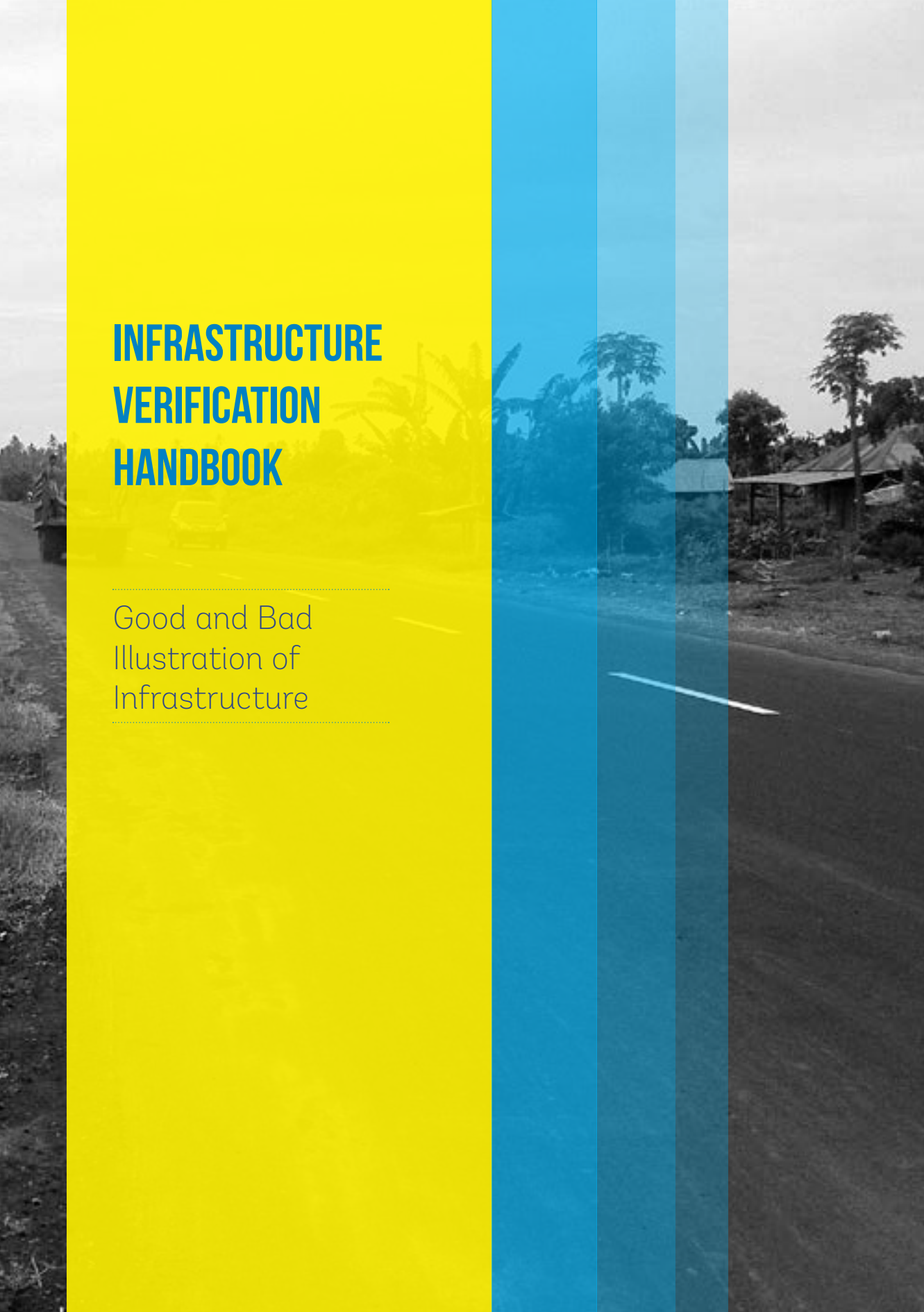
INFRASTRUCTURE VERIFICATION HANDBOOK

Good and Bad Illustration of Infrastructure



INFRASTRUCTURE VERIFICATION HANDBOOK

Good and Bad Illustration of Infrastructure

DEPARTEMEN KEUANGAN RI

bpkp

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This Verification Handbook is one of reference in quick qualitative assessments on infrastructure outputs. This Book illustrates the Good and Bad conditions of specific infrastructure outputs: Road/ Bridge, Irrigation, Water and Sanitation.

Pictures of infrastructure in the Book are tagged with brief narration and colored notations.

The Book marks red-colored frame for Bad illlustration and green-colored frame for Good illustration.

Each of pages is marked on outer-side of pictures.

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CONTENTS

PRAKATA

Proyek Pemerintah Daerah dan Desentralisasi (P2D2) merupakan proyek yang ditujukan untuk meningkatkan akuntabilitas dan sistem pelaporan dari Dana Alokasi Khusus (DAK) untuk sektor infrastruktur (jalan, irigasi, air minum, dan sanitasi) di 30 Provinsi di Indonesia. Proyek ini dipandang sangat strategis untuk mendorong dan memastikan bahwa penggunaan DAK digunakan sesuai dengan petunjuk terkait dari Kementerian Keuangan dan Kementerian Pekerjaan Umum dan Perumahan Rakyat.

Komponen ketiga dari P2D2 adalah verifikasi atas hasil pekerjaan DAK di provinsi/kabupaten/kota di daerah peserta P2D2. Badan Pengawasan Keuangan dan Pembangunan (BPKP) merupakan badan independen yang ditunjuk untuk melakukan verifikasi ini. Perwakilan BPKP di tiap provinsi bertugas untuk melakukan verifikasi setiap tahunnya, dengan menggunakan verification check list yang terdiri dari beberapa kelompok kriteria verifikasi termasuk diantaranya untuk teknis pelaksanaan DAK di daerah, proses pelelangan pekerjaan DAK infrastuktur, manajemen keuangan terkait dana transfer DAK, pelaporan hasil DAK di lapangan, dan pengamanan sosial dan lingkungan.

Buku ini bertujuan untuk membantu tim BPKP di lapangan untuk melakukan verifikasi keluaran DAK infrastruktur. Buku ini disusun sebagai bagian usaha bersama dari Kementerian Pekerjaan Umum dan Perumahan Rakyat dan BPKP Pusat untuk mencapai peningkatan efektifitas pemanfaatan dari proses verifikasi. Di dalamnya mencakup objek infrastruktur dasar yang dibiayai oleh DAK.

Dalam melakukan verifikasi, BPKP mendapatkan tantangan yang salah satunya adalah pengetahuan teknis dan pemahaman komprehensif untuk mendukung kualitas hasil pemeriksaan dan keputusan yang diambil. Untuk itu, buku ini dapat digunakan sebagai suatu instrumen pendukung untuk melakukan penilaian yang memaparkan titik-titik penting dan kritis dalam pemeriksaan. Secara spesifik, mengingat latar belakang pemeriksa BPKP di lapangan yang beragam, instrumen ini disampaikan dengan pendekatan sederhana dan gamblang dengan tetap menyampaikan setiap pesan secara utuh tanpa bias pengertian yang berlebihan.

Dengan didukung oleh contoh-contoh ilustratif berupa gambar dan foto, setiap bagian dilengkapi dengan deskripsi ringkas dan padat. Objek infrastrukur buku ini dibagi menjadi 4 (empat) bagian yaitu:
a. Jalan dan Jembatan
b. Irigasi
c. Air Minum
d. Sanitasi Berbasis Masyarakat

Semoga substansi dari Buku ini dapat bermanfaat bagi khalayak pembaca, utamanya para pemeriksa BPKP dalam menjalankan tugasnya untuk pemeriksaan output infrastruktur DAK. Buku ini juga dapat menjadi bagian dari sebuah proses pembelajaran yang mengedepankan perhatian pada aspek pelayanan publik serta mengambil pengalaman-pengalaman terbaik dilapangan sebagai referensi utama.

Terima kasih,

Proyek Pemerintah Daerah dan Desentralisasi

FOREWORD

The Local Government and Decentralization Project (LGDP) aim to improve the accountability and reporting of the Government of Indonesia Specific Purpose Grants (DAK) for infrastructure sub-sectors (road, irrigation, water and sanitation) in selected 30 local governments in Indonesia. This project is considered straetgically appropriate to support the local governments on improving the implementation of DAK infrastructure.

The third component of LGDP is verification of outputs for DAK activities at the participating districts. The Government of Indonesia Internal Auditor (BPKP) is an independent agent appointed to conduct the verification of outputs for LGDP. BPKP representatives in each participating Province is responsible to conduct verification every year, using the verification check list, which consist of several criteria including: technical aspect on the implementation of DAK in the field; procurement for DAK infrastructure sub-sectors; financial management related to DAK transfer in infrastructure sector, reporting of DAK results from the field, and social and environmental safeguards criteria.

This handbook aim to provide guidance for BPKP team in the field on conducting the verification of outputs for DAK infrastructure. This handbook is created as part of collaboration between the Ministry of Public Works and the BPKP at the central level, to improve the effectiveness of BPKP technical verification. It describes all the basic infrastructure objects that are financed by DAK transfer at the local governments.

On conducting the verification of outputs, initially, BPKP faces many challenges which one of them are on the technical knowledge and capacity to support quality of reports and the decision. Therefore, this book serves as supporting document to determine the critical items for the verification process. Considering the fact that BPKP auditors in the field have different education backgrounds, this handbook is presented in a simple and concise way, while keeping the main message clear with intact and unbiased definitions.

Each chapter of this handbook is illustrated with pictures or photos and short paragraphs. The subjects are divided in four chapters:
a. Road and bridge.
b. Irrigation.
c. Water.
d. Community-based sanitation.

We hope that the content of this handbook would be useful for the readers, especially BPKP auditors in the field on reviewing DAK infrastructure outputs. The book should also be part of a learning process which focuses on improving the delivery of public services and taking lessons learned from the field as a reference.

Thank you,

Local Government and
Decentralization Project

ROAD & BRIDGE

Technical observation is ideally assessed along the verified road.

Perfect timing for observation is during low-traffic hour (not during peak hour) with sufficient daylight (not additional lighting).

Necessary equipments for technical observation are:

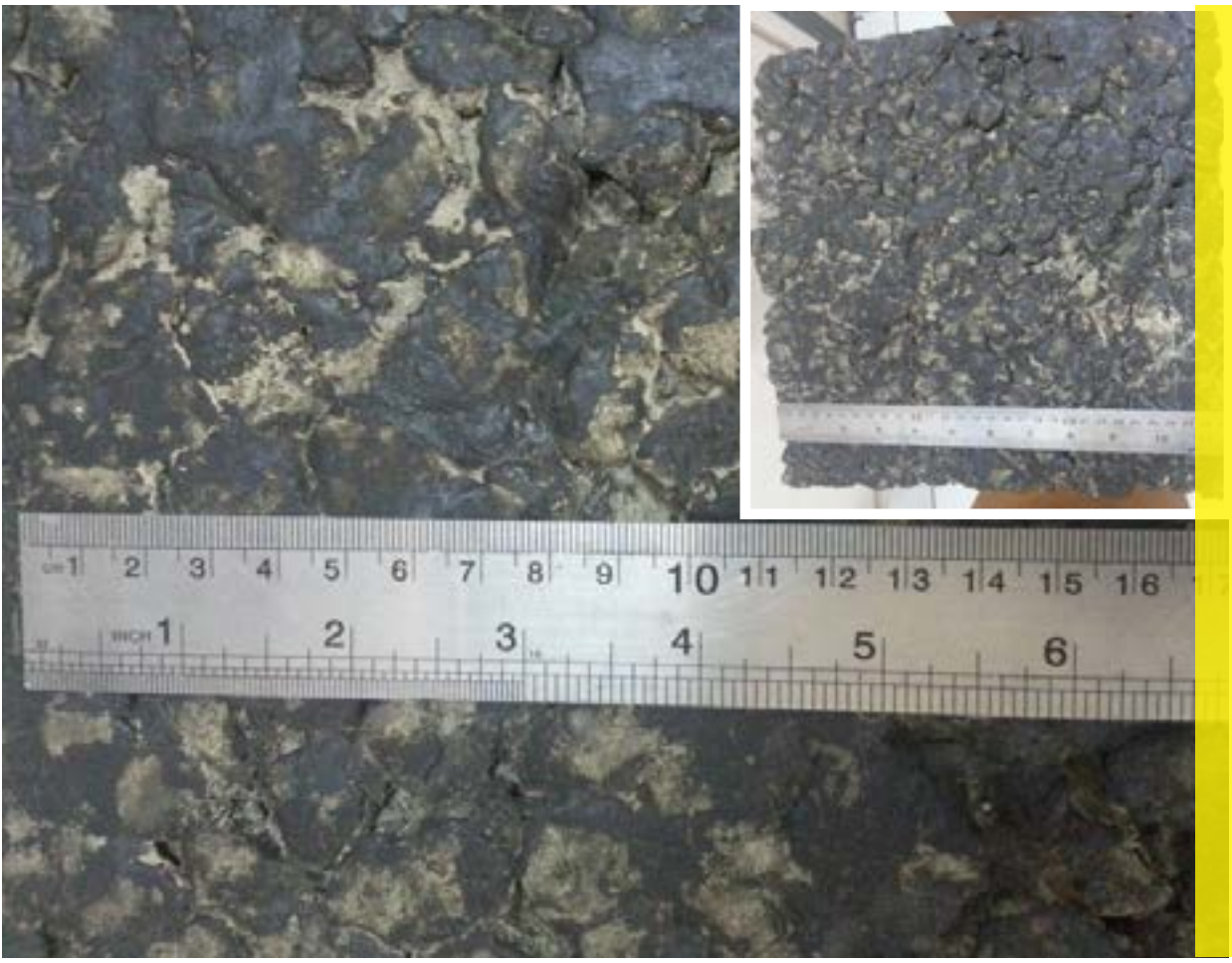
- Traffic safety signs.
- Map of road network.
- Walking measure.
- Tape measure.
- Waterpass.
- Color Camera.
- Stationery.
- Project vest and helmet.
- Marking/*Stationing* blocks.

