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METRO VANCOUVER REGIONAL DISTRICT
SOLID WASTE AND RECYCLING INDUSTRY ADVISORY COMMITTEE

Tuesday, June 10, 2025
2:00 pm – 4:00 pm
Zoom Teleconference

A G E N D A

1. AGENDA

1.1 June 10, 2025 Meeting Agenda

2. MINUTES

2.1 May 6, 2025 Meeting Minutes

3. REPORTS AND ITEMS FOR DISCUSSION

3.1 SWMP: Regulatory Strategy
For small group discussion
Designated speaker: Terry Fulton, Senior Project Engineer, Solid Waste Services

3.2 SWMP: Idea Generation Engagement Summary Report Back
For information/Q&A
Designated speaker: Stephanie Liu, Program Manager, Community Engagement, Solid Waste Services

4. OTHER BUSINESS

4.1 Zero Waste Committee and Other Updates
For information
Designated Speaker: Paul Henderson, General Manager, Solid Waste Services

4.2 September Facility Tour and Zero Waste Conference Registration
Designated Speaker: Samantha Joy, Engagement Specialist, Solid Waste Services

5. INFORMATION ITEMS

5.1 Concrete and Asphalt Recycling Opportunities Review
5.2 Regional Waste Flows
5.3 2025 IAC Work Plan

Committee Co-Chairs:
Director Craig Hodge, Zero Waste Committee Vice-Chair
Lori Bryan, Executive Director, Waste Management Association of BC

Membership:

Abrams, Izzie – Waste Connections of Canada
Agassiz, Sam – West Coast Reduction Ltd.
Bryan, Lori – Waste Management Association of BC
Collins, James – Tymac Launch Service Ltd.
Crawford, Jeremy – Waste Control Services
Dietrich, Christian – Ecowaste Industries
Furtado, Glen – Cement Association of Canada
Hankins, Grant – Canada Minibins.com Ltd.
JansenVandoorn, Josh – Anaconda Systems Ltd.
Janzen, Tessa – Recycle BC
Johnson, Gord – Northstar
Johnston, Kurt – CleanStart Property Services
Kaminski, Jamie – HSR Zero Waste
Kawakami, Sean – Convertus Canada Ltd.
Kheyrandish, Ataollah – Richmond Steel Recycling
Kiani, Aiden – Lock-Block Ltd.
Lannin, Mike – Super Save Group
MacNeil, Patrick – Wescan Disposal Ltd.
MacFarlane, Angus – Growing City
Mallari, Achilles – Sierra Waste Services Ltd.
McRae, Ralph – Revolution Infrastructure Inc.
Millman, David – Waste Management of Canada Corp.
Moucachen, Maya – Merlin Plastics
Muir, Wesley – Veolia North America (Canada)
Pantazopoulos, Dimitri – Waste Connections of Canada
Punja, Rustam – Geocycle Canada Inc.
Prasad, Shad – Cascade Recovery +
Skei, Dayton – Evergen Infrastructure Corp.
Skoropada, Lorne – Ridge Meadows Recycling Society
Sigmund, Sandy – Encorp Pacific Canada, Return-It
Van Beusekom, Brent – product Care Association
Vargas, Pinky - Republic Services
Von Stefenelli, Nicole – Urban Impact Recycling Ltd.
Zarbl, Michael - Major Appliance Recycling Roundtable

METRO VANCOUVER REGIONAL DISTRICT
SOLID WASTE AND RECYCLING INDUSTRY ADVISORY COMMITTEE MEETING

Minutes of the Regular Meeting of the Solid Waste and Recycling Industry Advisory Committee Meeting held at 2:30 p.m. on Tuesday, May 6, 2025, virtual zoom meeting.

MEMBERS PRESENT:

Bryan, Lori, Executive Director, Waste Management Association of BC (Co-Chair) (via teleconference)
Craig Hodge, Director, Zero Waste Committee (Co-Chair)
Agassiz, Sam – West Coast Reduction Ltd.
Atkinson, Brooke
Collins, James – Tymac Launch Service Ltd.
Crawford, Jeremy – Waste Control Services
Gauci, Joanne Gauci – NZWC
Hankins, Grant – Canada Minibins.com Ltd.
Johnston, Kurt – CleanStart Property Services
Kaminski, Jamie – HSR Zero Waste
Kheyrandish, Ataollah – Richmond Steel Recycling
Lannin, Mike – Super Save Group
MacFarlane, Angus – Growing City
Mac Neil, Patrick – Wescan Disposal Ltd.
McRae, Ralph – Revolution Infrastructure Inc.
Moucachen, Maya – Merlin Plastics
Muir, Wesley – Veolia North America (Canada)
Pantazopoulos, Dimitri – Waste Connections of Canada
Prasad, Shad – Cascade Recovery+
Skoropada, Lorne – Ridge Meadows Recycling Society
Van Beusekom, Brent – product Care Association
Vargas, Pinky – Republic Services
Zarbl, Michael – Major Appliance Recycling Roundtable

MEMBERS ABSENT:

Abrams, Izzie – Waste Connections of Canada
Dietrich, Christian – Ecowaste Industries
Furtado, Glen – Cement Association of Canada
JansenVandoorn, Josh – Anaconda Systems Ltd.
Janzen, Tessa – Recycle BC
Johnson, Gord – Northstar
Kawakami, Sean – Convertus Canada Ltd.
Kiani, Aiden – Lock-Block Ltd.
Mallari, Achilles – Sierra Waste Services Ltd.
Millman, David – Waste Management of Canada Corp.
Punja, Rustam – Geocycle Canada Inc.
Skei, Dayton – Evergen Infrastructure Corp.
Sigmund, Sandy – Encorp Pacific Canada, Return-It
Von Stefenelli, Nicole – Urban Impact Recycling Lt

METRO VANCOUVER STAFF PRESENT:

Allen Jensen, Senior Project Engineer, Solid Waste Planning
Chris Underwood, Division Manager, Solid Waste Planning
Karen Storry, Senior Engineer, Solid Waste Planning
Paul Henderson, General Manager, Solid Waste Services
Lynne Vidler, Lead Senior Engineer, Solid Waste Services
Samantha Joy, Engagement Specialist, Metro Vancouver
Stephanie Liu, Program Manager, Community Engagement, Solid Waste
Terry Fulton, Senior Project Engineer, Solid Waste Planning

PREPARATION OF MINUTES: Jasmeen Dhillon, Raincoast Ventures Ltd.

Solid Waste and Recycling Industry Advisory Committee Meeting

May 6, 2025
2:30 PM – 4:30 PM
Virtual, Zoom Meeting

Agenda

1. Agenda
   1.1 May 6, 2025 Meeting Agenda

2. Minutes
   2.1 April 8, 2025 Meeting Minutes

3. Reports
   3.1 Updated Draft Hierarchy and Goals
   For information/Q&A
   Designated Speaker: Terry Fulton, Senior Project Engineer, Solid Waste Services

   3.2 Recycling and Waste Centre Strategy Development
   Small group discussions
   Designated Speaker: Paul Henderson, General Manager, Solid Waste Services

4. Other Business
   4.1 Zero Waste Committee and Other Updates
   Designated Speaker: Paul Henderson, General Manager, Solid Waste Services

   4.2 Upcoming Meetings and Key Topics
   Designated Speaker: Lori Bryan, IAC Co-Chair

   4.3 Review of the Industry Advisory Committee Terms of Reference
   Designated Speaker: Director Hodge, IAC Co-Chair

5. Information Items
   5.1 Regional Waste Flows
   5.2 2025 Industry Advisory Committee Meeting Schedule
   5.3 2025 Industry Advisory Committee Work Plan

Co-Chair, Director Craig Hodge, called the meeting to order at 2:30 p.m. and welcomed attendees to the Solid Waste Industry and Recycling Advisory Committee (Industry Advisory Committee) meeting. Members were advised that the meeting was being live-streamed and a recording would be posted to the Industry Advisory Committee webpage.

1. AGENDA

1.1 May 6, 2025, Meeting Agenda

Co-Chair Hodge reviewed the April 6, 2025, meeting agenda. No additions were made.

2. MINUTES

2.1 April 8, 2025, Meeting Minutes

Co-Chair Hodge called for any additions or changes to the Minutes of the April 8, 2025, Industry Advisory Committee meeting. No additions or changes were made.

3. REPORTS AND ITEMS FOR DISCUSSION

3.1 Updated Draft Hierarchy and Goals

Terry Fulton, Senior Project Engineer, Solid Waste Services, shared a presentation titled "Updated Hierarchy and Goals" and highlighted:

- The waste hierarchy provides an indication of priorities, a decision-making framework, a way to categorize ideas, and is linked closely to plan goals.
- Next Steps:
  - Goals and hierarchy to Zero Waste Committee and Greater Vancouver Sewerage and Drainage District Board
  - Fall: Options analysis and target setting discussions
  - Early 2026: Review and comment on draft updated solid waste management plan

Co-Chair Hodge invited members to share related questions and/or comments on the presentation. The following questions and comments (Q/C) and *responses* (*R*) were captured:

Q/C: The Provincial government includes fuel substitutes in its definition of recycling, but other countries have excluded creating fossil fuels from their definitions. Has Metro Vancouver confirmed that fuel substitutes should be included in the recycling section?

