KURSUS PEMERIKSAAN PENILAIAN STRUKTUR MARIN

26 FEBRUARI 2020

BAHAGIAN MARITIM CKIP

1.

Jetty Inspection Equipment And Procedure

Client

Jetties are built not just to monitor but also for many significant reasons such as for regulating rivers, berthing at docks, as entrances to jetty harbour, tourism, and many more. The clients in the Maritime are listed as follows:

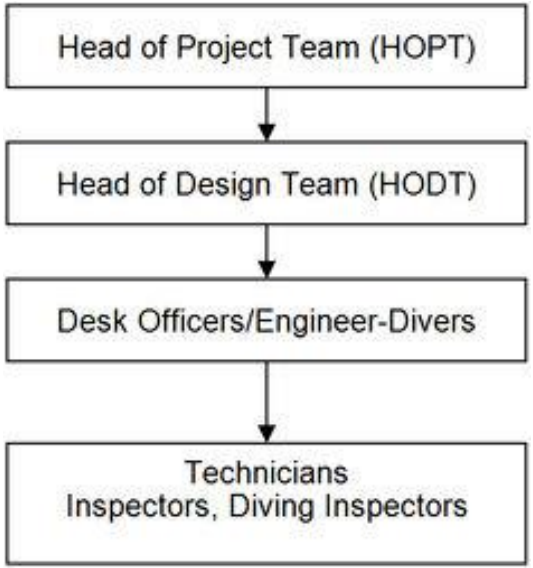
- 1. The Royal Malaysian NAVY
- 2. Marine Park Department
- 3. Royal Customs Department
- 4. Fisheries Department
- 5. Marine Department (JLM)
- 6. Police Marine (Minister of Internal Security)
- 7. Immigration Department
- 8. Malaysia Maritime Enforcement Agency (APMM)
- 9. Other government agencies.

Challenge / current issues

- Lack of Information/data of the structure
- Knowledge of inspector /experience
- Time
- Inspection team
- Weather / tidal / current / wave
- Equipment
- Certification/skill
- Cost
- Health fitness level
- Site condition

Organization

The inspection of jetty structures, including underwater inspection; is very specialized and should only be carried out by personnel with relevant experience and expertise required to successfully complete the work. Figure below shows the inspection program personnel.

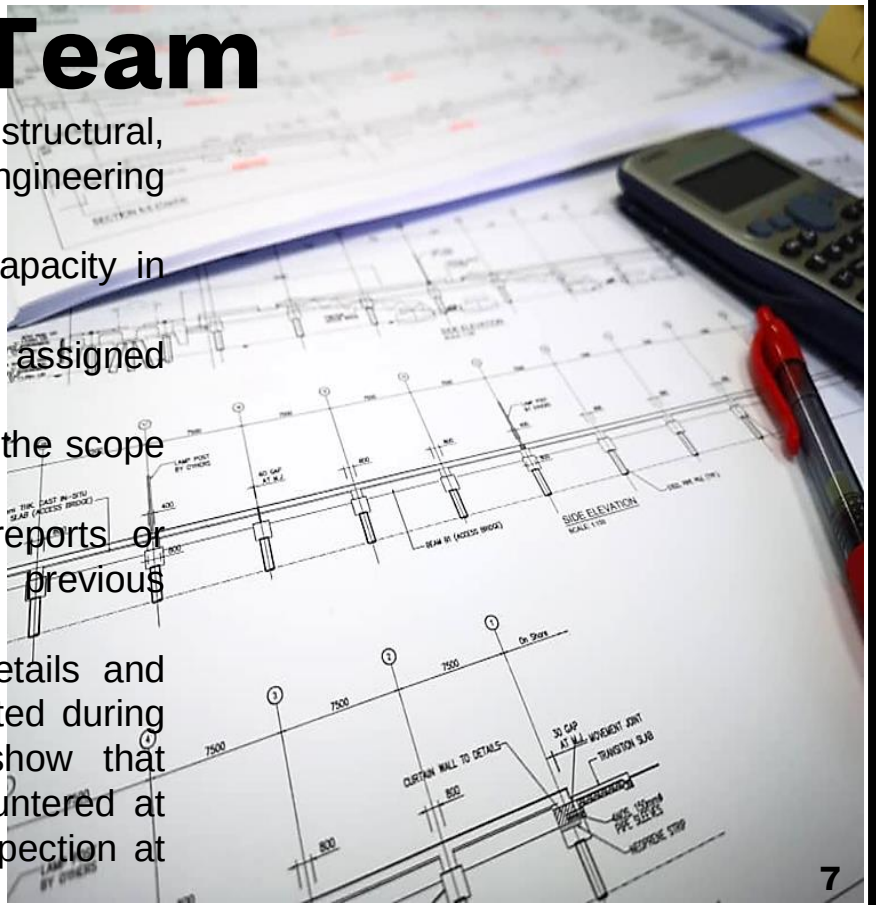


Head of Project Team

- Inspection program for a particular project should be under the direct supervision of the Head of Project Team (hereinafter referred as HOPT).
- registered engineer (BEM), specializing in civil, structural or relevant engineering background with min. 10 yrs experience in a responsible capacity in the inspection, design, and construction of jetty structures.
- The main responsibilities of the HOPT are defining the scope of the inspection program and ensuring that the inspection program is carried out within the budget allocated by the respective client. The HOPT may not be present during the jetty inspection.

