



# DARWin-ME

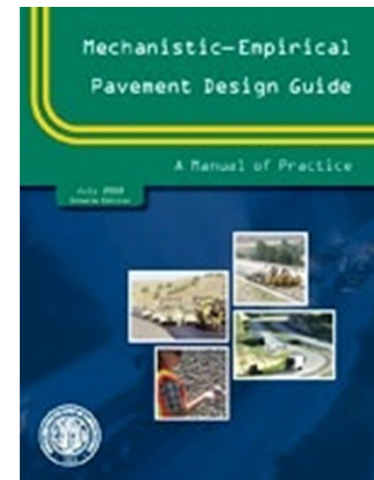
## Pavement Design Software

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Asphalt Program Manager –  
VDOT  
Pavement Evaluation 2010

# Background



- DARWin-ME supports AASHTO's Mechanistic Empirical Pavement Design Guide published in 2008
  - Work product of NCHRP projects I-37A and I-40D
  - Nearly a decade of development
  - Base software: Freeware, available through the Transportation Research Board
- DARWin-ME covers 17 pavement design situations
  - New concrete and asphalt pavements and various types of asphalt and concrete overlays

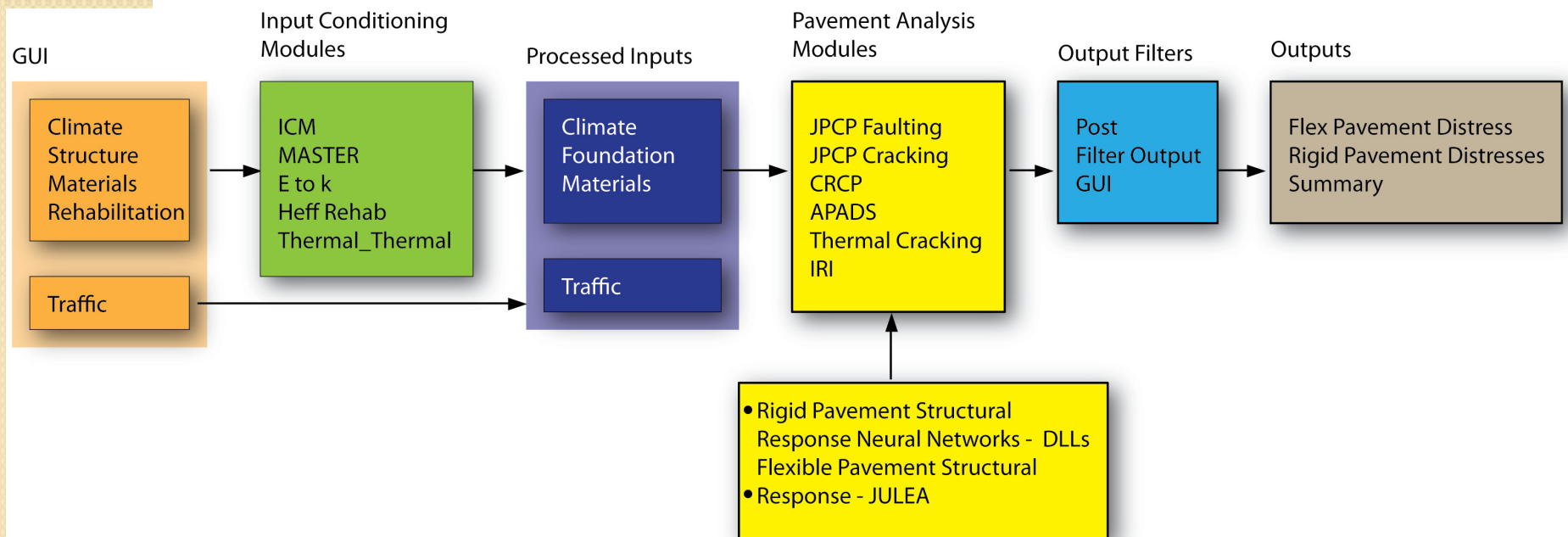


# MEPDG Base

## Software Overview



- Designed to operate on Microsoft Windows® OS
- Majority of development used MFC C++ and IDE
  - Several analysis modules written in Fortran90
- Over 20 engineering modules



# DARWin-ME Inputs/Outputs

DARWin-ME

## System Inputs

- Project information
- Design information
- Materials & structure data
- Traffic data
- Climate data
- Rehabilitation information
- Initialization data

Interfaces for data import from  
MEPDG, third party software,  
external files

## System Outputs

- Input summary
- Climate summary
- Design pass/fail checks
- Material properties  
summary
- Pavement distress  
summary/charts

XML Input Files  
XML Output Files  
PDF, Excel Reports

# DARWin-ME Goal



*Provide the transportation community with a production level, state-of-the-art software tool for the design of new and rehabilitated pavement structures consistent with AASHTO's MEPDG*

# DARWin-ME — Planned Improvements



- Redesign GUI using .NET 3.5 framework in C#
  - User configurable screens
  - Agency defined data libraries
  - Input control at the central office
  - Expansion capabilities for new analysis engines
  - Improved display on large or multiple monitors
  - Improved error handling stability and error display
  - Multiple project editing
  - Handicap accessibility options
  - Improved reporting (stability, speed and quality)
  - Utilities for importing previous version files, third party data
  - Multiple language extensibility

# DARWin-ME — Planned Improvements



- **Efficiency**
  - Increase software speed
  - Automated thickness optimization
  - Batch mode
  - Sensitivity
- **Functionality**
  - SI version
  - Traffic caps
- **Stability**
  - Correct reported bugs (Task Force directed)
  - Improve error handling

# DARWin-ME Task Force



- Judy Corley-Lay (Chair), North Carolina
- Marta Juhasz, Alberta, Canada
- Jay Goldbaum, Colorado
- Dave Andrews, Indiana
- Williams F. Barstis, Mississippi
- J.F. Bledsoe, Missouri
- Julian Bendana, New York
- Madgy Mikhail, Texas
- Trenton Clark, Virginia

Interested Agency Liaisons: Federal Highway Administration  
Transportation Association of Canada



# Current Project Status



- Project solicitation issued in July 2008
- Received commitments from 20 member agencies and the FHWA.
- Sole Source Contract to ARA
  - Correct known bugs and those discovered during development
  - Incorporate enhancements outlined in solicitation
- Alpha testing underway and to be completed October 30<sup>th</sup>
- Beta testing by three agencies in November and December
- Software Release March 2011

# Enterprise Software

DARWin-ME

DARWinME Version 1.0 Login Screen

## DARWin-ME

**Database/Enterprise Login**

Open DARWin-ME without database connection

Login

Password

Database  ...

