東ティモール国

国家開発庁

東ティモール国

国家開発庁組織能力強化技術支援（フェーズ２）

【有償勘定技術支援】

業務完了報告書(2/3)

平成 25 年 10 月
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独立行政法人　国際協力機構　（ＪＩＣＡ）

大日コンサルタント株式会社
東京水道インターナショナル株式会社
株式会社ジオプラン
株式会社ニュージェック

添付資料 11 座学研修教材（道路）（テトン語版）

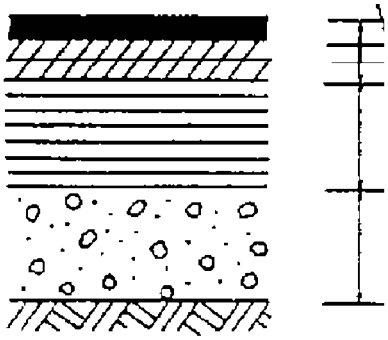
Planeamentu husi Estrada (1)

11 Maio de 2013

Kategoria Estrutura Pavimentu/Pavement

Fonte:Manual Desena Pavement 2008 iha ADN Wiki Database

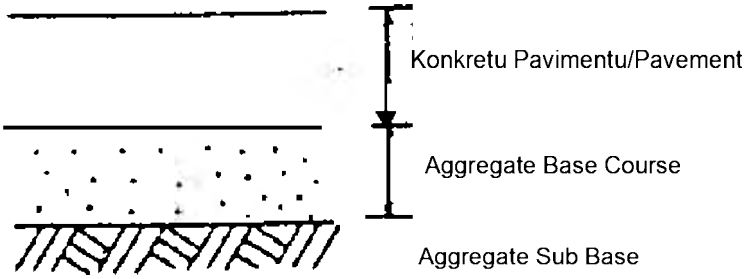
1.Fleksivel ; Tipu Bitumen(aspal) husi pavimentu/pavement



Kategoria Estrutura Pavimentu/Pavement

Fonte:Manual Desena Pavement 2008 iha ADN Wiki Database

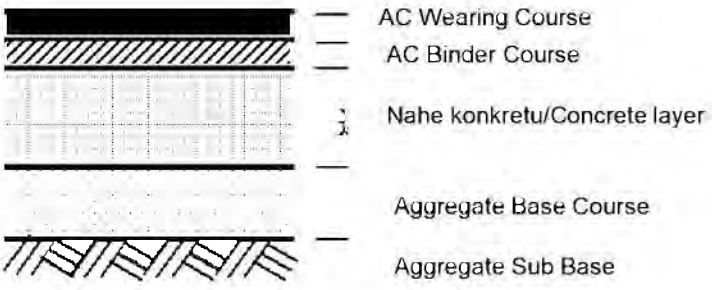
2.Rigid(Metin/Forsa) ; Sementi Konkretu Portland



Kategoria Estrutura Pavimentu/Pavement

Fonte:Manual Desena Pavement 2008 iha ADN Wiki Database

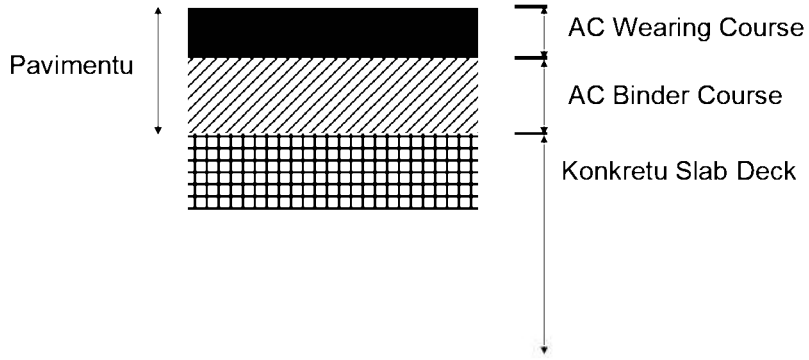
3.Mixtura/Campuran ;



Kategoria Estrutura Pavement

Fonte:Manual Desena Pavement 2008 iha ADN Wiki Database

4.Ponte ;



AMBIENTE UMIDADE/KELEMBABAN

- Rejime Uminidade assosiadu/belun ho pavimentu ke iha influensia prinsipal ba iha dezempenu(performance) husi pavimentu/pavement.
- Dura(stiffness)/Forsa husi materiais ke la belit ho sub-grau(subgrade/permukaan dasar tanah) mak fortemente dependente ba konteudu umidade husi material sira ne'e.

AMBIENTE TEMPERATURA

- Ambiente temperatura iha influensia prinsipal ba dezempenu/performance husi pavimentus apar ho aspal kansativa nia lolon (aspalt wearing surfaces).
- Aspal sai dura no fragil(rapuh/toradu) iha temperatura baixa enquantu nia mamar no elastika iha temperatura aas.

SUB-GRAU (SUBGRADE/permukaan dasar tanah)

- Apoiu fornesidu husi subgrade mak fator importante tebes iha determinasaun mahar (thickness) husi dezenu pavimentu, kompozisaun nomos dezempenu(performance).
- Forsa subgrade mak dependente ba kondisaun iha konstrusaun no durante servisu.
- Tipu Rai, densidade no konteudu umidade bo'ot tebes hodi determina forsa subgrade.
- Objetivu husi evaluasaun subgrade mak atu estimativa valor husi apoiu subgrade hodi uza iha dezena.

DETERMINASAUN KAMPU HUSI SUBGRADE CBR

- Kondidaun subgrade no parametrus dezenu tenke ser avaliadu husi investigasaun subsurface.
- Nudar minimu, investigasaun subsurface no teste laboratoriu husi subgrade tenke fornese rezultadus tuir-mai:

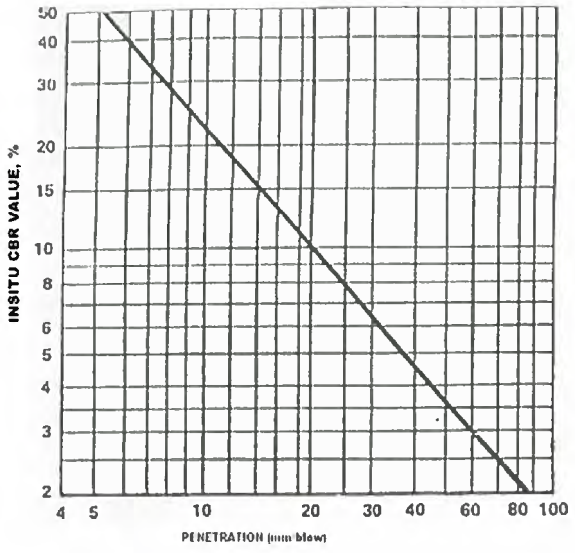
(1) Hoban CBR loron 4.

(2) Distribusaun medida partikula(Particle).

(3) Plastiku limita(Plastic limits), liquidu limita(liquid limits) no plastisida indise(plasticity index (PI), karik aplikavel.

(4) Mais menus dynamic cone penetrometer teste ida (DCP) para teste ku'ak.

KORELASAUN CBR VS TESTE PENETRASAUN



TIPIKU PRESUMSI VALOR DEZENU CBR

TIPU HUSI RAI	KLASIFIKAS AUN RAI	VALOR CBR, %	
		DRENAJEN KAPAS	DRENAJEN LA DI'AK
• Altamente plastika Liat • Sutera/Silt	CH	5	2 – 3
• Liat bersutra • Liat berpasir	ML CL	5	2 – 3
• Raihenek	SC	6 – 7	4 – 5
	SW, SP	15 - 20	-

MATERIAIS PAVIMENTU

- Eskolha husi materiais ba aplikasaun partikular ruma bazeia ba konsiderasaun husi rekerementus estruturais, ekonomia, durabilidade, bele-servisu no experiensiais.
- Haktuir ba sira nia funsaun, materiais ba pavimentu flexivel bele klasifikadu iha grupu tuir-mai nia laran, hanesan;
  1). Rai subgrade
  2). Materiais musan (granular material)
  3). Material Alkantraun/aspal (Bituminous material).

MATERIAIS MUSAN (GRANULAR MATERIALS)

- Materiais granular konsiste husi kerikil natural no rai-henek ka fatuk rahun nebee ke iha klasifikasaun katak halo sira mekanikamente estavel , exakutavel no bele kompak.
- Materiais granular bele klasifikadu tama iha kategoria tolu (3), hanesan:
  1). Agregadu grossu (Coarse aggregate)
  2). Agregadu Diak (Fine aggregate)
  3). Ensedor (Filler)

MATERIAL AIKATRAUN/ASPAL (BITUMINOUS MATERIAL)

- Materiais alkatraun mak material nebee iha funsaun nudar ajenti belit ba pavimentu flexivel produz husi industria petroleo no/ka aspal fatuk produz husi depozitu naturais.
- Material Alkatraun/aspal bele klasifikadu tama iha kategoria lima hanesan tui-mai:
  (1) Aspal petroleo (petroleum asphalt)
  (2) Aspal emulsifikadu (Emulsified asphalt)
  (3) Aspal redusaun (Cut back asphalt)
  (4) Aspal modifikadu (Modified asphalt)
- Selesaun husi utilizasaun ba kada kategoria bazeia ba tipu pavimentu, volume trafiku, metodu konstrusaun nomos konsiderasaun ba kustu konstrusaun.

Aspal Petroleo (Petroleum Asphalt)

- Aspal petroleo mak alkatraun restu husi mina-rai matak depois ke nia komponentes kaman hasai tiha ona liu-husi atmosferiku no destilasaun hotu/mamuk tiha.
- Ba tipu mina-rai matak balun, prosesu seluk mak persija para hetan tipu hatu-hotu husi aspal petroleo.
- Anin huu ba aspal ka kahur ho tipu tos no mamar husi aspal mak adoptada ba kazu ne'e.
- Prosessu oi-oin depende ba tipu husi metodu produsaun mina-rai matak.

Aspal Petroleo (Petroleum Asphalt)

REKEREMENTU HUSI ASPAL PETROLEO (PETROLEUM ASPHALT)

PARAMETER	TEST METHOD	ASPHALT GRADE				
		40-50	60-70	85-100	120-150	200-300
• PENETRATION	AASHTO T49	Min. 40 Max. 50	Min. 60 Max. 70	Min. 85 Max. 100	Min. 120 Max. 150	Min. 200 Max. 300
• FLASH POINT	AASHTO T48	Min. 232 Max. -	Min. 232 Max. -	Min. 232 Max. -	Min. 218 Max. -	Min. 177 Max. -

Aspal Emulsifikadu (Emulsified Asphalt)

- Aspal emulsifikadu normalmente mak emulsaun/larutan ida kompostu husi aspal diretu relativamente mamar, ajente emulsifikasaun, estabilizador no bee.
- Haktuir ba sira nia mudansa partikula, aspal emulsifikadu mak klasifikadu nudar:

  (a). Cationic(mudansa regular ion +) emulsified asphalt

  (b). Anomic(mudansa irrigular) emulsified asphalt

Aspal Emulsifikadu (Emulsified Asphalt)

Aspal Redusaun (Cutback Asphalt)

- Aspal redusaun mak produtu petroleo liquidu,produz husi mudansa aspal baze ho distila petroleo satifatorio, hodi uza iha tratamentu iha pavimentu nia oin (pavement surface).
- Kombinasaun husi sementi aspal no solvente/pelarut petroleo.
- Bazeia ba kura tempu, cutback asphalt bele klasifikada tama iha tipu rua laran; hanesan;
  (a). Tipu kura tempu mediu/Medium curing time type (MC)
  (b). Tipu kura tempu invazaun/Raid curing time type (RC)

Aspal Redusaun (Cutback Asphalt)

Aspal modifikadu (Modified Asphalt)

- Aspal modifikadu mak aspal nebee husi materiais hanesan boracha no aumenta resin/ai-ben iha tentativa hodi hadia viskosidade/grossu iha 60o C, dura, metin no tahan temperatura.
- Aspal modifikadu mak mos aspal semi-assoadu/huu nebee mak tratadu husi prosessu huu no Aspal emulsifikadu cationic modifikadu polymer/Polymer modified Cationic Emulsified Asphalt.

Aspal Modifikadu/Modified Asphalt

Nahe aspal mihis, kahur modifikadu polimer/polymer-modified mix.

AHU/LIME BA ESTABILIZASAUN RAI

- Ahu mak materiais hanesan ahu rapidu, ahu hidratu,kualker kalsium aas, dolomite/mineral kristal ka ahu magnesium para uza ba estabilizasaun rai.
- Ahu rapidu no ahu hidratu kari iha rai/tanah liat leten no bele uza hanesan rai apropiadu ba konstrusaun rodoviariu/highway no ba aplikasaun konekta/porte karga seluk, iha kazu barak, ahu kauza diak-liu ba hafahe partikula liat nebee hadia koneksaun proriedade no hafoin ahu tratada rai tos husi reaksaun kimika.

AHU/LIME BA RAI

TRAFIKU DESENU (DESIGN TRAFFIC)

- Prosedimentu detalhu depende ba tipu husi disponivel dadu trafiku, tipu pavimentu dezignadu hela no adoptadu metodu dezenu.
- Karakteristiku trafiku nebee determina dezempenu bo'ok mak:
  (1) Numeru husi poros passagen
  (2) Poros Karga
  (3) Poros konfigurasaun
- Estandar poros/axle mak define nudar poros uniku ho roda rua nebee lori karga/todan 8, 20 tonaladas.

KONSTRUSAUN NO KONSIDERASAUN BA MANUTENSAUN

- Konstrusaun oi-oin no konsiderasaun ba manutensaun tenke ser hatama iha sasukat iha desenu pavimentu tamba sira bele influensia tipu husi lolon-oin/permukaan nebee adoptadu, rekerementus materiais base/pondasi leten no sub base/pondasi okos ka karik eskolha fundamental husi tipu pavimentu.

EXTENT AND TYPE OF DRAINAGE

- Special drainage provisions may be provided, including sub surface drains or porous drainage layers.
- In high rainfall regions or areas subject to high ground water levels, the use of a properly design designed drainage layer under near a granular pavement may be an effective means to remove water which has infiltrated through the surface, shoulders or from beneath the pavement.

DISPONIBILIDADE HUSI EKIPMENTU

- Tipu pavimentu tenke ser kompativel ho ekipamentu nebee mak disponivel ba konstrusaun.
- Ba projetu bo'ot nia bele ekonomika hodi importa ekipamentu rekeridu, maibe iha area remota lokalizamente ekipamentu disponivel sei afeita eskolha ba tipu pavimentu no kompozisaun.
- Dala-ruma, karik numeru husi servisu kikoan mak sei konstrui iha periodu badak nia laran iha rejiaun nebee hanesan, numeru husi alternativus ekonomia disponivel bele hasa'e.

Orariu Tuir-mai

Lisaun Sala de Aula ba Ponte parte 2;

Explikasaun husi Drawings

(1) Lista Drawings

(2) Mapa Lokalizasaun

(3) Planu & Perfil/Plan & Profile

(4) Cross Section/sesaun atravessada

(5) Velosidade Dezena/Design Speed

Lisaun Sala de Aula ba Ponte parte 3;

(1) Estrutura Estrada/Road structures

(2) Kondisaun rai/Soil Condition

Planeamentu husi Estrada (2)

18 de Maio, 2013

- Rede estrada mak extensivu, **standar/padraun estrada** mak jeralmente **ki'ak**. **Estrada nia Luan mak** jeralmente **klot (metrus 3.5 to'o 5.5)** no ejiji veikulus halai sa'e trotoar(pavement) hodi passa liu veikulus seluk. **Alinhamentu Vertikal no horizontal** nebee ki'ak, limita ba **velosidade viajen** no distansia vizaun(**sight distance)**. Drenajen la adequadu hetok halo at liu tan estraga estrada.

- **Transportasaun Rural**
- Estrada fornese assesu ba parte rural sira iha país, nebee ke mayoria ki'ak hela ba. Estrada liga kommunidade rural sira ba merkadu, servisu, no partisipasaun iha sosiedade nebee luan tebes.
- Koneksaun ho zona ekonomia area sul nebee kruza area foho-lolon no area rai-klaran, mak-nebee inklui etapa rai husi Fatuk la-stavel(**unstable rock)** no solo pobre(**poor soils)** katak altamente fasil atu kona **erosaun** no Rai-halai(**landslides).**
- **Topiku loron ohin mak Estrada nia Luan (Road Width) & Rai-halai(Landslide).**

Estrada nia Luan(Road Width)

[Estrada Klassifikasaun-A]

- Estrada nia kabas(road shoulder) 1.0 m + dalan passajen(travelled way) **7.0 m** + estrada nia kabas(road shoulder) 1.0 m = Luan total(Total width) **9.0** m (Funda husi JICA)
- **Estrada klassifikasaun-A aplika ba Estrada Nasional iha Timor-Leste.**

[Estrada Klassifikasaun-B]

- Estrada nia kabas(road shoulder) 1.0 m + dalan passajen(travelled way) **6.0** m + estrada nia kabas(road shoulder) 1.0 m = Luan Total **8.0** m
- **Estrada Klassifikasaun-B aplika ba Estrada Nasional** (Foho-lolon) iha Timor-Leste. (Funda husi Banku Mundial, ADB, JICA)

[Estrada Klassifikasaun-C]

- Estrada nia kabas1.0 m + dalan passajen **4.5** m + Estrada nia kabas1.0 m = Luan total **6.5** m
- **Estrada Klassifikasaun-C aplika ba Estrada Lokal** nebee estrada klot ke existe hela iha Timor-Leste.

Projetu Rehabilitasaun Estrada iha Maubisse-Turiscai

- Estrada Maubisse-Turiscai aplika ba Standar Klassifikasaun estrada-C tamba estrada nia luan ke existe klot hela no karik loke-luan aproxima 2.0 m ba estrada nebee existe hela, estrada nia kabas 1.0 m + dalan passajen 2.5 m + estrada nia kabas(road shoulder) 1.0 m = Luan total4.5 m.

- Estrada be Existe hela iha linha kurva ki'ik barak,nomos alinhamentu horizontal foun tenke ser korta dalan(short-cut) iha linha kurva ki'ik

Fatuk musan grossu/kasar(Coarse Aggregate) iha Maubisse-Turiscai

- Assuntu ba fatuk grossu(coarse aggregate) mak karik aggregate mak fasil metin iha rai, nebee mak liu-husi 30 % husi Metodu ba rock slaking test no liu-husi 50 % husi Metodu ba Teste Fatuk Rahun(rock crushed test).

Fatun mutik hare hanesan tos no la problema ba fatuk grossu(coarse aggregate). Ne'e diak liu hodi halo teste.

Rai-halai(Landslide) iha Maubisse-Turiscai

- Nebaa iha area rai-halai iha Maubisse-Turiscai, nebee deklive(slope) proteje husi bronjo(gabion). Ami propoin atu tau atensaun ba Sikun korta badak(low-angle cut) no korta velosidade(cut speed).

- Fonte husi explikasaun rai-halai mak "Slope Protection Guideline 2008", rai-ona iha ADN Wiki Server, hanesan folha tuir-mai.

Tipu husi Rai-halai(Landslide)

- Tipu jeral tolu husi rai-halai mak jeralmente hasoru ba iha Liuron(highway):

(1) Movimentu ke involve material superfisie(**surface)**

(2) Movimentu involve Klean hodi hatur rai mamar(**deep seated soft soils)**

(3) Movimentu involve strata husi fatuk(**rock strata)**

Levantamentu/Peskiza(Survey) ba Rai-halai(Landslide)

- Estudu Deskritu(Desk Study)
- Levantamentu ba Rekonhesementu-terrenu (Reconnaissance Survey)
- Levantamentu Detalhu(Detailed Survey)
- Peskiza ba Topografia(Topography Survey)
- Levantamentu ba Geoteknika(Geotechnical Survey)
- Peskiza Drenajen(**Drain Survey)**
- Peskiza Ambiental
- Peskiza Frakeza ba Deklive(**Slope Failure Survey)**

Levantamentu ba Drenajen(Drainage Survey)

(1) Konseitu Dezenhu husi sistema drenajen iha area problema nia laran

(2) Intensidade Udan-ben (Rainfall intensity)

(3) Estimasaun husi area kaptasaun(catchment area)

(4) Tipu husi utilizasaun rai no kondisaun ambiente

Tipu husi Rai-halai(Landslide)

(1) Rai-halai --- **Movimentu neneik-liu (lower** Movement)

(2) Movimentu Mass --- Akuntese Lalais (Take place **suddenly)**

(2)-1. Frakeza Deklive(Slope Failure) --- iha rai-lolon

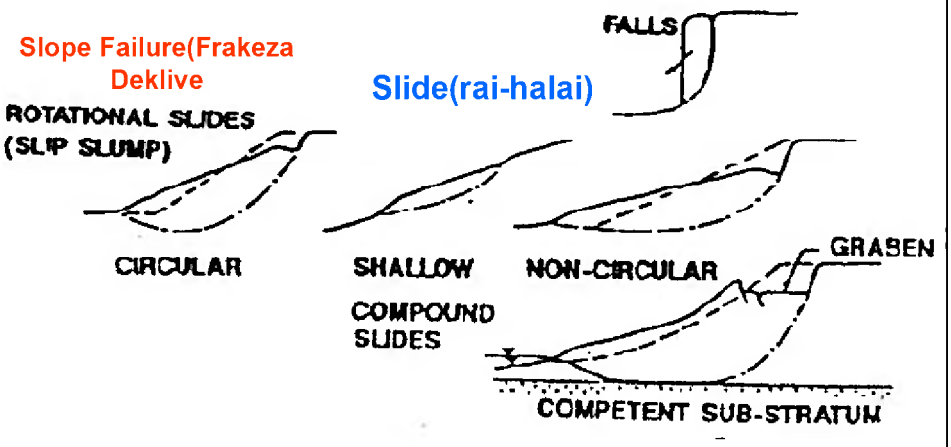
(2)-2. Fluxu-Tahu(Mudflow) ka Tahu-suli;Debris Flow (Sabo) --- iha area Sabo

Iha Japaun, Rai-halai mak hafahe-diferensa entre 1) Rai-halai(Landslide), 2) Frakeza deklive(Slope Failure) nomos 3) Fluxu Debris(Debris Flow).

Tipu Baziku husi Movimentu Massa(**Mass Movement)** iha Deklive Tanah Liat (Clay Slope)

Slope Failure(Frakeza Deklive

Slide(rai-halai)

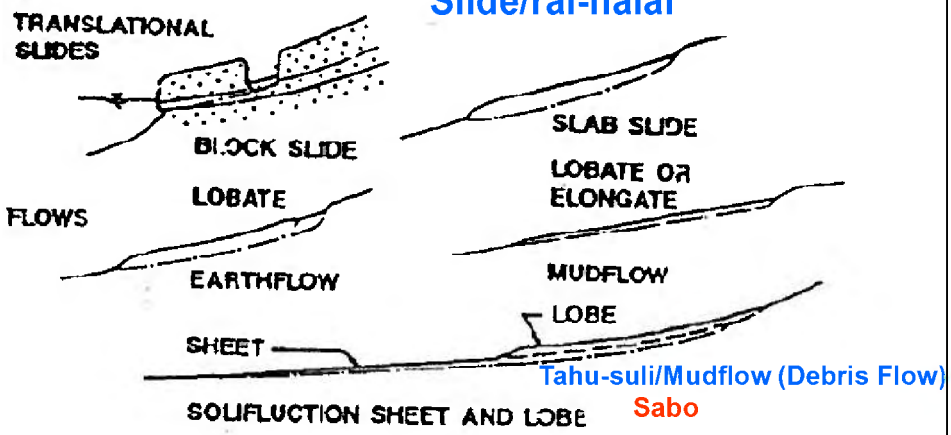


(Para Peskiza Frakeza Deklive/Slope Failure Survey)

Tipu Baziku husi Movimentu Massa(**Mass Movement)** iha Deklive tanah liat/Clay Slope (Kontinua.)

Frakeza Deklive(Slope Failure)

Slide/rai-halai



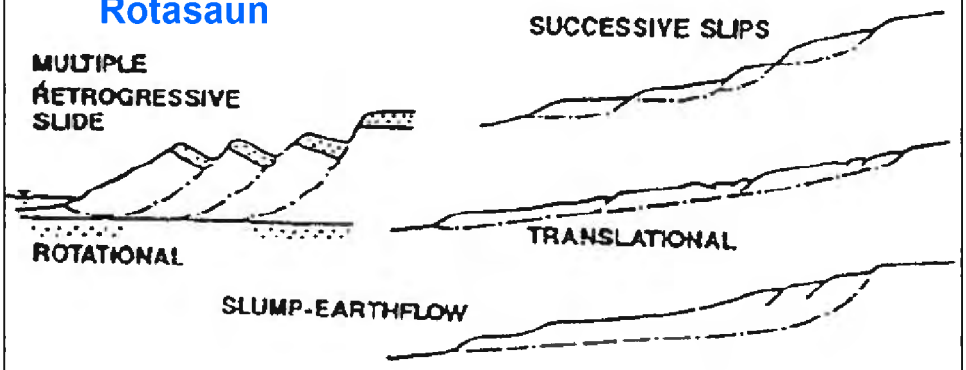
Tahu-suli/Mudflow (Debris Flow)

Sabo

Tipiku Rai-halai(**Landslide**)

Rai-monu (lalais)&translasional
(rai monu tutuir-malu)

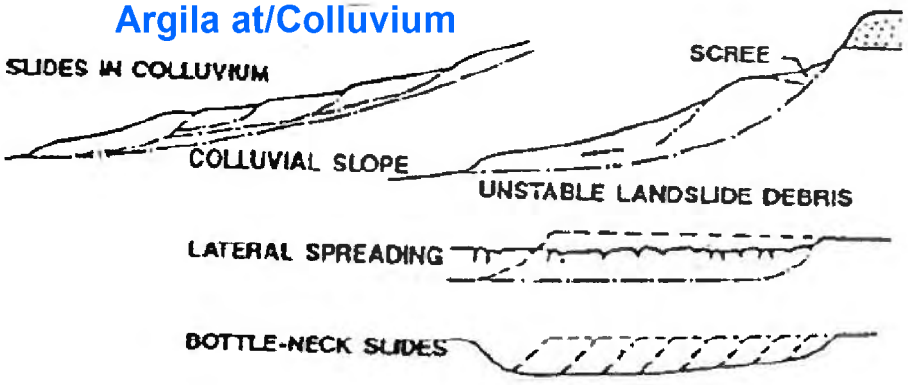
Rotasaun



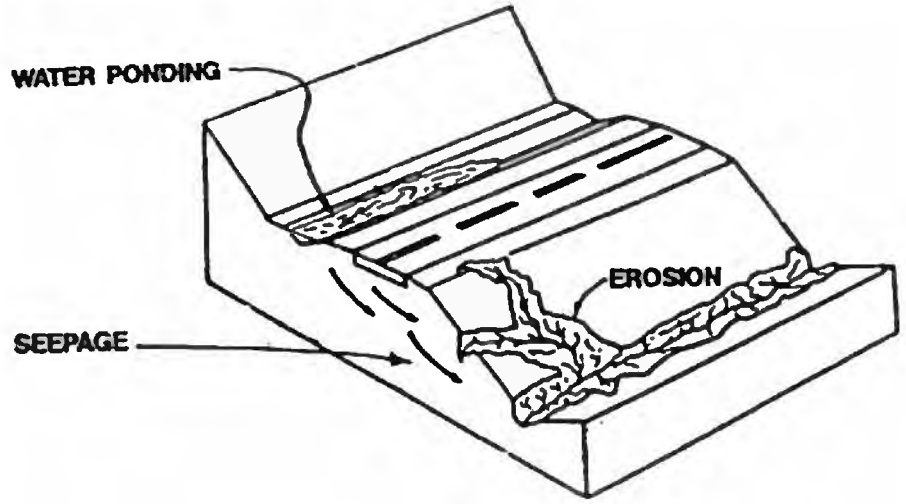
Rai-halai(Landslide)

Tipiku Rai-halai(**Landslide**) (kontinua.)

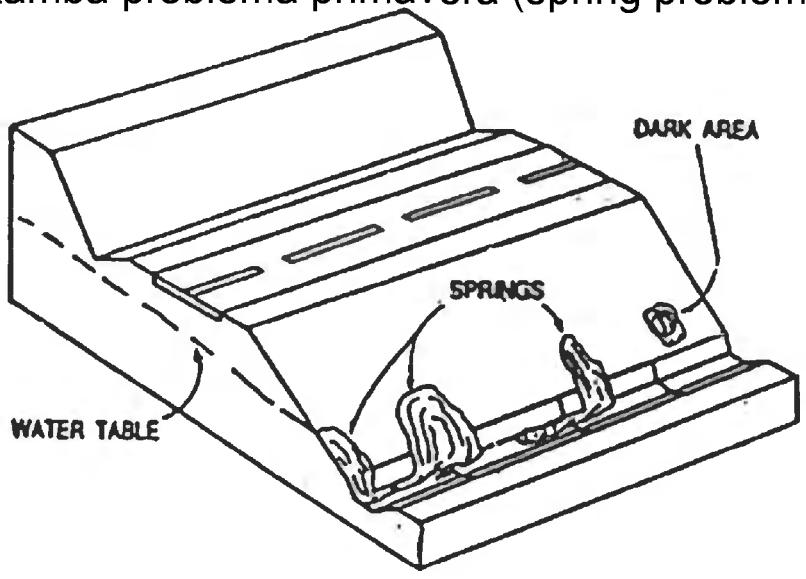
Argila at/Colluvium



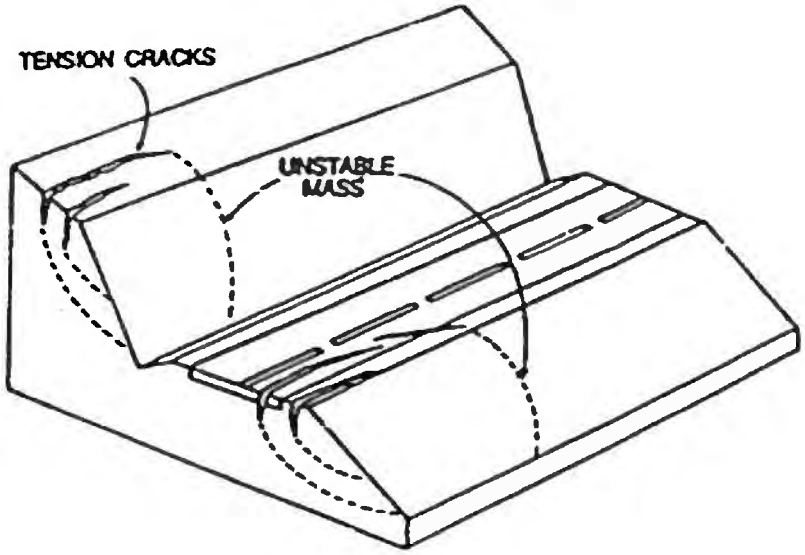
Tipiku Rai-halai(Landslide) tamba Ki'ak ba drenajen(poor drainage)



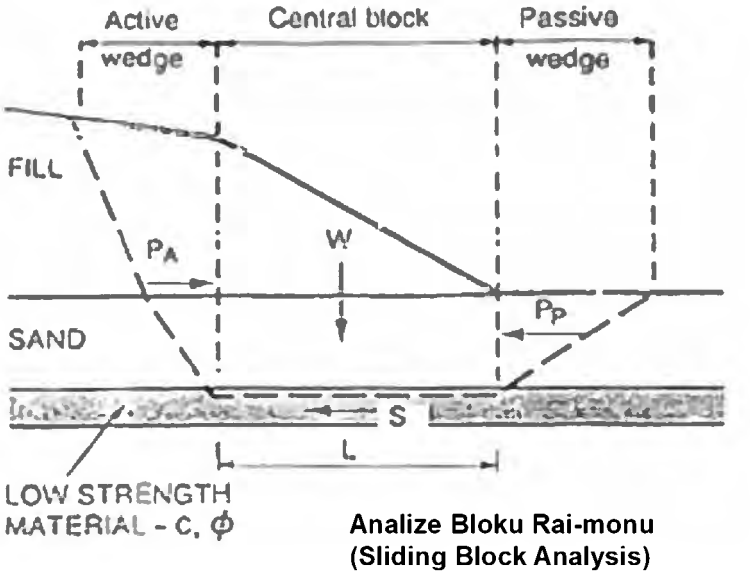
Tipiku Falhansu Deklive(Slope Failure) tamba problema primavera (spring problem)



Dezenvolvimentu husi Tensaun Sinál/retak(Tension Crack) iha korta deklive(cut slope) nia leten

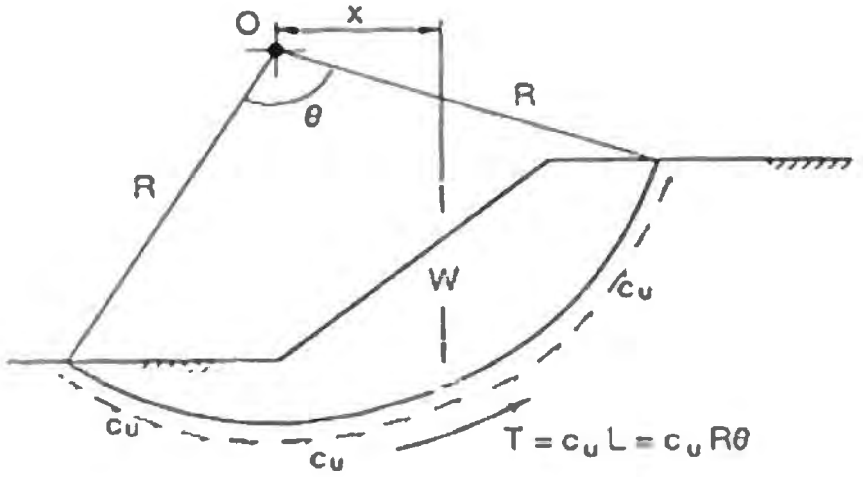


Analize Estabilidade Deklive/Slope Stability Analysis (1)



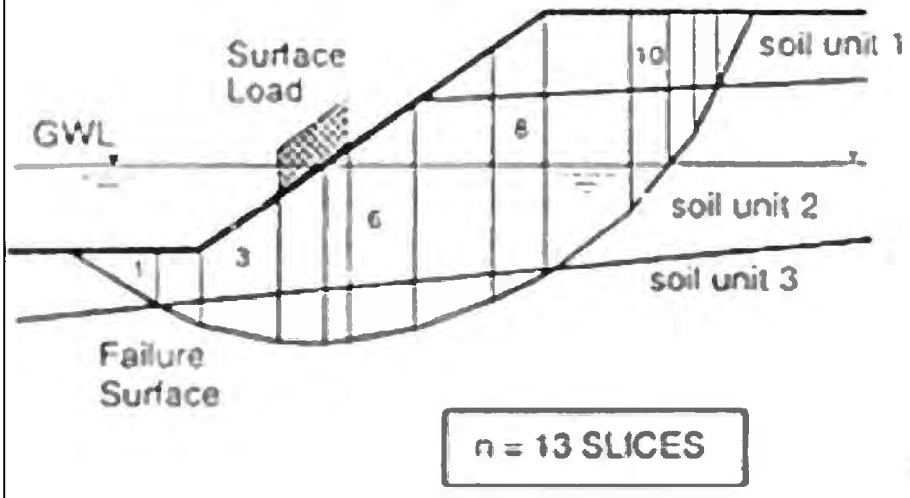
Analize Bloku Rai-monu (Sliding Block Analysis)

Analize Estabilidade Deklive/Slope Stability Analysis(2)



Analize Superfisie Sirkular
(Circular Surface Analysis)

Analize Estabilidade Deklive/Slope Stability Analysis(3)



Metodu Sabir/Slice Method

Metodu Protesaun Deklive (Slope Protection Method)

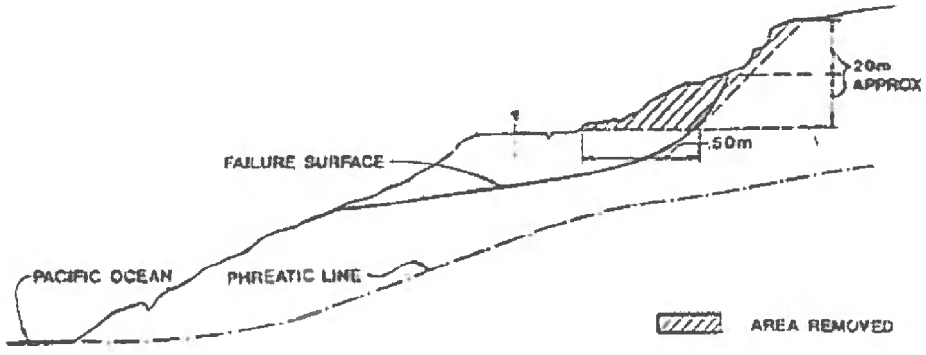
(1) Deskarregamentu (Unloading)

(2) Konstrusaun ba Sistema Drenajen (Drainage System)

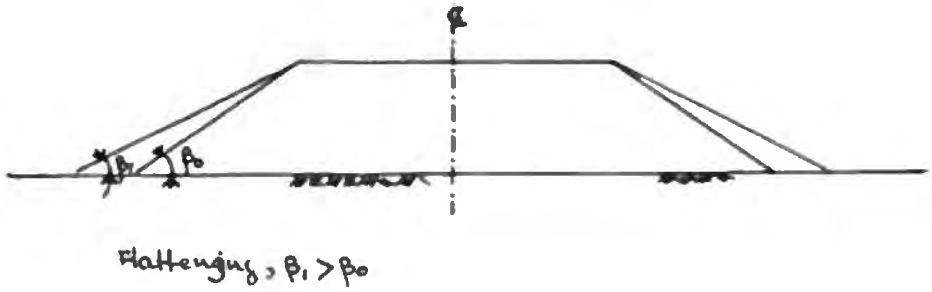
(3) Konstrusaun ba Estrutura Protesaun(Retaining Structures)

(4) Metodu seluk-seluk tan

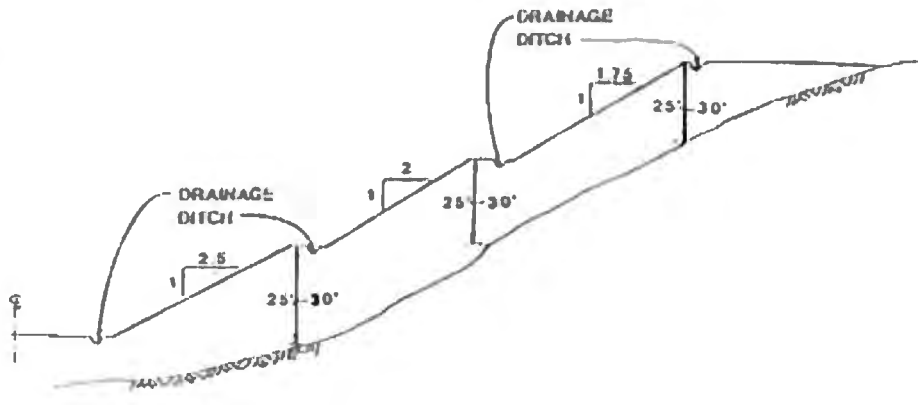
Hasai Material husi Deklive Ulun(Removing Material from Slope Head)



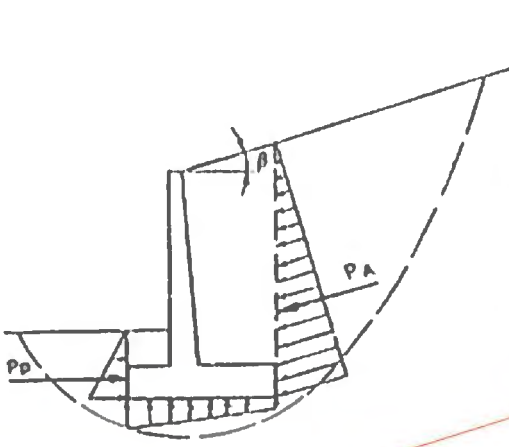
Halo-kaber Deklive iha Moru Rai-lolon (Slope Flattening in Embankment Slope)



Halo eskada/teras iha Rai deklive lolon (Terracing in Slopping Ground)



Fator Ejijensia Siguransa iha Moru Protesaun(Retaining Wall)



Kriteria estabilidade

STABILITY CRITERIA
(STATIC CASE)

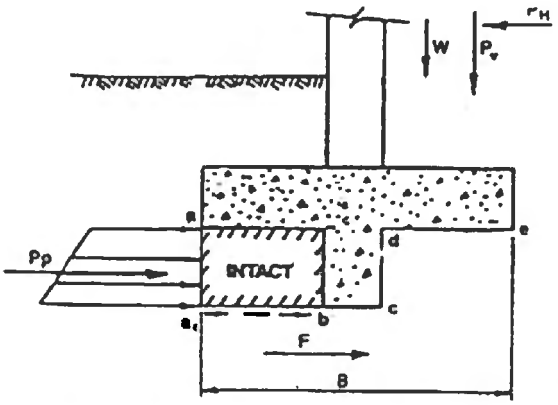
(1) Rai-halai /Sliding

FS	SLIDING	≥ 1.5
FS	OVERTURNING	≥ 2.0
FS	GLOBAL	≥ 1.2 - 1.5
FS	BEARING CAPACITY	≥ 3.0

Konsiderasaun ba Rai-halai/Landslide

(3) Kapasidade satan/peyangga (Bearing Capacity)

Gravidade(Gravity) no Modilhaun(Cantilever) Moru Protesaun (Retaining Wall)



C =SHEAR STRENGTH OF FOUNDATION SOIL
Pp=PASSIVE RESISTANCE
δ =FRICTION ANGLE-CONCRETE ON SOIL
Fs=FACTOR OF SAFETY
Ca=ADHESION-CONCRETE ON SOIL

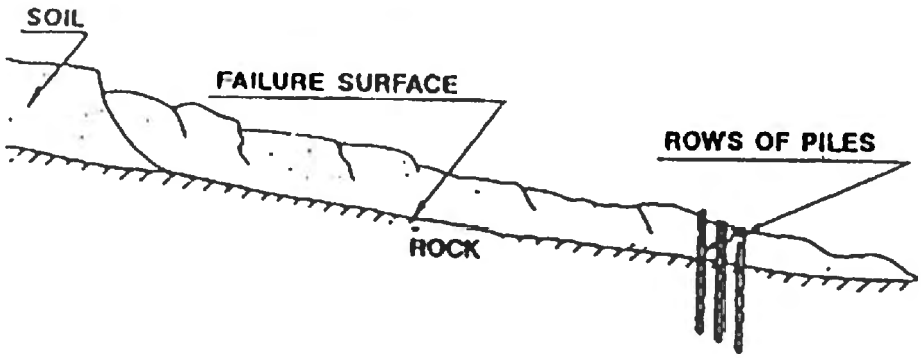
RESISTANCE AGAINST SLIDING ON KEYED FOUNDATIONS

COHESIVE SOILS $F=(W+P_v)\ \tan\delta + C_a(B-\overline{a_1b}) + C\ (\overline{a_1b}) + P_p$

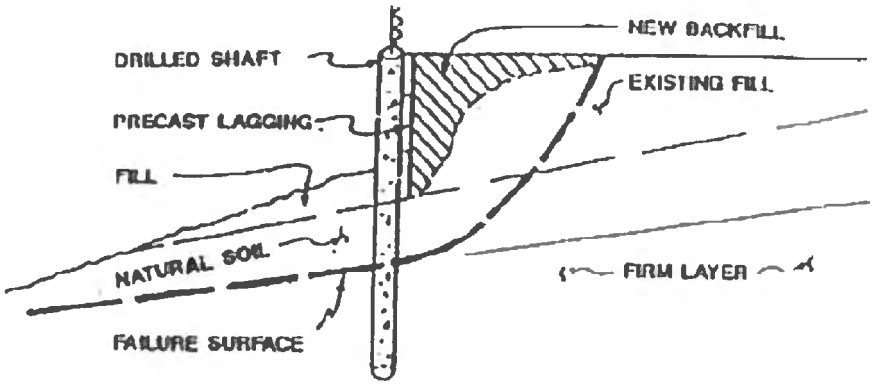
GRANULAR SOILS $F=(W+P_v)\ \tan\delta + P_p$

$F_s = F/P_H$ (SLIDING)

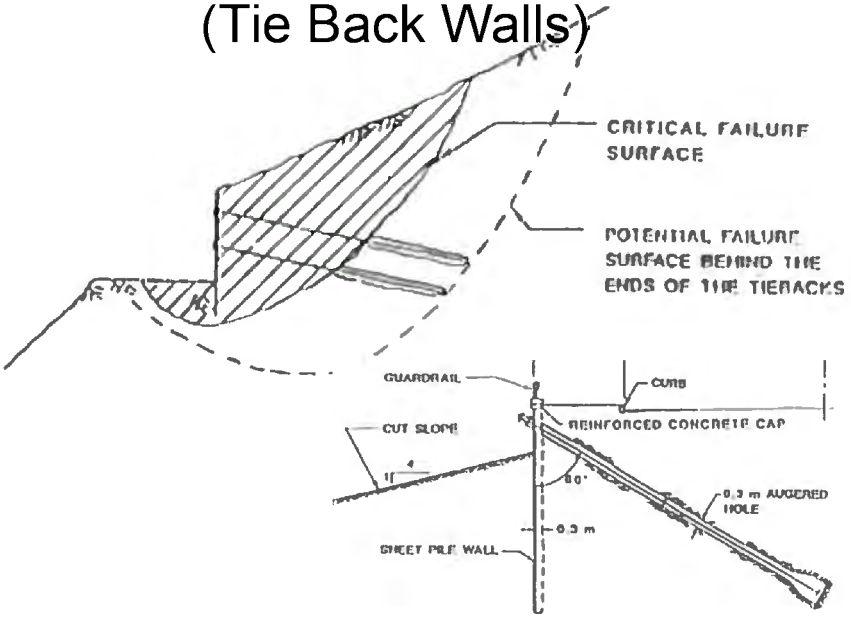
Pilhar Dirijida(Driven Piles) atu Estabiliza Deklive/Slope



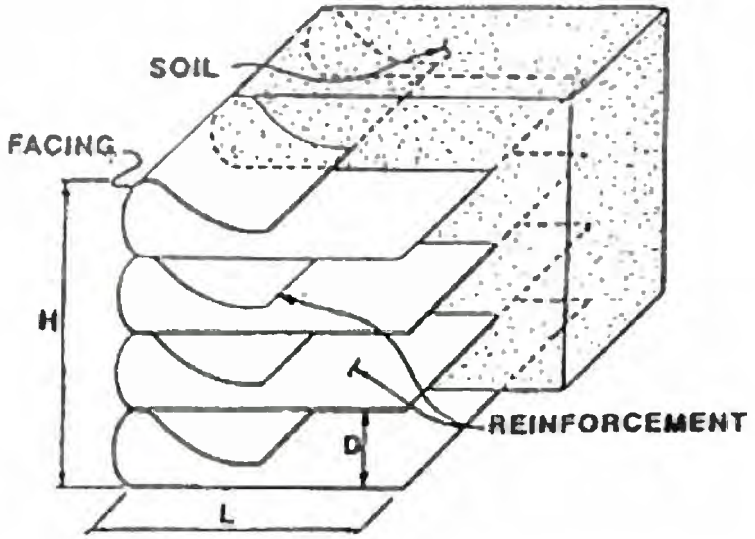
Moru Kabu Perfurada (Drilled Shaft Wall)



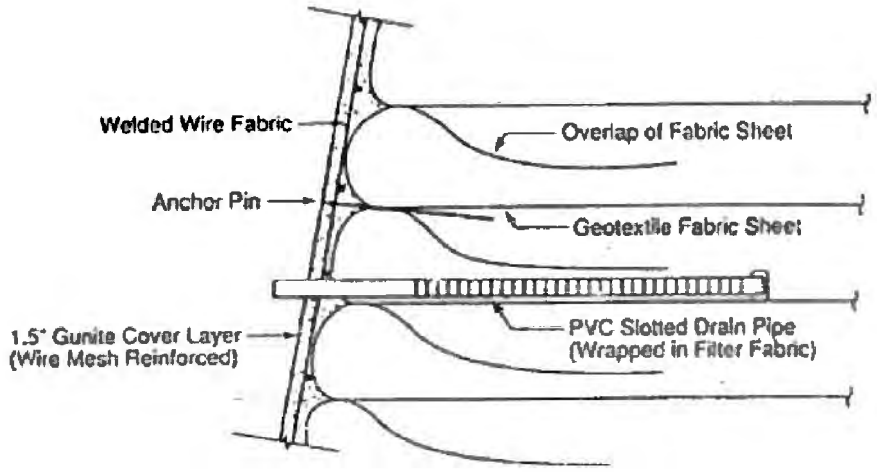
Kesi fatin/pengikat Moru Kotuk (Tie Back Walls)



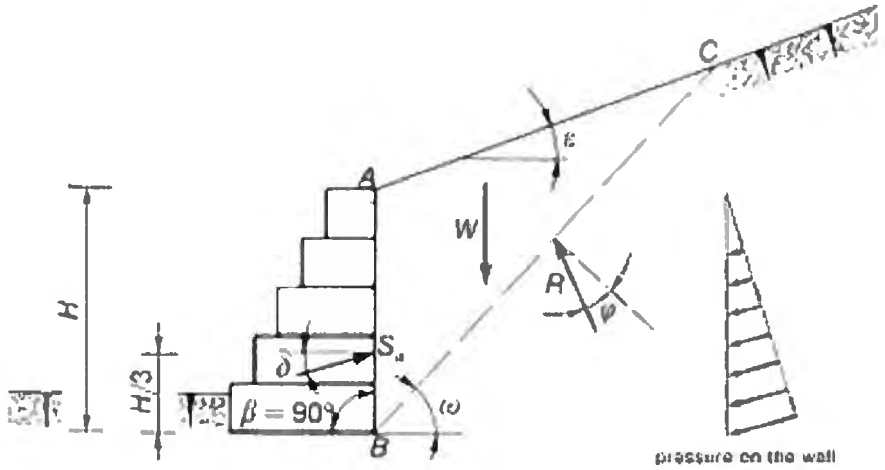
Fibra Jeo-sintétika Hametin Deklive (Geo-Synthetic Fiber Reinforced Slope)



Moru Jeo-textil Detailha (Geotextile Wall Detail)

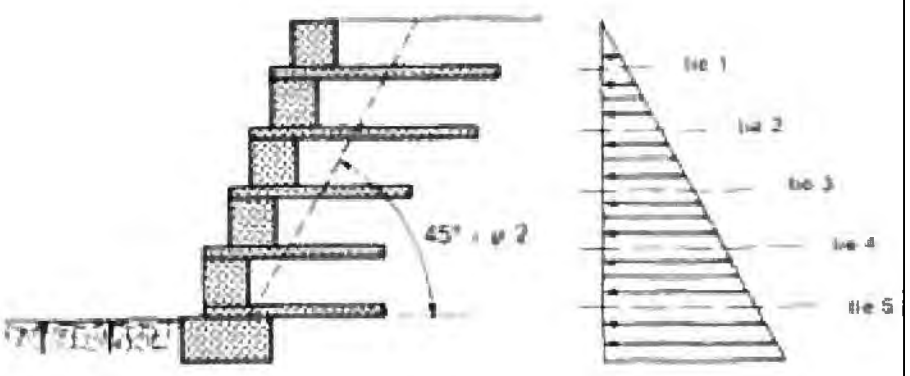


Estrutura Bronjo Protesaun (Gabion Retaining Structure)



Tipu Flexibilidade

Bronjo Hametin Rai
(Soil Reinforcement Gabion)



Tipu Flexibilidade

Orariu Tuir-mai

3ª Lisaun Sala de aula kona-ba Estrada
Explikasaun ba Drawings
(1) Lista Drawing, (2) Mapa Lokalizasaun,
(3) Planu & Prefil/Profile,
(4) Cross Section/seksaun Kruzada,
(5) Design Speed/Velosidade Dezenha,

4ª Lisaun Sala de aula
(1) Estrutura Estrada (Culvert=Bueiru)
(2) Estrutura Estrada (Pipe=pipa)

Planeamentu ba Estrada (3)

Juñu 1 de 2013

Verifikasaun ba Dezeñu(Drawings)

Staff ADN sira tenke verifika dezeñu(drawings) tender liu-husi hare pontu husi item hirak tui-mai, utiliza Lista-verifikasaun/checklist manual ADN iha pajina 9, (8) Dezeñu(Drawings), P59, Checklist A, nomos Checklist C2.

