Local Road Surface Selection Tool
Technical Report

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1. INTRODUCTION

With over 90,000 miles of roadway classified as local roadways (county and township) in the state of North Dakota, local road quality has a large impact on commodity movement, safety, and the quality of life for its residents and visitors. Local road managers have long faced the difficulties of properly managing low-to-medium volume county gravel roadways as traffic volumes and conditions change. Outside pressures rather than sound economic factors often drive the decisions on the various surface treatment options available. The surface selection tool developed by the Upper Great Plains Transportation Institute (UGPTI) provides a means for local roadway managers to develop an economic basis to make the best treatment option decisions possible. This selection tool was developed by UGPTI based on previous work by the South Dakota Department of Transportation (SDDOT) and the South Dakota Local Transportation Assistance Program (SDLTAP). With this background and input from NDLTAP, North Dakota Association of Counties, and NDDOT Local Government Division, UGPTI was able to develop an online, web-based decision tool to help determine the most economical way to manage low-volume roadways based on traffic, local maintenance practices, and construction costs. This report will outline the development of the tool, how to use the tool, how the program adapts to additional information provided by the user base, and areas of further development for the tool.

2.   PROGRAM DEVELOPMENT

In 2004, Applied Pavement Technology, along with SDDOT, created the report, "Local Road Surfacing Criteria" (SDDOT, 2004-F). In this report, the researchers were tasked with determining the costs and benefits associated with four types of roadway surfaces: paved, gravel, blotter (chip seal), and stabilized gravel. A companion Visual Basic program based in Microsoft Excel was developed and distributed using the SDLTAP. This program allowed South Dakota roadway managers to determine the most economical way to surface a new or existing roadway. However, the program had baseline assumptions on cost and maintenance practices that were not easily updated or calibrated for local conditions. This caused the program to eventually become out of date. UGPTI and SDDOT remained in contact regarding the user base of the project, and continually discussed possible updates and changes to the program. Using the foundation of that program and the report and knowledge base created during usage, UGPTI has developed a similar web-based tool to help roadway managers develop economic scenarios for roadway decisions.

The Local Road Surface Selection Tool was developed at UGPTI within the Department of Transportation Support Center (DOTSC). The tool was created by Brad Wentz, P.E., along with IT staff Megan Bouret and DOTSC students. The tool includes several technological and technical updates to the SDLTAP program. The largest technological reformation was making it a web-based program that can be run in any web browser on any type of device (desktop computer, tablet, etc.). Additionally, the new program allows individual counties to create their own default values and to continuously update information. To grow the program database, the tool allows for a statewide administrator to be assigned to create larger county regions in order to develop regional defaults for use by counties with less data at their disposal. Technical updates and expanded roadway surface options allow comparison of five different roadway surfaces: hot mix asphalt (HMA), gravel, stabilized gravel, asphalt surface treatment (Otta seal, chip seal, etc.), and dust controlled gravel. Small modifications to the technical approach have been instituted, such as the removal of safety cost considerations in the total costs, replacing the safety cost considerations with a user cost, and addition of a user-cost multiplier based on the surface type.

The program and data are housed on the DOTSC servers at North Dakota State University, where they will be permanently maintained. For participating states, an independent manager, such as the LTAP director, will be identified to help administer the regional information, including regional distributions and baseline cost values. Each statewide administrator will be given credentials to update the regional defaults. Participating counties will be given log-in information for a county manager to administer county cost data. These county cost data are aggregated within the regions, by the program, and can help reshape the default values for each region if costs change over time. The data input by each individual county and other data sources, such as surveys, can be used by the administrator to improve local program calibration. In addition, regions can be modified by the statewide manager if a change in construction practices or other forces cause a change in cost data (i.e., an oil-based construction boom). Planned rollout schedules and future expansion of the program will be further discussed in Section 5.

3.   SURFACE SELECTION TOOL

The tool takes into account the initial costs of roadway construction, the costs to the owner for maintenance, the costs of the roadway to the user, and any salvage value that can be derived from the roadway at the end of the analysis period. Usually, gravel roadways are not paved due to the high initial costs of construction. Further analysis over a longer period of time sometimes shows that, based on increased maintenance and user costs, gravel may not be the most cost-effective low volume roadway. Many counties have created an internal set of rules based on traffic counts or are burdened with public pressure to pave or improve a roadway before a project is selected. This tool has been developed to generate an economic perspective that local roadway managers can present to their commissions and residents. This section outlines the process of using the program for a roadway manager, along with decisions and flexibility afforded to these roadway experts in the analysis.

Many default values are built into the program to help roadway managers create a rational economic analysis of projects, which may not be common practice within their jurisdiction. Regional baseline values are assigned by the statewide program manager based on the average values entered by county administrators within that region. Each analysis allows analysts to choose between the regional default values or the county assigned default values (if entered), or they may input their own analysis values based on engineering judgment. The values may be some combination of these options. Each analysis is unique based on practices and costs entered, but all analyses follow a similar procedure.

4. ROADWAY ANALYSIS PROCEDURE

Step 1: Gather General County Maintenance and Construction Practices

To effectively use the selection tool, background information and adopted countywide practices should be considered. While there are default regional values and possibly county default values available from the tool, there may be unique situations that call for the analyst to override the default values that are available. Data that will be considered for each manager's particular county include:

- Current gravel roadway maintenance practices, such as blading frequency, re-graveling frequency and depth, and frequency of chemical applications
- Current gravel roadway construction costs, such as bid gravel costs, blade and labor costs for maintenance, and costs for chemicals and application
- Current pavement maintenance practices, such as chip seal frequency, crack seal frequency, and overlay frequency and common depths
- Current pavement construction costs, such as average asphalt cost per ton, chip seal and crack seal costs per mile, and striping costs
- Decisions on whether future gravel and paved roadway maintenance or construction will be completed by contract or county forces (or a combination of both)

These data will allow the roadway manager to create a more accurate representation of the asset management practices for each roadway surface. After the information has been gathered, the tool can be accessed via a web browser (e.g., Internet Explorer, Mozilla Firefox, Google Chrome) and input to analyze any roadway.

Step 2: Identify the Road Section

To identify the road section, the roadway manager must decide what length of an existing roadway to consider in the analysis. Many times, full length county roadways are broken into smaller paving districts or project segments based on intersections with other county or state highways. The roadway manager must identify the project length, daily traffic, and width of the roadway segment being analyzed. These data will be entered into the analysis to calculate the costs based on the area and characteristics of the roadway being studied.

Step 3: Select Surface Types and Alternative Cost Items

After the roadway section has been identified, the roadway manager is then tasked with deciding which surface types to analyze. Depending on usual practices of each county or region, there may not be sufficient cost or contractor data to analyze certain roadway surface types with the local calibration. However, there are regional default cost and maintenance practices for these lesser used roadway surfaces. It is up to the user to decide which surface types will be analyzed by the program. Additionally, a roadway manager can include additional analyses such as the future salvage value of the roadway surface at the end of the analysis period, and the user costs based on roadway surface. The salvage value includes a reclaiming/milling cost that is added to the analysis for HMA pavements. User costs are explained in depth later in the report. Figure 4.1 shows the entry screen for the analysis portion of the program and what surface types and alternative cost items are available for analysis.

Figure 4.1 Initial Analysis Setup Screen

Step 4: Identify Common Parameters of all Road Types

Common parameters are defined as the information about the roadway segment that does not change regardless of surface. These parameters include the average daily traffic (ADT), the discount rate, the analysis period, starting year of the analysis, and the base user costs.

- ADT is the number of cars and trucks that use the selected segment of roadway on a daily basis. This value can vary based on season and time of day, and is to be averaged out over the course of a year. In the analysis, a range of ADT are given as choices for the roadway manager. Many times, a single traffic count can be attained as a solid estimate of the daily traffic.
- Discount rate is defined as the estimated difference between the interest and construction inflation rates over the analysis period. It is set to a default value of 3.5% in the program, which was referenced in the previous report SD2002-10 and established by the Office of Management and Budget (FHWA-SA-98-079 and Caltrans LCCA Investigation). Roadway managers can raise or lower the discount rate for the analysis, which will change the relationship of how maintenance costs and initial construction costs are handled.
- Analysis period specifies how long the roadway manager wants the program to calculate the costs of the roadway surfacing, and what year the analysis should start.
- Base user costs are an optional analysis value that associates a cost to the driver on the roadway based on the surface. The cost is based on vehicle efficiency (driving speed, fuel costs, etc.), possible damage to the vehicle due to surface damage, and costs associated with the safety of the roadway (crash rates, injury severity, and related costs). These user costs are where the roadway manager can address long-term concerns of roadway noise, pollution and safety associated with gravel, and lower initial cost surfaces. User costs are normalized across the county as a single cost per user, and the default value can be set by the statewide or county administrator. The base user costs are also affected by each roadway surface, and the default value is for the HMA pavement

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type (Cost Factor =1). Other pavement surfaces can increase or decrease the user costs based on quality of roadway and other factors, and these user cost factors can be set further in the analysis. The roadway manager must collect as much of these data as possible to ensure correct analysis of all roadway types.

Figure 4.2 Common Parameters Input Screen

Step 5: Update Roadway Specific Costs

Each county has been assigned a baseline construction cost for each surface type based on region or county defaults. To edit these default values for initial construction costs, a roadway manager must click on the "Initial Cost Calculator" button near the top of the analysis page. Within the Initial Cost Calculator dialogue, roadway managers can adapt the baseline regional or county costs to the specific project being analyzed. The initial construction baselines include the depth of the new surface, reshaping costs, reclaiming costs, widening costs if applicable, contingencies, and other applicable costs to the roadway surface. Figure 4.3 shows the HMA initial cost parameters and the cost that is derived (in $/mile) for each item. All supporting data should be gathered by the roadway manager in previous steps to ensure that the initial cost values are correct for analysis. Figure 4.3 shows the input screen for an HMA cost parameter setup. Each value can be updated from the regional or county default values to update the initial costs of construction. After changing any values, roadway managers can also revert back to the default values using the "Cancel" or "Reset" buttons at the bottom of the screen if no changes wanted. To save the updated values, the "Done" button brings the user back to the cost parameters setup. These steps must be completed for each roadway surface that will require editing from the defaults.

Figure 4.3 Initial Cost Parameters Setup (HMA shown)

After setting the initial costs, roadway managers are required to input maintenance intervals and maintenance costs for each surface type being analyzed. These maintenance costs will allow roadway managers to get a clearer picture of the total cost associated with each surface over the analysis period. Again, all available supporting data should be collected to get an accurate analysis of the costs for each roadway type. Often, each county has its own practices for maintenance and construction that are similar to nearby counties, but have modified them to fit their specific needs. The program allows roadway managers to input their maintenance practices for each individual project, and keep regional or countywide data for lesser used procedures within their jurisdiction.

Figure 4.4 shows an example of the maintenance costs that can be entered by a roadway manager. Each entry box contains inputs that will be placed into the cost model to ascertain the costs of paving or other road surfaces. Maintenance practices include HMA crack sealing, seal coats, gravel blading and reshaping, and re-gravelling. Overall, there are 22 different treatments across the five roadway surfaces that require information in the initial rollout. Each treatment requires data on how many applications per year are applied, the yearly maintenance interval (if more than one year between operations), when the maintenance starts (what year), and how much the maintenance costs. It is important for roadway managers to gather as much of these data and update them to their practices to get an accurate picture of the long-term costs associated with each pavement type. These long-term costs can become the difference in the cost efficiency of various surfaces.

