Environmental Paving Techniques
Adaptation In the Urban Environment

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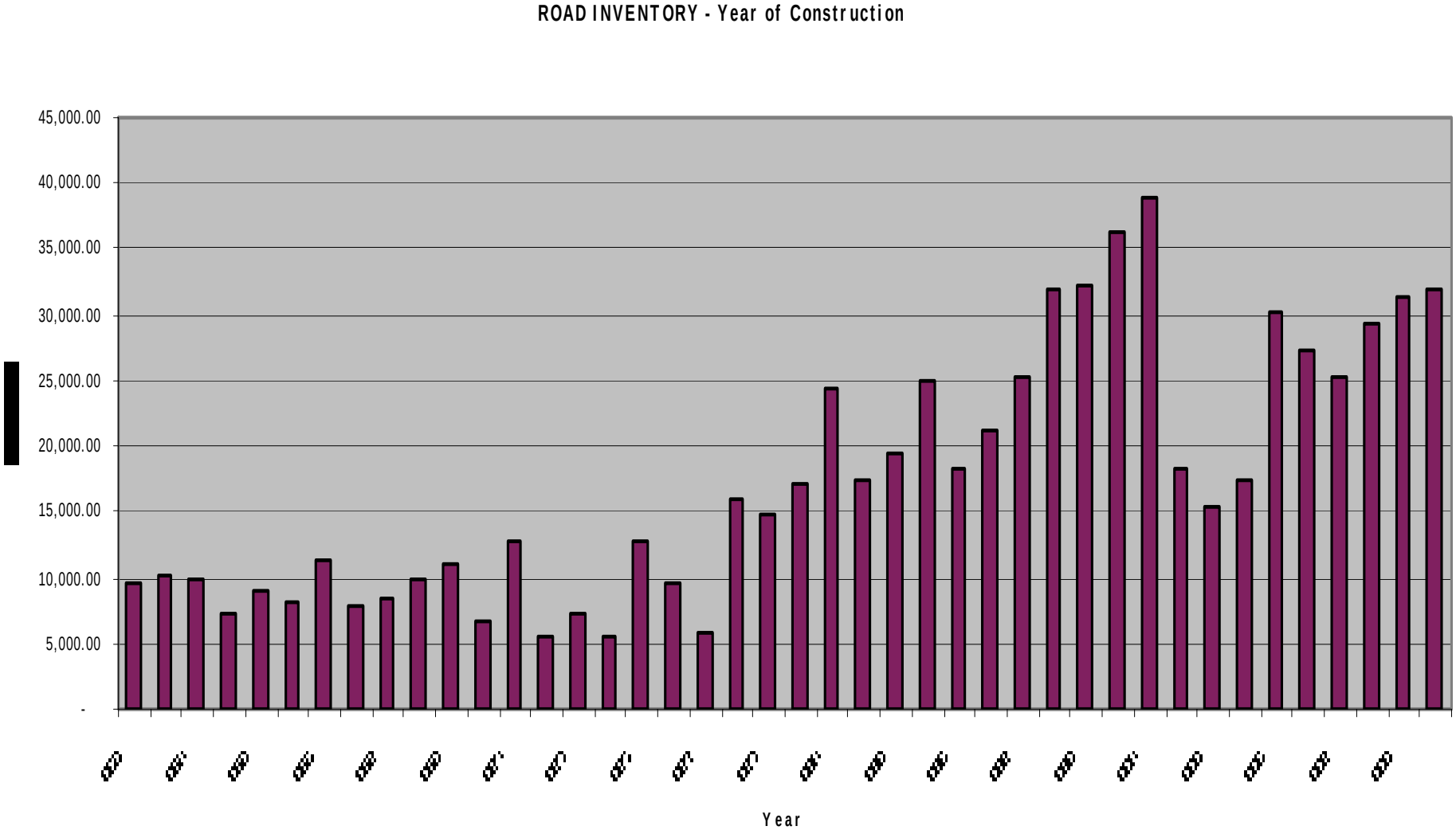
Overview

