# MALAYSIA GEOSPATIAL FORUM

# SABAH INTERNATIONAL SURVEYORS CONGRESS 2014

**11 -12 MARCH 2014**
**KOTA KINABALU, SABAH,MALAYSIA**

# FOSTERING QUANTITY SURVEYORS IN CIVIL ENGINEERING WORKS


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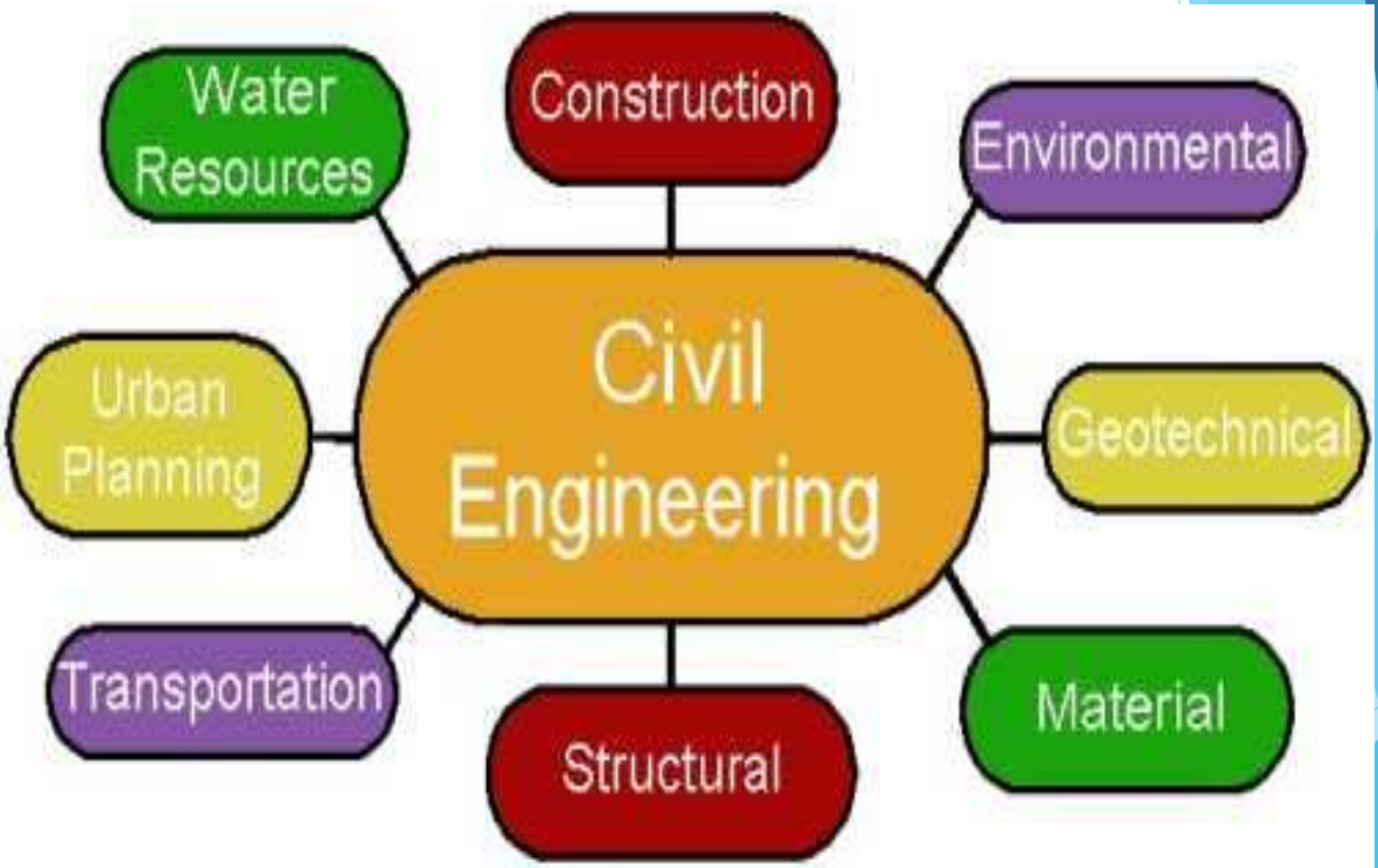
# WHAT IS CIVIL ENGINEERING WORKS.~

# CIVIL ENGINEERING WORKS :

- planning, design, construction, maintenance and management of physical infrastructure networks.
- Fixed structures, public works related to earth, water or energy and their processes.
- power plants, bridges, roads, railways, structures, water supply, irrigation, the natural environment, sewer, flood control, transportation and traffic.


Water Resources
Construction
Environmental
Civil Engineering
Urban Planning
Geotechnical
Transportation
Structural
Material

# CHALLENGES:

- Knowledge in civil engineering
- Terminologies
- Special requirements
- Alternative designs & alternative materials
- Value engineering exercises
- Latest technology
- Identify major costs:
  - Controllable
  - uncontrollable
- Unit costs and all-in cost
- Elemental cost analysis

# HIGHWAYS

# HIGHWAYS

- A public road ie a major road connecting two or more destinations.
- Often named and numbered eg E2 (PLUS)

# NORMAL HIGHWAY



# ELEVATED HIGHWAY

# SINGLE CARRIAGEWAY

one, two or more lanes arranged within a single carriageway with no median (divider) to separate opposing flows of traffic.

**2 lanes**

**3 lanes**

**4 lanes**

# DUAL CARRIAGEWAY

**For traffic travelling in opposite directions separated by a central reservation. Roads with two or more carriageways which are designed to higher standards with controlled access.**

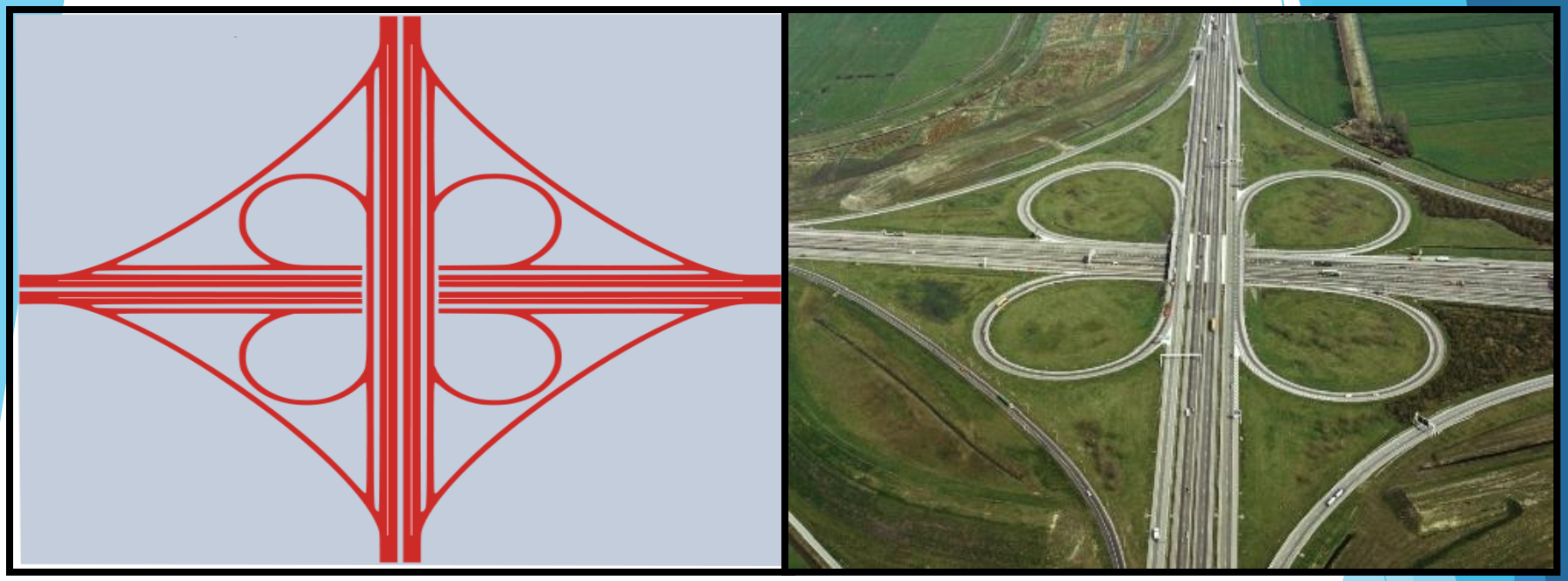
- 1 lane in each direction.
- 2 lanes in each direction.
- 3 lanes in each direction.
- 4 lanes in each direction.

# ROAD INTERCHANGES

- A road junction that uses grade separation, and one or more ramps, to permit traffic to pass through the junction without crossing any other traffic stream.

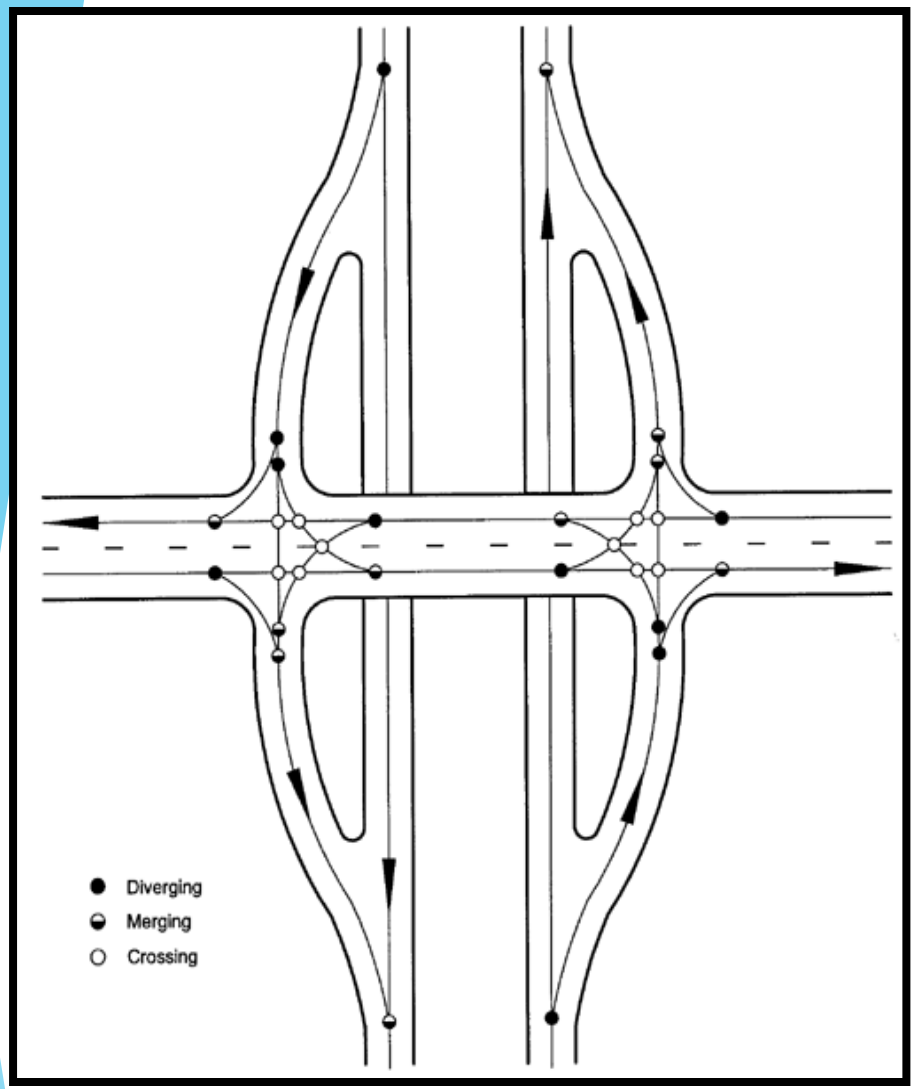
- Interchanges are used when at least one of the roads is a limited-access divided highway (eg expressway or freeway)

