CHAPTER III

GEOTECHNICAL STUDY PROGRAM

The geotechnical study methods done in the present work include the assessment of rock mass quality along the diversion tunnel and at the portal slopes and foundation of main dam. The investigation of the properties and suitability of dam construction material or borrow area was also performed. These were done by analysing the existing data, field mapping and logging, field measurement, in-situ tests, petrographic examination, and classifying the rock mass using some engineering classification systems. The study methods will be described in detail as follow.

3.1 Preliminary Study of the Investigation Area

(1) Collecting and interpreting geological data from previous studied documents, geological maps, air photographs and borehole core logs.

(2) General geologic reconnaissance around the existing location site.

(3) Considering the relationship between the rock mass characteristics and the geometry of the proposed excavation openings.

3.2 Rock Mass Investigation

An intensive engineering geologic investigation in the studied area had been carried out by the present writer during late December 1982 to middle May 1983. This includes the general geologic mapping, engineering geologic mapping, tunnel logging, field recording, and in-situ measurements and sample collecting. Further evaluation of the rock mass quality along the diversion tunnel and its portals was also done.

3.2.1 Engineering Geological Investigation

The geologic mapping in this project was done at a scale 1:2,000, and a detailed record of the geology of the diversion tunnel and its portals as the tunnel logs and portal maps at a scale of 1:100 were collected using the graph paper, a Clar geological compass, a Schmidt rebound hammer (L-type), and 2 m- and 15 m-measuring tapes. The geologic controls on the methods and rate of excavation, the quantities and type of tunnel support were added to these reports. The typical characteristics and behavior of each rock type were used to demarcate the rock masses into the structural regions, each of which has the uniform features and similar behavior characteristics. The in-situ uniaxial compressive strength of rock was determined by using the Schmidt rebound hammer. The rock samples were also collected for the field-laboratory point-load testing on the irregular chumps, and for the diametrical and axial tests.

3.2.2 Hydrological Investigation

The method is to observe and measure the amount of groundwater flowing out of the jointing planes and cavity into the

underground excavation. Most of the investigation was done at the top heading of the diversion tunnel, as the portals were practically dry after excavation except for some isolated damp or moist patches and occasional drips to medium inflow along the fault zones or zones of slightly open-joints. At the station 256 m along the tunnel line numerous trickles (<1.5 litre/min. each) were noted along a series of subparallel faults which had a strike almost normal to the tunnel axis.

3.2.3 In-Situ Deformation Measurements

The measurement of rock displacement and deformation due to the stress relief in the tunnel walls and within the rock were done using a single position borehole extensometer inserted in the 36-mm diameter boreholes. The instrument used in this study consisted of three main sections (Figure 3.1), namely, the headpiece, the movement transmission element and the anchor core with anchor point. The headpiece is the only part visible when the instrument installed and it represents the point of reference; it is held in position mechanically or by using the grouting technique. The read-out unit incorporates a dial gauge which is removed after a reading has been taken. This borehole extensometer can be read repeatably to 0.02 mm accuracy.

3.2.4 Borehole Logging

The core samples from the existing diamond drilling boreholes were restudied and the rock quality designation (RQD) was accounted.