**About DARWin-ME**

AASHTOWare mechanistic-empirical pavement design software.  
Copyright: AASHTOWare 2010  
License key: (unlicensed)  
Version 1.0 Build 0.0.44 Date: 10/18/2010

Reset DarwinME to default screen position

OK Cancel

# Opening Screen



AASHTO DARWin-ME Version 1.0 Build 0.0.44 (Date: 10/18/2010)

Menu: Recent Files, New, Open, Save As, Save, Close, Exit, Run, Import, Export, Undo, Redo

**GENERAL INFO**

General Information

Type of Design: New Pavement  
Pavement type: Jointed Plain Concrete Pavement(JPCP)  
Design life (years): 20  
Pavement construction: June 2011  
Traffic opening: September 2011

**ANALYSIS PARAMETERS**

Parameter	Limit	Reliability
Initial IRI (m/km)	0.39	
Terminal IRI (m/km)	2.7	90
JPCP transverse cracking (percent slabs)	15	90
Mean joint faulting (mm)	3	90

**EXPLORER WINDOW**

- Projects
  - Project1
    - Traffic
    - Climate
    - JPCP Design Properties
    - Pavement Material Layers
    - Analysis Calibration Factors
      - Sensitivity
      - Optimization
      - Output Report
    - Multiple Project Summary
    - Tools
      - Advanced Search
      - Calculator
      - Units
      - DARWin-ME calibration factors

**PAVEMENT STRUCTURE**

- Click here to edit Layer 1 PCC : JPCP
- Click here to edit Layer 2 Non-stabilized Base : Crushed stone
- Click here to edit Layer 3 Non-stabilized Subgrade : Highly fractured and weathered
- Click here to edit Layer 4 Bedrock : Highly fractured and weathered

**LAYER PROPERTIES**

Layer: Layer 2 Non-stabilized Base:Crushed stone (A-1-a) Output Report

Resilient modulus (MPa)	207
<b>Sieve</b>	
Gradation & other engineering properties	A-1-a
Soil Water Characteristic Curve	User defined
Degree of saturation	0
<b>Identifiers</b>	
Display name/identifier	Crushed stone
Description of object	Default material
Author	AASHTO
Date created	1/1/2011
Approver	
Date approved	1/1/2011
State	
Display name/identifier	
Display name of object/material/project for outputs and graphical interface	

**ERROR LIST**

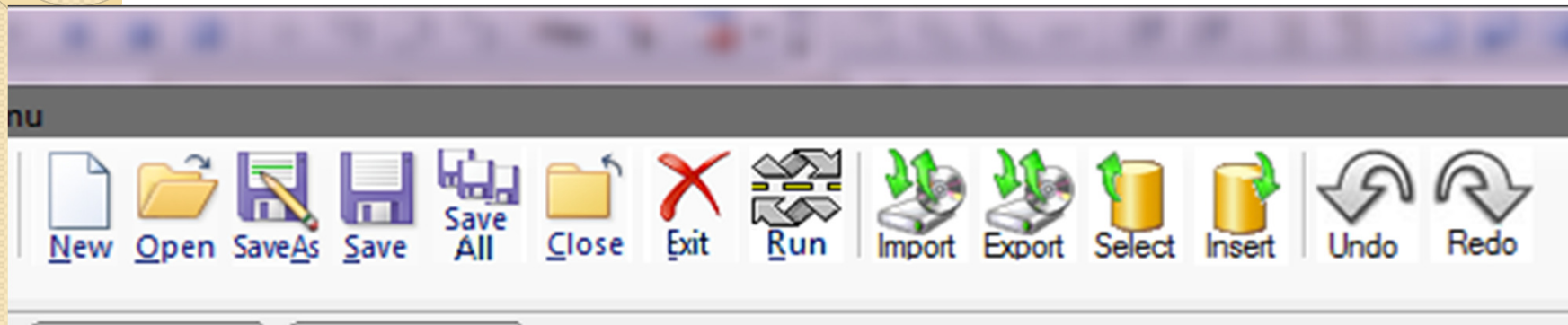
Project	Object	Description
---------	--------	-------------

**RUN PROGRESS**

Task	Progress (%)
A101-F	%
Running Integrated Climate	100
Extending climate solution	100
Calculating modulus subgrade	100
Preparing PCC Inputs	100
Preparing thermal gradient	?
Calculating Faulting	0
Calculating Cracking	0
Calculating JPCP IRI	0

DARWin-ME Output Window | Error List | Compare

# DARWin-ME Toolbar



# Project Creation

DARWin-ME

Project 102-F

General Information

Analysis type: New Pavement

Pavement type: Jointed Plain Concrete Pavement (JPCP)

Design life (years): 7

Base construction: August 2006

Pavement construction: September 2006

Traffic opening: October 2006

Use special traffic loading for flexible analyses.

[Click here to edit PCC-PCC over stabilized base](#)  
[Click here to edit Stabilized Base](#)  
[Click here to edit Subgrade](#)  
[Click here to edit Subgrade](#)

Use	Analysis	Limit	Reliability
<input checked="" type="checkbox"/>	initialIRI	63	
<input checked="" type="checkbox"/>	terminalIRI	172	90
<input checked="" type="checkbox"/>	crackingPCC	15	90
<input checked="" type="checkbox"/>	faulting	0.12	90

Layer: Layer CSB:

**ChemicallyStabilized**  
 Layer thickness(in):  4  
 Unit weight (pcf):  150  
 Poisson's ratio:  0.2

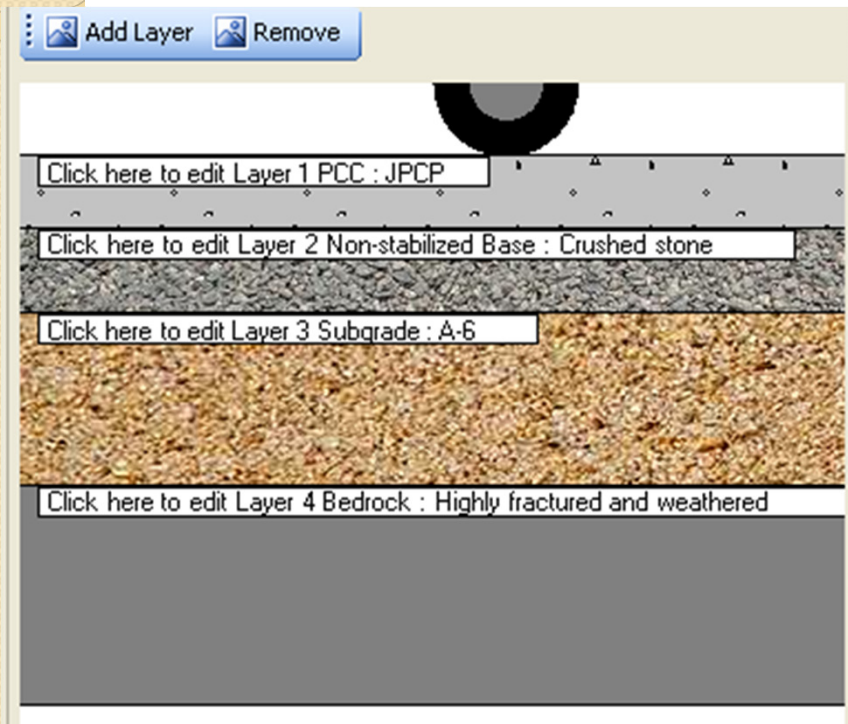
**Strength**  
 Elastic/resilient modulus (psi):  1000000