# TYPES OF INTERCHANGES



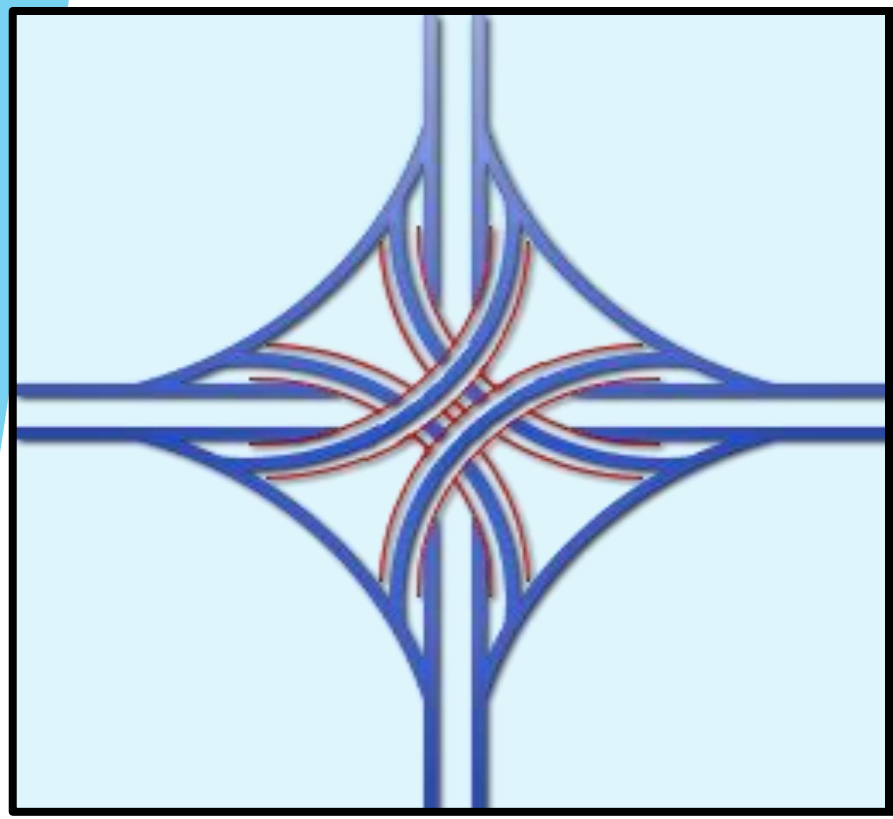
**Cloverleaf Interchange**

# TYPES OF INTERCHANGES



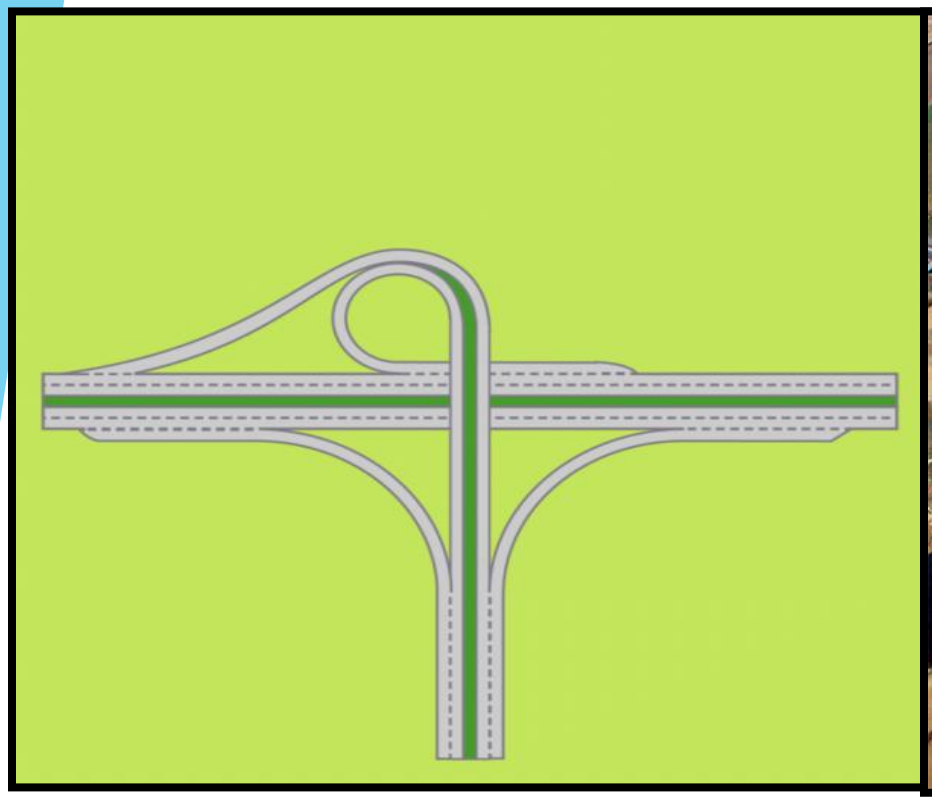

**Diamond Interchange**

# TYPES OF INTERCHANGES



**Stack Interchange**

# TYPES OF INTERCHANGES



**Trumpet Interchange**

# CHALLENGES IN HIGHWAY PROJECTS

- Working on a “life” highway
- Extra costs on :-
  - Preliminary works
  - Temporary works
  - Relocation of existing services
  - Temporary road diversion
  - Overtime works / odd hours
  - Risks to road users – extra safety measures

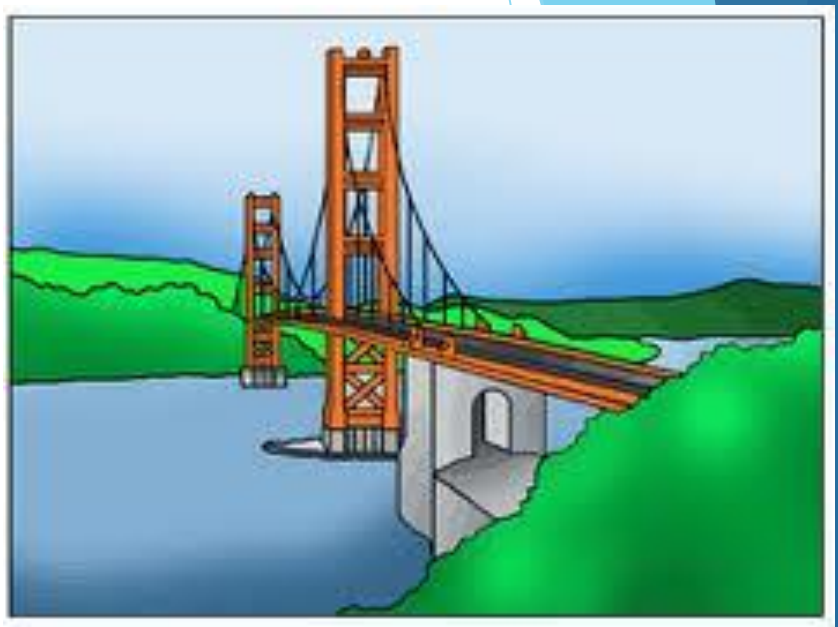
# BRIDGE

# BRIDGE

- An overpass that allows one transportation route, such as a highway or railroad line, to cross over another without traffic interference between the two routes
- To cross over river, straits, lake, deep valley, ravine, land

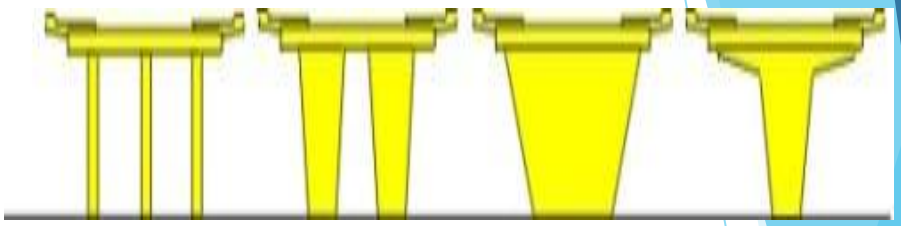
# TYPES OF BRIDGE

1. Beam Bridge
   - Girder Bridge
   - Truss Bridge
   - Rigid Frame Bridge
2. Arch Bridge
3. Cantilevered Bridge
4. Suspension Bridge
5. Cable-Stayed Bridge



# COMPONENTS OF A BRIDGE

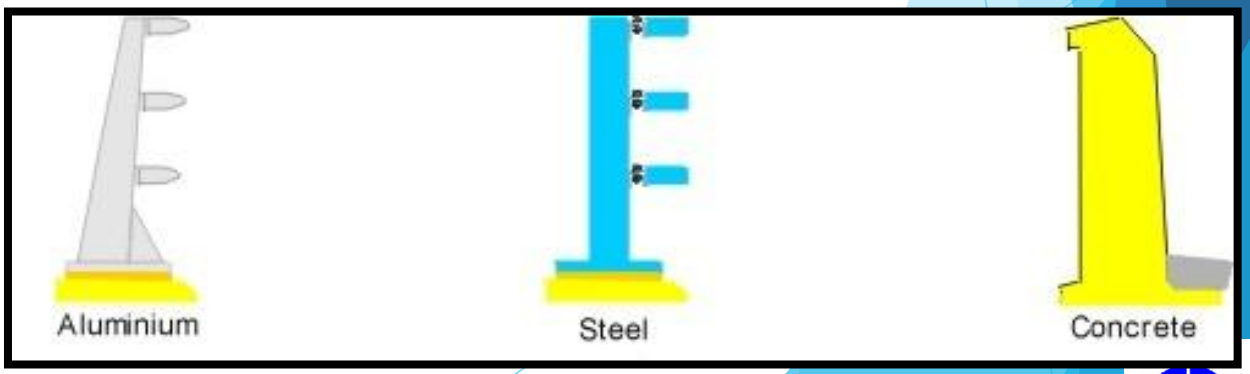
- Pier & Foundation
- Abutment
- Tower
- Cable
- Anchor
- Hanger
- Deck
- Bearing
- Parapet wall



Pier Designs

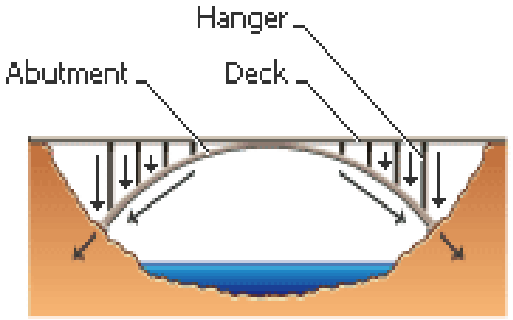
Towers

Cable & Anchorage

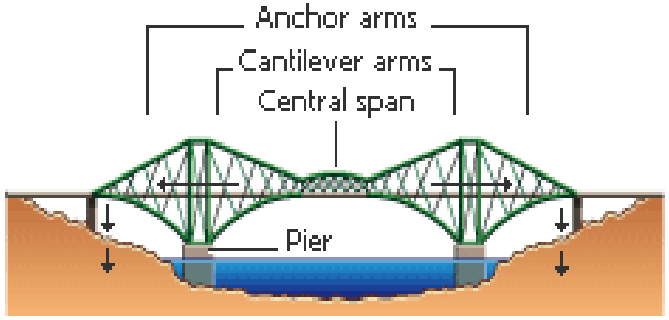



Parapet Walls

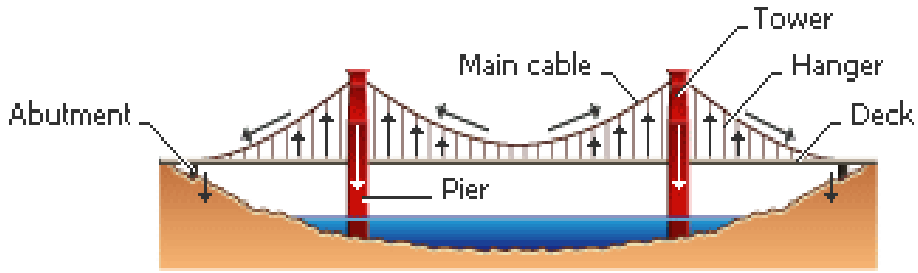
# Main Components and Load Distribution of a Bridge