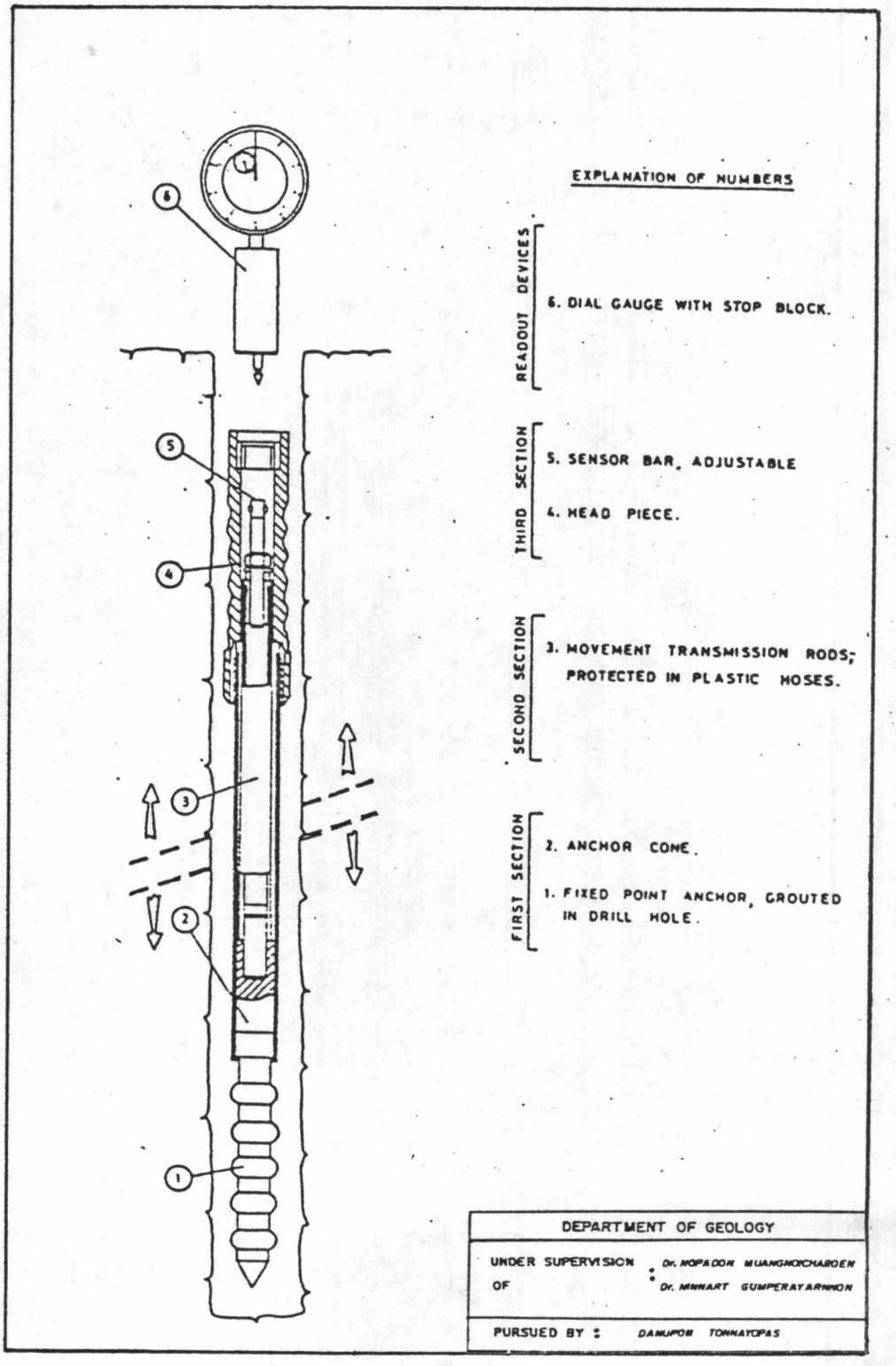

Figure 3.1 A single-point rod extensometer (after Bieniawski, 1975)

3.2.5 Rock Mass Rating

The rock mass rating was carried out by determining the discontinuity parameters in each structural region to assess the in-situ rock mass behavior.

3.2.6 Analysis of Pook Mass Classification

The results from the rock mass classification were analysed to predict the being-concerned tunnel-, slope- and foundation stability.

3.3 Intact Rock Quality Index

The rock samples were collected from the field in the form of NX cores (54 mm diameter) and regular hand specimens. These samples were carefully chosen to avoid the part which are highly weathered or which have the obvious defects such as faults, joints, and other cracks. The samples were for the laboratory testing of the physical and mechanical, static and dynamic properties. The mineralogical characteristics were carried out in the laboratories of Khon Kaen University's Geotechnology Department and Geology Department, Chulalongkorn University. The sequence of experimental works is as follow.

(1) The samples were collected mostly from various locations in the key trench foundation of the main damsite and the upstream diversion tunnel portal.

(2) A total of 233 test specimens were prepared from the available NX cores. They were used in the uniaxial compression test, direct shear test, Braxilian test, point-load test and pulse velocity test.

(3) The aggregates were prepared for the slake durability test, Los Angeles abrasion test, sodium sulphate soundness test. The other properties were compiled from the existing data of EGAT laboratory.

(4) Two samples of mudshale were investigated by means of X-ray diffraction. Other 49 thin-sections of all rock types observed here were prepared for the petrographic examination.

(5) Various geotechnical properties of the pebbly graywackes to pebbly mudstones were determined and analysed, and the results were discussed. This gives an engineering classification of the intact rocks.

(6) The results of the in-situ and laboratory tests were compared for a general practical application to establish the index rock properties.

