

# *Innovative Ways of Meeting Local Governments' Pavement Needs - Durham Case Study*

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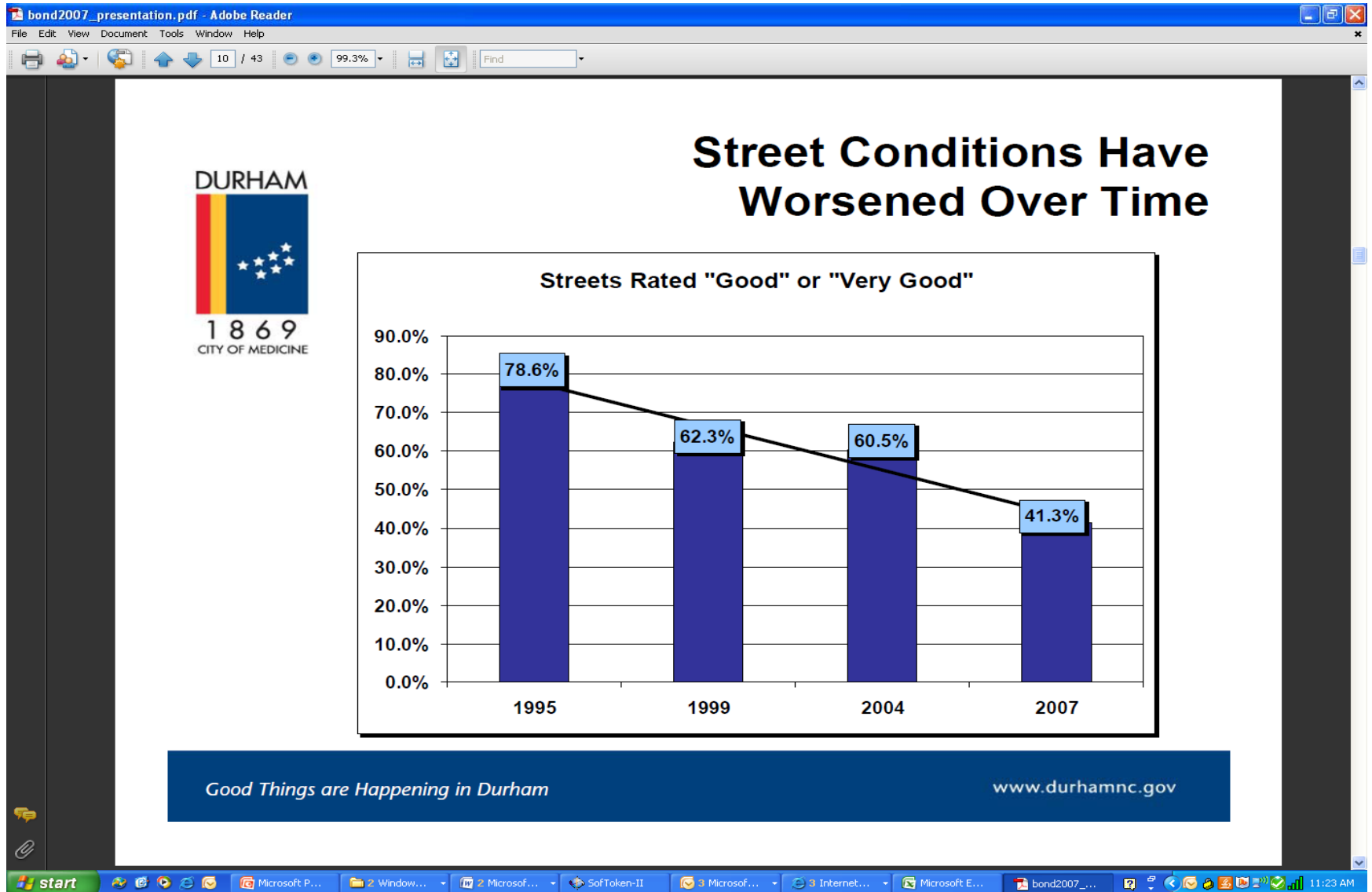
## *Background - City of Durham*

- 652 miles of paved streets to maintain
- 409 miles of sidewalks to maintain
- Similar to other cities
  - struggled with low levels of funding for resurfacing
  - “catch-up”
- 2005 general obligation bonds-\$110 Million
  - Sidewalk repair-\$2.5 million
  - Resurfacing-\$4.7 million
  - ST-226-Resurfacing project
    - *30 miles resurfaced*
    - *Project completed in 2007*

## *2007 Pavement Condition Survey (Based on NCSU-ITRE Rating System)*

<b>Rating</b>	<b>Overall Condition</b>
• 91-100	• Very good
• 81-90	• Good
• 66-80	• Fair
• 51-65	• Poor
• Below 51	• Very poor

