LAND USE PLANNING NOTES

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Recommended Fire Siting Standards for Dwellings and Structures *and* Fire Safety Design Standards for Roads

PURPOSE: This technical bulletin has been developed jointly by the Department of Forestry and structural fire protection agencies in Oregon as technical guidance and recommended minimum standards to meet the requirements of new administrative rules, OAR 660-06-035 (fire siting standards for dwellings and structures) and OAR 66006-040 (fire safety design standards for roads) adopted by the Land Conservation and Development Commission for forest land zones (Goal 4 lands). Counties are encouraged to adopt stricter rules in forest zones where these recommendations might not adequately address a particular hazard or risk.

RULE REQUIREMENTS:

OAR 660-06-035 (Fire Siting Standards for Dwellings and Structures) requires that:

"[T]he following fire siting standards or their equivalent apply to new dwelling or structures in a forest or agriculture/forest zone:

"(1) If a water supply is available and suitable for fire protection, such as a swimming pool, pond, stream, or lake, then road access to within 15 feet of the water's edge shall be provided for pumping units. The road access shall accommodate the turnaround of fire fighting equipment during the fire season. Permanent signs shall be posted along the access route to indicate the location of the emergency water source.

"(2) Road access to the dwelling shall meet road design standards described in OAR 660-06-040.

"(3) The owners of the dwellings and structures shall: maintain a primary fuel-free break area surrounding all structures; clear and maintain a secondary fuel-free break area; and maintain adequate access to the dwelling for fire fighting

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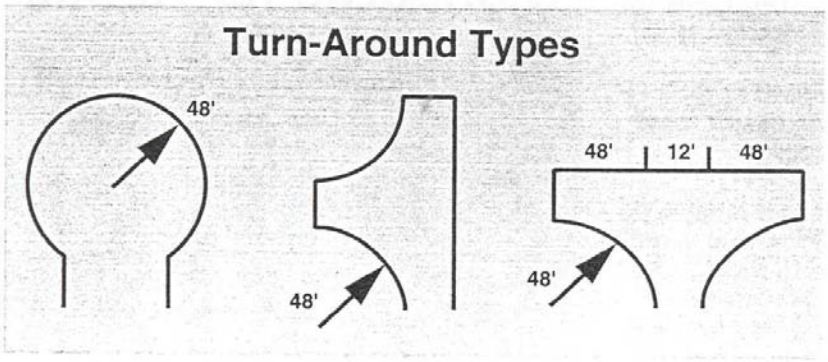
equipment vehicles in accordance with the provisions in *Protecting Your home from Wildfire* (National Fire Protection Association)."

OAR 660-06-040 (Fire Safety Design Standards for Roads) requires that:

"[T]he governing body shall establish road design standards, except for private roads and bridges accessing only commercial forest uses, which ensure that public roads, bridges, private roads and driveways are constructed so as to provide adequate access for fire fighting equipment. Such standards shall address maximum grade, road width, turning radius, road surface, bridge design, culverts, and road access taking into consideration seasonal weather conditions. The governing body shall consult with the appropriate Rural Fire Protection District and Forest Protection District in establishing these standards."

Though there are no similar rule requirements to be met in rural residential zones in forested areas, the Department of Forestry encourages the adoption by local government of these recommended fire safety standards in these zones as well.



Though some of the recommendations are strictly to accommodate structural fire protection apparatus and needs, it is recommended that the standards be applied to all lands within forest zones, regardless of the presence or absence of a rural (structural) fire protection district. The standards should be applied in anticipation of structural fire protection eventually becoming present.

RECOMMENDED FIRE SITING STANDARDS FOR DWELLINGS AND STRUCTURES:

A. Water Supply Standards:

1. Access— If a water supply—such as a swimming pool, pond, stream, or lake—of 4,000 gallons or more exists within 100 feet of the driveway or road at a reasonable grade (12%) an all-weather approach to a point within 15 feet of the water's edge should be provided. The all-weather approach should provide a turn-around with a **48**-foot radius of one of the types shown in the illustration below.