PAVEMENT TYPE: HOT ROLLED ASPHALT UK (HRA-UK)

Characteristics
Smooth surface with *High Flexibility* level.

Gradient Type
Gap Graded.

Mixture
Gap-graded aggregate, a mixture of medium size (2.36 to 10 mm) aggregate, sand matrix, mineral filler, asphalt and coarse aggregate (14 mm).



PAVEMENT TYPE: SPLIT MASTIC ASPHALT GER/UK (SMA-GER / SMA-UK) or STONE MASTIC ASPHALT USA (SMA-USA)

Characteristics
Maximum Macrotexture with High Stiffness level.

Gradient Type
Gap Graded.

Campuran
High proportion of coarse aggregate. The skeleton is filled with mastic (mixture of bitumen, fine aggregate and filler).

PAVEMENT TYPE: ASPHALTIC CONCRETE USA (AC-USA)

Characteristics
Medium Macrotexture with Interlocking stability.

Gradient Type
Continous graded.

Mixture
Coarse and Fine aggregate; and filler with asphalt binder.

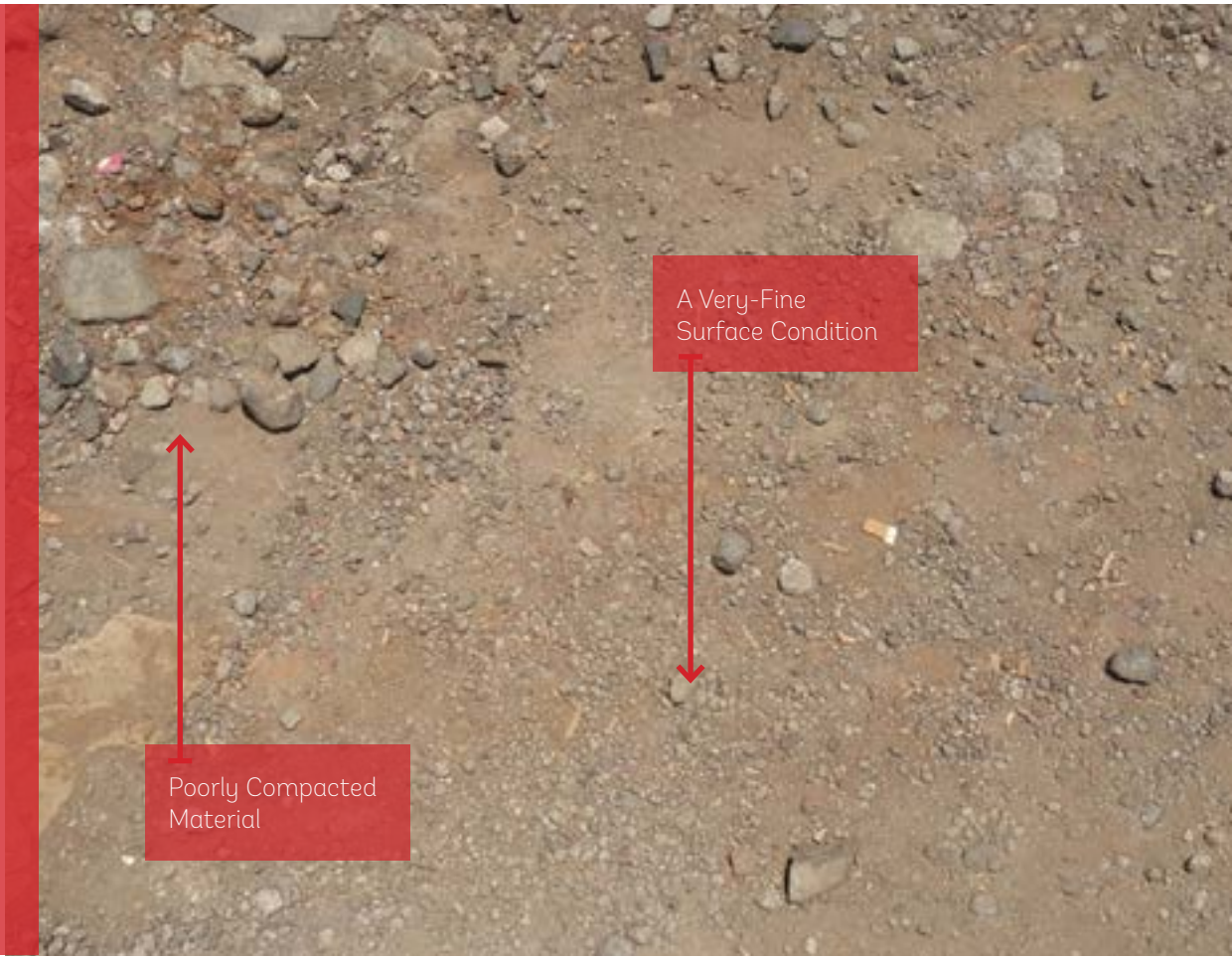
SIZE AND FITNESS OF AGGREGATES

Why is Bad?

1. Poorly shaped aggregate and its surface (round shaped).
2. Aggregate size is too big.

What is the Treatment?

1. Aggregate should be crushed to form binding angular shapes.
2. Treatment with crusher or manually by hammer to produce a controlled size.



SURFACE LAYER MATERIAL

Why is Bad?

1. This is a very-fine surface course materials.
2. Surface course material is less bonded and poorly compacted.
3. Mixing segregation between coarse and fine aggregates.

What is the Treatment?

1. Replace the course materials or adding proper aggregate.
2. Rework or recompact the materials to prevent erosion.
3. Properly segregate the material.

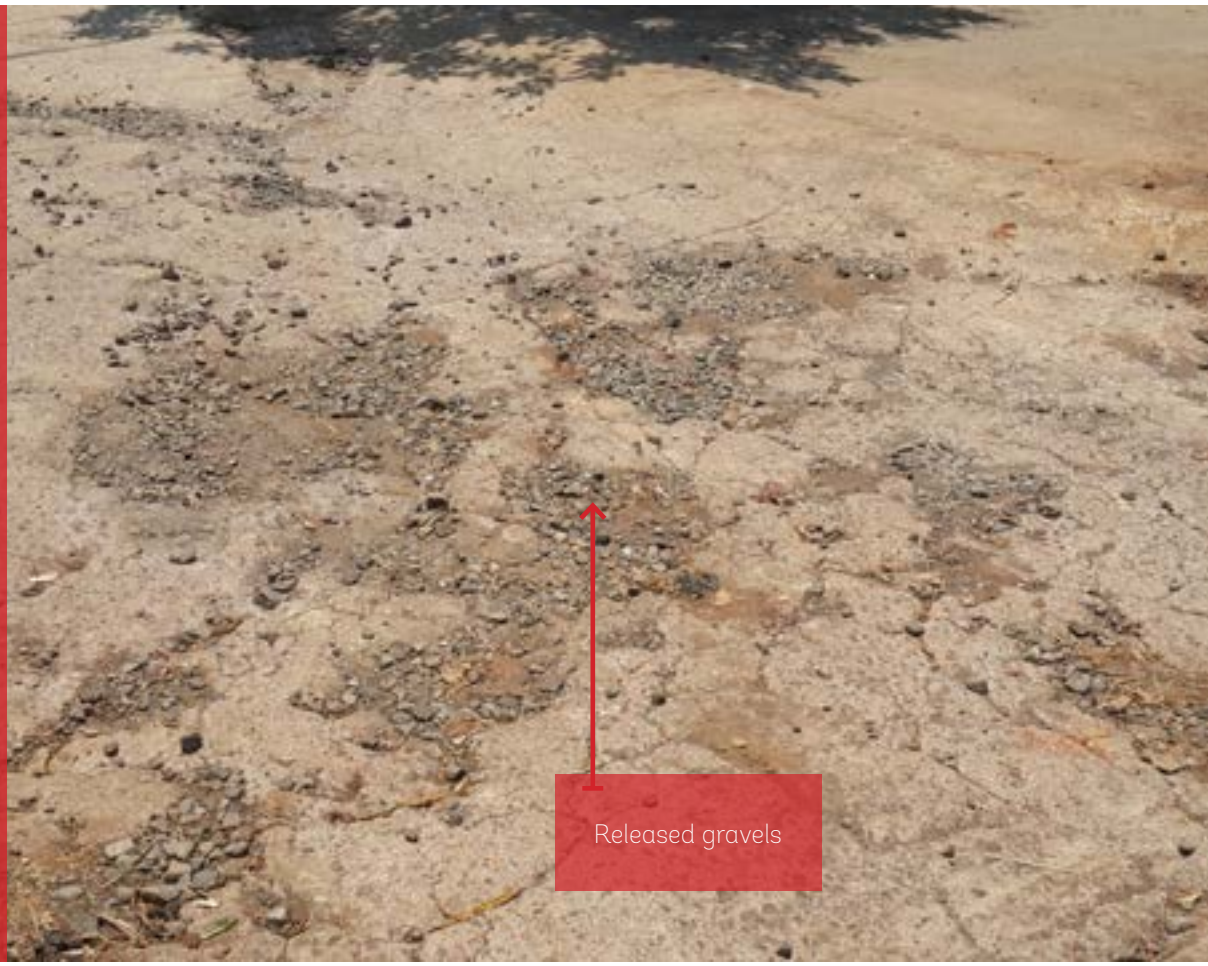
FLEXIBLE PAVEMENT DAMAGE: ALLIGATOR CRACKING

Why is Bad?

1. Cracks with a large gap and resembles as alligator skin may cause water seeping to subgrade in over time which in turns will create pot-holes because the release granular pavement materials.
2. Cracking occurs because of repetitive-stress which results in fatigue of surface cource.

What is the Treatment?

1. Temporary treatment by patching with single or double AC; or, sealing with hot rolled sheet (HRS).
2. Full treatment has to remove and dispose wet parts, seal it with proper material specifications.
3. The drainage system should be improved to prevent pooled water on pavement.



FLEXIBLE PAVEMENT DAMAGE: RAVELING

Why is Bad?

1. Ravels due to decrease bonds between sub-base and upper course materials which may affect riding safety and comfort.
2. The structural distress will decreasing periode of road-services.

What is the Treatment?

Patching the upper course to cover raveled particles, after the area is removed and dried.

RIGID PAVEMENT DAMAGE: POLISHED AGGREGATE

Why is Bad?

1. This damage reduce roughness level and creates a slippery surface.
2. May cause of slipping vehicle.

What is the Treatment?

1. Perform diamond grinding.
2. Perform the overlay.

RIGID PAVEMENT DAMAGE : PACTHING

Why is Bad?

1. Even though the surface functions normally, the pacthed area is classified damage since pacthed mixture is different materials.
2. Driving inconvenience.

What is the Treatment?

1. Proper slab replacement or overlay.
2. Sealed with fine asphalt sheet and milled.

RIGID PAVEMENT DAMAGE: POPOUTS/POROUS

Why is Bad?

1. Loosen gravels on upper slab surface and marked popouts with dia. 25 to 100 mm.
2. It reduce the surface roughness.
3. It also indicates a poor aggregate durability.

What is the Treatment?

1. Patch or seal the minor popouts with cement paste fillings.
2. Large popouts should be repaired with partial depth patching.

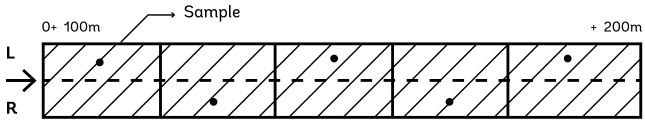
CORE DRILLING MISTAKE ON FLEXIBLE PAVEMENT

Why is Bad?

1. Horizontal line of core drill sampling.
2. Repairing materials on drilled hole is different with pavement material.

What is the Treatment?

1. Sampling pattern must be collected diagonally as following:



2. Repairing material must be similar with tested pavement.

FLEXIBLE PAVEMENT DAMAGE: CRACKED ON PAVEMENT AND SHOULDER JOINT

Why is Bad?

1. Shoulder surface is higher than primary surface which may trap water in the joint.
2. Water is seeping beneath the course with loosing of gravels from the cracks, leads to further deterioration.

What is the Treatment?

1. Paving the shoulders or recompact the sructure.
2. Repair and increase drainage capacity.
3. Filling cracks with mixture of bitumen and sands.