# City of Durham - 2007 Pavement Condition Survey



## 2007 - Street and Sidewalk Bonds

- 34% (224 miles) have alligator cracking



- 34% (223 miles) have block/transverse cracking



- 49% (322 miles) have raveling

## *2007 - Street and Sidewalk Bonds*

- \$20 Million Street and Sidewalk Bonds - Approved in Nov 2007
  - \$15 Million, Street resurfacing: 100 miles of streets
  - \$2 Million, Paving dirt streets
  - \$3 Million, Sidewalk repair and reconstruction
  - Regular updates on the web (transparency of process)

## 2007 - Street and Sidewalk Bonds

- Status
  - ST-228 Resurfacing: \$2.5 Million
    - *Completed in 2009*
    - *26 miles total*
  - ST-233 Resurfacing: \$6.7 million appropriated
    - *14 miles completed*
    - *Projected completion by May 2011*
  - ST-234 Resurfacing: \$6.1 million appropriated
    - *12 miles completed*
    - *Projected completion by May 2011*

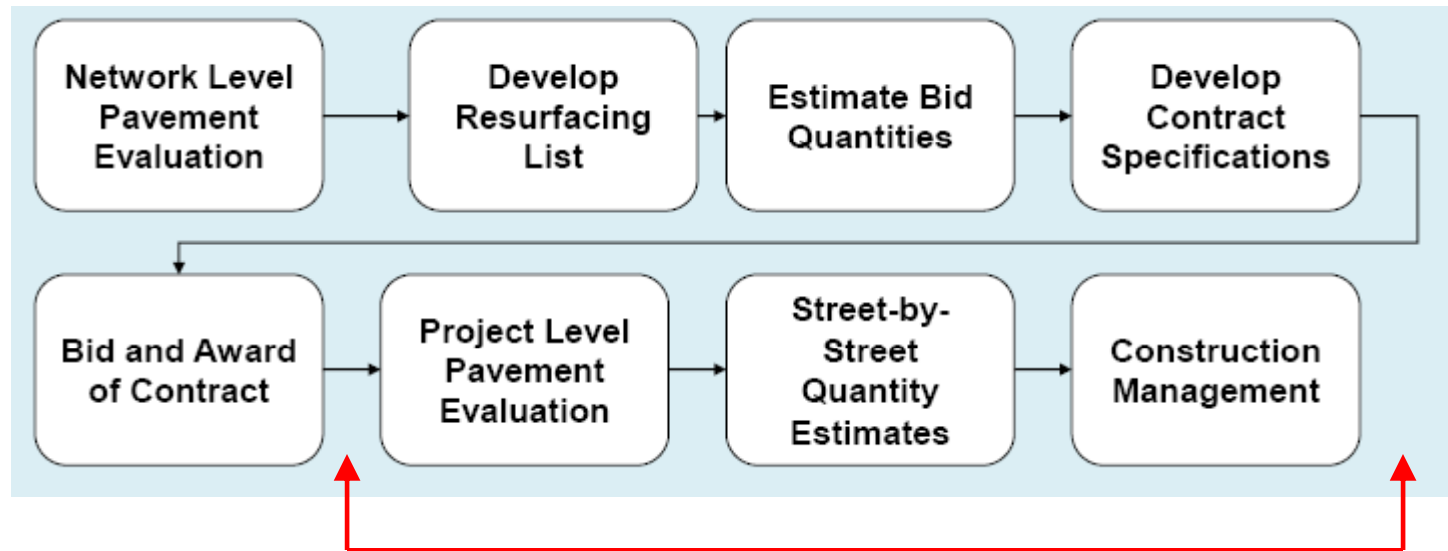
# City of Durham's CMS Projects with AECOM

- ST-227 Street Improvements Project
  - Provided QA services for the project
  - Completed in 2007
- ST-233 Street Resurfacing Project
  - Provided pavement evaluation, material testing and CEI services
  - Innovative approaches:
    - *Project management using Primavera System*
    - *Pavement evaluation using GPS handheld devices*
    - *Pavement design and cost alternatives*
    - *Pavement reclamation design / support*
    - *Street reassignment*

# City of Durham's CMS Projects with AECOM

- ST-234 Street Resurfacing Project
  - Provided pavement evaluation training and tools
  - Providing QA services
  - Innovative approaches:
    - *Partnered with the City staff during difficult economic times*
    - *Pavement evaluation training*
    - *Pavement evaluation manual*
    - *MS Access database using Tablet PCs for pavement evaluation*
- ARRA Projects (ST-246, ST-247 and SW-25)
  - Providing material testing and CEI services

