{m より}$$

$$C_m = 0.034 \times 30 + 0.25 = 1.27 \text{ (分)}$$

$$Q = \frac{60 \times 0.679 \times 1.0 \times 0.45}{1.27} = 14.4\text{m}^3/\text{hr}$$

$$\text{1日当り作業量: } Q_d = 14.4 \times 8 = 115.2\text{m}^3/\text{day}$$

② クラムシェル (0.8m³) による積込能力

クラムシェルの運転1時間当り作業量は次式により求める。

$$Q = \frac{3,600 \times q \times f \times E}{C_m} \quad (6.9)$$

ここに、Q : 運転1時間当り作業量 (m³ /hr)

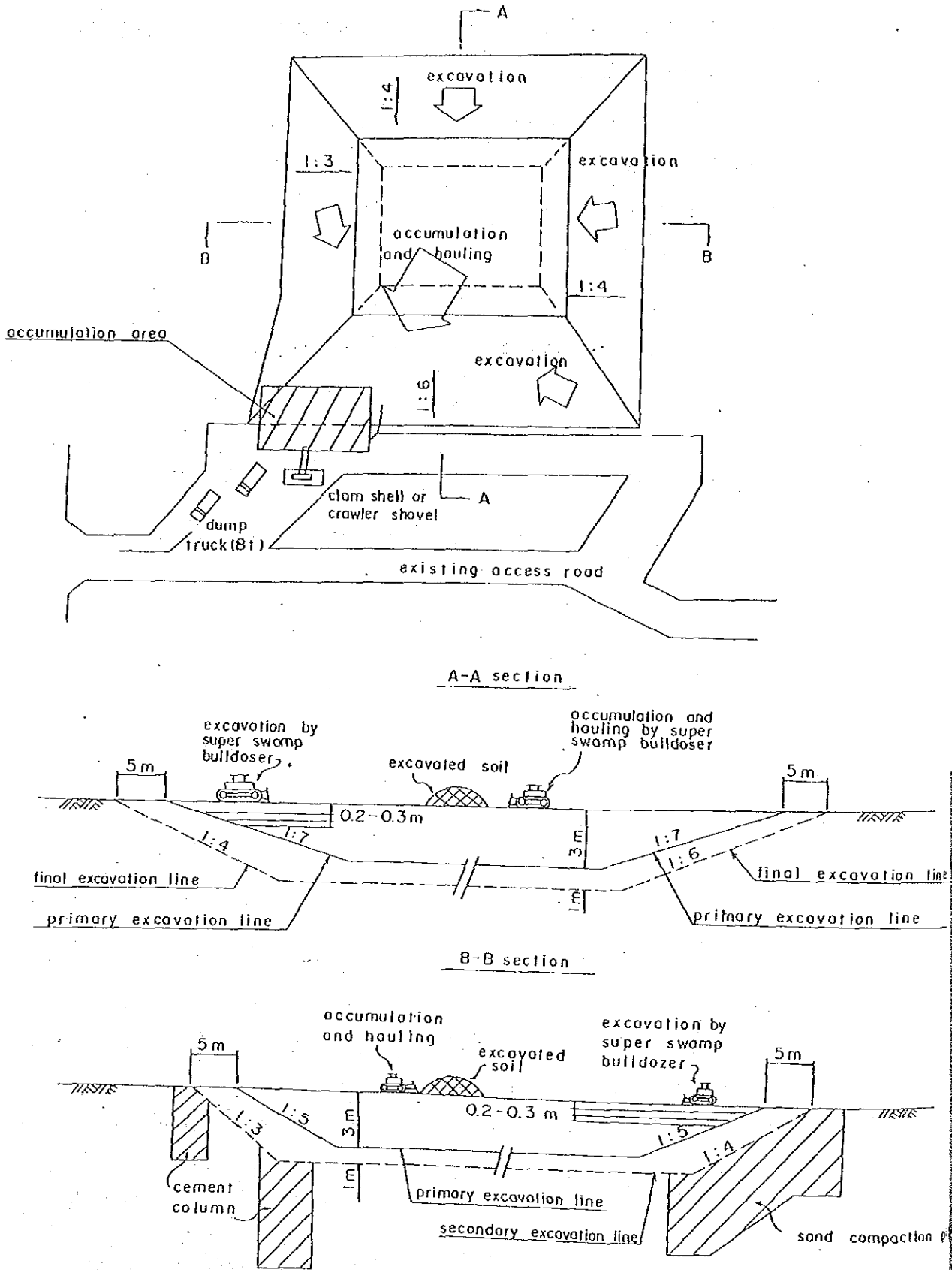


図6.6.1 第一次掘削の施工方法

q : 1サイクル当り掘削量 (m³) で次式による。

$$q = q_0 \times K \text{ ----- (6.10)}$$

q₀ : 標準バケット平積容量 (m³)

K : 積載係数 0.73

f : 土量換算係数で、表-6.6.2による。

表-6.6.2 土量換算係数

土質	ほぐした土量	締固めた土量
	地山土量	地山土量
粘土	1.20~1.45	0.85~0.95

E : 作業効率 0.45

C_m : 1サイクルの所要時間 (秒)

旋回角度 180° とし C_m = 42秒

従って、

$$Q = \frac{3,600 \times (0.8 \times 0.73) \times 1/1.20 \times 0.45}{42} = 18.8 \text{ m}^3 / \text{hr}$$

1日当り作業量 : Q_d = 18.8 × 8 = 150.4 m³ / day

③ クローラーショベル (0.8 m³) による積込能力

クローラーショベルによる運転1時間当りの作業量は、式(6.9)により求める。

ここに、 q₀ = 0.8 m³

K = 0.73

f = 1/1.2

E = 0.50

C_m = 45 (秒)

従って、

$$Q = \frac{3,600 \times (0.8 \times 0.73) \times 1/1.2 \times 0.50}{45} = 19.5 \text{ m}^3 / \text{hr}$$

1日当り作業量 : Q_d = 19.5 × 8 = 156.0 m³ / day

④ ダンプトラック (8ton) による運搬能力

ダンプトラックの運転1時間当り作業量は次式により求める。

$$Q = \frac{60 \times q}{C_m} \text{ ----- (6.11)}$$

ここに、 Q : 運転1時間当り作業量 (m^3 /hr)

q : 1サイクル当り作業量 (m^3)

C_m : 1サイクル当り所要時間 (分)

- 1サイクル当り作業量 (q) は次式による

$$q = \frac{T}{W} \text{ ----- (6.12)}$$

ここに、 T : 公称積載量 (ton)

W : 土の単位体積重量 (ton/m^3)

$$q = \frac{8.0}{1.47/1.2} = 6.5 m^3$$

- 1サイクル当り所要時間 (C_m)

$$C_m = 0.0054 \times L \times \alpha + (C_{ms} + 4.0) \text{ ----- (6.13)}$$

ここに、 L : 運搬距離 (m) = 500

α : 運搬路補正係数 = 1.6

C_{ms} : 積込機械によるサイクルタイム (分)

$$C_{ms} = \frac{60 \times q}{Q_s} \text{ ----- (6.14)}$$

Q_s : 積込機械運転1時間当り

作業量 (m^3 /hr)

クラムシェル $0.8 m^3$ の場合

$$C_{ms} = 14.6 m^3 / hr$$

$$C_{ms} = \frac{60 \times 6.5}{14.6} = 26.7 \text{ (分)}$$

従って、

$$\begin{aligned} C_m &= 0.0054 \times 500 \times 1.6 + (26.7 + 4.0) \\ &= 35.0 \text{ (分)} \end{aligned}$$

$$\text{故に、 } Q = \frac{60 \times 6.5}{35.0} = 11.1 \text{ m}^3 / \text{hr}$$

$$\text{1日当り作業量： } Q_d = 11.1 \times 8 = 88.8 \text{ m}^3 / \text{day}$$

⑤ ブルドーザー (21 t) による土捨場敷均し

ブルドーザーの運転1時間当り作業量は次式による。

$$Q = 10E \times (11D + 8) \text{ ----- (6.15)}$$

ここに、Q：運転1時間当り作業量 (m³ /hr)

E：作業効率 (=0.50)

D：仕上り厚さ (=0.30m)

$$Q = 10 \times 0.50 \times (11 \times 0.30 + 8) = 56.5 \text{ m}^3 / \text{hr}$$

$$\text{1日当り作業量： } Q_d = 56.5 \times 8 = 452.0 \text{ m}^3 / \text{hr}$$

ii) 二次掘削

二次掘削では、陸上機械ではトラフィカビリティーの確保はむずかしいと考えられるので、台船付バックホウにて掘削を行いベルトコンベアーにて搬出し、クラムシェルあるいはクローラーショベルにて8tトラックに積込み、土捨場へ運搬する。

a) 工事数量

$$\text{掘削土量： } 6,910 \text{ m}^3$$

c) 機械の作業能力

① 台船付バックホウ (0.4m³) による掘削能力

運転1時間当りの作業量は式(6.9)による。

$$\text{ここに、 } q_0 = 0.4 \text{ m}^3$$

$$K = 0.9$$

$$f = 1.0$$

$$E = 0.45$$

$$C_m = 33 \text{ 秒}$$

故に、

$$Q = \frac{3,600 \times (0.4 \times 0.9) \times 1.0 \times 0.45}{33} = 17.7 \text{ m}^3 / \text{hr}$$

$$\text{1日当り作業量： } Q_d = 17.7 \times 8 = 141.6 \text{ m}^3 / \text{day}$$

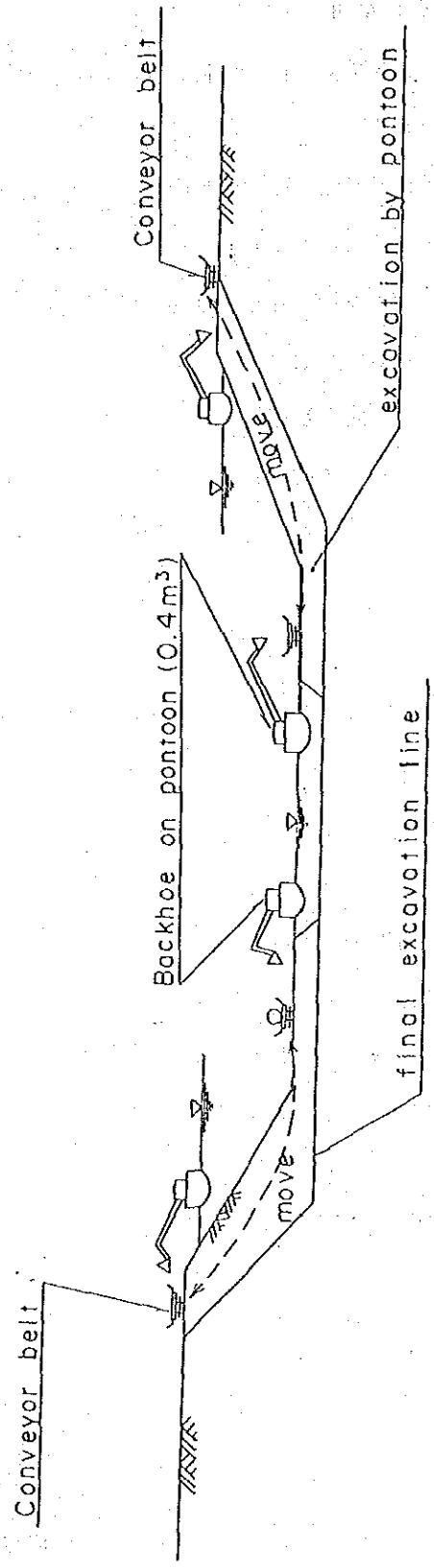


図 6. 6. 2 第二次掘削の施工方法

② ベルトコンベア運搬能力

運転1時間当りの作業量は次式による。

$$P = 60 \times K \times (0.9 \times B - 0.05)^2 \times v \quad \text{-----} \quad (6.16)$$

ここに、P：運転1時間当りの作業量（ m^3/hr ）

K：トラフ角及び側角による係数（ $=0.059$ ）

B：ベルト巾（ $=0.35m$ ）

v：コンベアー速度（ $=30m/min$ ）

$$\begin{aligned} P &= 60 \times 0.059 \times (0.9 \times 0.35 - 0.05) \times 30 \\ &= 7.5 m^3/hr \end{aligned}$$