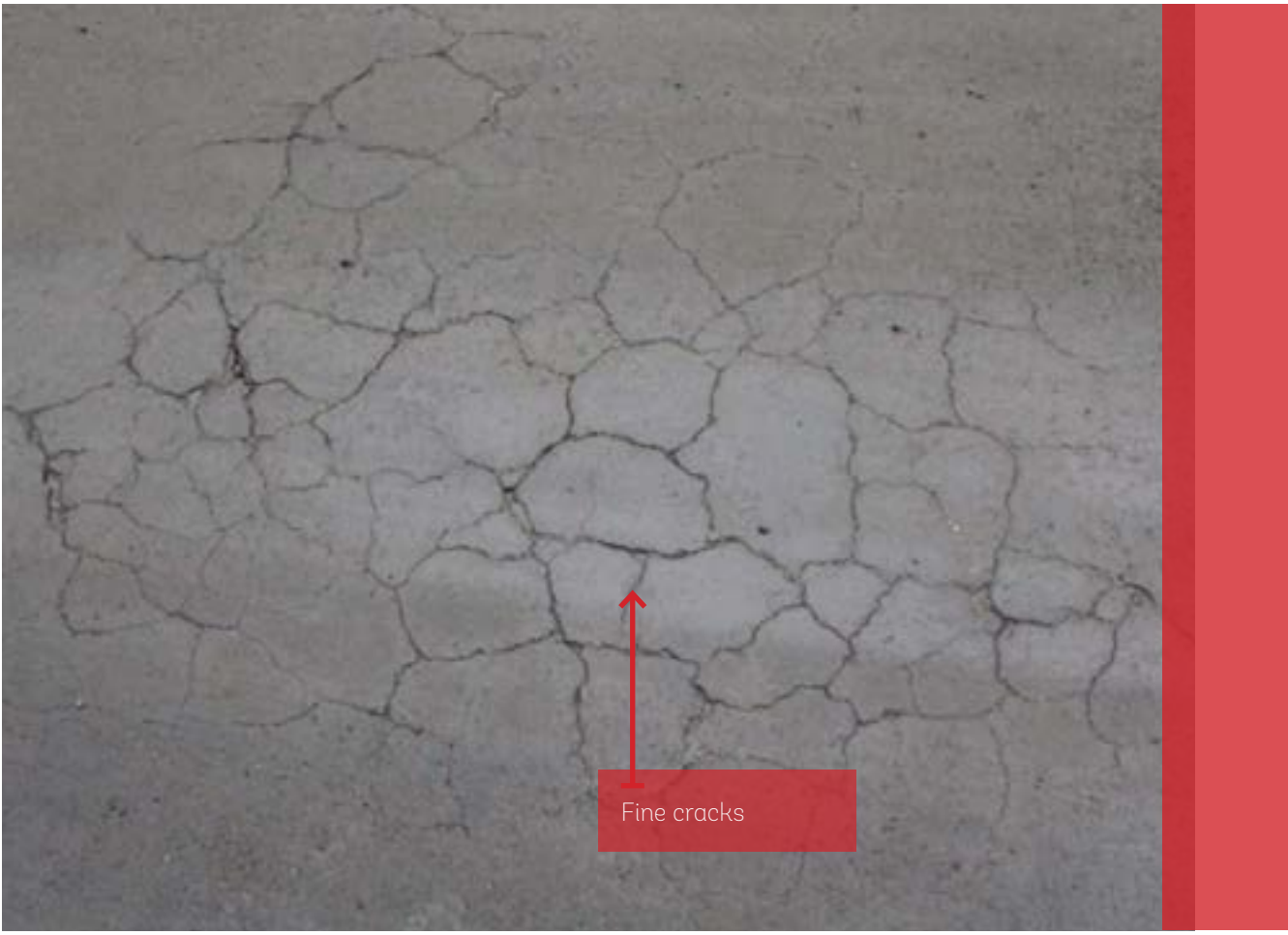
FLEXIBLE PAVEMENT DAMAGE: SHOULDER CRACK

Why is Bad?

1. Poor ground support under shoulder and poor drainage system.
2. Cracks will become larger with holes.
3. Water will seep beneath the course and distress surface.
4. It will result a total damage of pavement, courses and distract the riding comfort.

What is the Treatment?

1. Filling cracks with asphalt-sand mixtures.
2. Improve the drainage.
3. Extend the shoulders and solidified.



FLEXIBLE PAVEMENT DAMAGE: FINE CRACK

Why is Bad?

There are fine cracks with gaps which will seep the water beneath pavement courses.

What is the Treatment?

1. Replace the surface course by removing damage parts and coated with new materials (similar specification).
2. Coating with asphalt sand sheet for maintenance purpose
3. Improve the drainage system to prevent water ponding that damage the surface

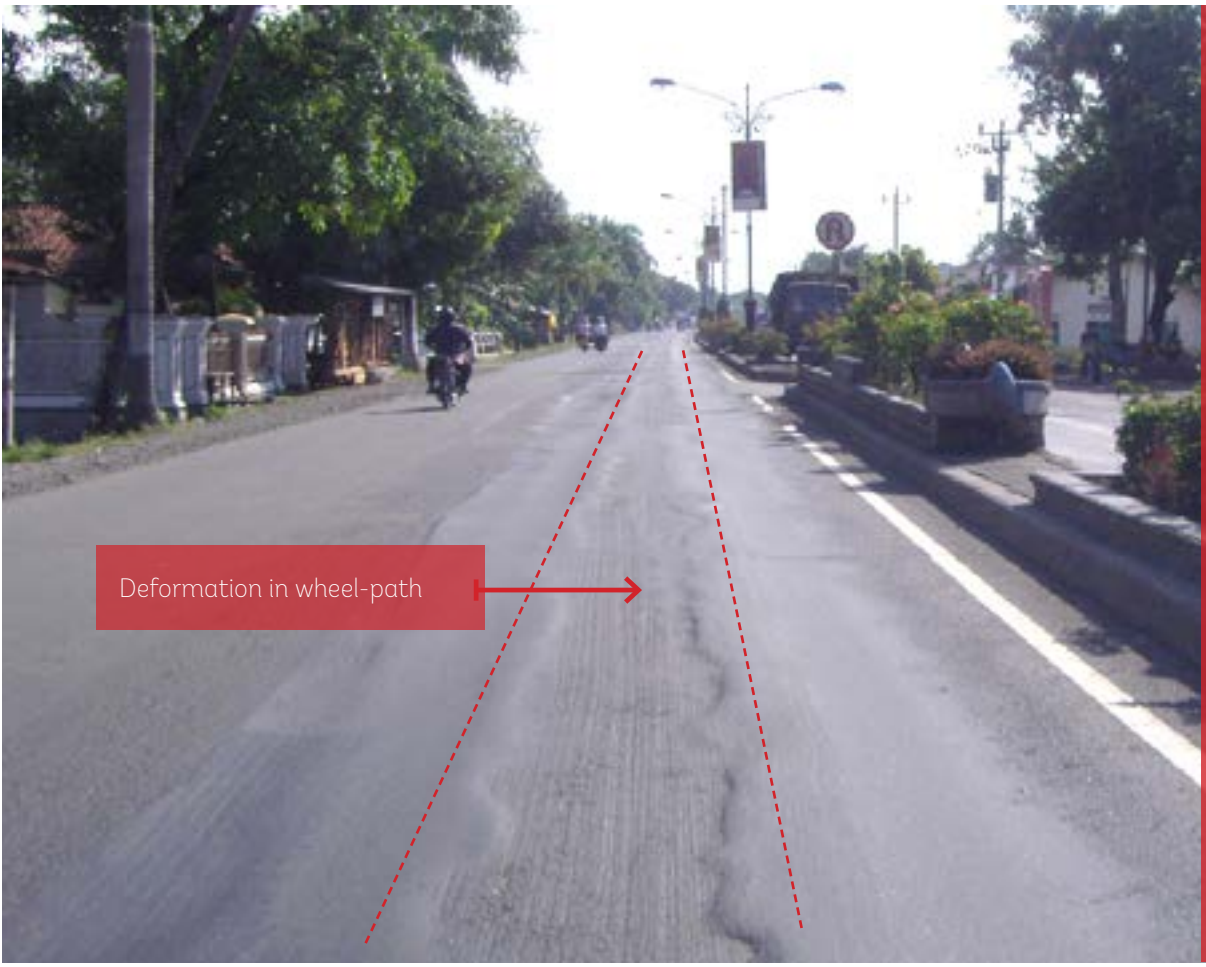
FLEXIBLE PAVEMENT DAMAGE: POTHOLES

Why is Bad?

1. Potholes will seep water beneath the pavement course and results more severe damage on the road.
2. This damage potentially cause fatal accident for riders.

What is the Treatment?

1. Clear off the hole from water and materials.
2. Cut straight the damage surface including its base course.
3. Open the upper and sub-base layers, place bonding mixtures of asphalt and compact it.
4. Improve the drainage system to prevent worse condition.



FLEXIBLE PAVEMENT DAMAGE: RUTTING

Why is Bad?

1. The uplifted and wavy surface is very dangerous and uncomfortable for riding.
2. The wheelpath will collect rainwater on pavement surface.

What is the Treatment?

Patching additional upper coat with similar specification; or, road reconstruction.

FLEXIBLE PAVEMENT DAMAGE: INUNDATION

Why is Bad?

Water inundation damage the structure by loosing the structural bonding between aggregates and asphalt.

What is the Treatment?

1. Improve the drainage system for properly channel the rainwater.
2. Regularly maintain the drainage channel, clear from debris and vegetation to prevent overflow and inundation on road surafces.

FLEXIBLE PAVEMENT DAMAGE: VEGETATION ON PAVEMENT

Why is Bad?

1. There is tree and bushes growing on the road that harmful for riding safety. It also indicates a poor maintenance.
2. Vegetation root will absorb the water and damage the base course.

What is the Treatment?

1. Clearing off the vegetation from road structure.
2. Repairing the damage course.

FLEXIBLE PAVEMENT DAMAGE: SHOVING

Why is Bad?

1. Poor support on the road edge. Driver discomfort when riding.
2. Poor stability of mixture as results of excessive bitumen, excessive fine-aggregates, high penetration on surface.

What is the Treatment?

1. Corrective maintenance by patching sand-sheet asphalt course or HRS.
2. Treatment by removing damage area, clearing the wet and replace with similar material specification.
3. Improving drainage system to prevent excessive water seeping due to inundation.

FLEXIBLE PAVEMENT DAMAGE: RAVELING

Why is Bad?

1. Major surface has been raveled or stripped from the road segments.
2. The road slope is deformated which is blocking the flow of water into drainage.

What is the Treatment?

1. Relaying the surface course with bonding mixtures or asphalt sheet.
2. Rehabilitation by remove the pavement courses and recompact with proper slope (as in the road design and specification).

MEDIAN DAMAGE

Why is Bad?

1. There is material damage and missing curbs which erode the soil in rainwater.
2. Materials are spilling off onto the road surface.
3. The median is unpaved or support with paving blocks for pedestrians crossing facility.

What is the Treatment?

1. The damage median must be repaired by installing curbs.
2. Paved the median for pedestrians crossing.

OVERHEIGHT MEDIAN

Why is Bad?

Overheight curbs which is disrupt the access and comfortability for pedestrians crossing.

What is the Treatment?

The design should take consideration of proper median height at specific segments for other purposes i.e. emergency crossing for ambulance.

DAMAGES OF PEDESTRIAN FACILITIES

Why is Bad?

1. The facilities are used for parking.
2. Pedestrian facilities is designed only for pedestrians load.
3. Damage the materials.

What is the Treatment?

1. Park the vehicles only on assigned parking area.
2. Place parking-banned signs to sterilize the area from parking vehicles.
3. Materials for the parking facilities has to be properly maintained.

ROAD EQUIPMENT

Why is Good?

1. The equipments is complete: good structured of road, shoulders, open drainage, and safe area for road inspection.
2. In this condition, the road has fulfilled the standard of good road construction.

Alternatives

Other supporting road equipments (only if required): median for pedestrians, road separator, paved shoulder, drainage, sideways, and retaining walls.

CLEAR AND SAFE

Why is Good?

1. The cleanliness is properly maintained.
2. Zero damage is a safe condition for riders.

Alternatives

Vegetation on road side should be cleared to give better view for pedestrians crossing.

COMFORTABILITY

Why is Good?

1. The surface is smooth and straight, give a comfort riding.
2. Black colored surface will comfort the feeling of riders.

Alternatives

Drainage should be constructed evenly to maintain the good condition.

DRAINAGE EQUIPMENT

Why is Bad?
Absence of drainage will collect the rainwater on surface.

What is the Treatment?
Construct a proper drains channel and repair the surface slope (AC and HRS).

IMPROPER SIZE OF DRAINAGE CHANNEL

Why is Bad?

1. Capacity of drains channel is very low.
2. There is no retaining structure on upper side of channel. The height of channel is aligned with road surface.

What is the Treatment?

Increasing the width as minimum standard capacity for drain requirement; Q=(Axr)/3600, "A" is square of road, "r" is rainfall.

ABSENCES OF RETAINING WALL

Why is Bad?

Debris and soil materials falls directly into gully, create sediments and blocking the water-flow.

What is the Treatment?

Use retaining walls on slope to prevent erosion.

ROADSIDE DRAINS

Why is Good?

1. The size is properly opened and fulfill the technical specification (material).
2. The gullies are kept clean and fully operational.

Alternatives

None.

ROADSIDE DRAINAGE

Why is Good?

1. Road sloping and the shoulder is ideally flow the rainwater to open channel.
2. Natural sloping and the minor vegetation between shoulder and channel is good to prevent erosion, but regular maintenance is also needed.

Alternatives

1. The channel could be formed of solidified ground with lower cost, but maintenance will be more complex.
2. The natural sloping could maintain with permanent construction. Higher cost but cheaper maintenance.

VEGETATION AND TRASH IN DRAINAGE CHANNEL

Why is Bad?

Vegetation and plugging trash inside the gully will block the water flow.

What is the Treatment?

Vegetation and plugging trash should be removed priodically to clear the water flow.

VEGETATION ON SHOULDER

Why is Bad?

1. Vegetation on this shoulder will block the water flow since the road surface in align with channel.
2. Blocked water will seep beneath the course and damage the structure.

What is the Treatment?

1. Clear the vegetation periodically if reconstruction of channel or road is difficult,
2. Concreting the shoulder.

ABSENCE OF SHOULDER STRUCTURE

Why is Bad?

1. No shoulder structure.
2. Significant gap of height between road and side ground, extremely dangerous for riders.

What is the Treatment?

1. Cover the side ground to raise the surface.
2. Constructing support structure for shoulder.

RIGID PAVEMENT DAMAGE: JOINT CRACKING

Why is Bad?

1. Poor bonding between slabs.
2. The faulting will lead to deterioration due to release particels.
3. Water will enter and accumulate under the pavement structure.

What is the Treatment?

Repairing maintenance by filling crack sealent (mixtures of asphalt and sands).

RIGID PAVEMENT DAMAGE: SHOULDER CRACKING

Why is Bad?

1. Poor drainage conditions or vegetation on shoulder that damage the sub-course and roadside structure.
2. There is material settlement which leads to spalling.

What is the Treatment?