# City of Durham - Resurfacing Projects



**Supported by AECOM**

# *ST-233 Resurfacing Project Innovative Approaches*

- City's objectives / needs included:
  - Confirm resurfacing candidate vs. reconstruction
  - Identify patch / repair location
  - Field marking prior to construction
  - Measurements of quantities for bid and construction management
  - Location and condition of manholes / valve boxes / gas valves
- Solution: Data collection using GPS handheld devices

# *ST-233 Resurfacing Project Innovative Approaches*

- Resource / Equipment needs included:
  - Experienced pavement inspectors (AECOM)
  - GPS Handheld device, rugged preferred (AECOM)
  - Data collection software (customized by AECOM)
  - GIS base maps (City of Durham)
  - Resurfacing candidate list (City of Durham)
  - Measuring wheels and paint (AECOM)

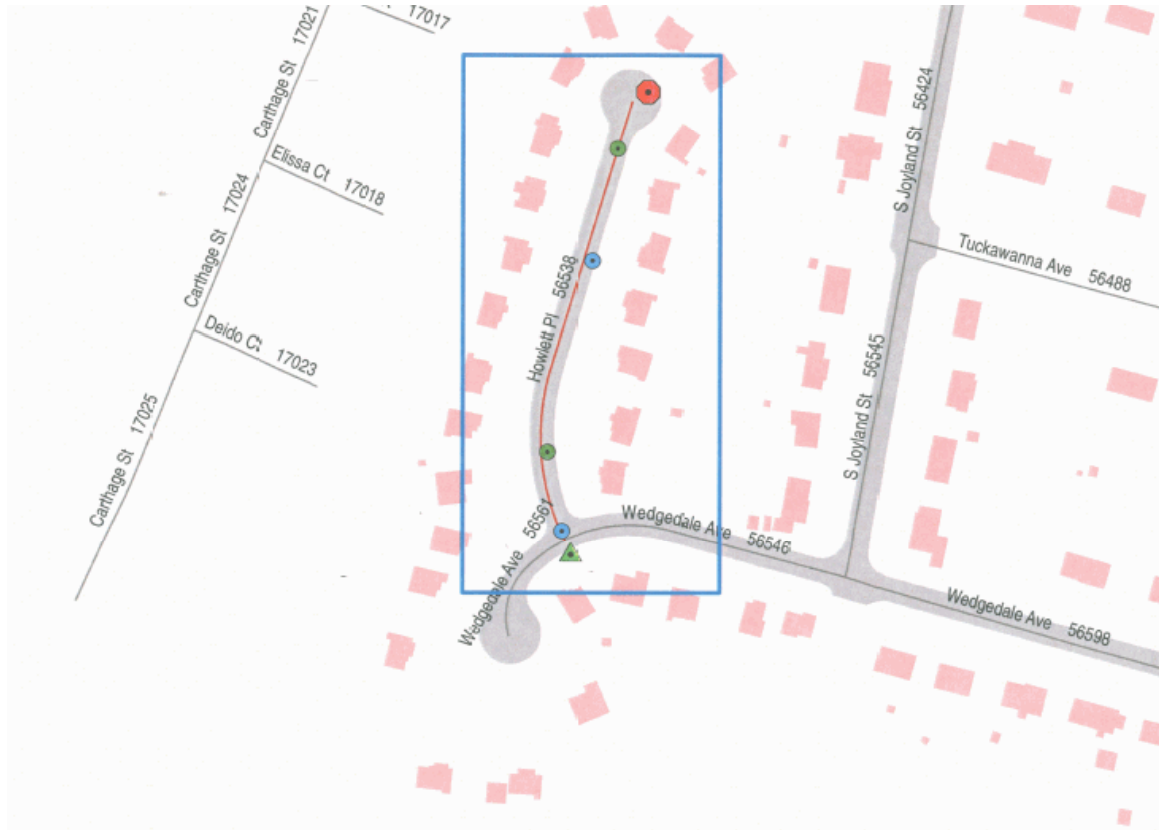


# ST-233 Resurfacing Project Innovative Approaches

- The Process:
  - GIS mapping of the candidate road list
  - Field routing plan
  - Two person crew
  - Confirm resurfacing candidate vs. reconstruction
  - Confirm limits; add / reduce as necessary
  - Geo-reference:
    - *Start and end points*
    - *Repair locations*
    - *Locate MH/CB/GV/VB*
  - Paint as you go



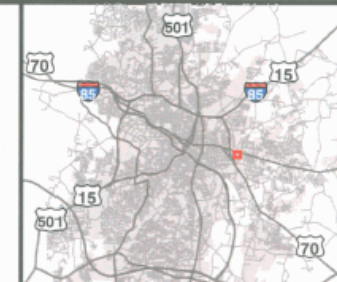
# ST-233 Resurfacing Project Innovative Approaches



