Pavement Management

The Lucity pavement management modeling program is used to perform budget and maintenance forecasting. This helps you determine when and where to perform pavement rehabilitation, which rehabilitation techniques to use, and the ideal budget needed to accomplish your maintenance goals. Here are two training work books to help you go through this process.

- Workbook 1 Explains and demonstrates the relationships between the Street Segment, Pavement Subsegment, and Pavement Supersegment modules. These are the three inventory modules required to complete a model run. Then, this workbook focuses on setting up pavement standards to help predict pavement condition over. Finally it goes into creating Field Inspection and Pavement Maintenance records for the street subsegments. These are used to determine the pavements' current conditions and PCI values, which are also required to complete the modeling process.
- Workbook 2 This book is about the actual pavement models. It demonstrates how to setup the Model Run parameters, run a model, view and interpret model run results, export model run results, and view results in the Supersegments module.

Table of Contents

Street Segments	2
Header	
Attributes	
Sub/Field	
Toolkit Function	7
Street Subsegments	9
Toolkit Function	12
Street Supersegments	14
Linked Supersegments	15
Supersegment Condition	16
Model Results	18
Pavement Setup	
Pavement Standards	
Pavement Distresses	
Match Up Your Pavements and Distresses	
Set Up Severity and Density Values	24
How Severity/Density is Calculated	
Field Inspections	
Imported Data	
Pavement Maintenance	

Street Segments

The Street Segment module allows you to define each street segment from intersection to intersection. These segments are then used to create subsegments and supersegments. Throughout the Pavement Forecasting workbooks you'll notice that *Field Inspections* and *Model Runs* are mentioned many times. Field inspections are conducted on subsegments whereas model runs are conducted on supersegments. In order to accurately forecast your pavement maintenance needs, segment, subsegment, and supersegment records must all be created.

1. To view the segment records, open **Transportation>>Street Master>>Segment Network** from the Lucity main menu.

Segment Network - No Filter		
	▲▲▶▶ \$ % ፼ 명	
Street Name I E RANCH RD From Street I S RACINE LN To Street I S TUCANA LN	Se Ni Ni	gment ID 7934 ode 1 ID 3810 ode 2 ID 3811
Attributes Sub/Field Super/Con Routes Poles Signs Ligh	nts Traffic Accidents ROW Structur	es W0/PM Custom Comments ADT Volume 2990
District Name 2 District 2 Section Name 1 Section A	Length 261.4 User Length 25.00	ADT Date 05/24/2007 Speed Limit 25
Owner 1 City Travel Direction 1 Two-Way City 1 Your Town	# of Lanes 2 Lane Length 523 Mile Number 25.0	Street Number
Subdivision 1		
Left L From Address	7929 7934 0 Right R From Address R To Address S/E Shidr Width	7934 7930 1.0
	Record	1 of 353 View Mode Ready //

2. Click GO to bypass the filter. The Segment Network module will open.

- 3. Street segment records can input by hand or imported:
 - Importing street segment records: Many users will not enter street segments by hand due to the volume of information. With extensive segment networks, it is easier for users to import data from a geodatabase.
 - Inputting street segment data by hand: If you choose not to import your data, you can input it by hand. Additional details for this process are provided in the online help guide. Since most users import their street segment data, we will not go over a step-by-step example showing you how to add a segment record. Instead, we'll show you an example using an already created record and explain its most important features and functions.

Header

The *Segment Network* header fields allow you to select streets from the street name list. These streets are then linked to specific intersections. If you have imported your segment network data, segment and node IDs associated with the streets in the geodatabase will also be imported.

Street Name	Segment ID	7934
From Street S RACINE LN	Node 1 ID	3810
To Street STUCANA LN	Node 2 ID	3811

Attributes

The Attributes tab allows you to record basic information about your street segments. This can include the street segment's district, section, owner, city, travel direction, speed limit, length, block width, and number of lanes. Additionally, you can use the Subdivision 1 and 2 fields to assist you with filtering for streets in specific parts of the city or with creating subsets based on filters.

Attributes Sub/Fiel	Super/Con Rou	utes Poles Signs	Lights Traf	ic Accident:	ROW Struc	ctures W0/PM	Custom Com	ments
			_	(7	-			
Classification	2 Collec	tor	Segm	ent Lock		ADT Vo	lume	2990
District Name	2 Distric	t 2	Le	ength	261.4	ADT D	ate 05	/24/2007 💌
Section Name	1 Sectio	nA	User	Length	25.00	Speed	Limit	25
Owner	1 City		# of	Lanes	2	Street N	umber	
Travel Direction	1 Two-V	Vay	Lane	Length	523	Block Nu	umber	7934
City	1 Your T	lown	Mile	Number	25.0	Segment	Rec #	1
Subdivision 1								
Subdivision 2								
	Left-	(=-		Right -				
	LI	From Address	7929	R Fr	om Address	7934		
		. To Address	7934	BI	o Address	7930		
	N/	W Shldr Width	2.0	S/E	Shldr Width	1.0		

Sub/Field

This tab identifies subsegments associated with the street segment in this record. Subsegments can be edited and split from here. In addition, this tab displays any field inspections for the subsegment. This provides quick and easy access to the related records.

Segment Network - No Filter	
	<u>/ </u>
Street Name E RANCH RD From Street S RACINE LN	Segment ID 7934 Node 1 ID 3810
To Street STUCANA LN	Node 2 ID 3811
Attributes Sub/Field Super/Con Routes Poles Signs Lights Traffic Accidents RD	W Structures WO/PM Custom Comments
Subsegments Width Pavement Type 0.0 130.7 7934-1 20.0 Asphalt 130.7 261.4 7934-2 20.0 Asphalt	Text Length Starting Desc 130.7 130.7
Field Inspections for Subsequent Becords	
Inventory Date △ Inventory PCI Override PCI Override PCI Date 05/24/2007 27.9 10/11/2007 26.0 05/23/2008 100.0	Most Recent Insp. No No Yes
	Record 1 of 353 View Mode Ready

Each time you add a new street segment to the *Segment Network* the system automatically adds a subsegment of the same length to the system. You can then edit and split subsegments to alter their length and other details.

1. To edit a subsegment, right click on the listing in the grid and select *Edit Record*. The Street Subsegment dialog will appear.

Γ.	Subsegments								
	Start Station \triangle	End Station	Subseg	Width	Pave	ment Type Text	Length	Starting Desc	
	0.0	130.7	7934-1	20.0	Asphalt	View Record	130.7		
	130.7	261.4	7934-2	20.0	Asphalt.		. 130.7		
						Edit Record			
	<							>	
12									

• Right click on the street diagram or Subseg # header and select *Edit.* You can then make any changes needed in the Subsegment # dialog.

Notes:		 	

Street Subsegment								
Length: 261.4								
s RACINE LN	1 Edit Subsegment #1							
Subsea #	Start Station 0.0	_						
Length	130.7 End Station 130.7							
Start Station	0.0 Width 20.0							
End Station	130.7 Pave Area (SY) 290.44							
Width	20.0 1 ave Alea (31) [230.44							
Surface Code	Pavement Type 1 Asphalt							
Surface Type	Asphalt Subsegment Code 7934-1							
Subsegment Code	7934-1							
	OK Cancel							
	Save Close							

- As you can see in the example above, you can edit the start and end stations, width, pavement area, pavement type, and subsegment code. Click *OK* when your updates are complete. The new values will appear in the Street Subsegment dialog.
- 2. To split a subsegment, left click on the street diagram in the Street Subsegment dialog. This will highlight the street. Then, right click and select *Split*.
 - In the Split Subsegment dialog, indicate the number of subsegments into which you would like the segment to be split. Then click *OK*.
 - For our example, we'll split this segment portion into two subsegments.

Street Subsegm	ent		
		Length: 261.4	
S RACINE LN	Split	Split Subsegment	S TUCANA LN
Subseg #	1	Split this piece into how many subsegments?	
Length	130.7	2 Cancel	
Start Station	0.0		
End Station	130.7		
Width	20.0	20.0	
Pavement Area	290.4	290.4	
Surface Code		1	
Surface Type	Asphat	Asphart	
Subsegment Code	7934-1	/934-2	
	I		
		Save	Close

- After the split, the screen will resemble the following. There are now two subsegments of equal length, in addition to the third subsegment. To change the length of any portion or alter other attributes, edit the record as explained before.
- Note that if there are historical *Field Inspections* for the subsegment they will only be associated with the original street subsegment, not with the new portion.



Toolkit Function

The Toolkit is used to attach subsegments to existing supersegments or create new supersegments. To explain how this works, we'll go over a step-by-step example. Note that these Toolkit options also appear in the *Subsegments* module. You'll follow these same steps listed below to create a supersegment from a subsegment or attach a subsegment to an existing supersegment.

