資料　8　その他の資料・情報

8．１　JICA 環境社会配慮ガイドライン（スクリーニング様式）

8．2　 技術メモ（平成 16 年 2 月 20 日）

8．3　 測量・地質調査

8．4　 目視観察調査による健全度評価

8．1　JICA 環境社会配慮ガイドライン（スクリーニング様式）

JICA 環境社会配慮ガイドライン

別紙 3 スクリーニング様式

案件名：エリトリア国アスマラーマッサワ道路橋梁架け替え計画基本設計調査

事業実施機関：Ministry of Public Works, Infrastructure Department

記入責任者の氏名、所属･役職名、組織名、連絡先
名前：Mr. Petros Tseggay
所属･役職名：環境担当
組織名：Ministry of Public Works, Infrastructure Department
TEL：(291-1)120442
FAX：(291-1)120484
E-Mail：tspetros02@yahoo.com
記入日：2004 年 6 月 1 日
署名：

チェック項目

項目１．プロジェクトサイトの所在地
エリトリア国アスマラーマッサワ道路

項目２．プロジェクトの内容
2-1 以下に掲げるセクターに該当するプロジェクトですか。
■YES □NO

YES の場合、該当するセクターをマークしてください。
□鉱業開発
□工業開発
□火力発電(地熱含む)
□水力発電、ダム、貯水池
□河川･砂防
□送変電･配電
■道路、鉄道、橋梁
□空港
□港湾
□上水道、下水･廃水処理
□廃棄物処理･処分
□農業(大規模な開墾、灌漑を伴うもの)
□林業
□水産業
□観光

2-2 プロジェクトにおいて以下に示す要素が予定想定されていますか。
□YES ■NO
（ただし、本件の中のギンダ橋建設の上位計画である「ギンダ町内バイパス整備計画」では、50 世帯の非自発的住民移転が発生する）

YES の場合、該当するものをマークしてください。
□大規模非自発的住民移転 (規模： 世帯 人)
□大規模地下水揚水 (規模： m3／年)
□大規模埋立、土地造成、開墾 (規模： ha)
□大規模森林伐採 (規模： ha)

2-3 プロジェクト概要
（プロジェクトの規模、内容）
アスマラーワッサワ道路は 1930 年代に建設されたエリトリア国にとって最重要幹線道路である。同道路は 1993 年の独立後から 1997 年まで EU の資金援助により補修・改築工事が実施されたが、橋長 25m 以上の橋梁に対しては補修・改築の対象とはならなかった。これらの橋梁は、経年劣化や車両衝突により安全性が失われた状態のまま共用されている。本計画は、以下の 5 橋の改修を行うことにより、走行の安全性を確保することを目的とする。

計画対象橋梁	改修構想
ギンダ橋（L=39.0m）	バイパス建設に合わせて新橋建設
Gahtelay 1 橋（L=29.9m）	現橋位置にて上部工架け替え
Dogali 1 橋（L=139.4m）	現況の補修
Digali 2 橋（L=34.9m）	現橋付近に新橋建設
Emculu 橋（L=132.3m）	現橋の補修

2-4 どのようにしてプロジェクトの必要性を確認しましたか。
プロジェクトは上位計画と整合性がありますか。
■YES：上位計画名を記載してください。
（ギンダ橋建設に係る上位計画として「ギンダ町内バイパス整備計画」があり、ギンダ橋建設は「ギンダ町内バイパス整備計画」の一部である）
□NO

2-5 要請前に代替案を検討しましたか。
■YES：検討した代替案の内容を記載してください。
（既存橋梁の補修か、或いは新橋建設かが検討された。また、「ギンダ町内バイパス整備計画」に係る EIA 報告書ではバイパス道路を建設しない場合の比較検討を行っており、渋滞緩和や交通事故の防止、経済の活性化のためにバイパス建設は必要であると結論付けている。）
□NO

2-6 要請前に必要性確認のためのステークホルダー協議を実施しましたか。
■実施済み □実施していない
実施済の場合は該当するステークホルダーをチェックしてください。
■関係省庁（Department of Environment, ギンダ町自治体）
□地域住民
□ＮＧＯ
□その他（ ）

項目 3. プロジェクトは、新規に開始するものですか、既に実施しているものですか。既に実施しているものの場合、現地住民より強い苦情等を受けたことがありますか。

□新規 □既往(苦情あり) □既往(苦情なし)
■その他：ギンダ橋については「新規」、残りの 4 橋は「既往(苦情なし)」

項目 4. 環境影響評価の法律またはガイドラインの名称

(Eritrea Environmental and Social Impact Management Guideline for Road Operation および National Environmental Assessment Procedures and Guideline)

プロジェクトに関して、環境影響評価(EIA、IEE 等)は貴国の制度上必要ですか。

□ 必要 ■不要

（ただし、本件のギンダ橋建設の上位計画である「ギンダ町内バイパス整備計画」に対しては「EIA のみ必要」で、EIA は「実施済み」である）

必要な場合、以下の該当する箇所をチェックしてください

□IEE のみ必要 (□実施済み、□実施中、□実施予定)

□IEE と EIA の両方が必要 (□実施済み、□実施中、□実施予定)

□EIA のみ必要 (□実施済み、□実施中、□実施予定)

□その他：以下に記入してください。

項目 5. 環境影響評価が既に実施されている場合、環境影響評価は環境影響評価制度に基づき審査･承認を受けていますか。既に承認されている場合、承認年月日、承認機関について記載してください。

（「ギンダ町内バイパス整備計画」の環境影響評価に対し）

□承認済み(附帯条件なし) □承認済み(附帯条件あり) ■審査中

（承認年月日： 承認機関：Ministry of Land Water and Environment, Department of Environment）

□ 手続きを開始していない

□ その他（ ）

項目 6. 環境影響評価以外の環境や社会面に関する許認可が必要な場合、その許認可名を記載してください。

□取得済み □取得必要だが未取得

許認可名：( )

□ 取得不要

■ その他（既存橋梁解体後に発生する建設廃棄物の処分について Department of Environment から許可を得る必要がある。ただし、廃棄物に係る明文化された法制度は現段階では存在していない。）

項目 7. 事業対象地内または周辺域に以下に示す地域がありますか。

□YES ■NO □分からない

YES の場合、該当するものをマークしてください。

□国立公園、国指定の保護対象地域(国指定の海岸地域、湿地、少数民族･先住民族のための地域、文化遺産等)及びそれに準じる地域

□原生林、熱帯の自然林

□生態学的に重要な生息地(サンゴ礁、マングローブ湿地、干潟等)

□国内法、国際条約等において保護が必要とされる貴重種の生息地

□大規模な塩類集積あるいは土壌浸食の発生する恐れのある地域

□砂漠化傾向の著しい地域

□考古学的、歴史的、文化的に固有の価値を有する地域

□少数民族あるいは先住民族、伝統的な生活様式を持つ遊牧民の人々の生活区域、もしくは特別な社会的価値のある地域

項目 8. プロジェクトは環境社会影響を及ぼす可能性がありますか。

☐YES ■NO ☐分からない

理由：本件対象 5 橋の架け替え新設に係る環境社会影響は軽微である。ただし、ギンダ橋建設の上位計画である「ギンダ町内バイパス整備計画」では、ギンダ橋建設地以外の場所で 50 世帯の非自発的住民移転が必要であり、また、建設時および供用後に新規の雇用の創出や騒音・ダスト･排気ガス、市場の変化などの影響が発生すると想定される。

項目 9. 関係する主要な環境社会影響をマークし、その概要を説明してください。

■大気汚染
☐水質汚濁
☐土壌汚染
■廃棄物
■騒音･振動
☐地盤沈下
☐悪臭
☐地形・地質
☐底質
☐生物･生態系
☐水利用
☐事故
☐地球温暖化

☐非自発的住民移転
☐雇用や生計手段等の地域経済
☐土地利用や地域資源利用
☐社会関係資本や地域の意思決定機関等の社会組織
☐既存の社会インフラや社会サービス
☐貧困層･先住民族･少数民族
☐被害と便益の偏在
☐地域内の利害対立
☐ジェンダー
☐子どもの権利
☐文化遺産
☐HIV/AIDS 等の感染症
☐その他（ ）

関係する環境社会影響の概要：

対象 5 橋梁の架け替えおよび新設工事に伴い発生するダストや騒音が地域住民、特に学校やモスク内の人々に影響を与える。また、既存橋梁の解体に伴い建設廃棄物が発生する。

項目 10. 情報公開と現地ステークホルダーとの協議

10-1 環境社会配慮が必要な場合、JICA 環境社会配慮ガイドラインに従って情報公開や現地ステークホルダーとの協議を行うことに同意しますか。

■YES ☐NO

10-2 NO の場合、その理由は何ですか？

8. 2 技術メモ（平成 16 年 2 月 20 日）

Memorandum of the Rehabilitation of Bridges on the Asmara – Massawa Road in the State of Eritrea at the second site survey conducted from January to February 2004,regarding bridge design and repair works

Eritrean side heading Kidane Berhane and Japanese Consultant Team held series of discussions together with site survey regarding bridge and repair works during 20th January up to 20 th February ,2004.