Head of Design Team

- registered engineer, specializing in civil, structural, mechanical, electrical or other relevant engineering discipline,
- Min. 5 years of experience in a responsible capacity in marine structure inspection or related work.
- responsible of carrying out desk study on the assigned inspection program for his/her respective field.
- may be more than one personnel depending on the scope of work they are involved.
- Upon receiving as-built drawings, complaint reports or other relevant documents such as photos, previous inspection reports (if any),
- will identify possible structural problems or details and conditions that should be observed and evaluated during the inspection. Should the documentation show that significant structure problems have been encountered at site, the HODT shall be present during the inspection at site.



Desk-officers

-shall be a registered engineer in civil, structural or other relevant engineering discipline, with at least one year experience in marine structures inspection or related work.

-will gather reports and findings from the respective HODT and organize all activities involved for the inspection program, such as ensuring every report are well-documented, coordinate discussion when necessary; among designers and inspectors, etc.

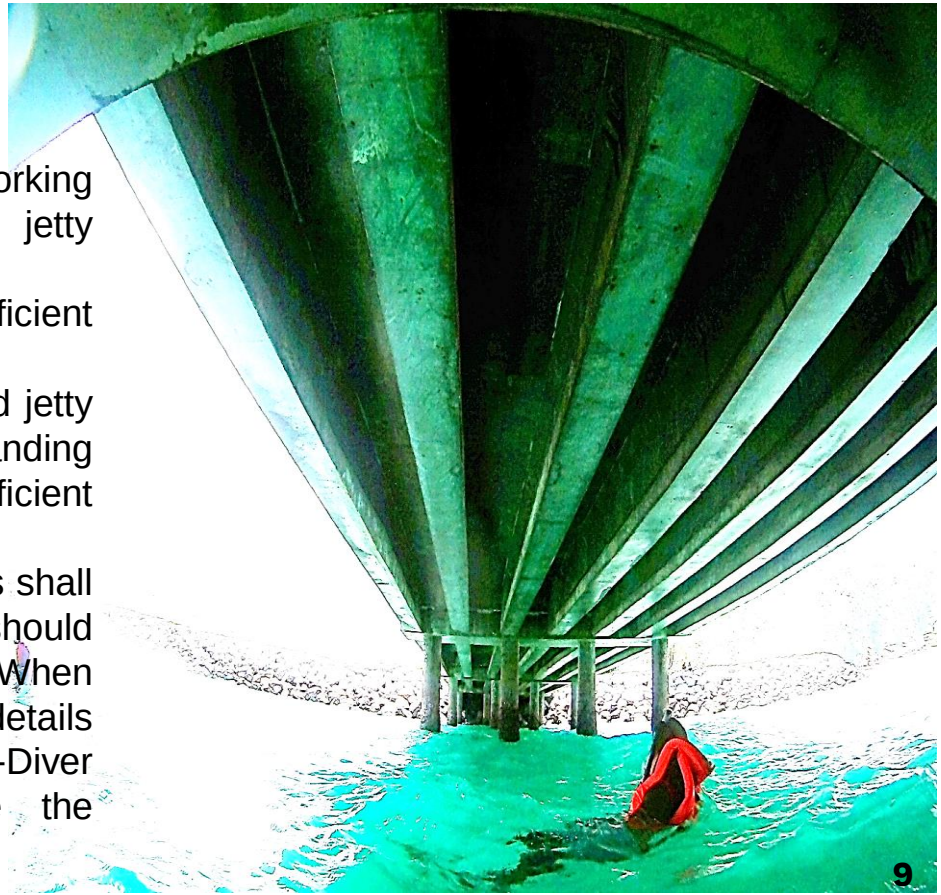
-Before the inspection, the Desk Officer shall coordinate the inspection team and ensure the purpose of the inspection outing is well defined.

-shall be at the site for the duration of the jetty inspection.

-When the HODT is not present the Desk Officer shall personally lead the inspection team, and ensure that each component is properly inspected and its condition is properly documented.

