

VISUAL INSPECTION AND ASSESSMENT OF OPERATING DEVICES IN IR. H. DJUANDA DAM - INDONESIA

RENI MAYASARI AND BUDI NUGRAHA

Jasa Tirta II Public Corporation, Purwakarta, Indonesia

1. INTRODUCTION

Visual inspection is a visual inspection of ground and water inspection objects, such as dam surfaces, auxiliary buildings, ridges and reservoir cliffs, hydro mechanical equipment, instrumentation and so on. Reservoir Manager Ir. H. Djuanda performs visual inspections twice a year for dams located in his working area, which are around May - June at the time of the high water reservoir and November - December at the time the water level is low.

Visual inspection conducted includes inspection of dam Ir. H. Djuanda in Purwakarta District. The purpose of the visual inspection work is to find out as early as possible about the current state of the field on dams, complementary buildings and facilities for the purpose of encountering unusual things (anomalies) and / or symptoms that may threaten the safety of the dam so that immediate precautions are taken and risk reduction to the safety and safety of dams.

Visual inspection work consists of a series of inspection activities on dam bodies, complementary buildings, hilltop, rim (roving) reservoirs and the surrounding dam environment. Matters inspected during the visual inspection of the dam include cracks, seepage, leaks, basins, springs, burrows, erosion of surface erosion, abrasion scouring, excessive plant growth, top straightness, bulge or slope subsidence or berm, animal burrows of rip-rap quality deterioration as well as other slope protective materials. As for the concrete buildings are examined for cracks, crushing, dissolving, leaking, indication of deterioration of quality or chemical reaction, and or the damage caused by erosion and cavitation, the reliability of construction connections.

Based on the method of implementation, the inspection is divided into two types: visual inspection and underwater inspection. Visual inspection is a visual inspection of ground and water inspection objects, such as dam surfaces, auxiliary buildings, ridges and reservoir cliffs, hydromechanical equipment and so on. The work of this inspection is a work performed by visual inspection method based on the March 2003 Safety Dam Inspection and Evaluation Guidelines published by the Ministry of Public Works. The steps taken against a finding on the ground during the visual inspection are S I M P L E i.e:

- (a) Sketch: Drawing / Sketch that describes a finding in the field.
- (b) Investigate: Investigate further on a finding in the field.
- (c) Measure: Measuring dimensions of a field findings such as cracks, avalanches, leakage discharge and so on.
- (d) Photograph: Take a picture / photo of a finding in the field.
- (e) Locate: Marking the location / place of a find in the field is associated with easily recognizable objects such as shear, piezometer, Observation Well and so on.
- (f) Engage: Engage experts or engineers who are experienced in visual inspection to be a resource person in consultation every problem that exists.

The tools and materials commonly used in visual inspection at Ir.H.Djuanda Dam include : Four-wheeled vehicles, camera, handy cam, meter tool 50 m and 5 m, stationery, handbags, cranes and steel cages as a means to descend to the bottom of the spillway during Hollow Jet Valve inspection, belt safety (Safe Belt) for Hollowjet Valve inspection, buoy (Life Vest) for Rim Reservoir inspection, boat (Speed Boat) for inspection Rim Reservoir, handheld GPS (Global Positioning Tool).

1.1 Dam Ir. H. Djuanda

Located approximately 100 km southeast of Jakarta and 60 km northwest of Bandung, Ir. H. Djuanda dam is a new urugan dam with clay core, irin (Rock Fill with Inclined Clay Core). It has four saddle dam (saddle dam), namely the saddle dam of Pasir Gombang Barat, Pasir Gombang Timur, Ciganea, and Ubrug. The main spillway shaped tower type of morning glory, which at the bottom also functions as a powerhouse, as "Figure.1".



Figure 1 : Ir. H. Djuanda Dam

To assist in the event of a shortage of supply from downstream through the power cord, two irrigation supply channels (hollow jet valve) are available on the eve of +49 m.dpl, see as “Figure 2 and Figure 3”. Based on the result of the year 2000, the volume of TMA +107 m.dpl (normal pool level) of 2.448 million m³ with the puddle area of 81.3 km². The dam was built in 1957 and completed in 1967 on the Citarum River, with a catchment area of 4,500 km², while the catchment area directly to the reservoir after the construction of Saguling and Cirata Dam in the upper reaches 380 km².

Ir. H. Djuanda dam is a multipurpose dam, function as a hydropower plant with installed capacity of 187.5 MW, flood control in Karawang regency and Bekasi district, irrigation for 242,000 hectares of rice field in north coast of West Java, water supply for brackish water fishery cultivation along the west coast of West Java covering an area of 20,000 hectares and tourism.