1 inch equals 200

### Construction Quantities

Street Name:	Howlett PI	Asphalt Binder (PG 64-22) (Ton):	10.09
Facility ID:	56538	PDP (up to 10") (SY):	0
From:	WEDGEDALE AV	FDP (up to 18") (SY):	0
To:	CUL DE SAC	Concrete Walk/DW, 6" (SY):	0
Phase:	1	C/G Repair, 30" (LF):	0
Mill (0" to 1.5") (SY):	416.67	MH Adjust (#):	2
Mill (1.5" to 3") (SY):	0	VB Adjust (#):	2
Mill (3" to 4.5") (SY):	0	MH Replace (#):	0
AC (Patch/Level/Wedge) (Ton):	4.88	VB Replace (#):	0
AC Base Course (B25.0b) (Ton):	0	Speed Bump (#):	0
AC Intm. Course (I19.0b) (Ton):	0	D/W Repair:	0
AC Surface Course (S9.5b) (Ton):	163.33	Pavement Marking:	N
Aggregate Base Course (Ton):	0		



# *ST-233 Resurfacing Project Innovative Approaches*

- Benefits of GPS Handheld Pavement Evaluation
  - Paperless approach
  - Field markings could not be lost with time lag
  - Mapping of locations for repairs and manholes / valve boxes / gas valves
  - Compatible with City's GIS database and map
  - Database for bid quantities
  - Reference for Contractor / CM

# *ST-233 Resurfacing Project Alternative Solutions - Design*

- Make the most out of limited budgets
- Reduce wasted monies by identifying streets during field review that will not benefit from resurfacing
- Result:
  - Pavement design alternatives with cost evaluation
- Design considerations:
  - Existing condition
  - Existing / future traffic
  - Priority
  - Core data for thickness / material type
  - Laboratory testing of material
  - Maintenance of traffic

# *ST-233 Resurfacing Project Alternative Solutions - Design*

- Alternatives considered included:
  - Full Depth Reconstruct
  - Full Depth Reclamation
  - Combinations
  - Variable milling thicknesses

# *ST-233 Resurfacing Project Alternative Solutions - Design*

- Example - Jackson Street
  - Is this a resurfacing candidate?



# ST-233 Resurfacing Project Alternative Solutions

- Condition: Severe alligator cracking throughout, rutting at intersection approaches and along full length of curb lane (>70% of road)
- Traffic: City bus traffic, CHANGE since initial design
- Priority: Downtown, high priority
- Maintenance of traffic: Need one lane open at all times



# ST-233 Resurfacing Project Alternative Solutions

- Alternatives Considered
  - Full Depth Reconstruct
  - Full Depth Reclamation
  - Combinations:
    - Full depth patching with resurfacing



# ST-233 Resurfacing Project Alternative Solutions

- Core Data:
  - 2 to 3 inches of asphalt
  - 7 to 10 inches of aggregate base
  - Reddish sandy clay
- Subgrade Testing
- Material / Lab Tests
  - Gradation of base

