

Recycled Asphalt Pavement (RAP)

Solid Waste, Stormwater, and Drinking Water
Considerations

Town of North Castle, New York
DPW and Middle Patent Yards

RAP Background

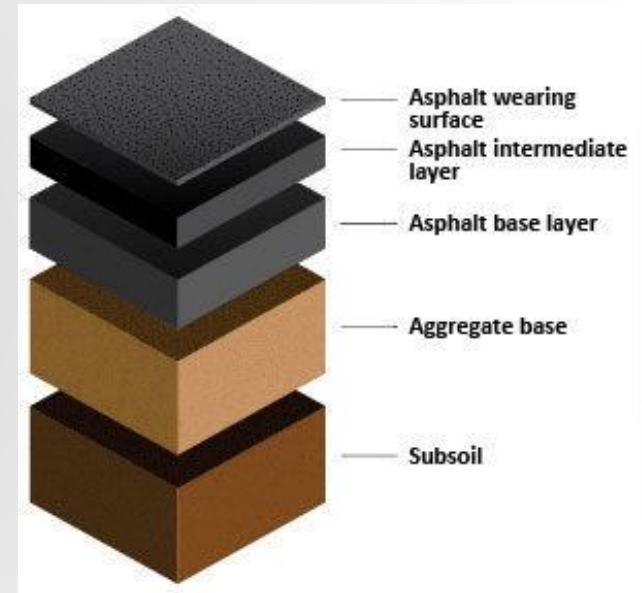
- Asphalt produced from virgin material consists of two primary ingredients:
 1. Aggregate (crushed rock) – 90 to 95%
 2. Asphalt Binder (a viscous form of petroleum) – 5 to 10%



- Asphalt pavement eventually breaks down because of use and the elements
- Recycled Asphalt Pavement (RAP), aka reclaimed asphalt pavement or asphalt millings, is aged and weathered asphalt pavement removed from asphalt roads, parking lots, and other asphalt-containing surfaces

RAP Background

- Asphalt pavement recycling has been practiced since 1915
- The primary use of RAP is hot mix asphalt - standard practice in most states and referenced in ASTM International D3515
 - The RAP takes the place of conventional aggregates and is combined with new asphalt binder.
- RAP is used as granular base or sub-base in roadways, parking areas, bicycle paths, shoulders, and driveways.



RAP Background

Facts for the US:

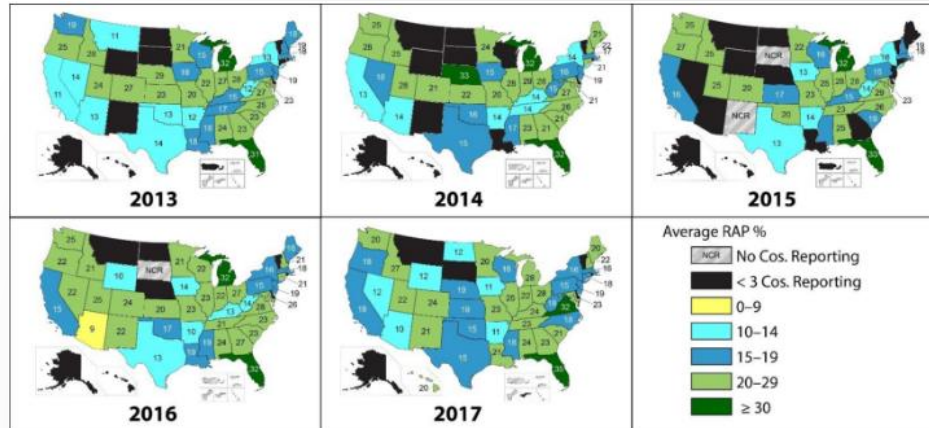
- About 3 million miles of roads are paved
- About 94% of paved roads are asphalt covered
- About 85% of all airport runways are asphalt covered
- Over 90 % of parking areas are asphalt covered
- Asphalt is the most recycled material (about 100 million tons per year)
- Local governments are responsible for about 77% of all roads



