2012

DARWIN-ME Pavement Analysis and Design Manual for NJDOT

Book 1 – Pavement Overview, Traffic and Climatic Inputs

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Darwin ME

Flexible Pavement Design and Flexible Overlay Design

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Darwin ME – Flexible Pavement Design and Flexible Overlay Design And Material Inputs

The design manual that follows is based on excerpts from the 2007 Manual of Practice for the ME Pavement Design Guide, the Darwin-ME Help files, and NJDOT Research Reports characterizing material inputs for Subgrade, Aggregate Base and Subbase, and HMA materials. Material characterization and design parameters for chemically stabilized soil material and PCC pavements can be found in the 2007 Manual of Practice for the ME Pavement Design Guide, and the Darwin-ME Help files. A new Manual of Practice for the Darwin ME Pavement Design Guide is being developed.

3.3 New Flexible Pavement and HMA Overlay Design Strategies Applicable for Use with the MEPDG (Manual of Practice for the ME Pavement Design Guide)

The MEPDG can be used to analyze the expected performance of new and reconstructed HMA-surfaced pavements, as well as HMA overlays. The HMA-surfaced pavement types include the following, which are illustrated in Figures 6 and 7.

- **Conventional Flexible Pavements**: Flexible pavements that consist of relatively thin HMA surfaces (less than 6 inches thick) and unbound aggregate base layers (crushed stone or gravel, and soil-aggregate mixtures). Many of the pavements used in the global calibration process had multiple aggregate base layers. Conventional flexible pavements may also have a stabilized or treated subgrade layer.

  Deep Strength Flexible Pavements: Flexible pavements that consist of a relatively thick HMA surface and a dense-graded HMA or asphalt stabilized base mixture placed over an aggregate base layer. Deep strength flexible pavements may also have a stabilized or treated subgrade layer. Many of the flexible pavements used in the global calibration process had asphalt stabilized base layers and would be defined deep strength flexible pavements.

- **Full-Depth HMA Pavements**: HMA layers placed on a stabilized subgrade layer or placed directly on the prepared embankment or foundation soil. Full-depth flexible pavements were also included in the global calibration process, but there were fewer test sections than for conventional and deep strength flexible pavements.

- **Semi-Rigid Pavements**: HMA placed over cementitious stabilized materials. Cementitious materials may include lime, lime-fly ash, and Portland cement stabilizers. This type of pavement is also referred to as composite pavements in the MEPDG. Semi-rigid pavements were not included in the global calibration process, and are not recommended for analysis using the MEPDG until this type of pavement has been calibrated.

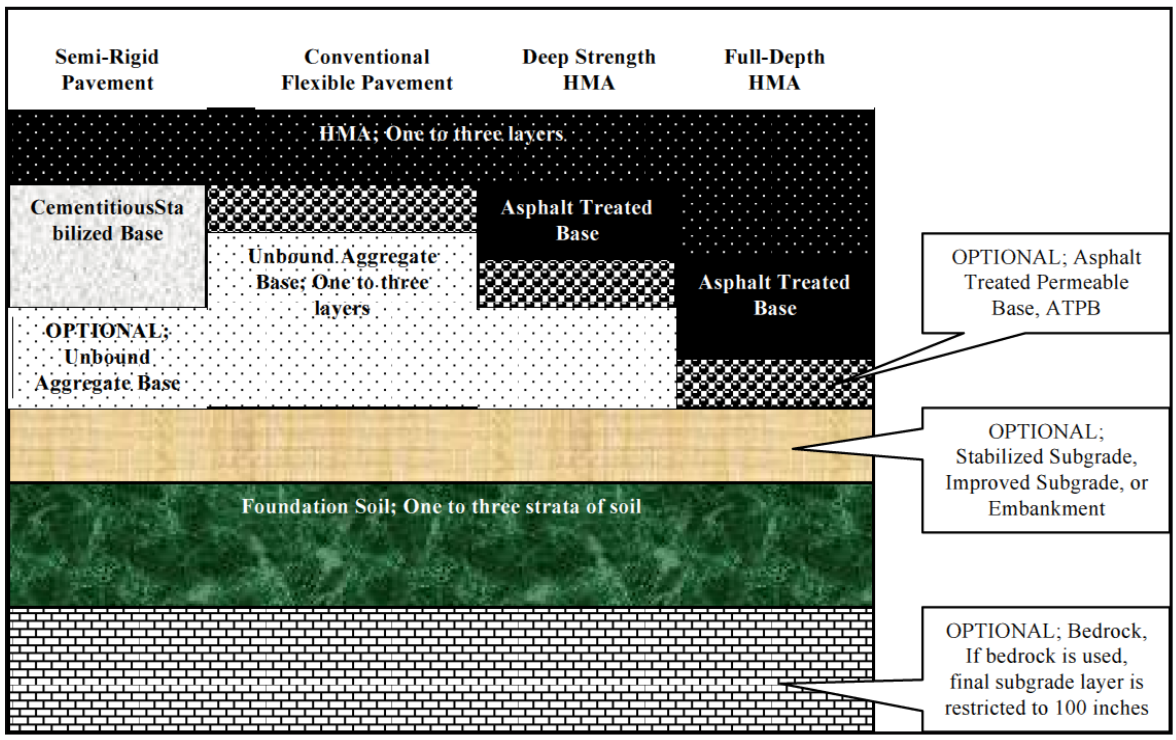
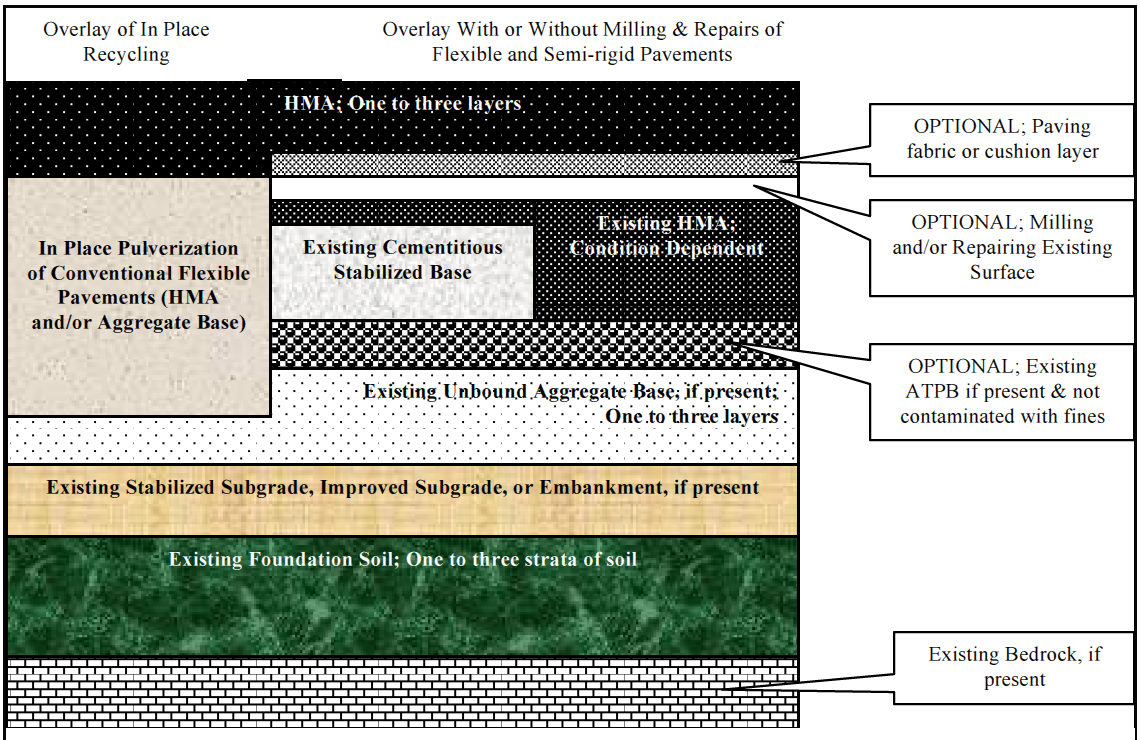


Figure 6. New (Including Lane Reconstruction) Flexible Pavement Design Strategies that can be Simulated with the MEPDG (Refer to Subsection 12.1); Layer Thickness not to Scale



7.a. Rehabilitation Options for Existing Flexible and Semi-Rigid Pavements

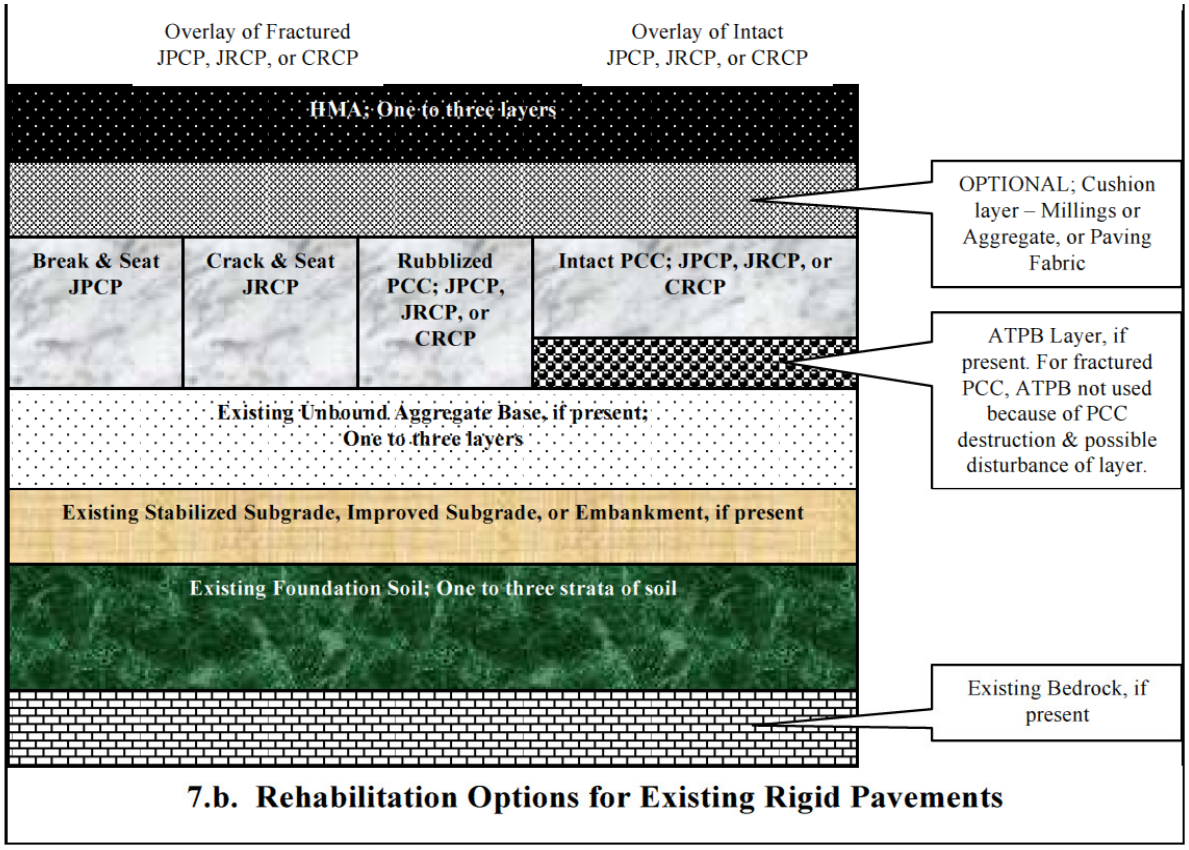


Figure 7. HMA Overlay Design Strategies of Flexible, Semi-Rigid, and Rigid Pavements that can be Simulated with the MEPDG (Refer to Subsection 13.2); Layer Thickness not to Scale

- **Full Depth Reclamation (In-Place Pulverization of Conventional Flexible Pavements)**: Cold in-place recycling of the HMA and existing aggregate base layers, and hot in-place recycling of HMA. Cold in-place recycling as a rehabilitation strategy is considered reconstruction under the MEPDG design/analysis process and would be defined as a new flexible pavement. Hot in-place recycling as a rehabilitation strategy is considered mill and fill with an HMA overlay of the existing flexible pavement. The thickness of the hot in-place recycled material is considered part of the HMA overlay, as well as the thickness of the milled material. Full depth reclamation, however, was not included in the global calibration of the MEPDG.

- **HMA Overlays** of all types of flexible and intact rigid pavements, with or without pavement repairs and surface milling. Pavement repairs and milling of the existing surface layer is considered by the MEPDG. The expected milling depth is an input value, and pavement repairs are considered by entering the condition of the pavement prior to overlay placement. The MEPDG may also be used to design HMA overlays of fractured PCC slabs (break and seat [applicable to JPCP]; crack and seat [applicable to JRCP]; and Rubblization [applicable to all PCC pavements]). HMA overlays of fractured PCC slabs, however, were not included in the global calibration process.

8 Selecting Design Criteria and Reliability Level

Design performance criteria and design reliability greatly affect construction costs and performance. Section 5 summarized all of the performance indicators that are predicted with the MEPDG for both HMA- and PCC-surfaced pavements. Guidance is provided within this section for selecting the design criteria and reliability for a particular project.

Each user or agency may evaluate these recommendations and modify them according to their experience, agency policies, and local needs. The design criteria and design reliability levels could be selected in balance with each other. A low level of distress should not be selected in conjunction with a high level of reliability because this may make it impossible or costly to obtain an adequate design.

These levels could become policy values that are usually fixed for routine designs.

8.1 Recommended Design-Performance Criteria

Performance criteria (or Analysis Parameters on the MEPDG software window) are used to ensure that a pavement design will perform satisfactorily over its design life. The designer selects critical limits or threshold values to judge the adequacy of a design. These criterion or threshold values could represent agency policies regarding the condition of the pavements that trigger some type of major rehabilitation activity or reconstruction. In addition, these values could represent the average values along a project.

These criteria are similar to the current AASHTO Design Guide use of the initial and terminal serviceability index levels (AASHTO, 1993). The distress and IRI specific design policy criteria could be selected by visualizing the pavement condition and its impact on safety, maintenance needs (e.g., amount of lane closure), ability to rehabilitate the pavement in that condition, and the realization that this level is set at a given level of design reliability (e.g., 90 percent).

These policy values may also be determined from an analysis of the agency's pavement management data through the use of survivability analyses (in terms of conditions when major rehabilitation activities are undertaken), or based on user considerations and for safety reasons (for example, a rut depth to reduce the probability of hydroplaning). The consequences of a project exceeding a performance criterion could likely require earlier than programmed maintenance or rehabilitation. Table 4 provides values for considerations by highway agencies, realizing that these levels may vary between agencies based on their specific conditions.

Table 4. Design Criteria or Threshold Values Recommended for Use in Judging the Acceptability of a Trial Design

Pavement Type	Performance Criteria	Maximum Value at End of Design Life
HMA pavement & overlays	Alligator cracking (HMA bottom up cracking)	Interstate:10 % lane area Primary: 20 % lane area Secondary: 35% lane area
	Rut depth (permanent deformation in wheel paths)	Interstate: 0.40-inches Primary: 0.50-inches Others (<45 mph): 0.65-inches
	Transverse cracking length (thermal cracks)	Interstate: 500-ft./mi. Primary: 700-ft./mi. Secondary: 700-ft./mi.
	IRI (smoothness)	Interstate: 160 in/mile Primary: 200 in/mile Secondary: 200 in/mile

8.2 Reliability

Reliability has been incorporated in the MEPDG in a consistent and uniform fashion for all pavement types. A designer may specify the desired level of reliability for each distress type and smoothness. The level of design reliability could be based on the general consequence of reaching the terminal condition earlier than the design life.

Design reliability (R) is defined as the probability (P) that the predicted distress will be less than the critical level over the design period.