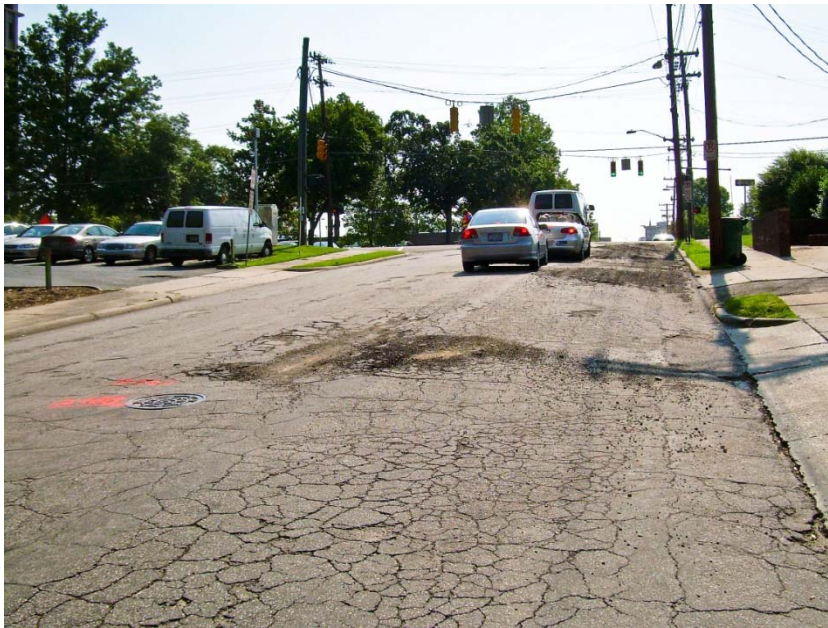
<b>Project Name:</b> ST-233				<b>CAPSTONE Project #:</b> 700-08-046			
<b>Client Name:</b> EarthTech-AECOM				<b>Date:</b> 6-8-09			
<b>Weather:</b> Partly Cloudy				<b>Temp(°F):</b> 89			
Test	Elev.	Grid Locations	Foundation Dimensions	Soil Description	Blow Count		Approval
1	-1	See sketch	n/a	Unclassified fill with debris		8	
	-2	See sketch	n/a	Unclassified fill with debris		8	
2	-1	See sketch	n/a	Reddish sandy clay		7	
	-2	See sketch	n/a	Reddish sandy clay		14	
3	-1	See sketch	n/a	Reddish sandy clay		14	
	-2	See sketch	n/a	Reddish sandy clay		16	
4	-1	See sketch	n/a	Reddish sandy clay		10	
	-2	See sketch	n/a	Reddish sandy clay		10	
<b>Design Bearing Capacity:</b> _____ (psf)				<b>Required Blows per 1 ¾" increment:</b> _____			
<b>Test locations established by:</b> <input type="checkbox"/> Grid Lines <input type="checkbox"/> Control Points <input checked="" type="checkbox"/> Estimation <input type="checkbox"/> Contractor							
<b>Depth or Elev. of test established by:</b> <input type="checkbox"/> Survey <input type="checkbox"/> Grade Stakes <input checked="" type="checkbox"/> Estimation <input type="checkbox"/> Contractor							
<b>Testing Conducted on:</b> <input type="checkbox"/> Full-Time <input checked="" type="checkbox"/> Intermittent							
<b>Loose Soil Removed:</b> <input type="checkbox"/> Yes <input type="checkbox"/> No				<b>Water Pumped Out:</b> <input type="checkbox"/> Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> N/A			
<b>Rebar Placed:</b> <input type="checkbox"/> Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> N/A							

# *ST-233 Resurfacing Project Alternative Solutions*

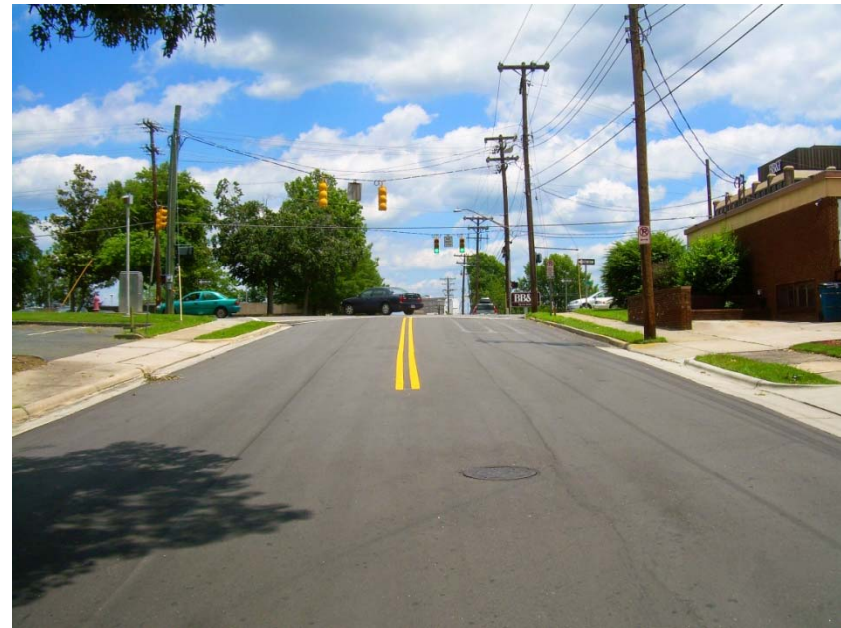
- Resultant Design:
  - Need stronger / thicker pavement
- Analysis:
  - Reclamation: provide cement stabilized base to increase strength and maintain grade
  - Reconstruct: provide thicker asphalt requiring significant hauling / removal of existing
  - Patch with resurface: extensive patching with an overlay
- Cost / Recommendation:
  - Patch alternative NOT cost effective
  - Reclamation provides approximately \$50K or 25% savings compared to reconstruction

# *ST-233 Resurfacing Project Alternative Solutions*

**BEFORE**



**AFTER**



# *ST-234 Resurfacing Project Innovative Approaches*

- City's objectives / needs, similar to ST-233:
  - Confirm resurfacing candidate vs. reconstruction
  - Identify patch / repair location
  - Field marking prior to construction
  - Measurements of quantities for bid and construction management
  - Condition of manholes / valve boxes / gas valves
- Problem:
  - City reduction in budget.
  - Limited funding for pavement evaluation
- Solution:
  - AECOM partner with the City to complete the work