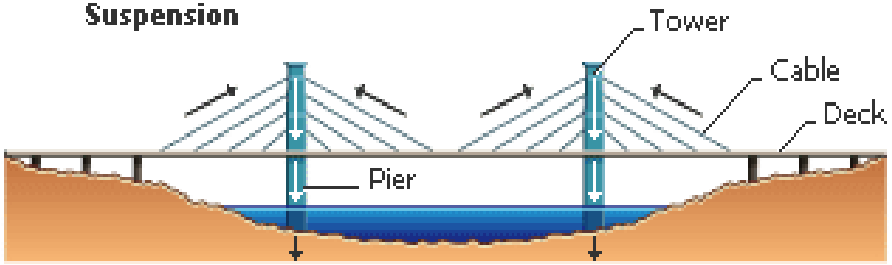

Concrete arch




Cantilever



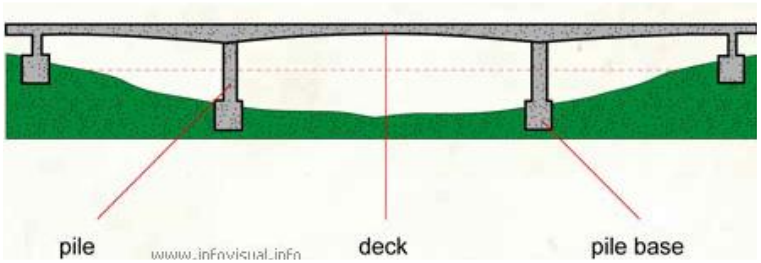

Suspension



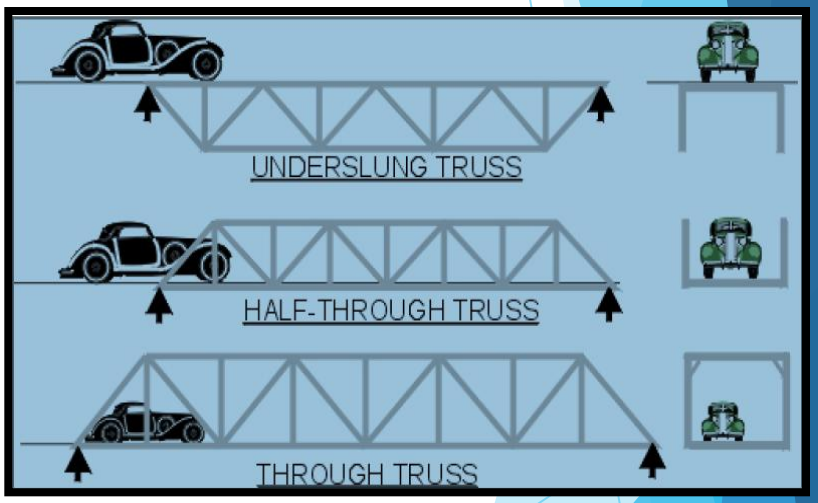

Cable-stayed

# Beam Bridge

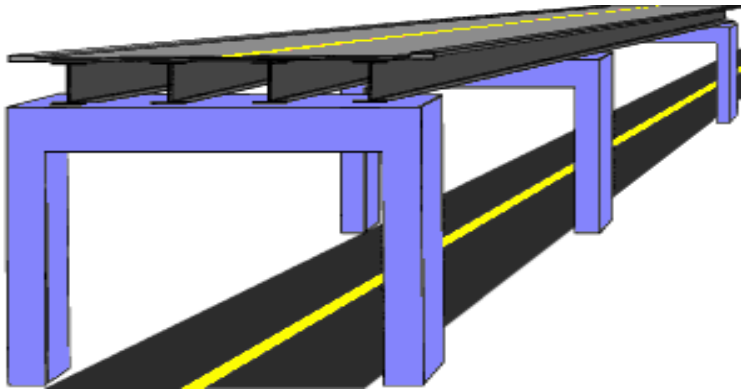
## Girder Bridge




## Truss Bridge



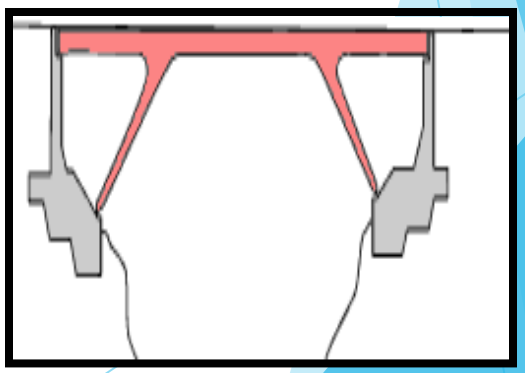

## Rigid Frame Bridge



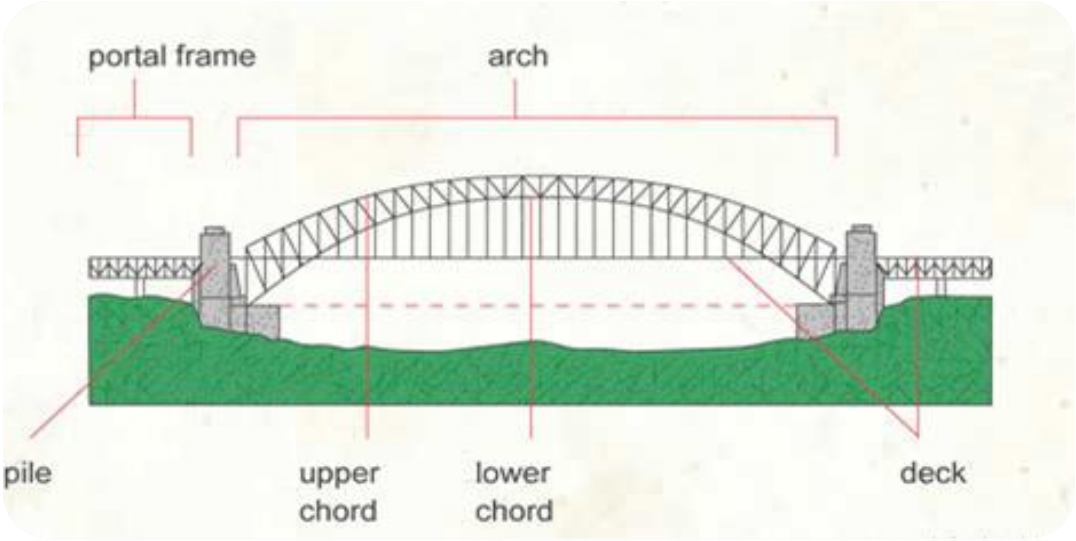
Girder Bridge

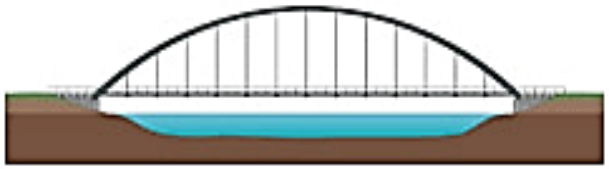
Steel Truss Bridge

Rigid Frame Bridge

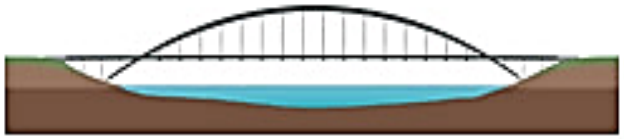


# Arch Bridge

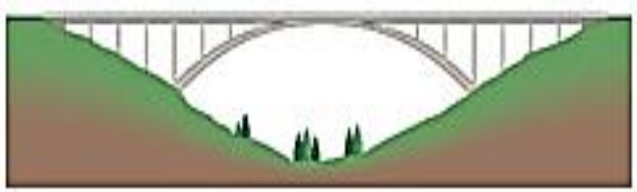


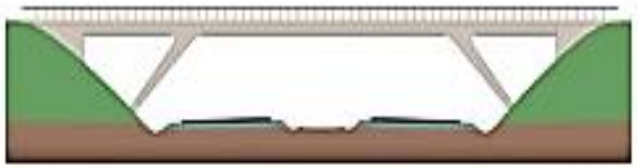
through arch bridge



half-through arch bridge



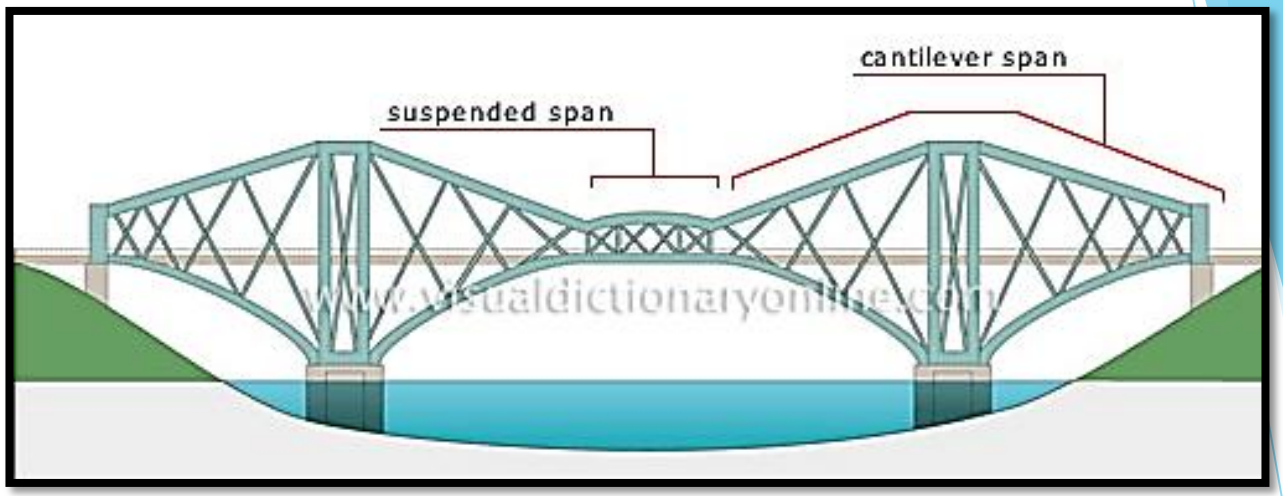
deck arch bridge



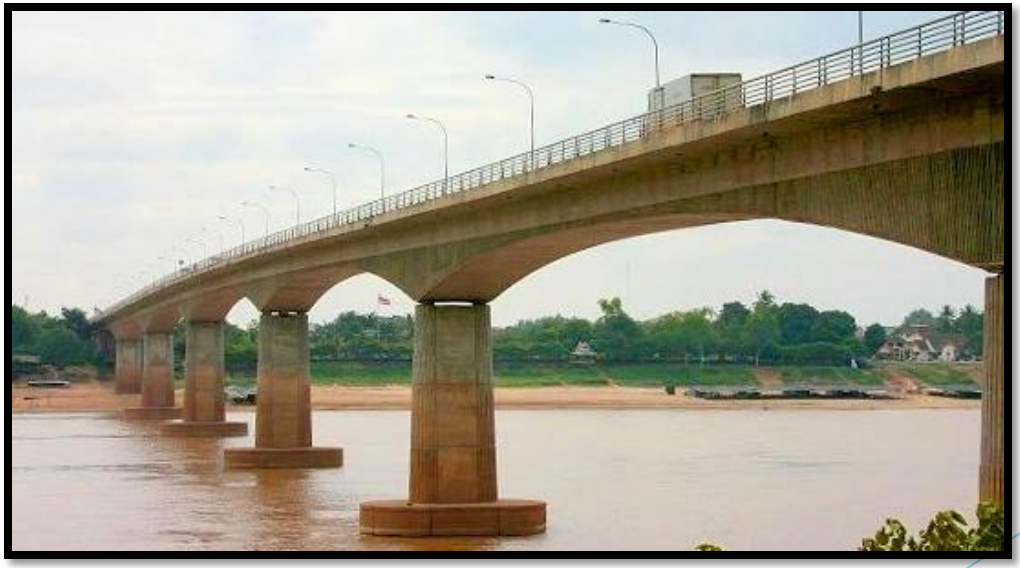
portal bridge

# Arch Bridge


# Cantilevered Bridge

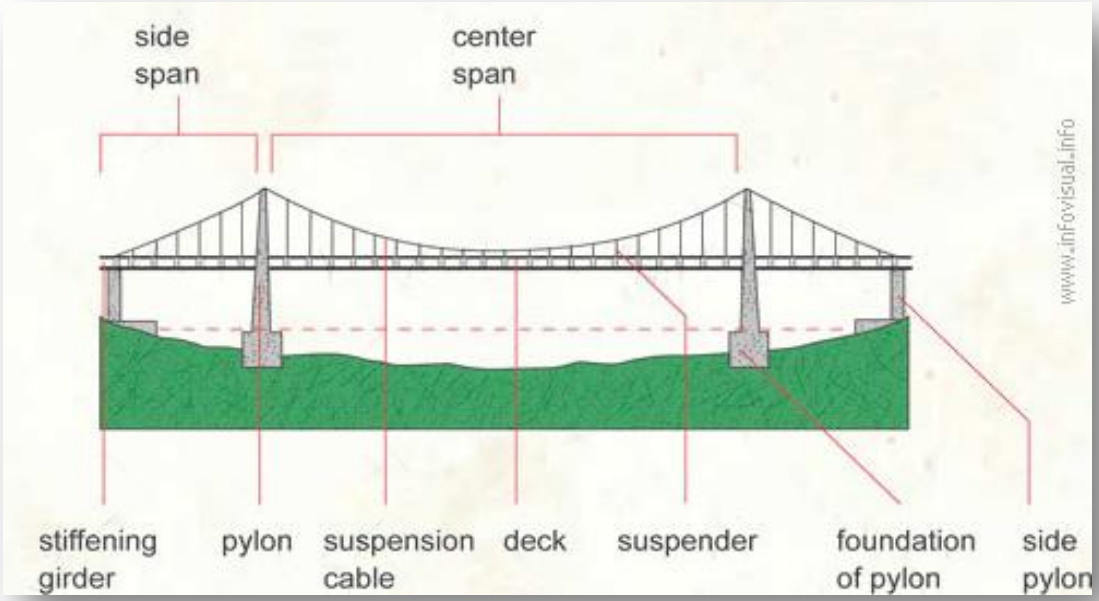



**Double-cantilevered Box Girder Bridge**



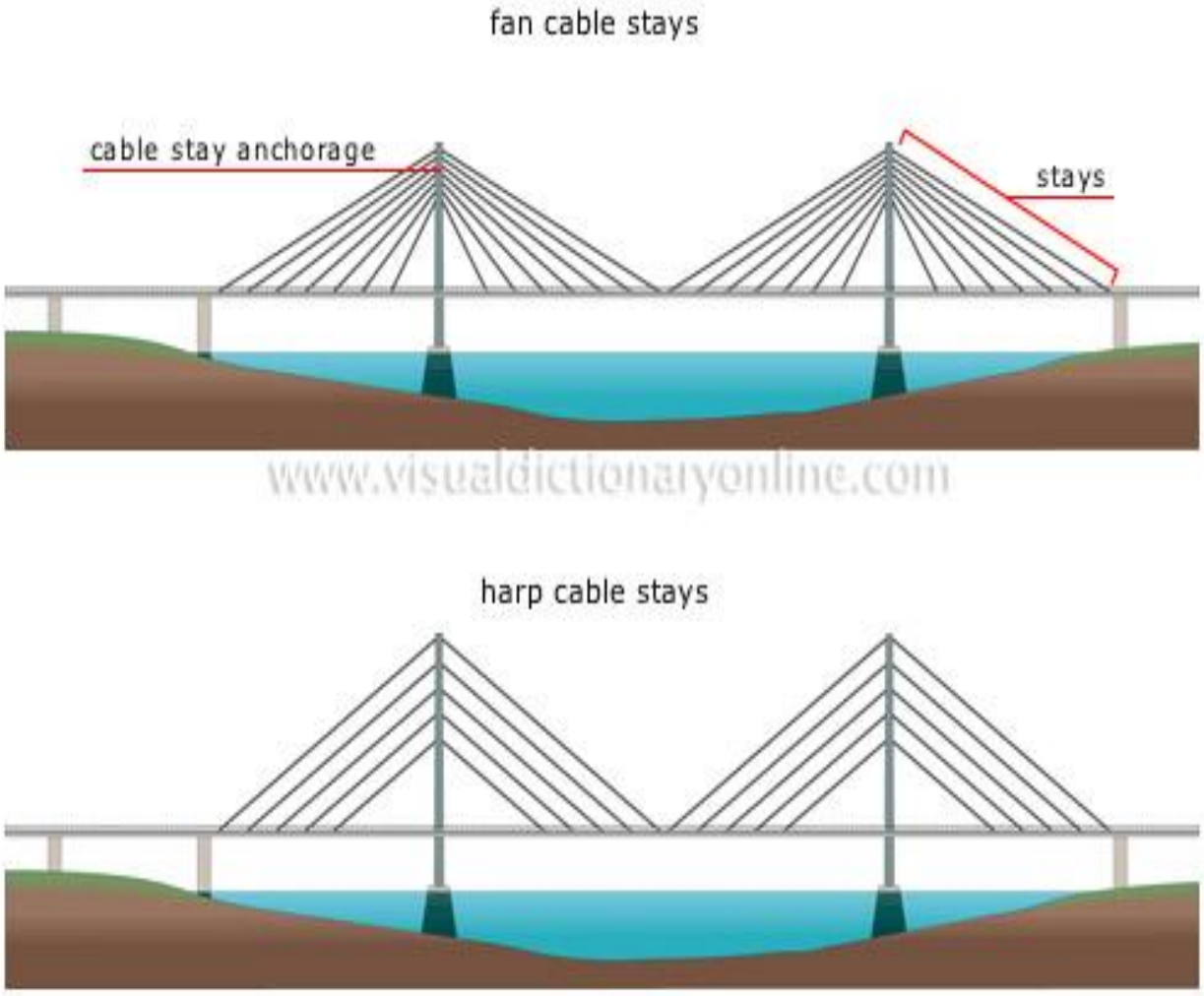
SG. SANTUBONG BRIDGE KUCHING, SARAWAK

# Suspension Bridge

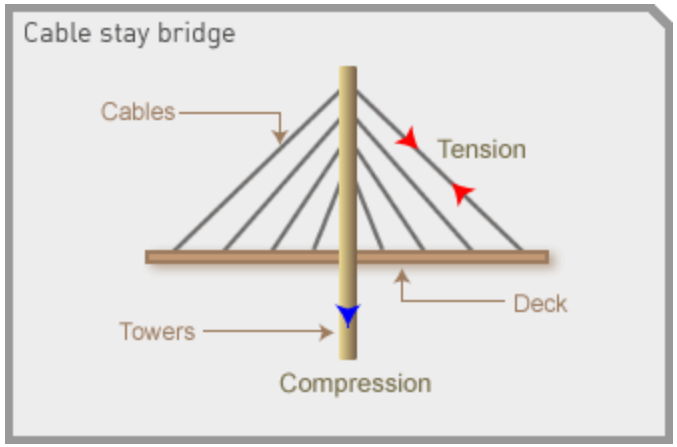



**Putrajaya Monorail Suspension Bridge**

# Cable-Stayed Bridge



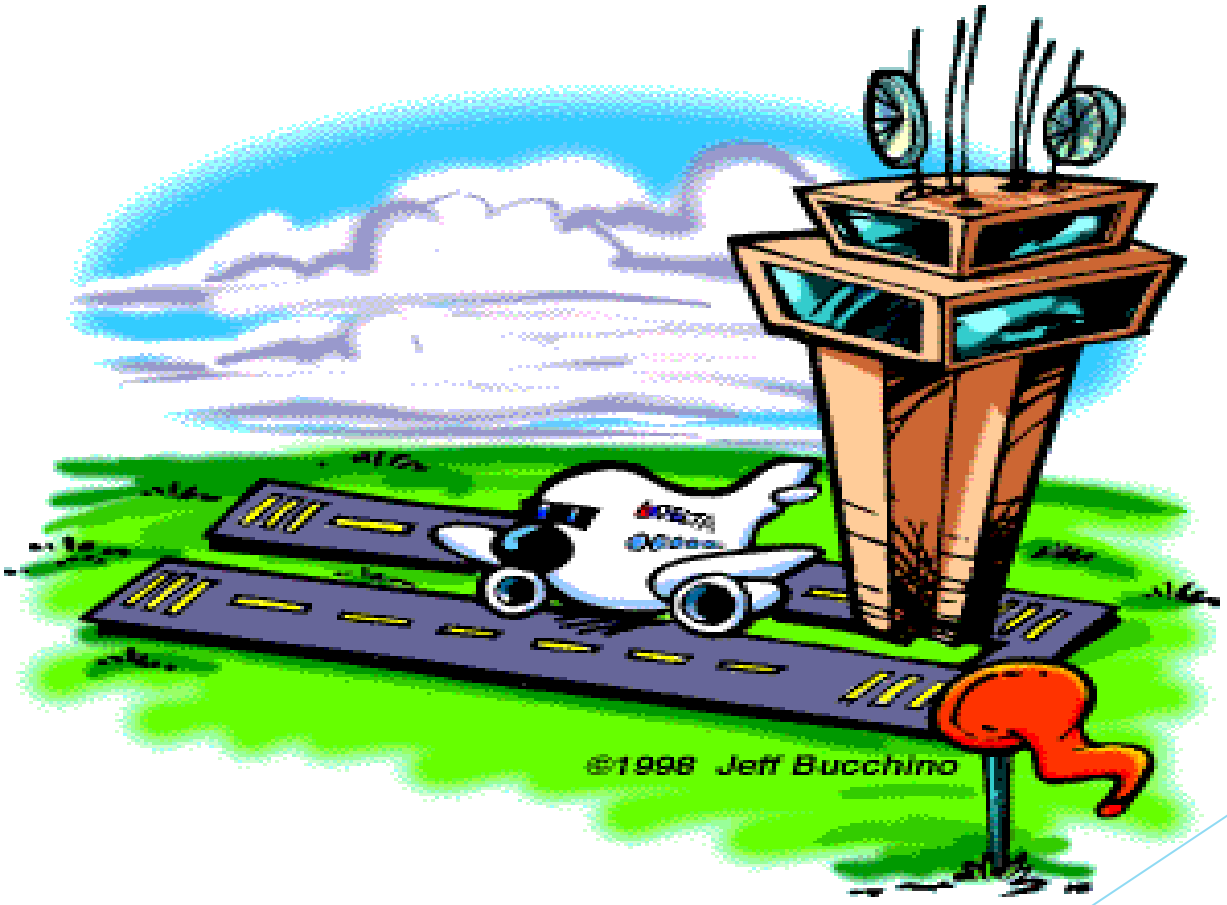