Facts for North Castle:

- About 93 miles of asphalt-paved roads (about 250,000 tons)
- For an average year, about 5-10 miles of road are repaved (13,000 to 26,000 tons)
- In 2020, about 11,000 tons of RAP were stored
- For 2021, about 15-20 miles of road will be repaved

RAP Background



| RAP | Tons, Millions | | Tons, Millions | |
|--|----------------|------|----------------|-------|
| Accepted | 35.6 | 35.7 | 81.8 | 79.9 |
| Used in HMA/WMA Mixtures | 32.8 | 33.8 | 76.9 | 76.2 |
| Used in Aggregate | 1.3 | 1.4 | 3.7 | 3.4 |
| Used in Cold-Mix Asphalt | 0.1 | 0.1 | 0.2 | 0.3 |
| Used in Other | 0.2 | 0.1 | 0.4 | 0.2 |
| Landfilled | 0.0 | 0.0 | 0.1 | 0.0 |
| Total Tons of RAP Stockpiled at Year-End | 41.2 | 45.8 | 93.6 | 102.1 |

| State | Reported Tons Stockpiled (Million) | | Estimated Tons Stockpiled (Million) | | State | Reported Tons Stockpiled (Million) | | Estimated Tons Stockpiled (Million) | |
|----------------------|------------------------------------|------|-------------------------------------|------|--------------------------|------------------------------------|--------------|-------------------------------------|---------------|
| | 2016 | 2017 | 2016 | 2017 | | 2016 | 2017 | 2016 | 2017 |
| Alabama | 1.14 | 1.94 | 2.28 | 2.78 | Montana | * | * | * | * |
| Alaska | * | * | * | * | Nebraska | * | 0.22 | * | 1.17 |
| American Samoa | NCR | * | NCR | * | Nevada | 0.23 | 0.05 | 0.79 | 0.12 |
| Arizona | 0.36 | 0.10 | 1.05 | 0.54 | New Hampshire | 0.08 | 1.01 | 0.08 | 1.23 |
| Arkansas | 0.23 | 0.20 | 0.54 | 0.64 | New Jersey | 2.33 | 5.91 | 3.84 | 15.05 |
| California | 1.63 | 0.60 | 4.20 | 2.63 | New Mexico | 0.10 | 0.10 | 0.35 | 0.31 |
| Colorado | 0.72 | 0.70 | 2.28 | 1.85 | New York | 1.37 | 1.07 | 4.10 | 2.40 |
| Connecticut | 1.02 | 1.14 | 1.86 | 1.97 | North Carolina | 1.10 | 1.02 | 3.46 | 2.55 |
| Delaware | * | * | * | * | North Dakota | * | 0.15 | * | 0.34 |
| District of Columbia | NCR | * | NCR | * | Ohio | 2.17 | 3.58 | 3.96 | 4.58 |
| Florida | 1.08 | 2.04 | 3.02 | 7.26 | Oklahoma | 0.39 | 0.36 | 0.91 | 0.72 |
| Georgia | 5.27 | 0.36 | 7.58 | 2.37 | Oregon | 0.65 | 0.21 | 2.19 | 0.78 |
| Hawaii | * | 0.12 | * | 0.18 | Pennsylvania | 1.59 | 2.71 | 4.12 | 7.01 |
| Idaho | 0.34 | 0.53 | 0.73 | 0.86 | Puerto Rico | NCR | NCR | NCR | NCR |
| Illinois | 0.59 | 0.53 | 3.79 | 3.26 | Rhode Island | * | * | * | * |
| Indiana | 1.75 | 2.20 | 3.65 | 3.94 | South Carolina | 0.46 | 0.89 | 0.95 | 1.74 |
| Iowa | 0.42 | 0.22 | 0.76 | 0.51 | South Dakota | * | * | * | * |
| Kansas | 0.56 | 0.23 | 1.19 | 0.43 | Tennessee | 0.85 | 0.87 | 2.98 | 3.16 |
| Kentucky | 0.44 | 0.96 | 0.94 | 0.96 | Texas | 0.48 | 2.00 | 1.44 | 5.04 |
| Louisiana | 0.18 | 0.17 | 0.25 | 1.06 | Utah | 1.41 | 1.42 | 1.25 | 1.62 |
| Maine | 0.44 | 0.53 | 0.34 | 0.46 | Vermont | * | * | * | * |
| Maryland | 1.18 | 0.71 | 2.64 | 2.29 | Virginia | 2.20 | 1.47 | 3.57 | 3.58 |
| Massachusetts | 0.97 | 0.56 | 2.04 | 0.72 | Washington | 0.54 | 0.87 | 1.67 | 1.18 |
| Michigan | 1.80 | 3.42 | 4.26 | 5.18 | West Virginia | 0.13 | 0.32 | 0.24 | 0.55 |
| Minnesota | 0.93 | 1.15 | 2.61 | 1.31 | Wisconsin | 1.46 | 1.16 | 2.45 | 1.60 |
| Mississippi | 0.48 | 0.16 | 0.83 | 0.27 | Wyoming | 0.03 | 0.02 | 0.21 | 0.40 |
| Missouri | 1.11 | 1.51 | 3.84 | 2.53 | Total¹ | 41.15 | 45.84 | 93.59 | 102.11 |