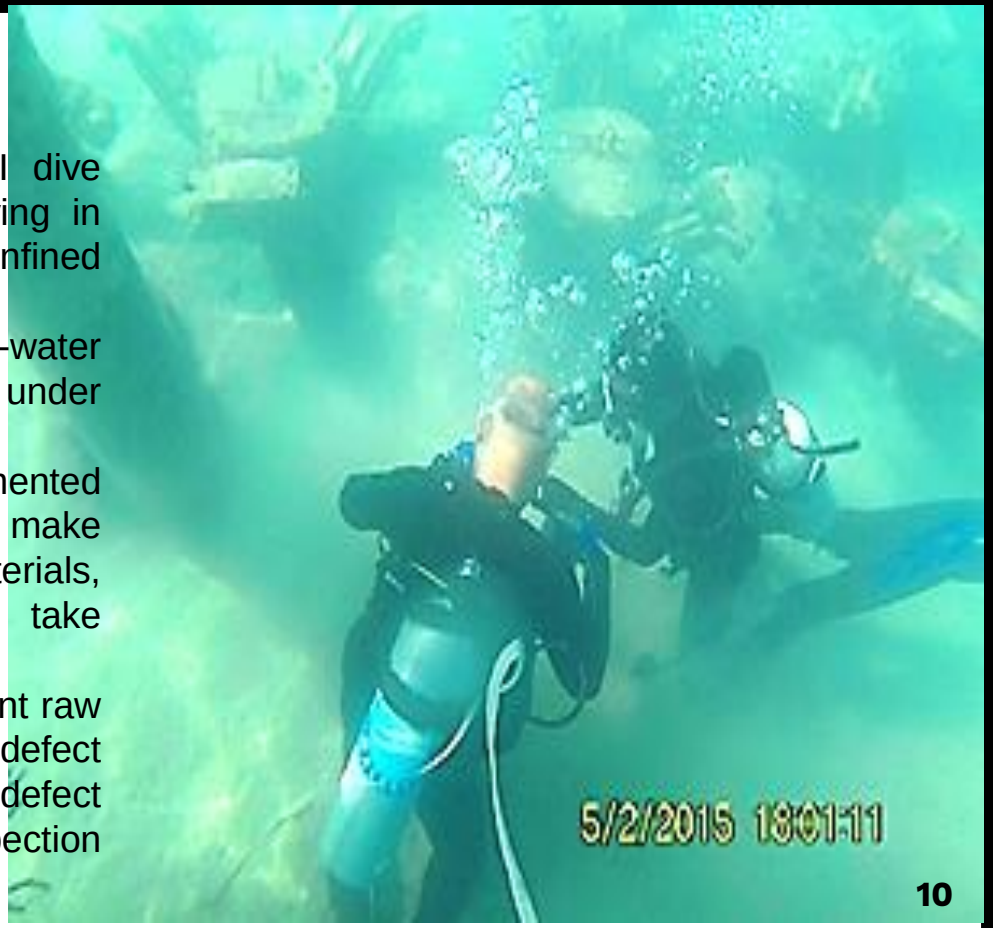
Technicians

- Minimum 1 year of experience and a working knowledge of timber, steel, and concrete jetty construction.
- have the capability that leads to a more efficient and accurate inspection program
- have a firsthand knowledge of the inspected jetty components and there is no loss of understanding of critical information due to inefficient communication.
- For underwater inspection, Diving Inspectors shall supervised by an Engineer-Diver who should perform a minimum of 25% of the work. When significant structural problems or any details underwater are encountered, the Engineer-Diver shall personally observe and evaluate the situation.



Technicians

- All divers shall be certified (i.e. PADI dive school) and shall have experience diving in low visibility, high currents, and confined spaces.
- should have a minimum 20 hours of in-water diving experience being employed under conditions similar to the inspection site.
- The divers should have documented experience and/or training to make determinations of the condition of materials, retrieve samples, perform NDT, and take underwater photographs.
- shall be responsible to collect the relevant raw data such as NDT results, sketches of defect components, location mapping of defect components, and photographs for inspection reports.



Qualification And Training Of A Jetty Inspector

The success of inspection exercise depends on the ability of the Jetty Inspector. Suitable candidates need to be selected and trained as building inspectors. In general, a good inspector should possess the general traits as follows:

i. Reliability
ii. Technical and communication skills
iii. Health
iv. Attitude
v. Inquisitive mind

Training by personnel from the JKR HQ must be carried out regularly to achieve three main objectives:

i. transfer of knowledge
ii. sustain interests of regional inspectors
iii. maintain coherence of the overall marine structure maintenance management procedure

Above Water & Under water Inspection Equipment

Inspection Equipment

Normally for inspection of marine structure required **ABOVE WATER** inspection and **UNDERWATER** inspection.

In order to carry out the inspection properly , Jetty Inspector must be properly equipped with inspection equipment.This equipment is needed for measurement , recording , safety and access. Aset of recommended list of equipment is given below. For more specialized inspection, non-destructive testing (NDT) equipment may sometime be needed.

