Gravel Roads Management

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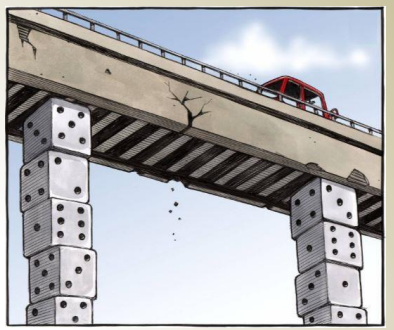
Introduction

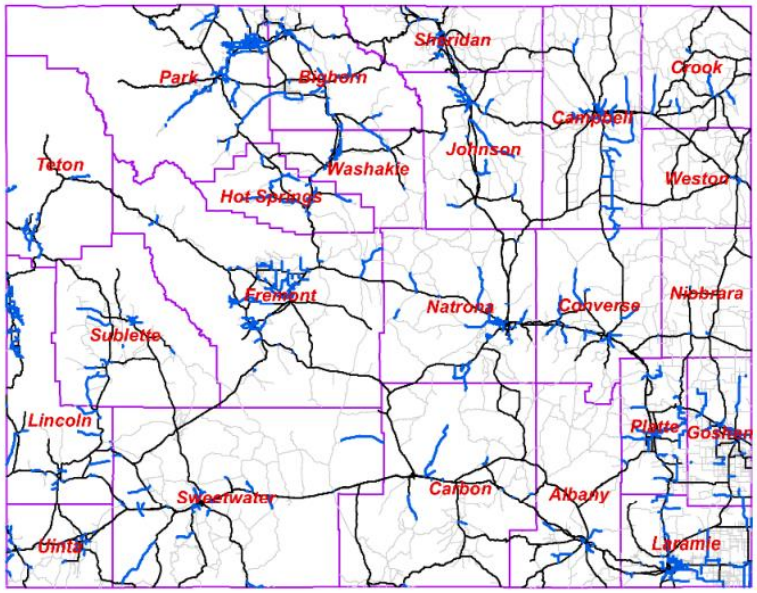


- **Asset Management:**

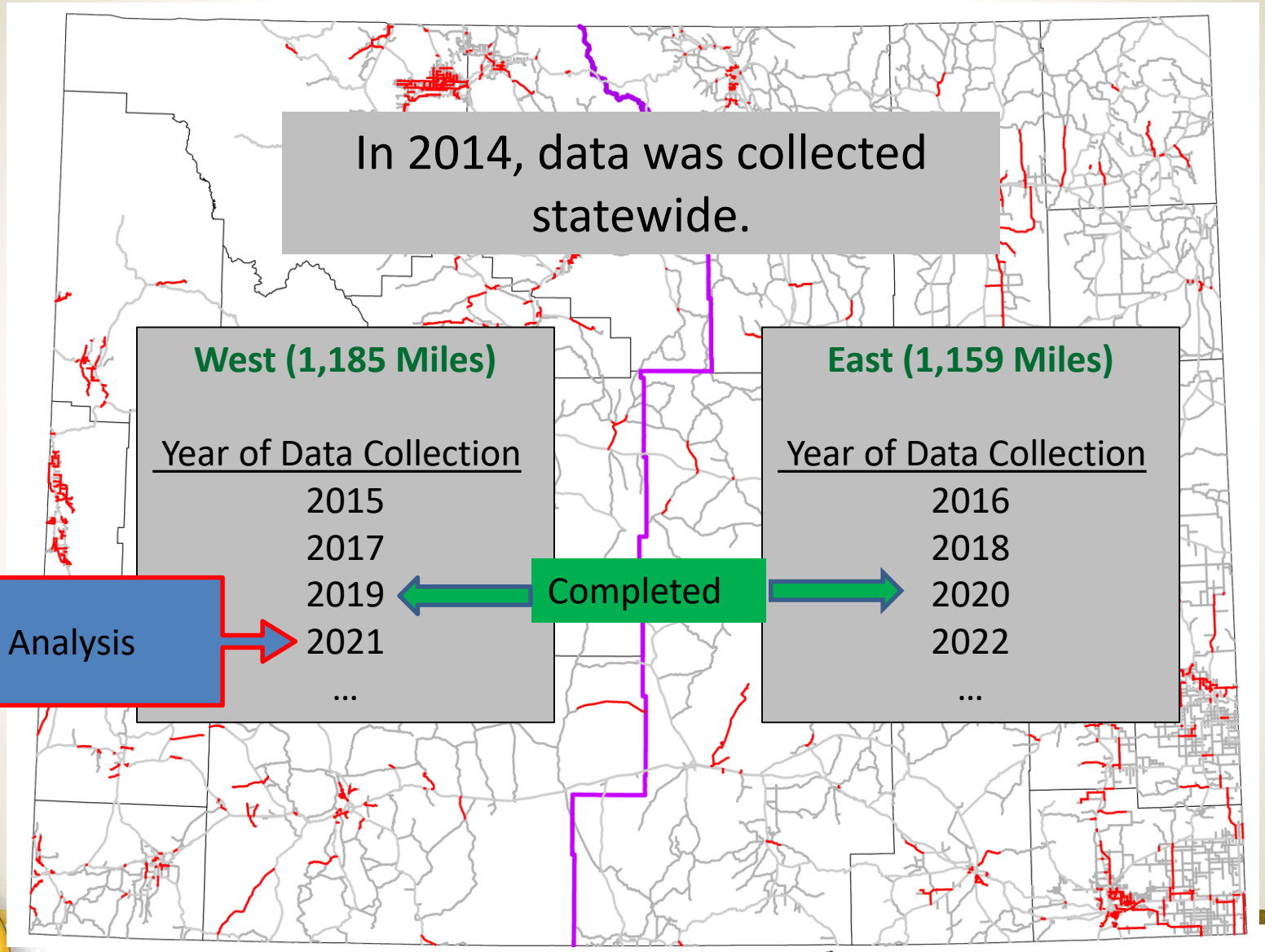
Is the process of operating, maintaining, and upgrading the transportation physical assets such as gravel roads, paved roads, bridges, guardrails, signs, etc.