1日当りの作業能力

$$P_d = 7.5 \times 8 = 60.0 m^3/day$$

③ 人力積込（ベルトコンベアー）能力

1日当りの作業量は次式により算定する。

$$V = \frac{\text{掘削・積込労務配置}}{0.35} \quad \text{-----} \quad (6.17)$$

労務配置を10人とする。

$$V = \frac{10}{0.35} = 28.6 m^3/day$$

④ クラムシェル（ $0.8m^3$ ）による積込能力

運転1時間当り作業量は式(6.9)より求める。

$$Q = 18.8 m^3/hr$$

$$Q_d = 150.4 m^3/day$$

⑤ ダンプトラック(8t)による運搬能力

ダンプトラックによる作業能力は、式(6.11)，(6.12)及び(6.13)による。

$$Q = 11.1 m^3/hr$$

$$Q_d = 88.8 m^3/day$$

3) 施工日数

i) 一次掘削

一次掘削土量を施工機械の組合せにより、次の様に仕別けする。

機械の組合せ	土量
① 湿地ブル+クラムシェル+ダンプトラック	4,345m ³
② 湿地ブル+クローラーショベル+ダンプトラック	4,345
計	8,690

上記計画による機械の必要のべ台数は次の様になる。

- ① 湿地ブル : $8,690 \div 115.2 \text{ m}^3 / \text{day} = 75 \text{ 台} \cdot \text{日}$
- ② クラムシェル : $4,345 \div 150.4 \text{ m}^3 / \text{day} = 29 \text{ 台} \cdot \text{日}$
- ③ クローラーショベル : $4,345 \div 156.0 \text{ m}^3 / \text{day} = 28 \text{ 台} \cdot \text{日}$
- ④ ダンプトラック : $8,690 \div 88.8 \text{ m}^3 / \text{day} = 98 \text{ 台} \cdot \text{日}$

湿地ブル2台で施工するとすると、施工日数は

$$75 \text{ 台} \cdot \text{日} \div 2 \text{ 台} = 38 \text{ 日}$$

ii) 二次掘削

二次掘削に必要な機械のべ台数は次の様になる。

- ① 台船付バックホウ : $6,910 \text{ m}^3 \div 141.6 \text{ m}^3 / \text{日} = 49 \text{ 台} \cdot \text{日}$
- ② ベルトコンベアー : $6,910 \div 60.0 = 116 \text{ t} \cdot \text{日}$
- ③ クラムシェル : $3,455 \div 150.4 = 23 \text{ 台} \cdot \text{日}$
- ④ クローラーショベル : $3,455 \div 156.0 = 22 \text{ 台} \cdot \text{日}$
- ⑤ ダンプトラック : $6,910 \div 88.8 = 78 \text{ 台} \cdot \text{日}$

一方、ベルトコンベアーに積込みは、バックホウより直接積込が60%、残りは人力により行うこととすれば、人力積込みによるベルトコンベアー必要セット数は、

$$6,910 \times 0.4 \div 28.6 \text{ m}^3 / \text{日} = 97 \text{ t} \cdot \text{日} < 116 \text{ t} \cdot \text{日}$$

二次掘削の施工日数は、台船付バックホウによって決まる。

従って、49日となる。

6-7 土捨場計画

試験水路の掘削土量は約 16,000 m³ と見積られた。掘削土のゆるみを考慮すると、土捨場は約 20,000 m³ の捨土可能な用地が必要となる。

土捨場を本試験水路サイトの排水路をはさんだRIDの用地内に図-6.7.1に示す通り計画する。

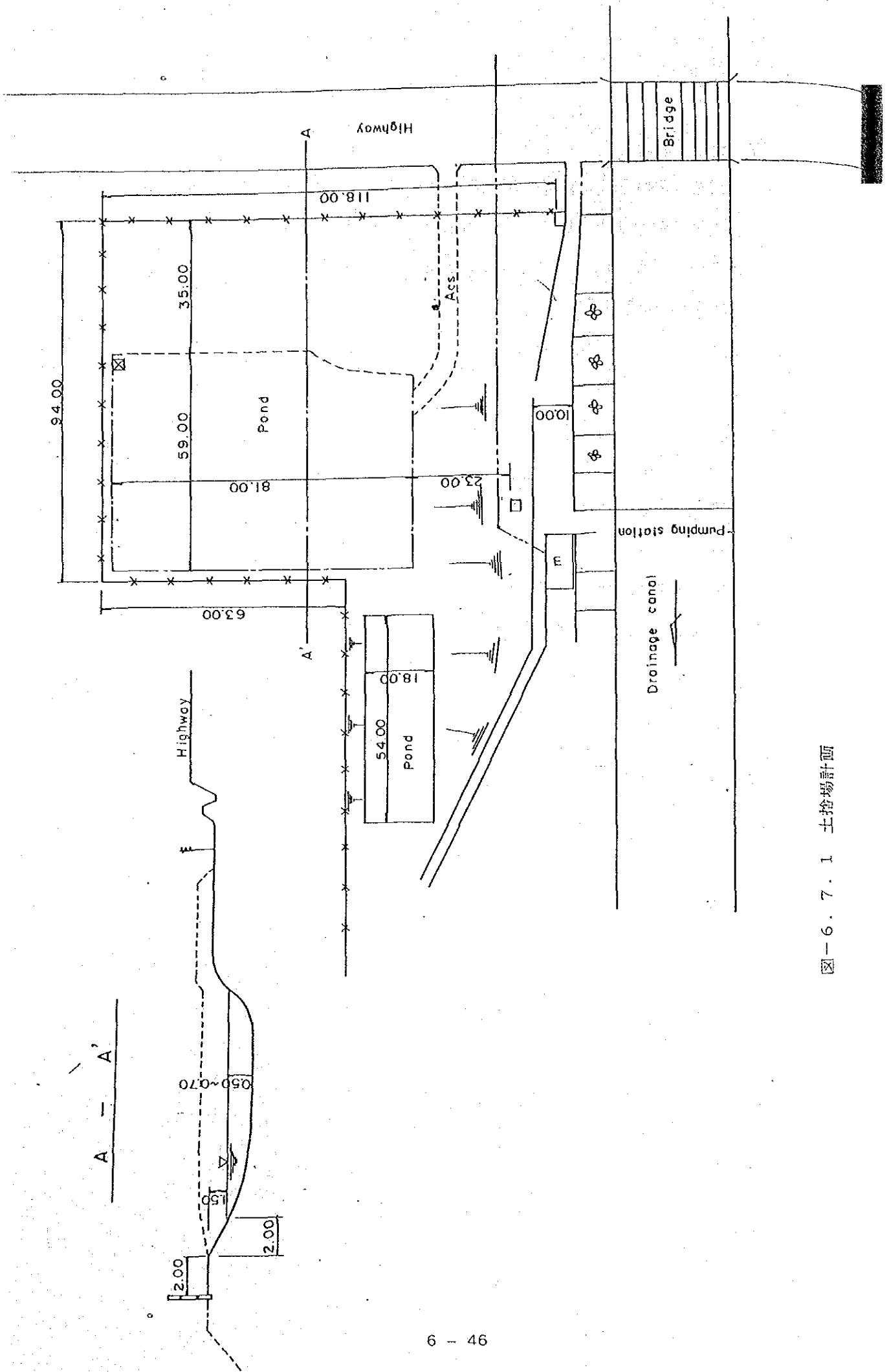


圖-6.7.1 土捨場計画

6-8 施工日程

本試験水路工事に要する期間は図-6.8.1に示す通り工事発注契約に必要な1ヶ月及び後始末を含み8.0ヶ月とする。

Work Items	Unit	Quantities	Month								
			1st	2nd	3rd	4th	5th	6th	7th	8th	
I. CONSTRUCTION OF TESTING CANAL FACILITY											
1. Tendering	-	-									
2. Preparatory Work	L.S	-									
- Mobilization & Demobilization	m	5,600									
- Dewatering	m	270									
- Construction of Construction Road											
3. Foundation Improvement work											
- Laboratory Tests	L.S	-									
- Experimental Construction	L.S	-									
- Construction of Soil Cement Columns	m	1,257									
- Construction of Sand Compaction Piles	m	1,085									
4. Earth Works											
- Construction of Cofferdam	m ³	95									
- Construction of Drainage Ditch	m	270									
- Primary Excavation	m ³	8,690									
- Secondary Excavation	"	6,910									
5. Other Work											
- Related Work for Monitoring System	L.S	-									
- Shifting of Existing Houses	L.S	-									
II. INSTALLATION OF MONITORING INSTRUMENT											
1. Auto-measuring Instrument											
- Inclinator	Location	2									
- Extensometer	"	1									
- Piezometer	"	6									
2. Manual-measuring Instrument											
- Inclinator	Location	5									
- Settlement Gauge	"	7									
- Displacement Piles	Nos.	104									
- Water Stand Pipe	Location	2									

图 6. 8. 1 施工进度

第7章 工事費積算

7-1 供与機械の調達

本試験水路工事は、プロジェクト協力活動の円滑な運営を進めるにあたって、早急に実施する必要があり、モデルインフラ事業として実施するものである。

しかしながら、事業費が限られている為、計測用計器および資機材の調達は、機材供与事業により行う。機材の調達は現地で行う。

事業費総括表

I. 工事費

A. 直接工事費

1. 土工事費	1式	¥ 1,831,000
2. サンドコンパクションパイル工事費	1式	¥ 543,000
3. ソイルセメントコラム工事費	1式	¥ 692,000
4. 地盤改良工試験工事	1式	¥ 30,000
5. その他雑工事費	1式	¥ 13,000
6. 観測小屋建設工事	1式	¥ 79,000
小計		¥ 3,188,000

B. 間接工事費

1. 共通仮設費	1式	¥ 724,000
2. 現場管理費・一般管理費	1式	¥ 186,000
3. 諸経費	1式	¥ 397,000
小計		¥ 1,307,000

計（工事原価） ¥ 4,495,000

C. 予備費（A+Bの10%） ¥ 450,000

計（工事費） ¥ 4,945,000

II. 工事諸費（Iの5%） ¥ 247,000

合計 ¥ 5,192,000

（同上円換算）（¥27,000,000）

（¥ 1.0=¥ 5.2）

明第 1 号

直接工事費明細書

¥ 3,188,000.-

単位 パーツ (¥)

名 称	規 格	単 位	数 量	単 価	金 額	明細書 番 号	摘 要
1. 土 工 事		式	1		1,831,000	1-1	
2. 砂利の敷き詰め 工事		〃	1		543,000	1-2	
3. ソイルセメント コラム工事		〃	1		692,000	1-3	
4. 地盤改良工試験 工事		〃	1		30,000	1-4	
5. その他雑工事		〃	1		13,000	1-5	
6. 観測小屋建設 工事		〃	1		79,000	-	220 ^m ² × 1,200 × 0.3
合 計					3,188,000		

明第1-1号

土 工 事 費 明 細 書

β 1,831,000.-

単位 パーツ (β)

名 称	規 格	単 位	数 量	単 価	金 額	明細書 番 号	備 考
1. 1次掘削工事		式	1		910,780	1-1-1	
2. 2次掘削工事		〃	1		862,972	1-1-2	
3. 締切堤盛土工事		〃	1		28,847	1-1-3	
4. 排水路掘削工事		〃	1		29,286	1-1-4	
合 計					1,831,885		
				改 め	1,831,000		

明第 1-1-1号

1 次掘削工事明細書

β 910,780.-

単位 パーツ(β)

名 称	規 格	単 位	数 量	単 価	金 額	単価表 番 号	摘 要
1. 機 械 費	湿地7AF-f (10t)	台・日	75	4,500	337,500	機-5	8,690m ³ ÷ 115.2m ³ /d=75
	グラムシエル (35t)	〃	29	8,000	232,000	〃-11	4,345m ³ ÷ 150.4m ³ /d=29
	加-ラ-ソベル(0.4m ³)	〃	28	4,000	112,000	〃-6	4,345m ³ ÷ 156.0m ³ /d=28
	ダンプトラック(8t)	〃	98	1,800	176,400	〃-8	8,690m ³ ÷ 88.8m ³ /d=98
	ブルドーザー (11t)	〃	10	4,500	45,000	〃-5	8,690m ³ ÷ 452.0m ³ /d=10
	小 計				902,900		
2. 労 務 費	世話役	人	19	225	4,275	労-1	38日×0.5×1人=19
	普通作業員	〃	38	85	3,230	〃-3	40日×1人/日=38
	小 計				7,505		
3. 材 料 費	雑材料	式	1		375		労務費の5%
	合 計				910,780		

明第 1-1-2号

2 次 掘 削 工 事 明 細 書

β 862,972.-

単位 パーツ (β)

名 称	規 格	単 位	数 量	単 価	金 額	単価表 番 号	摘 要
1. 機 械 費	バックホウ (0.4 π^3)	台・日	49	3,500	171,500	機-1	$6,910\pi^3 \div$ $141.6\pi^3 / d=49$
	台 船	〃	49	2,500	122,500	-	
	ベルトコンベアー	ト・日	116	800	92,800	-	
	クラムシエル (35t)	台・日	23	8,000	184,000	機-11	$3,455\pi^3 \div$ $150.4\pi^3 / d=23$
	クローラーショベル (0.4 π^3)	〃	22	4,000	88,000	機-6	$3,455\pi^3 \div$ $156.0\pi^3 / d=22$
	ダンプトラック	〃	78	1,800	140,400	〃-8	$6,910 \div 88.8 = 78$
	ブルドーザー (11t)	〃	8	4,500	36,000	〃-5	$6,910 \times 0.5 \div 452.0$ $= 8$
	小 計				835,200		
2. 労 務 費	世話役	人	25	225	5,625	労-1	$49日 \times 1人 / 日 \times 0.5$ $= 25$
	普通作業員	〃	245	85	20,825	〃-3	$49日 \times 5人 / 日 = 245$
	小 計				26,450		
3. 材 料 費	雑材料	式	1		1,322	-	労務費の5%
	合 計				862,972		