1. For linear cracking (horizontally or diagonally), repair with filling mixture of asphalt and sands.
2. For square cracking, repair with removing damaged structure and replace with similar materials/specification.

RIGID PAVEMENT DAMAGE: LINEAR CRACKING

Why is Bad?

1. Major cracks on main lane will deformate the slab.
2. This damage will punch the slab partially.
3. This damage will erode the base and subbase soil materials.

What is the Treatment?

1. Narrow linear cracks could be maintained by crack sealing with AC.
2. Multiple large cracks must be majorly repaired with full depth patch.
3. The slabs must be removed, dried the wet parts, and covered with new material (similar specification).

RIGID PAVEMENT DAMAGE: TRANSVERS CRACK

Why is Bad?

1. Cracks on the old slab were not repaired properly prior to overlay works.
2. Cracks will be larger with holes.
3. Water will seep under the slab and damage the surface layer.

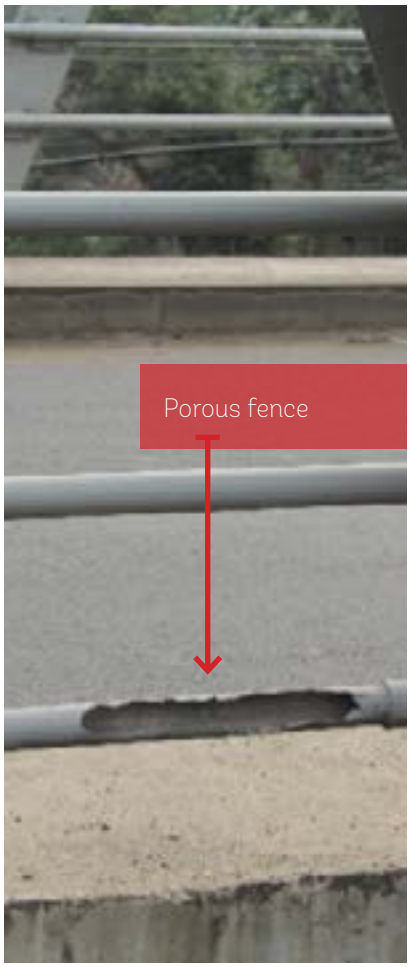
What is the Treatment?

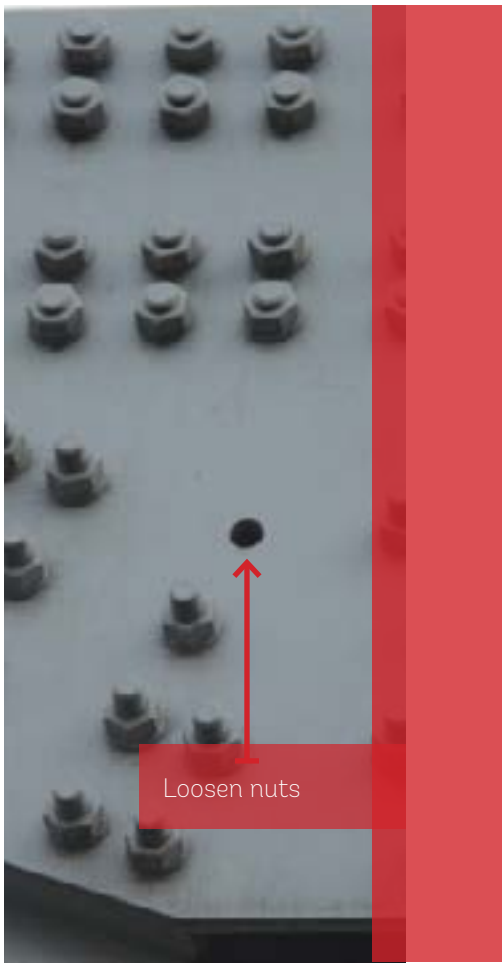
1. For linear cracking (horizontally or diagonally), repair with filling mixture of asphalt and sands.
2. For square cracking, repair with removing damaged structure and replace with similar materials/specification.

DRAINING PIPE ON RETAINING WALL (UNDER BRIDGE)

Why is Good?

1. Absorbed water creates pressure on wall. The draining pipe will realease the water and pevent overpressure on wall structure.
2. Drainage pipe has to use plastics or other anti-corrosive materials.





DAMAGE OF BRIDGE

Why is Bad?

1. Loosen nuts from bridge structure.
2. Corroded steel structures.
3. Holders of safety-support are damaged.

What is the Treatment?

Maintenance and special treatment for steel structures and replace damage parts.

VEGETATION ON BRIDGE STRUCTURE

Why is Bad?

1. Vegetation will absorb water into steel structure, make corrotion and failure on structure.
2. Corrotion on supporting structures.

What is the Treatment?

1. Vegetation should be removed to prevent water bleeding into bridge structure.
2. Remove the corrotion and repaint with anti-corrosive epoxy.

LACK OF RETAINING WALL FOR EROSION

Why is Bad?

Lack of retaining wall to prevent erosion.

What is the Treatment?

Construct the retaining wall with proper drainage system to strengthen the ground structures.

BRIDGE ABUTMENT

Why is Good?

1. The abutment is made of hardened stonewall, preventing erosion.
2. The abutment also useful for supporting base structure, transferring pressures and deck placement.

Alternatives

Abutment could be support by pillars to improve supporting capacity.

CONCRETE SLAB ON BRIDGE

Why is Good?

1. Concrete slab is used for short bridge.
2. Bridge with reinforced slab is economically lower cost for construction.
3. Detailed design of concrete slab for bridge is simple and less-technicalities.

Alternatives

1. Place short-span slab to distribute the bigger pressures.
2. If the load service is medium, the length of bridge may be extended.

SAFETY FENCE ON BRIDGE

Why is Good?

1. This bridge is equipped with safety fence to prevent fatal accidents.
2. The material is more than required standard for medium load services.

Alternatives

Higher fences with steel-reinforced pillars to prevent fatal accident on medium loaded vehicles.

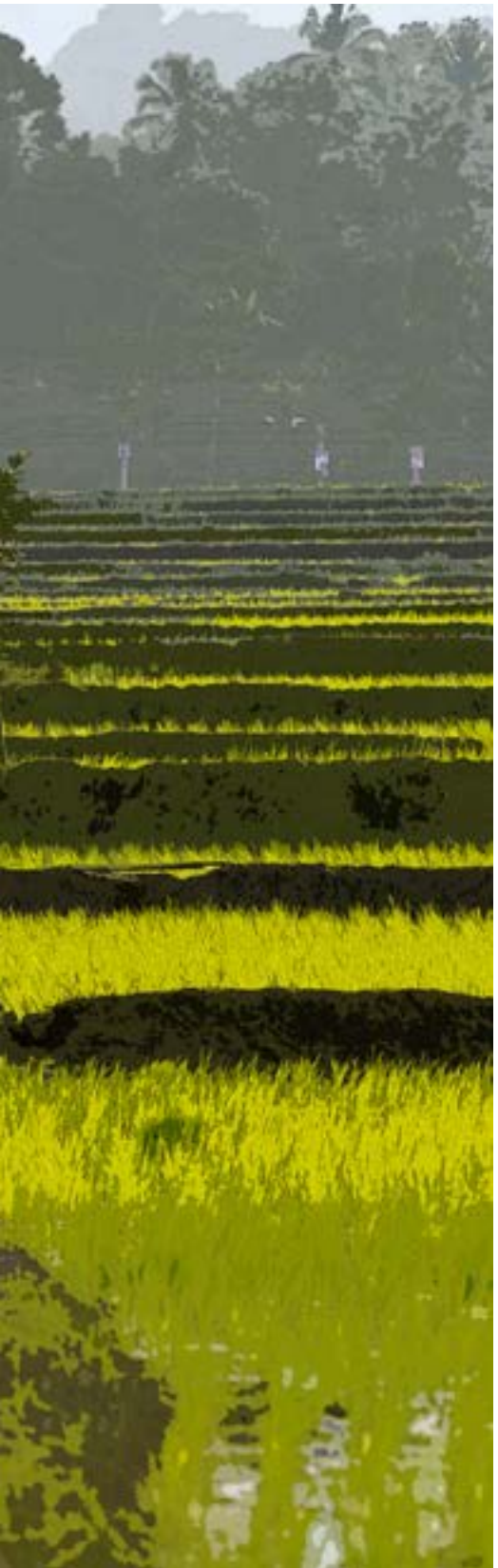
POOR SAFETY CONDITION

Why is Bad?

1. THe wood panel (for construction) was not cleared properly.
2. The panel will absorb water and its humidity will corrode the structure.
3. Poor quality of finishing works will damage the material instantly.

What is the Treatment?

1. All of wood panels should be cleared off the structure once the physical construction had been completed.
2. There must be partial inspection to check quality of finishing works and instantly repair the concrete damages.



IRRIGATION

PREVENTING EROSION

Why is Good?

Stonewall will prevent erosion on canals, vegetation, and reduce maintenance of damage canal walls.

Alternatives

Canals from ground soils is lot cheaper, but require intensive maintenance and clearance of sediment.

STONES ON CANAL BASE

Why is Good?

1. Stones will support the ground structure, especially in sloping area.
2. Preventing downward pressure and scours on canal base.

CONSTRUCTION MATERIAL ON THE CANALS

Why is Bad?

Construction material (sand) is placed next to approaching inlet of the canal. The materials will spill into the channel and make sediments.

What is the Treatment?

Do not place construction material on canal, and ensure the stocking area will not overflow the material into irrigation channel.

NO RETAINING WALL

Why is Bad?

1. Retaining structure is damaged..
2. The soil or other materials will be spilled into channel and creates sedimentation.

What is the Treatment?

Preventing erosion and soil sedimentation within the canal is important. Thus, retaining wall must be constructed with proper structures.

IRRIGATION WALL

Why is Good?

1. The concrete material will properly restrain the water pressures.
2. Streams in concrete material is higher than stonewall. This condition will reduce sedimentation in the channel.
3. Preventing vegetation within the channel.

Alternatives

1. Stonewall as alternative material.
2. Placed pressure gauge/door or chutes to control the overflow/overpressure.

DAMAGE ON IRRIGATION WALL

Why is Bad?

Porous surface of irrigation wall. This damage will affect the inner layers and ground structures.

What is the Treatment?

Permanently sealed the sruface with proper material specification.

CRACKS ON CANAL BANK

Why is Bad?

1. Cracked wall will extremely reduce the physical support in restraining the streams.
2. This damage will completely deter the canal since water will be absorbed under the structure.

What is the Treatment?

1. Permanent repairment by subdue the damage structure with concrete material, than seal the cracks (water flow should be diverted during construction).
2. The construction should be well-conducted to supervise technical acpects.

CONCRETE MATERIAL FOR SIDE SUPPORT

Why is Good?

1. Use the concrete material for side support and road over the canals. It will support the pressure.
2. Concrete material in this small bridge is low-cost maintenance than wood-material.

Alternatives

1. Use T-slab for >5 meter bridge.
2. If the load services only for pedetrians, wood and steel material will be more economic.

NO RETAINING WALL

Why is Bad?

1. Lack of retaining support will disrupt the canals, especially the rainwater.
2. Natural slope require more space.

What is the Treatment?

Reinforce the side slope with stone or concrete material to prevent erosion. This construction need fewer space than natural slope.

SLOPING OF CANAL SIDE

Why is Good?

1. Side area of canal is sloping in medium. This condition will prevent excessive soil erosion.
2. Protection could also be placed on canal wall.

Alternatives

Higher canal surface to prevent spilling soild into channel. This reconstruction might be costly.

NATURAL STEEP OF CLIFFS

Why is Bad?

The steep cliffs on canals will erode the soil into channel, create sedimentation.

What is the Treatment?

1. Constructed the outer line on the side of canal (same height with the canal) as an alternative channel.
2. Planting the cliff to prevent erosion.

WATER CHANNEL PROTECTION

Why is Good?

1. There is drop structure that reduce the velocity.
2. Streams will be controlled since high velocity is reduced.

Alternatives

Protection could be done by placing stones at drop structures.

GAP ON GATE STRUCTURE

Why is Bad?

There is gap or holes between concrete wall and the gate frame which will decrease support on water gate to restraing water pressure.

What is the Treatment?

Use proper panel during construction for firmly locking the frame on concrete wall.

DIVISION WALL AND WATER GATE

Why is Good?

1. There is division wall/box to control the downstream.
2. Control gate is also critical component in irrigation system.

INSPECTION STAIRS ON SIDE CANALS

Why is Good?

This inspection stairs will ease the operation, maintenance and inspection of irrigation channels.

SCREEN ON CONTROL GATE

Why is Bad?

There is plugged trash on gate which block the water flow.

What is the Treatment?

1. Installing trash screen to prevent water blocking because of plugged trash at the gate.
2. Screen will be easier to maintain and cleaned rather than inspecting the channels to identify the blocking spot.

DRAINING PIPE ON CANAL WALL

Why is Good?

There is draining pipe on canal wall as outlet for undground water and reduce the inside pressure.

SCREEN ON GATE

Why is Good?
The screen will collect the trash off the water.

Alternatives
Use steeled screen for longer period of service.

ABSENCES OF GATE, DIVISIONS, AND SCREEN ON CANAL

Why is Bad?

1. There is no control gate for proper water distribution.
2. There is no division to channel the water flow.
3. There is no screen to filter trash.

What is the Treatment?

1. Permanent gate must be placed on canal.
2. Temporary gate should be placed during maintenance of permanent gate.
3. Place the trash screen to collect debris off the water.

CORROSION AND TRASH ON COLLECTION GATE

Why is Bad?

1. Rusting gate will decrease the operationality and structural ability in restraining the stream.
2. Plugged debris and trash will block the water flow.

What is the Treatment?

1. Rusting gate could be replaced with steel plate and painted with anti-corrosive epoxy.
2. Remove the trash periodically to clear the collection gate.

