Lessons Learned from Research in Innovative Resurfacing and Pavement Preservation Techniques on Roadways in Metro Nashville – Davidson County

Using The Right Treatment - At The Right Place - At The Right Time

Mr. Donald Reid
Paving Operations Manager,
Public Works Department
The Metropolitan Government of Nashville – Davidson County

Metro Nashville PUBLIC WORKS

This Presentation Covers 3 Main Topics

- Why Do Agencies Need a Paving & Pavement Preservation Program
- The Benefits of a Strategic Plan & Pavement Management System
- Nashville's Perspective of Various Pavement Preservation Products & Resurfacing Techniques Tested on Nashville Roadways

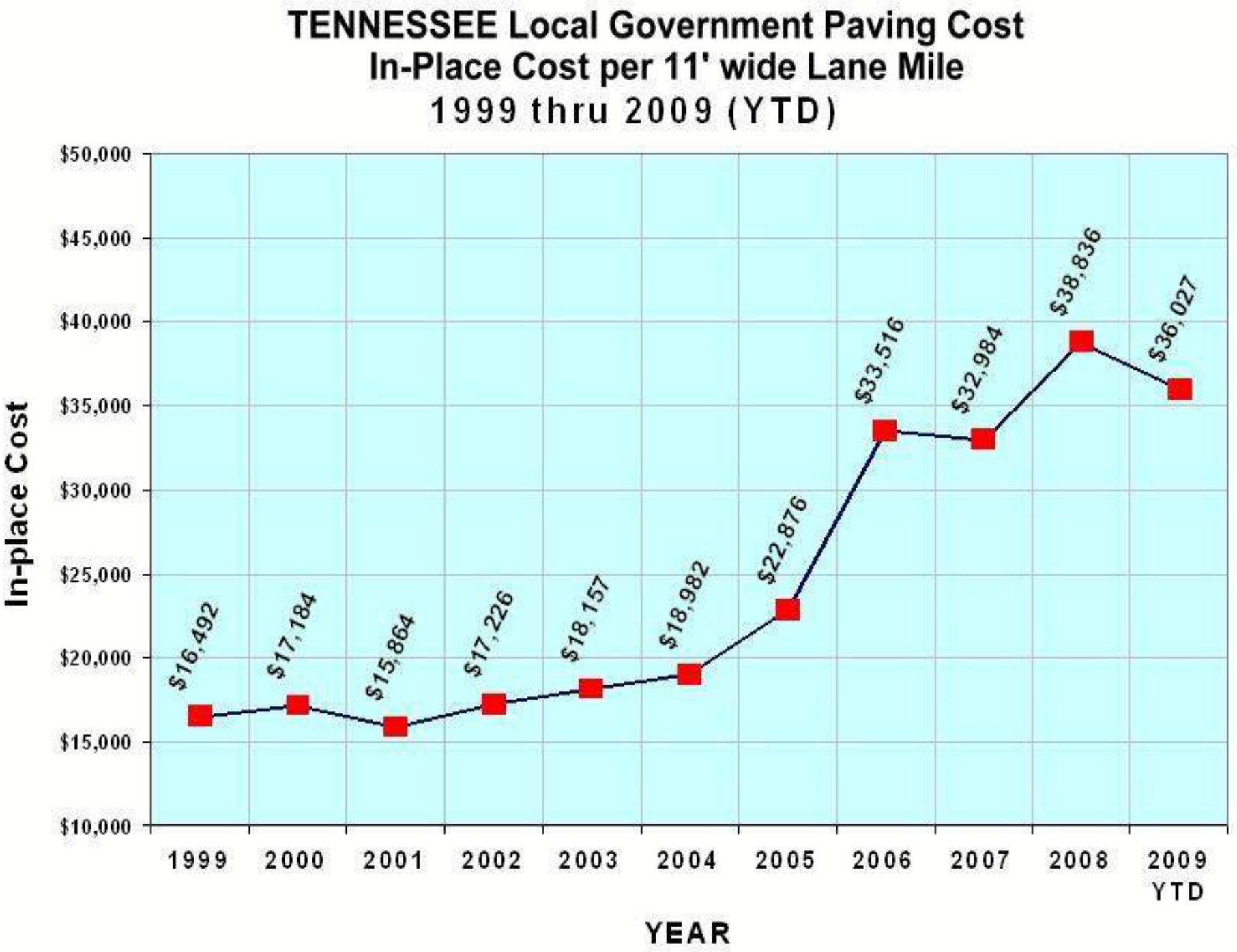
Why Do Agencies Need a Paving & Pavement Preservation Program

Historical Paving Program

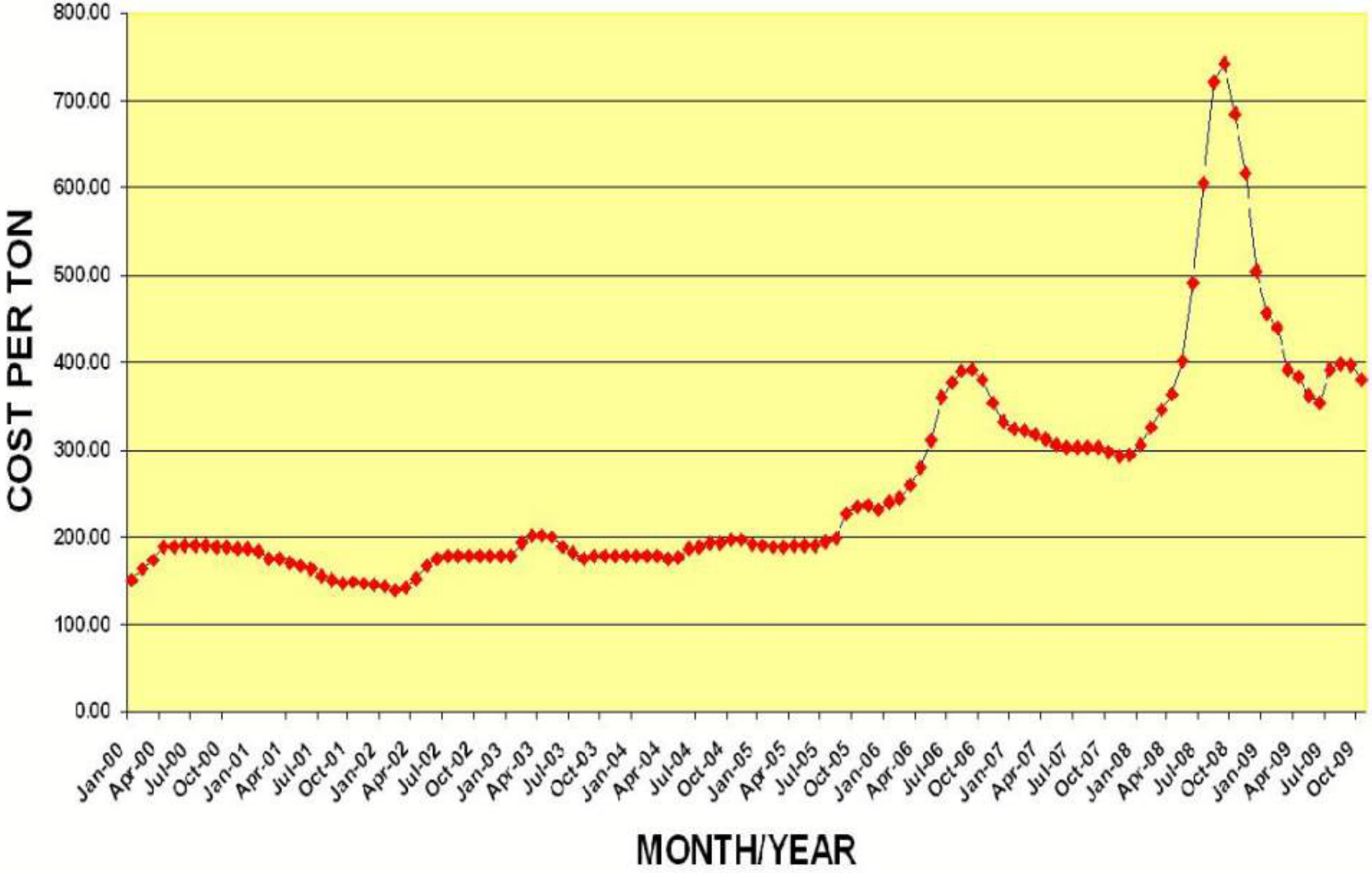
- Identify roads in poor condition.
- Pave what you can until the budget runs out.
- Does not take into account the various pavement distresses in the roadway network.
- Does not incorporate pavement preservation techniques.
- Does not address roads that need attention but may not need paving at that time.

