Maintenance of ITS Devices in Rural Areas: Case Studies

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Overview

- Introduction
- Project Objectives
- Methodology
- Analysis
- Results
- Future Research

Introduction

- Rural ITS Maintenance
  - Contracting gets expensive
  - Long distances between field devices and maintenance offices
  - Specialized training requirements
  - Limited system redundancy
  - Limited research to date on rural ITS maintenance

Introduction (Contd.)

- Better
  - Planning by including maintenance in planning
  - Budgeting by more accurate information on maintenance costs
  - Responsiveness to critical maintenance needs
  - Estimation of reliability and life time of field devices

COATS Showcase

- A bi-state partnership to improve rural transportation through the demonstration and evaluation of advanced technologies
- Provide information to improve the performance of existing ITS elements
- Provide data to justify, support or direct future deployment of ITS in the COATS study area

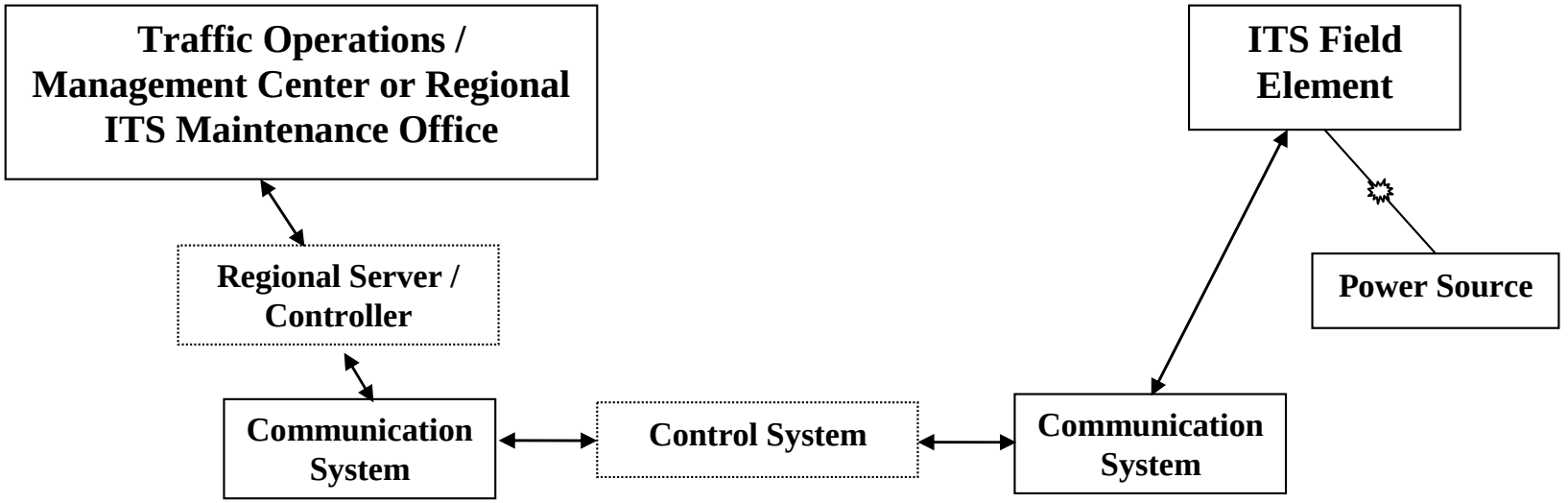
COATS Showcase Partners

- California Department of Transportation, Division of Research and Innovation
- Oregon Department of Transportation
- USDOT, Research and Innovative Technology Administration
- Western Transportation Institute \ Montana State University

Project Objectives

- Research ITS maintenance in COATS study area
- Develop case studies to provide lessons learned
  - To guide future ITS deployments in COATS study area
  - To improve maintainability of field devices in the design and procurement stages
  - To help get more accurate information on maintenance costs