Figure 4.4 Agency Cost Parameters Setup (HMA shown)

Analysis Reporting

After all the relevant data have been input into the program, a final report of the total costs to the agency will be created by clicking "View Analysis Summary." The final report shows a breakdown of the total cost over the analysis period for all surfaces being analyzed. It also creates a cumulative comparison chart of the total costs of all surface types so the roadway manager can see a continuous full cost projection of all the different surface types. Figure 4.5 is an example of a final analysis summary shown from the web page. The roadway manager can then go back and change parameters that may be incorrectly entered or print a PDF of the inputs and outputs that can be brought to other decision makers regarding the roadway. A sample PDF output has been attached to this report in Appendix B.

Figure 4.5 Final Agency Cost Summary

Help Documentation

An interactive help document has been created within the program to help users while working with the program. The document, which is accessible by clicking the "Help" box during any point of the analysis, gives basic information and guides the user through the information required for each input. Many of the concepts presented in this document are discussed more in depth to help the user along during the analysis. The help document has been attached to this report as Appendix A, and is available as an interactive PDF document during program usage.

5.   COST DATABASE UPDATES

The program has been created to allow counties that have developed individual cost data to input their own county-specific data. These data then will be accounted for across the region, along with the regional default values input by the statewide manager. Each statewide administrator will also have the ability to change the regional default values to the average of all counties within the region. This allows for default regional cost data to be periodically updated by the statewide administrators, keeping the program current into the foreseeable future.

The county-based cost and maintenance data will be administered and updated by county managers. Each county will have a designated county manager, assigned by the statewide administrator, who will be responsible for input of all baseline data for their individual county. County managers will be given log-in information that allows them to update their county baseline values directly on the website. If counties have maintenance or project data for any of the roadway surfaces, they can input their information into the program. These data then can become their default values for future analyses, requiring less new data for each analysis, allowing for more efficient analyses. Additionally, the county data are aggregated and reported by region to the statewide administrator to allow them to update the regional cost data on a regular basis.

These cost baseline values allow for local road managers to understand what road surfaces will cost to construct within their area, even if they are not practicing the technology themselves. These shared cost data help roadway managers make informed decisions about newer surfacing techniques that may not be common practice in their jurisdiction.

6. FURTHER PROGRAM DEVELOPMENT

The initial program rollout will begin with program administrators in North Dakota, South Dakota, and Minnesota, with plans to expand to Montana. These states contain large amounts of diversity, and can allow for county road managers in other states to use the program by finding a county similar to theirs. Future program updates may allow for expansion into other states. Other interested states will be expected to contribute to setup and maintenance fees and agree to assign accountability to an administrator to ensure their statewide data are up to date. With these updates, each state administrator can create county-based regions and also provide baseline regional data. These administrators will also be responsible for upkeep of the user database for each county, geographic makeup of each region, and upkeep of regional baseline averages. Time and cost estimates for these tasks for other adopters will become more evident after the initial rollout phase is complete. Each county within supported states will be given log-in information to input countywide bid data, but will not be required to input information. This access will allow counties with smaller staffs or less bid data to use the regional averages rather than their historical data.

REFERENCES

California Department of Transportation, 2011, Caltrans Research and Innovation, Using Life Cycle Cost Analysis in Highway Project Development.

Federal Highway Administration, 1998, Pavement Division, Life-Cycle Cost Analysis in Pavement Design, FHWA-SA-98-079, Washington, D.C.

SD Department of Transportation, 2004-F, Office of Research, Local Road Surfacing Criteria, SD2002-10-F, Pierre, South Dakota.

SD Department of Transportation, 2004-TB, Office of Research, Local Road Surfacing Criteria, SD2002-10-TB, Pierre, South Dakota.

FEEDBACK AND RESOURCES

HMA Pavement | Pavement Interactive
www.pavementinteractive.org › Pavement › Pavement Types

Dec 29, 2010 - Flexible *pavement* information in this Guide is generally concerned with dense-graded *HMA*. Dense-graded *HMA* is a versatile, all-around mix making it the most common and well-understood mix type in the U.S. Stone matrix asphalt (SMA).

What is Hot Mix Asphalt Pavement?
www.apa-mi.org/what_is_hot_mix_asphalt_paveme.php

Asphalt *pavement* refers to any paved road surfaced with asphalt. *Hot Mix Asphalt* (*HMA*) is a combination of approximately 95% stone, sand, or gravel bound together by asphalt cement, a product of crude oil. Asphalt cement is heated aggregate, combined, and mixed with the aggregate at an *HMA* facility.

[PDF]**HMA Pavement Mix Type Selection Guide - FHWA**
https://www.fhwa.dot.gov/publications/research/infrastructure/pavements/.../HMA.pdf
The *HMA Pavement* Mix Type Selection Guide provides designers with methods for selecting appropriate mix types while considering factors such as traffic, ...

Asphalt concrete - Wikipedia
https://en.wikipedia.org/wiki/Asphalt_concrete
Asphalt concrete is a composite material commonly used to surface roads, parking lots, airports ... *Hot mix asphalt* concrete (commonly abbreviated as HMAC or *HMA*) is produced by heating ... Superpave, short for "superior performing asphalt *pavement*," is a *pavement* system designed to provide longer lasting roadways.

[PDF]**full-depth hma pavement design - Illinois Asphalt Pavement Association**
www.il-asphalt.org/index.php/download_file/view/181/293/
FULL-DEPTH. *HMA PAVEMENT* DESIGN. Marshall R. Thompson. Department of Civil Engineering. University of Illinois @ U-C ...

[PDF]**Hot Mix Asphalts 101**
www.state.nj.us/transportation/eng/pavement/pdf/HotMix0709.pdf
Hot Mix Asphalt 101 ... *pavement* layer. (≈ 5% binder and ≈ 95% aggregate) .... Gap-graded *HMA* produced from the modified Venezuelan binder, 0.5 x 0.7 mm ...

Pavement Design Guide: Hot Mix Asphalt Concrete Pavement Mixtures
onlinemanuals.txdot.gov/.../pdm/hot_mix_asphalt_concrete_pavement_mixtures.htm
General. *Hot mix asphalt* (*HMA*) is a generic term that includes many different types of mixtures of aggregate and asphalt cement (binder) produced at elevated ...

Hot Mix Asphalt Pavement - Industrial Resources Council
industrialresourcescouncil.org/Applications/HotMixAsphaltPavement/.../Default.aspx
Asphalt concrete pavement, or hot mix asphalt (*HMA*) *pavement* as it is more commonly called, refers to the bound layers of a flexible pavement structure.

Searches related to HMA Pavement
hot mix asphalt paving handbook

[**what is asphalt** pavement](#)
[**hot mix asphalt vs cold mix**](#)
[**pcc** pavement](#)
[**hot mix asphalt cost**](#)
[**types of hot mix asphalt**](#)
[**hot mix asphalt calculator**](#)
[**hot mix asphalt center**](#)

APPENDIX A – SURFACE SELECTION TOOL HELP DOCUMENT

SURFACE SELECTION

HELP DOCUMENT

Contents:
(Click on any to go to that page)

ANALYSIS

The following are the pages associated to analysis. Click on any page name to go directly to that page's help.

[State County Selection](#)

[General Setup](#)

[Common Parameters](#)

[Agency / Maintenance Cost Setup](#)

[Agency Cost Summary](#)

ADMINISTRATION

The tool supports two types of administrators. State administrator - who can manage all the regions in the user's state. County administrator - who can manage only the user's county. The login page is same for all the administrators. Based on the credentials used by the user, the tool will check whether the user is a state administrator or county administrator and navigates the user to the respective page.

Click on the respective administration link to navigate directly to that page's help.

[Administration Login](#)

[State Administration](#)

[County Administration](#)

Note: In all the images, to go to any link, click on the number in the related blue box in the image.

ANALYSIS

State County Selection

Please select your state and county:

1 Select your state
   Minnesota ▼

2 Select your county
   Aitkin ▼

3 **Next**

Overview

The user is prompted to provide some general information like *state* and *county* selection, based on the user requirements. The *state* and *county* selected will remain same throughout the remaining pages of the analysis setup process. At any point of time, the user can navigate back to this page and select a different *state* or *county*.

Select your state

This drop-down list contains an alphabetical list of some of the states in United States. Select the appropriate state from the *state* drop-down list.

Select your county

This drop-down list contains an alphabetical list of all the counties available under the selected *state*. The values in the county list will vary based on the state selected. Select the appropriate county from the *county* drop-down list.

Next

This button will navigate the user to the next page where the user needs to provide/select some of the general settings required for the analysis.

General Setup

General Setup

	Selection of Default Setting Type	⦿ **Region-Level** Default Base Year: 2015
1		○ **County-Level** Default Base Year: 2014

2 Selection of Surface Types

- ☑ **Hot-Mix Asphalt (HMA)**
- ☑ **Asphalt Surface Treatment (AST)**
- ☑ **Gravel**
- ☑ **Dust Control**
- ☑ **Stabilized Gravel**

3 Selection of Alternative Cost Items

- ☐ **Include salvage value**
- ☐ **Include user costs**

Back   Next   Help

OVERVIEW

The "General Setup" page provides controls used to collect some of the more general required cost analysis-related inputs. This page is divided into three functional areas titled "Selection of Default Setting Type," "Selection of Surface Types" and "Selection of Alternative Cost Items." Each of these different areas is described below in more detail.

Selection of Default Setting Type

There are two sets of default agency costs parameter values: county-level and region-level. A state constitutes several regions and each region includes several counties. Each region and each county belong to only one state and one region, respectively. When the user previously selected a state and county, the region is automatically determined.

Any type of user can choose to apply region-level or county-level default parameter values initially by making the appropriate selection in this functional area. Both the region-level and county-level display the default base year (if available). Sometimes, only one of the levels is available. If the region-level alone is available, it indicates that the default values available for the county are not updated and the region values are used for the county. If the county-level alone is available, it indicates that there are no values for that region/county.

Selection of Surface Types

The user has an option to choose which of the five available surface types (Hot-Mix Asphalt [HMA], Asphalt Surface Treatment [AST], Gravel, Dust Control, and Stabilized Gravel) are to be compared for a given project. To include a particular surface type in the analysis, click on the surface type name or its associated check box to enable it. To disable a previously selected surface type, click again on the surface type name or check box. By default, all the surface types are selected.

Selection of Alternative Cost Items

The two cost items in this selection area (salvage value & user cost) are optional cost items. Click on individual check box to include the optional costs. Initial costs and maintenance costs will always be analyzed. If none of these optional cost items are selected, then only the initial costs and maintenance costs will be analyzed. Below is a brief description of these optional cost items.

Salvage value

A salvage value may be defined as the estimated value of an asset at the end of its useful life. Within the analysis approach, a salvage value is computed for each included maintenance treatment used in the analysis. Specifically, a salvage value is computed for a given maintenance treatment by determining the estimated remaining life of a maintenance treatment at the end of the defined analysis period, and then "giving back" the cost of the unused life of the treatment. The salvage value is negative.

User costs

Here, user costs only include the vehicle operating costs and crash cost. Brief descriptions of each of these cost types are as follows.