- Background on Markham's Pavement Management Journey
- Environmental Pavement Techniques Selected and Their Benefits
- Adaptation of Environmental Paving Techniques in the Urban Setting

Background on Markham's Pavement Management Journey

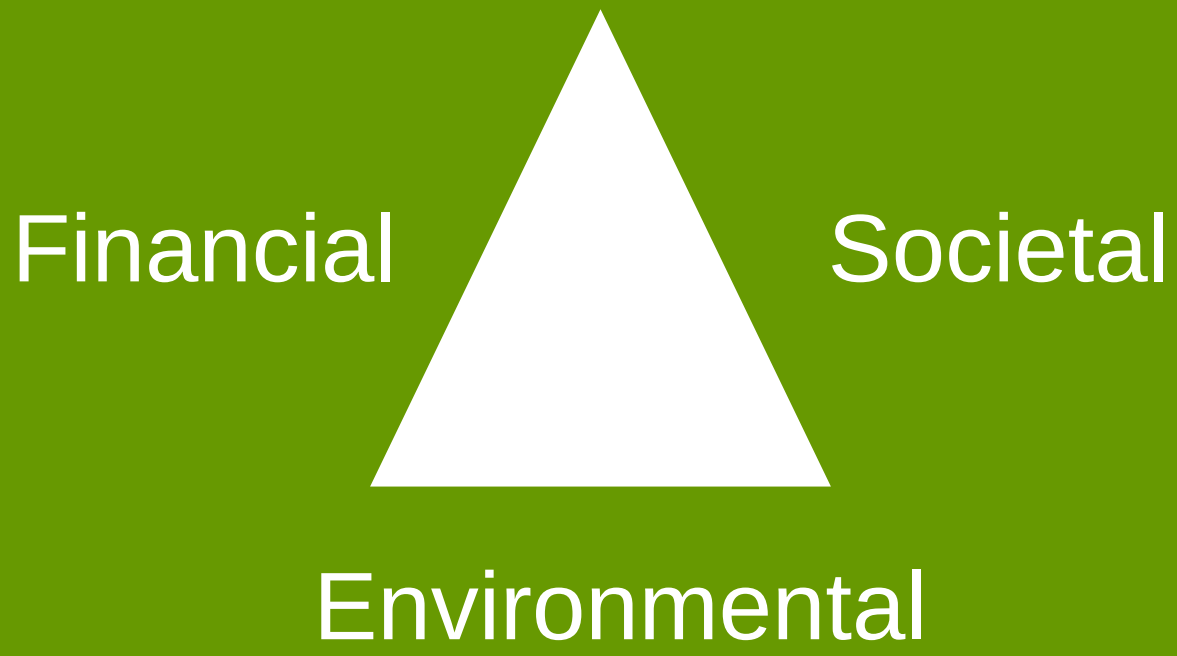
1999 Road Inventory



Conclusions from 2000

- 117 km of rehabilitation needed by 2005 to clear backlog
- That level of work needs to be maintained after 2005 to deal with system needs
- **Need to develop a pavement preservation program to prolong life of roads**
- **Need to develop repaving strategies to improve longevity of pavements**
- **Need to improve environmental balance of program**

Sustainability Triangle



Environmental Paving

Techniques Used

- In-Place Asphalt Recycling
- Micro-Surfacing
- Recycled Shingle Hot Mix Asphalt (RAS)

Environmental Paving Techniques

In-Place Recycling

Partial Depth Cold In-Place Recycling

Full Depth Expanded Asphalt Recycling

Environmental Benefits

- Conserves natural resources
- Shorter construction durations minimize traffic disruption and congestion
- Heating of materials is not required
- Haulage of material on and off site is significantly reduced
- ½ CO_2, ½ NOx, 1/3 SO_2 compared to milling and overlay

Environmental Paving Techniques

Micro-Surfacing

Environmental Benefits

- Materials are odourless, non-flammable, and contain zero volatile organic compounds
- Shorter construction durations minimize traffic disruption and congestion
- Heating of materials is not required
- Raw material consumption is minimal