Remote ITS Elements



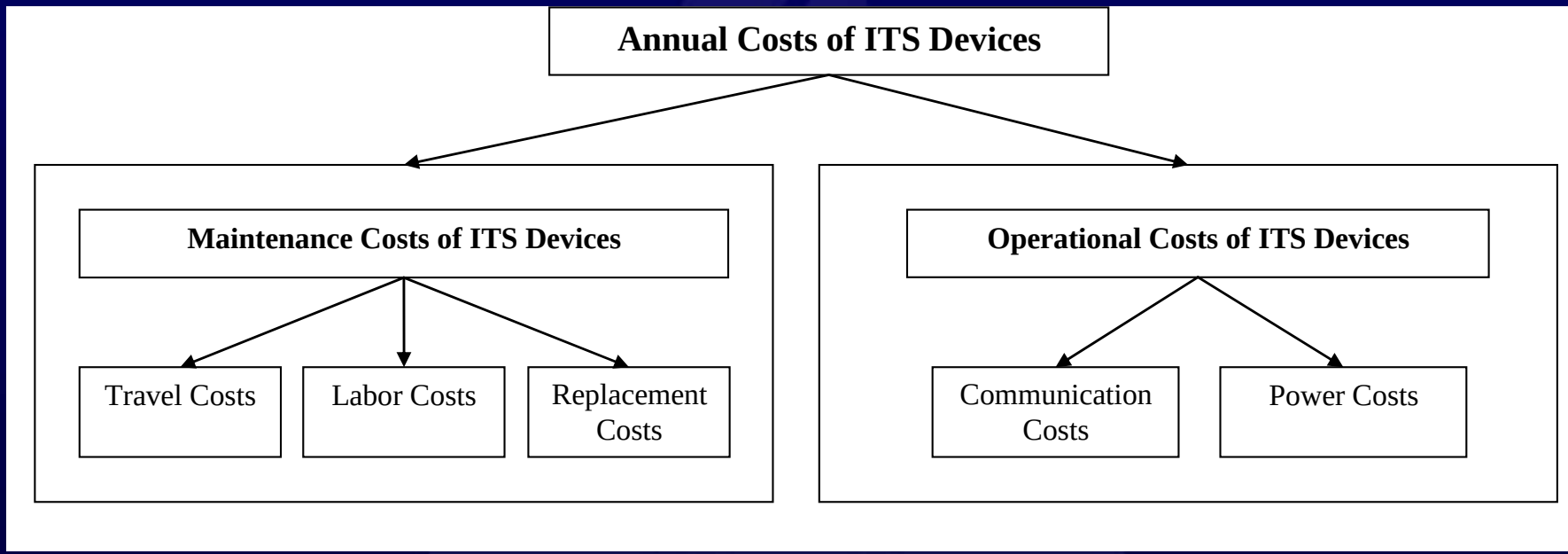
Principal COATS ITS Elements

- Cameras
- CMS/VMS/DMS
- TOC/TMC
- AVL
- RWIS
- HAR
- Landslide detectors

Sites Selected

System	Number in Oregon	Number in California	Total
CCTV	10	6	16
RWIS	2	3	5
CMS/VMS	4	3	7
HAR	1	2	3
TOC/TMC		2	2
Radar CMS		3	3
		Total	36

