

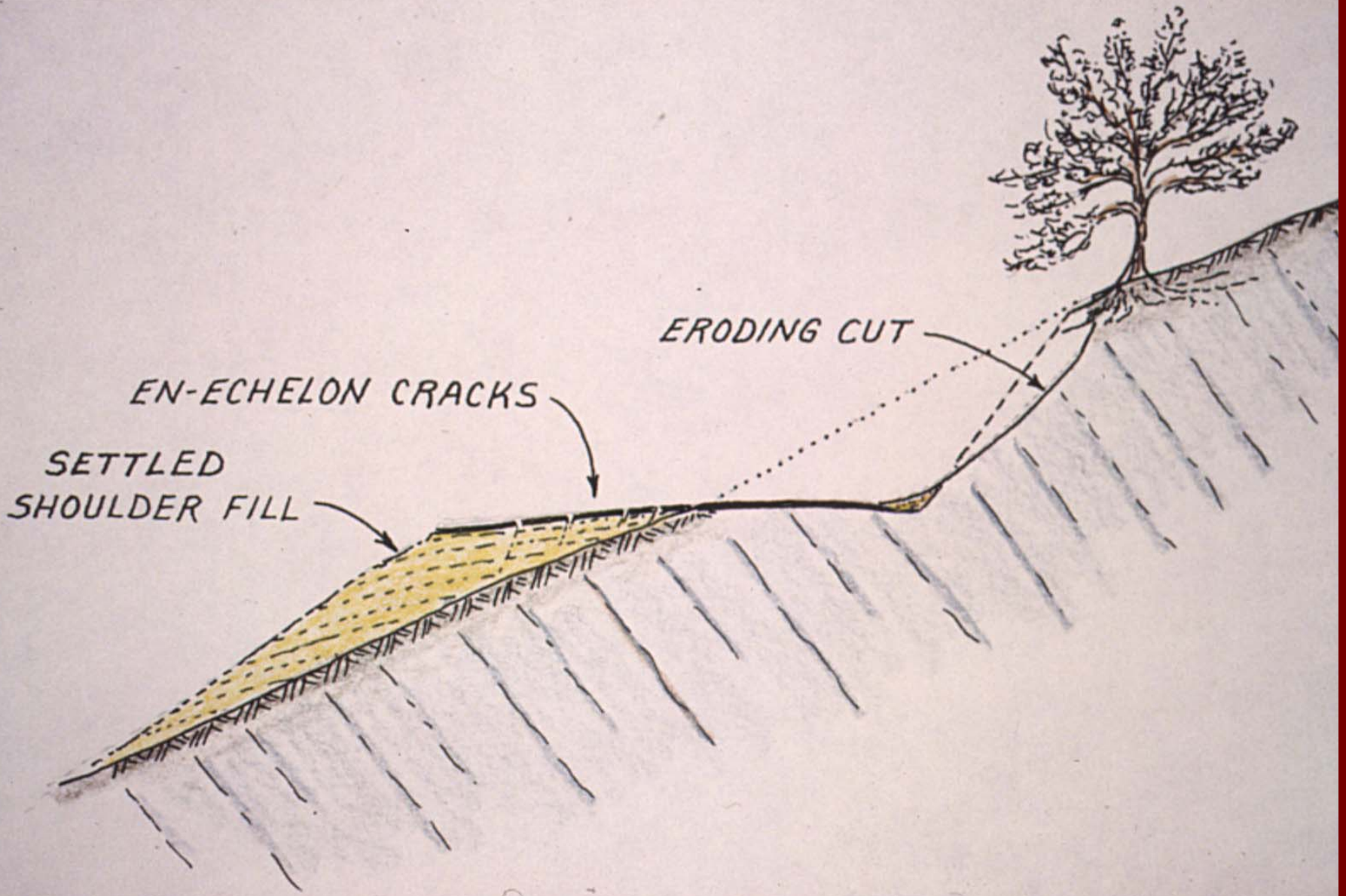
History of Geohazard-Related Building Code Provisions in California