R: Metro Vancouver is not bound by the Provincial hierarchy; however, the current practice is to count material used as a fuel substitute as recycling.

R: One of the potential metrics and targets for the updated plan could include tracking and maximizing the amount of material that is recycled into new products and

materials. Metro Vancouver will continue to be responsive to feedback on potential metrics.

3.2 Recycling and Waste Centre Strategy Development

Paul Henderson, General Manager, Solid Waste Services, Metro Vancouver, shared a presentation titled "Recycling and Waste Centre Strategy Development – Component of an updated Solid Waste Management Plan" and highlighted:

- Draft Guiding Principles for Recycling and Waste Centre Strategy:
  - Consistent and maximized reuse and recycling opportunities
  - Best practices in facility design, construction, and operation
  - Reasonable and consistent drive times
  - New facilities developed in areas with expected future growth
  - Resilient and cost-effective service delivery
- Recycling and Waste Centre Strategy: possible elements to include:
  - Describe future upgrades to existing facilities
  - Outline potential locations for future facilities
  - Highlight plans to expand reuse and recycling
  - Identify best practices in facility design, construction, and operation.

The members broke into small groups for continued discussion on the presented draft guiding principles and possible elements for the Recycling and Waste Centre Strategy. Metro Vancouver staff took notes on the discussion. Groups were asked to consider the following questions:

- *"Is there anything missing or that should be changed in the draft guiding principles for the Recycling and Waste Centre Strategy?"*
- *"Are there any comments on the possible elements for the development of the Recycling and Waste Centre Strategy?"*
- *"Any other comments?"*

The group reconvened, and one representative from each small group was asked to highlight main ideas discussed to share with the larger group. The following comments were provided:

- Need to provide deeper definitions, including scientific data and percentages
- How to determine reasonable and consistent drive times?
- Effective cost savings measures need to be prioritized
- Ensure investment in capital structures to ensure longevity
- Define "best practices"
- Clarification needed on "resilience" and "service delivery"
- Collaboration with private sector is still a high priority for this committee
- Determining services available at private and public facilities is a priority for this committee

Co-Chair Hodge invited other committee members to share related questions and/or comments on the breakout activity. The following questions and comments (Q/C) were captured:

Q/C: Previously, facilities served single-family and multi-family, and industrial, commercial or institutional would go to the private sector.

Q/C: The primary customer at Metro Vancouver's facilities is not business, it is small vehicles.

Q/C: Need economies of scale, should have one central facility, and have drop-off facilities serving industrial/commercial/institutional, multi-family, and single-family, and create a consistent flow of material.

A feedback summary from the small group discussions will be posted to the Industry Advisory Committee web page separately from the minutes.

4. OTHER BUSINESS

4.1 Zero Waste Committee and Other Updates

Paul Henderson, General Manager, Solid Waste Services, Metro Vancouver, shared a presentation titled "Other Business" and highlighted:

- May 2025 Zero Waste Committee meeting cancelled
- Used oil is now accepted at the Langley Recycling and Waste Centre
- National Zero Waste Council is the recipient of the Knowledge and Insights Leadership award through the Canada Plastics Pact.

Co-Chair Hodge invited members to share related questions and/or comments on the presentation. No comments were made.

4.2 Upcoming Meetings and Key Topics

Co-Chair Lori Bryan shared a presentation titled "Upcoming Meetings" and highlighted the remaining meeting dates and key topics for 2025. The committee was invited to give feedback on the preferred topic for the second in-person meeting in October and to review the remaining key topics in the workplan to ensure they will have the chance to give input on the topics of most interest.

Co-Chair Hodge opened the floor for members to respond to the information presented. The following questions and comments (Q/C) and *responses* (*R*) were captured:

Q/C: Add "SWMP: Options Analysis/Targets" topic to the October meeting.

Q/C: Industry Advisory Committee members can direct additional topic ideas to Co-Chair Hodge or Co-Chair Bryan.

Q/C: Request that Metro Vancouver inform the Industry Advisory Committee members on goals and targets proposed to include in the draft solid waste management plan before the fall. Members will comment on specifics at the October meeting.

Q/C: Industry is waiting to understand their role within the region's waste management plan. Currently it there is too much uncertainty around private industry capital investment as we wait to see the draft plan.

R: A draft plan should be prepared by early 2026, and Metro Vancouver will seek feedback from the Industry Advisory Committee.

Q/C: Are there any items on the list that do not seem relevant to the Industry Advisory Committee, or anything that needs to be weighed in on prior to that draft?

Q/C: The topics have been discussed, and the concrete and asphalt study report was reviewed two years ago. There are consultations and documentation on all these topics.

R: We will add the concrete and asphalt recycling report as an information item rather than as a workplan item and note the change on the workplan.

Q/C: Prepare four to five topics from the plan with a summary for review by the Industry Advisory Committee at the October meeting.

Q/C: Find private sector opportunities within this plan.

R: Part of the work will involve defining the role of the private sector.

R: The September meeting will be a good time to provide an outline of the solid waste management plan.

R: The "Concrete and Asphalt Recycling Opportunities Review" will be circulated; the key interests are noted, with a need to focus on the key items.

R: This is an Industry Advisory Committee for industry input. Metro Vancouver will provide Industry Advisory Committee feedback to the Zero Waste Committee. The Industry Advisory Committee also provides valuable feedback on relevant items apart from updating the solid waste management plan.

4.3 Review of the Industry Advisory Committee Terms of Reference

Co-Chair Hodge shared that the committee terms of reference requires regular review.

- The Industry Advisory Committee will review the Terms of Reference at least every 18 months, for consideration on whether any amendments or modifications are required.
- Requesting the Industry Advisory Committee review the Terms of Reference prior to the June 2, 2025, meeting and reach out to staff or Co-Chairs with any changes required.

Co-Chair Hodge invited members to share related questions and/or comments on the Terms of Reference. No comments were made.

5. INFORMATION ITEMS

5.1 Regional Waste Flows

5.2 2025 Industry Advisory Committee Meeting Schedule

5.3 2025 Industry Advisory Committee Work Plan

ADJOURNMENT

Co-Chair Hodge thanked members for their comments and feedback and advised that the next Solid Waste and Recycling Industry Advisory Committee meeting would be held online on June 10, 2025.

The Solid Waste and Recycling Industry Advisory Committee meeting adjourned at 4:30 p.m.

Metro Vancouver Solid Waste Management Plan – Concrete and Asphalt Recycling Opportunities Review

Final Draft Report

June 3, 2025

Prepared for:
Solid Waste Services, Metro Vancouver
Metrotower III, 4515 Central Boulevard
Burnaby, BC V5H 0C6

Prepared by:
Stantec Consulting Ltd.
Suite 310, 4321 Still Creek Drive
Burnaby, BC V5C 6S7

Project/File:
133800068

Stantec

Limitations and Sign-off

The conclusions in the Report titled Metro Vancouver Solid Waste Management Plan – Concrete and Asphalt Recycling Opportunities Review are Stantec's professional opinion, as of the time of the Report, and concerning the scope described in the Report. The opinions in the document are based on conditions and information existing at the time the scope of work was conducted and do not take into account any subsequent changes. The Report relates solely to the specific project for which Stantec was retained and the stated purpose for which the Report was prepared. The Report is not to be used or relied on for any variation or extension of the project, or for any other project or purpose, and any unauthorized use or reliance is at the recipient's own risk.

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Metrotower III, 4515 Central Boulevard
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Signature

(insert name and title)
Printed Name and Title

Reviewed by: *(insert digital signature here, delete this line of text before creating pdf)*
Signature

(insert name and title)
Printed Name and Title

Approved by: *(insert digital signature here, delete this line of text before creating pdf)*
Signature

(insert name and title)
Printed Name and Title

Executive Summary

Metro Vancouver is updating the region's Solid Waste Management Plan. As part of this process, opportunities to reduce waste and increase recycling are being identified and assessed through research and engagement. This report focuses on exploring opportunities to increase the recycling of concrete and asphalt in the region. Metro Vancouver estimates that in 2021, 1.16 million tonnes of asphalt and concrete were recycled in the region. Yet suppliers have increasingly large stockpiles of these materials and face difficulties finding sufficient demand to remain financially sustainable. This locally available, under-utilized resource presents significant opportunities for increased recycling and reducing pressures on natural resources.

A review and comparison of six sources of standards and best practices that are applicable to Metro Vancouver and their member jurisdictions identified opportunities for increased recycling of concrete and asphalt. They include opportunities such as updating the specifications in the Master Municipal Construction Documents for adoption and alignment by Metro Vancouver and member jurisdictions, eliminating alternative or supplementary construction specifications that hinder recycling of concrete and asphalt, and establishing standard contract provisions supporting the use of recycled aggregates.

Engagement through interviews and a webinar were undertaken during this review. The interviewees included twenty regional stakeholders in the public and private sectors, and nine consultants within Stantec working across North America. They expressed their experiences and perceived challenges of recycling concrete and asphalt, and suggested ideas and actions that may address them. The identified ideas and actions included establishing clearer, context specific quality requirements, clarifying environmental regulations, increasing the number of contexts in which the use of recycled aggregates is permitted, increasing the quantity of recycled asphalt pavement incorporated in new asphalt, and reducing the reliance on contract administrator approval for its use.