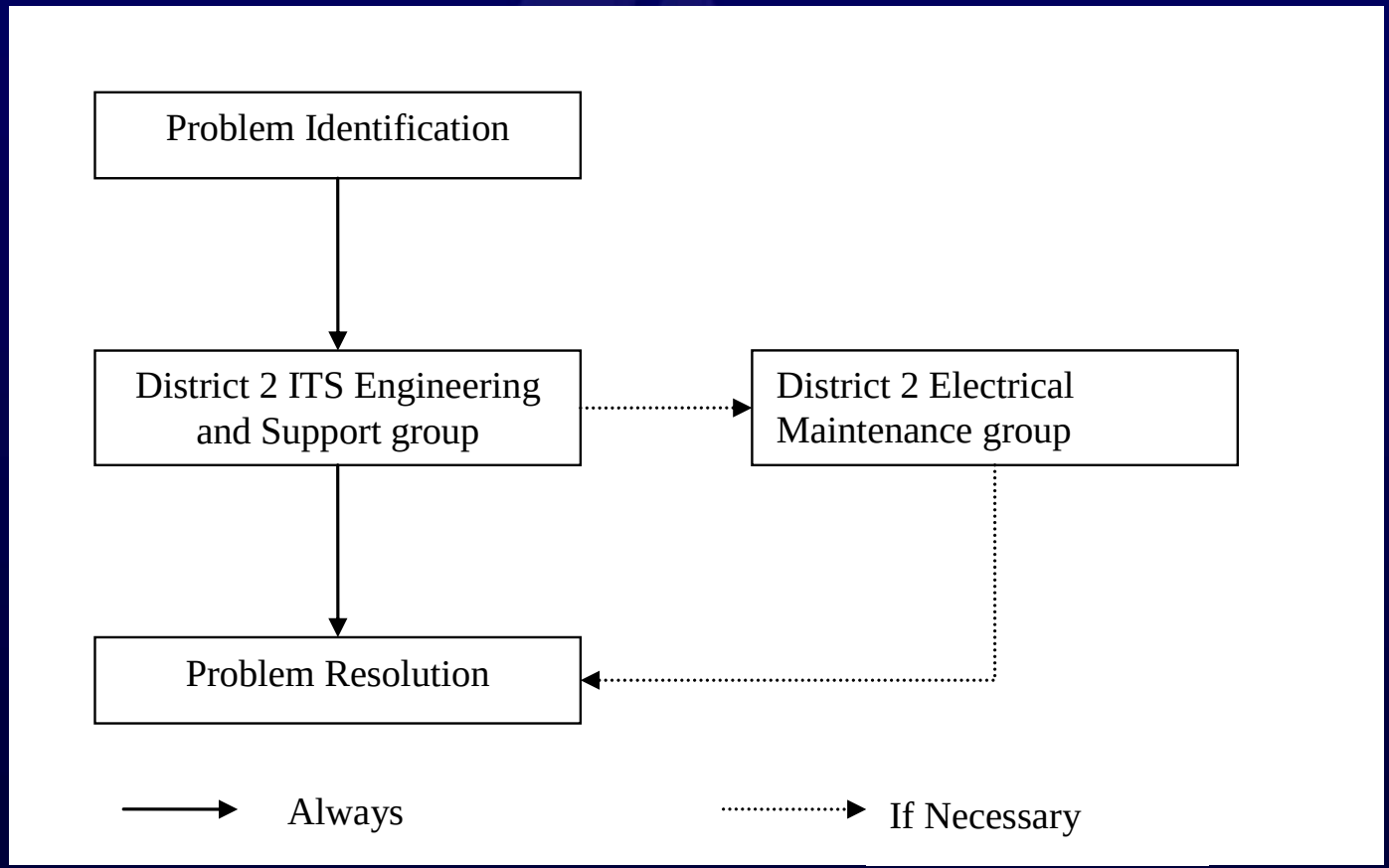
Maintenance Costs



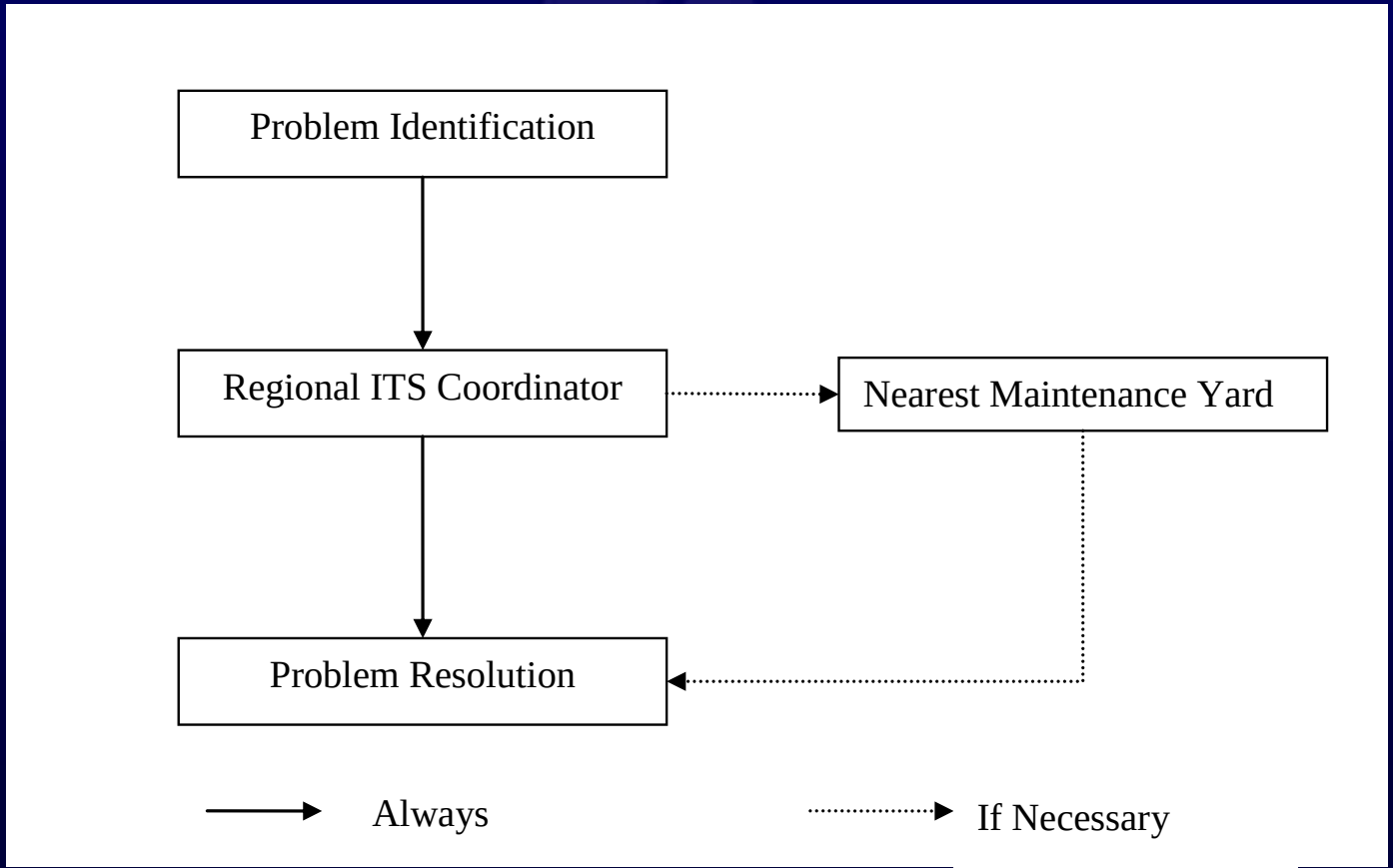
Study Limitations

- Preventive maintenance and reported maintenance
- Varying priorities and performance standards for different elements and states
- Estimations of travel costs used
- NOT all sites in the region were included

Typical ITS Maintenance Process in Caltrans District 2