Lisaun loron-ohin:

(1) Dezeñu ba Velosidade(Design Speed)
(2) Lista Dezeñu(Drawing List),
(3) Mapa Lokalizasaun (Location Map),
(4) Planu & Prefil (Plan & Profile),
(5) Seksaun Kruzada (Cross Section),

(1) Dezeñu ba Velosidade (Design Speed)

- Dezeña ba velosidade(Design speed) mak selesionadu velosidade uza hodi determina varius karakteristika geometrika (geometric features) husi dalan-estrada(roadway). Assumidu dezeñu ba velosidade tenke ser ida be lojika ho respeita ba topografia(**topography)**, antisipada ba operasaun velosidade(**operating speed)**, hakbesik-malu ba Utilizasaun Rai(**land use)**, nomos klassifikasaun funsional(**functional classification)** husi Altu Estrada/rodoviáriu (highway).

Dezeñu Velosidade (Design Speed) iha Japaun

Tipu husi Dalan-estrada/ Type of Roadway	Klassifikasaun	Grau/ Grade	Dezeñu ba Velosidade/ Design Speed		Volume Tráfiku (víkulus/loron)			
					> 30,000	30,000-20,000	20,000-10,000	< 10,000
Rodoviariu/ Dalan Expressa (Highway / Express Way)	1	1	120	100	Flat/mendatar			
		2	100	80	Montañozu	Flat/mendatar		
		3	80	60		Montañozu		Flat/datar
		4	60	50				Montañozu
	2	1	80	60	Estrada Nasional Exklusivu			
		2	60	40	Urbana			

(Fonte: Express Highway Design Standard of NEXCO, Japan)

(2) Lista Dezeñu(Drawing List)

- Verifika lista dezeñu nebee rekere hamutuk ho BoQ.
- Normalmente dezeñu(drawings) husi estrada iha konteúdus hanesan iha-okos:

1) Mapa Lokalizasaun(Location Map)
2) Planu & Perfil (Plan & Profile)
3) Seksaun Kruzada(Cross Section)
4) Estrutura husi Estrada

Lista Dezeñu Projetu Estrada ba Altu-estrada(Highway) Suai – Beaço

A. Jeneralidade(General)
B. Típika Seksun Kruzada(Typical Cross Section)
C. Trasa Aliñamentu(Alignment Layout) no Dadus Kurva(Curve Data)
D. Planu & Perfil(Plan & Profile)
E. Estrutura (inklui Ponte)
F. Drenajen(Drainage)
G. Padraun/Standard (Sinal Tráfiku, iluminasaun, etc.)

(3) Mapa Lokalizasaun (Location Map)

Konsidera buat-hirak iha-okos, wainhira hare Mapa Lokalizasaun

(1) Dezeñu Detalhu rekere hanesan ho Estudu Viabilidade(Feasibility study) ka Planu Mestre(Master Plan).

(2) Avalia utilizasaun rai, impaktu ambiental & sosial, interfensia husi obstaklu sira, notifika ba konstrusaun no inundasaun iha fatin survey.

(3) Avalia aquizisaun rai no Direitu ba rai/Right of Way (ROW).

(4) Avalia area husi rai-halai/landslide ka assuntu sira seluk husi kondisaun rai/soil condition.

(4) Planu & Perfil(profile)

A. Distânsia husi visibilidade/Jarak pandang(Sight Distance)

B. Super Elevasaun(Super-elevation)

C. Radius husi Kurva Horizontal

D. Kurva Clothoid(Clothoid Curve)

E. Deklive Vertikal (Vertical Slope)

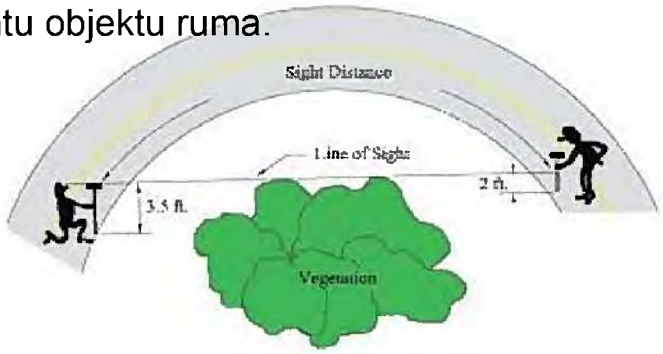
F. Radius husi Kurva vertikal(Vertical Curve)

G. Notifika ba dezeñu perfil nebee at/la-diak

H. Notifika ba kombinasaun ke la-diak husi Kurva Vertikal no Kurva Horizontal

A. Distânsia husi visibilidade(Sight Distance)

Distânsia husi visibilidade ke disponivel husi pontu ida mak distânsia aktual besik ba superfisie estrada/road surface, Alein motorista nebee husi fatin altura espesializada ke passa dalan kareta nian nebee ke bele hare/iha visibilidade ba objektus estasionáriu ka movimentu objektu ruma.



Distânsia Visibilidade(Sight Distance) iha Japaun

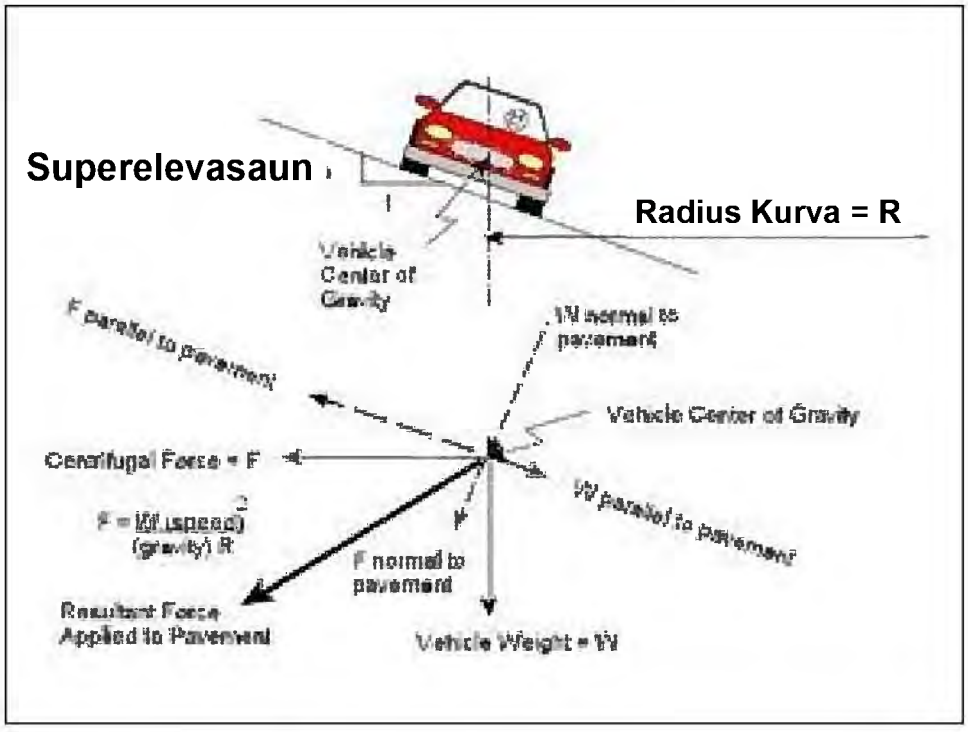
Dezeñu Velosidade /Design Speed (km/h)	Dezeñu Tráfiku /Traffic Speed (km/h)	Tempu halai inaktivu (Idle running time) (sec)	Koefisiente friksaun(Gesekan) /Friction coefficient	Hapara distânsia visibilidade /Stopping sight distance (m)	Distânsia Visibilidade /Sight Distance (m)
120	102	2.5	0.29	212	210
100	85	2.5	0.3	154	160
80	68	2.5	0.31	100	110
60	54	2.5	0.33	72	75
50	45	2.5	0.35	54	55

(Fonte: Express Highway Design Standard of NEXCO, Japan)

B. Superelevasaun(Superelevation)

(1) Superelevasaun maka rotasaun husi pavimentu/pavement iha besik ba no liu-husi kurva horizontal.

(2) Superelevasaun mak pretende hodi ajuda motorista liu-husi aksaun-kontraria ba aselerasaun lateral/horizontal nebee produz husi rute kurva.

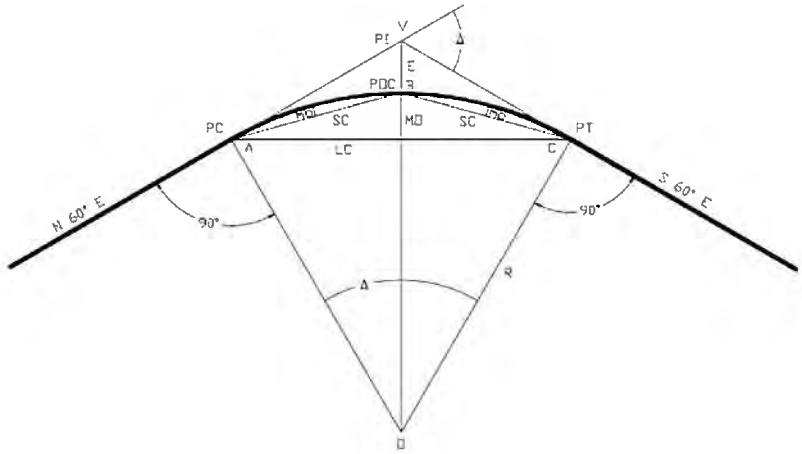


Superelevasaun iha Japaun

Dezenhu ba Velosidade /Design Speed	120 km/h	100 km/h	80 km/h	60 km/h	50 km/h	Superelevasaun/ Superelevation (%)
Radius husi Kurva/ Radius of Curve (m)	1,140 > > 1,040	870 > > 960	630 > > 710	350 > > 390	240 > > 270	6.00%
	1,380 > > 1,540	1,060 > > 1,200	790 > > 900	440 > > 500	300 > > 350	5.00%
	1,740 > > 1,980	1,360 > > 1,560	1,030 > > 1,190	570 > > 660	400 > > 460	4.00%
	2,310 > > 2,750	1,820 > > 2,180	1,400 > > 1,680	780 > > 940	540 > > 650	3.00%
	> 3,390	> 2,700	> 2,090	> 1,170	> 810	2.00%

(fonte: Express Highway Design Standard of NEXCO, Japan)

C. Radius husi Kurva Horizontal

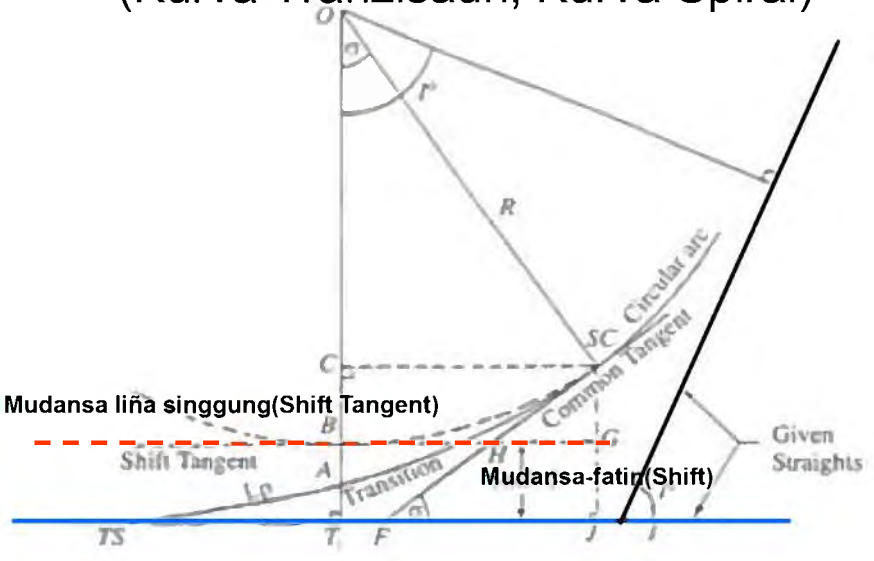


Radius husi Kurva Horizontal iha Japaun

Dezenhu ba Velosidade (Design Speed)	Desejavel Radius Minimu husi Kurva(Desirable Minimum Radius of	Radius Minimu husi Kurva(Minimum Radius of Curve)	
		Superelevasaun/ Superelevation = 8 %	Superelevasaun/Superelevation = 6 %
120	1,000	630	710
100	700	410	460
80	400	250	280
60	200	140	150
50	150	90	100

(fonte: Express Highway Design Standard of NEXCO, Japan)

D. Kurva Clothoid (Kurva Tranzisaun, Kurva Spiral)



Objetivu husi Kurva clothoid/ Clothoid Curve (KurvaTranzisaun, Kurva Spiral)

(1) Fornese dalan-ki'ik(path) ba veíkulu hodi muda husi dalan-reta(straight) ba kurva sirkular(circular curve)

(2) Hadi'a aparesimentu(appearance) husi kurva ba motorista tamba diresaun kaber(smooth steering)

(3) Permite introdusaun husi superelevasaun no haluan pavimentu(pavement widening)

Kurva husi "Spiral – Sírklu- Spiral"

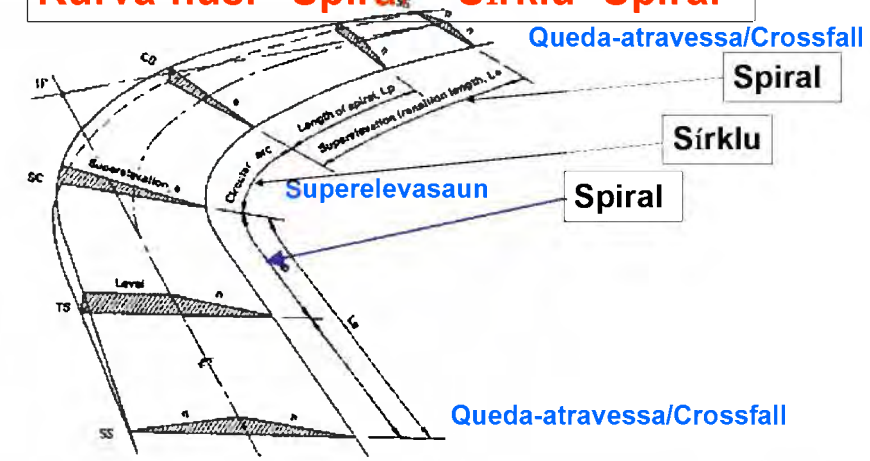
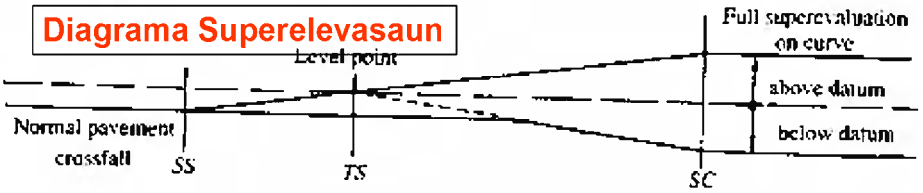


Diagrama Superelevasaun

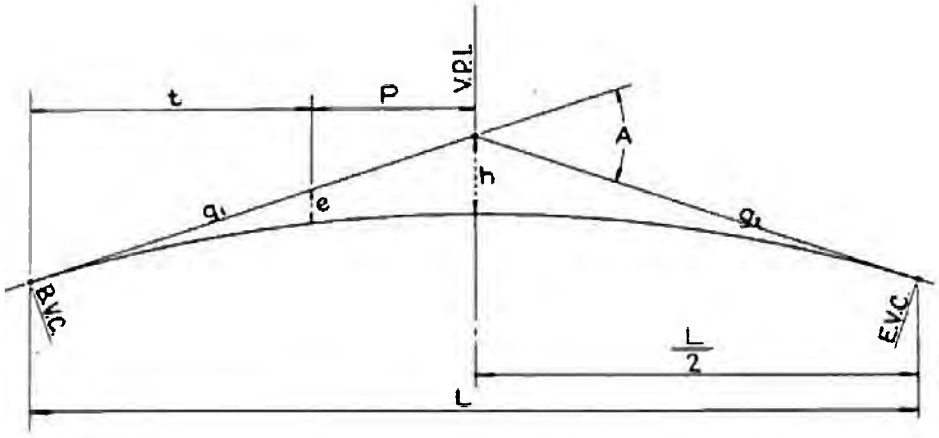


E. Deklive Vertikal (Vertical Slope)

Velosidade Dezeñu/Design Speed (km/h)	Grau Máximu/Maximum Grade (Deklive Vertikal/Vertical Slope) (%)
120	2
100	3
80	4
60	5
50	6

(fonte: Express Highway Design Standard of NEXCO, Japan)

F. Radius husi Kurva Vertikal



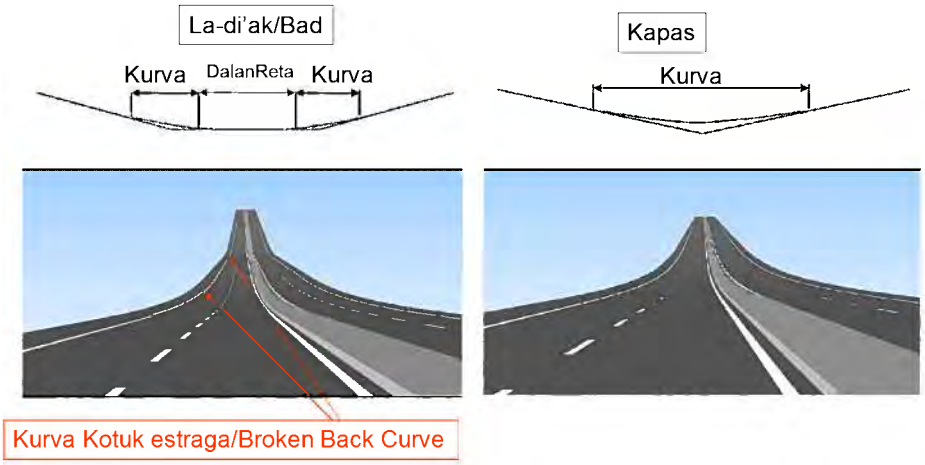
h = Distânsia Vertikal husi pontu intersesaun/intersection to'o ba kurva.
L = Kurva Vertikal nia Naruk/Vertical curve length.

Naruk Mínimu husi Kurva Vertikal (Minimum Vertical Curve Length (VC)

Dezeña ba Velosidade/ Design Speed (km/h)	Naruk Mínimu husi Kurva Vertikal/Minimum Vertical Curve Length (m)
120	100
100	85
80	70
60	50
50	40

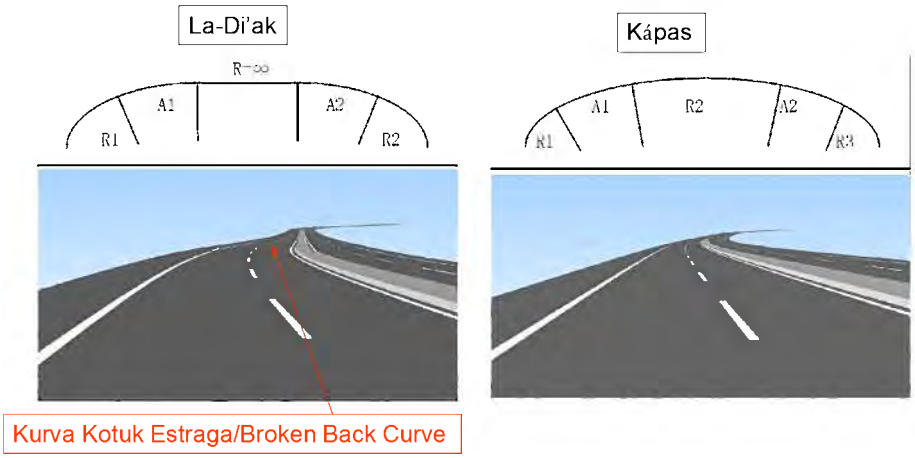
(Fonte: Express Highway Design Standard of NEXCO, Japan)

G. Notifika ba dezeñu Perfil ke At/La-di'ak(bad profile design)



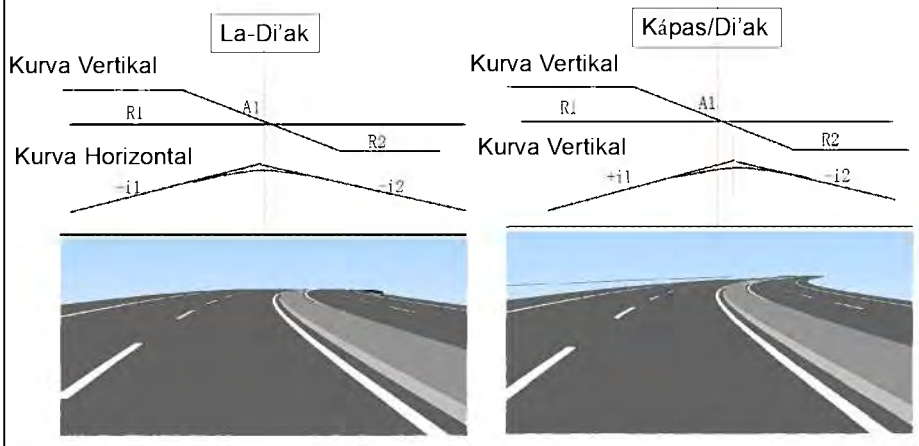
(fonte: Express Highway Design Standard of NEXCO, Japan)

H. Notifika ba Alinamentu La-di'ak husi Dezenu Trasadu (bad Alignment Layout design)



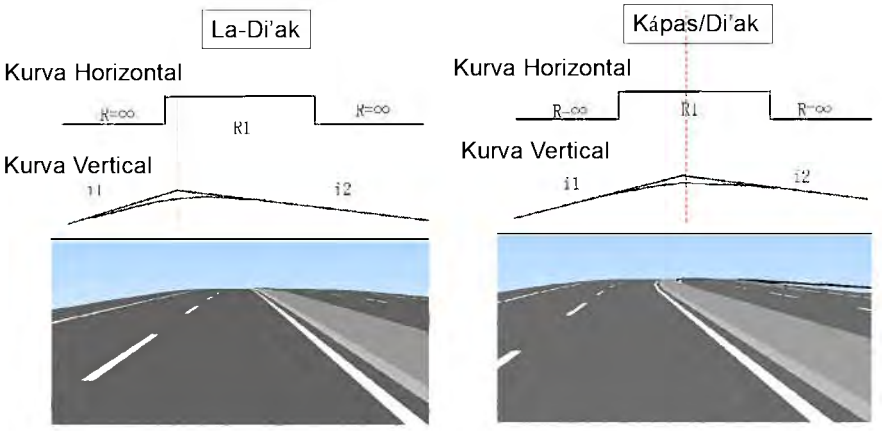
(fonte: Express Highway Design Standard of NEXCO, Japan)

I. Notifika ba kombinasaun La-Di'ak husi Kurva Vertikal no Kurva Horizontal



(fonte: Express Highway Design Standard of NEXCO, Japan)

J. Notifika ba kombinasaun La-di'ak husi kurva Vertikal no kurva Horizontal



(fonte: Express Highway Design Standard of NEXCO, Japan)

(5) Seksaun Kruzada (Cross Section)

1) Estrada nia Luan (Road width)
2) Tipu Pavimentu/Pavement type (AC / DBST)
   AC: Konkretu Aspal/Asphalt Concrete
   DBST: Bitumen Dobre/ Double Bituminus
3) Ângulu Deklive(Slope Angle) iha area kortada(Cut Area) /area ense(Fill Area) /area dique ka moru (Embankment Area)
4) Preferensial ka direitu ba rai/ROW (Right of Way)
5) Drenajen/Drainage
6) Lutu iha estrada ninin(Guardrail)

(6) Estrutura husi Estrada

1) Propoin Ponte / Ponte ke Existe hela
2) Propoin Kaixa Baleta rai-okos(Box Culvert) / Kaixa Baleta-rai-okos ke existe hela
3) Propoin RCP / Existe hela RCP (Pipa)
4) Propoin Drenajen(Drainage) / Drenajen ke Existe hela(Existing Drainage)
5) Besi-rin Elektroníka(Electric Pole) / Telefone rin
6) Pipa Abastimentu Bee(Water Supply Pipe)
7) Lampu tráfiku(Traffic Light)
8) Lutu-estrada-ninin(Guardrail) / Barreira Konkreta(Concrete Barrier)

Oráriu Tuir-mai

4ª Lisaun Sala de aula kona ba Estrada

Análiza(Analysis), Dezeñu(Design), rebarra/besi(Re-bar), Dimensaun iha (Dimension on)

(1) Estrutura Estrada/Road Structures (Baleta rai-okos/Culvert)

(2) Estrutura Estrada/Road Structures (Moru Protesaun/Retaining Wall)

5ª Lisaun Sala de aula sobre Konstrusaun husi Estrada, Pavimentasaun(Pavement)

Planeamentu Estrada (4)

Loron 8 Juñu de 2013

Verifikasaun ba Denzeñu(Drawings)

Staff ADN sira tenke verifika dezeñu tenderizasaun(tender drawings) liu-husi pontu vizaun husi item sira tuir-mai, utiliza manual ADN pájina Lista-verifikasaun/checklist 9, Dezeñu/Drawings(8), P59, Checklist A, nomos Checklist C2.

Lisaun Loron-ohin:
(1) Kondisaun Rai/Soil Condition
(2) Dezeñu husi Moru Protesaun/Retaining Wall & Tranka-besi/Re-bar
(3) Dezenu husi Kaixote drenajen-rai okos;perit/Box Culvert
(4) Rai-halai/Landslide

(1) Kondisaun Rai

1) Forsa Hamaran husi Rai Kohesivu/**Cohesive Soils (Tanah liat/Clay)**

Parâmetrus Forsa Tensaun Efektivu ba Longo-prazu(Long-term effective stress strength parameters), c' no φ', husi tanah-liat/clays tenke ser avaliada liu-husi hamaran konsolida/haforte neneik direta ba teste kaixa kose/gesek(shear box tests), Hamaran Konsolida /consolidated drained (CD) teste triaksial/trialxial tests, ka La-hamaran Konsolida /consolidated undrained (CU) teste triaksial/triaxial tests ho medidas pressaun ba poru/pori(pore pressure measurements).

Iha-nebee;

c' : Kohesivu husi rai(Cohesion of soil)

φ': Angulu husi friksaun internal ba hamaran rai (grau)/Angle of internal friction of drained soil (degrees)

(1) Kondisaun Rai (kontinua...)

2) Forsa Hamaran/Drained Strength husi Rai Musa-musan/**Granular Soils (Raihenek)**

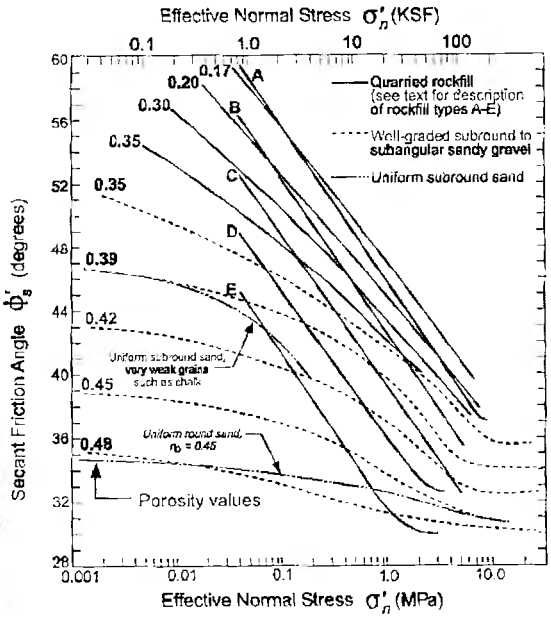
Hamaran angulu kose-ba-mai/friction angle husi depositu musa-musan/granular deposits tenke ser avalia husi korrelasaun ba rezultadus husi koko SPT (Padraun Teste Penetrasaun/ Standard Penetration Test: N-value/Valor-N), koko CPT (Cone Penetration Test/Teste Penetrasaun kerucut), ka relevante teste seluk iha-situ.

N = Kontajen SPT golpe;pukulan dirrijidu/blow count corrected ba efisiensia matelu/hammer efficiency (Golpe;blows/ft, ka golpe;blows/30 cm)

[foot;Âin = 30.48 cm]

- Ba kerikil/**gravels** no fatuk/**rock** ense materiais iha-nebee Teste SPT mak la konfiável.
- Figura ida-ne'e tenke ser uza.

Rock Fill Grade	Particle Unconfined Compressive Strength (ksf)
A	>4610
B	3460–4610
C	2590–3460
D	1730–2590
E	≤1730



(fonte: AASHTO LRFD BRIDGE DESIGN SPECIFICATION 10.18, 2010)

(2) Dezeñu husi Moru Protesaun/Retaining Wall

Fundasaun husi Moru Protesaun/Retaining Wall

- Expansaun Âin-fatin/Spread Footings

Expansaun Âin-fatin tenke ser proporsionada no dezeñadu forma ruma ke suporta rai ka fatuk fornese rezisténsia nominal adekuada/adequate nominal resistance, konsidera potensial rua-ne'e ba forsa aguenta adekuadu/adequate bearing strength nomos potensial ba tur-fatin/settlement.

1. Reviravolta;jungkirbalik/Overturning (Exsentrisidade/ Eccentricity)
2. Moda-an/Sliding
3. Elevasaun/Uplift
4. Estabilidade global/Overall stability (Forsa Aguenta;Sasatan/Bearing strength & Tur-fatin/settlement)
5. Lakon ba suporta lateral/loss of lateral support (Rai-halai/Landslide)

Kle'an husi Sasatan;aguenta/Bearing Depth

- Iha-nebee potensial ba tohik/scour, erosaun ka existe eskavasaun iha-okos / undermining exists, expansaun âin/spread footings tenke ser alokada hodi satan/bear okos husi kle'an antisipada maxima ba tohik/scour, erosaun, ka eskavasaun iha-okos/underminings.

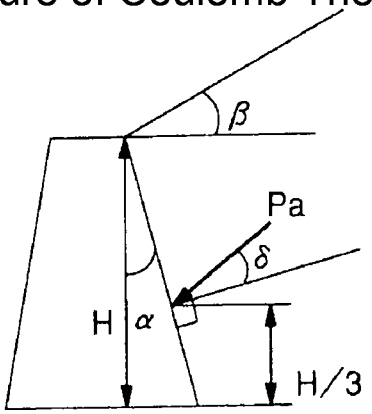
Nanahe husi Sasatan/Bearing Layer

- **Rai kahur raihenek/Sandy soil no nanahe kerikil/ gravel layers** dala ruma haktuir hanesan kualidade di'ak ba sasatan nahe/**bearing layers** karik sira nia valor N ka N value (SPT) mak aproximadamente equal ba ka luan liu duké 30/larger than **30.**
- Nu'udar moru protesaun ki'ik, sasatan nahe/Bearing layers husi rai kahur raihenek/**Sandy soil no nanahe kerikil/gravel layers** bele sai **20** husi STP.
- **Nanahe rai Kohesivu/Cohesive soil layers** bele propoin sai kualidade-di'ak ba sasatan nahe/bearing layers, karik valor N ka N value ma aproximadamente equal ba ka luan-liu duké **20**. Forsa kompresaun limitada Qu(Unconfined compression strength Qu) mak liu duké aproxima 0.4 N/mm2.

(fonte: Specifications for Highway Bridges Part IV Substructures, Japan)

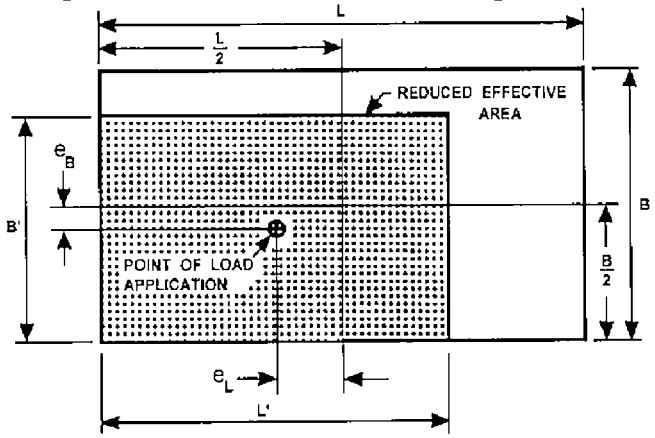
Análiza Estabilidade husi Moru Protesaun
Stability Analysis of Retaining Wall

- Pressaun Rai husi Teoria Coulomb/
  Earth Pressure of Coulomb Theory



Dimensaun Efektivu ba Âin-fatin/
Effective Footing Dimensions

- Dimensaun sira reduzidu ba âin-fatin ka pijakan retangular ke exsentrikamente rekargada mak hatudu iha figura.



Tur-fatin husi Expansaun Ain-fatin;pijakan Settlement of Spread Footing

Fundasaun ba tur-fatin tenke kalkuladu utiliza metodu komputasional bazea ba rezultadus husi laboratóriu ka teste iha deslokamentu/in-situ testing, ka rua ne'e hotu.

Total tur-fatin/Total settlement inklui elástika, konsolidasaun, no komponentes sekundárius.

Tur-fatin Elástika/Elastic settlement mak deformasaun instantânea wainhira rai ne'ebe deskargadu.

Tur-fatin Konsolidasaun/Consolidation settlement maka deformasaun importante tebes konsiderasaun iha depozitu rai ke kohesivu/cohesive soil deposits.

Tur-fatin Sekundáriu/Secondary settlement mak husi atensaun prinsipal iha depozitu plastiku aas-liu ka depozitu rai organiku

Rezistênsia Sasatan/Bearing Resistance husi Expansaun Âin-fatin/Spread Footings

- Pozisaun husi tabela Bee-rai-okos/**groundwater** bele signifikamente influensa ba rezistênsia sasatan iha rai.
- Em jeral, Hoban-an/**submergence** husi rai sei reduz forsa kose/pergesekan nebee efektivu/ shear strength husi menus materiais kohesivu (ka granular;musa-musan), nu'udar hanesan forsa kose longo prazu/ long-term shear strength husi rai kohesivu (tanah-liat;clay).

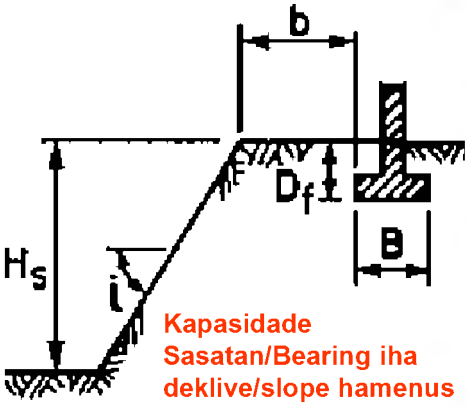
Rezistênsia Sasatan/Bearing Resistance husi Expansaun Âin-fatin/Spread Footings(kontin…)

- Formulasaun rezistênsia Sasatan fornesida iha okos ne'e igual maka formulasaun kompletu ne'e.

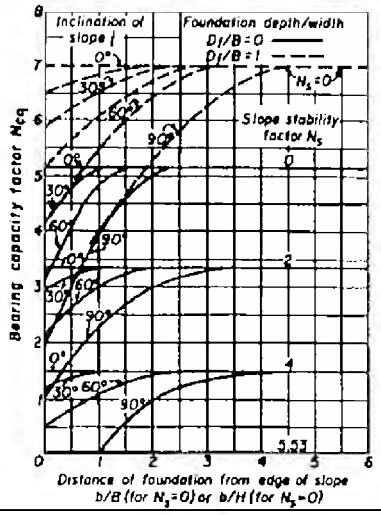
$$q_n = cN_{cm} + \gamma D_f N_{qm} C_{wq} + 0.5\gamma \quad BN_{\gamma m} C_{w\gamma}$$

Konsiderasaun ba Ain-fatin; fundamentu/Footings iha Deklive /Slopes

Fátor Kapasidade Sasatan(bearing) Modifikadu tenke ser uza besik ba deklive/slope.



Kapasidade Sasatan/Bearing iha deklive/slope hamenus duke iha rai-tetuk.



Pilares Dirijida/Driven Piles

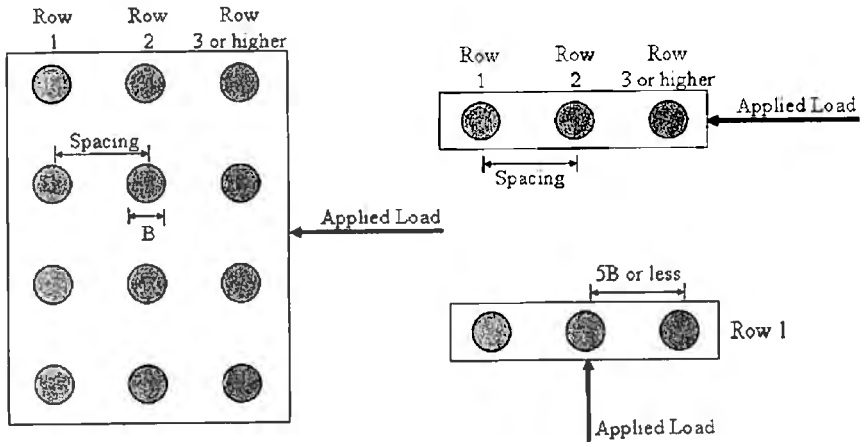
Pilar Dirijida tenke ser konsiderada iha situasaun tuir-mai:

1) Wainhira expansaun âin-fatin/spread footings **labele harii iha fatuk leten, ka iha rai nebee kapas;kompotensia/competent soils** ho kustu ke razoavel,
2) Iha lokalizasaun iha-nebee kondisaun rai sei normalmente permite utilizasaun ba expansaun âin-fatin/spread footings maibe potensial existe ba **tohik/scour**, liquidasaun ka expansaun lateral, iha kazu nebee pilar sasatan dirijida/driven piles bearing iha materiais sastifatóriu iha rai fasil-monu okos tenke ser konsidera utilizasaun hanesan **protesaun ida** hasoru problema hirak ne'e,
3) **Wainhira direitu ba rai/right-of-way ka espasu limitasaun seluk sei la permite atu uza expansaun âin-fatin/spread footings, ka**
4) **Wainhira laiha akordu ba montante husi hatur-fain/settlement ba expansaun fundamentu/ain-fatin(spread footings) dala ruma bele akuntese.**

Espasu Pilar Mínimu, Apuramentu(Clearance), no Inkrustasaun(Embedment) iha Limitasaun Maximu(Cap)

- Espasu pilar husi sentru-ba-sentru tenke labele menus dukė 30.0 inc. ka 2.5 husi diâmetru pilares.
- Distânsia hosi medida pilar ruma ba besik-liu ninin husi limitasaun pilar maximu/pile cap tenke labele menus husi 9.0 inc.
- Laletek husi pilares tenke projekta pelu menus 12.0 inc. tama iha limitasaun pilar maximu hafoin material estragu hotu-hotu hasai tiha ona.

Definisaun husi diresaun karrega(Loading Direction) nomos Espasu ba Grupu Efektadu husi Pilares



Determinasaun husi Rezistênsia Sasatan Nominal (Bearing Resistance) ba Pilares

1) Teste Diskarga Estátika (Static Load Test)
2) Teste Dinámika(Dynamic Testing)
3) Análiza iqualidade Laloran/Wave Equation Analysis
4) Formula Dinámika/Dynamic Formula
5) **Análiza Estátika/Static Analysis** **---Relatóriu Dezeñu/Design Report**

(Rezistênsia Sasatan husi Pilares/Bearing Resistance of Piles) = (Fátor Rezistênsia/Resistance Factor) x ((Pilar Rezistensia husi Hali'is/Pile Tip Resistance) + (Pilar Rezistensia Horizontal/Pile Side Resistance))

BRP= (RF) x ((PTR) + (PSR))

Utilizasaun dadus SPT ka CPT **---Relatóriu Dezeñu(Design Report)**

Posu Furadu(Drilled Shafts)

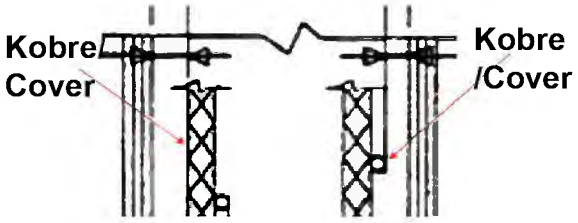
Posu Furadu bele nudar alternativa ekonomia ida ba expansaun ain-fatin(spread footing) ka fundasaun pilares, partikularmente kuandu expansun âin-fatin labele harii alma ka estrata fatuk adekuadu iha kle'an ke razoavel laran(**within a reasonable depth)** ka kuandu pilar dirijida mak la viavel/**cocok**.

Posu furadu bele nudar alternativa ekonomia ba expansaun âin-fatin iha-nebee kle'an tatohik/**scour depth** mak luan. Posu furadu/Drill shafts bele mos konsiderada ba reziste lateral aas/**resist high lateral ka formasaun deskarga/axial loads**, ka kuandu tolerânsia deformasaun nian mak ki'ik.

Tranka Besi-betaun(Re-Bar) (Besi-betaun Reforsamentu)

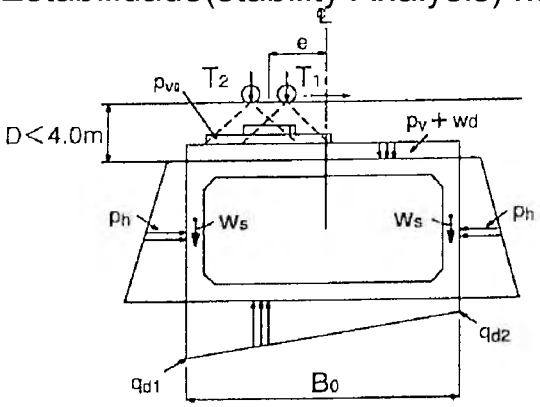
Kobre/Cover : Kuran distansia entre superfisie/oin husi reforsamentu no nia oin/superfisie external husi konkretu. Revista dezeñu/Check Drawings.

Espasador/Spacer (Bloku kobre/Cover Block) : dispozitivu/Device ne'e katak mantein reforsamentu iha pozisaun próprio, nomos dispozitivus/alat ida para salva formatu moru ketak-ketak iha distansia ke fo ba antes no durante fui-konkretu.



(3) Dezeñu husi Kaixa Baleta rai-okos(Box Culvert)

- Analiza Estabilidade(stability Analysis) husi Box Culvert



Baleta rai-okos(Box Culvert) mak estável liu duké moru protesaun iha pressaun rai nia laran.

Modelu Falhansu(Failure Mode) husi kaixa baleta rai-okos(Box Culvert)

Box Culvert ke Existe-hela mak fase tiha-ona durante inundasaun.

Iha Upstream/hulu husi mota Bidau iha Dili

Razaun mak seksaun kruzada/cross section husi Box Culvert hasoru debris durante inundasaun.
Luan husi kaixa baleta dalan-okos foun/ box culvert persija mínimu 3.00 m tamba mota-oan ke existe nia luan mak 3.00 m.

(4) Rai-halai/Landslide

Rai-halai/Landslide iha Maubisse
iha Estrada Nasional A02.

Rai-halai/Landslide iha Dili iha Estrada Nasional A01.

Obra bronjo tinan 15 liu tamba Rai-halai/Landslide

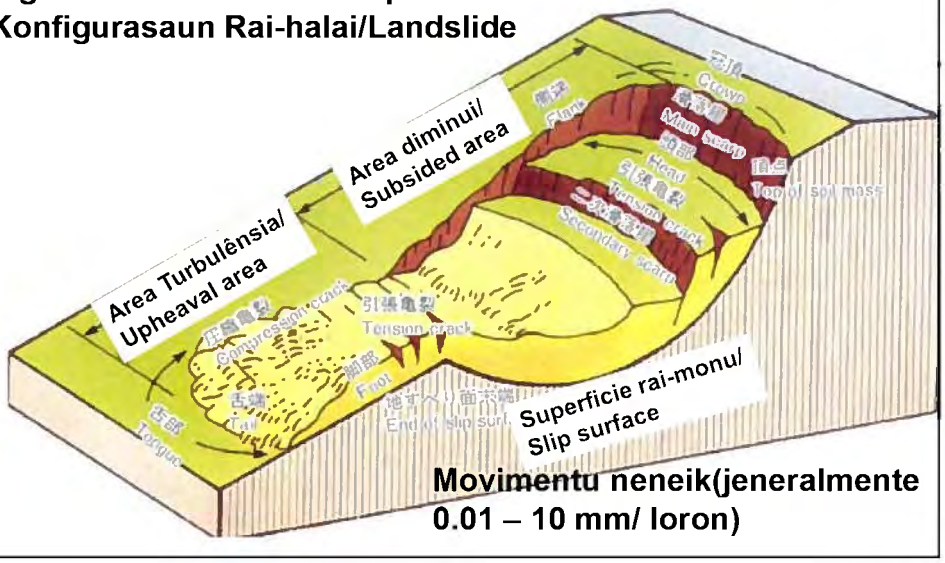
Rai-halai komesa fali ona kada etapa.

Rai-halai besik 70 % husi estrada nia luan.

(fonte: JICA long-term expert Dr. Kazama)

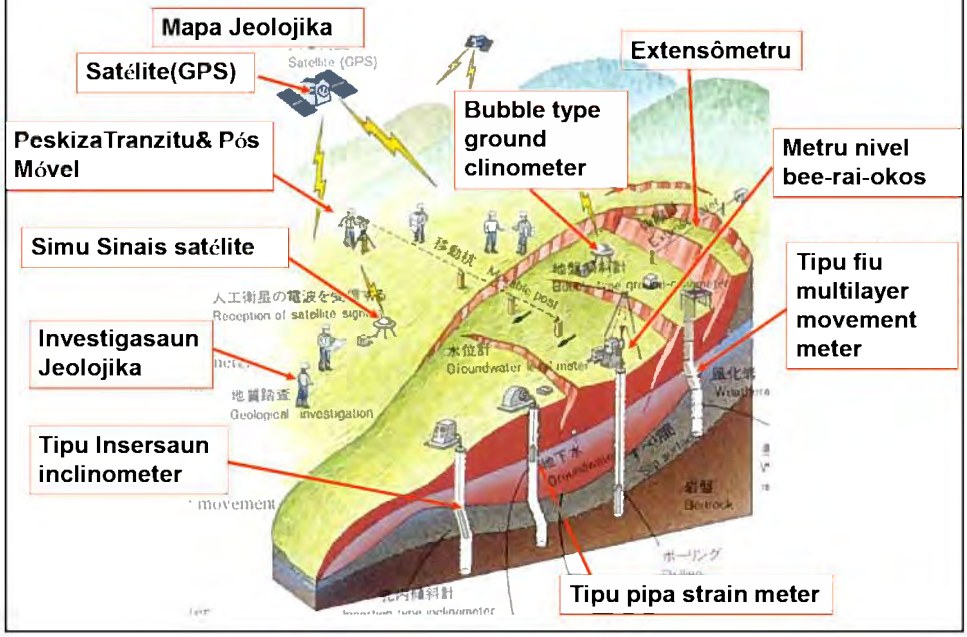
Mekanismu husi Rai-halai

Figura Eskematika husi Típika Konfigurasaun Rai-halai/Landslide

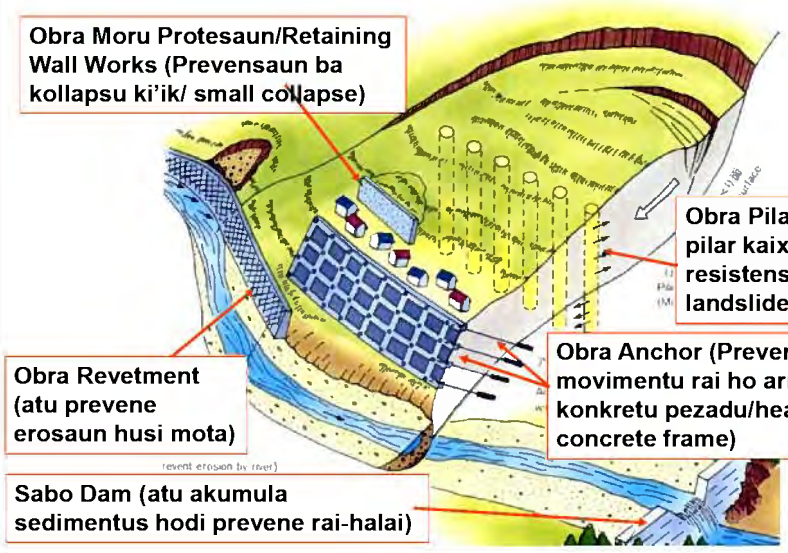


Movimentu neneik(jeneralmente 0.01 – 10 mm/ loron)

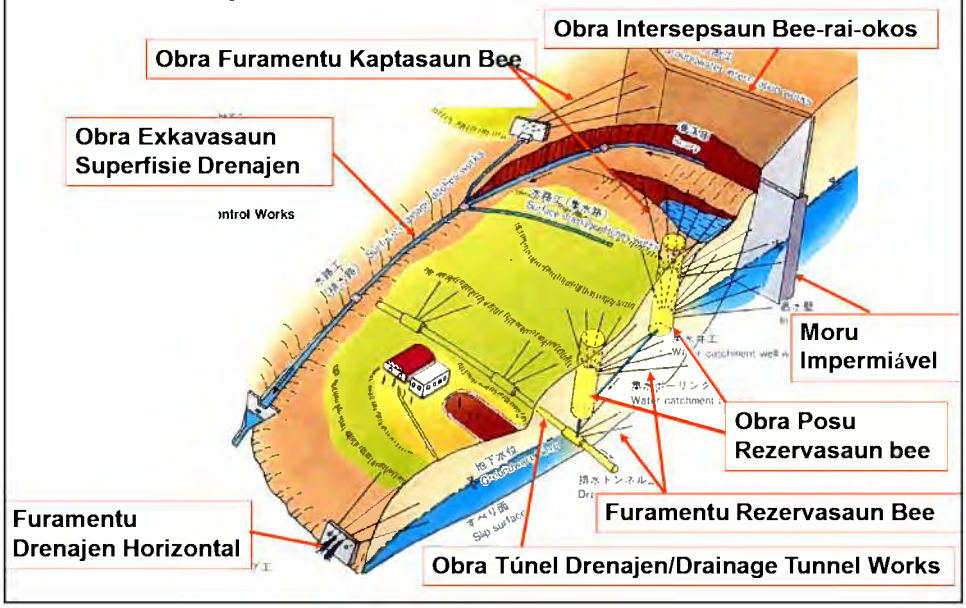
Levantamentu Rai-halai/Landslide



Obra Kontrolamentu hodi hapara Mekanikamente Rai-halai/landslide



Obra Kontrolu Prinsipalmente Aponta iha Kontrolu Bee

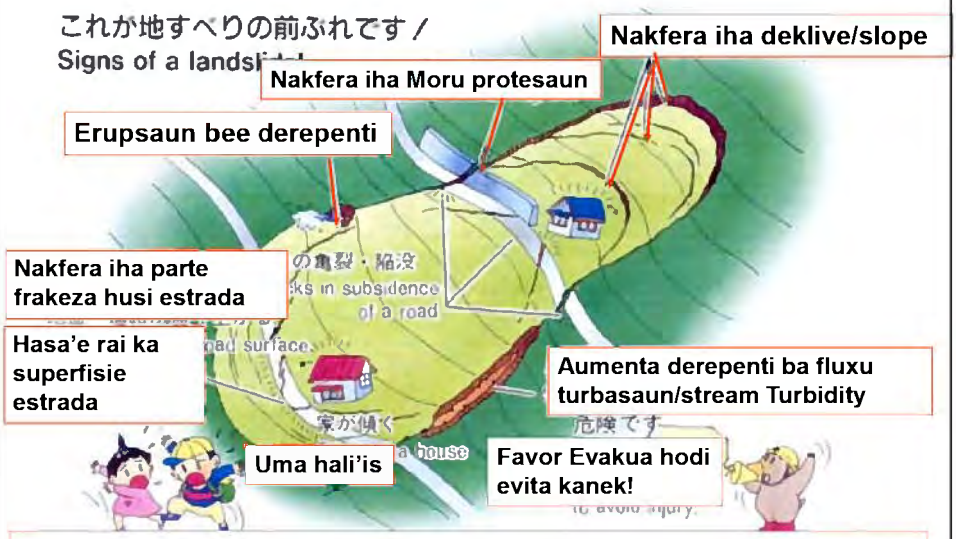


Rai-halai Jizukiyama iha Japaun, 1990

Dezastre Rai-halai 1990

Hafoin kompleta husi obra prevensaun

Sinais husi Rai-halai/Landslide



Aktividades nebee ke bele kauza ka agrave rai-halai mak previdu durante iha area tratadu rai-halai laran

Orárius Tuir-mai

5ª Lisaun Sala de Aula

Konstrusaun husi Estrada, Pavement(Pavimentu;Lapisan aspal)

6ª Lisaun Sala de Aula

Konstrusaun husi Estrutura Estrada (Moru Protesaun/Retaining Wall, Bronjo/Gabion, Kaixa baleta iha dalan-okos/Box Culvert)

Planeamentu ba Estrada (5)

Juñu 22 de 2013

Verifikasaun ba Dezeñu/Drawings

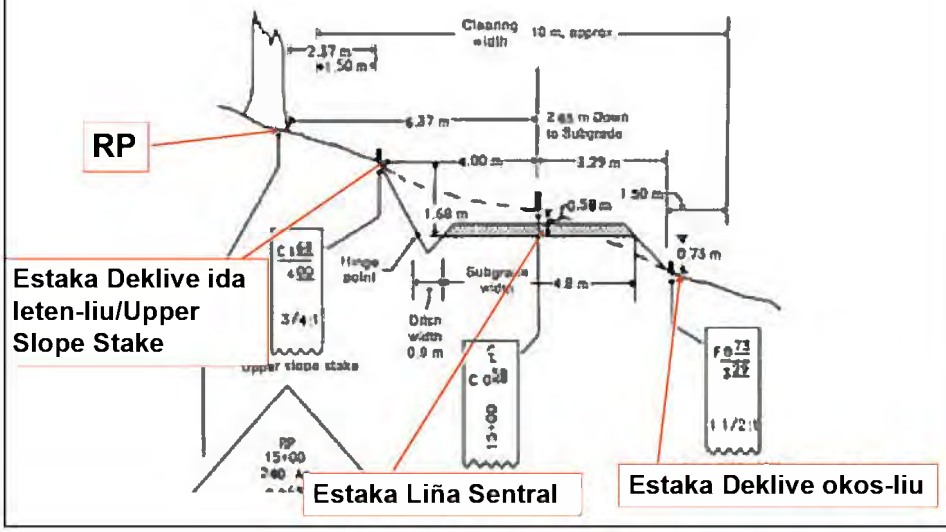
Staff ADN sira tenke verifika dezeñu/tender drawings através pontu de vista husi item sira tuir-mai, utiliza lista-verifikasaun manual ADN/ADN manual checklist.