Paving & Pavement Preservation Program

- Paving only is not the most cost effective application to address the various roadway distresses.
- Paving only became an issue when the cost of asphalt increased drastically in 2005.
- Increasing the life of the road through pavement preservation is a good use of tax payers dollars.


TENNESSEE Local Government Paving Cost
In-Place Cost per 11' wide Lane Mile
1999 thru 2009 (YTD)
In-place Cost
$50,000
$45,000
$40,000
$35,000
$30,000
$25,000
$20,000
$15,000
$10,000
$16,492
$17,184
$15,864
$17,226
$18,157
$18,982
$22,876
$33,516
$32,984
$38,836
$36,027
1999
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009 YTD
YEAR

TDOT BITUMINOUS INDEX



The Benefits of a Strategic Plan & Pavement Management System

Strategic Plan

- A Strategic Plan is a good road map to a Pavement Preservation Program.
- Includes Data Collection Process, Pavement Management System, and Detail of Various Treatments based upon Roadway Condition.
- Provides Support for Pavement Management Decision made.

Pavement Condition Data

- Pavement Condition Data On Your Roadway Network is the Key to Pavement Management.
- Pavement Condition Data is Needed to Define Your Paving & Pavement Preservation Program.
- Data Needed; Longitudinal and Transverse Cracking, Raveling, Fatigue & Block Cracking etc.

Data Collection Process

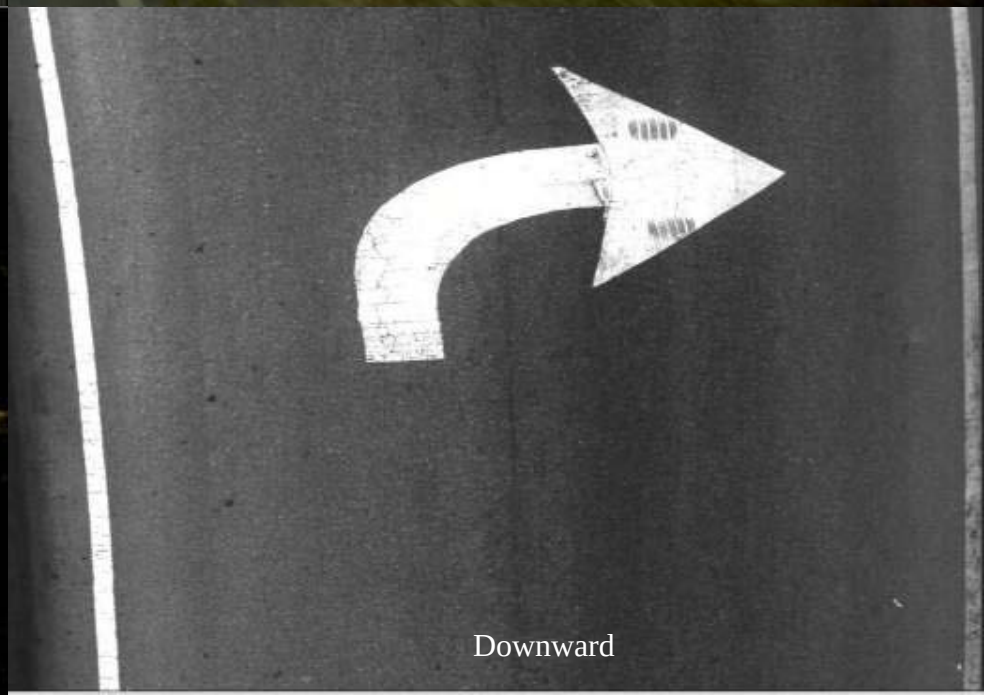
- There are Several Processes used to collect Pavement Distress.
- Vehicle Road Profiler, Wind Shield Survey, Random Survey, & Walking Survey.
- A Pavement Distress Protocol Needs to be Selected.


Pavement
Testing

Forward

Side

Reverse



Downward

Weathering/Raveling

- Raveling is a good Distress for Pavement Preservation Projects.
- Raveling is the loss of fines and aggregates in the pavement.
- Exclude Raveling on roads paved within the last five years.
- Pavement Preservation Projects were selected on roads with Low to Medium Raveling and no cracking .

Pavement Management System

- Metro's Pavement Management System
  - Cartegraph Pavement View & Pavement View Plus.
  - Pavement View contains the inventory data such as current conditions and physical attributes.
  - Pavement View Plus is the segment analysis model that generates paving plan for Metro's pavement network.