Typical ITS Maintenance Process in ODOT Region 3 and 4



Data Collection

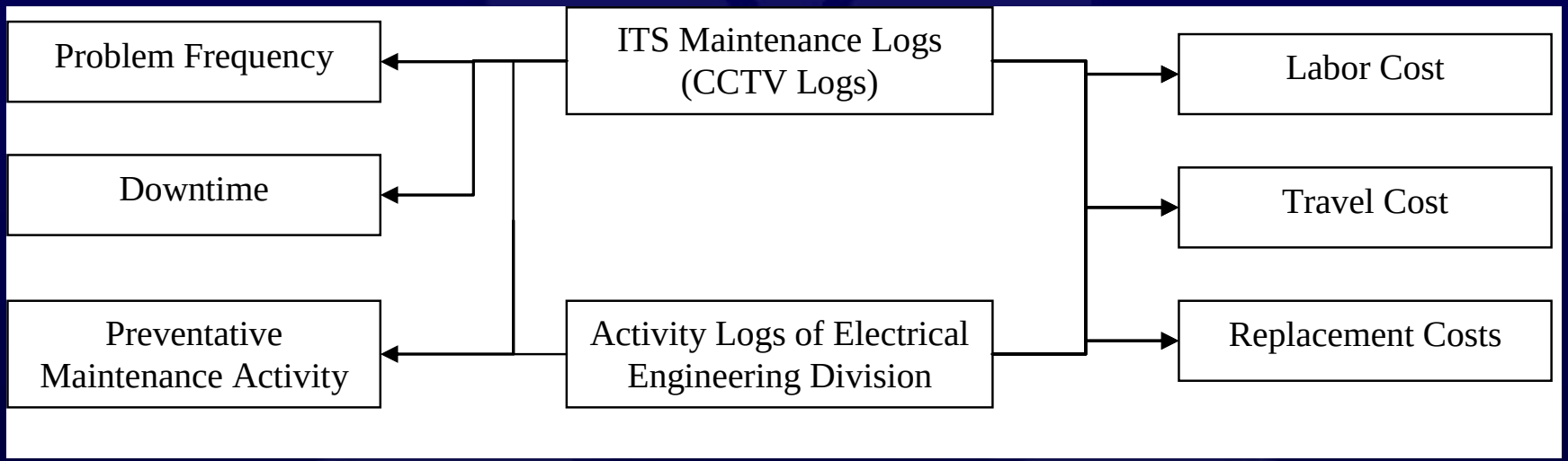
- Location
- Intended Purpose
- Actual Use
- Integration into the main system
- Vendor / Contractor support
- Maintenance Costs
- Operations Cost
- Maintenance History
- Travel Distance
- Reporting System
- Ease of replacement