Regulatory Considerations

- Solid Waste
 - NYSDEC
- Stormwater
 - USEPA
 - NYSDEC
 - Westchester County
- Drinking Water
 - USEPA
 - NYSDEC



Solid Waste

- In New York State, solid waste regulations are enforced by NYSDEC under New York Code of Rules and Regulations (NYCRR) Part 360
- The latest version of Part 360 was enacted in September 2017
 - For clarification, NYSDEC issued Enforcement Discretion letters, most recently in February 2021, to address provisions of Part 360

According to NYSDEC, RAP storage and reuse by the Town of North Castle is **exempt** from solid wastes rules. For two reasons:

Solid Waste - Storage

1. Transfer and storage facilities located at the site of waste generation or at a location in the State under the same ownership or control as the site of waste generation, are exempt from Part 360. **For the purposes of this Part, all locations under the ownership or control of municipal agencies and departments are considered under the ownership or control of the parent municipality.** (Part 360.14(b)(1))



Solid Waste - Reuse

2. Reuse of RAP is considered a pre-determined Beneficial Use Determination (BUD) provided that the millings meet a municipal or State specification or standard for use as in asphalt pavement or other paved surface if separated from other waste prior to processing and subsequently processed and stored in a separate area as a discrete material stream (Part 360.12(c)(3)(ix))

Conditions for North Castle include:

- RAP must not be stored for more than 365 days prior to beneficial use
- A report must be submitted to NYSDEC if more than 10,000 tons of RAP are distributed for beneficial use

Solid Waste

Benefits

- No excavation required from quarries or refineries
- Old asphalt from streets does not travel to landfills
- Reduces the amount of new petroleum needed to make asphalt
- Use of RAP can contribute directly to LEED credits for a building project

| How Asphalt Earns LEED Credits | | | |
|--------------------------------|--|--|---------|
| Rating Category | Credit Description | Pavement Type | Credits |
| SS Credit 6.1 | Stormwater Design: Quantity Control | Porous Asphalt | 1 |
| SS Credit 6.2 | Stormwater Design: Quality Control | Porous Asphalt | 1 |
| SS Credit 7.X | Heat Island Effect: Non-Roof | Reflective surfaces Open-graded asphalt Porous pavements | 1 to 3 |
| MR Credit 2.X | Construction Waste Management: Divert from Disposal (based on weight/volume) | RAP | 1 to 2 |
| ID Credit 1.X | Exceptional Performance Exceeding Expectations or Areas Not Addressed | Warm-mix asphalt High-RAP mixes | 1 to 4 |