# Cable-Stayed Bridge (cont'd)




**Seri Wawasan Bridge, Putrajaya.**

**Sultan Abdul Halim Mu'adzam Shah Bridge (Second Penang Bridge)**

# AIRPORTS



# AIRPORT CLASSIFICATIONS

- Based on “highest requirement” of an aircraft that can use the airport.
- In layman terms, the “biggest” aircraft that can land at the airport.

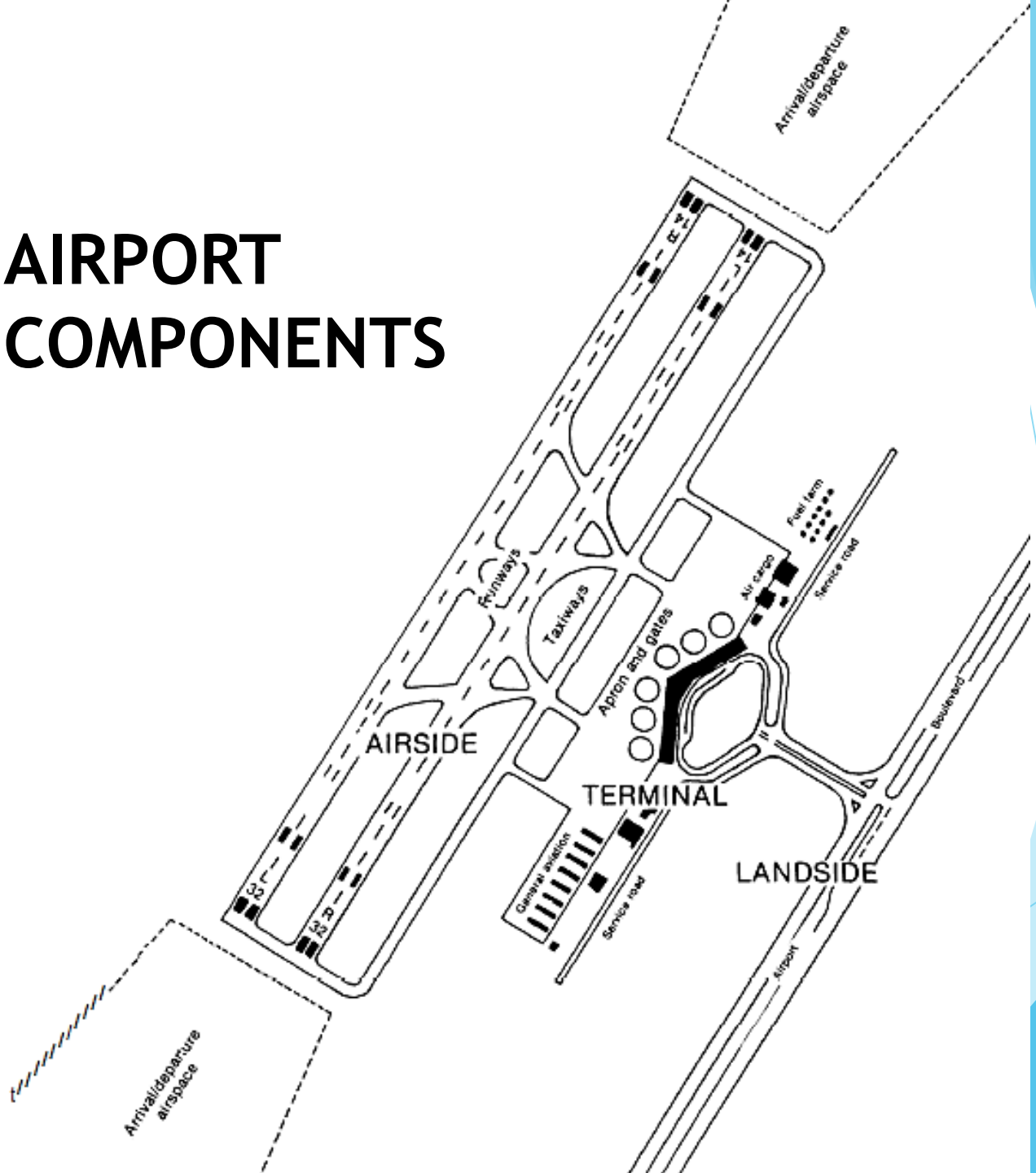
# AERODROME CODE REFERENCE

Table 1-1. Aerodrome reference code
(see 1.3.2 to 1.3.4)

| Code element 1 | | Code element 2 | | |
|---|---|---|---|---|
| Code number (1) | Aeroplane reference field length (2) | Code letter (3) | Wing span (4) | Outer main gear wheel span[a] (5) |
| 1 | Less than 800 m | A | Up to but not including 15 m | Up to but not including 4.5 m |
| 2 | 800 m up to but not including 1 200 m | B | 15 m up to but not including 24 m | 4.5 m up to but not including 6 m |
| 3 | 1 200 m up to but not including 1 800 m | C | 24 m up to but not including 36 m | 6 m up to but not including 9 m |
| 4 | 1 800 m and over | D | 36 m up to but not including 52 m | 9 m up to but not including 14 m |
| | | E | 52 m up to but not including 65 m | 9 m up to but not including 14 m |
| | | F | 65m up to but not including 80m | 14m up to but not including 16m |

a. Distance between the outside edges of the main gear wheels.