Lisaun Loron-ohin:
(1) Konstrusaun & Pagamentu ba Estrada
(2) Konstrusaun & Pagamentu ba Superfisie pavimentu;pengaspalan/Pavement

Staka Konstrusaun (Construction Staking)

- Antes aktividades konstrusaun, informasaun dezeñu tenke ser muda hosi planu ba iha rai. Ida-ne'e maka rematada husi staka.
- **Estaka** mak pilar ai-balok/wooden pile, aproxima nanaruk 50 cm.
- Estaka mak uza husi operador ekipamentu sira iha lokalizasaun iha-nebee atu komesa ko'a/cutting.
- Para atu reloka estaka sira (liña-sentral/centerline, estaka deklive/slope stakes), ida- ne'e mak ajuda tebes hodi estabelese Pontu referênsia/**reference points (RP)** iha liur husi limitasaun limpeza/clearing limits. Pontu referênsia tenke ser regula mais-menus 3 to'o 5 metrus iha rai-aas husi limitasaun limpeza nia kotuk/uphill clearing limits.

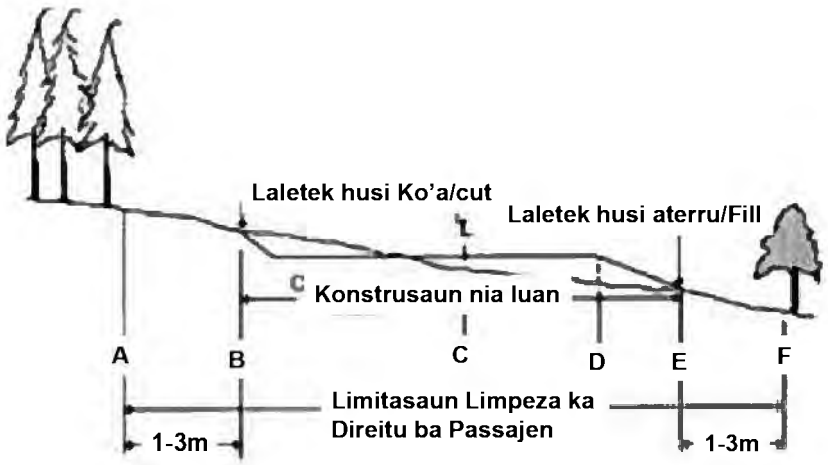
- Uzu husi RP nian (Pontu referênsia/Reference Points) ka estaka deklive/slope stakes ba eskavasaun propriu mak hatudu figura iha okos.



Hamos;Limpeza no Hasai/Grubbing husi Area Konstrusaun Estrada

- Prepara **Direitu-ba-Passajen/right-of-way** husi estrada ka **area konstrusaun** mak refere ba Limpeza/hamos no hasai/grubbing.
- Durante faze limpeza, ai-hun tá tiha. Hasai/Grubbing refere ba limpeza no Foti-sai ai-restu sira no debris/puing-puing orgániku.
- **Ai-hun** tenke ser tá tiha no hamos tiha mínimu **1 to'o 3 m** iha laletek husi ko'a fatin/cut ka ponta;fatin husi aterru.
- Log/ai-tesi bele enfeita/dekora iha liur husi area konstrusaun ka fora husi deslizadu.

- Limitasaun Limpeza iha relasaun ba luan husi estrada dalan-fatin, kuantidades signifikante husi materiais orgániku mak hasai-tiha entre B no E.



Pagamentu husi Limpeza no Hasai/ Grubbing

Númeru Item Selu	Deskrisaun	Unidade husi Medisaun
201(1)	Limpeza/Clearing no Hasai/Grubbing	Hektares/Hectare
201(2)	Limpeza/Clearing no Hasai/Grubbing	Montante fixu/Lump Sum
201(3)	Foti-sai ida-ida ba ai-hun,ai-ki'ik/Individual Removal of Trees, Small	Kada ida/Each
201(4)	Foti-sai ida-ida ba ai-hun,ai-ki'ik/Individual Removal of Trees, Small	Kada ida/Each

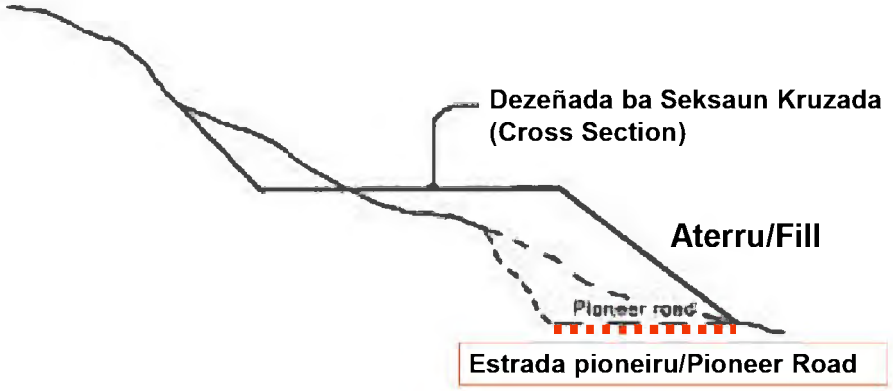
(fonte: MTCPW Standard Specifications, 2005)

Estrada Pioneiru/Pioneer Road

- Durante faze hasai/grubbing phase, ka faze preparasaun, estrada pioneiru mak frekuentamente konstruida hodi fasilita assessu ekuipamentu, movimentu ba ekuipamentu tesi-ai/logging equipment movement, no entrega husi materiais konstrusaun, hanesan baleta-rai-okos sira/culverts.
- Ida-ne'e mak frekuentamente sai kazu wainhira aktividades konstrusaun maka hala'o iha varius maneiras lokalizasaun oi-oin. Karik estrada pioneiru mak konstrui ona, sira harii frekuentamente iha laletek husi konstrusaun nia luan no normalmente laiha tan seluk duké harii dalan-ik'ik ba bull dozer.

- Wainhira bele konsidera ba konstrusaun aterru rai-aas mak planeadu ona, dozer nia ain tenke ser lokadu iha ain-okos/**toe** ka baze/**base** husi aterru ke propin ba/ proposed fill.

  Estrada Pioneiru/Pioneer road iha nia okos husi aterru ke propoin fornese banku para kaer material aterru husi kompleta estrada.



Harahun;fregmenta(Break Up) & Rekopera(Reclaim)

- Estrada Rekoperador/Road Reclaimer: Fregmenta/Breaking up, rekopera/reclaiming, resiklajen/recycling ka harahun-u'ut/milling

Pagamentu husi Remosaun;hasai/Removal ba Estruturas no Obstaklu sira

Numeru Item selu	Deskrisaun	Unidade husi Mediasaun/Measurement
202(1)	Remosaun ba Estruturas no Obstaklus	Montante Fixu/Lump Sum
202(2)	Remosaun ba Estruturas no Obstaklus (espesifiku)	Kada ida/Each
202(3)	Remosaun ba pavimentasaun/pavement, parte la'o-fatin/side walks, trotoar-ninin/curbs, etc.	Metru Eskuardu/Square meter
202(4)	Removal of	Linear meter

(ponte: MTCPW Standard Specifications, 2005)

Bulldozer iha Konstrusaun Estrada

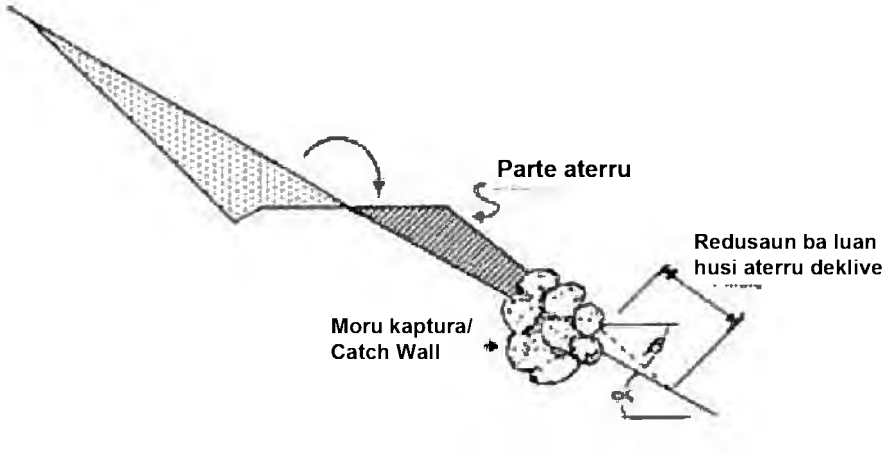
- Provalvemente ekipamentu pidasuk ke komun iha konstrusaun estrada floresta nebee ekipada husi bulldozer ho reta ka lamina tipu-U/U-type blades.
- Hirak ne'e mak provalvemente **ekonómiku liu/ most economical** ba ekipamentus pidasuk wainhira tenke ser hasai tiha iha **tempu badak**.
- Dudu ekonomiku/economic haul ka distânsia dada/push distance ba bulldozer ida ho lamina reta/straight blade mak hosi **17 to'o 90 metrus** depende ba tetuk/grade.

Ekipamentu Dudu-sai rai/ Earthmoving Equipment

Eskavador Hidráuliku (Mákina Suru/Power Shovel) iha Konstrusaun Estrada

- Eskavador hidráuliku mak relativamente téknolojia fo'un iha konstrusaun estrada floresta.
- Mákina ida-ne'e bazikamente opera hodi ke'e/ digging, halo-balânsiu/swinging no depozita/bo'u-hamutuk material.
- Balânsiu massa/Mass balance besik liña-sentral mak limitada ba kada eskavador, tipikalmente aproxima metrus 15 to'o 20.

- Naruk husi aterru deklive/Fill slope length mak reduzida husi métodu moru kaptura iha ain-okos husi aterru/catch wall at toe of



Pagamentu ba Eskavasaun

Númeru Item selu	Deskrisaun	Unidade husi Mediasaun/Measurement
203(1)	Eskavasaun ke inadekuada/ Unsuitable excavation	Metru kúbiku/Cubic meter
203(2)	Eskavasaun komun;bou-hamutuk ke liu-tiha/Surplus Common Excavation	Metru kúbiku/Cubic meter
203(3)	Eskavasaun Fatuk ke liu-tiha/Surplus Rock Excavation	Metru kúbiku/Cubic meter
203(4)	Eskavasaun La klassifikada Liu-tiha/Surplus unclassified Excavation	Metru kúbiku/Cubic meter

(fonte: MTCPW Standard Specifications, 2005)

Pagamentu ba Eskavasaun Estrutura

Númeru Item Selu	Deskrisaun	Unidade ba Medisaun/ Measurement
204(1)	Eskavasaun Estrutura	Metru Kúbiku/Cubic meter
204(2)	Eskavasaun Ponte/bridge Excavation	Metru Kúbiku/Cubic meter
204(3)	Aterru;ense Fundasaun/Foundation Fill	Metru Kúbiku/Cubic meter
204(4)	Eskavasaun ordenada iha Planu elevasaun nia okos/excavation ordened below Plan elevation	Metru Kúbiku/Cubic meter
204(5)	Sasatan(Shoring), krib(cribbing), obra relasionada	Montante Fixu/Lump sum
204(6)	Eskavasaun ba pipa baleta rai-okos/Pipe culverts no drenajen/drain	Metru Kúbiku/Cubic meter

(fonte: MTCPW Standard Specifications, 2005)

Pagamentu ba Aterru(Embankment)

Númeru Item Selu	Deskrisaun	Unidade ba Medisaun/ Measurement
205(1)	Aterru/Embankment	Metru Kúbiku/Cubic meter
205(2)	Rekere-temporáriu selesionada ba laletek/Selected Borrow for topping	Metru Kúbiku/Cubic meter
205(3)	Rekere-temporáriu selesionadu ba laletek/Selected Borrow for topping	Metru Kúbiku/Cubic meter
205(4)	Suporta Rai/Earth Berm	Metru

(fonte: MTCPW Standard Specifications, 2005)

Konstrui;harii ba Fundasaun Leten/ Building Base Courses

- Fundasaun Leten estrada nian(Road base courses)rekere tetuk lolos(right grade), Deklive/slope, Mahar/thickness, materiais no kompaksaun/compaction.

Pagamentu ba Preparasaun kamada/lapisan superfisial/permukaan rai(Subgrade)

Númeru Item Selu	Deskrisaun	Unidade ba Medisaun/ Measurement
206(1)	Preparasaun Kamada superfisie rai/Subgrade (Material Komun/bai-bain)	Metru Eskuadradu/ Square meter
206(2)	Preparasaun Kamada superfisie rai/Subgrade (Material Existe hela)	Metru Eskuadradu/ Square meter
206(3)	Preparasaun Kamada superfisie rai/Subgrade (Material La adekuadu)	Metru Eskuadradu/ Square meter

Pagamentu ba Ekipamentus Kompaksaun no Deskansa Kontrola Solidasaun/Density Control Strips

Laiha pagamentu.

(fonte: MTCPW Standard Specifications, 2005)

Pagamentu ba Reparasaun-jeral(Overhaul)

Númeru Item Selu	Deskripsaun	Unidade ba Medisaun/ Measurement
208(1)	Reparasaun-jeral/Overhaul	Kúbiku-metru-kilometru
208(2)	Reparasaun/Overhaul ba rekere-temporáriu/Borrow, Kazu 1	Kúbiku-metru-kilometru

Pagamentu ba Agregadu;Fatuk iha Superfisie Okos(Aggregate Subbase Course)

Númeru Item Selu	Deskrisaun	Unidade ba Medisaun/ Measurement
301	Fundasaun Superfisie Agregadu;Fatuk Okos Aggregate Subbase Course	Metru Kúbiku/Cubic meter

Pagamentu ba Agregadu;Fatuk iha Superfisie Leten(Aggregate Base Course)

Númeru Item Selu	Deskripsaun	Unidade ba Medisaun/ Measurement
302	Fundasaun Superfisie Agregadu Leten(Aggregate Base Course)	Metru Kúbiku/Cubic meter

Pagamentu ba Agregadu;fatuk Rahun iha Superfisie Leten/Crushed Aggregate Base Course

Númeru Item Selu	Deskrisaun	Unidade ba Medisaun/ Measurement
303	Fatuk Rahun iha superfisie;lapisan Leten(Crushed Aggregate Base Course)	Metru Kúbiku/Cubic meter

Pagamentu ba Ahu Estabilizada hodi kahur iha Superfisie Estrada Leten(Lime Stabilized Road Mix Base Course)

Númeru Item Selu	Deskrisaun	Unidade ba Medisaun/ Measurement
304	Ahu Estabelizador hodi kahur iha Superfisie Estrada Leten(Lime Stabilized Road Mix Base Course)/ (Fo'un ka Rekupera) Rai-Agregadu/fatuk	Metru Kúbiku/Cubic meter

Pagamentu ba Sementi Portland hodi kahur iha Superfisie Estrada Leten

Númeru Item Selu	Deskripsaun	Unidade ba Medisaun/ Measurement
305	Sementi Portland hodi kahur iha superfisie leten/(Fo'un ka Rekupera) Rai/Soil-Fatuk/Aggregate	Metru Kúbiku/Cubic meter

Pagamentu ba Aspal Estabilizada hodi kahur iha superfisie estrada leten

Númeru Item Selu	Deskrisaun	Unidade ba Medisaun/ Measurement
306	Aspal Estabilizada hodi kahur iha superfisie estrada leten/(Fo'un ka rekupera) Rai(soil)-Agregadu/fatuk	Metru Kúbiku/Cubic meter

Pagamentu ba Sementi Portland hodi kahur Planta Tratadu iha superfisie leten/Cement Treated Plant Mix Base Course

Númeru Item Selu	Deskrisaun	Unidade ba Medisaun/ Measurement
307	Pagamentu ba Sementi Portland hodi kahur Planta Tratadu iha superfisie leten/ (fo'un ka Rekuperasaun) Rai/Soil-Fatuk/Aggregate	Metru Kúbiku/Cubic meter

Pavimentasaun/Pengaspalan

Ita-bo'ot tenke ser konsidera plantas kapasidade produsaun, unidade Lalin husi kambioneta/haul truck units, rute distânsia/route distance, Luan husi pavimentasaun/paving width, mahar/thickness no velosidade/speed.

Pagamentu ba Superfisie Fatuk Aspal nian/Aggregate Surface Course

Númeru Item Selu	Deskrisaun	Unidade ba Medisaun/ Measurement
401	Superfisie Fatuk Aspal/Aggregate Surface Course	Metru kúbiku kompaktadu iha fatin/Cubic meter Compacted in place
401(1)	Superfisie Gravel;krikil aspal/Gravel Surface Course	Metru kúbiku kompaktadu iha fatin/Cubic meter Compacted in place
401(2)	Fatuk rahun iha superfisie aspal/Crushed Aggregate Surface Course	Metru kúbiku kompaktadu iha fatin/Cubic meter Compacted in place

Pagamentu ba Konkretu Alkatraun iha superfisie aspal leten/Bituminous Concrete Surface Course, Nahe ho manas/Hot-Laid

Númeru Item Selu	Deskripsaun	Unidade ba Medisaun/ Measurement
411	Konkretu Alkatraun iha superfisie aspal leten/Bituminous Concrete Surface Course, Nahe ho manas/Hot-Laid	Tonaladas/Tonne

Pagamentu ba Sementi/Portland Cement iha Pavimentu Konkretu/Concrete Pavement

Númeru Item Selu	Deskrisaun	Unidade ba Medisaun/ Measurement
412(1)	Pavimentu PCC/PCC Pavement (Polos/Plain)	Metru Eskuadra/Square meter
412(2)	Pavimentu PCC/PCC Pavement (Reforsada/Reinforced)	Metru Eskuadra/Square meter

Oráriu Tuir-mai

6ª Lisaun iha Sala Laran kona-ba Estrada

Konstrusaun ba Estrutura Estrada (Moru Protesaun/Retaining Wall, Bronjo/Gabion, Kaixa Baleta rai-okos/Box Culvert)

添付資料 12 座学研修教材(洪水対策)(英語版)

ANNEX-6

CLASSROOM LESSON ON FLOOD CONTROL

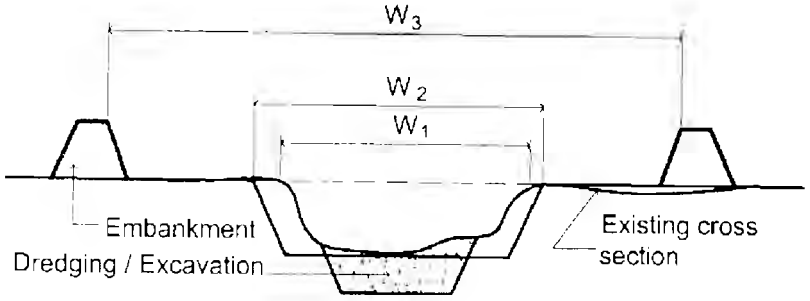
Planning of Flood Control (1)

11th May 2013

Categories of Flood Control

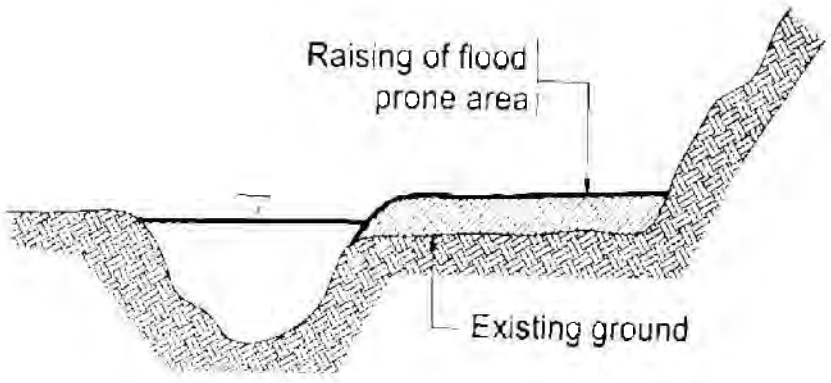
- (1) To increase the river discharge capacity
- (2) To protect flood prone area from overflow
- (3) To reduce and/or control the peak discharge of flood
- (4) To prevent inland flood
- (5) To prevent bank collapse and harmful degradation
- (6) To prevent obstruction against river flow and/or maintain/conserve the good condition of the river in order to keep the flow uninterrupted.

(1) To increase the river discharge capacity

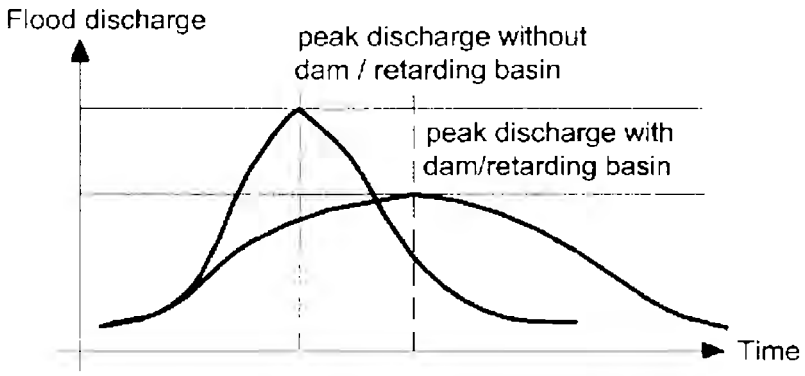


W_1 = Existing river width
W_2 = Improved river width by widening
W_3 = Improved river width by diking

(2) To protect flood prone area from overflow

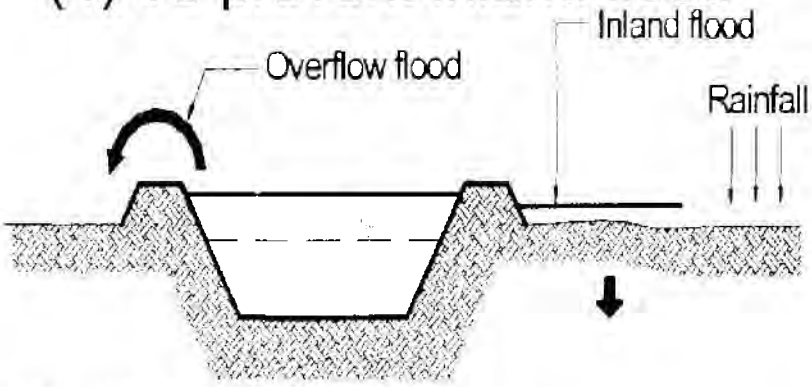


(3) To reduce and/or control the peak discharge of flood



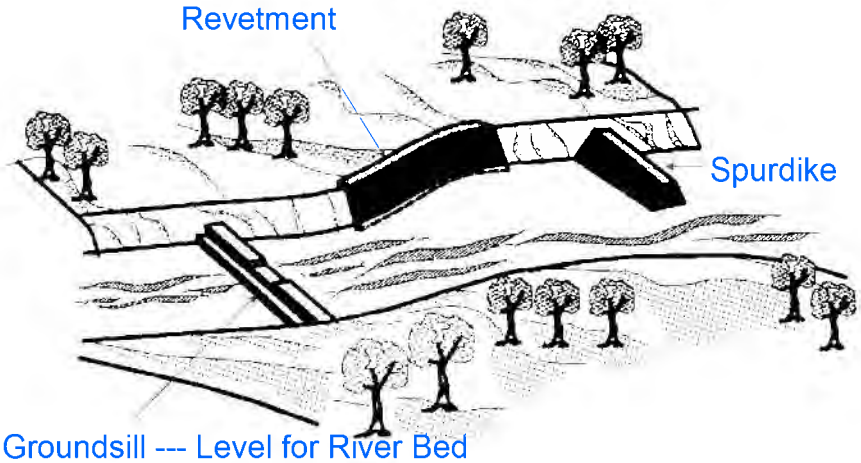
Hydrograph of reduction of peak discharge

(4) To prevent inland flood



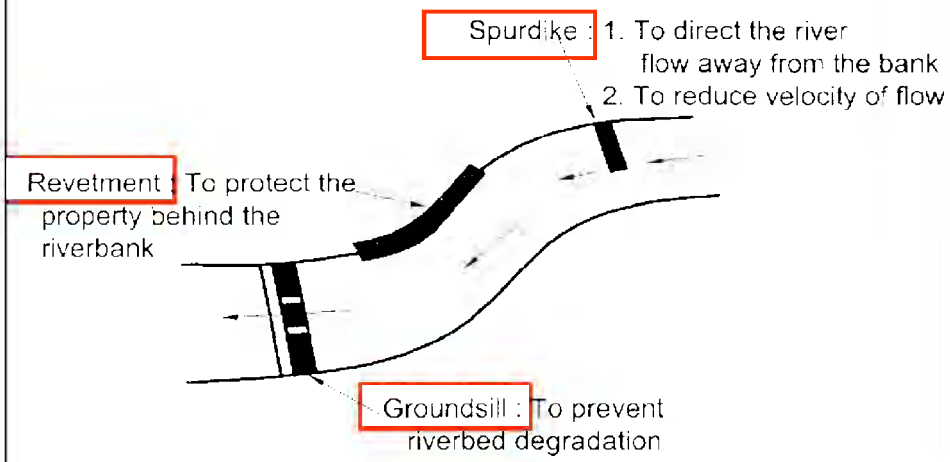
Inland Flooding could be prevented by:
(1) Lateral improvement (Ex. Storm drain, drainage main, open canals, ditches, etc.)
(2) Tributary improvement (Ex. Branches of main river)
(3) Pumping station

(5) To prevent bank collapse and harmful degradation



Groundsill --- Level for River Bed
Weir --- Height for River Bed

(5) To prevent bank collapse and harmful degradation



(6) To prevent obstruction against river flow and/or maintain/conserve the good condition of the river in order to keep the flow uninterrupted

- By sabo works (for sediment control)
- By regular maintenance (channel excavation / dredging)

Necessity of Flood Control Plan

Flood Control Plan should be formulated from the basin-wide view point, and requires proper coordination with the other plans such as:

(1) Irrigation development plan

(2) Road network / bridge plan

(3) Sabo plan

(4) Environmental management plan

Design Flood Freaquency

- Design Flood Frequency is expressed by return period, i.e., the probability (expressed in years) where a flood of a target size/magnitude is likely to occur. The return period should be determined based on the size of catchment area, the degree of importance of the proposed project area and economic viability of the project.

Flood Control Project Implementation Plan

- (1) Channel plan (1:1,000-1:10,000)
- (2) Cross section (Existing/ Design)
- (3) Longitudinal profile (Existing/ Design)
- (4) Structural design drawings
- (5) Cost estimates
- (6) Benefit estimation
- (7) Environmental/ Social Impact
- (8) Project evaluation

Next Schedule

2nd Flood Control in Class Room Lesson;

(1) Topographic Survey

(2) Hydrologic Analysis

3rd Flood Control in Class Room Lesson

(1) River structures

Planning of Flood Control (2)

18th May 2013

Topographic Information for Master Plan

- To understand the general profile of a river system, catchment area and flood prone area, the following maps are required;

1. Topographic map with a scale of 1:50,000 or larger
2. Land use map
3. Geological map
4. Other available map from the related Local Government Units

Topographic Information for Master Plan (contin.)

- From the maps mentioned, the following activities shall be conducted:
- 1. Delineate catchment area
- 2. Classify the geological/ geographical features of each sub-catchment area
- 3. Classify the existing vegetation by each sub-catchment area

- 4. Identify the flood prone sites roughly. (Exact area should be identified and determined from the field investigation and water level analysis)
- 5. Identify the cities and municipalities in the flood prone area.
- 6. Identify the important public facilities such as national road, provincial road, city hall, church and school, etc. within the flood prone area.
- 7. Classify the land use in flood prone area, such as commercial area, residential area, industrial area, agricultural area, etc.
- 8. Identify the changes in the river course and longitudinal profile.

General Information

- Collect all information regarding land use, population, economic activities, future development plans, etc. within the catchment area and flood prone area.

1. Population by city / municipality
2. Increasing ratios of population by city
3. Statistics of commercial activities per year by region and city
4. Statistics of industrial product per year by region and city
5. Statistics of agricultural products per year by region and city
6. Long term and medium term development plan by region, city and municipality.

Hydrologic Data

- Collect the following hydrologic data of the river basin:

1. Daily rainfall data of all gauging stations within and around the catchment area throughout the recording period from meteorological observatory and other related agencies.
2. Hourly rainfall data of all gauging stations within and around the catchment area during the duration of the flood.
3. Hyetographs of past typical floods on all synoptic rainfall gauging stations from meteorological observatory and other related agencies.

Hydrologic Data (contin.)

4. Data on the maximum water levels during peak floods at all water level gauging station from gauging station and by interview. (For rainfall and runoff analysis)
5. Discharge measurement record for all water level gauging stations.
6. H-Q (Height-Discharge relationship) rating curve for all water level gauging stations (with location, cross-section and flow velocity during flooding time)

Field Survey for Master Plan

- Conduct field survey as follows:

1. River cross sections at typical sites

- - Every 500 m to 1,000 m intervals along the stretches of river proposed for improvement

2. Longitudinal profile

- - Rough profile of the river to be taken from topographic map
- - Longitudinal profile taken from cross section survey

3. Identification of the riverbed material

- - By segment features of the river

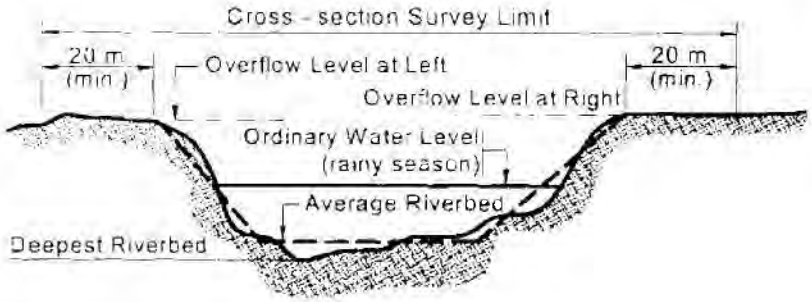
Field Investigation for Master Plan

- Conduct field investigation and interviews to get the following information.

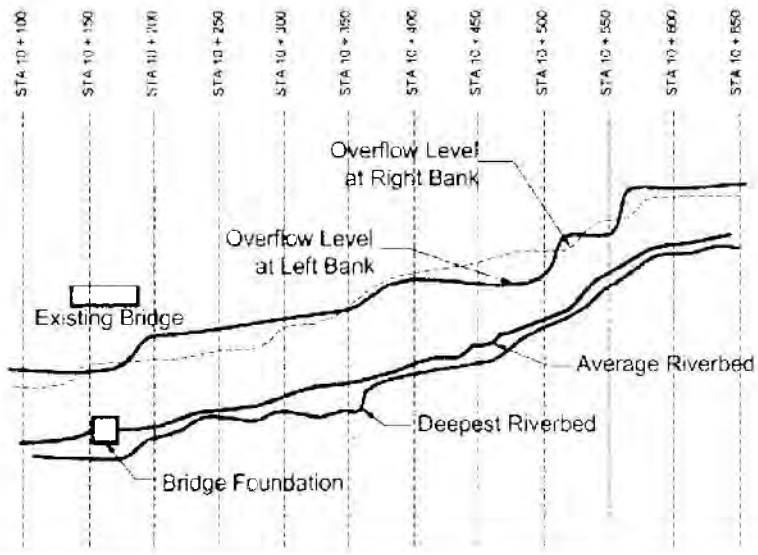
1. The information/ records of past floods (Frequency, area, depth, during of flooding)
2. Conditions of the existing river facilities.
3. History of flood control activities in the basin.

Project Implementation Plan

- 1. Need more detail topographic survey
- 2. Need more detail cross section survey



- 3. Need more detail longitudinal profile survey



Material Survey

- The type of materials of riverbank and water area shall be surveyed and indicated in the topographic map and cross section profiles in order to:
- - Determine the riverbed characteristics (Manning's "n")
- - Determine the quality of riverbed materials (if suitable for construction use)
- - Determine the relationship of diameter of riverbed materials, riverbed gradient, etc. with the velocity of flow.
- - Classify the river segment based on the river morphology.

Hydrologic Analysis

Survey and Investigation

↓

Rainfall Analysis

↓

Runoff Analysis

↓

Compare

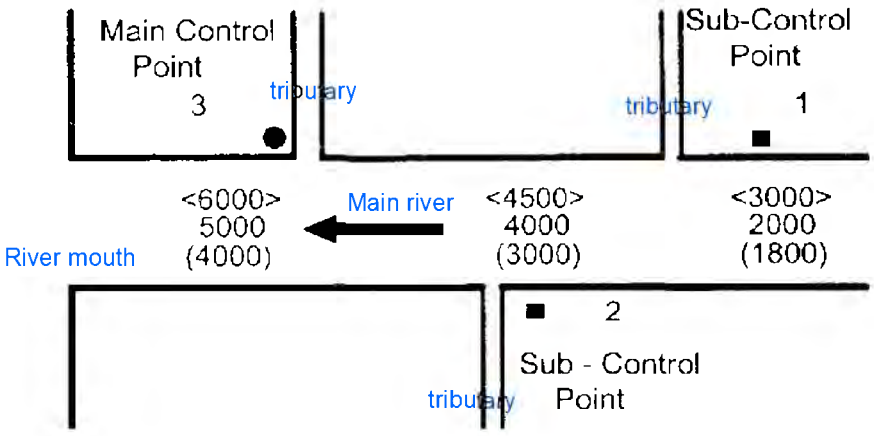
↓

Design Discharge

(1) Calculated Discharges on each Control/ Sub0control Points (on several return period)

(2) Existing Discharge Capacity of Each Control Point

Diagram of Discharges (Example)



<Q> = Long-term target discharge

Q = Design discharge

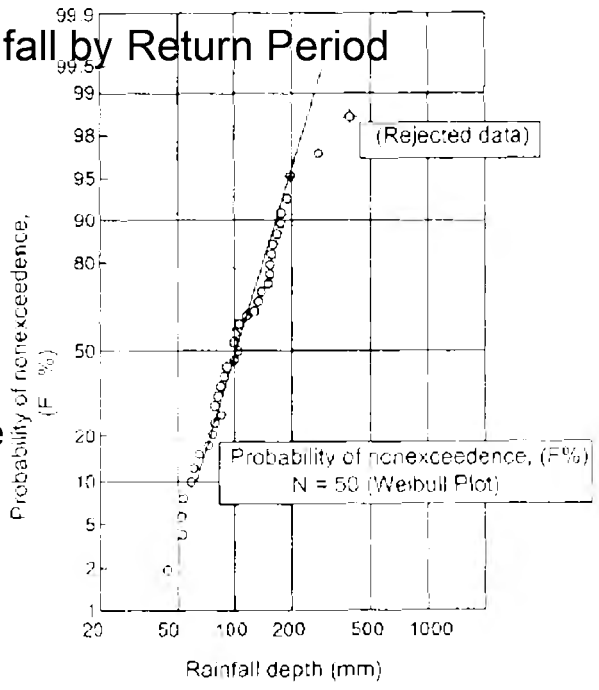
(Q) = Existing discharge capacity

Rainfall Analysis

1. Delineation of catchment area
2. Calculate average rainfall in catchment area
3. Calculate annual maximum average rainfall (2-days, 3-days, etc.)
4. Calculate average rainfall by selected return periods
5. Collect typical rainfall patterns (hyetographs) of past major floods and establish typical rainfall accumulation mass curve for each duration.
6. Generate hyetograph for each duration and return period.

Average Rainfall by Return Period

Relationship of Probability of non exceedance and Rainfall Depth (mm)



Runoff Analysis

- There are many methods for runoff analysis already developed/ being developed. Methods of runoff analysis are the following:

1. **Rational Formula** --- simple river
2. **Unit Hydrograph Method** --- many tributary river (consider time-lag)
3. **Storage Function Method** --- dam or inland flood area

Rational Formula

- $Qp = \frac{ciA}{3.6}$
- where:
- Qp = maximum flood discharge (m^3/s)
- C = dimensionless runoff coefficient
- I = rainfall intensity within the time of flood concentration (mm/h)
- A = catchment area (km^2)

Next Schedule

3rd Flood Control in Class Room Lesson
(1) River structures (dike, revetment)

4th Flood Control in Class Room Lesson
(2) River structures (spur dike, weir)

Planning of Flood Control (3)

1st Jun 2013

Today's Lesson

- Design of River structures

(1) Channel Characteristic
(2) Channel Morphology
(3) Economic Analysis
(4) Dike
(5) Revetment
(6) Spur dike
(7) Groundsill
(8) Weir

(1) Channel Characteristics

- Characteristics and morphology of channel are determined by several factors. The main ones are:

(1) Discharge and its hourly change (refer Class Room No.2)

(2) Sediment load and its hourly change

(3) Bed materials and topography around river channel, and

(4) Followed by local climate, riparian vegetation and land use in the drainage basin.

River Segment and Channel Characteristics

Classification	Segment M	Segment 1	Segment 2		Segment 3
			2-1	2-2	
Geography	Mountain ←	Allivial →	Narrow Plane →	Natural Levee →	Delta →
Diameter of Typical Riverbed Materials	Various materials	More than 2 cm.	3-1 cm,	1-0.3 mm	less than 0.3 mm
Riverbank Material	Many tyoes of soil and rocks appear on the banks as well as on riverbed	Riverbank material is composed of thin layer of sand and silt which is same as the riverbed	Lower layer of the riverbank material is the same with the riverbed.	Mixture of fine sand, clay and silt. Same material with riverbed	Silt and Clay

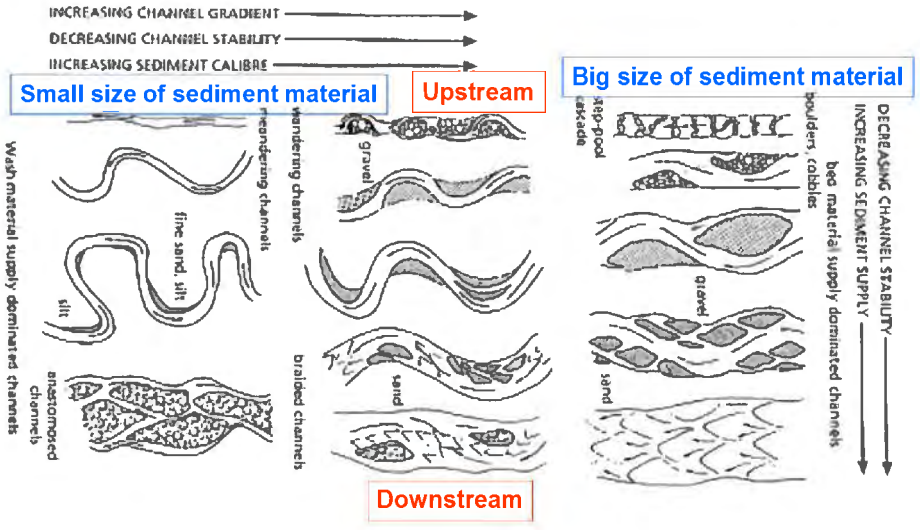
Upstream Downstream

River Segment and Channel Characteristics (contin.)

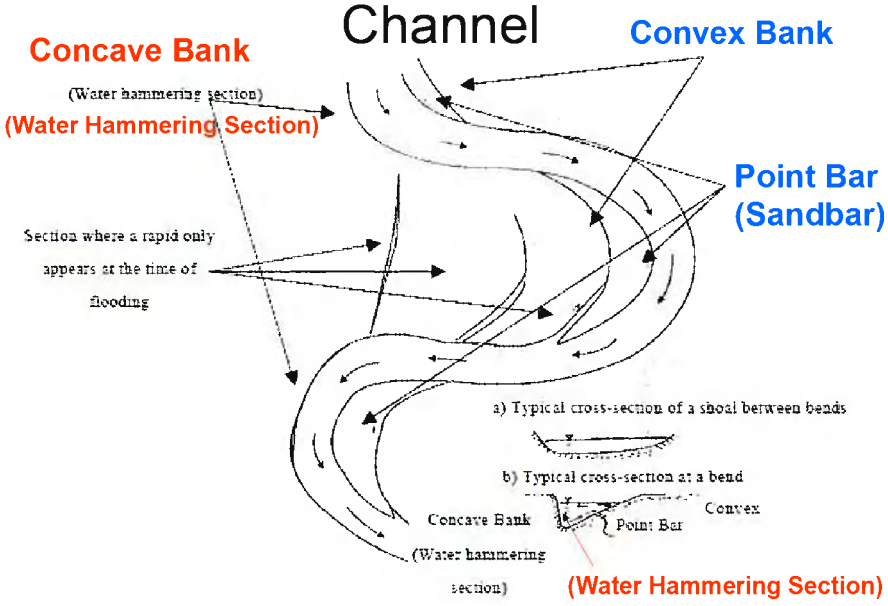
Classification	Segment M	Segment 1	Segment 2		Segment 3
			2-1	2-2	
Gradient	Various Generally steep gradient	1:60 – 1:400	1:400 – 1:5,000		1:5,000 – Level
Meandering	Various	Few bend / meander	Heavy meandesing		Large and small meandering
Bank Scouring	Heavy	Heavy	Medium. Mainstream cources changes where bigger riverbed materials exist.		Weak. Location/ course of stream is almost fixed.
Water Depth of Annually Maximum Flood	Various	0.5–3.0 m	2.0–8.0 m		3.0–8.0 m

Upstream Downstream

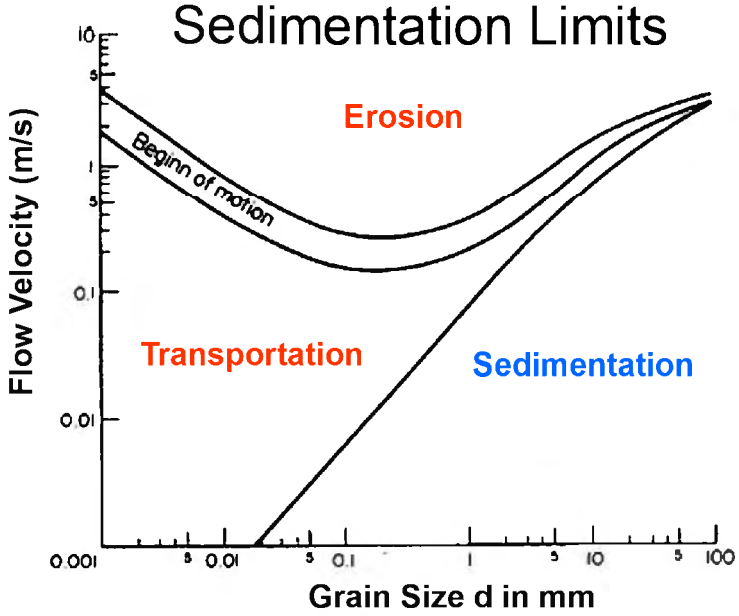
(2) Schematic Diagramme of Channel Morphology



Characteristics of Meandering Channel



Erosion, Transportation and Sedimentation Limits



(3) Economic Analysis

- The projects shall be subjected to economic evaluation to determine their viability and justify the implementation.

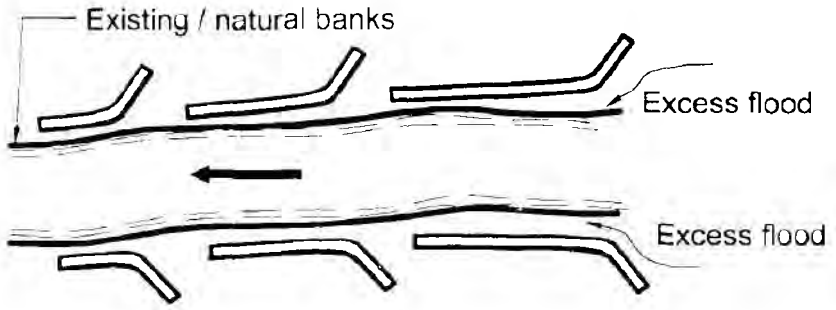
a) The Net Present Value "**NPV**" should be at least nil. NPV = (Present Value of Benefits) – (Present Vale of Cost)

b) The benefit-Cost Ratio "**B/C**" should be at least one.

c) The Internal Rate of Return "**IRR**" should be at least 15 %. IRR = Discount Rate that will make the Present Value of Benefits equal to Present Value of Cost.

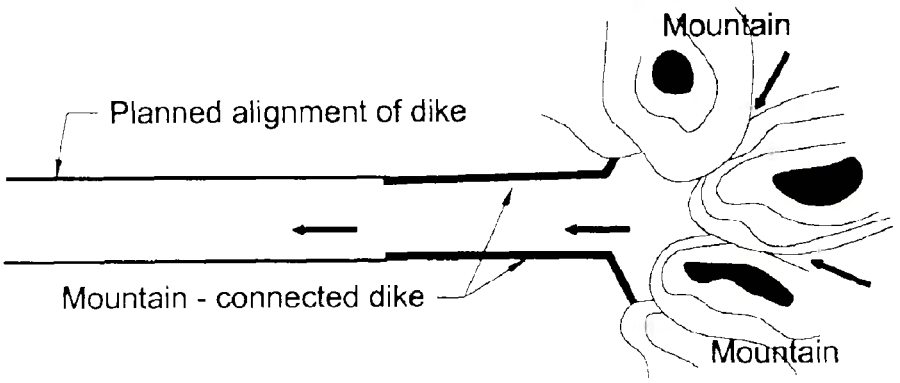
(4) Dike

a) Open Dike



(4) Dike (contin.)

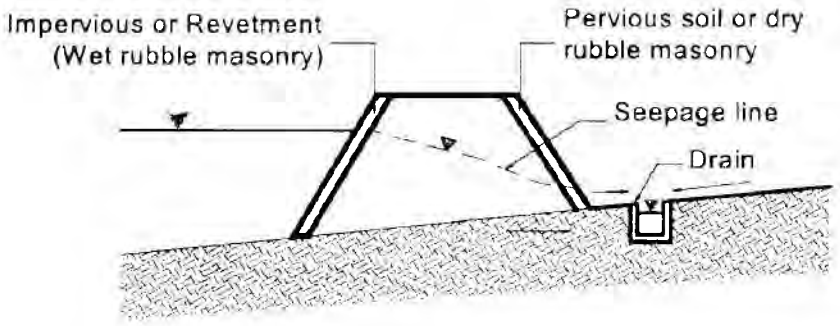
b) Mountain-Connected Dike



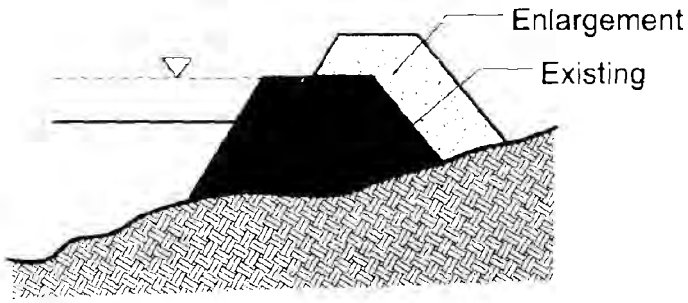
Main cause of damages on Dike

1) Erosion (Scouring)
2) Overflow
3) Seepage
4) Earthquake

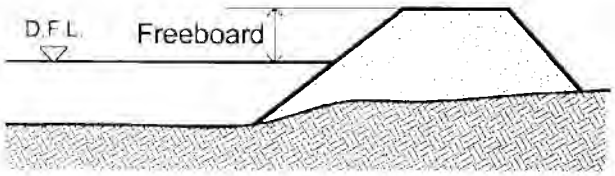
Countermeasure against Seepage



Enlargement of Existing Dike



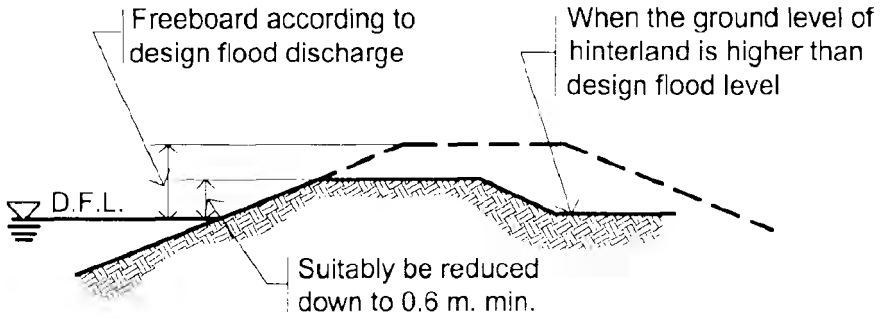
Height of Dike



Dike Height = Design flood level + Freeboard

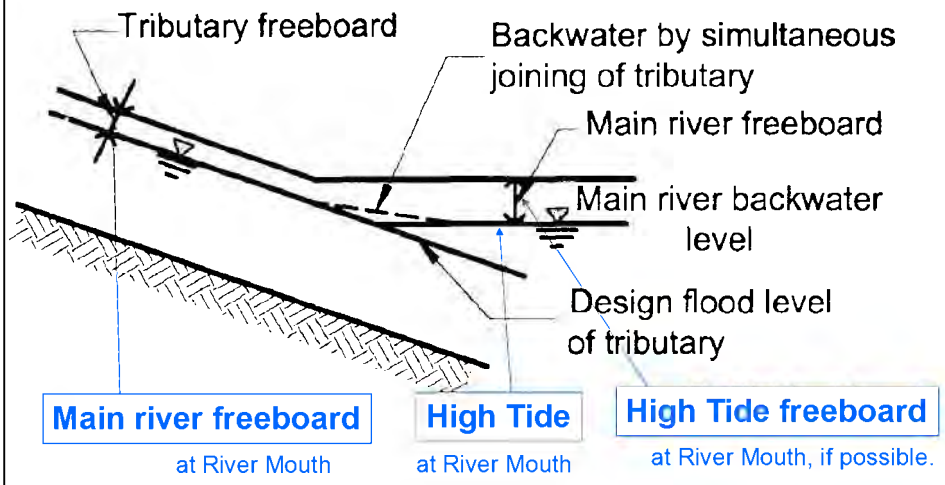
Design flood discharge (m^3/s)	Freeboard (m)
Less than 200	0.6
200 and up to 500	0.8
500 and up to 2,000	1
2,000 and up to 5,000	1.2
5,000 and up to 10,000	1.5
10,000 and over	2

Height of Dike (exception)



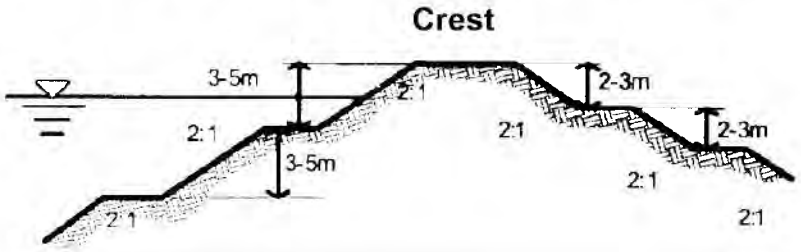
- **Freeboard is reduced down to 0.6 m minimum, when hinterland is higher than design flood level.**

Back Water



The dike , affected by high tide, should be generally covered on the respective three faces by concrete or similar material, taking into account the wave overtopping action.