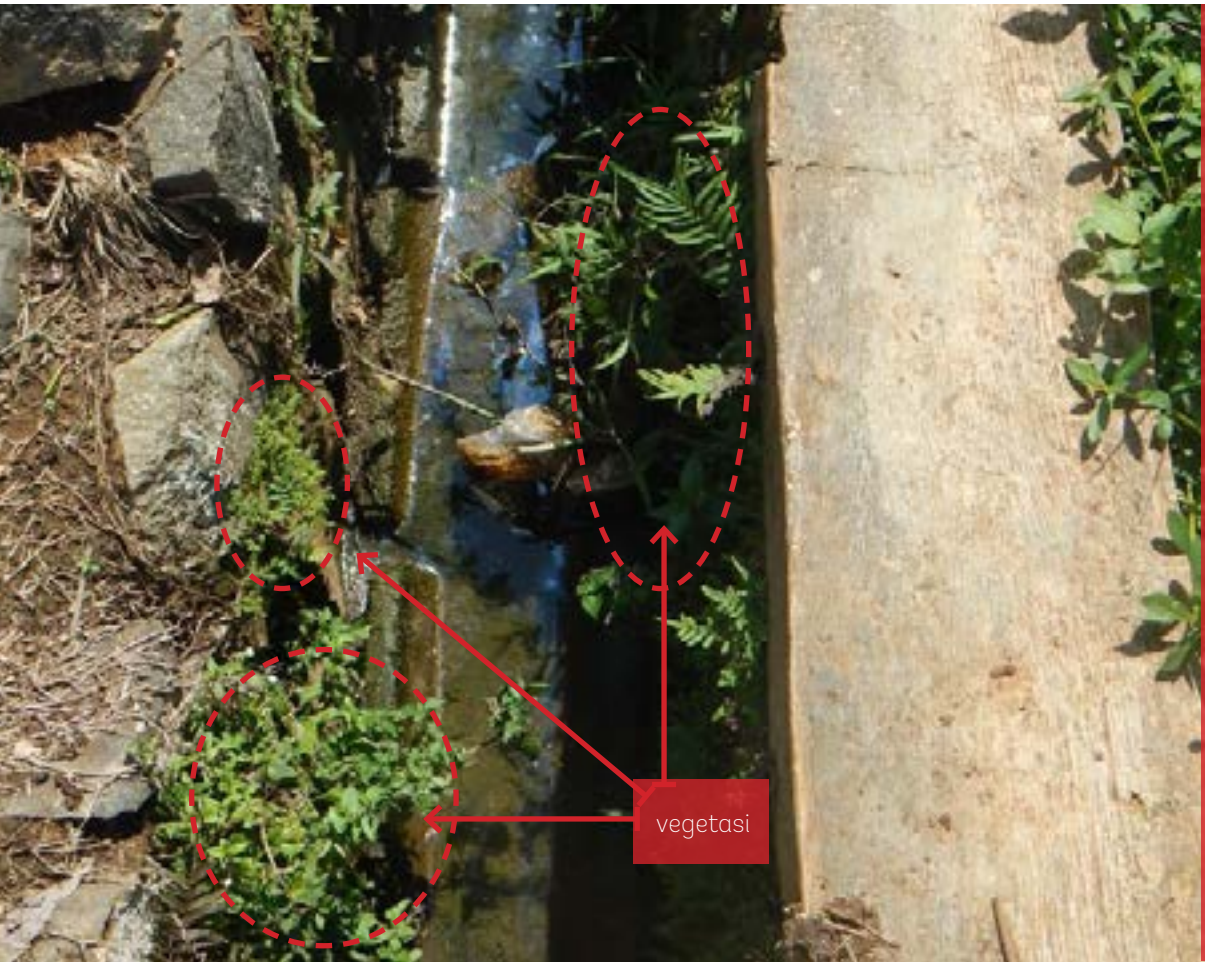
TRASH ON OVERFLOW GATE

Why is Bad?

1. There are many trash plugged on overflow gate.
2. The gate is opened all-day.

What is the Treatment?

1. Remove the trash, and place the trash screen.
2. Overflow gate is used to control water level inside the irrigation canals and overflow the sediments.
3. Gate must be opened and closed within certain hours, not all-day.



VEGETATION IN CANAL

Why is Bad?

1. There is vegetation in canals which block the water flow.
2. Vegetation will absorb water and damage the wall structure.

What is the Treatment?

1. Clear the vegetaion off the wall.
2. Replace the material by sealing or reconstruction.
3. Regular maintenance to prevent vegetaion on the wall.

TRASH IN CANALS

Why is Bad?

1. Trash in canals will block the water flow.
2. Inundation also dangerous for healthy

What is the Treatment?

1. Clean and remove the trash periodically.
2. Regular maintenance and direct restriction for disposing trash to canal.

SEDIMENTATION

Why is Bad?

1. There is soil sedimentation on canal bottom.
2. Sedimentation will decrease water and flow capacity.

What is the Treatment?

1. Remove the sedimentation.
2. Design the sloping properly to ensure velocity and streamings off correctly.

CHANNELS AROUND THE FARMING FIELD

Why is Good?

1. The channel will distribute the water evenly on farming field and improve the productivity.
2. The channel will minimalize rat breeding.

CLEANLINESS AND FUNCTIONALITY OF CANAL

Why is Bad?

1. Poor cleanliness.
2. The canal is inoperable due to blocked water at control gate.

What is the Treatment?

Maintain the cleanliness will ensure the canal can be functioned properly.

CLEANLINESS OF CANAL AND DAMAGE OF WATER GATE

Why is Bad?

1. Lots of sedimentation, trash and vegetation in canal which will block the water flow.
2. Water is improperly flowed.
3. The gate is damaged, disrupt the water distribution, and restraining capacity on water pressure.

What is the Treatment?

1. Clear the trash and sedimentation off the canal.
2. Replace the gate with better material.

TUNNELS IN CANAL

Why is Good?

1. This square tunnel is used to overflow the water out of channel to nearest river.
2. The structure is durable for supporting pressure from the road.

Alternatives

A pipe tunnel from concrete ring which placed and support with reinforced pillars.

SLOTS FOR STOPLOGS

Why is Good?

1. There is slots to install stoplogs if needed.
2. Stoplogs from wood panel or steel plate is more operable than permanent gate.

Alternatives

Valved gate is better but more expensive.

DROPPING POOL IN CANALS

Why is Good?

1. Dropping pool is used to cut the high velocity or streams before tertiary distribution.
2. The dropping pool will prevent grease on canal bottom due to high streams.

WATER FLOW IN IRRIGATION CHANNEL

Why is Bad?

The irrigation channel is not functioned properly since water is empty. This may caused of bad management in water intake.

What is the Treatment?

COntructed small ponds to channel intake off bigger dam or collect more rainwater as buffer supply for canals.

CRACKS ON IRRIGATION WALL

Why is Bad?

Cracks on irrigation wall will loose the cement surface, and affecting the strength of wall structure.

What is the Treatment?

1. Regular maintenance for improving the structure.
2. Replace the cement composition with better mixture to increase its durability, as the standards of irrigation channel.

CLEANLINESS OF IRRIGATION CANALS

Why is Good?

Clean canals.

Alternatives

Place the off-stream line which is useful for:

a. Reduce the water-loss from absorbtion
b. Preventing erosion
c. Preventing vegetation
d. Reduce the maintenance cost

STAGNATE WATER IN CHANNEL

Why is Bad?

1. Water is not flowing properly.
2. The sloping is not properly downward the streams.

What is the Treatment?

1. The sloping should be designed properly to create good downstreams for reach all of serviced area.
2. Maintain the cleanliness for preventing water stagnate along the channel.

PILLARS AND RETAINING WALL

Why is Good?

1. There are pillars and retaining wall to support the canal and preventing erosion on ground structure.
2. Retaining wall supports the canal and distribute the water pressure to ground.

OVERFLOW GATE IN CHANNEL

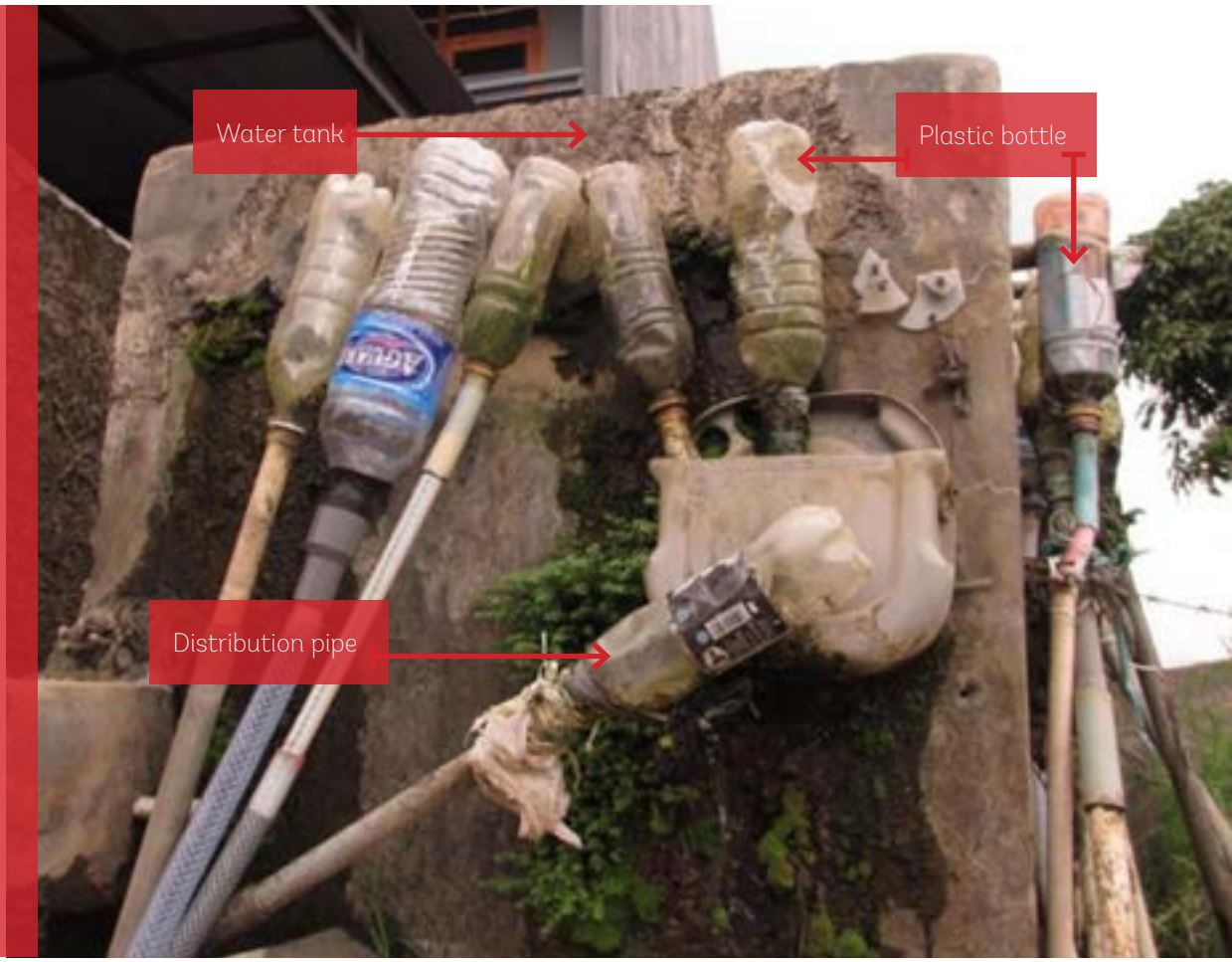
Why is Bad?

There is no overflow gate in this channel which affecting water distribution and overflow management during raining season.

What is the Treatment?

Place a permanent overflow gate i.e. wood panels, steel or concrete material.

CLEAN WATER



PIPING - WATER DISTRIBUTION

Why is Bad?

1. Plastic bottle is not for fitting.
2. Connections must be firmed to prevent leakages or broken pipes.

What is the Treatment?

1. Replace the plastic bottle with fittings.
2. In emergency (if there is no fitting available), use bended pipe. When bended with fire, insert soft-fillet into the pipe to maintain the diameter.

PIPING - CONNECTION

Why is Bad?

1. Using plastic bottle for connecting the distribution pipe.
2. Connections must be firmed to prevent leakages or broken pipes.

What is the Treatment?

1. Replace the plastic bottle with fittings.
2. In emergency (if there is no fitting available), use bended pipe. When bended with fire, insert soft-fillet into the pipe to maintain the diameter.


Cutted steel


Wire


Rubber

PIPING : IMPROPER PIPING CLAMP

Why is Bad?

1. Pipes should be clamped firmly, not loose or laggy because the connection will be broken.
2. Pipe will be brittled on continous exposure of sunslight.

What is the Treatment?

1. Use proper clamp (PVC) with correct size of pipe diameters.
2. Shield the pipe with concrete mix to prevent continous exposure of sunlight. Once the pipe shielded, clamp is no longer useful.

WATER INTAKE CONSTRUCTION

Why is Bad?

1. There is no treatment on intake water and reservoir is opened, which may affect the quality of water, even polluted.
2. Distribution pipe is opened.
3. No drainage for spilled over which flooded the water during high intensity of rainwater.

What is the Treatment?

1. Place the cover to protect water from falling items.
2. Install faucets.
3. Build drainage for spillover water.
4. Protect the quality with regular maintenance.

WATER INTAKE CONSTRUCTION

Why is Good?

1. This intake construction is a closed reservoir in which protect the quality of water.
2. Collected water may also be distributed for irrigation.
3. There is proper distribution gate.
4. There is drainage from intake to nearest channel.

Alternatives?

Simplee intake construction may cost cheaper rather than this intake.

WATER INTAKE CONSTRUCTION IN HILL GROUND

Why is Good?