CartêGraph Navigator - PAVEMENTview - [Nashville Segments *]

File Edit View Forms Filters Records Actions GIS Reports Tools Window

<Unnamed>

PAVEMENTview

Segments

GIS

MAPdirector

ArcMap.exe

System

Home

Administrator

Segment Information

Segment ID: SEG-000028192

Old ID: 25929

Location

Route Name: RICHARDS RD

Route Start: UNA ANTIOCH PK

Route End: ANTIOCH PK

Route Length: 6602.33 ft

Segment Start: UNA ANTIOCH PK

Segment End: DEBRA DR

Address

Start Address: 631

End Address: 631

Features

Pavement Classification: AC Asphalt Concrete

Functional Classification: Urban Collector

District: 28

Paving Group: 5

Pavement Length: 1011.97 ft

Pavement Width: 20 ft

Pavement Area: 20239.4 ft²

GIS Status: 3

Forward Images

View All Images

Details

Inspections | Suggested Maintenance | Traffic | Events

Record: 1 of 4 Date: 06/23/2007

Inspected By: ARA

Type: Network-Level

OCI: 81.9

Inspections:ID: 59327

Condition Category	Index	Is Required	Notes	Rating
Distress	81.2	☐		Acceptable
Ride	60	☐	259 in/mi	Acceptable
Weathering	100	☐	None	None

Detailed Distress

New Segment

Save Segment

E-mail Segement

View Segments Report

CartêGraph Navigator - PAVEMENTview - [Detailed Distress]

File Edit View Forms Filters Records Actions GIS Reports Tools Window

<Unnamed>

PAVEMENTview

Segments

GIS

MAPdirector

ArcMap.exe

System

Home

Administrator

Segment ID: SEG-000028588 OCI: 30.37

Add Previous Samples | Add Single Sample | Add USACERL Samples

ID	Type	Length	Area	Notes
1	Random	301.45 ft	4220.32 ft²	

Distress Information

Distress: AC Fatigue (alligator) Cra

Pavement Class: AC Asphalt Concrete

Description:

Category: Cracking
Alligator or fatigue cracking is a series of interconnecting cracks caused by fatigue failure of

Do Severities Apply?:

Low Severity | ModerateSeverity | HighSeverity

Fine, longitudinal hairline cracks running parallel to each other with no, or only a interconnecting crack(s). The cracks are not spalled (crack spalling is a breakdown of the material along the

Distress	Severity	Extent	Measure 1	Measure 2
AC Fatigue (alli	High	2.38	100.61	
AC Fatigue (alli	Low	4.66	196.58	
AC Fatigue (alli	Moderate	0.59	25.02	
AC Linear Crac	Low	1.78	74.97	
AC Linear Crac	High	0.98	41.19	
AC Linear Crac	Moderate	2.6	109.87	
AC Patching	Moderate	0.18	7.42	
AC Patching	High	0.86	36.32	

CartêGraph Navigator - PAVEMENTview Plus - [Settings]

File Edit View Forms Filters Records Actions Reports Tools Window Help

PAVEMENTview
PAVEMENTview Plus

Segment Analysis Models

GIS

MAPdirector

ArcMap.exe

System

Home

Administrator

Pick a Setting

This form allows you to set the parameters PAVEMENTview Plus uses for its calculations. The initial settings reflect CartêGraph's experience and judgment, but you can make adjustments based on your own research.

Activities

The Activities Library is used to specify maintenance, rehabilitation, and reconstruction (MR&R) activities and the associated cost information.

View Report

Conditions & Impacts

Opens the Condition Category Library. This library describes characteristics of a segment and the weight assigned to each characteristic used when calculating OCI. Impacts and Rankings are child recordsets for this library.

View Report

Performance

The Performance Library contains pavement deterioration data used to predict the future OCI as well as the remaining life of the segment.

View Report

Model Scopes

The Segment Model Scopes Library constrains the analysis by storing filter statements that identify which segments are selected for the analysis.

View Report

Budget Plans

The Budget Plan Library stores annual budget figures, and includes the capability of tracking various multi-year budget plans.

View Report

MR&R Protocols

Stores the MR&R decision matrix as well as the activity selection hierarchy. You can tie the MR&R protocol to each analysis scenario that you run.

View Report

Network Priority

45c+34d-
Σ(9c2+4)
+9,4→N

The Network Priority Rating (NPR) establishes the overall priority of each segment to be considered for MR&R each year. The NPR calculation combines the OCI value with many other factors to come up with an inclusive index of maintenance priorities. The library contains filters used to select records based on functional class, pavement class, priority ranking, ADT, OCI and detour length.

View Report

Pavement Management System

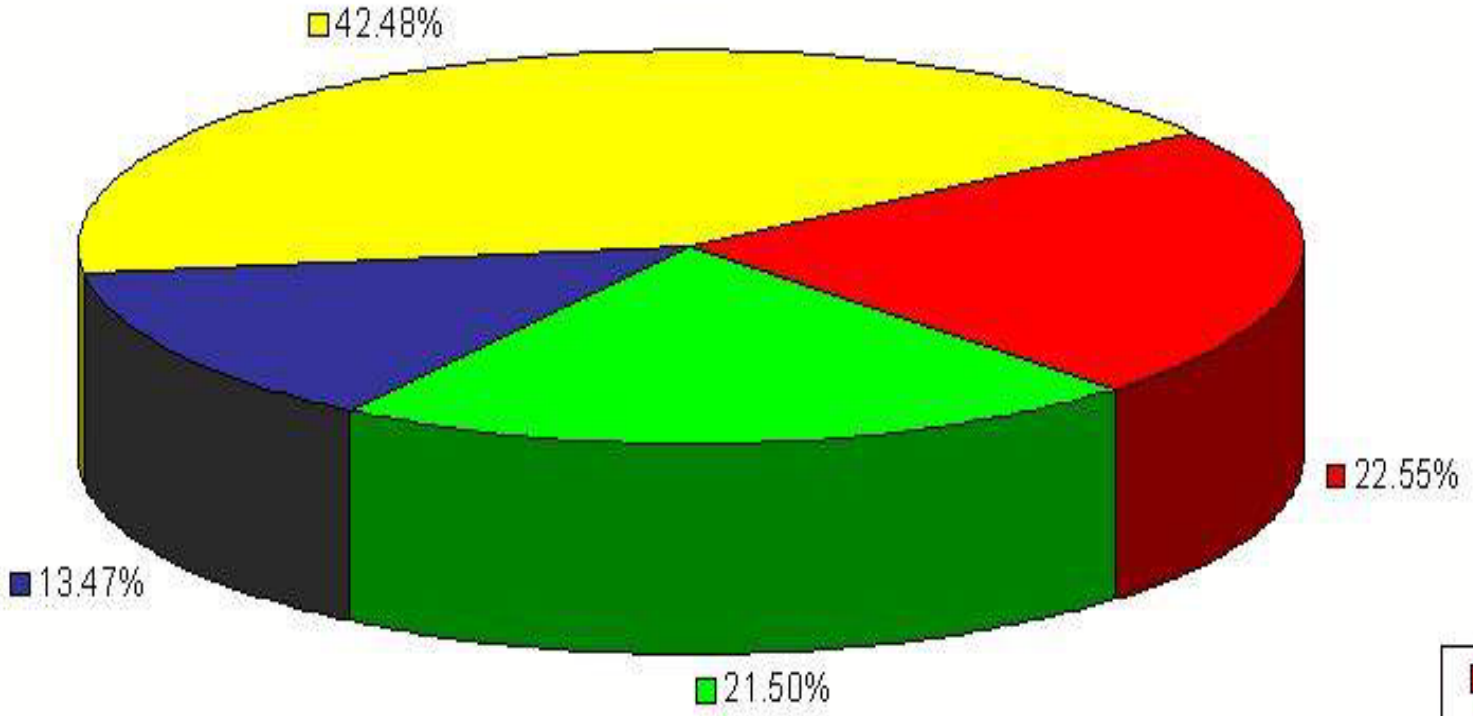
- Ability to generate reports for GASB requirements.

