

Chapter 1

INTRODUCTION

This chapter provides a definition and brief history of RWIS and outlines the purpose and contents of the report.

Each year in the United States, more than 7,000 people are killed and 450,000 injured in highway incidents caused by adverse weather conditions [1]. Currently, the California Department of Transportation (Caltrans) has Roadway Weather Information Systems (RWIS) in place throughout critical areas where atmospheric and pavement data can be used for maintenance and transportation management to help reduce the number of incidents. An assessment of their level of use and evaluation of their effectiveness is necessary to increase user access and improve performance of existing systems.

Definition of RWIS

Road Weather Information Systems, or RWIS, are networks of weather monitoring stations that collect data pertinent to weather conditions around roadways. The system consists of environmental sensors or roadside sensors, communication systems, central computers to store the information, a user interface to display processed data, and site-specific weather forecasting equipment (See FIGURE 1-1). RWIS is different from other weather stations because it incorporates information on pavement conditions and temperatures. This is accomplished via pavement sensors that collect data that can be used to help predict weather and pavement conditions [2]. In the larger definition of the road weather information system, it also includes surface forecasts for identified trouble spots.

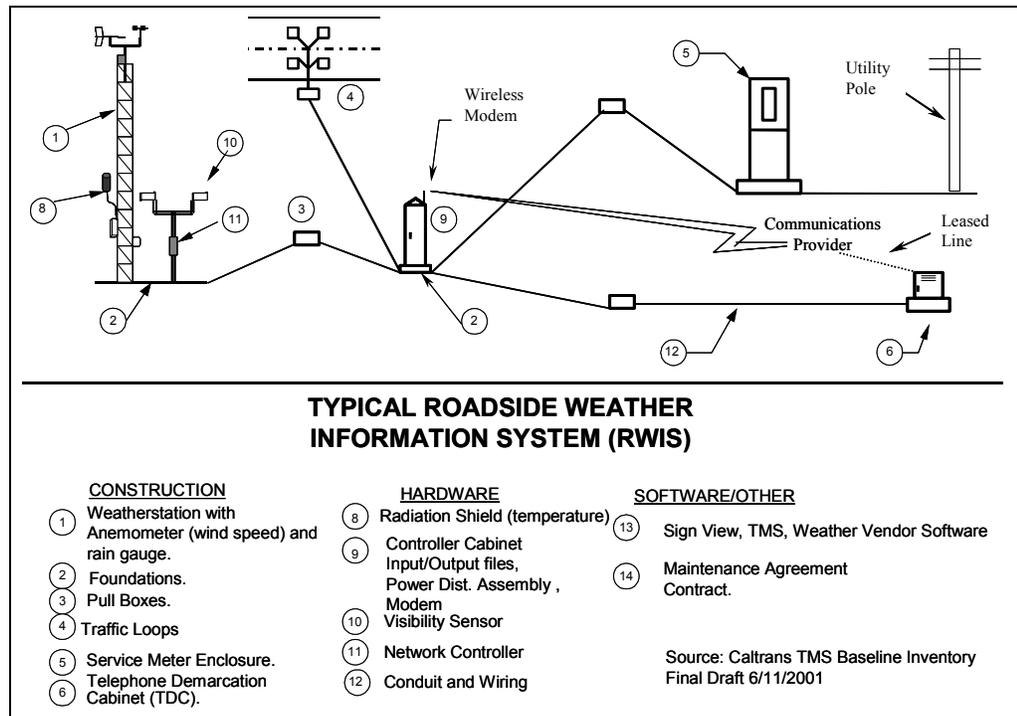


FIGURE 1-1 Typical components of RWIS with potential associated systems.

Terminology

There are many different terms associated with weather information systems. RWIS, in general, includes the entire system that is used to obtain data. This includes the roadside equipment, the Remote Processing Unit (RPU) that obtains data from the site, the Central Processing Unit (CPU) that receives the data, and the communication systems that send the data. FIGURE 1-1 shows a standard design for California RWIS. Environmental Sensor Stations (ESS) are defined as the roadside equipment used in weather information sites compatible with the National Transportation Communications for ITS Protocol (NTCIP) and the national ITS Architecture. The ESS equipment is basically the roadside equipment that is NTCIP compliant, while RWIS is the entire system and not necessarily compliant. In this document, RWIS will be used in reference to the entire system. When referring to the roadside sensor stations, the document will use RWIS station, or ESS if it is NTCIP compliant.