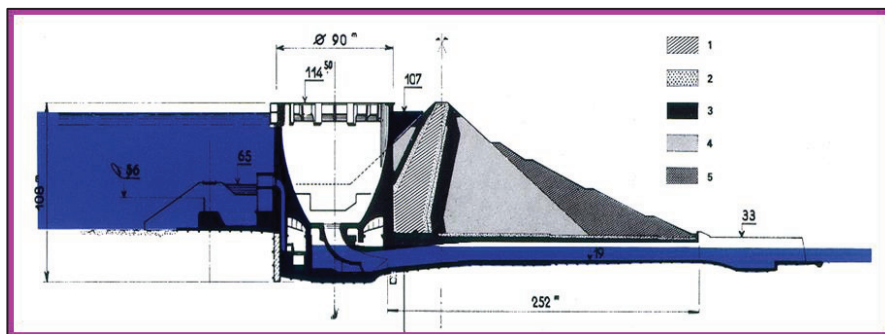


Figure 2 : Profile of the main Dam Ir. H. Djuanda

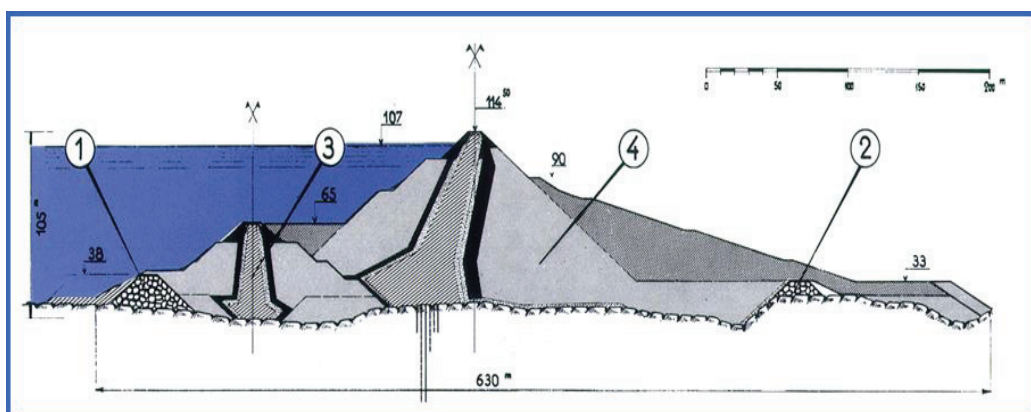


Figure 3 : cross Section of the main Dam Ir. H. Djuanda

1.2 Pasir Gombang Saddle Dam

Pasir Gombang saddle dam is a type of Homogenous Earth Fill dam with cover using andesite and some places using chimney drain. Elevation of the saddle hose +114.5 m.dpl. sand dunes sands west of 1950 m long, 19.0 m high maximum and sand dunes sands east of eastern with a length of 400 m, maximum height 15 m.

1.3 Ciganea saddle dam

The Ciganea saddle dam is a Homogenous Earth Fill type dam similar to the Pasaj Gombong Strip Dam with a cover using andesite rocks and in some places using Chimney Drain. Peak shed elevation +114.5 m.dpl. the length of this saddle dam is 330 m, the maximum height is 12.5 m.

1.4 Ubrug saddle dam

The Ubrug saddleback is also a Homogenous Earth Fill type dam similar to Pasir Gombong saddle dam with a cover with andesite stone and in some places using Chimney Drain. Peak shed elevation +114.5 m.dpl. The length of this saddle dam is 550 m, the maximum height of 17 m is equipped with an overflow auxiliary. Overflow aids at the Ubrug Saddle Dam has 4 (four) doors with a width of 12.4 m, elevation of overflow floor +102 m.dpl with abundance capacity 2000 m³ / sec.

2. IR H. DJUANDA VISUAL INSPECTION

Based on the results of visual inspection and observation of the dam body and its complementary building, that in general the dam Ir. H. Djuanda relatively good and normal, with the condition of findings in the field, among others:

- (a) On the hillside there are several rip-rap rock spots happening dislocations, and found grass and shrubs plants growing on the sidelines of rip-rap stones.
- (b) On the slopes downstream on the sidelines still visible grass and shrubs that grow, the frequency of grass that needs to be reproduced so that the roots of the plant does not penetrate the body of the dam that could be the outlet of water seepage on the lining wall structure and lining paving blocks access road to the dock.
- (c) Generally the condition of instrumentation in the main dam is relatively good, but on OW5 protective wall made of concrete slab looks damaged and not closed. The accelerometer installed in the Access Gallery of the tool is damaged, the error sign continues and the voltage indicator panel shows 5.4 volts which should be +/- 11 volts. The condition of the surface monument has small damage to the slope (surface monument) which is located at the upper lining of the dam top.
- (d) Conditions of drainage channels in some places at the foot of the dam and downstream areas appear to be clogged with soil, moss and grass so that the water flow cannot flow smoothly and inundated.
- (e) Rip-rap conditions are generally good, but need to be weaned and additions around the C2 sliding mark downstream.

