Reduce, Reuse, Repurpose

INTEGRATING RECYCLED PLASTICS INTO NYC'S ROADWAYS

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EXECUTIVE SUMMARY

This capstone project evaluated the feasibility of incorporating post-consumer recycled plastics (PCRPs) into New York City's roadway infrastructure. Through Town+Gown:NYC @ NYC DDC, a city-wide research program in the built environment (Town+Gown), and in collaboration with the Department of Sanitation (DSNY), the Department of Transportation (NYCDOT) and the New York City Department of Design and Construction (DDC), the project used the City's built environment as a laboratory to assess whether roadway systems can serve as a viable end-use pathway for post-consumer plastics. The analysis was carried out in conjunction with the draft 2026–2036 DSNY Solid Waste Management Plan (SWMP) and the City's broader circular economy goals.

The research was guided by two central questions: Firstly, what does existing research indicate about the performance, long-term viability, and environmental implications of PCRP-modified asphalt, and how should these findings inform New York City's approach to pilot testing and potential implementation? Secondly, what policy, regulatory, and institutional conditions shape the feasibility of incorporating PCRPs into New York City roadways?

To answer these questions, the authors used a mixed-methods approach that combined a scientific and technical literature review, policy and regulatory analysis, stakeholder engagement, semi-structured interviews with experts, and site visits to relevant facilities. This approach allowed the authors to evaluate both the technical evidence base as well as the institutional and operational conditions that would shape such implementation.

The research identified three central findings. First, incorporating PCRPs into asphalt is technically possible. Laboratory testing and early pilot programs, including the Staten Island pilot coordinated with MacRebur Ltd., confirm as of the writing of this report that plastic can be incorporated into asphalt as an additive, in a manner similar to the incorporation of recycled asphalt pavement (dry-process) or as a blended component of asphalt concrete (wet-process). However, this technical feasibility exists in the absence of consistent raw-material quality, contamination rates, and dosage rates for widespread use. Further, controlled conditions do not establish long-term viability.

Second, only certain plastics are viable candidates for incorporation into asphalt. Resin compatibility, feedstock consistency, contamination levels, and existing contracts with the City's Material Recovery Facility (MRF) all constrain the availability and use of the plastic supply. Under NYC's current waste management system, reliable sourcing of sufficient, consistent feedstock presents a significant operational challenge.

Finally, notwithstanding the above, the current body of evidence is insufficient to confirm that PCRP-modified asphalt performs comparably or better than conventional asphalt over time. Long-term field performance data under various City-relevant traffic loads and seasonal conditions do not yet exist, or are very scarce. Additionally, environmental uncertainties, such as possible microplastic generation through traffic abrasion, and the compatibility with reclaimed asphalt pavement (RAP) recycling practices, remain unresolved. A relevant National Academies of Sciences study (NAS Report) characterizes potential incompatibility with RAP as potentially "game-ending," given that RAP is the most recycled material in U.S. infrastructure and central to New York City's existing asphalt circularity strategy. Economic advantages over conventional asphalt also remain undemonstrated at scale.

Based on these findings, we propose three recommendations. First, the City should establish a mayoral-level interagency task force, composed of agencies that would use recovered materials in capital projects, to guide how these materials are integrated into City infrastructure. Rather than focusing exclusively on PCRP-modified asphalt, this body should reframe waste as working capital with salvage value and identify its highest-value uses across applications, particularly infrastructure. The task force would bring the agencies together to coordinate pilot programs, align procurement and specification processes, and report to the Mayor with priority recommendations in the near term.

Second, the City should implement a series of standardized pilot programs in partnership with the private sector. Building on the Staten Island pilot, future pilots should ideally include matched control sections for direct performance comparison, span low- to high-traffic corridors in a phased progression, and be designed to align with asphalt plant production cycles. Third-party academic partners, leveraged through Town+Gown, should be incorporated to ensure independent evaluation. Private firms should participate as material suppliers and technology partners with structured pathways to access DSNY feedstock.

Third, the task force should ensure alignment of the regulatory and procurement pathways necessary for recovered materials to move from pilots to broader city use. This includes confirming beneficial use determinations (BUDs) through the New York State Department of Environmental Conservation (NYSDEC), ensuring compliance with standards and specifications, and pursuing inclusion on state agencies' Approved Materials List, as needed. Supplemental agency guidance should be developed to clarify how existing frameworks apply to recovered materials, with the flexibility to evolve as evidence compounds.

INTRODUCTION

New York City (NYC) is advancing a set of ambitious waste reduction and resource recovery goals in alignment with a Circular Economy framework. These goals require identifying new end-use pathways for materials that are difficult to recycle through conventional systems. Within this effort, PCRPs present both a central challenge and a unique opportunity. Plastics make up a persistently large share of the waste stream, yet remain difficult to recycle at scale because stable end markets are limited. At the same time, NYC's roadway program is one of the few municipal systems large enough to potentially absorb meaningful quantities of recycled plastic. If viable, this approach could create a meaningful end use for plastics that are difficult to recycle through conventional channels, thereby putting circular economy goals into practice within the existing public infrastructure system..

This report was developed through DDC's Town+Gown program, which supports applied research projects that use the City's built environment as a laboratory for policy and infrastructure analysis, and was prepared in partnership with DSNY and NYCDOT. It evaluates the feasibility of incorporating PCRPs into NYC roadway infrastructure in tandem with DSNY's 2026-2036 SWMP. This project is a product of the broader City effort to reduce waste, expand its diversion, and identify viable end uses for materials that are difficult to recycle through conventional channels.

Within that context, our client agencies are interested in whether roadway asphalt could provide a viable end use for post-consumer plastics and whether any such material could meet existing approval requirements for use on city streets. This report therefore investigates the scientific, technical, regulatory, and institutional conditions that determine whether PCRPs could realistically be incorporated into asphalt in New York City, the barriers currently standing in the way, and the opportunities that may exist over the next 10 years. In doing so, it frames a central policy question for New York City: can PCRP-modified asphalt advance waste diversion and circular economy goals without compromising roadway durability, environmental safety, or the use of reclaimed asphalt pavement?

