Pavement Data Management & Decision Making

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Trimble, Inc.

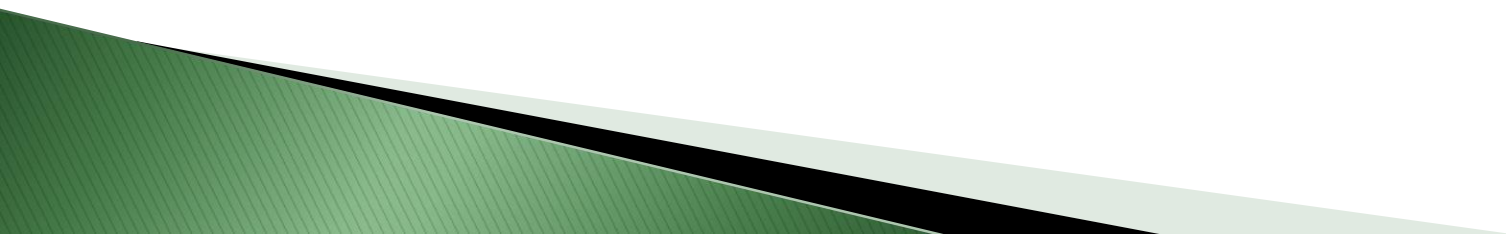# Outline

- What is Pavement Management

- Inventory Data

- Condition Data

- Analysis

What is Pavement Management Data
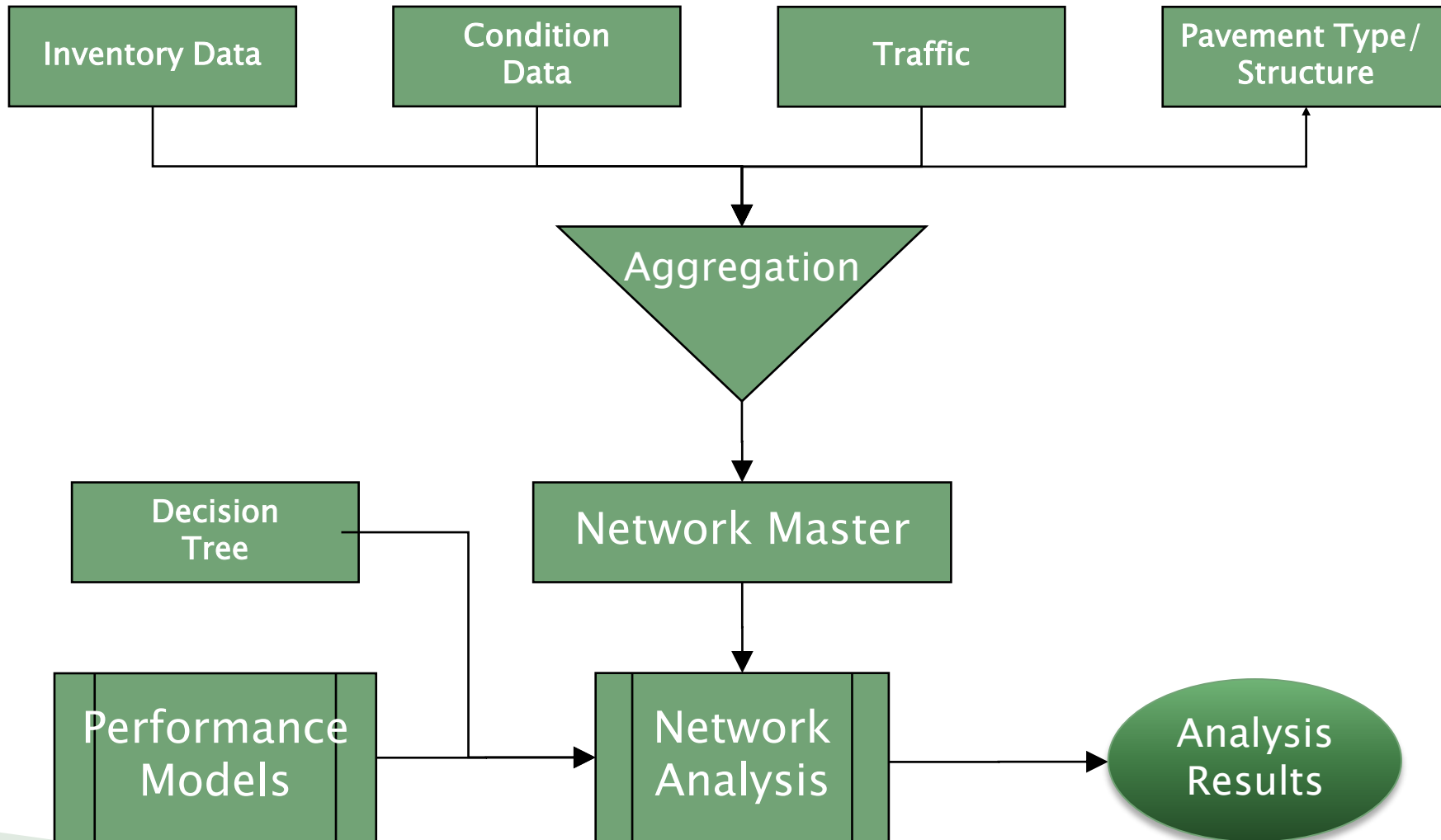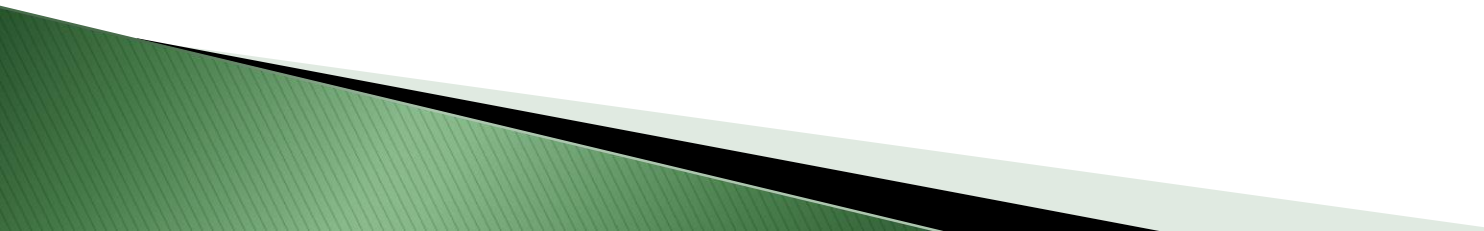
Right Treatment
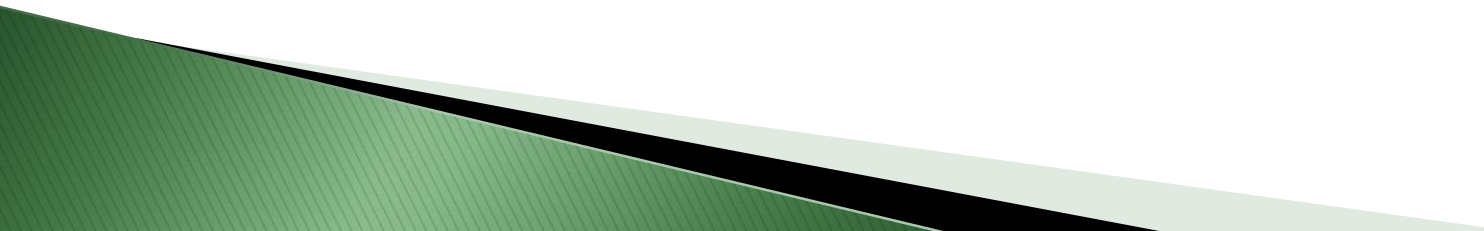
Right Time

Right Location

Analysis WorkFlow

Inventory Data → Condition Data → Traffic → Pavement Type/Structure → Aggregation → Network Master

Decision Tree → Network Analysis

Performance Models → Network Analysis → Analysis Results

Inventory Data

- Pavement Type
  - Broad Pavement Type
  - Detailed Pavement Type
- Route Designation (IH, US, SH, FM, etc.)
- District
- County
- Maintenance Section
- Functional class
- Pavement width
- Shoulder width
- Number of Lanes
- NHS
- Rural-Urban Code