R = P [Distress over Design Period < Critical Distress Level] (37.a) Design reliability is defined as follows for smoothness (IRI):

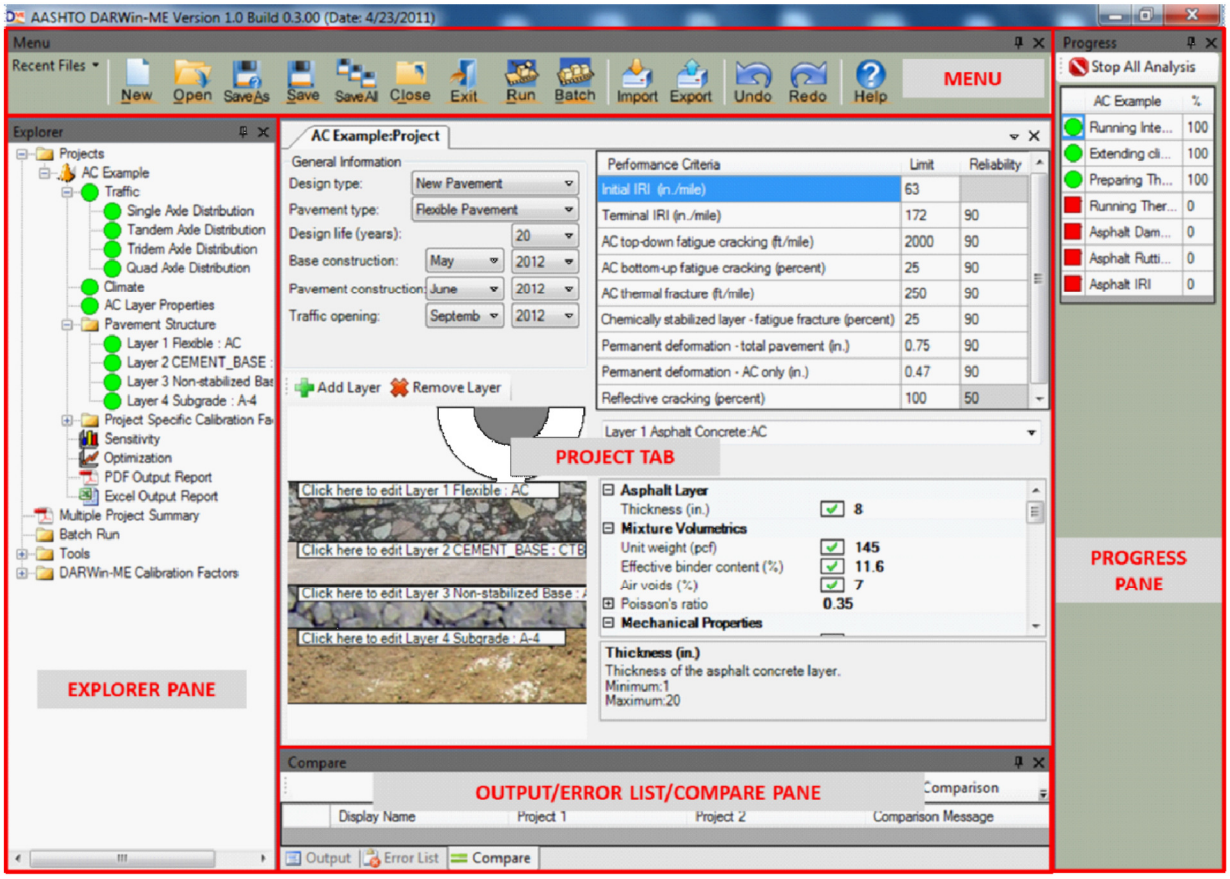
R = P [IRI over Design Period < Critical IRI Level] (37.b)

This means that if 10 projects were designed and constructed using the MEPDG and each had a design reliability for fatigue cracking of 90 percent, one of those projects, on average, would show more than the threshold or terminal value of fatigue cracking at the end of the design period. This definition deviates from previous versions of the AASHTO Design Guide in that it considers multiple predicted distresses and IRI directly in the definition. Design reliability levels selected may vary by distress type and IRI or may remain constant for each. It is recommended, however, that the same reliability be used for all performance indicators.

Table 5. Levels of Reliability for Different Functional Classifications of the Roadway.

Functional Classification	Level of Reliability	
	Urban	Rural
Interstate/Freeways	95	95
Principal Arterials	90	85
Collectors	80	75
Local	75	70

3.8 DARWin-ME Main Window



DARWin-ME Main Window

Explorer Pane: The Explorer Pane contains controls for Projects, Multiple Project Summary, Batch Run, Tools, and Calibration settings. See the Explorer Pane topic for more information.

Menu: The Menu contains a dropdown for Recent Files and buttons for basic program operation. See the Menu topic for more information.

Project Tab: The Project Tab allows you to select the type of design and pavement type. It also allows you to define the pavement structure, design and material properties and performance criteria. See the Project Tab topic for more information.

Output Pane: The Output Pane displays a log of analysis activities. See the Output Pane topic for more information.

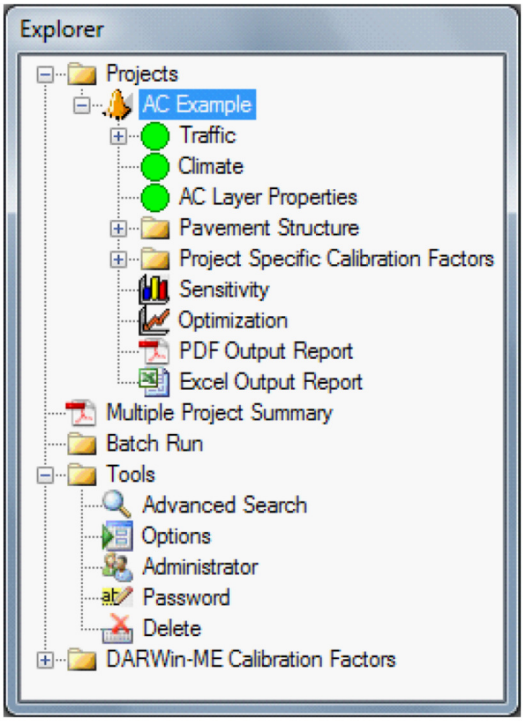
Error List Pane: The Error List Pane displays a list of errors. See the Error List topic for more information.

Compare Pane: The Compare Pane allows the user to compare two projects and display any differences between them. See the Compare Pane topic for more information.

Progress Pane: The Progress Pane displays the progress of an analysis as it runs. Click the Stop All Analysis button to abort a run.

4 General DARWin-ME Features

4.1 Explorer Pane



Explorer Pane

The Explorer Pane displays information about your project and the DARWin-ME application as a whole.

Projects: The Projects folder contains information about any open projects, their analyses, preferences for those projects, and any output results.

Multiple Project Summary: The Multiple Project Summary displays a report for any Batch Runs you have performed.

Batch Run: This control allows you to perform an analysis for multiple projects without opening them individually.

Load Projects: This control allows you to load multiple projects in the program.

Run Batch Projects: This control allows you to run multiple projects.

View Batch Reports: This control allows you to view summary of multiple projects after batch is complete.

Close All: This control allows you to close all projects.

Stop All Execution: This control allows you to stop running all loaded projects.

Tools: The Tools folder contains options for changing the settings of the DARWin-ME application.

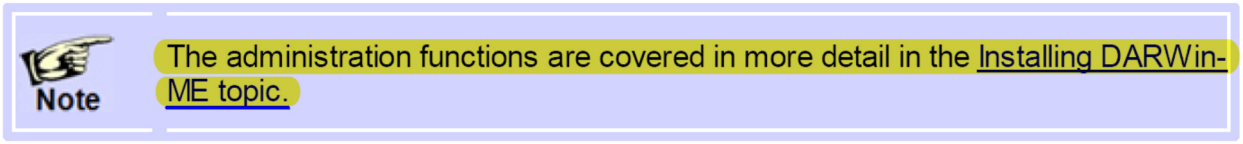
Advanced Search: This control allows you to search a database to which you are connected.

Options: This control opens the Options pane, which allows you to specify preferences for the application.

Administrator: This control allows a database administrator to create and edit user accounts.

Password: This control allows a database administrator to change the password for user accounts.

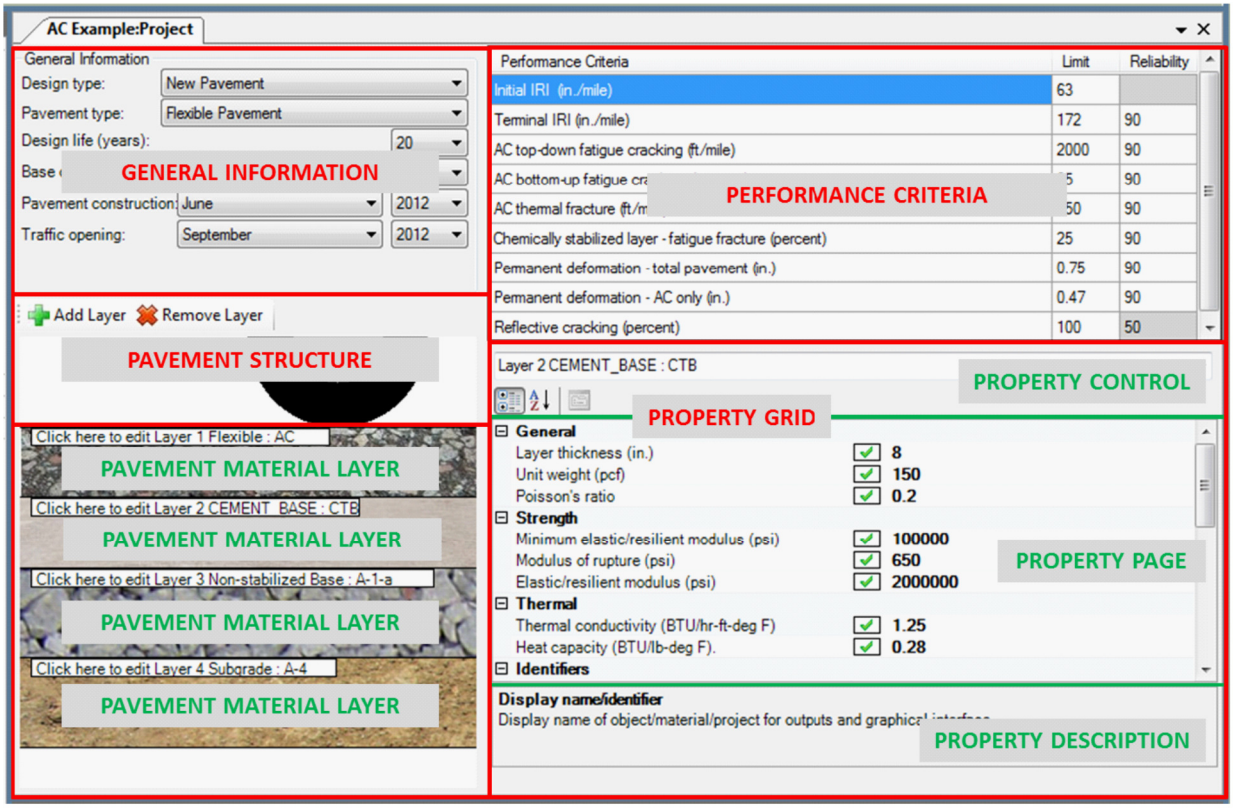
Delete: This control allows a database administrator to delete user accounts.



DARWin-ME Calibration Factors: This control allows the user to specify project specific calibration factors and also national level default calibration factors.

4.3 Project Tab

The Project Tab allows the user to select design options and inputs for a trial design. Note that the name assigned to the project appears on this screen.



Project Tab

General Info: The General Information pane contains controls for selecting the type of design (new, overlay or restoration), pavement type, and other general inputs.

Performance Criteria: The Performance Criteria pane allows you to define the limits of critical distresses and smoothness that can be tolerated by the agency at the specified reliability levels.

Pavement Structure: The Pavement Structure pane displays the layers that make up the pavement and allows the user to add or remove those layers. See the Pavement Structure topic for more information.

Pavement Material Layer: The Pavement Material Layer is representation of the material type that makes up a pavement layer. Clicking a pavement layer displays its properties on the Property Page.

Property Grid: The Property Grid pane allows you to view and define inputs for selective items (e.g. pavement material layer properties, design features, rehabilitation properties etc):

4.3.1 General Information

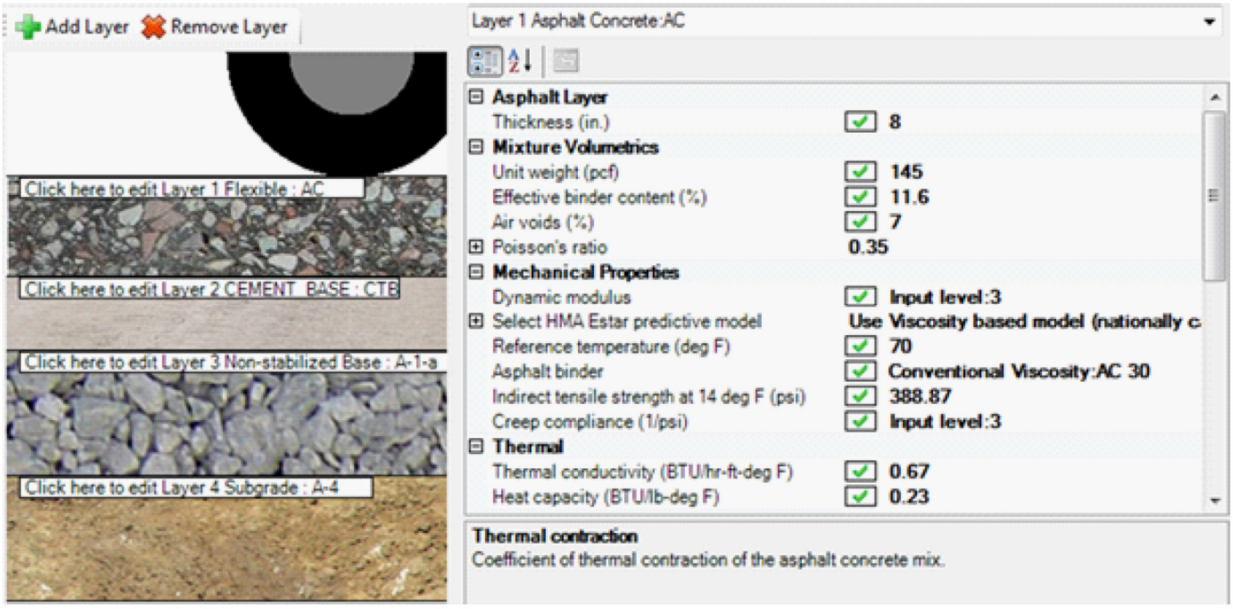
The controls for General Information pane change with the type of design (new, overlay or restoration) and pavement type you select. See the General Information topic under each pavement type for more information.

4.3.2 Performance Criteria

The controls for Performance Criteria pane change with the type of design (new, overlay or restoration) and pavement type you select. See the Performance Criteria topic under each pavement type for more information.

4.3.3 Pavement Structure

Once you select the pavement type for your project, DARWin-ME automatically provides the top layers of the selected pavement type. You are required to define the underlying layers and subgrade. If you try to insert a layer that violates the basic definition of the selected pavement type, DARWin-ME displays an error message “Invalid material insert: Structural validation error”.



Pavement Structure

Add Layer/Remove Layer

The controls available here allow you to add, remove, and edit pavement material layers for the trial design.