2. Identification— Emergency water supplies should be clearly marked along the access route with a county approved sign.

B. Fuel Break Standards:

1. Primary Safety Zone— The primary safety zone is a fire break extending a minimum of **30** feet in all directions around structures. The goal within the primary safety zone is to remove fuels that will produce flame lengths in excess of one foot. Vegetation within the primary safety zone could include green lawns and low shrubs (less than 24 inches in height). Trees should be spaced with greater than 15 feet between the crowns and pruned to remove dead and low (less than 8 feet) branches. Accumulated leaves, needles, limbs and other dead vegetation should be removed from beneath trees. Nonflammable materials (i.e., rock) instead of flammable materials (i.e., bark mulch) should be placed next to the house.

As slope increases, the primary safety zone should increase away from the house, parallel to the slope and down the slope, as shown in the table and illustration on the next page.

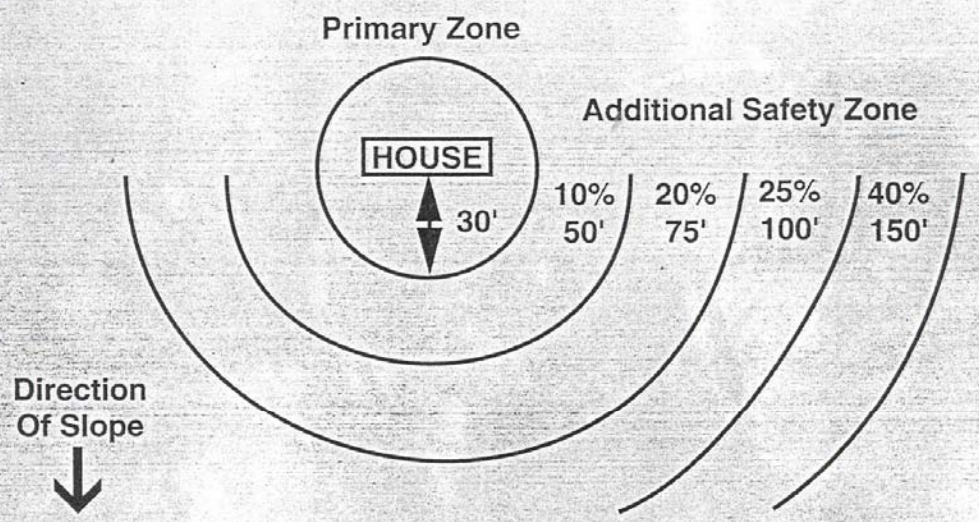
2. Secondary Fuel Break— The secondary fuel break is a fuel break extending a mini-

Size of Primary Safety Zone by Percent Slope

Slope	Feet of Primary Safety Zone	Feet of Additional Safety Zone Down Slope
0%	30	0
10%	30	50
20%	30	75
25%	30	100
40%	30	150

Buildings should be restricted to slopes of less than 40 percent.

EXAMPLE OF SAFETY ZONE SHAPE



mum of **100** feet in all directions around the primary safety zone. The goal of the secondary fuel break should be to reduce fuels so that the overall intensity of any wildfire would be lessened and the likelihood of crown fires and crowning is reduced. Vegetation within the secondary fuel break should be pruned and spaced so that fire will not spread between crowns of trees. Small trees and brush growing underneath larger trees should be removed to prevent spread of fire up into the crowns of the larger trees. Dead fuels should be removed.