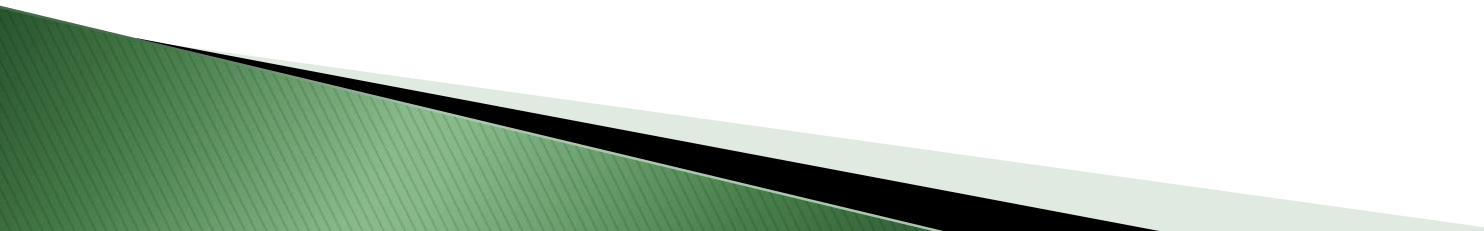# Traffic Data

- AADT

- Percent Trucks

- Current 18KIP ESALS

- Speed Limit

Pavement Condition Data

- Distress Data

- Surface Characteristics

- Structural Capacity

How is Condition Data Collected

- Visual Rating

- Automated
  - Fully Automated

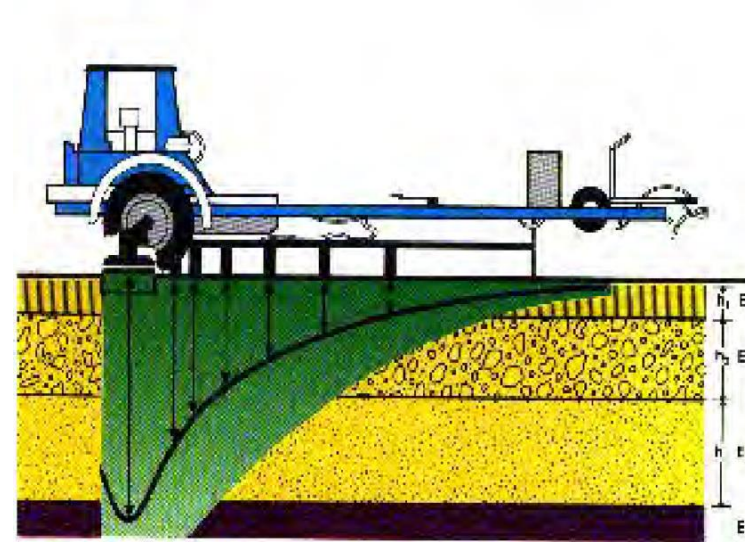 - Semi-Automated

Surface Characteristics

- Friction

- Texture

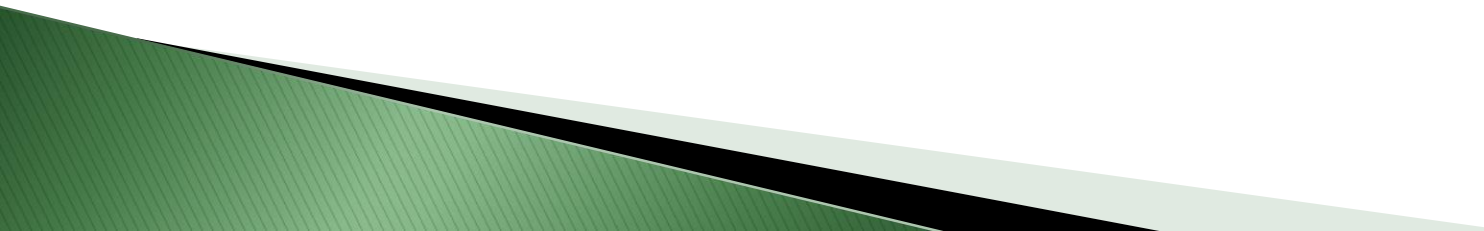# Structural Condition Data

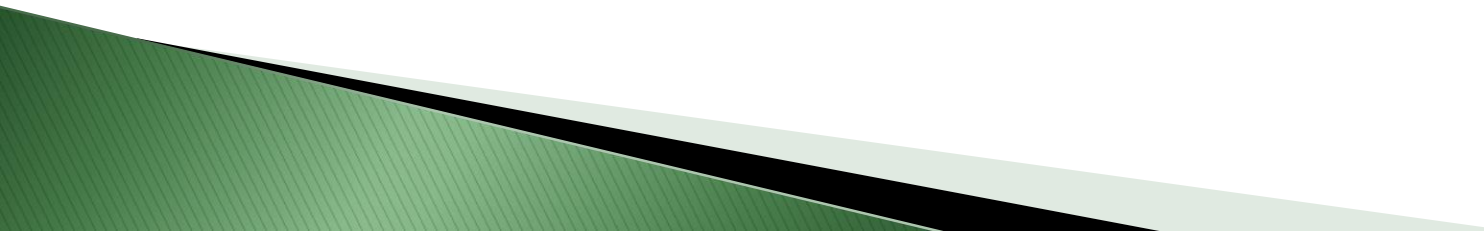▸ Falling Weight Deflectometer (FWD)