- Report for Maintaining CAPR:
  - It is the policy of the Government to maintain at least 70 % of its road and street system at a good or better condition

Metro Nashville Public Works

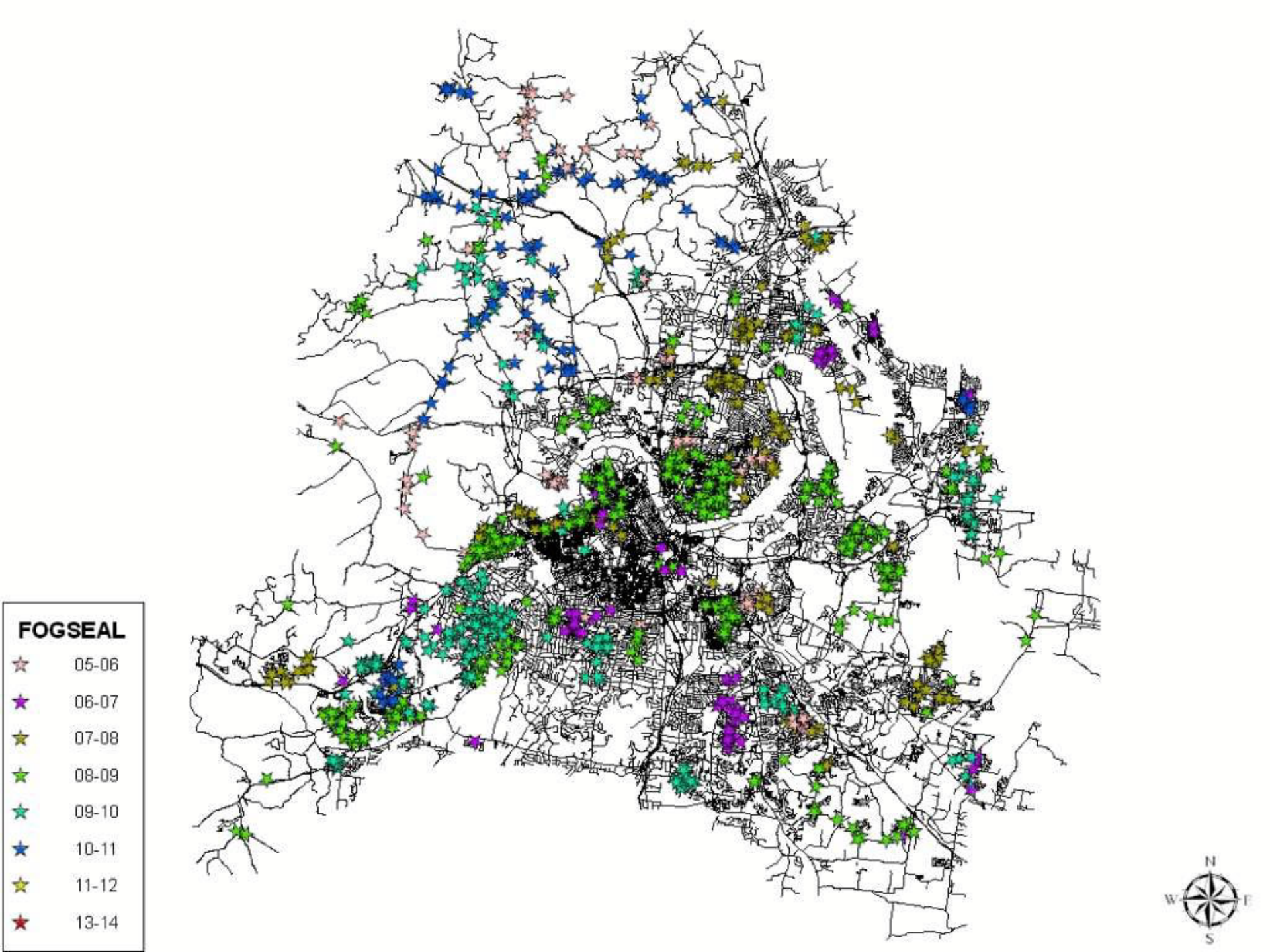
CURRENT CONDITION OF NETWORK

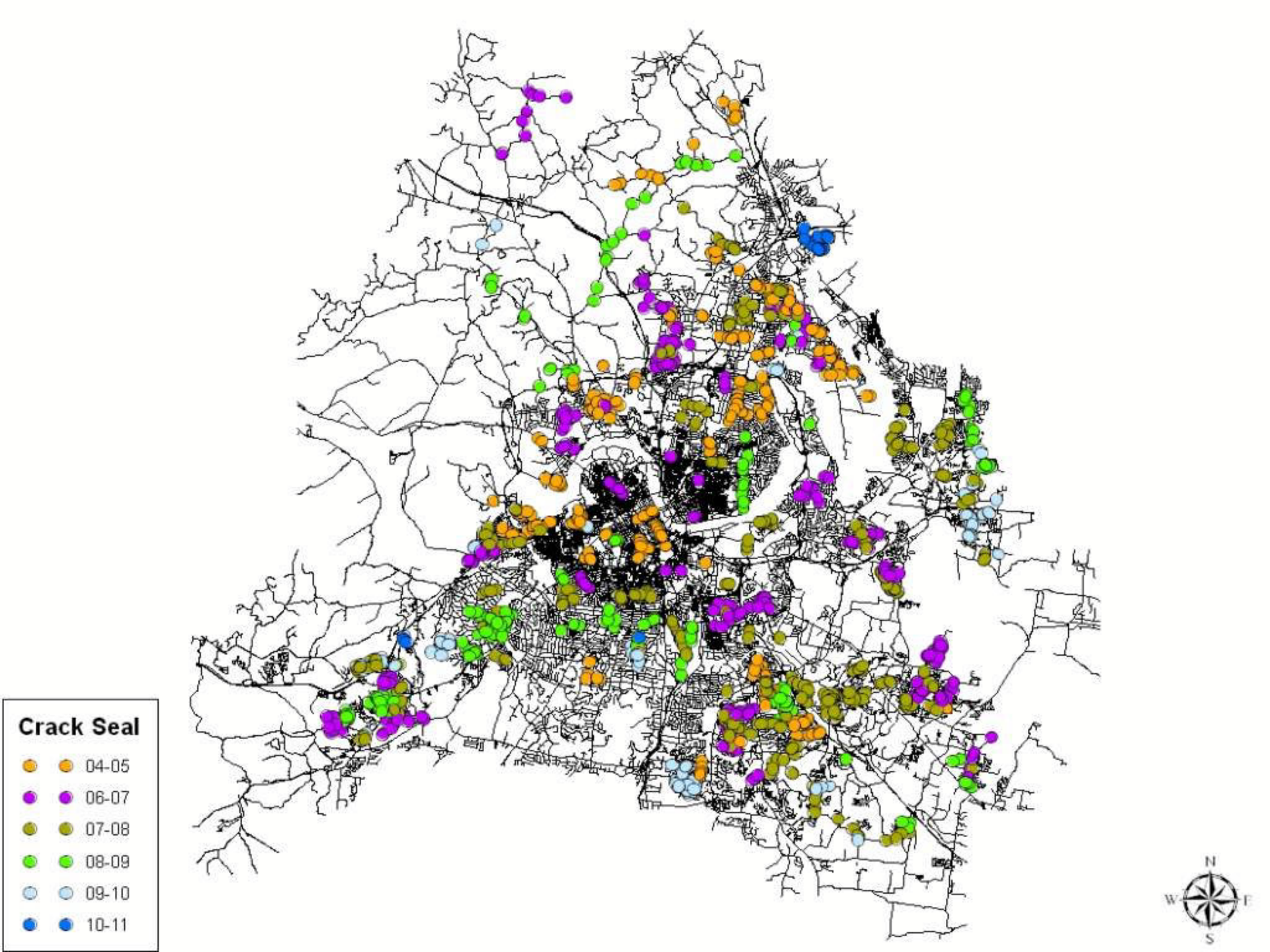
(BY % AREA)