The webinar was hosted by Metro Vancouver in January 2025 and was titled "Concrete and Asphalt Recycling Options" and attended by over 100 participants. It was also open to the public but oriented to public and private sector recycled aggregate stakeholders with an objective to share knowledge on current and future applications for recycled aggregates and to receive feedback from participants.

A review of best practices and experiences in jurisdictions outside of British Columbia was also conducted. Findings include the actions and/or experience of jurisdictions who have established a 25% recycling target for concrete and asphalt, a recycling facility approval process to ensure the production of quality recycled concrete aggregates, use-specific requirements for materials containing recycled aggregates, restrictions relating to proximity to waterbodies, and examples of jurisdictions that have updated their regulations and/or procurement contracts to promote and/or require the use of recycled aggregates.

Then lastly, the environmental and financial opportunities were explored, highlighting the potential for greenhouse gas emissions reduction, increasing circular economy, and cost savings. The risks and mitigation measures of recycled aggregate leachate were also summarized.

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Acronyms / Abbreviations

AASHTO	American Association of State Highway and Transportation Officials
AC	Asphalt Cement
ASTM	American Society for Testing and Materials
BC	British Columbia
BNQ	Bureau de Normalisation du Québec
CB	Clay Brick Recycled Material
CDW	Construction and Demolition Waste. CSA subcategory of RCA
CERIEC	Centre for Intersectoral Studies and Research in Circular Economy
CIP	Cold in Place
CO_2 eq.	Carbon dioxide Equivalent
CSA	Canadian Standards Association
DLC	Demolition, Land Clearing, and Construction
DNV	District of North Vancouver
EA	FDR with Expanded Asphalt
ÉTS	École de Technologie Supérieure
FDR	Full Depth Recycling
GHG	Greenhouse Gas
HMA	Hot-Mix Asphalt
kg	Kilogram
kms	Kilometers
LEED	Leadership in Energy and Environmental Design (a green building rate system)
LCMB	Laboratory for Pavement and Bituminous Materials
mg/kg	Milligram per kilogram
MMCD	Master Municipal Construction Documents
MOTT	Ministry of Transportation and Transit (formerly Ministry of Transportation and Infrastructure – MOTI)
MTMD	(Quebec) Ministry of Transport and Sustainable Mobility
NAPA	National Asphalt Pavement Association
NCHRP	National Cooperative Highway Research Program

QC	Quality Control
RAB	Recycled Aggregate Base. Term used by the ASTM for mixes of concrete and asphalt, who also indicates that it may also be called Recycled Asphalt Pavement (RAP) and Recycled Concrete Aggregate (RCA).
RAP	Recycled (or reclaimed) Asphalt Pavement. Term used by Member jurisdictions, MMCD, MOTT and TAC for defining asphalt concrete or pavement materials composed of asphalt and aggregates.
RCA	Reclaimed (or recycled) Concrete Aggregate. Term used by CSA for recycled concrete.
RCA	Recycled Concrete and Asphalt. Term used by MMCD and member municipalities using MMCD contract documents for mixes of concrete and asphalt.
RCAM	Recycled Concrete Aggregate Material. Term used by MOTT defined as a blended material which may be comprised of Recycled Concrete Aggregate, Reclaimed Asphalt Pavement, Recycled Granular Base Aggregate, and virgin granular materials.
RCM	Reclaimed Concrete Material. Term used by TAC for recycled concrete.
RCM	Term used by CSA for subcategory of RCA.
RCW	Revised Code of Washington
RHC	Returned Hardened Concrete
RM	Recycled Materials Aggregates
RPRT	(Quebec) Regulation on Respecting the Protection and Rehabilitation of Land
TAC	Transportation Association of Canada
UBC	University of British Columbia
% w/w	Percentage by Weight
WMA	Warm-Mix Asphalt
WSA	Water Sustainability Act
WSDOT	Washington State Department of Transportation
YVR	Vancouver International Airport

1 Introduction

1.1 Background

As part of updating its solid waste management plan, Metro Vancouver has identified the need to review opportunities and challenges for concrete and asphalt recycling. The organisation estimates that 1.16 million tonnes of asphalt and concrete were recycled in the region in 2021, making up almost 50% of all recycled material in 2021. This highlights the opportunity for innovative solutions for recycling of a material stream that is in steady supply.

Production and transportation of concrete and asphalt is an energy-intensive process. Hence, recycling the materials can result in significant financial and environmental benefits through avoided greenhouse gas emissions, minimized landfill consumption, and offsetting the need for use of virgin materials.

Metro Vancouver is looking to identify and assess potential new opportunities for concrete and asphalt recycling in support of efforts to maximize waste diversion and account for them in the new solid waste management plan.

1.2 Scope of Work

The scope of work for this concrete and asphalt recycling opportunities review is as follows:

- Identify options to reduce challenges and barriers.
- Evaluate new recycling opportunities for recycled concrete and asphalt (RCA) and recycled asphalt pavement (RAP).
- Determine best practices and leading-edge opportunities.
- Assess environmental and financial opportunities.

2 Literature Review: Local Regulatory & Contractual Framework

The following section is a preliminary review of local regulatory and contractual frameworks on recycled concrete and asphalt that apply to Metro Vancouver's member jurisdictions. Their similarities, differences and gaps can help inform opportunities and challenges for expanded and accepted concrete and asphalt recycling options. The review focuses on the following standards and best practices:

- Supplementary construction specifications, bylaws, and reports established by member jurisdictions. (City of Burnaby, 2021) (City of Coquitlam, 2022) (City of Langley, 2022) (City of Maple Ridge, 2023) (City of Pitt Meadows) (City of Richmond, 2016) (City of Surrey, 2020) (City of Vancouver, 2019) (Jackson, 2022)
- Master Municipal Construction Documents (MMCD). (Master Municipal Construction Documents Association, 2019)
- Ministry of Transportation and Transit's (MOTT) specifications and guidance. (British Columbia Ministry of Transportation and Infrastructure, 2020)
- Ministry of Transportation and Transit's (MOTT) draft RCAM specifications and guidance. (not published, under review)
- Transportation Association of Canada's (TAC) guidance. (Transportation Association of Canada, 2013)
- National Standard of Canada's (CSA Group) standards. (CSA Group, 2019)
- ASTM International's standards. (ASTM International, 2022)

The findings of the review are detailed in Appendix B and presents text extracts and paraphrased information from the entities listed above, organized by subject matter and recycled aggregate type. The following sub-sections are also organised by subject matter to summarize and interpret the findings.

The type of recycled aggregates covered by the reviewed standards and best practices are as shown in Table 1.

Table 1 Type of Recycled Aggregates Addressed Per Entity

	Recycled Asphalt	Recycled Concrete	Recycled Asphalt and Concrete (mix)
Member Jurisdictions	✓	✓	✓
MMCD	✓	✓	✓
MOTT	✓	✓	✓
TAC	✓	✓	✓
CSA		✓	
ASTM			✓

2.1 Recycled Aggregates Definitions

Recycled asphalt is commonly referred to as Recycled (or reclaimed) Asphalt Pavement (RAP). Member jurisdictions, MMCD, MOTT and TAC's descriptions of RAP are similar, defining it as asphalt concrete or pavement materials composed of asphalt and aggregates.

Recycled concrete is known as Reclaimed Concrete Material (RCM) by TAC and as Reclaimed (or recycled) Concrete Aggregate (RCA) by the CSA. The CSA further sub-categorizes RCA into three categories: RCM, Construction and Demolition Waste (CDW), and Returned Hardened Concrete (RHC).

A mix of recycled concrete and asphalt is known as Recycled Concrete and Asphalt (RCA) by member jurisdictions and the MMCD, as Recycled Crushed Aggregates (RCAs) by Toronto and Area Road Builders Association, as Recycled Concrete Aggregate Material (RCAM) by MOTT and as Recycled Aggregate Base (RAB) by the ASTM, who indicates that it may also be called RAP and Recycled Concrete Aggregate (RCA). The City of Vancouver has established a standardized recycled aggregates mix that specifies gradation and several physical, mechanical, and environmental properties.

A review of definitions and commonly used acronyms presents the following opportunities for member jurisdictions:

- Consider a standard application for the acronym RCA for consistency. It currently has several meanings, reclaimed concrete aggregate, recycled concrete and asphalt and recycled crushed aggregates, which can lead to confusion and misunderstandings.
- Distinguish recycled concrete from recycled concrete and asphalt, to create new recycling opportunities.

2.2 Uses

The MMCD, member jurisdictions, MOTT and TAC recommend incorporating RAP into the material mix used to build roadways. The MMCD allows for the use of RAP in warm-mix asphalt and hot-mix asphalt for Marshall and Superpave mix designs and the MOTT allows for the use of RAP in hot-mix asphalt for top and lower lifts of category A and B roads. TAC indicates that although RAP is used for embankment base or fill material, this is downcycling and an emphasis should be put on maximising the use of RAP in pavement mix designs. The City of Coquitlam allows asphalt millings to be used as pit run gravel. The City of Richmond's Supplementary Specifications and Detail Drawings doesn't allow recycled asphalt to be used as pipe bedding and surround material. This is primarily due to the nature of the City's subsoil and pea gravel or sand is the typical industry standard for uniform structural support required for pipe bedding. The recycled asphalt may sluff in the sedimentary deposits, providing insufficient structural support to the pipe. (City of Richmond, 2025).