THE NEW YORK CITY CONTEXT

The use of PCRPs in roadway infrastructure sits within a broader national and international effort to identify viable end-use applications for plastic waste. Policymakers and researchers have increasingly focused on infrastructure systems as potential material sinks, particularly for low-value plastics that are difficult to recycle through conventional markets. This is evidenced by the National Academies' *Consensus Study Report on Recycled Plastics in Infrastructure*, a 2023 expert review commissioned by the U.S. Congress through the Save Our Seas 2.0 Act.

The report is a peer-reviewed consensus study produced by the National Academies of Sciences, Engineering, and Medicine, an institution that provides independent, objective advice on scientific and technical questions. Within this report, the National Academies conclude that "one of the greatest opportunities for using recycled plastics in infrastructure may be as a component material in pavements.[1] Yet that opportunity is paired with significant uncertainty. The NAS Report did not find any hard evidence that PCRP-modified asphalt improves pavement life, structural performance, or environmental outcomes.[2] Additionally, it warns that introducing plastics into asphalt could threaten the circularity of reclaimed asphalt pavement (RAP), currently the most recycled material in the United States.[3] If plastic additives inhibit RAP recyclability, the report characterizes the consequence as "game-ending."[4]

Moreover, the City currently lacks the evidence and governance conditions necessary to determine whether PCRPs should move beyond limited pilots into standard roadway practice during the 2026–2036 planning cycle. Specifically, the City does not yet have long-term field performance data under NYC-specific traffic loads and seasonal temperature variations, environmental monitoring of particle generation and production-phase emissions, or clear evidence regarding end-of-life compatibility with RAP recycling. This gap is

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[1] National Academies of Sciences, Engineering, and Medicine. *Recycled Plastics in Infrastructure: Current Practices, Understanding, and Opportunities*. National Academies Press, 2023, p. 101.
[2] *Ibid.*, p. 177-178.
[3] Williams, B. A., Willis, J. R., & Shacat, J. (2024). *Asphalt pavement industry survey on recycled materials and warm-mix asphalt usage: 2023* (Information Series 138, 14th Annual Survey). National Asphalt Pavement Association. https://go.asphaltpavement.org/is-138
[4] *Ibid.*, p. 129.

especially significant because RAP recycling is central to the City's existing asphalt circularity and cost strategy.

Within this context, the question is not simply whether PCRPs can be used in asphalt, but whether they can be integrated into an existing, highly regulated infrastructure system without compromising its technical, environmental, and economic integrity.

In New York City, any effort to integrate PCRPs into infrastructure must operate within its distinct policy and institutional landscape. The City has adopted ambitious diversion and circular economy goals through its 2023 Zero Waste legislative package, which formalized the City's goal of achieving zero divertible waste by 2030, and its 2026–2036 Solid Waste Management Plan, which further emphasizes increasing waste diversion cost-effectively while acknowledging that traditional recycling and composting already accounts for more than two-thirds of the waste stream.[5] These frameworks recognize that traditional recycling and composting pathways are approaching structural limits. Even with full participation, diversion rates are expected to plateau, necessitating the development of alternative end-use markets for materials that are currently low-value or difficult to process.[6] Within this policy environment, PCRP-modified asphalt presents a potential pathway to leverage the existing public infrastructure system rather than requiring the creation of entirely new markets.

At the same time, NYC's roadway system presents a unique opportunity due to its scale and continuity. As one of the largest municipal roadway networks in the country, it has the theoretical potential to absorb significant volumes of material over time. This distinguishes roadway infrastructure from other potential end-use applications, which may be smaller in scale or not routinely procured for public projects.

In practice, this work is shaped by the City's existing agency structure. DSNY is responsible for managing waste streams and advancing diversion targets, creating a clear incentive to identify viable end markets for post-consumer plastics. NYCDOT and DDC, in turn, oversee roadway design, material specifications, and public capital project management. These agencies

[5] New York City Department of Sanitation. *Draft 2026 Solid Waste Management Plan (SWMP26).*
[6] *Ibid*, p. 162.

operate within established systems for material testing, approval, and quality control, which require new materials to be evaluated within a structured material- or performance-based framework. However, broader implementation would require coordination beyond City agencies, including alignment with binder manufacturers and industry-standard specifications, rather than the creation of a fully City-specific material firm.

Importantly, New York City has an established precedent for incorporating recycled materials into roadway construction. Local Law 71 of 2011 mandates that repaving projects incorporate a minimum of 30% reclaimed asphalt pavement (RAP).[7] This demonstrates that the City's procurement and engineering systems can accommodate recycled materials where performance standards are met.

This threshold is reinforced by the City's regulatory and technical framework, which governs how materials are used. NYCDOT's Standard Highway Specifications and DDC's quality assurance and control processes govern mix design, plant operations, and field deployment.[8] Commercial Waste Zone reforms and other diversion laws reinforce recycling requirements while strengthening accountability within the waste system.[9] Environmental review requirements and procurement rules introduce additional layers of oversight, ensuring that any new material is evaluated not only for technical performance but also for compliance with broader environmental and policy objectives. These systems enable pilot testing in a controlled and accountable manner, but limit the conditions under which broader adoption could presently occur.

Early-stage testing in New York City, specifically the Staten Island pilot project, demonstrates that PCRP-modified asphalt can be deployed on a limited basis within existing institutional structures.[10] However, moving beyond pilot testing would require a substantially stronger evidentiary foundation. Specifically,

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[7] New York City Council. *Local Law No. 71 of 2011: Use of Reclaimed Asphalt Pavement.* 2011.
[8] New York City Department of Transportation & New York City Department of Design and Construction. (2022). *Standard highway specifications (SB 22-003).* https://www.nyc.gov/assets/ddc/downloads/publications/scops/SB22-003NYCDOTStandardHighwaySpecifications_2022-05-16.pdf; New York City Mayor's Office of Environmental Coordination. *City Environmental Quality Review (CEQR) Technical Manual.* December 2021 ed., 1 Dec. 2021, https://www.nyc.gov/site/oec/environmental-quality-review/technical-manual.page
[9] New York City Council. *Local Law No. 199 of 2019: Commercial Waste Zones.* 2019.
[10] McEwan, Roddy, Manager of Operations at MacRebur Limited. Personal interview. 11 Nov. 2025.

broader adoption would depend on verified long-term field performance, robust environmental monitoring across the material lifecycle, and demonstrated compatibility with RAP recycling systems.

Overall, these conditions define both the opportunity and the constraint facing NYC. The City has the policy mandate and infrastructure scale to evaluate PCRPs as part of its circular economy goals. At the same time, given these uncertainties and the need to maintain existing systems, any expansion should be cautious and based on evidence from controlled pilots.