RECOMMENDED FIRE SAFETY DESIGN STANDARDS FOR ROADS:

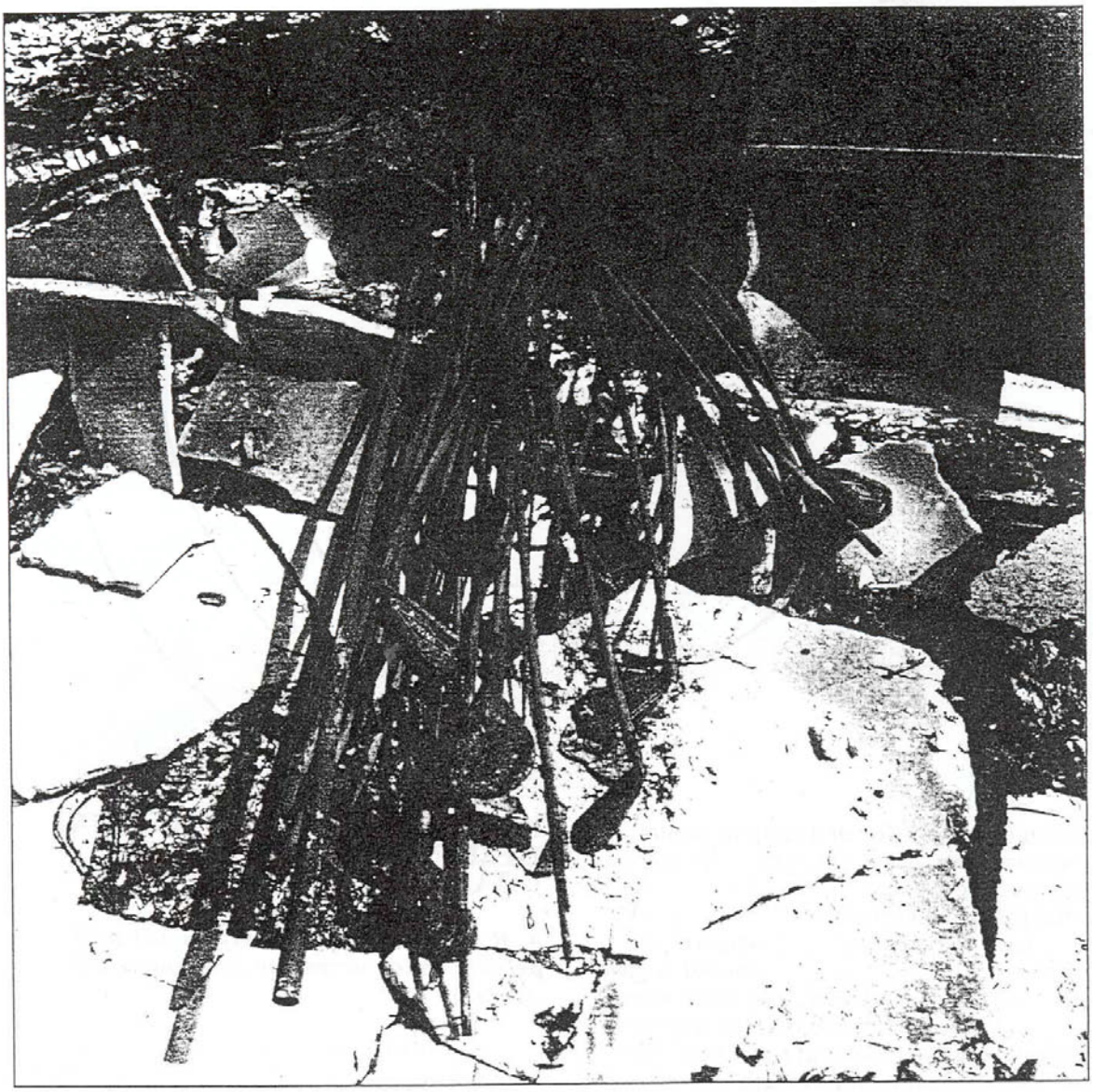
A. Road Standards (public roads and private roads accessing 2 or more residences):

1. Right-of-ways— Roads should be built and maintained to provide a minimum **20** foot width of all-weather surface capable of supporting gross vehicle weights of **50,000** pounds, a minimum curve radius of **48** feet and a vertical clearance of **13'6"**.