3. TOWER MAIN TOWER AND ACCESS GALLERY INSPECTION

Based on visual inspection and observation of the main spillway tower, Access Gallery and its complementary building. In general the condition of the main spillway tower and access gallery is relatively good and normal, with the condition of findings in the field, among others:

- (a) The connection between the plates on the bridge ladder has already started to loose due to run out by rust. And at some point bridge paint floor has begun to fade, the handrail and steel rope reinforcement on the right and left side of the bridge looks still pretty good.
- (b) There are cracks in the 3 concrete joints under the rails. Found the wild vegetation around joint 9 then on joint 11. Three Dimension Instrument (3D) Joint Apparatus looks rusty start and surface pin is not flat. The 3D Joint Apparatus protective cover is largely unlocked because the lock nut is missing. The sliding mark on the shoulders of the tower must be re-painted because the paint has begun to fade. Home / Box AWLR (automatic Water Level Recorder) SESAME must be repaired.
- (c) The condition of the ladder that is on the wall inside the spillway looks rusty.
- (d) The wet location or seepage trace is found in joint G0. The concrete connection is observed by 3 (three) Dimension Joint Apparatus. The condition of the former leakage monitoring tool in joint 0 that is Rive Droite (RD) and Rive Gauche (RG) still looks stagnant due to drainage of seepage see page clogged, If will be measured discharge leakage RD and RG must first pumped. Therefore the measurements of the RD and RG leakage discharges are now done in a new place through two pipes connected directly to the directional pipe steering join 0. The sliding benchmark in the Access Gallery is mostly without a protective cover.
- (e) In the ceiling space re-cavitation occurs on the concrete wall that has been done with the addition of using cement. Corrosion section contained in the cooling pipe casing on the staircase entering the ceiling has not been repaired.
- (f) In the left sump Pit found cracks in the concrete wall, concrete and concrete floor joints drainage see page (sump pit) left, so the concrete floor is relatively slippery when skipped.
- (g) The condition of the right collecting drum space (sump pit) mostly cavitation, moist and wet. The wet location is found almost in all the right (sump pit) areas, so the concrete floor is relatively slippery when skipped.

- (h) The condition of the bouchon, the tap (gate valve) to open the waterway has been consumed by corrosion. Condition of concrete wall, and concrete connection experience cavitation, moist and wet. Wet locations and puddles are found only on the side of the baton wall around the entrance hall.
- (i) The intake room of the riva pump is inundated about 2 meters deep and needs to be addressed immediately because of mild corrosion.
- (j) The old cracks in the majority of concrete are found in the interior walls of the circle and a small part is found in the exterior circle but the condition does not change significantly.
- (k) The old vapor that forms the cavity to the right of the tailrace (about 20 m to the left of OW IC748) has been repaired by means of the extraction and compaction of the material.
- (l) Elevators contained in the access gallery is not working and severely damaged (high corrosive) as well as around the elevator door area often leaks. The protective cable cover (concrete plate) at the top of the tower is partially cracked.

4. SADDLE DAM INSPECTION

4.1 Pasir Gombong Barat Saddle Dam

Generally the condition of Pasir Gombong Barat Saddle dam relatively good and normal with visual observation conditions as follows:

- (a) Avalanche / sliding in downstream profile 32 and profile 17 handling not entirely.
- (b) Some of the stucco slabs are plastered and there are many streaks.
- (c) In the downstream area there are many rushes on the drainage especially the lining of the stone pairs.
- (d) Water supply to basecamp does not exist.

4.2 Pasir Gombong Timur Saddle Dam

Generally, the condition of Pasir Gombong Timur Saddle Dam is relatively good and normal with visual observation conditions as follows:

- (a) The old erosion occurring in the original soil near the R42 and R44 profiles still has not been handled. There is still a wet / muddy area that has not formed a puddle on the original soil to the left of the R46B shear and the wet area around the R42b shear. There is erosion on the hillside to the left of the dam hill slope caused by water abrasion.
- (b) In the downstream of Pasir Gombong Timur saddle dam still found many surface erosion on the original soil.