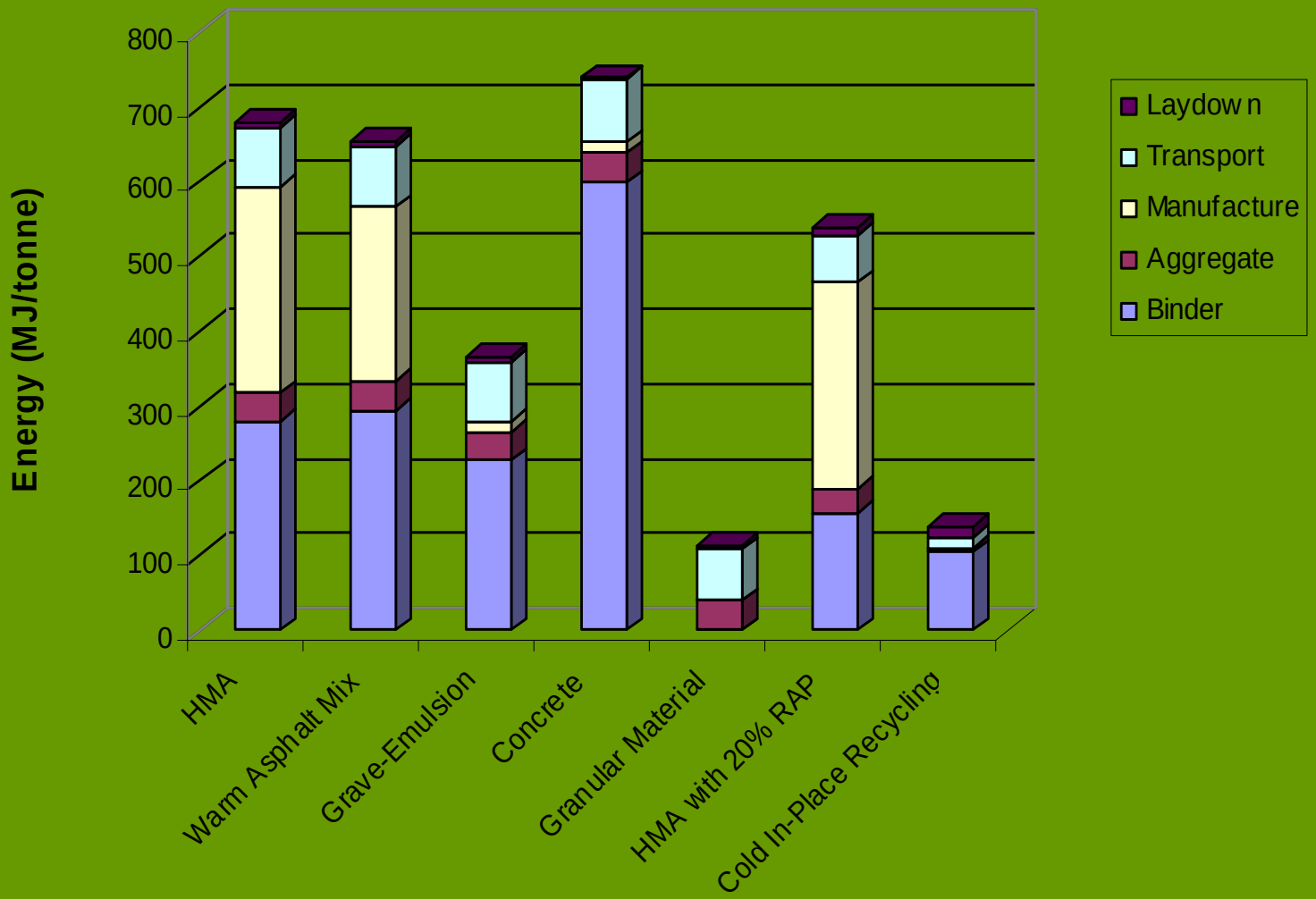
Environmental Paving Techniques

Recycled Shingle Hot Mix Asphalt

Environmental Benefits

- Reduce asphalt cement requirement by approximately 1.5 %
- Divert shingles from land fill
- Conserving aggregate resources
- Experimental process – Town currently working with Miller Paving and Ontario Centre of Excellence.
- Approximately 4 km of asphalt applied in 2007

Energy Requirements for Road Rehabilitation Techniques



Source: Road Rehabilitation Energy Reduction Guide for Canadian Road Builders, Natural Resources Canada, 2005, p. 16

Adaptation of Environmental Paving Techniques in the Urban Setting

Does This Scene Look Familiar?