- 1. Click the 🕮 button at the top of the module toolbar. The Toolkit dialog will appear.
 - Two options are available to attach subsegments to existing supersegments:
 - You can attach the current subsegment record to an existing supersegment if it is not currently attached to another supersegment.
 - You can attach all subsegments in the current filtered set to an existing supersegment. Currently attached subsegments will be excluded from the new supersegment.
 - Two additional options are available to create new supersegments:
 - You can create a new supersegment that will include all records in the current filtered set. This new supersegment will include all currently unattached subsegments.
 - You can create new supersegments for each unattached subsegment. No prompts will be given with this toolkit option. The system will use the Subsegment ID for the Supersegment's ID. For the description, the system will concatenate the Street Name, From, and To streets.

📫 Toolkit	×
Attach current record to Supersegment Attach Subsegments in filterset to Supersegment Create Supersegment from current filterset Create Supersegments for all unattached Subsegments Midblock Collision Diagram	Execute Close

- 2. To attach records to an existing supersegment, select either "Attach current record to Supersegment" or "Attach Subsegments in filterset to Supersegment" from the Toolkit dialog. Then click *Execute*. The Select Supersegment dialog will appear.
 - This dialog will list all available supersegments. You'll see the supersegment ID, a description of its location, its length, and group ID.
 - Highlight a supersegment in the list and click Select.

🖬 Select Supersegment							
Superseg ID 🔺	Description	Length	Group ID	^	Select		
S-015	202 EB Santan, Off Hi	393.2	SB-622				
S-101	Valencia, Virgina, Mul	1570.1	H-56		Llose		
S-102	Valencia, Agritopia, C	1075.7	GH-246				
S-103	Virginia, Agritopia	5818.5	GS-5223				
S-104	Tamarisk, Craftsman,	962.4	HD-5654				
S-105	Hobart, James	1816.1	HS-535				
S-106	Camellia, Mulberry, Cl	906.3	CMC-2564				
S-112	Hobart, Church, Tama	1292.2	HCT-4764				
S-113	Summerset, Church,	1169.3	SCM-323				
6557-1	S HIGLEY RD, E RAN	658.0					
1486-1	S GREENFIELD RD, E	212.3					
1077-1	S PARKCREST ST, E	698.1					
4049-1	E CALLE DEL NORTE	778.7					
3959-1	S PARKCREST ST, E	269.1					
1079-1	S PARKCREST ST, E	179.7					
2501-1	E KNOX RD, E JASPE	977.9					
4076-1	S KENDRA ST, E JAS	451.4		~			

• The supersegment you choose will appear in the Supersegments/Construction Tab. Double-click on the listing in the grid to view the record in the *Supersegments* module.

Г	Supersegment					
	Superseg ID 🗸	Description	Length	Area	Classification Text	
	S-015	202 EB Santan, Off Higley EB	393.2	585.89	Residential	
	7934-2	E RANCH RD, S RACINE LN	130.7	0.00	Collector	
Ľ						

- 3. To create a new supersegment, select either "Create supersegment from current filterset" or "Create supersegments for all unattached subsegments" from the Toolkit dialog. Then click *Execute*.
 - If any of your subsegments are currently attached to supersegments, you'll receive the following prompt informing you that those records will be excluded from the creation of a new supersegment. Select Yes to continue.

Lucity	
2	At least one record in the filtered set is already linked to a supersegment. Those records will be excluded from this creation. Do you wish to continue?
	Yes No

• You'll need to enter a unique ID and description for your new supersegment if the "Create supersegment from current filterset" option was selected.

Unique ID and Description	X
Enter Unique ID and Description	
Unique ID Description	
	OK Cancel

• The newly created supersegment(s) can then be located in the *Supersegments* module. Later in this workbook, we'll discuss supersegments in greater detail.

Street Subsegments

As discussed above, subsegments are created in the Subsegment module each time a record is added to the Street Segment module. Subsegments are not created in this module. Instead, they inherit their properties from the original segment. You can, however, edit the subsegment records to suit your needs.

- 1. To access the *Subsegments* module, select **Transportation>>Pavement Manager>>Subsegments** from the Lucity main menu.
- 2. To identify related segments and subsegments, you'll need to understand the numbering scheme.
 - The street segment we used earlier in this workbook has a segment ID of 7934. We'll use this record to show you an example of the numbering scheme.
 - When a street subsegment is created, the system adds a -1 to the segment ID. For example, our first subsegment is numbered 7934-1.
 - When you split a street subsegment as we demonstrated earlier, the second portion of the subsegment is identified with a -2 after the segment ID. In our example, the second street subsegment is numbered 7934-2.
 - Each time you split a subsegment, it will be identified in this manner (-3, -4, etc.).

Γ.	Subsegments		$ \longrightarrow $					
	Start Station 🗸	End Station	Subseg	Width	Pavement Type Text	Length	Starting Desc	
	130.7	261.4	7934-1	20.0	Asphalt	130.7		
	130.7	261.4	7934-2	20.0	Asphalt	130.7		
	65.4	130.7	7934-3	20.0	Asphalt	65.3		
			\square					
	<						>	ī
1								2

3. When a subsegment record is created, data from the *Street Segment Network* module is carried over into the header and Attributes tab; however, nearly all fields in this module can be edited by the user.

Street Subsegments - No Filter						
		🕨 🔶 🥖 🚺	58 🔤 🗃 👪	• • • •	<u> </u>	
Subsegment Rec # 1	Segment Red	c# 1	Segment ID	7934		_
Subsegment Code 7934-1	Street Nam	e E RANCH RD		-		
Start Station 0.0 % 0.0	From Stree	S RACINE LN				
End Station 130.7 % 50.0	To Street	S TUCANA LN	1			
Attributes Curb Sidewalk Office Inspections Maint	enance W0/Pl	M/Req Custom S	hared Comments			
Starting Desc						
Ending Desc						
Subdivision 1						
Subdivision 2						
Classification 2 Collector	_	Length	130.7	Median Width	2.0	
Pavement Type 1 Asphalt	-	Width	20.0	CDS Diameter	15.0	
Pavement Strength Average	-	Pave Area (SY)	290.44	# of Lanes	3	
Surface Type 1 Chip Seal	-	Additional Area	5.00	Street Number		
Group Number 865-45	-	Total Area	295.44	Block Number	7934	1
Owner 1 City	-	Cross Slope	2 Not Adequ	ate		
Superseg Rec # 1		Cross Slope %	15.0			
SuperSegment ID						
SuperSeg Desc						
			Decord 1 of 247	View Mada	Deadu	_

- The Starting and Ending Description text fields can be used to help define the starting and ending subsegment points.
- Using the Pavement Type pick list, you can select a pavement type from the *Pavement Standards* module. Also choose a Pavement Strength.
 - We will go over setting up pavement standards in this workbook on page 18. For this example we chose Asphalt.
- The Surface Type field simply stores information. It is not used in the model.
- The supersegment associated with the street segment will be identified in the SuperSegment ID and SuperSeg Desc fields. These cannot be edited by the user.
- 4. Several fields in the Attributes tab can be calculated by the system using the length and width data carried over from the street segment along with other user-entered data:

Attributes Curb Sidewalk Office Inspections Maintenance WO/PM	4 Custom Comments	
Starting Desc		
Ending Desc		
Subdivision 1		
Subdivision 2		
Classification 2 Collector	Length 130.7	Median Width 2.0
Pavement Type 1 Asphalt	Width 20.0	CDS Diameter 15.0
Surface Type 1 Chip Seal	Pave Area (SY) 290.44	# of Lanes 3
Group Number 865-45	Additional Area 5.00	Street Number
Owner 1 City	Total Area 585.89	Block Number 7934
SuperSegment ID S-015	Cross Slope 2 Not Adequa	ate
SuperSeg Desc 202 EB Santan, Off Higley EB	Cross Slope % 15.0	

- To calculate pavement area, press the **F5** key with your cursor in the Pavement Area (SY) field. The area in square yards will be calculated as follows:
 - Area = (Length * Width) / 9
- To calculate additional area, press the **F5** key with your cursor in the Additional Area field. The field must be empty; the system will not overwrite a value in this field. The calculation for this field follows: (note that the calculation assumes that the length of the road extends to the center of the cul-de-sac).
 - \tilde{W} = Width of Road (user entered)
 - D = Diameter of cul-de-sac (user entered)
 - C = Area of Circle (calculated by system)
 - h = Distance from center of CDS to circular segment (calculated by system)
 - \circ A = Area of circular segment (calculated by system)
- Thus, the simple calculation for the Additional Area is: AA = C - h * W - A
- The more advanced calculation for the Additional Area is: $A = \frac{D^2}{8} \left(2\left(ASin\left(\frac{W}{D}\right)\right) \right) - \left(Sin\left(2ASin\left(\frac{W}{D}\right)\right) \right)$
- To calculate total area, press the **F5** key with your cursor in the Total Area field. The system will add the values in the Pavement Area and Additional fields.
- 5. The subsegment record also contains data carried over from the *Field Inspection* module. This data can be found on the Curb, Sidewalk, and Inspections tabs. Note that the data on these tabs can be edited in this module. Any data you add or change here will also be added or changed in the corresponding inspection record.
 - The Curb tab contains field inspection data related to drainage and curbing.
 - The Sidewalk tab contains field inspection data related to sidewalks and driveway approaches.
 - The Inspections tab contains field inspection results for the street subsegment. This includes the PCI and factor values. The data in the Condition field can either be entered directly by the user or can be updated automatically from the

Field Inspections record. Later in this workbook, we'll discuss the *Field Inspections* module in greater detail.