2. Cul-de-Sacs— Cul-de-sacs should be defined as dead-end roads over **150** feet in length. Cul-de-sacs should have turn-arounds of not less than **48** feet radius at a maximum spacing of **500** feet between turn-a-rounds. All turn-a-rounds should be marked and signed as "NO PARKING."

3. Bridges and Culverts— Bridges, culverts, and other structures in the road bed should be constructed and maintained to support gross vehicle weights of 50,000 pounds.

4. Road Grades— Road grades should not exceed an average of **8** percent, with a maxi-



A set of burned golf clubs lay in the ruin of a home burned by the 1990 Awbrey Hall Fire. Twenty-two homes burned during this fire, which raced along the outskirts of Bend, Oregon. Most of the burned homes had insufficient fuel breaks surrounding them.

Photograph courtesy of The Bulletin, *Bend*

mum of **12** percent on short pitches. Variances could be granted by the fire service having responsibility for the area when topographic conditions make these standards impractical.

5. Identification— Roads should be uniquely named or numbered and visibly signed at each road intersection. Letters or numbers should be a minimum of three inches in height and constructed of reflectorized material.

B. Driveway Standards (private roads accessing a single residence):

1. Driveways— Driveways should be built and maintained to provide a minimum **12**-foot width of all-weather surface capable of supporting gross vehicle weights of **50,000** pounds, a minimum curve radius of **48** feet and a vertical clearance of **13'6"**.

2. Vehicle Passage Turnouts— Driveways in excess of **200** feet should provide **20**-foot wide by **40**-foot long passage space (turnouts) at a maximum spacing of 1/2 the driveway length or **400** feet, whichever is less. Wherever visibility is limited, these distances should be reduced appropriately.

3. Dead-end-driveways— Dead-end-driveways are defined as dead-end roads over **150** feet in length serving a single residence. Dead-end-driveways should have turn-a-rounds of not less than **48** feet radius.

4. Bridges and Culverts— Bridges, culverts, and other structures in the road bed should be constructed and maintained to support gross vehicle weights of 50,000 pounds.

5. Driveway Grades— Driveway grades should not exceed an average of **8** percent, with a maximum of **12** percent on short pitches. Variances could be granted by the fire service having responsibility for the area when topographic conditions make these standards impractical.

6. Identification— Driveways should be marked with the residence's address unless the residence is visible from the roadway and the address is clearly visible on the residence. Letters or numbers should be a minimum of three inches in height and constructed of reflectorized material.

C. Certification:

1. If bridges or culverts are involved in the construction of a road or driveway, written verification of compliance with the 50,000 gross vehicle weight standard should be provided from an Oregon Registered Professional Engineer. Otherwise, written verification of compliance should be provided by the applicant.

BASIS FOR RECOMMENDATIONS:

A. Water Supply

Water is a critical tool in fire suppression. Hydrants are generally not available in forested areas. Therefore, fire suppression in forested areas is dependent upon the water carried in the responding fire equipment and water sources available for refill or that can be pumped from an engine. Water available for refilling an engine can mean the difference between saving or losing a structure, or preventing a wildfire from escaping initial attack. When a fire engine or tanker runs out of water, turn around time to a refill site may be quite lengthy. A 4,000 gallon water supply is large enough to refill a large tanker or several smaller fire engines. Requiring construction of an all weather approach to within 15 feet of 4,000 gallon or larger water sources within 100 feet or less of a driveway or road will greatly help fire protection agencies.

B. Fuel Breaks

The steeper the slope, the greater the flame length, the hotter the flame front, and the faster the rate of fire spread. This greater fire activity is primarily due to preheating of the vegetation upslope from the fire, increased draft of fresh air to the fire from below, and more flame contact with upslope fuels. On steeper slopes, failure to provide for larger safety zones downslope from a residence will make it more difficult for fire personnel to protect the structure. The

firefighter is also in a more tenuous safety position.