# *ST-234 Resurfacing Project Innovative Approaches*

- Constraints:
  - Very tight schedule to complete
  - Construction season already in full swing!
- Resource / Equipment needs included:
  - Trained pavement inspectors (City trained by AECOM)
  - PC tablets (City owned)
  - Simplified data collection software (AECOM)
  - Automated calculation of quantities (AECOM)
  - GIS base maps (City)
  - Resurfacing candidate list (City)
  - Measuring wheels and paint (City)

# ST-234 Resurfacing Project Innovative Approaches

- Tablet PC with MS Access database
  - City staff had limited computer and pavement evaluation experience
  - SIMPLICITY was key!



# ST-234 Resurfacing Project

## Innovative Approaches

Pavement Repair Inventory Form

Project Name: CO#20 Project Desc: 2009 Street Repairs and Resurfacing Add Facility Change Project: CO#20

Facility ID: 63431 Street Name: Lassiter St Date/Time Recorded: 9/11/2009 2:01:16 PM Evaluator: rwh Beg Station: 0 End Station: 1196 Length (ft): 1196 Width (ft): 29

Cross Street (From): BOONE ST Cross Street (To): EUBANKS RD Butt Joints: 2 Curb and Gutter Type: Standard Concrete (J curb) Gutter Overlay?:  Pavement Depth Above Gutter: <1 in

Cul de sac?:  Cul de sac Dia.(ft): Speed Bumps?:  Traffic Loops?:  Tree Roots?:  Paint Marks?:  (Required Fields in Blue)

Pavement Repair >>Note: If a quantity record needs to be modified after uploading, instead delete the repair and create a new one. Utility Repair

Repair	Beg	End	Loc	Len(ft)	Wid(ft)	Comment	Repair	Sta
Speed Bump	295	307	N/A	12	29		Adj'wV	25
PDP	380	503	L	123	9		Adj'wV	28
PDP	625	667	L	42	9		Adj'wV	111
Speed Bump	684	697	N/A	13	29		Adj'wV	116
3' Mill adj to C&G	0	1196	B	1196	3		Adj MH	265
1.5 in O/L	0	1196	N/A	1196	29		Adj MH	436
*			N/A				Adj MH	836
							Adj'wV	1077
							Adj'wV	1167
							Adj'wV	1170
							Adj MH	1181
							*	

Photo Log

Photo ID	Sta	Loc	Photo Notes
1477	0	N/A	gen view
1478	625	N/A	PDP
1479	380	N/A	PDP
*		N/A	

General Notes

Date/Time Uploaded to DB:

Remove Facility Assessment Close Form

Record: 67 of 67 Filtered Search

# ST-234 Resurfacing Project

## Innovative Approaches

Distress	Load Related	Climate And Durability	Moisture and Drainage	Material / Construction
Alligator Cracking	✓		✓	✓
Block Cracking		✓		
Corrugation	✓			✓
Depression			✓	✓
Edge Cracking		✓		
Longitudinal & Transverse Cracking		✓		
Patching	✓	✓	✓	✓
Potholes	✓		✓	✓
Rutting	✓			✓
Shoving	✓			✓
Slippage Cracking				✓
Swell		✓	✓	
Weathering / Raveling		✓		✓

# ST-234 Resurfacing Project

## Innovative Approaches

Distress Type	Distress Severity		
	L	M	H
Alligator Cracking	None	None/Milling	Patch
Bleeding	None	None	None
Block Cracking	None	None	None / Milling
Corrugation	None	None	None
Depression	None	Leveling	Leveling
Edge Cracking	None	None	Patch
Joint Reflection Crack	None	None	None
Longitudinal & Transverse Cracking	None	None	Patch / Milling
Patching	None	None	Patch
Polished Aggregate	None	N/A	N/A
Potholes	Leveling	Leveling	Patch
Rutting	Leveling	Leveling	Leveling / Patch
Shoving	None	None	Patch
Slippage Cracking	None	None	Patch
Swell	None	Milling	Milling
Weathering / Raveling	None	None	None

# *ST-234 Resurfacing Project Innovative Approaches*

- Benefits of ST-234 Approach
  - *Paperless*
  - *Field markings could not be lost with time lag*
  - *Mapping of locations for repairs and manholes / valve boxes / gas valves*
  - *Compatible with City's GIS database*
  - City staff trained in evaluating pavements
  - Simple software
  - Automated and on-the-fly quantity calculations improves project management
  - Improved change order management capabilities
  - Training manual provides quality management and consistency