Data Details – Caltrans D2

Information Group	Information
General Information	Ticket Number
	Problem reported by
	Site location
	FEN
	TMC/BER
	Date opened
	Time opened
Repair Information	Ticket closed by
	Total man hours
	Date closed
	Time closed

Information Group	Information
Activity Details	Work Order Number
	Activity Type
	Asset Type
	Unit ID
	Date Initiated
	Date Completed
Cost Details	Charge Date
	Charge Type
	Item Number
	Item Description
	Quantity / Usage
	Cost per Item

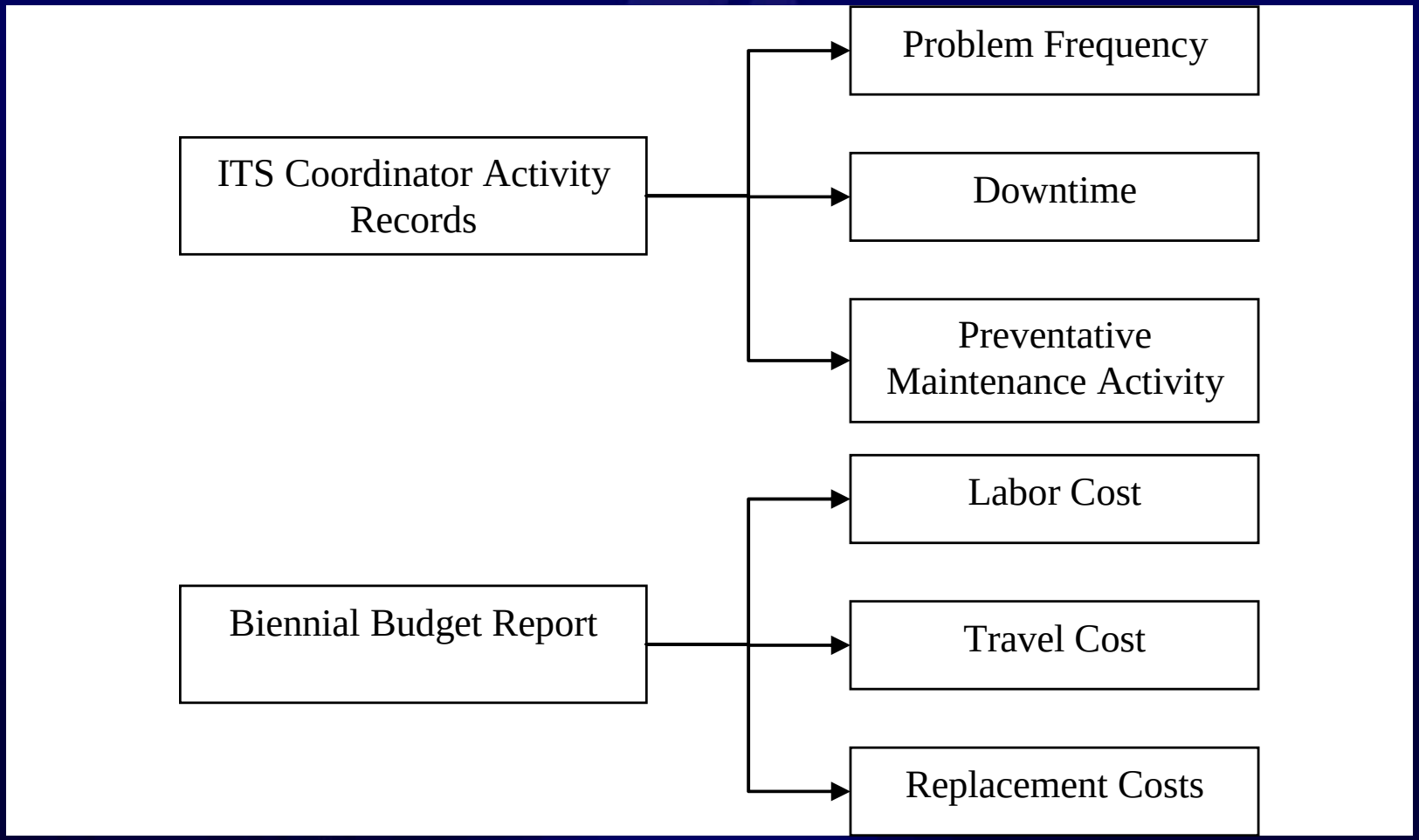
Data Synthesis – Caltrans D2



Data Details – ODOT Region 3 and 4

Information Group	Information
Activity Types	Personnel Services
	Electrical Crew
	Field Operations
	Other
	Service and Supplies
Cost Information	Biennial Budget
	Biennial Expenses
	Encumbarances
	Last Month Expenses

Data Synthesis - OR



CCTV

- CA
  - Ranges between $2336 and $ 288 per year
  - Downtime Ranges between 16 Hrs. and 7.5 hrs.
- OR
  - Ranges between $8374 and $ 670 per year

Summary of CCTV Case Studies

	Average Annual Cost							Down Time			
	Total Cost	Transportation Cost		Labor Cost	Operations Cost	Admin Costs	Replacement Cost	Primary Downtime		Preventive Maintenance Delay	
		Driver Costs	Vehicle Costs					Days	Hours or Days / Activity	Days	Days / Activity
CA	**6 Sites**										
Avg.	$2,236	$149	$267	$1,820				19	12:26:42	6	1
Std. Dev.	$1,422	$82	$276	$1,228				30.3	3:06:09	2.6	0.3
OR	**10 Sites**										
Avg.	$2,844	$512		$1,583	$319	$203	$227	8	2	1	1
Std. Dev.	$2,385	$459		$1,535	$156	$380	$183	2.9	0.6	1.4	1.3

RWIS

- Ranges between $ 6750 and $150

Summary of RWIS Case Studies

	Average Annual Cost							Down Time			
	Total Cost	Transportation Cost		Labor Cost	Operations Cost	Admin Costs	Replacement Cost	Primary Downtime		Preventive Maintenance Delay	