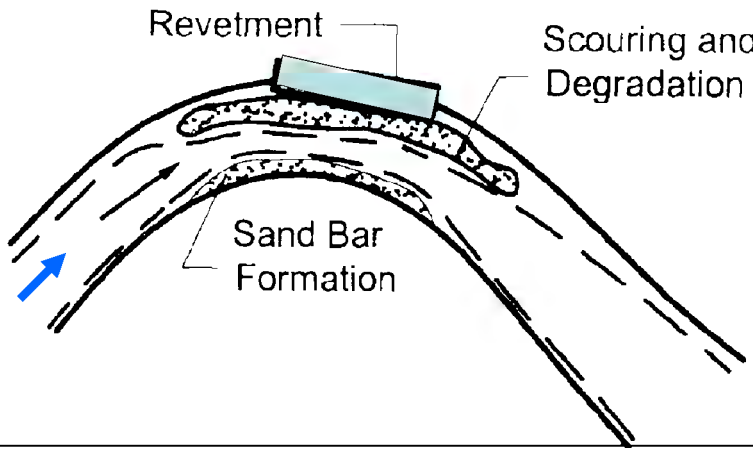
Arrangement of Berm



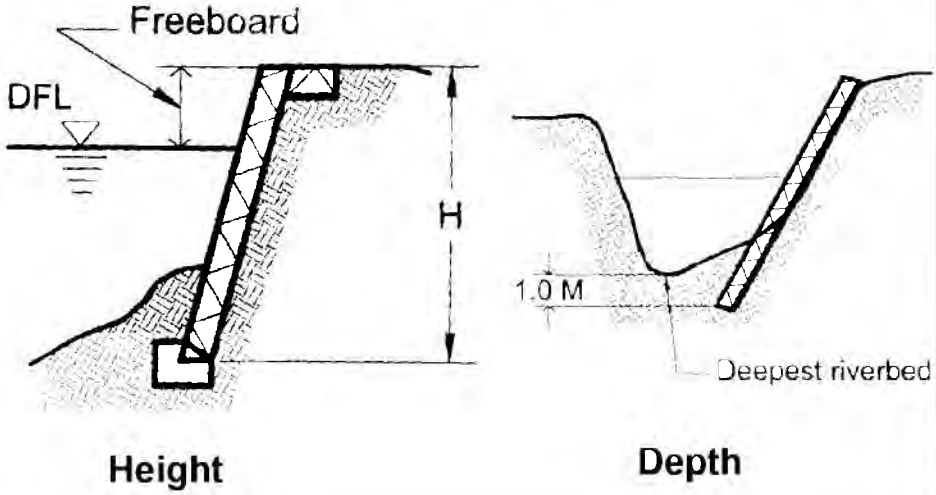
Design flood discharge (m^3/s)	Crest Width (m)
Less than 500	3
500 and up to 2,000	4
2,000 and up to 5,000	5
5,000 and up to 10,000	6
10,000 and over	7

(5) Revetment

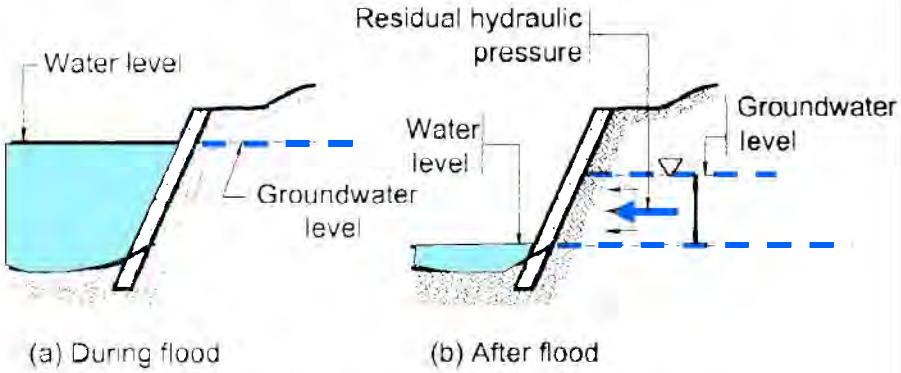
a) Construction of Revetment at River Bend



(5) Revetment

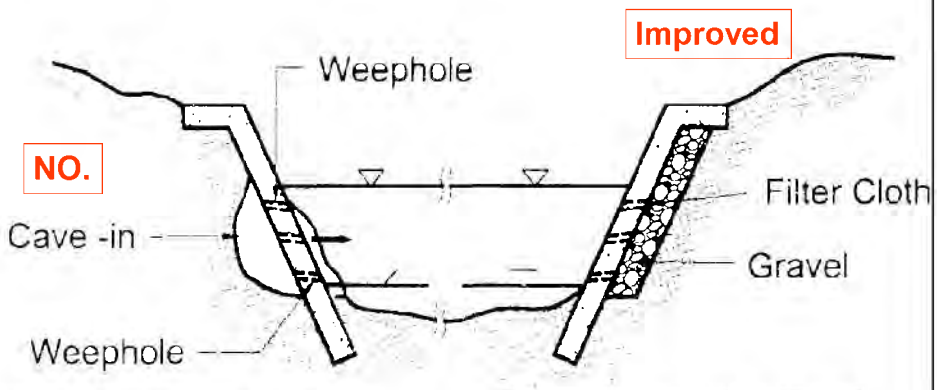


Drainage Pipe / Weep Hole



Development of Residual Hydraulic Pressure without Drainage Pipes/ Weep Holes

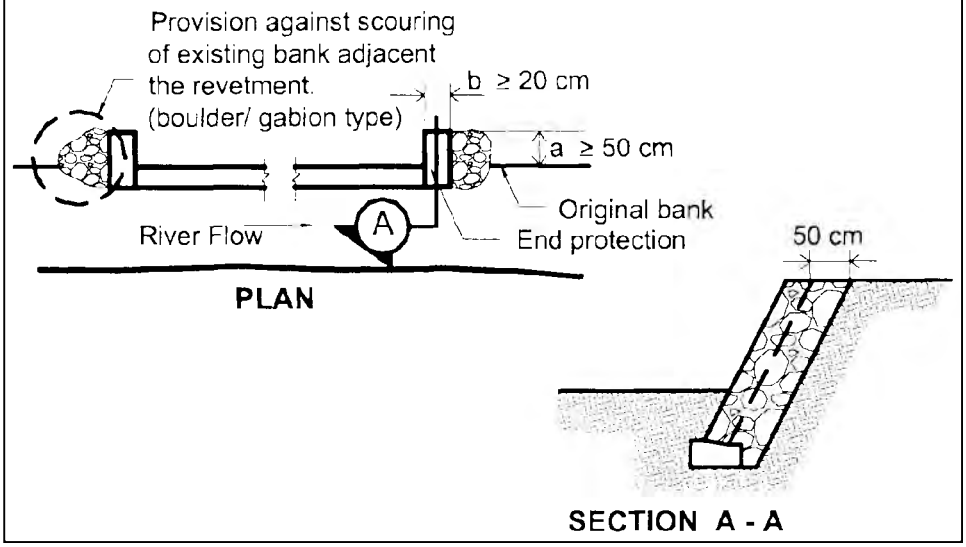
Prevention of Outflow of Backfill/ Behind Material



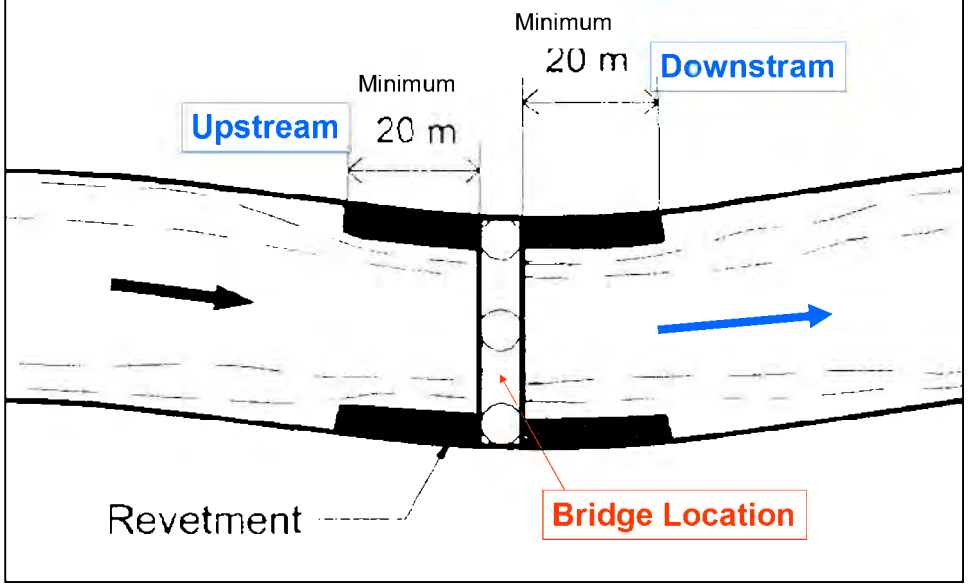
Weep hole without filler-cloth and gravel

Weep hole with filter cloth and gravel

End Protection Work



Revetment at Bridge Abutment

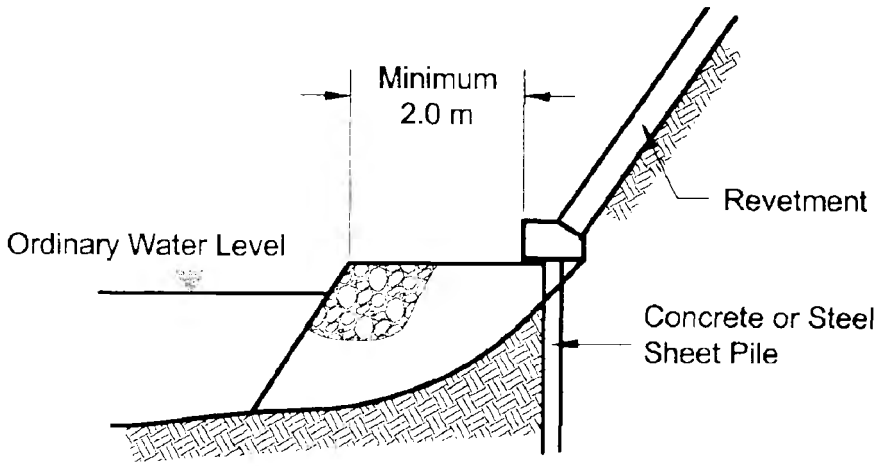


Countermeasure Works for Stability of Revetment

On degrading river or on end portions where revetment is always subjected to direct water attack, appropriate countermeasures (i.e., gabion mattress, spur dike) shall be provided for possible scouring resulting to its damaged/ destruction.

In case of ordinary deep water level area, sheet pile or concrete pile should be provided with adequate foot protection works.

Protection against scour at deep water area/ high tide



Selection of Type of Revetment

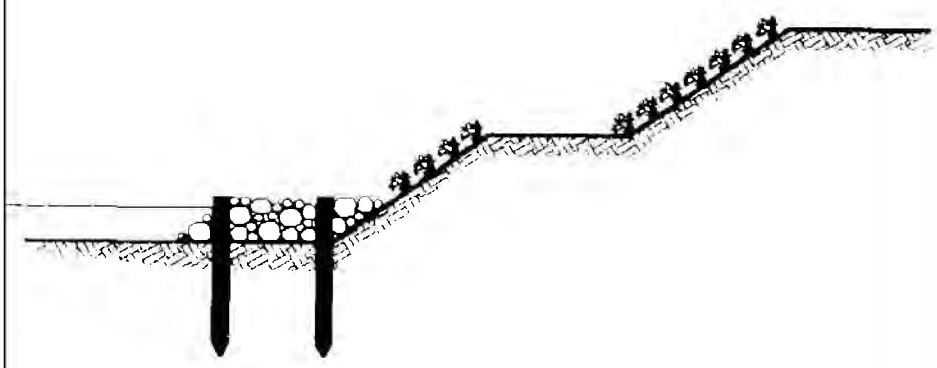
NO	Type of Revetment	Allowable Maximum Velocity (m/s)	Slope (H:V)	Height (m)	Remarks
1	Sodding with grass or some other vegetation (Natural bank)	< 2.0	Milder than 2:1	–	This revetment type is preferably built above the ordinary water level. If revetment is lower than the ordinary water level, use other type.
2	Wooden pile fence	< 4.0	Milder than 0.6:1	5	Preferably for rivers with considerably few boulders in riverbed and bank
3	Dry boulder riprap	< 5.0	Milder than 1.5:1	3	Small vegetation can grow in consideration to environment
4	Gabiom mattress, spread type	< 5.0	Milder than 1.5:1	–	Not preferable for rivers with salt waters. Not preferable for rivers where large boulders (> 20 cm diameter) are present
5	Grouted riprap, spread type	> 5.0	Milder than 1.5:1	5	If the height of bank is higher, provide berm
6	Gabion mattress, pile-up type	< 6.5	1:1 to 1.5:1	–	For interim use (Beginning/ End protection works)
7	Grouted riprap, wall type	> 5.0	Steeper than 1:1	–	Leaning wall type, rubble masonry

Selection of Type of Revetment (contin.)

NO	Type of Revetment	Allowable Maximum Velocity (m/s)	Slope (H:V)	Height (m)	Remarks
8	Rubble concrete	> 5.0	Steeper than 1:1	–	Gravity type
9	Stone masonry	> 5.0	Steeper than 1:1	–	Gravity type
10	Crib wall	> 6.0	Steeper than 1:1	–	
11	Reinforced concrete with concrete sheet pile foundation	–	Steeper than 1:1	–	Minimum thickness of 20 cm. Provide temperature bars 12 mm diameter spaced not to exceed 40 cm on center, both ways
12	Steel sheet pile	–	–	–	When ordinary water level is very high (affected by tidal fluctuation). Foundation depth must be analyzed considering the flow velocity, foudation material and scouring depth for keeping its stability.
13	Steel sheet pile and reinforced concrete (segment combination)	–	Milder than 1.5:1but not steeper than 1.5:1	–	When ordinary water level is very high (affected by tidal fluctuation). Foundation depth must be analyzed considering the flow velocity, foudation material and scouring depth for keeping its stability.

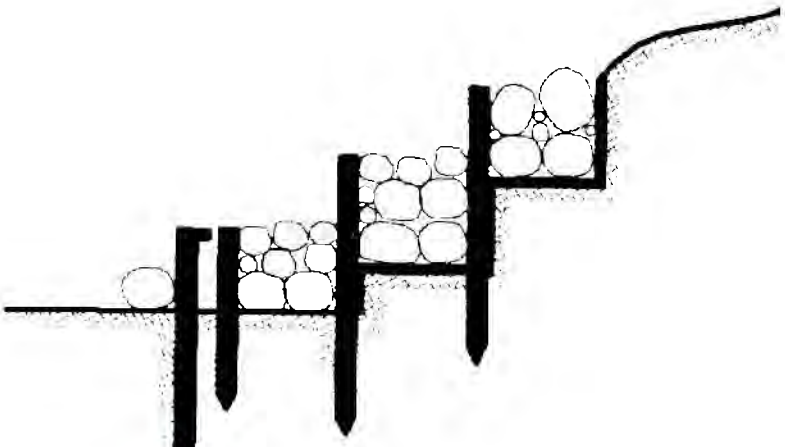
(source: Flood Control Manual, Japan)

1. Sodding with Grass or Some Other Plants (Natural Type)



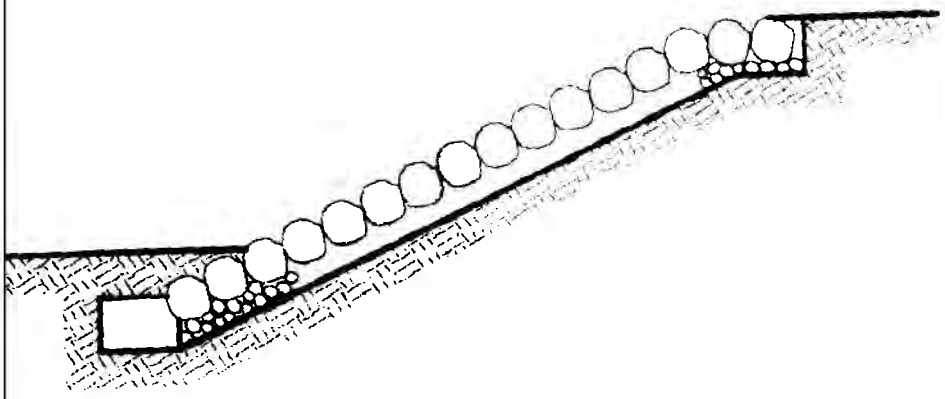
Allowable Maximum Velocity < 2.0 m/s

2. Wooden Pile Fence



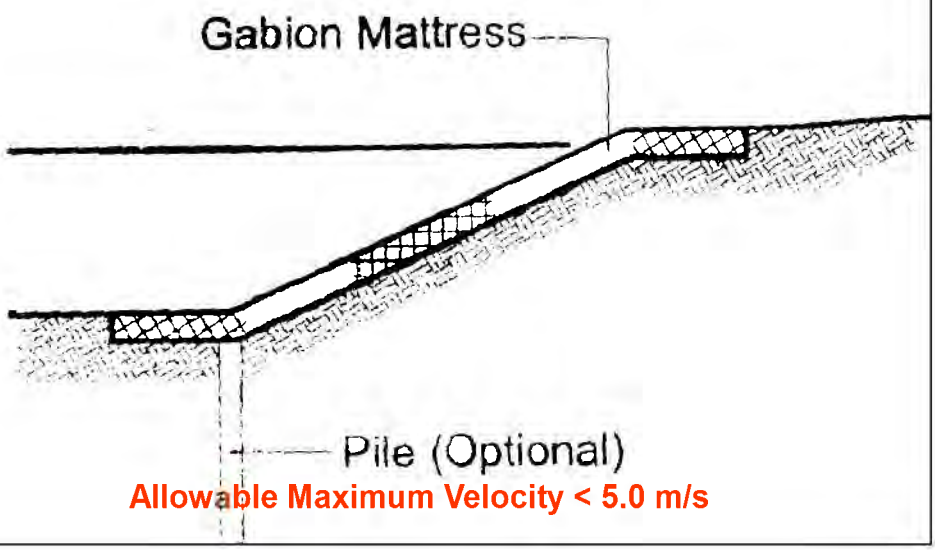
Allowable Maximum Velocity < 4.0 m/s

3. Dry Boulder Riprap



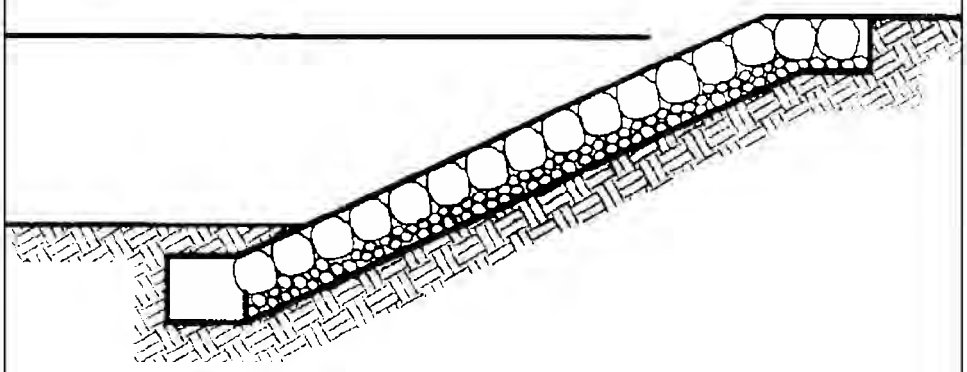
Allowable Maximum Velocity < 5.0 m/s

4. Gabion Mattress Spread Type



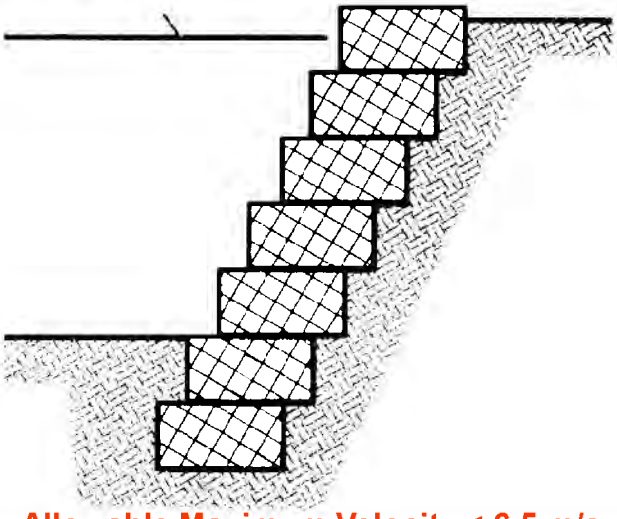
Allowable Maximum Velocity < 5.0 m/s

5. Grouted Riprap, Spread Type



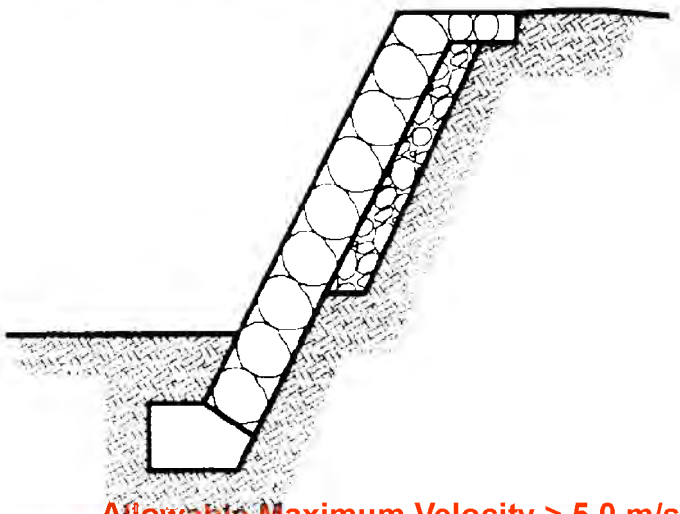
Allowable Maximum Velocity > 5.0 m/s

6. Gabion Mattress, Pile-up Type



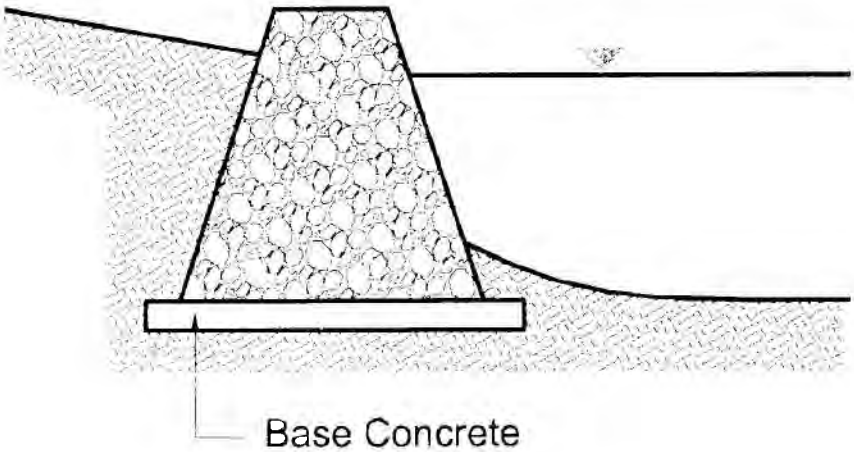
Allowable Maximum Velocity < 6.5 m/s

7. Grouted Riprap Wall Type



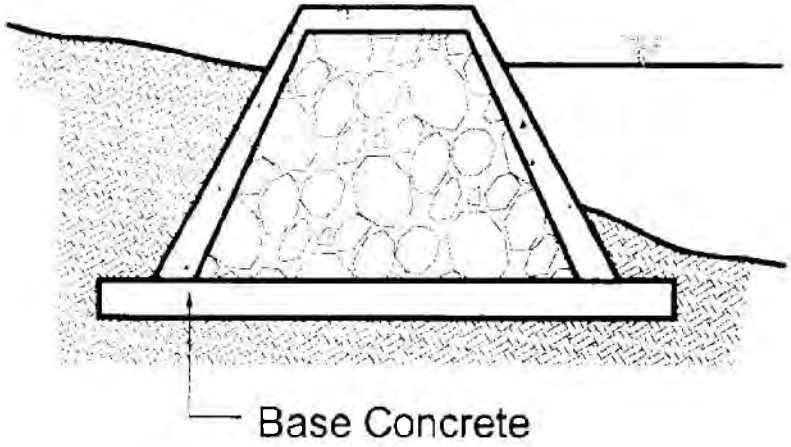
Allowable Maximum Velocity > 5.0 m/s

8. Rubble Concrete



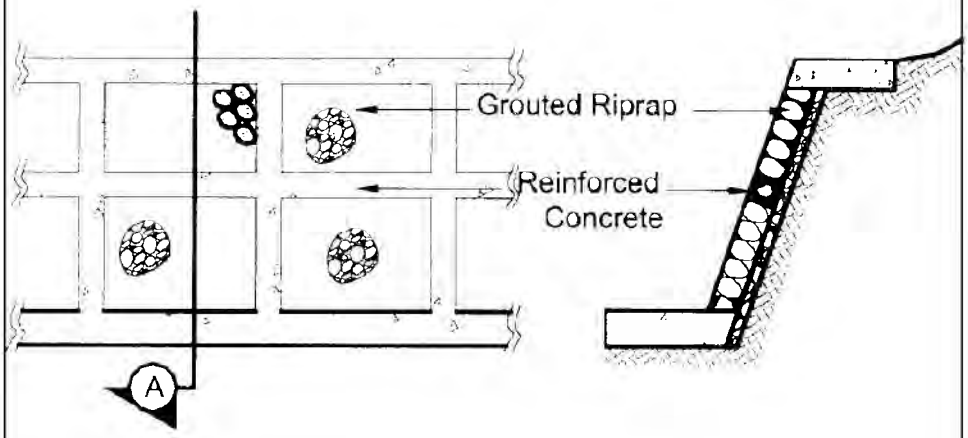
Allowable Maximum Velocity > 5.0 m/s

9. Stone Masonry



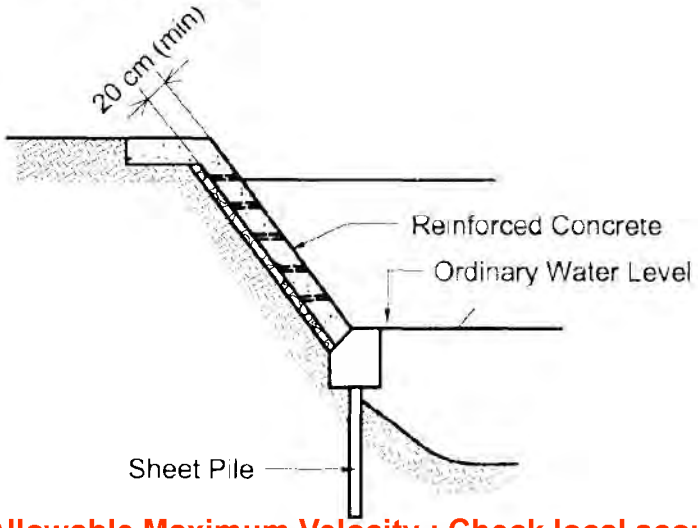
Allowable Maximum Velocity > 5.0 m/s

10. Crib Wall



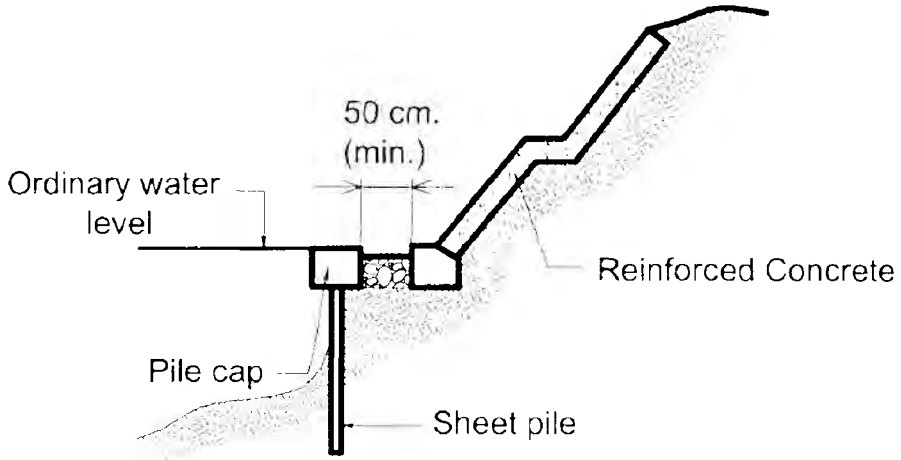
Allowable Maximum Velocity > 6.0 m/s

11. Reinforced Concrete



Allowable Maximum Velocity : Check local scouring depth based on velocity

12. Steel Sheet Pile and Reinforced Concrete (Segment Combination)



Allowable Maximum Velocity : Check local scouring depth based on velocity

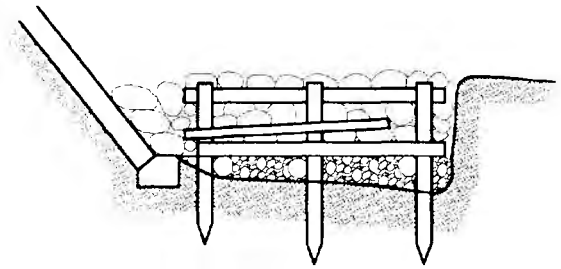
Foot Protection

Foot protection work is planned in order to protect the revetment foundation from local riverbed scouring and/or the degradation of riverbed. Foot protection reduces the force of flow at the foundation, thus reduces the abrupt scouring of riverbed.

Types of foot protection:

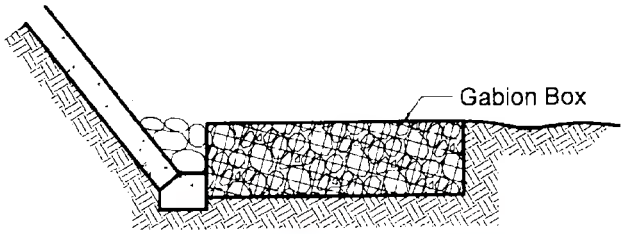
1) Wooden stockade
2) Gabion
3) Boulder
4) Concrete block

1) Wooden Stockade Type



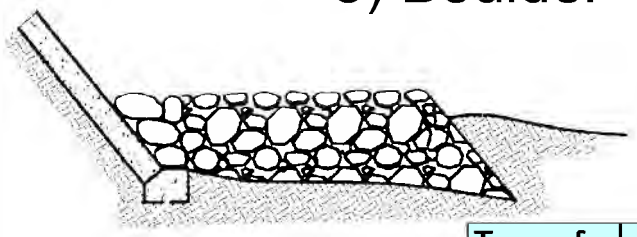
Type of Foot Protection	Water Depth (m)	Design Velocity (m/s)					
		1.0	2.0	3.0	4.0	5.0	6.0
		Diameter of Boulder (cm)					
Wooden stockade type	1.0	5	5	10	30	–	–
	2.0	5	5	10	15	35	65
	3.0	5	5	10	15	25	45
	4.0	5	5	5	15	25	40
	5.0	5	5	5	10	20	35

2) Gabion



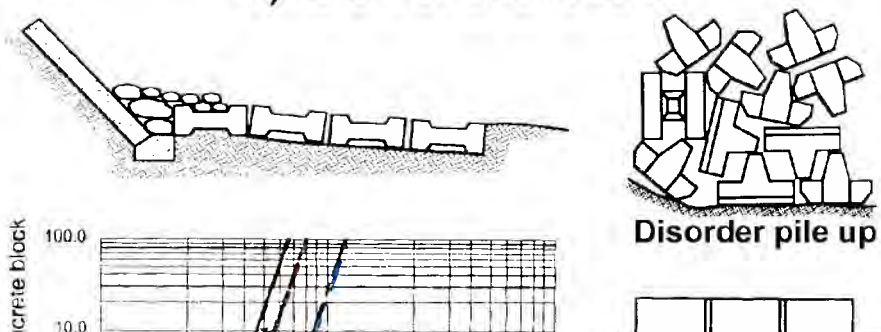
Type of Foot Protectio	Water Depth (m)	Design Velocity (m/s)					
		1.0	2.0	3.0	4.0	5.0	6.0
		Diameter of Boulder (cm)					
Babion type	1.0	5-15	5-15	5-15	10-20	-	-
	2.0	5-15	5-15	5-15	5-15	15-20	-
	3.0	5-15	5-15	5-15	5-15	15-20	15-20
	4.0	5-15	5-15	5-15	5-15	5-15	15-20
	5.0	5-15	5-15	5-15	5-15	5-15	15-20

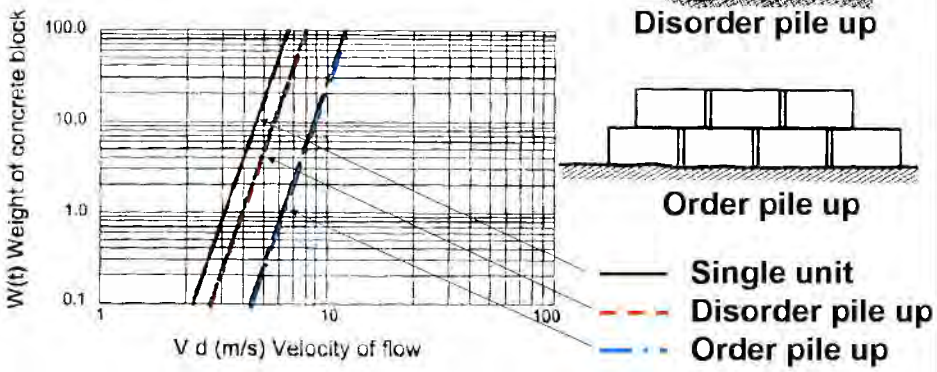
3) Boulder



Type of Foot Protection	Design Velocity (m/s)	Diameter (cm)
Boulder Type	2	-
	3	30
	4	50
	5	80
	6	120

4) Concrete block





Relationship between Velocity (m/s) and Weight (t)

(6) Spur dike

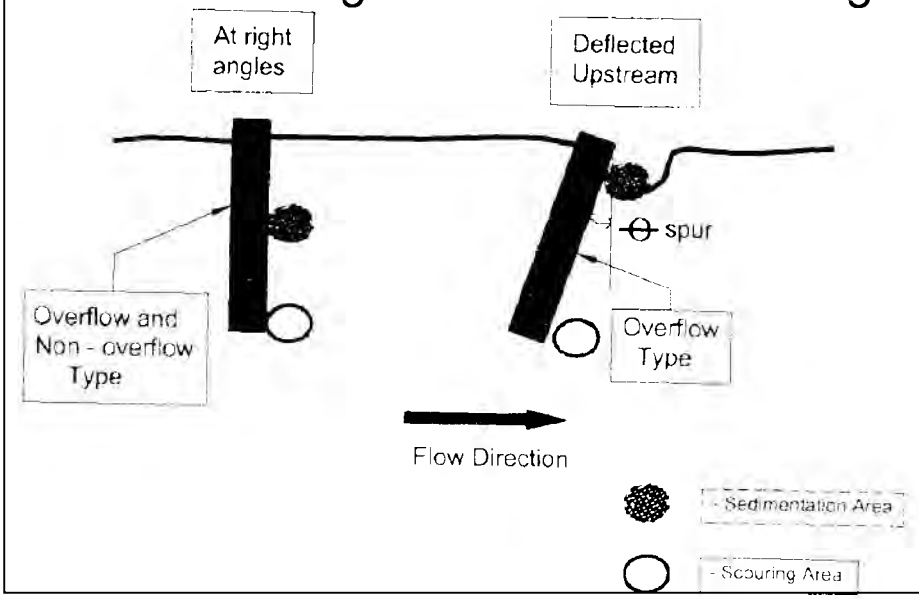
Purpose of spur dike are as follows:

- 1) Prevent bank scouring by reducing the river flow velocity.
- 2) Redirect river flow away from the riverbank.

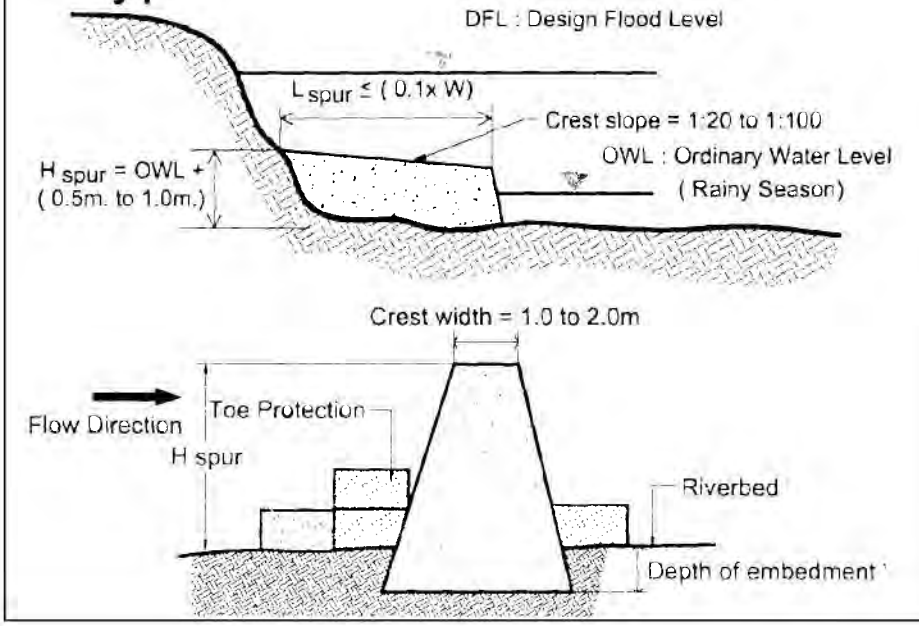
Types of Spur dike:

- 1) Permeable Type
- 2) Impermeable Type/ Semi-Permeable Type

Relationship between spur dike alignment and resulting sedimentation scouring



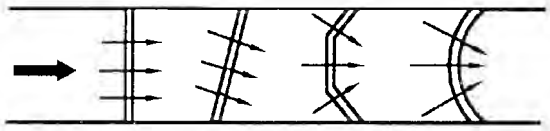
Typical dimensions and section



(7) Groundsill

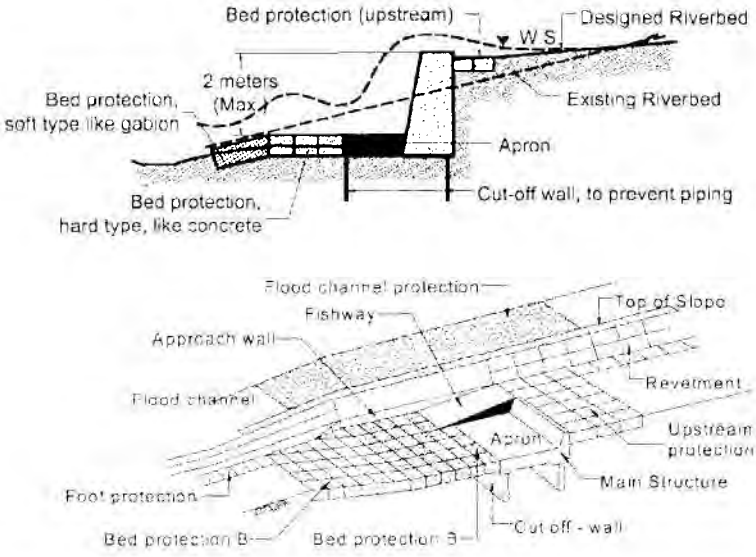
Purpose of groundsill is to fix the riverbed elevation in order to prevent riverbed degradation resulting to local scours under forces of turbulent flow during floods.

Type is 1) Drop structure type and 2) Sill type (No drop structure Type.



Plane Forms of Ground Sills and Flow Direction

Drop Structure Type



(8) Weir

- The location of a weir shall be selected according to the purpose of the construction.
- A curved section or a section with narrow section form of waterway shall be avoided as practically as possible. (It is difficult to control and maintain high velocity flow/ local scouring.)
- The weir is classified into an intake weir (irrigation etc.), diversion weir, tide weir, etc.

Next Schedule

4th Flood Control in Class Room Lesson
Construction of dike & revetment

5th Flood Control in Class Room Lesson
Construction of Gabion, Spur dike, & Weir

Planning of Flood Control (4)

8th Jun 2013

Today's Lesson

- Construction of River structures

(1) Dike

(2) Revetment

(1) Construction of Dike
1) Topographic Survey

Initially the extent of the dike footprint and any additional berms shall be surveyed and marked for the exact boundaries required to do the work.

2) Clearing, Grubbing and Stripping

- For new dike construction, changing the existing alignment or widening of the existing fill, the dike area shall be properly cleared, grubbed and stripped.

3) Dewatering

- Areas where minor seepage inflow is expected during sub-excavation of materials or trench excavation can likely be treated using conventional **ditching and sumping** techniques which are relatively inexpensive.
- **Pumping** to unwater a sealed **cofferdam** shall not commence until the seal has set sufficiently to withstand the hydrostatic pressure.
- Areas with moderate to major seepage will likely require more expensive and costly dewatering methods such as **well point** **or** **deep well** **dewatering.**

4) Cofferdam

- Cofferdams shall be constructed to adequate depths to assure stability and to adequate heights to seal all water.

Comoro Bridge

5) Shoring

- Shoring with sheeting and/or bracing shall be adequate to support all loads imposed and shall comply with any applicable safety regulations.

Guide Beam for Sheeting Works

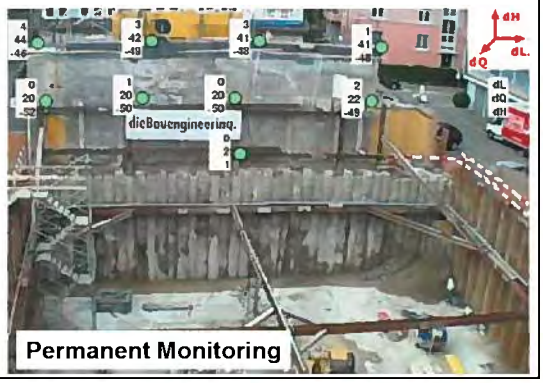
6) Excavation

- Stable excavation below the existing ground surface is highly dependant on **foundation soil** and **groundwater** conditions. Any proposed excavations shall be reviewed by engineer during the design and construction stages of a project.
- If space permits, the excavations can typically be carried out with **open cut slopes**.

7) Safety Control of Excavations

It is recommended that **monitoring gauges** be installed on the existing critical structures to permit measurement of any vertical and lateral deformations.

Gauges shall be monitored **prior to**, **during**, and **after** construction which is located close to any critical structures.

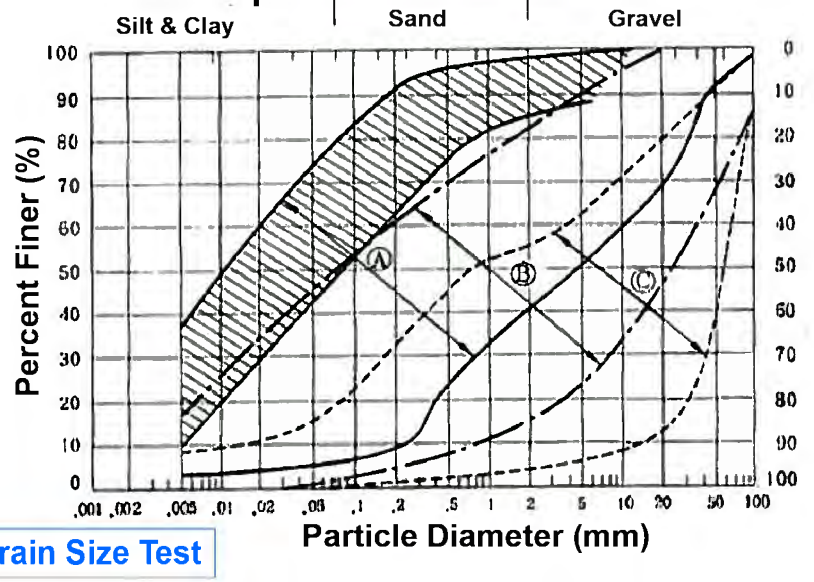


Permanent Monitoring

8) Production of Dike Materials

Dike fills shall limit the particle size to generally less than **100 mm** and shall not contain materials greater than 150 mm in diameter.

Proper Dike Material



Grain Size Test

A: Impermeable Material, B: Semi-permeable Material, C: Permeable Material

: Risk of Crack Occurrence

9) Compaction Fundamentals

- Soils containing fines can be compacted to a **specific maximum dry density** with a given amount of energy. However, maximum density can be achieved only at a unique water content.
- Maximum dry density and optimum water content are determined in the **laboratory** by carrying out Proctor testing on collected samples.

10) Compaction of Dike Fills

- Requirements of the more important compaction features, such as **water content limits**, **layer thickness**, **compaction equipment**, and **number of passes** will be contained in the specifications and must be checked closely by the inspector to ensure compliance.
- Specifications will generally state the type and size of compaction equipment to be used.

10) Compaction of Dike Fills (contin.)

- Uncompacted or loose lift thickness will be specified. Lift thickness specified will be based on type of material and compacting equipment used.
- Impervious or semipervious materials are commonly placed in **150 to 200 mm** loose lift thickness and compacted with **six to eight passes** of a sheepsfoot roller, or an approved alternative.

Sheepsfoot Roller

Bulldozer & Tire Roller

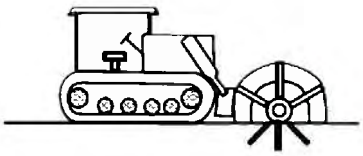
Vibrating Roller

Water Placement for Optimum Soil Moisture

Rapid Impact Compaction

Shallow Soil Stabilization

- If suitable materials are not, compaction grouting is the injection of a viscous **soil-cement** grout under pressure into soil mass, which consolidates and densified targeted soils insitu.



Stabilizer Type

Power Shovel + Stabilizer

Stepped Cut on Existing Dike

- Stepped cut is constructed by power shovel.
- Stepped cut is important for **integration** between existing dike and new embankment.

Reinforcing Filter Layer Placement

- Fiber reinforced composite is used, if necessary.

Final Grading

Final Grading

Soil Compaction Test

Soil density using nuclear gauge (Radioisotope : RI)

Soil density by the sand replacement method

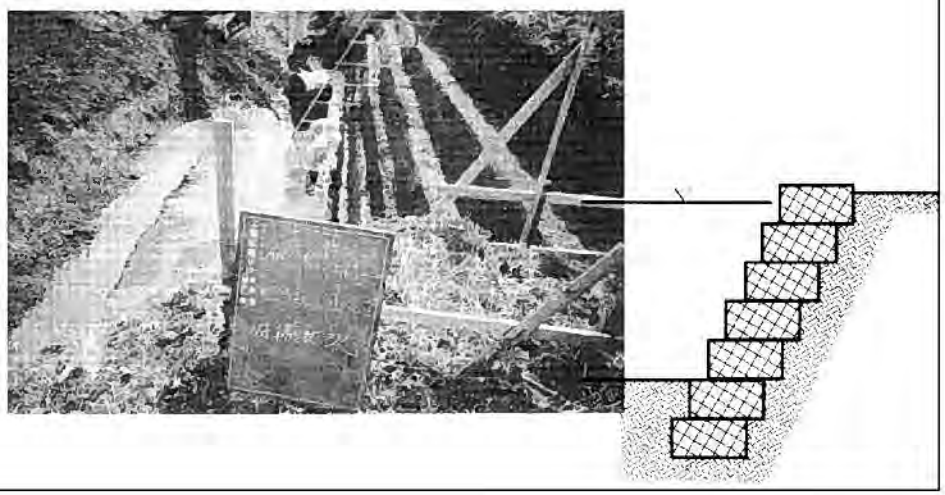
Sample of Inspection

Thickness of One Layer

Length of Slope

(2) Construction of Revetment

- Excavation for Gabion Mattress, Pile-up Type



- Filling the stone into Gabion.

- Curve portion of Gabion

Next Schedule

5th Flood Control in Class Room Lesson

Construction of Spur dike, Sabo Dam & Weir

Planning of Flood Control (5)

22nd Jun 2013

Today's Lesson

- Construction of River structures

(1) Spur Dike

(2) Weir

(3) Sabo Dam

(1) Construction of Spur Dike

Temporary Water Control System

- Temporary water control systems is necessary for dikes, by-pass channels, flumes and other surface water diversion works, cut-off walls.
- Pumping systems, including wellpoint and deep well systems, is used to prevent water from entering excavations for structures.

Working Drawings

- Working drawings for temporary water control systems, when required, shall include details of the design and the equipment, operating procedures to be employed, and location of points of discharge.
- The design and operation shall confirm to all applicable water pollution and erosion control requirements.