🔲 Street Subsegments - No Filter
$= \textcircled{\begin{tabular}{ c c c c c c c c c c c c c c c c c c c$
Subsegment Rec # 1 Segment ID 7934
Subsegment Code 7934-2 Street Name E RANCH RD
Start Station 130.7 % 50.0 From Street S RACINE LN
End Station 261.4 % 100.0 To Street S TUCANA LN
Attributes Curb Sidewalk Office Inspections Maintenance WO/PM Custom Comments
Drainage Urainage Type II Lurb
Inlets Present 1 Max Spacing 300' Inlets Present 1 Max Spacing 300'
Curbing Curb/Gutter Type 2 Roll Back Curb/Gutter Type 2 Roll Back
Curb Width NW 25.0 Curb Width SE 65.0
Curb Height NW 5.0 Curb Height SE 25.0
Curb Overlaid 1 Yes Curb Overlaid 0 N/A
Depth Above Lip NW 23.0 Depth Above Lip SE 25.0
Record 1 of 1 View Mode Ready

Toolkit Function

As we mentioned earlier, the *Subsegment* module contains Toolkit options that are also found in the *Segment* module. These are used to attach subsegments to existing supersegments or create new supersegments. In addition, a "Subsegment and Supersegment Association Tool" has been added for the version 7.0 release. This new tool allows you to select subsegments from a list and add them to an existing supersegment, or use them to create a new one. This provides you with an easy way to rapidly create supersegments.

1. Click the Toolkit button . The following dialog will appear:

📫 Toolkit	
Attach current record to Supersegment Attach Subsegments in filterset to Supersegment Create Supersegment from current filterset Create Supersegments for all unattached Subsegments Subsegment and Supersegment Association Tool	Execute Close

2. Select Subsegment and Supersegment Association Tool and click Execute.

E Stre	Street Subsegment/Supersegment Association									
Highligh Superse	Highlight Subsegments and press the "Create Supersegment" button to create a new Supersegement from the selected Subsegments or press the Add to Supersegment button to add the Subsegments to the selected Supersegment.									
Subsegr	Subsegments: Subsegment associated to a Supersegment									
	SB_ID	SB_SP_ID	SB_CODE	SN_STR_DIR	SN_STR_STR	SN_STR_TY	SN_STR_SFX	SN_		
	1	1	7934-2	E	RANCH	RD		S		
	2	374	7936-1	E	RANCH	RD		S		
	3	375	7935-1	E	RANCH	RD		S		
۱.	4	376	1408-1	E	RANCH	RD		S		
	5	377	4668-1	E	SHERRI	DR		E		
	6	378	4219-1	F	BANCH	BD		F Y		
<	IIII							>		
	Total Selected	Subsegment Length:	691.4		📃 Sh	ow Unassociated Sul	bsegments Only			
			<u> </u>							
		L	Create Supersegmer		Add To Supersegmer	10				
Superse	gments:									
	SP_ID	SP_UNIQUE	SP_GROUP	SP_DESCR	SP_LENGTH	SP_LANES	SP_WIDTH	SP_/		
•	1	S-015	SB-622	202 EB Santan,	393.2	2	25	585.8		
	3	S-101	H-56	Valencia, Virgina,	1570.1	22	15	5672		
	4	S-102	GH-246	Valencia, Agritopi	1075.7	2	215	2554		
	5	S-103	GS-5223	Virginia, Agritopia	5818.5	2	15	0		
	6	S-104	HD-5654	Tamarisk, Crafts	962.4	2	35	0		
	7	S-105	HS-535	Hobart James	1816 1	2	32	4779 💙		
<								>		

- 3. In the Subsegments grid at top, highlight one or multiple subsegments to associate with a supersegment.
 - Mark the "Show Unassociated Subsegments Only" box if you'd like the grid to display only the subsegments that are not currently associated with a supersegment. (Subsegments that are currently associated with a supersegment are highlighted in yellow.)
 - The Total Selected Subsegment Length will be automatically calculated by the system as you add each additional subsegment to the selection.
- 4. Once you've finished selecting subsegments, you can either add them to an existing supersegment or use them to create a new supersegment:
 - Add to Supersegment: To add the selected subsegments to an existing supersegment, highlight a supersegment in the bottom grid. Then, click the *Add* to Supersegment button.

• **Create Supersegment:** To add the selected subsegments to a new supersegment, click on the *Create Supersegment* button. The following dialog will appear. Enter a unique ID and description for the new supersegment and click *OK*. The new supersegment will be added to the Supersegments grid in this dialog as well as to the *Supersegments* module.

Unique ID and Description						
Enter Unique ID and Description						
Unique ID:						
Description:						
	Ok (Cancel				

Street Supersegments

Street supersegments are made up of one or more street subsegments and can be created from the *Segments* or *Subsegments* modules using the Toolkit function. Remember, we discussed the Toolkit earlier in this workbook. These supersegments are then used to run the maintenance forecasting model; the model cannot be run off of street segments or subsegments.

- 1. To access the street supersegments, open **Transportation>>Pavement Manager>>Supersegments** from the Lucity main menu.
- 2. The Subsegments tab lists all street subsegments included in this supersegment.
 - As you can see in the example below, subsegment 7934-2 is included in this supersegment. This is one of the subsegments that we split earlier in this workbook. The other subsegments in this supersegment are related streets. It's useful to create a supersegment from a number of related or connected subsegments such as we've done below.

🏥 Supe	er Segme	ents - Unnamed Filt	ter Set							
	8 8	• 😌 • 🛅 • 🖆 🛊		1 2 4		۶ 🖗 ۶	8 🔜 🗇 🔛	- 🧟 🛥	🧶 • 🛌	
Su	iperseg ID	S-015	0// U. L. ED		Group ID	SB-	622	C	-	
D	escription	segments Dijoked Supe	Uff Higley EB	tion Model Resul	Length	 ເງໂພດ/BK	393.2	Superseg H	ec #	
Attil	Jules Oub	Coginerita Dunked Supe	asegments Condi	uon model nesul	IS NOW I NOW	2 W07FN	i Maintenanc	e comment	2	
	Ord # 🛆	Subsegment Code	Street	From Street	To Street	Length	Start End	Width	Total Area	
	1	7934-2	E RANCH RD	S RACINE LN	S TUCANA LN	130.7	130.7 261.4	20.0	585.	89 As
	2	10634-1	S CHURCH ST	E ORCHID LN	E PISTACHIO	149.5	0.0 149.5	i .		A:
	<									>
	++									
1						F	Record 1 of 1	Vi	ew Mode R	eady

- 3. To view a subsegment record, double-click on a listing in the grid. The *Subsegments* module will open.
- 4. You can calculate the total length of all attached subsegments by right clicking in the grid and selecting *Calc Total Length*. The calculated value will appear in the header's Length field. This function is useful anytime you add, edit, or delete records associated with this supersegment.

Linked Supersegments

The *Supersegments* module allows you to link supersegments together. For example, you may have one supersegment that includes all of the residential streets in a subdivision and another including all of the collector streets through that subdivision. You may wish to link these two supersegments together if you'd like the model run to select them both for maintenance in the same model year.

1. On the Linked Supersegments tab, right click in the grid and select *Add Linked Supersegments*.

📴 Super Segments - Unnamed Filter Set									
◼▤◙◪੶▽੶≞੶▯◙ ×◈◢▯ ◀▸▶ ▶≠▨▫▫◙									
Superseg ID S-015 Description 202 EB Santan, Off Hig Attributes Subsegments Linked Supersegm	pley EB	Group ID SB-622 Length 393.2 Superseg Rec # 1 Results ROW 1 ROW 2 WO/PM Maintenance Comments							
Superseg ID 🛆 🛛 🖸	w⊐ select superseg		-						
S-103 Virginia, Ac	Superseg ID 🔺	Description Select	-						
	6557-1	S HIGLEY RD, E RANCH RD to E WARNER RD							
	1486-1	S GREENFIELD RD, E DEVON CT to E GILA ST							
	1077-1	S PARKCREST ST, E CALLE DEL NORTE DR to E GILA							
	4049-1	E CALLE DEL NORTE DR, S PARKCREST ST to S KARE							
	3959-1	S PARKCREST ST, E SHERRI DR to E CALLE DEL NOR							
	1079-1	S PARKCREST ST, E KNOX RD to E SHERRI DR							
	2501-1	E KNOX RD, E JASPER DR to S CLAIBORNE AVE							
	4076-1	S KENDRA ST, E JASPER DR to E KNOX RD							
	1488-1	S GREENFIELD RD, E KNOX RD to E DEVON CT							
	5288-1	E KNOX RD, S PARKCREST ST to S KENDRA ST							
	4281-1	S SUN SHORE DR, E KNOX RD to E SHERRI DR							
	1211-1	S ROLES DR, E RANCH CT to S CLAIBORNE AVE							
	4541-1	E SAN TAN CT, S WANDA DR to S WANDA DR							
	2259-1	S CLAIBORNE AVE, S CONSTELLATION WAY to S RO							
	5203-1	S CONSTELLATION WAY, S CLAIBORNE AVE to E RA	2						
	1197-1	S ROANOKE ST, E HIGHLAND CT to E BROOKS ST							
	7940-1	E STOTTLER DR, S BALBOA DR to S HIGLEY RD							
			11.						