- Safety Equipment
- Measuring Equipment
- Recording Equipment
- Access Equipment

Safety equipment- ABOVE WATER

No	Equipment	Purposes
1	Safety jacket(fluorescent)	To be worn at all times during inspection
2	Safety helmet	To be worn at all times during inspection
3	Safety boots	To be worn at all times during inspection
4	Life jacket	To be worn at all times during waterways
5	Traffic sign boards and cones	To be installed for traffic control (if necessary)
6	Safety belts	To be used when climbing the structure
7	First aid kid	For first aid treatment of any injuries
8	Goggles	To protect the eyes while looking under deck/soffit slab
9	Overalls	As a protective clothing
10		

Safety equipment- ABOVE WATER

Safety Belt

Safety Boots

Safety Helmet

Safety Jacket

First Aid Kit

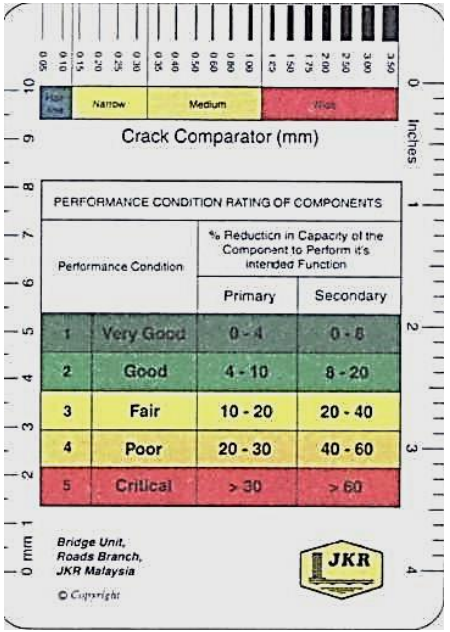
Goggles

Safety equipment- UNDERWATER

Measuring equipment

No	Equipment	Purposes
1	5m measuring tapes	For measuring short dimensions
2	50m-100m measuring tapes	For measuring span length,width and other longer dimension
3	Plumbob	For measuring degree of tilting at pile
4	Vernier/ calipers	For measuring thickness of steel flanges, webs, and plates, or diameters of piling
5	Crack scale	For measuring crack width
6	Deep sounding apparatus	For measuring river/sea depth and to check scoured depth
7	Spirit levels	For measuring perpendicular distance to any structural member and tilting of pier
8	Ranging rods	For probing and measuring scour under piles
9	Rebound hammer	To determine the strength of concrete
10	Tide table	To get information the tidal occurrence

Measuring equipment



Recording Equipment

No	Equipment	Purposes
1	Camera /drones	To take photographs/video of defect or damages to the structures and for jetty identification
2	Blackboard/whiteboard /slate/grease pencil	To record jetty number/name while taking photographs for defect identification:should be supplied with chalks, marker pen and duster
3	Clipboard	As hard surface to write on when filling forms
4	As Built Drawing	For drawing sketches
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6		
7		
8		
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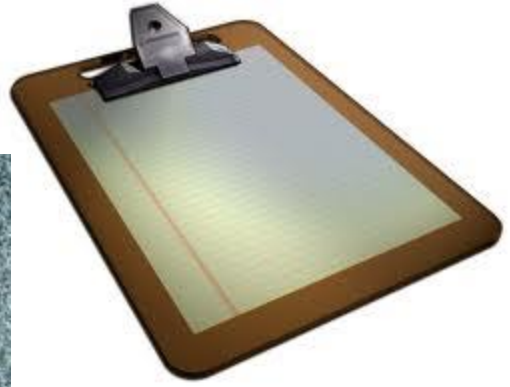
Recording equipment



Cleaning equipment

No	Equipment	Purposes
1	Wire brushes	To clean barnacle, marine growth on structure
2	scrapers	To clean barnacle, marine growth on structure
3	Probes	To clean barnacle, marine growth on structure
4	Hydraulic grinder	To clean barnacle, marine growth on structure
5	High pressure water jet gun	To clean barnacle, marine growth on structure
6	Hammer /pick axe	To clean barnacle , performing sounding to structure (chipping tool)
7		
8		
9		
10		