County Paved Roads

- In Wyoming, there is around 2400 miles of county paved roads.
- Some county roads have a history of relatively low traffic volumes.
- County roads are managed under the supervision of local governments.
- A monitoring system on these paved county roads began in 2014.



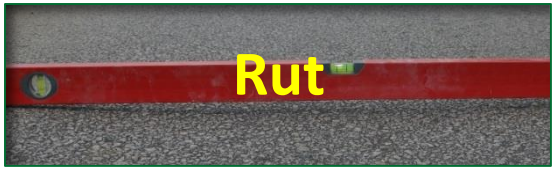
Data Collection Strategy



Road Condition Parameters

International roughness index (IRI)

Rutting

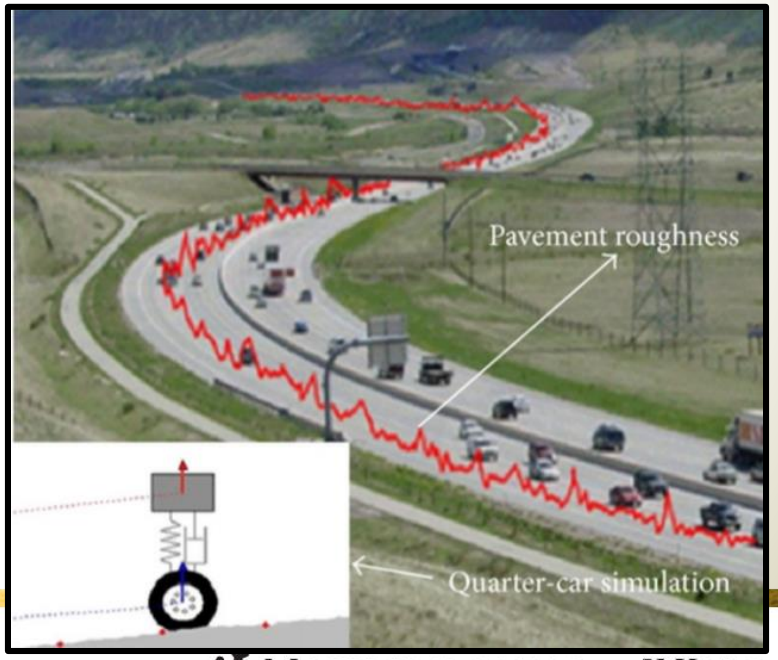


Pavement condition index (PCI)

Overall Condition: Pavement serviceability index (PSI)

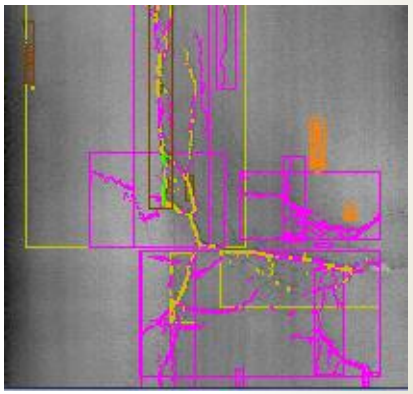
Roughness (IRI)

- **Ride comfort depends on roughness.**
- **Smoother roads require less maintenance.**
- **Smoother roads stay smoother longer.**
- **Smoother roads are safer.**

