

BOARD OF FORESTRY AND FIRE PROTECTION

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To: Board of Forestry and Fire Protection

From: Edith Hannigan, Board Analyst

Date: February 24, 2016

Subject: Cal Poly Single Access Subdivisions Assessment Research Project

Background:

In June 2012, CAL FIRE and the Board formed the 4290 Workgroup and task its members with researching and revising the regulations that implement and make specific Public Resources Code 4290, found in 14 CCR 1270 et seq and known as the SRA Fire Safe Regulations. Several sub-groups were formed to more efficiently evaluate the existing regulations, including a group dedicated to researching the road standards relating to ingress and egress and general access. The workgroup and sub-groups came up with recommended changes for the 1270 regulations based on their experience on fires, field tests at the Academy, and experience as fire marshal staff implementing the existing 1270 regulations.

These recommended changes were brought in front of the Board in 2014 and proceeded to go through regulatory review and Office of Administrative Law process. The revised SRA Fire Safe Regulations became effective on January 1, 2016.

While the workgroup was able to use their professional experience and field tests to either validate the existing regulations or recommend revisions, they felt addressing § 1273.09 Dead End Roads would require extension research and modeling which they did not have adequate time or resources to perform.

California Polytechnic State University Study:

The 4290 Workgroup utilized experts at Cal Poly with experience and scientific resources in urban planning, transportation modeling, and fire behavior analysis to perform the analysis required to evaluate § 1273.09 Dead End Roads and recommend changes, if any, to the regulation. The goal of their analysis was to develop a performance based metric to design a statewide minimum standard for dead end roads. More detail about the specific tasks, objectives, and deliverables are in the attached Statement of Work.

Final Report:

The Cal Poly study team has prepared their final results and report for presentation to the Board of Forestry and Fire Protection at the Board's March 2 meeting. Board staff do not anticipate any immediate changes to § 1273.09 Dead End Roads to occur as a result of this presentation and study, but the study results will become part of the background information informing any future regulatory updates to the SRA Fire Safe Regulations. The study results do not necessarily reflect and may conflict with current CAL FIRE or Board policy.

**CAL FIRE – Cal Poly-SLO
Single-Access Subdivisions Assessment Project:
Design Guidelines for Dead-End Roads**

**Statement of Work
March 24, 2014**

1. Statement of the Problem

When a wildfire threatens residential or commercial single-access subdivisions (i.e., developments accessible only by one dead-end road), potentially life-threatening problems arise getting residents/occupants out and emergency first responders in. Even if access is not blocked by fire itself, factors such as inadequate road widths, steep grades, presence of obstacles, etc., can interfere with safe/timely in- and out-movement, possibly causing entrapment of civilians and the inability of responders to do their job.

Under current standards established several decades ago (California Code of Regulations title 14, 1270, Fire Safe Regulations, Section 1273.09 Dead-end Roads), the maximum length of a dead-end road, including all dead-end roads accessed from that dead-end road, shall not exceed the following cumulative lengths, regardless of the number of parcels served:

Table 1. Dead-end Road Maximum Lengths

Parcels zoned for less than one acre	800 feet
Parcels zoned for 1 acre to 4.99 acres	1320 feet
Parcels zoned for 5 acres to 19.99 acres	2640 feet
Parcels zoned for 20 acres or larger	5280 feet

These standards were established on the basis of practical experience of firefighting and planning professionals in 1991. As indicated, road lengths are not dependent on the number of parcels served, which can vary widely within the four street length categories included (see Table 1). Furthermore, they do not take into account other factors affecting egress and ingress, such as maximum allowable density under zoning, roadway width and grade, number of vehicles to be evacuated, evacuation time, and other variables. There is a need for systematic analysis of all of the important factors, to provide a sound basis for evaluating the present standards and, if necessary, proposing revisions thereto.

2. Goal

Develop a performance based metric to be utilized to support the intent of the California Code of Regulations title 14, 1270, Fire Safe Regulations, Section 1273.09 Dead-end Roads when determining the design of single-access subdivisions. *The metric will be used to*

develop minimum standards to meet the intent and allow for the creation of “same practical effect” measures for a land development project (where same practical effect” means alternative practices that meet the intent section of the regulation).