On the last page are two graphs showing the relationships of flame length and dozer line construction speeds to slope for two fuel types. Flame lengths increase with slope and dozer fire line construction rates decrease. Other fire fighting methods such as water attack and hand line construction are also hampered by steep slopes. Generally, hand lines are useless when flame lengths reach 4 feet; dozer lines fail with 8-foot flame lengths.

C. Road & Driveway Specifications

Fire fighting apparatus (fire engines, tankers, dozer and lowboy, etc.) are much larger and heavier than personal vehicles. These vehicles require greater road width and clearance for passage, wider road curves for turning, and level or at most moderate road grades for maintaining vehicle engine performance and driver safety.

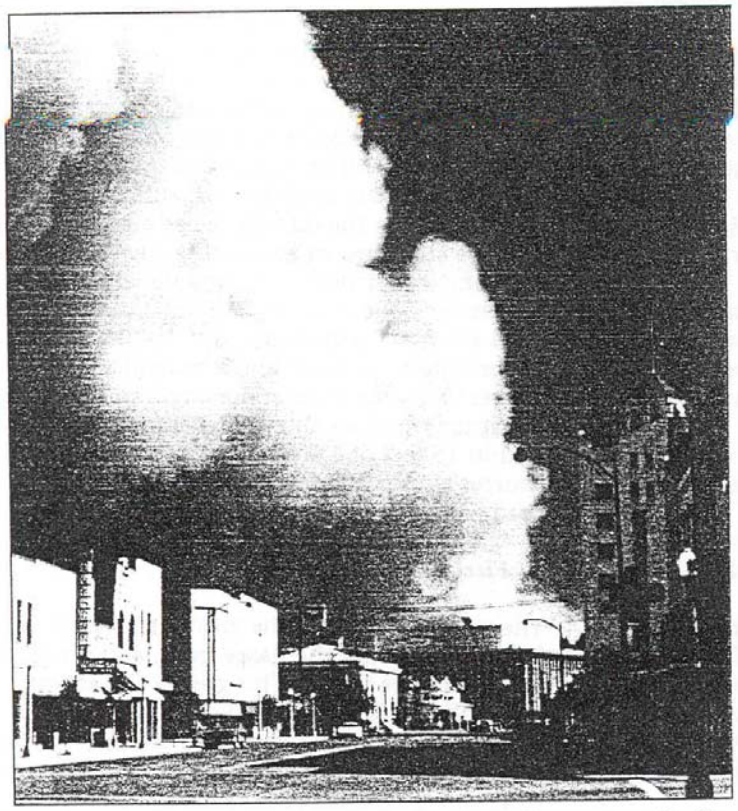
- The 1988 Oregon Uniform Fire Codes, Chapter 10.207 specifies that all roads shall be all weather surfaced, minimum 20 feet width, and have a vertical clearance of 13' 6".

- A filled, fully equipped 3,000 gallon tanker weighs around 40,000-45,000 pounds. Many rural fire departments utilize this size tanker as a water source for the small fire engines. A minimum road surface load limit of 50,000 pounds provides for this load plus an appropriate safety margin.

- Large, heavy vehicles have difficulty driving up and down steep road grades. Additionally, most rural fire departments are principally staffed by volunteers and most forest fire agency employees are seasonal. While these people are capable drivers, very few are professional truck drivers and they may have a more difficult time maneuvering a truck up a steep winding road than would the professional driver.