The simplified flow chart and subflow charts of the overall sequence of study on the geotechnical characteristic of the jointed rock mass at the Chiew Larn damsite are illustrated as Figures 3.2 to 3.3

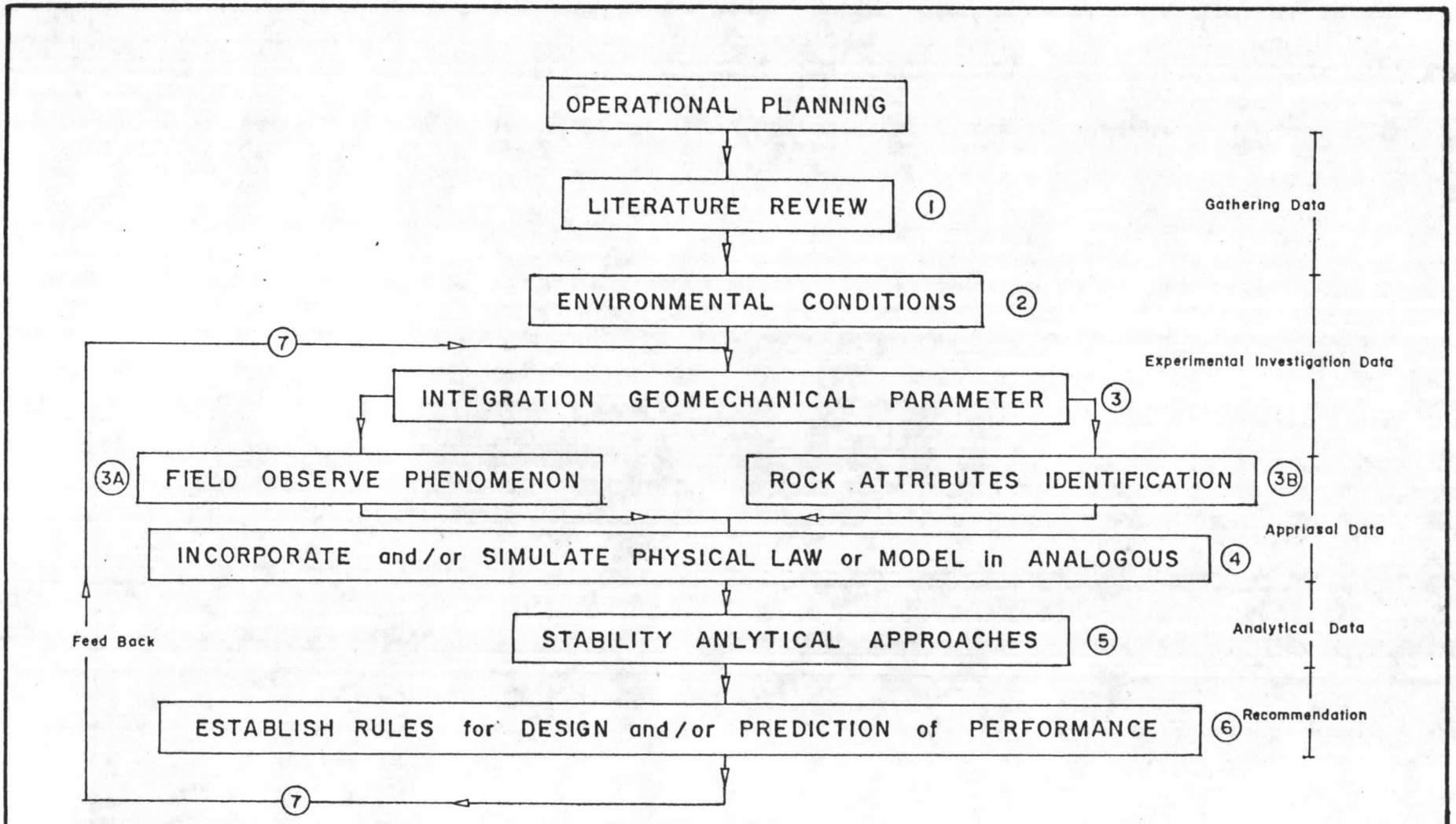

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Figure 3.2	PURSUED BY : DANUPON TONNAYOPAS	MASTER FLOW CHART OF THESIS RESEARCH