- 2. Choose a supersegment from the dialog and click *Select*. That supersegment will appear in the grid. To view the linked supersegment, right click on the listing and select *Go to Linked Supersegment*.
 - The associated supersegment record will now display the current supersegment on its Linked Supersegments tab.

🗜 Super Segments - Unnamed Filter Set								
▤▤▧ਸ਼ੑ੶ਲ਼੶๒੶₽₽`ਸ਼×◈◢ょヽ▶▶`≠≠ਲ਼ਲ਼ਖ਼◙๏◙∞∞੶◈੶≥								
Superseg ID S-015 Group ID SB-622								
Description 202 EB Sar	ntan, Off Higley EB			Superseg Rec # 1				
Attributes Subsegments Linked	Supersegments Londition M	10del Results RUW I RUV	V 2 WU/PM Maintenance	e Lomments				
Superseg ID 🛆	Description	Pavement Type Text	Classification Text	Section Text				
S-103	Virginia, Agritopia	Concrete Add Linked Superceaments	Atterial	Section B				
Add Linked Juperseginencs								
Delete Linked Supersegments								
		Go to Linked Supersegment						

Supersegment Condition

The Condition tab summarizes the condition of the supersegment using the results from the most recent *Field Inspections* for each subsegment linked to this supersegment.

Attributes Subsegments Linked Supersegments Condition Model Results R0W 1 R0W 2 W0/PM Maintenance Comments								
Override PCI Override PCI Date / / 💌 Use Control Value Min Controlling % 🚺 25.00								
Blended Values from Subsegment In	spections	Controlling Values from Subsegment Inspections						
Blended PCI 99.7		Control PCI 99.7						
B Load Factor 0.00	B Load Rating 0.00	C Load Factor 0.00 C Load Rating 0.00						
B Non-Load Factor 0.00	B Non-Load Rating 0.00	C Non-Load Factor 0.00 C Non-Load Rating 0.00						
B Environ Factor 0.00	B Environ Rating 0.00	C Environ Factor 0.00 C Environ Rating 0.00						
B Structural Factor 0.0	B Structural Rating 0.0	C Structural Factor 0.0 C Structural Rating 0.0						
B Roughness Factor 0.0	B Roughness Rating 0.0	C Roughness Factor 0.0 C Roughness Rating 0.0						
Curb Length 1364.10	Sidewalk Length 320.90	Driveway Units 3.00 Highest Seg ADT 2990						
Curb Replace Est 0.00	SW Replace Est 0.00	DW Replace Est 0.00 Calculated Priority 0.3						
Total Patching 7 Patching 7								

- 1. The Override PCI and Date fields allow you to manually set the PCI value that you would like for the modeling program to use. Otherwise, the calculated Blended or Controlling values will be used in the model runs.
- 2. Blended values are a blending of all subsegments connected to the supersegment. The system calculates these values as follows:
 - For each associated subsegment, the system multiplies the PCI * Area.
 - The system then adds the total value of the PCI * Area for all subsegments.
 - This total value is then divided by the total area of the supersegment.
 - This new value equals the blended or average PCI (Pavement Condition Indices).
- 3. Controlling Values allow you to set a portion of the supersegment as the controlling PCI for the supersegment. These are calculated by the system when you mark the Use Control Value checkbox and enter a Minimum Controlling Percent at the top of the tab (i.e. 20%, 50%). For instance, you could mark the checkbox and set the minimum controlling percent to 50. This would mean that if any of the connected subsegments are 50% or greater in area as compared to the supersegment, then that subsegment (or those subsegments) will be selected. The system then finds the subsegment(s) values with the largest PCI and displays that subsegment(s) data in this Supersegment record.
- 4. The Curb Length, Sidewalk Length, Driveway Units, replacement estimates, and Total Patching are simply totaled from the connected subsegments. The value for the segment with the Highest ADT (Average Daily Traffic) will be imported as well.
- 5. If you see that all of the fields in this tab are blank, you can use the Toolkit function to recalculate the values:
 - Click 🕮 on the module toolbar.

• In the Toolkit dialog, select *Update Supersegment Current Ratings* and click *Execute*. The system will then rerun the calculations.

Model Results

Results from completed model runs can be seen on the Model Results tab. As we discussed before, pavement forecasting models can only be run against supersegments. Here, you can quickly and easily access model run results for the various model years associated with this supersegment. We'll discuss the model runs in greater detail in the related workbook, Pavement Management 2.

🗓 Super Segments - Unnamed Filter Set									
	◼兽◙;x •♀ • ▣ • ◙ ₽ × ◊ / x ◀ • ▶ ▶ ≯ 8 9 8 8 8 • Q • ▶ ≤								
Superseg II	Superseq ID S-015 Group ID ISB-622								
Description	202 EB Sar	ntan, Off Higley EB			Length		393.2 Sup	erseg Rec #	1
Attributes Si	ubsegments Linked	Supersegments []	Condition Mo	del Results	nw 1 l BO		M Maintenance I C	omments	
Annouces		Supersegments	condition		10 11 11 11 11 11	~ 2 ~0/i		oninona	1
	Andel Description	Model Year	Selected	Keu/Zone	Forced	Skinned	Behab Zone	Begin PCI	Total Cc 🔨
1416 1605	Noder Breachpaicht	2009	Yee	No.	Yee	No	Overlau	99.7	
1001 1Mil		2000	No	No	No.	No	Ovenay	00.7	ć
1011 166		2000	No	No	NU No	No		33.7	
2161 1665		2003	No	No	No	No		JO.U 0E 0	
2161 1000	ин У.	2010	NO N-	NO Na	NO Na	NO N-		30.0	
2411 1Mil3	UT V.	2011	NO No	NO No	NO No	NO No		33.0	
2001 1110	111	2012	NO V	NO No	N0 V	NO No	Oundation	31.3	
2668 85PL	л м	2008	res	NO	res	NO	Uveriay	99.7	<u>ا</u> = ۱
2913 85PL	4	2008	NO	No	NO	NO		99.7	
3163 85PC	1	2009	No	No	No	No		98.0	
3413 85PC	1	2010	No	No	No	No		95.8	
3663 85PC	1	2011	No	No	No	No		93.5	
3913 85PC]	2012	No	No	No	No		91.3	
4163 85PC	2	2013	No	No	No	No		89.0	
4413 85PC)	2014	No	No	No	No		86.8	
4663 85PC	3	2015	No	No	No	No		84.5	
4913 85PC	3	2016	Yes	No	No	No	Seal Coat	82.3	í 🗸 🖉
	N	2017						00.0	
							Record 1 of 1	View Mode	Ready

Pavement Setup

The pavement management modules provide you with four pavement setup modules. In the following pages, we'll demonstrate how these modules are used.

Pavement Standards

This module allows you to create records for the different types and classifications of pavements along with their associated deterioration rates. The model runs will then select street segments for rehabilitation based on their deterioration schedules. Additionally, this module can be used to associate rehab techniques with these records.

In the next workbook we will return to this module to show you how this is accomplished; but first, we'll demonstrate the steps to create your *Pavement Standards*.

- 1. Open Transportation>>Pavement Manager>>Pavement Setup>>Standards from the Lucity main menu.
- 2. Click GO to bypass the filter screen. The Pavement Standards module will open.