Beginnings

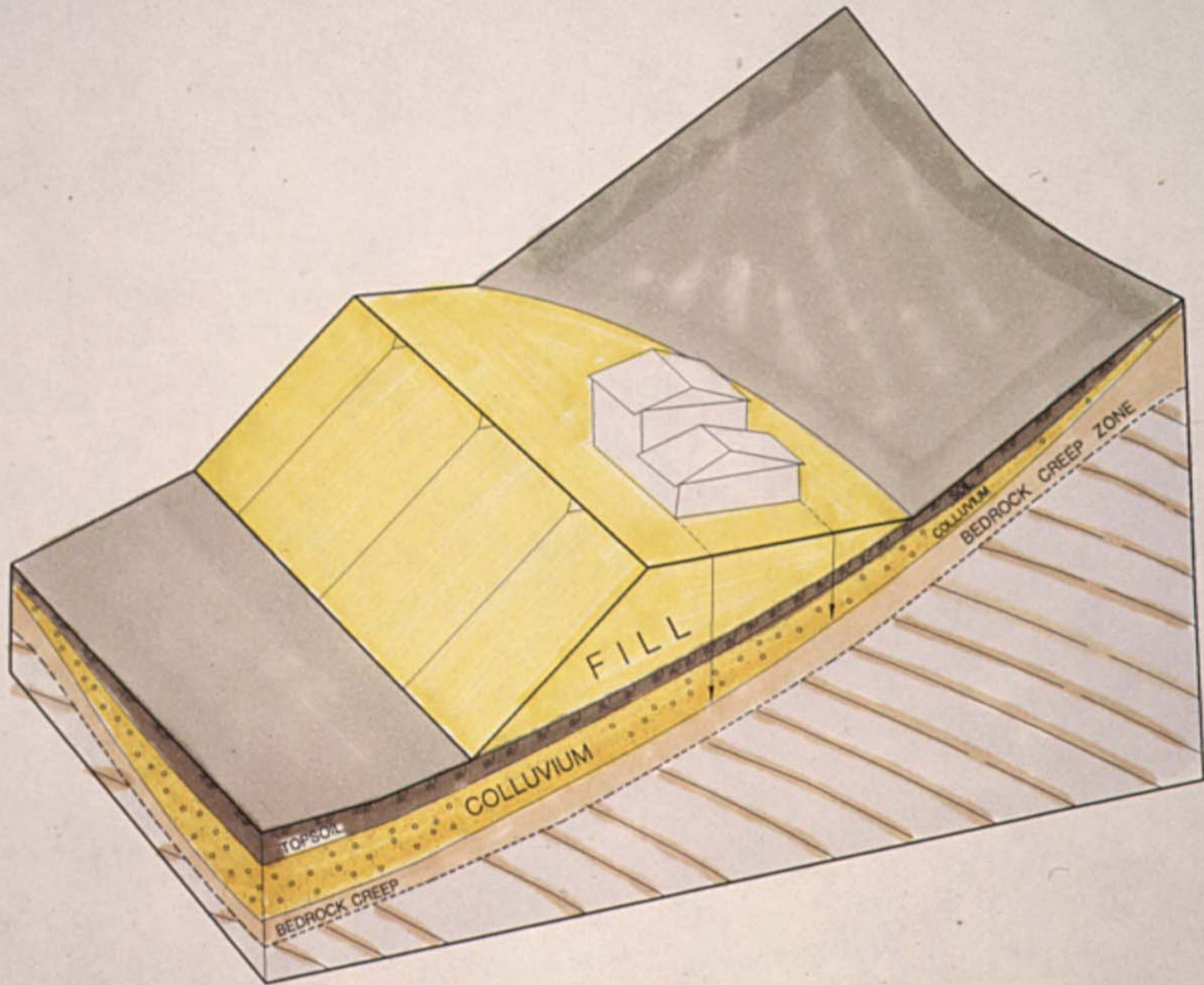
- Post World War II population growth in California
- Improved earthmoving equipment
- More discretionary income
- Land development extends into hillside areas
- Hillside homesites considered more desirable

Grading Practices – Late 1940s

- Used same design and construction methods that were being used for roads
- No input from geotechnical engineers or engineering geologists
- Minimal removals of unsuitable soils
- Substandard compaction
- Steep slopes
- Insufficient drainage provisions
- No grading codes, grading permits, or grading inspections









1952 – A Turning Point

- First wet winter in ten years
- One storm in January 1952 yielded 7.5 inches of rainfall in six days at downtown Los Angeles

1952 – A Turning Point

- Extensive erosion damage and slope failures in the newly built hillside developments
- Estimated 250,000 cubic yards of soil and debris removed from Los Angeles city streets
- \$7.5 million property damage in City of Los Angeles alone

First Grading Code

1952 – City of Los Angeles adopts the nation's first grading code, and forms a grading section within the Department of Building and Safety to enforce this code

“This ordinance is hereby declared to be urgently required for the immediate preservation of the public peace, health and safety, and shall take effect immediately upon its publication.”