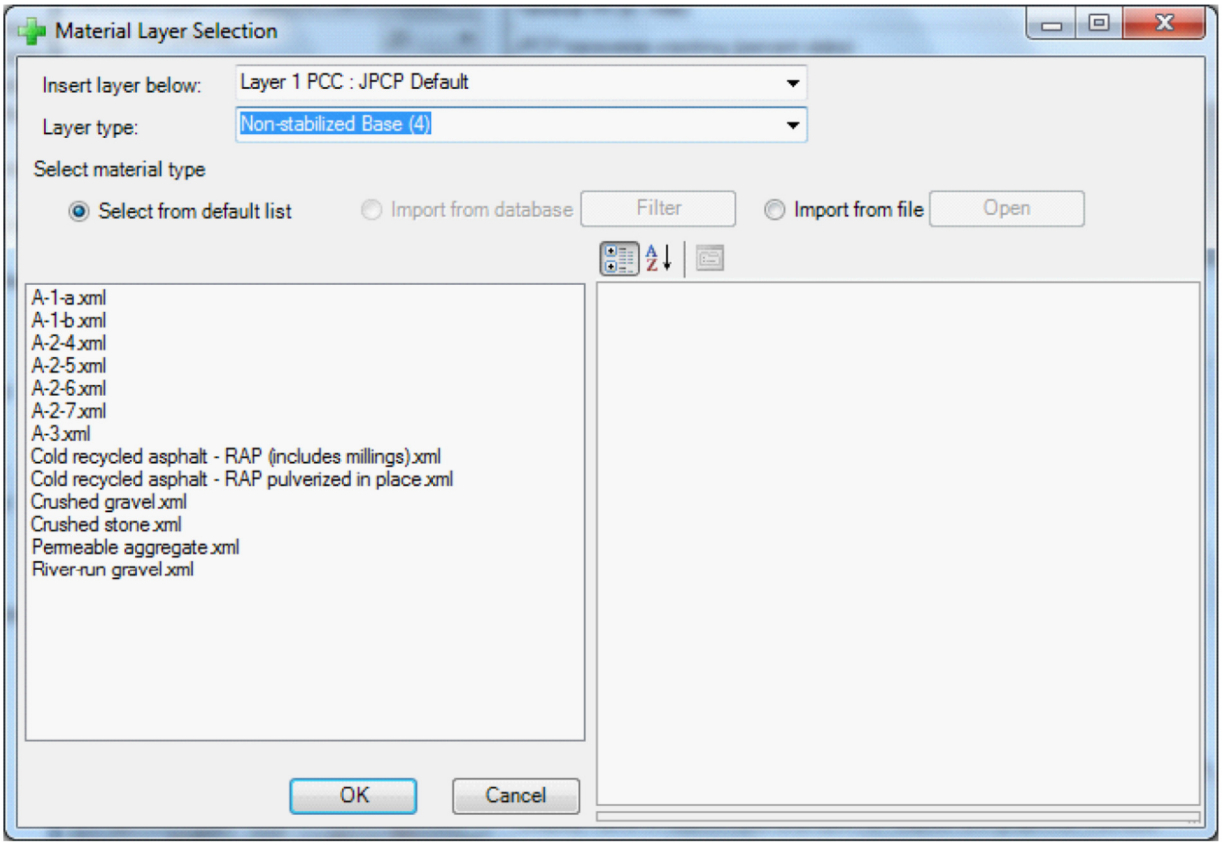
Add Layer: The Add Layer button opens the Material Layer Selection dialog, which allows you to add layers, select the layer material type, edit the properties of that material, and determine the position of the layer relative to the other layers in the pavement structure. The layer you add appears in the graphic.

Remove Layer: The Remove Layer button allows you to remove any pavement material layer. The layer you remove disappears in the graphic. Click the layer on the graphic to display its properties in the Property Page. See the Property Grid topic for more information.

Note

Although the properties of a pavement material layer can be changed in the Property Page, the type of the pavement material layer itself cannot be changed. This can only be accomplished by removing the layer, then adding it again with a different material type using the Material Layer Selection dialog.

4.3.4 Material Layer Selection



Material Layer Selection

Insert Layer Below: This control allows you to a layer under which the new layer should be placed.

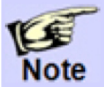
Layer Type: This control allows you to select the type of layer you are adding to the pavement.

Select Material Type: This control provides you the options to select the material type of your layer. Material type can be selected from a list of default material types, or from your agency's data libraries database or from an external source.

Select from Default List: This control allows you to select the material type for your new layer from the list of default material types. For each material type selected, DARWin-ME provides a set of default inputs. You can customize the default input values for your new layer by using the controls that appear on the right.

Import from Database: This control allows you to retrieve layer information in XML format from the database (if you are connected).

Import from an External Source: This control allows you retrieve layer data in XML format from an external source or folder.



Note that the available options vary, depending on the Pavement Type you originally selected for the pavement. For example, if you selected FLEXIBLE-Default asphalt concrete, you have five options: Flexible, Cement Stabilized, Sandwiched Granular, Subgrade, and Bedrock.

4.4 Property Grid

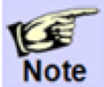
The Property Grid pane allows you to select the following items for viewing and defining inputs:

Pavement Material Layers
AC Layer Properties (includes AC Rehabilitation)
JPCP Design Properties
CRCP Design Properties
JPCP Rehabilitation
CRCP Rehabilitation
Foundation Support
Project-specific Calibration Factors
Project Identifiers

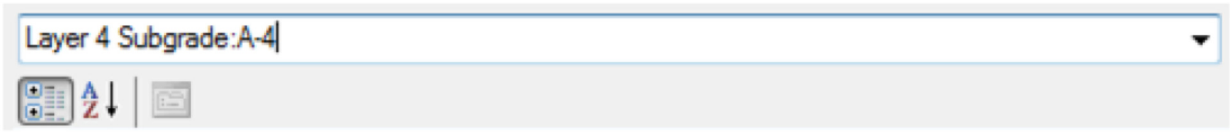
You can also open these items from the Explorer pane.

Property Page: The Property Page pane allows you to view and define inputs for the selected items.

Property Controls: The Property Controls allows you to select an item for display in the Property Page.

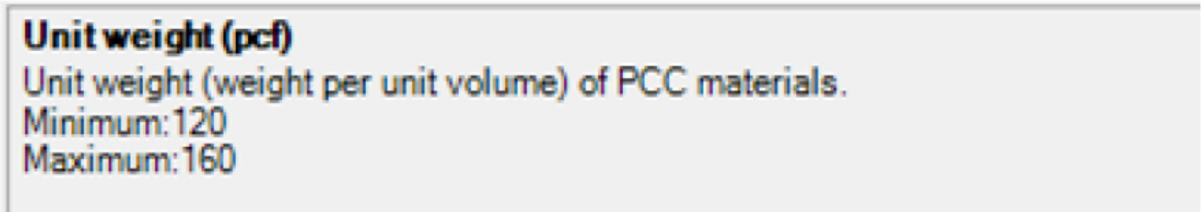


You cannot open the following items using the Property Controls: Traffic, Climate, Sensitivity, Optimization and Backcalculation. You can only open them from the Explorer pane.



Property Controls

Property Description: The Property Description section provides a brief description for each control on the Property Page, including limits for values as appropriate.

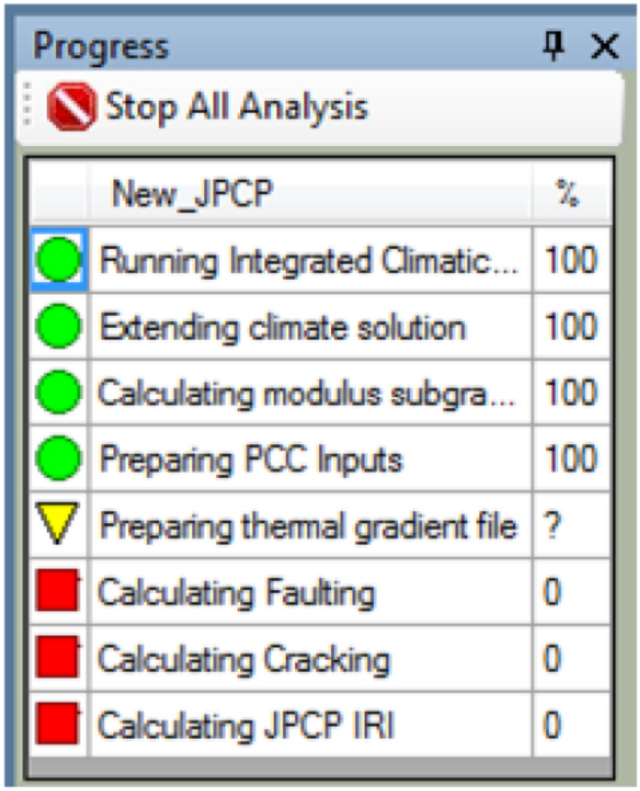


Property Description

 ***Categories Button***: Click the Categories Button to sort the properties displayed on the Property Page by category.

 ***A-Z Sort Button***: Click the A-Z Sort Button to sort the properties displayed on the Property Page alphabetically.

4.5 Progress Pane



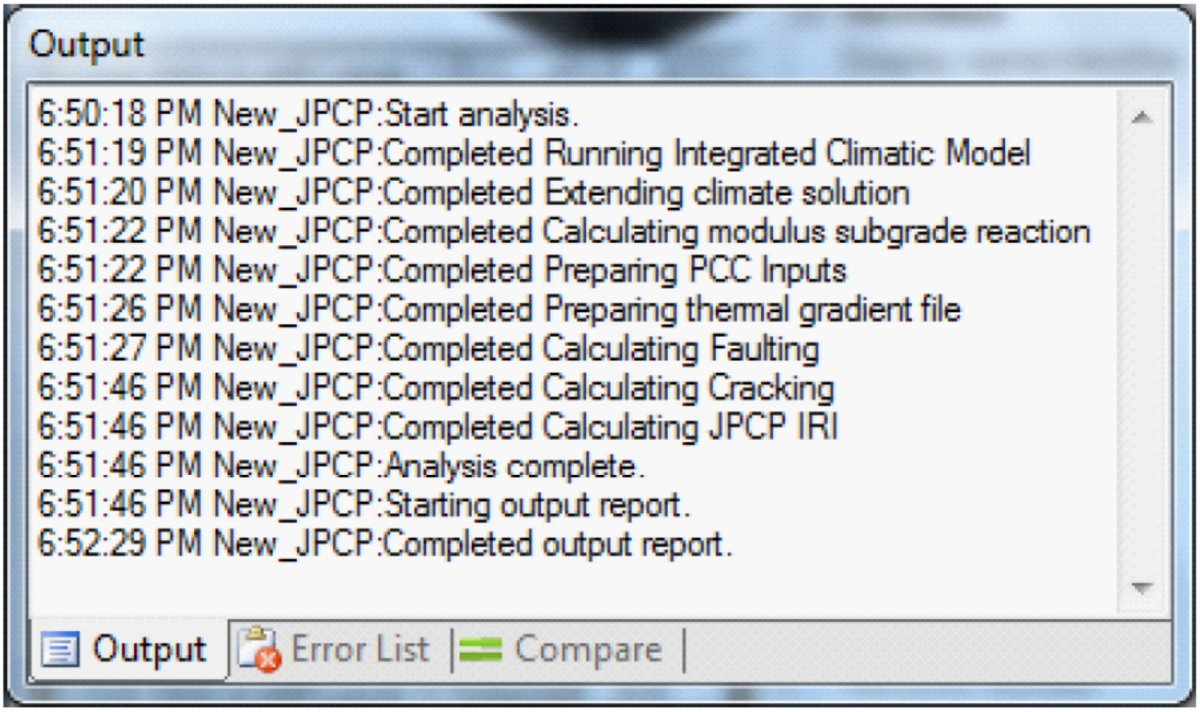
Progress Pane

The Progress Pane displays the status of any ongoing analyses.

A green circle indicates that the analysis has been completed.
A yellow triangle indicates that the analysis is on-going.
A red square indicates that the analysis has not yet been run.

You can force the program to terminate the on-going analyses by selecting Stop All Analysis control.

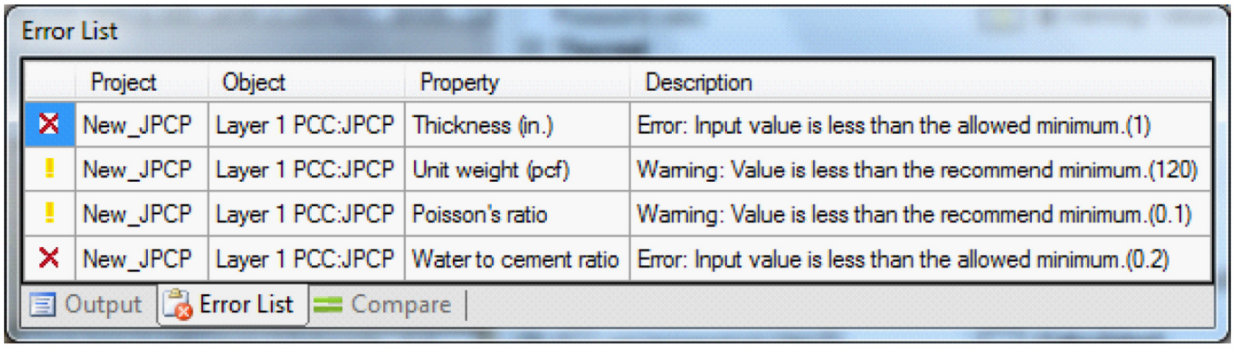
4.6 Output Pane



Output Pane

The Output Pane displays a log of the analysis activities, including timestamps for each entry.

4.7 Error List Pane



Error List Pane

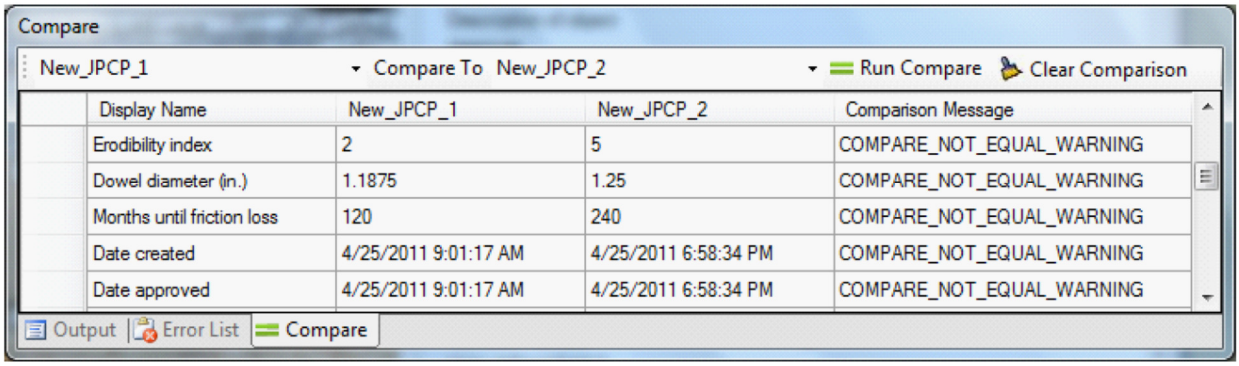
DARWin-ME cannot run your project if it contains errors and gaps in inputs. In this case, the program will track and report these errors and gaps in an error list that appears in the lower section of the screen.

Project: The Project column displays the project in which the error occurred.
Object: The Object column displays the item (layer, pavement, etc) in which the error occurred for that project.

Property: The Property column displays the property of the object in which the error occurred for that project.

Description: The Description column provides a description of the error.

4.8 Compare Pane



Compare Pane

Project Dropdown: This control allows you to select an open project on which to base your comparison.

Compare To Dropdown: This control allows you to select a project to compare to the previously specified project.

Run Compare: Click Run Compare to compare the two projects and identify differences.
Clear Comparison: Click Clear Comparison to reset the Compare Pane.

Display Name: The Display Name column shows the name of the property that differs between the two projects.

Project 1: The Project 1 column displays the value of the property shown in Display Name for the base project.