Vehicle operating costs (VOC)

Vehicle operating costs refers to a function of surface type, number of vehicles (by vehicle type), vehicle speed, and road grade. The vehicle operating cost data used as the basis of these calculations are based on industry averages for the cost of operating vehicles on paved surfaces that are converted based upon the different factors.

Crash costs

Crash costs refer to the costs to society as a whole associated with roadway crashes. As it is typically done, the crash costs computed in the analytical tool are categorized into costs associated with fatalities, non-fatal injuries, and property damage.

Based on these values, the default values are set to the fields related to the user costs. If the user cost is selected, the user will be asked to enter "*Base User Cost per Vehicle*" and other related details in later stages of the analysis setup process. If the user chooses not to include user costs, all user cost-related inputs will be hidden throughout the analysis setup process.

Common Parameters

Common Parameters Setup

1 Project Length	5	miles	Project Width	24	feet	2
3 Average Daily Traffic (ADT)	300-399 ▾	vehicles/day	Analysis Period	20	years	4
5 Discount Rate	3.5	%	Start Year of Analysis	2015		6
			Base User Cost per Vehicle	0.75	cents/mile	7

8 Reset

9 Back   Next   Help

OVERVIEW

This page enables the user to specify six or seven different parameter values (one additional parameter based on user cost inclusion), which are the common basis for almost every item cost calculation. They include: project length, project width, average daily traffic (ADT), analysis period, discount rate, start year of analysis and base user cost per vehicle (available only when the user cost is included). By default, an initial value is populated for each parameter when navigated to this page. The user can change any of them based on their practical needs. Below is a brief description of each parameter.

PROJECT LENGTH

The primary importance of this input is that it is used to translate any costs entered as total project costs, to a unit cost per mile. For example, if the user defined a project that was five miles in length and entered an annual total project maintenance cost of $5,000, the cost analysis would translate this total cost into a unit cost of $1,000 per mile (i.e., $5,000/5 miles = $1,000 per mile). All cost-related results from the cost analysis are presented in standard units of dollars per mile.

PROJECT WIDTH

The role of this parameter is similar to that of the project length, in that width is also used together with project length to convert a total project cost or a unit area (sq. ft.) cost to unit cost per mile under the standard 24-feet road width.

ADT

ADT in this tool is available for selection as a level instead of a specific value. Each ADT level corresponds to a set of default agency cost parameter setup values. Also, if the user chooses to include user costs in the analysis, the number of vehicles using that road directly influences these costs. Select the level that fits.

ANALYSIS PERIOD

The analysis period specifies the time period over which the cost analysis is evaluated. Based upon input from the Technical Panel, the default analysis period was set to 20 years. The user can change this value by deleting the current value and entering a new value in terms of years.

Note: A 20-year analysis period is often considered the minimal range for a life-cycle cost analysis. Analysis periods less than 20 years should not be used without specific reasoning. It should also be noted that the analysis period is limited to 50 years.

DISCOUNT RATE

By definition, the discount rate is the estimated difference between the interest and inflation rates over a long period of time, therefore, representing the true time value of money. The interest rate (or market interest rate) is described as the cost of borrowing money. The inflation rate is typically defined as the rate of increase in the prices of goods and services (e.g., construction of highways) over time. In the analysis tool, the discount rate is used to adjust all user-provided cost values to present worth dollars. The default value of 3.5 percent, which falls in the commonly quoted acceptable industry-wide range of 2 to 4 percent, is based upon the recommendations of the research team and Technical Panel.

START YEAR OF ANALYSIS

This parameter reflects the base year used in conducting the analysis. This parameter is important because if the user chooses to use default agency cost setup parameter values associated with certain updated base years, which are not necessarily the same as the start year of analysis, then the default values from database should be updated using this parameter and presumed inflation rate before doing any cost calculations. By default, this value is set to the current year.

BASE USER COST PER VEHICLE

This parameter is available only if the user includes user cost in the previous page. There will be some cost associated to every vehicle. This parameter gets that average cost value that is associated to a vehicle. This cost is normalized to cents per mile. By default, this value is set to 0.75.

RESET

The user can change the default values available on loading the page. After changing some of the parameters, if the user wants to revert back to the default values then user can click Reset button and all the values will be changed to default values.

NAVIGATION

After giving all the values and on clicking next, the user will be navigated to the agency cost parameters page where the user needs to provide values to parameters related to each surface type and each treatment.

The user will have an option to navigate back to previous page to change the general settings or to change the surface type selections.

Agency / Maintenance Cost Setup

OVERVIEW

This page provides controls that are used to define all the maintenance treatment timing, frequency, start year, and costs associated per unit with the different surface types.

Note that a separate tab is displayed for each of the surface types previously selected on the General Setup dialog box. While the maintenance treatments differ between the surface types, the controls and general layout of the different surface-related tabs use the same format. Some of the treatments may be the same for some of the surface types, but may have different values – values related to that surface type.

The following is the general layout for the agency cost parameter setup.

Agency Cost Parameters Setup

	HMA	AST	Gravel	Dust Control	Stabilized Gravel

1

Gravel

INITIAL COST

Total Initial Cost ($/mile): $ 508,773 **Initial Cost Calculator**

2

MAINTENANCE COST

Treatment Selection	Treatment Name	Application Times per year	Year Interval Between Applications	Application Start Year	Unit Cost (dollars)	Unit Selection
☑	Blading	75	1	1	200	per mile ▼
☑	Regravel	1	2	2	20000	per mile ▼
☑	Reshape Cross Section	2	1	1	3000	per mile ▼
☑	Spot Gravel / Maintenance	1	1	3	2000	per mile ▼
☐	Other	1	1	1	0	per mile ▼

Reset

3

USER COST

User Cost Factor: 1.55

4 Previous Surface | Next Surface | Back to Common Parameters Setup | View Analysis Summary | Help

All these parameters are divided into three functional areas. They are "Initial Cost," "Maintenance Cost" and "User Cost." Each of these different areas is described below in more detail.

INITIAL COST

The initial cost area contains one parameter "Total Initial Cost ($ / mile)." The total value of initial cost is displayed on the right side of it. This value is calculated based on some parameters. All these parameters are available if we click on the button "Initial Cost Calculator."

Initial Cost Calculator

The Initial Cost Calculator is available on all the surface type tabs. This will open a new page which includes a different number of parameters based on the surface type. By default, an initial value is populated for every parameter for every surface type. The user can change any value as per the requirement. The value of total initial cost is displayed on the right side of text in blue. This value will be changed for every change made to the parameters. Reset will set the parameter values to the default values.

Table 1 summarizes the different initial costs and respective parameters that are commonly used.

Table 1: INITIAL COST DETAILS

Initial Cost Parameters		
Surface Type	**Parameter Name**	**Description**
HMA	HMA Thickness	Planned HMA surface thickness of the road in inches
	HMA Cost(placed)	Cost of HMA surface in $ per ton
	Base Thickness	Planned base thickness of the road in inches
	Base Gravel Cost	Cost of base gravel in $ per ton
	Reshaping / Sub-grade Prep	Cost of reshaping / sub-grade prep in $ per mile
	Reclaiming / Milling (if asphalt)	Cost of reclaiming / milling in case of asphalt in $ per square yard
	Widening	Cost of widening (if there is any) in $ per mile
	Pavement Marking	Cost of pavement markings in $ per mile
	Engineering / Contingencies	What percentage of total is for engineering / contingencies
AST	Asphalt & Aggregate Cost	Cost of asphalt surface in $ per mile
	Base Gravel Thickness	Planned base thickness of the road in inches
	Base Gravel Cost	Cost of base gravel in $ per ton

	Base Stabilization	Cost of base stabilization (if required) in $ per mile
	Reshaping / Sub-grade Prep	Cost of reshaping / sub-grade prep in $ per mile
	Reclaiming / Milling (if asphalt or AST)	Cost of reclaiming / milling in case of asphalt in $ per square yard
	Widening / Reconstruction	Cost of widening (if there is any) in $ per mile
	Pavement Marking	Cost of pavement markings in $ per mile
	Engineering / Contingencies	What percentage of total is for engineering / contingencies
Gravel	Surface Gravel Thickness	Planned gravel surface thickness of the road in inches
	Surface Gravel Cost(placed)	Cost of gravel surface in $ per ton
	Reshaping / Sub-grade Prep	Cost of reshaping / sub-grade prep in $ per mile
	Widening / Reconstruction	Cost of widening (if there is any) in $ per mile
Dust Control	Dust Control Application	Cost of dust control application in $ per mile
	Surface Gravel Thickness	Planned gravel surface thickness of the road in inches
	Surface Gravel Cost(placed)	Cost of gravel surface in $ per ton
	Reshaping / Sub-grade Prep	Cost of reshaping / sub-grade prep in $ per mile
	Widening / Reconstruction	Cost of widening (if there is any) in $ per mile
Stabilized Gravel	Surface Gravel Thickness	Planned gravel surface thickness of the road in inches
	Surface Gravel Cost(placed)	Cost of gravel surface in $ per ton
	Reshaping / Sub-grade Prep	Cost of reshaping / sub-grade prep in $ per mile
	Widening / Reconstruction	Cost of widening (if there is any) in $ per mile
	Base Stabilization Additive	Cost of base stabilization (if required) in $ per mile
	Dust Control	Cost of dust control application in $ per mile

Screenshots of parameters for all the surface types with sample data are available below.

HMA Initial Cost Parameters Setup

PARAMETER	VALUE	UNIT	PARAMETER	VALUE	UNIT
HMA Thickness (new)	5	inches	Reshaping / Sub-grade Prep	250000	$/Mile
HMA Cost (placed)	120	$/Ton	Reclaiming / Milling (if asphalt)	0	$/Sqyd
Base Thickness (New)	6	inches	Widening (if necessary)	0	$/Mile
Base Gravel Cost (placed)	26	$/Ton	Pavement Marking	2000	$/Mile
			Engineering / Contingencies	20	% of total

Total Initial Cost ($/mile) $ 927,149

Done Cancel Reset Help

AST Initial Cost Parameters Setup

PARAMETER	VALUE	UNIT	PARAMETER	VALUE	UNIT
Asphalt & Aggregate Cost (placed)	100000	$/Mile	Reshaping / Sub-grade Prep	50000	$/Mile
Base Gravel Thickness (new)	8	inches	Reclaiming / Milling (if asphalt or AST)	0	$/Sqyd
Base Gravel Cost (placed)	26	$/Ton	Widening / Reconstruction	400000	$/Mile
Base Stabilization (if necessary)	5000	$/Mile	Pavement Marking	2000	$/Mile
			Engineering / Contingencies	15	% of total

Total Initial Cost ($/mile) $ 804,269

Done Cancel Reset Help

Gravel Initial Cost Parameters Setup

PARAMETER	VALUE	UNIT
Surface Gravel Thickness (new)	6	inches
Surface Gravel Cost (placed)	26	$/Ton
Reshaping / Sub-grade Prep	2000	$/Mile
Widening / Reconstruction	400000	$/Mile

Total Initial Cost ($/mile) $ 508,773

Done | Cancel | Reset | Help

Dust Control Initial Cost Parameters Setup

PARAMETER	VALUE	UNIT
Dust Control Application	25000	$/Mile
Surface Gravel Thickness (new)	6	inches
Surface Gravel Cost (placed)	30	$/Ton
Reshaping / Sub-grade Prep	20000	$/Mile
Widening / Reconstruction	400000	$/Mile

Total Initial Cost ($/mile) $ 568,200

Done | Cancel | Reset | Help

Stabilized Gravel Initial Cost Parameters Setup

PARAMETER	VALUE	UNIT
Surface Gravel Thickness (new)	6	inches
Surface Gravel Cost (placed)	32	$/Ton
Reshaping / Sub-grade Prep	50000	$/Mile
Widening / Reconstruction	400000	$/Mile
Base Stabilization Additive	40000	$/Mile
Dust Control	25000	$/Mile

Total Initial Cost ($/mile) $ 646,413

Done Cancel Reset Help

These are the five screenshots for different surface types containing all the parameters with default values. After all changes, clicking on "Done" will save all the changes along with the total initial cost and navigates the user back to the agency cost parameters setup page. If the user clicks on "Cancel," all the changes are lost and the tool navigates the user back to the agency cost parameters setup page.