Structural Condition Data

- High Speed Deflection Devices

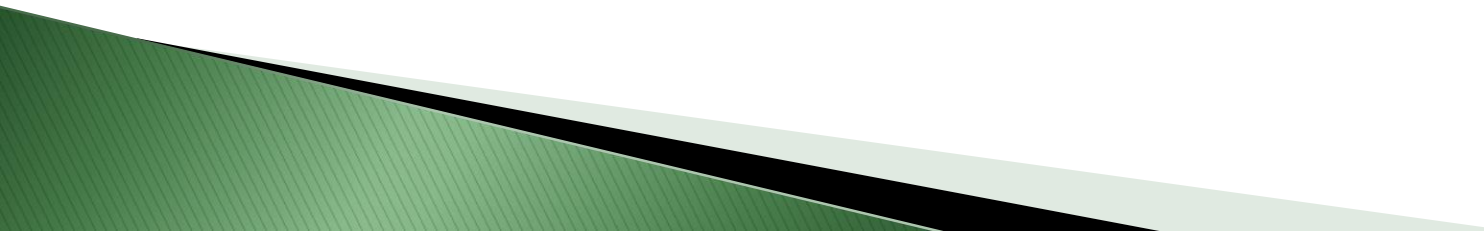# Work History and Layer Data

- Surface Age

- Treatment Type

- Layer Type

- Layer Thickness

Decision Trees

- Purpose
  - To accommodate the selection of treatment types based on relevant decision variables including distresses, ride, scores, traffic, etc.
- Treatment types
  - Do Nothing, PM, LR, MR, HR (generic)
  - Overlay, Chips seal, Mill & overlay (Specific)
- Procedure
  - For a given section, its decision variables are input into the decision trees.
  - Multiple treatments are usually recommended by the trees (e.g., PM for transverse cracking, MR for rutting, etc).
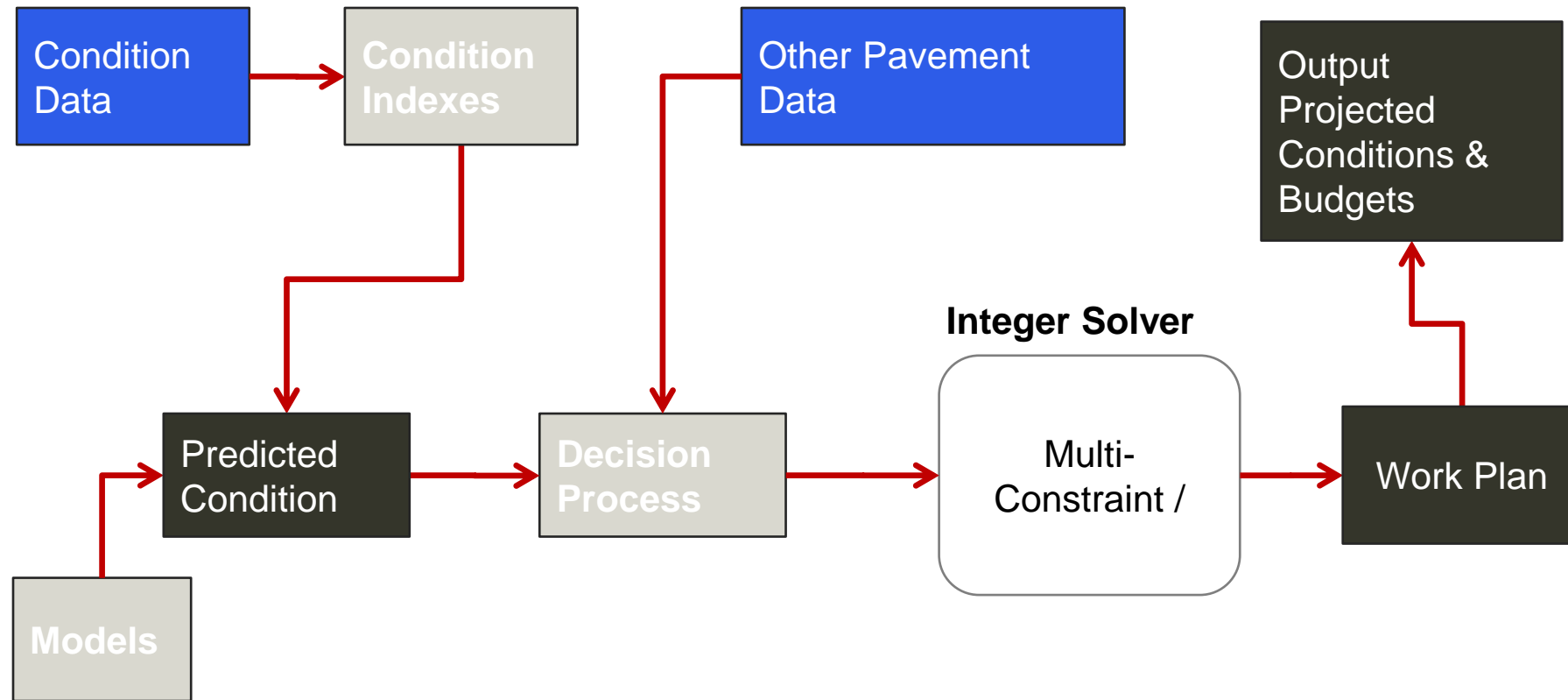 - The most severe treatment type is picked as the output.

Performance Models

- **Exponential**.

- **Hyperbolic**

- **Inverse Exponential Linear**

- **Piecewise Linear**

- **Power**

- **Sigmoidal**

What Does Optimization Mean?

- An optimization problem is a problem formulated as follows:
  - You desire to maximize or minimize a value (this is called the Objective Function)
  - Your problem is limited by some set of rules that control what solutions are allowed. These are the called the constraints
  - You run the whole process by varying some set of values, these are the Variables

- In general the way to specify an optimization type problem is to state:
  - I want to Maximize or Minimize something (Objective)
  - Subject to these conditions being true (A,B,C) (Constraints)
  - By varying these quantities (X1,X2,X3 …) (the variables)

Optimization Analysis

Optimization Analysis

The Objectives Are to:

- Maximize network condition
- Maximize percentage of network above given condition threshold
- Minimize treatment cost
- Minimize user costs
- Minimize Air Pollution

The Constraints are to stop Analysis When:

- Annual budget amounts are reached
- Average condition is achieved annually
- Average remaining service life is achieved annually
- When a specified percentage of the network exceeds a user defined condition threshold

Summary and Conclusion

- Pavement Management is a data driven approach

- Can help agencies save a lot of money

- Requires significant efforts