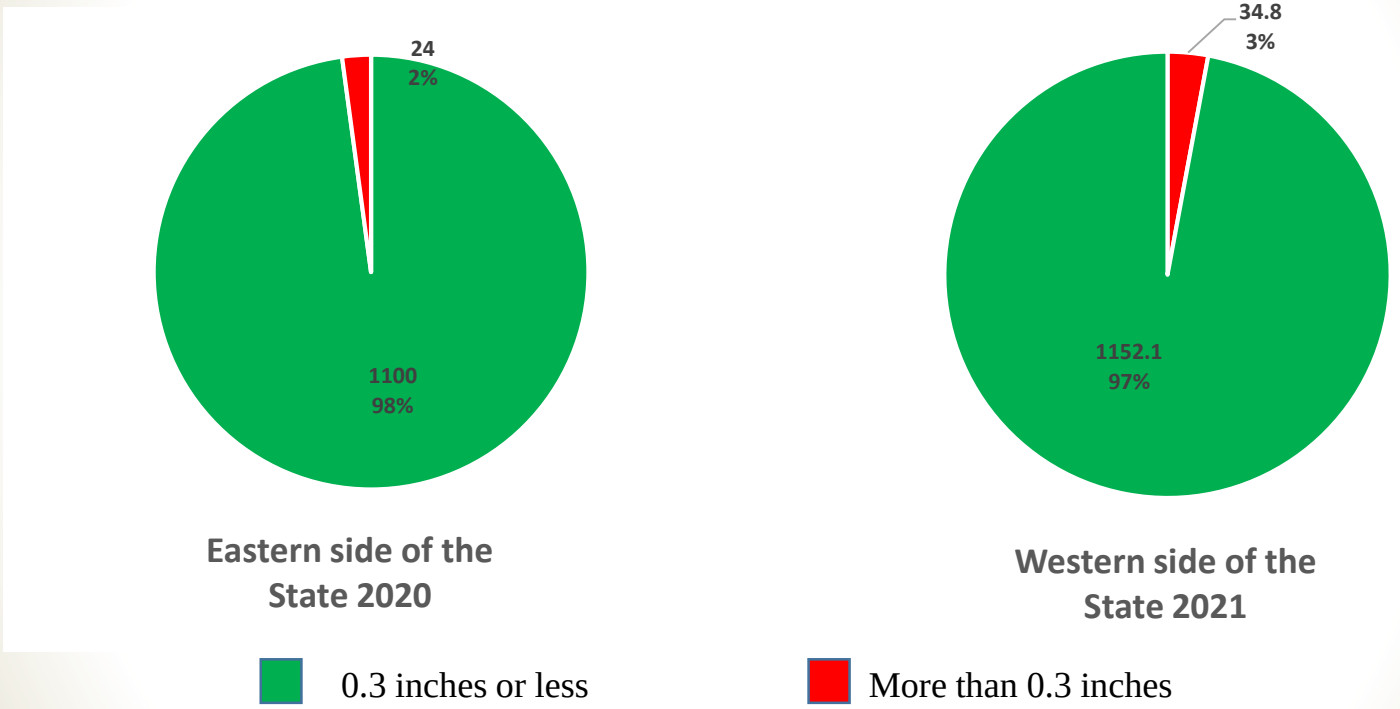


Pavement Condition Index (PCI)

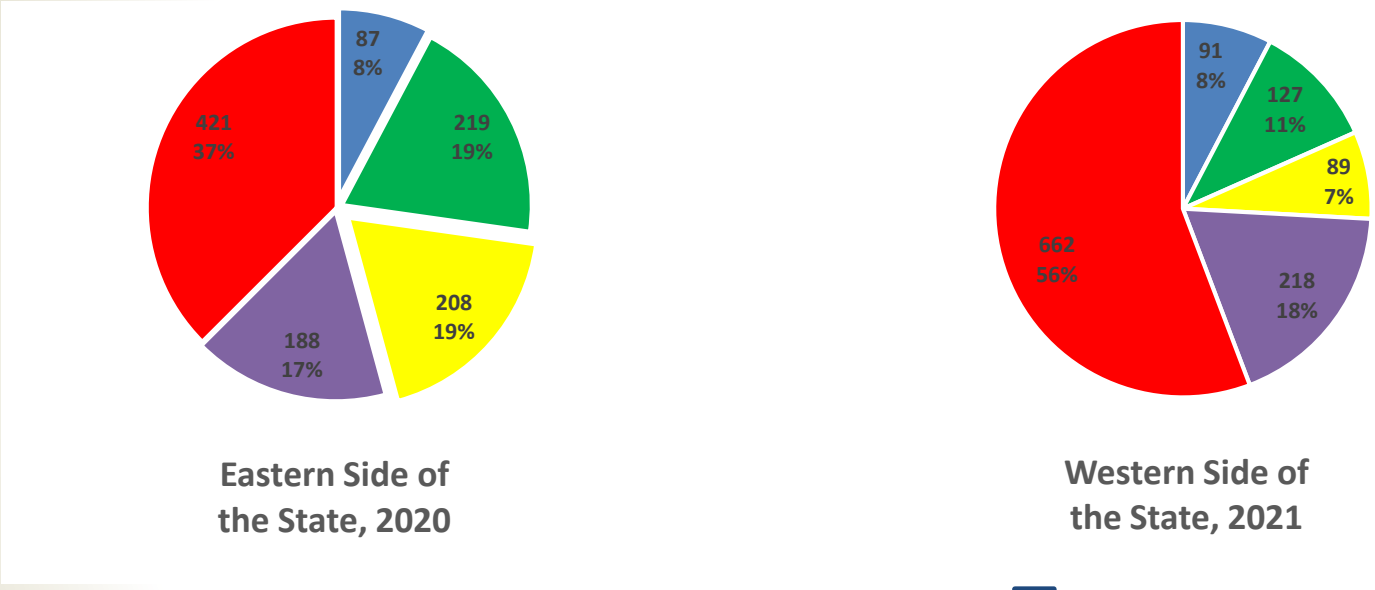
- **Cracks increase roughness.**
- **Cracks allow water to infiltrate pavement.**
- **Cracks accelerate pavement deterioration.**