MAINTENANCE COST

The controls in the maintenance cost panel allows the user to define which maintenance treatments are to be applied to a given surface type, how many times it is to be applied per year, when they are to be applied, and how much they are going to cost per unit.

The following is the sample screenshot of "HMA" surface type.

1 Treatment Selection	Treatment Name	2 MAINTENANCE COST Application Times Per Year	Year Interval Between Applications	Application Start Year	3 Unit Cost (dollars)	Unit Selection
☑	Crack Sealing	1	4	4	13000	per mile ▾
☑	Seal Coat	1	6	3	25000	per mile ▾
☑	Thin Lift OverLay	1	19	19	200000	per mile ▾
☑	Striping and Marking	1	3	3	2000	per mile ▾
☑	Patching/Maintenance	1	3	3	6000	per mile ▾
☐	Other	1	1	1	0	per mile ▾

Reset

Treatment Selection

The first step in setting up a maintenance strategy is determining which maintenance treatments are to be used on each included surface type. There are different number of treatments available for different surface types. Table 2 summarizes the different maintenance treatments that are commonly used on low volume roads.

To include a particular maintenance treatment as part of a particular maintenance strategy, click on the check box before the treatment name. To deselect a particular maintenance treatment that is checked, simply click on the associated check box again to uncheck the box.

To include one of the user definable *Other* fields, first click the associated check box to enable the *Other* maintenance treatment field, and then enter a descriptive maintenance treatment name in the text box directly to the right of the associated check box, then provide values to all the parameters.

The following is a table that summarizes the different maintenance treatments that are commonly used on low volume roads.

Table 2: MAINTENANCE TREATMENTS

TREATMENTS		
Surface Type	**Available Maintenance Treatments**	**Description**
Hot-Mix Asphalt (HMA)	Crack Sealing	Crack seals are used for repairing transverse and longitudinal cracks. This is typically the use of a rubberized tar material or mixture of sand and asphalt emulsion to fill the crack. Cracks and joints 1/4? or greater should be cleaned of any incompressible material including old sealant, and then sealed prior to applying a BST.
	Seal Coat	Seal coat involves spraying asphalt cement on the surface of an existing pavement followed by the application of a cover aggregate. The asphalt cement is usually emulsified (suspended in water) to allow for it to be applied without the addition of extreme heat. The cover aggregate is normally either naturally occurring gravel or crushed aggregate such as granite, quartzite or trap rock (basalt).
	Thin Lift OverLay	Thin Lift Overlays are typically defined as surface mixes of 1.5" or less in compacted thickness. They can be a simple overlay or part of a mill-and-fill operation. They are not typically intended to strengthen the pavement structure, but instead to address functional problems as part of Pavement Preservation.
	Striping and Marking	Road surface markings are used on paved roadways to provide guidance and information to drivers and pedestrians.
	Patching/Maintenance	Patching may be done to repair wheel ruts, edge raveling, and delaminated or pothole areas. Common construction practices in placing HMA for patching include use of a spreader box, grader/blade patching, or using a paver.

AST	Seal Coat	Seal coat involves spraying asphalt cement on the surface of an existing pavement followed by the application of a cover aggregate. The asphalt cement is usually emulsified (suspended in water) to allow for it to be applied without the addition of extreme heat. The cover aggregate is normally either naturally occurring gravel or crushed aggregate such as granite, quartzite or trap rock (basalt).
	Striping and Marking	Road surface markings are used on paved roadways to provide guidance and information to drivers and pedestrians.
	Patching/Maintenance	Patching may be done to repair wheel ruts, edge raveling, and delaminated or pothole areas. Common construction practices in placing HMA for patching include use of a spreader box, grader/blade patching, or using a paver.
	Reapply AST	This reapplies AST treatment on the existing AST surface type.
Gravel	Blading	Once the road surface has adequate moisture (characterized by no dust), a motor grader loosens the top 2 inches or so. This of course helps smooth the road, but the primary purpose is to create a loose, well-graded layer of material to allow uniform penetration of the MgCl2.
	Regravel	Applies the gravel treatment on top of gravel road.
	Reshape Cross Section	Severe rutting, loss of crown, gravel loss and deep secondary ditches — a combination of any two or more of these calls for a major reshaping. This requires a much greater effort. It often occurs after a gravel road has been subjected to an unusually heavy haul. This will be worse if a heavy haul occurs during wet weather.
	Spot Gravel / Maintenance	Spot treatment with calcium chloride can be employed when local funds or traffic conditions do not permit full-scale dust laying. Such spot treatment is practical at intersections, corners, detours, markets, in front of houses, on grade crossings, shoulders, breakups in blacktop pavements, and gravel roads adjacent to paved trunk lines.

Dust Control	Blading	Once the road surface has adequate moisture (characterized by no dust), a motor grader loosens the top 2 inches or so. This of course helps smooth the road, but the primary purpose is to create a loose, well-graded layer of material to allow uniform penetration of the MgCl2.
	Regravel	Applies the gravel treatment on top of dust control surface type.
	Reshape Cross Section	Severe rutting, loss of crown, gravel loss and deep secondary ditches — a combination of any two or more of these calls for a major reshaping. This requires a much greater effort. It often occurs after a gravel road has been subjected to an unusually heavy haul. This will be worse if a heavy haul occurs during wet weather.
	Reapply Dust Control	This re applies dust control treatment on the existing dust control surface type.
Stabilized Gravel	Blading	Once the road surface has adequate moisture (characterized by no dust), a motor grader loosens the top 2 inches or so. This of course helps smooth the road, but the primary purpose is to create a loose, well-graded layer of material to allow uniform penetration of the MgCl2.
	Regravel	Applies the gravel treatment on top of stabilized gravel road.
	Reshape Cross Section	Severe rutting, loss of crown, gravel loss and deep secondary ditches — a combination of any two or more of these calls for a major reshaping. This requires a much greater effort. It often occurs after a gravel road has been subjected to an unusually heavy haul. This will be worse if a heavy haul occurs during wet weather.
	Reapply Stabilization	Applies the stabilized gravel treatment on top of stabilized gravel road.
	Dust Control	Airborne dust from roads and open surfaces, called fugitive dust, is a form of air pollution. Dust control measures may include facility planning and layout, vehicle traffic patterns, and dust control treatments – liquids applied to roads and open surfaces to control dust.

Timing and Frequency

The second set of inputs in the *Maintenance Cost* area allows the user to define the timing (when to start) and frequency (how many times to apply) of each included maintenance treatment for a given surface type. All the column headings of the parameters give detailed explanations on what the parameters are going to be. "Application Times per Year" indicate the frequency that the treatment is to be applied. "Year Interval between Applications" indicates the interval in years for reapplying the treatment in order to maintain the road. "Application Start Year" indicates the year at which the first application is to be applied.

For example, if the user wanted to schedule one seal coat every four years, starting in year seven, then the *Seal Coat* treatment is set to one in the "Application Times per Year," four in the "Year Interval between Applications" and seven in the "Application Start Year." As another example, if the user wanted to reblade a gravel road four times a year, every year, starting in year one, then the *Blading* treatment is set to four in the "Application Times per Year" and one in the "Application Start Year."

Maintenance Treatment Unit Costs

The final set of inputs in the *Maintenance Cost* area are used to define the cost associated with applying one application of a particular maintenance treatment. To define the cost of a particular treatment application, enter the cost in the input box and set the corresponding cost units to either dollars per application ($/app), dollars per mile ($/mile) or dollars per square foot ($/sq. ft.). Note that when choosing units of "$/app," the cost that is expected is the total cost of applying one application of the maintenance treatment over the entire project length.

For example, assume that a seal coat costs $5,000 per mile and is applied on a four mile long project. Such a cost could be entered as "$20,000 per app" or as "$5,000 per mile." Both cost descriptions would be equivalent in the cost analysis.

Also note that for maintenance treatments that are typically applied more than one time in a year (e.g., blading), the cost that should be entered is the cost associated with one application of that maintenance treatment (i.e., the cost associated with one blading).

USER COST

The user cost factor is only displayed if the user cost is included. This is not available for HMA. Because, for HMA, the user cost factor is always considered as 1. The cost factor for all the remaining surface types is based on the HMA.
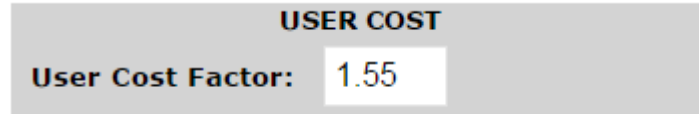
For example, the user cost factor for gravel is 1.55, this indicates that the user cost is 1.55 times to the user cost of the HMA (which is always 1).

DEFAULT VALUES

If the user does not have the data necessary to populate all initial construction cost, maintenance costs, and frequencies for the various surface types they wish to analyze, the defaults that the tool provided are the county/region defaults.

Note: The default values provided for initial construction cost do not include the cost of upgrading a road from one surface type to another. Therefore, if the user wishes to consider upgrade costs in the analysis, the default cost values must be increased by the appropriate amount.

NAVIGATION

At any point of time, the user can navigate across the surface types by clicking on the respective surface tab.
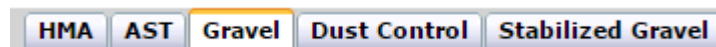
The currently selected tab will be highlighted (example: "Gravel" in above screenshot). Every surface type will have all the functionalities like calculating the input costs, providing values to the maintenance treatments, and user costs (if included).

The user can also navigate across surface types by clicking on "Next Surface" and "Previous Surface" buttons available at the bottom of the page. The user can navigate back to the previous page to change some of the parameter values. There will be no loss of data even if the user is navigating across the pages. The last saved data will remain on the pages until changed.
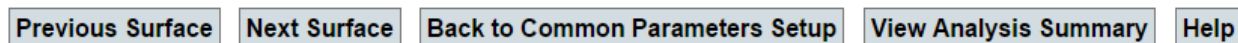
Once all the values are entered correctly, the user can click on "View Analysis Summary." This will take the user to a new page which displays all the respective values in a table format and in a chart.

Agency Cost Summary

OVERVIEW

The general results of the cost analysis are displayed on this page. The page consists of three areas. The first area contains the result in a table format. The second area contains a chart that plots the comparison details of all the surface types selected. The third area contains an option to save the result including all the parameter values in a PDF report. This area also contains a back button so that the user can navigate to the previous page. Each of the areas is described below in detail.