**Thermal**  
 Thermal conductivity (BTU/hr-ft-F):  1.25  
 Heat capacity (BTU/lb-F):  0.28

**Identifiers**

**Layer thickness(in):**  
 Thickness of the chemically stabilized base  
 Minimum:4  
 Maximum:24

# Pavement Structure



- Layers can be added/removed using visual aid
- Layer labels editable
- Layer represented graphically
- Layering check to disallow illegal entries

# Material Properties – AC



Layer:

**Asphalt**

Thickness (mm)	<input checked="" type="checkbox"/> 250
Unit weight (kg/m <sup>3</sup> )	<input checked="" type="checkbox"/> 2300
<input checked="" type="checkbox"/> Poisson's ratio	0.35

**Dynamic Modulus**

Dynamic modulus	Analysis level:3
-----------------	------------------

**Asphalt Binder**

Asphalt binder	Conventional Viscosity:AC 20
----------------	------------------------------

**General**

Reference temperature (deg C)	<input checked="" type="checkbox"/> 21.1
Effective binder content (%)	<input checked="" type="checkbox"/> 11.6
Air voids (%)	<input checked="" type="checkbox"/> 7
Thermal conductivity (watt/meter-kelvin)	<input checked="" type="checkbox"/> 1.16
Heat capacity (joule/kg-kelvin)	<input checked="" type="checkbox"/> 963

**Identifiers**

Display name/identifier	Default asphalt concrete
Description of object	
Author	
Date created	9/16/2010
Approver	





# Material Properties – Non-Stabilized Materials & Subgrade



Layer: Layer 3 Non-stabilized Base:A-2-7

Output Report

## Unbound

Layer thickness (mm)	<input type="checkbox"/> Semi-infinite
Poisson's ratio	<input checked="" type="checkbox"/> 0.35
Coefficient of lateral earth pressure (k0)	<input checked="" type="checkbox"/> 0.5

## Modulus

Resilient modulus (MPa)	166
-------------------------	-----

## Sieve

Gradation & other engineering properties	A-2-7
Soil Water Characteristic Curve	User defined
Degree of saturation	0

## Identifiers

Display name/identifier	A-2-7
Description of object	Default material
Author	AASHTO
Date created	1/1/2011
Approver	
Date approved	1/1/2011
State	
District	

# Material Properties – Stabilized Layer



Layer:

General	
Layer thickness (mm)	<input checked="" type="checkbox"/> 300
Unit weight (kg/m <sup>3</sup> )	<input checked="" type="checkbox"/> 2402.8
Poisson's ratio	<input checked="" type="checkbox"/> 0.2
Strength	
Elastic/resilient modulus (MPa)	<input checked="" type="checkbox"/> 13790
Thermal	
Thermal conductivity (watt/meter-kelvin)	<input checked="" type="checkbox"/> 2.16
Heat capacity (joule/kg-kelvin)	<input checked="" type="checkbox"/> 1172.3
Identifiers	
Display name/identifier	Cement stabilized
Description of object	Default material
Author	AASHTO
Date created	1/1/2011
Approver	
Date approved	1/1/2011
State	
District	
County	
Highway	
Direction of travel	
From station (km)	
To station (km)	
Province	

# Material Properties for Rehab Design – Backcalculation Inputs



Project1 **Project1:Back Calculation**

Create Project from Back Calculation ~~X~~ Delete New Back Calculation

**FWD**

Backcalculation data by layer **0 back calculation layers**

Location **Station 100**

	Modulus(psi)	Unit Weight(pcf)	Poisson's Ratio	Thickness(in)
	4000000	150	0.2	8.1
	25000	120	0.35	12
▶	15000	110	0.35	
*				

**Identifiers**

- Display name/identifier
- Description of object
- Author
- Date created
- Approver
- Date approved
- State
- District
- County
- Highway
- Direction of travel
- From station (miles)
- To station (miles)
- Province
- User defined field 2
- User defined field 3
- Revision Number

# Backcalculation

DARWin-ME

AASHTO DARWin-ME Version 1.0 Build 0.0.44 (Date: 10/18/2010)

Menu

Recent Files



DARWin-ME Explorer Wind...

- Projects
  - Project1
    - Traffic
    - FoundationSupport
    - JPCP Design Propertie
    - Thermal Cracking
    - HMA Design Propertie
    - JPCPR rehabilitation
    - Climate
    - Pavement Material La
      - Layer 1 FLEXIBLE
      - Layer 2 PCC : JPC
      - Layer 3 Non-stabi
      - Layer 4 Subgrade
    - Analysis Calibration Fa
      - New Flexible
      - Rehabilitation Flex
      - New Rigid
      - Restore Rigid
      - Bonded Rigid
      - Unbonded Rigid
    - Sensitivity
    - Optimization
    - Output Report
    - Backcalculation
      - Station 100
      - Station 120
  - Multiple Project Summary
  - Tools
  - DARWin-ME calibration factor

Project1 **Project1:Back Calculation**

Create Project from Back Calculation X Delete + New Back Calculation

**FWD**

Backcalculation data by layer 3 back calculation layers

Location **Station 120**

Frequency (Hz)	<input checked="" type="checkbox"/> 10
Surface Temperature (deg F)	<input checked="" type="checkbox"/> 76
Air Temperature (deg F)	<input checked="" type="checkbox"/> 68
Are backcalculation results used ?	True
Is average value of modulus used ?	False

**Identifiers**

Display name/identifier	Station 120
Description of object	
Author	
Date created	10/18/2010
Approver	
Date approved	10/18/2010
State	
District	
County	
Highway	
Direction of travel	
From station (miles)	
To station (miles)	
Province	
User defined field 2	
User defined field 3	
Revision Number	0

**Display name/identifier**

# National Defaults

DARWin-ME

FormLayerSelection

Insert after layer: Subgrade

Layer type: Non-stabilized Base (4)

Layer thickness(in): 12  Check if this is last layer.

Material Selection

Default values  Select from database   Select from file

Default\_A-1-a.xml  
Default\_A-1-b.xml  
Default\_A-2-4.xml  
Default\_A-2-5.xml  
Default\_A-2-6.xml  
Default\_A-2-7.xml  
Default\_A-3.xml  
Example Base.xml

<b>Unbound</b>	
k0	<input checked="" type="checkbox"/> 0.5
poisson	<input checked="" type="checkbox"/> 0.35
thickness	<input checked="" type="checkbox"/> 12
<b>Modulus</b>	
modulus	40000
<b>Sieve</b>	
Degree Saturation	0
Sieve	P200(3.0) P40(0.0) P4(20)D10(0.000) D20(0.075) D40(0.425) D75(2.0) D150(0.425) D300(0.425)
swcc	af(11.1). bf(1.83). cf(0.51). hr(361)
<b>Identifiers</b>	
Approver	
Author	
County	
Date approved	
Date created	
Description of object	
Direction of travel	
Display name/identifier	Default_A-1-a
District	
From station (miles)	
Highway	
Province	
revisionNumber	0
State	
To station (miles)	
User defined field 2	
User defined field 3	

Identifiers

OK Cancel

# Materials from Enterprise Database



FormLayerSelection

Insert after layer: Subgrade

Layer type: Non-stabilized Base (4)

Layer thickness(in): 12  Check if this is last layer.