In series of discussions, repair works on Emculu Bridge is especially highlight based on attachment of chapter 2 "Items Requested by Eritrean Side " describing as "- Emculu Bridge; Repair works to be considered subjected to further investigation" in " Minutes of Discussions on the Basic Design Study on the Project for Rehabilitation of Bridges on the Asmara-Massawa Road in the State of Eritrea(The second field study)" signed January 23, 2004.

Both side have reached to agreement as attached to following pages.
Eritrean side,however, emphasized that the treatment of Emculu Bridge will be clarify after receiving draft final report to be submitted around the end of May,2004.

Asmara、 February 20 、2004

Kidane Berhane	多田一正
	Kazumasa Tada
Director General	Japanese Consultant Team
Department of Infrastrucure	in charge of bridge design
Ministry of Public Works	
State of Eritrea	

MINISTRY OF PUBLIC WORKS
DEPARTMENT OF INFRASTRUCTURE

Memorandum regarding the Rehabilitation of Bridges on the Asmara – Massawa Road in the State of Eritrea at the second site survey conducted from January to February 2004.

1 Comparison with Live Load between AASHTO and Japan Standard

Maximum shearing force and maximum bending moment inclusive of impact are compared regarding Truck Load and Lane Load through 20 – 50 m span bridges, referring Eritrean live load (HS20-44x1.25) and Japan criteria (B live load).

After comparison with both above mentioned criteria, Eritrean side agreed to apply Japan Standard regarding live load with some consideration into HS20-44x1.25 because induced force by Japan Standard always exceeds that of Eritrean standard.

Attachment 1 (Comparison between HS20-44x1.25 and B Live Load)

2 Ghindae Bridge

2–1 Location of planned bridge

Left side two lanes from Asmara in Section (0+000-1+110) is to be implemented as stage construction by Eritrean side in which bridge portion is targeted to be implemented by Japan side, scheduled to be roughly completed whole said by-pass plan totaling 3.3 km long by Eritrean side within 2004 year.

Attachment 2–1 (Location of bridge)

2–2 Bridge Design

2–2–1 Bridge Type

Eritrean side keenly requested to apply Prestressed-Concrete Type Bridge in every newly constructed bridge including this Ghindae Bridge.

Both Japan and Eritrean side agreed to design this Ghindae Bridge as follows;

Bridge length will be 39m long as same as that of Ghindae by-pass plan initially designed by Eritrean side.

2–2–2 Standard Cross Section

(1) Width of Carriageway

Width of Carriageway; (2x3.5m+2x0.25) = 7.50m
Authority; Road Design Standard Part-2 Geometric Design State of Eritrea Ministry of Public Works Infrastructure Department April, 2003
Chapter 6.3 Lane Width, Shoulder Width and Marginal Strip

(2) Side Walks

1) Necessity of both side walks

Authority; Infrastructure Department of Ministry of Public Works has directed to provide side walk on both side of the bridge because of two direction traffic.

Attachment 2−2−2−1 (Reference drawings in other project such as Kna-Fna Bridge)

Road Rank classification for Kna-Fna Bridge (Adikeyih-Menddefera Road) is categorized into the secondary road. Kna-Fna Bridge is scheduled to implement by World Bank finance.

2) Width of Side Walks

1.5m; it is just same as Ghindae Bridge in 4 lane plan.

Attachment 2−2−2−2 (Standard cross section as reference drawings in Ghindae Bridge / 4 lane traffic in By-Pass Plan)

(3) Hand Rail on side walk

New Bridge will be same specification shown in Kna-Fna Bridge (h=1.1m).

2−2−3 General Plan on Ghindae Bridge (Stage Construction, two lane to be constructed by Japanese side)

Attachment 2−2−3 (General Drawing on Ghindae Bridge)

2−2−4 River Bank Protection

River Bank Protection is to be constructed by Japanese side up to 20m away to upstream and downstream on both sides from abutment, judging from violent erosion hazard due to steep valley with zigzag flow around Ghindae Bridge.

3 Ghtelay 1 Bridge・Dogali 2 Bridge

3－1 Carriageway Width and Side Walk

It will be the same as Ghindae Bridge.

3－2 Bridge location of Dogali 2 Bridge

Planned bridge's location is shown in attached topographical survey conducted by Japanese Consultant.

Attachment 3－2 (Location of bridge)

4 Vertical Clearance on the Bridge

Required clearance along Road is stipulated as follows;

Maximum vehicle height shall be 4.60 m height as designated in Article 7 Vehicle External Dimension (b) in Gazette of Eritrean Laws Legal Notice No.61/2002 (Asmara, May 13/2002).

Required vertical clearance stipulated as 5.00 m height directed by the Ministry of Public Works.

Attachment 4 (Vertical Clearance on Existing Concrete Arch Bridge between Asmara and Massawa measured by Japanese Consultant on February, 2004)

5 Emculu Bridge (Repair works)

Attachment 5 (Present condition)

5－1 Repair of Portal (middle span)

Vertical clearance of middle span at Emculu Bridge is measured by 4.74m height, of which clearance is the least one among other concrete bridges except Ghtelay 1 Bridge and Dogali 2 Bridge, so that both Asmara and Massawa side portal members (upper cross beams) were wholly collapsed due to passing vehicles.

Repair works;

Following proposed repair works shown in attachment 5－1 are to secure required vertical clearance at portal position as 5.0 m height so as to install lower portion of repairing portal member at the height of existing lateral member.

In addition, every proposed plan is to provide steel gate with 5.0 m clearance at the out side of concrete arch structure in Asmara and Massawa direction in order to prevent for passing vehicle with excesses height from entering into existing concrete arch.

Alternative A;

Repairing portal member is established, reusing some of remaining reinforcement steel bars at collapsed portal member rapping with new concrete.

Alternative B;

New portal member with H shape girder is connected with friction high-tension bolts through splice plates at the connector made of steel plates installed with concrete main arch. This H shape girder is to embedded with concrete as steel reinforced concrete (SRC) structure.

Alternative C;

Anchor to be fixed with portal member is set at arch main member, drilling arch member. Portal member is connected with this anchor as reinforced concrete or SRC structure.

Among these three alternatives, the Consultant recommends alternative A.

Reason; Judging from overall evaluation of each alternative, alternative A is recommended.

Attachment 5－1 (3 alternatives on repair works of portal member and evaluation of 3 alternatives)

5－2 Investigation results at bearings

Investigation on bearing structures at Emculu Bridge was conducted on 14th, February, 2004. Following facts can be recognized in the wake of this site investigation.

5－2－1 Tilting movable bearing

Some displacement can be found at the movable bearing mainly due to temperature change. This displacement is rotation at bearing structure of which is composed of vertical displacement to the bridge axis and angle rotation.

Rectangular shape of pillow member made of reinforced concrete sandwiched between upper shoe and lower one has rotated induced by bearing rotation seems to be tilted as if shoe structure itself would have tilted. Tilting at this pillow member has not indicated malfunction of movable bearing, preferably has been showing normal performance as expected to the movable bearing.

Attachment 5－2－1 (Observation Results of Movable Bearing Emculu Bridge / Dogali 1 Bridge)

5－2－2 General description induced by temperature stroke regarding movable bearing

(1) To satisfy characteristics of 3 hinged arch structure in proper movement at movable bearing

Proper movement at movable bearing ensures that no constrain force occurs、namely no internal force, at bearing, transforming to displacement at bearing by angle rotation and horizontal displacement, on an account of temperature stress, enforced movement by seismic force to the direction of bridge axial or some reason, for example, running vehicle's collision force to portal member.

It is judged that these bridges characteristics, that are statically determinate one, can be satisfied as properly movable at bearing as expected.

(2) Movement history of movable bearing caused by temperature stress

Movement of movable bearing by temperature is not always followed by change of temperature. Namely, it is said that movement of superstructure normally shows discontinuous history.