3. Objectives

- 3.1. Conduct systematic assessment of the existing Section 1273.09 dead-end road length/lot size standards in relation to estimated evacuation times under defined scenarios.
- 3.2. Based on systematic assessment prepare single-access subdivision dead-end roads design guidelines proposing changes to the existing standards, as necessary.

4. Tasks

- 4.1. Identify and review relevant existing literature, including documented case studies, regarding standards, experience, and other related factors
- 4.2. Based on consultation with CAL FIRE, define performance criteria on which standards should be based.
 - 4.2.1. Roadways should be designed to permit, in an emergency situation, simultaneous evacuation of civilians and ingress of emergency personnel and vehicles to a given area during a wildfire event.
 - 4.2.2. Determine what this means in terms of maximum time for civilians to be evacuated and emergency personnel/vehicles to reach furthest point on dead-end streets. The nature and scale of fire hazard is likely to be a variable.
- 4.3. Identify the key variables affecting the time needed to safely evacuate civilians while permitting ingress of emergency personnel and vehicles to a given area in a wildfire environment. Possible variables to be considered include:
 - zoning (maximum allowable residential density, vehicles per commercial acre)
 - density range (minimum and maximum allowable dwelling units per acre)
 - roadway condition surface (all weather/paved, unpaved)
 - roadway width
 - right-of-way width (between property lines)
 - topography (average slope for site)
 - roadway grade (percent)
 - horizontal curvature
 - nature and configuration of roads into which dead-end roads are connected
 - vegetation/fuel modifications
 - potential fire behavior

- 4.4. Develop and document in a user guide (in terms that are easily understandable) relationships between key variables (or combinations thereof) and the times needed for evacuation of residents/occupants with simultaneous ingress of emergency response personnel and vehicles.
- 4.5. Develop calculators based on the relationships developed in 4.4, allowing users to determine evacuation times by inserting values of the key variables. Calibrate calculators based on documented past experience.
- 4.6. Consider the likely effects of complicating factors such as:
 - 4.6.1. time for communication of evacuation order
 - 4.6.2. nature and scale of fire hazard, posing resistance to traffic flow
 - 4.6.3. time to collect belongings
 - 4.6.4. need to transport animals, including horses
- 4.7. Compare evacuation times estimated in 4.4 to performance criteria established in 4.2.
 - 4.7.1. Assess performance of existing standards
 - 4.7.2. Explore combinations of variables that would satisfy criteria, as basis for developing possible changes to existing standards
 - 4.7.3. Test potential alternative “same practical effect” design modifications
 - 4.7.4. Determine and elaborate “same practical effect” design modifications

5. Deliverables

- 5.1. The project deliverables will be:
 - 5.1.1. Systematic assessment of the existing Section 1273.09 dead-end road length/lot size standards in relation to estimated evacuation times under defined scenarios.
 - 5.1.2. Proposed changes as necessary to the existing standards governing the design of single-access subdivision dead-end roads, based on systematic assessment in 5.1.3.
 - 5.1.3. Easily understandable user guide for tool in 5.1.4, describing relationships between key variables (or combinations thereof) and the times needed for evacuation of residents/occupants with simultaneous ingress of emergency response personnel and vehicles.
 - 5.1.4. Tool allowing users mathematically to test whether proposed designs of single-access subdivisions meet intent of California Code of Regulations title 14, 1270, Fire Safe Regulations, Section 1273.09 Dead-end Roads.

5.2. Project deliverable requirements:

- 5.2.1. Usable for Planner and Fire Protection Planner with minimal training
- 5.2.2. Applicable anywhere in the state
- 5.2.3. Easily distributed

6. Reports

- 6.1. Progress reports, addressing deliverables in section 5, will be submitted on Dec 31 2014 and June 30 2015; draft final report on Sep 30 2015; final report, addressing deliverables in section 5, (after receipt of comments from sponsor) on Oct 31 2015.
- 6.2. All reports and deliverables will be provided to sponsor in appropriate electronic format, suitable for duplication.

PROJECT TEAM

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