Material Selection

Default values  Select from database   Select from file

Default\_A-1-a.xml  
 Default\_A-1-b.xml  
 Default\_A-2-4.xml  
 Default\_A-2-5.xml  
 Default\_A-2-6.xml  
 Default\_A-2-7.xml  
 Default\_A-3.xml  
 Example\_Base.xml

<b>Unbound</b>	
k0	<input checked="" type="checkbox"/> 0.5
poisson	<input checked="" type="checkbox"/> 0.35
thickness	<input checked="" type="checkbox"/> 12
<b>Modulus</b>	
modulus	40000
<b>Sieve</b>	
Degree Saturation	0
Sieve	P200(3.0) P40(0.0) P4(20)D10(0.000) D20(0.000) D60(8.00
swcc	af(11.1), bf(1.83), cf(0.51), hr(361 )
<b>Identifiers</b>	
Approver	
Author	
County	
Date approved	
Date created	
Description of object	
Direction of travel	
Display name/identifier	Default_A-1-a
District	
From station (miles)	
Highway	
Province	
revisionNumber	0
State	
To station (miles)	
User defined field 2	
User defined field 3	

**Identifiers**

OK Cancel

# Traffic

DARWin-ME

Project1
Project1:Traffic
⌵

**AADTT**

Two-way AADTT  4001

Number of lanes  2

Percent trucks in design dir  50

Percent trucks in design lar  55

Operational speed (kmph)  55

**Axle Configuration**

Average axle width (m)  2.59

Dual tire spacing (mm)  305

Tire pressure (kPa)  827 *Warning: Value is*

Tandem axle spacing (m)  1.31

Tridem axle spacing (m)  1.25

Quad axle spacing (m)  1.25

**Lateral Wander**

Mean wheel location (mm)  457

Traffic wander standard de  254

Design lane width (m)  3.66

**Wheelbase**

Average spacing of short a  0.3 *Warning: Value is*

Average spacing of mediur  0.38 *Warning: Value is*

Average spacing of long ax  0.46 *Warning: Value is*

Percent trucks with short ax  33

Percent trucks with mediur  33

Percent trucks with long ax  34

**Identifiers**

Display name/identifier **Default Traffic**

**Number of lanes**

Number of lanes in design direction

Minimum: 1

Maximum: 6

HIGHWAY CAPACITY

TTCGrowth Load Default Growth

VehicleClass	PERCENT	GROWTH	GROWTH TYP
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

HourlyAdjustment

TOD	PERCENT
12:00 am	2.3
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

MonthlyAdjustment

Month	CLASS4	CLASS5	CLASS6	CLASS7	CLASS8	CLASS9	CLASS1
January	1.0	1.0	1.0	1.0	1.0	1.0	1.0
February	1.0	1.0	1.0	1.0	1.0	1.0	1.0
March	1.0	1.0	1.0	1.0	1.0	1.0	1.0
April	1.0	1.0	1.0	1.0	1.0	1.0	1.0
May	1.0	1.0	1.0	1.0	1.0	1.0	1.0

AxlesPerTruck

VehicleClass	SINGLE	TANDEM	TRIDEM	QUAD
Class 4	1.62	0.39	0	0
Class 5	2	0	0	0
Class 6	1.0	0.3	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

**TRAFFIC INPUTS**

**VEHICLE CLASS**

**MONTHLY ADJUSTMENT**


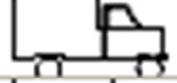



**HOURLY ADJUSTMENT**

**AXLES PER TRUCK**

# Traffic

DARWin-ME

TTCGrowth Highway Capacity Load Default Growth

VehicleClass	PERCENT	GROWTH	GROWTH TYP	
Class 4	3.3	3	Linear	
Class 5	3.4	3	Linear	
Class 6	11.7	3	Linear	
Class 7	1.6	3		
Class 8	9.9	3		
Class 9	36.2	3		
Class 10	1	3		
Class 11	1.8	3		
Class 12	0.2	3	Linear	
Class 13	0.3	3	Linear	

Traffic Growth Rate for Each Truck Class

Linear  
None  
Linear  
Compound



# Highway Capacity Limits



**Highway capacity limits**

Annual average daily traffic excluding trucks (i.e. cars):

Non-truck linear traffic growth rate (%):

Highway facility type:

Traffic lights

Highway terrain type:

Rural or urban highway environment:

checkBoxOverrideCalculated

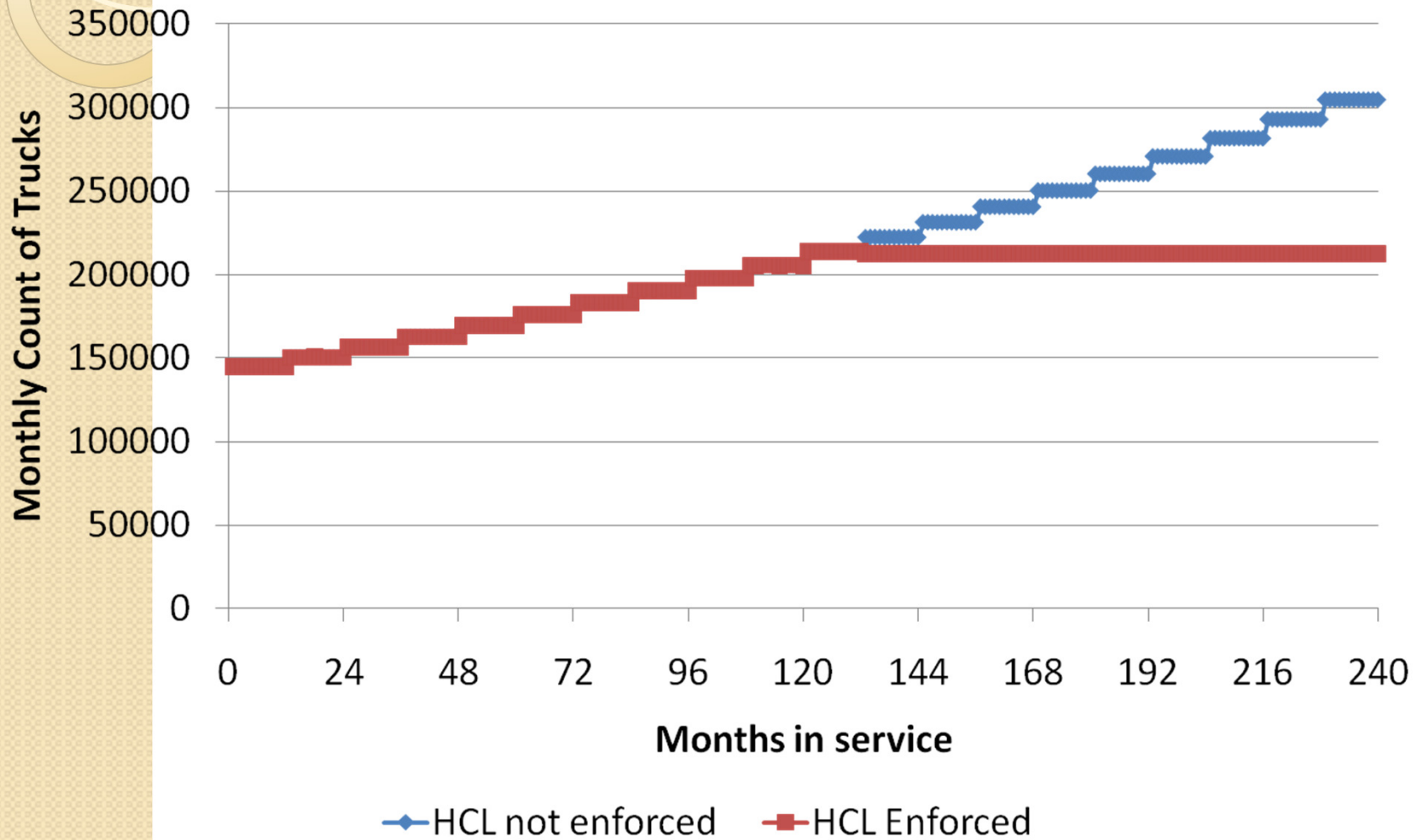
Enforce highway capacity limits.

