

# Appendix 3 - Checklist of Dam Technology Issues

Issues that should be considered when preparing a Design Report or a Safety Review Report

## 1. General

- Report on any specific investigations and analyses carried out.
- Report on design methods, standards and loads adopted and the design data gathered and developed (ie plans, reports of investigations).
- Report on the proposed and actual construction methods (including results of testing).
- Report on operational and maintenance intentions used in developing the design or necessitated by the constraints of the design.
- Describe the expected performance and condition of the structure.
- Describe the instrumentation and monitoring requirements for the dam.

## 2. Drawings

- Plan of the dam and appurtenant works drawn on a contour plan of the site.
- Arrangements, elevations and sections showing details of the structures, the proposed foundation levels and sub-surface geological features.

## 3. Summary of Principal Data

- Type of dam.
- Type of foundation cut-off (if any).
- Type of spillway.
- Height of dam (as defined in the *Water Act 2000*).
- Length of (as applicable) embankment(s) or non-overflow structure(s).
- Spillway crest(s).
  - Type, number and dimensions of spillway and any crest or sluice gates.
- Elevations of (as applicable):
  - original stream bed or lowest natural surface at toe
  - base of cut-off
  - spillway crest(s)
  - top of dam
  - full supply level
  - top of flood control storage (if any)
  - maximum flood level.
- Volumes of (as applicable):
  - excavation for foundations, cut-off and spillway
  - fill in each embankment zone and total
  - concrete in spillway, if separate
  - concrete in dam wall and appurtenance.
- Reservoir storage capacity:
  - to full supply level
  - in flood control storage
  - in surcharge storage.
- Reservoir surface area at full supply level.
- Catchment area.

- For the maximum design flood:
  - estimated recurrence interval
  - peak inflow rate
  - peak spillway discharge.
- For outlet works:
  - number and dimensions of outlet pipes and conduits
  - number, sizes and types of guard and regulating valves and gates
  - discharge capacity of each outlet with reservoir at full supply level.
- List of reports prepared by any person or organisation in the course of investigation and design.

#### **4. Hydrological and Hydraulic Data and Analyses**

- Failure impact assessment (including dam break analysis) and consequence assessment.
- Topographic map of the catchment or description of the terrain including elevations.
- Area of the catchment and of each sub-area controlled by other storages or lakes.
- Summary of stream flow, flood flow or rainfall records on which the hydrological analyses are based.
- Adequacy of spillway and means of assessment.
- Tables or curves of reservoir area and storage capacity versus water surface level.
- Summaries, as applicable, of hydrological analyses leading to the determination of flood frequencies, probable maximum flood, reservoir capacity, outlet capacity, spillway capacity and freeboard above maximum flood level.
- Recurrence interval of maximum flood adopted for the design of spillway and outlets, as applicable.
- Particulars of proposed reservoir operation including operation of outlets and spillway crest gates during floods.
- Tailwater rating curve(s) for spillways and outlets.
- Hydraulic data including formulae and co-efficients used in determining capacity of spillways and outlets.
- Discharge rating curves for spillways and outlets.
- Summary of assumptions and methods adopted for the design of energy dissipaters for spillways and outlets.
- Results of any physical or numerical hydraulic model studies.
- Fetch of reservoir and estimated wave height and run-up.

#### **5. Foundation conditions and treatment**

- Map and description of the general geology of the dam site and reservoir area showing major faults and identifying any other potentially hazardous features requiring special consideration.
- Report on any underground mine workings in the vicinity of the dam or reservoir and any provisions considered necessary to accommodate these workings.
- Records of foundation exploration holes, pits, excavations and other sub-surface investigations indicating:
  - nature and depth of material on which the dam, spillway, outlets and other appurtenant works are proposed to be founded
  - summaries of results of laboratory and in-situ tests for determining the engineering properties of the foundation materials indicating the number of tests, sampling locations and extreme as well as average values.
- Nature and extent of any proposed foundation treatments such as:
  - cut-off through pervious strata
  - provisions for drainage
  - curtain, blanket or consolidation grouting;
  - measures to consolidate, decrease permeability or otherwise modify the properties of the foundation or remedy defects.

## 6. Properties of construction materials

- For earthfill, filter materials, pervious materials, transition materials and rockfill:
  - approximate locations of the borrow areas and quarries and estimated volumes of reserves of each material
  - numbers of exploration holes, pits and excavations in each proposed borrow area and quarry
  - summaries of results of laboratory tests for determining the engineering properties of each type of material, and of results of geological examinations and tests on rock materials, indicating the number of test samples and extreme as well as average values.
- For concrete aggregates, if not obtained from sources of materials previously described:
  - approximate locations of proposed sources and estimated volumes of reserves of aggregates
  - number of exploration holes, pits and excavations in each proposed source
  - summaries of results of laboratory tests for determining the engineering properties of each type of material, and of results of geological examination and tests on rock materials, indicating the number of test samples and extreme as well as average values.

## 7. Embankment Design and Stability Analyses

- Details of each design case considered.
- Summaries of the properties of the material in each zone of the embankment and the foundation adopted for the stability analyses including density and shear strength parameters both as placed and saturated as appropriate and the justification for the adopted properties.
- Basis for the estimates of the pore pressures in the impervious zones adopted for each design case examined.
- Particulars of the methods of stability analyses used, formulae used in the analyses or references in technical literature, and the upstream and downstream water levels used in each design case.
- Minimum values of the factor of safety obtained for each design case and the locations of the critical slip surface for each case drawn on a cross-section of the embankment or results of any other method of assessment of the stability of the embankment.
- References in technical literature to design rules if used to determine dimensions of a small embankment without analyses.

## 8. Stress and Stability Analysis of Concrete Structures & other structural components

- Details of each design case considered.
- Summaries of the properties of concrete and foundation materials adopted for the analyses.
- Assumptions as to loads, including combinations of loads due to water, dead weight, uplift, earthquake, silt or other solids and temperature change when appropriate.
- Limiting stresses.
- Methods of analysis.
- Results of any structural model studies.
- Results of analyses including safety factors and stresses in the structure and foundation or the results of any other method of assessment of the stability of the structure.

## 9. Instrumentation

- Layout and description of embedded instruments and other devices installed to observe the behaviour of the works including, as applicable, pore pressures and uplift, leakage, embankment settlements, foundation deformations, alignment, deflections, stresses, strains, temperatures, contraction joint openings, seismic and mechanical vibrations.
- Pore pressure and uplift values assumed for the design of the associated structures at instrument locations
- Recommended for frequency of observations/readings

## 10. Construction specifications

- Clauses dealing with:
  - foundation treatment and grouting
  - sources of construction materials
  - methods of treatment and placement of materials
  - acceptability criteria.
- Construction schedule and sequence of construction operations, if specified.
- Stream diversion plan with respect to safety during construction.