First Grading Code

- Established "Hillside Grading Areas"
- Permits and inspections required in these areas – implemented mostly by city staff
- Required submittal of grading plan
- Maximum 1:1 cut slopes (steeper slopes allowed if recommended by a licensed civil engineer experienced in erosion control)

First Grading Code

- Maximum 1.5:1 fill slopes
- Required compaction of fills that were to support buildings
- Required drainage provisions to prevent excessive erosion on slope face and proper water flow to street, storm drain, or natural watercourse. Drains did not need to be paved.

First Grading Code

- No geotechnical or geological investigation prior to construction
- *“The Department may require a certificate by an approved soil testing agency based on tests of the fill at selected stages. If favorable conditions exist, the Department may, by prior approval, waive requirements for supervision of, or soil tests by an approved soil testing agency.”*
- Geologists rarely asked to participate
- Geotechnical engineering was mostly limited to providing density tests

Incremental Improvements in City of LA Grading Code

- 1956 – Minimum building setbacks from slopes
- 1956 – Geologic reports sometimes required
- 1957 – Revised setback requirements
- 1958 – Minimum 2% finish grade slope
- 1959 – Paved surface drainage devices
- 1960 – Planting of fill slopes

Others Soon Followed

1952 – Beverly Hills

1953 – Pasadena

1954 – Glendale and Burbank

1956 – San Francisco

1957 – County of Los Angeles

1958 – Ventura

1959 – County of Santa Barbara

1960 – County of San Mateo

"Licensing" and Guidelines

- Early geological investigation reports were usually not well done, and not very useful
- 1958 – City of LA Geologic Hazards Committee, chaired by Dr. Richard Jahns of Cal Tech, developed a roster of qualified geologists (state licensing of geologists did not begin until 1970)
- 1960 – Geologic Hazards Committee develops first guidelines for geological investigations

1963 – First Major Revision to City of LA Grading Code

- Followed another wet winter
- Maximum 2:1 cut and fill slopes
- Paved terrace drains and paved drainage devices
- Geologic and engineering investigation report required before grading permit is issued
- Grading operations “supervised” by both a geologist and an engineer
- Grading report required before building permits issued

Uniform Building Code

Through a joint effort between AEG and ICBO, a new chapter on grading (Chapter 70) was added to the Uniform Building Code. This chapter first appeared in the 1964 edition of the code. It was revised in 1970