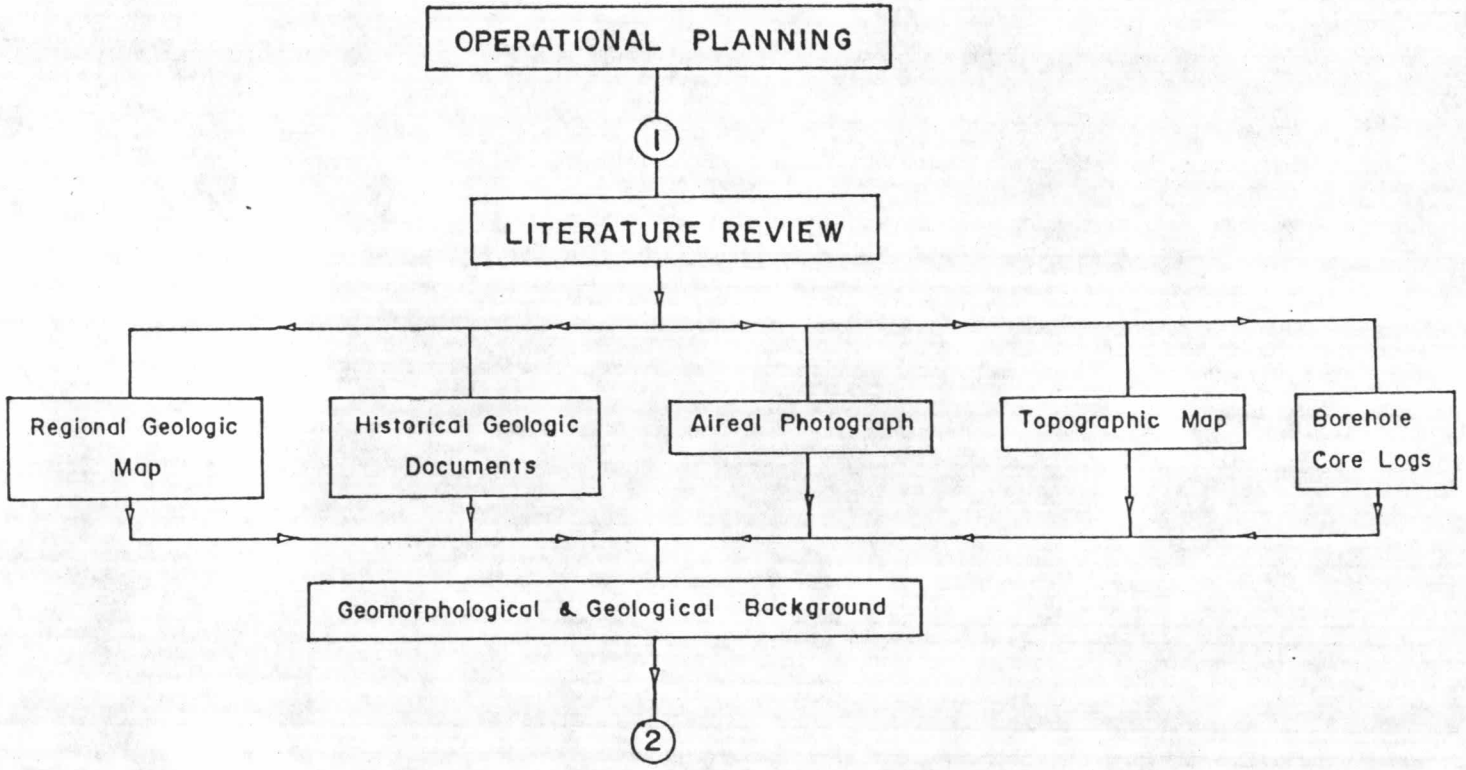

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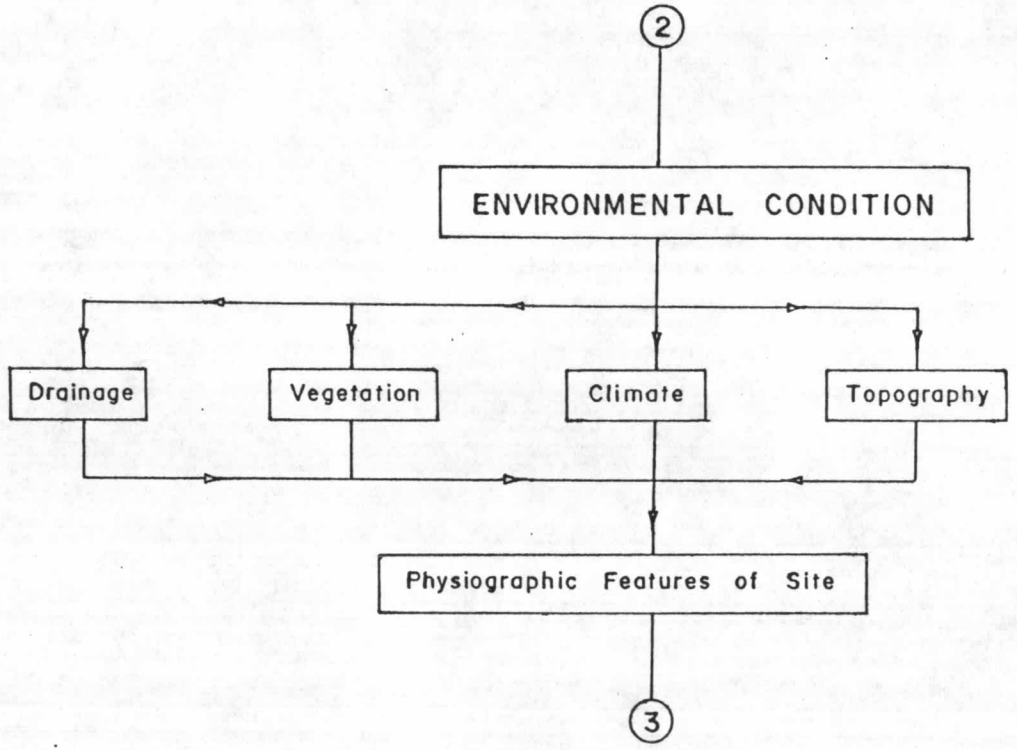
Figure 3.3	PURSUED BY : DANUPON TONNAYOPAS	SUBFLOW CHART OF THESIS RESEARCH



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PURSUED BY : DAMRONG TONNAYOPAS	SUBFLOW CHART OF THESIS RESEARCH

Figure 3.3 cont.