(3) Bi- metal effect

A movement induced by temperature in general is rotatary displacement at movable bearing with so called by-metal effect due to two dimensional configuration of superstructure, which is bridge axis direction and vertical direction, rather than one dimensional horizontal displacement.

5－2－3 Fixed bearing

Following facts can be recognized after site investigation conducted 14th, February, 2004.

(1) Fixed bearing has properly maintained initially expected function as no major displacement has occurred.

(2) Excessive external force caused by constrain of displacement could be produced because of constrain of movement due to temperature change and other external force such as seismic force or collision force so on. From these reasons, crock around end

lateral beam near by bearing and bearing attachment, and flaking of covering concrete.

5－3 Repair works of bearing

5－3－1 Replacement of bearing shoe

In displacing bearing shoe, following procedure is applied normally.

a) jacking up superstructure
b) replacement existing shoe by new one
c) jacking down to proper position after removal of support to superstructure

Following problems may arise in order to above mentioned procedure in jacking up method.

(1) It is concerned about possibility of collapse to superstructure because of friction cut at the position of hinge portion at arch crown.

(2) Although this collapse is prevented in physically, but it needs considerable costly countermeasures. For this reasons, this jacking up method is not recommendable in terms of technically and economically stand views.

(3) When Emculu Bridge was constructed; jacking up method for replacement of bearing was not anticipated. As no installation of jacking up point in which reinforcement or strengthening rigidly at the contact point was introduced, additional reinforcement is required.

From these several reasons, it is not applied to replace bearing by jacking up method.

5－3－2 Recommendable countermeasure towards bearing repair

Following four repair works on bearing is proposed;

Attachment 5－3－2 (Repair work plan on bearing)

(1) Expansion of bearing position

It is necessary that bridge superstructure should not fall down from substructure in case of strong earthquake for bridges between Asmara and Massawa located in Great Rift Valley in African Continent.

For this purpose, girder has long enough to the extent that girder has adequate room to the forced horizontal movement not to fall down by expanding length of bearing position.
This installation will enable to prevent from extreme tragedy situation such as personnel damage due to falling down of running vehicles over bridge or bridge collapse influencing social impact in rainy season by loosing crossing over bridge.
It is also expected that substructure's reinforcement could be secured by expanding bearing position as reinforcement of exposed steel bars or surface cracks are repaired for strong earthquake.
However, this proposal was not accepted by the Ministry of Public Works.

(2) Installation of stopper on bearing
It is vital for superstructure not to deviate from proper bearing position to the strong earthquake force by equipping with stopper to bridges located between Asmara and Massawa situated in Great Rift Valley zone.

(3) Repair works on end lateral beam around shoe
As steel bar exposure or cracks can be found around end lateral beam near bearing, rigid ness of end beam is expected to decrease compared with initial construction day.
In order not to further deteriorate rigid ness of end beam.

(4) Cleaning abutment and pier around bearing
Investigation around bearing clarifies following facts;
A piece of mounding up asphalt falling between slab gaps was accumulated as if function of bearing may hinder from proper movement. This asphalt shall be removed periodically, say once a year.

5−4 Repair works on main members
Depending on deteriorated members of superstructures, members to be repaired are categorized as follows;
(1) Slightly damaged member which is possible to be reused
(2) Seriously damaged member to the extent that its reinforced steel bar is needed to replace as this bar yielded
According above criteria, each member is classified to way of repairs works.

Attachment 5−4 (Repair work plan on main members)

6 Dogali 1 Bridge (Repair works)

Dogali 1 Bridge with over 5.0 m vertical clearance is not damaged on portal member by passing vehicles over bridge. On the other hand, repairs on main member like Emculu Bridge are needed to be repaired.

In addition, there are some problems for the bearing but it is not as serious as Emculu Bridge.

Attachment 6 (Present condition and repair work plan)

7 Repair works on lower slab deck on Emculu Bridge and Dogali 1 Bridge

Concrete is spalling off and steel bar is exposed at lower slab deck. In order for bar rust not to penetrate into inside portion, epoxy resin is apply to this slab surface, but this measure is not substantial repair to strong then loading capacity to slab.

Number of repair portion (enclosed section between lateral and stringer)

(1) Emculu Bridge; 30 portions

(2) Dogali 1 Bridge; 20 portions

8 Handrail on Emculu Bridge and Dogali 1 Bridge

As both bridges are lacking of handrail, it is strongly recommended to install handrail made of steel to prevent from falling accidents.

Attachment 1

(Comparison between HS20-44x1.25 and B Live Load)

Summary of bending moment and shaer force depending on span length

1. Bending moment and shaer force without impact

Following table shows maximum forces(bending moment and shearing force) due to life load on siml beams, in which larger value in T-load and L-load will be applied to design works in AASHOTO or Japan Standard.

Bending moment

span	span	AASHTO(HS20-44)				Japan Standard(BLiveLoad)		
L	L	T-Mmax	L-Mmax	Mmax	(Mmax)	T-Mmax	L-Mmax	Mmax
(m)	(feet)	(kNm)	(kNm)	(kNm)	(xE3 f-p)	(kNm)	(kNm)	(kNm)
20.000	65.617	1,222	867	1,222	901	1,500	1,650	1,650
25.000	82.021	1,622	1,230	1,622	1,196	1,875	2,320	2,320
29.000	95.144	1,942	1,562	1,942	1,433	2,175	2,904	2,904
30.000	98.425	2,022	1,651	2,022	1,492	2,250	3,056	3,056
35.000	114.829	2,423	2,131	2,423	1,787	2,625	3,858	3,858
38.000	124.672	2,663	2,447	2,663	1,964	2,850	4,370	4,370
39.000	127.953	2,743	2,556	2,743	2,023	2,925	4,546	4,546
40.000	131.234	2,823	2,669	2,823	2,082	3,000	4,725	4,725
45.000	147.638	3,223	3,265	3,265	2,408	3,375	5,658	5,658
50.000	164.042	3,624	3,920	3,920	2,891	3,750	6,656	6,656

Shearing force

span	span	AASHTO(HS20-44)				Japan Standard(BLiveLoad)		
L	L	T-Smax	L-Smax	Smax	(Smax)	T-Smax	L-Smax	Smax
(m)	(feet)	(kN)	(kN)	(kN)	(xE3 p)	(kN)	(kN)	(kN)
20.000	65.617	275	209	275	62	300	375	375
25.000	82.021	284	232	284	64	300	419	419
29.000	95.144	289	251	289	65	300	450	450
30.000	98.425	290	256	290	65	300	458	458
35.000	114.829	294	279	294	66	300	492	492
38.000	124.672	296	293	296	67	300	512	512
39.000	127.953	297	298	298	67	300	519	519
40.000	131.234	297	302	302	68	300	525	525
45.000	147.638	300	326	326	73	300	556	556
50.000	164.042	302	349	349	78	300	587	587

2. Bending moment and shearing force with impact

Following table shows maximum forces(bending moment and shearing force) due to life load on siml beams. In this table, forces with impact for steel and PC bridge are sumalized while imact coeficient is categolized into various type of bridge such as steel bridge, reinforced concrete bridge(T-load and L-load) and prestressed concrete bridge(L-load).

Bending moment

span	span	AASHTO (HS20-44)			Japan Standard (BLiveLoad)				
L	L	Mmax	I	Mmax+I	Mmax	i-steel	Mmax+I (M)	i-P C	Mmax+I (P)
(m)	(feet)	(kNm)		(kNm)	(kNm)		(kNm)		(kNm)
20.000	65.617	1,222	26.2%	1,542	1,650	28.57%	2,121	22.22%	2,017
25.000	82.021	1,622	24.2%	2,014	2,320	26.67%	2,939	20.00%	2,784
29.000	95.144	1,942	22.7%	2,383	2,904	25.32%	3,639	18.52%	3,442
30.000	98.425	2,022	22.4%	2,475	3,056	25.00%	3,820	18.18%	3,612
35.000	114.829	2,423	20.8%	2,928	3,858	23.53%	4,766	16.67%	4,501
38.000	124.672	2,663	20.0%	3,196	4,370	22.73%	5,363	15.87%	5,064
39.000	127.953	2,743	19.8%	3,285	4,546	22.47%	5,568	15.63%	5,257
40.000	131.234	2,823	19.5%	3,374	4,725	22.22%	5,775	15.38%	5,452
45.000	147.638	3,265	18.3%	3,864	5,658	21.05%	6,849	14.29%	6,466
50.000	164.042	3,920	17.3%	4,598	6,656	20.00%	7,988	13.33%	7,544