4.3 Ciganea Saddle Dam

In general, the saddle cave dam conditions are relatively normal and normal with visual observation conditions as follows:

- (a) Drainage holes in the hills and downstream of the saddle dam are partially clogged up by soil deposits and garbage.
- (b) Some parts of the lining of the upstream and downstream of the saddle dam are still visible damage to the stone pairs.
- (c) Wild grass and shrubs are seen along the top of the saddle dam, on the sidelines of the ripa-rap of the upstream slope and downstream slope.
- (d) Livestock poultry found in some places on the original soil downstream of the saddle dam.

4.4 Ubrug Saddle Dam

In general, Ubrug saddle dam conditions are relatively good and normal with visual observation conditions as follows:

- (a) There are cracks along the 11 meters wide 50 cm in 30 between the c.10 -c.11 segment.
- (b) There is still original soil erosion near the downstream drainage next to the emergency spillway.
- (c) The protective building of the instrumentation apparatus in the downstream area of the partially damaged partition (rock pairs on the loose wall) and part of the protective cover is lost.
- (d) Drainage system overgrown with weeds and there is damage to the lining of stone pairs.
- (e) The position of the right collector building is not suitable, the drainage channel is higher than the position of the container tub.
- (f) Grasses and herbaceous plants are still visible in several places on the sidelines of the hill and downstream of the dam, rip-rap hillsides and rafting downstream.

4.5 Reservoirs Rim Inspection

In general the condition of the reservoir rim is relatively good and normal with the visual observation conditions as follows:

- (a) Found water vegetation in the form of water hyacinth in Cimanggu area.
- (b) There are many patches of illegal floating net cages in the Pasir Gombang Barat, Madang, Kertamanah, Pagadungan - Sukasari, Sukasari - Sodong, Cilendi and Jamaras – Tajur Sindang area.
- (c) More and more fishing rafts on the edge of the reservoir between the main dam – pasir gombang and Pagadungan area.
- (d) More and more non-permanent buildings and floating buildings in the puddle area and side of lake reservoir Sukasari, Cidadap, Cimanggu, Bojong, Warung Jeruk, Cilangobar, Sindang, Ciganea - Ubrug area, which is used by the community to trade and as a place of residence that has the potential to produce waste is relatively large.
- (e) Found erosion and landslides and landslide potential in the right bluff that is wide enough around the outlet Cirata reservoir.

5. CONCLUSION

Ir. H. Djuanda Dam is one of the largest dams and the first multipurpose dam in Indonesia. The dam with an area of 8,300 ha was built by the French franchise contractor Compagnie francaise d'entreprise in 1957 and completed in 1967, with a water potential of approximately 12.9 billion m³ / year. The capacity of this dam is 2.44 billion m³.

Visual inspection of large dams Ir. H. Djuanda is a routine activity undertaken in the context of monitoring activities on dam safety. Visual inspection is done periodically and continuously to get the latest visual data about the condition of Dam Ir. H. Djuanda. Visual inspection is important because not all changes in the condition and behavior of the dam can be described from the measurement or reading of the instrument. This visual inspection is done twice a year i.e., May - June at high water level and November - December when the water level is low.

Visual inspection activities consist of a series of inspection activities on dam bodies, complementary buildings, hilltop, rim (roving) reservoirs and the surrounding dam environment. Matters inspected during the visual inspection of the dam include leakage, basement, springs, evaporator, erosion eruption, surface erosion, scouring, abrasion, excessive plant growth, top straightness, protrusion or subsidence of slopes, animals, deterioration of rip-rap quality as well as other slope protective materials. As for the concrete buildings are examined for cracks, crushing, dissolving, leaking, indication of deterioration of quality or chemical reaction and or damage due to erosion and cavitation, the stability of construction joints.

The method of inspection implementation is divided into 2 types: visual inspection and underwater inspection. Visual inspection is a visual inspection of the ground and water inspection objects, such as dam surfaces, auxiliary buildings, ridges and reservoir cliffs, hydro mechanical equipment and so on.

Based on the results of visual inspection and observation of the dam body, main spillway towers, access galleries, saddle dam bodies, reservoir reefs and complementary buildings that are generally in relatively good condition and normal.

REFERENCES

- Directorate General Of Water Resources, Ministry of Public Works, March 2003. Guidelines for Inspection and Evaluation of Dam Safety.
- Jasa Tirta II Public Corporation, 2017. Report Six Monthly Visual Inspection Dam Ir. H. Djuanda.
- Indonesia Government Regulation No.37 Year 2010 on Dams.
- Jasa Tirta II Public Corporation, Quality System Document No. 1 / DL / PT / 30.21. 2010. applied in Jasa Tirta II Public Corporation on Dam Monitoring and Reporting and Operational Guidance of dam monitoring unit