TABLE RESULT

The table contains the surface type as the first row that displays all the selected surface types. The second and third row contains the "Total Initial Cost" and "Total Maintenance Cost." The costs for surface types are displayed under the surface type name respectively.

The below screenshot displays the sample result in the table.

FIGURE 2: RESULTS – AGENCY COST SUMMARY

Surface Type	HMA	AST	Gravel	Dust Control	Stabilized Gravel
Total Initial Cost	$ 927,149	$ 804,269	$ 508,773	$ 568,200	$ 646,413
Total Maintenance Cost	$ 255,799	$ 227,348	$ 478,962	$ 526,793	$ 395,040
Total User Cost	$ 1,361,726	$ 1,838,330	$ 2,110,675	$ 2,110,675	$ 2,110,675
Total Salvage Value	$ 98,671	$ 37,451	$ 5,201	$ 0	$ 13,930
Total Agency Cost	$ 2,446,003	$ 2,832,496	$ 3,093,209	$ 3,205,668	$ 3,138,198

The next two rows are optional (based on whether the user cost and salvage costs are included or not). If they are included, then the fourth row displays the "Total User Cost" for all the selected surface types, and the next row displays the "Total Salvage Cost."

Finally, the last row displays the "Total Agency Cost." Subtracting the salvage cost from the sum of all costs except salvage cost gives the "Total Agency Cost."

CHART RESULT

The same table format result is also displayed as a chart. The x-axis contains the years since initial construction and y-axis contains the cumulative cost. The graph is plotted for all the selected surface types.
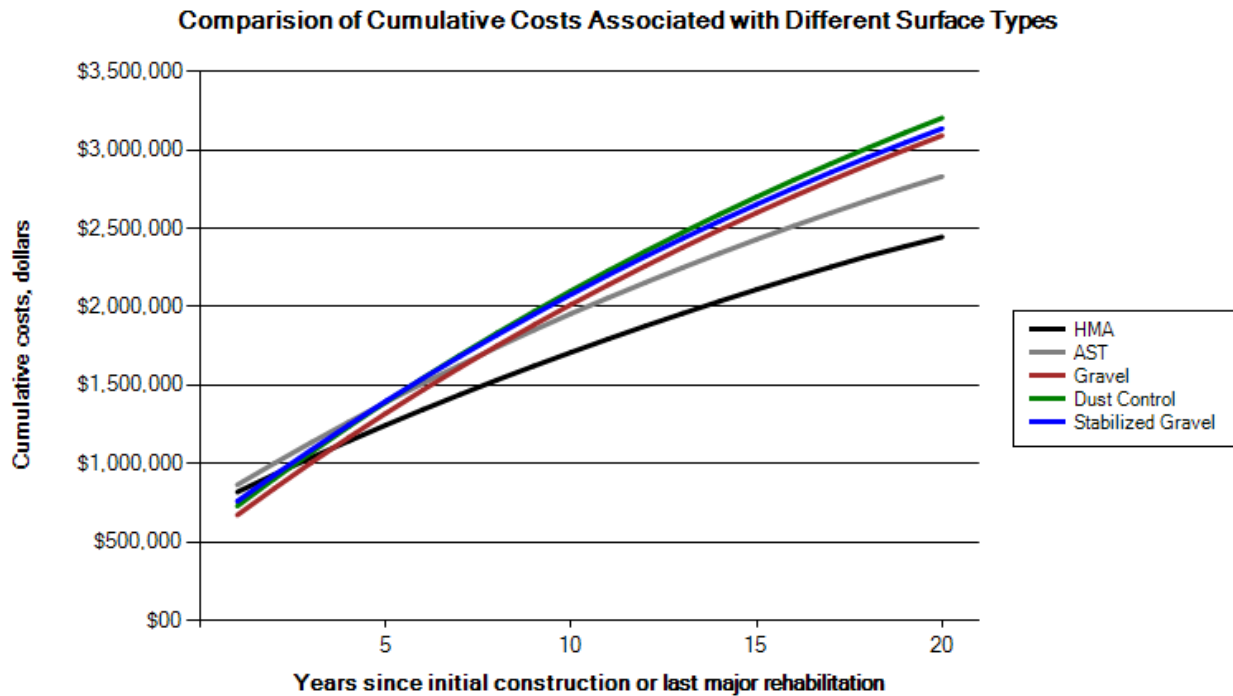
This is the sample result as a chart.

GENERATE PDF

Generate PDF will generate a report as a PDF report. This report contains the initial, maintenance, and user cost details in a table and a chart.

All the values for general parameters selected like state, county, project length, width, ADT level, analysis period, discount rate, start year of analysis, is salvage value included, and is user cost included are displayed.

Below is the sample screenshot of the generated PDF report displaying all the parameter values.

Local Road Surface Selection Analysis Results

8/3/2015

INPUT SUMMARY

Project Description and General Parameters

PARAMETER	VALUE	PARAMETER	VALUE
State	North Dakota	County	Dunn
Project Length	5	Project Width	24
ADT Level	300-399	Analysis Period	20
Discount Rate	3.5	Start Year of Analysis	2015
Is Salvage Value Included?	Yes	Is User Costs Included?	Yes

The PDF report displays all the initial cost information for all the selected surface types.

Below is the sample screenshot for "HMA – Initial Cost Details."

Agency Cost - Per Mile

Initial Cost Details

HMA

PARAMETER	VALUE	UNIT	PARAMETER	VALUE	UNIT
HMA Thickness (new)	5	inches	Reshaping / Sub-grade Prep	250000	$/Mile
HMA Cost (placed)	120	$/Ton	Reclaiming / Milling (if asphalt)	0	$/Sqyd
Base Thickness (New)	6	inches	Widening (if necessary)	0	$/Mile
Base Gravel Cost (placed)	26	$/Ton	Pavement Marking	2000	$/Mile
			Engineering / Contingencies	20	% of total

Similarly, it displays the initial costs for all the selected surface types.
The PDF report also displays the maintenance cost details for all the selected surface types.

Below is the sample screenshot for the "HMA – Maintenance Cost Details."

Maintenance Cost Input Details

HMA

TREATMENT	TIMES/YEAR	YEARS BETWEEN APPS	START YEAR	UNIT COST ($)	COST UNIT
Crack Seal	1	3	4	13000	$/mile
Seal Coat	1	6	3	25000	$/mile
Overlay	1	19	19	200000	$/mile
Striping and Marking	1	3	3	2000	$/mile
Patching	1	3	3	6000	$/mile

Similarly, the report displays the maintenance costs for all the selected surface types.

The PDF report displays user costs if included.

Below is the sample screenshot for the user cost details.

User Cost Input Details

PARAMETER	VALUE
User Cost Per Vehicle Per Mile	0.75
HMA Cost Factor	1
AST Cost Factor	1.35
Gravel Cost Factor	1.55
Dust Control Cost Factor	1.55
Stabilized Gravel Cost Factor	1.55

Finally, the PDF displays the results as a table and a chart.

Below is the sample screenshot of the cost summary.

Maintenance Cost Summary Results
(Unit Cost $ Per Mile)

Surface Type	HMA	AST	Gravel	Dust Control	Stabilized Gravel
Total Initial Cost	$ 927,149	$ 804,269	$ 508,773	$ 568,200	$ 646,413
Total Maintenance Cost	$ 255,799	$ 227,348	$ 478,962	$ 526,793	$ 395,040
Total User Cost	$ 1,361,726	$ 1,838,330	$ 2,110,675	$ 2,110,675	$ 2,110,675
Additional User Cost Per Mile	--	$ 476,604	$ 748,949	$ 748,949	$ 748,949
Total Salvage Value	$ 98,671	$ 37,451	$ 5,201	$ 0	$ 13,930
Total Agency Cost	$ 2,446,003	$ 2,832,496	$ 3,093,209	$ 3,205,668	$ 3,138,198

The chart generated is the same chart that is generated earlier.

ADMINISTRATION

<u>Administrators Login</u>

Please log in using your administrator account

<u>1</u> **Username**

<u>2</u> **Password**

<u>3</u> **Log in**   <u>4</u> **Forgot Password?**   **Help**

Username

The user is required to enter the e-mail address for the respective county/state. If the e-mail address is not entered, the tool will give this error message "**The username field is required.**"

Password

The user is required to enter the password for the respective county/state. This field is required. If the password is not entered, the tool will give this error message "**The password field is required.**" To make sure that the password is protected, the password is encrypted in the database.

Log in

On login, the tool will check the username and password provided by the user against the database. If the username or password is incorrect, the tool will give this error message "**Your Username or Password is invalid!**" While logging in, the password retrieved from the database is decrypted and checked with the given password.

Forgot Password

If the user forgot the password, by providing the username and clicking on the "Forgot Password," the tool will email the password to the user. If the username is not provided, the tool will give this error message "**Please input your email address!**"

State Administration

State Administration

Welcome state administrator of North Dakota!

Functionality

1 • **Region Management**

2 • **Update Initial Cost Default Values**

3 • **Update Maintenance Cost Default Values**

4 • **Update Regional User Cost Default Values**

5 • **County Administrator Account Management**

6 • **Reset Personal Password**

7 • **Communication**

8 **Log Out**   **Help**

The state admin page allows the user to select one of the actions to proceed. All the actions are described below in detail. The above is a sample screen for the North Dakota state administrator.

Region Management

This page allows the user to manage available regions or to create a new region. There are two main sections in this page. The first section provides all the available functions in region management. There are four functions. The user can pick any one of the function by clicking on the name or by clicking on the radio button available before the name. The following is the sample screenshot in which the second option is selected.

1 ○ **Create a new region**
2 ● **Copy default values from one existing region to another**
3 ○ **Update associations between counties and regions**
4 ○ **Delete an existing region**

At a time, only one function can be selected and the available actions for the related function will be displayed right below the options. Whenever the option is changed, the action changes as per the option selected.

All the available actions for each option are described below in detail.

Create a new region

This action allows the user to create a new region. The user needs to enter a name for the new region. The user can select, from which state and region this new region should import the values from.

Creat A New Region

New Region Name: [   ]

Import Values From: [Minnesota ▾] [South Central ▾]

[Create New Region]

Note that the newly created region will automatically be assigned the same default parameter values in the beginning as those of the region you specified. If the state you logged in doesn't have any existing regional default values for reference, then other states with existing regions will appear in the dropdown lists.

For example, if the user wants to create a new region North Area in North Dakota, then the new region name is entered in the related text box. And the user can select North Dakota in the first drop-down list (if there are no regions in North Dakota, then that state will not be visible. In that case, the user can select some other state), this will populate with all the available regions in that state in the second drop-down. The user can select any region from the second region, like West Area. This indicates that a new region North Area is created in the user's state with the default values same as West Area. The user can change the values of North Area in different pages "Update Initial Cost Default Values," "Update Maintenance Cost Default Values" and "Update Regional User Cost Default Values."

Copy default values from one existing region to another

This action allows the user to copy values from any region in any state to any region available in the user's state. In the drop-down list available next to "Copy to Region," the region that needs to be copied into is selected. The "Copy from Region" indicates from which state and from which region the values are supposed to be copied.