朝張 1-1-3号

締切堤盛土工事費明細書

¥ 28,847.-

単位 パーツ (B)

名 称	規 格	単 位	数 量	単 価	金 額	単価表 番 号	摘 要
機 械 費	ブルドーザー (110)	台・日	2	4,500	9,000	機-5	
	小 計				9,000		
勞 務 費	普通作業員	人	18	85	1,530	勞-3	$95.0\text{m}^3 \div 5.2\text{m}^3 / \text{d} = 18$
	小 計				1,530		
材 料 費	ラテライト土	m^3	114	160	18,240	資-2	$95.0\text{m}^3 \times 1.2 = 114\text{m}^3$
	雑 材 料	式	1		77	-	
	小 計				18,317		
	合 計				28,847		

明細 1-1-4号

排水路掘削工事費明細書

␣ 29,286.-

単位 パーツ(␣)

名称	規格	単位	数量	単価	金額	番号	備 要
バックホウ	0.4m ³	台・日	3	3,500	10,500	機-1	$380 \div 141.6 = 3$
グンプトラック		〃	4	1,800	7,200	カ-8	$380 \div 88.8 = 4$
普通作業員		人	73	85	6,205	労-3	$380 \div 5.2 = 73$
雑材料		式	1		5,381	-	上記の20%
合計					29,286		

明細1-2号

サンドコンパクションパイル工事費明細書

¥ 543,000.-

単位 パーツ (β)

施工17日 (試験工事含) + 組立・解体 3日 = 20日

名 称	規 格	単 位	数 量	単 価	金 額	単価表 番 号	摘 要
1. 材料及び消耗品	砂	m ³	417	170	66,720	資-1	0.7 ² × 3.14 × 1/4 × 1.085 × 1.2 = 417m ³
	コンプレッサー軽油	ℓ	816	6.3	5,141	〃-3	50PS × 0.12 × 8 × 17 = 816ℓ
	発電機軽油	〃	1,975	6.3	12,443	〃-3	121PS × 0.12 × 8 × 17 = 1,975
	油 脂 類	式	1		3,517	-	
	ケーシングパイプ	〃	1		18,000	-	
	バケツ	〃	1		9,000	-	
	レシーバータンク	〃	1		1,000	-	
	雑 品	〃	1		2,800	-	
	小 計				118,621		
2. 労 務 費	世 話 役	人	20	225	4,500	労-1	20日 × 1人/日
	特殊作業員	〃	40	150	6,000	〃-2	20日 × 2人/日
	普通作業員	〃	60	85	5,100	〃-3	20日 × 3人/日
	小 計				15,600		
3. 機 械 費	ベースマシン	台・日	20	12,000	240,000	機-12	
	門 け ん	〃	20	800	16,000	-	

名 称	規 格	単 位	数 量	単 価	金 額	単価表 番 号	備 考
	発 電 機	台・日	17	3,400	57,800	機-17	
	コンプレッサー	〃	17	1,600	27,200	〃-18	
	クローラーショベル 0.3m ³	〃	17	4,000	68,000	〃-6	
	小 計				409,000		
	合 計				543,221		
				改 め	543,000		

明細1-3号

ソイルセメントコラム工事費明細書

¥ 692,000.-

単位 パーツ(β)

施工13日(試験工事含む)+組立・解体 4日

名称	規格	単位	数量	単価	金額	単価表 番号	摘要
1. 材料及び消耗品	セメント	t	155.4	1,686	262,004	資-5	0.875 × 1.256.8 × 150 × 1.05 = 155,387kg
	発電機軽油	ℓ	1,132	6.3	7,129	机-3	93PS × 0.117ℓ/PS × 8hr × 13
	発電機油脂類	式	1		1,426	-	
	オーガスクリュー	机	1	40,000	40,000	-	
	オーガヘッド	机	1	28,000	28,000	-	
	ホース等雜材	日	13	200	2,600	-	
	水タンク	ヶ	1		5,000	-	
	足場仮設				4,208	-	セメント除く計の5%
	小計				350,367		
2. 労務費	世話役	人	17	225	3,825	労-1	17日 × 1人/日 = 17人
	特殊作業員	机	51	150	7,650	机-2	17日 × 3人/日 = 51人
	普通作業員	机	85	85	7,225	机-3	17日 × 5人/日 = 85人
	小計				18,700		
3. 機械費	ベースマシン	台・日	17	12,000	204,000	機-12	
	オーガロード	机	15	750	11,250	-	

名 称	規 格	単 位	数 量	単 価	金 額	単価表 番 号	摘 要
	グラウトポンプ	台・日	15	18,000	27,000	-	
	グラウトミキサ	〃	15	1,200	18,000	-	
	発 電 機	〃	15	3,400	51,000	機-17	
	水中ポンプ	〃	30	65	1,950	〃-20	15日×2台=30台・日
	プラント施設	式	1	10,000	10,000	-	
	小 計				323,200		
	合 計				692,267		
				改 め	692,000		

明細1-4号

地盤改良工試験工事費明細書

β 30,000.-

単位 パーツ(β)

名 称	規 格	単 位	数 量	単 価	金 額	明細書 番 号	摘 要
1. 室内配合試験	ソイルセメントコラム	式	1		2,606	1-4-1	
2. 粒 度 試 験	サンドグラベルコンパクションバイ	試 料	4	300	1,200	-	
3. 試 験 工 事	ソイルセメントコラム サンドコンパクションバイ グラベルコンパクションバイ	-	-		-	-	本工事に含む
4. 土質調査・試験		式	1		27,180	1-4-2	
合 計					30,986		
				改 め	30,000		

明第 1-4-1号

室内配合試験説明冊

β 2,606.-

単位 パーツ (β)

名 称	規 格	単 位	数 量	単 価	金 額	単価表 番 号	備 考
1. セメント		袋	1	67	67	資-5	
2. 労務費-損料		日	1	1,200	1,200	-	
3. 特殊作業員		人	1	150	150	勞-2	
4. 普通作業員		〃	3	85	255	〃-3	
5. 試料採取	現場粘土	式	1		500	-	
6. その他		式	1		434	-	上記の20%
合 計					2,606		

明第 1-4-2号

土質調査・試験費明細書

β 27,180.-

単位 パーツ (β)

名 称	規 格	単 位	数 量	単 価	金 額	単価表 番 号	摘 要
1. 原位置試験	標準貫入試験	回	14	200	2,800	-	サンド 7回 グラベル 7回
	同上ボーリング	m	14	400	5,600	-	サンド 1孔 グラベル 1孔
	原地盤粘土シンクォ ールサンプリング	試料	8	300	2,400	-	
	同上ボーリング	m	14	400	5,600	-	
	現場密度試験	回	4	380	1,520	-	
	ソイルセメントコラ ム, コアボーリング	m	6	540	3,240	-	400 × 1.34 = 540
	小 計				21,160		
2. 室内試験	自然含水比	試料	26	20	520	-	
	湿潤密度	//	26	50	1,300	-	
	一軸圧縮試験	//	14	300	4,200	-	
	小 計				6,020		
	合 計				27,180		

明第1-5号

その他雑工事費明細書

¥ 13,000.-

単位 パーツ (β)

名 称	規 格	単 位	数 量	単 価	金 額	単価表 番 号	備 考
1. 変位杭設置	コンクリート製固定杭	ヶ	8	150	1,200	-	
	木製変位杭	式	1	2,000	2,000	-	約 150本
	測 量 士	人・日	4	300	1,200	労-4	
	測量助手	〃	4	120	480	〃-5	
	普通作業員	〃	16	85	1,360	〃-3	
	雑 品	式	1		1,248	-	上記の20%
	小 計				7,488		
2. 計測計器保護	鉄筋コンクリートパイプ φ200	m	20	95	1,900	資-6	
	砂	m ²	4	170	680	〃-1	
	普通作業員	人	5	75	375	労-3	
	竹製保護	式	1		3,000	-	
	小 計				5,955		
	合 計				13,443		
				改 め	13,000		

明第 2 号

共通仮設費明細書

¥ 724,000.-

単位 パーツ(β)

名 称	規 格	単 位	数 量	単 価	金 額	明細書 番 号	摘 要
1. 運 搬 費		式	1		86,300	2-1	
2. 測量、改良工事 品質管理		〃	1		128,370	2-2	
3. 仮設工事費		〃	1		423,367	2-3	
4. その他共通仮設 費		〃	1		86,600	2-4	
合 計					724,637		
				改め	724,000		

明第2-1号

運 搬 費 明 細 書

¥ 86,300.-

単位 パーツ (円)

名 称	規 格	単 位	数 量	単 価	金 額	単価表 番 号	摘 要
ブルドーザー	11t	回	4	1,500	6,000	機-16	2台×2回=4回
バックホウ	0.4 ^m ³	//	4	1,500	6,000	//-16	2台×2回=4回
クラムシエル	35t	//	4	2,200	8,800	//-14	2台×2回=4回
バックホウ	0.4 ^m ³ 台船据付	//	2	1,800	3,600	//-15	
台 船	8 ^m ×15 ^m ×1.0 ^m	//	2	4,400	8,800	//-14	
ベルトコンベアー	0.60 ^m 巾	//	2	900	1,800	-	
発 電 機		//	2	900	1,800	-	
杭打機リーダー		//	2	1,500	3,000	機-16	
クレーン付トラック	5t	日	45	1,500	37,500	//-16	
アースオーガー		回	2	900	1,800	-	
コンプレッサー		//	2	900	1,800	-	
コンクリートポンプ		//	2	900	1,800	-	
クローラーショベル		//	2	1,500	3,600	機-16	
合 計					86,300		

明第2-2号

測量費，改良工事品質管理費明細書

¥ 128,370.-

単位 パーツ(β)

名 称	規 格	単 位	数 量	単 価	金 額	単価表 番 号	摘 要
1. 測量、丁張り費	測 量 士	日	60	300	18,000	勞-4	10人/月×6月=60人
	測 量 助 手	人	60	120	7,200	//-5	"
	測 量 人 夫	"	180	85	15,300	//-3	30人/月×6月=180人
	測 量 資 材	月	6	500	3,000	-	
	測 量 機 材 損 料	"	6	1,000	6,000	-	
	雑 品	式	1		4,950	-	上記の1%
	小 計				54,450		
2. 改良工事品質 管理	標準買入試験	回	35	600	21,000		7本×5n=35n ボーリング含む
	シンクォールサンブ リング	試 料	35	300	10,500		原地盤粘土
	コアボード	m	36	400	14,400		2本×13+ 2本×5n =36n
	一軸圧縮試験	試 料	71	300	21,300		7×5 + 2 ×13+ 2×5 =71回
	そ の 他	式	1		6,720		上記の10%
	小 計				73,920		
	合 計				128,370		

明第2-3号

仮設工事費明細書

¥ 423,367.-

単位 パーツ (¥)

名 称	規 格	単 位	数 量	単 価	金 額	明細書 番 号	摘 要
工 事 用 道 路		式	1		266,615	2-3-1	
水 替 工		〃	1		28,382	2-3-2	
動 力 設 備		〃	1		18,400	2-3-3	
セメントスラリー基礎		〃	1		34,500	2-3-4	
サンドマット工		〃	1		75,470	2-3-5	
合 計					423,367		

明第 2-3-1号

工 事 用 道 路 工 事 明 細 書

¥ 266,615.-

単位 パーツ (¥)

名 称	規 格	単 位	数 量	単 価	金 額	単価表 番 号	摘 要
1. 材 料 費	ラテライト土	m ³	131	160	20,960	資-2	119 × 1.1
	砂	〃	762	170	129,540	〃-1	693 × 1.1
	土木シート	m ²	1,704	50	85,200	-	2,840 × 1.2 × 0.5
	雑 材 料	式	1		11,785	-	上記の5%
	小 計				247,485		
2. 労 務 費	世 話 役	人	2	225	450	労-1	4日 × 0.5人/日 = 2.0
	普通作業員	〃	8	85	680	〃-3	4日 × 2人/日 = 8.0
	小 計				1,130		
3. 機 械 費	ブルドーザー (11t)	台・日	4	4,500	18,000	機-5	
	小 計				18,000		
	合 計				266,615		

明第 2-3-2号

水 替 工 事 費 明 細 書

β 28,382.-

単位 パーツ (β)

名 称	規 格	単 位	数 量	単 価	金 額	単価表 番 号	摘 要
既 存 水 排 水							
1. 材 料 費	軽 油	ℓ	281	6.3	1,770	資-3	7.5PS × 0.12 × 24 × 13日 = 281
	油 脂 類	式	1		354	-	
	小 計				2,124		
2. 労 務 費	普通作業員	人	9	85	765	労-3	4日 + 5日 = 9日
	小 計				765		
3. 機 械 費	水中ポンプ (4")	台・日	13	300	3,900		
	小 計				3,900		
	合 計				6,789		
工 事 中 排 水							
1. 材 料 費	軽 油	ℓ	648	6.3	4,082	資-3	7.5 × 0.12 × 4 × 90 × 2 = 648
	油 脂 類	式			816	-	
	小 計				4,898		