# AIRPORT COMPONENTS



# Main components :-

- LANDSIDE
  - **Main Terminal Building (MTB)**
    - to serve passengers and facilities
  - **Airport Traffic Control Tower (ATC)**
    - Air controllers responsible for the separation and efficient movement of aircraft and vehicles.
  - **Meteorological Department**
    - meteorological service for aircraft flying in and out

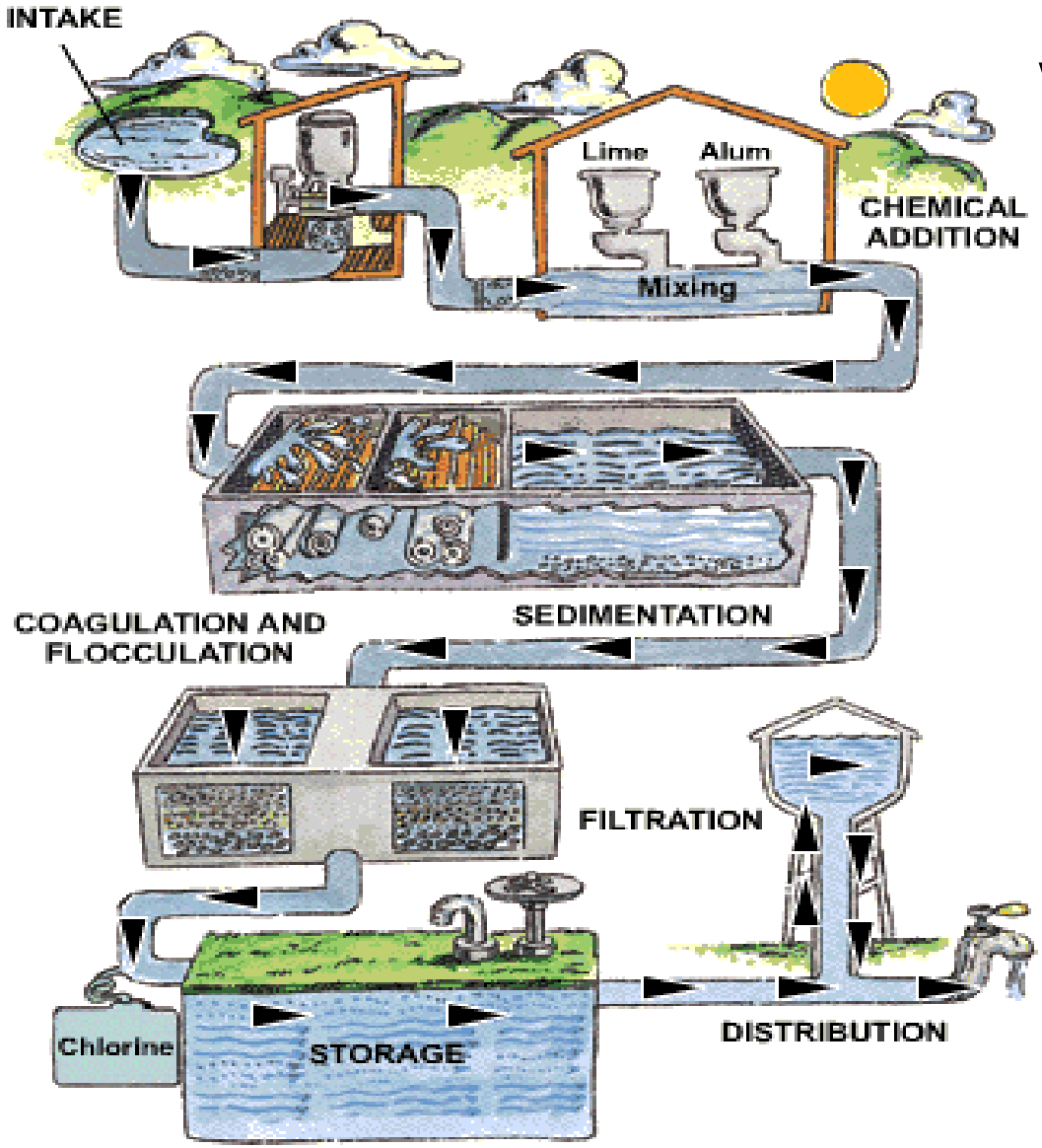
# **Main components** (cont'd):-

- **AIRSIDE** - where aircrafts operate
  - **Runway**
    - Aircraft take off and land.
  - **Apron**
    - Passengers embark and debark and where aircraft are parked
  - **Taxiway**
    - Movement between runway & terminal
  - **Hangar (MRO)**
    - To hold aircraft in a protective storage

# AIRPORT TERMINOLOGIES

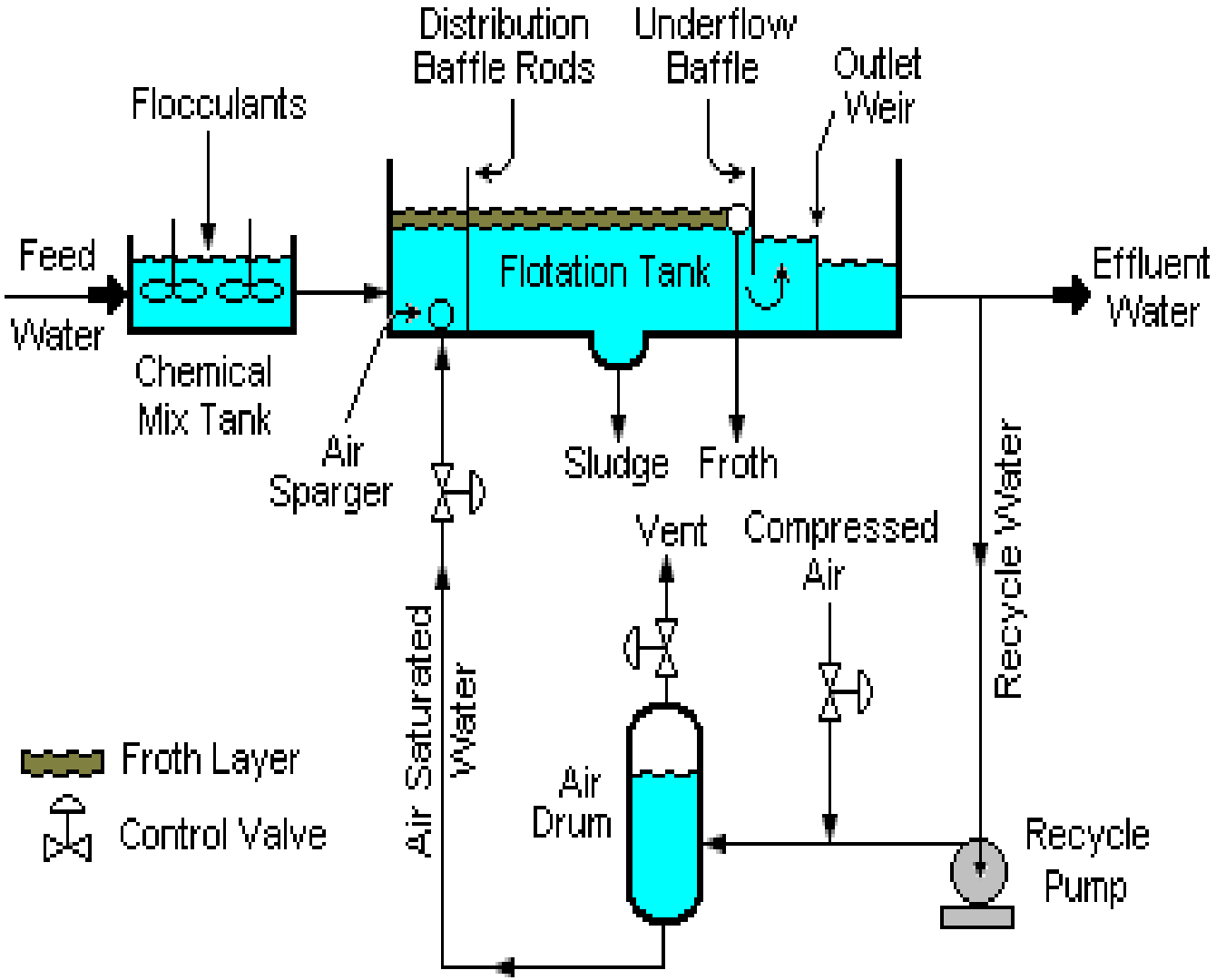
- DCA - Department of Civil Aviation
- Airside – Airfield
- Landside – Surface transportation
- MTB – Main Terminal Building
- ATC – Air Traffic Control
- MRO – Maintenance, Repair & Overhaul (hangar)
- ILS – Instrument Landing System
- FIDS - Flight Information Display System
- BHS – Baggage Handling System

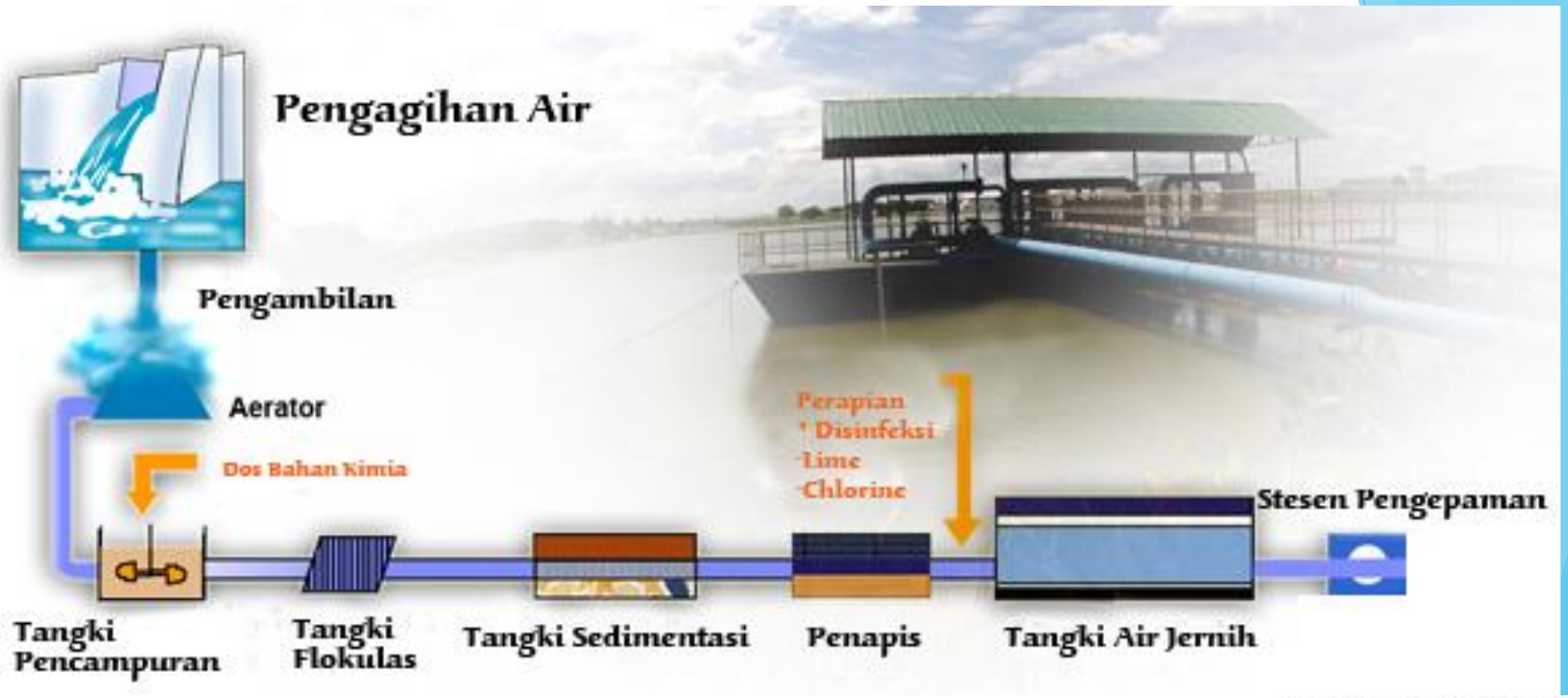
# WATER TREATMENT PLANT




## WATER CYCLE

# Water Treatment Process Flow




Pengagihan Air
Pengambilan
Aerator
Dos Bahan Kimia
Perapian
Disinfeksi
Lime
Chlorine
Stesen Pengepaman
Tangki Pencampuran
Tangki Flokulas
Tangki Sedimentasi
Penapis
Tangki Air Jernih