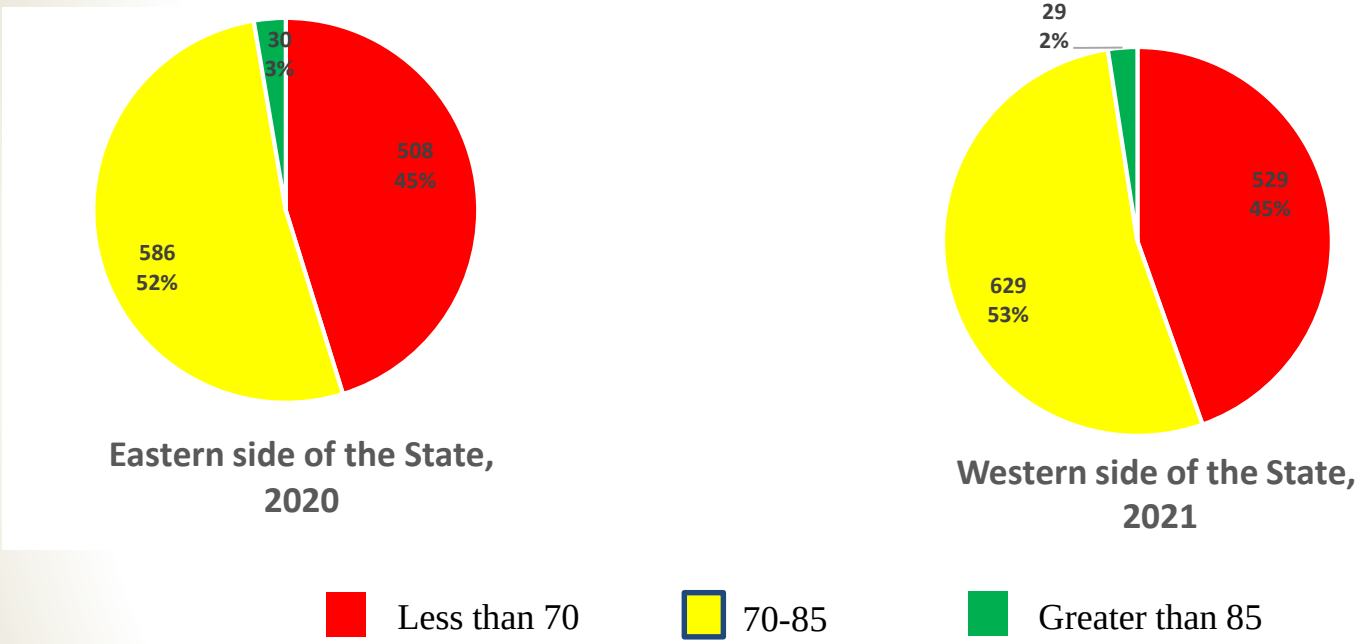
Rut Depth on Paved County Roads



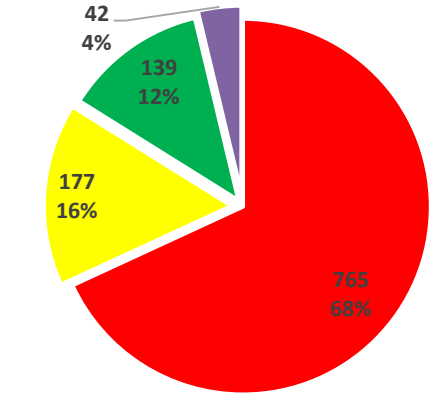
International Roughness Index (IRI) on Paved County Roads