名 称	規 格	単 位	数 量	単 価	金 額	単価表 番 号	廣 要
2. 労 務 費	普通作業員	人	45	85	3,825	労-3	3ヶ月×30日× 0.5人/日 =45
	小 計				3,825		
3. 機 械 費	水中ポンプ(2")	台・日	180	65	11,700	機-20	3ヶ月×30日× 2台=180
	ホース損料	式	1		1,170	-	
	小 計				12,870		
					21,593		
	合 計				28,382		

明第 2-3-3号

動力設備費明細書

β 18,400.-

単位 パーツ(β)

名 称	規 格	単 位	数 量	単 価	金 額	単価表 番 号	機 要
1. 材 料 費	電磁遮断器	ヶ	2	600	1,800	-	
	〃	〃	2	500	1,000	-	
	ビニールキャブタイ ヤ電線	m	100	25	2,500	-	
	〃	〃	100	18	1,800	-	
	電力計計器	ヶ	1	2,750	2,750	-	
	電磁開閉器	〃	2	700	1,400	-	
	雑 品	式	1		250	-	
	小 計				11,500		
2. 労 務 費	電 工	人	20	200	4,000	労-6	
	普通作業員	〃	20	85	1,700	〃-3	
	小 計				5,700		
3. 機 械 費	トラック(4t)	台・日	1	1,200	1,200	機-10	
	小 計				1,200		
	合 計				18,400		

明細 2-3-4号

セントスラリープラント基礎工事費明細書

β 34,500.-

単位 パーツ (β)

名 称	規 格	単 位	数 量	単 価	金 額	単価表 番 号	構 要
1. 材 料 費	砂	m ³	149	170	25,330	資-1	15×30×0.3 ×1.1
	土木シート	m ²	90	50	4,500	-	15×30×1.2
	小 計				29,830		
2. 労 務 費	普通作業員	人	2	85	170	労-3	1日× 2人/日=2.0
	小 計				170		
3. 機 械 費	ブルドーザー (11t)	台・日	1	4,500	4,500		
	小 計				4,500		
	合 計				34,500		

サンドマット工事費明細書

¥ 75,470.-

単位 パーツ (¥)

名称	規格	単位	数量	単価	金額	単価表 番号	備 考
1. 材 料 費	砂	m ³	388	170	66,130	資-1	30×12×0.50×1.2 +30×16×0.3×1.2
	小 計				66,130		
2. 労 務 費	普通作業員	人	4	85	340	労-3	2日×2人/日=4.0
	小 計				340		
3. 機 械 費	湿地ブルドーザー	台・日	2	4,500	9,000	-	
	小 計				9,000		
	合 計				75,470		

明第2-4号

その他共通仮設費明細書

¥ 86,600.-

単位 パーツ (円)

名 称	規 格	単 位	数 量	単 価	金 額	番 号	摘 要
1. 安全費		式	1		9,000	-	
2. 技術管理費		〃	1		12,000	-	
3. 営繕費		〃	1		65,600	-	
合 計					86,600		

勞 務 單 價 一 覽 表

No.

番 号	名 称	規 格	單 位	金 額	摘 要
勞-1	世 話 役		人	225	
勞-2	特 殊 作 業 員		〃	150	
勞-3	普 通 作 業 員		〃	85	
勞-4	測 量 士		〃	300	
勞-5	測 量 助 手		〃	120	
勞-6	電 工		〃	200	
勞-7	大 工		〃	200	
勞-8	鉄 筋 工		〃	200	
勞-9	特 殊 運 転 手		〃	200	
勞-10	普 通 運 転 手		〃	150	
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資 材 単 価 一 覧 表

No. _____

番 号	名 称	規 格	単 位	金 額	摘 要
資-1	砂		m ³	170	
資-2	ラテライト		//	160	
資-3	軽油		ℓ	6.3	
資-4	鉄板	t=1.5cm 1,219×2,438	枚	4,500	
資-5	セメント		t	1,686	
資-6	鉄筋コンクリートパイプ	φ200mm	m	95	
資-7	鉄筋コンクリートパイプ	φ300mm	//	160	
資-8	荒砂		m ³	180	
資-9	切込砂利		//	195	
資-10	鉄筋(丸鋼)	SR24	t	9,800	
資-11	異形鉄筋	S030	//	9,800	
資-12	塩ビ管	φ20mm×4m	pec	36	
資-13	塩ビ管	φ25mm×4m	//	48	
資-14	塩ビ管	φ30mm×4m	//	60	
資-15	ガソリン	レギュラー	ℓ	8.9	
資-16	木材	家屋用	m ³	10,000	
資-17	木材	型枠用	//	7,000	
資-18	釘		t	12,500	
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機 械 運 転 経 費 一 覧 表

No.

番 号	名 称	規 格	単 位	金 額	摘 要
機-1	バックホウ	0.4m ³	日	3,500	オペレーター費含む
機-2	ロングアーム,バックホウ	0.4m ³	//	5,500	//
機-3	バックホウ	0.8m ³	//	5,500	//
機-4	ブルドーザー	21ton	//	7,000	//
機-5	ブルドーザー	11ton	//	4,500	//
機-6	クローラーショベル	0.4 ⁴ / ₃ m ³	//	4,000	//
機-7	ダンプトラック	11ton	//	2,600	//
機-8	ダンプトラック	8ton	//	1,800	//
機-9	トラッククレーン	5ton	//	1,500	//
機-10	トラック	4ton	//	1,200	//
機-11	クローラークレーン	35ton	//	8,000	//
機-12	三点式杭打機	35ton	//	12,000	//
機-13	台 船	8m×15m×1m	//	4,500	//
機-14	トレーラー	35ton	//	2,200	//
機-15	トレーラー	25ton	//	1,800	//
機-16	トレーラー	15ton	//	1,500	//
機-17	発 電 機	220V, 100KVA	//	3,400	
機-18	コンプレッサー	5.0m ³ /hr	//	1,600	
機-19	水 中 ポ ン プ	4インチ	//	300	
機-20	水 中 ポ ン プ	2インチ	//	65	
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第8章 契約 図 書 (案)

8-1 工事契約書 (案)

8-2 工事仕様書 (案)

8-1 工事契約書(案)

BID DOCUMENTS

C O N T E N T S

- ✧ INVITATION TO BID
- ✧ INSTRUCTION TO BIDDERS
- ✧ TERMS AND CONDITIONS OF THE CONTRACT
- ✧ PLEDGE AGREEMENT
- ✧ CONTRACT
- ✧ TECHNICAL SPECIFICATIONS
- ✧ PROPOSAL

BID DOCUMENT
ON
CONSTRUCTION OF MODEL INFRASTRUCTURE OF SOFT SOIL FOUNDATION
FOR
THE IRRIGATION ENGINEERING CENTER PROJECT
IN
THAILAND

THAILAND OFFICE
JAPAN INTERNATIONAL COOPERATION AGENCY

JAPAN INTERNATIONAL COOPERATION AGENCY, THAILAND OFFICE

INVITATION TO BID

The Japan International Cooperation Agency, Thailand Office hereby invites you to submit the sealed written bids on the Construction of Model Infrastructure of Soft Soil Foundation for the Irrigation Engineering Center Project which is located in charoenvay, Samur Prakan Prefecture.

This Contract will include, among, others the followings;

1. Invitation to Bid
2. Instruction to Bidders
3. Terms and Conditions of the Contract
4. Pledge Agreement
5. Contract
6. Technical Specifications
7. Bill of Quantities
8. Drawings
9. Proposal

Bids shall be addressed to Mr. Tsutomu SAITO, President Representative, Japn International Cooperation Agency, Thailand Office,

C/O Embassy of Japan, 1674, New Petchburi Road, Bangkok, Thailand, and marked "Sealed Proposal, Model Infrastructure Project of Softf Soil Foundation".

The date for the opening of bids will be held at.....
o'clock p.m. (a.m.),Standard Time on (month) (day)
, 1988 at the JICA, Thailand Office. Mr. Tsutomu SAITO PRESIDENT
Representative of JICA Thailand Office.

INSTRUCTION TO BIDDERS

IB-01 PREPARATION OF BIDS

All bids shall be submitted in an original and three (3) copies on or before the hour and date fixed for receipt of bids, in accordance with the Invitation for Bids, and shall conform to the following requirements;

- a) One copy of proposal shall be marked "Original". The original and copies of bids shall be submitted in its entirety with all blanks in the proposal properly filled in.
- b) Bids prices shall be written in words as well as in figures. In case of discrepancy between the words and figures, the price in words shall prevail.
- c) The proposal must be signed by the Bidder with his usual signature and shall show his full business address.

IB-02 BASIS ON WHICH BIDS ARE REQUESTED

The form of the Contract to be awarded is on fixed unit price basis of payment to the Contractor, as specifically set forth in these Contract Documents. Bids are requested on the above basis and a proposal which is on any other basis will not be considered.

Quotation of prices shall be made in Thai Bath and the Contractor shall be paid in Local Currency.

IB-03 BID SECURITY

The original, but not the copies of each bid, shall be accompanied by a proposal bond in an amount equivalent to (10)% of the total bid price in the form of cash or certified check, as a guarantee that the successful bidder will, within ten (10) days from receipt of the notice of award, enter into Contract with the Japan International Cooperation Agency, Thailand Office, and complete faithful performance of the work specified in these Contract Documents. In case the successful bidder fails for any reason to execute

such contract within the stipulated time, the bid security shall be forfeited to the Japn International Cooperation Agency, Thailand Office, as liquidated damages.

The bid securities will be returned without interest after the successful bidder has signed the Contract.

IB-04 DELIVERY OF BIDS

Bids shall be directly delivered to JICA Thailand Office, to Mr. Tsutomu SAITO on or before the hour and date set for the opening of bids.

IB-05 WITHDRAWAL OF BIDS

A bidder will be allowed to withdraw his bid prior to the time set for the opening of bids if he communicate his purpose in writting to the Japan International Cooperation Agency, Thailand Office, and his bid shall be returned to him unopened. No bid can be withdraw for any reason whatsoever after the opening of bids has been made.

IB-06 BIDDER'S RESPONSIBILITY

The Bidders shall be responsible for having taken steps to carefully examine all of the Contract Documents and also to have fully informed themselves as to all conditions, local and otherwise, affecting the carrying out of the Contract Works.

Failure to do so will be at the Bidder's risk.

IB-07 DATA TO BE SUBMITTED WITH PROPOSAL

All proposal shall contain the following document:

- a) A construction schedule showing the detailed proposal plan of operation and construction of each main item in the Bill of Quantities from start to completion of the Contract work.

The schedule shall be in a bar chart form with weeks shown as the least unit of time and each main item on a separate horizontal line. The schedule shall also show expected monthly accomplishment and financial requirements based on the Bill of Quantities.

b) A list of equipment proposed to be used for the performance of the Contract work. This list shall specifically enumerate the number, type and capacity.

IB-08 INTERPRETATION OF CONTRACT DOCUMENTS

If the prospective Bidder is in doubt as to the true meaning of any part of the Contract Documents, the Bidder may submit to the Japan International Cooperation Agency, Thailand Office, a written request for interpretation allowing sufficient time for a reply to reach him before submission of his bid. Any interpretation of the proposed documents will be made only by a Supplemental Notice duly issued.

IB-09 PRE-BIDDING CONFERENCE

A pre-bidding conference will be scheduled on
(month) (day), 1988 at (hour) o'clock p.m./
(a.m.) at JICA Thailand Office
Attendance for Contractors is desirable but not
mandatory.

IB-10 COMPARISON OF BIDS

In making its selection, the Japan International Cooperation Agency Thailand Office will not be bound to award a Contract to the Bidder submitting the Bid with the lowest indicated cost, but will take into consideration the bid prices, unbalanced bids, guaranteed completion time and other relevant consideration.

IB-11 AWARD OF CONTRACT

Bids will be opened in the presence of the Bidders who may desire to attend such opening by the Japan International Cooperation Agency, Thailand Office, at
(hour) o'clock p.m./ (a.m.) (Thailand) Standard
Time on (month) (day), 1988.

Promptly after the opening of the bids the Japan International Cooperation Agency, Thailand Office will undertake a detailed study and appraisal of the proposal submitted. The Contract will be award to the Bidder whose proposal is considered to be most advantageous to the Japan International Cooperation Agency, Thailand Office. The Japan International Cooperation Agency, Thailand Office reserves the right

to reject any and all bids received.