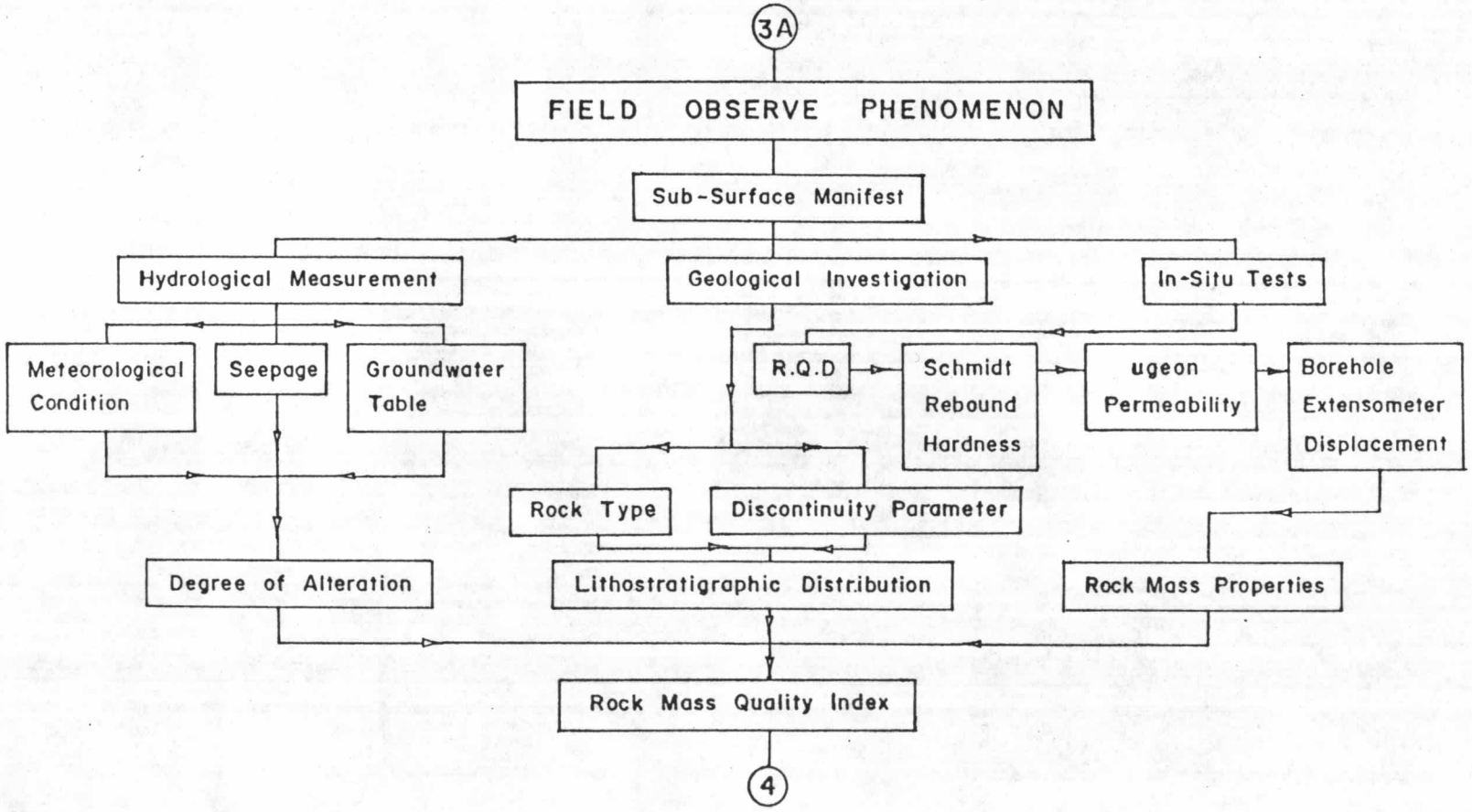

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Figure 3.3 cont.