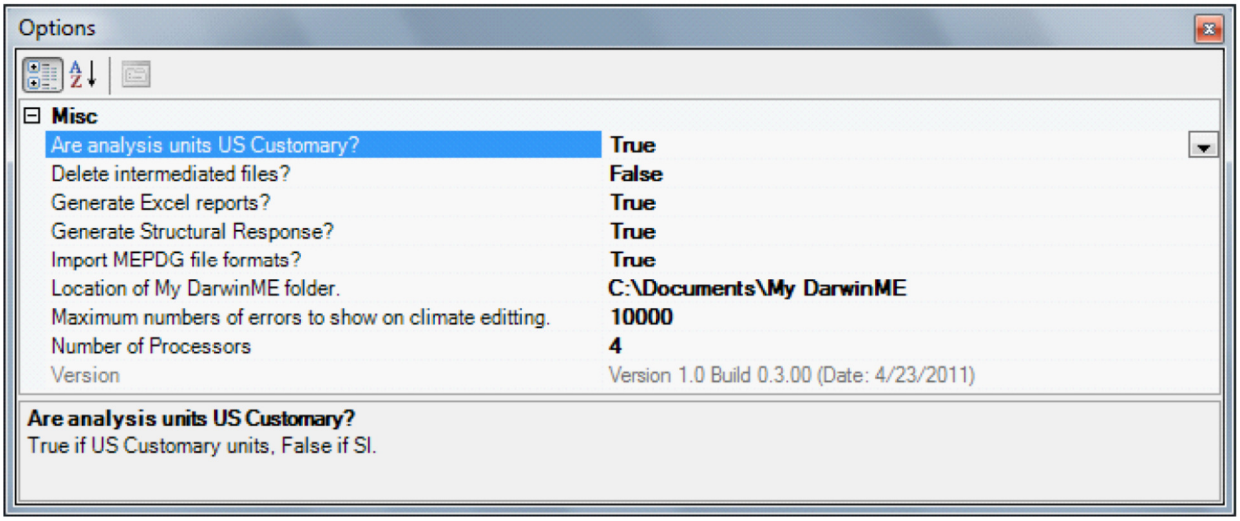
Project 2: The Project 2 column displays the value of the property shown in Display Name for the compare to project.

Comparison Message: The Comparison Message column displays how the property shown in the Display Name is unequal (usually COMPARE_NOT_EQUAL_WARNING).

4.9 Options

Way to Access this Interface

Select Options from the Explorer Pane under Tools.



Options

Delete intermediate files?: DARWin-ME produces several intermediate files that contain a wide range of calculated output parameters. Select True to delete these files after the analysis is complete. The default value is False.

Generate Excel reports?: DARWin-ME produces an output report in PDF format. Select True to generate an additional report in Excel format. The default value is False (PDF report only).

Generate structural response?: Select True to produce structural response in an intermediate file. The default value is False.

Import MEPDG file formats?: Select True to import MEPDG "legacy" data tables and project files. The default value is False.

Are analysis units US customary?: Shows the units convention you selected during installation. The value is True for US Customary units and False for SI units.

Location of My DARWin-ME folder: Specify the location of the default user folder for DARWin-ME.

Maximum number of errors to show on climate editing: Specify how many errors to display when editing hour climate data.

Version: Displays the current version and build number of the program.

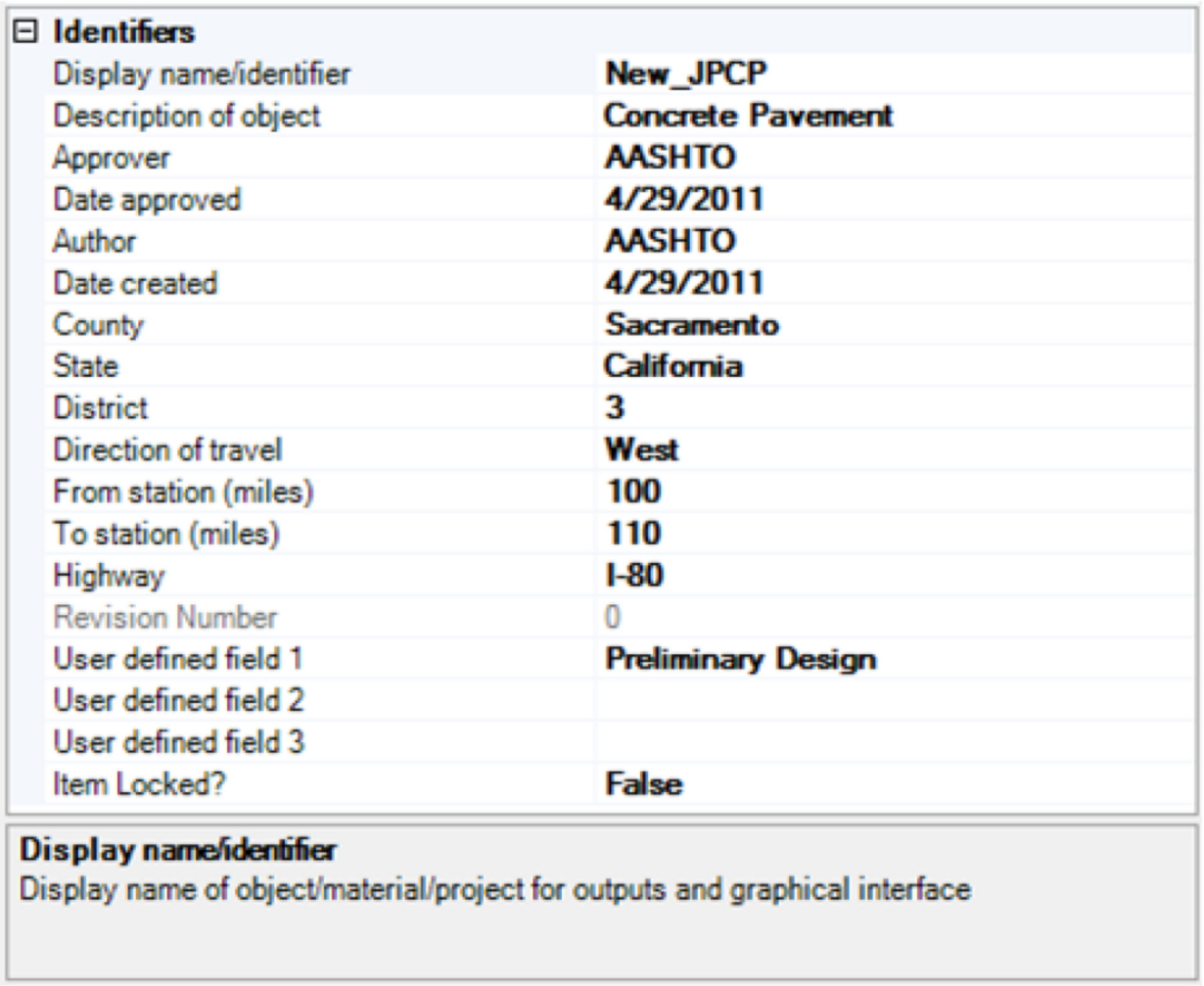
4.10 Identifiers

Identifiers are the unique informational tag specific to each object. Objects can be any discrete item such as pavement material layer data, axle load distribution factors, climate

and design features or the project itself. Identifiers are used to identify, search, filter, save and retrieve information in a database environment.

Way to Access this Interface Element

Identifiers are available for the following objects--Project (from the Project Tab), Traffic (by right clicking the traffic and axle load spectra input screens), Climate (from the Climate tab), Pavement Materials (from each individual layer input screens), Backcalculation (from the input screen), Design Properties (AC, JPCP, and CRCP), all Rehabilitation screens (from the input screen), and Project-Specific Calibration Factors (from the input screens).



Identifiers

Display name/identifier: This control allows you to define the display name of the object/material/project for outputs and graphical interface.

Description of object: This control allows you to define or modify a description for the selected object.

Approver: This field control allows you to define the person who approved the use of the selected object/material/project.

Date approved: This control allows you to define the date the approver accepted the selected object/material/project.

Author: This control allows you to define the designer responsible for creating the selected object/material/project.

Date created: This control allows you to define the date the selected object/material/ project was created.
County: This control is optional, and allows you to define the political/organization division for which the selected object/material/project was created.

State: This control is optional, and allows you to define the political/organization division for which the selected object/material/project was created.

District: This control is optional, and allows you to define the political/organization division for which the selected object/material/project was created.

Direction of travel: This control allows you to define which side of the roadway the design project is located.

From station (miles): This control allows you to define the design project's begin station for linear referencing.

To station (miles): This control allows you to define the design project's end station for linear referencing.

Highway: This control allows you to define the roadway where the design project is located.

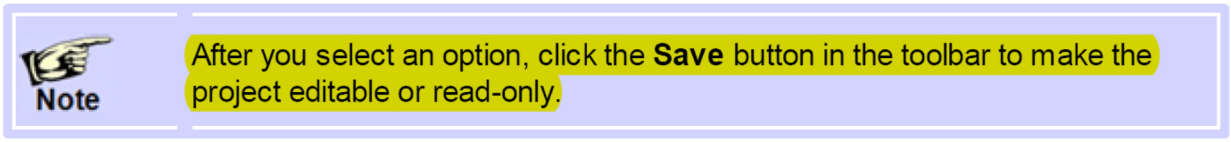
Revision Number: This control displays the project's current revision number.

Province: This control allows you to define the province where the project is located.

User-defined fields (1-3): This series of controls allows you to define your own custom data fields for the project.

Item Locked?: This control allows you to mark the project as editable or read-only. The default setting for this configuration property is False. For enterprise versions of DARWin-ME, if a user with administrator privileges changes the setting to True, the configuration grid becomes read-only. The application will gray it out to show that future changes are disabled. Only a user with administrator privileges can reset the Item Locked property to False. Select one of the following options:

False: This option allows you to edit the values of the project.
True: This option allows you to make the project read-only.



4.11 Saving a Project to Folder

Projects created in DARWin-ME are saved as .dgpx files in a folder you specify in the Options tab. If the user does not specify a folder, the default folder for saved project files is *My Documents\My Darwin ME\Projects*.

4.12 Exiting

Click the Exit button on the Menu to close all open projects and exit the program. If you are running the enterprise version of DARWin-ME, the program will require you to save each updated project to a new project name before closing. DARWin-ME will not overwrite an existing project that has been saved to the database.

4.14 Absolute and Recommended Inputs Ranges

DARWin-ME uses two sets of input ranges for identifying errors and outliers in input values: recommended and absolute. Outliers are input data that lie outside the recommended range but are within the absolute range. Errors are input data that lie outside the absolute range. For outliers, the program will give a warning flag for your review. You can choose to accept or modify the input as needed. For an input value flagged as an error, you must provide a new value that is within the absolute range for the program to run.

4.15 Input Hierarchy

DARWin-ME uses a three-level hierarchical input scheme for most of the input parameters related to traffic, material, and pavement condition. This approach provides DARWin-ME users with a lot of flexibility in obtaining the inputs for your project based on its criticality and the available resources. The following defines each hierarchical input level:

Input Level 1 – Input parameter is measured directly; it is site- or project-specific. This level represents the greatest knowledge about the input parameter for a specific project but has the highest testing and data collection costs to determine the input value.

Input Level 2 – Input parameter is estimated from correlations or regression equations. In other words, the input value is calculated from other site specific data or parameters that are less costly to measure. Input level 2 may also represent measured regional values that are not project-specific.

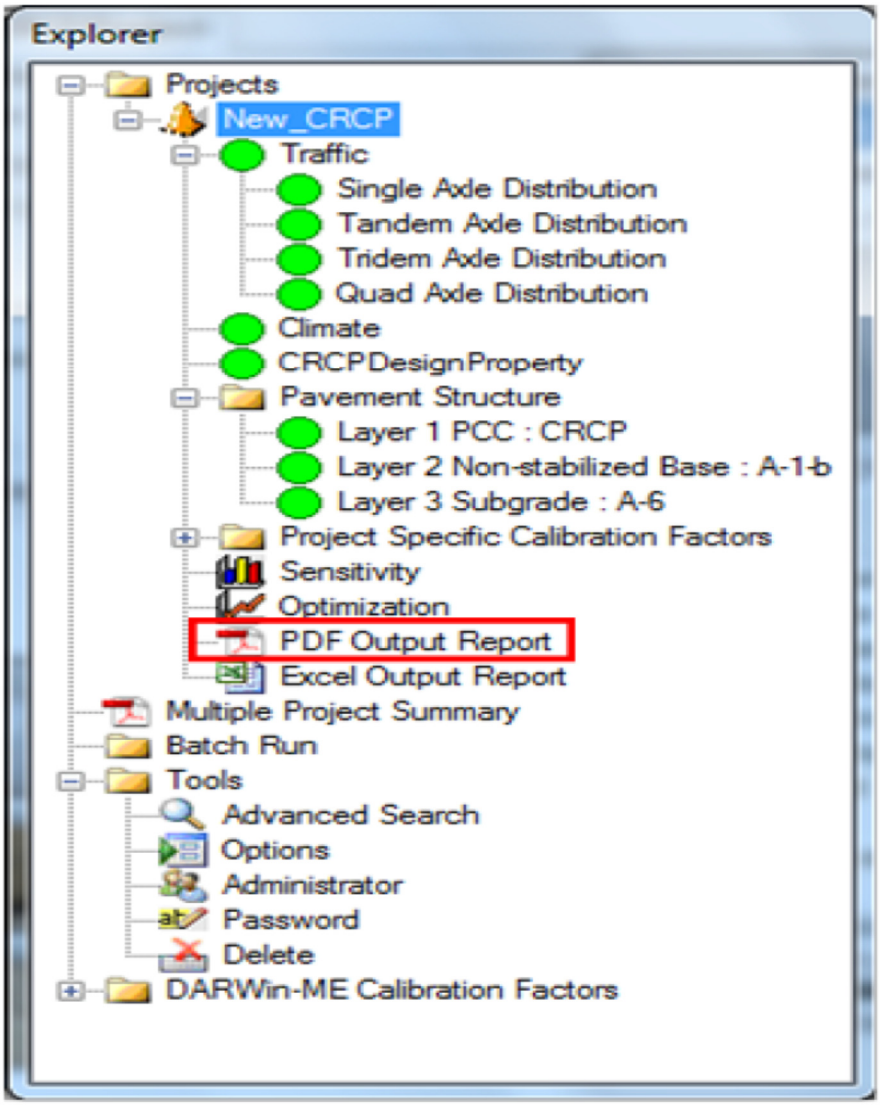
Input Level 3 – Input parameter is based on "best-estimated" or default values. Level 3 inputs are based on national or regional default values – the median value from a group of data with similar characteristics.

Refer to the AASHTO Manual of Practice for more guidance on selecting an input level.

4.16 Reports

PDF Output Report

After a design/analysis run has been successfully completed, the application will generate and display a PDF file containing input summary and output results of the trial design. Once the PDF report is closed, you can re-open by double-clicking the PDF Output Report node located in the project tree view of the Explorer pane.

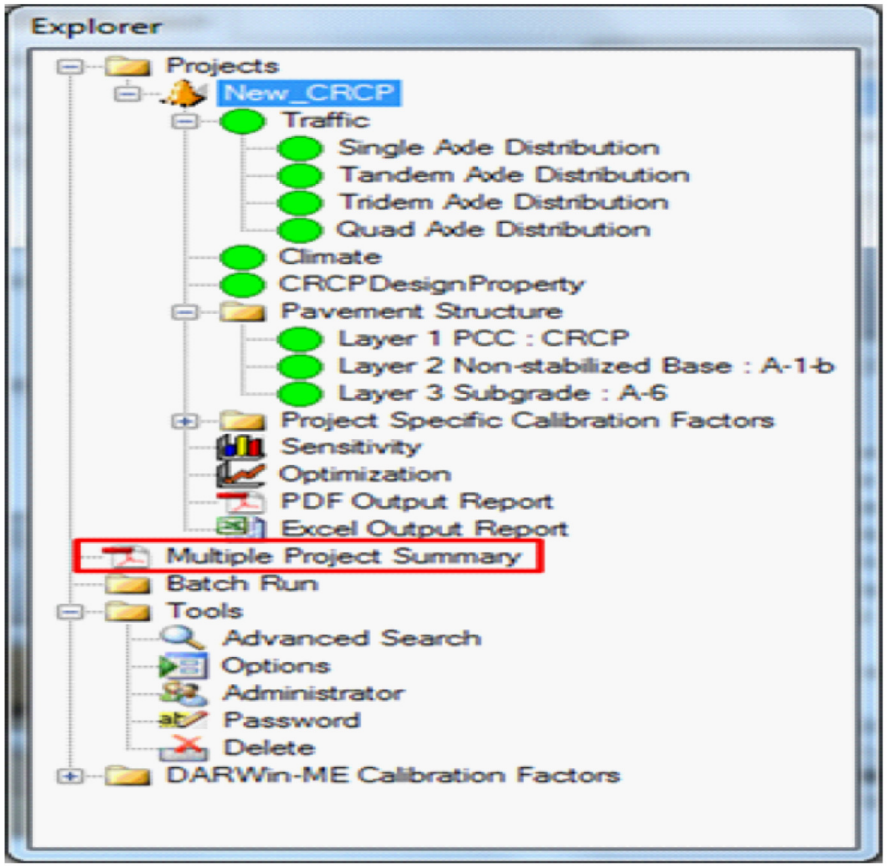


To locate the PDF report, go to the folder where the project file (.dgpx) is saved. The PDF report also shows the folder path of the project file. That folder will include a subfolder with the same name as the project file. The PDF report is inside the project subfolder.