The MMCD currently allows recycled concrete aggregates to be used as pit run gravel and as pipe bedding and surround material, although the proposed updated specifications are planning to not include pipe bedding as an option. In terms of geotechnical performance, due to the angular nature and water absorption of recycled concrete aggregates, it can be challenging to achieve optimal compaction and

uniform support for the pipe without creating point loads on the pipe which could potentially lead to stress concentrations, especially for thinner-walled or more flexible pipes. The cities of Surrey, Maple Ridge and Pitt Meadows also do not permit its use as pipe bedding and surround material. The City of Surrey added this stipulation in 2018 to avoid using recycled concrete aggregates that contained other undesirable materials, such as glass. The City of Surrey does frequently approve the use of recycle concrete aggregates for this use, but on a case-by-case basis. (City of Surrey, 2025) The MOTT allows recycled concrete aggregates to be used in concrete for minor works. CSA notes that recycled concrete aggregates are typically used for “unbound road base” applications; however, it may also be used as coarse aggregate in the concrete for non-structural applications, some pavements or concrete base, unshrinkable fill and other low risk applications.

The MMCD allows recycled concrete and asphalt aggregate material to be used as backfill for embankment fill if they are approved by the contract administrator. Some member jurisdictions have more specific recommendations, such as allowing its use for urban nature trails (City of Langley), as backfill material for sanitary and storm sewers (City of Vancouver), as granular base and granular subbase for sidewalks and multi-use pathways where leachates would not cause harm to the environment (City of Burnaby). The City of Coquitlam requires City approval for the use of aggregates containing recycled material, in addition to the contract administrator. TAC points out that mixing these materials should be avoided unless they’re unusable in a bound application such as new pavement. Mixing materials does not use the asphalt cement binder or recover the energy invested in their production, hence materials are not used to their highest reuse potential.

Our review of material uses, presents the following opportunities for Metro Vancouver and member jurisdictions:

- Encourage the use of RAP in asphalt paving mixes.
- Look into permitting the use of recycled concrete aggregates into new concrete for non-structural applications.
- Only combine asphalt and concrete aggregates if not effectively able to keep separate.
- Monitor concrete recycling management and construction process controls to ensure environmental risks are minimized.

2.3 Sourcing

The sources of RAP prescribed by the MMCD (asphalt removal, surplus generated during plant start-up, transition between mixes, plant clean out, or excess mix produced that could not be placed) are aligned with those recommended by the MOTT and TAC. The MOTT also distinguishes between RAP sourced exclusively from its roadways and RAP from other sources.

MMCD does not specify sources of recycled concrete and asphalt. TAC notes that RAP and RCM are typically produced during roadway projects and ASTM indicates that the sources of recycled aggregates include asphalt or concrete pavement or structural concrete. The City of Vancouver requires that sources of recycled concrete and asphalt be pre-approved by the City Engineer.

Our review of material sourcing, presents the following opportunity for Metro Vancouver and member jurisdictions:

- Ensure that suppliers of recycled concrete and asphalt have quality control procedures that identifies:
    - How they receive, collect, separate, and sort concrete and asphalt materials based on project requirements.
    - How they remove various deleterious materials from recycled concrete and asphalt.
    - The frequency of their sampling and testing of processed recycled concrete and asphalt for quality assurance.

2.4 Quality Control

The MMCD references the National Asphalt Pavement Association's (NAPA) guide for best practices for RAP and RAS [reclaimed asphalt shingles] management for guidance on handling and storing RAP, and to the National Cooperative Highway Research Program (NCHRP) Report 452 for processing, quality and use requirements. The guidance from the MOTT covers handling, processing, stockpiling, sampling and testing and TAC reviews existing processing practices and how the quality of the source material can impact the resulting product. The City of Surrey notes that when removing RAP for reuse, measures should be taken to avoid contamination by (or the incorporation of) the base aggregates.

For recycled concrete, the CSA recommends frequent controls of the concrete being brought to the recycling facility, suggests testing parameters and a framework for a contractor/supplier quality control plan. TAC notes that the presence of sulphates/sulphides, chlorides and alkali reactive aggregates can affect the concrete's recyclability.

The MMCD's testing requirements for recycled concrete and asphalt are currently limited to the California Bearing Ratio. The City of Vancouver has a more comprehensive testing program. ASTM provides guidance on sampling, quality control and quality assurance measures, and requirements for the finished product. Clear guidelines on testing also helps manage and reduce the risks tied to replacing virgin materials with less homogenous recycled ones and will help ensure a consistent, quality product.

Since April 2024, the MMCD Civil Committee comprised of stakeholders involved in road construction and transportation infrastructure, including representatives from consultants, contractors, suppliers, local government, and Metro Vancouver have been meeting to thoroughly review and prepare recommended updates to the MMCD specifications for recycled concrete and asphalt in 2025.

Our review presents the following opportunities for MMCD:

- Investigate aligning existing RAP quality control testing requirements with those of the MOTT.
- Investigate incorporating CSA's guidance on recycle concrete quality control and quality assurance measures.

- Investigate incorporating ASTM's guidance on recycled concrete and asphalt quality control and quality assurance measures.
- Collaborate with suppliers and the construction industry to set quality control and quality assurance measures.
- Establish environmental standards for the use of recycled aggregates.

2.5 Mix Design

The MMCD provides two mix design guidelines, one for Marshall mixes and another for Superpave mixes for both warm-mix asphalt (WMA) and hot-mix asphalt (HMA). For Marshall mixes, up to 15% recycled asphalt cement (AC) replacement may be used without changing binder grade. As for Superpave mixes, the MMCD allows up to 25% RAP in the lower course and up to 15% in the upper course of pavement. The guidance from member jurisdictions varies, capping the incorporation of RAP between 10 to 30%. The MOTT also has guidelines with regards to HMA mix design, allowing up to 30% RAP AC replacement

MOTT leaves the design mix of minor concrete works that use recycled concrete aggregates up to the contractor, as long as they meet sulphate exposure criteria. CSA cautions against certain deleterious substances and materials, and TAC notes that recycled concrete aggregates may absorb more water and their fines may decrease the fresh concrete's workability.

Our review presents the following opportunities for MMCD:

- Investigate aligning RAP mix design requirements with those of the MOTT.
- Incorporate the guidance for concrete mix design from TAC, MOTT and CSA.
- Consider increasing the maximum % of RAP asphalt cement (AC) replacement.
- Consider increasing the maximum % RAP by weight/mass of total mix.
- Consider establishing a concrete mix design for non-structural work such as walkways, concrete collars around electrical service boxes in boulevard areas and other low load detailing works.

2.6 Contractual Framework

The use of recycled aggregate is primarily left up to the discretion of contractors and contract administrators.

The MOTT indicates that contract special provisions need to specify RAP use to ensure its reuse by projects at desired locations.

Our review presents the following opportunities for Metro Vancouver and member jurisdictions:

- Consider incentivising, mandating and/or providing guidance on the use of recycled aggregates in contract provisions in the procurement of public projects.
- Establish standard contract provisions and guidance documents on the use of recycled aggregates.

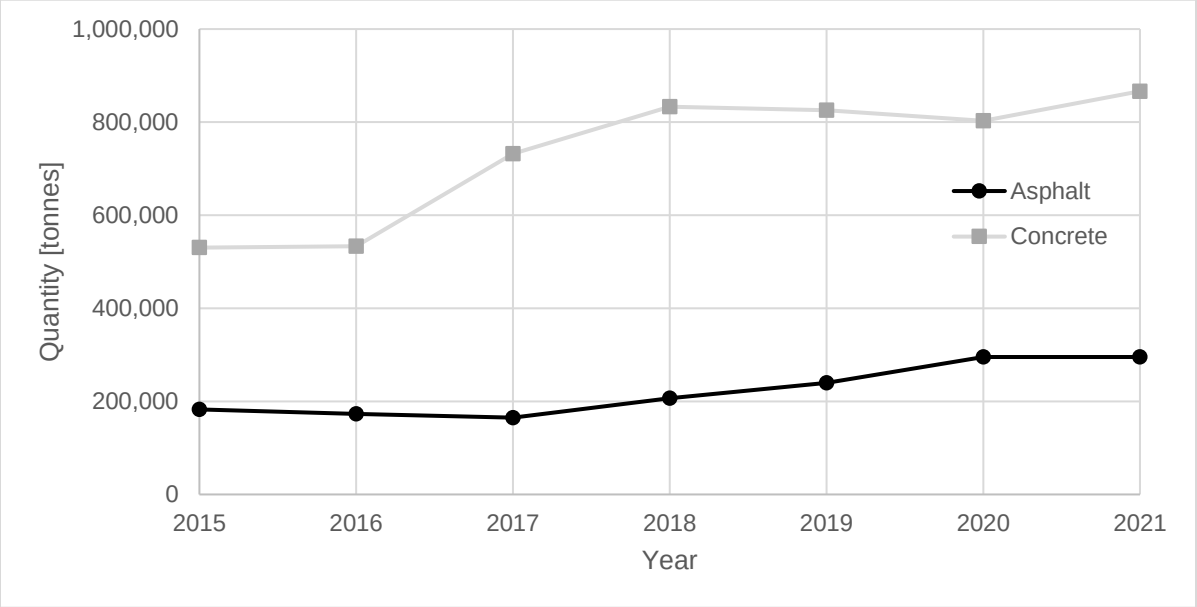
3 Current Status of Concrete and Asphalt Recycling in Metro Vancouver

This section analyses the status of existing management practices for concrete and asphalt recycling in the region of Metro Vancouver. The information presented in the following section was obtained through data published by Metro Vancouver and twenty interviews with regional stakeholders in the public and private sectors.