1. Fit the hillside tophography, away from water resources and access of piping water.
2. This intake is a closed reservoir which protect the quality of water resources.
3. There is proper distribution gate.
4. There is outlet pipe for spillover water to nearest irrigation channel.

Alternatives?

1. Design of intake may be vary to local condition and applicable technology.
2. Proper drainage system beside outlet pipe to irrigation which may prevent overpressure and inundation around the structure.

WATER INTAKE - RAINWATER

Why is Bad?

1. This open intake collecting rainwater which not protect the quality of water.
2. Outlet pipe is opened.
3. There is no drainage for overflow water which make puddles around the structure, or, flooding the area during heavy rainwater.
4. There is no draining outlet to clean the intake.
5. Collecting pipe is too small.

What is the Treatment?

1. Cover the intake to prevent fallen items into the water.
2. Install faucets.
3. Build drainage for spillover.
4. Drain the intake periodically or give cholrine to clear the water.
5. Use water tank instead of opened intake.

WATER TANK - RAINWATER

Why is Good?

1. Rainwater tank is a closed tank to protect the quality of water.
2. Inlet for rainwater will direct the water into tank in minutes.
3. Minor use of pipes to collect the water.

Alternatives

1. This tank will be very useful during wet season. There should be alternative collection during dry season.
2. The water may collected from other resources which is costly.
3. Design and size of tank is varied on local condition.

WATER INTAKE - RIVERWATER

Why is Bad?

1. The intake is operated by sand trap and water is flowed to intake through pipe.
2. Piping for spillover is not channeled to drainaged which heavily risks in heavy rainwater and over capacity. It can damage the structure and flooded the area.

What is the Treatment?

1. Inlet must be filtered properly to screen the materials when the river is overflowing.
2. Reinforce the ground support and build the upper cover for intake.

DIGGING WELL

Why is Bad?

1. The open condition is heavily polluting the water.
2. There is no safety ring/fence for preventing user from harmful accident.
3. Potentially excess the usage, disrupt the ground water cycle and other risks.

What is the Treatment?

1. Build upper cover to prevent fallen items into the well.
2. Build ring or fence for user safety.
3. Build retaining wall to prevent soil pollution and erosion into the well.

DIGGING WELL

Why is Good?

1. This well is equipped with standard items i.e. pulley and basin, cover, spillover outlets, concreted floor.
2. The wall meet the standard with minimum depth of 3 meters from ground, constructed with water-resistant mix.
3. Concreted floor with size ± l,5 meter from well to avoid water spilled back into well.
4. The floor is solid without cracks, easy to maintain and sloped properly to flow off the dirty water.

Alternatives?

1. Installing pump to collect water from well.
2. Build simple wastewater treatment (min. capacity is 2% of daily use) before water is outflowed to nearest drainage.

PIPING NETWORK

Why is Bad?

1. Without pipe bridge, this piping will be bended and leaked because of river streams.
2. Broken pipe when the river is flooded.
3. Opened pipe will be easily damaged.

What is the Treatment?

Place supporting material i.e. bamboo that attach to it and place it over 1 meter of river surface. Placed a solid structure on the sides of river. This structure must be inspected and maintained regularly.

WATER INTAKE - GRAVITATION TECHNIQUE

Why is Good?

1. A gravitation intake not require pumping to distribute the water which will reduce the oeprational cost significantly compare to pumping system.
2. There is water filter.
3. There is proper distribution pape to channel collected water to nearest reservoir, public hydrant, or house connection.

Alternatives

1. Build an upper cover to protect the intake from fallen items.
2. Design of intake is varied to local conditions.

WATER TOWER

Why is Good?

The tower will ensure continuity of water supply in sufficient quantity and quality.

Alternatives

Design of water tower is varied to local condition and applicable technology.

RESERVOIR - GROUND WATER

Why is Bad?

1. The reservoir is opened and not protect quality of water.
2. Outlet pipe is opened.
3. There is no drainage for spillover and may creates puddles or flood during heavy rainwater.

What is the Treatment?

1. Installing faucets/stop gauge.
2. Build drainage for spillover to prevent puddles or flooded water.

RESERVOIR - GROUND WATER

Why is Bad?

1. This reservoir is opened and not protect the quality of water.
2. Outlet pipe is opened.
3. There is no drainage for spillover and may creates puddles or flood during heavy rainwater.

What is the Treatment?

1. Installing faucets/stop gauge.
1. Build drainage for spillover to prevent puddles or flooded water.

RESERVOIR - GROUND WATER

Why is Good?

1. Filters and sands trap will screen the sediment inside main distribution pipe, main tank and distribution networks.
2. Sands trap and the gravels will preventing the sediment which should be inspected and cleaned regularly.

Alternatives

Design and variation of reservoir may vary to local condition and topography.

RESERVOIR - SMALL RIVER

Why is Good?

1. This reservoir operates a sand trap, and channel the water through pipe.
2. Outlet pipes is properly installed.
3. It is better to screen the inlet for preventing trash or other item when the river is overflowed.

Alternatives

Reservoir should be placed next to intake to prevent mixing water whenever both places is overcapacity.

RESERVOIR - RIVER WATER

Why is Good?

1. Collecting ponds is constructed parallel for slowing down the inlet water, and trap the sands and sedimentation in collecting ponds.
2. Stones are placed under the dropping points to control the overflow before distribute to reservoir.
3. Control gate will flushed the sand and sedimentation out of reservoir.

Alternatives

1. Design/variaty of reservoir is vary to local condition, topography and lowest streams of river water.
2. Parallel reservoir is best option to collect the sedimentation before distribution.

RESERVOIR - RAIN WATER

Why is Bad?

1. The reservoir is opened and not protected the quality of water.
2. There is no outlet pipe.
3. There is no drainage for spillover which may cause puddles and flooded water during heavy rain.

What is the Treatment?

1. Build the cover.
2. Installing outlet for draining the water.
3. Build drainage for preventing overcapacity and flooded area.

RESERVOIR - GROUND WATER

Why is Good?

This reservoar ini is placed as ground water storage. The place is closed and locked to protect quality of water.

Alternativesnya?

Design of reservoir may vary to local condition, location and applicable technology.

PUMPING HOUSE

Why is Good?

1. The pumping house will secure the equipements from unnecessary access and weather.
2. It is better to have access to pumping house to ease the inspection and maintenance.

Alternatives

Size of house is depended on design, and equipments.

RESERVOAR - CLEAN WATER

Why is Good?

This reservoir collects clean water from rain or other surface water. This system maintain the supply, continuity, the quantity and quality for distribution.

Alternatives

Design of reservoir may vary to local condition and applicable technology.

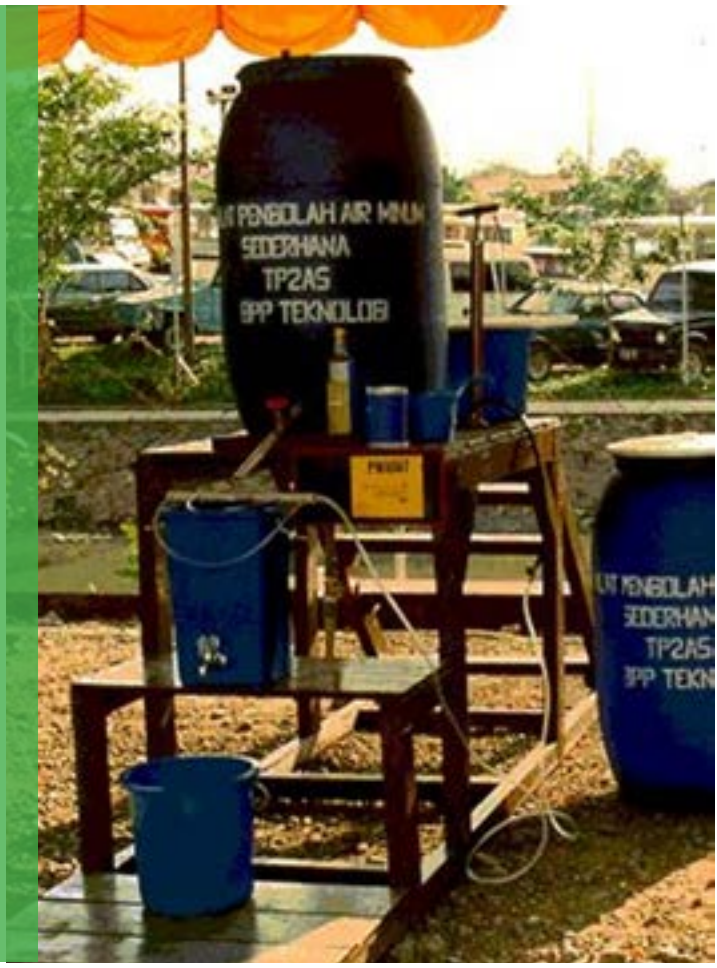
PUBLIC HYDRANT

Why is Good?

1. The hydrant will connect the clean water from reservoir or water tower to surrounding people.
2. This hydrant meets the technical standard, drainage and distribution pipe.

Alternatives

Design of public hydrant may vary to local condition and applicable technology.



SIMPLE WATER TREATMENT - PEAT WATER

Why is Good?

1. This treatment will process peat or muddy water.
2. SImple and easy to install and operate; and low cost. It uses minor checmical composition, i.e. chlorine and lime-stone.
3. This treatment unit can also be used for collecting rainwater.

Alternatives

Design of this water treatment (especially the capacity) may vary to local condition and demand.

WATER TANK - DISTRIBUTION

Why is Bad?

1. This water tank is opened.
2. Quality of water is not protected.
3. Distribution pipes are installed on tank wall which highly risks for leakage.

What is the Treatment?

1. Tank should be covered from pollutant material.
2. For small tank (around 2 x 2 m), the cover should be removeable for maintenance.
3. For bigger tank (more than 2 x 2m), there should be manhole for easy access and maintenance.
4. Place a gauze on ventilation pipe to filter the water before distributed.

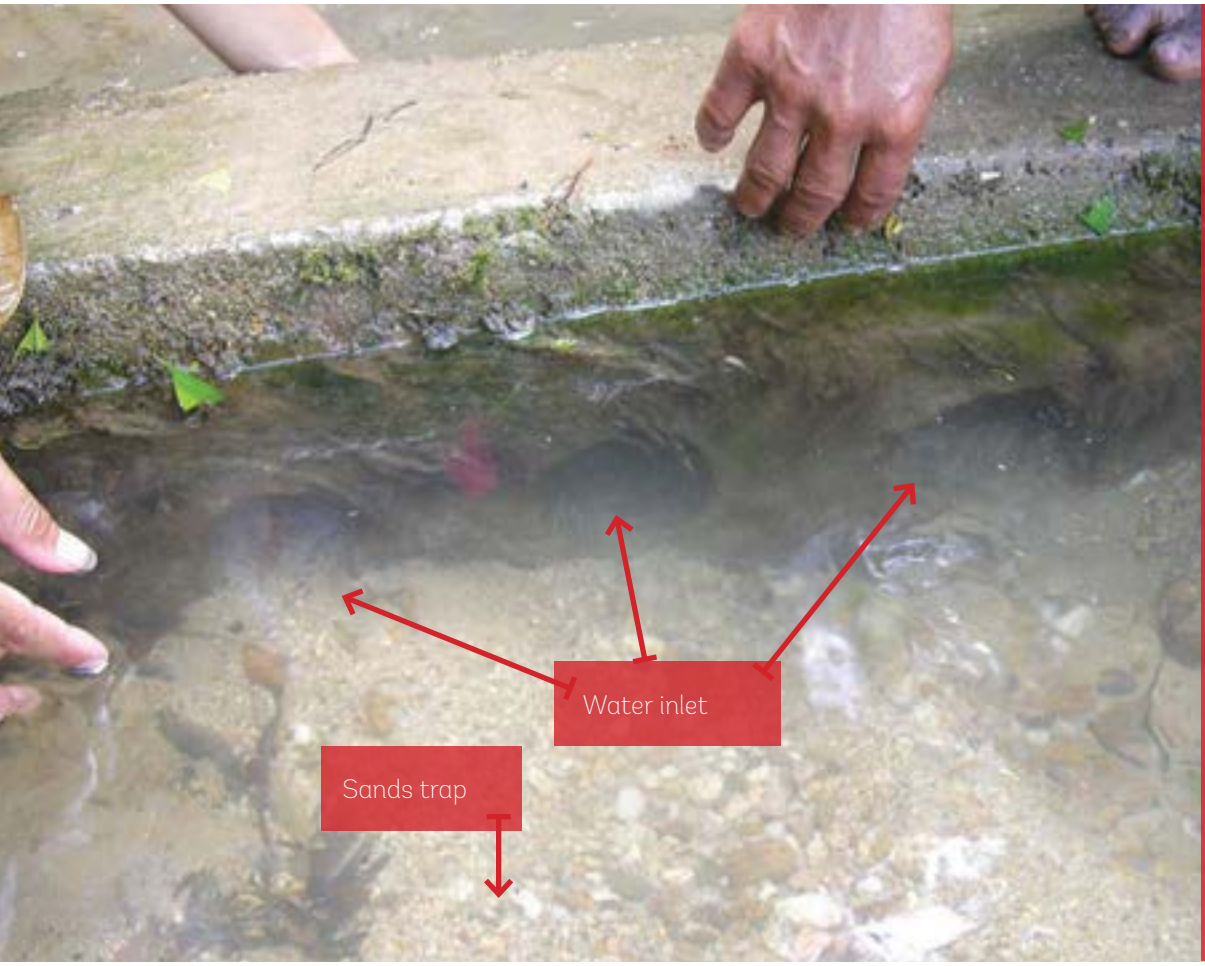
WATER TANK AND PIPE

Why is Good?

1. The tank has complete facility for washing and distribute water.
2. Combination of water tank and washing floor.
3. Proper sloping of concrete floor to drainage outlets.
4. Water is flowing easily to drainage channels and kept the floor dry.