PDF Multiple Project Summary (Batch Report)

If you have multiple project tabs open and you perform analysis on each of them, you can click on the Multiple Projects Summary option in the Explorer Pane project tree to obtain a summary report for all the projects that are open and have been run successfully.

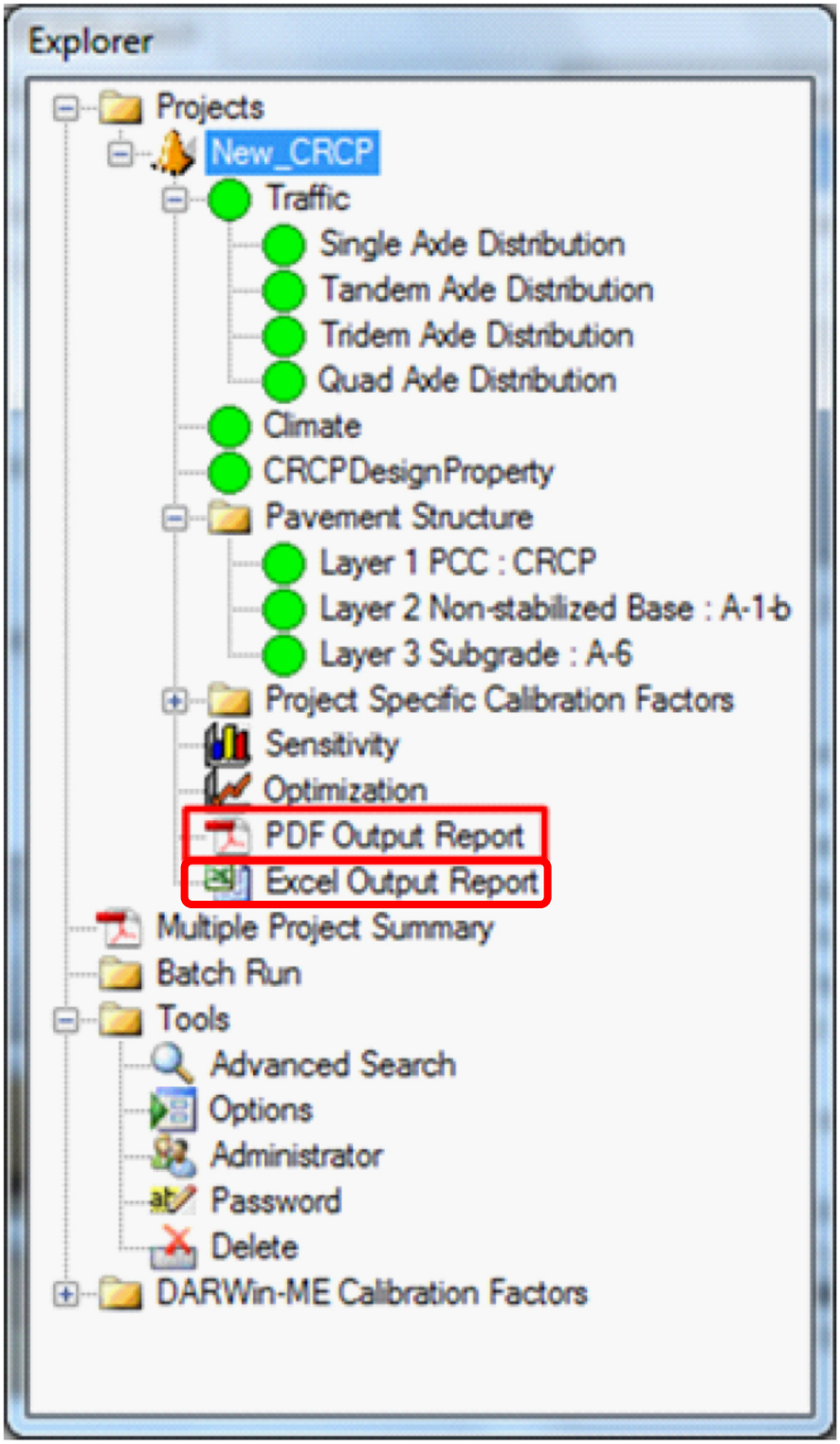
Alternatively, if projects which have been previously run and which contain valid results in the respective project folders are opened, clicking on the Multiple Projects Summary option provides a summary report for all the analysis with valid results.

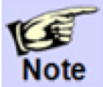


The application will open a batch report file (PDF) that will display the first page of each individual report, including the file pathway to the location of the project.

Excel Output Report

As long as the Excel Report Option is set as True in the Options tab, the output report will also be available as an Excel file. Click on the Excel Output Report option under each project in the tree to open the report in Excel.


Explorer
Projects
New_CRCP
Traffic
Single Axle Distribution
Tandem Axle Distribution
Tridem Axle Distribution
Quad Axle Distribution
Climate
CRCPDesignProperty
Pavement Structure
Layer 1 PCC : CRCP
Layer 2 Non-stabilized Base : A-1-b
Layer 3 Subgrade : A-6
Project Specific Calibration Factors
Sensitivity
Optimization
PDF Output Report
Excel Output Report
Multiple Project Summary
Batch Run
Tools
Advanced Search
Options
Administrator
Password
Delete
DARWin-ME Calibration Factors



Excel reports do not generate even for valid projects that have successfully generated a PDF report if another instance of Excel is already running in the background. The user is warned when this occurs by the DARWin-ME application. In such cases, closing the Excel instance and double-clicking on the Excel icon in the project tree view will generate an Excel report if the project run was successful.

5.3 Traffic

Traffic data is one of the key data elements required for the structural design/analysis of pavement structures. It is required for estimating the loads that are applied to a pavement and the frequency with which those given loads are applied throughout the pavement's design life.

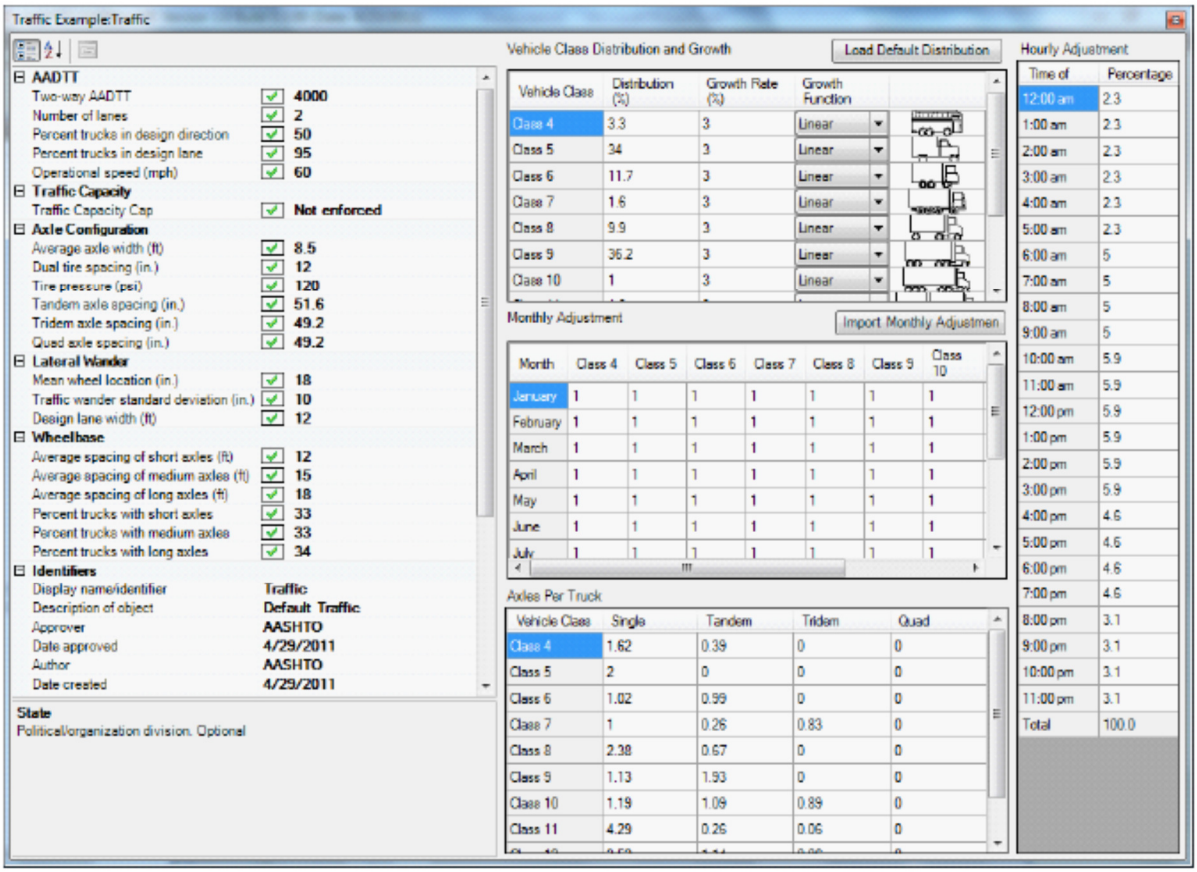
The following lists traffic data required for design:

- Base year truck volume and speed
- Traffic capacity
- Axle configuration
- Lateral wander
- Wheelbase
- Vehicle class distribution and growth
- Hourly adjustment
- Axles per truck
- Monthly adjustment
- Axle load distribution factors

DARWin-ME uses a hierarchical approach (Levels 1 through 3) to define traffic inputs based on the source of traffic data available. These levels represent how well you can estimate future truck traffic characteristics for the roadway being designed. Level 1 data is considered as the most representative of the past and future traffic characteristics of the project. It uses the actual axle weights and truck traffic volume distributions measured using weigh-in-motion (WIM) and automatic vehicle classification (AVC) sites that are located on nearby highway segments, assuming that there are no features or major intersections that could change the truck traffic stream. The regional summaries (statewide averages) obtained from the agency's traffic and planning departments can be considered as Level 2 data, while the Level 3 defaults (national averages) included in the program can be used when there are no regional data available from similar roadways.

Way to Access this Interface

1. In the Explorer tab under the Projects treeview, double-click the Traffic node.
2. Another way is to click on the tire in the *Pavement Structure Definition* area.

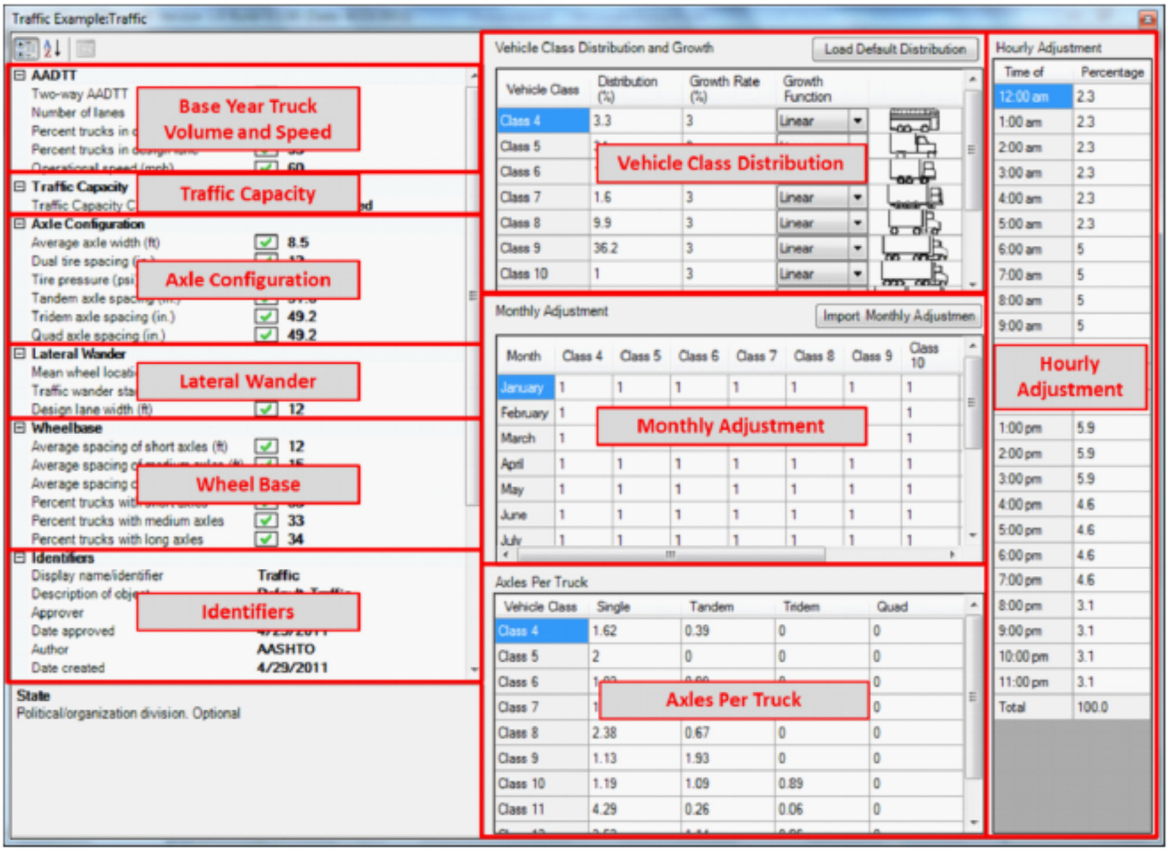


Traffic Tab

Links to Relevant Section in AASHTO Manual of Practice

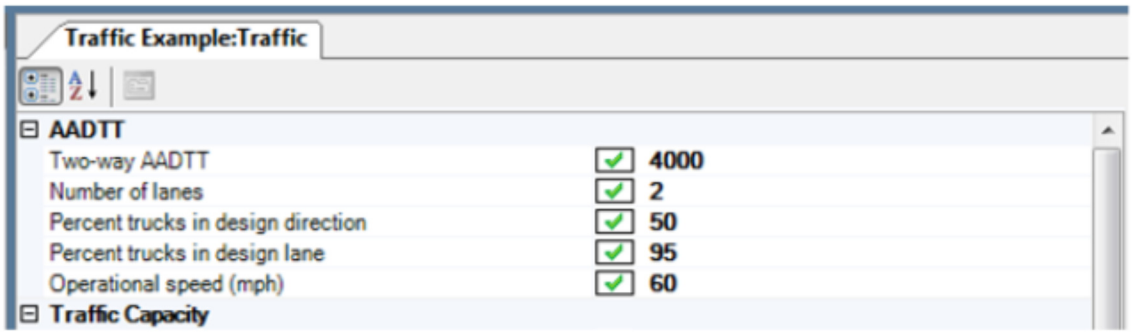
Refer to Section 9.1 Truck Traffic.

5.3.1 Traffic Inputs



Traffic Inputs

Base Year Truck Volume and Speed



Base Year Truck Volume and Traffic Capacity

Base year two-way AADTT: This control allows you to define the average annual daily truck traffic (FHWA vehicle classes 4-13) expected over the base year in both directions of travel for your project.

Number of lanes in the design direction: This control allows you to define the number of lanes present in the design direction. The program uses the number of lanes to estimate the traffic distribution in each lane.