3.1 Quantities Recycled

Metro Vancouver publishes annual reports on the status of the region's recycling and solid waste management. The reports include data on the quantities of asphalt and concrete recycled, presented in Figure 1. It's sourced in part through voluntary reporting by unlicensed private recycling facilities. Metro Vancouver strives to determine the quantities of concrete and asphalt generated by construction and demolition activity, which are typically considered municipal solid waste, and to exclude material originating from road construction; however, determining the origin of the material is challenging. (Metro Vancouver, 2024)

Figure 1 Quantities of Asphalt and Concrete Recycled in Metro Vancouver between 2015 and 2021 (Metro Vancouver, 2024)



The data indicates that the quantities of asphalt and concrete recycled in the region have been increasing over the years.

3.2 Interviews

To gain insights into the status, challenges and opportunities surrounding the use of recycled concrete and asphalt in Metro Vancouver, stakeholder interviews were conducted in the summer of 2024. The interviewees included 20 representatives from local concrete and asphalt recycling service providers, member jurisdictions within the Metro Vancouver region, municipal and industrial associations, the MOTT, and engineering and laboratory consultants.

Key questions addressed during the interviews included:

- Where do you see opportunities in expanding the use of recycled concrete and asphalt?
- What are the most common/challenging barriers to recycling concrete and/or asphalt? (e.g., quality, permitting, planning, financial, legal, etc.)
- What are potential solutions to remove or reduce barriers?
- How have risks and barriers prevented you, and others in the industry, from incorporating recycled aggregates in projects?
- What data should be collected and tracked to better understand and encourage the use of recycled concrete and asphalt?
- Any other comments or insights?

From the interviews, several themes emerged, offering insights into the current challenges and opportunities for expanding concrete and asphalt recycling in Metro Vancouver. The themes included quality management, environmental and operational considerations, regulatory standards, and change management.

Adding recycled asphalt aggregates into new asphalt paving mixes seems to be widely accepted although mix design requirements vary. There is significantly less consensus on the requirements to use recycled concrete and asphalt aggregates mixes or only recycled concrete aggregates, therefore these aggregates will be the focus of the following sub-sections unless otherwise specified.

3.2.1 Quality Challenges and Opportunities

Feedback on quality can be summarized as follows:

- **Quality Of Recycled Aggregates and Their Final Products are Inconsistent**

  Interviewees mentioned this could be addressed with existing testing standards, although some felt the existing testing and quality requirements weren't sufficiently clear and should be context specific depending on loading and/or structural requirements.

- **Testing Limitations Need to be Considered**

  Interviewees flagged that excessive testing requirements can result in the use of recycled aggregates being prohibitively expensive compared to virgin aggregates. Some felt there was no need to have distinctive or additional testing for final products that contain recycled aggregates as compared to those that only contain virgin aggregates. Some noted that there are characteristics that cannot be accurately tested for and should be avoided, such as the percentage of recycled aggregates in a final product. Interviewees also noted that products tested in the field resulted in reduced infiltration rates and aggregate size when compared to laboratory results, likely due to greater compaction.

- **Source Can Impact Quality**

  Interviewees mentioned that recycled aggregates sourced for road projects were generally of better or more consistent quality than those sourced from building demolition projects, in part due to additives and/or contamination. It was suggested that the aggregates be sorted by source and/or quality to improve the consistency of the final product.

- **Stockpile Management Practices Affect Quality**

  It was mentioned that recycled aggregates tend to bind together, either due to concrete aggregates absorbing water and/or asphalt aggregates adhering to one another over time, making old stockpiles harder to utilize. The need for large stockpile areas was also mentioned as a concern, especially if one wished to segregate the aggregates by type and quality resulting in a greater number of stockpiles. One interviewee mentioned being open to centralising the stockpiling and processing of recycled aggregates produced by jurisdictions. Another mentioned that disposal fees are a strong incentive for the industry to sort aggregates at their source for recycling.

- **Presence Of Contaminants**

  Aggregate contaminants may include polymers, asbestos, engine oil, metal slag, etc., and interviewees mentioned they may also impact the quality of end products. Testing for the contaminants known to be of concern in Metro Vancouver could address this issue.

Establishing a quality assurance program to pre-qualify aggregate sources, recyclers, and/or end products was also discussed. The consensus seemed against such a system, due to the cost to put in place, the additional cost to suppliers, and/or due to doubts on its effectiveness.

Interviewees noted that institutions such as the University of British Columbia (UBC) and Vancouver International Airport (YVR) are already reusing concrete and asphalt aggregates on-site and could share their data, results and best practices to support the broader adoption of recycled materials across Metro Vancouver.

The MMCD also plans to publish new specifications for recycled aggregates in 2025, which is expected to provide clearer guidelines and support the increased use of recycled materials. Some jurisdictions have already successfully reused large volumes of recycled aggregates in infrastructure projects, but the data on the performance of these materials is not publicly available.

In Ontario, recycled concrete and asphalt aggregates are used as a complete replacement for virgin aggregates in road construction with promising results. Other regions that have developed recycled aggregate specifications including Quebec, Edmonton, Washington State, Halifax, and Kelowna, and could serve as examples for Metro Vancouver member jurisdictions to follow as it expands its recycling efforts.

3.2.2 Environmental Challenges and Opportunities

Feedback on environmental aspects can be summarized as follows:

- **Leachate Management**

  Interviewees mentioned that recycled concrete aggregates can raise the pH of contact water, especially when fines are present, posing a risk to sensitive ecosystems and waterways. One interviewee also indicated that concrete aggregates have also been shown to leach other pollutants such as chromium and sulfate. They indicated that these risks could be managed by placing recycled materials under impermeable layers to reduce the quantity of leachate produced.

  A few interviewees mentioned that leachate from recycled asphalt aggregates had little to no environmental impact.

- **Broad Environmental Regulations**

  A source of concern is also a lack of clarity in regulatory frameworks, such as the Water Sustainability Act (WSA), which contributes to hesitancy in adopting recycled materials. Interviewees pointed to the broad definition of waterways under the WSA that creates uncertainty for environmental consultants and contractors.

  An interviewee also mentioned that it was unclear how recycled aggregates were to be handled if used for example as a road base than dug up later during maintenance activities of underground utilities. Project owners may face expensive disposal fees if the recycling requirements of such materials aren’t clear.

- **Greenhouse Gas Emissions**

  Interviewees mentioned that the use of recycled materials can help reduce carbon dioxide emissions in construction projects, promoting sustainability and reducing the carbon footprint. In addition, recycled aggregates can be processed on-site for large-scale demolition or construction projects, reducing the need for transportation and promoting the efficient use of materials.

- **Circular Economy and Net-Zero Waste**

  Interviewees pointed out the opportunities of a "net-zero" approach, where jurisdictions could use the quantity of recycled materials they produce, encouraging a circular economy, reducing the reliance on virgin materials and reducing waste. Some have suggested that more or earlier involvement of environmental and sustainability departments in project planning can ensure that recycled concrete and asphalt environmental targets are established and met, fostering greater collaboration and promoting the use of recycled materials in construction.

3.2.3 Operational and Regulatory Challenges and Opportunities

Feedback on operational and regulatory aspects can be summarized as follows:

- **Proximity to Urban Centers**

  Recyclers highlighted the high land costs and zoning restrictions, particularly near urban areas, increasing the expense of accepting, storing, and selling recycled concrete aggregates and RAP. In regions where land is cheaper, recyclers struggle to compete with virgin aggregates due to the proximity of quarries. Favorable zoning requirements would help recyclers establish themselves closer to urban areas where demand for recycling aggregates is greatest and would help reduce trucking distances and its associated costs.

- **Recycled RAP Content**

  Interviewees mentioned that increased use of RAP in road construction projects has been tested, with some trials showing promising results when using 30 to 40% RAP. Increasing the quantity of RAP in base and top asphalt layers could provide significant cost and environmental savings, provided that the materials meet quality and performance standards.

- **Alignment With Environmental Plans and Objectives**

  It was noted that governments and organizations should implement green procurement standards that require a minimum percentage of recycled content in construction projects, thereby creating demand for recycled concrete aggregates and RAP and reducing the reliance on virgin materials. Furthermore, jurisdictions could standardise the use of recycled concrete aggregates or RAP in low-risk applications, making its use more routine and widespread without the need for special approvals.