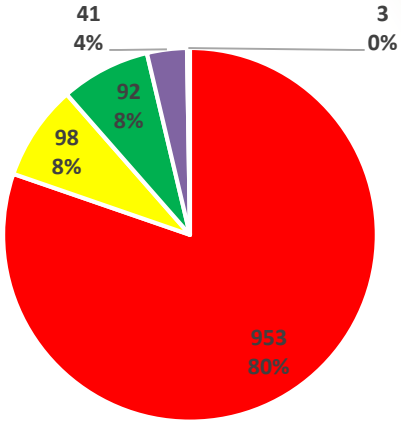
Pavement Condition Index (PCI) on Paved County Roads



Pavement Serviceability Index (PSI) on Paved County Roads



Eastern Side of the State, 2020



Western Side of the State, 2021

Less than 2 | 2.00-2.50 | 2.51-3.00 | 3.01-3.50 | Greater than 3.51

How come so many roads are in poor condition?

- **Many roads were paved in the 1950's, '60's and '70's.**
  - Designed for lighter loads, if they were designed at all.
- **The asphalt has aged.**
- **They need more routine maintenance.**

Why monitor paved county roads?

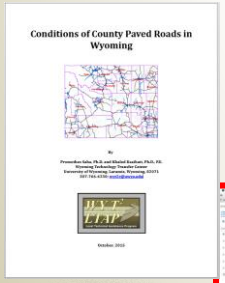
- **Wyoming counties face significant risk if heavy truck traffic increases on many paved county roads.**

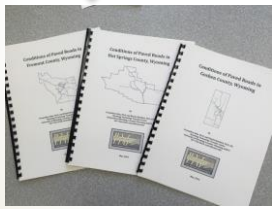
What if they fall apart?

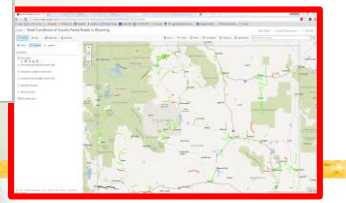
- No inexpensive options. You can't blade this.