IB-12 BID DOCUMENTS

BID DOCUMENT SHALL INCLUDE THE FOLLOWING;

- A) INVITATION TO BIDS
- B) INSTRUCTION TO BIDDERS
- C) TERMS AND CONDITIONS OF THE CONTRACT
- D) PLEDGE AGREEMENT
- E) CONTRACT
- F) TECHNICAL SPECIFICATION
- G) BILL OF QUANTITIES
- H) DRAWING
- I) PROPOSAL

TERMS AND CONDITIONS
OF THE CONTRACT
ON
CONSTRUCTION OF MODEL INFRASTRUCTURE OF SOFT SOIL FOUNDATION
FOR
THE IRRIGATION ENGINEERING CENTER PROJECT
IN
THAILAND

THAILAND OFFICE
JAPAN INTERNATIONAL COOPERATION AGENCY

TERMS AND CONDITION OF THE CONTRACT

Section 1 General Information

1.1 Objective

According to the Record and Discussion signed March 8, 1985, a five-year-cooperation concerning the Irrigation Engineering Center Project in Thailand (hereinafter referred to as I.E.C Project) has been started since April 1, 1985. Besides, the Royal Irrigation Department requested JICA to start the Model Infrastructure Project (hereinafter referred to as the Project) for the study on Soft Soil Foundation under the I.E.C. Project.

The objective of the work are to construct the Testing Canal Facility and Monitoring System for the purpose of the investigation, planning and design of structures to be constructed on Soft Soil Foundation as one of I.E.C. Project's activities.

1.2 Location of the site

The job site is located in Bang Pu Kao Village, Samut Prakan Prefecture about 40km to the southeast of the center of Metropolitan Bangkok as the crow flies and about 600 meters inland from the coast of the Gulf of Thailand. The location of the Project Site is at latitude about 13° 30' north

and at longitude about 100°45' east.

1.3 Callaboration

According to the objective of technical cooperation, the counterpart agency of JICA, the Royal Irrigation Department (hereinafter referred to as R.I.D.), is executing several investigations around the job site. Prior to or during the course of the works, the Contractor shall make the good relation with R.I.D. for the satisfactory implmentation of the works to secure full collaboration. Should it happen that the relation between R.I.D. and the Contractor is disputed, the Contractor shall inform against the matter to the Inspection Committee who will conciliate the both parties.

Section 2 Submission of Notices

2.1 Work schedule

The Contractor shall submit the work schedule in the following item before the commencement of the work at the job site. If the Contractor intends to change the work schedule, the approval from the Inspection Committee shall be obtained prior to the modification of the schedule.

1. Preparation of facilities and transportation of equipment etc. to the job site.
2. Dewatering work
3. Construction road
4. Foundation treatment for foundation improvement work
5. Foundation Improvement works by Soil Cement Columns
6. Foundation Improvement works by Sand or Gravel Compaction Piles
7. Excavation of testing canal facility
8. Other work

Also the Contractor shall submit the machineries scheme including the numbers, and kind of machineries and using period of them.

2.2 Notices

The JICA and the Contractor shall submit the notices to each other, as necessary, in accordance with Article 19 in the Construction Contract Document within reasonable time except that special articles are provided in the Contract Document and Terms and Conditions of the Contract.

Section 3 Field Test and Inspection

The field tests in accordance with the Technical Specifications and the demands from the Inspection Committee shall be the responsibility of the Contractor. The charges for such field test shall be included in the total amount of the construction cost, and the Contractor is not entitled to claim any amount of the field test charges.

Section 4 Modification of Plan

In case JICA estimates the cost for the modification in accordance with Article 14, and if there are two portions, one for the increase and the other for the decrease of the construction cost resulting from such modification, JICA shall have the right to offset them in the payment and pay or claim the difference between the increase and decrease of the construction cost as the case may be.

Section 5 Release from the Work

After the final acceptance of the work by JICA, the Contractor shall remove its own temporary facilities, office, warehouses, construction roads, electric wiring, surplus material, debris and so forth which were provided by

the Contractor within 10 (ten) days.

Upon approval of the Inspection Committee for the removal of the abovementioned facilities etc., the Contractor will be released from its responsibility of the works but remains responsible under 1 (one) year guarantee of the work as specified in Article 11 in this Contract.

Section 6 General Obligations of the Contractor

6.1 Temporary office and residence

In case the Contractor intends to build the temporary office, residence and so forth, the Contractor shall submit the plan to the Inspection Committee for approval at least 10 (ten) days in advance of the commencement of the work.

The Contractor is required to always keep the buildings and facilities in good condition and to make proper drainage and sanitary system. Should the Contractor build them outside of the job site, the Contractor shall arrange with the owner of such land and at its own expense.

6.2 Fuel storage

In area of temporary office and residence, the fuel tank capacity shall not exceed the regulation of Thailand and shall be far away from the housing area.

Fuel storage and transportation shall be done with care and shall have a good system of fire prevention. If storage licence is required, the Contractor shall arrange for obtaining it.

6.3 Other facilities

All necessary facilities for the work and the Contractor's convenience shall be provided and maintained in good condition by the Contractor.

Section 7 Monitoring System

The installation work of monitoring instructions should be carried out by the nominated supplier himself, not the contractor.

In case that the Government of Japan provides the Government of Thailand with the monitoring instructions such as inclinometers, settlement gauge, piezometers, extensometer, and so forth for the Project, the Contractor shall exercise utmost care so that his construction operation will not damage any installed monitoring instrument.

Section 8 General Text

The Contractor shall implement the works in accordance with the Contract Documents in broad sense, such as the Contract, Terms and Conditions of Construction Contract, Technical Specifications and Guideline for Supervision. Should the events occur that the both parties can not reach agreement on the interpretation of the above-mentioned Contract Documents in broad sense, both parties shall negotiate with sincerity and good faith for settlement of any disagreement, and if failing which the decision of the JICA shall prevail.

PLEDGE AGREEMENT

Date _____, 1988

To Japan International Cooperation Agency, Thailand Office

We, _____, the
Contractor hereby agree that all equipment, materials and
supplies brought to the job site under the Construction
Contract made with JICA dated on _____ 1988,
shall be pledged by us with the JICA as security for our
execution of work, and shall not be removed at any time
without prior approval of JICA in writing.

We further agree that should there be any loss or
damage to pledged equipment, materials and supplies kept at
the job site, JICA shall bear no responsibility whatsoever
for such loss or damage.

(Contractor's Signature)

CONTRACT
ON
MODEL INFRASTRUCTURE OF SOFT SOIL FOUNDATION
FOR
THE IRRIGATION ENGINEERING CENTER PROJECT
IN
THAILAND

THAILAND OFFICE

JAPAN INTERNATIONAL COOPERATION AGENCY

CONTRACT

ON

Construction of Model Infrastructure of Soft Soil Foundation
for the irrigation Engineering Center Project in Thailand

This Contract is executed on the day of
..... 1988 at the JICA Thailand Office between Japan
International Cooperation Agency, Thailand office by
Mr. Tsutomu SAITO, Resident Representative as its authorized
representative of JICA Thailand called "JICA" of the one
part, and
whose office is situated at

road Tambon Amphon

..... Changwat

Tel. Represented by

Nationality Title

hereinafter called "the Contractor", of the other part.

Both parties mutually agree under the terms of this
Contract as follows:-

Article 1 Purpose of agreement and Contract Price

The JICA agrees to employ Contractor and the
Contractor agrees to perform the work for the construction of
Model Infrastructure of Soft Soil Foundation for the
Irrigation Engineering Center Project located at Charoeyay,

Saaut Prakam Prefecture, for the total amount of _____
_____ Baht. (_____), hereinafter
called "Contract Price".

The following documents shall form integral part of
the Contract:-

Terms and conditions of this contract _____

Pledge agreement _____

Technical specifications _____

Bill of Quantities _____

Drawings _____

Article 2 Performance Bond

As a security for the faithful performance of the
work under this Contract, the Contractor has on the execution
of this Contract deposited a performance bond with JICA

_____ Baht (_____) in
cash, or in lieu thereof a Bank Guarantee issued by the _____

_____ bearing the number _____
and dated _____ in the amount of _____

Bhat (_____) which represents
five (5) percent of the Contract Price, the name of the
issuing bank and the form of the bank guarantee are to be
approved by JICA.

The JICA will return the performance Bond in cash or the bank guarantee to the Contractor as the case may be at the end of the twelve (12) months after final acceptance of the work by JICA as stipulated in Article 15 of this Contract, provided that the completed work shall not show any defect or damage caused through the fault of the Contractor, or through the fault of any new Contractor in the case of termination of Contract by JICA under Article 4.

Should the Contractor be in default, JICA shall have the right to demand payment from all or any part of the performance bond. In addition, the Contractor shall remain liable for the full loss sustained by JICA.

Article 3 - Payment

The JICA agrees to effect payments for the work to the Contractor in the following manner:-

a. Advance Payment, to be effected upon the bringing of equipment and materials required for the work and properly stored at the job site by the Contractor and of value estimated by the Inspection Committee.

..... which corresponds to Thirty (30) percent of the Contract Price shall be paid upon signing of this Contract.

b. Interim Payment, to be effected according to the progress of the work satisfactorily executed by the Contractor and accepted by the Inspection Committee.
..... which corresponds to Thirty (30) percent of the Contract price shall be requested for payment at

c. Final Payment, to be effected upon the satisfactory completion of the work by the Contractor and accepted by the Inspection Committee.

The remainder of
..... which corresponds to Forty (40) percent of the Contract Price, shall be paid after the Final Certificate by the JICA for payment to the Contractor.

Payment under (b) and (c) shall be effected within day after the respective acceptance of the work by the Inspection Committee.

Taxes payable by the Contractor, if any, shall be deducted at source by JICA on each payment.

It is expressly understood that payments by JICA do not mean acceptance responsibilities under this Contract.

Article 4 Completion Time

The Contractor agrees to commence the work at the site within ten (10) days from the date of signing of the Contract (commencement date) and the Contractor agrees to satisfactorily complete the work within days (completion time) after the date hereof which will become due on 1987 (completion date).

If the Contractor fails to commence the work by the above commencement date, or should in the course of the construction any event occur which may reasonably cause JICA to believe that the Contractor will not be able to complete the work on the completion date, or should the Contractor fail to meet any of the Contract requirements, JICA shall have the right to terminate the Contract by giving written notice to the Contractor.

However, in case that the Contractor fails to complete the work by the completion date, or to meet any of the Contract requirements, if the Inspection Committee judges that the Contractor has the ability for completion of the work within reasonably extended period, the Contractor may be permitted by JICA to continue the work beyond the completion date but within the time.

Article 5 Penalty

In case that the Contractor is in default as mentioned in Article 4, the Contractor agrees to be responsible to JICA as follows:-

5.1 In case of the termination by the default of commencement for the work, the Contractor shall pay a penalty of twenty thousand Baht (20,000.00 Baht) per day counting from the commencement date until the new Contract is completely executed with a new Contractor for this work, the period of which is included the time spent for finding the new Contractor and excuting the new Contract etc.

5.2 In case JICA judges that the Contractor will not be able to complete the work within the completion time and thereby terminates the Contract, the Contractor shall pay a penalty of twenty thousand Baht (20,000.00 Baht) per day counting the number of days in the same manner as prescribed in 5.1 above. However, the JICA may reduce such number of days according to the ratio between the completed work and the total work as may be decided by the Inspection Committee.

5.3 In case the Contractor fails to complete the work by the completion date or to meet any Contract requirement, the Contractor shall pay a penalty of twenty thousand Baht (20,000.00 Baht) per day counting from the date

following the completion date until the work satisfactorily completed and accepted by the Inspection Committee.

Article 6 Compensation

If JICA sustains any losses as direct or indirect damages caused by the Contractor's failure, the Contractor shall compensate JICA for such losses. The parties agree that time is essential for completion of the work.

Article 7 JICA's right for default

The JICA has the sole and absolute right to decide whether to terminate the Contract, to impose only the penalty on the Contractor or to claim the compensation for the damage as stated in Article 5 or Article 6. The money due to JICA exercising its right under this article shall be retained and deducted from any money due to the Contractor but yet unpaid, including from the performance bond. If the total amount of the loss is larger than the money above-mentioned, the Contractor agrees that the JICA has the right to retain the construction equipment, materials and supplies etc. and demand payment of the balance from such equipment etc. or proceeds of sale thereof.

Article 8 Contractor's responsibility on termination of the Contract

After the Contract has been terminated in accordance with the foregoing Article 4, JICA shall have the right to employ another Contractor (hereinafter called the "New Contractor") to carry out the remaining parts of the work, and the payment for the Contractor that fail to complete the work shall be made out of the necessary Contract Price for the remaining work. Should the remaining amount after payment of the advance and interim payment from the Contract price, be insufficient to effect payment to the new Contractor, the difference between such remaining amount and actual cost estimated by JICA for the satisfactory completion work carried out by the New Contractor, shall be deemed as direct loss sustained by JICA, and the Contractor shall pay such difference to JICA within ten (10) days from the date of request by JICA, failing which interest at the rate of eighteen (18) percent per annum shall be charged thereon.