Access equipment

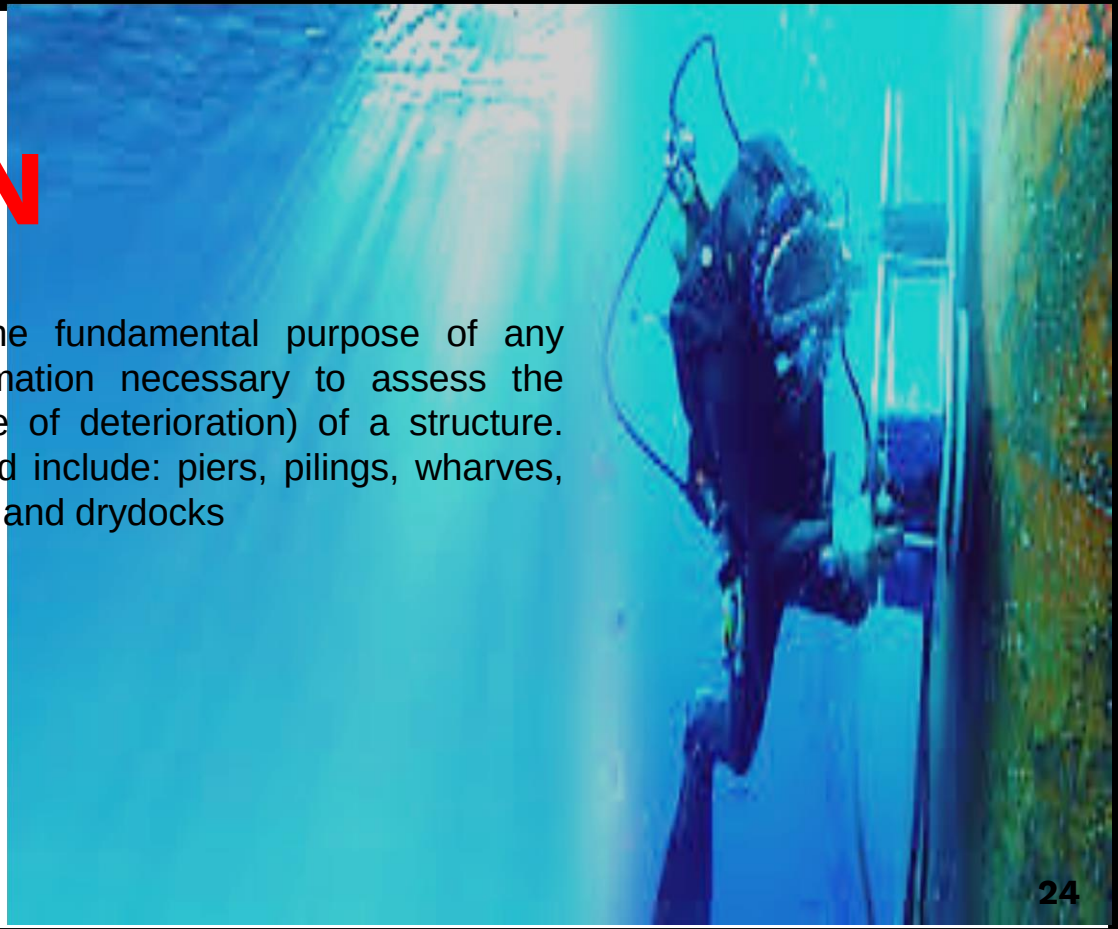
No	Equipment	Purposes
1	Aluminum collapase	For access to soffit
2	Binocular	To be used when there is no access to the structure
3	Boat or inflatable dinghy	For access to river/sea piles/piers and span
4	Tapping hammer	For tapping the concrete surface in order to determine the soundness of the structure
5	Flashlights	For lighting dark areas
6	Shoulder bag	For holding equipment
7	Ropes & harness	For tying and climbing
8	Communication equipment	For communication during inspection
9		
10		

2.

Guideline And Procedures For Conducting Jetty Inspection

INSPECTION

GENERAL CONSIDERATIONS. The fundamental purpose of any inspection is to provide the information necessary to assess the condition (capacity, safety, and rate of deterioration) of a structure. Waterfront structures to be inspected include: piers, pilings, wharves, quaywalls, fender systems, dolphins, and drydocks



INSPECTION

Inspection Objectives. Inspections are classified according to the objectives. These include:

• Baseline - to obtain data on a facility that has not been inspected. This inspection involves the greatest “pre-inspection” effort.

• Routine - to obtain data on general condition, confirm drawings, estimate repair costs, etc.

• Design Survey - to obtain data for specifications or for detailed cost estimates.

• Acceptance - to obtain data confirming that a repair has been completed according to plan or specification.