For example, if the user wants to update East Area region values (East Area is a region that is already available under user's state). In the drop-down list available next to Copy to Region, East Area is selected. In the other drop-down lists, respective state and region are selected. Here, the values from South Central Area region in Minnesota state are copied to East Area region.

Update associations between counties and regions

This action allows the user to select a region for all the counties available in the user's state.

All the counties in the state are displayed and each county has an option to select any region (indicating that this county belongs to this region). Once all the regions are selected, clicking the update button will save all the values.

For example, in North Dakota state, if Adams county belongs to West Area region, the user changes the value in drop-down list next to Adams to West Area. After all the changes have been made, the "Update" button is clicked to save them.

Delete an existing region

This action allows the user to delete an existing region from the user's state. The user needs to select any region in the state. In the state drop-down, only the user's state is displayed. In the region drop-down, all the regions available in the user's state are displayed. The user can select any region and clicking on delete will delete that region.

All the values (initial, maintenance, and user cost values) of that region will be deleted. All the associations to counties will also be deleted and the counties associated to that region will not be associated to any region. The user can update the associations in "Update associations between counties and regions."

Back To Administration

This option is available on every page except on "State Administration" page.

"Back to Administration Page" will not log out the user from the tool. It will navigate the user back to the state admin home page where all the options are available for the admin. This will navigate the user to page "State Administration."

Default Initial Cost Values

This action allows the user to update the initial cost default values of any region for all the surface types. This page contains three sections. The first section allows the user to select a region to update. The second section will load the default values to that region. In this section, the user can make changes to the default values. The last section will provide an option to save the changes to database and to go back to the administration page.

Each of the sections is described below in detail.

Default Initial Cost Values

1 Select the region you want to update [East Area ▼]

2 | HMA | AST | Gravel | Dust Control | Stabilized Gravel |

HMA - East Area - North Dakota

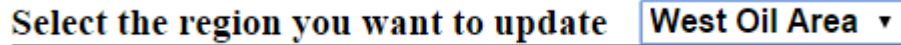| ADT Level [vehicles/day]	HMA Thickness (County AVG) [inches]	Base Thickness (County AVG) [inches]	Reshaping / Sub-grade Prep (County AVG) [$/mile]	Widening (County AVG) [$/mile]
0-99	3 (N/A)	4 (N/A)	50000 (N/A)	0 (N/A)
100-199	4 (N/A)	4 (N/A)	50000 (N/A)	0 (N/A)
200-299	4 (N/A)	6 (N/A)	50000 (N/A)	0 (N/A)
300-399	4 (N/A)	6 (N/A)	50000 (N/A)	0 (N/A)
400-499	5 (N/A)	8 (N/A)	50000 (N/A)	0 (N/A)
500-599	5 (N/A)	8 (N/A)	50000 (N/A)	0 (N/A)
>=600	6 (N/A)	10 (N/A)	50000 (N/A)	0 (N/A)

HMA Cost (County AVG) [$/ton]	Base Gravel Cost (County AVG) [$/ton]	Reclaiming / Milling (County AVG) [$/sqyd]	Pavement Marking (County AVG) [$/mile]	Engineering / Contingencies (County AVG) [%]
120 ()	26 ()	0 ()	2000 ()	20 ()

[Set To County Average] [Restore Region Default]

3 [Save and Update All] [Back to Administration Page] **4**

Select the region you want to update

There is a drop-down list that contains all the regions available in the user's state. The user can select any one region that the user wants to update the default initial cost values.

Select the region you want to update   **West Oil Area** ▾

In the above screenshot, the West Oil Area is selected.

Update values to surface types

This part contains five different sections as described in screenshot below. The first one is navigation across the surfaces. The second one displays for which "Surface type – Region – State" the user is modifying data. The third and fourth sections focus on updating values. The fifth one allows the user to set to any specific default values.

Each of the sections is explained below in detail.

1 | HMA | AST | Gravel | Dust Control | Stabilized Gravel

2 AST - West Area - North Dakota

3

ADT Level [vehicles/day]	Base Thickness (County AVG) [inches]		Reshaping / SubGrade Prep (County AVG) [$/mile]		Base Stabilization (County AVG) [$/mile]		Asphalt & Aggregate Cost (County AVG) [$/mile]		Widening / Reconstruction (County AVG) [$/mile]	
0-99	4	(4)	20000	(20000)	5000	(5000)	50000	(50000)	0	(0)
100-199	4	(4)	20000	(20000)	5000	(5000)	50000	(50000)	0	(0)
200-299	4	(4)	20000	(20000)	5000	(5000)	70000	(70000)	0	(0)
300-399	6	(6)	20000	(20000)	5000	(5000)	70000	(70000)	0	(0)
400-499	8	(8)	20000	(20000)	5000	(5000)	70000	(70000)	0	(0)
500-599	8	(8)	30000	(30000)	5000	(5000)	80000	(80000)	0	(0)
>=600	10	(10)	30000	(30000)	5000	(5000)	80000	(80000)	0	(0)

4

| Base Gravel Cost (County AVG) [$/ton]		Reclaiming / Milling (County AVG) [$/sqyd]		Pavement Marking (County AVG) [$/mile]		Engineering / Contingencies (County AVG) [%]	
26	(26)	0	(0)	2000	(2000)	15	(15)

5 | Set To County Average | Restore Region Default |

Navigation

At any point of time, the user can navigate across the surface types by clicking on the respective surface tab.

HMA	AST	Gravel	Dust Control	Stabilized Gravel
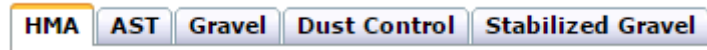
The currently selected tab will be highlighted (example: "HMA" in above screenshot). Every surface type will have similar functions like updating initial costs for respective fields.

Notification

Notifies the user, for which surface type, in which region and in which state the default values are updated for.

Dust Control - West Area - North Dakota

This indicates that the user is in "Dust Control" surface type, in West Area region in North Dakota state.

ADT Level Values

For every surface type, there are some fields that are related to each ADT level and some fields that have same values for all ADT levels. In this section, the only fields related to each ADT are updated.

For all surface types, the first column will be ADT level, which contains the values of all the levels available. Based on the surface types, the names and number of columns may vary from the second column.

The following is the screenshot for the "HMA" surface type.

ADT Level [vehicles/day]	HMA Thickness (County AVG) [inches]	Base Thickness (County AVG) [inches]	Reshaping / Sub-grade Prep (County AVG) [$/mile]	Widening (County AVG) [$/mile]
0-99	3 (3)	4 (4)	50000 (50000)	0 (0)
100-199	4 (4)	5 (4)	50000 (50000)	0 (0)
200-299	4 (4)	6 (6)	50000 (50000)	0 (0)
300-399	4 (4)	6 (6)	50000 (50000)	0 (0)
400-499	5 (5)	8 (8)	50000 (50000)	0 (0)
500-599	5 (5)	8 (8)	50000 (50000)	0 (0)
>=600	6 (6)	10 (10)	50000 (50000)	0 (0)

All the columns can be updated except the ADT level column. For every updatable column, for every ADT level, there are two parts (two different columns). The first part is a text box where the user can change values. The second part is a read-only text which contains the county average value for that surface type and for that field for that ADT level. The county average is the average value of that field for all the counties in that region.

For example, consider the value for ADT level 100-199 and field "Base Thickness" (highlighted in yellow in screenshot), the value is five and the county average is four. The user will have an option to set all the values to the county average and to set all the values to default values ("Restore Defaults") explained in the coming sections.

Non ADT Level Values

For every surface type, there are some fields that are related to each ADT level and some fields that are same for all ADT levels. In this section, only fields that are the same to all ADT levels are updated.

HMA Cost (County AVG) [$/ton]		Base Gravel Cost (County AVG) [$/ton]		Reclaiming / Milling (County AVG) [$/sqyd]		Pavement Marking (County AVG) [$/mile]		Engineering / Contingencies (County AVG) [%]	
120	(120)	30	(27)	0	(0)	2000	(2000)	20	(20)

All these values are same for any ADT level. The number of columns may vary based on the surface type. The above screenshot is for "HMA" surface type.

There are two parts (two different columns) in every field. The first part is a text box where the user can change values. The second part is a read-only text that displays the county average value for that surface type and for that field for that ADT level. The county average is the average value of that field for all the counties in that region.

For example, consider the value for field "Base Gravel Cost" (highlighted in yellow in screenshot), the value is 30 and the county average is 27. The user will have an option to set all the values to the county average and to set all the values to default values ("Restore Defaults") explained in the coming sections.

## *Set to county average / set to default values*

This action allows the user to set all the values to county average values or set to region default values.

This will change all the values in all the fields.

Save and Update All

This action allows the user to save any changes made to the values. If any value is invalid, an alert will display an indication to the user where the value is invalid.
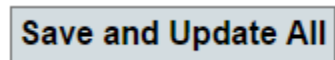
Once all the values have saved successfully, an alert will display an indication to the user that all the values have saved successfully.

Default Maintenance Cost Values

This action allows the user to update the maintenance cost default values of the selected region for all the surface types and for all treatments available for every surface type. This page contains three sections. The first section allows the user to select any region.


The second section will load the default values of that region. In this section, the user can make changes to the default values to all the treatments in all surface types. The last section will provide an option to save the changes to database and to go back to the administration page.

Each of the sections is described below in detail.

Select the region you want to update

There is a drop-down list that contains all the regions available in the user's state. The user can select any one region that the user wants to update the default maintenance cost values.

Select the region you want to update | East Area ▾
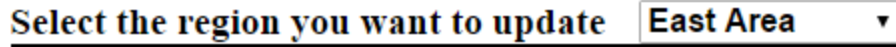
In the above screenshot, East Area is selected. By default, one region will be selected.

Update values to surface types

This part contains five different sections as described in screenshot below. The first one is navigation across the surfaces. The second one is to select any treatment that is available under selected surface type. The third one displays for which "Surface type – Treatment" the user is modifying data.

1 | HMA | AST | Gravel | Dust Control | Stabilized Gravel

2 Select a treatment Crack Sealing ▾
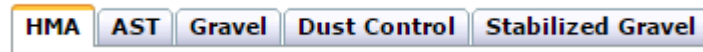
3 HMA: Crack Sealing

4

ADT Level [vehicles/day]	Times per Year (County AVG)		Year Interval (County AVG)		App Start Year (County AVG)		Unit Cost (County AVG) [$/mile]	
0-99	1	(N/A)	7	(N/A)	6	(N/A)	10000	(N/A)
100-199	1	(N/A)	7	(N/A)	6	(N/A)	10000	(N/A)
200-299	1	(N/A)	7	(N/A)	4	(N/A)	10000	(N/A)
300-399	1	(N/A)	7	(N/A)	4	(N/A)	13000	(N/A)
400-499	1	(N/A)	7	(N/A)	4	(N/A)	13000	(N/A)
500-599	1	(N/A)	6	(N/A)	4	(N/A)	15000	(N/A)
>=600	1	(N/A)	6	(N/A)	4	(N/A)	15000	(N/A)

5 | Set To County Average | Restore Region Default

The fourth one focuses on updating values. The fifth one allows the user to set to any default values.

Navigation

At any point of time, the user can navigate across the surface types by clicking on the respective surface tab.

The currently selected tab will be highlighted (example: "HMA" in above screenshot). Every surface type will have similar functions like treatment selection and updating maintenance costs for respective fields.