Article 9 Inspection Committee

The Inspection Committee, authorized to act on behalf of JICA will be appointed by JICA and the Inspection Committee is entitled to do all things that JICA may do so. The Inspection Committee shall control and supervise the work

all the times whether it is in the preparation or implementation of the work and the Contractor shall promptly furnish all necessary Facilities for proper inspections of the work in accordance with the Inspection Committee's request. At any moment the Inspection Committee can request the Contractor to stop the Works, if necessary and the Contractor shall have no claim on JICA for extension of the completion time due to such suspension of the work under this Article.

The inspection will not be deemed as the acceptance of the work, and the Contractor shall not be relieved from his responsibility to meet the Contract requirements by the fact that the Inspection Committee exercise their duties. Should it be found that the work has not been satisfactorily performed in the faithful manner, the Contractor shall correct any part of the work indicated by the Inspection Committee within the period specified by the Inspection Committee.

Article 10 Prohibition for the equipment removal

Should the Contractor fail to complete the work during the completion time or the Inspection Committee judges that the Contractor will not be able to satisfactorily complete the work, any equipment and materials brought to the site for use on the work shall not be removed without the prior approval of the Inspection Committee in writing.

Article 11 Rectification of the defective construction

For a further period of one (1) year after satisfactory completion and final acceptance of the work by JICA, whether completed by the Contractor or by the new Contractor in case of termination of Contract under Article 4, any damage to the work which is caused by the Contractor's fault, either because of defective workmanship or the use of inferior materials or any other cause, shall be made good as necessary by the Contractor to the satisfaction of JICA at no extra cost.

In case of the termination of the Contract, JICA may decide which part of the work should come under the Contractor's responsibility, and requests the Contractor to make good of the damaged work. Should the Contractor fail to do so within period specified after receipt of written request to do so from the JICA, JICA shall have the right to employ another Contractor to carry out such work and the Contractor agrees to bear all expenses incurred.

Article 12 Discrepancies among the Contract Documents

If, prior to or during the course of the work, any discrepancies are found in the drawings and/or the Technical Specification etc. attached to the Contract, the Contractor

shall follow the ruling given by the Inspection Committee at no additional cost to JICA.

Article 13 Construction method and temporary work

The construction method including implementation schedule and plan of the temporary work such as installation of temporary facilities, offices, ware houses, construction roads, electric wiring, etc. shall be submitted by the Contractor and approved by the Inspection Committee at least 10 (ten) days in advance of the commencement of the work.

Should the cost of the above temporary work be estimated in the unit cost of each work items of Bill of Quantities in this Contract, and the Contractor is not entitled to claim any amount of charges for the temporary work.

Article 14 Mondification of plan

If the Inspection Committee finds it necessary to make modification of construction design, quantities and/or materials and so forth during the course of construction, JICA has the right to order the modification of the work to the Contractor, and such order shall be made in writing from the Inspection Committee to the Contractor.

The JICA agrees to adjust upwards or downwards the necessary expense for such modification to the Contractor, which will be estimated by unit price in the bill of quantities of the Contract in case of modification of quantities of construction works. In the case of additional work which are not quoted by unit price in the bill of quantities of the Contract, the Inspection Committee will make estimation thereof and JICA will pay to the Contractor for such additional works accordingly. But if the Contractor does not agree to such estimation, the Contractor is then entitled to negotiate with JICA. Also the extension of the completion time due to the modification shall be given by JICA who shall have the sole right to decide the number of days of such extension.

Article 15 Acceptance of the work

When the entire work has been completed, the Contractor shall submit the invoice in written form indicating the work actually completed to the Inspection Committee. If there are compliance with drawings or Technical Specifications, JICA shall accept the work as the final acceptance of satisfactory completion work within ten (10) days after the receipt of the written form and it shall be deemed that the final acceptance has been made on such date of the receipt of the written form.

On the other hand, should non-compliance with drawings or Technical Specifications or defects be found in the work executed by the Contractor, the Inspection Committee will have the right not to accept the work and to order the rectification of the work. If the required period for the rectification of the work is beyond the completion date, the Contractor shall not be relieved from its responsibility to pay the penalty as stipulated under clause 5.3, and after the completion of rectification of the work, then the final acceptance will be made in the same manner as described in the first paragraph of this Article.

During the course of construction, whether in the completion time or of extended time specified in the last paragraph of Article 4, JICA has the right to accept a part of the work already completed in the written form which shall be considered as a part of final acceptance. However, both parties shall negotiate with each other for the maintenance and usage of the accepted part of the work, and the Contractor is not entitled to request the extension of the completion time due to any interruption caused by the use of such accepted work by JICA, the Inspection Committee or the officers of Thai Government authorities, or any delay in repairing such accepted work.

Article 16 Construction engineer

The Contractor shall appoint a construction engineer at his own expence for the supervision of the work performance, who shall be authorised to act on behalf of the Contractor, and the instructions given to him shall be deemed as given to the Contractor, and accepted by JICA, who shall stay at the job site all the time and shall not leave without obtaining the prior approval of the Inspection Committee. If the Contractor replaces the construction engineer, the Contractor shall obtain the prior approval from the Inspection Committee in writings.

Article 17 Replacement of Labour, Engineer and Foreman

The Inspection Committee may request the Contractor to remove any of the Contractor's labours, foremen or engineers if it appears to the Inspection Committee that such labourer, foreman or engineer is incompetent for his job or is not suitable or is not capable of handling his workmen or staff, and the Contractor shall promptly replace any such labourer, foreman or engineer. No extra cost or claim for extension of time will be allowed because of such replacement.

Article 18 Sub- Contractor

The Contractor shall not sub-contract or assign any portion of the work under the Contract without obtaining the prior approval of JICA who has the sole right to decide which portion of the Works may be sub-contracted or assigned to the sub-Contractor. However, the Contractor shall be fully responsible for the work done by the sub-contractor.

Article 19 Notice

All notices required by the Contract shall be effective only at the time of receipt thereof, and only when received by the parties concerned at following address:-

JICA

Thailand Office.

1674/1 New Petchburi Road, Bangkok.

The Contractor

.....
.....
.....
.....

All notices required by the terms of the Contract shall be made in writing in English Language, and delivered by registered mail or hand delivery.

Article 20 Dispute

In the event of any dispute arising from the interpretation and performance of the terms of the Contract, both parties agree to make the best attempt with sincerity and in good faith to negotiate and amicably settle such dispute, failing which the parties agree to refer such dispute to arbitration under Thai Commercial Arbitration Rules and Regulation, Bangkok, by two(2) arbitrators, each of which is to be appointed by each party. If either party fails to appoint its arbitrator within seven (7) days or should the arbitrator fail, within fifteen (15) days after their appointment, to agree upon the decision of the dispute or no decision is reached on the appointment of an umpire, then dispute shall be brought before the Court the Thainland decision under the laws and procedures of the Kingdom of Thailand.

The Contract is executed in duplicate of same tenor, one of the original copy to be kept by JICA and the other original copy to be kept by the Contractor. Both JICA and the Contractor have set their signatures and affixed the seals thereto in the presence of the witnesses.

..... JICA

Mr. Tsutomu SATO, Resident Representative,
Thailand office, Jaapan International Cooperation
Agency

..... Contractor

..... Witness

..... Witness

8 - 2 工事仕様書 (案)

TECHNICAL SPECIFICATIONS
ON
CONSTRUCTION OF MODEL INFRASTRUCTURE OF SOFT SOIL FOUNDATION
FOR
THE IRRIGATION ENGINEERING CENTER PROJECT
IN
THAILAND

THAILAND OFFICE

JAPAN INTERNATIONAL COOPERATION AGENCY

(JICA)

TECHNICAL SPECIFICATIONS

PART 1. SPECIAL PROVISION.

PART 2. GENERAL CONSTRUCTION FACILITIES

PART 3. CARE OF WATER DURING CONSTRUCTION

PART 4. COFFER DAM

PART 5. EXCAVATION.

PART 6. EXPERIMENTAL CONSTRUCTION OF FOUNDATION IMPROVEMENT
WORKS.

PART 7. IMPROVEMENT WORKS OF FOUNDATION BY SAND COMPACTION
PILE METHOD

PART 8. IMPROVEMENT WORKS OF FOUNDATION BY SOIL CEMENT
COLUMN METHOD

PART 9. IMPROVEMENT WORKS OF FOUNDATION BY GRAVEL
COMPACTION PILE METHOD

PART 10. OTHER RELATED CONSTRUCTION WORKS

TECHINICAL SPECIFICATIONS

PART 1 SPECIAL PROVISION

1-01 The Contractor shall exercise utmost care so that his construction operations will not damage any existing structure except such structures as specified to be dismantled. Any damages on the such existing structure or facilities shall be made good by the Contractor at his expense.

1-02 If it is necessary in the prosecution of the work to interrupt or obstruct the drainage of the surface, the flow of artificial drains and the flow of irrigation canal, the Contractor shall provide for the same during the progress of the work in such a way that no damage shall result to either natural or artificial irrigation or drainage which he may interrupted, he shall be held liable for all damages which may result therefrom during the progress of the work.

1-03 The Contractor is expected to visit the location of the work and make his own estimate of the facilities needed for the work.

In the successful execution of the Contract, the Contractor is expected to familiarize himself with local conditions, availability of labour, transportation facilities, uncertainties

of weather, and other contingencies. From investigations, made at site, it is believed that topographical conditions are approximately as shown on the drawings, but the nature of the materials and the depth of satisfactory foundations, are not guaranteed. It is expressly understood that JICA will not be responsible for any deduction, interpretation, or conclusions made by the Contractor. JICA does not guarantee that other materials will not vary from those indicated by the drawings.

1-04 Elevation referred to the datum plane are to be determined from bench marks established by JICA or the Inspection Committee at the site of the work.

1-05 The Inspection Committee will establish the necessary survey monuments and bench marks at convenient points in the area covered by this contract for use of the Contractor in laying the lines and grades required for the proper conduct and execution of the work. All stakes, bench marks, etc., placed by the Inspection Committee in laying out the work shall be carefully guarded and preserved by the Contractor, and in such case stakes or marks are misplaced or rendered useless through the carelessness or negligence of the Contractor or his agents, employees or workmen, they will be replaced by the Inspection Committee at the expense of the Contractor.

1-06 The Contractor shall execute the work to the lines and grades given by the drawings and/or the Inspection Committee. The Contractor shall, at his own expense, furnish all stakes, templates, pattern, platforms and labor that may be required in setting or laying out any part of the work.

PART 2 GENERAL CONSTRUCTION FACILITIES

2-01 SCOPE

This part covers the construction and/or maintenance of access roads, setting up of Contractor's camp facilities, providing camp security and the disposition of the Contractor's various facilities at the end of the Contract.

2-02 ROADS

(a) The Contractor shall improve, repair and widen, if necessary, existing roads to satisfactorily meet his haulage requirements. He shall also construct all other roads within the construction area which he deems necessary in the prosecution of his work. The improving, widening new roads shall be made without cost to JICA, and same shall be the responsibility of the Contractor during and up to the completion of all construction work under the Contract.

2-03 CONTRACTOR'S CAMP FACILITIES

(a) If the Contractor deems necessary, he shall grade his camp site; construct his office, employees' housing, warehouses, machine and repair shops, fuel storage tanks; and provide such other facilities that the Contractor deems necessary for maintaining health, peace and order in the camp and work area.

(b) The location, construction, operation and maintenance of such camps and facilities shall be subject to the approval of the Inspection Committee. At least ten (10) calendar days to the date on which the Contractor desires to begin to work on in feature of camp construction, the Contractor shall submit for the approval of the Inspection Committee drawings and specifications, in sufficient detail to permit determination of suitability of the construction in compliance with these specifications, and no camp construction of any kind shall be undertaken until such drawings and specifications have been approved by the Inspection Committee.

2-04 CAMP SECURITY

The Contractor shall provide his own security force to the extent that he deems necessary for maintaining peace and order in the camps and work areas and to safeguard materials and equipment.

2-05 DISPOSITION OF CAMP AND CONSTRUCTION

FACILITIES

After the completion of the work covered by the Contract, the entire camp of the Contractor, including its water supply system, quarters, warehouses, shops and other facilities therein; and all other temporary installations at work areas shall be removed by the Contractor and the site shall be cleaned.

APART 3 CARE OF WATER DURING CONSTRUCTION

3-01 SCOPE

In accordance with specifications contained in this part, the Contractor shall care the water during construction so that improvement work of foundation and excavation of testing canal can be performed in areas free from water. Care of water during construction shall include provision for drainage and pumping system for dewatering the specified areas corresponding to the construction methods and the stages, the construction of coffer dam, drainage canal and temporary bulkheads necessary for the protection of construction operations from encroachment by water.

3-02 DRAINAGE AND PUMPING

The contractor shall submit a water control plan during a whole construction period for approval by the Inspection Committee at least one (1) week in advance of the dewatering all work areas so that work can be carried out in a suitable dry condition by draining and/or pumping all water during the process of construction until its completion except for a certain space of pontoon if used.