- **Updating Existing Standards and Specifications**

  As flagged by numerous interviewees, there exists an opportunity to establish clearer and more thorough standards for recycled concrete aggregates and RAP, which would encourage broader use of recycled aggregates. For example, updating the Master Municipal Construction Documents (MMCD) more frequently to provide modern, standardized guidelines for recycled materials across jurisdictions would simplify the approval process. This improvement would reduce delays, foster confidence among contractors, and promote the seamless integration of recycled concrete aggregates and RAP into construction projects.

3.2.4 Change Management Challenges and Opportunities

Another challenge mentioned by numerous interviewees is resistance to change. Contract administrators, consultants and engineers seem generally unfamiliar with the use of recycled aggregates, and therefore hesitant to approve their use into their projects. It seems that for many decisions makers, the environmental gains and potential cost savings don't currently outweigh the perceived technical risk. Interviewees mentioned that this could be addressed by:

- Increased knowledge sharing and education of stakeholders.

- Supporting research on the use of recycled aggregates, including their potential environmental impacts.
- Sharing the results of existing and future studies and test trials.
- Increased collaboration between stakeholders to exchange ideas and build trust.
- Increased transparency from industrial partners.
- Promoting the use of the existing RAP toolkit.
- Reducing the reliance on contract administrator approval.
- Establishing concrete and asphalt recycling targets and procurement requirements.
- Encourage economic development and innovation opportunities.

4 Best Practices & Experience in Other Jurisdictions

4.1 Review of Best Practices & Experience in Other Jurisdictions

This section explores best practices and experiences from the City of Edmonton, City of Kelowna, Washington State, City of Halifax, and Province of Quebec, communities identified through interviews with stakeholders and subject matter experts, and research. The information was gathered through a review of publicly available resources.

4.1.1 Edmonton

The City's construction specifications include the standards to (City of Edmonton, 2023):

- Reclaim roadway base courses: the specifications include quality assurance and quality control measures, definitions, products specifications for materials and equipment, and execution measures.
- Include RAP in hot-mix asphalt: the mix design can contain up to 25% RAP (by mass of total mix) in base asphalt, up to 20% RAP in surface asphalt for low traffic conditions, and up to 10% RAP in surface asphalt for high traffic conditions.

The City of Edmonton used to operate an aggregate recycling program that processed concrete and asphalt from various sources, including household renovations and construction projects. The program offered products such as 63mm (2.5 inches) recycled crushed concrete and ballast (dolostone) and 6mm-38mm (¼ inch-1 ½ inches), suitable for applications like residential driveways, walkways, patios, and commercial bases for parking lots, roads, pipe laying, and erosion control structures. The recycled concrete aggregate typically comprises 65% concrete, 25% asphalt, and 10% other materials. (City of Edmonton, 2024) However, the program was not profitable and has been ended.

4.1.2 Kelowna

The City of Kelowna permits the use of recycled materials in the following conditions: (City of Kelowna, 2024)

- Type 1 granular pipe bedding and surround materials may contain up to 30% RAP by weight, and hot-mix asphalt may contain up to 20% RAP without changing binder grade, provided that the properties of RAP material are considered in the trial mix design.
- Recycled concrete and asphalt (RCA) may be used as a subbase or base within the pavement structure and can be used as fill in the subgrade if certain restrictions are met. RCA may contain up to 30% RAP by weight. Recycled concrete may not be used as pipe bedding.

The Glenmore Landfill, operated by the City of Kelowna, plans to offer recycled concrete and asphalt for sale at $8 per tonne starting in spring 2025. (City of Kelowna, 2024)

4.1.3 Washington State

In 2015, Washington State enacted Revised Code of Washington (RCW) 70.95.805, mandating the Washington State Department of Transportation (WSDOT) to develop strategies for reusing construction aggregates and recycled concrete materials. The legislation set a target for WSDOT projects to utilize 25% recycled materials annually, provided they are available and cost-effective. (Washington State Department of Transportation, 2018)

Between November 2019 and December 2020, WSDOT received 87 recycled materials reports from contractors. The reports are based on a standardized form established by WSDOT to report the quantity in tons of each type of recycled material used per contract. Contractors reported using 157 tons of recycled concrete aggregate out of a potential 361,479 tons of eligible material (listed in Table 3). Between 2017 and 2020, a total of 12,141 tons of recycled concrete aggregate has been utilized on WSDOT projects. (Washington State Department of Transportation, 2021) Hence the target of 25% recycling has not yet been achieved.

The primary barrier to achieving the 25% usage target has been cost. Contractors have indicated that the expenses associated with recycled concrete aggregate often exceed those of native materials, hindering broader adoption. (Washington State Department of Transportation, 2021)

WSDOT's standard practice specifications for road, bridge, and municipal construction include:

- WSDOT Standard Practice QC 9: Standard Practice for Approval of Recycled Materials Facilities of WSDOT Recycled Concrete and Returned Concrete. (Washington State Department of Transportation, 2024)
    - It specifies processes for approving the Recycled Materials Facilities that produce/supply RCA from either returned concrete and/or WSDOT concrete, including the requirement for a Quality Control Plan for the facilities. The approval process determines if the Plan ensures production of non-contaminated quality RCA.
- WSDOT Standard Practice QC 10: Standard Practice for Approval of Recycled Materials Facilities from Stockpiles of Unknown Sources. (Washington State Department of Transportation, 2024)
    - It specifies the processes for approving recycling materials facilities that produce/supply recycled materials from unknown sources.
- WSDOT Standard Specifications for road, bridge, and municipal construction specifies requirements and restrictions for recycled materials and uses as shown in Figure 2 below. (Washington State Department of Transportation, 2025)

WSDOT's Construction Manual indicates that projects that require water quality monitoring as per their permit, the "water impacted by pH modifying sources must be characterized and, if authorized, must be

neutralized prior to discharge to ensure it is within the range 6.5 to 8.5". (Washington State Department of Transportation, 2024).

Figure 2 Maximum allowable percent of recycled materials as per Washinton State Department of Transportation Standard Specifications for road, bridge, and municipal construction.

9-03.21(1)F Table on Maximum Allowable percent (By Weight) of Recycled Material

Maximum Allowable percent (by weight) of Recycled Material					
		Recycled Asphalt Pavement	Recycled Concrete Aggregate	Recycled Glass (glass cullet)	Steel Slag
Fine Aggregate for Concrete	9-03.1(2)	0	0	0	0
Coarse Aggregates for Concrete	9-03.1(4)	0	0	0	0
Coarse Aggregate for Concrete Pavement	9-03.1(4)	0	100	0	0
Coarse Aggregate for Commercial Concrete and Class 3000 Concrete	9-03.1(4)	0	100	0	0
Aggregates for Hot Mix Asphalt	9-03.8	See 5-04.2	0	0	20
Ballast	9-03.9(1)	25	100	20	20
Permeable Ballast	9-03.9(2)	25	100	20	20
Crushed Surfacing	9-03.9(3)	25	100	20	20
Aggregate for Gravel Base	9-03.10	25	100	20	20
Gravel Backfill for Foundations – Class A	9-03.12(1)A	25	100	20	20
Gravel Backfill for Foundations – Class B	9-03.12(1)B	25	100	20	20
Gravel Backfill for Walls	9-03.12(2)	0	100	20	20
Gravel Backfill for Pipe Zone Bedding	9-03.12(3)	0	100	20	20
Gravel Backfill for Drains	9-03.12(4)	0	0	20	0
Gravel Backfill for Drywells	9-03.12(5)	0	0	20	0
Backfill for Sand Drains	9-03.13	0	0	20	0
Sand Drainage Blanket	9-03.13(1)	0	0	20	0
Gravel Borrow	9-03.14(1)	25	100	20	20
Select Borrow	9-03.14(2)	25	100	20	20
Select Borrow (greater than 3 feet below Subgrade and side slopes)	9-03.14(2)	100	100	20	20
Common Borrow	9-03.14(3)	25	100	20	20
Common Borrow (greater than 3 feet below Subgrade and side slopes)	9-03.14(3)	100	100	20	20
Foundation Material Class A and Class B	9-03.17	0	100	20	20
Foundation Material Class C	9-03.18	0	100	20	20
Bank Run Gravel for Trench Backfill	9-03.19	25	100	20	20

4.1.4 Halifax

The Halifax Regional Municipality's specifications for hot mix asphalt allow for up to 20% RAP in each lift for new construction works, subject to a few conditions, and the mix is to be designed according to the Ontario Ministry of Transportation Design Procedure for Recycled Hot Mix Asphalt. (Halifax Regional Municipality, 2024)

The municipality also mentions the use of recycled aggregates in its pavement maintenance & rehabilitation strategies where existing roads are fully or partially milled, screened, and the millings reused in the asphalt mix. (Halifax Regional Municipality, 2024)

4.1.5 Quebec

In Quebec, the provincial regulatory framework was updated in the last two years and includes detailed requirements which allow the use of recycled granular materials in various projects. In theory, the recycled content could be as high as 100%, but no target has been set in the regulatory framework. However, most contracting authorities like the municipalities or major institutions have restrictions in using such recycled materials, regardless of their compliance with the provincial regulation and standards. Some of them have conducted pilot projects and changed their specifications to increase the allowable content of recycled materials. The use of recycled aggregates is not mandated by the province. It has established a list of requirements to allow the use of recycled aggregate without the need for Ministry approval.