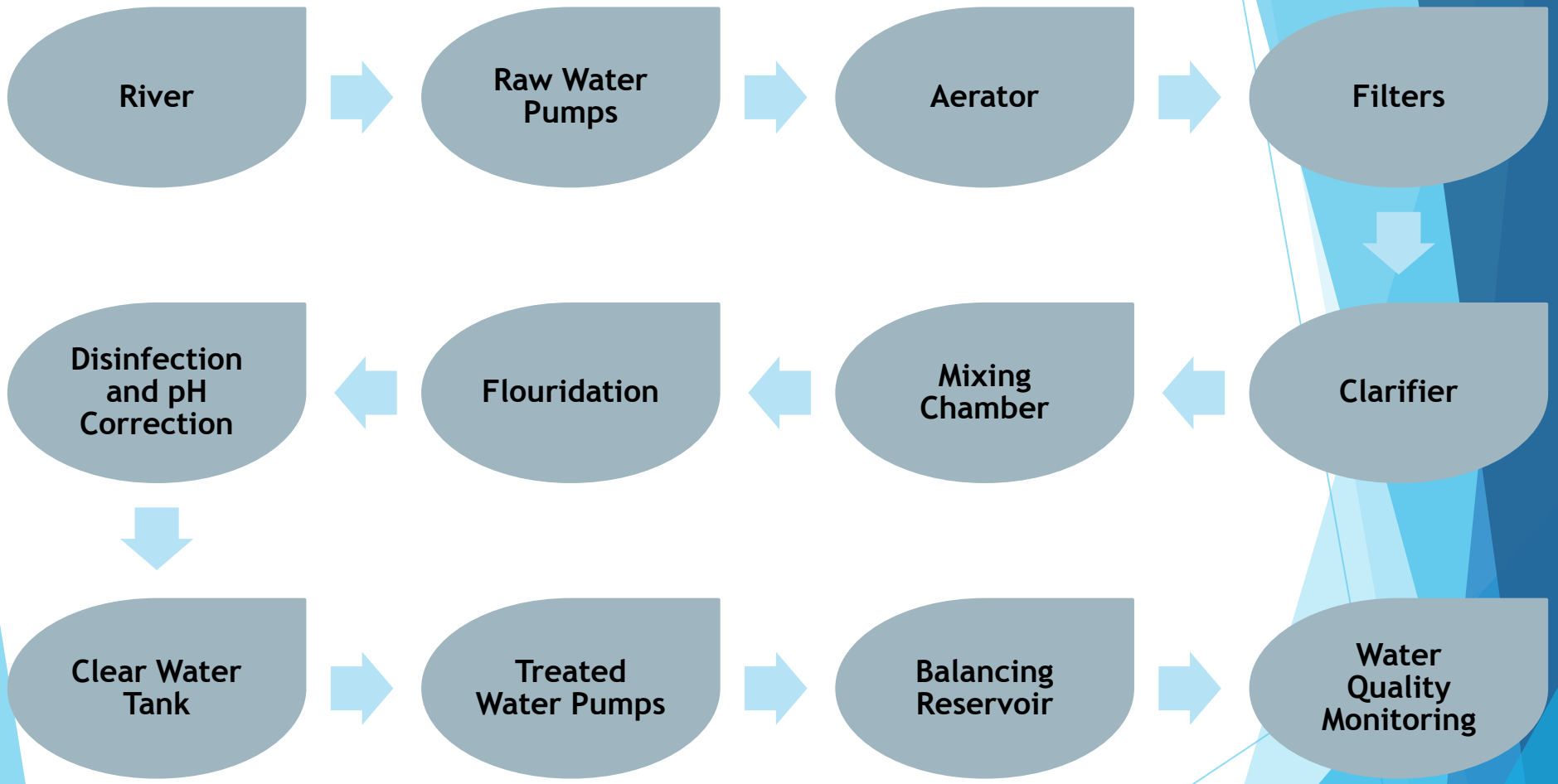

Pengagihan Bekalan Air
Stesyen Pengepaman
Takungan Air
Takungan Air
Tangki Imbangan

# Water Treatment Process

- **Filtration** : Process of removing suspended solids from water by passing the water through a permeable fabric or porous bed of materials.

- **Chlorination** : Adding disinfectants to destroy microorganisms that can cause disease in human. Adding of lime to reduce acidity of water.

# Water Treatment Process



# Water Treatment Process (Cont'd)

**River**

Raw water flows to the raw water pump sump.

**Raw water pumps**

water is pumped to treatment plant via a raw water pipe.

**Aerator**

Create turbulence to achieve dissolved oxygen content of 80% saturation. Pre-lime & primary coagulant, poly aluminium chloride (PACI) are added.

**Filters**

Rapid gravity sand filters - remove fine particles that have not settled in the clarification process. Clarified water is filtered through a sand filter media to trap unsettled particles.

**Clarifiers**

Clarifiers - floc concentration, collection & discharge. Settled water overflows into collection channels for onward flow to the filters.

**Mixing chamber**

**Cont'd**

Flash mixing chamber where a flocculent aid (polyelectrolyte) is added to enhance floc formation for easier removal in the clarification process.

# Water Treatment Process (Cont'd)

Cont'd → **Fluoridation** → **Disinfection & pH correction** → **Clear water tank**

Filtered water collected at filtered water channel & sodium silicofluoride is added, then flows to clear water tank.

Add chlorine for disinfection & tests carried out to ensure treated water free from pathogenic organisms. Hydrated lime is added for pH correction.

Provide sufficient contact time for disinfection & conditioning chemicals to work on the water

**Water quality monitoring**

Treated water quality is tested in lab to ensure water clean & safe for consumption.
An independent external testing lab is also engaged

**Balancing reservoir**

Store treated water is gravitated towards service reservoirs to cater the consumers. Recorded by custody transfer flowmeter

**Treated water pumps**

To pump clean & treated water from balancing reservoir or clear water tank to the water supply distribution agency

# Components of Water Treatment Cycle

- **Dams** - A barrier that impounds water or underground streams. Collect raw water from rivers.
- **Raw water pipes** – Transfer raw water from dams to reservoir.
- **Water treatment plants** – Treat raw water to become potable water.
- **Treated water pipes** – Transfer treated water to reservoir
- **Elevated water tank** – Restore water

# COSTS ANALYSIS OF WATER TREATMENT WORKS

**MILD STEEL CONCRETE LINING PIPE**

| Size of Pipe | Estimated Rate (RM) |
|---|---|
| 500 mm dia. MSCL | 490.00/m |
| 700 mm dia. MSCL | 620.00/m |
| 800 mm dia. MSCL | 690.00/m |
| 1000 mm dia. MSCL | 910.00/m |
| 1200 mm dia. MSCL | 1,180.00/m |

## ELEVATED RESERVOIR

- Rate (RM)/litre = RM 1.00/litre

## RESERVOIR

- Rate (RM)/litre = RM 0.50/litre

# COSTS ANALYSIS OF WATER TREATMENT WORKS

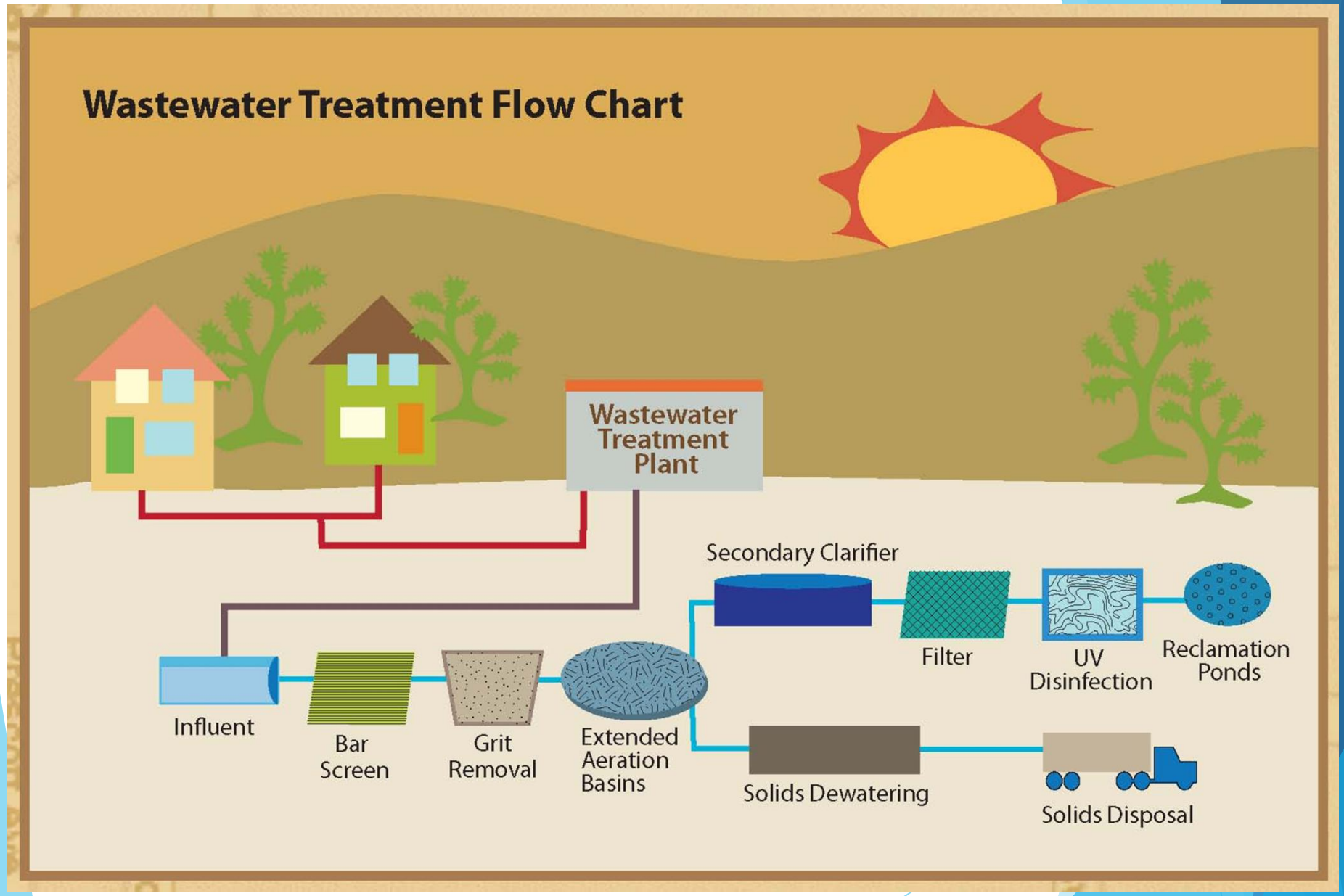
**HOT TAPPING WORKS**

| Size of Pipe | | Estimated Rate (RM) |
|---|---|---|
| 250 | mm dia. MSCL | 6,000.00 /no |
| 300-450 | mm dia. MSCL | 21,000.00/no |
| 400-500 | mm dia. MSCL | 25,000.00/no |
| 700-900 | mm dia. MSCL | 50,000.00/no |
| 800 | mm dia. MSCL | 80,000.00/no |
| 900 | mm dia. MSCL | 100,000.00/no |

**LINE-STOPPING WORK**

| Size of Pipe | | Estimated Rate/LS (RM) |
|---|---|---|
| 700 | dia. mm | 500,000.00 |
| 900 | dia. mm | 600,000.00 |
| 1200 | dia. mm | 1,000,000.00 |

# WASTE WATER MANAGEMENT


Wastewater Treatment Flow Chart
Wastewater Treatment Plant
Secondary Clarifier
Filter
UV Disinfection
Reclamation Ponds
Influent
Bar Screen
Grit Removal
Extended Aeration Basins
Solids Dewatering
Solids Disposal

# Wastewater Treatment Technologies

- Conventional Activated Sludge System (CASS)
- Advance Oxidation Process
- Aerated Lagoon
- Anaerobic Digester
- Sequential Batch Reactor (SBR)
- Anaerobic, Anoxic and Oxic Zone (A2O)
- Multi Step Feed Aeration