		Driver Costs	Vehcile Costs					Days	Days / Activity	Days	Days / Activity
CA	**3 Sites**										
Avg.	$1,137	$400	$102	$635				27	4		
Std. Dev.	$965	$353	$93	$558				2.9	1.4		
OR	**9 Sites**										
Avg.	$870	$399		$231	$0	$48	$192	26	2	0	0
Std. Dev.	$1,212	$679		$323	$0	$143	$344				

VMS / CMS

- Ranges between $1415 and $282

Summary of VMS Case Studies

	Average Annual Cost							Down Time			
	Total Cost	Transportation Cost		Labor Cost	Operations Cost	Admin Costs	Replacement Cost	Primary Downtime		Preventive Maintenance Delay	
		Driver Costs	Vehicle Costs					Days	Days / Activity	Days	Days / Activity
CA	**3 CMS Sites**										
Avg.	$418	$105	$29	$283				6	2		
Std. Dev.	$195	$103	$30	$62				4.7	1.7		
CA	**2 Radar CMS Sites**										
Avg.	$648	$242	$54	$351				14	4		
Std. Dev.	$137	$59	$4	$90				4.2	0.0		
OR	**2 VMS Sites**							**2 Other VMS Sites**			
Avg.	$648	$120		$468	$0	$0	$60	17	5	7	2
OR	**2 Portable VMS Sites**										
Avg.							$180	25	7	2	1

HAR

- Ranges between $ 6535 and $0

Summary of HAR Case Studies

	Average Annual Cost							Down Time			
	Total Cost	Transportation Cost		Labor Cost	Operations Cost	Admin Costs	Replacement Cost	Primary Downtime		Preventive Maintenance Delay	
		Driver Costs	Vehcile Costs					Days	Days / Activity	Days	Days / Activity
CA	**2 Sites**										
Avg.	$2,997	$1,081	$215	$1,701				45	6		
OR	**1 Site**										
Avg.	$5,038	$1,649		$1,525	$215	$0	$1,649	15	7	2	2

Future Research

- Follow-up study to include all of the sites in COATS region
- Better activity tracking for ITS maintenance
- Identify factors influencing maintenance costs
- Training needs for maintenance staff
- Pooled fund study on ITS maintenance

Thanks

- Ian Turnbull, Caltrans District 2
- James (JAWS) Wittenberg, ODOT Region 4
- Charles Erickson

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