METHODOLOGY

This project was conducted using a mixed-methods policy research approach combining literature review, stakeholder engagement, semi-structured interviews, and field observation through site visits. The research was conducted from October 2025 through May 2026 as part of the capstone program for the NYU Wagner Graduate School of Public Service MPA in Public & Nonprofit Management. The purpose of the project was to evaluate feasibility of PCRP integration into NYC roadways infrastructure over the next 10 years.

The Capstone team began with an initial literature review to establish a technical foundation. Early findings informed stakeholder outreach, interview design, and additional research pathways. Stakeholder input, obtained from client meetings, interviews, and site visits, then helped refine research priorities as well as identify technical and operational constraints to contextualize these findings within existing NYC agency practice. This phased structure enabled the authors to integrate technical research with institutional realities and considerations throughout the project.

DATA COLLECTION & STAKEHOLDER ENGAGEMENT

The analysis draws on multiple sources to support a policy-oriented evaluation. First, the authors reviewed federal, state, and local regulatory documents related to solid waste management, recycling systems, procurement, and roadway materials. This included legislation, agency regulations, technical standards, and procurement documents relevant to New York City and this project. In parallel, the authors examined current research evaluating the incorporation of PCRP into asphalt, including its performance, durability, environmental impacts, and lifecycle considerations. The NAS Report served as the primary technical reference, and additional sources were identified through targeted research based on themes emerging from the NAS Report, client meetings, stakeholder interviews, and site visits.

Second, the authors engaged directly with agency stakeholders to understand institutional roles, priorities, and operational considerations related to recycling and roadway pavement processes. The authors held recurring meetings with representatives from DDC, DSNY, and NYCDOT, including DDC's Chief Engineer and the Director of Town+Gown; DSNY's Program Manager for Research and Innovation and Deputy Commissioner of Solid

Waste Management; and NYCDOT's Director of Technical Services, Innovation and Quality Assurance, along with the Project Manager for Technical Services, Innovation and Quality Assurance within the Roadway Repair and Maintenance Division. These discussions clarified agency decision-making structures, testing and specification requirements, current institutional needs and limitations, risk considerations, and alignment with existing climate and circular economy goals.

Third, the authors conducted semi-structured interviews with field experts and relevant stakeholders involved in materials science, pilot program implementation, recycling systems, and roadway infrastructure. The authors interviewed Roddy McEwen, Operations Manager at MacRebur Ltd., a leading company in PCRP-modified asphalt products, to understand the NYCDOT Staten Island pilot, as well as broader private-sector perspectives on product development, market needs, and public–private collaboration for future pilots and scalability. The authors also interviewed Jen Harper, Research Director at the Missouri Department of Transportation (MoDOT), and Dr. William G. Buttlar of the University of Missouri, who led a state-level pilot on PCRP-modified asphalt. Dr. Buttlar was also consulted for his expertise in materials science, contributing insights on material behavior, testing, and broader limitations within the field.

To ground the analysis in materials science, the authors consulted with Dr. Pavel A. Kots (NYU Tandon) and Dr. Huiming Yin (Columbia University), drawing on their expertise in polymers and recycled plastic-modified materials to better understand material behavior, compatibility with asphalt systems, and technical uncertainties. Finally, the authors interviewed Kara Napolitano, Education Director at Circular Services, to better understand the recycling process in New York City, including feedstock availability, contamination challenges, and operational constraints, given Circular Services' role in managing one of the City's primary recycling facilities.

The goal of these interviews was to complement the literature review with real-world insights into how PCRP applications perform in practice and what is required to move from pilot to implementation. Interviews focused on participants' direct experience with pilot programs, material performance, and system-level constraints, as well as broader questions related to scalability, regulatory and procurement barriers, data gaps, and the conditions necessary for integrating PCRPs into existing roadway infrastructure systems.

Finally, the Capstone team visited the Sunset Park Material Recovery Facility (commonly known, and referred to herein as SIMS), operated by Circular Services, and NYCDOT's Hamilton Avenue Asphalt Plant to better understand waste management, materials processing, and roadway construction in NYC. These visits provided practical insight into system constraints and implementation realities not fully captured in technical literature or policy documentation.

LIMITATIONS OF THE REPORT

This report is subject to several limitations. PCRP-modified asphalt is an emerging field and much of the available evidence is based on laboratory testing or small pilot projects rather than long-term field performance under varied traffic and climate conditions. As a result, uncertainties remain regarding long-term durability, performance, and environmental impacts, among other considerations. Access to detailed technical data was limited in some instances due to proprietary protections surrounding specific asphalt additives and mixtures. In addition, this analysis was conducted by a graduate Capstone team within the defined scope and timeline of an academic year, from September 2025 through May 2026. The authors' expertise is grounded in policy analysis and public administration rather than engineering or materials science, and the project therefore focuses on regulatory feasibility, institutional readiness, and implementation considerations rather than independent technical validation of PCRP-modified pavement performance.

KEY FINDINGS

FINDING #1: RESEARCH INDICATES THAT THE INCLUSION OF PCRPs IN ASPHALT IS TECHNICALLY POSSIBLE.

The NAS Report and supporting literature confirm that incorporating PCRPs into asphalt mixtures through both wet-mix (binder modification) and dry-mix (aggregate substitution) processes is technically feasible under controlled conditions (See Figure 1).[11] In controlled laboratory settings, polyethylene-based additives, particularly high-density polyethylene (HDPE) and low-density polyethylene (LDPE), can be dispersed within asphalt binders without immediate phase separation when processing conditions are properly controlled. Under these conditions, mixes do not exhibit short-term instability during production or laboratory evaluation.[12]