# Construction Management Innovative Approaches, Primavera

Primavera Contract Manager-Repository for Project Related Documents

Primavera - Microsoft Internet Explorer provided by AECOM

File Edit View Favorites Tools Help

Address: http://primavera-pw.durhamnc.gov:9001/exponline/mainframe.jsp

PRIMAVERA Welcome, AECOM Jun 11, 2010

log out Transmittal Queue Print Search

All Projects expand\_all collapse\_all find

Contract Manager Control Center Workspace: (My Workspace) Go

refresh\_page customize\_this\_page

**Actions** edit

High	0
Normal	0
Low	0

View All Actions

**Alerts** update subscriptions edit

High	0
Normal	0
Low	0

View All Alerts

**Request for Information (0)** edit

No Data Available

**Issues (0)** edit

No Data Available

**Submittals (1)** edit

All Types

1
...
0.5
...
0

SNO

**Prepare Reports** edit

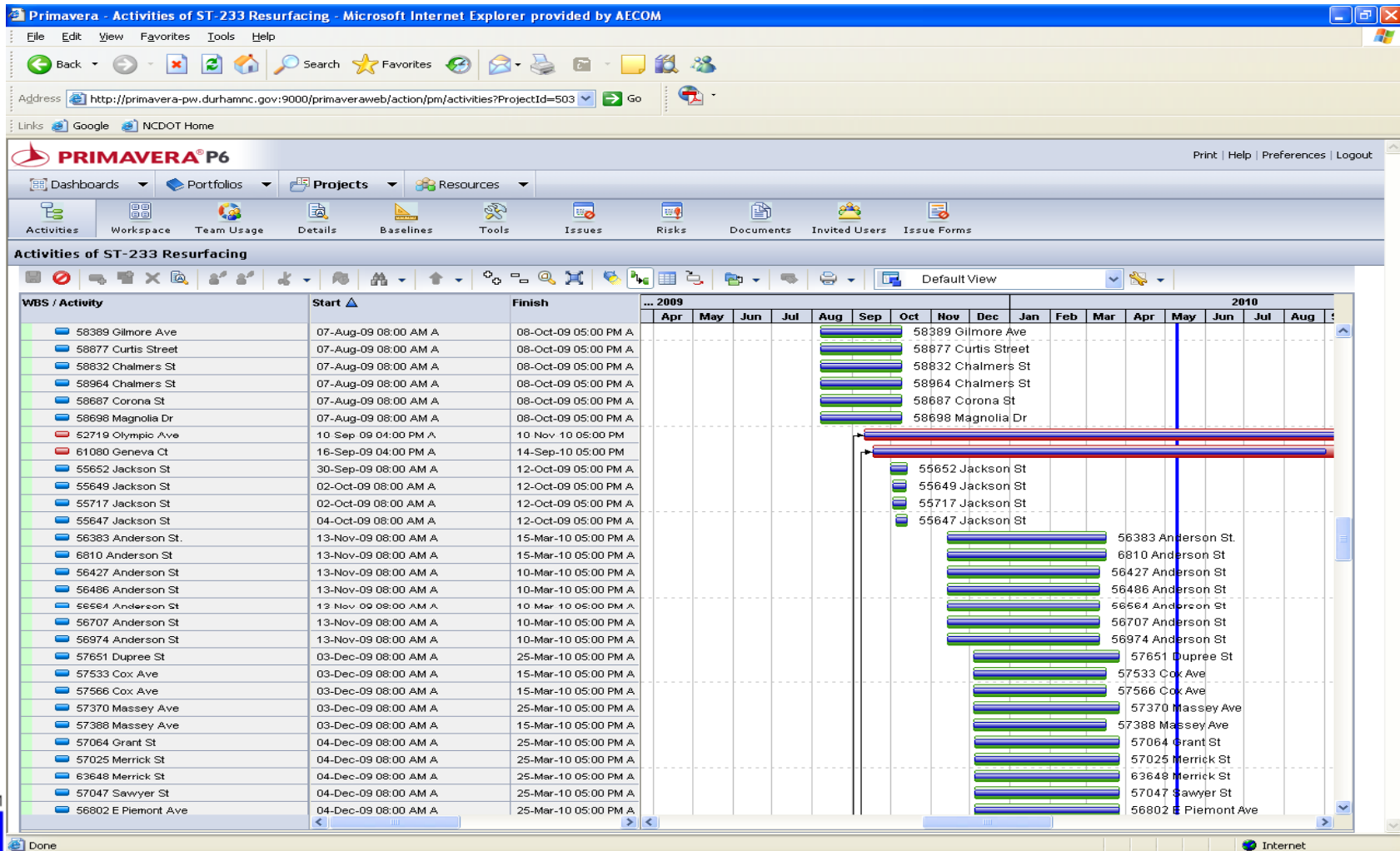
To add reports, click edit or [click here](#)