The Challenge

- Existing recycling trains suitable for rehabilitating only a small percentage of Markham's road network
- How do you modify the recycling process for work on confined urban streets?

The Method

- Utilize both Cold In Place (CIP) and Full Depth Reclamation (FDR) as recycling strategies
- Primary rehabilitation strategy now FDR with expanded asphalt stabilization (Foamed Asphalt)
- Utilize pre-pulverize, stabilize and grade method (grader laid foamed asphalt)

Pre-pulverize And Blend Existing Asphalt Surface With Underlying Granular Material

Remove Surplus Blended Material

Rough Grade Blended Material And Compact

Stabilize Blended Material (Full Depth Expanded Asphalt Process)

Fine Grade Stabilized Material And Compact

Achieving Compaction At Pavement Edge

Final Recycled Product Prepared For New Hot Mix Surface

Perceived Barriers To In-Place Asphalt Recycling

- Working in confined urban areas
- Achieving the desired curb reveal
- Lowering and raising of maintenance hole structures

Working In Confined Urban Areas

- Presents challenges when attempting to recycle irregular areas (i.e. cul-de-sacs and intersections)
- Our experience – exclude these areas from recycling process
- Achieve better product in terms of material consistency and compaction
- Repair non-recycled areas using conventional means (i.e. base repair or fiberglass grid)

Intersection Work

Cul-de-Sacs And Wide Corners

Achieving Desired Curb Reveal

- **This is a material management exercise**
- Must consider desired curb reveal at all stages of the recycling process
- Removing too much material will affect desired 50/50 RAP/Granular blend and leave excess curb reveal

Consistent Curb Reveal for Overlay

Consistent Curb Reveal For Overlay

Lowering/Re-raising Structures

- Initially, the lowering of all structures seemed overwhelming
- This process now completed safely and efficiently
- Must keep accurate record of structure locations (both documented and in the field)

Lowering/Raising Structures

Maintenance hole lowered below
Grade prior to pulverization process

Removing Steel Plate

Final Adjustment/Compaction

Pictorial Overview

2002 CIP Project

Frontenac Drive

2002 CIP Project

Clayton Drive

2002 FDR Project

Reesor Road

Pavement Preservation

- Primary preservation treatment applied in Markham is micro-surfacing
- Utilized primarily on major and minor collector roadways
- Target roadways in 7 to 10 year age range