UNIFORM BUILDING CODE

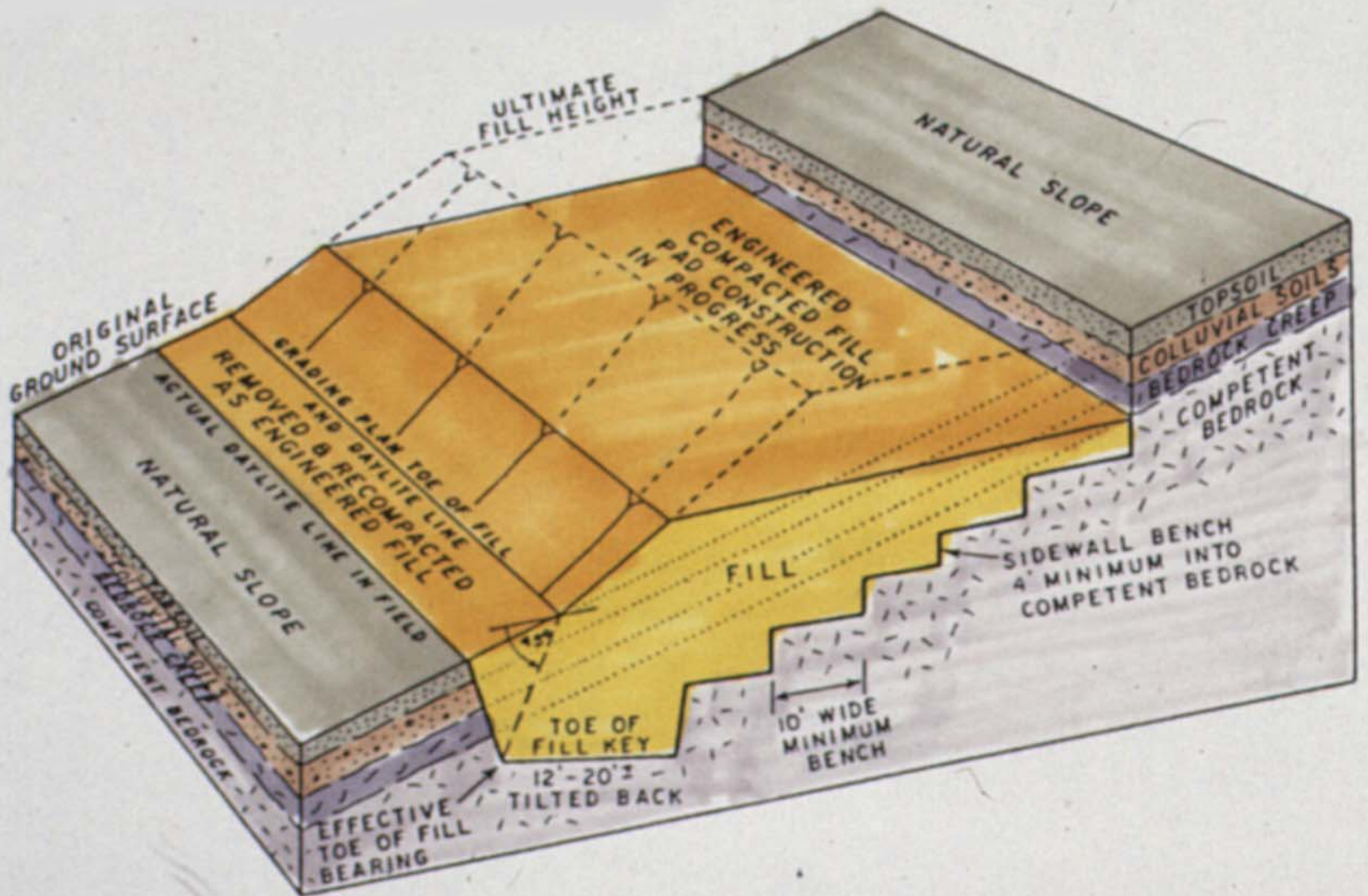
*1964 Edition
Volume I*



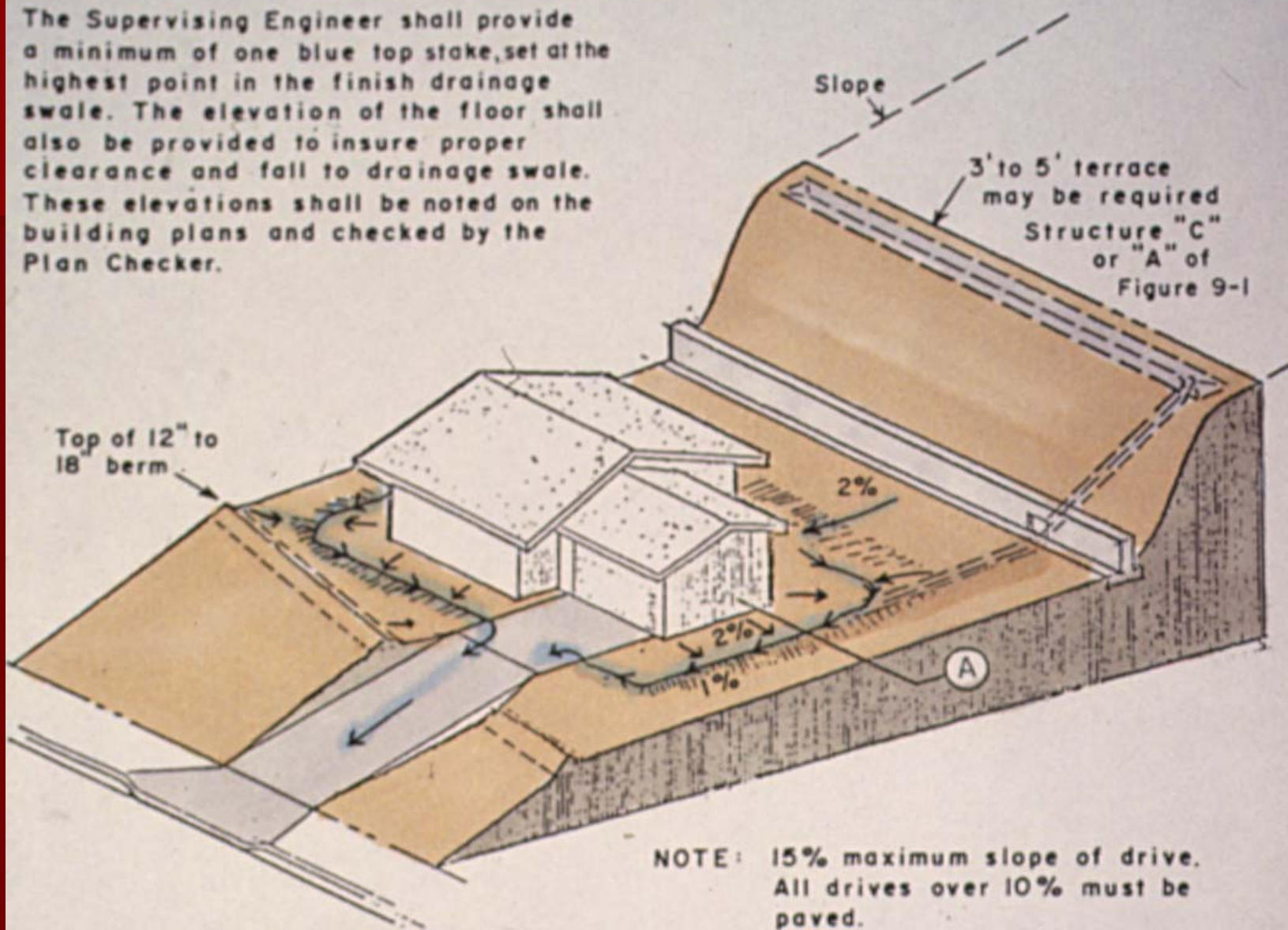
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The Supervising Engineer shall provide a minimum of one blue top stake, set at the highest point in the finish drainage swale. The elevation of the floor shall also be provided to insure proper clearance and fall to drainage swale. These elevations shall be noted on the building plans and checked by the Plan Checker.