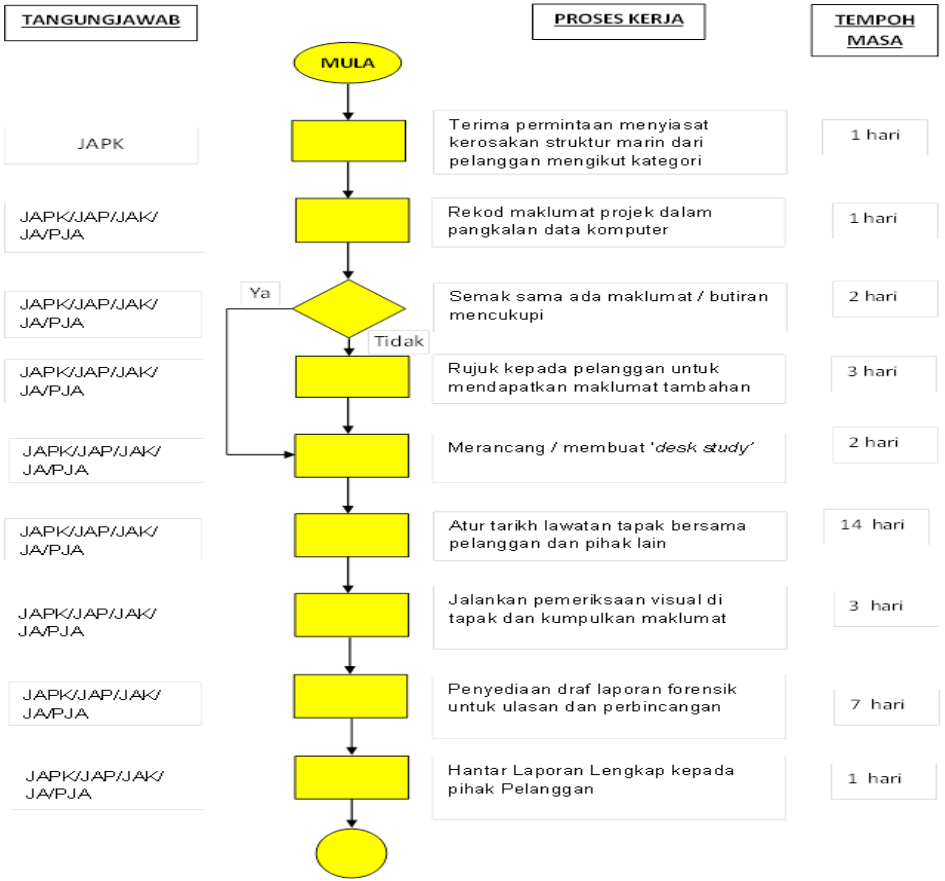
• Research - to obtain data on deterioration rates, etc.

INSPECTION

The usefulness of an inspection depends on establishing a clear and complete record. Although the level of inspection will determine the extent of information to be provided, in general the inspection will address the:

- Identification and description of all major damage and deterioration of the facility.
- Description of facilities inspected including updated layouts of pile plans (which occasionally differ significantly from the drawings available at the activity).
- Documentation of types and extent of marine growth, if applicable.
- Water depth, visibility, tidal range, and water current.
- Assessment of general physical condition including projected load capacities.
- Recommendations for required maintenance and repair (M&R).
- Budgetary estimates of costs of this M&R, including examples of how estimates were derived.
- Identification of any problems associated with mobilization of equipment, personnel, and materials to accomplish repairs/maintenance.
- Estimate of expected life of each facility.
- Recommendations for types and frequencies of future underwater inspections.

Flowchart Chart For Repair Inspection Work



Levels of Inspection

Three basic levels of assessment are used for inspecting jetty structures

- Level I – General Visual Assessment
- Level II – Close Up Visual Assessment
- Level III - Highly Detailed inspection

The resources and preparation needed will distinguish the work carried out and determine the type of damage/defect that is detectable.

Level I – General Visual Inspection

- no cleaning of any structural elements and, therefore, is the most rapid of the three types of inspection.
- Purpose of this Level - is to confirm as-built structural plans, provide initial input for an inspection strategy, and detect obvious major damage or deterioration due to overstress, impacts, severe corrosion, or extensive biological growth and attack.

Level II – Close Up Visual Inspection

- toward detecting and identifying damaged or deteriorated areas that may be hidden by surface bio fouling or deterioration and obtaining a limited amount of deterioration measurements. The data obtained should help estimate the facility's load capability.

- Cleaning concrete surface prior to or during close level underwater inspection is need and this method is employed to detect and specify problems which are covered or hidden by marine growth. Cleaning is usually applied for critical locations of the structure because cleaning of the structure takes lots of time.

- In this method, the quantity of information which can be used to assess initial load carrying capacity of concrete structure or member is not adequate and is limited.

- The amount and quality of cleaning is controlled by the quantity of information required to produce a general evaluation of the structure.

Level III – Highly Detailed Inspection

- primarily designed to provide data that can be used to perform a structural assessment and will often require the use of NDT techniques and Semi-Destructive Testing techniques such as core sampling of concrete and wood structures, physical material sampling, or surface hardness testing.

- The procedures are conducted to detect hidden or imminent damage, loss in cross-sectional area, and material homogeneity.

- Cleaning and testing requirements will vary depending on the type of damage/ defect that is to be investigated and the type of inspection equipment to be used.