Alternatives

1. Routine maintainenance to kept the facility cleanliness.
2. Place the tank, pipe and washing area in open space for easy access.



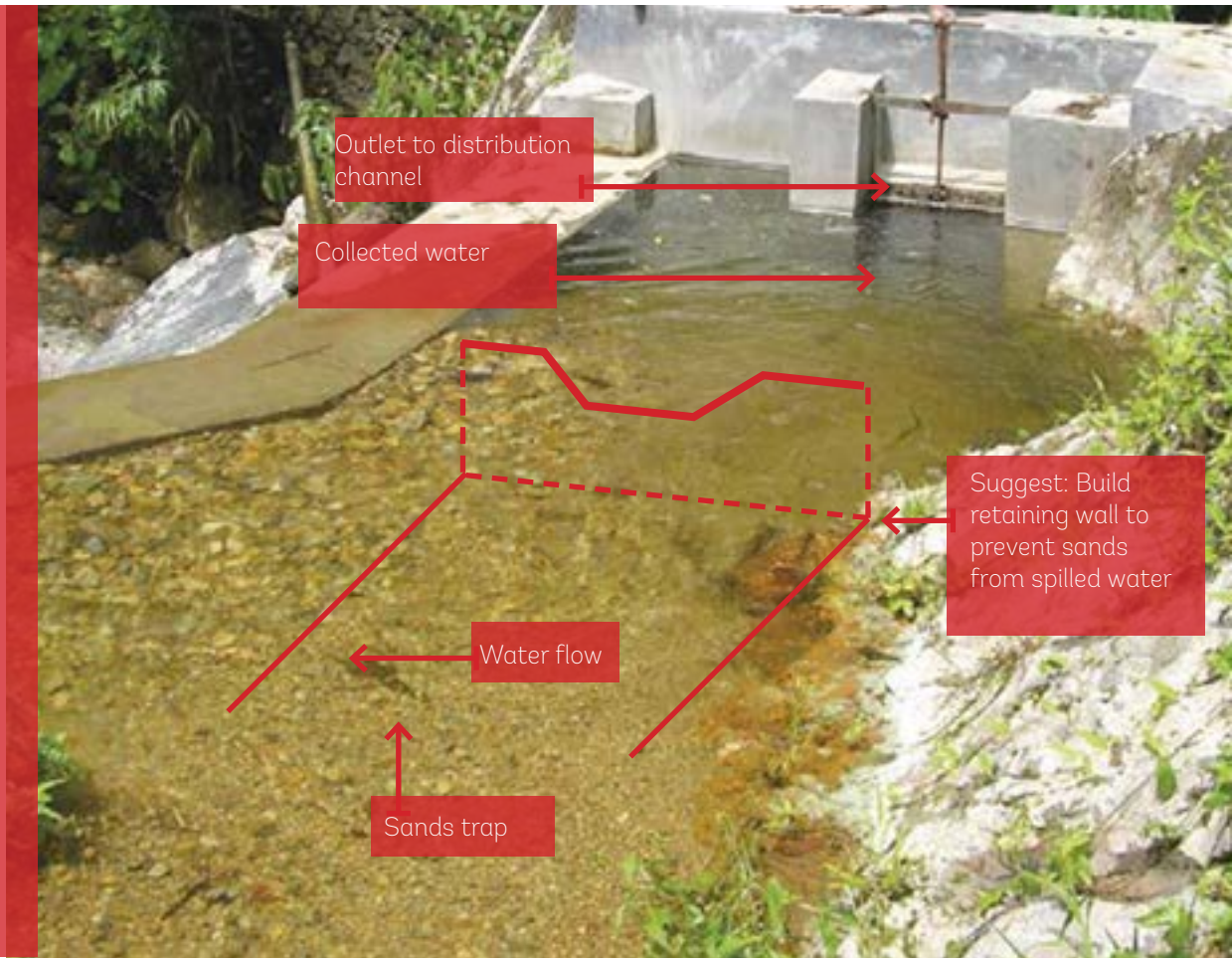
SANDS TRAP IN RIVER WATER

Why is Bad?

1. The water flow will slowing the sands and other sediments.
2. Sands will not traps due to high water pressures through water inlets.
3. The traps will slowing water and plug the sands at inlet.

What is the Treatment?

1. There should be drop wall to divide inlet and tunneled the stream through one inlet.
2. Closed other inlets.
3. Clear the approaching hole from plugged sands periodically.



SANDS TRAP IN RIVER WATER

Why is Bad?

1. The sands will be plugged behind the retaining wall and the surface will raise, cleared and spilled over the traps into intake.
2. The sand will trap inside the pond and block the water.
3. Sands will flushed easily on outlet channel due to slower debit of water.

What is the Treatment?

1. Place the retaining wall to channel the sands back to river.
2. Bend the wall to overflow the cleanwater directly into intake.
3. Clear the trapped sands periodically.


A


B


C


D


E

A. Connection with glue
B. Connection with screwed pipe.
C. Connection with screwed pipe
D. Connection with top welding.
E. Connection with permanent welding

TYPES OF VENTILATION PIPE

Why is Good?

1. Ventilation pipe is important to release air pressure within the tank.
2. THe ventilation pipe should be PVC or galvanized steel.
3. Connections might be placed with glue, screwed or welded.
4. Ventilation should be placed on top of water tank.

Alternatives

1. Place a screen on the tip of ventilation pipe.
2. Design and variaty of ventilation pipe may vary to local condition and tank location.

OVERFLOW OF WATER TANK

Why is Bad?

1. This overflow is damage the wall.
2. Overflow pipe should be channeled directly to drainage system.

What is the Treatment?

1. Place a permanent pipe to control the overflow to drainage.
2. Place the pipe with diameter of 2x inlet.

COVER OF WATER TANK

Why is Bad?

1. This intlet pipe should be removed when the cover is opened.
2. This inslet should be permanently attached to tank wall.
3. Mainhole should be closed and locked.

What is the Treatment?

1. Removed the inlet pipe to tank wall
2. Place the ventilation pipe on top of water tank.

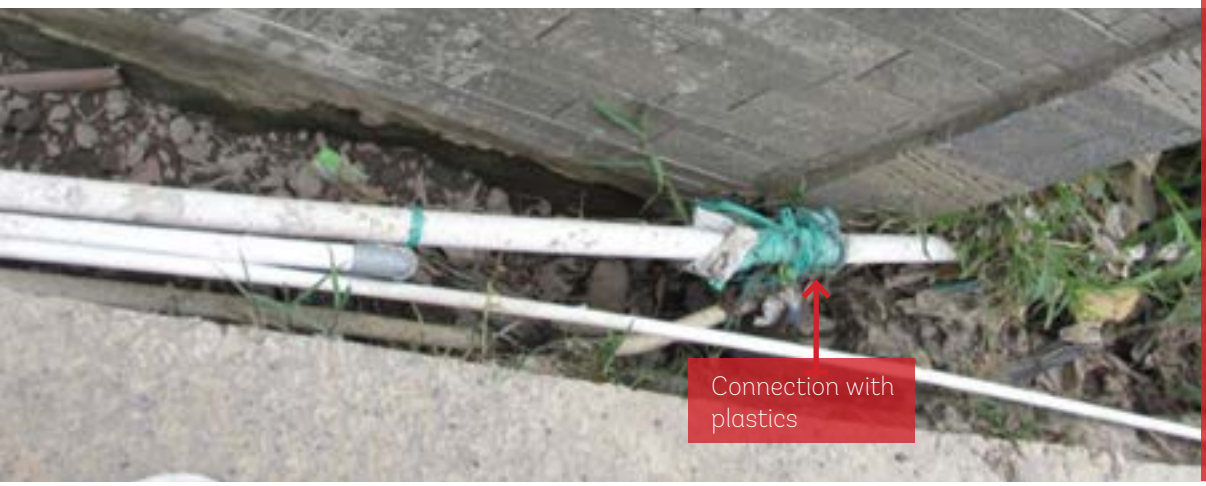
OUTLET PIPE IN PUBLIC HYDRANT

Why is Good?

1. This public hydrant installed with two faucets and other facilities for house connection.
2. The concrete wall is sloped properly to drainage hole.
3. The wastewater is channel to drainage.

Alternatives

Design and variety of public hydrant may vary to local condition.



PLACEMENT AND CONNECTION OF PIPE

Why is Bad?

1. Pipes are not placed properly, nor covered with stronger material.
2. Pipe should be covered with stronger material to prevent damage (i.e. passing vehicle).
3. Connections shoudl be firmed and sturdy to prevent leakages.
4. COntinous exposed on sunlight will damage the pipe.

What is the Treatment?

1. Plased the pipe underground ((min. 50 cm).
2. Further protection to sunlight is not needed if pipe is placed underground.
3. Use proper fitting to prevent overstressed.
4. Place the pipe horizontally.

PIPING

Why is Bad?

1. The connection will be stretched and leak the water.
2. There is no bonding between the connection and fail the joints with leakage.

What is the Treatment?

1. Place the joint with glue and proper fitting.
2. Clamp and hold the pipe firmly.
3. Check the connection between fitting and pipes.

PIPING - STACKS

Why is Good?

1. The stack is arranged properly on the wall. It also fixed with proper clamps.
2. Simple Layout and neat.
3. Distribution line will be traceable and easy for inspections.

Alternatives

The stacks may also be arranged based on distribution scheme or simpler variation.

PIPING - EQUIPMENTS

Why is Good?

Cover is hosted firmly and protected from external risks which may damage the pipe.

Alternatives

Place a steel cover and locked to protect it from damage.

PIPING PLACEMENT AND CONTROL GAUGE

Why is Bad?

1. Ppes and the gauge is placed next to road which highly risks (i.e. passing vehicle).
2. The gauge is opened.
3. PIpe is not protected from sunlight.
4. Unsupported pipes.

What is the Treatment?

1. Placed the pipe underground, beside the gully or beneath, and cover with cement (min.10 cm).
2. Control faucets should be 1.5 meter off the streets to be safety during water inspection.

COVER PIPES IN SLOPING AREA

Why is Good?

1. The cover will protect pipes from water and erosion.
2. Steel pipe will protect the distribution in sloping area i.e. river.
3. The pipe is bonded firmly on ground.
4. Uncovered pipe will be easily damaged and required replacement.

Alternatives

1. Diameter of cover pipe is 1.5 x supply pipe.
2. Ideally build pipe bridge but more expensive.

PLACEMENT OF DISTRIBUTION PIPE

Why is Bad?

1. Unprotected pipe from external damage (i.e. passing vehicle).
2. Exposing sunlight will damage the pipe.
3. Unsupported pipes will be easily damage.
4. The bending will course the pressure.

What is the Treatment?

1. Place the pipe underground (min.50 cm).
2. More protection from sunlight in unnecessary.
3. Place the pipe horizintally.

PLACEMENT OF DISTRIBUTION PIPE ON DRAINAGE

Why is Bad?

Pipes are not supported and placed nearly the drainage which risk the pipe i.e. leakage and damage.

What is the Treatment?

1. Place the pipes underground and shield with concrete mix (min.10 cm).
2. Regular maintenance to inspect the waterflow.

PLACEMENT IN HILL AREA

Why is Bad?

1. Pipe is unsupported and passing the slopes.
2. Bended pipes will leak the connections.
3. Highly risks for broken and overpressures.

What is the Treatment?

1. Place with structure, i.e. bamboo, attach and compact the pipe and bamboo together.
2. Place the bamboo every 1 meter, place a solid ground on trees.

PIPING PLACEMENT

Why is Bad?

1. Place unhorizontally, uncovered and inconsistent.
2. Minor protection from mechanical failure.
3. Exposed water temperature.

What is the Treatment?

1. Placed the pipe underground, min 50 cm.
2. Placed the pipe horizontally.
3. Avoid extreme sloping to maintain the safe pressure.

PIPING PLACEMENT

Why is Good?

1. Placed horizontally to reduce overpressure or underpressure.
2. Placed underground properly and protected from sunlight.

Alternatives

Ensure the pipe is placed min. 50 cm underground.

PIPING PLACEMENT

Why is Bad?

Connections will fail due to overbending pipe. In every segments of connection, pipe is not fitted on wall or sturdy area.

What is the Treatment?

1. Placed the pipe with clamps or placed underground.
2. Periodically check the fitting and connections to prevent over leakage.
3. Protect the pipe from direct sunlight.