The Contractor shall construct drainage ditches, pits, culverts, dikes or other protective work to ensure that surface water of any origin be kept away from the work areas and shall furnish, operate, and maintain at his own expense all necessary pumps, to keep all work areas in amply dry condition, and prior to final acceptance of the work by JICA, the Contractor shall remove, fill or plug all temporary drainage structures and pumping equipments at his expense.

The Contractor shall be fully responsible for any damage or delay to the work caused by failure of dewatering of protective work, and also shall repair or reinstate at his expense any damage to foundations, excavation slopes or any other parts of the work.

Pumped water shall be discharged to a suitable distance as far as possible from the work area. The systems used for dewatering and water eliminations shall not cause any damage to the testing canal facility.

3-03 PAYMENT

No separate payment shall be made for the care of water during construction. But the cost of furnishing, constructing, operating, maintaining, and removal of temporary drainage structures, canals, and pumping system necessary to keep construction operations free from water shall be included in

the item of Temporary works as indicated in the Bill of Quantities.

PART 4 COFFER DAM

4-01 SCOPE

This part covers the work necessary to construct, maintain a coffer dam necessary to protect the works from water coming from and/or discharging any source including sea, river, rain and subterranean, so that performed work, except where precisely approved, can be performed free from stagnant and/or running water.

4-02 COFFER DAM

A coffer dam at the lower part near an existing shrimp farm shall be constructed and maintained in accordance with the drawings and these specifications.

The coffer dam at the lower part is to be constructed for the permanent structure. The Contractor shall install discharge pumps near the coffer dam and shall operate the dewatering artificially during construction period at this own expense.

4-03 MATERIALS

The Contractor shall submit for the approval of the Inspection Committee locations, areas, drawing and other necessary specifications of borrow areas which the Contractor proposes to use for obtaining fill material.

The Contractor shall maintain and operate sufficient excavating and hauling equipment so that an adequate amount of fill material from all sources is available as required. Operations in borrow areas shall not be on danger roads, buildings, or structures. Borrow areas shall be graded to provide drainage from all parts of the excavated areas. When operations in a borrow area have terminated, the area shall be dressed to a neat and orderly appearance, as approved by the Inspection Committee.

Materials containing brush, roots, sod or other perishable material will not be considered suitable for fills. The suitability of the materials shall be subject to the approval of the Inspection Committee.

4-04 FOUNDATION PREPARATION

All horizontal and sloped earth surfaces, upon which embankment material is to be placed or other foundation surfaces whose locations are specifically indicated by the Inspection Committee, shall consist of undisturbed or compacted material and shall be clean, damp, free from standing or running water and free from organic matter; and shall be as a foundation for the material to be placed upon them.

4-05 FILL

The fills shall be constructed to the lines, grades and cross sections indicated on the drawings, unless otherwise directed by the Inspection Committee. Generally, a tolerance of plus or minus 0.05 meter from the slope lines and grades shown on the drawings will be allowed in the finished surfaces of the embankments except that the tolerances shall not be continuous over an area greater than twenty (20) square meters.

The fill material shall be dumped and spread in horizontal layers having an uncompacted thickness of not over 20 cm. When material is spread, chunks larger than 10 cm in the size shall be broken down by approved means or removed.

The Contractor shall keep the elevation of coffer dam indicated on the drawings during the construction period of the work using extra banking or additional banking at this own cost.

PART 5 EXCAVATION

5-01 SCOPE

In accordance with the specifications, contained in this part, and as shown on the drawings, or otherwise directed by the Inspection Committee the Contractor shall perform all required open excavation and foundation preparation pertinent to the construction work.

5-02 EXCAVATION SLOPES OF TESTING CANAL

The excavation slopes of testing canal facility consists of the following four (4) types.

1. Non-treatment foundation, slope 1:4
2. Non-treatment foundation, slope 1:6
3. Sand compaction pile treatment, slope 1:3
4. Soil cement column treatment, slope 1:4

5-03 OPEN EXCAVATION

(a) Genral

Open excavation under these specifications consists of the removal, hauling, dumping, and satisfactory disposal of the all materials from required excavations for testing canal and miscellaneous excavations for other structures included under this Contract.

Open excavation shall be performed to the lines and grades

shown on the drawings or established by the Inspection Committee. The Inspection Committee may modify slopes of excavation to fit conditions encountered during construction. Such changes or modifications shall not be considered by the unit prices bid. All necessary precautions shall be taken to preserve the ground outside the specified lines and grades in the soundest possible condition.

(b) Commencement of excavation works

The excavation works of testing canal facility shall be commenced after the foundation improvement works. Any work of excavation shall not be commenced without prior approval of the Inspection Committee. After the commencement of excavation works, any loads shall not be placed on the top of slope except for the two(2) corners shown on the drawings and any heavy equipment also shall not be allowed to travel on these places.

(c) Influence of construction equipment

The Contractor shall pay utmost careful attention to decrease the influence by construction equipment on the soft soil foundation during excavation works.

At the excavation works, the contractor shall take care not to loosen the foundation of testing canal.

(d) Finishing works

Finishing excavation works shall be performed to use manual digging within thirty (30) centimeters from specified lines. The specified lines shown on the drawings shall be finished to be flat and smooth as much as possible.

(e) Monitoring instruments

The Contractor shall exercise the time of installation of monitoring instruments and cables. The Contractor shall not give any damages to the monitoring instruments and cables. In cases where any damages are caused to these facilities, the Contractor shall be liable to repair or compensate such damages at his own expense by the date appointed by the Inspection Committee.

(f) Other conditions

- i. The Contractor shall pay attention to overturing, sliding and non-uniform settlement of heavy equipment on soft soil foundation.
- ii. On the soft soil foundation, the maximum converted weight of heavy equipment shall be deducted less than 0.3 kgf/cm² using sandmat or steel plate, etc.

5-04 DISPOSITION OF EXCAVATED MATERIALS

The material coming from the excavations and not suitable to be utilized for fills, backfills and aggregates must be unloaded in disposal areas indicated on the drawings or designated by the Inspection Committee.

The Contractor shall submit for the approval of the Inspection Committee on appropriate utilization plan of the spoil area which the Contractor uses for the work under this Contract, and any kind of disposition shall not be undertaken before obtaining the said approval. Excavated material not suitable for fill or otherwise not needed shall be wasted in approved spoil areas. Spoil piles shall be constructed to the stable slopes of the material being wasted. Any spoil pile exceeding two (2) meters in height above the ground surface shall not be performed. Spoil material shall be spread and graded so that surface drainage will not be concentrated and will not create and/or accelerate undesirable erosion in spoil areas.

5-05 MEASUREMENT FOR PAYMENT OF OPEN EXCAVATION

A survey of the areas to be excavated shall be made by the Contractor prior to the commencement of the work under this Contract, and all measurements of excavation shall be based on this survey without regard to any change that may occur during the prosecution of the work. All such surveys shall be the subject to check and approval by the Inspection Committee. Volumes will be computed and shall be the amount between the

original ground determined by the survey and the slopes, lines and grades shown on the drawings or established by the Inspection Committee.

PART 6 EXPERIMENTAL CONSTRUCTION OF FOUNDATION
IMPROVEMENT WORKS

6-01 SCOPE

Preceding the improvement works for foundation of the inside slopes of the testing canal, the following experimental works of improvement methods shall be carried out as shown on the drawings.

- i. Sand compaction pile method
- ii. Gravel compaction pile method
- iii. Soil cement column method

6-02 MAIN OBJECTIVE OF EXPERIMENTAL CONSTRUCTION

The Contractor shall exercise the bellow mentioned main objective of this experimental construction works.

- i. To estimate internal friction angle in constructed sand compaction piles and gravel compaction piles by standard penetration tests.
- ii. To confirm shear strength of constructed soil cement column,
- iii. To confirm diameters of constructed sand compaction piles and gravel compaction piles.
- iv. To check influence on strength of nearby foundations caused by the introduction of sand compaction piles and gravel compaction piles.
- v. To check influence on nearby foundation such as

lateral flow and swelling of original ground surface caused by foundation improvement works.

6-03 TEST ITEMS

The following tests shall be carried out in the experimental construction works.

- i. Mixing test of soil cement column in a laboratory
- ii. Physical property tests on the materials for sand compaction piles and gravel compaction piles.
- iii. Implementation of field experimental construction
- iv. Test on confirming the improvement effect of treatment (by geotechnical investigations and tests)
- v. Arrangement of test results

6-04 MIXING TEST OF SOIL CEMENT COLUMN

Testing condition is shown in the PART 8.

6-05 PHYSICAL PROPERTY TEST

The following tests shall be carried out on sand and gravel material, which will be used for the main construction works.

Sample : at least one (1) sample for each of sand and gravel material from every borrow pit

- Test Item :
- Grain size analysis
 - Unit weight
 - Moisture content

6-06 FIELD EXPERIMENTAL CONSTRUCTION

The location and pile arrangement of the field experimental construction such as sand compaction piles, gravel compaction piles and soil cement columns are shown on the drawings, also the quantities of the field tests by each method shall be based on the Bill of Quantities and the following table.

Quantities of Experimental Construction

Construction Method	Number of Pile	Length of Pile	Total Length of Pile	Remarks
Sand Compaction Pile	3	5.00 ^m	15.00 ^m	included in the real construction
Gravel Compaction Pile	3	5.00	15.00	
Soil Cement Column	3	6.00	12.00	

The following geotechnical investigation and tests shall be performed after the completion of the field experimental construction.

Items and Quantities of In-situ Tests
for the Experimental Construction

Item of Test	Sand Compaction Pile	gravel Compaction Pile	Soil Cement Column
Standard Penetration Test(Inside the Piles)	<ul style="list-style-type: none"> • Location : Center of pile, 1 hole • Boring Depth : 7m • Number of Test : 7times (Depth : every 1m) 	Same as the left	—
Core Bouing (Inside the Piles)	—	—	<ul style="list-style-type: none"> • Location : Center of pile, 1 hole • Boring Depth : 6m • Core Sampling : 6samples (Depth : every 1m)
Thin Wall Sampling (Clay of original ground)	<ul style="list-style-type: none"> • Location : Center between Three Piles, 1 hole • Boring Depth : 7m • Core Sampling : 4samples • Sampling Depth : -1.0, -3.0, -5.0, & -7.0 	Same as the left	—
Field Deusity Test	<ul style="list-style-type: none"> • Location : Center of Pile, 2hole • Numbes of Test : 2times 	Same as the left	—

Items and Quantities of Tests in Laboratory
for the Experimental Construction

Item of Test	Sand Compaction Pile	Gravel Compaction Pile	Soil Cement Column
1. Test on Physical Property			
• Natural Moisture Conteut	<ul style="list-style-type: none"> • Pile Material : 2samplas • Clay : 7samplas 	<ul style="list-style-type: none"> • Pile Material : 2samplas • Clay : 7samplas 	
• Wet Density	<ul style="list-style-type: none"> • Clay : 4samplas 	<ul style="list-style-type: none"> • Clay : 4samplas 	
2. Mechanical Test			
• Unconfined Compression Test	<ul style="list-style-type: none"> • Clay : 4samplas 	<ul style="list-style-type: none"> • Clay : 4samplas 	<ul style="list-style-type: none"> • Pile : 6samples

PART 7 IMPROVEMENT WORKS OF FOUNDATION BY SAND
COMPACTION PILE METHOD

7-01 GENERAL

After the field experimental construction mentioned in the Clause 6-03, the improvement works of foundation by sand compaction pile method shall be carried out at the location as shown in the drawings.

7-02 WORK QUANTITY

The quantity of the works shall be as follows but the improved diameter shall be confirmed by the field experimental construction works.

Quantity of Work by Sand Compaction Pile

Length of Pevitration	Improved Length	Improved Diameter	Number of Piles	Total Improved Length
7.88 m	5.0 m	0.70 m	217 Piles	1,085 m

7-03 SIZE OF IMPROVED DIAMETER

The target value of improved diameter of sand compaction piles shall be 70 cm ($A=0.385m^2$).

7-04 SAND MATERIAL

The range of particle size of sand material shall be

$D_{10} > D_{1mm}$ in the effective diameter of the sand and

$D_{60}/D_{10} = U > 5$ in the coefficient of uniformity. However the

Contractor shall follow the instruction of the Inspection Committee in case that the coefficient of uniformity can not be satisfied with the above value.

7-05 CONSTRUCTION EQUIPMENT

The construction equipments shall be based upon the following class. The Contractor shall submit his list of construction equipment which shall be used at the job site and the approval from the Inspection Committee shall be obtained prior to the commencement of the works.