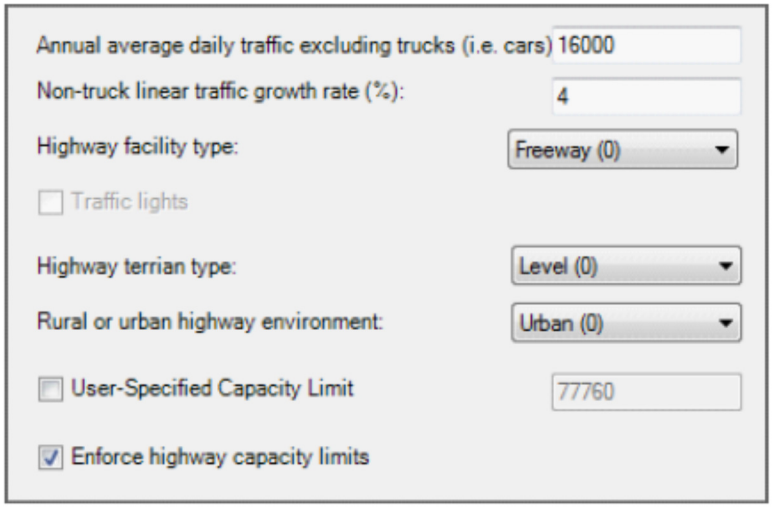
Percent trucks in design direction: This control allows you to define the percentage of trucks (from the entire two-way AADTT count) that is expected to travel in the design direction. Note that although this value is close to 50 percent, it is not necessarily so especially in cases where truck traffic does not use the same route for the onward and return trips.

Percent trucks in design lane: This control allows you to define percentage of trucks in the design direction expected to use the design lane (typically the outer right lane).

Operational speed (mph): This control allows you to define the expected speed of traffic traveling in the design lane. Note that the inputs in this control impact the loading frequency of asphalt layers.

Traffic Capacity Cap

Traffic Capacity Cap: This control opens the traffic capacity cap dialog, which allows you enforce a cap on estimated traffic volumes used in the design/analysis so that the expected highway capacity is not exceeded. In the Traffic tab, click on the Traffic Capacity Cap control. The following drop-down will appear:



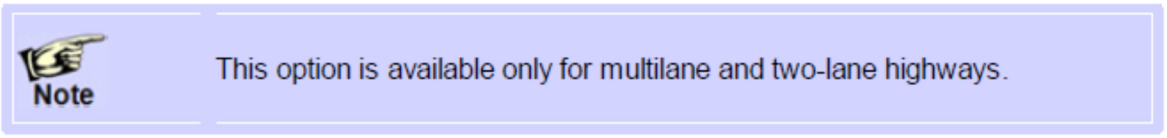
Traffic Capacity Cap

Annual average daily traffic excluding trucks: This control allows you to define the annual average daily volume of FHWA vehicle classes 1 through 3 (motorcycles, cars, pick-up trucks, vans and SUVs). This value is computed as the difference between annual average daily traffic (AADT) and annual average daily truck traffic (AADTT). The AADT includes both cars (or light vehicles - classes 1-3) and trucks (classes 4-13).

Non-truck linear traffic growth rate (%): This control allows you to define the annual linear growth rate of non-trucks (i.e., light vehicles - classes 1-3).

Highway facility type: This control allows you to select freeway, multilane highway, or two-lane highway.

Traffic signal: Check this box to estimate highway capacity for signalized intersections. This option is available only for multilane and two-lane highways.



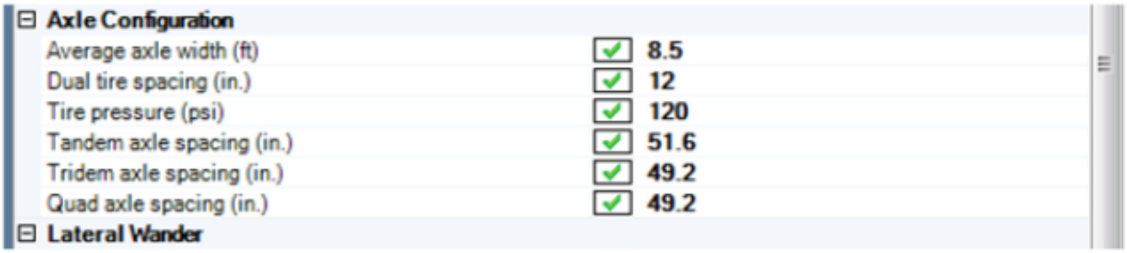
Highway terrain type: This control allows you to select whether the terrain is level (includes short grades of no more than 1 to 2 percent) or rolling (otherwise).

Rural or urban highway environment: This control allows you to select an urban or rural highway environment.

User-specified capacity limit: DARWin-ME by default internally computes capacity estimates based on the 2000 Highway Capacity Manual (HCM). Enable this control to define a specific value for capacity limit.

Enforce highway capacity limits: Enable this control to enforce traffic capacity cap. Disable this control to prevent DARWin-ME from enforcing traffic capacity cap.

Axle Configuration



Axle Configuration

Average axle width (ft): This control allows you to define the distance in feet between two outside edges of an axle. DARWin-ME provides a default value of 8.5 ft.

Dual tire spacing (in.): This control allows you to define the transverse distance in inches between the centers of a dual tire. This value is calculated from WIM data measured over time by averaging the distance measured between the dual tires of a tandem, tridem, or quad axle for each truck class. DARWin-ME provides a default value of 12 in.

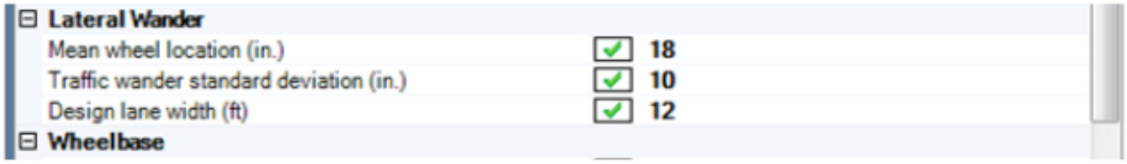
Tire pressure (psi): This control allows you to define the hot inflation pressure of tires in pounds per square inch. It is assumed that the hot inflation pressure equals the contact pressure and is 10% above cold inflation pressure. DARWin-ME provides a default value of 120 psi.

Tandem axle spacing (in.): This control allows you to define the center-to-center longitudinal spacing in inches between two consecutive axles in a tandem configuration. This value is calculated using WIM data by averaging distance measured between the tandem axles for each truck class. DARWin-ME provides a default value of 51.6 in.

Tridem axle spacing (in.): This control allows you to define the center-to-center longitudinal spacing in inches between two consecutive axles in a tridem configuration. This value is calculated using WIM data by averaging distance measured between the tridem axles for each truck class. DARWin-ME provides a default value of 49.2 in.

Quad axle spacing (in.): This control allows you to define the average distance in inches between two consecutive axles in a quad configuration. This value is calculated using WIM data by averaging distance measured between the quad axles for each truck class. DARWin-ME provides a default value of 49.2 in.

Lateral Wander



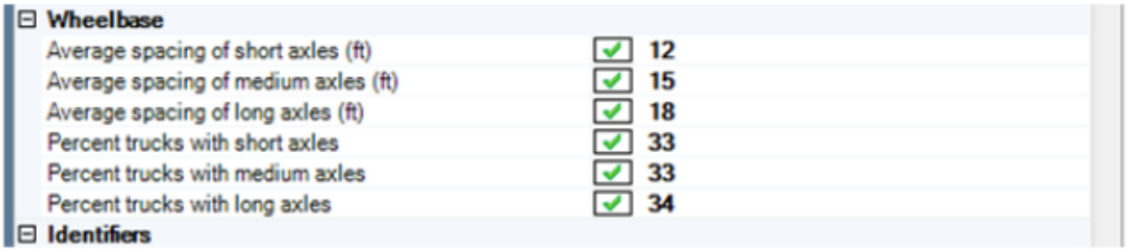
Lateral Wander

Mean wheel location (in.): This control allows you to define the distance in inches from the outer edge of the wheel to the pavement marking. DARWin-ME provides a default value of 18 in.

Traffic wander standard deviation (in.): This control allows you to define the divergence from average in inches of the lateral traffic wander. This standard deviation is used to estimate the number of axle load repetitions over a single point in a probabilistic manner for predicting distress and performance. DARWin-ME provides a default value of 10 in.

Design lane width (ft): This control allows you to define the distance in feet between the lane marking on either side of the design lane. DARWin-ME provides a default value of 12 ft.

Wheelbase [not used for new flexible design or HMA overlay designs]



Wheelbase

Average spacing of short axles (ft): This control allows you to define the average longitudinal spacing in feet of short axles. DARWin-ME provides a default value of 12 ft.

Average spacing of medium axles (ft): This control allows you to define the average longitudinal spacing in feet of medium axles. DARWin-ME provides a default value of 15 ft.

Average spacing of long axles (ft): This control allows you to define the average longitudinal spacing in feet of long axles. DARWin-ME provides a default value of 18 ft.

Percent of trucks with short axles: This control allows you to define the percentage of trucks in your design with short axles. DARWin-ME provides a default value of 33 percent.

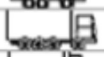
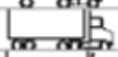
Percent of trucks with medium axles: This control allows you to define the percentage of trucks in your design with medium axles. DARWin-ME provides a default value of 33 percent.

Percent of trucks with long axles: This control allows you to define the percentage of trucks in your design with long axles. DARWin-ME provides a default value of 34 percent. Wheelbase is not required for new flexible pavements, AC overlay of existing flexible pavement and AC overlay of fractured JPCP/CRCP.

Wheelbase is not required for new flexible pavements, AC overlay of existing flexible pavement and AC overlay of fractured JPCP/CRCP.

5.3.2 Vehicle Class Distribution and Growth

Vehicle Class Distribution and Growth — Load Default Distribution

Vehicle Class	Distribution (%)	Growth Rate (%)	Growth Function	
Class 4	3.3	3	Linear	
Class 5	34	3	Linear	
Class 6	11.7	3	Linear	
Class 7	1.6	3	Linear	
Class 8	9.9	3	Linear	
Class 9	36.2	3	Linear	
Class 10	1	3	Linear	
Class 11	1.8	3	Linear	
Class 12	0.2	3	Linear	
Class 13	0.3	3	Linear	
Total	100			

Vehicle Class Distribution and Growth Table

You can either select the default set (Level 3) of vehicle class distribution for a Truck Traffic Classification (TTC) group that best describes the truck traffic mix of your project or directly enter project-specific or regional default values (Levels 1 and 2) in the "Distribution" column.

Load Default Distribution: This button opens the Truck Traffic Classification (TTC) Groups dialog to load default vehicle class distribution factors based on the group that best describes the truck traffic mix for your project.

Vehicle Class: This column displays the 10 classes (classes 4-13) used to classify types of trucks.

Distribution (%): This column allows you to define the percentage of each vehicle class designated for the selected TTC group. The column will run a total, which displays in the bottom row and should always equal 100.

Growth rate: This column allows you to define the common growth of truck volume based on the function of the truck class.

Growth function: This control allows you to select the traffic growth function to compute the growth or decay in truck traffic over time (forecasting truck traffic). Select one of the following options:

None: This option sets traffic volume to remain the same throughout the design life.

Linear: This option allows traffic volume to increase by constant percentage of the base year traffic across each truck class growth to happen at the defined rate.

Compound: This option allows traffic volume to increase by constant percentage of the preceding year traffic across each truck class.

Right-Click Menu Options

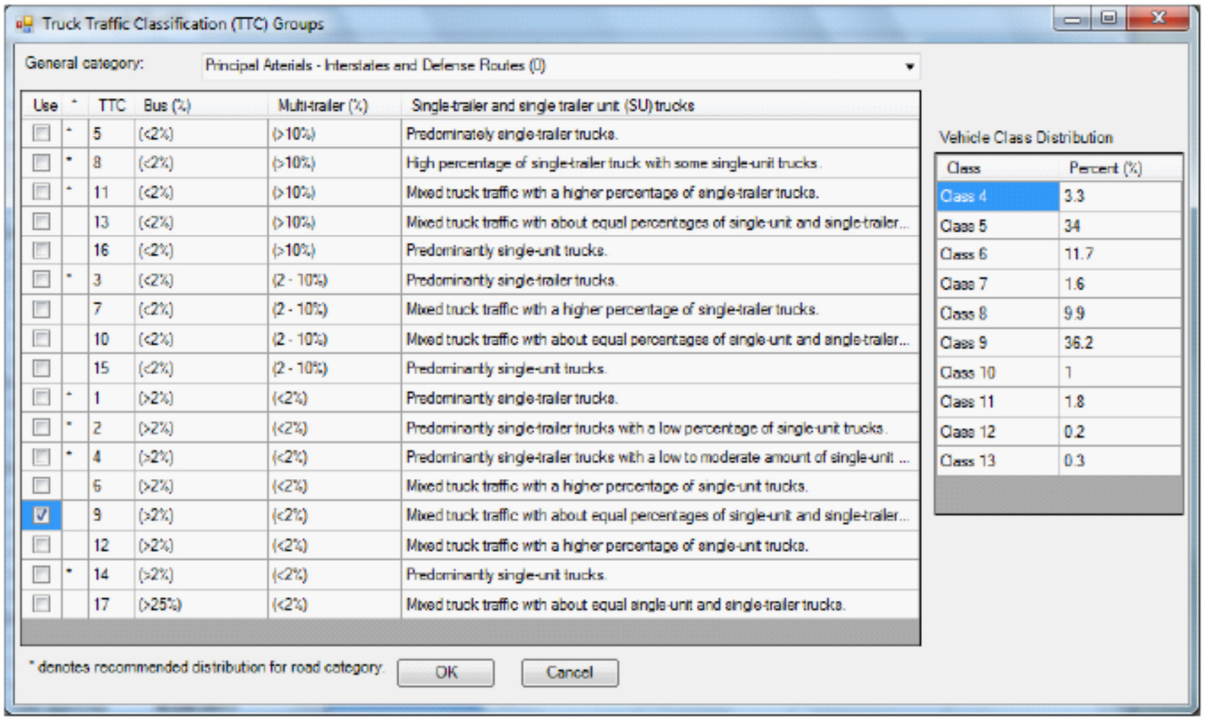
Right-click on a cell in the table to access the following functionality:
Copy: This menu item copies the selected value.
Paste: This menu item pastes the copied value.
Save to Database: This menu item saves the current table data to the database.
Get from Database: This menu item retrieves database data to overwrite any information in the current table.

Truck Traffic Classification (TTC) Groups

This dialog box provides default Vehicle Class Distribution that you can use in your design. TTC factors are developed based on default traffic patterns noted from LTPP data for different highway classes.

Way to Access this Interface

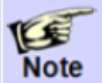
In the Traffic tab, click Load Default Distribution.



Truck Traffic Classification (TTC) Groups

General Category: This control allows you to select the highway functional class and updates the data marked with an asterisk in the TTC Groups Table accordingly. The asterisk denotes recommended distribution data for the selected highway functional class.

Use: Enable this control to select the associated data. Disable this control to prevent DARWin-ME from including the associated data.



When you select a set of data, the Vehicle Class Distribution Table will update based on the data.

****:*** This column denotes recommended distribution data for the selected highway functional class.

TTC: This column displays the truck traffic classification.

Bus (%): This column displays the percentage of buses on the roadway.

Multi-trailer (%): This column displays the percentage of trucks with multiple trailers on the roadway.

Single-trailer and single trailer unit (SU) trucks: This column describes the amount of single-trailer and single-trailer unit trucks on the roadway.

Vehicle Class Distribution Table: This table displays traffic distribution values (expressed as percentage by vehicle class) that pertain to the data selected in the TTC Table.

OK: This closes the dialog and saves your changes.

Cancel: This closes the dialog without saving any changes.

5.3.3 Monthly Adjustment

Monthly Adjustment — Import Monthly Adjustmen

Month	Class 4	Class 5	Class 6	Class 7	Class 8	Class 9	Class 10	Class 11	Class 12	Class 13
January	1	1	1	1	1	1	1	1	1	1
February	1	1	1	1	1	1	1	1	1	1
March	1	1	1	1	1	1	1	1	1	1
April	1	1	1	1	1	1	1	1	1	1
May	1	1	1	1	1	1	1	1	1	1
June	1	1	1	1	1	1	1	1	1	1
July	1	1	1	1	1	1	1	1	1	1
August	1	1	1	1	1	1	1	1	1	1
Septem...	1	1	1	1	1	1	1	1	1	1
October	1	1	1	1	1	1	1	1	1	1
Novem...	1	1	1	1	1	1	1	1	1	1
Decem...	1	1	1	1	1	1	1	1	1	1

Monthly Adjustment Table

Import Monthly Adjustment: This button allows you to browse and import monthly traffic volume adjustment data in MEPDG (*.txt) format

Monthly Adjustment Table: This table allows you to distribute the truck traffic within each class throughout the year. Truck traffic monthly adjustment factors represent the proportion of the annual truck traffic for a given truck class that occurs in a specific month. In other words, the monthly distribution factor for a specific month is computed by dividing the monthly truck traffic for the given class for the month by the total truck traffic for that truck class for the entire year. The default values are 1.0 for each month assuming no seasonal variations in truck volume. You can override the defaults to enter project-specific values. The sum of monthly factors for all months (columnwise) for each vehicle class must equal 12. There are three ways to enter data in the table: enter data manually, retrieve data from the database, and import monthly traffic volume adjustment factors from the MEPDG (.txt) format.