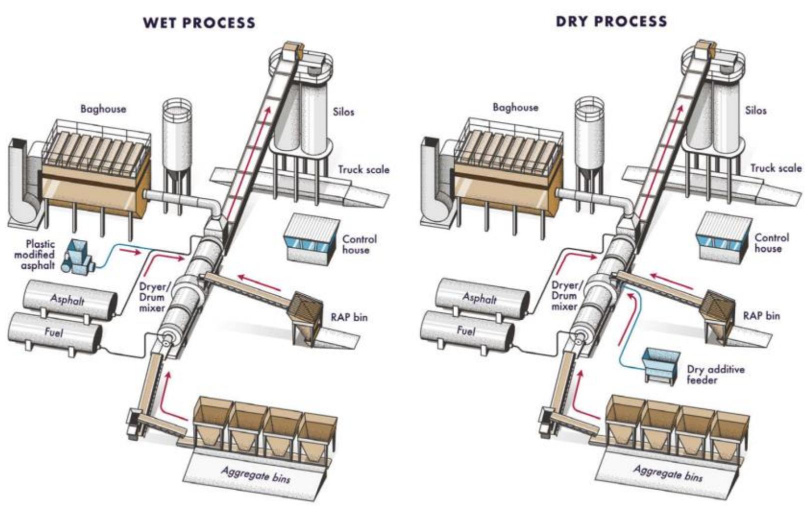

FIGURE 1 [13]

[11] National Academies of Sciences, Engineering, and Medicine. *Recycled Plastics in Infrastructure: Current Practices, Research Needs, and the Path Toward Innovation.* The National Academies Press, 2023, p. 10.
[12] *Ibid.*, p. 117.
[13] Image from the National Academies of Sciences, Engineering, and Medicine. Recycled Plastics in Infrastructure: Current Practices, Research Needs, and the Path Toward Innovation. The National Academies Press, 2023, p. 115.

Controlled studies frequently report measurable changes in binder properties following plastic incorporation, including increased stiffness, higher softening points, and improved resistance to rutting under high-temperature simulations.[14] In laboratory tests provided by private contractor MacRebur, PCRP-modified mixes show reduced permanent deformation compared to traditional asphalt. These findings indicate that certain plastic additives can alter binder and mixture behavior rather than simply adding volume to the mix.

However, the NAS Report cautions that improvements observed under laboratory conditions do not automatically translate into improved long-term durability.[15] Field performance under sustained traffic loads, seasonal temperature variations, moisture exposure, and aging remains insufficiently documented.

Through stakeholder interviews with the MoDOT and NYCDOT, we found that active pilot projects have not reported early-stage structural failures to date.[16] The pilots are a proof of concept and show that PCRP-modified asphalt can be produced and installed using the City's plant and paving infrastructure. While these pilots are still too recent to yield meaningful conclusions about long-term performance, we must note that private companies Dow Inc. (better known as Dow Chemical) and MacRebur Ltd. are behind the specific formulations of these pilots and carry years of research and development experience in the field. To date, Dow Inc. has projects smaller than Missouri across the United States, as well as further testing in Bulgaria, Mexico, Colombia, and large-scale tests in India.[17] MacRebur has done work beyond Staten Island, including Virginia, New Jersey, Spain, Bahrain, and others.[18]

Scale is another key advantage of pavement applications. Asphalt is produced in large volumes, meaning it can absorb significant amounts of low-value

[14] National Academies of Sciences, Engineering, and Medicine. *Recycled Plastics in Infrastructure: Current Practices, Research Needs, and the Path Toward Innovation.* The National Academies Press, 2023, p. 115

[15] *Ibid.*

[16] MacRebur. *Copy of NYCDOT Trial Road Report: Rice Avenue and Royal Oak Road, Staten Island, New York*. 30 Aug. 2022.

[17] Dow, Inc. Sustainable Road Solutions: https://www.dow.com/en-us/market/mkt-building-construction/sub-build-construction-chem/app-build-constchem-asphalt-modification/recycled-polymer-modified-asphalt.html#accordion-10916a6d1b-item-faf5f75ad0

[18] MacRebur Ltd., Projects: https://www.macrebur.com/#projects

plastic if compatibility is confirmed. The NAS report notes that this sets pavement systems apart from smaller recycled-plastic markets that cannot handle materials at this scale. At the same time, the lifecycle impact of PCRPs on landfill use and virgin material demand is not yet well understood. As it stands, the role of PCRP-modified asphalt remains limited within the City's broader circularity goals. Recycled plastics can replace only a small portion of asphalt binder, and the binder itself makes up a small share of total asphalt volume.

If PCRP-modified asphalt can still be recycled through existing RAP processes, it could fit into the City's current system for reusing roadway materials. Because NYC mandates significant RAP content in repaving projects, successful integration would allow plastic inputs to move through a system that is routinely milled and reused.[19] However, long-term compatibility under repeated milling and reheating cycles has not yet been demonstrated.

While production and placement appear operationally feasible, standardized specifications for feedstock quality, contamination thresholds, and dosage rates have not been established for widespread use. Variability in post-consumer plastic streams also introduces uncertainty into mix consistency and reproducibility across projects.

Taken together, current evidence shows that PCRPs can be incorporated into asphalt mixtures, and that pavement systems offer both structural containment and production scale. However, key questions remain around long-term durability, environmental exposure, RAP compatibility, and feedstock standardization. Although the approach is technically feasible, its long-term performance has not yet been established.

FINDING #2: ONLY CERTAIN RECYCLED PLASTICS ARE VIABLE FOR INCORPORATION INTO ASPHALT IN NYC.

The literature highlights clearly that viability depends first and foremost on the chemical and physical properties of the resin type. Plastics must have compatible melting points and rheological behavior (or how the plastic may flow and disperse in the mix) to properly blend with asphalt binder and

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[19] National Academies of Sciences, Engineering, and Medicine. *Recycled Plastics in Infrastructure: Current Practices, Understanding, and Opportunities*. National Academies Press, 2023, p. 129.

contribute to pavement performance.[20] Thermoplastics such as HDPE, LDPE, linear low-density polyethylene (LLDPE), polyethylene terephthalate (PET), and polypropylene (PP) have shown the most promise because their properties align most closely with asphalt production temperatures and performance needs.[21] Other plastics, such as polyvinyl chloride (PVC) , present compatibility or processing challenges that limit their performance in asphalt production.[22] In short, successful asphalt modification requires resin-specific inputs rather than general "recycled plastic" streams.

Beyond chemical compatibility, plastics must also be available in sufficient volume and with enough consistency for producers and end users to confidently incorporate them into long-term infrastructure supply chains. Binder manufacturers and contractors may require a more predictable material feedstock than the City can reliably provide to ensure uniform performance and meet specifications. DSNY's plastic feedstock can vary in resin composition from day to day lowering predictability for manufacturers seeking uniform polymer inputs.[23] Variability in feedstock composition, contamination rates, or supply volumes may deter private-sector participation and complicate any future scaling efforts.