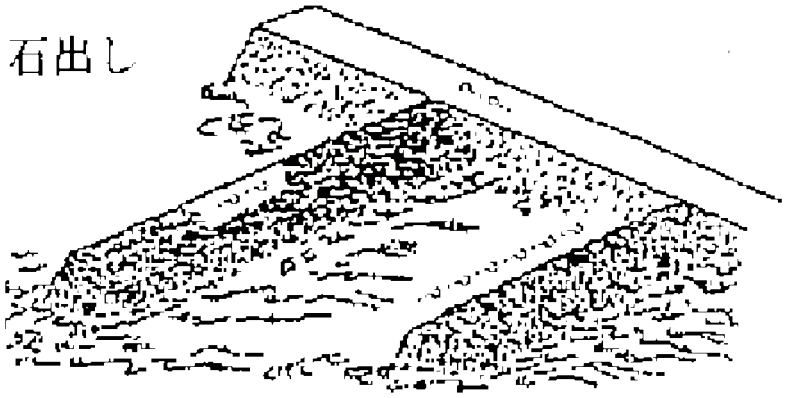
Construction Method of Spur Dike

(1) Underwater construction with crane

(2) **Dry condition work** with cofferdams/ shoring and/or temporary water control systems

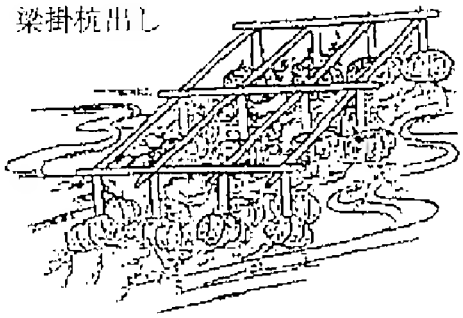
Traditional Spur Dike (1)

- Spur Dike by Stone



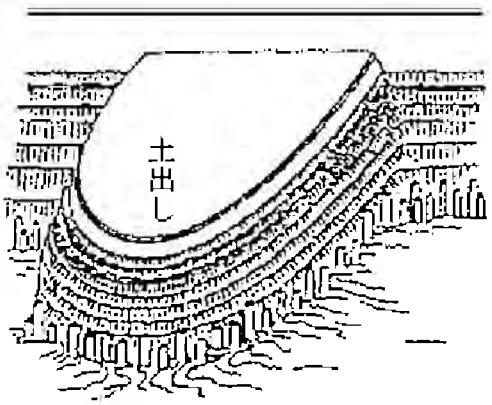
Traditional Spur Dike (2)

- Spur Dike by Wooden Pile and Basket



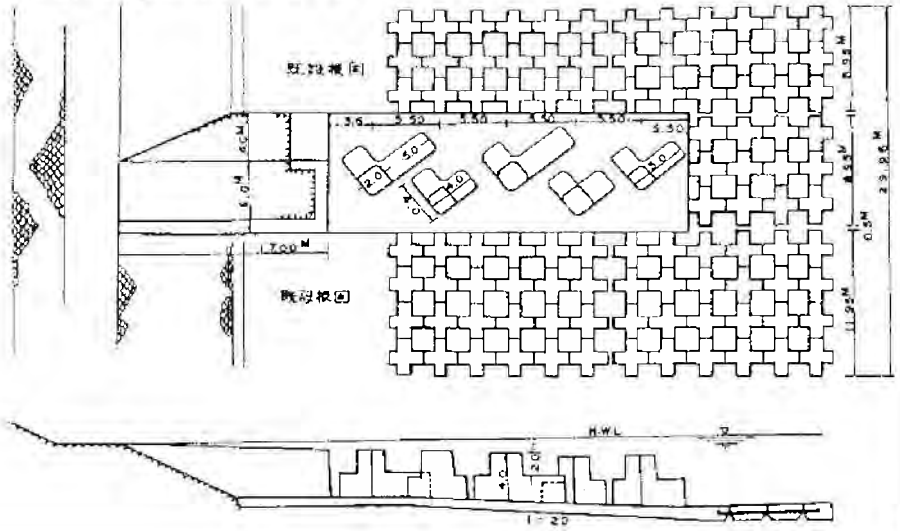
Traditional Spur Dike (3)

- Spur dike by soil embankment



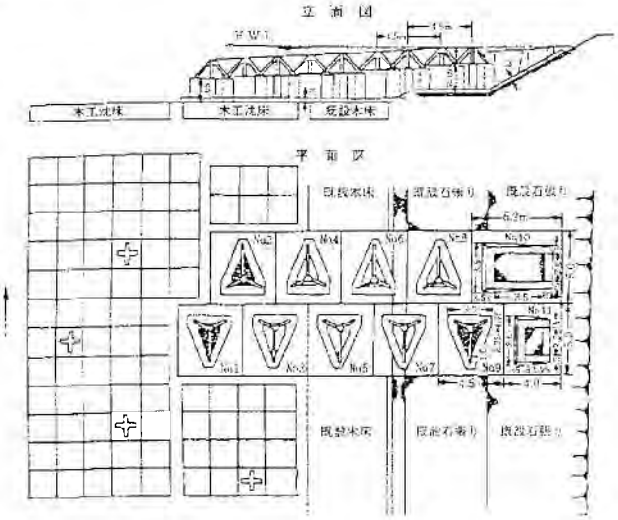
Kurobe River Spur Dike

For Segment 1, D>15 cm



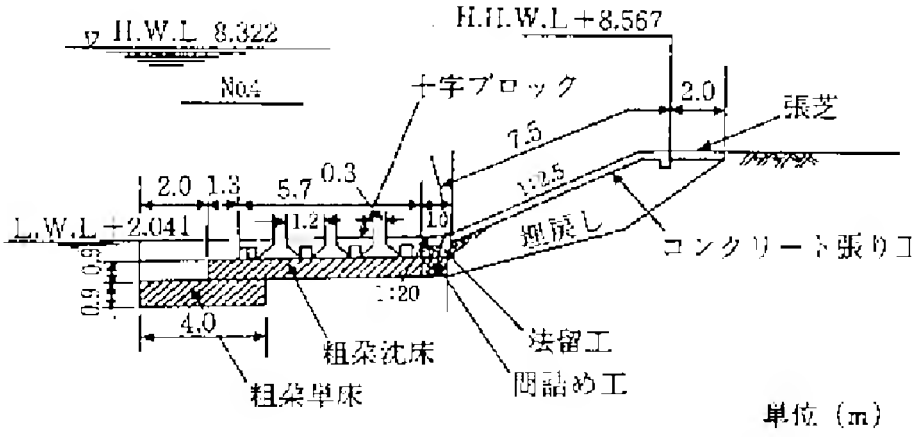
Fuji River Spur Dike

- **For Segment 1, 2 cm< D < 15 cm**

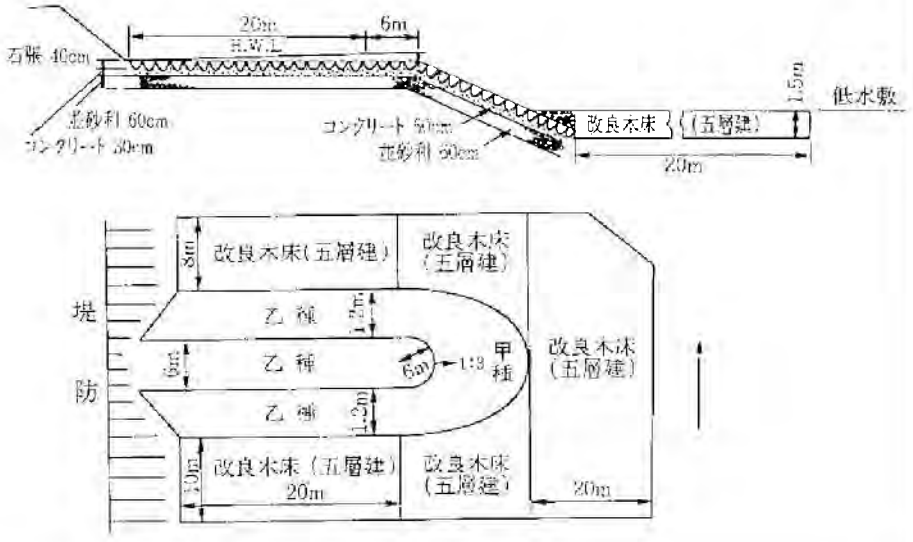


Mogami River Spur Dike

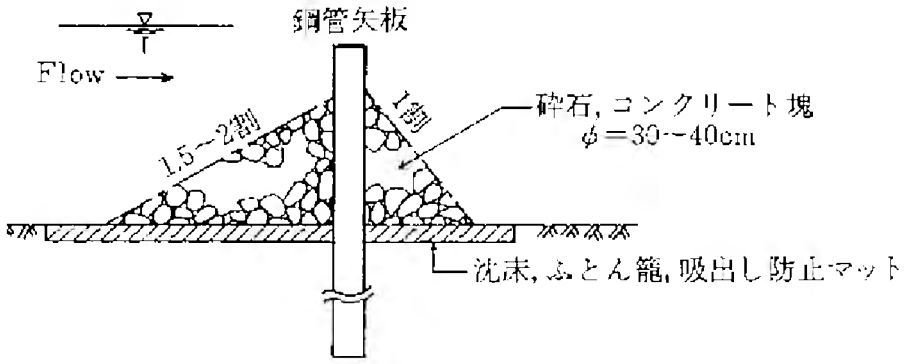
- **For segment 2-1**



- **For segment 1**



Latest Spur Dike (1)



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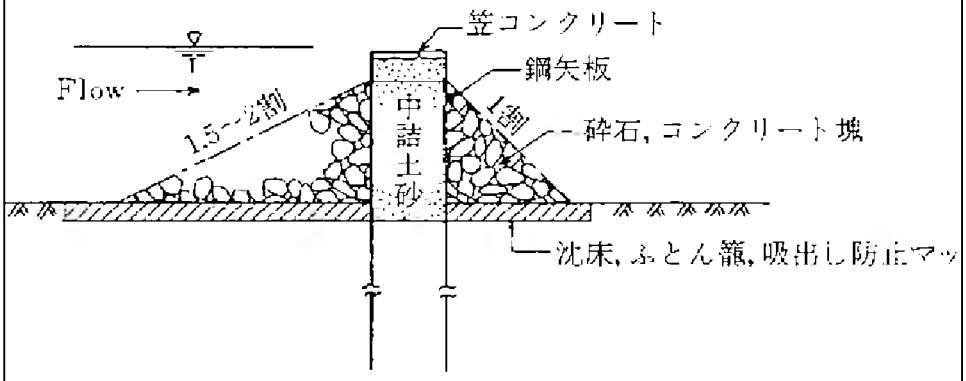
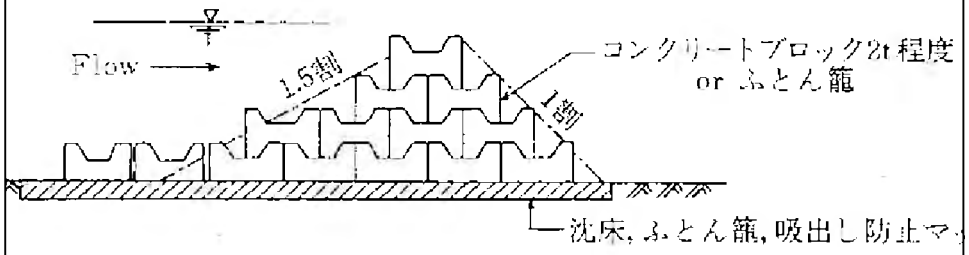
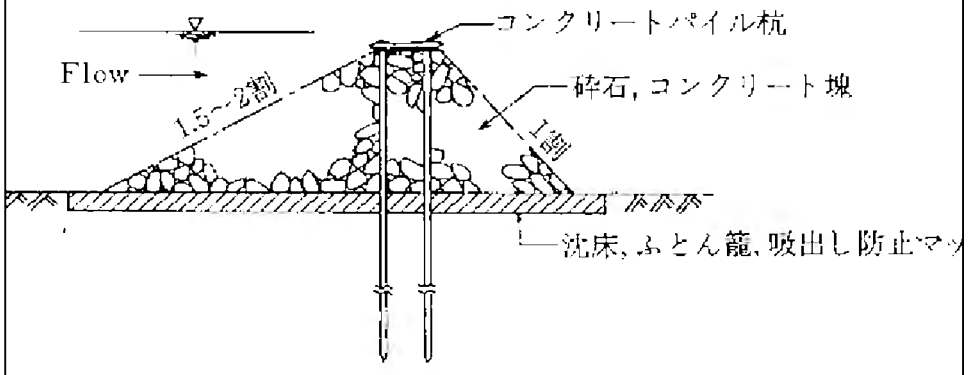


Latest Spur Dike (3)



Latest Spur Dike (4)



Matanuska River Spur Dike in USA

- Existing spur dikes were installed in 1992. They have successfully protected their section of river bank from further erosion since their installation, but have required periodic maintenance and repairs.

Matanuska River Spur Dike in USA

- The photo shows the existing spur dikes and the natural bank. Existing spur dike has a round head.
- The preferred alternative is the barb-headed spur dike for bank protection.

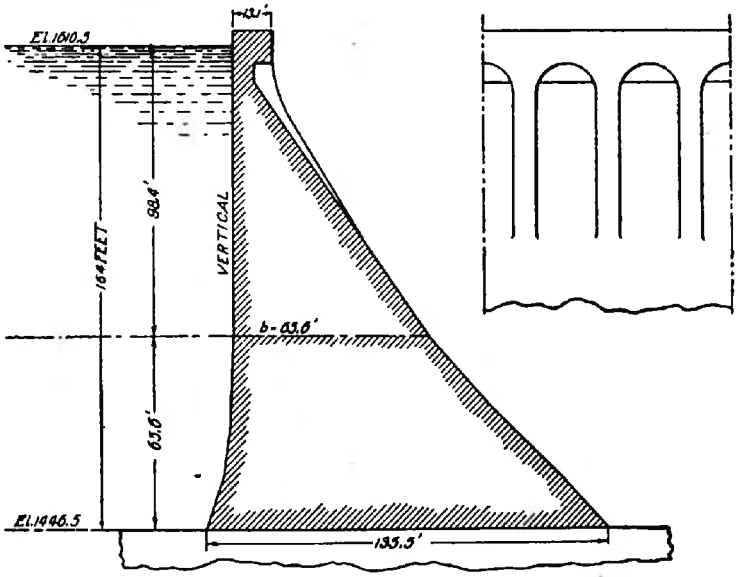
Akashi River Spur Dike

(2) Weir

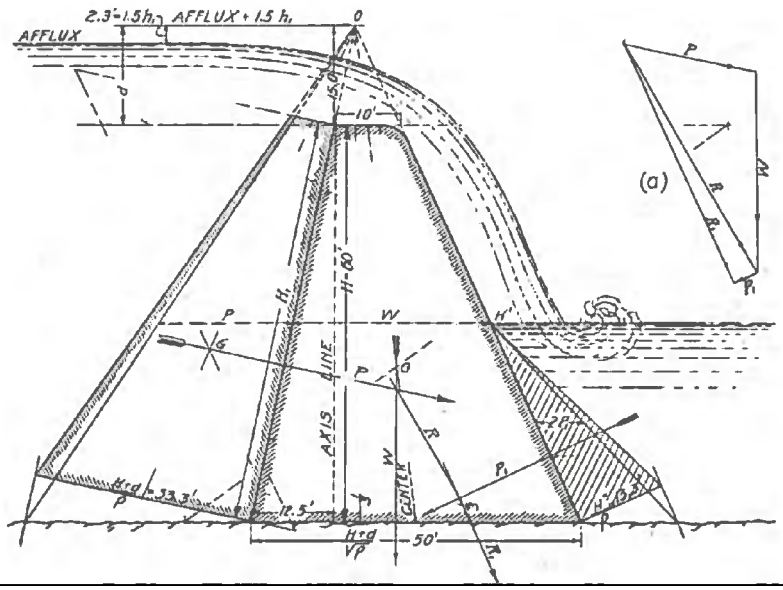
Dams and weirs may be classified as follows:

1. Gravity Dams
2. Gravity Overfalls, or Weirs
3. Arched Dams
4. Hollow Arch Buttress Dams
5. Hollow Slab Buttress Dams
6. Submerged Weirs
7. Open Dams, or Barrages

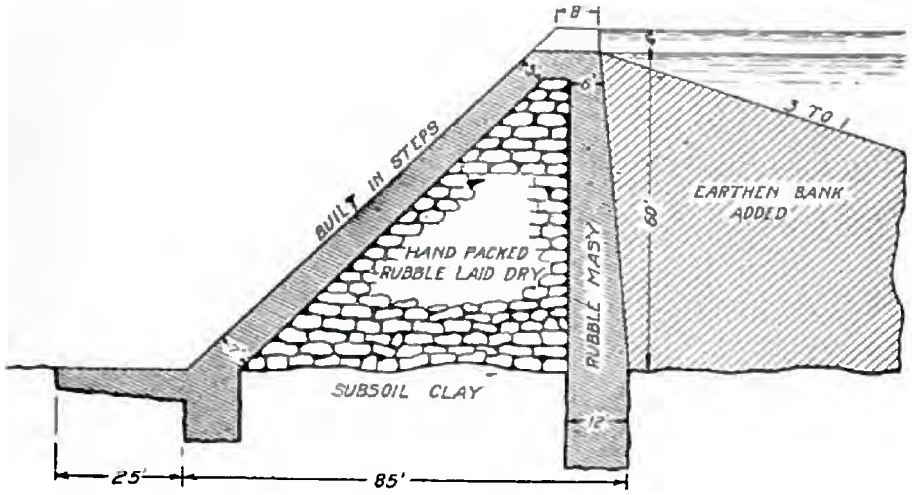
1. Gravity Dams



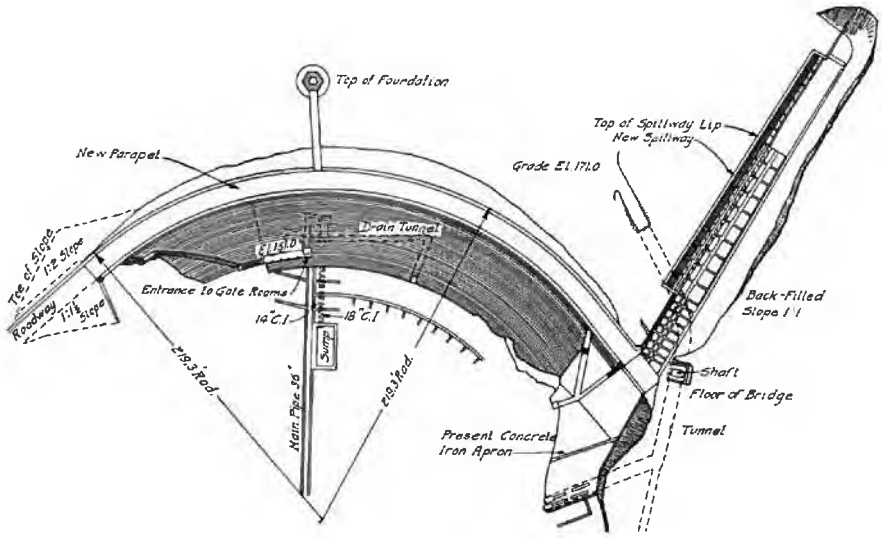
2. Gravity Overfall, or Weirs



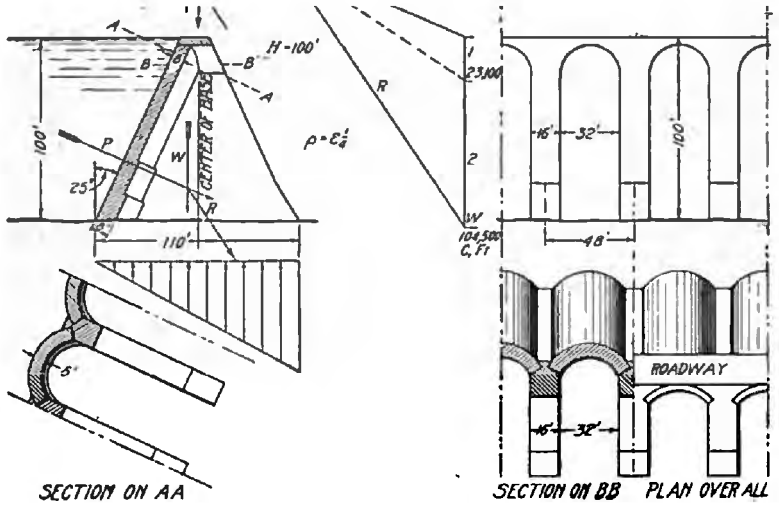
2. Gravity Overfall, or Weirs



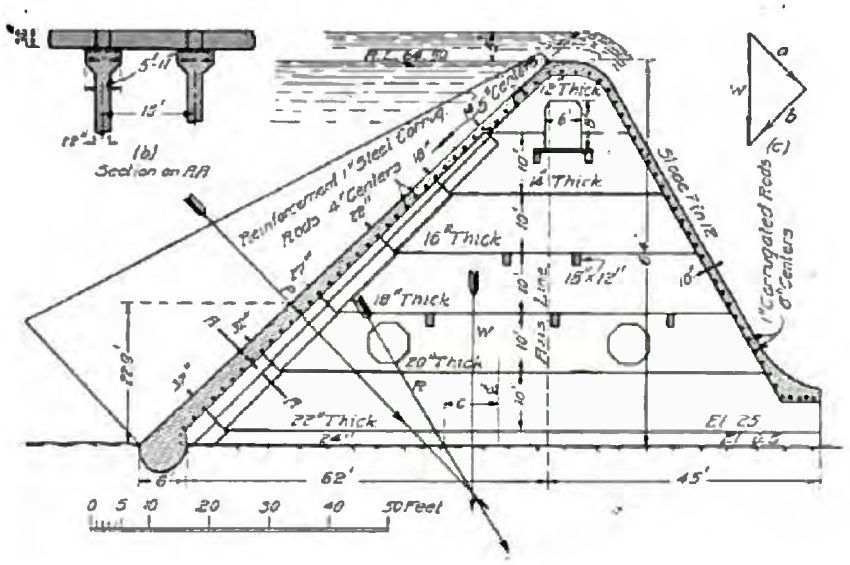
3. Arched Dam



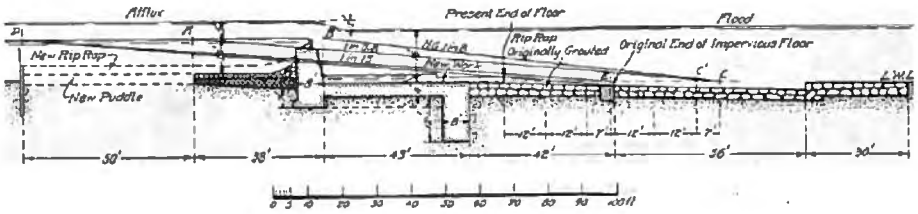
4. Hollow Arch Buttress Dams



5. Hollow Slab Buttress Dams



6. Submerged Weirs



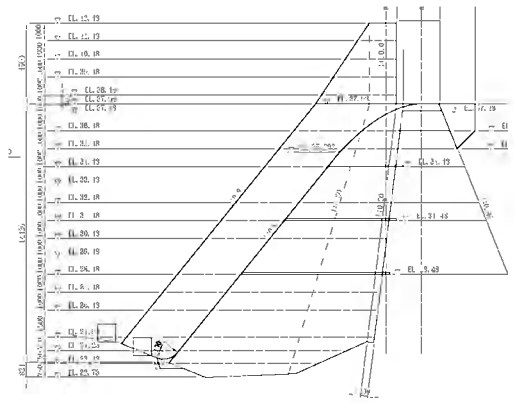
7. Open Dams, or Barrages

- Canal and sluiceway with sluice gate
- There are a lot of Irrigation dams in Timor-Leste.

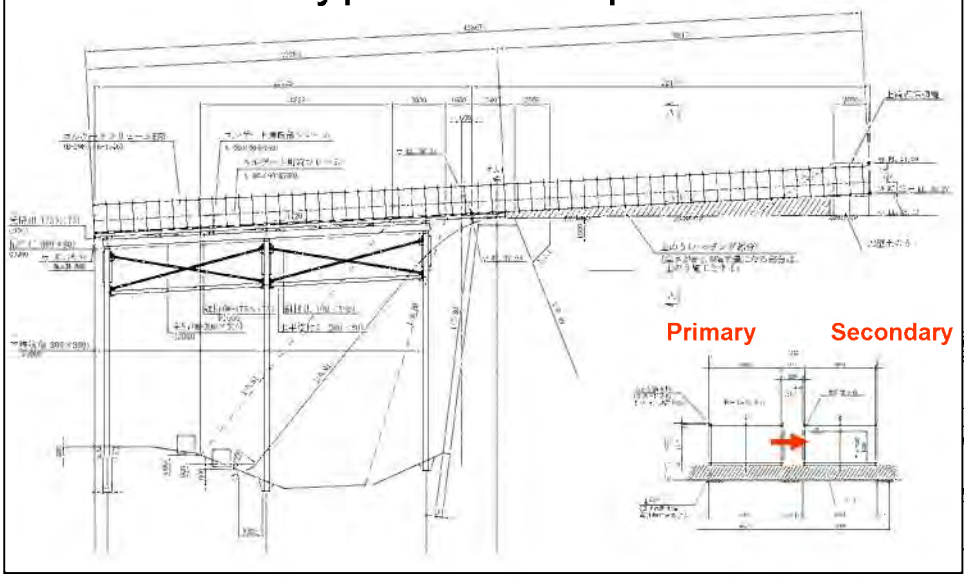
Construction Method of Weir/ Dam

- Place concrete of one lot is 0.75 m – 2.0 m due to control of cracking in mass concrete.

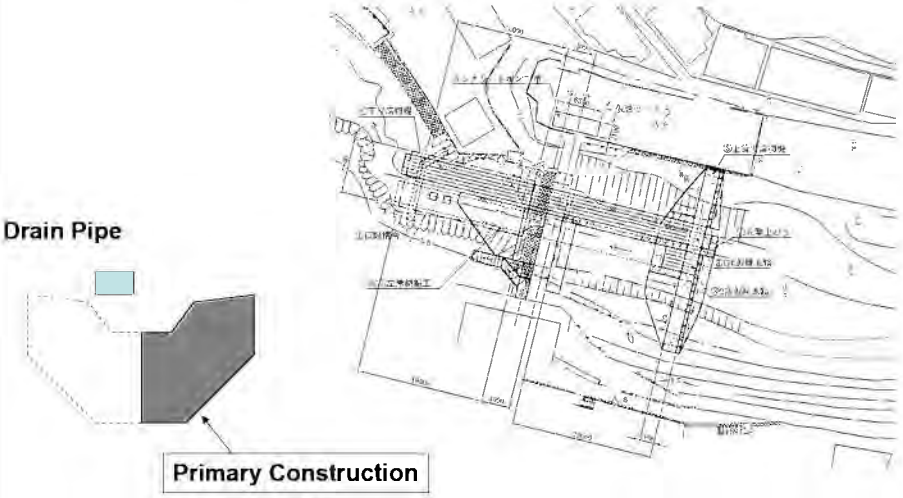
Elevation of each lot of concrete



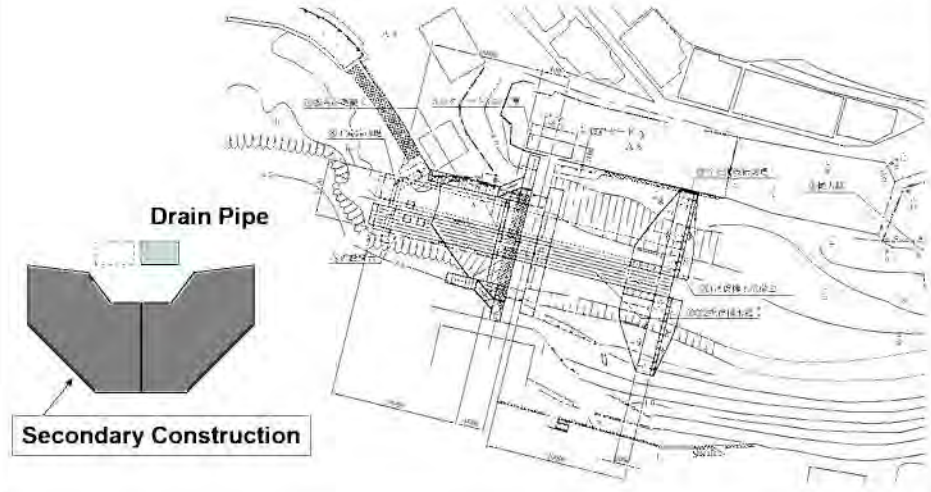
Temporary Water Control by U-type Drain Pipe



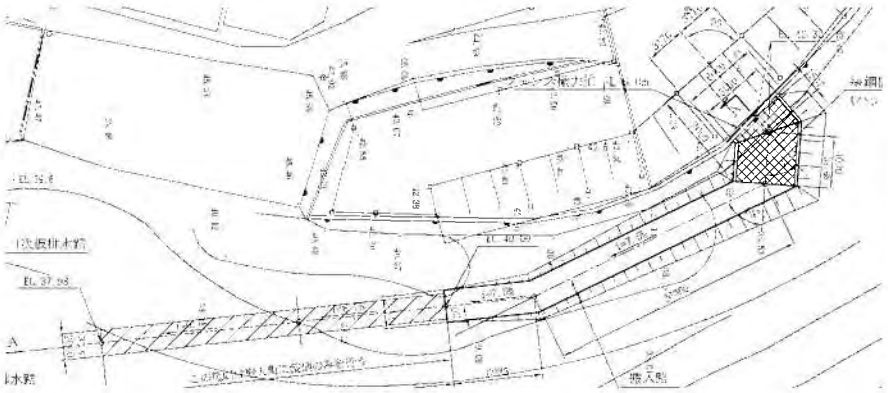
Primary Construction



Secondary Construction



Temporary approach road

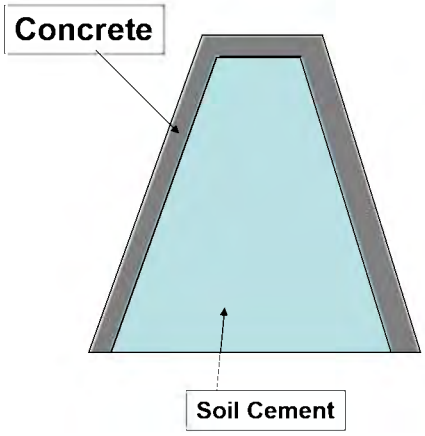


Sabo Dam made of Soil Cement

- Target strength is 1.5 N/mm^2.

Mix of **cement**

Sabo Dam made of Soil Cement



Next Schedule

6th Flood Control in Class Room Lesson
Cost Estimate

添付資料 13 座学研修教材(洪水対策)(テトン語版)

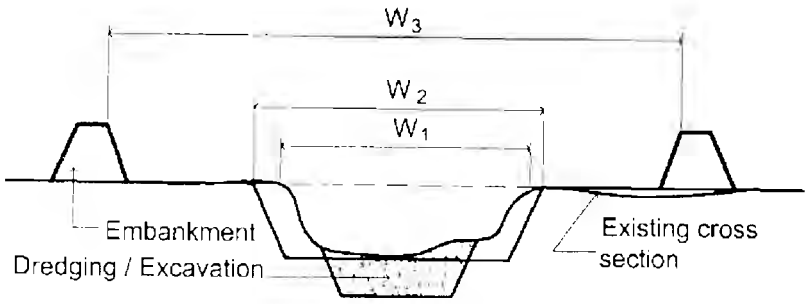
Planeamentu husi Kontrolu de Cheia/Inundasaun (1)

11 Maio de 2013

Kategoria sira husi Kontrolu de Cheia

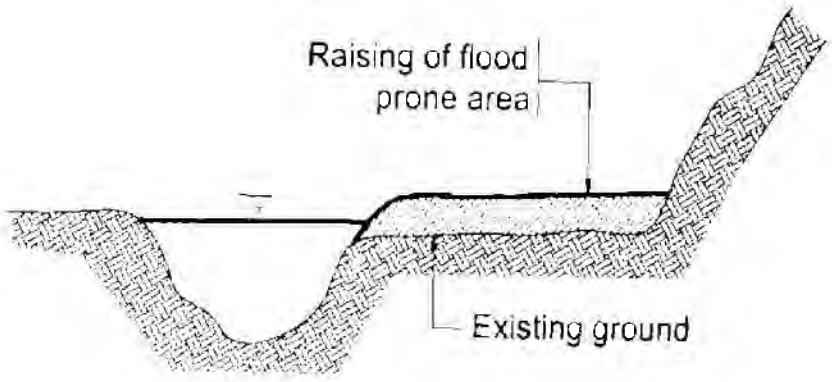
- (1) Atu hasa'e kapasidade diskarga husi mota
- (2) Tu proteje inundasaun iha area kurva husi be suli sai/overflow
- (3) Atu reduz no/ka kontrola pontu-altu diskargu husi inundasaun
- (4) Atu prevene inundasaun internal
- (5) Atu prevene kolapsu husi banku no prejudika degradasaun
- (6) Atu prevene obstaklu kontra mota suli no/ka mantein/konserva kondisaun diak husi mota nune'e mantein mota-suli laiha interrompidu.

(1) Atu hasa'e kapasidade rekarga husi mota

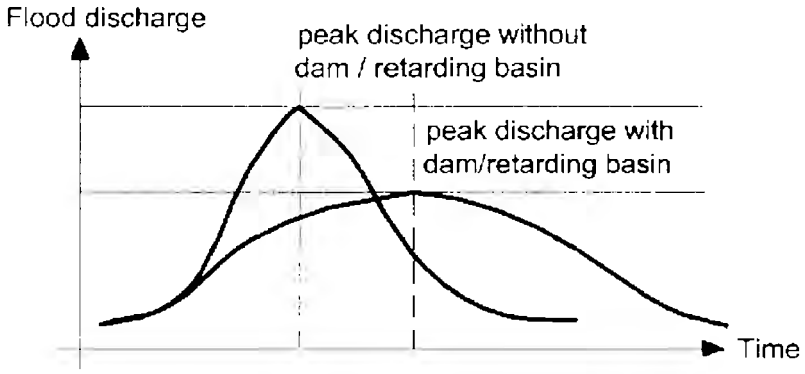


W_1 = Existing river width
W_2 = Improved river width by widening
W_3 = Improved river width by diking

(2) Atu proteje inundasaun iha area kurva husi be nakonu-suli sai/overflow

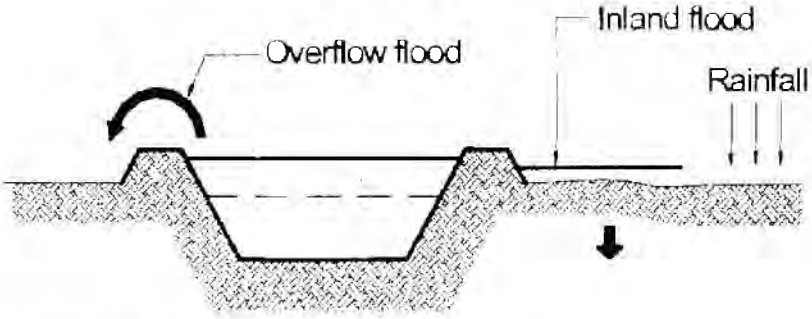


(3) Atu reduz no/ka kontrola pontu-alta diskarga husi inundasaun



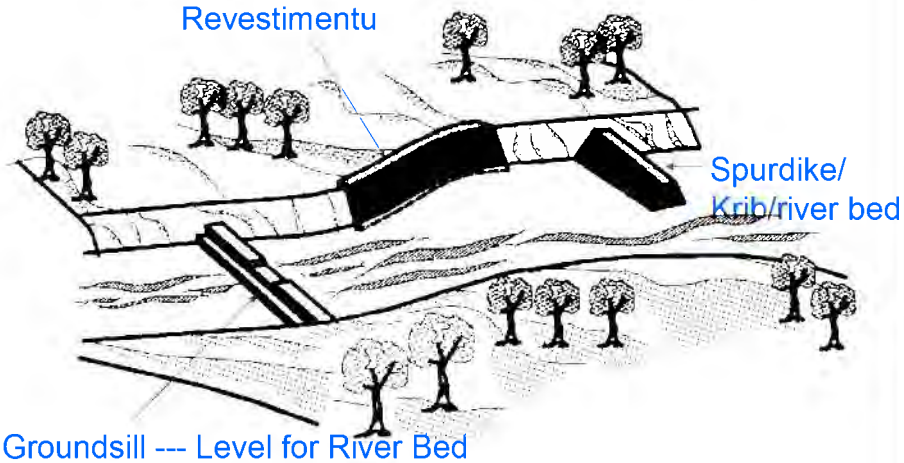
Hydrograph of reduction of peak discharge

(4) Atu prevene inundasaun internal



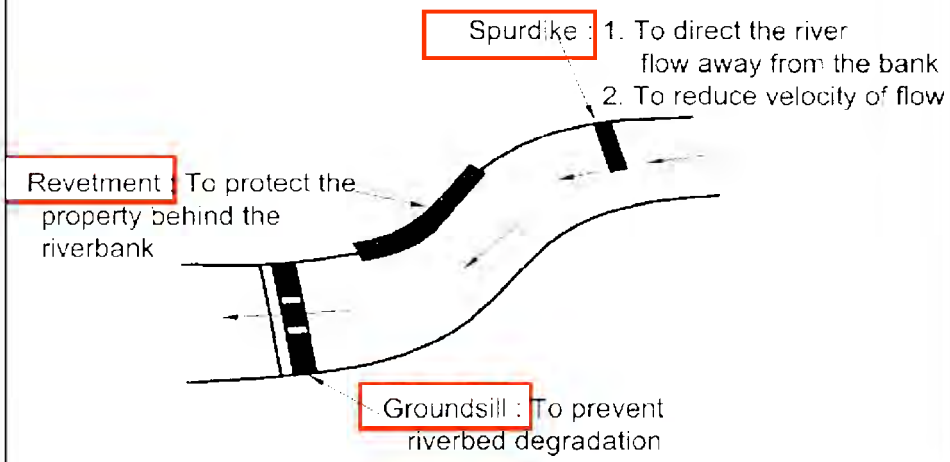
Inundasaun internal bele prevene liu-husi:
(1) Hadia Lateral/hanesan(Ex. Drenu tempestada, drenajen prinsipal, kanal aberta, baleta, etc.)
(2) Hadia Tributaria/mota-oan (Ex. Sanak husi mota prinsipal)
(3) Estasaun Bomba

(5) Atu prevene kolapsu husi banku no prejudika degradasaun



Groundsill --- Level for River Bed
Bareira --- Altura husi River Bed

(5) Atu prevene kolapsu husi banku no prejudika degradasaun



(6) Atu prevene obstaklu kontra mota suli no/ka mantein/konserva kondisaundiak husi mota nune'e mantein mota-suli laiha interrompidu

- Liu-husi obra sabo (para kontrola sedimentu)
- Liu-husi manutensaun regular (eskavasaun / pengerukkan kanel)

Nesessidade husi Planu ba Kontrolu de Cheia/inundasaun

Planu kontrola de cheia tenke ser formulada husi pontu vizaun ba luan-basia(basin-wide view point), no ejiji kondisaun propriu ho planu hirak tuir mai:

(1) Planu Dezenvolvimentu Irrigasaun

(2) Planu rede estrada / ponte

(3) PlanSabo

(4) Planu Jestaun Ambiente

Dezena Frequensia Inundasaun

- Dezena frequensia inundasaun mak expressada husi periudu retornu/fila, Ex., probabilidade (expressada iha tinan) iha-nebee inundasaun husi tarjeitu luan/metade luan mak gosta akuntese. Periodu retornu tenke ser determinadu bazeia ba luan husi area waduk/catchment area, grau husi area importansia projetu nebee sujere no viabilidade ekonomia husi projetu

Planu Projetu Implementasaun Kontrola de Cheia/inundasaun

- (1) Planu kanel/Channel (1:1,000-1:10,000)
- (2) Sesaun atravessada/Cross section (Existe hela/ Dezenu)
- (3) Perfil Longitudinal (Existe hela/ Dezenu)
- (4) Drawings dezena Estrutural/Structural design drawings
- (5) Estimasaun kustu
- (6) Estimasaun benefisiu
- (7) Impaktu ambiental/ Sosial
- (8) Evaluasaun/avaliasaun projetu

Orariu Tuir-mai

Lisaun sala de aula sobre Kontrola de Cheia,Parte 2;

(1) Peskiza Tofografika/Topographic Survey

(2) Analiza Hidrolojika/Hydrologic Analysis

Lisaun sala de aula sobre Kontrola de Cheia,Parte 3;

(1) Estrutura Mota/River Structures

Planeamentu husi Kontrolu de Cheia/Inundasaun (2)

18 de Maio, 2013

Informasaun Topografia ba Planu Mestre

- Hodi komprende perfil jeral husi sistema mota, area kaptasaun(catchment area) no area inklina inundasaun(flood prone area), Mapa tuir-mai mak rekere;

1. Mapa topografia ho skala husi 1:50,000 ka luan-liu
2. Mapa Utilizasaun Rai/Land use map
3. Mapa Geolojika
4. Mapa disponivel seluk husi Unidade Governu Lokal relasionadu

Informasaun Topografia ba Planu Meste (kontinua.)

- Husi mapa mensiona, aktividades hirak tuir-mai tenke ser jere hodi:
- 1. Deskrita area kaptasaun/catchment area
- 2. Klassifika falhansu geologika/ geografika husi kada area sub-kaptasaun/sub-catchment
- 3. Klassifika vegetasaun be existe hela husi kada area sub-kaptasaun

- 4. Identifika fatin inklina inundasaun asperamente/secara kasar. (Area Exaktu tenke ser identifikadu no determinadu husi investigasaun terrenu no analiza nivel bee/water level analysis)

- 5. Identifika sidade no munisipalidade iha area inklina inundasaun/flood prone area.
- 6. Identifika fasilidade publiku importante hanesan estrada nasional, estrada provinsia, moru husi sidade, Igreja nomos eskola, etc. iha area inklina inundasaun nia laran.

- 7. Klassifika utilizasaun rai iha area inklina inundasaun, hanesan area kommersial, area rezidensia, area industria, area agrikultura, etc.
- 8. Identifika mudansa iha diresaun mota/river course no prefil longitudinal/ longitudinal profile.

Informasaun Jeral

- Kollekta informasaun hotu-hotu haktuir ba utilizasaun rai, populasaun, aktividades ekonomia, planu dezenvolvimentu Futuru, etc. iha area kaptasaun/catchment area nomos area inklina inundasaun/flood prone area nia laran.

1. Populasaun husi sidade / munisipalidade
2. Rasio Kresimentu husi populasaun sidade
3. Estatistika aktividades komersiu kada tinan husi rejiaun no sidade
4. Estatistika produtu industria kada tinan husi rejiaun no sidade
5. Estatistika produtus agrikultura kada tinan husi rejiaun no sidade
6. Planu dezenvolvimentu longu prazu no mediu prazu husi rejiaun, sidade nomos munisipalidade.

Dadus Hidrolijika(Hydrologic)

- Kollekta dadus hidrolojika husi basia mota nian/river basin:

1.Dadus udan-ben lor-loron/Daily rainfall data husi estasaun hidrometrika hotu-hotu iha no besik ba iha area kaptasun tomak haktuir periodu gravasaun husi observatoriu meteorolojiku nomos ajensia relasionada seluk.

2. Dadus udan-ben kada oras/Hourly rainfall data husi estasaun hidrometrika hotu-hotu iha no besik ba area kaptasun durante durasaun husi inundasaun.
3. Grafiku/Hyetographs husi tipiku inundasaun passada husi sumariu/synoptic udan-ben iha estasaun hidrometrika husi observatoriu meteorolojika no ajensia relasionadu seluk.

Dadus Hidrolojika/Hydrologic Data (Kontinua.)

4. Dadus sobre nivel bee maximu/maximum water levels durante pontu-as/puncak inundasaun(peak floods) ba nivel bee hotu-hotu iha estasaun hidrometrika husi estasaun hidrometrika no liu-husi intervista. (Ba udan-ben/rainfall nomos analiza korrida/runoff analysis)
5. Rekorda medida diskarga/Discharge measurement record ba nivel bee hotu-hotu iha estasaun hidrometrika.
6. H-Q (Height-Discharge relationship/relasaun diskarga alta) avalia kurva ba nivel bee estasaun hidrometrika hotu-hotu (ho mos fatin, seksaun kruzada/cross-section no velosidade suli durante tempu inundasaun)

Levantamentu/Survey Terrenu ba Planu Mestre

- Kondukta survey terrenu hanesan tuir-mai:

1. Seksaun atravessa mota/River cross sections iha tipiku terrenu
- - Intervalu hotu husi 500 m to'o 1,000 m kbesik ba nanaruk husi mota nebee propoin hodi hadi'a ba
2. Perfil Longitudinal/Longitudinal profile
- - Prefil kasar/Rough profile husi mota nebee foti husi mapa topografia
- - Perfil Longitudinal foti husi levantamentu seksaun cruzada/cross section survey
3. Identifikasaun husi materia mota-sulu-fatin/riverbed material
- - Liu-husi falhansu segmentasaun/segment features husi mota

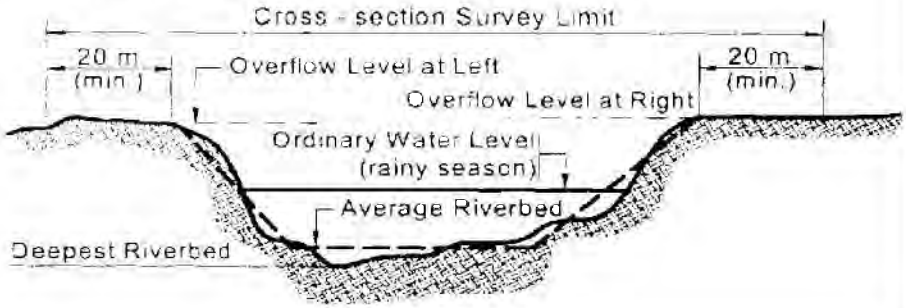
Investigasaun Terrenu ba Planu Mestre/Master Plan

- Realiza investigasaun terrenu no intervista hodi hetan informasaun tui-mai.

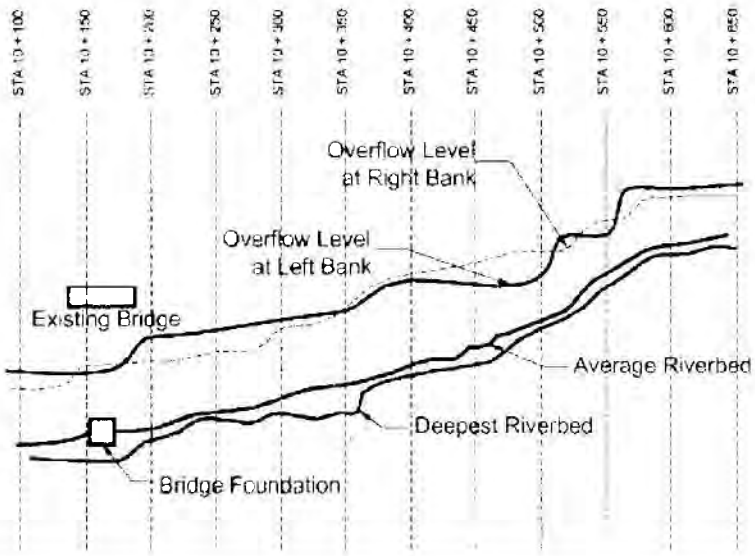
1. Informasaun/ rekorda husi inundasaun passada (Frequensia, area, klean, durante inundasaun/temporal)
2. Kondisaun hirak husi fasilidade mota ke existe hela.
3. Istoria husi aktividades kontrola inundasaun iha basia husi mota.

Planu Implementasaun Projetu

- 1. Persija liu-tan Survey/peskiza topografia nebee detailha
- 2. Persija liu-tan survey detalha ba seksaun kruzada/ detail cross section survey



- 3. Persija li-tan Levantamentu perfil longitudinal detalha(Need more detail longitudinal profile survey)



Peskiza Materia (Material Survey)

- Tipu materia husi banku-mota/riverbank no area bee tenke ser pekizadu nomos indikadu iha mapa topografia no prefil seksaun kruzada/cross section profiles atu nune'e:
- - Determina karakteristika mota-suli-fatin/riverbed characteristics (Signifika "n")
- - Determina qualidade husi materia mota-suli-fatin/riverbed materials (karik disponivel ba utilizasaun konstrusaun)
- - Determina relasaun diametru husi materia mota-suli-fatin(riverbed materials), Gradiente/tanjakan(riverbed gradient), etc. ho velosidade husi fluxu/sasuli.
- - Klassifika segmentu mota bazea ba morfolojia husi mota(river morphology).

Analiza Hidrolojia (Hydrologic Analysis)

Survey no Investigasaun

↓

Analiza Udan-ben

↓

Analiza Eskoamentu (Runoff survey)

↓

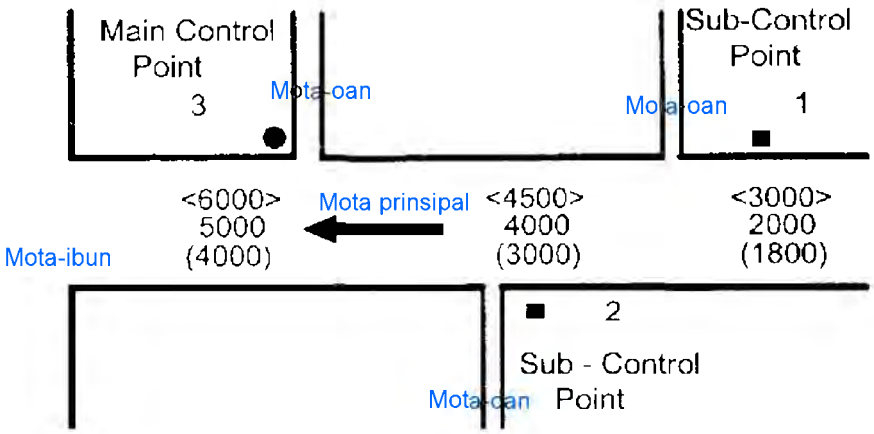
Kompara ← (1) Kalkuladu Diskarga ba kada Kontrolu/ Subkontrolu Pontus 0 (iha varius periodu retornu/several return period)

Kompara ← (2) Kapasidade Deskarga be existe hela ba Kada Pontu Kontrolu (Existing Discharge Capacity of Each Control Point)

↓

Desenha Diskarga (Design Discharge)

Diagrama husi Diskarga/Discharges (Exemplu)



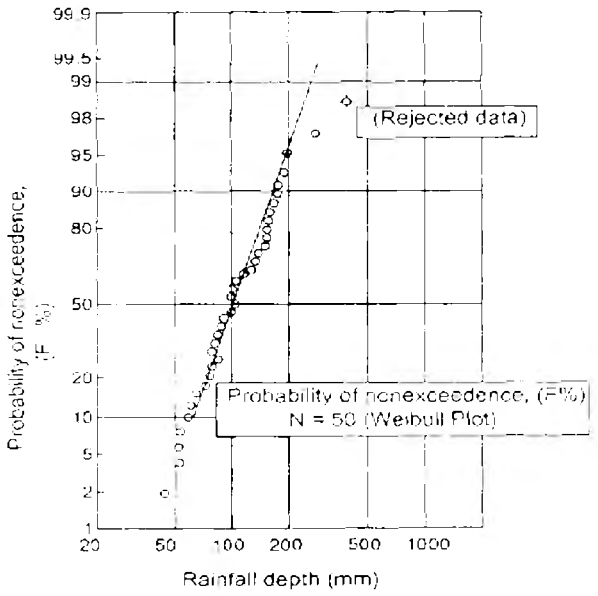
<Q> = Long-term target discharge(Tarjeitu diskarga longu prazu)
Q = Design discharge (Dezenha Diskarga)
(Q) = Existing discharge capacity(Kapasidade diskarga existe-hela)

Analiza Udan-ben(Rainfall Analysis)

1. Deskrisaun husi area kaptasun (Delineation of catchment area)
2. Kalkula Mediu Udan-ben(average rainfall) iha area kaptasaun
3. Kalkula udan-ben mediu maximu annual (loron-2, loron-3, etc.)
4. Kalkula udan-ben mediu/rata² liu-husi seleksiona periodu retornu(return periods)
5. Kollekta modelu tipu udan-ben/typical rainfall patterns (Grafiku/hyetographs) husi inundasaun prinsipal passadu no estabelese tipu kurva akumulasaun massa (typical rainfall accumulation mass curve) ba kada durasaun.
6. Produz Grafiku(Generate hyetograph) ba kada durasaun nomos periodu retornu(return period).

Udan-ben Mediu/Rata² husi Periodu Retornu/return period

Relasaun Probabilidade husi non exedensia(non exceedance/tidak melampaui) nomos Klean husi Udan-ben/Rainfall Depth (mm)



Analiza Eskoamentu (Runoff Analysis)

- Iha metodu barak ba runoff analysis ke dezenvolve tiha-ona/sei dezenvolvidu hela. Metodu husi runoff analysis mak tuir-mai:

1. **Formula Rasional/Rational Methods** --- Mota simplis
2. **Metodu Unidade Hidrografia/Unit Hydrograph Method** --- tributariu/mota-oan barak (konsidera tempu-ultimu)
3. **Metodu Funsaun Armajenamentu/Storage Function Method** --- barrajen(dam) ka area inundasaun interna(inland flood area)

Rumus/formula Rasional (Rational Formula)

- $\mathbf{Qp = \frac{ciA}{3.6}}$
- Nebee:
- **Qp** = diskarga inundasaun maximu/maximum flood discharge (m^3/s)
- **C** = Kofisiente kuran-dimensional husi eskoamentu/dimensionless runoff coefficient
- **I** = Intensidade Udan-ben iha tempu konsentrasaun husi inundasaun/rainfall intensity within the time of flood concentration (mm/h)
- **A** = area kaptasaun/catchment area (km^2)

Orariu Tui-mai

3ª Lisaun Sala de Aula kona-ba Kontrolu de Cheia/Inundasaun

(1) Estrutura Mota/River structures (dike/dique;Tanggul, Revestimentu/revetment)

4ª Lisaun sala de aula kona-ba Kontrolu de Cheia/Inundasaun

(2) Estrutura Mota(Krib/spur dike, Barreira/weir)

Planeamentu Kontrolu de cheia/Inundasaun (3)

Loron 1 Juñu de 2013

Lisaun Loron-ohin nian

- Dezeñu husi Estrutura Mota

(1) Karakteristika kanal/Channel Characteristic
(2) Morfolojia Kanal/Channel Morphology
(3) Análiza Ekonômia/Economic Analysis
(4) Dique (Dike;Tanggul)
(5) Revestimentu;kamada-protesaun/Revetment
(6) Krib/Spur dike
(7) Sinta-rai-okos/Groundsill
(8) Bareira/Weir(tanggul kruza hodi regula bee suli)

(1) Karakteristika Kánal/ Channel Characteristics

- Karakteristika no morfolojia ba kanal mak determina husi faktor oi-oin. Faktor prinsipal primeiru mak:

(1) Diskarga no nia mudansa kada oras(refere ba Sala de Aula No.2)

(2) Karga Sedimentasaun no nia mudansa kada oras

(3) Materiais iha Bee-suli-fatin/Bed no topografia besik ba kanal mota, nomos

(4) Halo tuir ba klimátika lokal, vegetasaun besik mota-ninin no utilizasaun rai iha basia drenajen/drainage basin.