Right-Click Menu Options

Right-click on a cell in the table to access the following functionality:

Copy: This menu item copies the selected value.

Paste: This menu item pastes the copied value.

Import Monthly Factors in MEPDG (.txt) Format: This menu item allows you to browse for a monthly factors file that was created in using MEPDG.

Save to Database: This menu item saves the current table data to the database.

Get from Database: This menu item retrieves database data to overwrite any information in the current table.

5.3.4 Axles per Truck

Axles Per Truck

Vehicle Class	Single	Tandem	Tridem	Quad
Class 4	1.62	0.39	0	0
Class 5	2	0	0	0
Class 6	1.02	0.99	0	0
Class 7	1	0.26	0.83	0
Class 8	2.38	0.67	0	0
Class 9	1.13	1.93	0	0
Class 10	1.19	1.09	0.89	0
Class 11	4.29	0.26	0.06	0
Class 12	3.52	1.14	0.06	0
Class 13	2.15	2.13	0.35	0

Axles Per Truck Table

Axles Per Truck Table: This table allows you to define the average number of axles for each truck class (classes 4 to 13) for each axle type (single, tandem, tridem, and quad). You can override the defaults populated in the table to enter project-specific values. There are two ways to enter data in the table: enter data manually or retrieve data from the database.

Right-Click Menu Options

Right-click on a cell in the table to access the following functionality:

Copy: This menu item copies the selected value.

Paste: This menu item pastes the copied value.

Save to Database: This menu item saves the current table data to the database.

Get from Database: This menu item retrieves database data to overwrite any information in the current table.

5.3.5 Hourly Adjustment [Not required for new Flexible design or HMA Overlay]

Hourly Adjustment

Time of Day	Percentage
1:00 am	2.3
2:00 am	2.3
3:00 am	2.3
4:00 am	2.3
5:00 am	2.3
6:00 am	5
7:00 am	5
8:00 am	5
9:00 am	5
10:00 am	5.9
11:00 am	5.9
12:00 pm	5.9
1:00 pm	5.9
2:00 pm	5.9
3:00 pm	5.9
4:00 pm	4.6
5:00 pm	4.6
6:00 pm	4.6
7:00 pm	4.6
8:00 pm	3.1
9:00 pm	3.1
10:00 pm	3.1
11:00 pm	3.1
Total	100.0

Hourly Adjustment

Hourly Adjustment Table: This table allows you to define the hourly distribution factors, as the term describes, is the fraction (in percentage) of truck traffic traveling in a given hour relative to the 24-hour period. It is calculated from hourly AVC/WIM or vehicle count data measured over time by dividing the average annual truck traffic within a particular hour by the AADTT. The hourly adjustment factors are constant over time and between truck classes. The sum of the 24-hourly distribution factors should equal 100. You can override the defaults populated in the table to enter project specific values.

Note

Hourly adjustment is not required, and therefore, not displayed for new flexible pavements, AC overlay of existing flexible pavement and AC overlay of fractured JPCP/CRCP.

Right-Click Menu Options

Right-click on a cell in the table to access the following functionality:

Copy: This menu item copies the selected value.

Paste: This menu item pastes the copied value.

Save to Database: This menu item saves the current table data to the database.

Get from Database: This menu item retrieves database data to overwrite any information in the current table.

5.3.6 Axle Load Distribution

These tabs allow you to define the axle load distribution factors, which simply represent the percentage of the total axle applications within each load interval for a specific axle type (single, tandem, tridem, and quad) and vehicle class (classes 4 through 13). The following lists the load intervals for each axle type:

Single Axle Load Distributions: 3,000 lb to 40,000 lb at 1,000-lb intervals

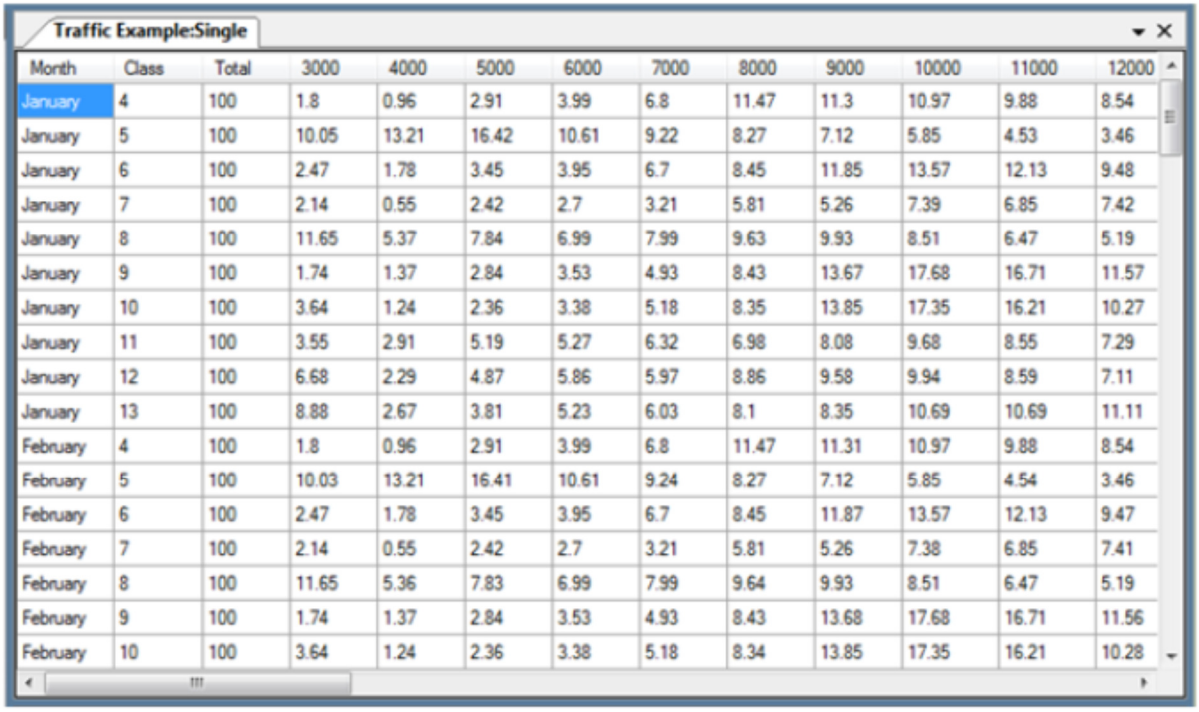
Tandem Axle Load Distributions: 6,000 lb to 80,000 lb at 2,000-lb intervals

Tridem and Quad Axle Load Distributions: 12,000 lb to 102,000 lb at 3,000-lb intervals

Way to Access this Interface

In the Explorer tab, expand the Traffic node and double-click an Axle Distribution node.

Single Axle Load Distribution



Month	Class	Total	3000	4000	5000	6000	7000	8000	9000	10000	11000	12000
January	4	100	1.8	0.96	2.91	3.99	6.8	11.47	11.3	10.97	9.88	8.54
January	5	100	10.05	13.21	16.42	10.61	9.22	8.27	7.12	5.85	4.53	3.46
January	6	100	2.47	1.78	3.45	3.95	6.7	8.45	11.85	13.57	12.13	9.48
January	7	100	2.14	0.55	2.42	2.7	3.21	5.81	5.26	7.39	6.85	7.42
January	8	100	11.65	5.37	7.84	6.99	7.99	9.63	9.93	8.51	6.47	5.19
January	9	100	1.74	1.37	2.84	3.53	4.93	8.43	13.67	17.68	16.71	11.57
January	10	100	3.64	1.24	2.36	3.38	5.18	8.35	13.85	17.35	16.21	10.27
January	11	100	3.55	2.91	5.19	5.27	6.32	6.98	8.08	9.68	8.55	7.29
January	12	100	6.68	2.29	4.87	5.86	5.97	8.86	9.58	9.94	8.59	7.11
January	13	100	8.88	2.67	3.81	5.23	6.03	8.1	8.35	10.69	10.69	11.11
February	4	100	1.8	0.96	2.91	3.99	6.8	11.47	11.31	10.97	9.88	8.54
February	5	100	10.03	13.21	16.41	10.61	9.24	8.27	7.12	5.85	4.54	3.46
February	6	100	2.47	1.78	3.45	3.95	6.7	8.45	11.87	13.57	12.13	9.47
February	7	100	2.14	0.55	2.42	2.7	3.21	5.81	5.26	7.38	6.85	7.41
February	8	100	11.65	5.36	7.83	6.99	7.99	9.64	9.93	8.51	6.47	5.19
February	9	100	1.74	1.37	2.84	3.53	4.93	8.43	13.68	17.68	16.71	11.56
February	10	100	3.64	1.24	2.36	3.38	5.18	8.34	13.85	17.35	16.21	10.28

Axle Distribution Table: This table allows you to define the percentage of the total axle applications within each load interval for a specific axle type (single, tandem, tridem, and quad) and vehicle class (classes 4 through 13). There are four ways to enter data in the table: enter data manually, import an axle load file in MEPDG (.alf) format, retrieve the data from the DARWin-ME database, or import third party data in an XML format.
The recommended method is to create the table in Excel and copy and paste the values into Darwin ME Axle Load Distribution tables.

Right-Click Menu Options

Right-click on an Axle Distribution node in the Explorer tab to access the following functionality:

Copy: This menu item copies the selected value.

Paste: This menu item pastes the copied value.

Save to Database: This menu item saves the current table data to the database.

Get from Database: This menu item retrieves database data to overwrite any information in the current table.

Import XML: This menu item retrieves axle load distribution factors data from an XML file to overwrite any information in the current table.

Export XML: This menu item saves the axle load distribution factors data to an XML file.
Import ALF File: This menu item retrieves axle load distribution factors data from a MEPDG (.alf) format to overwrite any information in the current table.

You can retrieve/save traffic data (excluding axle load distribution factors) as XML files using Import/Export menu items by right-clicking the traffic node under the Projects treeview in the Explorer pane. To retrieve/save axle load distribution factors, you can use any of the axle type nodes that appear below the traffic node.

5.4 Climate

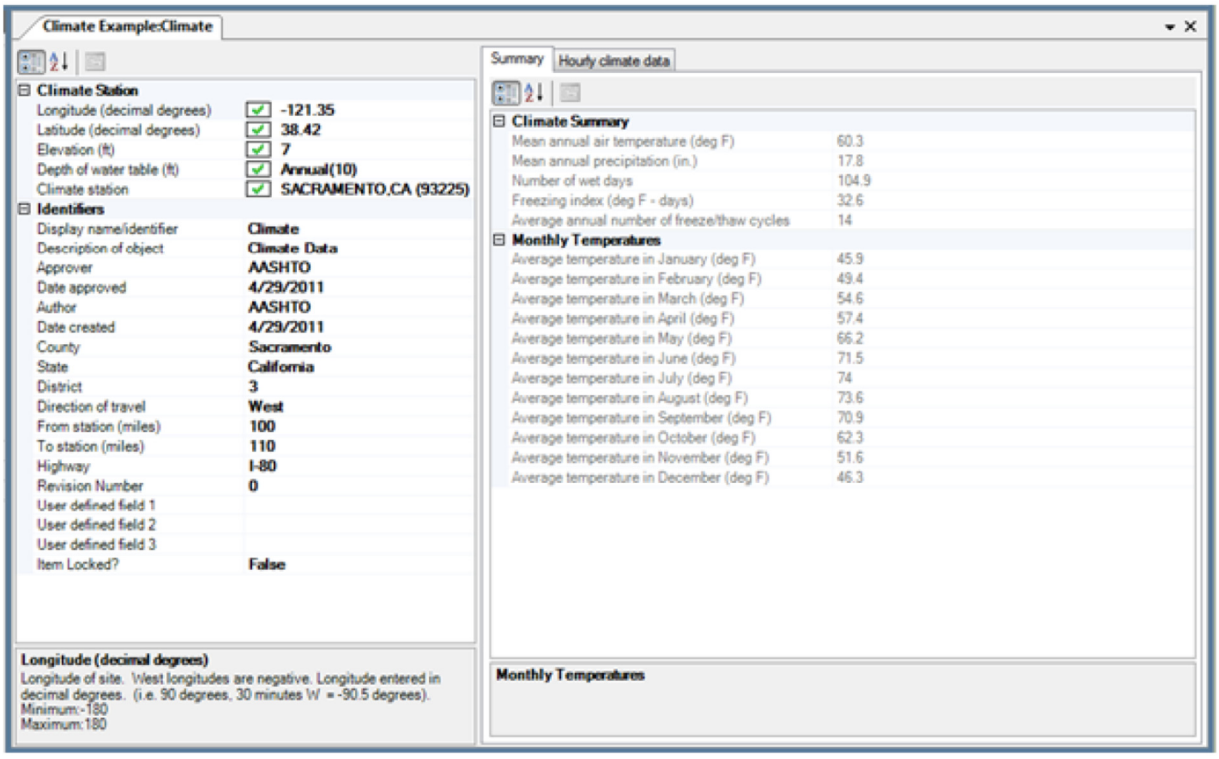
Environmental conditions have a significant effect on the performance of both flexible and rigid pavements. Factors such as precipitation, temperature, freeze-thaw cycles, and depth to water table affect temperature and moisture contents of unbound materials, which, in turn, directly affect the load-carrying capacity of the pavement. Further, the temperature levels have a direct bearing on the stiffness in the case of asphalt materials, and temperature gradients induce stresses and deformations in the case of PCC layers.

DARWin-ME considers the affects of the environmental factors. Therefore, DARWin-ME models diurnal and seasonal fluctuations in the moisture and temperature profiles in the pavement structure brought about by changes in ground water table, precipitation/infiltration, freeze-thaw cycles, and other external factors. This dialog allows you to define the effects of climatic variables on pavement responses and pavement performance.

Way to Access this Interface

1. In the Explorer tab, expand Project tree and double-click on the Climate node.
2. Another way to access is to click on the white area (left of the tire) in the *Pavement Structure Definition* area.

5.4.1 Climate Station



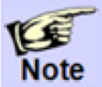
Climate Tab

Populating the Inputs in this Interface

Climate Station

Longitude (decimal.degrees): This control allows you to define the longitude of the project site. Enter west longitudes using negative values. For example, if you wanted to define the site at 47 degrees, 30 minutes W, you would enter *-47.30* in this control.

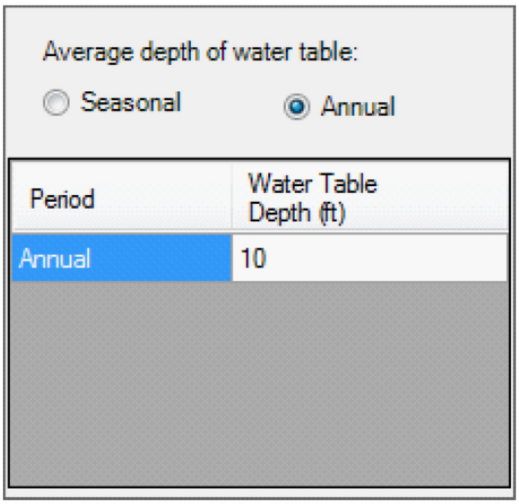
Latitude (decimal.degrees): This control allows you to define the latitude of the project site. Enter south latitudes using negative values. For example, if you wanted to define the site at 69 degrees, 30 minutes S, you would enter *-69.30* in this control.



The latitude and longitude of North American sites use North and West cardinal directions, respectively. For example, the geographic coordinates of Wichita, Kansas are 37°41' N and 97°20' W. You would define the latitude and longitude of this location as 37.41 and -97.20, respectively.