Shearing force

Sspan	span	AASHTO (HS20-44)			Japan Standard (BLiveLoad)				
L	L	Smax	I	Smax+I	Smax	i-steel	Smax+I (M)	i-P C	Smax+I (P)
(m)	(feet)	(kN)		(kN)	(kN)		(kN)		(kN)
20.000	65.617	275	26.2%	347	375	28.57%	482	22.22%	458
25.000	82.021	284	24.2%	352	419	26.67%	531	20.00%	503
29.000	95.144	289	22.7%	354	450	25.32%	564	18.52%	534
30.000	98.425	290	22.4%	355	458	25.00%	572	18.18%	541
35.000	114.829	294	20.8%	356	492	23.53%	608	16.67%	574
38.000	124.672	296	20.0%	356	512	22.73%	629	15.87%	593
39.000	127.953	298	19.8%	357	519	22.47%	635	15.63%	600
40.000	131.234	302	19.5%	361	525	22.22%	642	15.38%	606
45.000	147.638	326	18.3%	386	556	21.05%	673	14.29%	636
50.000	164.042	349	17.3%	410	587	20.00%	704	13.33%	665

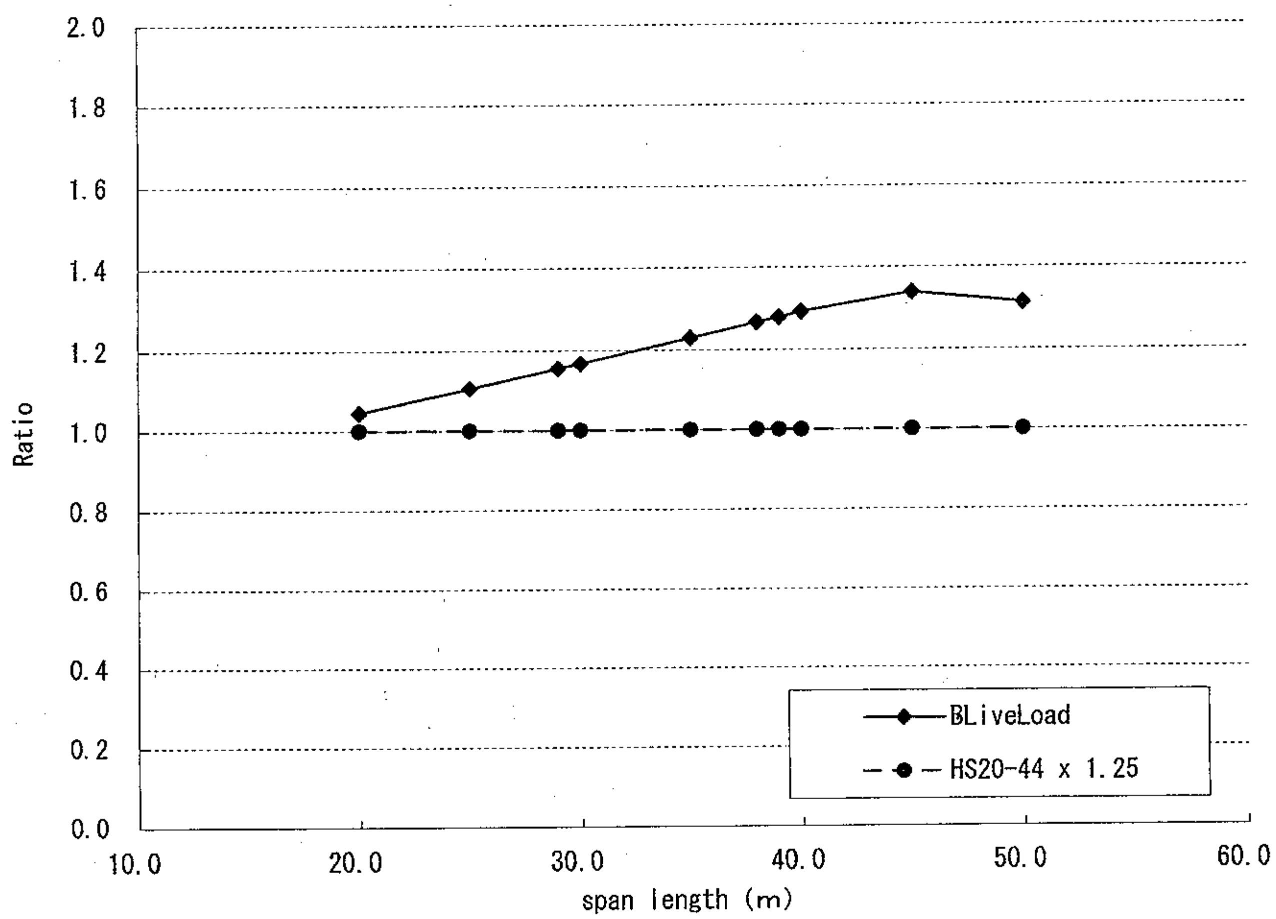
(comparative figure on bending moment)

span L (m)	span L (feet)	ASSHTO (HS20-44) Mmax (kNm)	x 1.25 (kNm)	Japan Standard (BLiveLoad※1) Mmax (kNm)	Ratio ※2
20.000	65.617	1,542	1,928	2,017	1.046
25.000	82.021	2,014	2,517	2,784	1.106
29.000	95.144	2,383	2,979	3,442	1.155
30.000	98.425	2,475	3,094	3,612	1.167
35.000	114.829	2,928	3,660	4,501	1.230
38.000	124.672	3,196	3,995	5,064	1.267
39.000	127.953	3,285	4,107	5,257	1.280
40.000	131.234	3,374	4,217	5,452	1.293
45.000	147.638	3,864	4,830	6,466	1.339
50.000	164.042	4,598	5,747	7,544	1.313

※1 impact coeffi. (BLiveLoad,PC,L load

※2 Ratio: BLiveLoad／HS20-44 x 1.25

Ratio : Bending moment



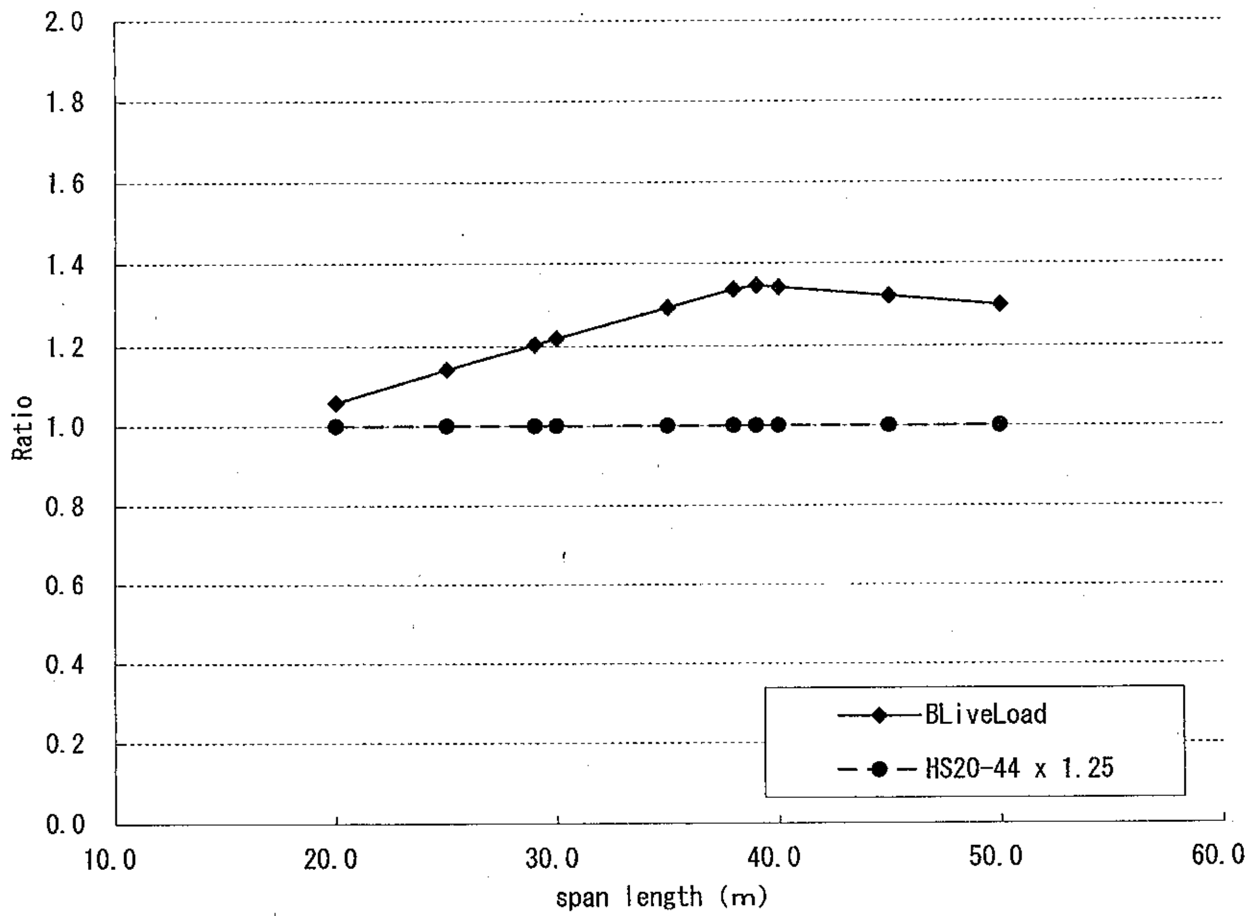
(comparative figure on shearing force)