2005 Micro-surfacing Project

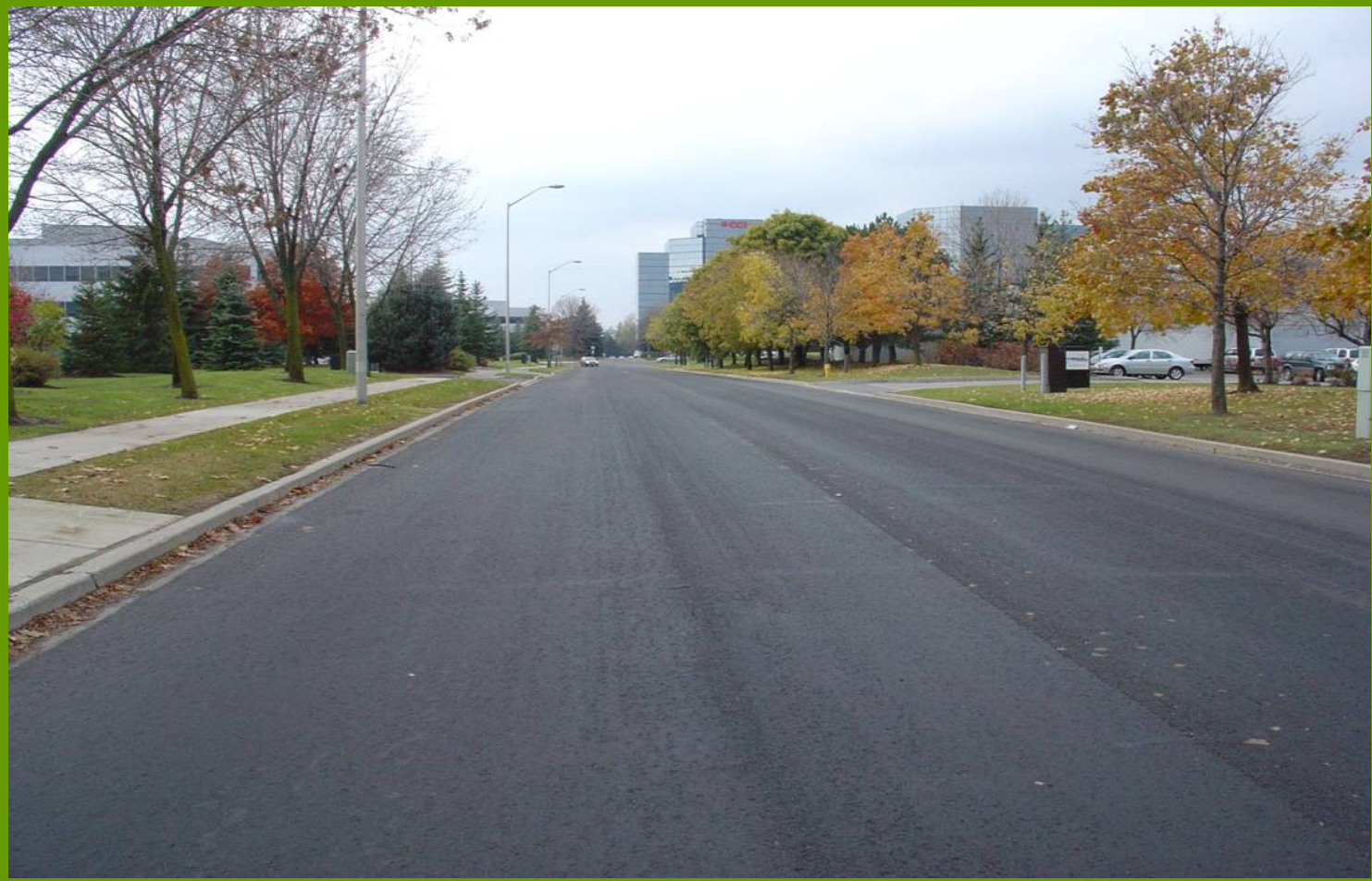
Apple Creek Boulevard

2006 Micro-surfacing Project

Rodick Road

2007 Micro-surfacing Project

Valleywood Drive



Recycled Asphalt Shingles (RAS) In Hot Mix Asphalt

- RAS incorporated in SuperPave mixes placed in 2007
- Green Lane Project – involved the placement of two lifts of hot mix over a foam stabilized base
- Typically place only one lift of hot mix

19mm SP Base Course
Green Lane

12.5mm SP FC1 Surface Course
Green Lane

In-Place Asphalt Recycling

- Perceived barriers to asphalt recycling not really barriers at all
- Initial projects completed in 2002 performing very well
- We look forward to continued use of in-place asphalt recycling as a major component of our road rehabilitation program