The *Bureau de Normalisation du Québec* (Standard BNQ 2560-600, 2024) pertains to the classification and characteristics of recycled materials produced from concrete, hot mix asphalt, and brick residues. It outlines the physical, chemical, and intrinsic properties of these recycled materials (RM) which are made from concrete, bituminous coatings and clay bricks coming from construction or demolition sites, construction or demolition waste sorting centres or other suppliers of residual granular materials, ensuring they meet specific requirements for their use in construction projects. The standard includes:

- classifications and designations (RM (as aggregates) type recycled materials and CB (clay bricks) type recycled materials);
- general requirements (composition of recycled materials);
- specific requirements for RM-1 to RM-7 recycled materials (sampling, classification, granularity, intrinsic characteristics, fabrication characteristics, complementary characteristics); and
- special requirements for CB recycled materials.

BNQ 2560-600 links the different Québec standards and guidelines which regulate the use of recycled aggregates, including the regulation respecting the reclamation of residual materials, handbooks and guidelines from the Ministry of Transport and Sustainable Mobility (MTMD), American Association of State Highway and Transportation Officials (AASHTO), ASTM, and CSA.

The province's *regulation on respecting the reclamation of residual materials* defines four categories and their specific cases of residual granular materials in Section 26 based on their maximum concentrations

of certain contaminants (Table 2). (Government of Quebec, 2024) Categories 1 to 3 apply to residual granular materials that will be reused on-site or off-site. Category 4 applies only to residual granular materials that are generated and reused on the same site. The four categories are divided into cases and five criteria. These criteria are based on the material's concentration of metals, metalloids and other inorganic parameters, petroleum hydrocarbons (C10-C50), organic compounds, leachates, and impurities. Section 19 lists specific cases that don't require a characterization depending on the origin of residual granular materials and/or its asphalt content.

Table 2 Categories of Residual Granular Materials According to Regulation Respecting the Reclamation of Residual Materials, Article 26)

CATEGORY 1

Case 1 The residual granular material contains 1% or less of asphalt and is covered under subparagraph 1 or 2 of the second paragraph of section 19.

Case 2 The residual granular material contains 1% or less of asphalt and meets the following requirements:

Concentration of metals, metalloids and other inorganic parameters	Concentration of petroleum hydrocarbons (C10-C50)	Concentration of organic compounds	Leachates	Impurities content
Less than or equal to the concentration of the second column of Table 1 of Schedule I	Less than or equal to 100 mg/kg	Less than or equal to the concentration of the second column of Table 2 of Schedule I	N/A	Less than or equal to 1% (w/w) and 0.1% (w/w) for light materials

CATEGORY 2

Case 1 The residual granular material contains 1% or less of asphalt and is covered under subparagraph 3 of the second paragraph of section 19.

Case 2 The residual granular material contains 1% or less of asphalt and meets the following requirements:

Concentration of metals, metalloids and other inorganic parameters	Concentration of petroleum hydrocarbons (C10-C50)	Concentration of organic compounds	Leachates	Impurities content
Greater than the concentration of the second column and less than or equal to the level of the third column of Table 1 of Schedule I	Less than or equal to 100 mg/kg	Less than or equal to the concentration of the second column of Table 2 of Schedule I	Leachates do not exceed the maximum concentration of Table 1 of Schedule I, where applicable	Less than or equal to 1% (w/w) and 0.1% (w/w) for light materials

CATEGORY 3

Case 1 The residual granular material is from road infrastructures covered under subparagraph 4 of the second paragraph of section 19 or contains more than 1% of asphalt and is covered under the second paragraph of section 19.

Case 2 The residual granular material is composed of a mixture of category 1 or 2 residual granular materials and more than 1% of asphalt.

Case 3 The residual granular material meets the following requirements:

Concentration of metals, metalloids and other inorganic parameters	**Concentration of petroleum hydrocarbons (C10-C50)**	**Concentration of organic compounds**	**Leachates**	**Impurities content**
Less than or equal to the concentration of the third column of Table 1 of Schedule I, except in the case of asphalt containing slag from steel mills	Greater than 100 mg/kg but less than or equal to 3,500 mg/kg, except asphalt	Less than or equal to the concentration of the third column of Table 2 of Schedule I, except asphalt	Leachates do not exceed the maximum concentration of Table 1 of Schedule I, where applicable	Less than or equal to 1% (w/w) and 0.1% (w/w) for light materials

CATEGORY 4

The residual granular material is reclaimed on the land where the material was excavated and meets the following conditions:

(1) it has an impurities content less than or equal to 1% (w/w) and 0.1% (w/w) for light materials;

(2) it has a concentration of contaminants less than or equal to the limit values prescribed in Schedule I to the Land Protection and Rehabilitation Regulation (chapter Q-2, r. 37) or in Schedule II of that Regulation for land with the following uses:

(a) land on which, under a municipal zoning by-law, industrial, commercial or institutional uses are authorized, except

i. land where totally or partially residential buildings are built;

ii. land where elementary-level or secondary-level educational institutions, childcare centres, day care centres, hospital centres, residential and long-term care centres, rehabilitation centres, child and youth protection centres, or correctional facilities are built;

(b) land constituting, or intended to constitute, the site of a roadway within the meaning of the Highway Safety Code (chapter C-24.2) or a sidewalk bordering a roadway, a bicycle path or a municipal park, except play areas for which the limit values provided for in Schedule I to the Land Protection and Rehabilitation Regulation remain applicable for a depth of at least 1 m.

According to Section 18, the residual materials must be conditioned to a maximum particle size of 300 mm in the case of roadway backfilling, except for work undertaken to stabilize a slope in a structure or build a noise-abatement wall, in which case the maximum particle size is determined in the plans and specifications signed and sealed by an engineer, and 112 mm in other cases.

Article 27 includes a table that summarises permitted uses for recycled aggregates (refer to Table 3 below). (Government of Quebec, 2024)

Table 3 Permitted use of Categories 1-4 residual granular materials in Québec, according to the Regulation respecting the reclamation of residual materials, Section 27.

Type of use	Categories			
	1	2	3	4
Miscellaneous Activities				
Grading down or raising up of ground level using crushed stone	X			X
Road abrasives – crushed stone and cuttings and tailings from the dimension stone sector only	X			
Construction on residential or agricultural land, an elementary-level or secondary-level educational institution, a childcare centre or a day care centre	X			X
Parking area – asphalt or non-asphalt – on residential land	X			X
Mulching, rockfill, landscaping – crushed stone, brick and cuttings and tailings from the dimension stone sector only	X			
Backfilling areas excavated during a demolition	X			X
Construction on institutional, commercial or industrial land, including municipal land	X	X		X
Recreation and tourism facilities (bicycle path, park, etc.)	X	X		X
Access road, farm road	X	X		X
Noise-abatement embankment and visual screen	X	X		X
Construction and rehabilitation of a snow disposal site	X	X		X
Concrete manufacturing	X	X		
Hot-mix or cold-mix asphalt	X	X	X	X
Storage area on industrial land	X	X	X	X
Parking area and traffic lanes of industrial or commercial establishments	X	X	X	X
Bedding, surrounding soil and backfilling for pipes on residential land	X			

Type of use	Categories			
	1	**2**	**3**	**4**
Bedding, surrounding soil and backfilling for pipes (other than waterworks and sewers)	X	X	X	X
Bedding and surrounding soil for pipes (waterworks and sewers) – crushed stone or cuttings and tailings from the dimension stone sector only	X			
Backfilling for pipes (waterworks and sewers) less than 1 m from the pipes – crushed stone or cuttings and tailings from the dimension stone sector only	X			
Backfilling for pipes 1 m or more from the pipes (waterworks and sewers)	X	X	X	
Construction or repair of highways and streets, including those in residential, municipal and agricultural sectors				
Filtering layer – crushed stone or cuttings and tailings from the dimension stone sector only	X	X		
Mineral filler	X	X		
Roadbed – asphalt or non-asphalt	X	X	X	X
Road shoulder – asphalt or non-asphalt	X	X	X	X
Cushion	X	X	X	X
Anti-contaminant layer	X	X	X	X
Screenings	X	X	X	X
Surface treatment	X	X	X	X
Granulates for sealing grout	X	X	X	X
Encasing for culverts	X	X	X	X
Roadway backfilling	X	X	X	X
Road underbed	X	X	X	X

Recycled aggregates must respect regulatory requirements regarding size, environmental and geotechnical aspects, as well as restrictions relating to proximity to waterbodies. They may not be used in wetlands, nor within 10 m of a lakeshore or 15 m of a riverbank, as measured from a waterbody's edge,

the top of a continuous slope greater than 30% leading to the waterbody, or from the top of a bank higher than 5 m, whichever is greatest (Governement of Québec, 2020). This can be done with no request of authorization. If the works are located in a riverbank, a request for authorization is required.

In addition, the transformation and storage of recycled aggregates (not their usage) must be done outside a buffer zone (60 m or more from a watercourse or lake and 30 m or more from a wetland).