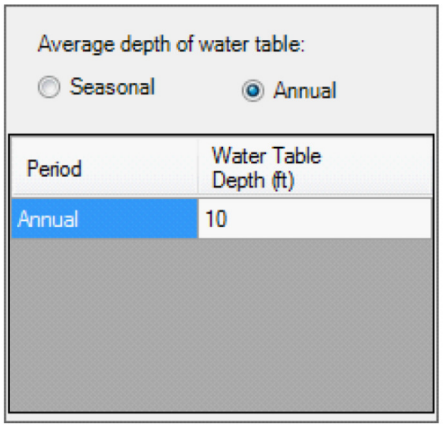
Elevation (ft): This control allows you to define the elevation of the project site, which determines the lapse rate that temperatures change due to change in elevation. You can enter a negative value for a project site located below the Earth's mean sea level.

Depth of water table (ft): This control opens the Water Table dialog, which allows you to define average depth of ground water table on an annual or seasonal basis. The depth is defined from the top surface of the subgrade to the ground water table. Clicking this control displays a table for entering depth values. The view of this information differs, depending on whether the Seasonal or Annual control is selected.



Depth of Water Table

Annual: Mutually exclusive with the Seasonal control. When this control is selected, the Depth of Water Table field in the Climate Tab displays the Annual designation and its associated water table depth, in feet. DARWin-ME by default displays this control.

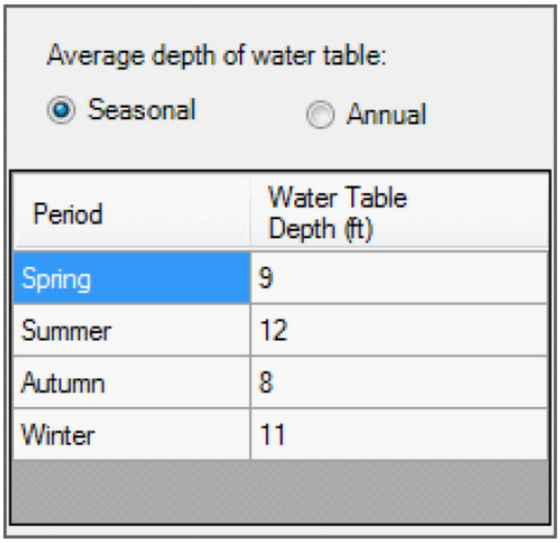


Annual Depth of Water Table

Period: Annual (display-only)

Water Table Depth (ft): Enter the annual average water table depth value.

Seasonal: Mutually exclusive with the Annual control. When this control is selected, the Depth of Water Table field in the Climate Tab displays four Seasonal designations and the water table value for each season. Selecting the "Seasonal" control activates the following table:



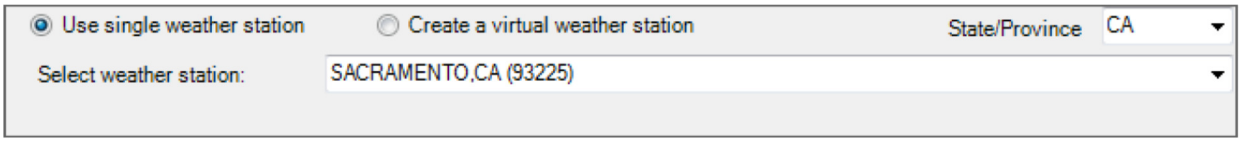
Seasonal Depth of Water Table

Period: The contents of this column are display-only are as follows:

- Spring (*Seasonal)* – March to May
- Summer (*Seasonal)* – June to August
- Autumn (*Seasonal)* – September to November
- Winter (*Seasonal)* – December to February
-

Water Table Depth (ft): Enter the average water table depth values for each season.

Climate Station: This control opens the Climate Station dialog, which allows you to select a single weather station or create a virtual weather station. Click the Climate Station name to display the following drop-down menu:



Use single weather station: This control allows you to select an existing weather station from the Select weather station control. DARWin-ME by default activates this control.

State/Province: This control allows you to select the state or province in which your weather station is located.

Select weather station: This control allows you to define the weather station that will provide climate data for the project. You can also add new stations to this list by adding new hourly climate data files to the \AASHTO\Darwin ME\HCD folder and the station information to the station.dat file located in the \AASHTO\Darwin ME\Defaults folder.

Create a virtual weather station: This control allows you to select several weather stations from the Weather Station Table. DARWin-ME creates the virtual weather station using climate data from the selected stations. Selecting the Create a virtual weather station" option activities the following table:

Use single weather station Create a virtual weather station

	Distance (miles)	City	State	Latitude (decimal degrees)	Longitude (decimal degrees)	Elevation (ft)	Description	firstMonth	lastMonth
☑	0	SACRAMENTO	CA	38.42	-121.35	7	SACRAMENTO INTL AIRPO...	5/1998	2/2006
☑	13.8	SACRAMENTO	CA	38.31	-121.29	12	SACRAMENTO EXECUTIVE...	4/1998	2/2006
☑	30.1	VACAVILLE	CA	38.23	-121.58	34	NUT TREE AIRPORT	4/1998	2/2006
☑	41.8	MARYSVILLE	CA	39.06	-121	22	YUBA COUNTRY AIRPORT	10/2000	2/2006
☑	50.5	NAPA	CA	38.13	-122.17	14	NAPA COUNTY AIRPORT	5/1998	2/2006
☑	54.1	OROVILLE	CA	39.29	-121.37	59	OROVILLE MUNICIPAL AIR...	6/1998	2/2006

Creating a Virtual Weather Station

Weather Station Table: This table allows you to define the weather stations that will be combined and averaged to create data for a virtual weather station.

Select weather stations based on the following information:
Distance (miles): This column displays the distance in miles between the weather station and associated city.

City: This column displays the city associated with the weather station.

State: This column displays the state/province where the weather station is located.
Latitude (decimal degrees): This column displays the latitude of the weather station.

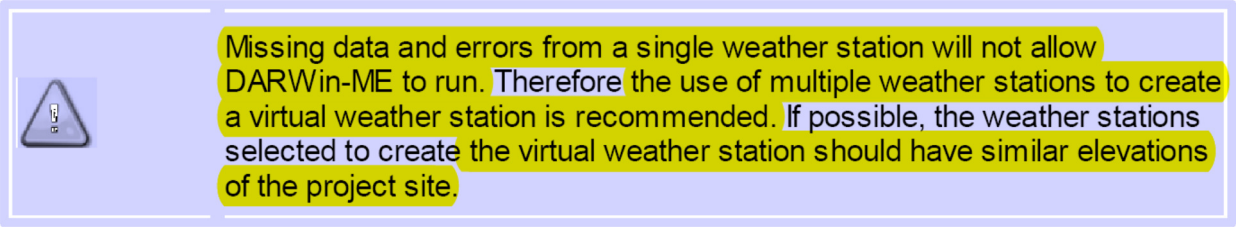
Longitude (decimal degrees): This column displays the longitude of the weather station.

Elevation (ft.): This column displays the elevation of the weather station.

Description: This column displays the name of the weather station.

First month/year: This column displays the month and year that data is first available for the weather station.

Last month/year: This column displays the month and year that data is last available for the weather station.



Missing data and errors from a single weather station will not allow DARWin-ME to run. Therefore the use of multiple weather stations to create a virtual weather station is recommended. If possible, the weather stations selected to create the virtual weather station should have similar elevations of the project site.

Other ways to use Climate Data

DARWin-ME allows other ways to use climate data:

You can import a previously created climate data file in MEPDG (*.ICM format) by clicking the “Import ICM” button on the “Hourly climate data” tab. Make sure that “Import MEPDG file formats” in the “Options” tree of the Explorer pane is set as TRUE.

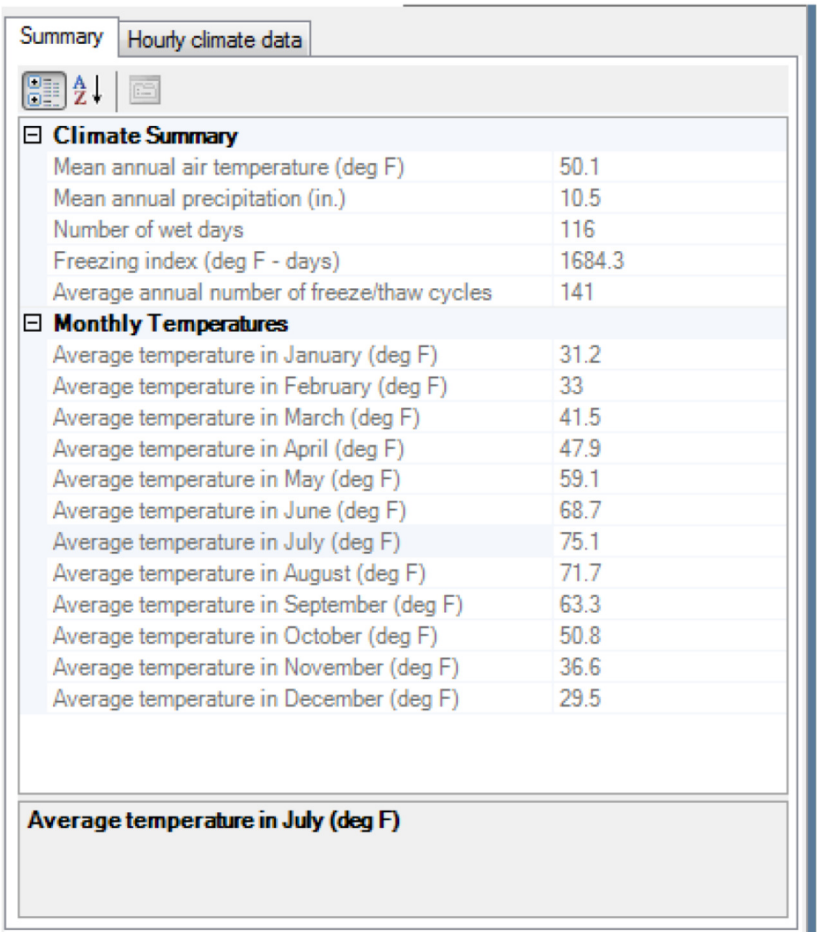
You can import climate data in XML format from an external source or folder using the Import option on the menu. You can also import climate data in XML format from an agency database by using the “Get from Database” option. You can access this option by right clicking the climate node in the Explorer pane under the Projects treeview.

5.4.2 Summary Tab

This tab allows you to view the summary of input climate data for your selected weather station.

Climate Summary: This control allows you to view the summary of temperature and precipitation data for your selected weather station.

Monthly Temperatures: This control allows you to view the mean temperature for each month for your selected weather station.



Climate Summary Tab

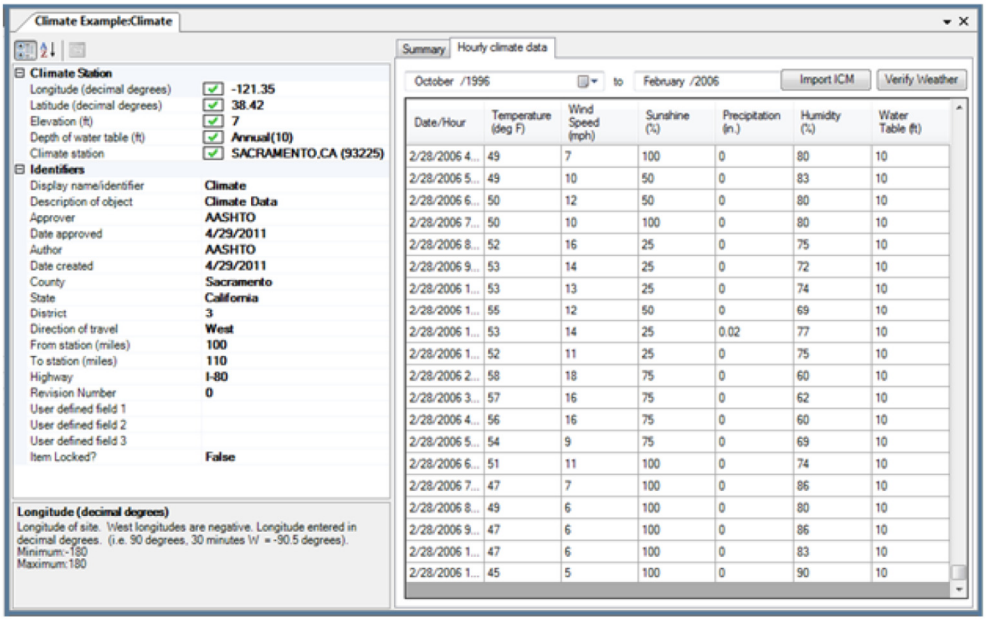
5.4.3 Hourly Climate Data Tab

This tab tabulates the hourly climate records for your selected weather station. This tab also allows you to view the available hourly records for the start and end dates you select and verify if these records meet the minimum quality requirements.

Start Date: This control allows you to define beginning date of the date range for which you want weather data.

End Date: This control allows you define the end date of the date range for which you want weather data.

Verify Weather: This button verifies the values you defined in the Weather Data Table.



Hourly Climate Data

Weather Data Table: This table allows you to define various aspects of climate for the selected date range. Define the following values:

Date/Hour: This column allows you to define the date and time associated with the climate information defined in the row.

Temperature: This column allows you to define the temperature associated with the date/hour and other climate information defined in the row.

Wind Speed: This column allows you to define the wind speed associated with the date/hour and other climate information defined in the row.

Sunshine: This column allows you to define the percentage of sunshine associated with the date/hour and other climate information defined in the row.

Precipitation: This column allows you to define the inches of precipitation associated with the date/hour and other climate information defined in the row.

Humidity: This column allows you to define the humidity percent associated with the date/hour and other climate information defined in the row.

Water Table: This column allows you to define the water table associated with the date/hour and other climate information defined in the row.

Right-click a cell to perform one of the following actions:

Copy: This menu item copies the value(s) in the highlighted cell(s).

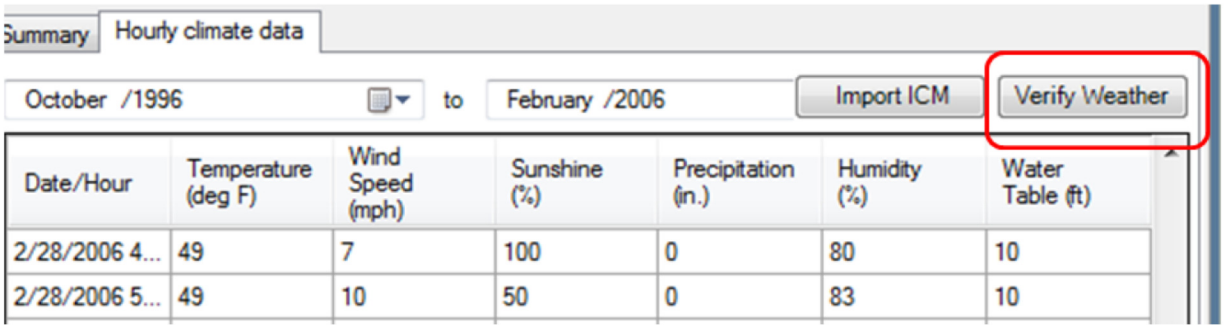
Paste Special: This menu item pastes sets of sparse data values.

Paste: This menu item pastes copied values into the highlighted cell(s).
Delete: This menu item deletes the value(s) in the highlighted cell(s).

Select the cell in the first row in the first column, then right-click in the cell and select the Paste Special menu item to use this feature.

5.4.4 Verify Weather

Click on the "Verify Weather" button located on the top right side of the Hourly Climate Data tab.



This control allows you to perform quality checks of climate data for the station you selected. Clicking the "Verify Weather" button allows DARWin-ME to check for the following:

- If the data value of an hourly record is within an acceptable range
- If the difference between the data values of two consecutive hourly records are within
- an acceptable range
- If there are any missing or blank data in a record

If an hourly record does not meet all the criteria mentioned above, the program displays an error or a warning message listed in the Error List Pane area of the program. Double-clicking the error message takes you to the hourly record of concern. You must correct the erroneous data value.