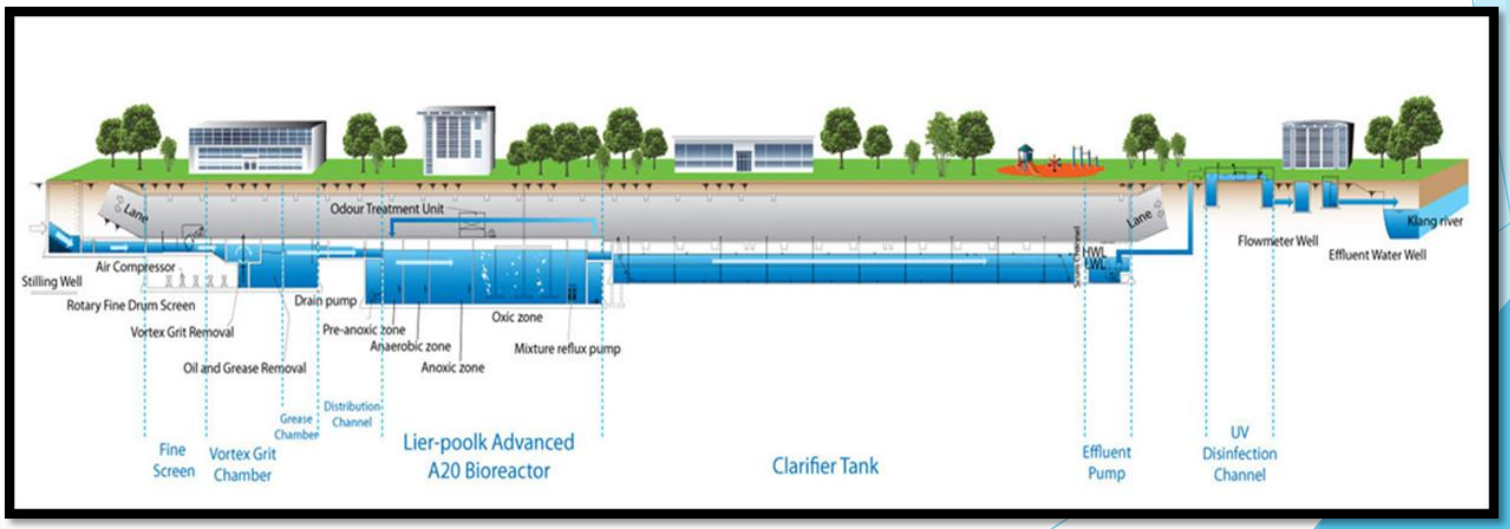
# Comparison of various types of STP in Malaysia

| Sewage Treatment Plant | Treatment Process | PE | Process Plant Footprint | sqm/PE |
|---|---|---|---|---|
| **Existing Pantai 2 STP** | Aerated Lagoon | 566K | 136,600 m2 | 0.24 |
| **Jelutong STP, Penang** | Sequential Batch Reactor (SBR) | 1.2mil | 32,000 m2 | 0.03 |
| **New Pantai 2 STP** | A2O | 1.43 mil | 25,000 m2 | 0.02 |
| **Langat CSTP - Concept Design Stage** | Multi Step Feed Deep Aeration | 995K | | |

# A20 – Anaerobic, Anoxic and Oxic Zone

- A compact treatment facility using **Advanced A2O process + sludge treatment + dewatering facilities.**
- to **replace the existing aerated lagoons**, which will incorporate anaerobic digestion with solid dewatering.

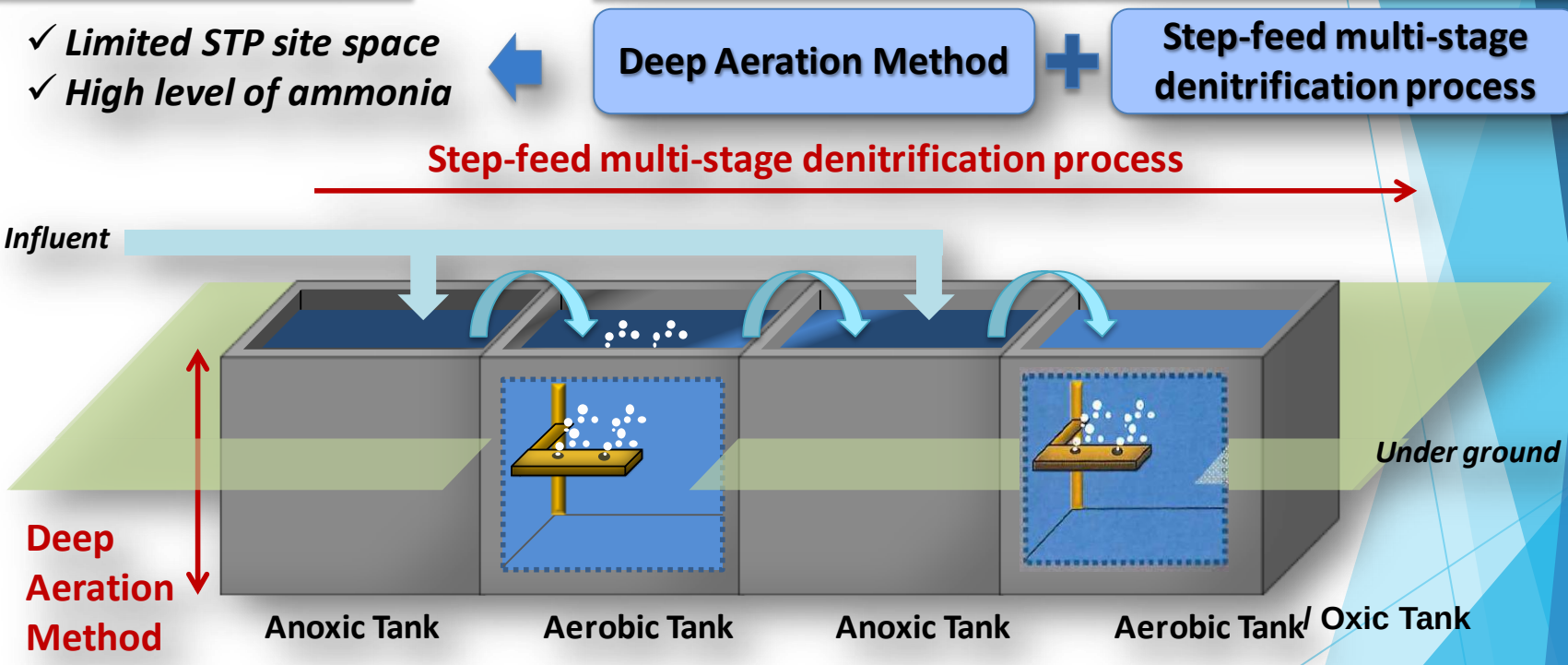
**PANTAI 2 SEWAGE TREATMENT PLANT**



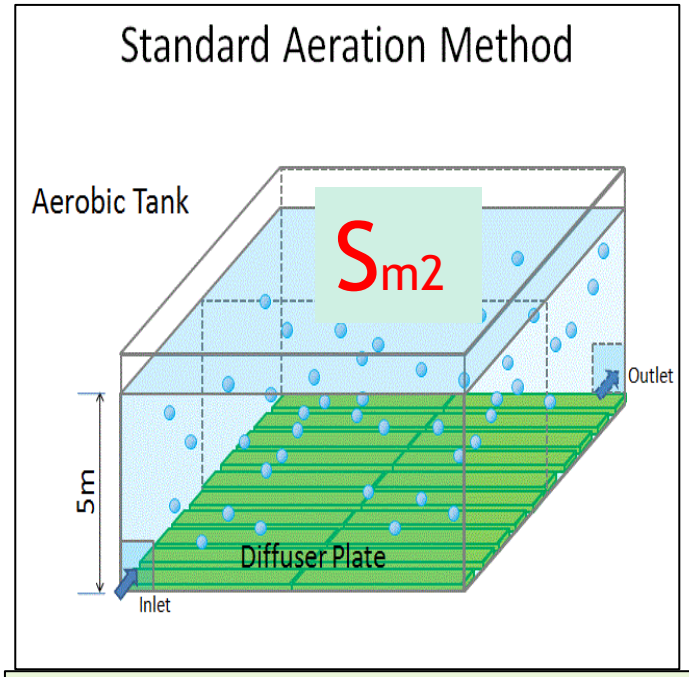
# A20 - Anaerobic, Anoxic and Oxic Zone & Multi Step Feed Deep Aeration

- ✓ *Limited STP site space*
- ✓ *High level of ammonia*

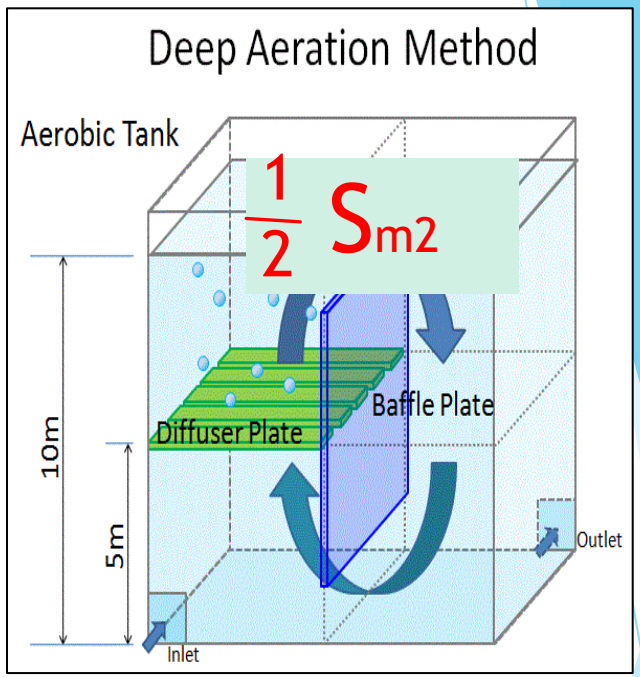
**Deep Aeration Method** + **Step-feed multi-stage denitrification process**



# Deep Aeration Method



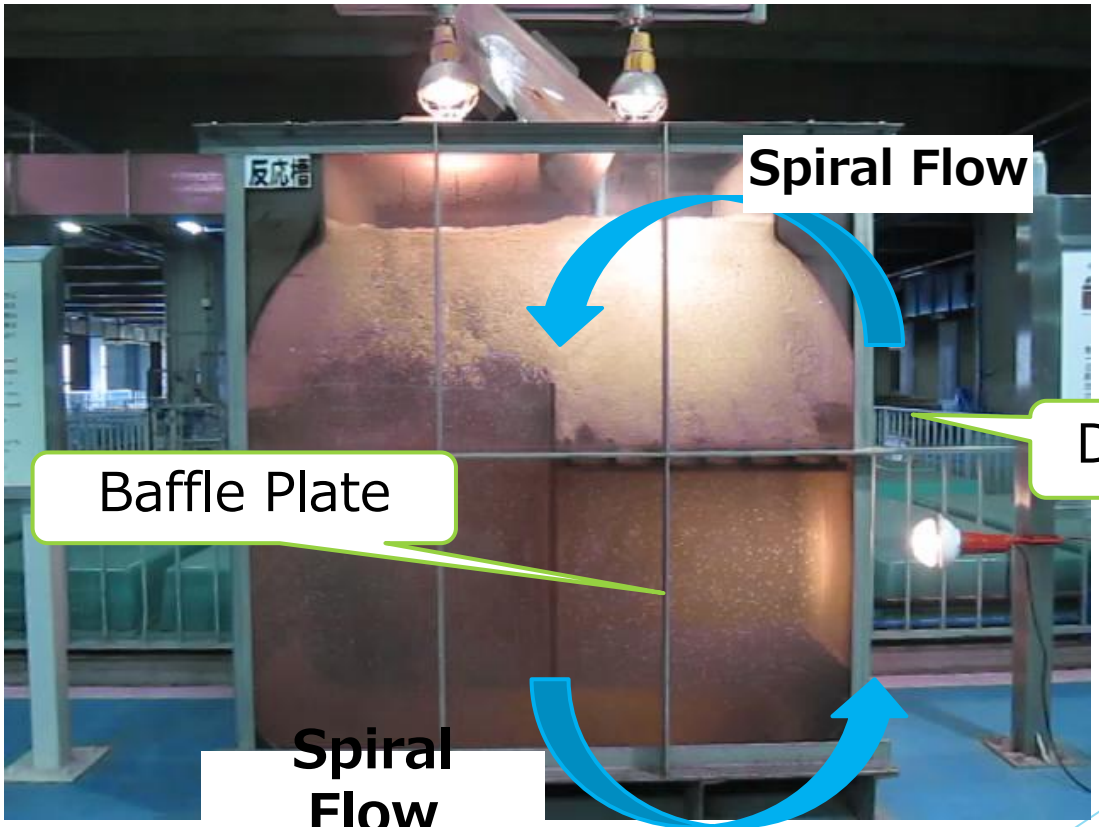

1/2




## Features of Deep Aeration Method

1. Sizable STP in Small Footprint : The required land is half of the one for the standard aeration method, so this can be a solution for land constraint.
2. High Treatment Efficiency : Baffle Plate makes/rectifies circular flow in the aeration tank.