Purpose of Report

The goal of this project is to increase the use and improve the effectiveness of Caltrans RWIS. To meet this goal, Caltrans has identified the following objectives:

1. Identify the current and planned uses of RWIS devices
2. Research their usefulness
3. Recommend how to standardize the communication systems, as necessary, to ensure system interoperability
4. Recommend more effective and efficient uses
5. Identify potential partnerships with external agencies
6. Identify appropriate standards and protocols to foster communications

This report provides the results of the research and data collection that has occurred over the past year. Along with the specific objectives defined above by Caltrans, the report also strives to provide an update on the state of RWIS use in California and nationwide, recommendations for institutional improvements, and resources and technical assistance to users of RWIS.

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Background

Development and Early Use

Modern meteorology owes much of its advancement to the safety needs of the aviation industry. Other advancements have been driven by agricultural needs and by efforts to protect the general public from natural disasters (flooding, blizzards, hurricanes, etc.). Meteorology and weather monitoring was first applied to roadways in the 1960's when the first RWIS was put into place in the United States.

By 1975, the primary RWIS vendor, Surface Systems International (SSI), had implemented more than 200 sensors in highways throughout American, Canada, and Europe. These new and improved sensors could determine the amount of surface chemical concentrate and pavement surface temperatures under wet conditions. Further adoption of RWIS was slow until the early 1990's when the Federal Highway Administration (FHWA) sponsored research into the effectiveness and application of the RWIS data [2]. More recently, FHWA and the Office of the Federal Coordinator for Meteorology (OFCM) have jointly sponsored efforts to identify requirements for weather information for surface transportation (WIST) and to develop a maintenance decision support system.

Caltrans Use of RWIS

Caltrans began using RWIS in 1990. District 7 in Los Angeles and Ventura Counties installed their first three sites on the Grapevine on I-5. Since then, ten of the twelve Districts have installed sites to help with road maintenance and traffic operations. RWIS helps Caltrans staff determine when ice and snow are present in certain areas, when low visibility and wind conditions exist, and when winter road maintenance is required.

Broad Use in Various Fields

There are many potential applications for RWIS. Nationally, the most common use is for snow and ice detection and subsequent removal and motorist notification. The focus of this document reflects California's current use of RWIS, which is to provide spot data and forecasts for specific roadway sites.

However, RWIS can be tailored to the needs of a transportation department to gather additional data and serve broader applications. Systems can be designed to gather data such as atmospheric observations and forecasts over an entire region. Another data collection option would be to include thermal mapping, which could provide insights into conditions over a length of road.

All of this meteorological data can be used by a transportation agency to develop a wide range of applications for RWIS, such as:

- Maintenance decision support
- Alert messages on roadside changeable message signs (CMS) (automated or manual)
- Automated de-icing systems on bridge decks
- Traveler information via phone or web systems

RWIS has even broader implications for the transportation community at large, including shared data between agencies and regions, more accurate forecasts from the increased number of sites, and a reduced need for Caltrans sites. In the context of the National Architecture, all of these uses are moving the practice towards a more generic definition of road weather information systems.

Summary of Caltrans' Vision of RWIS

Caltrans administration sees value and potential in further development of RWIS because the current systems have demonstrated a capability to:

- improve safety for the motorist through informing the traveler,
- improve safety for maintenance workers by increasing awareness of potentially hazardous weather conditions, and
- improve the cost effectiveness and efficiency of snow and ice control operations through up-to-date data that facilitates strategic decisions.

In order to guide future RWIS growth and development, Caltrans initiated this assessment project, which included oversight by a Technical Advisory Committee (TAC). The TAC is composed of representatives from Caltrans Headquarters as well as the District offices. Through this project, the TAC has agreed upon a vision for RWIS at Caltrans:

Create and maintain a statewide linked road weather information system for road maintenance, traffic operations, and traveler information utilizing the best practices from around the world.

- Procure flexible, cost effective road weather information systems that meet the needs for the designed use and consider the needs of partners
- Work with vendors and partners to provide quality, cost effective forecasting services
- Create the best possible return on investment through
 - Proper system maintenance and training
 - Knowledge and data sharing between districts and with partners

This vision is depicted in FIGURE 1-2.