Pavement Type 1 Asphalt		Classific	cation	1 Arterial
		Filony		
Deterioration/Factors Rehab Techniques				
Dete	rioration Rates		.	
Initial PCI Rating 100	Starting Year	0	Slopes	Weighting Factor % - All values must add up to 100
PCI 1 84.0	Year 1	8.0	2.00	Distress WF 100.0
PCI 2 72.0	Year 2	12.0	3.00	Structural WF 0.0
PCI 3 59.0	Year 3	16.0	3.25	Roughness WF 0.0
PCI 4 10.0	Year 4	24.0	6.13	
PCI 5 2.0	Year 5	30.0	1.33	Max PCI for Backlog
PCI 6	Year 6		15.00	
Penultimate Rating 1	Penultimate Year	100	0.0014	
Ultimate Rating 0	Ultimate Year	1000	0.0011	

- 3. Create a unique Pavement Type and Classification combination to identify your street. You'll use this module to create one record for each of the pavement type/ street classification/ pavement strength combinations used in your segment network.
 - In the example above, we've created a record for an Asphalt/Arterial/Average street.
 - Other combinations may include Asphalt, Concrete, Composite, or Gravel pavements paired with Arterial, Collector, or Residential streets (for example).
 - These would then be given a pavement strength as well.
- 4. Set the Priority Weighting Factor. The higher the value, the more likely the supersegment is to be selected in the model run (when all other elements are equal).
- 5. Set the pavement deterioration rates.
 - Each street is given an initial PCI (Pavement Condition Indices) rating of 100 and a starting year of 0. This indicates the best possible condition of the street at the time it was created. Since streets deteriorate over time, you'll need to indicate the street's deterioration rate. This will help the model runs plan the pavement rehabilitation schedule.
 - To set up the deterioration schedule, you'll need to indicate the decreasing PCI ratings by year to form the points along the curve.
 - Note that the PCI values have a penultimate rating of 1 and an ultimate rating of 0. This means that the calculated PCI values can never reach 0. Similarly,

the street's age has a penultimate year of 100 and an ultimate year of 1000. This means that the calculated year can never reach 1000. Finally, based on the PCI and age, the deterioration slope can never reach 0.0011.

- In our example below, we've created a 30-year deterioration schedule with five points along the curve. For each point, we've set an increasingly smaller PCI value until the PCI reaches 2 (at the 30-year mark). We've also indicated each year in which the PCI values will change. Note that the PCI value must be greater than 1. Our deterioration schedule is as follows:
 - The street's PCI rating will equal 84 in the street's 8th year.
 - The street's PCI rating will equal 72 in the street's 12th year.
 - The street's PCI rating will equal 59 in the street's 16th year.
 The street's PCI rating will equal 10 in the street's 24th year.

 - The street's PCI rating will equal 2 in the street's 30th year.
- When you click 📕 to save the record, the system will automatically calculate the pavement deterioration slopes. These indicate the points along the curve. The final slope calculation is found using the penultimate year and last year entered.
 - Since our slope ends at 30 years, our final point on the slope equals 0.014.
- 6. Set the pavement distress, structural, and roughness weighting factors. These values allow you to default the emphasis that these factors have on the subsegment PCI.
 - Note that these three values must add up to 100. •
 - If only visual distresses are being collected, then set the Distress WF to 100.
 - In our example, we've set the Distress WF to 70, Structural WF to 20, and Roughness WF to 10. This means that the Distress PCI will contribute 70% of the final PCI, the Structural PCI will contribute 20%, and the Roughness PCI will contribute 10%.

	Dete	rioration Rates ——			1
Initial DCL Bating	100	Charling Vers	0	Deterioration Slopes	Weighting Factor % - All values must add up to 100
inidal FCI hadrig	100	starting rear		2.00	Distross V/E
PCI 1	84.0	Year 1	8.0	2.00	
PCI 2	72.0	Year 2	12.0	3.00	Structural WF 20.0
				3.25	Roughness WF 10.0
	59.0	Year 3	16.0	0.10	
PCI 4	10.0	Year 4	24.0	6.13	
	2.0	У Е		1.33	
	2.0	Year 5	30.0		
PCI 6		Year 6			
Penultimate Rating	1	Penultimate Year	100	0.014	
Ultimate Rating	0	Ultimate Year	1000	0.0011	

Pavement Distresses

This module allows you to record individual pavement distresses that will be rated when inspecting street subsegments. Here, you can assign weighting factors to those distresses and indicate distress types. These records will be used again in the

Pavement/Distress Matchups module. In addition, the model runs will use these distresses to calculate PCI and determine which street segments to select for rehabilitation.

- 1. Open Transportation>>Pavement Manager>>Pavement Setup>>Pavement Distresses from the Lucity main menu.
- 2. Click GO to bypass the filter. The Pavement Distresses module will open.

Pavement Distresses - No Filter	
◼▤◙◪੶ਲ਼੶⊡੶₽₽ ■×◈≀	▏▓▕┫▕▌▶▐▶▏\$◇▓▏▇▆
Order 1	
Distress Riding Comfort	Use Severity/Density?
Weighting Factor	
Distress Type 4 Roughness	
	Record 1 of 25 View Mode Re

- 3. Create a unique distress name and indicate the order in which this distress record will initially appear in the Field Inspection grid.
 - For our example, we've created a distress for riding comfort.
- 4. Indicate the Distress Type. These help categorize the type of impact that the distress has on the pavement.
 - The five Distress Types are: Load, Non-Load, Environmental, Roughness, and Structural.
 - When performing Field Inspections, the system will total up the final deduct values for each Distress Type. Those values then help to determine the appropriate rehabilitation method.
- 5. Set the weighting factor. This indicates the negative effect a distress has on pavement. This factor is combined with the quantifiable field observation to calculate PCI. You can use this value to declare the maximum deduction this particular distress can have against the PCI from Distresses. Consider the following when setting up your weighting factors:
 - All distresses are rated on a 10 point system: **10** represents a perfect street with no defects while **0** represents the worst possible street condition.
 - The numerical value for the pavement deterioration (from the field observation) is subtracted from the rating of 10. This new rating is then multiplied by the weighting factor to calculate PCI. In other words, the calculations are as follows:
 0 - Rating = Initial Deduct
 - Initial Deduct * Weighting Factor = Final Deduct
 - Based on the calculation we just defined, let's look at an example using the Riding Comfort Distress on the previous page:
 - If the Riding Comfort on a particular pavement was given a rating of 6, there would be 4 deduction points (10 6 = 4). These 4 points are then

multiplied by the Weighting Factor of 1.0 ($4 \times 1.0 = 4$). This Weighting Factor is defined in the *Pavement Distress* record above. Thus, 4 points would be deducted from the PCI.

- If the Weighting Factor in the *Pavement Distress* record had been 3, then the total deduction points would have equaled 12 (4 * 3 = 12). 12 points would then be deducted from the PCI.
- If you have been using an older version of *Master Series* and recently upgraded to v. 6.72 or higher, you'll want to use the following weighting factors to maintain your previous distress setup.
 - If your previous distress had a possible 10 index points, set the weighting factor to 1.
 - If your previous distress had a possible 5 index points, set the weighting factor to 0.5.
- 6. Mark the checkbox if you want to use severity and density analysis in the *Field Inspections* module calculations. Severity/density ratings indicate how bad a problem is and how often it occurs.

Match Up Your Pavements and Distresses

The *Pavement/Distress Matchups* module is used to associate pavement types created in the *Pavement Standards* module with distresses created in the *Pavement Distresses* module. This helps you identify which distresses will be rated for different types of pavements. The relationships established here will be used in the *Field Inspections* module to calculate PCI. The model runs will then use these matchups and PCI values to help determine which street segments to select for rehabilitation.

- 1. Open Transportation>>Pavement Manager>>Pavement Setup>>Pavement/Distress Matchups from the Lucity main menu.
- 2. Click GO to bypass the filter. The Pavement/Distress Matchups module will open.

III P	avemen	t/Distress Matchups - No Filter				
	s	<u>* • 🖓 • 🖻 • 🖩 🗙 🏼 /</u>	<u>∦</u> ◀ ◀	🕨 🕨 🏓 🗯	Ľ	
F	Pavement				Max Deduc	Value 180.0
	dromonk					1 100.0
D	istress Pa	ge 1				
	Order 🛆	Distress	Use S/D	Weighting Factor	Distress Type Text	<u>^</u>
	1	Riding Comfort	No	1.0	Roughness	
	2	Faulting	No	1.0	Load	
	3	Rutting	Yes	1.0	Load	
	4	Lane/Shlder Drop	Yes	1.0	Non-Load	
	5	Pumping	No	1.0	Non-Load	=
	6	Joint Seal Dam.	No	1.0	Non-Load	
	7	Joint Failures	Yes	1.0	Load	
	8	Fatigue Cracks	Yes	1.0	Load	
	9	Long. Cracks	Yes	1.0	Load	
	10	Block Cracks	Yes	1.0	Non-Load	
	11	Corner Cracks	Yes	1.0	Non-Load	
	12	Drainage	No	1.0	Environmental	
	13	Durability Cracks	Yes	1.0	Load	
	14	Trans. Cracks	Yes	1.0	Non-Load	
	15	Misc. Cracks	Yes	1.0	Non-Load	
	16	Poor Cross Sect.	No	1.0	Non-Load	
	47	N .	61 61	1,0		_
ļ,	<					2
_						
				Record 1 of	4 JView Mode	Ready

- 3. Select a Pavement Type from the *Pavement Standards* module.
 - In our example, we've selected an Asphalt street. This matches the record we created at the beginning of this workbook.
- 4. Using the Distresses grid, add distresses from the *Pavement Distresses* module.
 - Right click in the grid and select Add Record.
 - Choose one or multiple distresses from the pick list and click Select.
 - You can highlight multiple selections by holding down your SHIFT or CTRL key.
 - In the example below, we've highlighted "Riding Comfort". This is the distress from our earlier example. We'll also be adding a number of other distresses to the grid.