# The Status of Flow in Model Deep Aeration Tank



# TERMINOLOGIES

- CENTRALIZED SEWAGE TREATMENT PLANT (CSTP)
  - ✓ Anti-Floatation Pile
  - ✓ Ground Anchor
  - ✓ Soil Nailing
  - ✓ Primary & Secondary Clarifier
  - ✓ Biological Nutrient Removal Reactor
  - ✓ Anaerobic Digester
  - ✓ Thickened Sludge Storage
  - ✓ Effluent Chamber
- SEWERS
  - ✓ a) Force Main
  - ✓ b) Gravity Sewers
    - Open cut
    - Pipe Jacking
    - Micro tunneling
    - Pipe Bursting
  - ✓ C) Receiving Chamber
  - ✓ d) Manholes and Chambers
- NETWORK PUMPING STATION
  - ✓ Population Equivalent (PE)
  - ✓ Temporary Treatment Plant (TTP)

# COST ANALYSIS OF WASTEWATER TREATMENT WORKS

# PIPE LAYING WORKS

## FORCE MAIN

| DESCRIPTION | RATE (RM)/m |
|---|---|
| 100mm DI Pipe | 860.00 |
| 200mm DI Pipe | 1,300.00 |
| 300mm DI Pipe | 1,500.00 |
| 600mm DI Pipe | 1,900.00 |
| 700mm DI Pipe | 2,200.00 |
| 1400mm DI Pipe | 4,2000.00 |

* method : open cut & pipe jacking for crossing

# GRAVITY SEWERS

- Pipe jacking

| DESCRIPTION | ESTIMATED RATE (RM)/m |
|---|---|
| 225mm VCJP | 1,600.00 |
| 300mm VCJP | 1,900.00 |
| 450mm RCJP | 2,400.00 |
| 600mm RCJP | 3,000.00 |
| 750mm RCJP | 3,500.00 |
| 900mm RCJP | 4,000.00 |
| 1050mm RCJP | 4,600.00 |
| 1200mm RCJP | 5,500.00 |
| 1500mm RCJP | 6,500.00 |
| 1800mm RCJP | 7,700.00 |

- Jacking & Receiving pit

| DESCRIPTION | ESTIMATED RATE (RM)/m |
|---|---|
| Jacking pits | 50,000 - 185,000.00/no |
| Receiving pits | 40,000 - 165,000.00 /no |

* Rate depends on depth of pit.

# B) NETWORK PUMPING STATION

| DESCRIPTION | ESTIMATED RATE(RM) |
|---|---|
| NPS 1 (55,000PE) | 140.00 / PE |
| NPS 4 (85,000PE) | 100.00 / PE |
| NPS 5 (13,000PE) | 400.00 / PE |
| NPS 9 (900,000PE) | 40.00 / PE |
| NPS 10 (12,000PE) | 420.00 / PE |
| NPS 12 (9,000PE) | 330.00 / PE |

# CHALLENGES IN WASTEWATER MANAGEMENT

**Rapid development in urban areas has increased**

- importance of sustainable wastewater management
- complexity of its implementation

**Complex due to:**

- increased population but limited land availability
- work within developed community
- work within developed infrastructure
- Working in life STP(Sewage Treatment Plant)
- Upgrading a life STP

# CHALLENGES IN WASTEWATER MANAGEMENT

**Sustainable wastewater management has to address:**

- Wastewater collection infrastructure issues
- Wastewater treatment issues
- Bio-solids reuse and disposal issues
- Effluent reuse issues
- Effluent dispersal issues
- Impact to environment
- Impact to social well-being of community

# CASE STUDY

# UPGRADING BATU BERENDAM INTERNATIONAL AIRPORT

- **Client :** Uni Integrated Sdn Bhd
- **Total contract value :** RM180 Mil.
- **Completion date :** March 2010

# PROPOSED BERTAM DAF PHASE 2 WATER TREATMENT PLANT, DURIAN TUNGGAL, MELAKA

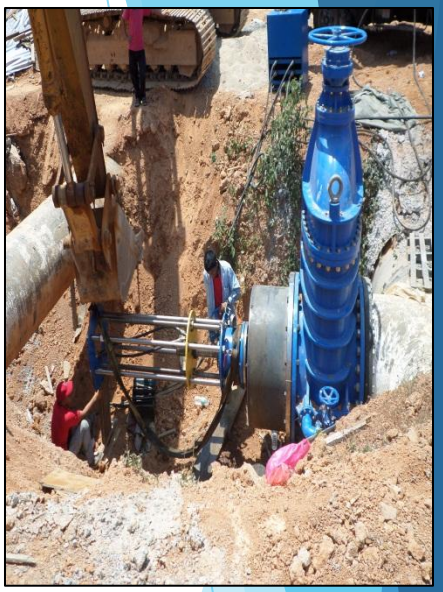
**PACKAGE 1** – CONSTRUCTION AND COMPLETION OF INTAKE TOWER AND RAW WATER PUMPING STATION AT DURIAN TUNGGAL DAM AND 1200MM DIAMETER RAW WATER PIPELINE FROM DURIAN TUNGGAL DAM TO BERTAM DAF PHASE 2 WATER TREATMENT PLANT.

**PACKAGE 2** - CONSTRUCTION AND COMPLETION OF 120MLD BERTAM DAF PHASE 2 WATER TREATMENT PLANT.

**PACKAGE 3** - CONSTRUCTION AND COMPLETION OF 2 x 5ML NEW BERTAM BALANCING RESERVOIR, 10ML NEW SUNGAI UDANG RESERVOIR, 20ML NEW AIR SALAK RESERVOIR AND INTERCONNECTION AT EXISTING CHENG RESERVOIR AND PIPELAYING OF 1000MM, 800MM, 600MM AND 500MM MSCL PIPE

**PACKAGE 4** - CONSTRUCTION AND COMPLETION OF 23ML NEW BUKIT JELUTONG RESERVOIR, INTERCONNECTION AT EXISTING BUKIT BERANGAN AND EXISTING BUKIT BERUANG RESERVOIR AND PIPELAYING OF 700MM AND 400MM MSCL PIPE

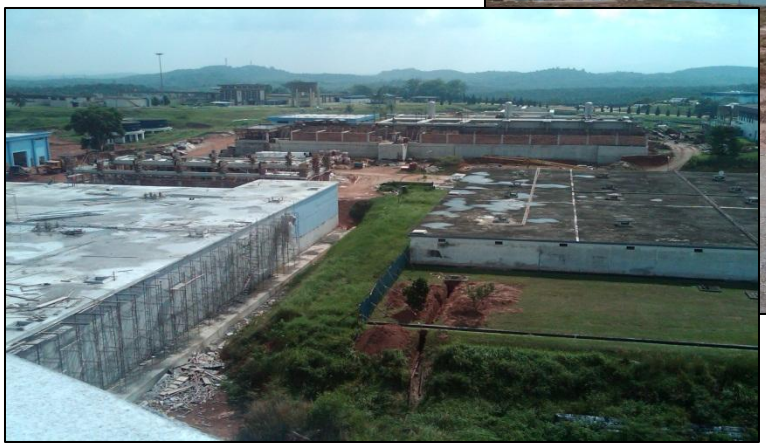
# **PACKAGE 2** - CONSTRUCTION AND COMPLETION OF 120MLD BERTAM DAF PHASE 2 WATER TREATMENT PLANT.



**Client :** Pengurusan Aset Air Berhad (PAAB)

**Total contract value :** RM 65,000,000.00
**Date of Commencement** : May 2011
**Date of Completion** : April 2014

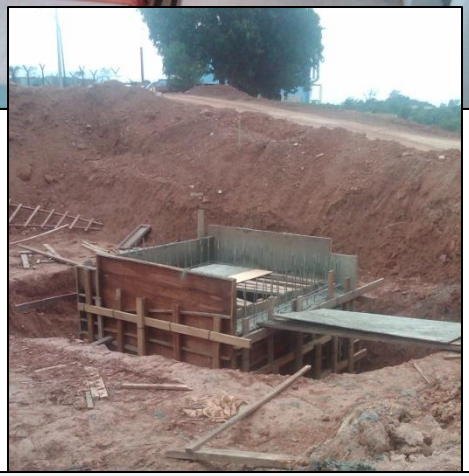
# **PACKAGE 3** - CONSTRUCTION AND COMPLETION OF 2 x 5ML NEW BERTAM BALANCING RESERVOIR, 10ML NEW SUNGAI UDANG RESERVOIR, 20ML NEW AIR SALAK RESERVOIR AND INTERCONNECTION AT EXISTING CHENG RESERVOIR AND PIPELAYING OF 1000MM, 800MM, 600MM AND 500MM MSCL PIPE



**Client :** Pengurusan Aset Air Berhad (PAAB)

**Date of Commencement** : November 2011
**Date of Completion** : September 2013
**Project Amount** : RM 59,000,000.00

# PACKAGE 4 - CONSTRUCTION AND COMPLETION OF 23ML NEW BUKIT JELUTONG RESERVOIR, INTERCONNECTION AT EXISTING BUKIT BERANGAN AND EXISTING BUKIT BERUANG RESERVOIR AND PIPELAYING OF 700MM AND 400MM MSCL PIPE



**Client :** Pengurusan Aset Air Berhad (PAAB)

**Date of Commencement** : October 2011
**Date of Completion** : October 2013
**Project Amount** : RM 29,981,722.00

# Pakej D47 – Pembinaan Rangkaian Paip Pembetungan di Kawasan Petaling Jaya(Utara)

- **Client** : Jabatan Perkhidmatan Pembetungan,KeTTHA
- Upon completion capable to carry 200,000 PE of wastewater
- **Contract value** : RM 277 Mil.
- **Start date** : March 2013
- **Expected completion date** : March 2017

# JELUTONG SEWAGE TREATMENT PLANT (JSTP)

- **PMC :** Kumpulan Ikhtisas Projek (M) Sdn Bhd
- **Client :** Jabatan Perkhidmatan Pembetungan,KeTTHA
- **Capacity :** to treat 1.2 Mil. PE of wastewater
- **Contract value :** RM478 Mil.
- Completed 2004

# PANTAI 2 SEWAGE TREATMENT PLANT

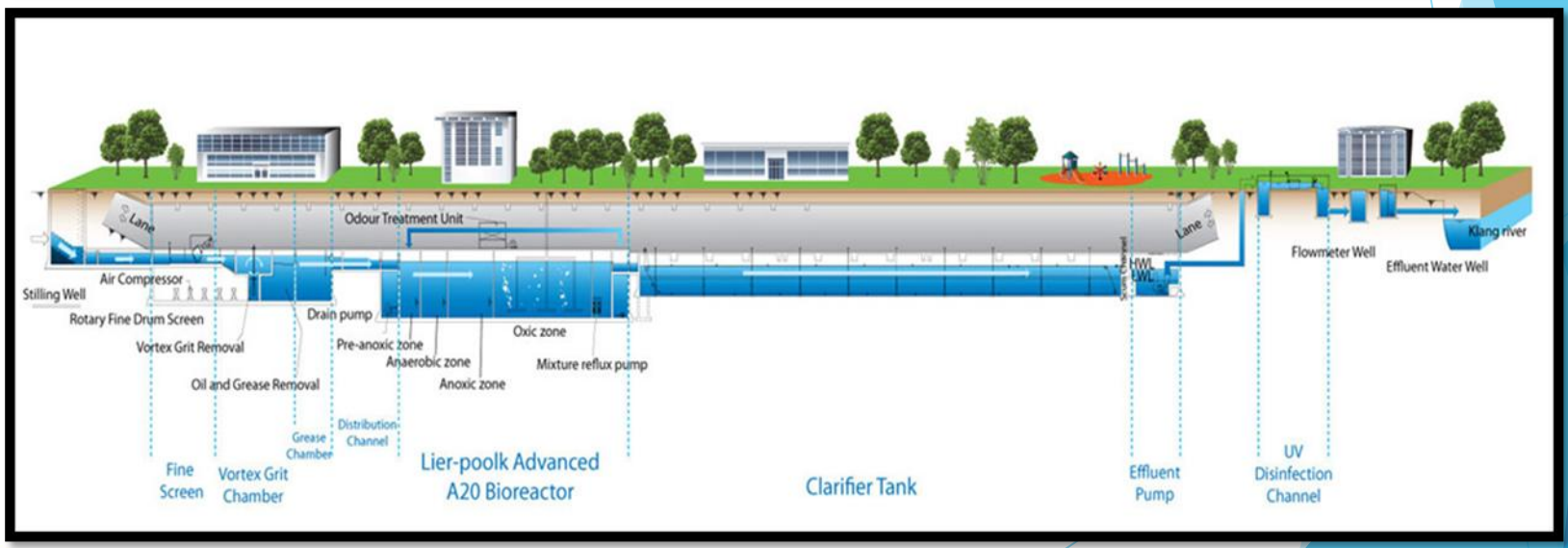
**Client :** Jabatan Perkhidmatan Pembetungan, KeTTHA

Upon completion capable to treat 1,423,000 PE of wastewater

**Total contract value :** RM 983 Mil.
**Start date :** July 2011
**Expected completion date** : July 2017


A – PPR Sri Pantai
B – Taman Permainan Kanak-kanak
C – Pusat Komuniti
D – Kampung Dato Tahah
E – Gelanggang Futsal Tertutup
F – Gelanggang Bola Keranjang
G – PPR Cempaka
H – Padang Bolasepak
I – Gelanggang Tenis
J – Bangunan Pentadbiran
K – Tangki Pencernaan Enapcemar

- Kolam pengudaraan sedia ada akan dinaiktaraf kepada loji rawatan kumbahan bersistem mekanikal bagi meningkatkan keupayaan rawatan sedia ada.
- Sebuah loji rawatan kumbahan yang mengaplikasikan sistem 'Advanced A2O' yang dapat memproses air kumbahan dan enapcemar akan dibina.



# CHALLENGES:

- Knowledge in civil engineering
- Terminologies
- Special requirements
- Alternative designs & alternative materials
- Value engineering exercises
- Latest technology
- Identify major costs:
  - Controllable
  - uncontrollable
- Unit costs and all-in cost
- Elemental cost analysis

# THANK YOU