GUIDELINES FOR PREPARING ENGINEERING GEOLOGIC REPORTS IN OREGON

Adopted by
The Oregon State Board of Geologist Examiners

This is a suggested guide for the preparation of an engineering geologic report in Oregon. The engineering geologic report should include sufficient facts and interpretation regarding geologic materials, processes, and history to allow evaluation of the suitability of the site for the proposed use. Because of the wide variation in size and complexity of projects and scope of work, the guidelines are intended to be flexible and should be tailored to the specific project. The guidelines are intended to be fairly complete; however, not all items would be applicable to small projects or low-risk sites. In addition, some items may be addressed in separate reports prepared by a geotechnical engineer, geophysicist, structural engineer, or hydrologist.

The guidelines are based on a publication developed by the Guidelines Committee of the Utah Section of the Association of Engineering Geologists, a series of guidelines published by the California Division of Mines and Geology in the CDMG Note series, and the Bulletin of the Association of Engineering Geologists (Slosson, 1984).

I. GENERAL INFORMATION

The following items should be addressed:

A. Client or party that commissioned the report.

B. Name(s) of geologist(s) who did the mapping and other investigation on which the report is based, and dates when the work was done.

C. Location and size of area, and its general setting with respect to major or regional geographic and geologic features.

D. Purpose and scope of the report and geologic investigation, including the proposed use of the site. Also, identify level of the study, i.e., feasibility, preliminary, final, etc.

E. Topography and drainage within or affecting the area.

F. General nature, distribution, and abundance of exposures of earth materials within the area.

G. Nature and source of available subsurface information and geologic reports or maps. Suitable explanations of the available data should provide a technical reviewer with the means of evaluating the reliability. Reference to cited works or field observations should be made, to substantiate opinions and conclusions.

H. Disclosure of known or suspected geologic hazards affecting the area, including a statement regarding past performance of existing facilities (such as buildings or utilities) in the immediate vicinity.

I. Location of test holes and excavations (drill holes, test pits, and trenches) shown on maps and sections and described in the text of the report. The actual data, or processed data upon which interpretations are based, should be included in the report to permit technical reviewers to make their own assessments regarding reliability and interpretation.

J. All field and laboratory testing procedures (by ASTM designation, if appropriate) and test results.

K. Disclosure statement of geologist's financial interest, if any, in the project or the client's organization.

L. The signature and seal of the certified engineering geologist who prepared the report.

II GEOLOGIC MAPPING AND INVESTIGATION

A. Geologic mapping of the area should be done at a scale which shows sufficient detail to adequately define the geologic conditions present. For many purposes, available published geologic maps are unsuitable to provide a basis for understanding the site conditions, so independent geologic mapping is needed. If available published geologic maps are used to portray site conditions, they must be updated to reflect geologic or topographic changes which have occurred since map publication. It may be necessary for the geologist to extend mapping into adjacent areas to adequately define significant geologic conditions.

B. Mapping should be done on a suitable topographic base or aerial photograph, at an appropriate scale with satisfactory horizontal and vertical control. The date and source of the base should be included on each map or photo.

C. The geologist doing the investigation and preparing the map should report the nature of bedrock and surficial materials, the structural features and relationships, and the three-dimensional distribution of earth materials exposed and inferred within the area. A clear distinction should be made between observed and inferred features and relationships.

D. The report should include one or more appropriately positioned and scaled cross sections to show subsurface relationships that cannot be adequately described in words alone. Fence or block diagrams may also be appropriate.

III. GEOLOGIC DESCRIPTIONS

The report should contain brief but complete descriptions of all natural materials and structural features recognized or inferred within the subject area. Where interpretations are added to the recording of direct observations, the basis for such interpretations should be clearly stated. Describe all field mapping and exploration procedures (surface geologic reconnaissance, drilling, trenching, geophysical survey, etc.)

The following checklist may be useful as a general, though not necessarily complete, guide for descriptions:

A. Bedrock

1. Identification of rock types.

2. Relative and absolute age and, where possible, correlation with named formations and other stratigraphic units.

3. Surface and subsurface expression, areal distribution, and thickness.

4. Pertinent physical characteristics (e.g., color, grain size, nature of stratification, strength, variability).

5. Distribution and extent of zones of weathering; significant differences between fresh and weathered rock.

6. Special engineering geologic characteristics or concerns (e.g., factors affecting proposed grading, construction, and land use).

B. Structural features – stratification, faults, discontinuities, foliation, schistosity, folds

1. Occurrence, distribution, dimensions, orientation and variability; both within and projecting into the area.

2. Relative ages, where pertinent.

3. Special features of faults (e.g., topographic expression, zones of gouge and breccia, nature of offsets, age of movements, youngest faulted unit and oldest unfaulted unit).

4. Other significant structural characteristics or concerns.

C. Surficial deposits – alluvial, colluvial, eolian, glacial, lacustrine, marine, residual, mass movement, volcanic (such as cinders and ash), and fill.

1. Identification of material, grain size, relative age, degree of activity of originating process.

2. Distribution, dimensional characteristics, variations in thickness, degree of soil development, surface expression.

3. Pertinent physical and engineering characteristics (e.g., color, grain size, lithology, compactness, cementation, strength, thickness, variability).

4. Special physical or chemical features (e.g., indications of volume change or instability, such as expansive clays or peat).

5. Other significant engineering geologic characteristics or concerns.

D. Surface and shallow subsurface hydrologic conditions, including groundwater, springs, and streams and their possible effect on the site. Indicate how conditions may be affected by variations in precipitation, temperature, etc.

1. Distribution, occurrence, and variations (e.g., drainage courses, ponds, swamps, springs, seeps, aquifers).

2. Identification and characterization of aquifers; depth to groundwater and seasonal fluctuations, flow direction, gradient, recharge and discharge areas.