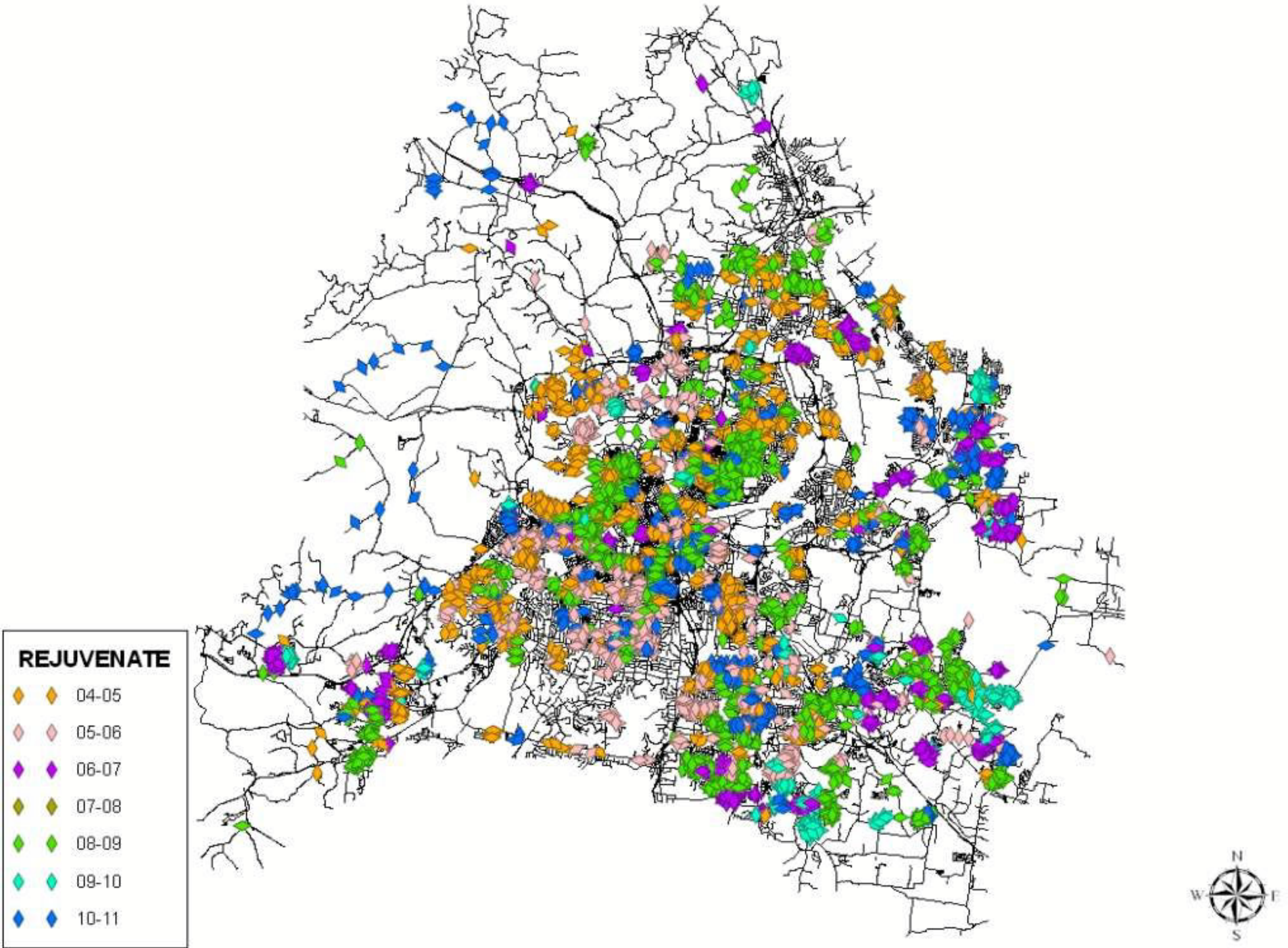


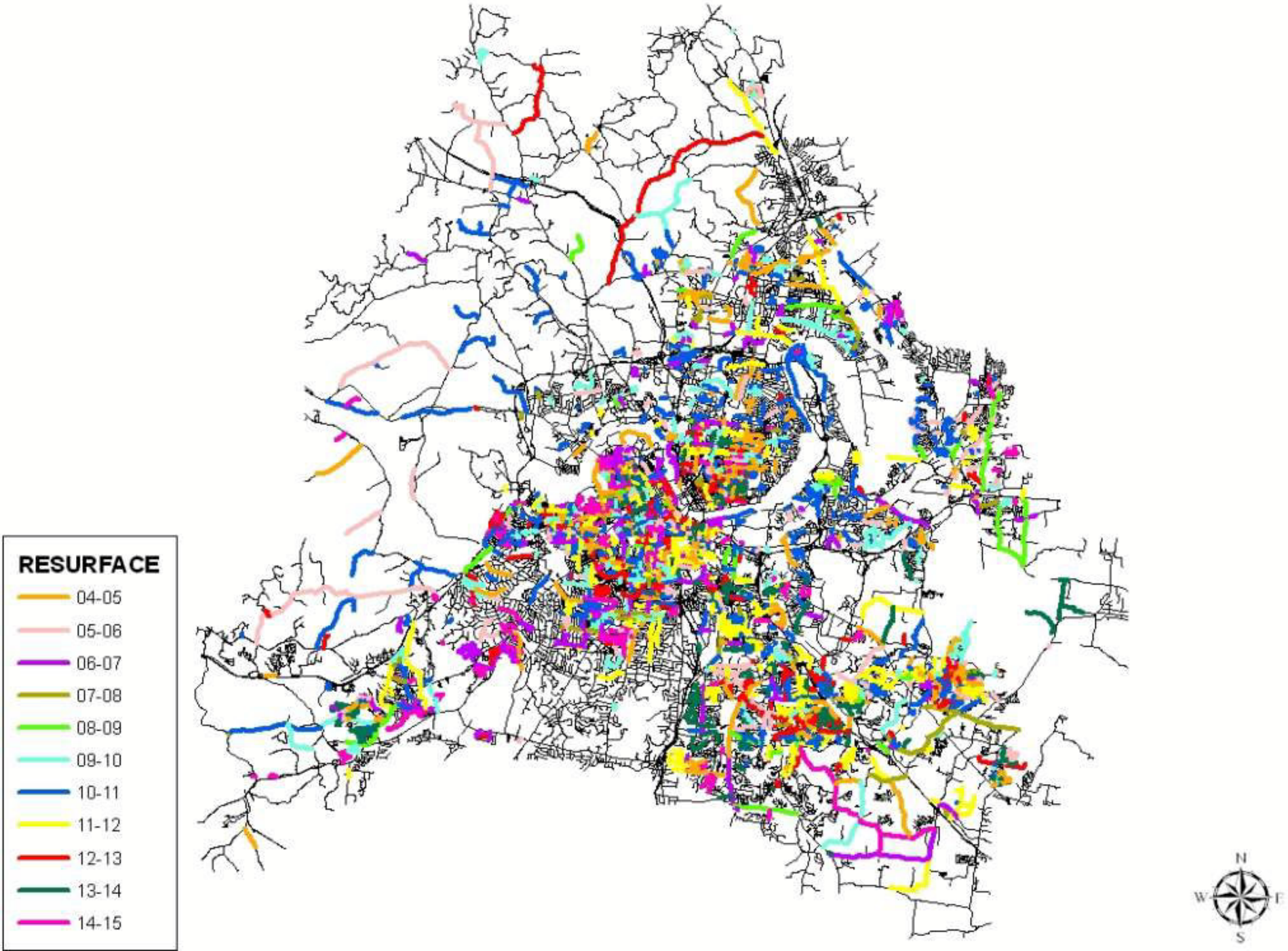
The Use of GIS for Planning & Scheduling

- Pavement Distress Data is used to plan and schedule activities.
- Type of activity (i.e. fog seal, crack seal, paving, rejuvenating) is represented by symbol.
- The Activities Scheduled Year is represented by different Colors.


FOGSEAL
05-06
06-07
07-08
08-09
09-10
10-11
11-12
13-14
N
W
E
S


Crack Seal
04-05
06-07
07-08
08-09
09-10
10-11
N
W
E
S


REJUVENATE
04-05
05-06
06-07
07-08
08-09
09-10
10-11
N
W
E
S


RESURFACE
04-05
05-06
06-07
07-08
08-09
09-10
10-11
11-12
12-13
13-14
14-15
N
W
E
S

Do I Need a Pavement Management System?