- Freeway
- Multilane highway
- 2-lane highway

- Level
- Rolling

- Urban
- Rural

# Highway Capacity Limits



# Axle Load Distribution



AASHTO DARWin-ME Version 1.0 Build 0.0.44 (Date: 10/18/2010)

Menu

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      - Quad Axle Distrib
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    - Analysis Calibration Fa
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    - Options
    - User Options
  - DARWin-ME calibration factor

Month	Class	Total	1361	1814	2268	2722	3175	3629	4082	4536	4990	5443	5897	6350	6804
January	4	100	1.8	0.96	2.91	3.99	6.8	11.47	11.3	10.97	9.88	8.54	7.33	5.55	4.23
January	5	100	10.05	13.21	16.42	10.61	9.22	8.27	7.12	5.85	4.53	3.46	2.56	1.92	1.54
January	6	100	2.47	1.78	3.45	3.95	6.7	8.45	11.85	13.57	12.13	9.48	6.83	5.05	3.74
January	7	100	2.14	0.55	2.42	2.7	3.21	5.81	5.26	7.39	6.85	7.42	8.99	8.15	7.77
January	8	100	11.65	5.37	7.84	6.99	7.99	9.63	9.93	8.51	6.47	5.19	3.99	3.38	2.73
January	9	100	1.74	1.37	2.84	3.53	4.93	8.43	13.67	17.68	16.71	11.57	6.09	3.52	1.91
January	10	100	3.64	1.24	2.36	3.38	5.18	8.35	13.85	17.35	16.21	10.27	6.52	3.94	2.33
January	11	100	3.55	2.91	5.19	5.27	6.32	6.98	8.08	9.68	8.55	7.29	7.16	5.65	4.77
January	12	100	6.68	2.29	4.87	5.86	5.97	8.86	9.58	9.94	8.59	7.11	5.87	6.61	4.55
January	13	100	8.88	2.67	3.81	5.23	6.03	8.1	8.35	10.69	10.69	11.11	7.32	3.78	3.1
February	4	100	1.8	0.96	2.91	3.99	6.8	11.47	11.31	10.97	9.88	8.54	7.32	5.55	4.23
February	5	100	10.03	13.21	16.41	10.61	9.24	8.27	7.12	5.85	4.54	3.46	2.56	1.92	1.54
February	6	100	2.47	1.78	3.45	3.95	6.7	8.45	11.87	13.57	12.13	9.47	6.82	5.05	3.74
February	7	100	2.14	0.55	2.42	2.7	3.21	5.81	5.26	7.38	6.85	7.41	8.99	8.16	7.78
February	8	100	11.65	5.36	7.83	6.99	7.99	9.64	9.93	8.51	6.47	5.19	3.99	3.39	2.73
February	9	100	1.74	1.37	2.84	3.53	4.93	8.43	13.68	17.68	16.71	11.56	6.09	3.52	1.91
February	10	100	3.64	1.24	2.36	3.38	5.18	8.34	13.85	17.35	16.21	10.28	6.52	3.94	2.33
February	11	100	3.55	2.91	5.19	5.27	6.33	6.98	8.08	9.68	8.55	7.28	7.16	5.65	4.77
February	12	100	6.68	2.29	4.88	5.87	5.98	8.86	9.58	9.95	8.61	7.09	5.86	6.58	4.55
February	13	100	8.88	2.67	3.81	5.23	6.04	8.1	8.35	10.69	10.69	11.11	7.31	3.78	3.1
March	4	100	1.8	0.96	2.91	3.99	6.81	11.45	11.31	10.97	9.88	8.54	7.33	5.55	4.23
March	5	100	10.04	13.21	16.41	10.59	9.23	8.28	7.13	5.86	4.53	3.46	2.56	1.92	1.54

# Climate

DARWin-ME

Project1 Project1:Traffic Project1:Single **Project1:Climate**

Summary Hourly climate data

**ClimateStation**

Longitude (decimal degree)	<input checked="" type="checkbox"/> -88.17
Latitude (decimal degrees)	<input checked="" type="checkbox"/> 40.02
Elevation (m)	<input checked="" type="checkbox"/> 752
Depth of water table (m)	Annual(10)
Climate station	Not Set

**Identifiers**

Display name/identifier	
Description of object	
Author	
Date created	10/18/2010
Approver	
Date approved	10/18/2010
State	
District	
County	
Highway	
Direction of travel	
From station (km)	
To station (km)	
Province	
User defined field 2	

Use single weather station     Create a virtual weather station

Select weather station: CHAMPAIGN/URBANA,IL (94870)

Location:UNIVERSI OF IL WILL CHAMPAIGN/URBANA,IL (94870)

CHICAGO,IL (14819)

**Longitude (decimal degrees)**  
Longitude of site. West longitudes are negative.  
Longitude entered in decimal degrees. (i.e. 90 degrees, 30 minutes W = -90.5 degrees).  
Minimum: -180  
Maximum: 180