3. Relationships to topographic and geologic features.

4. Evidence for earlier occurrence of water at localities now dry (e.g., vegetation, mineral deposits, historic records).

5. Other significant engineering geologic characteristics or concerns, such as fluctuating water table and the effects of proposed modifications on future hydrologic processes.

E. Seismic considerations.

1. Description of the seismotectonic setting of the area (including size, frequency, and location of historic earthquakes), current seismic zoning, and expected seismic risk.

2. Potential for area to be affected by surface rupture (including sense and amount of displacement, and width of surface deformation zone).

3. Probable response of site to likely earthquakes (estimated ground motion).

4. Potential for area to be affected by earthquake-induced landslides or liquefaction.

5. Potential for area to be affected by regional tectonic deformation (subsidence or uplift.

IV ASSESSMENT OF GEOLOGIC FACTORS

Assessment of existing geologic conditions and processes with respect to intended use of the site constitutes the principal contribution of the report. It involves 1) the effects of the geologic features upon the proposed grading, construction, and land use, and 2) the effects of these proposed modifications upon future geologic conditions and processes in the area.

The following checklist includes topics that ordinarily should be considered in discussions, conclusions, and recommendations in geologic reports:

A. General suitability of proposed land use to geologic conditions.

1. Areas to be avoided, if any, and mitigation alternatives.

2. Topography and slope.

3. Stability of geologic units.

4. Flood and tidal inundation, erosion, and deposition.

5. Problems caused by geologic features or conditions in adjacent properties.

6. Other general problems.

B. Identification and extent of known or probable geologic conditions which may result in risk to the proposed land use (such as flood inundation, shallow groundwater, storm surge, surface and groundwater pollution, snow avalanche, landslide, debris flow, rock fall, expansive soil, collapsible soil, subsidence, erosion, deposition, earthquake shaking, fault rupture, tectonic deformation, liquefaction, seiche, tsunami, volcanic eruption).

C. Recommendations for site grading.

1. Protection of what materials and structural features will be encountered in proposed cuts.

2. Prediction of stability based on geologic factors; recommended avoidance or mitigation alternatives to cope with existing or potential landslide masses.

3. Excavation considerations (hard or massive rock, groundwater flows).

4. General considerations of proposed fill masses in canyons or on sidehills.

5. Suitability of on-site material for use as compacted fill.

6. Recommendations for positioning fill masses, provision for subdrainage, buttressing, and the need for erosion protection on fill slopes.

7. Other recommendations required by the proposed land use, such as the angle of cut slopes, position of drainage terraces, need for rock-fall and/or erosion protection on cut slopes.

D. Drainage considerations.

1. Protection from inundation or wave erosion along shorelines.

2. Soil permeability, suitability for septic systems.

3. Protection from sheet flood or gulley erosion, and debris flows or mud flows.

E. Limitations of study, and recommendations for additional investigations. Considering the scope of work and intended use of the site, provide a statement of the limitations of the study and the need for additional studies outside the stated scope of work.

1. Borings, test pits, and/or trenches needed for additional geologic information.

2. Percolation tests needed for design.

3. Program of subsurface exploration and testing that is most likely to provide data needed by the soils or civil engineer.

4. Program for long-term monitoring of the site to evaluate geologic conditions (survey hubs, inclinometers, extensometers, etc.).

V. RECOMMENDED TECHNIQUES/SYSTEMS TO CONSIDER

A. Engineering geology mapping can be done using the Genesis-Lithology-Qualifier (GLQ) system (Keaton, 1984), rather than the conventional Time-Rock system commonly used in geologic mapping. The GLQ system promotes communication of geology information to non-geologists. The Unified Soil Classification System (U.S. Army Corps of Engineers, 1960 - Tech. Memo 3-357, and American Society for Testing and Materials, 1984) has been used in engineering for many years and has been incorporated into the GLQ system.

B. The Unified Rock Classification System (Williamson, 1984) provides a systematic and reproducible method of describing rock weathering, strength, discontinuities, and density in a manner directly usable by engineers.

C. Systems for mapping landslide deposits are described by Wieczorek (1984) and by McCalpin (1984).

D. Commonly accepted grading requirements are described in Chapter 70 of the Uniform Building Code.

Direct your questions and comments regarding these guidelines to:

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REFERENCES

American Society for Testing and Materials, 1984, Standard practice for description and identification of soils (visual-manual procedure): ASTM Standard D-2488-84, p. 409-423.

Keaton, J.R., 1984, Genesis-lithology-qualifier (GLQ) system of engineering geology mapping symbols: Bulletin of the Association of Engineering Geologists, Vol. XXI, No. 3, p. 355-365.

McCalpin, James, 1984, Preliminary age classification of landslides for inventory mapping: 21st Annual Symposium on Engineering Geology and Soils Engineering, Proceedings, University of Idaho, Moscow, ID, p. 99-111.

Slosson, J.E., 1984, Genesis and evolution of guidelines for geologic reports: Bulletin of the Association of Engineering Geologists, Vol. XXI, No. 3, p. 295-316.

U.S. Army Corps of Engineers, 1960, The Unified Soil Classification System: U.S. Army Technical Memorandum 3-357.

Utah Section of the Association of Engineering Geologists, 1986, Guidelines for preparing engineering geologic reports in Utah: Utah Geologic and Mineral Survey Miscellaneous Publication M, 2 p.

Wieczorek, G.F., 1984, Preparing a detailed landslide-inventory map for hazard evaluation and reduction: Bulletin of the Association of Engineering Geologists, vol. XXI, No. 3, p. 337-342.

Williamson, D.A., 1984, Unified Rock Classification System: Bulletin of the Association of Engineering Geologists, Vol. XXI, No. 3, p. 345-354.