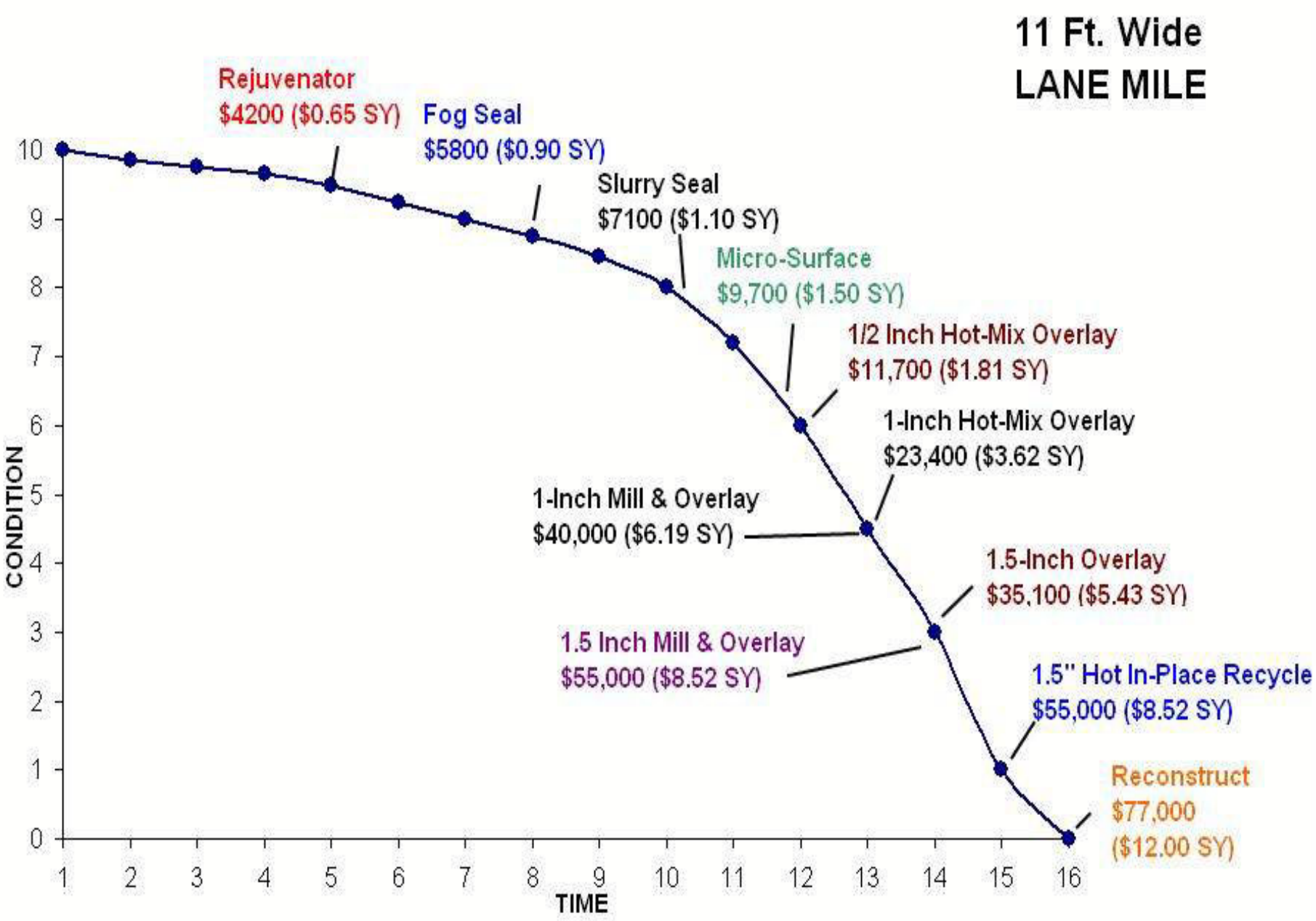
- No, a simple pavement management process will work.
- Must determine a rating system for the condition of the road.
- Must have place to store data.
- For more information check out: http://mpw.nashville.gov/Row/Paving/

Results of New Pavement Preservation & Resurfacing Techniques on Nashville Streets & Roads

Nashville's Audit

- Metro Public Works underwent a performance audit by Maximus in May 2002.
- Auditors said traditional paving is old-school; use slurry seal to increase pavement life.
- Auditors were forward-thinking, but slurry seal is not a cure-all.
- Luckily, we had official sources of relevant research (LTPP, SHRP, FP^2) to learn from.