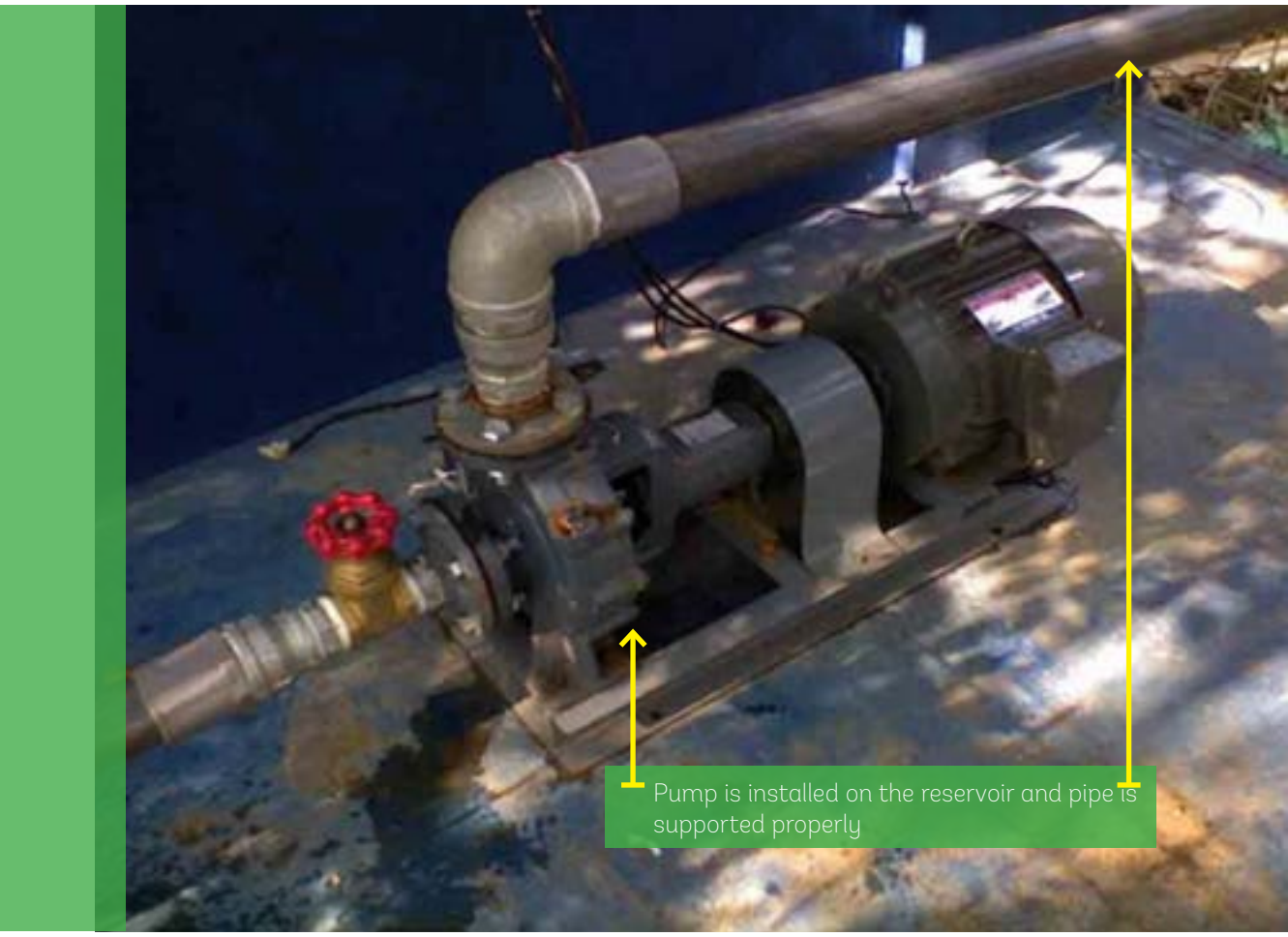
PIPE BRIDGE - OVER RIVER

Why is Bad?

1. The crossing pipe is not supported properly with firm structures.
2. PIpe will be risked to external damage.
3. The connection will be easily tipped-off.

What is the Treatment?

1. Placed 2 bamboo sticks, joint and attached on the top of pipe.
2. Bind the pipe with bamboo, every 1 meter.
3. Place a solid structure to stand the structure on river sides.
4. Use the right fittings beside glue or masking tape.



PIPING AND PUMPS

Why is Good?

1. Pipe is connected to pumps horizontally to minimize overpressure inside the pipe.
2. Overpressure will damage the pipe.

Alternatives

1. Supports, with bricks or clamp, and placed the pipe with bended connection.
2. The bended connection will reduce more pressure inside the pipe.

FAUCETS

Why is Bad?

1. Faucets is opened and only plugged with plastic sheet to stop the flow.
2. There is no other faucets installed, which dripping water created puddles around the tank.

What is the Treatment?

Install permanent faucets and stop gauge if needed.

WATER TANK - CONSTRUCTION PANELS

Why is Good?

The use of panels during construction is important to maintain the structure form and its quality.

Alternatives

Panel for water tank should be adjusted with design and availability of local material ie. wood or abmboo.

WATER TANK - WATER DISTRIBUTION

Why is Bad?

1. Pipes on tank wall is highly risk to damage the tank and leaks the water.
2. Unsupported pipe is easily damage or broken.

What is the Treatment?

1. Place a collecting pipe to host the distribution pipes.
2. Place the main pipe underground.
3. Mark the distribution pipe to ease inspection on leaks and damages.

FLOOR DRAINAGE

Why is Bad?

1. The overflow is not spilled to drainage.
2. Water is flowing everywhere.
3. There is no drainage near the tank.
4. Pooled water will be best spot for mosquito.

What is the Treatment?

1. The excess water must be directed to drainage.
2. Patch the floor to drainage.
3. Regularly maintain the drainage.

DRAINAGE - WATER TANK

Why is Bad?

1. There is no outlets and drainage near the water tank.
2. Water flow of the tank is directed everywhere and pool the water around the water tank. This is also risk for healthy issue.

What is the Treatment?

1. Place a ditch around the tank (or water resource) and channeled to exit pipe/ drainage.
2. Design or variety of water channel may be simpler and adjusted to demand and local topography.
3. Routine maintenance to inpect the water flow.

WASTEWATER CHANNEL

Why is Good?

The water is flew to drainage channel, not everywhere.

Alternatives

1. Place a ditch around the tank (or water resource) and channeled to exit pipe/ drainage.
2. Design or variety of water channel may be simpler and adjusted to demand and local topography.
3. Routine maintenance to inpect the water flow.

DRAINAGE - WATER TANK

Why is Good?

1. The sloping is good to direct the wastewater into lowest point and tunneled into drainage.
2. Wastewater is flew directly into drainage, not everywhere.

Alternatives

1. Design and variety of drainage channel may vary to local condition and the topography.
2. Routine maintenance to inpect the water flow.

SANITATION

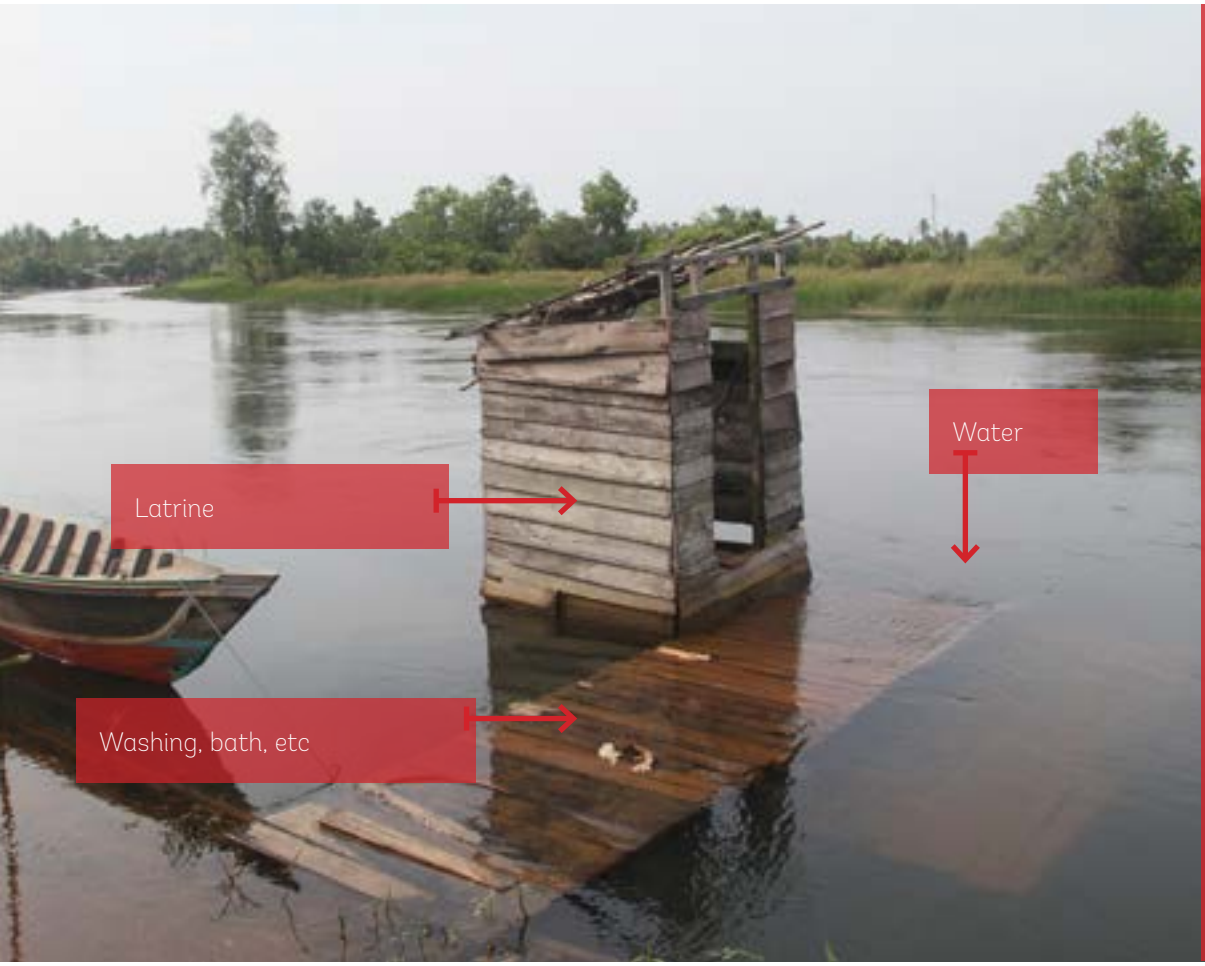
ECOFRIENDLY BIOFILTER SEPTICTANK

Why is Good?

1. The biofilter septictank is made of fibre, strong and durable, anti-corrosive.
2. Installing the biofilter is simple and easy, directly used after connection, unlike the conventional septictank.
3. Not affect the groundwater becuase this septictank is free absorption.
4. This biofilter septictank use media cell and bacteria to decompose solid wate into liquid material and filtrated as clear and safe waste to be disposed without pollution.

Alternatives

The capacity of biofilter septictank is adjustable to required demands.



PUBLIC LATRINE

Why is Bad?

1. This latrine is not equipped with closet, disposal outlet, water.
2. The waste is disposed on the river, will affect sorroundigs and highly risk in healthy issue.
3. The wooden floor and open to sunlight is made the place not hygienic.

What is the Treatment?

Build a public toilet, with proper equipment and septictank, with distance from river aournd 3 meters.

TRADITIONAL TOILET

Why is Bad?

1. This building and the rooms is made of plywood without proper structure.
2. The septictank is a hole sized 50x50 cm and depth of 60cm. This septictank is very dangerous for healthy issue, soil pollution and environment.

What is the Treatment?

1. Build a public toilet, with proper equipment and septictank.
2. The construction should be concreted and placed with bricked wall.

FACILITIES OF *MCK++ [BATHING, WASHING AND TOILET]*

Why is Good?

1. *MCK* is constructed with bricked wall, and reinforced foundation, with proper public washing area.
2. *MCK* also has a hand washing facilities.

Alternatives

1. Layout and deign may vary.
2. Maintain the cleanliness.

CONVENTIONAL SEPTICTANK

Why is Bad?

1. This septictank does not have absoprbing tank, disposing outlets for water and gas.
2. The waste will pollute the soil and surrounding environment.
3. There is no septictank cover which spread the smell and healthy risks.

What is the Treatment?

1. There should be absorbing tank placed in this conventional septictank, covered with concrete wall.
2. There shold be permanent cover of concrete slab and the ventilation pipe and cleaning access.

CONVENTIONAL SEPTICTANK

Why is Good?

1. Relatively cheaper with simpler construction, and long lifespan or services.
2. There is cleaning access for easy maintenance or sucking the waste.
3. There is ventilation for releasing gas.

Alternatives

1. Layout/design may vary to local condition.
2. To prevent over logging capacity, pay attention on piping slope (min 2%), and diameter of outlets min. 4 inch, according to domestic demands (i.e.: a family of four people, septictank sized 1,5mx1,5mx2m. Absorbing tank sized 1mx1mx2m. More resident means bigger septictank size) with concrete structure and water resistants.

CONVENTIONAL PUBLIC TOILETS

Why is Good?

MCK is equipped with bathrooms (separate entry for male and female), with communal septictank.

Alternatives

1. Design of bathrooms may vary.
2. Mantain the cleanliness (responsiblity of users).

ABSENCE OF VENTILATION ON SEPTICTANK

Why is Bad?

Manhole and control box is important to inspect the condition of septictank.

What is the Treatment?

1. Build manhole and disposal access to clean the septictank regularly.
2. Disposal access will be adjusted to regular euipment in sucking or cleaning the septictank.

SEPTICTANK: LEAKS AND OVERCAPACITY

Why is Bad?
Leak in septictank and overcapacity that spilled the waste outside the tank.

What is the Treatment?
Routine maintenance to inspect the septictank.

DAMAGE VENTILATION PIPE

Why is Bad?

Ventilation pipe is damage and over spilled the liquid waste outside the tank, spread the smeel to surrounding area.

What is the Treatment?

1. Replace the ventilation pipe. Size and deisgn to be adjusted.
2. Routine maintenance to inspect the tank (monthly).

ECOFRIENDLY COMMUNAL SEPTICTANK

Why is Good?

1. This communal septictank is not only collecting solidwaste, but also domestic liquid waste.
2. This septictank model is highly effective for slum area.
3. This communal septictank is successful in imprving quality of dispose liquid waste, decerase the pollutan and safer for environment.

Alternatives?

Layout/design of communal septictank may vary to applicable technology and local condition.

SANITATION PARK (*SANITA*)

Why is Good?

1. This park is design with integrated ecosystem approach, using waste as source of nutrient for imprving quality of soil and other vegetations.
2. Use the ability of vegetation to decompose and reduce pollutant material to produce safer waste and preventing pollution of soil, water and environment.
3. SANITA recycle the waste into good-nutrient for vegetation.
4. Create harmony in surrounding environment;

Alternatives

Layout/design of SANITA park may vary to available space and local condition.

OUTLETS

Why is Bad?

1. This sewerage is contain patogen bacteria, and should be treated properly prior dispose to open drainage.

What is the Treatment?

1. The disposal pipe should be direct to septictank or vegetation.
2. Septictank and other means of absorbing tanks will decompose the waste and improve the soil condition.

GPOBA

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