span L (m)	span L (feet)	ASSHTO (HS20-44) Smax (kN)	x 1.25 (kN)	Japan Standard (BLiveLoad※1) Smax (kN)	Ratio ※2
20.000	65.617	347	433	458	1.057
25.000	82.021	352	440	503	1.142
29.000	95.144	354	443	534	1.204
30.000	98.425	355	443	541	1.219
35.000	114.829	356	444	574	1.292
38.000	124.672	356	445	593	1.335
39.000	127.953	357	446	600	1.345
40.000	131.234	361	452	606	1.341
45.000	147.638	386	482	636	1.319
50.000	164.042	410	512	665	1.298

※1 impact coeffi. (BLiveLoad, PC, L load

※2 Ratio: B life load／HS20-44 x 1.25

Ratio : shearing force

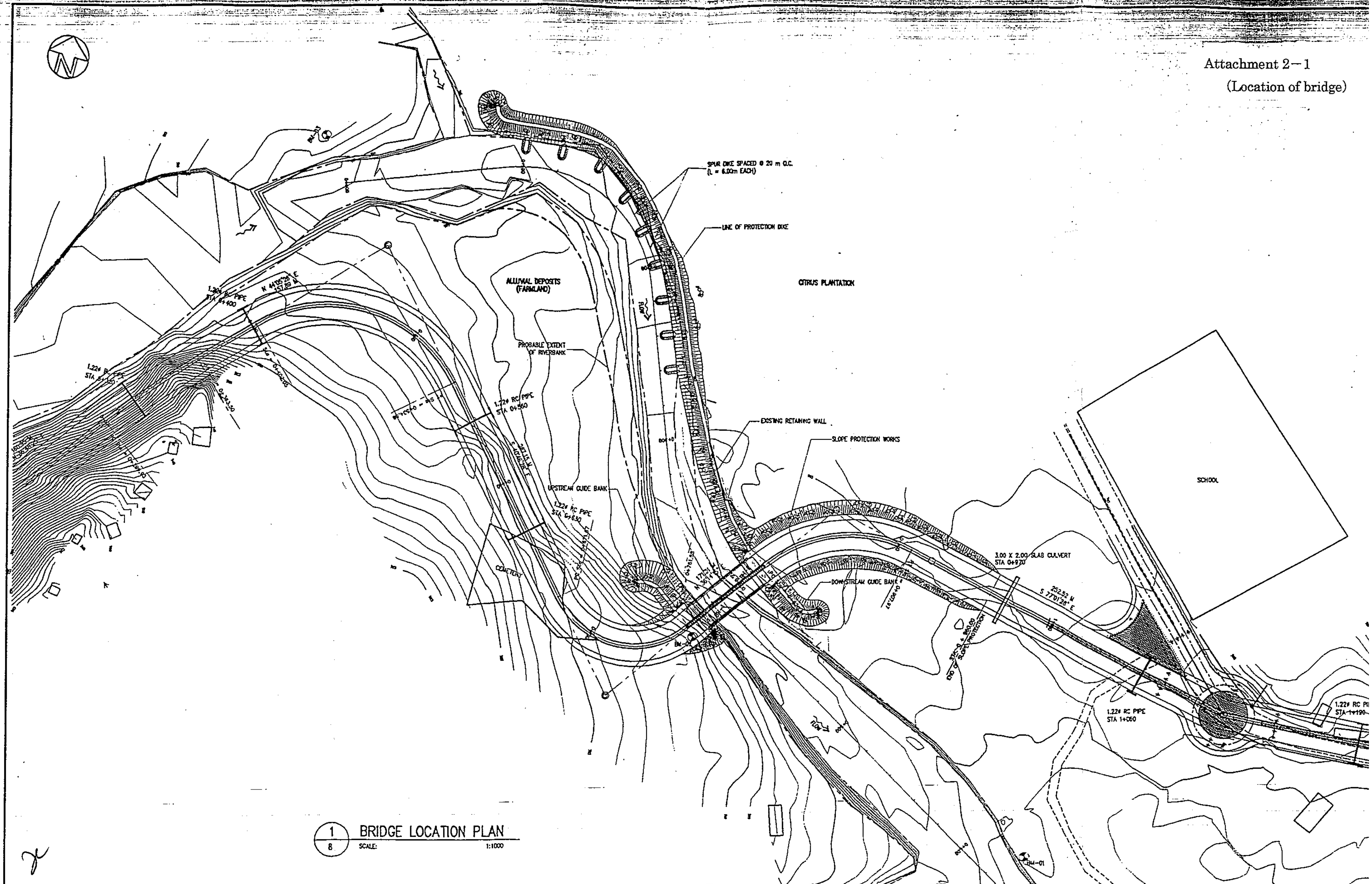


𝒳 𝒷

Attachment 2－1

(Location of bridge)

Attachment 2－1
(Location of bridge)

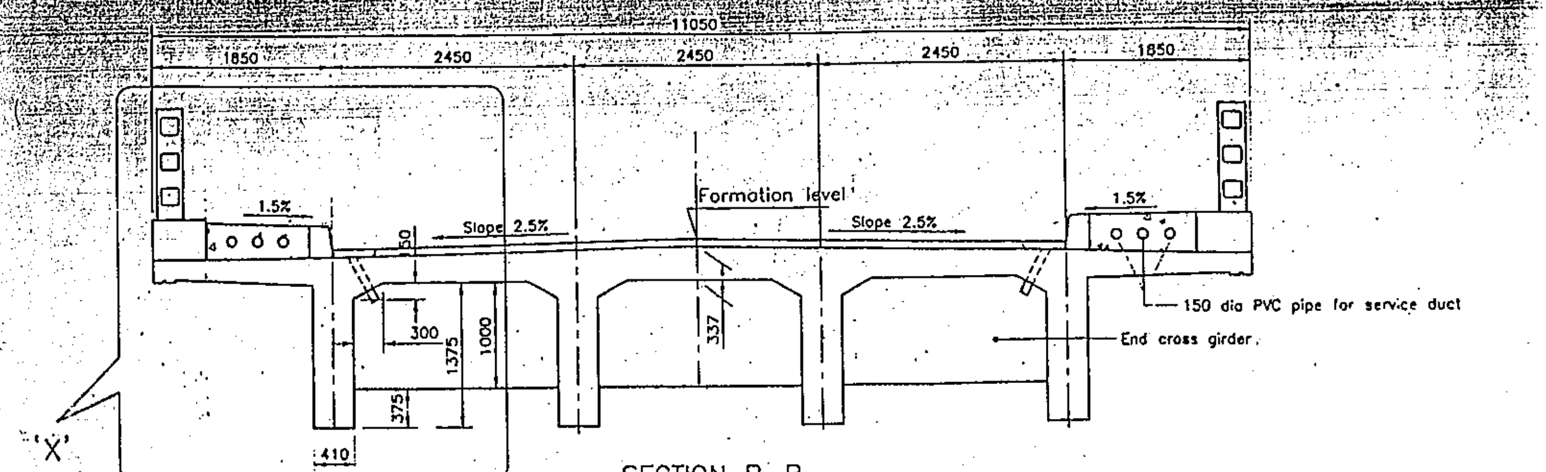


1
8
BRIDGE LOCATION PLAN
SCALE: 1:1000

GENERAL DEVELOPMENT, ENGINEERING & CONSTRUCTION CO., P.L.C. ENGINEERS CONSULTANTS CONTRACTORS	CLIENT: MINISTRY OF PUBLIC WORKS	PROJECT TITLE : GHINDA'E TOWN BY-PASS AND ASSOCIATED BRIDGES	DRAWING NO. 8
J. E. NASH / R. D. ACEDILLO / MOGOSIEN HABTEZION	KIDANE BEKHANE DIRECTOR/ID / HABTEAB TESFATZION DIRECTOR GENERAL/ID	SHEET CONTENT : BRIDGE LOCATION PLAN SHOWING THE LAYOUT OF PROTECTION WORKS	DATE PRINTED: SHEET 8 OF 31 SHEETS