2008 ESTIMATED COST TO BRING A PAVEMENT BACK TO EXCELLENT CONDITION



Product Tested in Nashville, Tn.

- Reclamite
- GSB 88
- Rejuvaseal
- PASS
- Re-Play (Soy)
- NovaChip
- Liquid Road
- Geogrid
- Road New
- Crack Seal
- GSB-Restore
- Slurry/Micro
- Joint Bond
- Infrared Patching
- Warm Mix
- Aspen
- Polymer-Modified Asphalt

Innovative Pavement Preservation Techniques

RECLAMITE –

- Made from the same light oils and resins used in making asphalt.
- A one-step method for restoring plasticity and durability of the asphalt binder.
- Used on newly constructed pavements (0-3 years) to improve durability of the mix, while providing an in-depth seal to reduce permeability.

RECLAMITE – Our Experience

- Pink surface while curing; color fades away within 24 hours.
- Requires aggregate (sand or slag) to be spread to retain skid resistance. This material coating can affect the visual appearance of the road.
- Nashville has adopted the use of pavement rejuvenators like Reclamite to protect pavement that is 3-5 years old.
- Average Cost: $0.65 Per Square Yd


Nashville - Oaklawn Ave.
CANTRELL
ROAD CLOSED
FRESH OIL
RECLAMITE Application
5-10-05




CRACK SEALING

Crack sealing is the most common maintenance option used to help protect the pavement structure.

First, the cracks are cleaned and dried using a hot compressed air heat lance. Then, the cracks are filled with hot poured rubberized joint and crack sealant.

It is often placed in advance of overlays and surface treatments to improve performance.

CRACK SEAL – Our Experience

- Joint separation is biggest failure on roadway.
- Crack sealant does just what its name implies.
- Nashville has adopted crack sealing.
- Average Cost: $1.70 per pound


11 1:21PM


11 1:38PM


11 1:59PM


11 1:48PM

GSB 88 –

- GSB Rejuvenating Sealant Binder is a low cost method to keep pavements in good condition longer by slowing the oxidation/deterioration process of your roads.
- GSB stands for Gilsonite, Sealer, and Binder
- Army Corp of Engineers found it to be four times more effective in holding a pavement's surface together than the leading saturate oil rejuvenator.

GSB 88 – Our Experience

- Very tacky. Cure time not conducive to quick traffic-readiness.
- Thin material composition – high water content in emulsion.
- Metro Nashville pursuing alternative methods more aggressively.
- Average Cost: $0.75 per Square Yard

GSB-RESTORE –

- Use on asphalt pavements within the first few years of their existence.
- Effective in solving specific pavement problems such as raveling and oxidation.

GSB-RESTORE – Our Experience

- Greater material composition than GSB-88. Less watery.
- Penetrates better than GSB-88.
- Asphalt “clogs” were left on our on finished surface during our test section.
- Outperforms GSB-88, but Metro still undecided on its use within Nashville.
- Average Cost: $0.75 per Square Yard

REJUVASEAL –

- Seals, protects, and revitalizes asphalt pavement.
- Penetrates the surface of asphalt; becomes integral part of the binder.
- Reduces viscosity and brittleness in the top 3/8” of asphalt while significantly increasing ductility and flexibility.
- Asphalt surfaces treated with RejuvaSeal are fuel, water, and chemical resistant.

REJUVASEAL – Our Experience

- Strong coal-tar smell calls attention to itself, caused unfavorable public perception.
- Nashville's opinion is that the smell is too strong for application on residential streets.
- Average Cost: $0.75 per Square Yard

SLURRY / MICRO-SURFACE – The Marketing Blurb

- Slurry seal is a mixture of emulsified asphalt oil, rock, water, and additives such as aluminum sulfate, Portland cement, lime, latex or carbon black.

- Micro-Surface = Slurry Seal + Additional Aggregate to increase skid resistance, color contrast, surface restoration, and service life to high-speed, heavy-traffic roadways.

MICRO-SURFACE – More Marketing

- Micro-Surfacing creates a thin, restorative surface course that does not alter drainage.
- Applied to roads or runways to eliminate hydroplaning problems that occur during periods of rain.
- Micro-Surfacing creates a new, stable surface that is resistant to rutting and shoving in summer and to cracking in winter.

MICRO-SURFACE – Our Experience

- A step up from slurry seal.
- Finish looks rough; highly textured.
- Finished surface is thin and brittle.
- Reflective cracking soon comes through.
- Average Cost: $1.50 per Square Yard

PASS –

- Polymer-modified Asphalt Surface Sealer, a type of fog seal.
- Rejuvenates and seals worn asphalt.
- Fills cracks; adds durable membrane to resist reflective cracking.
- It's got substance: 50% asphalt; 20% rejuvenator; 3% polymer. (Remaining composition is emulsifier + water.)

PASS – Our Experience

- Cures to black appearance in 2-3 hours, allowing traffic back onto roadway.
- Little impact on residents:
  - Requires no aggregate coating
  - Little or no odor
- PASS works well to stop raveling, seal out water, fill small cracks, and extend the lifetime of roadways that were last paved 7-10 years ago.