Solid Waste

- NYSDEC's overall goal is to reduce waste disposal by maximizing waste reduction, recycling and resource recovery and reducing the amount of waste destined for landfills
- NYSDEC achieves this goal through cooperation with both local and State governments



Stormwater Regulations

- The Town has a NYSDEC Permit for stormwater discharges known as SPDES General Permit for Municipal Separate Storm Sewer Systems (“MS4”)
- MS4 operators are required to comply with certain Minimum Control Measures. DEC knows that Municipalities engage in numerous construction, operation and maintenance activities and as such, DEC requires a municipality to:
 - develop operation and maintenance schedules
 - select appropriate practices to reduce pollutants of concern
 - design operation and maintenance procedures that follow standard NYS pollution prevention practices
 - provide their employees with training in correct operation and maintenance procedures
- The Town submits an annual report showing it’s compliance with MS4 requirements

Standard Best Management Practices (BMP)

- Proper Storage
- Stockpiling
- Segregation
- Runoff Control (hay bales, silt fencing, inlet protection, etc.)
- Ground Cover
- Tarp covers

Implemented Stormwater BMPs

(Highway Yard Milling Piles)

1. Historical BMP Measures implemented:

- Daily inspections by the Highway Department
- Inspections by the Highway Department before and after storms
- Sweeping the Highway Yard with a street sweeper on a regular basis
- Segregation of millings from other stored materials
- Installation of a silt boom around the catch basin

2. Additional Measures implemented:

- Placement of hay bales around millings piles and catch basin
- Placement of a silt fabric on the catch basin
- Pulling back of the millings pile closest to the brook
- Placement of a silt fence near the brook
- Placement of grass seed and Hay on the soil slope near the brook

Implemented Stormwater BMPs

(Middle Patent Yard Milling Piles)

1. Historical BMP Measures implemented:

- Weekly inspections by DPW staff
- Inspections by DPW staff before and after storms
- Segregation, containment, and maintenance of mulch, wood chips, and millings piles

2. Additional Measures implemented:

- Installation of a check dam
- Reshaping of the millings pile to be less spread out
- Installation of a silt fence along the backside of the millings pile to reduce soil erosion and runoff
- Placement of grass seed and hay on the soil around the backside of the millings pile

BMPs in Place Today



BMPs in Place Today



Drinking Water

- PAHs and metals are the principal contaminants of concern associated with RAP
 - PAHs come from the bitumen binder used to create the asphalt pavement and from external sources after the asphalt is placed
 - Metals (aluminum, cadmium, chromium, lead, silver, and selenium) are mostly from external sources including vehicles, road paint, and pesticide application
- PAHs and metals are ubiquitous in the environment
 - found in terrestrial and aquatic plants, soil and sediment, fresh and marine waters.
 - Emitted naturally from volcanoes and forest fires, and by humans via petroleum spills, automobiles, coal- and gas-fired boilers, incinerators, and many industrial processes.
 - “It is not possible to list all the sources or to count or measure the PAHs produced by them.” - National Research Council, 1983

Contaminant composition of RAP is variable, but the findings of over a dozen studies are consistent:

Drinking Water

Waste Asphalt Doesn't Pollute Groundwater

- University of Florida, 1998

All reported concentrations for the PAHs dibenzo(a,h)anthracene, benzo(a)anthracene, and benzo(a)pyrene were diluted/attenuated below their US EPA RSLs at all modeled conditions

- Spreadbury et al, 2021

Based on the results, RAP may be used as an unbound material in all environments except those which are highly acidic (i.e., $\text{pH} \leq 4$)

- NJDOT, 2017

Results of numerous field studies and standardized tests, including the Toxicity Characteristic Leachate Procedure (TCLP) test, suggest that typical RAP can be used as “clean fill” without undue negative environmental consequences

- VDOT, 2006

Based on the reviewed literature and our risk assessment analysis, the stockpiling and reuse of RAP is unlikely to contaminate underlying or adjacent water supplies under conditions reflective of the modeling exercise performed in this study.