It is also worth noting that, under the DSNY's current waste management system, plastics are not characterized or aggregated by strict resin type, meaning that usable quantities of a compatible polymer type may be distributed across multiple bale categories rather than consolidated into standardized streams.[24] Finally, contamination levels cannot be reliably controlled to the degree typically required for industrial material production. While this contamination is a constraint within DSNY's feedstock, it is not necessarily prohibitive. Bale commodities produced at a MRF like SIMS typically contain allowable levels of contamination and downstream processors generally expect to conduct additional sorting, washing or

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[20] National Academies of Sciences, Engineering, and Medicine. *Recycled Plastics in Infrastructure: Current Practices, Understanding, and Opportunities*. National Academies Press, 2023, p .114.
[21] *Ibid.* p. 117.
[22] Buttlar, William, Founding Director of the Missouri Center for Transportation Innovation, *Personal interview*. 11, Nov. 2025
[23] Napolitano, Kara. Education Director for the Sunset Park Material Recovery Facility. *Personal interview*. 21 Nov. 2025.
[24] New York City Department of Sanitation. *2023 NYC Waste Characterization Study.* Mar. 2024 (published), https://www.nyc.gov/assets/dsny/downloads/resources/reports/waste-characterization-studies/2023/wcs-2023.pdf

shredding before the material is used in manufacturing. In that sense, secondary processing is a normal part of the recycling supply chain rather than an extraordinary hurdle.[25] However, lower contamination rates still matter because excessive contamination can introduce variability in melt behavior and interfere with binder blending. Ultimately, reducing contamination begins upstream, at the point of consumer disposal.

Finally, as discussed earlier, some plastics are feasible from a chemical standpoint but are already sold to third parties, and their repurposing would affect the business model and contracts of MRFs in NYC prioritizing highest-value use.

Overall, the key takeaway is that not all plastics are viable as an asphalt additive. They must have the appropriate chemical properties, be available in a consistent, sufficient supply, and not diverted from profitable purchasing agreements. Under NYC's current waste management system, meeting these conditions presents a significant hurdle.

FINDING #3: LONG-TERM VIABILITY OF PCRP-MODIFIED ASPHALT REMAINS UNCONFIRMED.

While early results show some promise, the current body of research does not demonstrate that PCRP–modified asphalt provides significant performance gains, addresses environmental concerns, or offers economic advantages over conventional asphalt mixtures. This is largely due to most available evidence being derived from laboratory testing or small, recent pilot programs. Laboratory tests simulate real-world conditions, but still require on-field validation. On the other hand, pilot programs, while valuable, remain geographically limited, small-scale, and relatively recent, which prevents statistically robust conclusions. As a result, the absence of long-term field evidence reflects the inherent time frame required to decide whether it is a viable method. Outlined below are several key aspects that are yet to be fully considered:

[25] Buttlar, William, Founding Director of the Missouri Center for Transportation Innovation, *Personal interview*. 11, Nov. 2025

Long-term Performance Considerations

The most significant gap identified in the literature concerns long-term pavement behavior. Although laboratory testing indicates that adding recycled plastics can increase binder stiffness and may improve rutting resistance under controlled conditions, there is no long-term field data evaluating how PCRP-modified asphalt performs in key categories such as rutting, cracking, moisture susceptibility, varying traffic loads, seasonal temperature variation, maintenance cycles, compatibility with RAP content, and aging as it pertains to NYC. Existing pilot projects, like Missouri or Staten Island, have not shown significant visible failure but are too recent to generate meaningful durability conclusions. Without multi-year monitoring and full life-cycle assessment, it is not possible to determine whether plastic additives enhance, degrade, or have no meaningful impact on pavement longevity.[26]

Environmental Impact

Long-term environmental impacts also remain unresolved. While limited pilots have not shown evidence of leaching or microplastic release, comprehensive multi-year environmental studies have not been conducted. There is credible concern that traffic abrasion may generate microplastics from pavement surfaces, which could enter stormwater systems, combined sewer overflows, and surrounding waterways. In dense urban environments, these particles could affect water quality and aquatic systems. Additional uncertainties include potential emissions during asphalt production and the behavior of various plastics under heat exposure.[27] Further, no thresholds or standardized monitoring frameworks currently exist to evaluate acceptable risk levels regarding microplastic release.

The NAS Report warns that if plastic additives limit the ability to use RAP, the net environmental costs could outweigh any benefits. RAP is currently the most recycled material in U.S. infrastructure systems and plays a central role in NYC's asphalt production. If plastic-infused asphalt cannot be effectively milled, reheated, and reincorporated into new mixes without environmental or performance penalties, this would undermine existing circularity benefits. The

[26] Buttlar, William. Founding Director of the Missouri Center for Transportation Innovation. *Personal interview*. 11 Nov. 2025; McEwan, Roddy, Manager of Operations at MacRebur Limited. *Personal interview*. 11 Nov. 2025.
[27] Strothers, Joel, Environmental Engineer at AECOM. *Personal interview*. 29 Oct. 2025

NAS Report characterizes this possibility as potentially "game-ending," highlighting the importance of confirming long-term compatibility between PCRP additives and RAP processes before scaling.

Institutional Readiness

There is currently no standardized national or local framework governing feedstock quality, contamination thresholds, dosage rates, or incorporation methods for PCRP-modified asphalt. Variability in post-consumer plastic streams raises concerns about consistency and material performance. Additionally, pilot mixtures like those employed in Staten Island rely on proprietary formulations, limiting transparency and independent evaluation. Without clearly defined specifications for polymer type, processing requirements, and end-of-life recyclability standards, agencies lack the technical benchmarks necessary to confidently integrate PCRP additives into formal roadway specifications.

Economic Feasibility

The economic case for PCRP-modified asphalt remains questionable. While some studies suggest potential savings when recycled plastics substitute for virgin polymer modifiers, these savings may be offset by additional requirements such as stabilization agents, plant modifications, continuous agitation systems, or increased contractor risk premiums. Moreover, the literature suggests that some projected economic gains may be based on misconstrued asphalt mixture volumetrics and binder substitution dynamics. Further, the economic uncertainty might be outweighed by substantial performance or environmental gains. However, without full life-cycle cost analyses conducted at scale including production, maintenance, and end-of-life considerations, the cost-benefit proposition remains unclear.