Future Direction for County Paved Roads

Moving from Data Collection to Pavement Management System







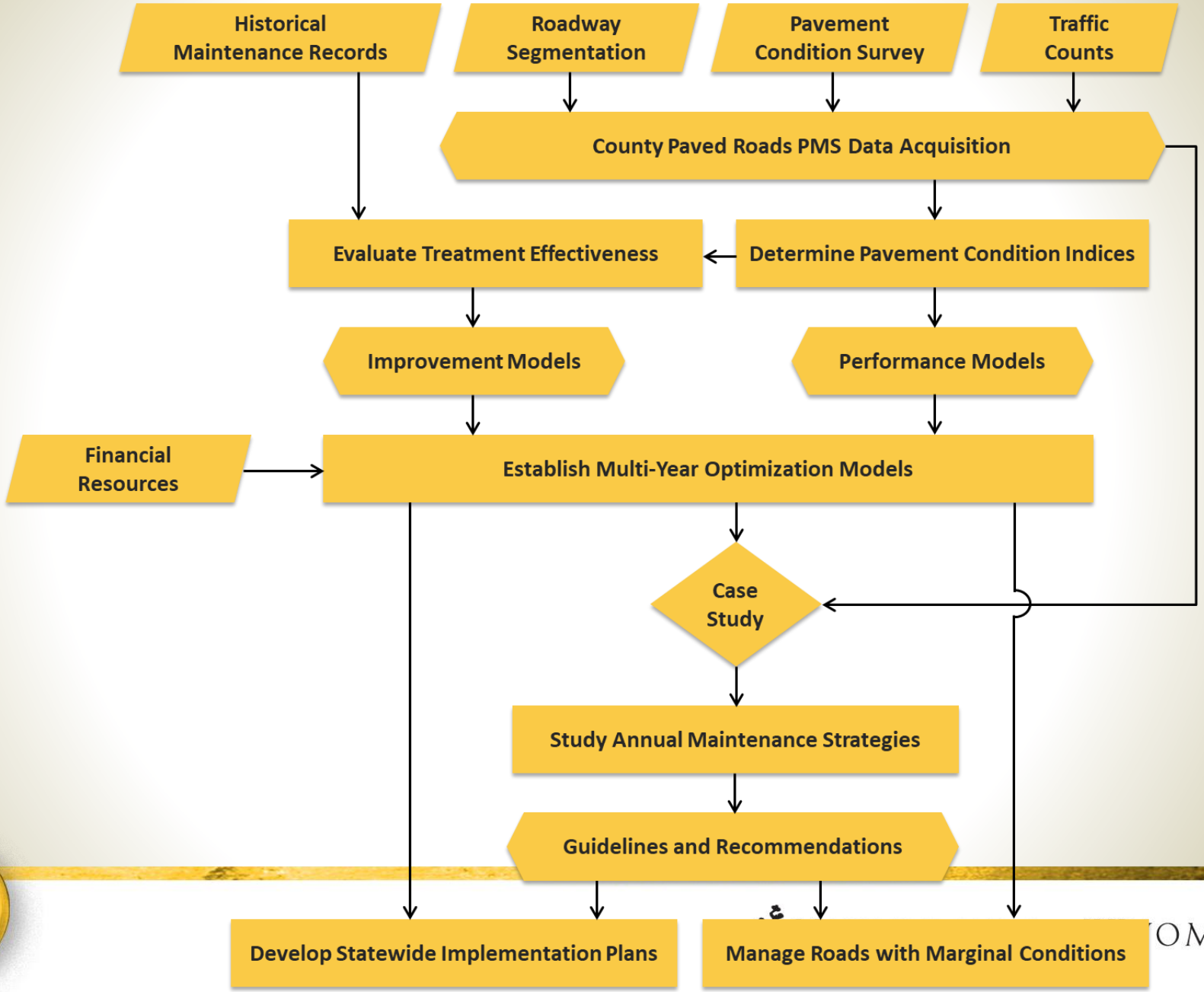
Performance Maximization

How Much I Have

Costs Minimization

How Much I Need

PMS Work Outline



Pavement Maintenance Strategies

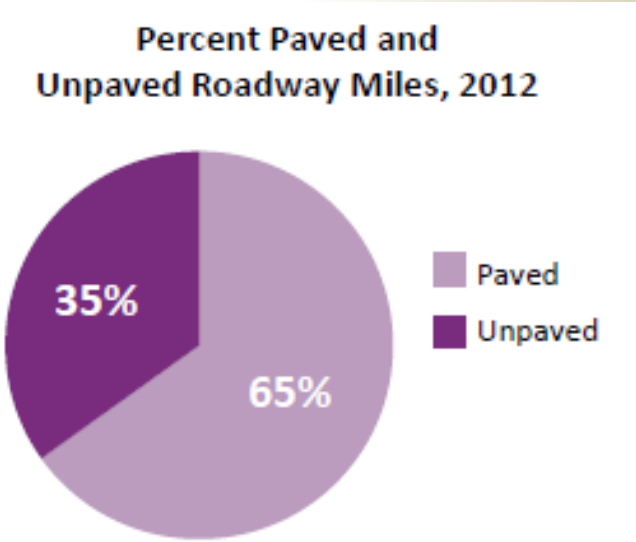
Treatment Type	Details and Applications	Est. Cost/Mile
GM General Maintenance	➢ General Maintenance Procedure ➢ Asphalt Patching ➢ Pothole Repair ➢ Crack Sealing ➢ Road Striping	$0
1-R Preventive Rehabilitation	➢ Chip Seal ➢ Micro-surface ➢ Thin Overlay (<2”)	$60,000
2-R Minor Rehabilitation	➢ Surface Preparation (mil, level, full-depth reclamation, or combination thereof) ➢ Thick Overlay (>2”) ➢ Seal Coat	$250,000
3-R Preventive Rehabilitation with Shoulder Needs	➢ 1-R plus shoulder or widening requirements ➢ Applicable on roads in good condition with shoulder needs	$350,000
4-R Major Rehabilitation	➢ 2-R plus shoulder or widening requirements ➢ Applicable on narrow roads with shoulder or widening needs	$650,000
5-R Full Reconstruction	➢ Complete Reconstruction	$1,200,000

End results of PMS for county paved roads

- A system similar to WYDOT currently has.
- It would identify current conditions.
- It will predict future conditions based on current funding.
- It will predict future conditions based on increasing/ increasing funding.
- It will identify the budget needs based on achieving a certain level of performance.

Gravel Roads

- According to FHWA, there are 1,357,430 miles of unpaved roads in the United States which accounts for almost 35% of more than 4 million miles of roadway in the Nation.
- Over 512,000 miles of unpaved roads are on Tribal lands.



Wyoming Technology Transfer Center
WY T² LTAP
Local Technical Assistance Program

Introduction

- **Needs to establish a GRMS in Wyoming:**

  - **Recent increased in energy prices which will increase truck traffic in the state due to mineral and drilling activities.**

  - **The excess truck traffic will highly increase the amount of generated dust and impact the structural capacity of gravel roads.**

  - **The available local expertise is more proficient in doing maintenance and rehabilitation works than managing them.**

Problem Statement

Considerations:

- Gravel roads are dynamic and their conditions change rapidly
- Local agencies have very limited resources
- There is no long-term plan!!
- Decisions are made based on local considerations (i.e. the amount of complaints received)
- GRMS requirements:
  - Data collection efforts must be limited
  - Analysis must be simple and transparent

Overall Goal

Developing a Comprehensive GRMS methodology

- ❑ **Identify cost associated with the best mix of preservation practices and projects that can be applied on gravel roads**
- ✓ **The developed methodology must be very simple to fit the needs of local agencies in the rural areas**

Expected Benefits

- **Developing matrices for maintenance and rehabilitation identification**
- **Estimating future rehabilitation needs which can help in estimating the different funding needs**
- **Developing a general methodology that can be followed by all local agencies (consistency!)**
- **Providing legislatures with reliable data that can be used to justify or defense any funding needs for gravel roads**

Background

- Management of gravel roadways by Counties, Tribes, and Cities in Wyoming.
- This study will concentrate on county gravel roads
- Coordinating the efforts will result in providing adequate resources for enhancing condition and safety of gravel roads state wide.