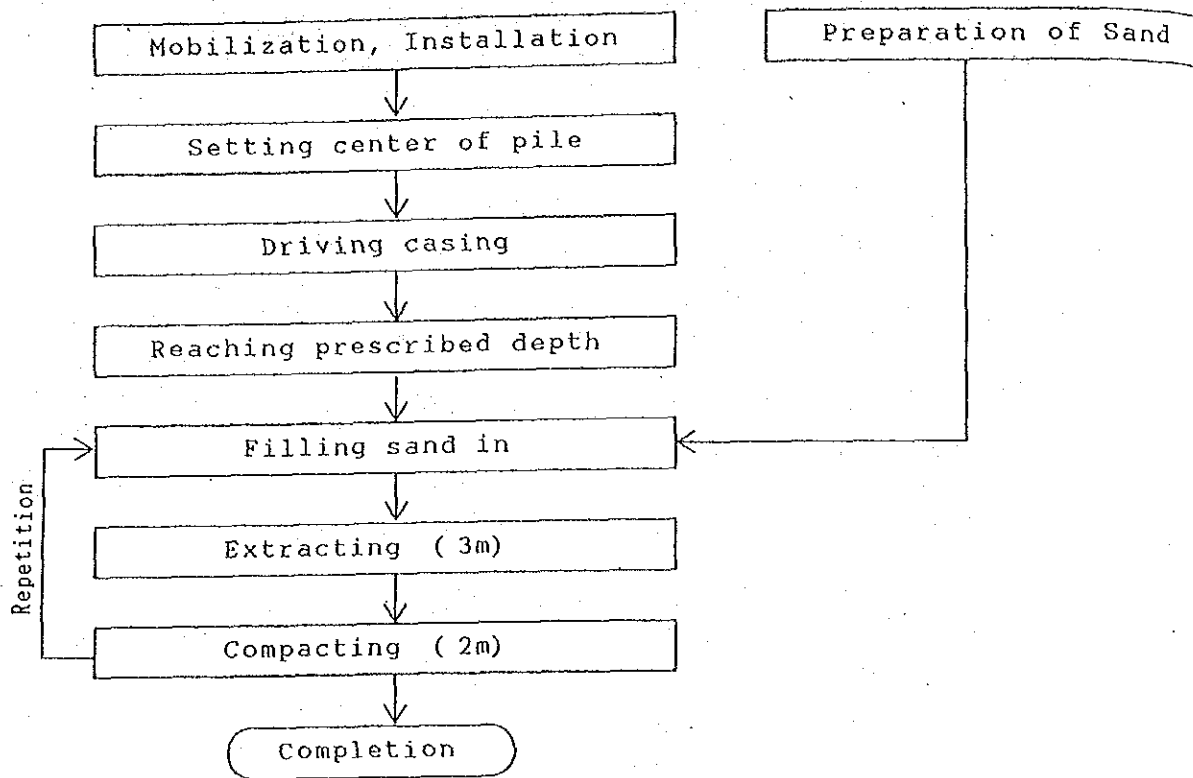
List of Construction Equipment

Name	Standard Specification
Base Machine	Crawler crane, 25 ^t ~ 27 ^t
Guide leader	L=15m
Hammer	3t class
Bumper	not specified
Hopper	not specified
Bucket	0.3m class
Casing	φ40cm, L=12m, steel
Compressor	75HP
Receiver Tank	3m ³ , 7KVA
Generator	75KVA

7-06 PROCEDURE OF CONSTRUCTION

The procedure of the construction shall be conformed to the following flow chart. In case of other construction procedure, the approval from the Inspection Committee shall be required before the commencement of the works. In order to make improvement effect on foundation by this method greater, piling works shall be started from the outside then moved to the inside concentrically in order as shown on the drawings.

Outline of Construction Procedure



7-07 QUALITY CONTROL

Frequency of quality control of works shall be performed as shown in the following table.

Construction Control of Sand Compaction Pile Method

Item of Control	Control Method	Frequency of Control
Pile materials	Mechanical analysis	1time/50m ³
Location of piling	Topo-survey to set up pile	each pile
Depth of piling	Apoint marked on a casing	each pile
Quantity of pile material to be filled in	Bucket	each compaction
Strength of pile	Standard penetration test	1time/30 piles, depth of every 1m
Strength of original ground	Unconfined Compression test	1time/30 piles, thin wall sampling

PART 8 IMPROVEMENT WORKS OF FOUNDATION BY SOIL CEMENT
COLUMN METHOD

8-01 GENERAL

After the field experimental construction mentioned in the clause 6-03, the improvement works of foundation by soil cement column method shall be carried out at the location as shown in the drawings.

8-02 WORK QUANTITY

The quantity of the works shall be as follows except for the variation order from the Inspection Committee.

Quantity of work by Soil Cement Column

Position	Excavation Length	Column Length	Number of Column	Total Excavation Length	Total Column Length
Upper part	6.89 ^m	5.50 ^m	53 columns	365.17 ^m	291.50 ^m
Lower part	17.92	13.79	70	1,254.40	965.30
Total			123 columns	1,619.57 ^m	1,256.80 ^m

8-03 DIAMETER OF MIXING COLUMN

The diameter of mixing column shall be 1.0 meter.

8-04 CEMENT MATERIAL

Improvement material shall be cement slurry made of ordinary Portland cement with a specific gravity of 3.15. Water content ratio (W/C) shall be 100% in weight ratio.

8-05 VOLUME OF CEMENT

For 1.00 m³ of original clay, 198 liter of improvement materials equivalent to 150 Kg of ordinary portland cement shall be used, however the precise amount shall be decided based on the actual data obtained from mixing tests in a laboratory before the construction.

8-06 CONSTRUCTION EQUIPMENT

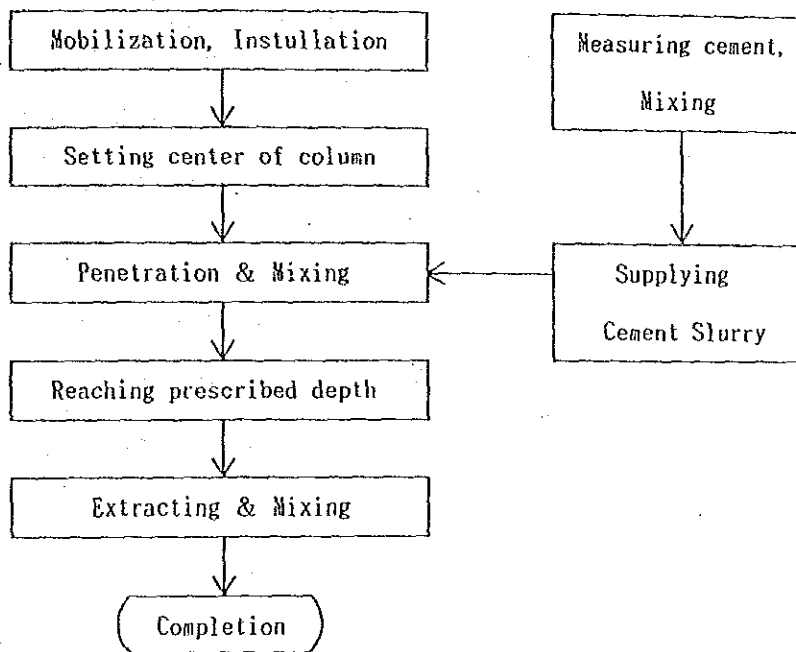
The construction equipment shall be based upon the following class. The Contractor shall submit his list of construction equipment with the same manner in accordance with the clause 7-05 of this technical specifications.

Name	Standard Specification	unit	Nos.	Remarks
Base Machine	Crawler crane, 35 ^t class	Nos.	1	
Leader	Mixing machine guide	Set.	1	
Earth Auger with Attachment	D-60k class	Nos.	1	
Mixing Rod	φ 200 ^m /m	"	1	L _{max} = 25m
Mixing Vane	φ 1000 ^m /m, double type	"	1	
Auger Head	φ 600 ^m /m	"	1	
Generator	125KVA class	Nos.	1	for Earth Auger
Mixer	750ℓx2 class	"	1	
Grouting Pump	150ℓ/min	"	1	
Water Tank	2m ³	"	1	
Submergible Motor Pump	2inches	"	1	

8-07 PROCEDURE OF CONSTRUCTION

The procedure of the construction shall be conformed to the following flow chart. In case of other construction procedures, the same formalities shall be needed in accordance with the specifications described in the clause 7-06.

Outline of Construction Procedure



8-08 QUALITY CONTROL

(a) With regard to the construction of soil cement column, the Contractor shall pay special attention to the following points.

-To control quantity of cement slurry, penetration and extraction velocities of mixing rod shall be checked strictly so as to supply cement slurry to each depth precisely.

-To maintain perpendicularity of the mixing rod.

-To grasp the capacity of a agitating mixer and to set its control standard for rate of rotation, agitating torque, up- down speed of agitating, etc.

-Safety of base machine should be well considered so as not to lower the work efficiency for the construction being carried out on the soft soil foundation.

(b) The Contractor shall perform the following control at the construction period.

- Concentration and amount of cement slurry to be injected

- Mix proportion of slurry shall be 1:1 for water and cement in weight ratio.

- The specific gravity of slurry shall be controlled using control charts and it's measurement frequency shall be once in the morning and in the afternoon.

- Amount of cement to be injected shall be 150kg/m^3 per 1m^3 of original clay.

- Perpendicular construction speed for penetration and

- extraction of soil cement column shall be 1.5 meter per minutes respectively.
- The speed of a rod up and down shall be set at 1.5 meter per minutes each, at the same time the construction speed shall be controlled by the use of marks made on the rod and staff.
 - The rate of rotation of agitating vane shall be gained by eye-measurement.
 - Vertical and horizontal inclination of the leader shall be measured by a theodolite.
 - In order to check the strength of constructed soil cement columns, unconfined compression test and measurement of unit weight shall be carried out using samples taken by core boring the rates of one column to 30 columns. Sampling of cores shall be done for every 1 meter's depth.

8-09 MIXING TEST IN LABOLATORY

- (a) For the determination of the amount of cement slurry to confirm the designed strength, 2.9 Kgf/cm², mixing test of cement slurry shall be performed.
- (b) The standard specifications for the mixing test in a laboratory shall be as follows.

The Standard Specifications for the Mixing Test

Item	Standard Specifications
Kind of material for improvement	Ordinary portland cement
Water-cement ratio(%)	100
Amount of cement to be mixed (kg/m ³)	100, 150 and 200
Mixing time required (min)	10
Age (days)	7, 14 and 28
Molding size	ϕ 5cm height 10cm
Number of mold for one sample (Nos.)	2

(c) Testing items of the mixing test in a laboratory shall be as follows.

-Test for physical property

- Unit weight : 3 samples according to 3 kinds of mixture, 100Kg/1m³, 150Kg/1m³, 200Kg/1m³.

-Test for mechanical property

- Unconfined compression test : 18 samples according to each mold

PART 9 IMPROVEMENT WORKS OF FOUNDATION BY GRAVEL
COMPACTION PILE METHOD

9-01 GENERAL

Implementation of the construction by this work method shall be decided in accordance with the results of field experimental construction described in the PART 6 of this specifications after comparing with the result of sand compaction pile method.

9-02 STANDARD OF PILE

The size of gravel compaction piles shall be decided by the field experimental construction, however the guideline is as follows.

Length of penetration; 7.88 meter

Improved length ; 5.00 meter

Improved diameter ; 0.50 meter

9-03 CONSTRUCTION EQUIPMENT

The construction equipment shall be same with the case of the sand compaction pile method mentioned the part 7 in this specifications.

9-04 CONSTRUCTION CONTROL

The method of construction control shall be same with the clause 7-07 of Part 7 in this specifications.

PART 10 OTHER RELATED CONSTRUCTION WORKS

10-01 GENERAL

The construction of model infrastructure improvement works include, under this Contract, miscellaneous works besides main earth work and foundation improvement works such as installation of displacement piles, installation of wooden staging for observation, protection work of measurement instruments and cable, and movement works of existing houses. The majority of the miscellaneous works shall be either small concrete structure or wooden works, which shall be constructed by means of the combination of earth works, concrete works and wooden works. From the view point stated above, the specifications contained in this part describes mainly special conditions for each work.

10-02 DISPLACEMENT AND FIXED PEGS

The Contractor shall install reinforced concrete pegs for fixed points of measurement and wooden pegs for displacement observation. The scale shall be as follows

-Reinforced concrete peg with a nail screw: 8 Nos

Size : 20^cm x 20^cm x 100^cm -

Wooden pegs with a nail : 133 Nos

Size : 10^cm x 10^cm x 100^cm

10-03 WOODEN STAGING

The Contractor shall construct the following wooden staging to walk for the observation of the testing canal facility.

Material : wooden plate and pegs

Construction length : 230 m

Width of wooden plate : 50 cm

Mean height of staging : 30cm

10-04 PROTECTION WORKS

The Contractor shall perform in the protection works such as concrete pipe works for monitoring cable under the temporary construction road, installation of colour flags on the cable line and installation of bamboo protector for monitoring instruments, etc.

10-05 MOVEMENT OF EXISTING HOUSE

The Contractor shall move the following two existing houses to the designated places.

One wooden two stories house, 192m²

One wooden two stories house, 28m²

10-06 OTHERS

The monitoring instruments shall be procured by JICA and the installation works shall be carried out by the supplier of JICA under the specifications and instructions of manufacturers or Inspection Committee.

The Contractor shall maintain all monitoring instruments

installed at the job site during construction period and the cost shall be included in the item of temporary works as indicated in the Bill of Quantities.