Attachment 2－2－2－1

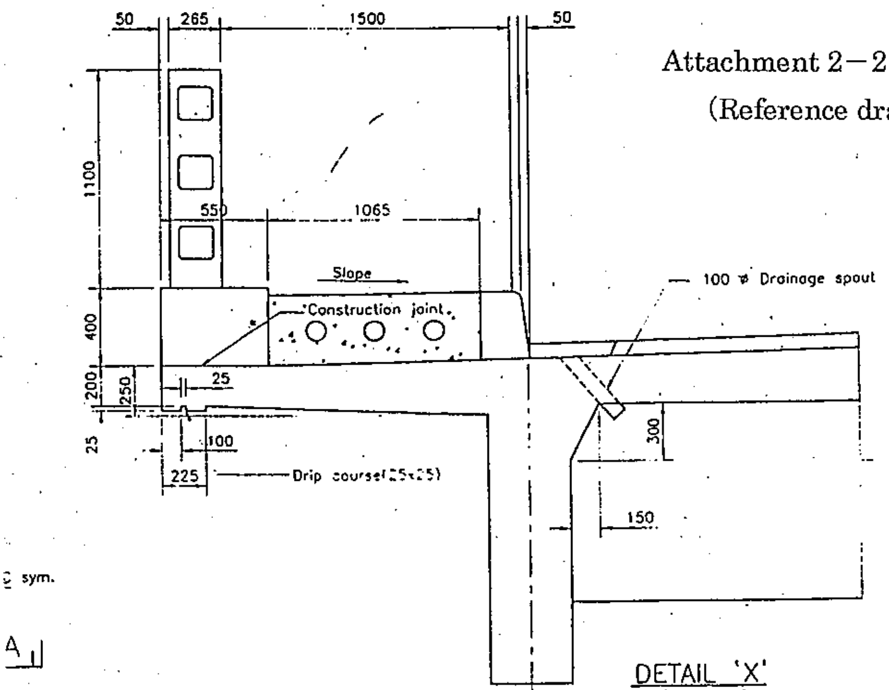
(Reference drawings in other project such as Kna-Fna Bridge)



SECTION B—B
(Scale A)

Attachment 2—2—2—1

(Reference drawings in other project such as Kna—Fna Bridge)



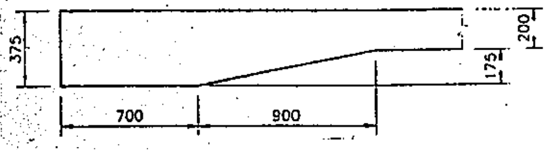
DETAIL 'X'
(Scale B)

NOTES:

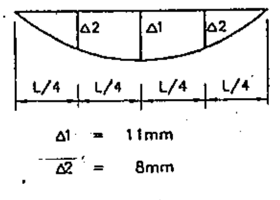
1. All dimensions are in millimetres unless otherwise speci
2. Dimensions are not to be scaled. Only written dimensic shall be followed.
3. For spacing of drainage spouts in plan refer general arrangement drawing of bridge.
4. Concrete in various elements shall be of A1 grade.
5. Longitudinal girders shall be given an upward camber Δ on account of dead load as shown.
6. For details of sidewalk refer miscellaneous drawing.

REFERENCE DRAWINGS:

• General notes	2001148/KNA-FNA/BS/GEN/C
• Reinforcement details of deck slab	2001148/KNA-FNA/BS/003
• Reinforcement details of longitudinal girders	2001148/KNA-FNA/BS/004
• Reinforcement details of cross girders	2001148/KNA-FNA/BS/005
• Miscellaneous drawings	2001148/KNA-FNA/BS/MISC/ to (



SECTION C—C
(Scale B)

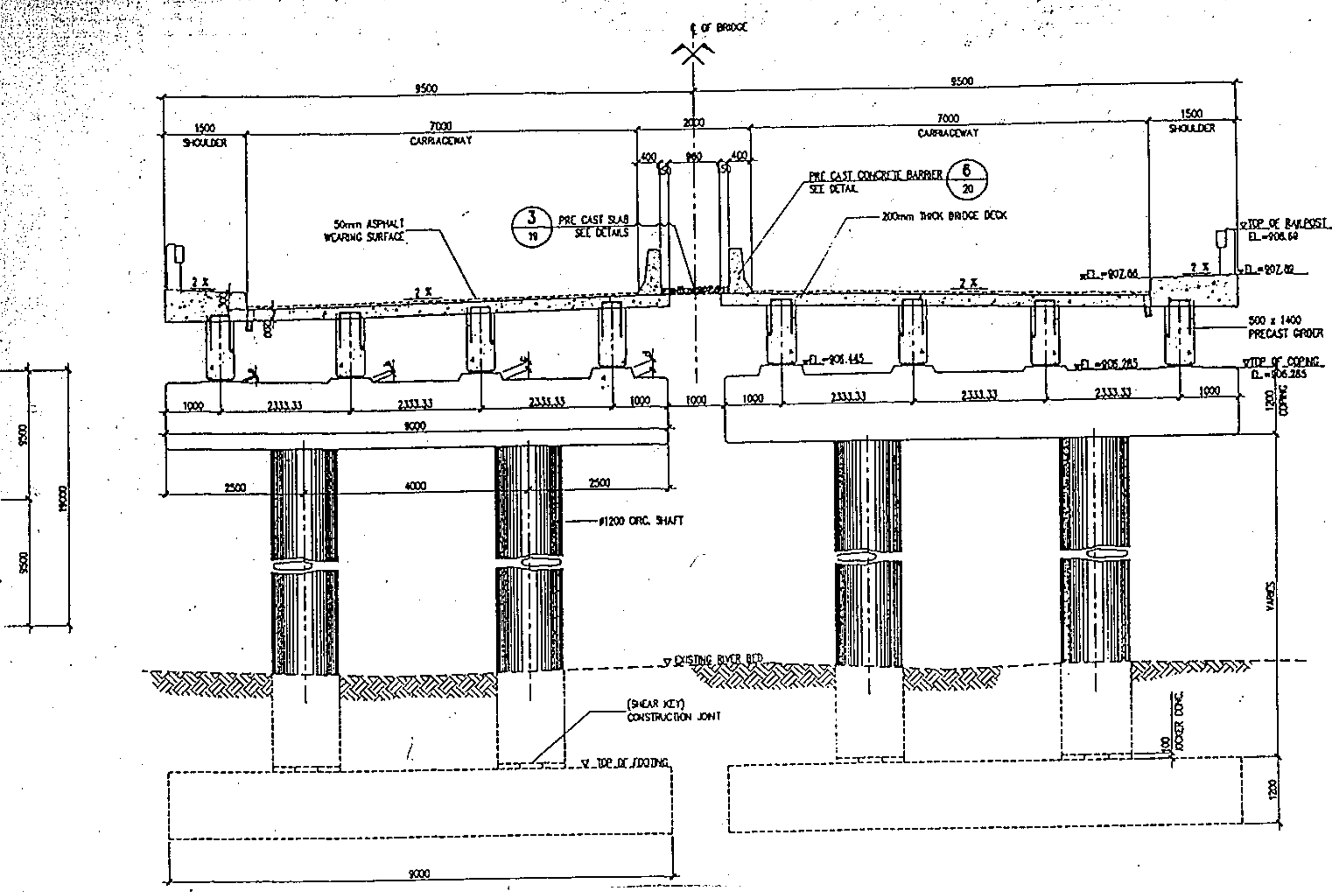


DEAD LOAD DEFLECTION DIAGRAM
(NTS)

INFRASTRUCTURE DEPARTMENT MINISTRY OF PUBLIC WORKS, ERITREA	PREP.BY	Senait f.		1 0 1 2 3 4m SCALE —A	BRIDGE
CONSULTANCY SERVICES FOR FEASIBILITY STUDY AND DETAILED ENGINEERING DESIGN OF KNA—FNA BRIDGE	CHK.BY	S.Gupta		0 1 2 2.5m SCALE —B	DRAWING NO. 2001148/KNA—FNA/BS
GENERAL ARRANGEMENT OF SUPERSTRUCTURE	APPROVED BY	A. Mukhopadhyay			REV. R0 DATE : JANUARY,