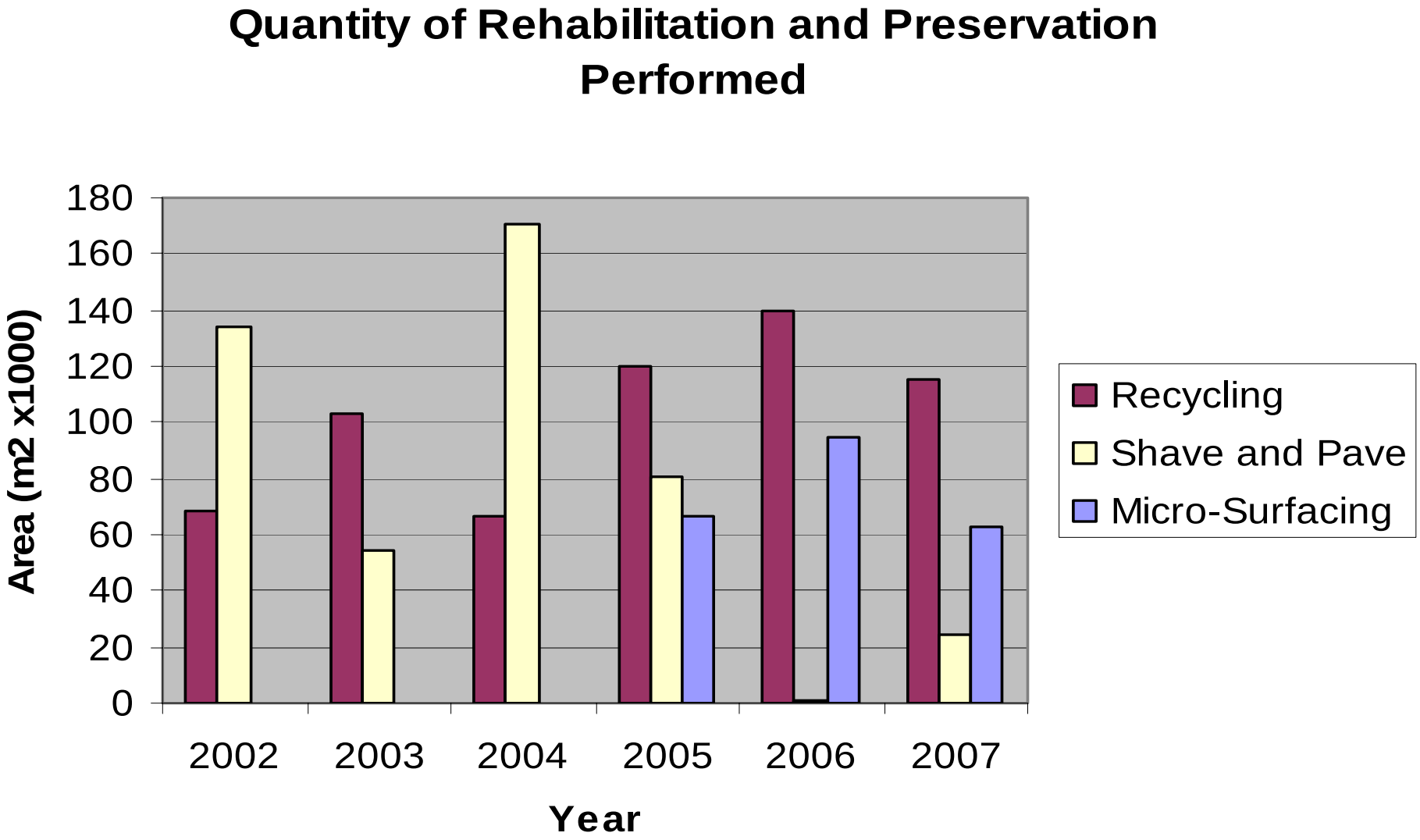
Micro-surfacing

- Frictional characteristics retained, thereby improving safety at intersections and curves
- Product performing well with periodic maintenance
- Micro-surfacing continues to comprise a large portion of Markham's pavement preservation program

RAS In Hot Mix Asphalt

- Initial projects completed in 2007
- RAS included in SuperPave base and surface course mixes
- We look forward to continued use of RAS in our mixes
- Will continue to monitor performance of product

Summary of Work (2002-2007)



Can Asphalt Recycling Be Adapted to the Urban Environment?

YES

- 80% of our road rehabilitation program has been Recycling in last 3 years and that percentage is increasing.
- It is an effective and efficient process providing superior strength with many environmental benefits.
- It has been well received by our residents as well.

Town of Markham Featured in Better Roads Magazine

Thank You!