PASS – Our Experience (cont'd)

- Requires re-striping.
- Metro Nashville has adopted the use of polymer-modified asphalt surface sealants like PASS.
- Using PASS lets Metro Nashville extend a roadway's lifetime by about 5 years before resurfacing is needed.
- Average Cost: $0.70 Per Square Yard

PASS – Relative Costs

ROAD NAME	ACTUAL SQ YDS	LAST PAVED DATE	FOG SEAL COST	OVERLAY COST	MILLING COST	SAVINGS: FOG SEAL vs MILL & FILL
SHERIDAN RD	6443	1994	$3,801.37	$31,167.37	$10,147.73	$37,513.72
AUTUMNRIDGE DR	7251	1995	$4,278.09	$35,075.99	$11,420.33	$42,218.22
HINKLE DR	7336	1992	$4,328.24	$35,487.17	$11,554.20	$42,713.13
GWYNNWOOD DR	7768	1993	$4,583.12	$37,576.92	$12,234.60	$45,228.40
CHESAPEAKE DR	10232	1992	$6,036.88	$49,496.28	$16,115.40	$59,574.80
IVY POINT	27646	1995	$16,311.14	$133,734.76		$117,423.62
RIDGEWOOD RD	32289	1992	$19,050.51	$156,194.81		$137,144.30
GREENBRIER RD	33710	1994	$19,888.90	$163,068.75		$143,179.85
OLD HICKORY BLVD	36372	1995	$21,459.48	$175,945.91		$154,486.43
GREER ROAD	66186	1992	$39,049.74	$320,168.16		$281,118.42
			$138,787.47	**$1,137,916.11**	**$61,472.25**	**$1,060,600.89**

Applying PASS to these 10 example streets costs around 1/8 the cost of traditional resurfacing.

PASS = $139K where MILL & FILL = $1.1M


14 10:10AM


4 12:29PM


13 1:56PM

JOINT BOND –

- To be applied just after resurfacing, while the pavement is new.
- Forms a strong construction joint if applied prior to initial separation.
- Prevents water from penetrating construction joints.

JOINT BOND – Our Experience

- Tested on 1, 2, and 3 year-old roadways.
- Determined it should be used on roads 1 to 2 years old.
- Sooner the Better; Joint starts opening up around 3rd Year.
- Average Cost: $0.65 per Linear Foot


6 9:22AM


SPEED LIMIT
15
6 9:22AM


16 12:38PM

RE-PLAY –

- Soy-based sealant product.
- Light odor; not unpleasant.
- More environmentally friendly than most options.

$ INVESTING CHECKOFF DOLLARS

Soybeans Help Protect Asphalt

by Jason Mombarger

Soybeans are probably not the first thing someone thinks of when driving down an asphalt road. But thanks to soybeans and the soybean checkoff, it really could be the "miracle bean" protecting the roads of Ohio and elsewhere.

RePlay Technologies, a St. Louis based company, has developed RePlay, a specialty product made from soybean oil that is used to restore aging asphalt roads. Locally, Asphalt Systems of Ohio, located in Sidney, has been testing RePlay for several years and is impressed with its remarkable results.

"RePlay worked really well and we are able to seal a lot faster and before water is able to penetrate."

Bill Knasel
Franklin Township trustee.

RePlay is a clear product applied to asphalt as a preventative, extending the life of the road and ultimately reducing resurfacing costs.

"Historically, asphalt roads have had a tendency to start cracking and breaking down within months of being laid," says Michael Pennebker, president of Asphalt Systems, Inc. "RePlay has proven to help asphalt resist this aging process as well as reverse the oxidation of older pavements. It should extend the life of roads four to five years and permeability testing on core samples of treated roads shows that RePlay reduces the water entering the pavement by 98 percent."

Soybean oil makes up nearly 40 percent of RePlay and, in addition to extending the life of the road, it also helps seal small cracks in asphalt.

Pennebker said that using the soybean derivative "can save 25-30 percent in long term costs" for roads and he has "seen some cracks actually narrow where vehicle traffic goes over them" as a result of using RePlay.

Township trustees from Franklin Township in Shelby County have applied RePlay to several township roads and are pleased with the results.

"RePlay worked really well and we are able to seal a lot faster and before water is able to penetrate," says Bill Knasel, Franklin Township trustee. "It also lasts longer and is clear so the roads are able to be lined before it is applied."

Another advantage of RePlay is that once applied to the road, it cures within 30 minutes, reducing the time motorists would have to refrain from driving on the surface.

"By being a farming community, we are using something farmers produce, and in the long run, saving money," says Knasel.

The difference between untreated (left) and treated (right) roads clearly demonstrates the effect an application of RePlay, an agricultural oil road treatment, has on asphalt. The product is available through ASI, 2323 Campbell Road, Sidney, Ohio 45365. For more information on how this soybean derivative can help asphalt surfaces, call ASI at (800) 729-8094.

RE-PLAY – Our Experience

- Currently under testing.
- Not enough experience with it yet to gauge its value to our program.

Infrared Repair

- Infrared heat is used to heat the existing asphalt.
- Is designed to repair asphalt defects such as pot holes, surface defects and old utility cuts.
- Average Cost $4.70 per square foot. .

Aspen –

- Clay-stabilized asphalt emulsion; a type of fog seal.
- Replenishes the binder lost through oxidation, weathering, and aging;
- Fills cracks; adds durable membrane to resist reflective cracking.
- It's got substance: 40% liquid asphalt; 30% clay fillers; 2% pigment. (Remaining composition is water.)

Aspen – Our Experience

- Cures to black appearance in 2-3 hours, allowing traffic back onto roadway.
- Little impact on residents:
  - Requires no aggregate coating
  - Little or no odor
- Aspen works well to stop raveling, seal out water, fill small cracks, and extend the lifetime of roadways that were last paved 7-10 years ago.

Aspen – Our Experience (cont'd)

- Requires re-striping.
- Metro Nashville is still testing and evaluating Aspen.
- Average Cost: $1.85 per Gallon

PASS VS. ASPEN

- Herman St
  - Collector
  - Raveled
  - Road Condition was Fair
- Side by Side Comparison


May 2009


May 2009


July 2009


July 2009

Liquid Road –

- Polymer modified, fiber reinforced asphalt emulsion coating.
- Job mixed with special graded aggregate.
- Fills cracks; adds durable membrane to resist reflective cracking.
- Contains: 25% liquid asphalt; 23% mineral fillers; 50% water; 2% pigment. (4 lbs of aggregate added for every gallon of liquid road.)

Liquid Road– Our Experience

- Appears to be a slow construction process.
- Cannot let traffic drive on it until fully cured.
- Major issue if gotten on concrete or aggregate driveways.
- Durable Product; excellent for sealing open construction joints or pop-outs
- Average Cost: $2.65 Per Gallon


21 12:05PM


21 11:58AM

Combo Test Project – Our Experience

- Infrared Repair + Liquid Asphalt + Aspen
- Centerline Popping Out
- Overall Road Condition: Fair

OUR PLAN TO CONTINUE PRESERVING PAVEMENT

- Pave streets that need it.
- Reclamite streets 0-3 years old.
- Use products like PASS on streets 7-10 years old, that are severely raveled and have little or no cracking.
- Crack seal streets that have construction joint separation.
- Continue to researching and test products on roadways.

Using the Right Treatment – At the Right Place – At the Right Time

Nashville is actively researching ways to effectively manage the pavement on its roadways, and it is paying off.

We are doing our homework to ensure we are
USING THE RIGHT TREATMENT
AT THE RIGHT PLACE
AT THE RIGHT TIME.

QUESTIONS?

CONTACTS:
DONALD REID
donald.reid@nashville.gov / 615.880.3358