# Climate

DARWin-ME

Project1 Project1:Climate

Summary Hourly climate data

Summary Hourly climate data

Thursday, May 02, 1996 to Tuesday, February 28, 2006

Verify Weather Import ICM

Date/Hour	Temperature	Windspeed (kph)	Sunshine(%)	Precipitation (mm)	Humidity(%)	Water table (m)
5/2/1996 12:00:00...	38.3	4.7	0	0.2	58.5	33
5/2/1996 1:00:00 ...	38.2	5.3	0	0.05	58.5	33
5/2/1996 2:00:00 ...	38	5.7	0	0.02	58.5	33
5/2/1996 3:00:00 ...	37.6	6.3	0	0	58.5	33
5/2/1996 4:00:00 ...	37.5	3	13	0	58.5	33
5/2/1996 5:00:00 ...	36.6	4	13	0	58.5	33
5/2/1996 6:00:00 ...	37	4.3	13	0	58.5	33
5/2/1996 7:00:00 ...	39.7	6	7	0	58.5	33
5/2/1996 8:00:00 ...	40.9	4	7	0	58.5	33
5/2/1996 9:00:00 ...	44.4	6.6	7	0	58.5	33
5/2/1996 10:00:00...	45.9	8	20	0	58.5	33
5/2/1996 11:00:00...	48.5	7.7	17	0	58.5	33
5/2/1996 12:00:00...	45.2	11.3	10	0	58.5	33
5/2/1996 1:00:00 ...	44.2	8.7	0	0	58.5	33
5/2/1996 2:00:00 ...	47.1	7.3	7	0	58.5	33
5/2/1996 3:00:00 ...	47.2	5.7	0	0	58.5	33
5/2/1996 4:00:00 ...	43.2	10.3	0	0	58.5	33
5/2/1996 5:00:00 ...	41.3	8.9	0	0	58.5	33
5/2/1996 6:00:00 ...	40.3	4.3	0	0	58.5	33

ClimateStation

Longitude (decimal)  -88.17

Latitude (decimal)  40.02

Elevation (m)  229

Depth of water table **Annual(10)**

Climate station **CHAMPAIGN/URBA**

Identifiers

PropertyGridView

Climate station  
Climate station selected from hourly climatic database (optional)

# Error Checking



fac

tie:

ay

fac

**Climate station:**  
Climate station selected from hourly climatic database (optional)

11/29/1997 2:00:00 AM	54	4	0	0	100	10
11/29/1997 3:00:00 AM	53.1	4	100	0	100	10
11/29/1997 4:00:00 AM	52	5	100	0	97	10
11/29/1997 5:00:00 AM	51.1	5	100	0	100	10
11/29/1997 6:00:00 AM	51.1	5	100	0	96	10
11/29/1997 7:00:00 AM	51.1	5	100	0	96	10
11/29/1997 8:00:00 AM	53.1	7	100	0	93	10
11/29/1997 9:00:00 AM	55.9	6	100	0	90	10
11/29/1997 10:00:00 AM	55	6	100	0	93	10
11/29/1997 11:00:00 AM	57	6	50	0	90	10
11/29/1997 12:00:00 PM	59	8	75	0.26	87	10
11/29/1997 1:00:00 PM	60.1	10	25	0	84	10
11/29/1997 2:00:00 PM	59	8	100	0	87	10

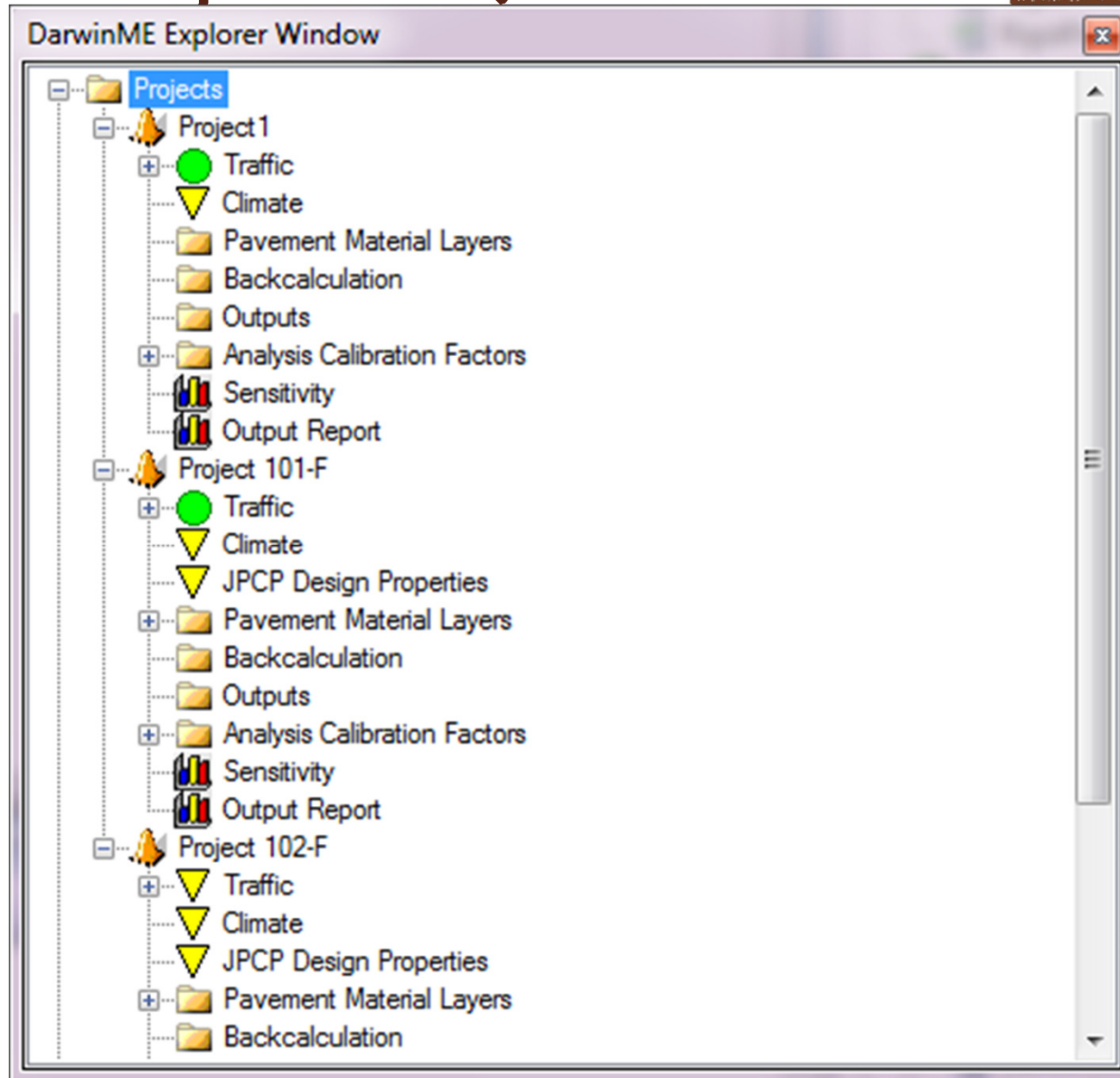
**Error List**

Project	Object	Property	Description
Project 1	TreeNodeTraffic...		WARNING_HOURLY_TOTAL
Project 1	ClimateTreeNode		11/28/1997 8:00:00 PM percent humidity of 104 is outside of allowable range (0-100)
Project 1	ClimateTreeNode		8/8/1998 12:00:00 AM percent humidity of 103 is outside of allowable range (0-100)
Project 1	ClimateTreeNode		3/29/1999 1:00:00 AM percent humidity of 104 is outside of allowable range (0-100)
Project 1	ClimateTreeNode		1/24/2000 4:00:00 AM percent humidity of 159.7 is outside of allowable range (0-100)
Project 1	ClimateTreeNode		1/24/2000 5:00:00 AM percent humidity of 238 is outside of allowable range (0-100)
Project 1	ClimateTreeNode		11/4/2003 6:00:00 PM air temperature change from hour to hour (35) is greater than warning level (30)