- Spreadbury et al, 2021

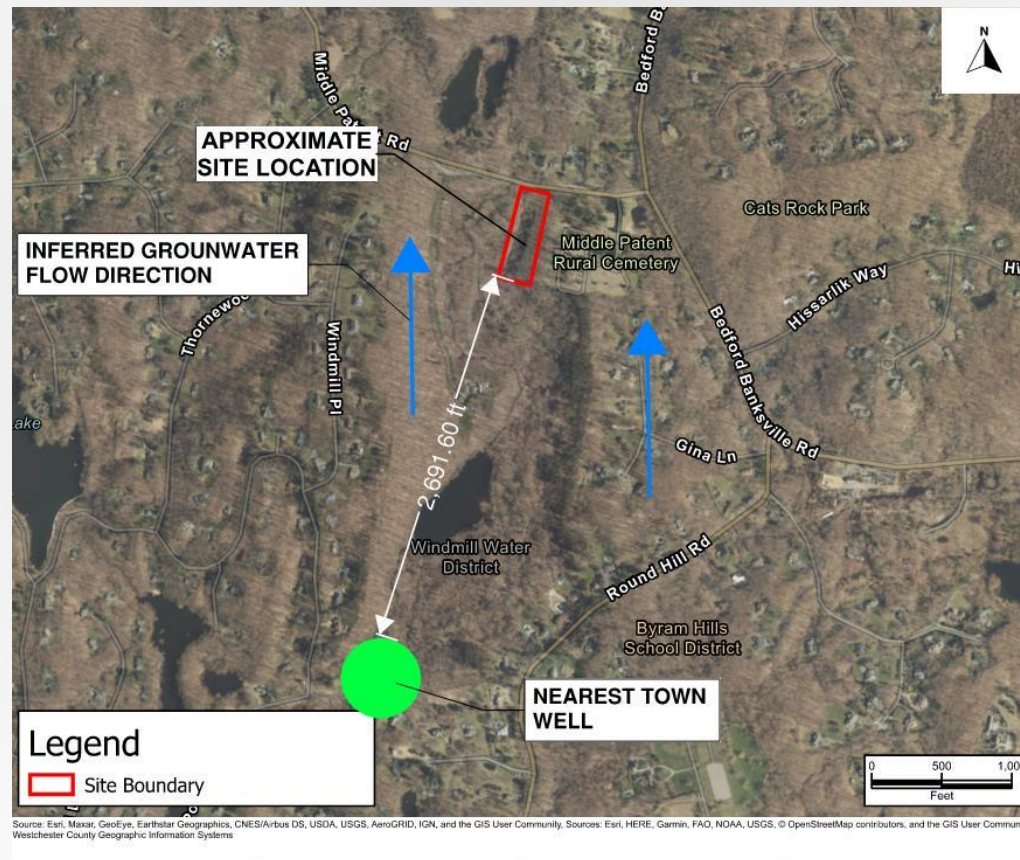
Drinking Water

1. PAHs and metals are not mobile after leaching from the RAP piles because of their chemical properties.
- The fate and transport properties of PAHs and metals generally associated with RAP include:
 - Sorption (binding) to soil particles
 - Low water solubility

Because of the factors above, the potential leachability of PAHs and metals from RAP under typical environmental conditions is **low**.

Drinking Water

2. The nearest drinking water supply well to Middle Patent is over **2,500 feet upgradient**.



Drinking Water

3. Drinking water sample results from 2015-2021 for Water Districts 2 (Middle Patent) and 4 (DPW Yard) show that levels of PAHs were **below the quantitation limit** (lowest concentration that is possible to be determined) and metals associated with RAP were either below the quantitation limit or did not exceed the USEPA Maximum Contaminant Level (MCL).