)_____)

Selecti	on List				
Order 🔺	Distress	Use Severity/Density?	Distress Type Text	^	Select
1	Riding Comfort	No	Roughness		
2	Faulting	No	Load		Close
3	Rutting	Yes	Load		
4	Lane/Shider Drop	Yes	Non-Load		
5	Pumping	No	Non-Load		
6	Joint Seal Dam.	No	Non-Load		
7	Joint Failures	Yes	Load		
8	Fatigue Cracks	Yes	Load		
9	Long. Cracks	Yes	Load		
10	Block Cracks	Yes	Non-Load		
11	Corner Cracks	Yes	Non-Load		
12	Drainage	No	Environmental		
13	Durability Cracks	Yes	Load		
14	Trans. Cracks	Yes	Non-Load		
15	Extreme Trans	Yes	Non-Load		
16	Poor Cross Sect.	No	Non-Load		
17	Dust	No	Environmental	~	

- 5. Once you have added distresses to the grid, the Max Deduct Value field in the header will be automatically calculated. This value will be updated each time you add or remove a distress from the grid.
 - The Max Deduct Value equals the sum of the weighting factors for all selected distresses multiplied by 10.

Set Up Severity and Density Values

Severity and density ratings are used in the *Field Inspections* module to evaluate distresses. These ratings and distresses help the model runs determine which street segments to select for rehabilitation. Follow the steps below to set the initial distress ratings by defining the impact of the Extent and Severity values that you wish to use.

- 1. Open Transportation>>Pavement Manager>>Pavement Setup>>Severity/Density Setup from the Lucity main menu.
- 2. Click GO to bypass the filter. The Severity/Density Setup module will open.

Sev	😹 Severity/Density Setup - No Filter							
0-10 Distress Rating by Extent Classification								
			Severity					
	Estant	1	2	3				
	Extent	Low	Moderate	Severe				
0	None	10.0	10.0	10.0				
1	Few	9.5	9.0	8.0				
2	Intermittent	9.0	8.0	6.0				
3	Frequent	8.5	7.0	4.0				
4	Extensive	8.0	6.0	2.0				
5	Throughout	7.5	5.0	0.0				
,			Record 1 o	f 1 View M //				

- 3. Only one severity/density record is needed. The example above displays the standard settings; however, you may choose to edit these values to suit your needs.
 - Click the 🖊 button to enter edit mode.
 - Our standard settings use three severity ratings (low, moderate, and severe) and five extent ratings (none, few, intermittent, frequent, extensive, and throughout).
 - The severity values are used to indicate how bad the effect of the distress is on the pavement.
 - The extent values are used to indicate how much of the pavement is affected by the distress.
 - Each rating has an available scale of 0-10. 10 represents the best possible street. Our ratings have been set in descending order to reflect the extent of the distress.
 - Click 📕 to save the record once you have made your changes.

How Severity/Density is Calculated

 During the field inspection, a distress is observed on the pavement. The inspector will quantify this distress using the values in the *Severity/Density Setup* module. Based on your setup, the system will select a rating and then multiply it by the weighting factor (defined in the *Pavement Distress* module). The Model Runs then use these ratings calculations to help determine which street segments to select for rehabilitation.

- 2. In our example, an inspector has observed the Riding Comfort distress on a section of pavement. Remember, this is the distress record we created earlier.
 - The inspector gives the distress a severity value of 2 Moderate.
 - The inspector gives the distress an extent value of 3 Frequent.
 - Based on these values, the system gives the pavement a rating of 7 (example shown below).
 - This value is then multiplied by 1.0 (the weighting factor found in the *Pavement Distress* module), determining the actual rating for the distress (7 * 1.0 = 7).

🕵 Sev	Severity/Density Setup - No Filter							
	0-10 Distress Rating by Extent Classification							
			Severity					
	Future	1		3				
	Extent	Low	Moderate	Severe				
0	None	10.0	10.0	10.0				
1	Few	9.5	9.0	8.0				
2	Intermittent	9.0	8.0	6.0				
3	Frequent — —		7.0	4.0				
4	Extensive	8.0	6.0	2.0				
5	Throughout	7.5	5.0	0.0				
			Record 1 of	1 View M				

Field Inspections

The Field Inspections module allows you to record street subsegment inspection results and observations. This module is then used to summarize the street defects, distresses, and ratings in order to calculate the street's PCI (Pavement Condition Indices). These values are then used by the Budget Forecasting Model Runs to determine which street segments to select for rehabilitation.

- 1. Open **Transportation>>Pavement Manager>>Field Inspections** from the Lucity main menu.
- 2. Click GO to bypass the filter. The Street Pavement Field Condition Assessments module will open.

- 3. To help you understand the typical workflow process, we'll continue using the segments and subsegments we created earlier in this workbook. Remember, from segment 7934, E. Ranch Rd., S. Racine Ln. to S. Tucana Ln., we created three subsegments. These subsegments are numbered 7934-1, 7934-2, and 7934-3.
- 4. Click the Add button Add the top of the module toolbar. Then, click the Subsegment Code field caption button to select from the pick list.
 - As you can see below, we've selected subsegment 7934-2. This is one of the subsegments we created in *the Street Segment*.
- 5. You'll need to add an Inventory Date (inspection date) in order to save the record.

Image: Street Pavement Field Condition Assessments - Unnamed Filter Set Image: Image: Street Pavement Field Condition Assessments - Unnamed Filter Set								
Field Rec # 308 Subsegment Code								
Street N	ame			Insp	ection Crew			
From	Subsegment Code							
To S	Euboogmont Code +	Street	End Doint 4	End Doint 1	Start Station	End Station		Soloot
General	7934.2	E RANCH RD	S RACINELN	S TUCANA I N	130.7	261.4	_ =	Jelect
	7935-1	E RANCH RD	S TUCANA I N	S BANNING ST	0.0	426.2		Close
	7936-1	E RANCH RD	S BANNING ST	S BALBOA DR	0.0	261.0		
Star	7937-1	E STOTTLER	S RACINE LN	S TUCANA LN	0.0	261.0		Caption
End	7938-1	E STOTTLER	S TUCANA LN	S BANNING ST	0.0	423.0		
	7939-1	E STOTTLER	S BANNING ST	S BALBOA DR	0.0	261.0		
Clas	7940-1	E STOTTLER	S BALBOA DR	S HIGLEY RD	0.0	221.3		Add
Pave	8520-1	E RANCH RD	S BALBOA DR	S HIGLEY RD	0.0	222.5		E .10
	8521-1	S HIGLEY RD	E STOTTLER DR	E RANCH RD	0.0	502.1		Edit
Surf	8735-1	S CRAFTSMA	E VALENCIA ST	E VIRGINIA ST	0.0	299.0		Delete
Dish	8736-1	S CRAFTSMA	E VIRGINIA ST	E TAMARISK ST	0.0	299.0		0 01010
	8737-1	S CRAFTSMA	E TAMARISK ST	E HOBART ST	0.0	298.9		
Sect	8738-1	S CRAFTSMA	E HOBART ST	E JAMES ST	0.0	299.0		
	8739-1	E VALENCIA	S CRAFTSMAN LN	S CRAFTSMAN LN	0.0	472.9		
	8740-1	E VALENCIA	S CRAFTSMAN LN	E AGRITOPIA LOOP	0.0	732.0		
Mile	8741-1	E VIRGINIA S	S CRAFTSMAN LN	S CRAFTSMAN LN	0.0	472.9		
	18742-1	E VIRGINIA S	S CRAFTSMAN LN	E AGRITOPIA LOOP	0.0	732.0		

Imported Data

Once you've selected the subsegment code, data from the corresponding module will be carried over into the header, General, Curb, Sidewalk, and Distress tabs.

• Examples of these tabs and their imported data are pictured below. These imported fields can all be edited by the user.