DarwinME Output Window | Compare | Error List

# Multiple Project Edit

DARWin-ME



# Optimization



The screenshot displays the DARWin-ME software interface. The main window is titled "A101-F: Optimization" and contains several panels:

- labelLastOptimizedThickness**: A text input field.
- labelDesignLayers**: A table with the following data:

Use	Layer	Default Thickness	Minimum Thickness	Maximum Thickness
<input checked="" type="checkbox"/>	Layer 1 PCC	12	6	15
<input type="checkbox"/>	Layer 2 Non-stabilized Base	8		
- OptimizationRules**: A table with the following data:

Use	Property	Rules	Criteria
<input type="checkbox"/>		▼	

In the foreground, the "DARWin-ME Explorer Wind..." window is open, showing a tree view of the project structure:

- Projects
  - A101-F
    - Traffic
    - Climate
    - JPCP Design Properties
    - Pavement Material Layers
    - Analysis Calibration Factors
    - Sensitivity
    - Optimization** (highlighted)
    - Output Report



# Optimization



AASHTO DARWin-ME Version 1.0 Build 0.0.44 (Date: 10/18/2010)

Menu: Recent Files, New, Open, Save As, Save, Save All, Close, Exit, Run, Import, Export, Undo, Redo, Help

DARWin-ME Explorer Window: A101-F, A101-F:Optimization

labelLastOptimizedThickness:  labelDesignLayers

Layer Thickness	Results
6	Running

labelDesignLayers

Use	Layer	Default Thickness	Minimum Thickness	Maximum Thickness
<input checked="" type="checkbox"/>	Layer 1 PCC	12	6	15

**Sequence of Runs:**  
**Min. Thickness = 6 inches**  
**Max. Thickness = 15 inches**

**6 inches – Failed**  
**15 inches – Passed**  
**10.5 inches – Failed**  
**12.5 inches – Passed**  
**11.5 inches – Passed**  
**11 inches – Passed**

Current: 6

Error List: Check Errors, Clear

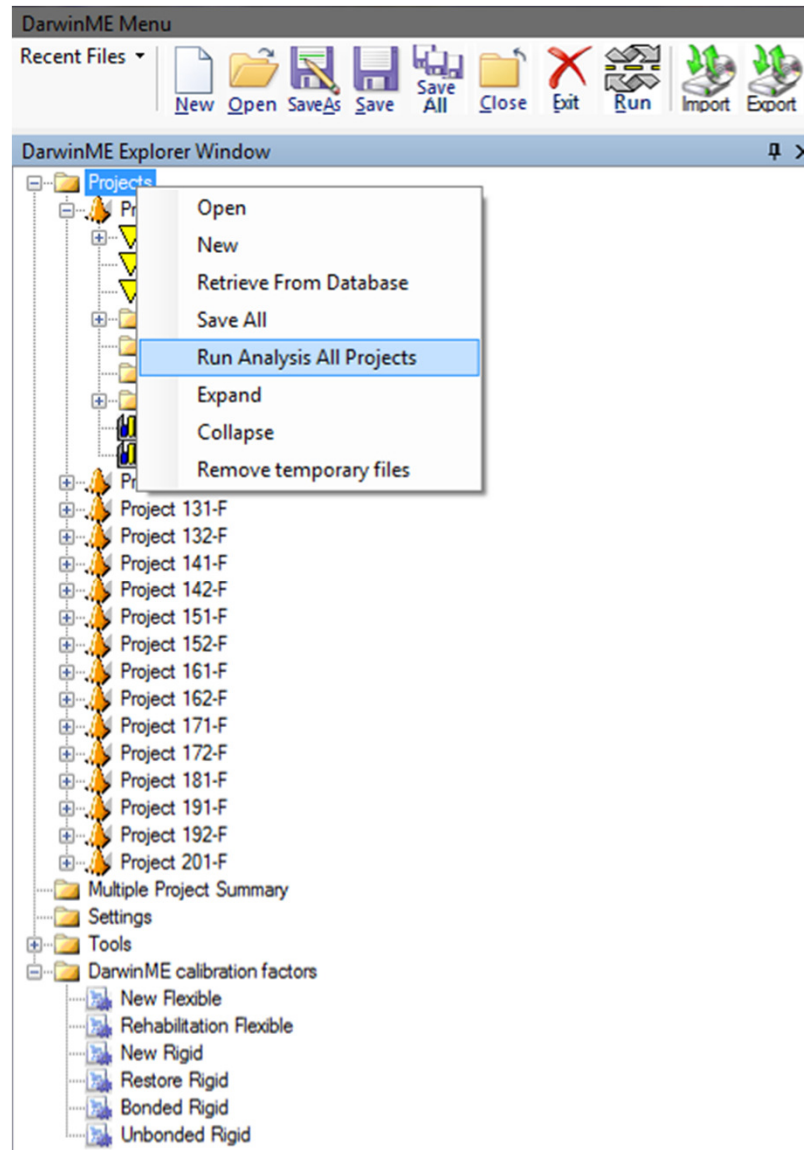
Project	Object	Description
---------	--------	-------------

DARWin-ME Output Window, Error List, Compare

Progress: Stop All Analysis

A101-F	%
Running Integrated Clim...	60
Extending climate solution	0
Calculating modulus sub...	0
Preparing PCC Inputs	0
Preparing thermal gradie...	0
Calculating Faulting	0
Calculating Cracking	0
Calculating JPCP IRI	0

# Batch Mode





# VMI File Formats



```
<?xml version="1.0" encoding="UTF-8"?>
<DarwinMeProject xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" xmlns:xsd="http://www.w3.org/2001/XMLSchema"><designr
  </displayName><description>
  </description><author>
  </author><authorDate>2011-01-01T00:00:00</authorDate><approver>
  </approver><approverDate>2011-01-01T00:00:00</approverDate><state>
  </state><district>
  </district><county>
  </county><highway>
  </highway><direction>
  </direction><fromStation>
  </fromStation><toStation>
  </toStation><laneNumber>0</laneNumber><user1>
  </user1><user2>
  </user2><user3>
  </user3><objectTypeId>0</objectTypeId><objectId>-1</objectId><revisionNumber>0</revisionNumber><hasStochastic>>false</ha
  </displayName><description>
  </description><author>
  </author><authorDate>2011-01-01T00:00:00</authorDate><approver>
  </approver><approverDate>2011-01-01T00:00:00</approverDate><state>
  </state><district>
  </district><county>
  </county><highway>
  </highway><direction>
  </direction><fromStation>
  </fromStation><toStation>
  </toStation><laneNumber>0</laneNumber><user1>
  </user1><user2>
  </user2><user3>
```