On top of this, the use of plastics in asphalt mixtures forces a broader discussion about the economics of recycling. As discussed, not all plastics are suitable for incorporation into asphalt mixtures from a chemical standpoint. Of those that are, most are already sold to third parties and their repurposing would touch upon the business model of an MRF such as SIMS in NYC. This results in a smaller feedstock that, aside from collection and contamination issues, calls for a deeper feasibility analysis.

Companies such as Dow Inc. and MacRebur Ltd. have developed business models around PCRP-modified asphalt, suggesting that some level of economic value may be achievable.

RECOMMENDATIONS

RECOMMENDATION #1: ESTABLISH A MAYORAL-LEVEL INTERAGENCY TASK FORCE TO GOVERN IMPLEMENTATION

New York City should establish an interagency task force to streamline coordination among agencies and with the administration and promote the use of recovered materials across the City's infrastructure. As proposed, the integration of PCRPs into asphalt involves multiple agencies with distinct operational constraints. A centralized body is therefore beneficial to define priorities and ensure that decisions related to pilots, procurement, and specifications are made efficiently and effectively.

However, given the impact limitations of plastic in asphalt discussed previously, the creation of a standalone task force focused exclusively on plastic in asphalt would not be an effective use of City resources. Instead, this effort should be directed toward a broader circular materials task force that seeks to reframe waste as working capital with salvage value and identify its highest and best uses across the City's systems. The structure of the task force can be modeled after existing interagency task forces established through legislation or executive order. It can serve to consolidate existing circularity efforts under a single interagency framework, building on existing goals and initiatives such as, but not limited to, those outlined in the draft DSNY Solid Waste Management Plan and Executive Order 23 of 2022 (EO 23), and supported by future work within Town+Gown's Urban Resource Recovery Working Group.

The precedent for this task force is the former Resource Recovery Task Force, established under Charter §1403(f), which brought together the Department of Environmental Protection and the Department of Sanitation to plan and implement energy and materials recovery programs for the City's waste streams.[28] Its existence reflected an early recognition that resource recovery does not fall neatly within a single agency's jurisdiction. However, the Charter section creating this Task Force was ultimately waived in 2012, before the circular economy framework had been embraced by the NYC SWMP, due to

[28] New York City Charter § 1403(f). Justia, 2006, law.justia.com/codes/new-york/2006/new-york-city-charter/nyc01403_1403.html.

perceived limitations at the time of a task force combining energy and material recovery for the city's solid and liquid wastes and composed of only two agencies with a role in the circular recovered resources economy, rather than a flaw in the task force model itself.[29] The current circular economy context is materially different. Advancing the use of recovered materials in infrastructure requires sustained coordination across multiple agencies, including the EO 23 Covered Agencies: DSNY, NYCDOT, DDC, DEP, the New York City Department of Citywide Administrative Services (DCAS), and New York City Department of Parks and Recreation (DPR); each of which holds distinct authority over materials management, procurement, design, and capital delivery. In this environment, a mayoral-level task force would not replicate existing agency functions, but rather align them to provide a centralized structure where members can coordinate pilots, standardize specifications, and guide implementation across agencies.

The task force should be chaired by the Deputy Mayor of Operations and consist of representatives from Mayoral agencies and offices, including all Covered Agencies (DSNY, NYCDOT, DDC, DEP, DCAS, and DPR), the Mayor's Office of Climate and Environmental Justice, the Mayor's Office of Environmental Coordination, the New York City Department of City Planning (DCP) and the New York City Department of Buildings, as well as representatives of other agencies or offices, such as the the New York City School Construction Authority (SCA) and the New York City Economic Development Corporation (EDC) as designated by the chair. The task force may also seek the participation and cooperation of state agencies, public authorities, public corporations, and other entities deemed appropriate. Membership should ideally include individuals with expertise in infrastructure and public building design, construction, waste management, procurement, material processing, and public administration or public policy. The task force should meet regularly at a designated pace, with flexibility to schedule additional meetings as needed to support cross-agency coordination. and adjust with appropriate notice to reflect operational needs.

The primary functions of the task force are priority-setting, inter-agency coordination, and implementation. Its duties can include unifying existing

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[29] New York City Report and Advisory Board Review Commission. (2010). Waiver determinations report. https://www.nyc.gov/html/rabrc/downloads/pdf/waiver_determinations.pdf

circular economy initiatives across agencies, particularly where they intersect with infrastructure systems. Such duties may include:

- Identifying opportunities to incorporate PCRPs and other recovered materials into City infrastructure projects.
- Coordinating pilot programs for PCRP-modified asphalt and other recovered material applications, including alignment with asphalt plant operations and procurement processes.
- Facilitating access to consistent feedstock for infrastructure applications, including coordination with DSNY and MRF operators.
- Identifying and addressing contractual, procurement, and other logistical barriers to the use of recovered materials, including constraints within DSNY–MRF agreements.
- Exploring alternative material handling pathways to improve feedstock consistency for infrastructure use while remaining cost-effective and actionable.
- Adapting specifications, whether material-based or performance-based, to facilitate the use of recycled materials in infrastructure while maintaining compatibility with existing systems and lab needs.
- Catalyzing research and identifying opportunities for the integration of other recovered materials (including recycled tire rubber) in infrastructure through mechanisms such as challenge-based procurement.
- Supporting state- and local-level legislation, such as Extended Producer Responsibility (EPR) policies, through coordinated agency advocacy efforts.

The task force can facilitate a structured evaluation of feasibility across participating agencies by having each agency conduct an internal survey for any necessary project, reflecting on their current capacities and evaluating potential changes needed to execute the plan. Each feasibility study should contemplate:

- The agency's proposed role within the project.
- The agency's current capacities, given its current structure, as well as its potential capacities.
- Internal changes under the agency's direct purview needed to further the project (regulations, personnel, workflows, etc.)

– External changes needed to further the project that may affect the agency directly, but are not entirely dependent on its governing structure (e.g., local, state, or federal legislation, funding, or negotiations with outside contractors).

The goal of the feasibility studies is to reflect each agency's operational context and the projects' collaborative nature with member agencies through the task force. To that end, we propose an iterative process culminating in a single, unified deliverable that ensures all stakeholders are aligned on agreed-upon findings and the path forward.

In addition, the task force can leverage existing reporting requirements under Local Law 36 of 2010, which mandates that City agencies create waste prevention, reuse, and recycling plans and submit annual implementation reports to DSNY. These reports can be consolidated and used to inform strategy development and track progress across agencies.