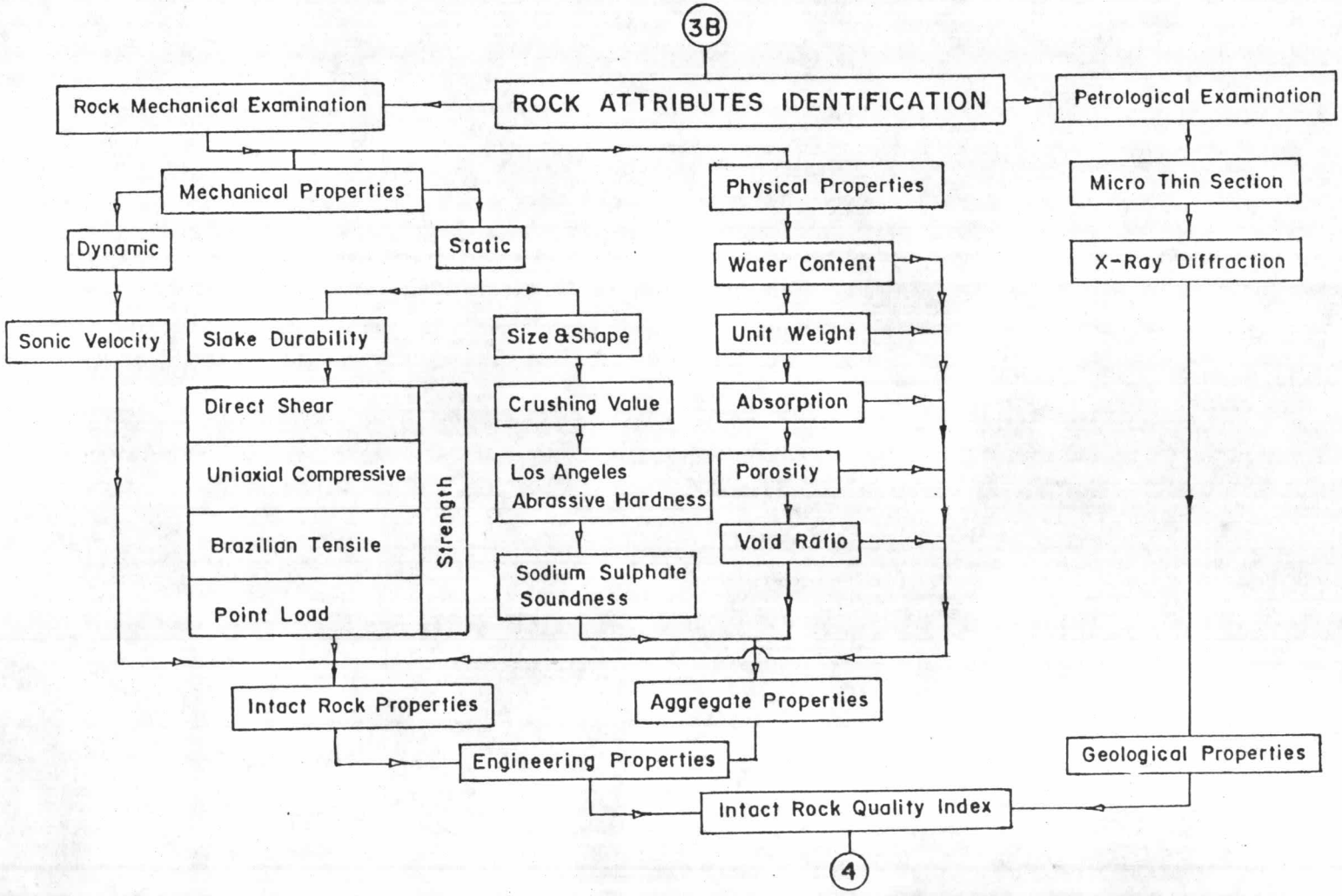

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Figure 3.3 cont.