Segmentu Mota no Karakteristika Kanal

Klassifikasaun	Segmentu M Segment M	Segmentu 1	Segmentu 2/Segment 2		Segmentu 3 Segment 3
			2-1	2-2	
Georafia/ Geography	Foho/Mountain	Alluvial/fatuk-musan	Dataran/Plane Klot/Narrow	Taggul/Levee Natural	Mota-ain / Delta
Diâmetru husi Tipiku Materiais mota suli-fatin/Riverbed	Materiais oi-oin/Various materials	Liu husi 2 cm/ More than 2 cm.	3-1 cm,	1-0.3 mm	menus husi 0.3 mm
Material Mota-ninin/ Riverbank Material	Tipu barak husi rai no fatuk mosu iha mota-ninin ke nu'udar mota-suli-fatin/ riverbed	Material mota-ninin/Riverbank mak kompostu hosi Dalas lotuk/thin layer husi rai-henek no raihenek uut/silt nebee ke mak hanesan ho mota-suli-fatin/riverbed	Dalas badak liu husi material mota ninin/ riverbank mak hanesan hoMota-suli-fatin/riverbed.	Mistura husi rai-henek di'ak, Tanah liat/clay no Rahenek-uut/silt. Material hanesan ho Mota-suli-fatin/ riverbed	Rai-henek uut/Silt no Tanah liat/Clay

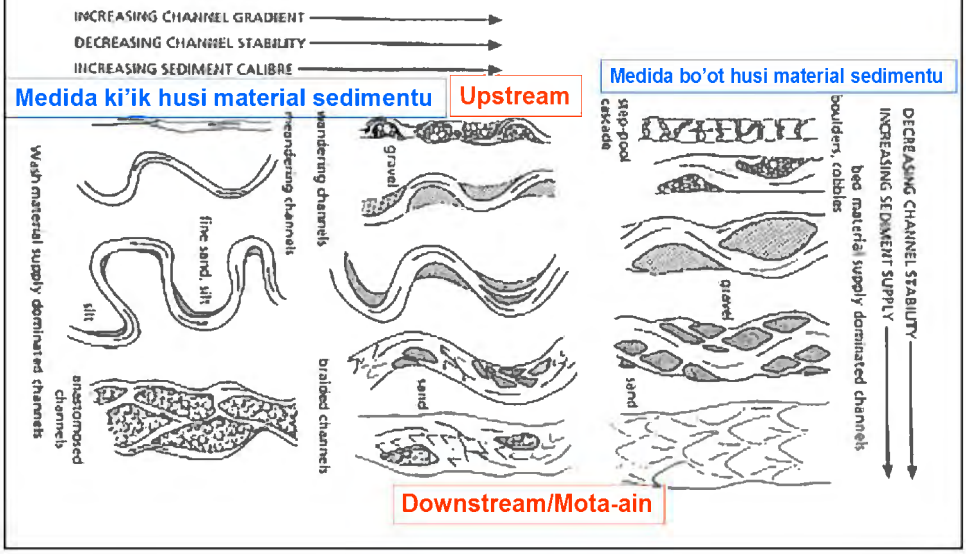
Upstream/mota-leten;hulu **Mota-ain;hilir**

Segmentu Mota no Karakteristika Kanal (kontinua.)

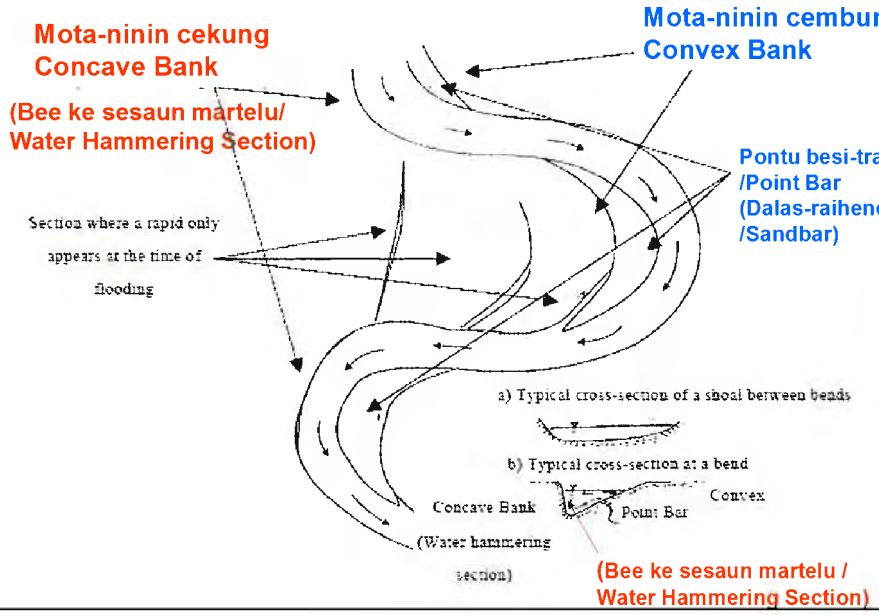
Klassifikasaun	Segmentu M	Segmentu 1	Segmentu 2		Segmentu 3
			2-1	2-2	
Gradiente;Foho-lolon/ lereng	Várius jeralmente foho-lolon subida	1:60 – 1:400	1:400 – 1:5,000		1:5,000 – Nivel
Meandering/ Kurva-ba-mai	Várius/Varios	Kurzamentu oitoan / kurva-ba-mai	Kurva ba-mai grave;todan/ Heavy meandering		Kurva ba-mai Luan no ki'ik
Tatohik iha ninin/Bank Scouring	Todan;grave/ Heavy	Todan;grave/Heavy	Naton/Medium. Arus-prinsipal husi diresaun bee muda wainhira materiais bo'ot-liu existe iha mota-suli-fatin.		Mamar. Fatin/ Arus husi sasuli mak kuaze fixu ona.
Bee nia kle'an husi Anualmente inundasaun máxima	Várius/Varios	0.5-3.0 m	2.0-8.0 m		3.0-8.0 m

Upstream/mota-leten;hulu **Downstream/hilir**

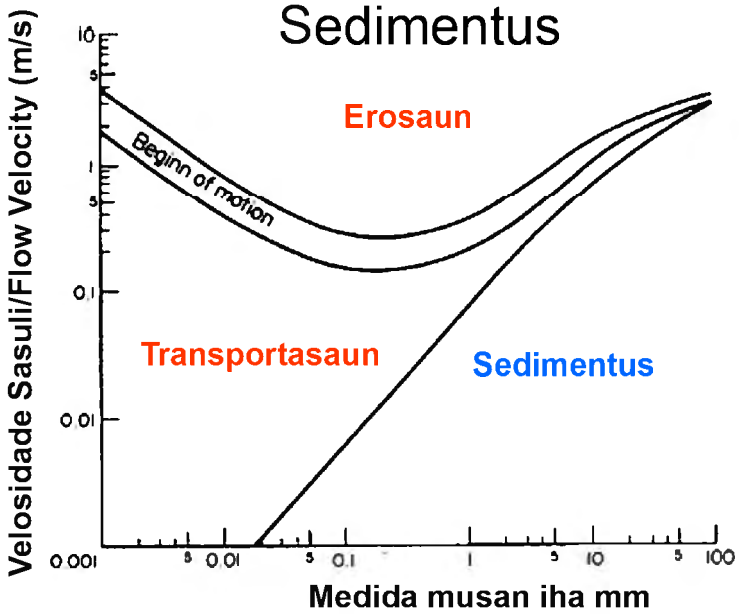
(2) Diagrama Skemátika husi Morfolojia Kanal



Karakteristika husi Kanal ke Kurva-ba-mai (Meandering Channel)



Erosaun, Transporte no Limite ba Sedimentus



(3) Análiza Ekonomia

- Projetu sira tenke ser sujeita ba avaliasaun ekonomia hodi determina sira nian viabilidade no justifika implementasaun.

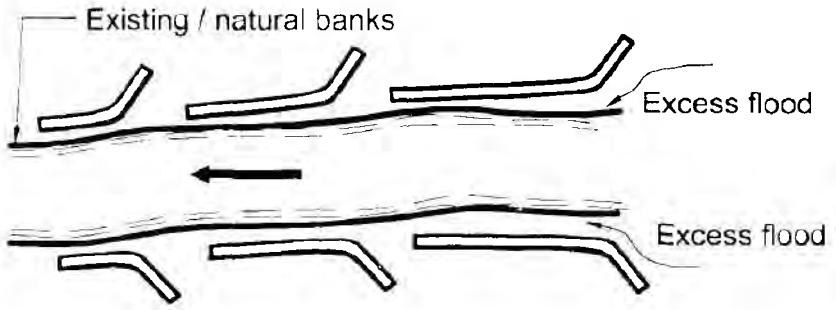
a) Valor Atual Liquidu ka The Net Present Value "**NPV**" tenke ser pelo-menus nulo/nihil. NPV = (Valor Benefisiáriu Atual ka Present Value of Benefits) – (Kustu husi Klean Atual ka Present Vale of Cost)

b) Rasio Kustu benefisiu ka The benefit-Cost Ratio "**B/C**" tenke ser menus husi ida.

c) The Internal Rate of Return "**IRR**" tenke ser menus husi 15 %. IRR = Discount Rate ne'ebe sei halo valor benefisiu atual ou the Present Value of Benefits equal ba Kustu Valor Atual ka Present Value of Cost.

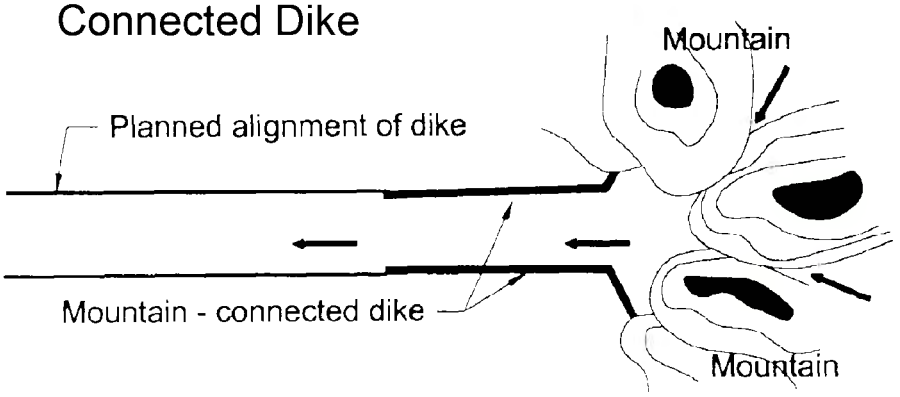
(4) Dique/Dike

a) Dique Nakloke/Open Dike



(4) Dique/Dike (kontinua..)

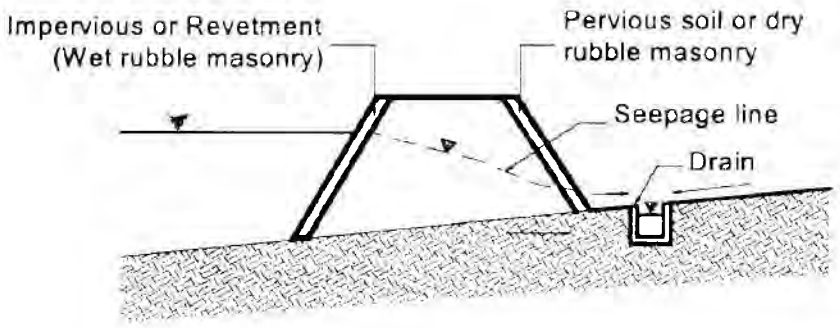
b) Dique Konekta ba Foho/Mountain-Connected Dike



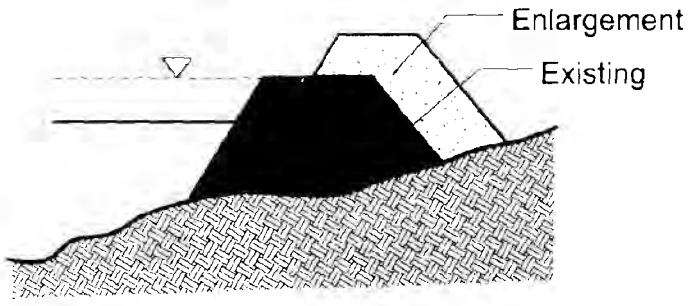
Kauza Prinsipal husi estragu ba Dique/Dike

1) Erosaun (Tatohik/Scouring)
2) Alagamentu;bee suli naresin/Overflow
3) Infiltrasaun-bee/Seepage
4) Rai-nakdoko/Earthquake

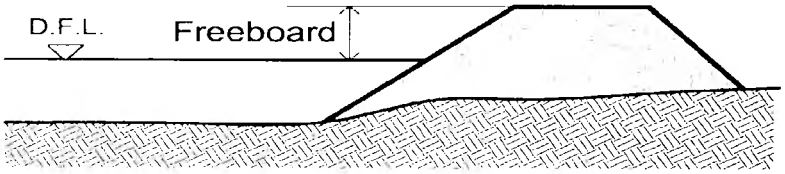
Kontramedida hasoru Infiltrasaun-bee/Seepage



Enlargamentu/haluan ba Dike ké Existe-hela



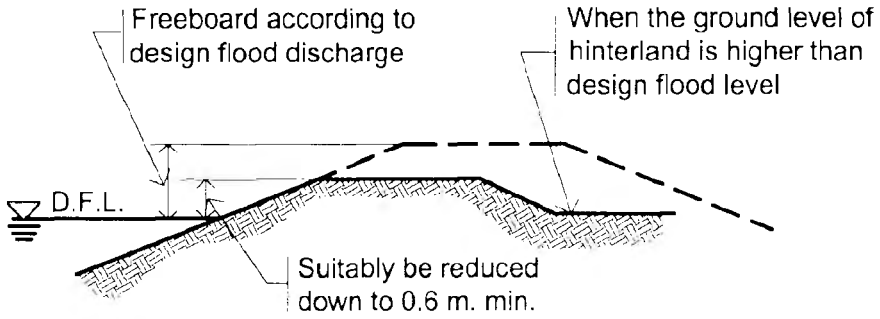
Altura/Aas husi Dique/Dike



Altura Dique = Dezeñu Nivel inundasaun **ou Design flood level +** Liña Livre **ka Freeboard**

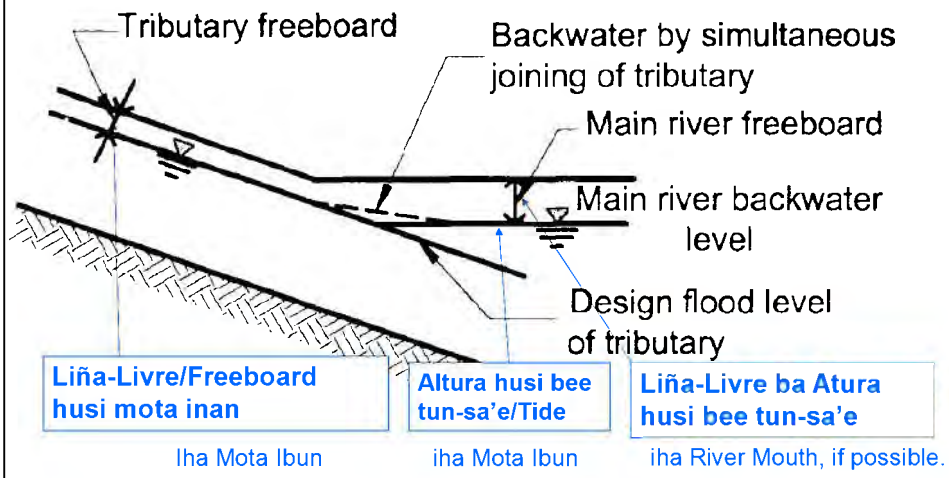
Dezeñu Deskarga Inundasaun/ Design flood discharge (m^3/s)	Parte Liña-Livre/ Freeboard (m)
Menus husi/Less than 200	0.6
200 no to'o 500	0.8
500 no to'o 2,000	1
2,000 no to'o 5,000	1.2
5,000 no to'o 10,000	1.5
10,000 nomos liu	2

Altura husi Dique/Dike (exsepsaun)



- **Liña-Livre/Freeboard mak reduz tun to'o mínimu 0.6 m, wainhira area-kotuk/hinterland mak aas-liu duké dezeñu nivel inundasaun/design flood level.**

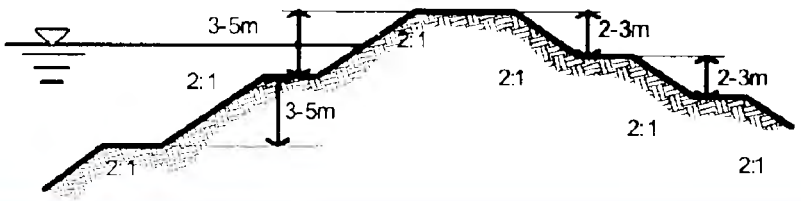
Volta husi Bee/Back Water



Dique/dike , afeita husi Altura bee tun-sa'e/high tide, tenke ser jeralmente kobre iha faze konsiderasaun tolu husi konkretu ka material ke hanesan, tenke konta mos asaun ondas Aas-liu husi ultrapassa/ the wave overtopping action.

Arranju husi Akostamentu/Berm

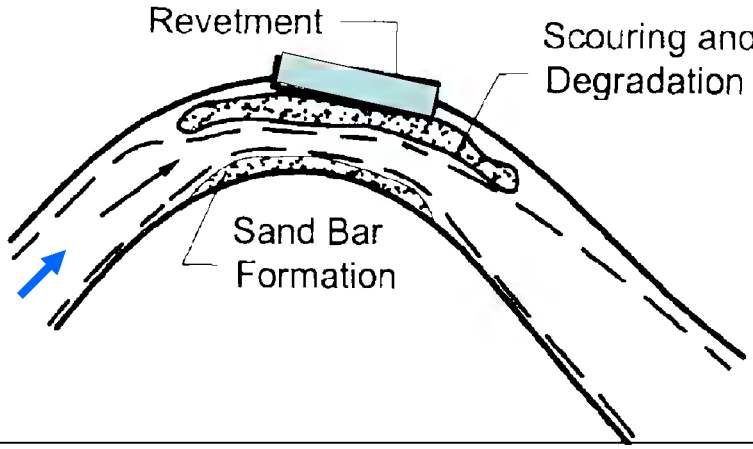
Crest;Krista;puncak



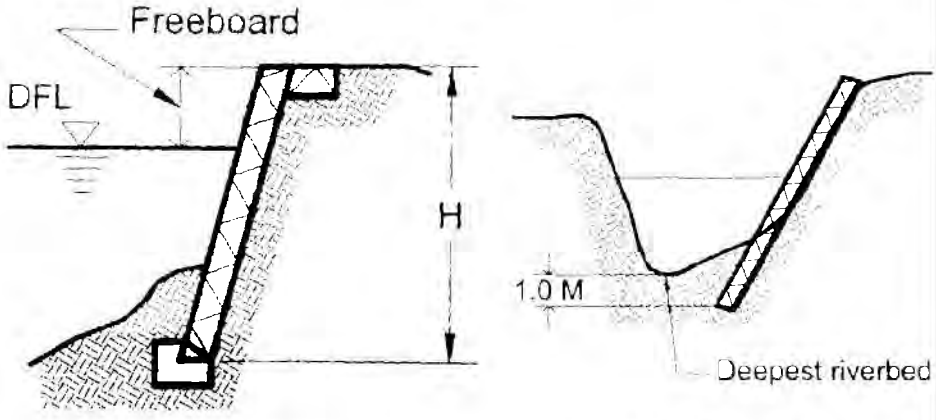
Dezeñu Deskarga Inundasaun/ Design flood discharge (m^3/s)	Luan ke Krista;Aas-liu;puncak/ Crest Width (m)
Menus husi/Less than 500	3
500 no to'o 2,000	4
2,000 no to'o 5,000	5
5,000 no to'o 10,000	6
10,000 no liu	7

(5) Revestimentu/Revetment

a) Konstrusaun husi Revestimentu/Revetment iha Kruzamentu Mota(River Bend)



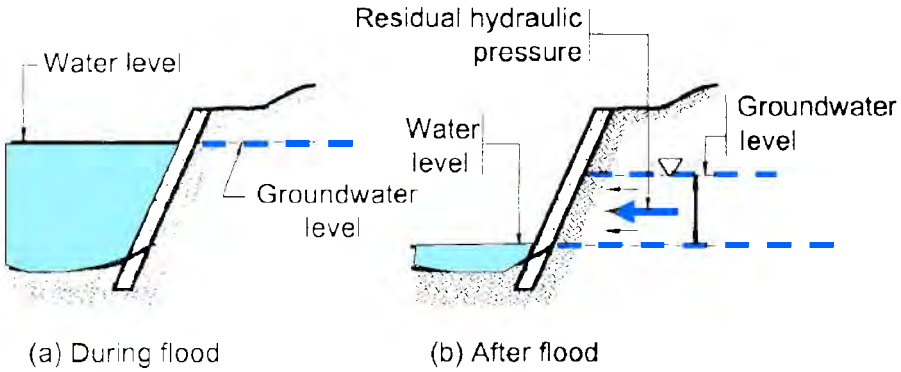
(5) Revestimentu/Revetment



Altu;Aas/Height

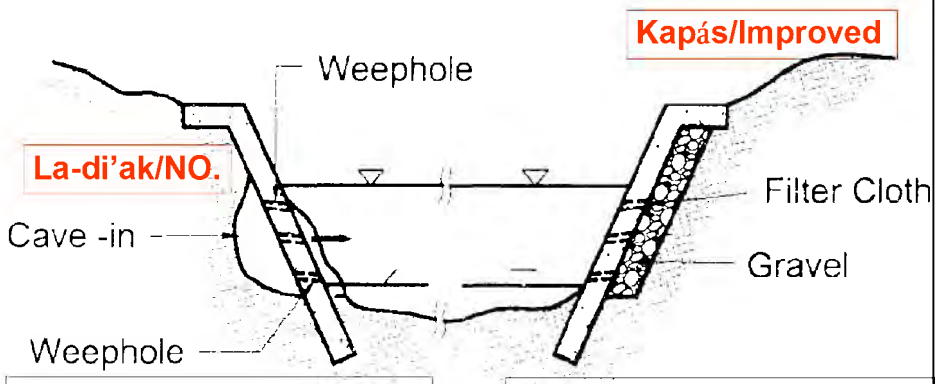
Kle'an /Depth

Pipa Drenajen(Drainage Pipe) / Ku'ak Berongga;Barkakas(Weep Hole)



Dezenvolvimentu husi Pressaun Hidráulika Residual sein;laiha Pipa Drenajen/Ku'ak Berongga (Hydraulic Pressure without Drainage Pipes/ Weep Holes)

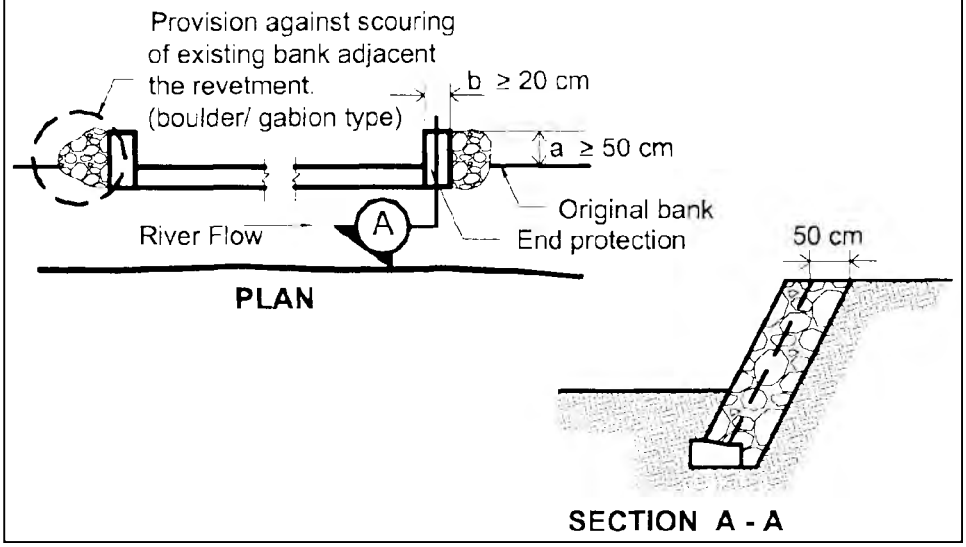
Prevensaun ba Suli-naresin(Outflow) husi Aterramentu(Backfill)/ Iha Material nia Kotuk



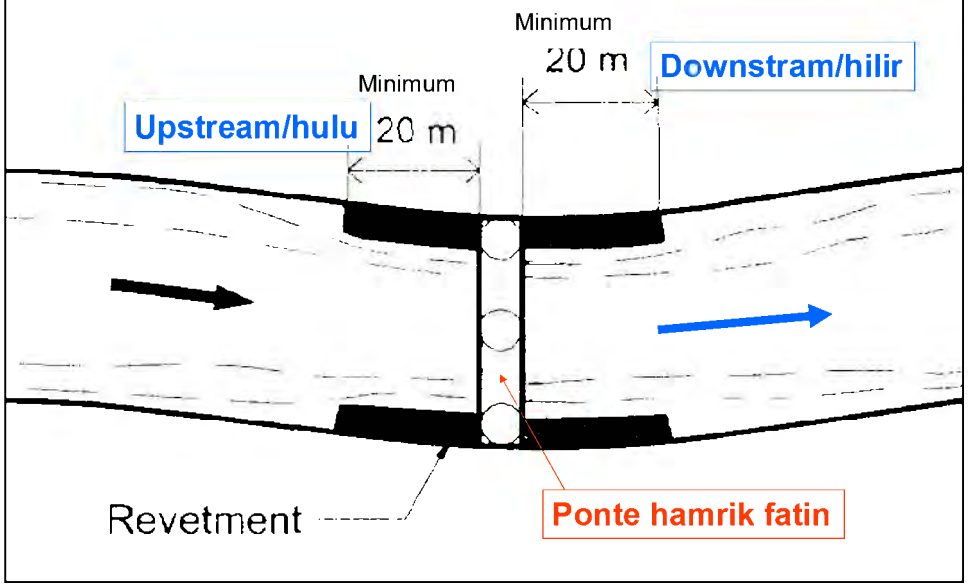
Barkakas(weephole) laiha hena-ensedor(filler-cloth) no kerikil(gravel)

Barkakas(weephole) ho hena-ensedor(filler-cloth) no kerikil(gravel)

Obra Protesaun Final (End Protection Work)



Revestimentu/Revetment iha Sasatan Ponte/Bridge Abutment

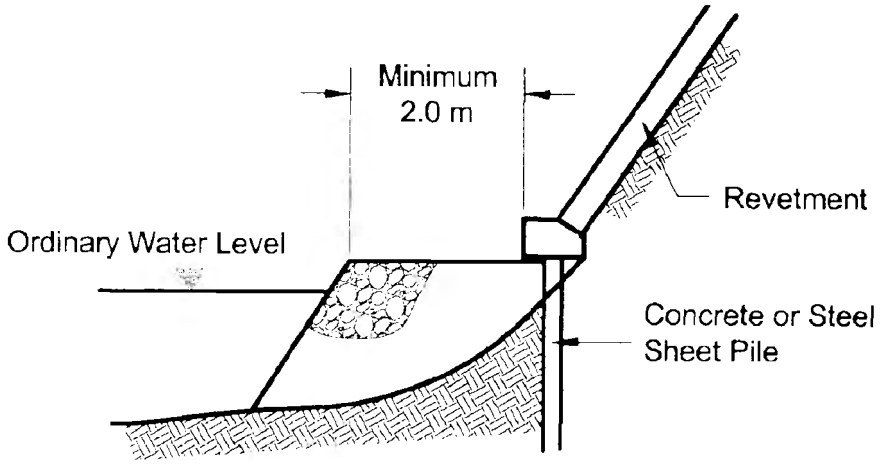


Kontramedida Obra ba Estabilidade husi Revestimentu/Revetment

Iha mota badak ka iha parte final iha-nebee revestimentu/revetment mak sempre sujeitada hodi deriji atake bee, kontramedida apropriada (i.e., matrass bronjo, krib/spur dike) tenke ser fornese para possível tatohik ke rezulta estragu/destruisaun.

Entantu husi area nivel bee nia kle'an hanesan bai-bain, pilar nahe/sheet pile ka pilar konkretu tenke ser fornesida ho obra protesaun eskada ke adequadu/adequate foot protection works.

Protesaun hasoru tohik/scour iha area bee kle'an/ Altura bee tun-sa'e(high tide)



Selesaun ba Tipu husi Revestimentu/Revetment

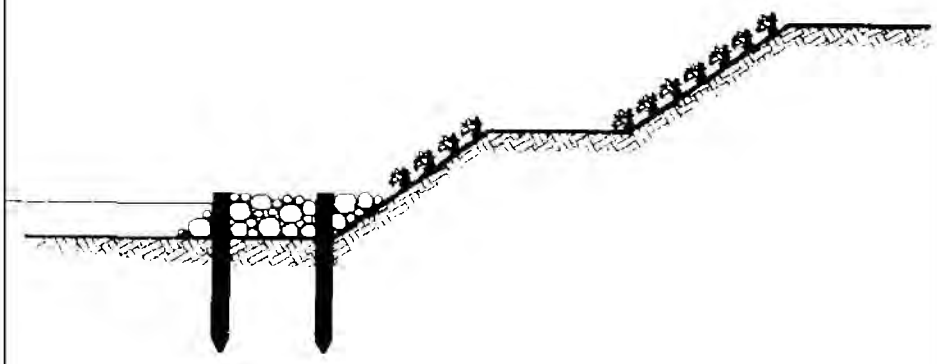
NO	Tipu husi Revestimentu/ Revetment (Kamada protesaun)	Velosidade Máxima permitida (m/s)	Deklive/ Slope (H:V)	Altura;aas / Height (m)	Observasaun
1	Mistura rai,foer/Sodding ho du'ut ka vegetasaun seluk ruma(Natural iha mota ninin/bank)	< 2.0	Kman-liu/Milder duké 2:1	–	Tipu revestimentu ida-ne'e mak preferivelmente konstrui iha-leten husi nivel bee normal. karik revestimentu mak badak-liu duké nivel bee normal, uza de'it tipu seluk.
2	Lutu Pilar Ai-balok/ Wooden pile fence	< 4.0	Kman-liu/Milder duké 0.6:1	5	Preferivelmente ba mota sira iha konsiderasaun oitoan ba batuk-bo'ot sira iha mota-suli-fatin/riverbed no mota ninin
3	Formasaun Karada-Fatuk-bo'ot mamuk nebee Maran/Dry boulder riprap	< 5.0	Kman-liu/Milder duké 1.5:1	3	Vegetasaun ki'ik-oan bele moris iha konsiderasaun ba ambiente.
4	Matras Bronjo/Gabion mattress, tipu expansaun/spread type	< 5.0	Kman-liu/Milder duké 1.5:1	–	La prefere ba mota no bee meer. La prefere ba mota ida-nebee karada-fatuk-bo'ot ké luan/large boulders (> 20 cm diameter) mak presente
5	Rebokada Formasaun fatuk mamuk/ Grouted riprap, Tipu expansaun/spread type	> 5.0	Kman-liu/Milder duké 1.5:1	5	Karik Altura husi mota-ninin mak aas-liu, Fornese berm
6	Matras Bronjo/Gabion mattress, Tipu hada/pile-up type	< 6.5	1:1 to'o 1.5:1	–	Ba uzu provizoriu (Komesa/Remata obra protesaun)
7	Rebokada formasaun formasaun fatuk mamuk/ Grouted riprap, Tipu moru/wall type	> 5.0	Subida-liu duké 1:1	–	Tipu moru inklinadu/Leaning wall type, Badaen Fatuk-musan/rubble masonry

Selesaun ba Tipu husi Revetment (kontin.)

NO	Tipu husi Revestimentu/ Revetment (Kamada protesaun)	Velosidade Máxima permitida (m/s)	Deklive/ Slope (H:V)	Altura;aas / Height (m)	Observasaun
8	Konkretu fatuk-musan/ Rubble concrete	> 5.0	Subida-liu duké 1:1	–	Tipu Gravidade/Gravity type
9	Badaen Fatuk/Stone masonry	> 5.0	Subida-liu duké 1:1	–	Tipu Gravidade/Gravity type
10	Moru krip;jiplakan/Crib wall	> 6.0	Subida-liu duké 1:1	–	
11	Konkretu reforsadu ho fundasaun pilar nahe konkretu	–	Subida-liu duké 1:1	–	Mahar Minimu 20 cm. Fornese temperatura besi-tranka/bars diametru 12 mm ho espasu la to'o 40 cm iha sentru, iha maneira rua
12	Pilar Nahe ho Besi/ Steel sheet pile	–	–	–	Wainhira nivel bee bai-bain mak aas tebes (afekta husi luktuasaun we-saeno tun/tidal fluctuation). Fundasaun nia klea'an tenke ser analiza konsidera ba velosidade bee nia suli, material fudasaun no klean tatohik/scouring depth para mantein nia estabilidade.
13	Pilar Nahe ho besi/Steel sheet pile no konkretu reforsadu (kombinasaun segmentasaun)	–	Kman-liu/Milder duké 1.5:1maibe la subida-liu duké 1.5:1	–	Wainhira nivel bee bai-bain mak aas tebes (afekta husi luktuasaun we-saeno tun/tidal fluctuation). Fundasaun nia klea'an tenke ser analiza konsidera ba velosidade bee nia suli, material fudasaun no klean tatohik/scouring depth para mantein nia estabilidade.

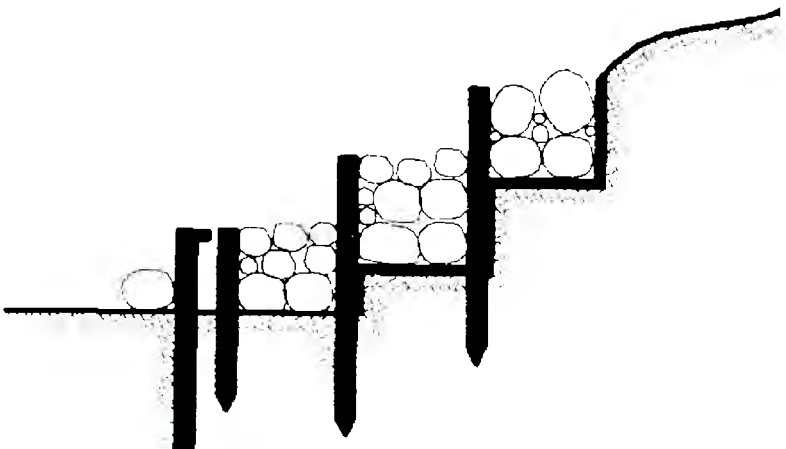
(fonte: Flood Control Manual, Japan)

1. Tate Rai no kuda Ai/Sodding ho Du'ut ka Ai-horis Seluk Ruma (Tipu Natureza)



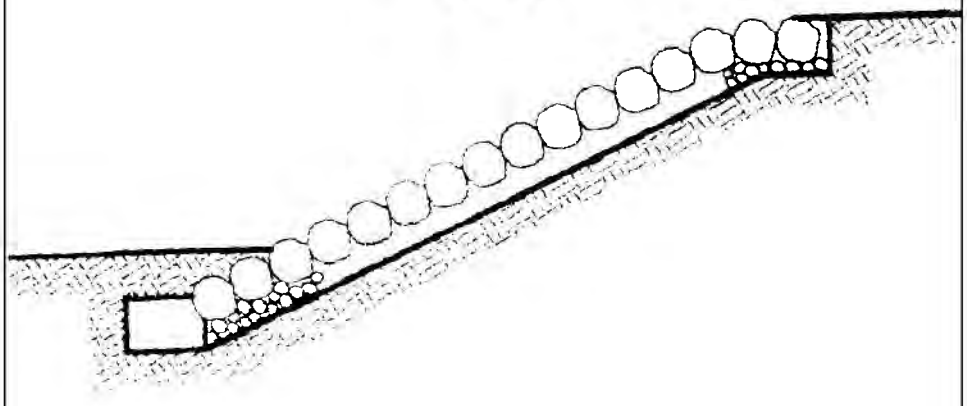
Bele permite Velosidade Máximu < 2.0 m/s

2. Lutu Pilar Ai-balok/Wooden Pile Fence



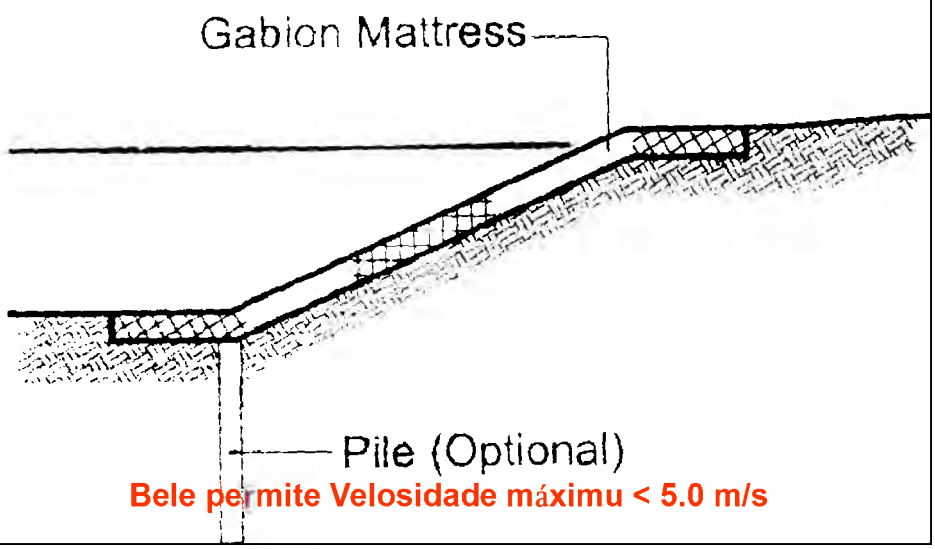
Bele permite Velosidade Máximu < 4.0 m/s

3. Hada Karada-Fatuk Bo'ot Maran;fatuk foho/Dry Boulder Riprap



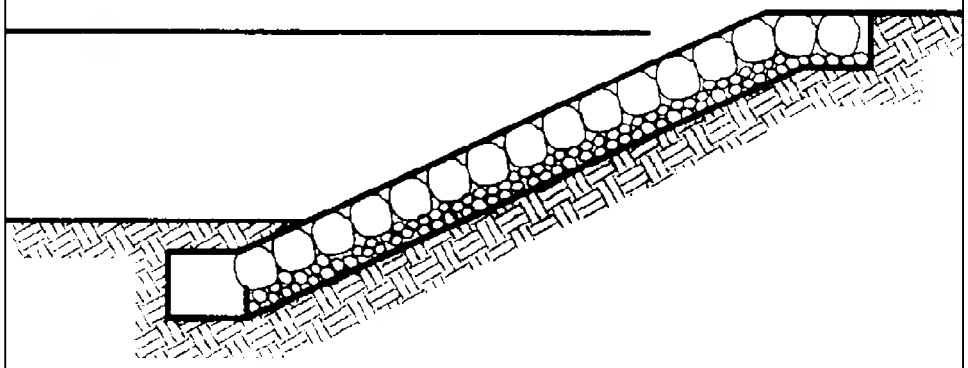
Bele permite Velosidade Máximu < 5.0 m/s

4. Matrass Bronjo Tipu Expansaun/Gabion Mattress Spread Type



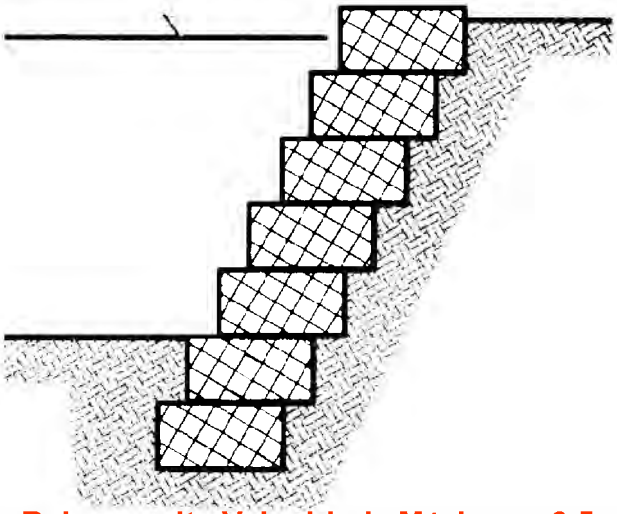
Bele permite Velosidade máximu < 5.0 m/s

5. Hada-Fatuk Rebokadu/Grouted Riprap, Tipu Expansaun/Spread Type



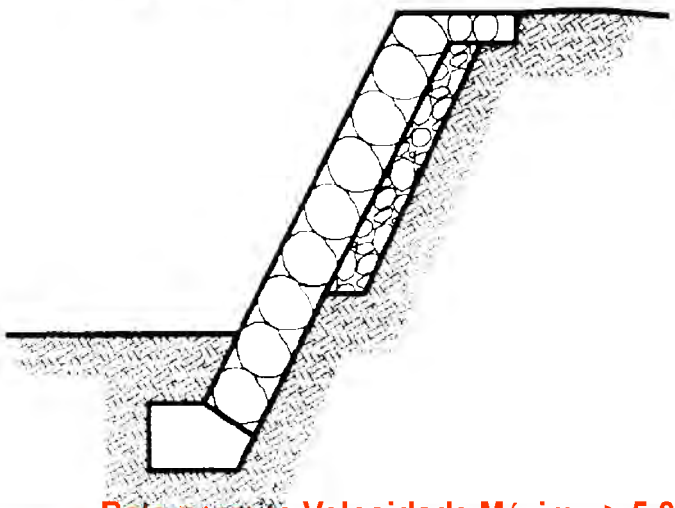
Bele permite Velosidade Máximu > 5.0 m/s

6. Matrass Bronjo/Gabion Mattress, Tipu Hada/Pile-up Type



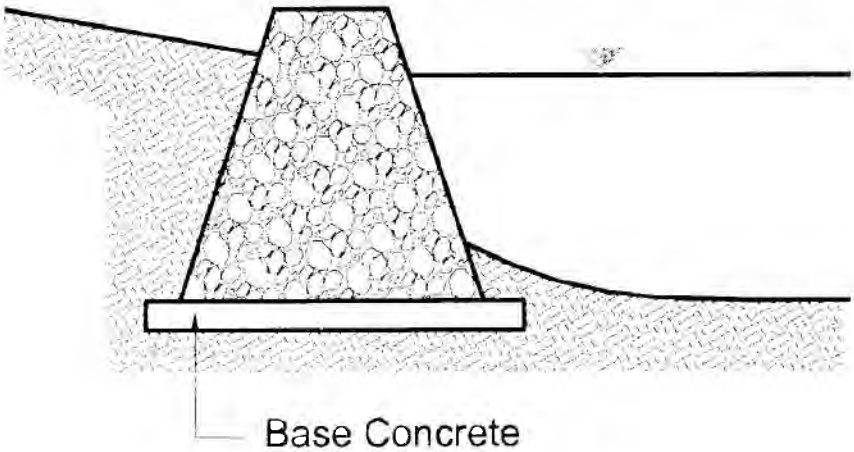
Bele permite Velosidade Máximu < 6.5 m/s

7. Hada-Fatuk Rebokadu Tipu Moru (Grouted Riprap Wall Type)



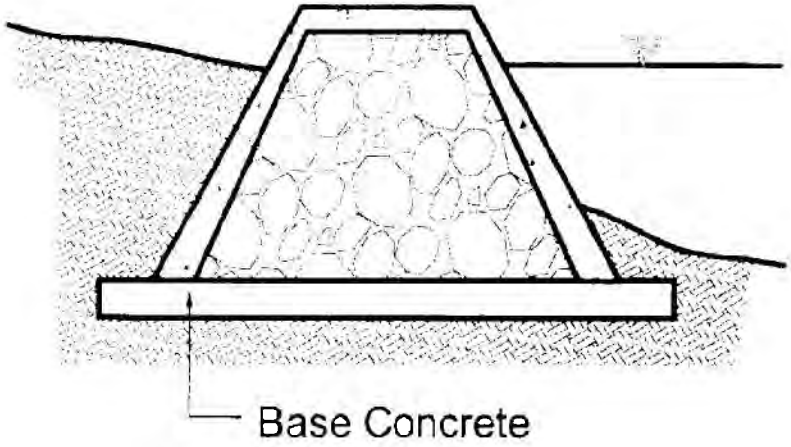
Bele-permite Velosidade Máximu > 5.0 m/s

8. Konkretu Fatuk-musan (Rubble Concrete)



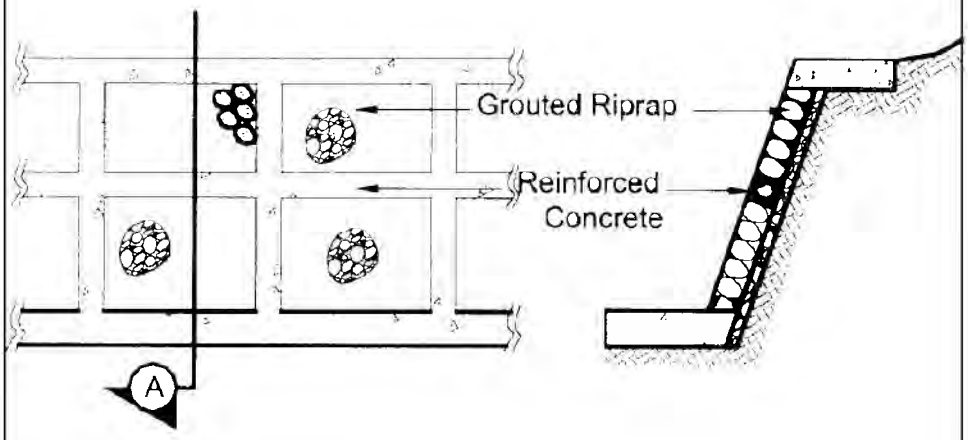
Bele-permite Velosidade Máximu > 5.0 m/s

9. Badaen/Plester Fatuk (Stone Masonry)



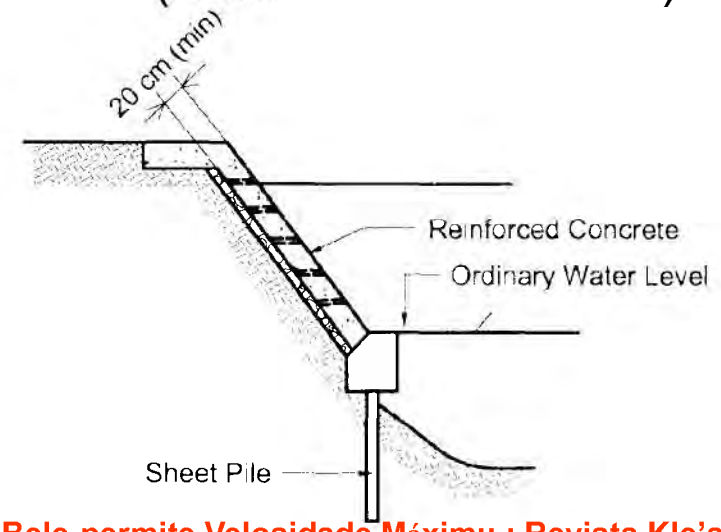
Bele-permite Velosidade Máximu > 5.0 m/s

10. Moru Krib/jiplakan (Crib Wall)



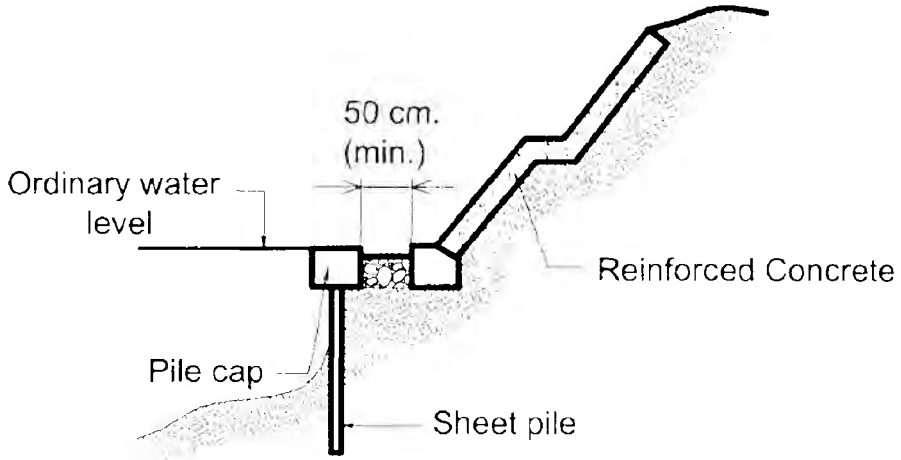
Bele-permite Velosidade Máximu > 6.0 m/s

11. Konkretu Reforsadu (Reinforced Concrete)



Bele-permite Velosidade Máximu : Revista Kle'an tatohik lokal bazea ba velosidade

12. Pilar Nahe Besi(Steel Sheet Pile) no Konkretu Reforsadu(Reinforced Concrete) (Kombinasaun Segmentu/Segment Combination)



Bele-permite Velosidade Máximu : Revista Kle'an tatohik lokal bazea ba velosidade

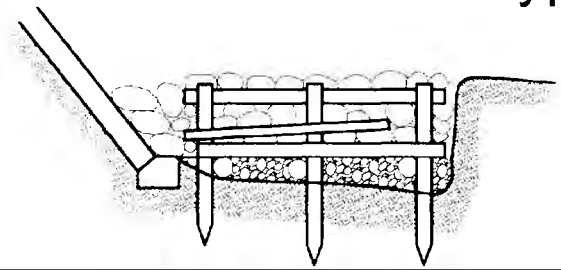
Protesaun nia Âin(Foot Protection)

Obra Protesaun nia âin mak planeadu para atu proteje fundasaun revestimentu husi tatohik lokal ba iha mota suli-fatin okos/riverbed scouring nomos/ka degradasaun ba mota suli-fatin/riverbed. Protesaun nia Âin/Foot protection reduz forsa husi sasuli/fluxu iha fundasaun, nune'e reduz tatohik kle'an ba mota suli-fatin/ riverbed.

Tipu husi protesaun nia âin/foot protection:

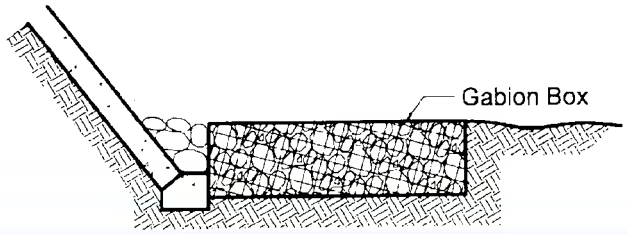
1) Estaka ai-balok/Wooden stockade
2) Bronjo/Gabion
3) Karada Fatuk-bo'ot/Boulder
4) Bloku Konkretu /Concrete block

1) Tipu Estaka Ai-balok (Wooden Stockade Type)



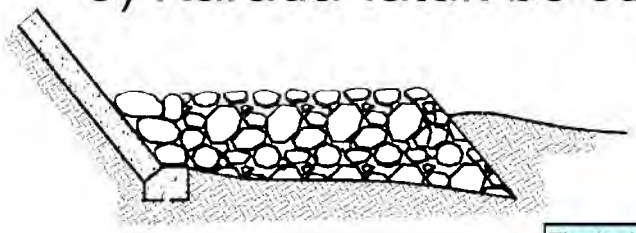
Tipu husi Protesaun nia Âin	Bee nia Kle'an (m)	Dezeñu Velosidade (m/s)					
		1.0	2.0	3.0	4.0	5.0	6.0
		Diamêtru husi Karada-Fatuk-bo'ot/ Boulder (cm)					
Tipu Estakada Ai-balok/Wooden stockade type	1.0	5	5	10	30	–	–
	2.0	5	5	10	15	35	65
	3.0	5	5	10	15	25	45
	4.0	5	5	5	15	25	40
	5.0	5	5	5	10	20	35

2) Bronjo/Gabion



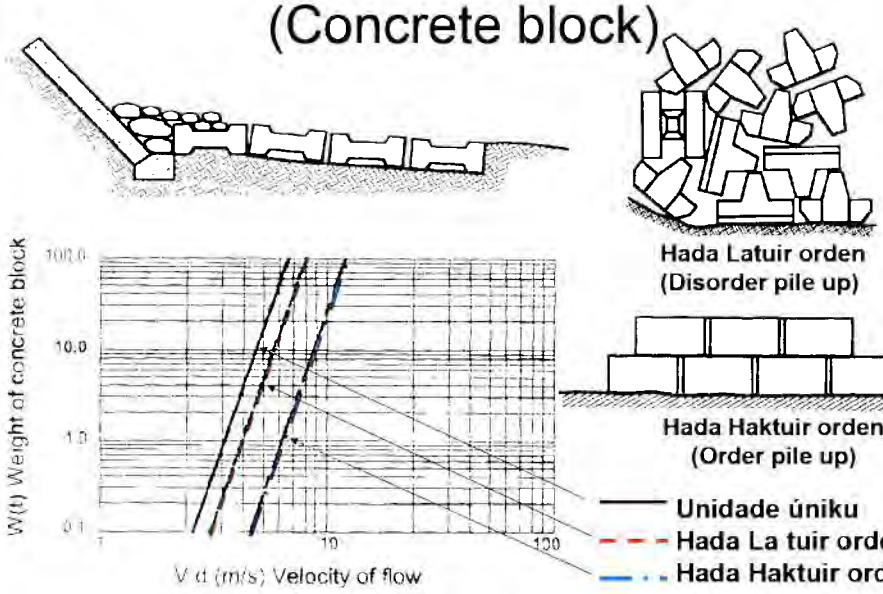
Tipu husi Protesaun nia Âin	Bee nia Kle'an (m)	Dezeñu Velosidade (m/s)					
		1.0	2.0	3.0	4.0	5.0	6.0
		Diamêtru husi Karada-Fatuk-bo'ot/ Boulder (cm)					
Tipu Bronjo/ Gabion type	1.0	5-15	5-15	5-15	10-20	-	-
	2.0	5-15	5-15	5-15	5-15	15-20	-
	3.0	5-15	5-15	5-15	5-15	15-20	15-20
	4.0	5-15	5-15	5-15	5-15	5-15	15-20
	5.0	5-15	5-15	5-15	5-15	5-15	15-20

3) Karada-fatuk bo'ot/Boulder



Tipu husi Protesaun nia Âin	Dezeñu Velosidade (m/s)	Diamêtru (cm)
Tipu Karada-fatuk-bo'ot/Boulder Type	2	-
	3	30
	4	50
	5	80
	6	120

4) Bloku Konkretu (Concrete block)



Relasaun entre Velosidade (m/s) no Altura/Weight (t)

(6) Krib(pemacu tanggul) (Spur dike)

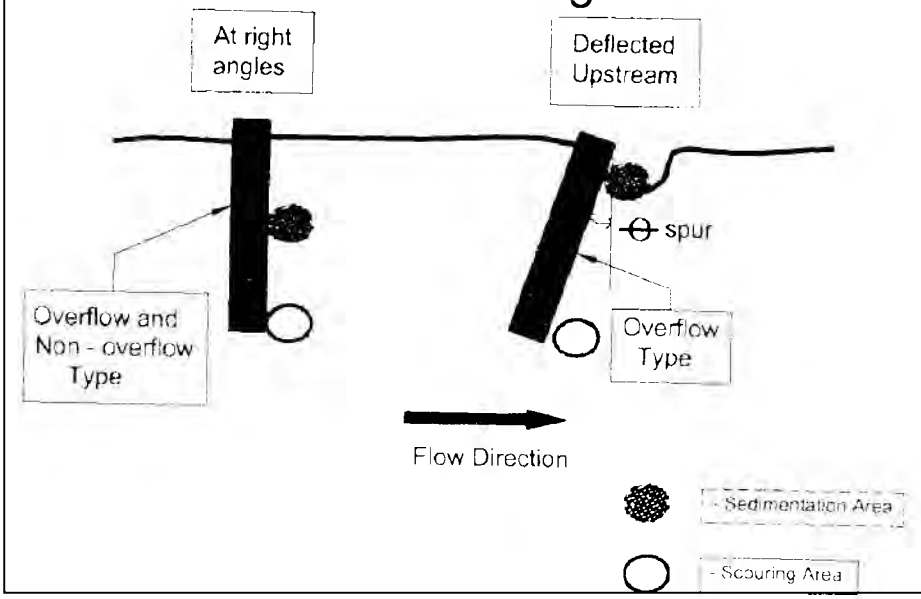
Objetivu husi Krib/spur dike mak hanesan tuimai:

- 1) Prevene tatohik iha mota-ninin/bank scouring liu-husi reduz Velosidade mota nia Sasuli/river flow velocity.
- 2) Deriji-fila ba mota nia sasuli ses hosi mota-ninin/riverbank.