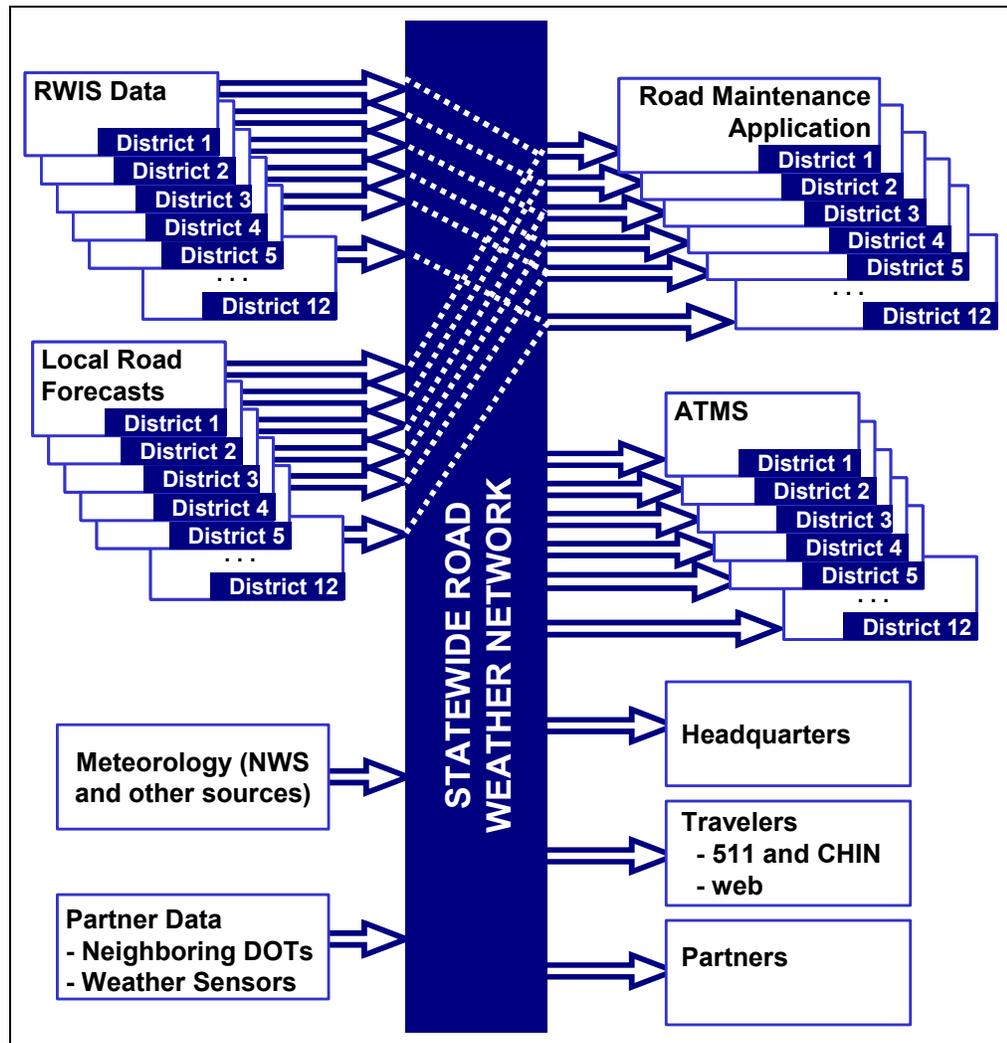


FIGURE 1-2 Statewide linked RWIS vision.

Document Overview

This report summarizes the work by Western Transportation Institute (WTI) to evaluate the existing RWIS system in California and provide recommendations for expansion and improvement. The remaining portion of this document is organized into seven chapters and a set of Technical Appendices:

- Chapter 2 is a review of the state of the practice, in particular other states' experiences in RWIS deployment
- Chapter 3 has District by District descriptions of how RWIS is currently used in California

- Chapter 4 summarizes and analyzes the results of Caltrans staff surveys on RWIS use
- Chapter 5 describes Caltrans goals for RWIS, for each District and statewide
- Chapter 6 details national standards that can guide RWIS development
- Chapter 7 describes institutional improvements needed to achieve Caltrans' goals for RWIS
- Chapter 8 includes final conclusions and recommendations
- Additional background material and resources for additional study are included in the Appendices