Treatment Selection

Once the surface type is selected, the user will have an option to select any treatment. The treatment drop-down list will contain all the available treatments in the selected surface type.
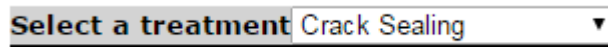
The above screenshot contains the selected treatment "Crack Sealing" for "HMA" surface type.

Notification

Notifies the user, for which surface type, for which treatment the default values are updated for.

This indicates that the user is in "HMA" surface type, and updating the default values for "Crack Sealing" treatment.

Update Values

For all surface types, the first column will be ADT level, which contains the values of all the levels available. All the column names are same for all the surface types and treatments, because all the treatments will have the same parameters.

The following is the screenshot for "HMA" surface type "Crack Seal" treatment. In the screenshot, we can see that all the ADT levels are available and there are four other columns.

The third and fourth columns display values related to time and frequency. This will allow the user to update default values for the timing (when to start) and frequency (how many times to apply) of each treatment for selected surface type. All the column headings give detailed explanations on what the field values are going to be. "Times per Year" indicate the frequency that the treatment is to be applied, "Year Interval" indicates the interval in years for reapplying the treatment in order to maintain the road. "App Start Year" indicates the year at which the first application is to be applied.
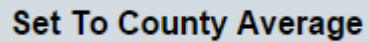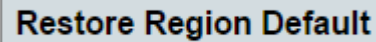
For example, if the user wanted to schedule the treatment every four years, starting in year seven, then set to one in the "Times per Year" and seven in the "App Start Year." As another example, if the user wanted to reblade a gravel road four times a year, every year, starting in year one, then the *Blading* treatment is set to four in the "Times per Year" and one in the "App Start Year."

All the columns can be updated except the ADT level column. For every updatable column, for every ADT level, there are two parts. The first part is a text box where the user can change values. The second part is a read-only text which contains the county average value for that surface type, for that treatment, and for that field for that ADT level. The county average is the average value of that field and that treatment for all the counties in that region.

If the county average is (N/A), this indicates that the county average is not available, meaning that the county values for maintenance cost are not set.

Set to county average / set to default values
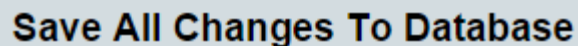
Allows the user to set all the values to the county average values or set to region default values. If the county average values are not available, and if the user clicks on "Set to County Average," the tool will display to the user stating that the county values are not available.

Set To County Average   **Restore Region Default**

This will change all the values in all the fields.

Save All Changes to Database

This action allows the user to save any changes made to the values. If any value is invalid, an alert will display an indication to the user where the value is invalid.

Save All Changes To Database

Once all the values have saved successfully, an alert will display an indication to the user that all the values have saved successfully.

Default User Cost Values

This action allows the user to update user cost settings for any selected region. The user selects a region updates the values for all surface types except HMA (has static default of one). The default value for Base User Cost per Mile per Vehicle can also be updated by user.

Updating Default User Costs Values

Select region you want to update   East Area ▾

Base User Cost Per Mile Per Vehicle	0.75
HMA Cost Factor	1
AST Cost Factor	1.35
Gravel Cost Factor	1.55
Dust Control Cost Factor	1.55
Stabilized Gravel Cost Factor	1.55

Update   Reset

1 Back To Administration Page

County Admin Account Management

This action allows the user to update the email address usernames for all counties available in the user's state.

County Administrator Account Management

This page allows you to create a new or update an existing county administrator account.

County	EmailAddress
Adams	adams@abc.com
Barnes	Barnes@abc.com
Benson	
Billings	billings@abc.com
Bottineau	
Bowman	

Update

1 **Back to Administration Page**

Once all the email address usernames are updated, all the updated county users will receive an email that contains the username, password, and a link where the county admins can login to the county admin portal. This password is generated automatically by the system and the tool stores an encrypted password in the database.

If the email address username entered is not in a valid format, the tool will display an error message "**Invalid Email Format!**" Once all the email address usernames are updated, the tool will process each email address username and generate a password for each new user.

Admin Reset Password

This action allows the user to change his password at any time.

Personal Password Reset

Old Password

New Password

Confirm New Password

Submit   Done

The user needs to provide the old password along with new password twice (for confirmation). If all the details are valid, the tool will save the encrypted password to the database. Clicking on "Done" will take the user to the previous page without saving any details.

Communication

This action allows the user to communicate with the county administrators available for the user's state.

Below is the sample screenshot for North Dakota state administrator.

Communication with County Administrators

List of all counties provides the available list of all county admins those who have valid email address usernames.

Add Selected will add only the selected county admins from the list.

Add All will add all the county admins.

Similarly, **Remove Selected** will remove only selected county admins and **Remove All** will remove all the county admins from the selected counties list.
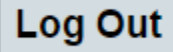
Selected Counties shows the list of selected counties by the user.

Once the county admins are selected, the user needs to provide the subject and the message of communication.

Send will send emails to all the selected county admins with the user provided subject and message.

Log Out

This will log out the user from the administration page and the user is navigated back to "Administration Login" page.

County Administration

The county admin page allows the user to select one of the actions to proceed. All the actions are described below in detail.

County Administration

Welcome county administrator of Aurora, South Dakota!

Functionality

1 • **Update Initial Cost Default Values**

2 • **Update Maintenance Cost Default Values**

3 • **Reset Personal Password**

4 **Log Out**   **Help**

The above is a sample screenshot for Aurora county in South Dakota.

Default Initial Cost Values

This action allows the user to update the initial cost default values of the user's county for all the surface types. This page contains two sections. The first section will load the default values of that county (if the county values are not available, default values of region are populated). In this section, the user can make changes to the default values. The second section will provide an option to save the changes to database and to go back to the administration page.

Each of the sections is described below in detail.

Default Initial Cost Values

1 | HMA | AST | Gravel | Dust Control | Stabilized Gravel |

HMA - Aurora - South Dakota

Parameters For Different ADT Levels

ADT Level [vehicles/day]	HMA Thickness [inches]	Regional HMA Thickness [inches]	Base Thickness [inches]	Regional Base Thickness [inches]	Reshaping / SubGrade Prep [$/mile]	Regional Reshaping/ SubGrade [$/mile]	Widening [$/mile]	Regional Widening [$/mile]	Last Update Year
0-99	3	3	4	4	50000	50000	0	0	2015
100-199	4	4	4	4	50000	50000	0	0	2015
200-299	4	4	6	6	50000	50000	0	0	2015
300-399	4	4	6	6	50000	50000	0	0	2015
400-499	5	5	8	8	50000	50000	0	0	2015
500-599	5	5	7	8	50000	50000	0	0	2015
>=600	6	6	10	10	50000	50000	0	0	2015

Parameters For All ADT Levels

HMA Cost [$/ton]	Regional HMA Cost [$/ton]	Base Gravel Cost [$/ton]	Regional Base Gravel Cost [$/ton]	Reclaiming / Milling [$/sqyd]	Regional Reclaiming / Milling [$/sqyd]	Pavement Marking [$/mile]	Regional Pavement Marking [$/mile]	Engineering / Contingencies [%]	Regional Engineering / Contingencies [%]	Last Update Year
120	120	24	26	0	0	2000	2000	20	20	2015

| Set To Regional Default | Restore County Default |

2 | Save and Update All | Back to Administration Page | **3**

52

Update values to surface types

This part contains five different sections as described in the screenshot below. The first one is navigation across the surfaces. The second one displays for which "Surface type – County – State" the user is modifying data. The third and fourth sections focus on updating values. The fifth one allows the user to set to any specific default values.

Each of the sections is explained below in detail.

| | HMA | AST | Gravel | Dust Control | Stabilized Gravel |

2 HMA - Aurora - South Dakota

Parameters For Different ADT Levels

ADT Level [vehicles/day]	HMA Thickness [inches]	Regional HMA Thickness [inches]	Base Thickness [inches]	Regional Base Thickness [inches]	Reshaping / SubGrade Prep [$/mile]	Regional Reshaping/ SubGrade [$/mile]	Widening [$/mile]	Regional Widening [$/mile]	Last Update Year
0-99	3	3	4	4	50000	50000	0	0	2015
100-199	4	4	4	4	50000	50000	0	0	2015
200-299	4	4	6	6	50000	50000	0	0	2015
300-399	4	4	6	6	50000	50000	0	0	2015
400-499	5	5	8	8	50000	50000	0	0	2015
500-599	5	5	7	8	50000	50000	0	0	2015
>=600	6	6	10	10	50000	50000	0	0	2015

Parameters For All ADT Levels

HMA Cost [$/ton]	Regional HMA Cost [$/ton]	Base Gravel Cost [$/ton]	Regional Base Gravel Cost [$/ton]	Reclaiming / Milling [$/sqyd]	Regional Reclaiming / Milling [$/sqyd]	Pavement Marking [$/mile]	Regional Pavement Marking [$/mile]	Engineering / Contingencies [%]	Regional Engineering / Contingencies [%]	Last Update Year
120	120	24	26	0	0	2000	2000	20	20	2015

5 | Set To Regional Default | Restore County Default |

Navigation

At any point of time, the user can navigate across the surface types by clicking on the respective surface tab.

| HMA | AST | Gravel | Dust Control | Stabilized Gravel |
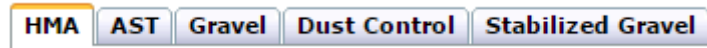
The currently selected tab will be highlighted (example: "HMA" in above screenshot). Every surface type will have similar functions like updating initial costs for respective fields.

Notification

Notifies the user, for which surface type, in which county, and in which state the default values are updated for.

HMA - Aurora - South Dakota

This indicates that the user is in "HMA" surface type, in Aurora county in South Dakota state.

ADT Level Values

For every surface type, there are some fields that are related to each ADT level and some fields that have same values for all ADT levels. In this section, only fields related to each ADT are updated.

For all surface types, the first column will be ADT level, which contains the values of all the levels available. Based on the surface types, the names and number of columns may vary from the second column.

The following is the screenshot for "HMA" surface type.

ADT Level [vehicles/day]	HMA Thickness [inches]	Regional HMA Thickness [inches]	Base Thickness [inches]	Regional Base Thickness [inches]	Reshaping / SubGrade Prep [$/mile]	Regional Reshaping/ SubGrade [$/mile]	Widening [$/mile]	Regional Widening [$/mile]	Last Update Year
0-99	3	3	4	4	50000	50000	0	0	2015
100-199	4	4	4	4	50000	50000	0	0	2015
200-299	4	4	6	6	50000	50000	0	0	2015
300-399	4	4	6	6	50000	50000	0	0	2015
400-499	5	5	8	8	50000	50000	0	0	2015
500-599	5	5	7	8	50000	50000	0	0	2015
>=600	6	6	10	10	50000	50000	0	0	2015

All the columns can be updated except the ADT level column. For every updatable column, for every ADT level, there are two parts (two different columns). The first part is a text box where the user can change values. The second part is a read-only text which contains the regional default value for that surface type and for that field for that ADT level. The regional default is the default value of that field for the region associated to that county.

For example, consider the value for ADT level 500-599 and field "Base Thickness" (<mark>highlighted in yellow</mark> in screenshot), the value is seven and the regional default is eight. The user will have an option to set all the values to regional defaults and to set all the values to county default values ("Restore Defaults") explained in the coming sections.