# Engineering Module Updates & Reporting



- Runtime, Accuracy, Stability Improvements
  - JULEA, TCMODEL, MASTER
  - APADS
  - JPCP
  - EICM
- New reports
  - AC Report (PDF, Excel)
  - JPCP Report
  - CRCP Report

# Runtime Improvements



UR01 – Asphalt pavement type analysis shall be improved to be completed within 15 minutes

## **PC comparisons – PRELIMINARY RESULTS**

Proj Name	Description	MEPDG-v1.1 Runtime		DarwinME Runtime	
		Overall *	APADS	Overall	APADS

Following runtime is measured on a laptop of **32bit XP, 3 GHz, 3.5 GB RAM**

121	New HMA: 8" AC , Binder 10%,Air voids 8.5%, Granular base.	13'45"	12'21"	5'11"	4'30"
-----	--	--------	--------	-------	-------

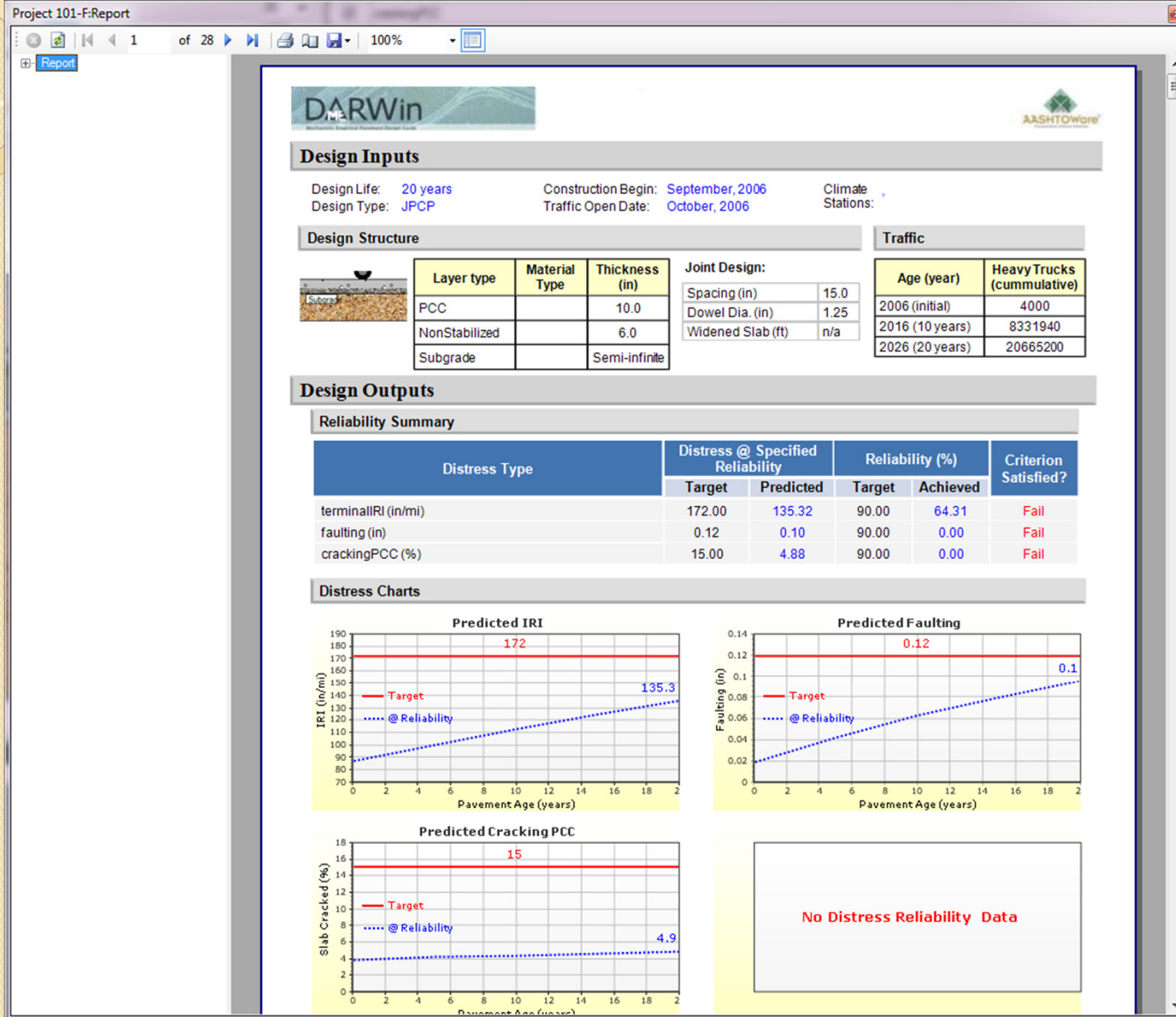
Following runtime is measured on a laptop of **32bit XP, 3 GHz, 1.0 GB RAM**

121	New HMA: 8" AC , Binder 10%,Air voids 8.5%, Granular base.	32'28"	30'00"	11'37"	9'40"
-----	--	--------	--------	--------	-------

Overall\* - time measure does not include Summary process for Excel report generation

# Integrated Reports

DARWin-ME



# License Fees for FY2011



**Individual License**<sup>1</sup> - The single user license allows for only one user. For two, three or four users, multiple single user licenses will have to be purchased.

Single user - \$5,000

**Site License**<sup>1</sup> - Site licenses based on the number of users and single user licenses will be available for DARWin-ME. The unlimited site license allows use of DARWin-ME on an unlimited number of workstations within an agency, and permits cities/counties, and contractors/consultants employed by the agency, access to the product on the Member Department's network.

Site License – 5-9 users \$20,000

Site License – 10-14 users \$30,000

Site License – unlimited users \$40,000

**Educational License** - will not be offered until FY 2012.

<sup>1</sup> Because the software won't be available until after the fiscal year has begun, license fees will be prorated for first time licensees.

License fees are **annual**

# Service Units



- Service Units are special fixed-fee units of contractor-provided service from ARA for consultation and support to assist the agency in preparing data and using DARWin-ME. During a fiscal year, an agency may commit to one or more service units. Units can be ordered in unit increments of \$11,600 and each service unit provides approximately 70 hours of labor by a contractor employee. This fee includes the AASHTO administrative costs. Each service unit provides \$10,000 in ARA contractor services.
- Service Units remaining at the end of a fiscal year will be carried forward into the next fiscal year.
- Using service units is not a pre-requisite to license DARWin-ME and choosing this special offering is strictly the prerogative of the agency.





Interested in Additional Information?

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