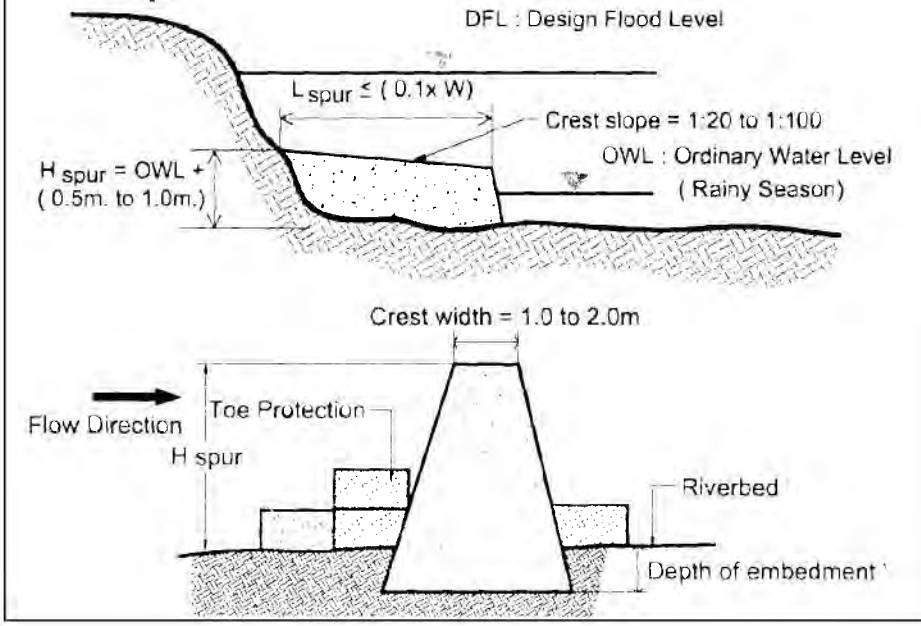
Tipu husi krib/Spur dike:

- 1) Tipu Supa;borus(Permeable Type)
- 2) Tipu La-Borus(Impermeable Type)/ Tipu Semi-Permeável

Relasaun entre aliñamentu krib(spur dike) no rezulta tatohik/scouring husi sedimentu



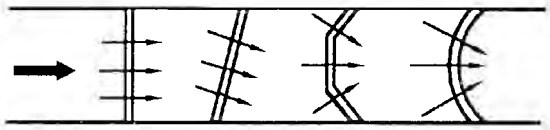
Típika dimensaun no seksaun



(7) Sinta Rai-okos (Groundsill)

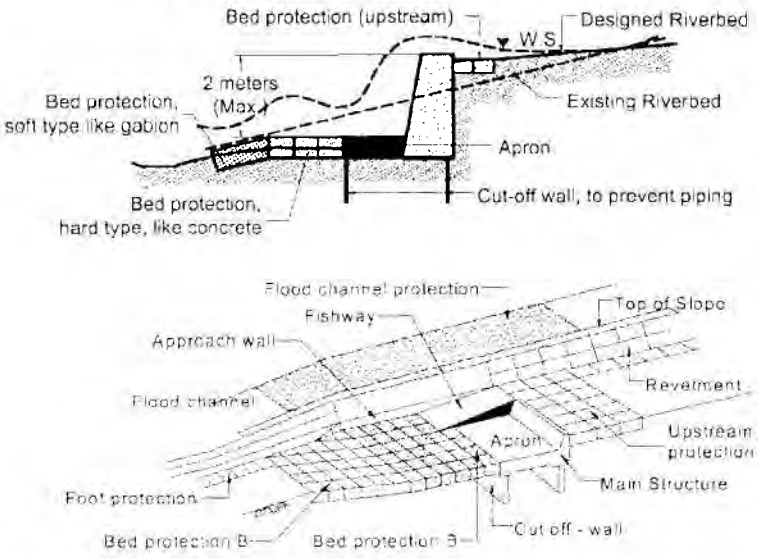
Objetivu husi Sinta rai-okos(groundsill) mak atu fixa elevasaun mota suli-fatin(riverbed elevation) nune'e prevene mota suli-fatin(riverbed) husi degradasaun ké rezulta ba tatohik lokal(local scours) nebee Forsa tun husi fluxu/suli-arbiru(turbulent flow) durante inundasaun.

Tipu mak 1) Tipu Taturuk ba Estrutura (Drop structure type) nomos 2) Tipu Sinta/Sill type (Laiha Tipu Taturuk ba Estrutura/ drop structure Type).



Formatu Rai-lolon(Plane Forms) husi Sinta Rai-okos (Ground Sills) nomos Diresaun Sasuli(Flow Direction)

Tipu Taturuk ba Estrutura (Drop Structure Type)



(8) Barreira bee-laran(Weir)

- Alokasaun husi Barreira(weir) tenke ser selesionada haktuir ba objetivu husi konstrusaun.
- Seksaun kurva ka seksaun ho formatu seksaun klot husi bee-dalan(waterway) tenke ser evitada hanesan possibilidade prátika nian. (Ida-ne'e mak defikulta atu kontrola no mantein altura husi velosidade sasuli(high velocity flow)/ Tatohik lokal/local scouring.)
- Barreira(weir) maka klassifikada tama iha barreira hatama-hasai bee/intake weir (irigasaun etc.), barreira rezerva bee(diversion weir),barreira tun-sa'e bee(tide weir), etc.

Oráriu Tuir-mai

4ª Lisaun Sala de Aula sobre Kontrolu de cheia

Konstrusaun ba dique(dike) & revestimentu;kamada protesun(revetment)

5ª Lisaun Sala de Aula sobre Kontrolu de cheia

Konstrusaun ba Bronjo(Gabion), Krib(Spur dike), & Barreira(Weir)

Planeamentu husi Kontrolu de cheia/Inundasaun (4)

Juñu 8 de 2013

Lisaun Loron-ohin

- Konstrusaun husi Estrutura Mota

(1) Dique/Dike

(2) Revestimentu/Revetment

(1) Konstrusaun husi Dique
1) Levantamentu Topografia

Inisialmente medida husi dique nia ain-fatin/footprint no kabás adisional(additional berms) ruma tenke ser peskizada no marka tiha para hetan baliza lolos hodi hala'o obra.

2) Hamos(clearing), Hasai(Grubbing) no Husik-hela(Stripping)

- Ba konstrusaun dique foun, muda aliñamentu ke existe-hela ka halo-luan ba ense/aterru ke existe-hela, area dique tenke ser moos, hasai(grubbed) no husik-hela(stripped) propriu tiha ona.

3) Rega-bee(Dewatering)

- Area iha-nebee infiltrasaun(seepage)sasuli minor maka hakarak-tebes durante sub-eskavasaun husi materiais ka eskavasaun baleta bele hare nudar tratadu utiliza téknikas eskavasaun no rai-bee hamutuk hanesan bai-bain(conventional **ditching and sumping)** ida-nebee mak relativamente la karu.
- **Bombamentu** ba fatin maran ke segel ona Protesaun Dijriji liña-bee(**cofferdam)** tenke labele komesa to'o segel/tranka sufisiente regula hodi tahan pressaun hidrostátika.
- Area moderada ba infiltrasaun bo'ot sei rekere karu-liu nomos metodu rega ke rekere kustu nu'udar rega ba **pontu ke di'ak ka kle'an ke diak**.

4) Protesaun Diriji Liña-bee(Cofferdam)

- Cofferdams tenke ser konstruidu ba kle'an ké adekuadu hodi assegura estabilidade no ba altura ke adekuadu hodi tranka bee hotu-hotu.

5) Satan(Shoring)

- Satan/Shoring ho kobre;terpal/sheeting no/ka Tahan/bracing tenke ser adekuadu hodi suporta impostu rekarga hotu-hotu no tenke halo-tuir ba regulamentu seguransa aplikável ruma.

Gia Balok/Beam ba obra terpal

6) Eskavasaun

- Eskavasaun estavel iha okos existe-hela superfisie/lapisan rai mak altamente depende ba kondisaun **fundasaun rai** no **Bee rai-okos**. Proposta eskavasaun ruma tenke ser avalia husi enjiñeiru durante dezeñu no etapa konstrusaun husi projetu.
- Karik espasu permite, eskavasaun bele tipikamente ser hala'o ho korta deklive nakloke(**open cut slopes**).

7) Kontrola Seguransa ba Eskavasaun

Ne'e mak rekomenda katak ekipamentu sukat monitorizasaun(m**onitoring gauges)** ser instaladu iha estrutura kritíka existe-hela hodi permite sasukat husi deformasaun lateral no vertikal hirak ruma.

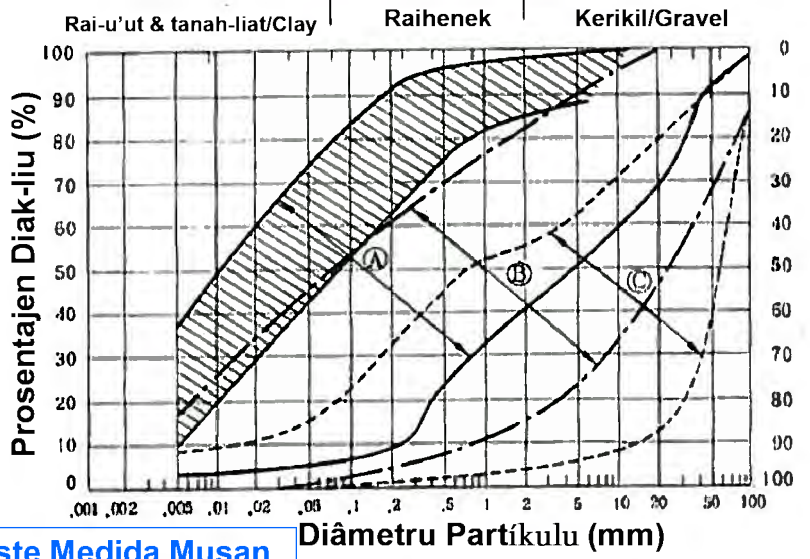
Ekipamentu sukat tenke ser monitorizada Antes/**prior to**, **durante**, no **depois** **k**onstrusaun ida-nebee kolokadu besik ba estrutura krítika ruma

Monitorizasaun Permanente

8) Produsaun ba Materiais Dique/Dike

Ense Dique/Dike tenke limita medida partíkula ba jeneralmente menus husi **100 mm** no tenke labele konteina materiais ke bo'ot-liu husi150 mm iha nia diâmetru.

Matérial Própriu ba Dique



Teste Medida Musan

A: Material Impermeável, B: MaterialSemi-permeável, C: Material Permeável

: Risku husi Okorransia Nakfera/Crack Occurrence

9) Fundamentais husi Kompaktasaun

- Konteina rai kápas bele kompaktada to'o densidade maran máximu/**specific maximum dry density** ho montante termina ona husi enérjia. Nune'e, densidade máximu bele atinji de'it iha konteúdu bee úniku.
- Densidade Máximu no konteúdu bee óptimu mak terminada iha laboratóriu através realizasaun Teste akadémiku(Proctor testing) sobre amostra kolektada(collected samples).

10) Kompaksaun husi Ense/aterru Dique(Dike Fills)

- Rekerementus husi karakteristika kompaksaun importante liu, hanesan Limitasaun konteina bee(**water content limits)**, nanahe ke mahar(**layer thickness)**, ekipamentu kompaksaun**(compaction equipment)**, nomos numeru husi passa**(number of passes)** sei hatama iha espesifikasaun no tenke ser revista besik-liu husi inspektor to guaranti kumprimentu.
- Espesifikasaun sei jeralmente indika tipu no medida husi ekipamentu kompaksaun sei uza ba.

10) Kompaksaun husi Ense;aterru Dique (kontinua….)

- La kompak ka lakon elevador nia mahar sei espesifikada. Elevador nia mahar(Lift thickness) espesifikada sei bazea ba tipu husi material no kompaksaun ekipamentu uzadu.
- Materiais impermeável ka semi-permeável mak bai-bain lakon elevador nia mahar(lift thickness) hatur iha **150 to'o 200 mm** no kompaktada ho nen to'o passa walu(**six to eight passes)** husi sheepsfoot roller(mákina pezada), ka alternativu ida lori hadi'a.

Sheepsfoot Roller(Mákina Pezada)

Bulldozer & Roller Roda

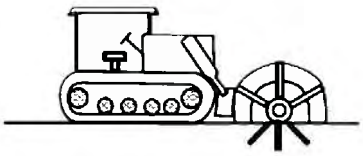
Vibrating Roller

Kolokasaun Bee ba Rai Bokon Óptimu(Optimum Soil Moisture)

Kompaktasaun Impaktu Rápidu(Rapid Impact Compaction)

Estabilizasaun Rai Badak;dangkal(Shallow Soil Stabilization)

- Karik materiais adekuadu mak labele, kompaksaun reboka mak injeksaun husi sementi-rai ke grossu **(soil-cement)** reboka iha pressaun nia-okos tama ba massa rai nian, ida-nebee ke konsolida(hatos) no densifika rai tarjetada iha situ/terrenu



Tipu Estabilizador

Mákina ke'e-suru rai/Power Shovel + Estabilizador

Teri Eskada iha Dique ke existe-hela(Stepped Cut on Existing Dike)

- Teri eskada mak konstruta husi mákina ke'e-suru/eskavador(power shovel).
- Teri eskada mak importante ba **integrasaun** entre dique existe-hela no tanggul/aterru(embankment) foun.

Alokasaun ba Reforsamentu Filtru Nanahe (Filter Layer Placement)

- *Fibra(abut)reforsada kompostu ké uza, sekarik presiza.(*Fiber reinforced composite is used, if necessary).

Remata hatetuk
(Final Grading)

Remata hatetuk
(Final Grading)

Teste Kompaksaun Rai (Soil Compaction Test)

Densidade Rai/Soil density utiliza ekipamentu sukat nuklear/nuclear gauge (Radioisotope : RI)

Densidade rai através Metodu Alokasaun Raihenek

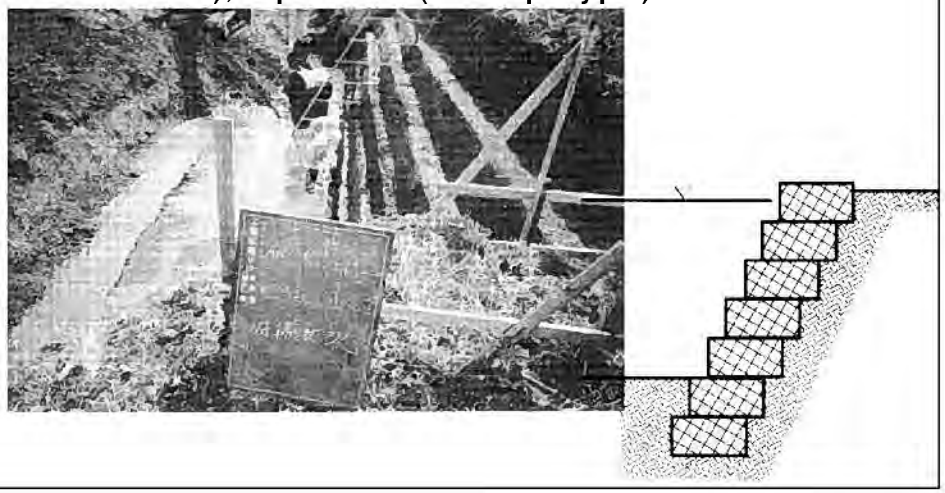
Amostra husi Inspesaun (Sample of Inspection)

Mahar husi Nanahe ida (Thickness of One Layer)

Nanaruk husi Deklive/Halis (Length of Slope)

(2) Konstrusaun ba Revestimentu(Revetment)

- Eskavasaun ba Matrass Bronjo(Gabion Mattress), Tipu Hada(Pile-up Type)



- *Enxe fatuk iha Bronjo/Gabion laran.*

- *Porsaun Kurva husi Bronjo(Gabion* Curve portion of Gabion)

Orário tuir-mai

5ª Lisaun iha Sala-Laran kona-ba Kontrola de cheia/Inundasaun

Konstrusaun ba Krib(Spur dike), Sabo Dam & Barreira(Weir).

Planeamentu ba Kontrolu de cheia/inundasaun (5)

Juñu 22, 2013

Lisaun ba Loron-ohin

- Konstrusaun ba Estruturas Mota/River structures

(1) Dique Estimulasaun;Krib /Spur Dike

(2) Barreira/Weir

(3) Barrajen Sabo/Sabo Dam

(1) Konstrusaun ba Krib/Dique Estimulasaun(Spur Dike)

Sisitema Kontrolu Bee Temporáriu

- Sistema Kontrolu Bee Temporáriu mak nesessáriu ba dique, Kánais loke-taka;kánal sekundáriu (by-pass channels), bee-dalan/flumes no obra superfisie/lapisan diversaun/pengaliran seluk, Moru Terik;korta/cut-off walls.
- Sistema Bombeamentu, inklui Pontu bee-matan/WellPoint no sistema kle'an wee-matan/deep well systems, mak utilizada hodi prevene wee tama hosi eskavasaun ba estruturas.

Dezeñu husi Servisu (Working Drawings)

- Dezeñu husi servisu ba sistema kontrola bee temporáriu, wainhira rekere, tenke inklui dezeña detalla no ekipamentu, prosedimentus operasaun ké utilizada, no fatin husi pontus diskarga/points of discharge.
- Dezeñu no operasaun tenke konfirma ba poluisaun bee aplikável hotu-hotu no rekerementus kontrola erosaun.

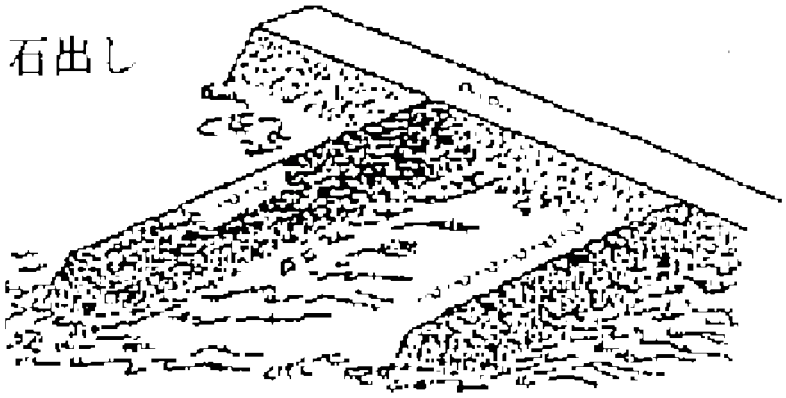
Métodu Konstrusaun ba Dique Estimulasaun/pemacu tanggul(Spur Dike)

(1) Konstrusaun iha bee-laran ho katrol

(**2) Obra iha Kondisaun Maran** ho Diriji liña-bee;cofferdams/ Sasatan;shoring no/ká sistema kontrola bee temporáriu

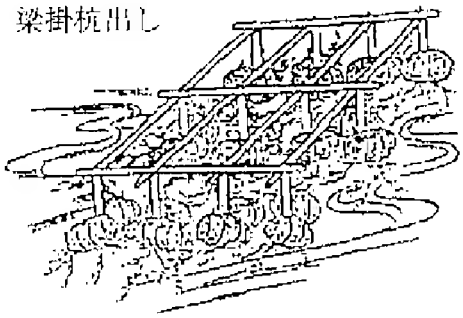
Dique Estimulasaun Tradisional/Traditional Spur Dike (1)

- Dique Estimulasaun husi Fatuk



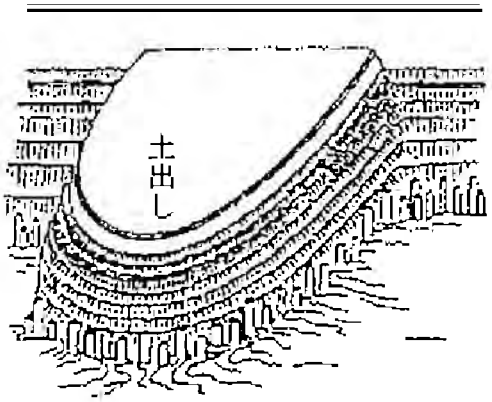
Dique Estimulasaun Tradisional/Traditional Spur Dike(2)

- Spur Dike husi Pilar Ai-balok no Raga/keranjang



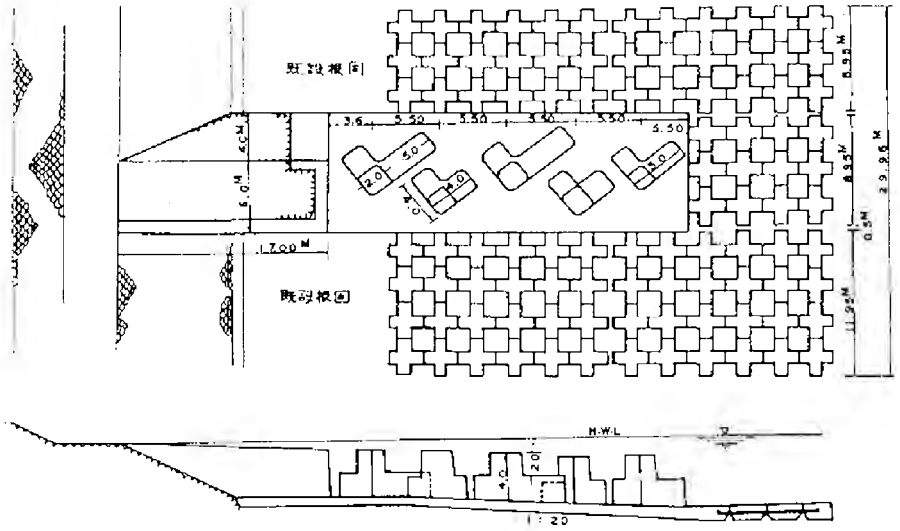
Dique Estimulasaun Tradisional/Traditional Spur Dike(3)

- Spur dike husi aterru/barrajen rai(embankment)



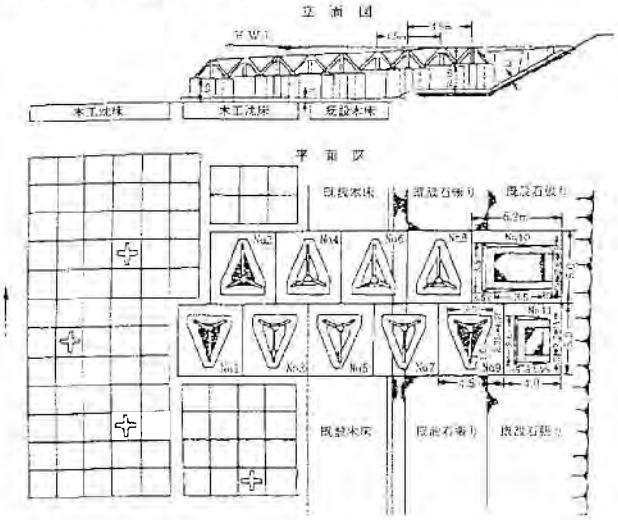
Dique Estimulasaun/River Spur Dike iha Mota Kurobe

Ba Segmentu 1, D>15 cm



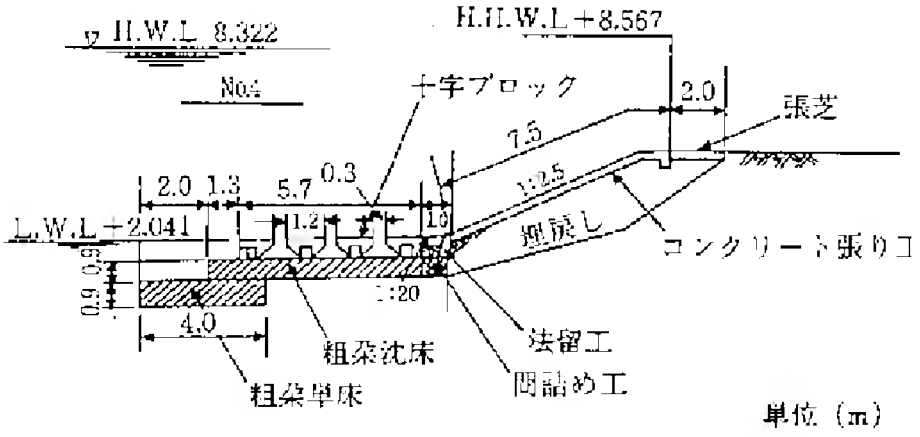
Dique Estimulasaun/River Spur iha Mota Fuji

- **Ba Segmentu 1, 2 cm< D < 15 cm**

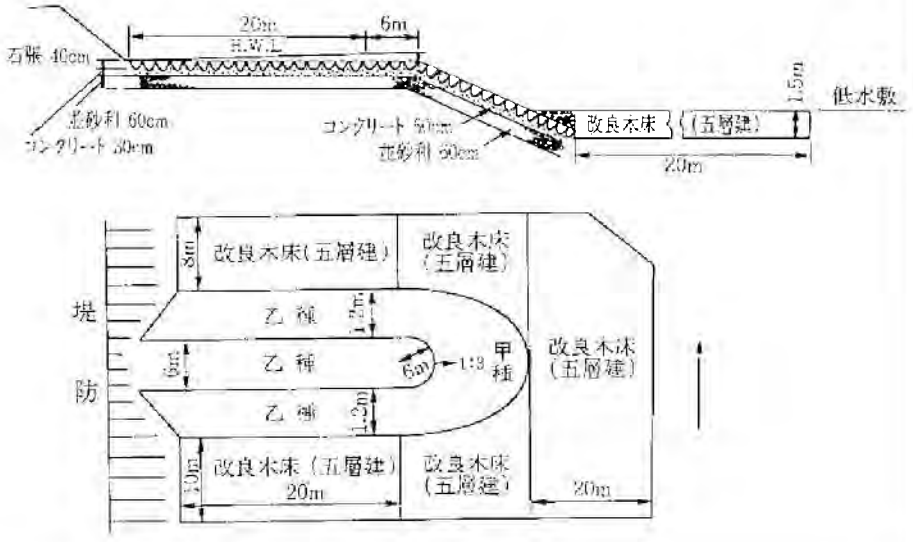


Dique Estimulasaun/River Spur iha Mota Mogami

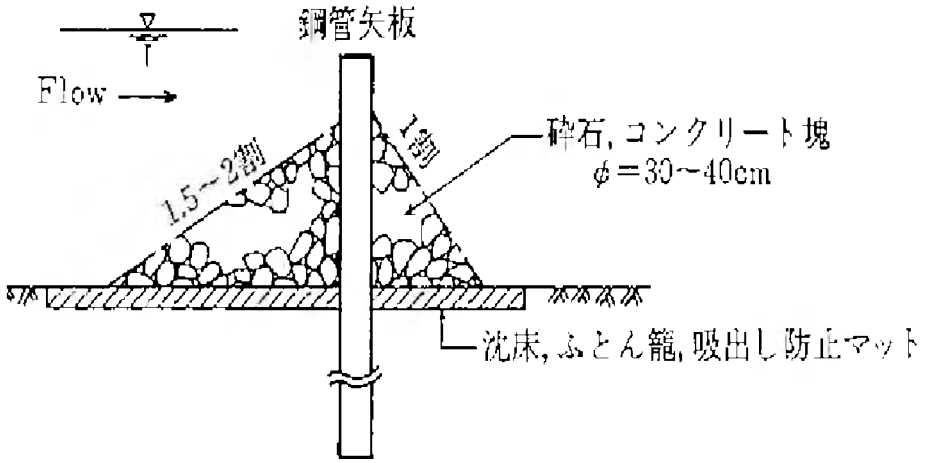
- **Ba segmentu 2-1**



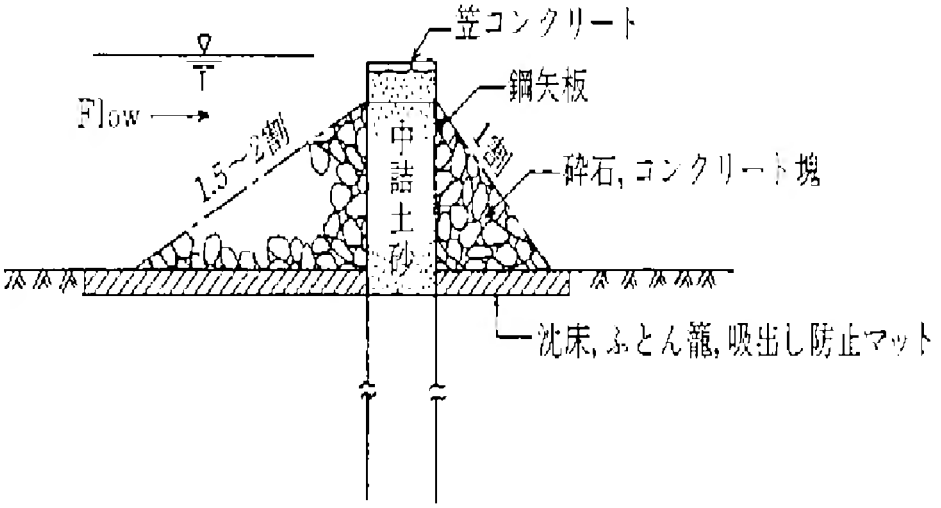
- **Ba segmentu 1**



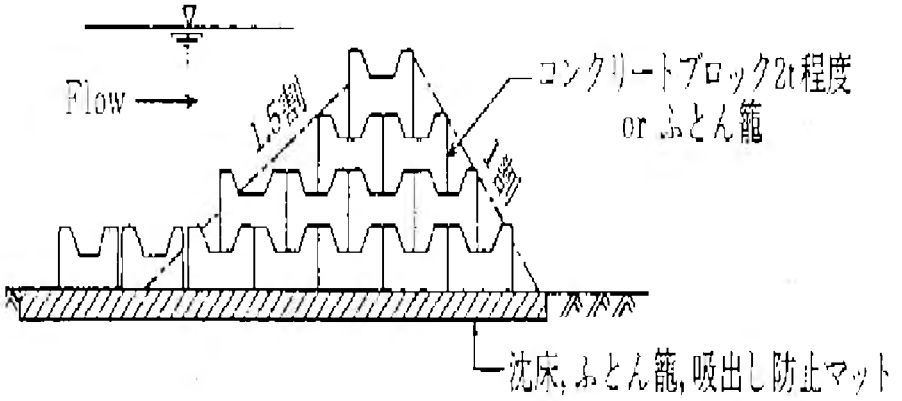
Dique Estimulasaun/River Spur Agora-dadaun (1)



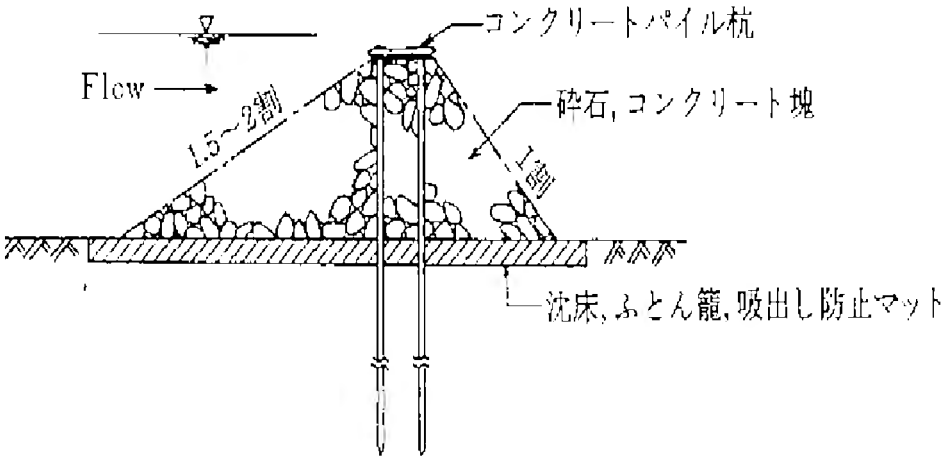
Dique Estimulasaun/River Spur Agora-dadaun(2)



Dique Estimulasaun/River Spur Agora-dadaun(3)



Dique Estimulasaun/River Spur Agora-dadaun(4)



Spur Dike Mota Matanuska iha USA

- Existe hela spur dike ne'ebé instaladu ona iha 1992. Sira suksesu-tebes proteje ona sira nia seksaun iha mota ninin hosi erosaun liu-tan durante sira halo instalasaun,maibé iha rekeridu periódiku manutensaun no reparasaun

Dique Estimulasaun/Spur Dike Mota Matanuska iha USA

- Foto hatudu existe hela spur dikes no banku naturalmente. Existe hela spur dike iha haleu mota ibun.
- Alternativu preferida mak tau ai-tarak iha spur dike nia ulun ba protesaun banku

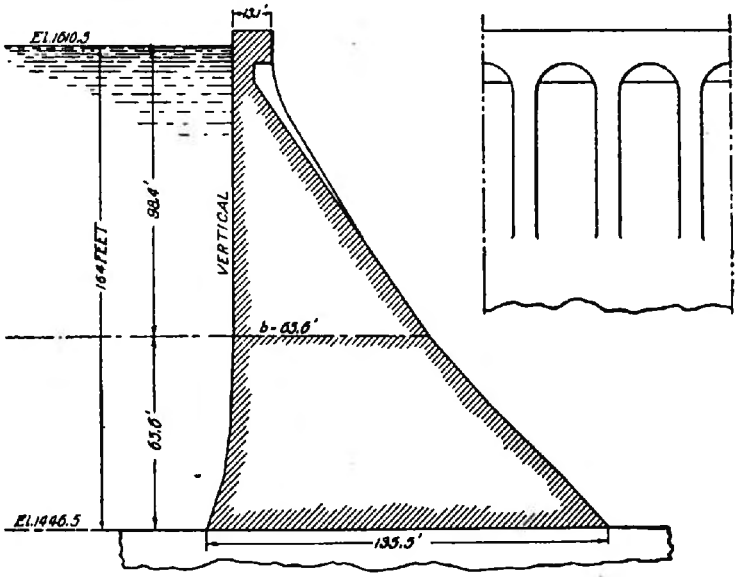
Dique Estimulasaun/Spur Dike iha Mota Akashi

(2) Barreira/Weir

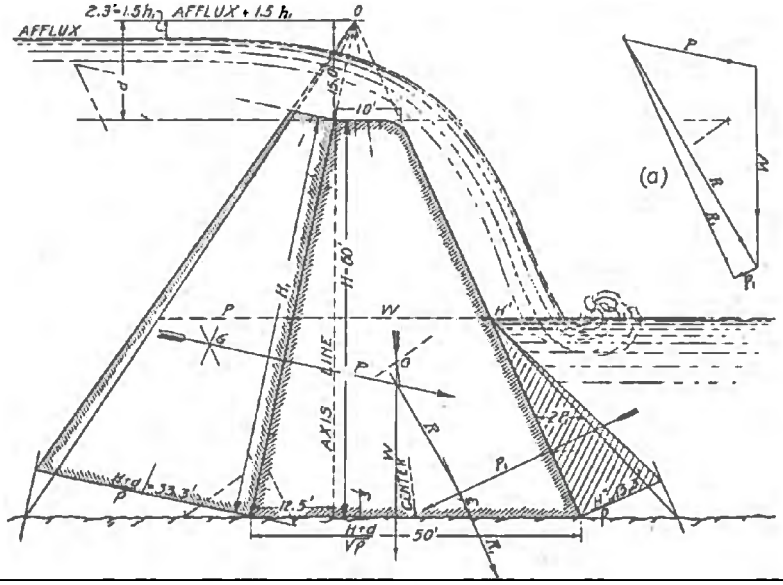
Barrajen no barreira sira bele klasifikadu hanesan tuir-mai:

1. Barrajen Gravidade/Gravity Dams
2. Gravidade Suli-tun/Gravity Overfalls, ka Barreira/Weirs
3. Barrajen Kleuk-tun;lenkung/Arched Dams
4. Barrajen kontra-forte Arku Kuak-ku'ak/Hollow Arch Buttress Dams
5. Barrajen Kontra-forte Balok-bo'ot Kuak-ku'ak/Hollow Slab Buttress Dams
6. Barreira Hoban/Submerged Weirs
7. Barrajen Nakloke/Open Dams, ka Barrajen

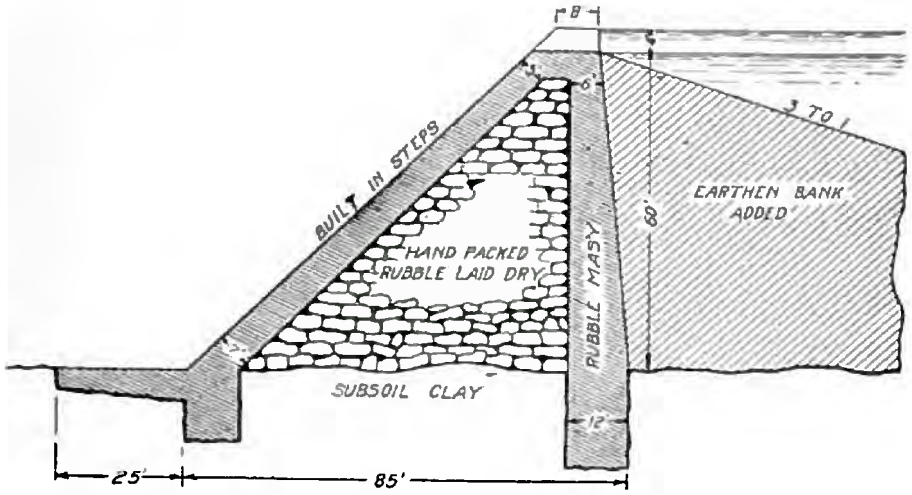
1. Barrajen Gravidade/Gravity Dams



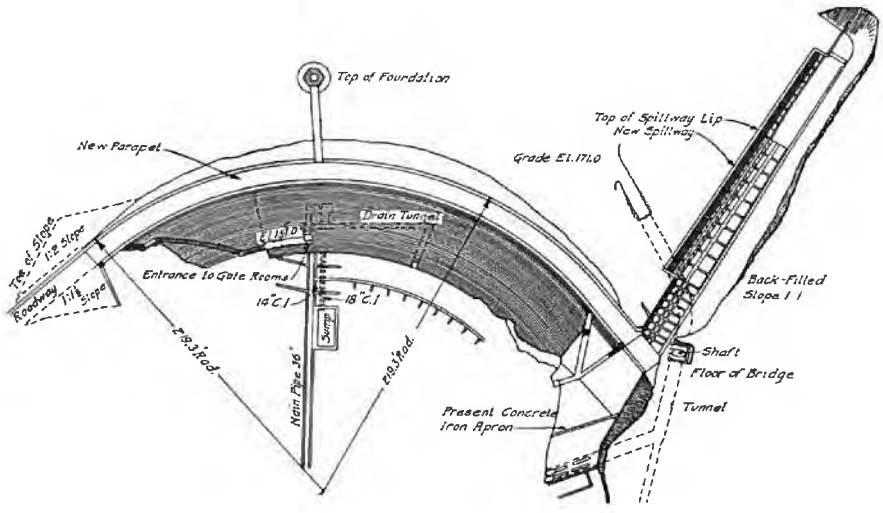
2. Gravidade Suli-tun/Gravity Overfalls, ka Barreira/Weirs



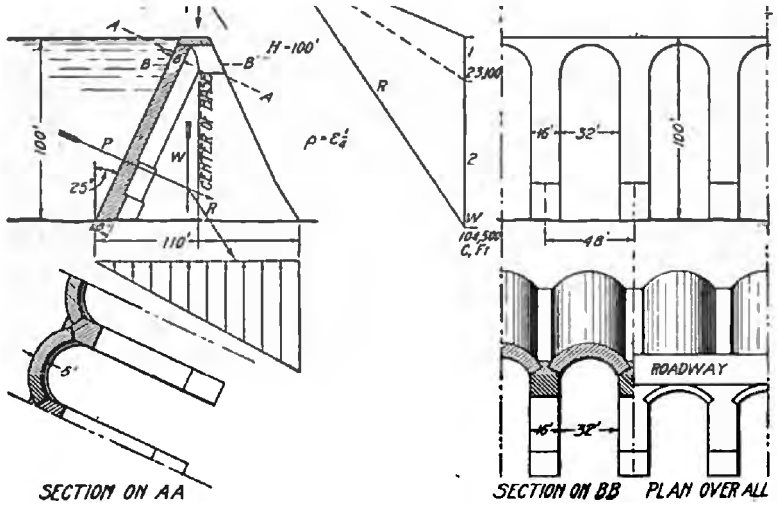
2. Gravidade Suli-tun/Gravity Overfalls, ka Barreira/Weirs



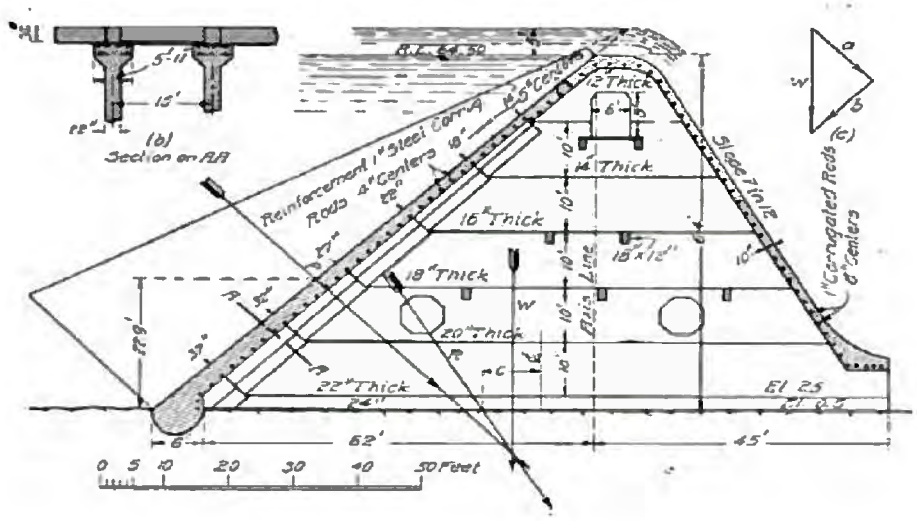
3. Barrajen Kleuk-tun;lenkung/Arched Dams



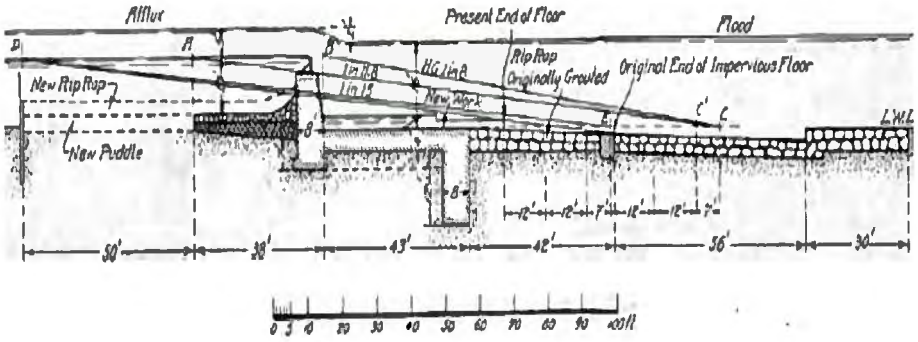
4. Barrajen kontra-forte Arku Kuak-ku'ak/Hollow Arch Buttress Dams



5. Barrajen Kontra-forte Balok-bo'ot Kuak-ku'ak/Hollow Slab Buttress Dams



6. Barreira Hoban/Submerged Weirs



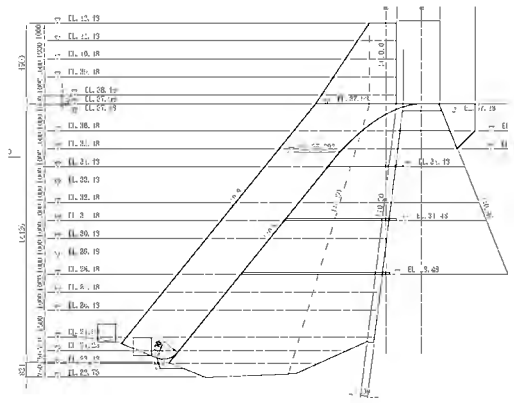
7. Barrajen Nakloke/Open Dams, ka Barrajen

- Kánal and bee-dalan/sluiceway ho bee nia odamatan/sluice gate
- Barrajen Irrigasaun Barak mak iha Timor-Leste.

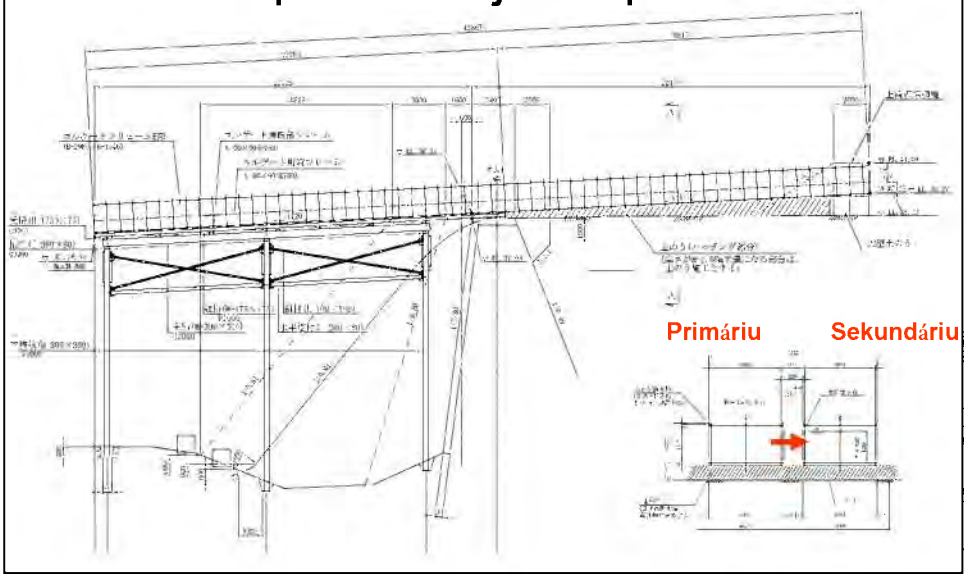
Metodu Konstrusaun husi Barreira;Weir/ Barrajen;Dam

- Konkretu fatin husi lot/bo'ot ida mak 0.75 m – 2.0 m tamba kontrola ba nakfera iha massa konkretu.

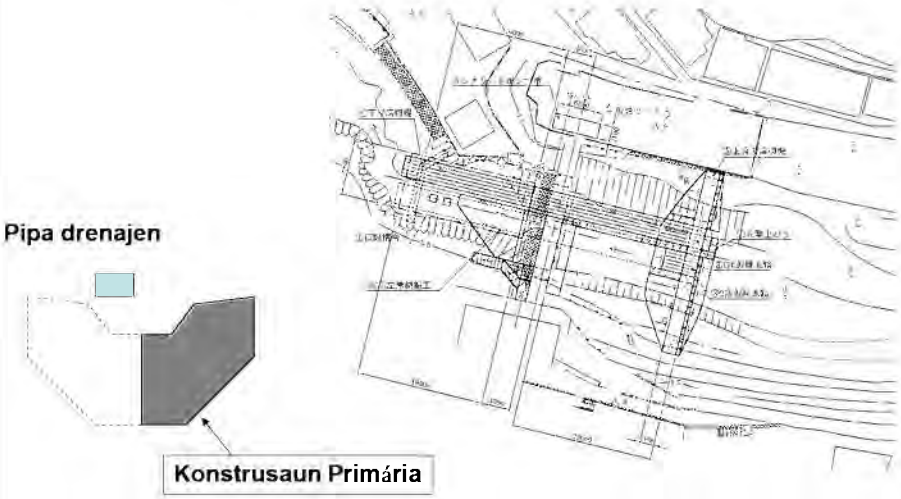
Elevasaun ba lot/bo'ot ida-idak husi konkretu



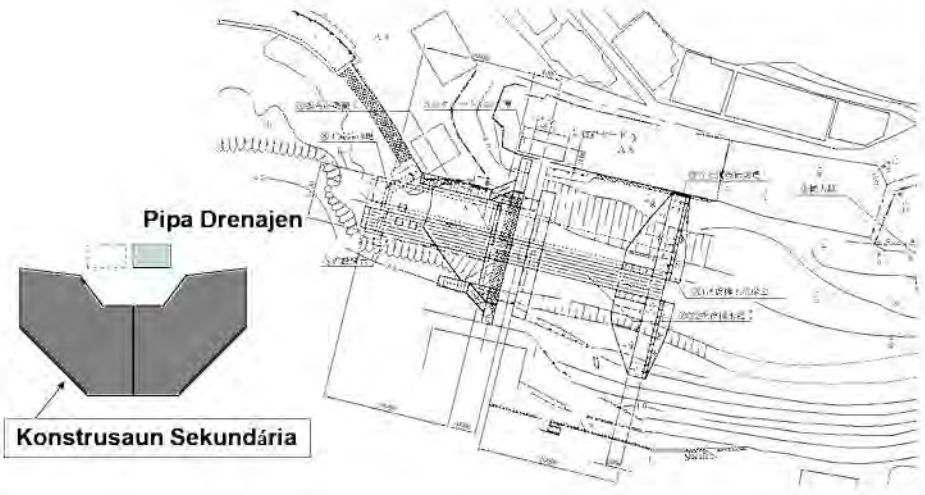
Kontrolu Bee Temporáriu liu-husi Pipa Drenajen Tipu-U



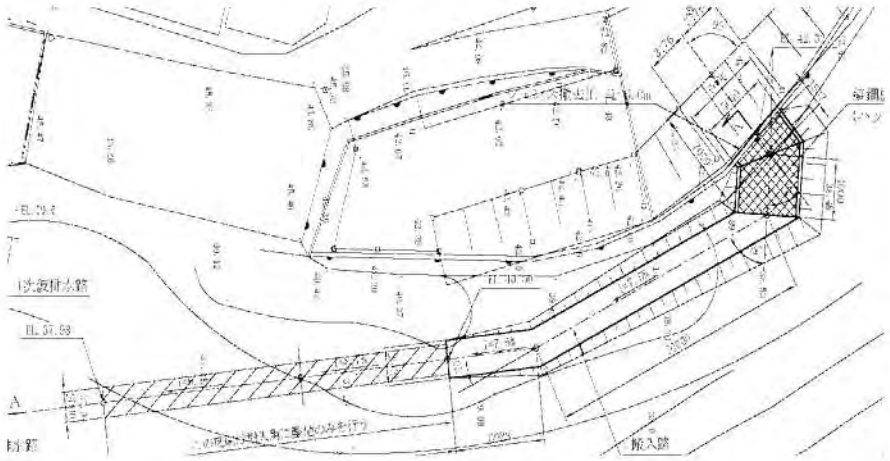
Konstrusaun Primária



Konstrusaun Sekundária



Estrada Hakbesik Temporáriu/Temporary approach road

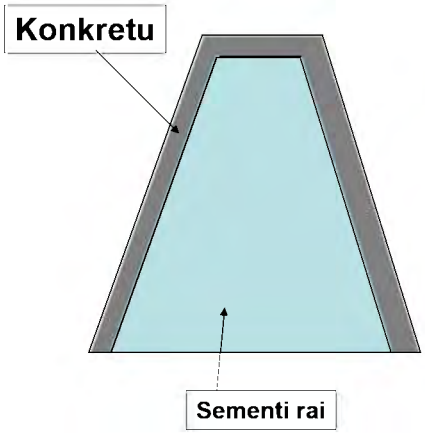


Barrajen Sabo/Sabo Dam halo husi Sementi Rai/Soil Cement

- Kbi'it Tarjeitu mak 1.5 N/mm^2.