Header

Field Rec #	309 Subsegment Code 7934-2	Inventory Date	■ 000000000000000000000000000000000000
Street Name	E RANCH RD	Inspection Crew	
From Street	S RACINE LN	Start Station	130.7 Most Recent Inspection
To Street	S TUCANA LN	End Station	261.4

General Tab

General Curb Sidewalk Distresses PCI Recom Maintenance Custom Comment								
	,							
Starting Desc								
Ending Desc								
Classification	2 Collector	Length	130.7	Median Width 2.0				
Pavement Type	Asphalt	Width	20.0	CDS Diameter 15.0				
Surface Type	1 Chip Seal	Pave Area (SY)	290.44	# of Lanes 3				
District Name	2 District 2	Additional Area	5.00	Total Area 585.89				
Section Name	Section A	Cross Slope	2 Not Adequate					
Owner	City	Cross Slope %	15.0	Street Number				
Mile Number	25.0	Group Number	865-45	Block Number				

Curb Tab

General Cur	b Sidewalk Distres	ses PCI Recom Maintenance Custom	Comment	
		N/W	S/E	
Drainage	Drainage Type	1 Curb	Drainage Type 1 Curb	
	Inlets Present	1 Max Spacing 300'	Inlets Present 1 Max Spacing 300'	
Curbing	Curb/Gutter Type	2 Roll Back	Curb/Gutter Type 2 Roll Back	
	Curb Width NW	25.0	Curb Width SE 65.0	
	Curb Height NW	5.0	Curb Height SE 25.0	
	Curb Overlaid	1 Yes	Curb Overlaid 0 N/A	_
	Depth Above Lip NW	23.0	Depth Above Lip SE 25.0	
	Curb Cond NW		Curb Cond SE	
	Replace Est NW		Replace Est SE	

• Note that the Curb Cond NW, Curb Cond SE, Replace Est NW, and Replace Est SE fields are not carried over from inspections. These fields allow you to enter condition data and replacement estimates. The *Supersegments* module then sums the total of all replacement estimates for all attached subsegments.

Sidewalk Tab

General Curb	Sidewalk Distresses PCI Recom Maintenance	Custom Comment
	N/W	S/E
Sidewalk	Sidewalk Type 1 Concrete	Sidewalk Type 1 Concrete
	Sidewalk Length NW 24.0	Sidewalk Length SE 6.0
	Sidewalk Width NW 62.0	Sidewalk Width SE 2.0
	Dist from Curb 2 Between 0 and 2 feet	Dist from Curb 2 Between 0 and 2 feet
	Sdwik Cond NW	Sdwlk Cond SE
	SW Rpl Est NW	SW Rpl Est SE
Driveway Approaches	# of Units NW 45	# of Units SE
	DW Rpl Est NW	DW Rpl Est SE

 Note that the Sidewalk Condition NW, Sidewalk Condition SE, Sidewalk Replacement Estimate NW, Sidewalk Replacement Estimate SE, Driveway Replacement Estimate NW, and Driveway Replacement Estimate SE fields are not carried over from inspections. These fields allow you to enter condition data and replacement estimates. The *Supersegments* module then sums the total of all replacement estimates for all attached subsegments.

Distresses Tab

Ge	neral Cu	rb Sidewalk Distres	ses PCI Re	com Maintena	nce Custom	Comment			
	Patching	g Est (SY)	Co	ndition				_	
ĺ	Order 🛆	Distress	Use S/D?	Severity	Density	Rating	Initial Deduct	Weighting Factor	~
[1	Riding Comfort	No					1.0	
	3	Rutting	Yes					1.0	
	4	Lane/Shider Drop	Yes					1.0	
	5	Pumping	No					1.0	
	8	Fatigue Cracks	Yes					1.0	
	9	Long. Cracks	Yes					1.0	
	10	Block Cracks	Yes					1.0	
	12	Drainage	No					1.0	
	14	Trans, Cracks	Yes					1.0	
	15	Misc. Cracks	Yes					1.0	
	16	Poor Cross Sect.	No					1.0	
	17	Dust	No					10	
	<								>

Note the fields above the Distresses grid. The Patching Est (SY) field allows you
to enter an estimated cost of patching the pavement, per square yard. The
Condition field can be used to enter a general condition description. If you
include a value in this field, and if this is the most recent inspection for the
subsegment, then this condition value is added to the Subsegment Condition
field on that record's Inspection tab.

Distresses Grid

The Distresses tab is one of the most important features of the *Field Inspections* module. It allows you to input pavement condition ratings and severity/density values that are needed to calculate PCI. PCI is used in the Model Runs to determine which street segments to select for rehabilitation. We'll go through a step-by-step example to show you how this tab is used.

- 1. When you select a subsegment code in the header, the system imports all distresses associated with the subsegment's pavement type. Remember, you matched distresses to your pavement types earlier in this workbook.
- 2. For each distress in the grid, you'll need to indicate either the severity/density or rating values.
 - You'll enter severity and density values for a distress only if the "Use S/D?" column for that distress is marked "Yes".
 - Severity is used to indicate how bad the effect of the distress is on the pavement. Density is used to indicate how much of the pavement is affected by the distress.
 - If the "Use S/D?" column for a distress is marked "No", you'll enter ratings only.
- 3. To indicate severity and density, right click on a distress and select Set Severity/ Density. Enter values for both severity and density in the dialog.

Order 🛆	Distress	Use S/D?	Severity	Density	Rating	Initial Deduct	Weighting Factor
1	Riding Comfort	No					1.0
2	Faulting	No					1.0
3	Rutting	Yes 🗖					1.0
4	Lane/Shlder Drop	Yes	Set Severity,	Density			1.0
5	Pumping	No	Set Rating				1.0 💳
6	Joint Seal Dam.	No	Set Rating				1.0
7	Joint Failures	Yes 🖣					1.0
8	Fatigue Cracks	Yes					1.0
9	Long. Cracks	Yes					1.0
10	Block Cracks	Yes					1.0
11	Corner Cracks	Yes					1.0 👝
12	Drainage	No					10
<							>

- On page 23, we showed you an example of our standard *Severity/Density Setup* module. Our settings are as follows:
 - Severity: 1 Low, 2 Moderate, 3 Severe
 - Density (extent): 0 None, 1 Few, 2 Intermittent, 3 Frequent, 4 Extensive, 5 – Throughout
- In the example below, we've indicated a severity value of 2 (moderate) and density value of 3 (frequent).

Set Severity/Density	X	
Severity	2	
Density		
	ОК	Cancel

- Once you've entered the severity and density values, the system will automatically calculate the distress rating. These ratings are also determined in the *Severity/Density Setup* module. Based on our standard settings, a severity value of 2 and density value of 3 equals a rating of 7.
- Once the ratings have been set, the system will calculate the initial deduct and final deduct on the Distresses tab. The calculations are as follows:
 - \circ 10 Rating = Initial Deduct
 - Initial Deduct * Weighting Factor = Final Deduct.
- In our example, the Initial Deduct equals 3 (10-7 = 3) and the Final Deduct equals 3 (3 * 1 = 3).
 - Remember, the Weighting Factor is defined in the *Pavement Distress* module. We discussed this module on page 20. You can see the Weighting Factor values in the Distresses grid below.

Order A	Distress	Use S/D?	Severity	Density	Rating	Initial Deduct	Weighting Factor	^
1	Riding Comfort	No					1.0	
- <u>-</u>	Foulting	No					1.0	
3	Rutting	Yes	2	3	7.0	3.0	1.0	
	Lanc/Shider Drop	Yes					1.0	
5	Pumping	No					1.0	
6	Joint Seal Dam.	No					1.0	
7	Joint Failures	Yes					1.0	
8	Fatigue Cracks	Yes					1.0	
9	Long. Cracks	Yes					1.0	
10	Block Cracks	Yes					1.0	
11	Corner Cracks	Yes					1.0	
12	Drainage	No					10	×
<								>

- 4. For distresses where the "Use S/D?" column is marked "No", you'll indicate a rating only.
 - Right click in the grid and select *Set Rating* or *Set Rating to 10*. A street with a distress rating of 10 is in perfect condition.

Order 🛆	Distress	Use S/D?	Severity	Density	Rating	Initial Deduct	Weighting Factor	^
	Riding Comfort	No					1.0	
2	Faulting	No	Set Severity/D	ensity			1.0	
3	Rutting	Yes	Set Rating	3	7.0	3.0	1.0	
4	Lane/Shlder Drop	Yes	Set Ration to 1	0			1.0	
5	Pumping	No -	Sec Rading to 1	°			1.0	_
6	Joint Seal Dam.	No					1.0	
7	Joint Failures	Yes					1.0	
8	Fatigue Cracks	Yes					1.0	
9	Long. Cracks	Yes					1.0	
10	Block Cracks	Yes					1.0	
11	Corner Cracks	Yes					1.0	
12	Drainage	No					10	<u> </u>
<								>

• In the Set Rating dialog, enter the rating for the distress on a scale of 0-10. In our example, we've set the rating to 8.

Set Rating	
Rating	
ОК	Cancel

• Once you have set the rating, the Initial Deduct and Final Deduct will be calculated as before. As you can see in the example below, the initial and final deducts both equal 2.