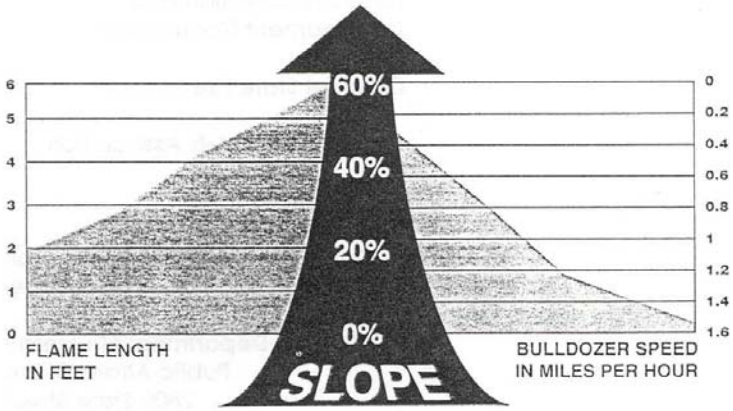
- Rural address identification is extremely important. While the local resident may be familiar with the localized road or driveway system, emergency responders generally will not. Proper signing of roads and driveways with 3" or larger reflectorized letters or numbers will assist fire fighters in locating threatened residences, especially when visibility is impaired by darkness or smoky conditions.

- It is very difficult to back up long distances in large fire apparatus, and this difficulty can be compounded if driveway grade is not level. Therefore, turnouts and turnarounds are very important.

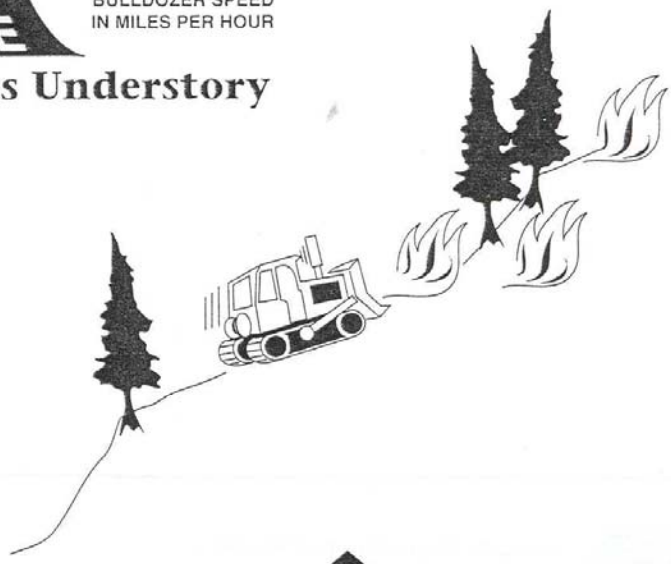


The 1989 Dooley Mountain Fire threatened the residents of Baker City.
Photograph courtesy of the Democrat-Herald, *Albany*

The Relationship of Flame Length to Fuel Type and Slope: Two Situations



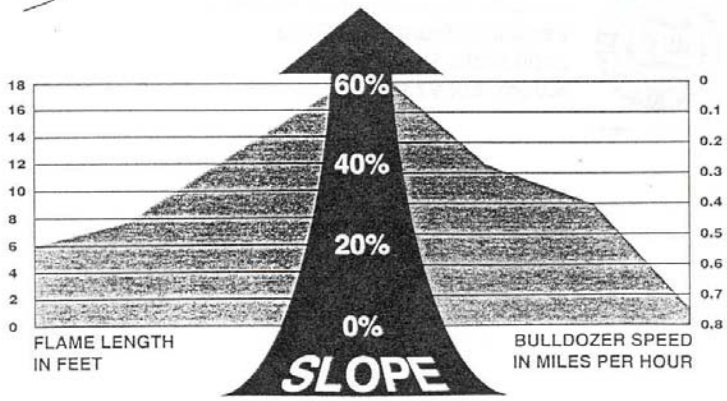
Timber with Grass Understory



These two graphs illustrate the effect of slope on flame length and bulldozer speed in two common fuel types.

In open timber with grass, flames traveling up a 20% slope can reach 3-4 feet in length. Chaparral, on the same slope, will generate flame lengths of 6-8 feet. Hand-constructed fire lines usually fail to stop fires having 4-foot or longer flame lengths. Bulldozer-constructed fire lines usually fail to stop fires having 8-foot or longer flame lengths.

Fire lines become less effective as slope increases and as fuel loads increase.



Chaparral

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