Recommendations for Improvement

Immediate/Short Term:

1. Additional perimeter controls around RAP piles (noted previously in this presentation)
2. Bi-Weekly BMP inspection by independent inspection firm
3. Continued town staff training and increased awareness of site BMPs, inspection and maintenance requirements

Long Term:

1. Preparation and implementation of a written long-term control plan to enforce BMPs. This plan will include but not be limited to inspection frequency, maintenance obligations, training, etc.

Recommendations for Improvement

2. Recordkeeping

| NEW YORK STATE OF OPPORTUNITY | | Department of Environmental Conservation |
|--|---|--|
| Pre-Determined BUD Large Quantity Annual Report This form may be used to submit annual reports for quantities of materials distributed pursuant to pre-determined beneficial uses in 6 NYCRR Part 360.12(c) that equal or exceed 10,000 tons in any calendar year. | | |
| Distributor Information | | |
| Distributor Name | <input type="text"/> <i>Name of entity distributing 10,000 tons or more in reporting year</i> | |
| Contact Person | <input type="text"/> | |
| Distributor Address | <input type="text"/> | |
| Contact Phone: | <input type="text"/> | Contact Email: <input type="text"/> |
| Check if this is a change from previous information <input type="checkbox"/> | | |
| Waste, Residual or By Product Information | | |
| BUD Information | <input type="text"/> <i>Pre-Determined BUD Reference (ex., 360.12(c)(3)(viii))</i> | |
| Waste Information | <input type="text"/> <i>Type of Waste, Residual or By-Product (ex., recognizable, uncontaminated concrete)</i> | |
| Beneficial Use: | <input type="text"/> <i>Brief Description of Approved Beneficial Use(s) (ex., commercial aggregate)</i> | |
| Annual Reporting for January 1, 2021 through December 31, 2021 | | |
| Total Quantity of Material Used Pursuant to this BUD | <input type="text"/> <i>Quantity</i> | <input type="text"/> <i>Units</i> |
| Certification | | |
| <i>(Must be completed by a responsible official – continued on next page)</i> | | |
| I certify that the distributor, <input type="text"/> , has been in compliance with the terms and conditions of the above-referenced BUD during this reporting period. | | |
| Revised 9/23/21 | | |
| Page 1 of 2 | | |

| NEW YORK STATE OF OPPORTUNITY | | Department of Environmental Conservation |
|--|--------|--|
| New York State Department of Environmental Conservation Division of Materials Management | | |
| USE OF PREDETERMINED BENEFICIAL USE DETERMINATION Pursuant to 6 NYCRR 360.12(c) | | |
| COMPANY NAME: | | <input type="text"/> |
| COMPANY ADDRESS: | | <input type="text"/> |
| LOCATION/ADDRESS OF SITE OF REUSE: | | <input type="text"/> |
| This material is being used in compliance with the pre-determined beneficial use determination described at 6 NYCRR 360.12(c)(3)(ix): | | |
| <i>"The following cease to be waste when the material meets the requirements for the intended use identified in this paragraph.... (ix) recycled material or residue generated from uncontaminated asphalt pavement and asphalt millings which meets a municipal or state specification or standard for use as an ingredient in asphalt pavement or other paved surface construction and maintenance uses if separated from other waste prior to processing and subsequently processed and stored in a separate area as a discrete material stream."</i> | | |
| Transportation of this material does not require a Part 364 Waste Transporter permit or registration. | | |
| CONTACT NAME: | TITLE: | |
| COMPANY NAME: | | <input type="text"/> |
| PHONE: | EMAIL: | |
| SIGNATURE: | DATE: | |
| With any questions, please contact (518) 402-8678 or benuse@dec.ny.gov. | | |