[$Order \vartriangle $	Distress	Use S/D?	Severity	Density	Rating	Initial Deduct	Weighting Factor	^
1	1	Riding Comfort	No			8.0	2.0	1.0	
1	2	Faulting	NO					1.0	
	3	Rutting	Yes	2	3	7.0	3.0	1.0	
	4	Lane/Shider Drop	Yes					1.0	
	5	Pumping	No					1.0	
	6	Joint Seal Dam.	No					1.0	
	7	Joint Failures	Yes					1.0	
	8	Fatigue Cracks	Yes					1.0	
	9	Long. Cracks	Yes					1.0	
	10	Block Cracks	Yes					1.0	
	11	Corner Cracks	Yes					1.0	_
	12	Drainage	No					10	<u>×</u>
	<								>

PCI Tab

The PCI tab (Pavement Condition Indices) performs automatic system calculations based on the data in the Distresses tab. This tab also contains several user-entered fields that contribute to the final PCI calculations. The calculations are described in detail below:



- 1. The Initial Distresses PCI field is calculated by totaling the Final Deduct values from Distresses and subtracting that total from 100. This value is then multiplied by the Weighting Factor (as set up in *Pavement Standards*) to find the Final Distress PCI.
 - You can edit the weighting factors if needed. If only visual distresses are being rated, set the Distress Weighting Factor to 100 and the other two factors to 0.
- 2. You can then alter this PCI value by entering the Initial Strength and Roughness PCI.
 - Strength ratings can improve or reduce the Inventory PCI. In our example, we've entered an Initial Strength PCI of 26. The weighting factor of 1 is carried over

from the *Pavement Standards* record for this type of pavement. The system multiplies these values to find the Final Structural PCI (0.3 in this example). This value is then added to the Final Distresses PCI to find the Inventory PCI.

- Roughness ratings are also used to calculate the Inventory PCI. We have entered an Initial Roughness PCI of 68 which has been multiplied by the Weighting Factor of 1 (carried over from *Pavement Standards*). The system has found a Final Roughness PCI of 0.7. This has been added to the Final Distress PCI and Final Structural PCI to find the Inventory PCI. After all of these calculations, the Inventory PCI now equals 27.9.
- 3. If you disagree with the Inventory PCI value, you can enter an alternate number and date in the Override PCI fields. These will be used by the system in subsequent PCI calculations and the model runs.
- 4. The system then calculates the Current PCI as follows:
 - The system uses either the Inventory PCI or Override PCI (if one exists) and determines the time elapsed by subtracting the Inventory Date or Override Date from the current system date.
 - The system then determines the proper deterioration slopes as indicated by the values you set up in the *Pavement Standards* module.
 - To find the Current PCI, the system calculates:
 - Inventory or Override PCI (time elapsed * slope)
- 5. The Weighted Rating is the final system calculation on this tab. It helps you prioritize your pavement repairs. The system uses the following equation:
 - 100 PCI * Priority Weighting Factor
 - Remember, you entered the Priority Weighting Factor for this type of pavement in the *Pavement Standards* module.

Pavement Maintenance

The Maintenance module allows you to record maintenance tasks performed on your street subsegments. You can record many additional details about the maintenance program used. In addition, this module is integrated with the pavement modeling program. In the example below, we'll show you how to create a *Pavement Maintenance* record and demonstrate how it is used to update values in the *Subsegment, Supersegment,* and *Model Runs*.

- 1. Open **Transportation>>Pavement Manager>>Maintenance** from the Lucity main menu.
- 2. Click Go to bypass the filter. The Pavement Maintenance module will open.
- 3. Click the Add button sat the top of the module toolbar. Then, click the Subsegment Code field caption button to select from the pick list.
 - In our example below, we've selected Subsegment 7934-2. You'll recognize this as the subsegment that was created earlier in this workbook.

🕵 Pavement M	laintenance - No Filter								
Is			/ % 4 4	▶ ▶ ⇒ ⊮ ₽		<u>ه</u> - ک			
Subsegment Co	ode			Rehab Tech	nique				
Street Nar									
From Stre	Subsegment Code								
To Stree	Subsegment Code 🔺	Street	End Point 1	End Point 2	Start Station	End Statio	n 🔥 (Select	7
	7934-2	E RANCH RD	S RACINE LN	S TUCANA LN	130.7	261.4			-
General Cu	7935-1	E RANCH RD	S TUCANA LN	S BANNING ST	0.0	426.2		Close	
	7936-1	E RANCH RD	S BANNING ST	S BALBOA DR	0.0	261.0		Contion	
Progr	7937-1	E STOTTLER	S RACINE LN	S TUCANA LN	0.0	261.0		Caption	
	7938-1	E STOTTLER	S TUCANA LN	S BANNING ST	0.0	423.0	_		
Maint By	7939-1	E STOTTLER	S BANNING ST	S BALBOA DR	0.0	261.0			
Marins	7940-1	E STOTTLER	S BALBOA DR	S HIGLEY RD	0.0	221.3		Add	
Mairic	8520-1	E RANCH RD	S BALBOA DR	S HIGLEY RD	0.0	222.5		Elabe	
Mate	8521-1	S HIGLEY RD	E STOTTLER DR	E RANCH RD	0.0	502.1		Ean	
	8735-1	S CRAFTSMA	E VALENCIA ST	E VIRGINIA ST	0.0	299.0		Delete	
Thickr	8736-1	S CRAFTSMA	E VIRGINIA ST	E TAMARISK ST	0.0	299.0		0.01010	
Cos	8737-1	S CRAFTSMA	E TAMARISK ST	E HOBART ST	0.0	298.9			
	8738-1	S CRAFTSMA	E HOBART ST	E JAMES ST	0.0	299.0			
	8739-1	E VALENCIA	S CRAFTSMAN LN	S CRAFTSMAN LN	0.0	472.9			
a	8740-1	E VALENCIA	S CRAFTSMAN LN	E AGRITOPIA LOOP	0.0	732.0			
Short Des	8741-1	E VIRGINIA S	S CRAFTSMAN LN	S CRAFTSMAN LN	0.0	472.9			
	8742-1	E VIRGINIA S	S CRAFTSMAN LN	E AGRITOPIA LOOP	0.0	732.0	M		
					Desard 0 of 0	a dal san da i ir)oodu		

• Once you select the Subsegment Code, the system will automatically fill in the corresponding Street Name, From Street, To Street, Start and End Station.

🎪 Pavement Main	itenance - No Filter		
	<u> </u>		
Subsegment Code	7934-2	Rehab Technique	
Street Name	E RANCH RD	Maint Date 🚺 / / 💌	
From Street	S RACINE LN	Start Station 130.7 Rec #	5
To Street	IS TUCANA LN	End Station 261.4	

- 4. Next, select the Rehab Technique; enter the Maintenance Date, and record additional details about the pavement maintenance program. You can include the maintenance type, material, thickness, cost, and a description of the maintenance task.
 - Here, we've indicated that the Overlay with Milling technique is being performed as routine maintenance to combat medium severity cracking and spalling.
- 5. Several fields in this module integrate with the modeling program. These special fields are described below:
 - The Rehab Technique field allows you to select a rehabilitation method from the *Rehab Techniques* pick list. We will cover this module in workbook 2. If the technique you select here has an associated Reset PCI value, that value will be entered into the Override PCI field on the General tab. You can then edit the PCI value as needed.
 - The Set Override PCI Value checkboxes allow you to indicate how you would like the Override PCI Value to be applied. If you mark the "Reset Field Insp PCI" box, the system will update the *Field Inspection* module with the designated value. If you mark the "Reset Superseg PCI" box, the system will update the *Supersegment* record with the designated value. This value will then be used in

the *Model Runs* if the Maintenance Date in the header is more recent than the date of the last *Field Inspection* or *Supersegment* Override PCI dates.

- In order to update the *Supersegment* record, the Subsegment must be associated with a Supersegment. When you select a Subsegment Code in the header, the Supersegment Rec # will be entered by the system.
- The Pavement Type field is carried over from the associated *Subsegment* record when you select a Subsegment Code in the header. It can be edited if needed.
- The Surface Type field allows you to indicate the surface type of the Subsegment in this record (i.e. Chip Seal, Slurry Seal, Crack Fill, etc.). If this *Pavement Maintenance* record is the most recent, then the linked *Subsegment* record's surface type will be updated with the data in this field.

🎄 Pavement Maintenance - No Fi	ilter					
	@ × 🏼 / 🕷 🔳		▶ ४ छि प	🔜 🔍 - 🖿 🍕	>- 🛋	
Subsegment Code 7934-2			Rehab Technique	1 Overlay	with Milling	
Street Name E RANCH RD			Maint Date	08/26/2009	•	
From Street S RACINE LN			Start Station	130.7	Rec #	5
To Street S TUCANA LN			End Station	261.4		
General Custom Comments						
Program Maint By Type 2 Routin Maint By Collier Material 2 Compo Thickness Cost 27	e Maintenance site 3.00 7000.00	Pa Set Ov Re Re	Superseg ID	7934-2 1 Asphalt 2 Slurry Seal 98 V		
	any cracking and spalling					
			Rec	ord 1 of 1	View Mode F	Ready