Gravel Roads Management Methodology

- **Identifying the size of the network**
- **Determining conditions such as:**
  - Surface distress
  - Roughness or riding quality
  - Dust
- **Determining factors influencing maintenance**
- **Conducting safety evaluation**
- **Establishing preservation cost**

Network size

- **In Wyoming:**
  - An approximate 12,000 miles of gravel roads managed by local governments
    - A significant portion of the entire local roads network in the state

- **Gravel roads:**
  - Any road with a surface that is made from earth, dirt, gravel, or treated gravel and reworked periodically with a motor grader is called a gravel road throughout this study

Identifying Gravel Roads in the State

- **Counties gravel roads**
- **Cities and towns gravel roads**
- **Tribal gravel roads**
- **Data needed:**
  - Beginning point
  - Ending point
  - Length

Determining Actual Condition

- Surface distresses (visually)
- Dust (smart phones)
- Roughness (smart phones)
- Riding quality (subjective)
- Condition changes rapidly

This data collection is costly and can be done at a later stage of the study

Windshield Survey

- **Windshield Surveys :**
  - Riding Quality Rating Guide (RQRG): Based on ride quality [1-10]
  - Gravel Roads Rating Standards (GRRS)

Potholes[1-9]

Rutting [1-9]

Washboards [1-9]

Loss Aggregate [1-9]

Dust [1-4]

Crown [1-3]

Drainage [1-3]

Roadroid System

This system is a system to monitor road conditions by the use of a smartphones. Consists of one application to measure roughness (IRI) by capturing the vibrations from the road with the smartphone's built in accelerometer.

The application analyzes road vibrations ~100 times per second. Roughness is saved in an estimated and a calculated IRI (International Roughness Index) every second with GPS-coordinates.


Vägkvalitet 2019
Powered by Roadroid.
Vägkvalitet 2019
BÄST
SÄMST
Norwegian Sea
FINLAND
NORWAY
Oslo
Helsinki
Saint Petersburg
Tallinn
ESTONIA
Riga
LATVIA
LITHUANIA
Tver
Glasgow
North Sea
DENMARK

Determining factors influencing maintenance

- **Average Annual Daily traffic (ADT)**
- **Average Annual Daily Truck Traffic (AADT)**
- **Roadway width**
- **Functional classification**
- **Land use:**
  - Industrial
  - Residential
  - Recreational
  - Agricultural

This data collection is recommended by County engineers

Potential Safety Projects Enhancement

- Installation of Advance Warning Signs, Delineators, Guard Rails
- Widening of Shoulders
- Culvert Extensions, Cattle Guard Extensions
- Improve Horizontal and Vertical Alignments
- Relocation of Mail Boxes and Fences