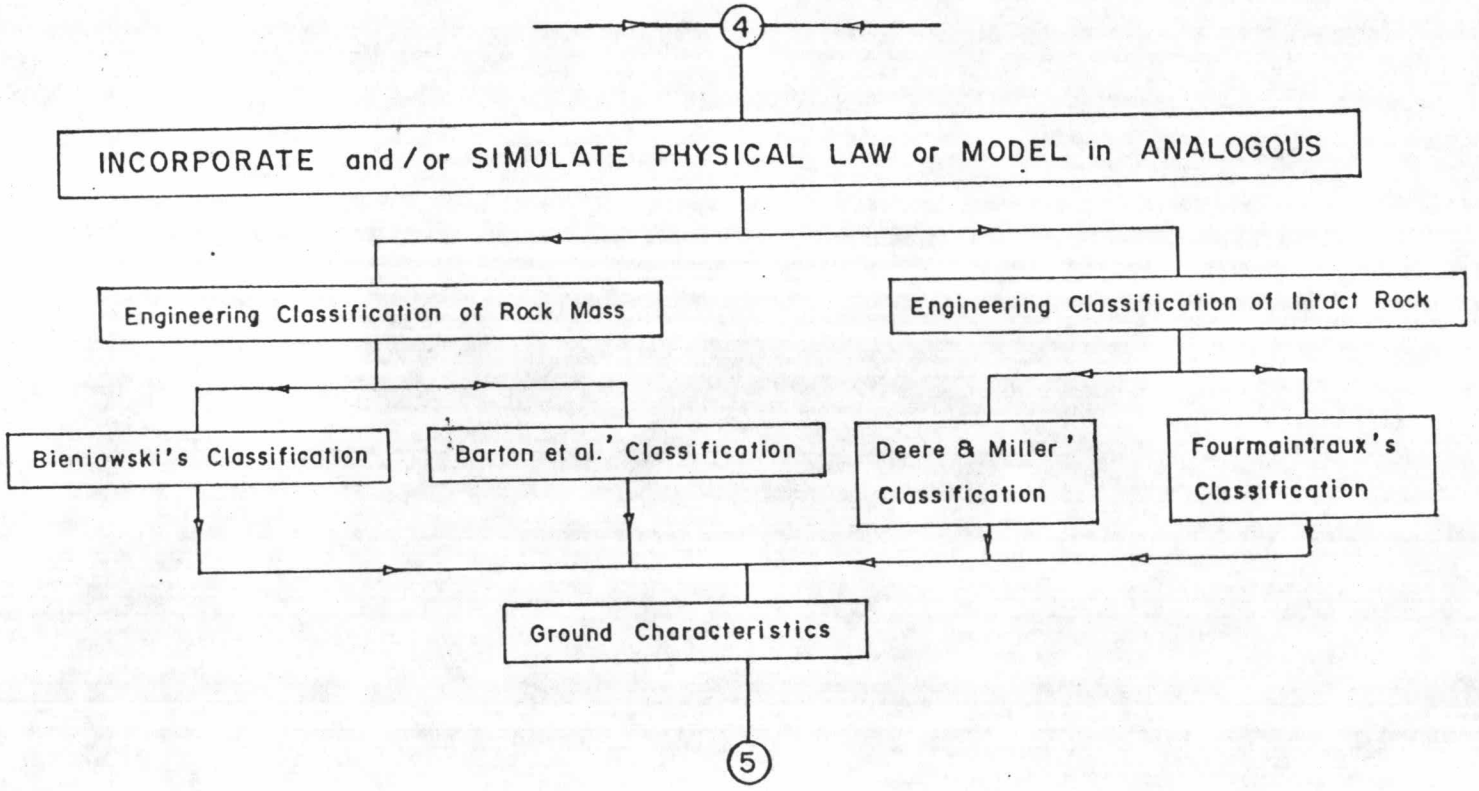

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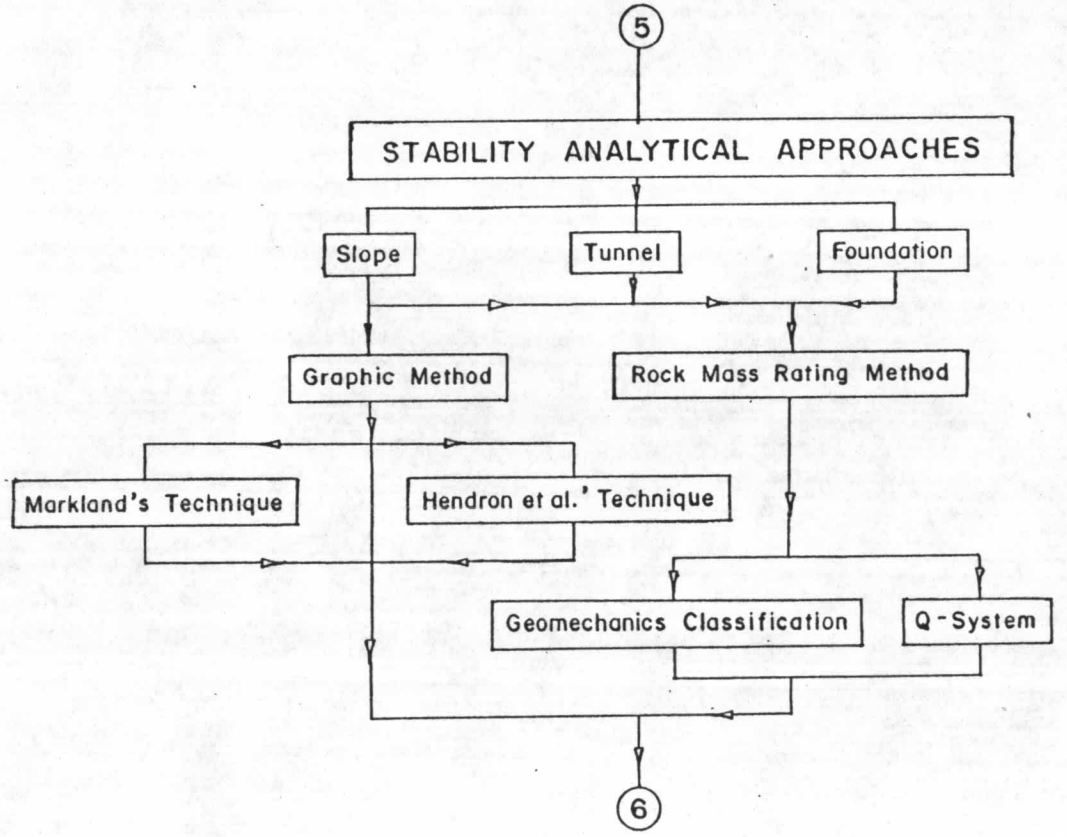
Figure 3.3 cont.