Attachment 2−2−2−2

(Standard cross section as reference drawings in Ghindae Bridge
/ 4 lane traffic in By-Pass Plan)



Attachment 2−2−2−2

(Standard cross section as reference drawings in Ghindae Bridge

/ 4 lane traffic in By-Pass Plan)

GENERAL STRUCTURAL NOTES

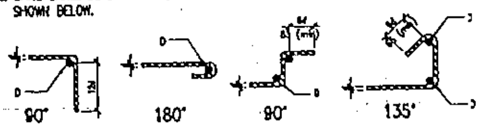
REFERENCE CODES
1. AASHTO STANDARD SPECIFICATIONS FOR HIGHWAY AND BRIDGES (1996 EDITION).
2. UBC FOR SEISMIC ANALYSIS. (AS BUILT-IN WITH STAAD SOFTWARE)

DESIGN LOADS:
1. CONCRETE DENSITY = 24.5 kN/m^3
2. FUTURE WEARING SURFACE (50mm THK) = 0.90 KPa
3. LIVE LOAD:
   3.a. TRUCK LOAD = HS 20-44 + 25 %
   3.b. LANE LOAD = 3.60 KPa/LANE

DESIGN AND MATERIALS PROPERTIES

C.1 STRUCTURES	CONC. COMP. STRENGTH (28 DAYS)
C.1a. FOOTING	21 MPa
C.1b. PIER SHAFTING	25 MPa
C.1c. GIRDERS/SLAB DECK/RAILINGS	25 MPa
C.1d. PILES (IF APPLICABLE)	21 MPa

C.2 REINFORCING STEEL
- C.2a. REINF. STEEL SHALL BE INTERMEDIATE DEFORMED BARS (GRADE 40) CONFORMING TO ASTM A-615 OR AASHTO M-31. fy = 414 MPa
- C.2b. THE CONTRACTOR SHALL SUBMIT DRAWINGS AND BAR BENDING DIAGRAM TO THE ENGINEER FOR APPROVAL PRIOR TO FABRICATION.
- C.2c. BARS SHALL BE COLD BENT. HOOKS SHALL BE FABRICATED AS SHOWN BELOW.



- C.2d. DIMENSIONS RELATING TO SPACING IN MILLIMETERS ARE CENTERS OF BARS.
- C.2e. UNLESS SHOWN ON THE DRAWINGS, THE CLEAR DISTANCE BETWEEN PARALLEL BARS SHALL NOT BE LESS THAN 1.5 TIMES BAR DIAMETER NOR 1.5 TIMES THE MAXIMUM SIZE OF THE COARSE AGGREGATE. WHEN REINFORCEMENT IN THE BEAMS OR GIRDERS IS PLACED IN TWO OR MORE LAYERS, SPACING SHALL NOT BE LESS THAN ONE BAR DIAMETER AND THE BARS IN THE UPPER LAYER SHALL BE PLACED DIRECTLY ABOVE THOSE IN THE BOTTOM LAYER.

D. CONCRETE COVER FOR REINFORCING STEEL

D.1 UNLESS OTHERWISE SHOWN ON THE DRAWINGS OR IN THE FOLLOWING TABLE (D.2) CONCRETE COVER SHALL BE 50mm.

TABLE D.2	
TOP OF DECK	30 mm
BOTTOM OF SLAB	25 mm
STIRRUPS IN GIRDER	25 mm
BOTTOM OF FOOTING	75 mm
PILES	75 mm

E. MINIMUM REQUIREMENTS FOR BAR SPLICES AND EMBEDMENT IN ACCORDANCE TO AASHTO 8-33.

TABLE E-1

BAR SIZE	SPLICE LENGTH		EMBEDMENT LENGTH	
	TENSION	COMPRESSION	TENSION	COMPRESSION
10 mmø	300	300	300	200
12 mmø	300	300	300	200
16 mmø	420	320	300	240
20 mmø	650	400	360	290
25 mmø	1020	500	570	360
28 mmø	1270	560	650	410
32 mmø	1650	640	970	470
36 mmø	2100	720	1110	510

F. ALL CONSTRUCTION JOINT CONCRETE SURFACES SHALL BE SCORED OR ROUGHENED WHILE CONCRETE IS STILL GREEN.

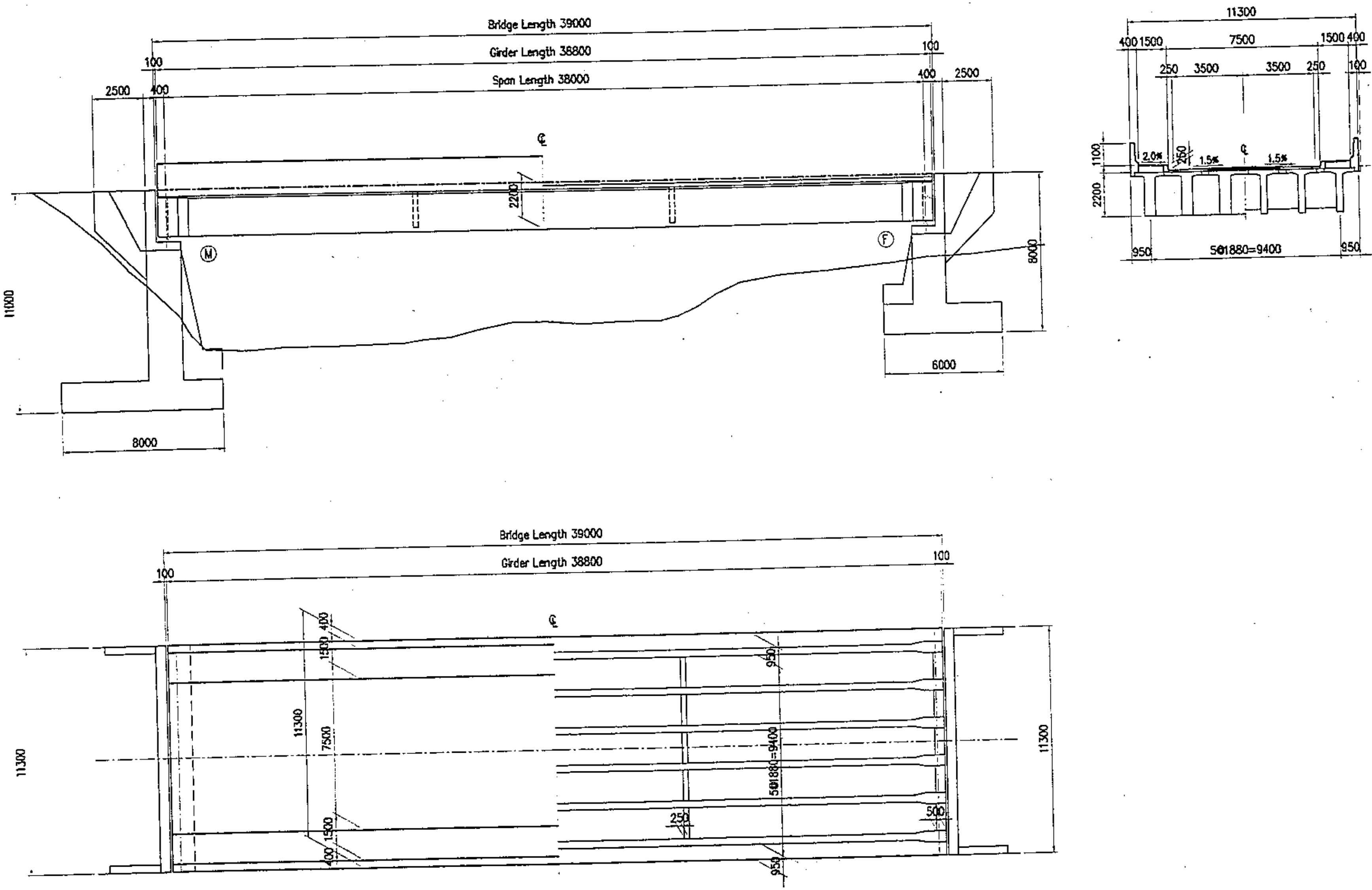
...METERS UNLESS OTHERWISE INDICATED.
...ING ARE IN METERS UNLESS OTHERWISE INDICATED.