Within the initial short-term period, the task force should report to the Mayor with a set of recommendations outlining priority actions to further the task force's mission. Following this, they can convene regularly to monitor implementation and refine strategies as needed. The task force can establish ad hoc committees to focus on specific material streams or operational challenges, including feedstock, procurement, contracting, data analysis, and policy coordination. The task force may also determine the appropriate level of public participation.

RECOMMENDATION 2: IMPLEMENT A SERIES OF STANDARDIZED PILOT PROGRAMS IN PARTNERSHIP WITH THE PRIVATE SECTOR

Building on Recommendation 1, the task force can coordinate the development of a series of standardized pilot programs to continuously test the incorporation of PCRPs and other recovered materials into City infrastructure.[30] A systems approach avoids the risk that pilot projects are implemented in a fragmented way, with variations in design and evaluation methods that may make it difficult to compare results or draw clear conclusions. The proposed framework would ensure that each pilot is

[30] See Additional Uses for Recycled Plastics below.

designed and conducted with consistent parameters, including site selection criteria, material inputs, production processes, and performance metrics. This consistency should also extend to post-installation monitoring so that outcomes related to durability and environmental impact are assessed using the same methods across all sites. While roadway resurfacing represents the most direct application, pilot projects should also reflect the range of project types through which NYCDOT delivers infrastructure. These may include new roadway asphalting, milling-and-paving projects, and maintenance-level interventions such as patching, as well as sidewalks, bike lanes, curb fills, and other assets where material performance requirements may differ. Evaluating recovered materials across these use cases allows the City to identify applications that may be more operationally feasible or cost-effective than new roadway asphalt alone.

Each pilot should include a test section using PCRP-modified asphalt and a corresponding control section using conventional asphalt for direct performance comparison. Traffic volume is a key variable in site selection, and roadways should be categorized into low-, medium-, and high-traffic corridors. Segments must also be evaluated for proximity to water runoff, given the potential for flooding, microplastic leaching, and performance degradation. Building on the Staten Island pilot, which was implemented on a low-volume roadway, a phased approach that progresses from low- to higher-traffic corridors may be more practical. This allows the City to build familiarity with production and placement processes and incrementally scale deployment as confidence in material performance increases. While this report outlines key considerations for pilot design and site selection, it does not identify specific roadway segments for initial implementation.

There are also operational considerations that will guide aspects of pilot design. Asphalt production requires sufficient volume to operate efficiently, and introducing new materials often requires dedicated production runs and recalibration of equipment. As a result, pilot projects should be geographically clustered and scheduled to align with asphalt plant production cycles. In the near term, implementation may need to be coordinated with facilities that have prior experience with PCRP-modified asphalt production. In practice, this would mean leveraging the City Asphalt Plant in Staten Island, where familiarity with the material and available space may reduce initial barriers to execution. Furthermore, incorporating new materials may require asphalt plants to lease additional equipment, such as storage or dosing systems, until the benefits of incorporating PCRP into asphalt production justify more permanent investments. Pilot programs should prioritize products that are compatible with existing production processes to minimize capital costs and operational disruption.

A standardized monitoring framework should ideally be applied across all pilots to ensure consistent evaluation in the long term. This should include consistent metrics such as rutting, cracking, and surface roughness, as well as tracking maintenance cycles and durability over time, as compared to the control section of road with traditional asphalt. To strengthen the reliability and credibility of this data, the City can incorporate third-party academic partners into the pilot program to help ensure that performance and safety outcomes are assessed using independent methodologies, while also contributing to the broader body of research on recovered materials in infrastructure. There is existing precedent for this type of engagement through the DDC's Town+Gown program, and their Master Academic Consortium Contract can be leveraged to support pilot design, data collection, and analysis.

Private-sector participation in the pilot projects should be expected. As noted in the previous findings, much of the innovation in this space is being driven by private firms with existing technical expertise. Pilot programs should therefore be structured to incorporate private-sector partners as material suppliers, technology providers, and implementation partners. This participation may include:

- Allowing private firms to supply PCRP-modified binders and additives for use in pilot projects.
- Creating pathways for firms to access higher-quality PCRP feedstock through DSNY and its contractors.
- Restructuring existing contracts with MRF operators to allow for the allocation of specific waste streams toward pilot applications, where feasible
- Alternatively, directly purchasing processed plastic bales from MRFs at market price for dedicated pilot use, thereby maintaining existing market structures while enabling targeted testing.
- Coordinating with asphalt plants and contractors to ensure that products can be integrated within existing operational constraints.
- Contracting with a private asphalt plant to conduct pilot programs when using publicly owned plants is not feasible.

RECOMMENDATION 3: ALIGN ADOPTION PATHWAYS FOR RECOVERED MATERIAL-BASED INFRASTRUCTURE COMPONENTS

To support the broader adoption of recovered materials in NYC's capital projects, the task force should focus on aligning existing approval, regulatory, and procurement pathways across agencies. While PCRP-modified asphalt provides an initial use case, this framework should be designed to apply to any recovered material considered for incorporation into City infrastructure.

Any waste-derived material proposed for use in capital projects must be designated as beneficial use under the regulatory authority of the New York State Department of Environmental Conservation (NYSDEC). Plastics are suitable for downstream uses under these regulations, provided they are processed through an MRF like SIMS or other similar facilities. The task force should ensure that recovered materials under consideration are eligible for use under applicable BUDs and, where necessary, coordinate with the relevant agencies to expand or clarify these determinations.

Once a material is deemed eligible for beneficial use, the next step is to ensure that applicable specifications and standards can accommodate its use. For asphalt, binder specifications are based on performance standards developed by the American Association of State Highway and Transportation Officials (AASHTO), which do not specify specific material inputs. As a result, products incorporating recovered materials may be used if they meet established performance criteria. To be used in practice, these materials must also be approved at the state level for inclusion on the New York State Department of Transportation's (NYSDOT) Approved Materials List. This process typically requires submission of performance data demonstrating compliance with relevant standards.

The task force should consider developing supplemental guidance to support implementation across agencies and materials. This could include clarifying how existing standards apply to recovered materials, identifying categories of materials that have demonstrated compatibility with current systems, and outlining documentation requirements for approval. Such guidance should remain flexible to evolve alongside changing data, ensuring that the City can incorporate new materials while maintaining performance, safety, and operational reliability.