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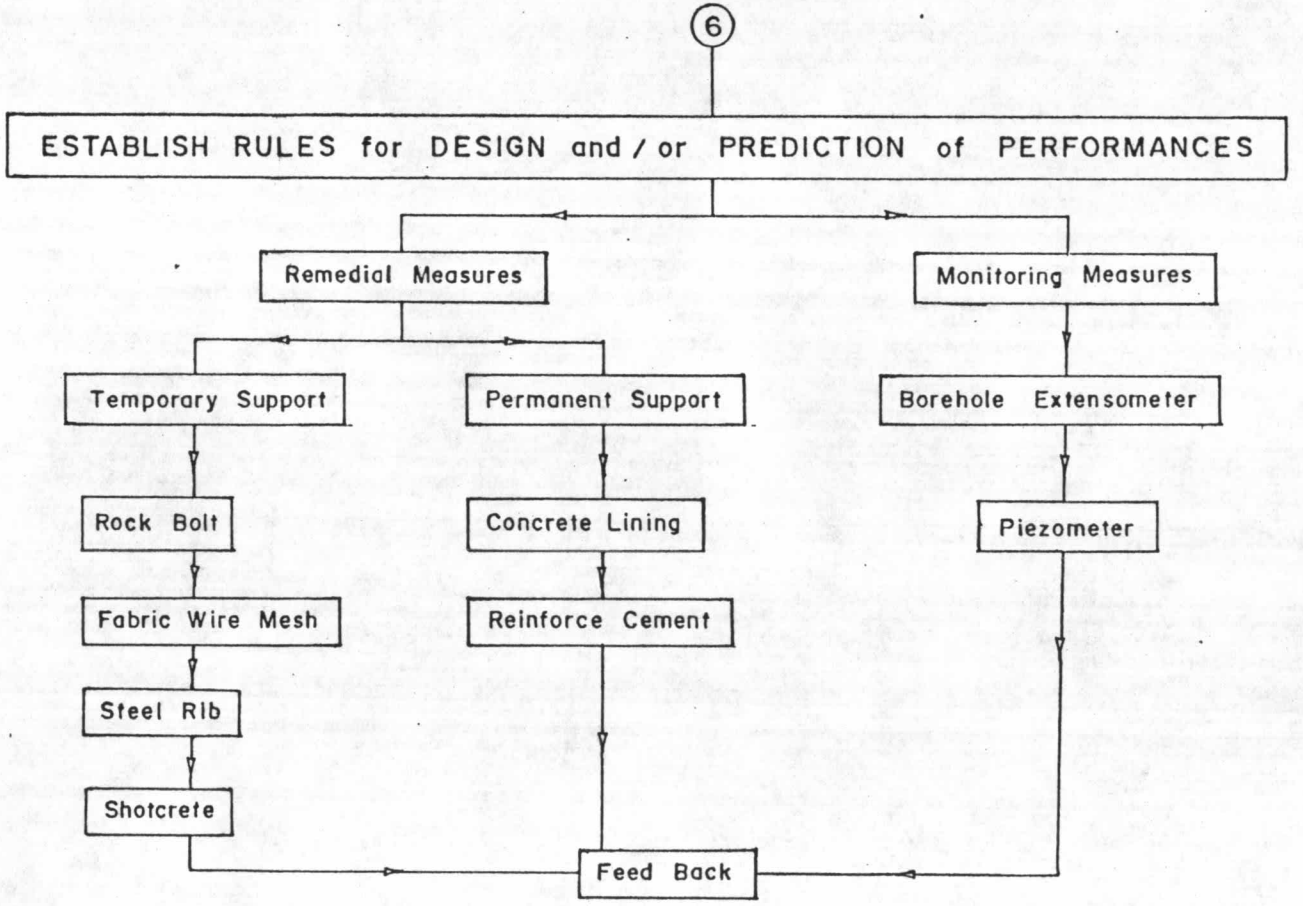

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Figure 3.3 cont.