NOTE: 15% maximum slope of drive. All drives over 10% must be paved.

Have Grading Codes
Been Effective in
Protecting the Public
from Geohazards?

Landslide and Flood Damage to Hillside Homes in the County of Los Angeles during the February 1969 Rainstorms

Description	Number of Hillside Homes Built	Number of Damaged Homes	Failure Rate	Damage Per Total Homes Built
Pre-1952	10,000	1040	10.4%	\$330
1952-1963	27,000	350	1.3%	\$102
Post-1963	11,000	17	0.2%	\$7

Slope Failures in the City of Los Angeles During the February-March 1978 Rainstorms

Description	Number of Sites Constructed	Number of Failures	Failure Rate	Dollar Value
Pre-1963	37,000	2,790	7.5%	\$40-49 million
Post-1963	30,000	210	0.7%	\$1-2 million



Geohazard-Related Laws Outside of the Building Code

- Seismic Hazards Mapping Act
- Alquist-Priolo Earthquake Fault Zoning Act
- Surface Mining and Reclamation Act (SMARA)
- Subdivision Map Act
- California Environmental Quality Act (CEQA)

Building Codes in California

California Building Code

- Since 1979, the building code in California has been adopted on a statewide level
- The California Building Code (CBC) has always been based on the UBC
 - 1979 CBC was based on the 1978 UBC
 - Revised every three years
 - Later editions have had extensive changes
- Adoption is required by state law
- Also may adopt “local amendments”

Geohazard-Related Problems
Introduced by the Building
Standards Commission's
Decision

Loss of Grading Chapter

- There is no grading chapter (i.e. nothing to replace Appendix Chapter 33 in the current CBC). Contains only a few very weak grading provisions in Chapter 36.
- Thus, 50+ years of experience in grading code development will be lost
- Removes the legal basis for regulation of earthwork and issuance of grading permits

Loss of Important Provisions Foundations & Retaining Walls

- No mention of liquefaction
- Substantially weaker provisions for expansive soils
- Nothing on post-tensioned floor slabs
- Loss of important seismic design provisions
- No provisions for minimum foundation setbacks from slopes
- Others

Unless these shortcomings are addressed, the next California Building Code will return us to the geohazard prevention provisions of 50 years ago.



Other Concerns

- The staff that enforces grading provisions of the building code are the same people that enforce the Seismic Hazards Mapping Act and the Alquist Priolo Act
- Some local agencies will not adopt local grading ordinances (due to ignorance, political pressures, or other reasons)

What is the California Association
of Grading Officials Doing
About This Problem?

- Expanding membership to Northern California
- Developing methods for resolving this problem
- Developing alliances with state-level boards
 - Mining and Geology Board
 - Seismic Safety Commission

Recommended Solution

- Develop a replacement for the existing grading chapter (CBC Appendix 33)
- Develop amendments to the foundations and retaining walls chapter in the NFPA code
- Attempt to have these documents incorporated into the CBC
 - Will require action from the California Building Standards Commission
 - If unsuccessful, can still be a model for local amendments

Questions and Discussion