United States
Department of
Agriculture

Forest Service

**Technology &
Development
Program**

7700—Transportation System
2500—Watershed and Air
Management
September 1997
9777 1805—SDTDC

The Water/Road Interaction Technology Series: An Introduction

The Water/Road Interaction Technology Series: An Introduction

Ronald Copstead, P.E.
Research Engineer, Pacific Northwest Research Station

USDA Forest Service

San Dimas Technology and Development Center
San Dimas, California

September 1997

THE WATER/ROAD INTERACTION TECHNOLOGY SERIES: AN INTRODUCTION

The Water/Road Interaction Technology Series is part of an effort coordinated by the San Dimas Technology Development Center and sponsored by USDA Forest Service Engineering Staff to identify information and methods on hydrological aspects of developing, operating, and managing forest roads. The goals of the effort are to 1) help communicate state-of-the-art water/road interaction information effectively among field personnel, 2) identify knowledge gaps, and 3) provide a framework for addressing future research, development, and technology needs on this subject.

Within the context of supporting transportation system development and management activities, the audience for the series includes journey level engineers and technicians, physical scientists, fish and wildlife biologists, and economists. Field personnel will benefit from the latest information available on the interaction between water and roads with respect to forest and aquatic resources. State-of-the-art water/road interaction information will help managers of riparian and aquatic resources to consider options from the widest possible range of alternatives. The series will rely on specialists in a variety of disciplines, including engineering, hydrology, and biology, to carry out this effort.

Topic areas for the series are organized around three themes:

1. Surface Drainage includes the interaction of water with road surface features including cut and fill slopes, travelway surfaces, lead-out and other ditches, cross drains and water bars, and other road-surface-related drainages. See figure 1 for a cross drain application. Alternative road surface shapes, surfacing materials, and maintenance techniques fall under this component, as do most erosion and many sedimentation concerns. Concentration of water and risk assessment are inherent in this component.

Figure 1—Elbow installed on cross drain to pond water and preserve sediment.

2. Subsurface Drainage involves below-ground flow related to or influenced by roads: infiltration, permeability, interception of subsurface flow, saturated fills, groundwater conductance and monitoring, and related risk assessment. Methodologies, models, instrumentation, field installations, and data analysis and interpretation on groundwater response to roads will be documented (see figure 2).
3. The Drainage Crossings component involves the selection of type and sizing of stream crossing structures; passage of debris, bedload, fish, and water; capacity improvement; end treatments; trash racks; low water crossings; fill encroachments; reducing modifications to stream hydraulics and hydrology, diversion prevention, and risk assessment. Figure 3 shows a gully plug constructed of concrete jersey barriers.

- The Water/Road Interaction Technology Series of publications will provide information on planning, development, operation, maintenance and rehabilitation of drainage features relating primarily to forest roads. Topic areas to look for include:
- Information on the collection, transport, and release of water.
- Information on erosion prevention measures for forested areas that are in managed areas.
- Descriptions of methods for planning and assessing drainage issues for example, the assessment of diversion potential.
- Recommendations regarding culvert inventories.
- Articles addressing environmental concerns within the context of water/road interaction—how does road generated sediment get to a stream, predicting erosion, and the effect of bedload and debris movement on road stream crossings and fish.
- Design and planning issues such as road location on slopes, hydrological methods pertaining to water/road interaction, and followup to recent projects on road obliteration.

Figure 2—Equipment used for monitoring the effects of roads on groundwater piezometric surfaces. (a) PVC well tip. (b) Unidata Starlogger. (c) Weatherproof enclosure. (d) Field termination strip. (e) Hydrostatic pressure transducer. (f) Tipping bucket rain gage.

Figure 3—Jersey barrier gully plug.

- Applying methods to existing drainage designs.
- Repairing drainage structures that have reached the end of their service life (e.g., culvert lining).
- Case history descriptions of problems or solutions that illustrate water/road issues.
- Background information such as an annotated bibliography, a glossary, and information on the historical and legal context for water/road interaction issues.

Currently, the plan is to produce the publications for this series over the next three years. Initially several introductory publications are being produced and made available for distribution. Periodically, new techniques and methods, or interesting case studies will be documented in additional publications.

In order to help communication, some publications in the series may include a glossary, or will at least explicitly define specialized terms and acronyms as they arise.

In addition to the publication series, the project will establish an Internet site where a searchable version of the annotated bibliography will be available. Portable document (readable electronic) format versions of the series publications may be available at this site as well.

The site will be accessible from the Forest Service Home Page on the world wide web (http://www.fs.fed.us/) by early 1999.

Although every effort will be made to assure thorough review of the information in these publications, you are encouraged to submit comments and suggestions for improvement in the products of this project. Please address feedback to:

Water/Road Interaction Project Leader
USDA Forest Service
Technology and Development Center
444 East Bonita Ave
San Dimas, CA 91773
(909) 599-1267, ext. 246
Mailroom:W07A

Aquatic Land Interaction Leader
PNW Research Station
Forestry Sciences Laboratory
4043 Roosevelt Way NE
Seattle, WA 98105
(206) 553-7814
PNWmail:R06F05A