- Advance Warning Signs

Before

After Sign Placement

- Advance Warning Signs

Statewide Implementation

- Cattle Guard Extensions

12’ Cattle-guard

24’ Cattle-guard

- Other Examples

Statewide Implementation

- Other Examples

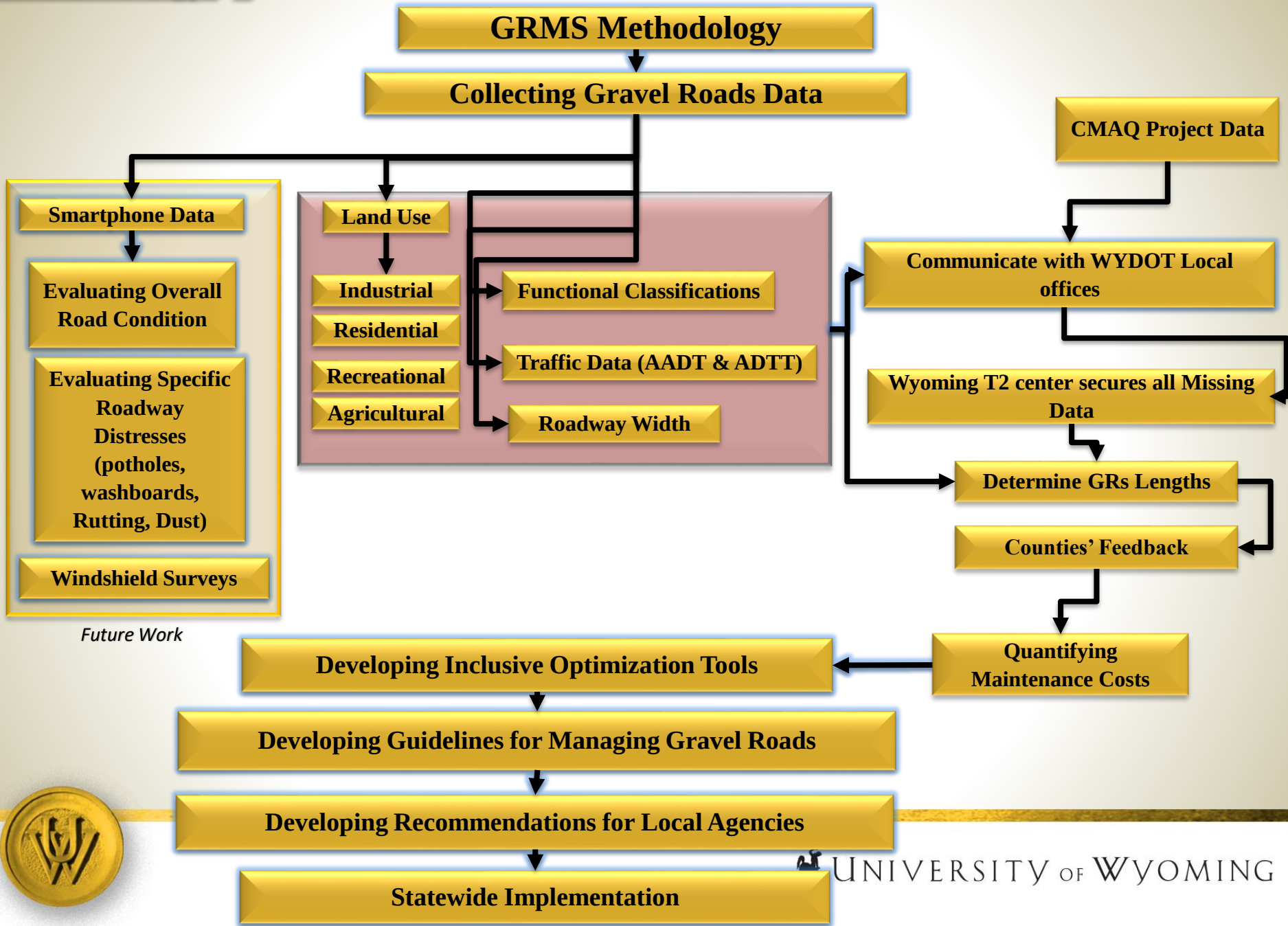
Proposed GRMS

- *The Wyoming Technology Transfer Center (WYT2/LTAP) can develop a new gravel roads management system.*
- *The new system can provide Wyoming legislatures and local transportation agencies with the cost of maintain gravel roads.*
- *The system will initially concentrate on identifying the factors behind maintenance decisions instead of determining roadway condition.*

Tasks

1. Collecting gravel roads location data from Counties
2. Securing functional Classification, land Use, ADT, and ADTT information from WYDOT and Counties
3. Obtaining information on maintenance based on factors in tasks 2
4. Quantifying maintenance costs associated with gravel roads based on ADT, ADTT, etc.
5. Developing an optimization model and tools
6. Estimating funding needs for all gravel roads in the state.
7. Actual gravel roads condition/safety improvements can be added in the future

Methodology



County data example
Carbon County

- 955 miles of county roads.
- 491 miles are maintained year-round. Most of which consist of a graded, crowned road top with a graveled surface making them category one or two roads.
- Approximately 90 miles of that 491 is consisting of asphalt-type surfaces.
- Leaving 366.59 miles category two or three roads
- The remaining 97.41 miles category four.

County data example
Carbon County

- Category One High Priority - Paved and/or Quality Graveled surfaced roads with high traffic volume, open and maintained year-round.
- Category Two Medium Priority - Good gravel or recycled asphalt surfaced roads. Portions of these roads are open and maintained year-round.
- Category Three Low Priority - Lower quality road with some gravel surfacing. Not a priority and less frequently maintained. Low traffic volume. Mostly seasonal roads and not maintained year-round.
- Category Four No Priority - Unimproved two-track or trail.

County data example
Carbon County

- Year-Round Maintenance per mile on high traffic areas $15,000 per mile
- Magnesium Chloride cost $11,000 per mile
- Rebuilding gravel roads per mile $30,000

GRMS

- The outcomes of the previous tasks will result in identifying the size of the gravel roads network in the state.
- The gravel roads will be classified based on actual use/ land use.
- The cost of maintaining various classes of gravel roads will be identified.
- Decisions can be then made by law makers on funding.

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Questions?