- require more experience and training than Level I or Level II inspections, and should be done by qualified engineering or nondestructive testing personnel.

Scheduled of Inspection

it is necessary to define the inspection types that will be used in the jetty inspection and assessment. Four types of inspection have been established for these guidelines:

- Operational Inspection
- Periodic Inspection
- Detailed Inspection
- Special Inspection

Flow of Detail Inspection Activities

Inspection Type	Purpose & Typical Level of Inspection Effort
Operational Inspection	• Whenever the structures are visited for some reason. • Simple visual inspection and completed inspection is to be registered in a logbook done by Engineer (Client technical department). • Reports to be sent to the JKR or appointed maintenance contractor if any damage or defects are observed. • Typical Inspection effort: Level I for all above and underwater components
Periodic Inspection	• To assess the general overall condition of the structure, assign a condition assessment rating, and assign recommended action for future maintenance activities. • Once in three years. Preference given to alternate inspections between high and low water level in the tide range every other year. • Typical Inspection effort: Level I for all above and underwater components, Level II for 10% of the components.
Detailed Inspection	• To perform detailed testing or investigation of a structure in order to understand the nature and/or extent of the deterioration and/or evaluate the capacity of a structure for a specific loading condition. • Normally every 10th year or when deem necessary as a result of Operational, Periodic, Special Inspection, or in order to determine the adequacy for a different use. • When decision has been made to proceed with repairs on the structure, the client is to be notified in good time about the date of inspection. • Typical Inspection effort: Level II for all appropriate components.
Special Inspection	• To perform a special visual inspection, above water and/or underwater evaluation of a structure, typically following a storm, vessel impact, earthquake, or similar event. • The purpose of the inspection is to determine if further attention for the structure is necessary. • Typical Inspection effort: Level I for all appropriate above water components.

PLANNING FOR INSPECTION

The levels of inspection to be used for a particular task must be decided early in the planning phase. The inspection objectives (i.e., baseline, design survey, repair acceptance, research) should be clearly defined. A site survey of the facilities should be obtained, or conducted if doing a first-time inspection. A site survey for underwater inspections includes: bathymetric, oceanographic, and geological data, as well as information on nearby obstructions or activities. A site survey accelerates the planning process and will help determine the levels of inspection to be used.

PLANNING FOR INSPECTION

The time and effort required to carry out the three different levels of inspection are quite different. The time required also depends on whether the inspection is surface or underwater; on environmental factors, such as visibility, currents, wave action, water depth, tides, severity of marine growth; and on the inspector’s skill and experience.

PLANNING FOR INSPECTION

Guide for estimating the time required to conduct Level I and II surface and underwater inpsections.

Ref: UNIFIED FACILITIES CRITERIA (UFC)

MAINTENANCE AND OPERATION:
MAINTENACE OF WATERFRONT FACILITIES,USA Navy

Table 5-2 Production Rate for Surface and Underwater Inspection of Structural Elements

Structural Element	Inspection time per Structural Element (minutes)			
	Level I		Level II	
	Surface	Underwater	Surface	Underwater
12 inch (30 cm) steel H-pile	2	5	15	30
12 inch (30 cm) wide strip of steel sheet pile	1	3	8	15
12 inch (30 cm) square concrete pile	2	4	12	25
12 inch (30 cm) wide strip of concrete sheet pile	1	3	8	15
12 inch (30 cm) diameter timber pile	2	4	10	20
12 inch (30 cm) wide strip of timber sheet pile	1	3	7	15

NOTE: This information is based on a 11 to 15 yard r (10 to 14 meter) water depth; 3.1 to 6.6 feet (1 to 2 meter) visibility; warm, calm water; moderate marine growth about2 inch (5 cm) thick; and an experienced engineering diver or diver supervised by an engineer. For the Level II inspection, it is assumed that 3.1 feet (1 meter) of the structural element is in the splash zone, 12 inch (30 cm) at mid-depth, and 12 inch (30 cm) at the bottom, and will be completely cleaned of marine growth. It is also assumed that the most efficient method of removing marine growth will be used.

PLANNING FOR INSPECTION

Guide for estimating the time required to conduct Level I and II surface and underwater inpsections.