FURTHER CONSIDERATIONS

Beyond the scope of this report, we recommend further analysis into the following topics, to support both the evaluation of PCRP-modified asphalt and the broader use of recovered materials in infrastructure.

ADDITIONAL USES FOR RECYCLED PLASTICS

Beyond asphalt roadways, other project types that may warrant future study include bike paths, parking lots, temporary paving used during roadway reconstruction, Port Authority of New York and New Jersey airport-related applications, and certain non-pavement construction materials. One example is the 2018 PlasticRoad pilot, a roughly 100-foot bike path made from 100 percent recycled polypropylene.[31] That project was designed not only as a surface application, but also as a drainage and climate-adaptation system, with hollow space beneath the path to store water and allow it to drain away from the riding surface, even during extreme rain events. The project achieved carbon savings of at least 52% compared with a traditional bicycle path and was presented as a concept that could eventually be adapted for both bike infrastructure and some future roadway uses.

Other recycled-plastic applications point in a similar, positive direction that warrant further consideration. Recycled-plastic bricks, for example, have been promoted as another possible end use for waste plastics. Gjenge Makers in Kenya has drawn attention for using post-industrial and post-consumer plastic waste to produce bricks that are 5-7 times stronger than conventional concrete.[32] The company's products have been certified by the Kenyan Bureau of Standards[33]. Examples such as this are significant because they suggest that the search for viable end uses for plastic waste does not begin and end with asphalt. Instead, plastics may hold value across a wider range of infrastructure and construction applications, particularly in lower-risk or more specialized contexts.

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[31] National Academies of Sciences, Engineering, and Medicine. *Recycled Plastics in Infrastructure: Current Practices, Understanding, and Opportunities*. National Academies Press, 2023, p. 150.
[32] *Ibid.*, p. 1, 6.
[33] Gjenge Makers. *UN SDG Action Awards*, UN SDG Action is used in Campaign, sdgactionawards.org/gjenge-makers/

FINANCIAL CONSIDERATIONS

One area where more consideration is required is a more detailed cost-benefit analysis and a lifecycle comparison between conventional asphalt and PCRP-modified asphalt. This could include considerations of upfront production costs, maintenance needs, durability, and long-term performance. Relatedly, there may be value in further examining how pilot projects and potential future applications could be funded. This would involve consideration of city resources, state and federal funding opportunities, and the potential role of private-sector participation in supporting funding and implementation.

CONSIDERATIONS FOR IMPROVING RECYCLING IN NYC

We also suggest the exploration of strategies to improve recycling outcomes in NYC. As mentioned in the findings, a key element of feasibility is purity and reliability of the PCRP feedstock. Additional analysis could consider how changes to collection, sorting, and processing systems might affect the availability and quality of recoverable plastics, particularly those that align with identified infrastructure uses.

Educational Campaigns

The task force can evaluate a public education effort to explain how recycled materials are already used in roadway construction and why that matters to New Yorkers directly. This should include clear, accessible information on RAP, how it functions within the City's repaving process, and why its continued use is important to the City's broader roadway system. A public-facing campaign could help residents understand that the use of recovered materials in roads relates to roadway quality and the responsible use of public resources. In this context, the City's interest in recovered materials would be connected to maintaining durable streets and reinforcing circularity practices that already provide a public benefit. Public education would therefore help residents better understand how recovered materials are evaluated and why compatibility with the City's existing asphalt recycling system matters in practice.

CONCLUSION

This report finds that PCRPs can be, and has been, incorporated into roadway infrastructure. However, current evidence does not support sustained adoption in NYC at this time, as it is yet to be proven feasible for long-term use. While existing pilot projects are valuable, they are too recent and small to address concerns regarding long-term durability, environmental safety, RAP compatibility, and economic benefit. PCRP-modified asphalt should be treated as an emerging material pathway that requires structured testing and monitoring before the City determines whether broader adoption is justified.

While PCRP-modified asphalt is unlikely to solve the City's waste challenges on its own, as its use would represent only a modest share of the overall waste stream, recovered materials policy is unlikely to advance through a single breakthrough or a single end use. This report recommends that the City establish a mayoral-level interagency task force to guide evaluation and potential use of PCRPs and other recovered materials in infrastructure. This approach avoids treating PCRP-modified asphalt as a standalone solution and instead places it within a broader circular materials strategy. Building on this governance structure, this report recommends that the task force coordinate standardized pilot programs designed to produce consistent evidence to support or refute the use of recovered materials in infrastructure. This ultimately requires aligning the approval, specification, and procurement pathways needed to move any one recovered material from pilot testing to sustained adoption.

New York City is known for its entrepreneurial and pioneering spirit. The City has the policy mandate, scale, and capacity to systematically test recovered materials in a serious way, but broader adoption needs stronger evidence. Moving forward, the City's aim should be to fully develop a circular economy by 2030. To achieve this, every effort must be made.

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ABBREVIATIONS

AASHTO - American Association of State Highway and Transportation Officials
BUD - Beneficial Use Determination (plural: **BUDs**)
DCAS - New York City Department of Citywide Administrative Services
DCP - New York City Department of City Planning
DDC - New York City Department of Design and Construction
DEP - New York City Department of Environmental Protection
DPR – New York City Department of Parks and Recreation
DSNY - New York City Department of Sanitation
EDC - New York City Economic Development Corporation
EPR - Extended Producer Responsibility
HDPE - High-Density Polyethylene
LDPE - Low-Density Polyethylene
LLDPE - Linear Low-Density Polyethylene
MoDOT - Missouri Department of Transportation
MRF - Materials Recovery Facility
NAS Report - National Academies of Sciences, Engineering, and Medicine, Recycled Plastics in Infrastructure: Current Practices, Understanding, and Opportunities Report
NYC - New York City
NYCDOT - New York City Department of Transportation
NYSDEC - New York State Department of Environmental Conservation
NYSDOT - New York State Department of Transportation
PCRP - Post-Consumer Recycled Plastic (plural: **PCRPs**)
PET - Polyethylene Terephthalate
PP - Polypropylene
PVC - Polyvinyl Chloride
RAP - Reclaimed Asphalt Pavement
SIMS - Sunset Park Materials Recovery Facility (operated by Circular Services)
SWMP - Solid Waste Management Plan