Kahur husi sementi

Barrajen Sabo/Sabo Dam halo husi Sementi Rai/Soil Cement



Oráriu Tuir-mai

6ª Lisaun Sala-laran kona-ba Kontrolu de cheia/Inundasaun

Estimativa Folin/Cost Estimate

添付資料 14 現地調査報告書(道路・橋梁)(英語)

Comment on Comoro II Bridge on 15th July 2013

Mr. Hideo Matsushima

[Abstract]

Superstructure: PCI Girder, H= 1.70m, Total Length = 183.3 m, 30m+3@ 40m + 30m, Post Tensioning, Delivery PC Segmental I Girder from Indonesia

Substructure: Concrete Abutment, Pier, Pier Head, Deck Slab, Approach Slab

Foundation: Bore piles foundation (Casing diameter 1,000mm)

[Point 1] Bridge Carriageway Width & Approach Carriageway Width

Bridge Carriageway Width should be same width with Approach Carriageway Width, considering traffic safety. Especially it is necessary to remove the side walk, mounted up (Width= 50 cm, Height = 20 cm) next to Parapet.

Bridge Carriageway Width

Indonesian "Bridge Design Code MBS" Class B

W = 7.0 m = shoulder 0.5 m + roadway 6.0 m + shoulder 0.5m

Approach Carriageway Width

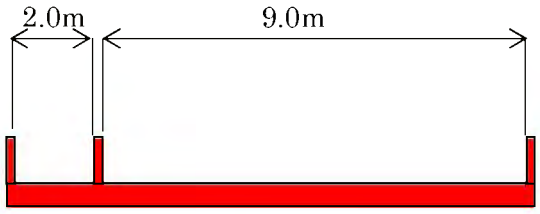
Indonesian "Bridge Design Code MBS" Class A

W = 9.0 m = shoulder 1.0 m + roadway 7.0 m + shoulder 1.0m

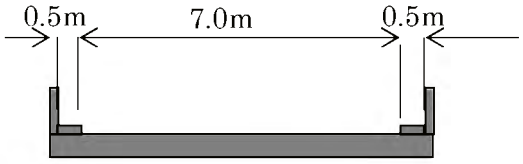
[Point 2] Footway (Pedestrian Width)

The Bridge in urban area requires footway, minimum with 1.5m and normally 2.0m-3.0m. Existing approach road has 2.0 m footway in front of Timor Plaza. Comoro bridge should has footway as following drawing.

Proposed Cross Section of Comoro II Bridge from Point 1 & 2



Existing Cross Section of Comoro II Bridge



[Point 3] Vertical Slope

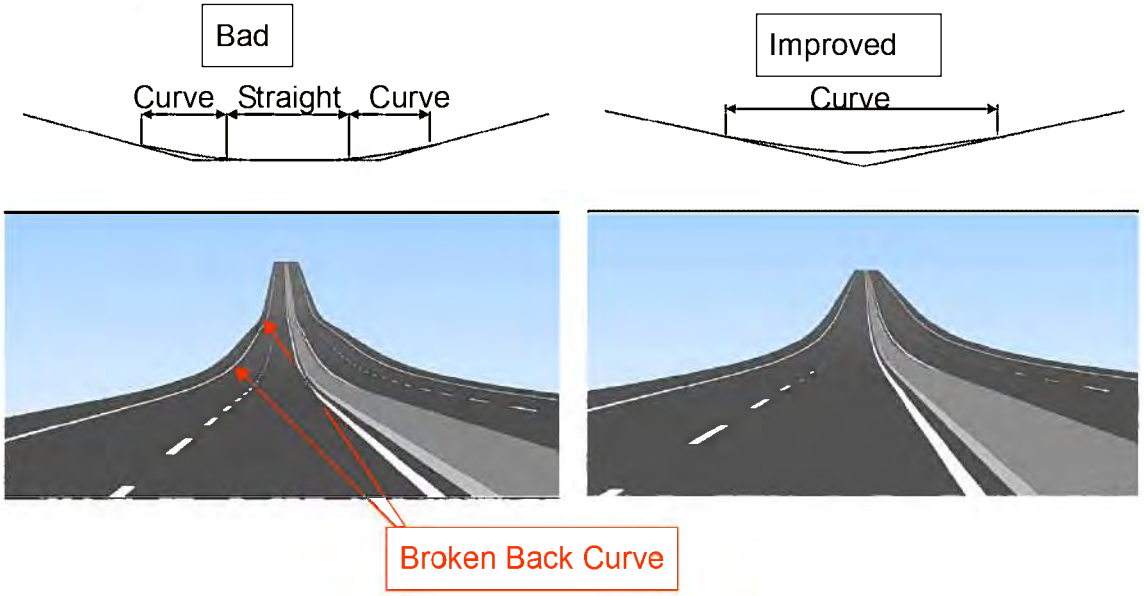
Vertical slope is decided by design speed and sight distance. Vertical slope is better less than 3 % or 4 %, which 4 % is shown in tender document. But it is 4.6 % as as-build drawing. It is a lack of sight distance and will cause traffic accident.

Sight distance of design speed, 60 km = 75 m

[Point 4] Vertical Curve

LV (Vertical Curve Length)= 50m + 4.00% slope + LV= 80m + 0.00% + LV= 80m + 4.00% + LV= 50m by tender document.

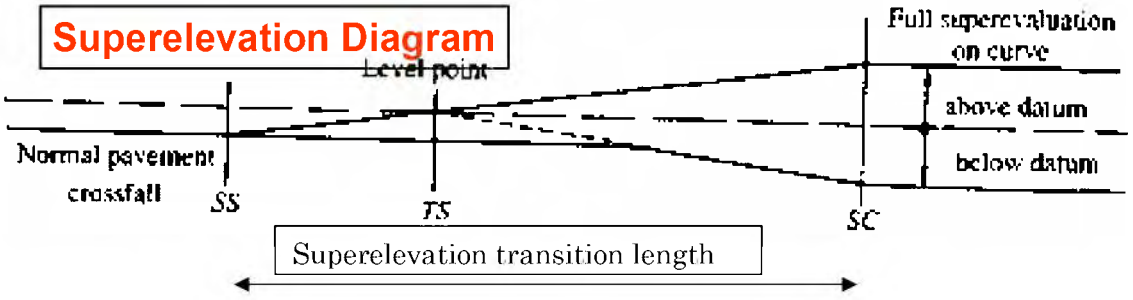
This is bad profile design as follows. One vertical curve is smoother than combination of curve & straight.

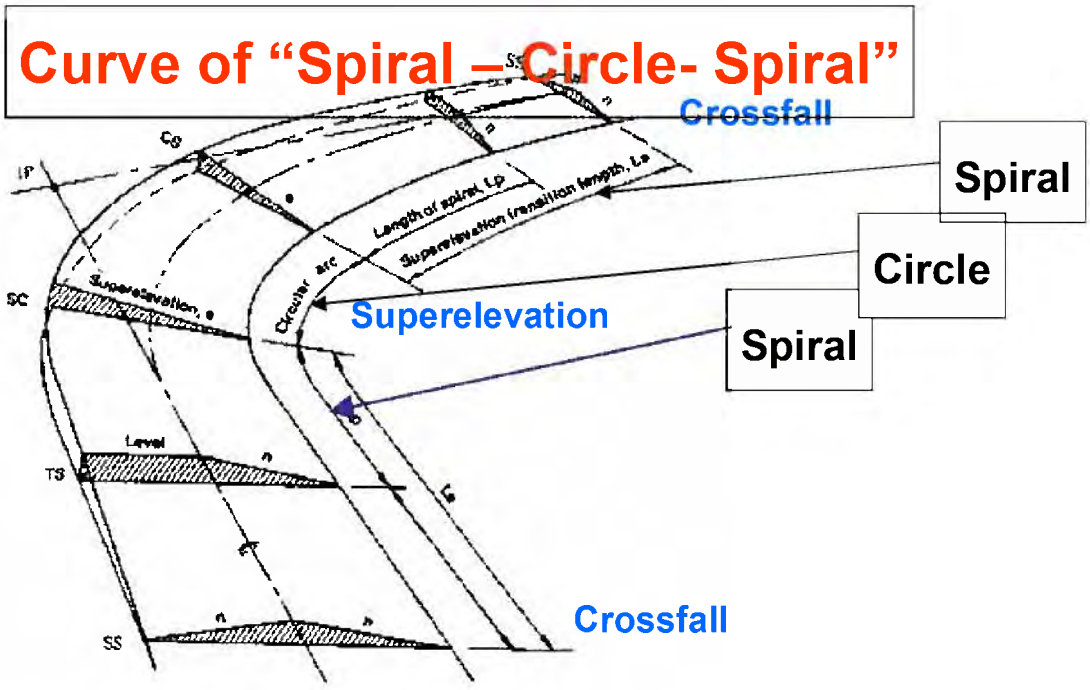


(source: Express Highway Design Standard of NEXCO, Japan)

[Point 5] Cross fall and Superelevation

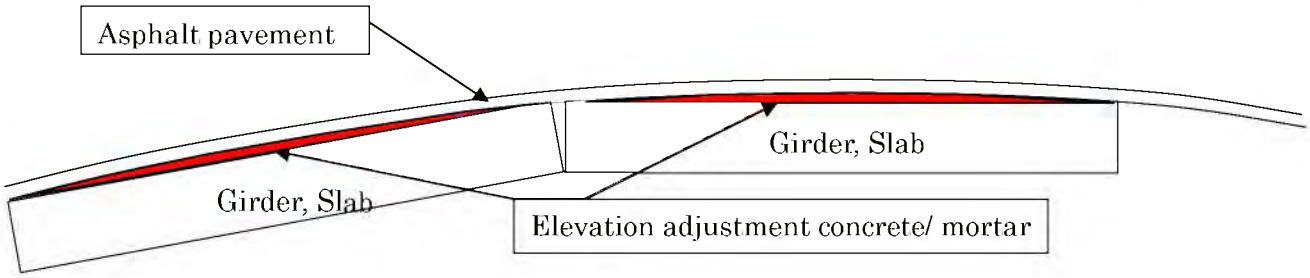
Tender document shows 2.0 % cross fall. As-build is superelevation. Point is transition between cross fall and superelevation. It is necessary to set the superelevation transition length, which is spiral curve length.





[Point 6] Elevation adjustment concrete/ mortar

It is better to use the elevation adjustment concrete/ mortar as bellow due to smooth drive.



[Point 7] RC-Panel for Slab Deck

Tender document shows the RC-Panel for Slab Deck, span length is 1.30m and thickness is 70mm instead of form work. This structure of integration between slab concrete and RC-Panel is high durability and long-life. As-build is to use galvanized steel plate instead of RC-Panel. Galvanized plate will have corrosion risk within 20 years.

[Point 8] Expansion Joint

Tender document shows joint-less type, asphaltic Plug Expansion Joint, which are rubber type caulking, plate and binder. Its life-span will be 10 -15 years old. As-build is rubber type expansion joint, which life-span will be 5- 10 years old and cheaper than asphaltic Plug Expansion Joint

[Point 9] Drain Pipe

Tender document shows horizontal place drain pipe. It is easy to become clogged. As-build is change to straight drain type, and it is easy to maintenance. It is good.

[Point 10] Utility Box drain

Drain pipe should be bottom of utility box. Un-drained water cause to reduce life expectancy

Comment on Debos Road, Suai on 13th Aug 2013

Mr. Hideo Matsushima

[Abstract]

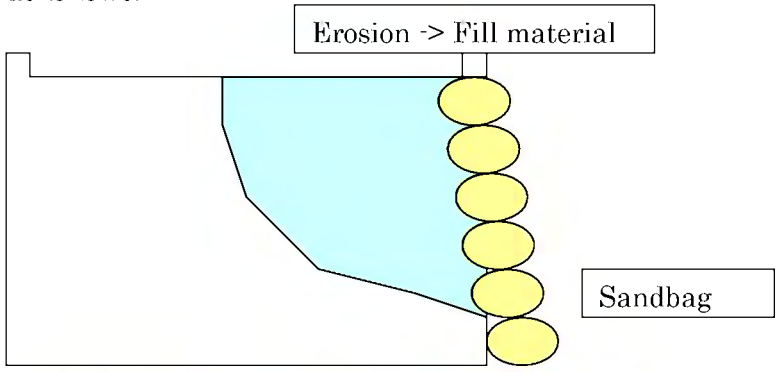
It is necessary to implement Emergency Rehabilitation of Debos Road in Suai by SEFOPE. In this year, road was damaged by flood.

Flood overflowed in the river bank, so that surface of road at the road of bridge side damaged and wingwall was broken.

[Point 1]

Temporary work is as follows.

Width is 5.5 m.



[Point 2]

Option 1: Bridge Plan

Width is 7 m, if Class B.

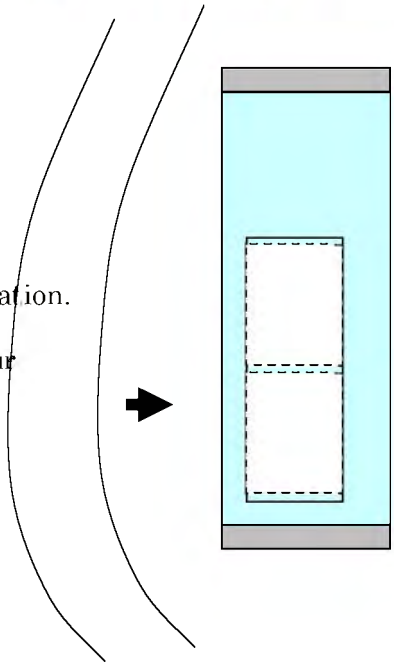
L = 20 m

(Consider flood prone area)

Flood water will be concentrated.

New Elevation is 2m higher than existing elevation.

Detour

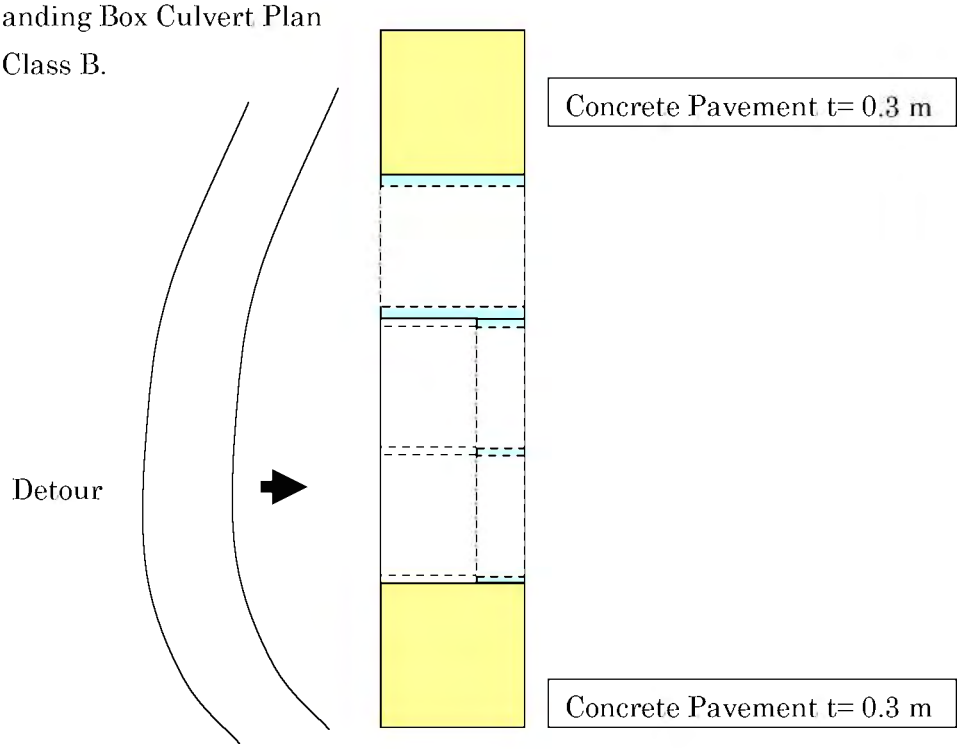


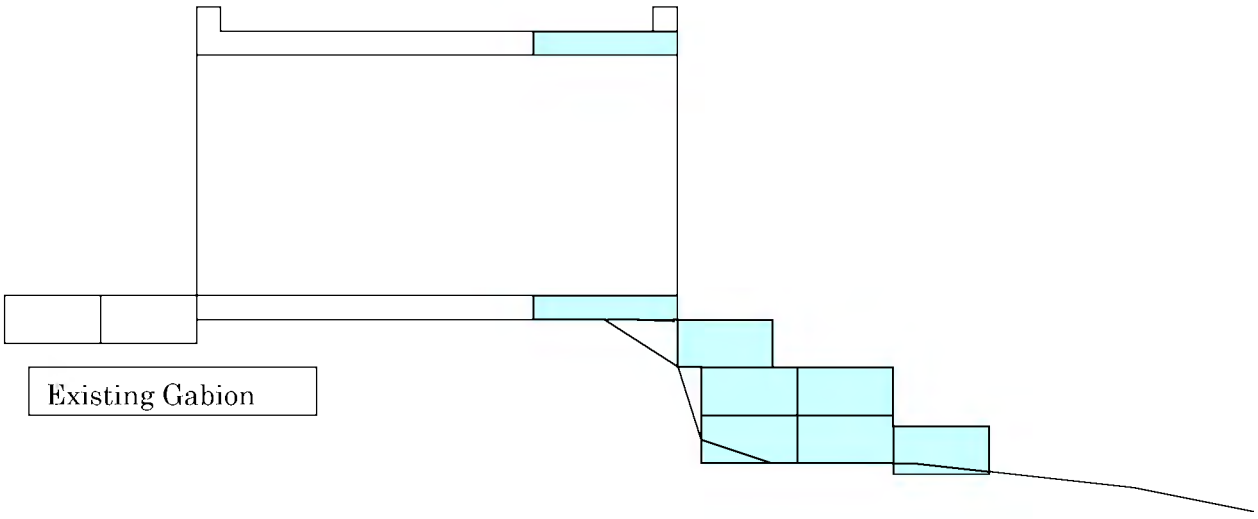
[Point 3]

Widening & expanding Box Culvert Plan

Width is 7 m, if Class B.

2@5m -> 3@5m



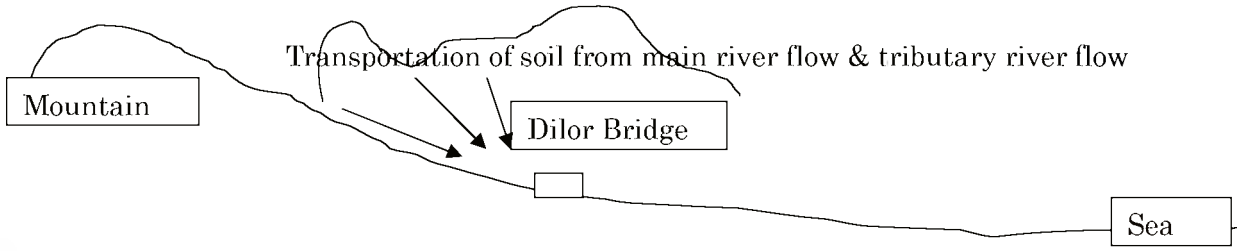


Comment on Dilor Bridge in Viqueque (3 span 60m= 180m)

Mr. Hideo Matsushima

[Point 1] General sedimentation area or Local sedimentation area?

General sedimentation area



If general sedimentation area, it is necessary to do rising of pier cap. It is difficult to maintain excavation of river bed every year.

Local sedimentation area

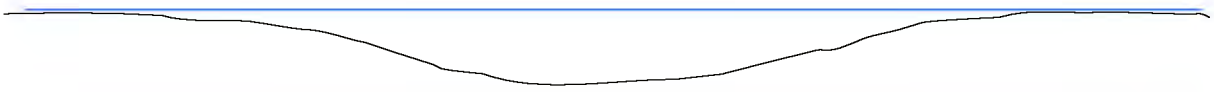
Meandering flow occurs local scouring area at convex curve and local sedimentation, sandbar, at concave curve. In this case, it is useful to use the countermeasure of river flow change, like spur dike or groundsill.

[Point 2] Interview of Existing maximum flood water depth for resident old person.

Probability of flood is normally used 100 years. Probability of flood by interview is normally from 30 years to 50 years, so that Design Flood Level (DFL) should be modified and increased than interview.

[Point 3] Flood-prone area or not?

Flood flow of flood-prone area is bellow. Flood flows widely before construction of bridge.



After construction, flood flows limited area, within bridge length, so that velocity increase and flood water level is higher than before.

Brief Description of Dilor Bridge

Dilor Bridge is located in Viqueque District. Its designed length is 180 meters with three (3) spans of 60 meter each. It was designed to support the pile cap of Abutments by ten (10) pieces R.C. Piles and the Pile Cap of pier 1 & 2 by fifteen (15) pieces and seventeen (17) pieces respectively. The size of the pile is 0.40 x 0.40 with length ranging from 15.00 to 17.00 meters. The superstructure will be a Modular Truss Bridge Class-B based from Indonesia Specifications.

The Contract for the construction of Dilor Bridge was awarded to PT DAYA MULIA TURANGGA JV PRECISION CORPORATION UNIP LDA. In the amount of US$ 3,251,535.80 to be completed within 365 calendar days. The Contractor received the Notice to Commence Work 31st of May 2011 and thereafter immediately start his mobilization period.

Consultant (Bonifica SpA) : Team Leader, Daniel V. Branzan

Comment on Jakarta II on 13th Aug 2013

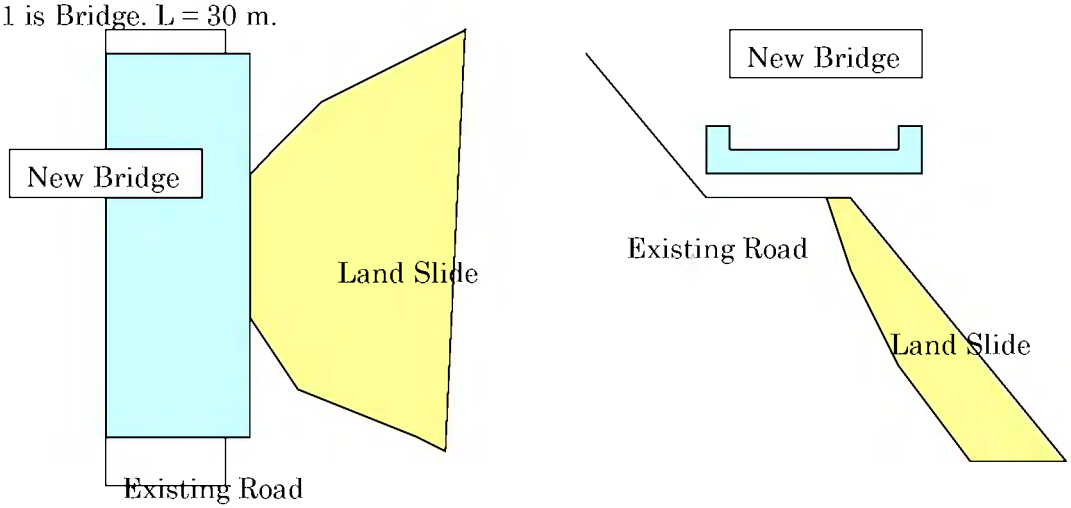
Mr. Hideo Matsushima

[Abstract]

It is necessary to implement Emergency work of Jakarta II road in Ainaro.

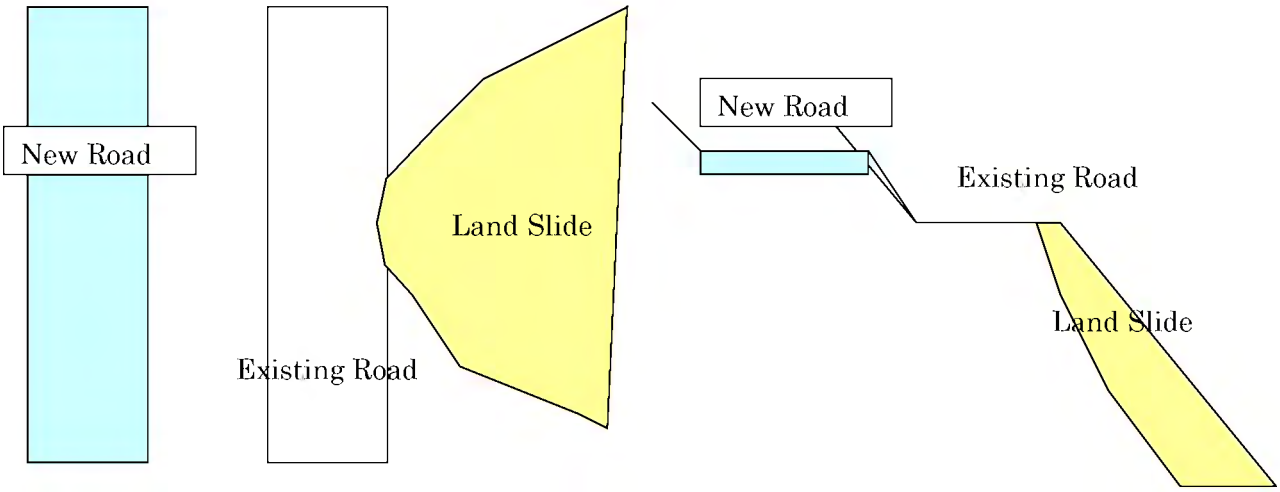
[Point 1]

Option 1 is Bridge. L = 30 m.



[Point 2]

Option 2 is new alignment. Sift is more than 20m from existing road.



Comment on Loes River Drawings (29th July 2013)

Mr. Hideo Matsushima

[Abstract]

FICA UNIPESSOAL Lda.
Rua Kofi Annan, Dato, Liquica District
No.Contacto: +670 77348345/ 77271597
Email: ficauniplda@gmail.com

DRAWING DOCUMENT
PROJECT: RIVER PROTECTION IN MOTA LOES (NEW CONSTRUCTION OF GABION SLOPES PROTECTION AND RETAINING WALL REPAIR & MAINTENANCE)
LOCATION: MOTA LOES, MAUBARA SUB-DISTRICT, LIQUICA DISTRICT, TIMOR-LESTE

Layout Plan is as follows.
(From bridge to upstream)
(1) Site A, Retaining Wall Repair, Length = 370m --- Drawing A-002, A-003, A-004, A-005
(2) Site B, Retaining Wall Repair, Length = 50m --- Drawing A-006
(3) Site C, Gabion slopes protection Repair, Length = 512m --- Drawing A-007
(4) Existing Retaining wall (No repair work)
(5) Site A, Install New Gabion slopes protection, Length = 655m --- Drawing A-008
(6) Site B, Install New Gabion slopes protection, Length = 655m --- Drawing A-009

[Comment 1]
(Refer Class Room Lesson "Planning of flood control No.3")
Common belief is that river mouth is general transportation and/or sedimentation area, not general scouring area. Nearness of river structure like abutment, pier and retaining wall of dike, is local scouring area.
Normally, it is necessary to calculate the local scour depth with river structure by HEC-Analysis.
In my experience, I assume Loes river local scour depth is 4-6m near abutment due to narrow river cross section and 2-4m near retaining wall/ Gabion, when big flood river depth is 4m and velocity is 4m/s. This means second main flow is near river structure.
Countermeasure is two types.

(Countermeasure-1)

To put foot protection against the condition that main flow is near river structure.

(Countermeasute-2)

To put Spur Dike (Groin) due to reduction of local scour depth by redirection of river flow away from the riverbank

Your design/drawing concept is Countermeasure-1.

[Comment 2]

(1) Site A, Retaining Wall Repair, Length = 370m --- Drawing A-002, A-003, A-004, A-005

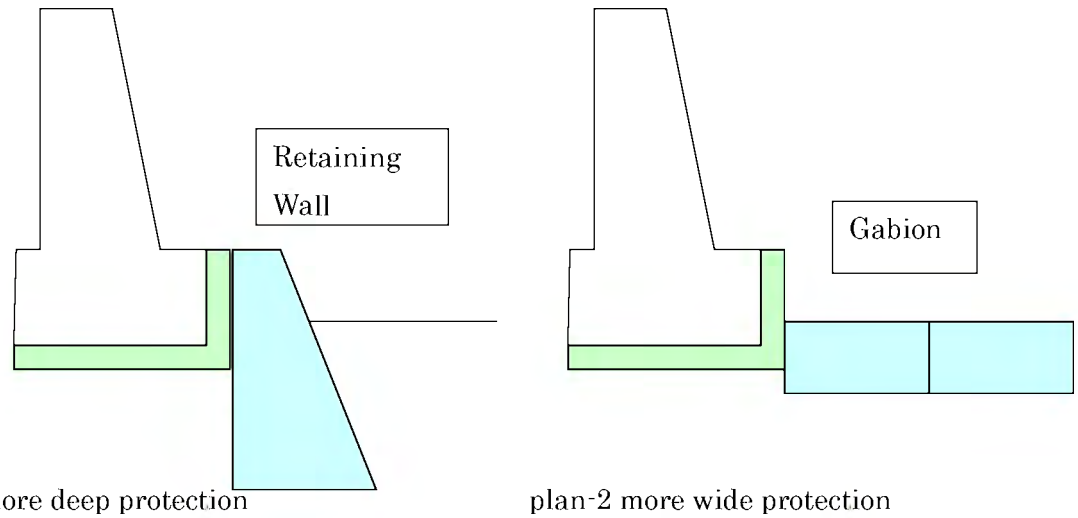
I assume maximum local scour depth is 4-6m. It occurred at maximum flood river depth, and decreased corresponding to flood river depth.

Concrete pile, 40 x 40 cm, is 6 m length. It is stable when big flood comes. In this case, Gabion slope protection will sink and move, but it is OK due to flexible structure. It is better to use 3m width of Gabion Slope Protection instead of 2m width.

[Comment 3]

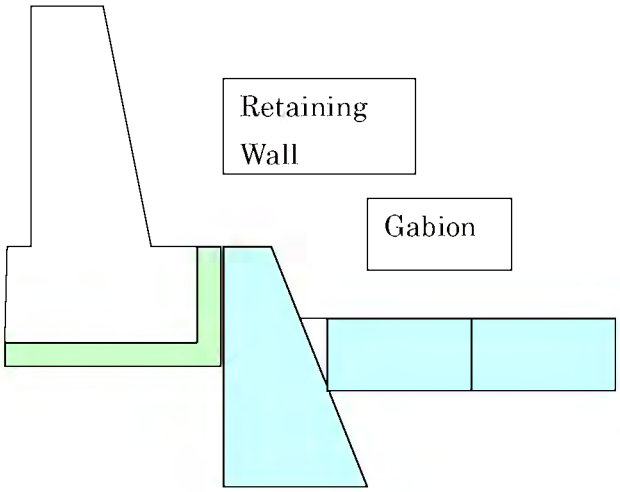
(2) Site B, Retaining Wall Repair, Length = 50m --- Drawing A-006

It is common damaged portion of river structure is easy to damage again, so that it is necessary to reinforcement structure, for example, more deep protection or more wide foot protection.



plan-1 more deep protection

plan-2 more wide protection



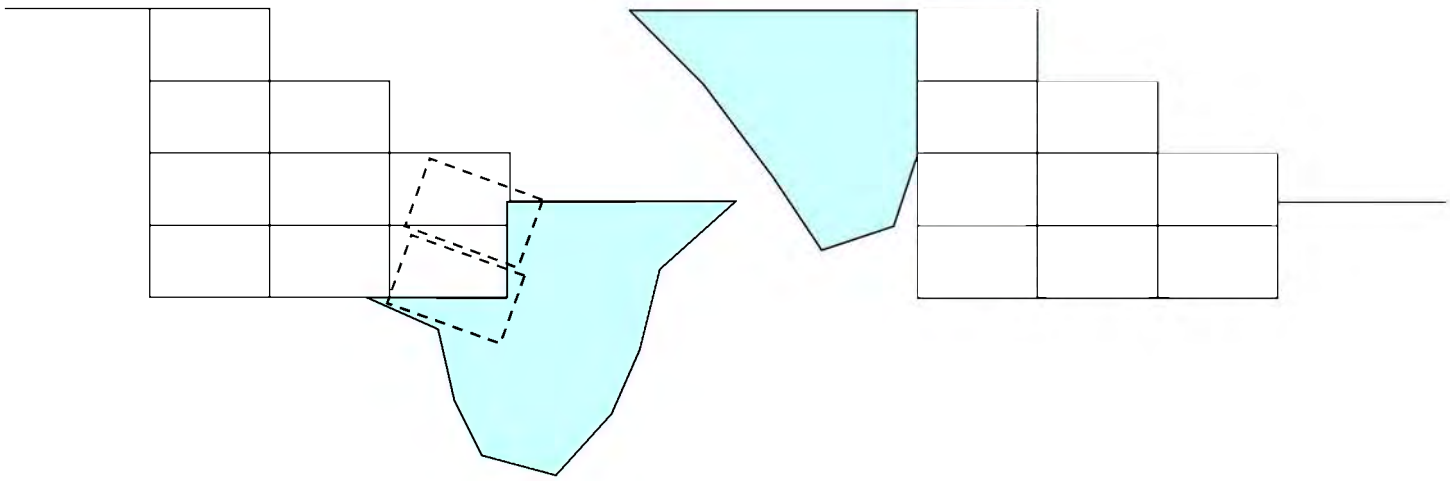
Best Plan Combination

You must consider the failure mode of retaining wall, if 2-4 m local scour occurs.

[Comment 4]

(5) Site A, Install New Gabion slopes protection, Length = 655m --- Drawing A-008

You must consider the two type of failure mode of retaining wall, if 2-4 m local scour occurs. This type may be stable for two type of failure mode.



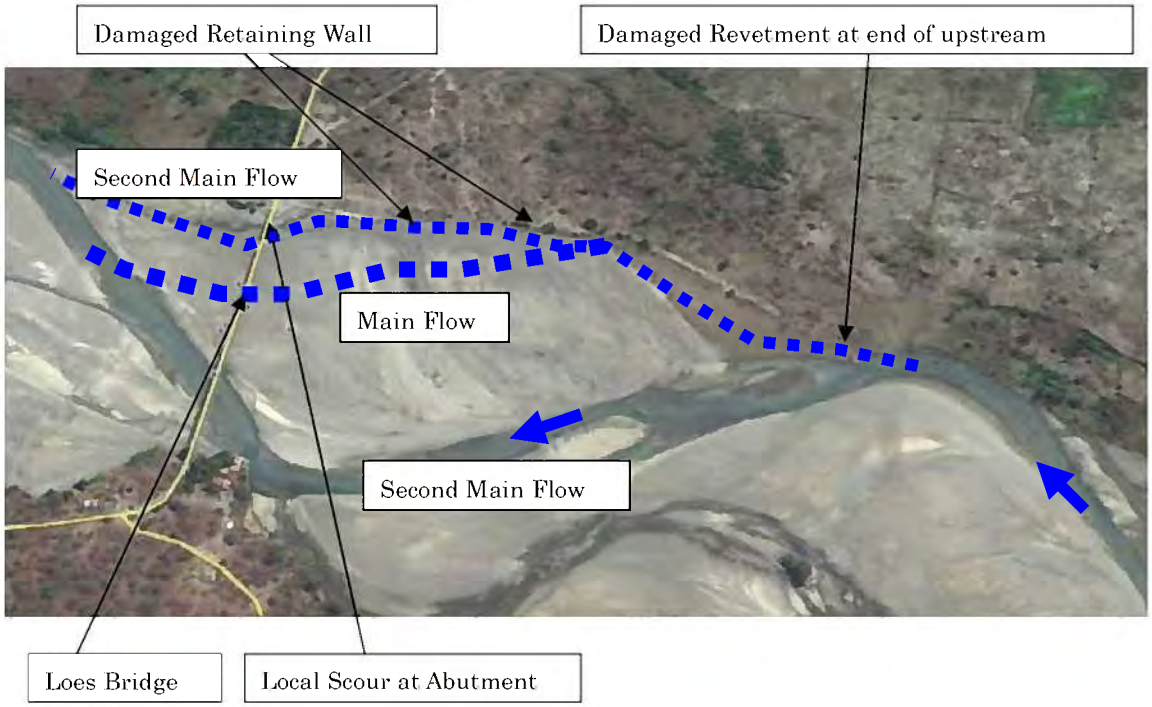
Failure Mode-1 Local scour

Failure Mode-2 Backfill scour

Comment on Loes Bridge and Loes River in Liquica (Site Visit on 8th July 2013)

Mr. Hideo Matsushima

[Abstract]



Main flow had sifted at right side from left side on Google map. Second main flow is near abutment and revetment of dike.

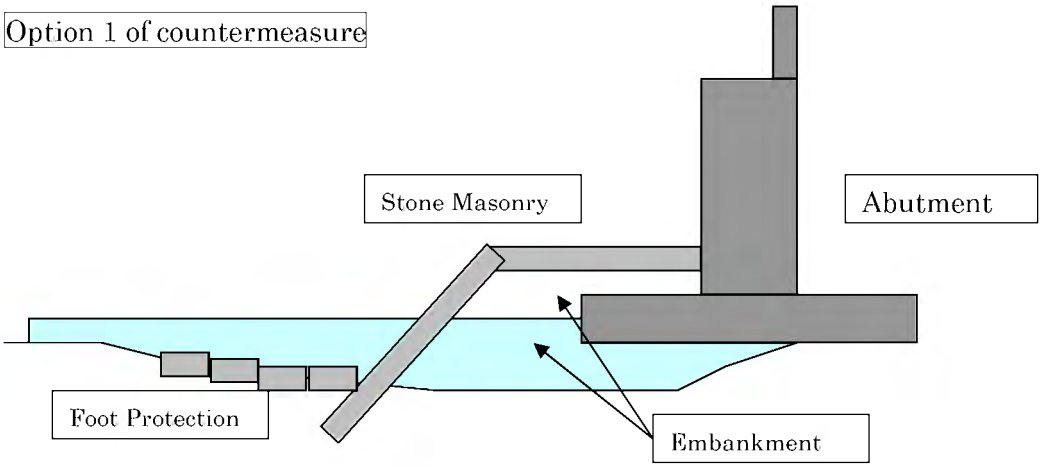
[Point 1] Local scouring at abutment

Second main flow occurred local scour at abutment and upstream side settlement of abutment occurred wide crack on abutment wall. This countermeasure is urgent due to high risk of flood damage.

Scouring at footing

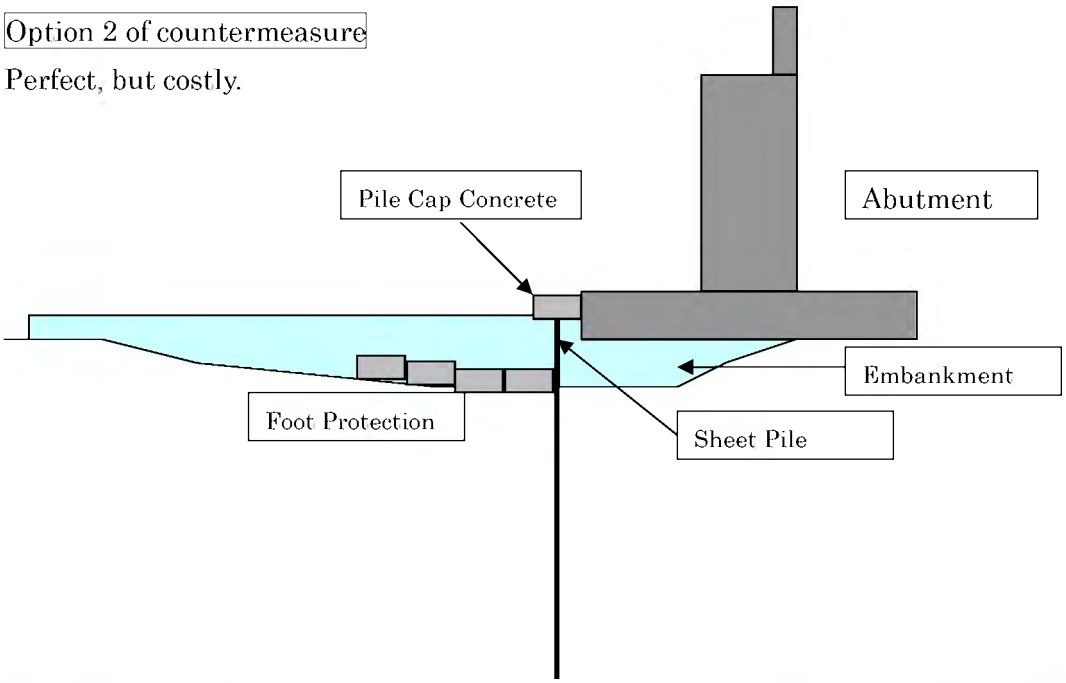
Second Main Flow

Option 1 of countermeasure



Option 2 of countermeasure

Perfect, but costly.



[Point 2] Damaged Retaining Wall

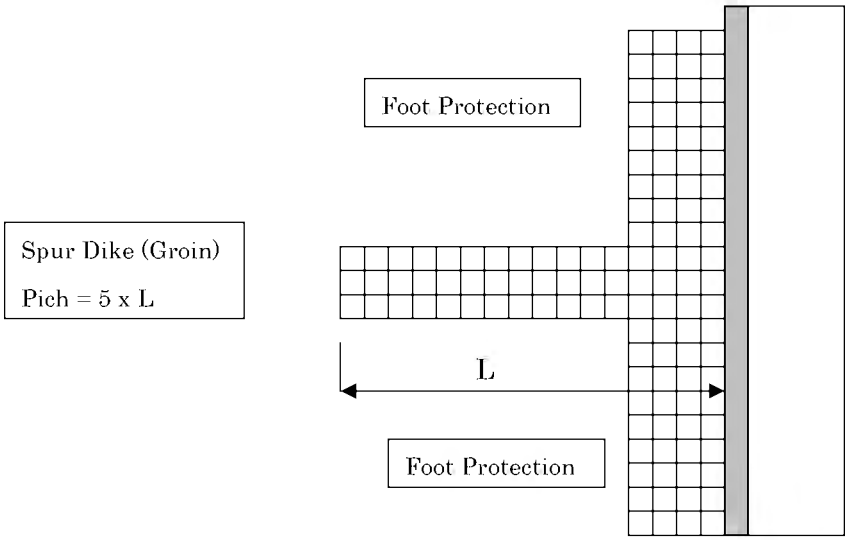
200m upstream from Bridge

100m upstream from Bridge

The reason of damage is local scouring at bottom of retaining wall. It is necessary not only to put foot protection for local scour, but also to set spur dike (groin) for redirection

of river flow away from the riverbank.

Plan of countermeasure



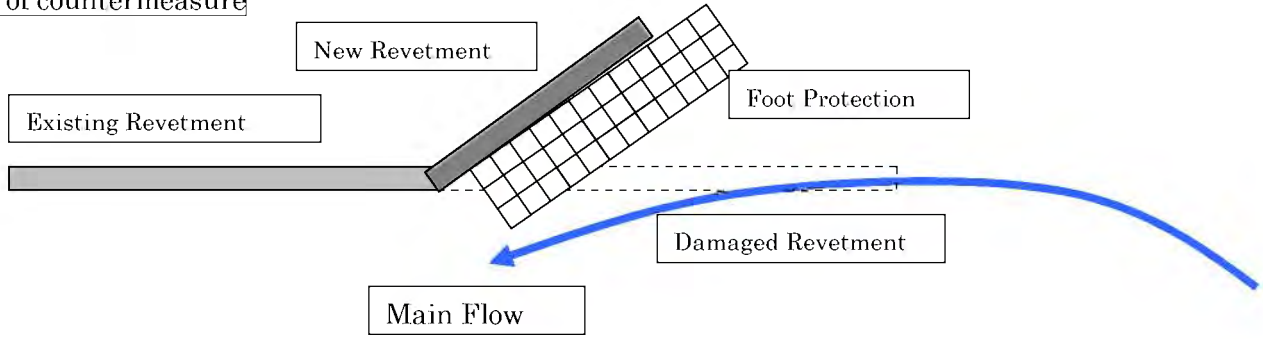
[Point 3] Damaged Revetment at end of upstream

Damaged Revetment

Washed Out of Revetment at End

Wrong direction of revetment was easy to have damage during flood. It is necessary to consider the end of abutment location based on main flow direction.

Plan of countermeasure



Comment on Loro Bridge, Suai on 13th Aug 2013

Mr. Hideo Matsushima

[Abstract]

It is necessary to implement Emergency Rehabilitation of Loro Bridge in Suai by SEFOPE.

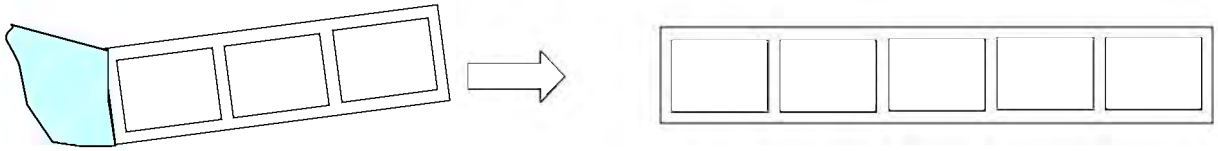
In this year, road was damaged by flood.

[Point 1]

Surface was damaged. Concrete pavement is long life for overflow.

[Point 2]

Expanding Box Culvert from 3@3m to 5@3m.



Local Scour

Comment on Lospalos - Iliomar Road Drawings on 2nd Aug 2013

Mr. Hideo Matsushima

Mr. Jiro Koyama

[Abstract]

Rehabilitation of Lospalos to Iliomar Road (km 0+000 – km 13+600) in Lautem

Ministry of Infrastructure, Secretary of Public Work, As-staked Drawing (STA 0+000-STA 2+000) and As-staked Drawing (STA 2+000-STA 13+600)

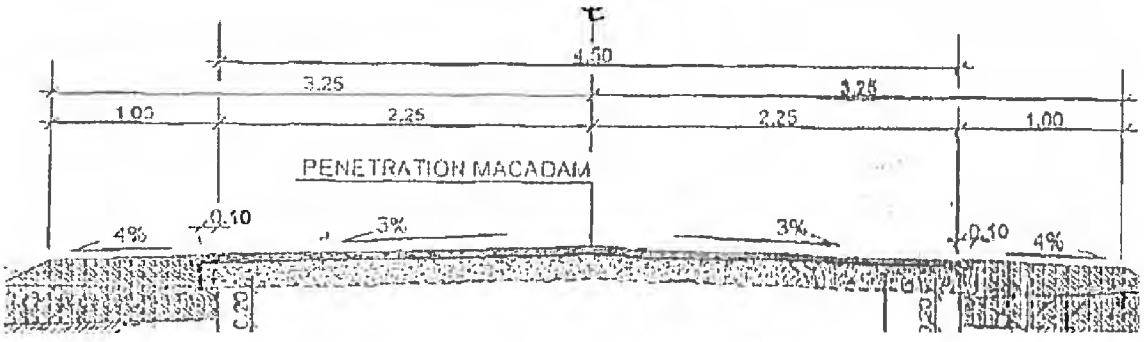
Contractor: KIAR MAEK UNIPESSOAL LDA

[Point 1]

Width of 150 mm thick crushed aggregate base course is not clear. regarding two set of drawings, one is 4.50 m in typical road section, and another is 4.70 m. Contractor explained 4.70 m is correct. But original BoQ shows 4.5 m as following list.

PAY ITEM NO.	DESCRIPTION	UNIT	QUANTITY	UNIT COST US $	TOTAL COST US $
300	SUBBASE AND BASE COURSE				
301	Aggregate Subbase Course	Cu.m.	5,600.00	28.50	159,600.00
303	Cruched Aggregate Base Course	Cu.m.	9,200.00	58.00	533,600.00
	TOTAL FOR SECTION 300				693,200.00

$4.5^{m} \times 13600 \times 0.15 = 9180\ m^2$



[Point 2]

Some part of crushed aggregate base course was washed out by drain of rainfall. It is

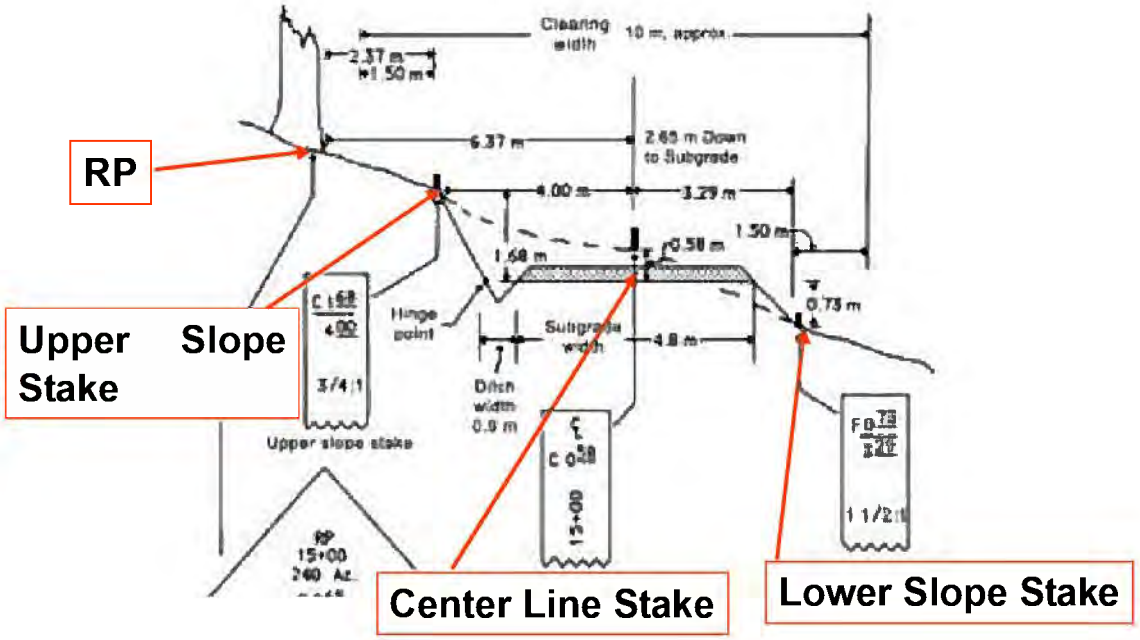
necessary to repair.

[Point 3]

Regarding sub base course, big stone which size is 20 cm was used in sub base course.

[Point 4]

It is necessary to check the centerline of crushed aggregate base course, using Reference Points, slope stake or center line stake. Consultant explained somebody stole them of bamboo stick, so that we were not able to measure centerline.



[Result]

It is necessary to recheck by ADN engineer in Lospalos.

Comment on Oges Road, Suai on 13th Aug 2013

Mr. Hideo Matsushima

[Abstract]

It is necessary to implement Emergency Rehabilitation of Oges Road in Suai by SEFOPE.

In this year, road was damaged by flood.

[Point 1]

At concave bank, erosion occurred and sedimentation of sand bar occurred at convex bank. River bed material is mainly rock, it means fix river bed. Counter measure is retaining wall and spur dike (Groin) is reasonable.