...IC WORKS	PROJECT TITLE : GHINDA'E TOWN BY-PASS AND ASSOCIATED BRIDGES	DRAWING NO. 9
HABTEAB TESFATION DIRECTOR GENERAL, ED	SHEET CONTENT : PROPOSED BRIDGE - BRIDGE PLAN, ELEVATION, AND BRIDGE SECTION	DATE PRINTED: SHEET 9 OF 31 SHEETS

Attachment 2－2－3

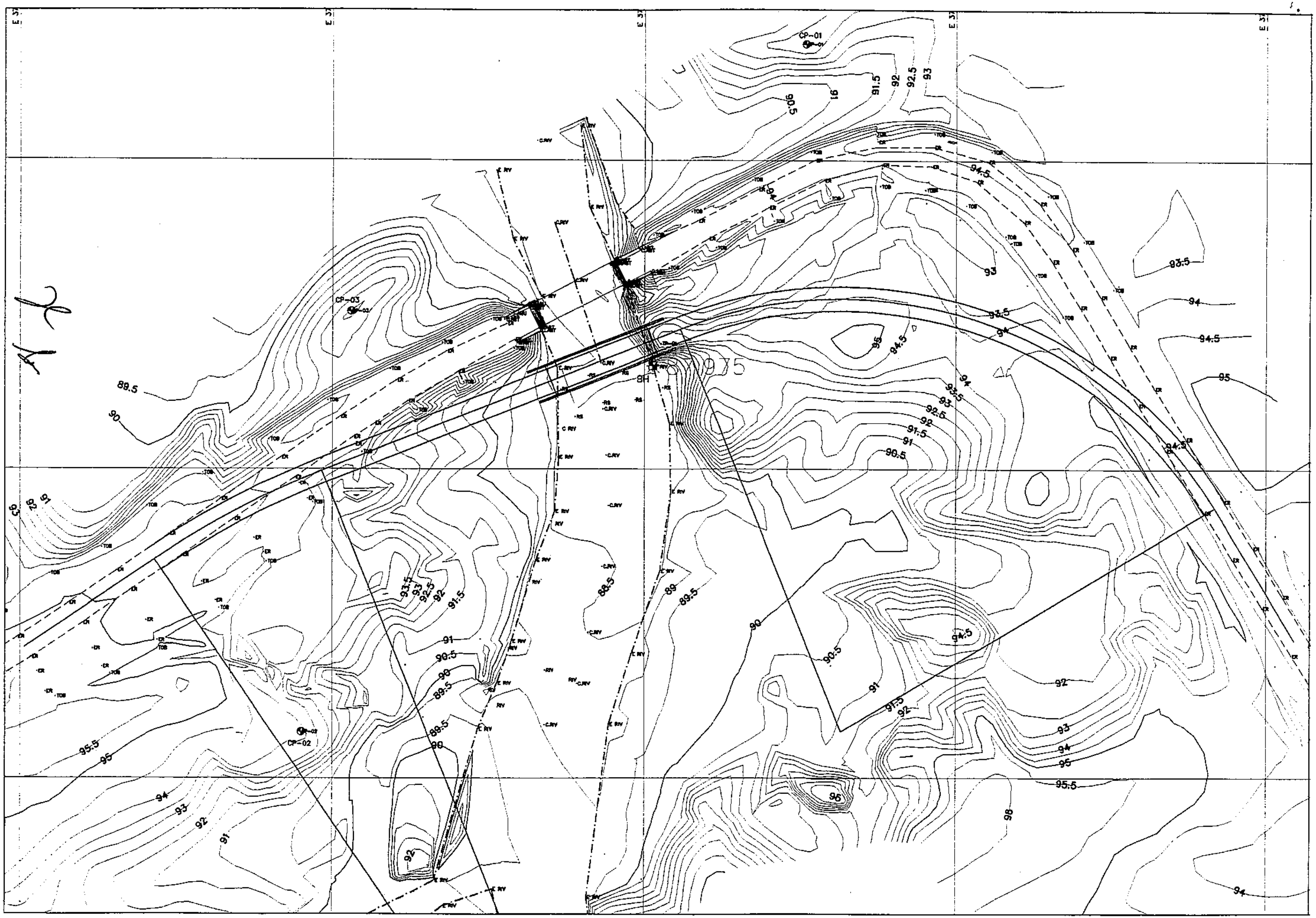
(General Drawing on Ghindae Bridge)

No.1 Gindae Bridge (Ghinda Bridge)



Attachment 3－2

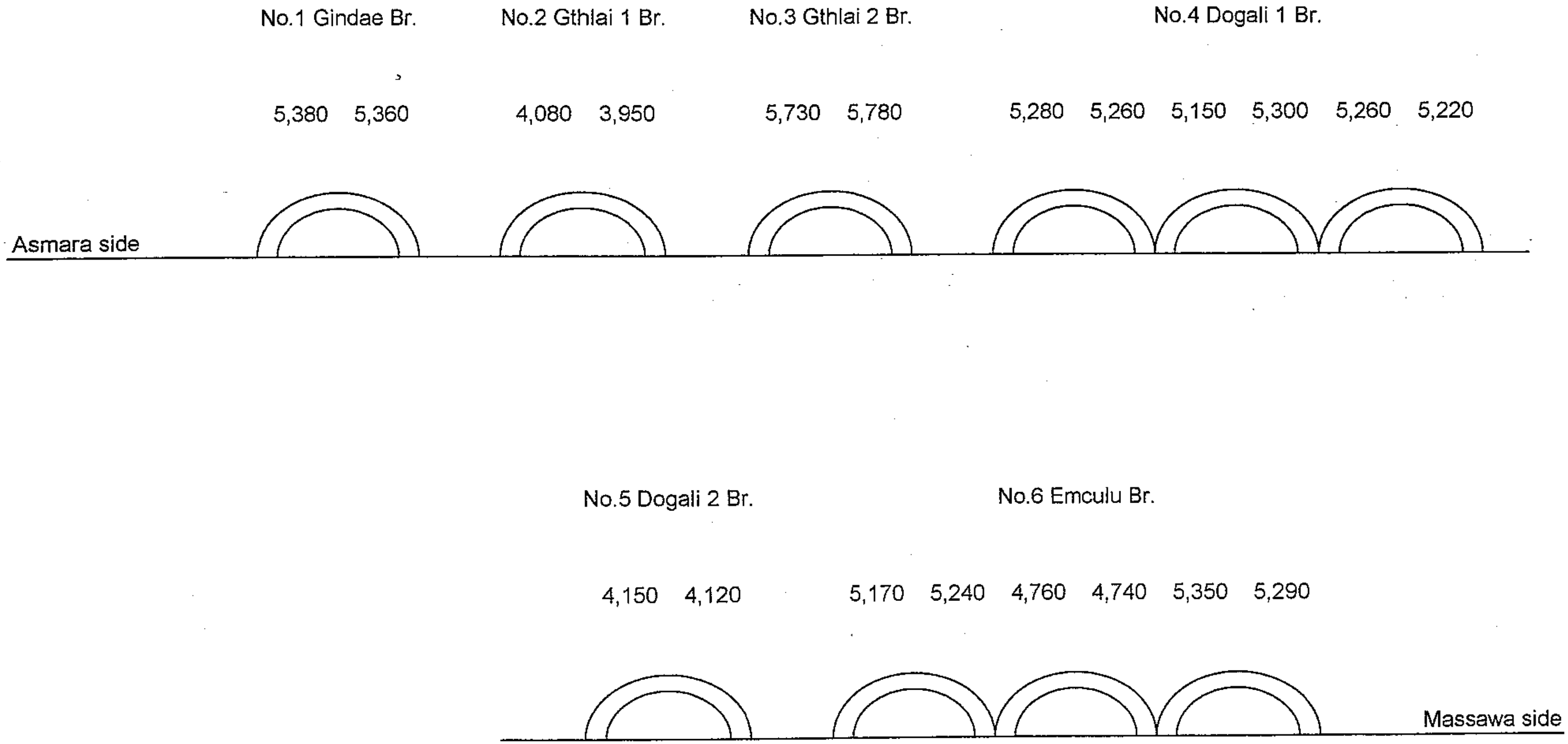
(Location of bridge)



CP-01
CP-03
CP-02
BH

Attachment 4

(Vertical Clearance on Existing Concrete Arch Bridge between Asmara and Massawa measured by Japanese Consultant on February, 2004)


No.1 Gindae Br.
No.2 Gthlai 1 Br.
No.3 Gthlai 2 Br.
No.4 Dogali 1 Br.
5,380 5,360
4,080 3,950
5,730 5,780
5,280 5,260 5,150 5,300 5,260 5,220
Asmara side
No.5 Dogali 2 Br.
No.6 Emculu Br.
4,150 4,120
5,170 5,240 4,760 4,740 5,350 5,290
Massawa side