Non ADT Level Values

For every surface type, there are some fields that are related to each ADT level and some fields that are same to all ADT level. In this section, only fields that are same to all ADT levels are updated.

HMA Cost [$/ton]	Regional HMA Cost [$/ton]	Base Gravel Cost [$/ton]	Regional Base Gravel Cost [$/ton]	Reclaiming / Milling [$/sqyd]	Regional Reclaiming / Milling [$/sqyd]	Pavement Marking [$/mile]	Regional Pavement Marking [$/mile]	Engineering / Contingencies [%]	Regional Engineering / Contingencies [%]	Last Update Year
120	120	24	26	0	0	2000	2000	20	20	2015

All these values are same for any ADT level. The number of columns may vary based on the surface type. The above screenshot is for the "HMA" surface type.

There are two parts (two different columns) in every field. The first part is a text box where the user can change values. The second part is a read-only text which contains the regional default value for that surface type and for that field for that ADT level. The regional default is the default value of that field for the region associated to that county.

For example, consider the value for field "Base Gravel Cost" (<mark>highlighted in yellow</mark> in screenshot), the value is 24 and the regional default is 26. The user will have an option to set all the values to regional defaults or county default ("Restore Defaults") explained in the coming sections.

Set to regional default / set to default values

This action allows the user to set all the values to regional default values or set to county default values (if available).

Set To Regional Default   **Restore County Default**

This will change all the values in all the fields.

Save and Update All

This action allows the user to save any changes made to the values. If any value is invalid, an alert will display an indication to the user where the value is invalid.

Save and Update All

Once all the values have saved successfully, an alert will display an indication to the user that all the values have saved successfully.

Back To Administration

This option is available on every page except on "County Administration" page.

Back To Administration Page

Back to Administration Page will not log out of the user from the tool. It will navigates the user back to the county admin home page where all the options are available for the admin. This will navigate the user to page "County Administration."

Default Maintenance Cost Values

This action allows the user to update the maintenance cost default values of the county for all the surface types and for all treatments available for every surface type.

This page contains two sections. The first section will load the default values of that county. In this section, the user can make changes to the default values to all the treatments in all surface types.

Default Maintenance Cost Values

The second section will provide an option to save the changes to the database and to go back to the administration page.

Each of the sections is described below in detail.

Update values to surface types

This part contains five different sections as described in screenshot below. The first one is navigation across the surfaces. The Second one is to select any treatment that is available under the selected surface type. The third one displays for which "Surface type – Treatment" the user is modifying data.

The fourth one focuses on updating values. The fifth one allows the user to set to any default values.

Navigation

At any point of time, the user can navigate across the surface types by clicking on the respective surface tab.

The currently selected tab will be highlighted (example: "HMA" in above screenshot). Every surface type will have similar functions like treatment selection and updating maintenance costs for respective fields.

Treatment Selection

Once the surface type is selected, the user will have an option to select any treatment. The treatment drop-down list will contain all the available treatments in the selected surface type.

Select a treatment Crack Sealing ▼

The above screenshot contains one selected treatment "Crack Sealing" for "HMA" surface type.

Notification

Notifies the user, for which surface type, for which treatment the default values are updated for.

HMA: Crack Sealing

This indicates that the user is in "HMA" surface type, and updating the default values for "Crack Sealing" treatment.

Update Values

For all surface types, the first column will be ADT level, which contains the values of all the levels available. All the column names are same for all the surface types and treatments, because all the treatments have the same parameters.

The following is the screenshot for "HMA" surface type "Crack Seal" treatment. In the screenshot, we can see that all the ADT levels are available and there are four other updatable columns.
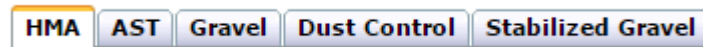
ADT Level [vehicles/day]	Times/year	Regional times/year	Year Interval	Regional year interval	App Start Year	Regional start year	Unit Cost [$/mile]	Regional cost [$/mile]	Last Update Year
0-99	1	1	7	7	6	6	10000	10000	2015
100-199	1	1	7	7	6	6	10000	10000	2015
200-299	1	1	7	7	4	4	10000	10000	2015
300-399	1	1	7	7	4	4	13000	13000	2015
400-499	1	1	7	7	4	4	13000	13000	2015
500-599	1	1	6	6	4	4	15000	15000	2015
>=600	1	1	6	6	4	4	15000	15000	2015

There are two parts (two different columns) for every field. The first part is a text box where the user can change values. The second part is a read-only text which contains the regional default value for that surface type and for that field for that ADT level. The regional default is the default value of that field for the region associated to that county.

The first three updatable columns display values related to time and frequency. This will allow the user to update default values for the timing (when to start) and frequency (how many times to apply) of each treatment for the selected surface type. All the column headings provide detailed explanations for field values. "Times/Year" indicate the frequency that the treatment is to be applied, "Year Interval" indicates the interval in years for reapplying the treatment in order to maintain the road. "App Start Year" indicates the year at which the first application is to be applied.

For example, if the user wanted to schedule the treatment every four years, starting in year seven, then set to one in the "Times per Year" and seven in the "App Start Year." As another example, if the user wanted to reblade a gravel road four times a year, every year, starting in year one, then the *Blading* treatment is set to four in the "Times per Year" and one in the "App Start Year."

Set to regional default / Restore county default

This action allows the user to set all the values to either regional defaults or county defaults.

Set To Regional Default   Restore County Default

This will change all the values in all the fields.

Save All Changes to Database

This action allows the user to save any changes made to the values. If any value is invalid, an alert will display an indication to the user where the value is invalid.

Save All Changes To Database

Once all the values have saved successfully, an alert will display an indication to the user that all the values have saved successfully.

Admin Reset Password

This action allows the user to change his password at any time.

Personal Password Reset

Old Password

New Password

Confirm New Password

[Submit] [Done]

The user needs to provide the old password along with new password twice (for confirmation). If all the details are valid, the tool will save the encrypted password to the database. Clicking on "Done" will take the user to the previous page without saving any details.

Log Out

This will log out the user from administration page and the user is navigated back to "Administration Login" page.

[Log Out]

APPENDIX B – SURFACE SELECTION TOOL ANALYSIS PDF RESULTS SAMPLE

Local Road Surface Selection Analysis Results

4/21/2017

INPUT SUMMARY

Project Description and General Parameters

PARAMETER	VALUE	PARAMETER	VALUE
State	North Dakota	County	Cass
Project Length	5	Project Width	24
ADT Level	300-399	Analysis Period	20
Discount Rate	3.5	Start Year of Analysis	2017
Is Salvage Value Included?	No	Is User Costs Included?	No

Agency Cost - Per Mile

Initial Cost Details

HMA

PARAMETER	VALUE	UNIT	PARAMETER	VALUE	UNIT
HMA Thickness (new)	4	inches	Reshaping / Sub-grade Prep	15000	$/Mile
HMA Cost (placed)	60	$/Ton	Reclaiming / Milling (if asphalt)	2.5	$/Sqyd
Base Thickness (New)	6	inches	Widening (if necessary)	0	$/Mile
Base Gravel Cost (placed)	26	$/Ton	Pavement Marking	1500	$/Mile
			Engineering / Contingencies	15	% of total

AST

PARAMETER	VALUE	UNIT	PARAMETER	VALUE	UNIT
Asphalt & Aggregate Cost (placed)	50000	$/Mile	Reshaping / Sub-grade Prep	15000	$/Mile
Base Gravel Thickness (new)	4	inches	Reclaiming / Milling (if asphalt or AST)	2.5	$/Sqyd
Base Gravel Cost (placed)	26	$/Ton	Widening / Reconstruction	0	$/Mile
Base Stabilization (if necessary)	5000	$/Mile	Pavement Marking	1500	$/Mile
			Engineering / Contingencies	15	% of total

Gravel

PARAMETER	VALUE	UNIT	PARAMETER	VALUE	UNIT
Surface Gravel Thickness (new)	3	inches	Surface Gravel Cost (placed)	26	$/Ton
Reshaping / Sub-grade Prep	10000	$/Mile	Widening / Reconstruction	0	$/Mile

Dust Control

PARAMETER	VALUE	UNIT	PARAMETER	VALUE	UNIT
Dust Control Application	6000	$/Mile	Surface Gravel Thickness (new)	3	inches
Surface Gravel Cost (placed)	26	$/Ton	Reshaping / Sub-grade Prep	10000	$/Mile
Widening / Reconstruction	0	$/Mile			

Stabilized Gravel

PARAMETER	VALUE	UNIT	PARAMETER	VALUE	UNIT
Surface Gravel Thickness (new)	3	inches	Surface Gravel Cost (placed)	26	$/Ton
Reshaping / Sub-grade Prep	15000	$/Mile	Widening / Reconstruction	0	$/Mile
Base Stabilization Additive	15000	$/Mile	Dust Control	6000	$/Mile

Maintenance Cost Input Details

HMA

TREATMENT	TIMES/YEAR	YEARS BETWEEN APPS	START YEAR	UNIT COST ($)	COST UNIT
Crack Seal	1	7	4	4000	$/mile
Seal Coat	1	7	3	40000	$/mile
Overlay	1	20	21	200000	$/mile
Striping and Marking	1	1	2	1500	$/mile
Patching	1	5	9	6000	$/mile

AST

TREATMENT	TIMES/YEAR	YEARS BETWEEN APPS	START YEAR	UNIT COST ($)	COST UNIT
Seal Coat	1	6	3	40000	$/mile
Striping and Marking	1	2	2	1	$/mile
Patching	1	3	3	9000	$/mile
Reapply AST	1	10	10	50000	$/mile

Gravel

TREATMENT	TIMES/YEAR	YEARS BETWEEN APPS	START YEAR	UNIT COST ($)	COST UNIT
Blading	44	1	1	100	$/mile
Regravel	1	2	2	28000	$/mile
Reshape Cross Section	1	1	1	3000	$/mile
Spot Gravel	1	1	3	2000	$/mile

Dust Control

TREATMENT	TIMES/YEAR	YEARS BETWEEN APPS	START YEAR	UNIT COST ($)	COST UNIT
Blading	8	1	1	100	$/mile
Regravel	1	3	3	28000	$/mile
Reshape Cross Section	1	1	1	3000	$/mile
Reapply Gravel	1	1	1	6000	$/mile

Stabilized Gravel

TREATMENT	TIMES/YEAR	YEARS BETWEEN APPS	START YEAR	UNIT COST ($)	COST UNIT
Blading	6	1	1	100	$/mile
Regravel	1	3	3	28000	$/mile
Reshape Cross Section	1	1	2	3000	$/mile
Reapply Stabilization	1	8	8	8000	$/mile
Dust Control	1	2	1	6000	$/mile

Maintenance Cost Summary Results
(Unit Cost $ Per Mile)

Surface Type	HMA	AST	Gravel	Dust Control	Stabilized Gravel
Total Initial Cost	$ 372,615	$ 204,564	$ 63,386	$ 69,386	$ 89,386
Total Maintenance Cost	$ 130,617	$ 194,683	$ 336,735	$ 267,211	$ 228,962
Total Agency Cost	$ 503,232	$ 399,247	$ 400,121	$ 336,597	$ 318,348

Comparision of Cumulative Costs Associated with Different Surface Types