**Prepare Documents** edit

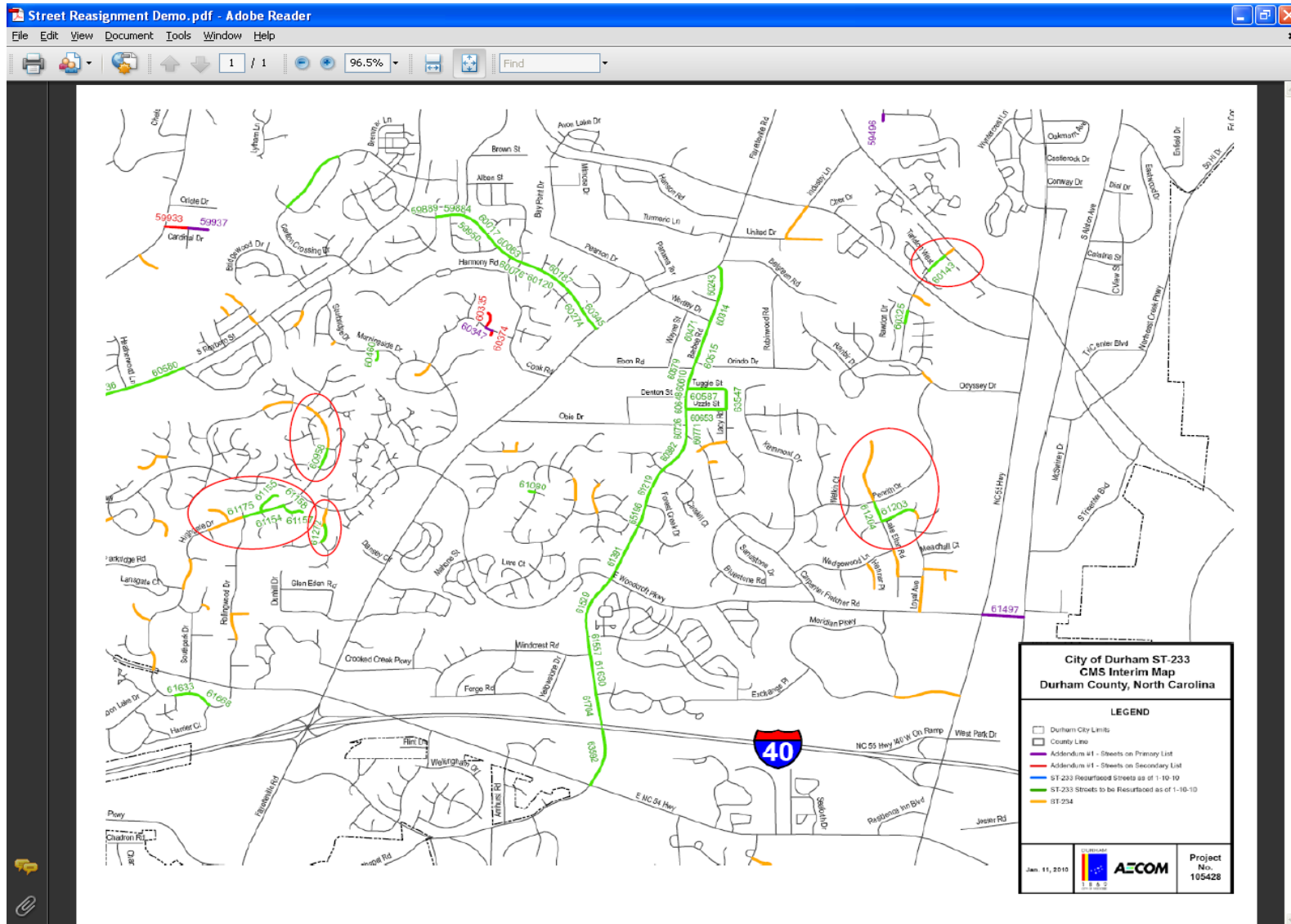
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# Construction Management-Innovative Approaches, Primavera

## Primavera – P6 Project Schedule



# Street Reassignment - Innovative Approaches



## *Lessons Learned*

- The best change order management approach is to have no changes!
  - Field confirmation of resurfacing candidates is critical
  - Ground truth during pavement evaluation
- Construction efficiency is key
  - Minimize reassignment by doing field confirmation EARLY in the process
  - Weekly status meetings together with Primavera are helpful
- Inexperienced staff can be trained to do a quality job
  - Invest the time to do this up front
  - Keep it simple!
- Automation / software provides benefit
  - Investing in minor development / customization effort up front means less effort throughout the duration of the project for the PM team
- Extensive pavement design/reclamation efforts-testament that resurfacing projects may be more than just resurfacing

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