Table 5-3. Daily Rates for Underwater Inspection Tasks*

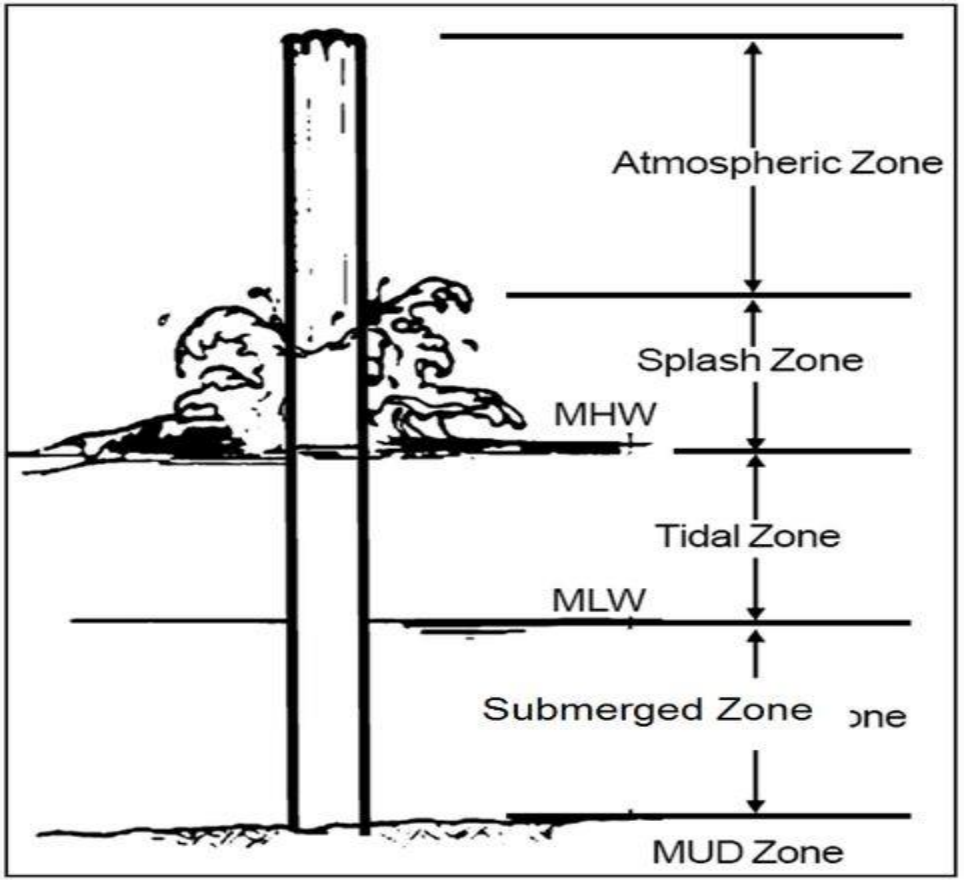
Inspection Task	Pile/Day	Bulkhead in Linear Meters Day
Swim by	300 to 600	150 to 450
Cleaning	30 to 70 at 3 to 15% of each pile	150 to 450 at 15 to 90meter (16 to 98 yard) intervals
Measurements	50 to 200 for wood at 5 to 15% of each pile 30 to 60 for steel at 3 to 10% of each pile 30 to 70 for concrete at 3 to 15% of each pile	150 to 450 at 15 to 90meter (16 to 98 yard) intervals

*Rates vary widely depending on the effects of many factors, such as: water visibility, facility size and age, marine growth, and construction.

Ref: UNIFIED FACILITIES CRITERIA (UFC)

MAINTENANCE AND OPERATION:
MAINTENACE OF WATERFRONT FACILITIES,USA Navy

Various Zone of Influence



Jetty Inspection Procedure

Is the process by which information on the structural & physical condition of a jetty and its immediate surroundings is collected. The inspection exercise involve identifying and quantifying the damage and deterioration in a jetty caused by the influences imposed by the environment.

Inspection must be systematic and meticulous in planning and performing the jetty inspection.

- Before inspection
- During Inspection

Jetty Inspection Procedure

Before Inspection

- Prepare an inspection schedule for the jetty inspection
- Do a desk study of available document for the jetty he/she will inspect
- Fill out the standard reporting form and structural condition checklist including location data, jetty type, structure data and previous rating any.
- Make sure all equipment needed for the inspection is available and in good working condition.

Jetty Inspection Procedure

During Inspection

- On arriving at the jetty , inspector should check the following to avoid mistake in identifying the jetty :
    - The jetty number (if any)
    - Jetty name (if any)
    - Location of jetty

•Check information on the top part of the structural condition checklist and the summary report
•Observe all precautions before starting to inspect the various member of jetty

Jetty Inspection Procedure

During Inspection

- Start inspecting the various members of the jetty following the structural condition checklist . A separate checklist is used for each span. Refer to the guide on types of damages for severity clarification and material condition rating card to determine the rating damage .
- Take photograph or make sketches to highlight the defects. The photograph should be taken with identification of location and date taken wherever possible.

Jetty Inspection Procedure

- Complete the summary report form , putting in all observations and comment. One Report form is used for each jetty . The worst member rating for that jetty shall be taken as the rating for all spans.

- At the end of the inspection , inspector have to ensure that:
  - All the form have been filled out including the date inspection and the name of the inspector
  - All photograph taken and sketches made are properly noted and listed.
  - All forms and checklist all properly complied.