Gilmour Vert, City of Lévis

The City of Lévis has changed their requirements in 2017 (Service du génie, Ville de Lévis, 2017), to promote the use of recycled materials in the following applications:

- Granular surface layer (for unpaved roads)
- Sub-base and transition layers
- Anti-contaminant layer
- Backfill

The materials used must have a conformity certificate according to the BNQ 2560-114 standard for the intended use. Additionally, the material must meet the requirements of the BNQ 2560-600 standard.

The City of Lévis does not allow the use of recycled granular materials in concrete and asphalt mixtures.

As an example, in 2019, the City of Lévis initiated the demolition of the Gilmour water treatment plant, an inactive facility built in 1920. (Ville de Lévis, 2019) In alignment with its Waste Management Plan, the City chose a sustainable approach by implementing a green construction site for this project. This strategy involved on-site decontamination of the demolition materials, with a focus on minimizing environmental impact. The primary material, concrete, was decontaminated and reused directly on site as backfill, reducing greenhouse gas emissions, transportation costs, and landfill waste.

Overall, 98.8% of the demolition materials were recovered, including 2,881 tonnes of clean, decontaminated concrete that were reused on-site as backfill.

Had the site followed conventional demolition practices, all lead-contaminated concrete would have been disposed of, lowering the waste recovery rate to 86.6% instead of the achieved 98.8%. This green approach allowed the diversion of an additional 428 tonnes of materials from landfills: only 36 tonnes went to landfills instead of 464 tonnes if it was managed with conventional demolition practices.

Highway 20, South of Montreal

The Ministère des Transports et de la Mobilité durable (MTMD) is currently leading a construction project to widen Highway 20 from Sainte-Julie to Beloeil over a stretch of approximately 13 km within the existing right-of-way (MTMD, 2025). The construction contract includes a clause requiring the contractor to crush the removed concrete slabs on site, in order to reuse around 12,000 tonnes of concrete as granular materials in the sub-base of the new construction.

MTMD is expecting the use of recycled aggregates for sub-base will generate cost savings, eliminating the need to transport and dispose of the demolished concrete as well as the need to purchase virgin materials.

Chemin du Lac Bleu, Municipality of Saint-Hippolyte

This project (Lachance-Tremblay, Ramirez Cardona, Bérubé, & Lamothe , 2023) is aligned with the mission of the Laboratory for Pavements and Bituminous Materials (LCMB) at the École de Technologie Supérieure (ÉTS), which focuses on developing and promoting sustainable and innovative technological solutions for road construction and maintenance in Canada. The project was carried out and funded through the Construction Lab of the Centre for Intersectoral Studies and Research in Circular Economy (CERIEC) at ÉTS, which aims to accelerate the transition to a circular economy in the construction sector, in collaboration with the Municipality of Saint-Hippolyte.

For this project, the targeted case study was a section of Chemin du Lac Bleu in Saint-Hippolyte. The section under study is 400 meters long and had numerous surface defects such as longitudinal cracking, alligator cracking, and raveling. The selected rehabilitation technique was pulverization also known as full-depth reclamation. The new pavement obtained following the pulverization process consisted of the following layers:

- Surface Layer: Composed of a high-content RAP (Recycled Aggregates Pavement – 30% by mass) asphalt mix.
- Base Layer: Made of GB-20 type asphalt (RAP 20% by mass).
- New Pulverized Foundation: Created from the pulverized existing materials.
- Existing Foundation.

The observations and lessons learned from the project indicate that the following aspects need to be addressed to successfully generalize the use of RAP in municipal roadworks in Quebec:

- Continue Research: Investigate the impact of RAP on properties related to stripping resistance, water resistance, and freeze-thaw resistance.
- Develop Training Strategies by enhancing industry skills in:
    - Preparing tender documents that include performance tests.
    - Available performance tests for RAP asphalt mixes.
    - Formulating high-content RAP asphalt mixes.
- Standardize RAP Incorporation Rates: Propose standard incorporation rates for pavement materials to be used in municipal road projects in Quebec to avoid confusion among different project owners.
- Establish Standard Procedures: Create a standard procedure for technical verification and validation of materials and their implementation in a pilot road project including at least 30% RAP. This procedure should include not only the verification of asphalt performance but also the verification of the actual RAP dosage.

This study also mentioned that the neighboring U.S. states of Vermont and Maine allow RAP incorporation rates of 50% and 30%, respectively, across their territories and outlined that New York City requires a minimum of 30% RAP in asphalt mixes for its municipal projects.

4.1.6 International

Europe is well advanced in the reuse of recycled aggregates in building and road constructions. Several countries, including Germany, the Netherlands, Denmark, Norway, and Switzerland, have already implemented the use of recycled aggregates in structural concrete. The primary drivers for Europe in the reuse of recycled aggregates in building and road constructions are:

- The cost of materials is one of the main expenses for construction because of the lack of raw materials,
- Incentives to GHG savings or restrictions to GHG emissions;
- Landfilling costs are much higher because of the lack of space for the development of additional landfill capacity;
- The European regulations (“directives”) are applicable to all European countries.

In France, the RECYBETON project (RECYBETON, 2019) has contributed to advancing research on the incorporation of recycled aggregates and sands in concrete. The findings of the program suggest new incorporation rates ranging from 5% to 60% by mass for recycled aggregates, but mainly between 20% and 40%. For recycled sand, the incorporation rates vary between 5% and 30%. These variations are determined by the exposure class of the concrete.

4.2 Summary of Experiences within Stantec

Our team engaged with colleagues across North America resulting in 9 interviews. All but one of the interviewees were based in Canada and a majority were working in the transportation sector, and the others work in the energy, mining, buildings or environmental services sectors.

Many of the challenges discussed in sections 2 and 3 were raised, as well as the seasonal nature of construction which impacts recycled material flows, seasonal variations that impact temperature and moisture sensitive recycling processes, and the often-lengthy regulatory approval processes faced by new recycling methods.

The interviewees also provided insights into potential opportunities to increase the use of recycled concrete and asphalt. They included the importance of establishing and implementing quality control standards, the environmental benefits (including reducing greenhouse gas emissions, conserving resources, and lowering demand for virgin materials), and the potential cost savings due to reduced trucking and landfilling. Additional potential opportunities that were mentioned included:

- Quality, Operation and Regulations:
    - Encouraging the re-use of recycled aggregates at their source / site of production.

    - Focusing on increased use in lower traffic loading, non-structural, and/or low-strength contexts.
    - Supporting additional research and development that encourages collaborations, develops case studies, initiates pilot projects, and improves the quality of the final products in different contexts and environments.
    - Support collecting and evaluating data, such as the performance of RAP, structural performance metrics, durability, environmental impact, particle shape and stability, case study results, and cost-benefit analyses.
    - Pre-qualifying contractors to ensure they have sufficient experience with recycled aggregates.
- Environmental:
    - Establishing protocols to screen for contaminated aggregates.
- Change management:
    - Supporting training and investments in recycling methods and equipment.
    - Increasing regulatory support to help new recycling methods comply with standards.
    - Offer financial subsidies or incentives to help recycled aggregates be more competitive.
    - Learn from the experience of other jurisdictions

4.3 Assessment of Current Practices in Metro Vancouver

Current concrete and asphalt recycling practices in Metro Vancouver were explored in sections 2 and 3 through a review of local best practices, guidelines, standards and regulations, and twenty interviews of local stakeholders.

The key findings can be summarized as follows:

- Overview
    - Recycling asphalt aggregates into new asphalt is generally accepted, although with varying standards.
    - Recycling concrete aggregates into new concrete is generally not practiced, although technically possible for some contexts.
    - Using a mix of concrete and asphalt aggregates to supplement or replace virgin aggregates as a base or fill varies significantly between jurisdictions in both its regulation and the application of the regulation.
- Strengths
    - Numerous pilot projects in the Metro Vancouver region have used recycled aggregates.
    - Numerous jurisdictions used recycled concrete and asphalt aggregates produced by their own projects and have in-house experience that could be studied and shared.

- Weaknesses
    - Varying regulations and best practices between jurisdictions are challenging and time consuming for contractors to manage, reducing the likelihood that recycled aggregates get used.
    - Requiring the contract administrator to approve the use of recycled aggregates, as required by MMCD specifications, is proving to be a disincentive for both the contract administrator and contractors. The former does not want to assume a real or perceived additional liability, and the latter is reluctant to invest time and energy into producing quality products that contain recycled aggregates that are perceived to be frequently disregarded or dismissed.
    - Data from pilot projects is underutilised and insufficiently shared.
    - The results of recent studies regarding leachate pH from recycled concrete aggregates should be reviewed to be better understood by stakeholders. In some cases, additional research or analysis may be required for new or untested recycled concrete aggregate applications.
    - There is a reluctance in most jurisdictions to allow the use of third-party recycled aggregates, even though some jurisdictions do use those produced from their own projects.
    - Best practices and standards should be updated more regularly to reflect and keep pace with improving technologies and recycling methods.
    - Recyclers struggle to provide competitive pricing relative to virgin materials due to restrictive zoning bylaws that keep their processing and storage facilities relatively far from urban areas and due to the cost of land.
    - There doesn't seem to be strategies, actions, or targets on increasing the use of recycled aggregates in municipal or regional plans (such as those that address climate change and/or circular economy).

4.4 Opportunities Identified for the Metro Vancouver Region

Based on the findings in sections 2 to 4, a list was developed to increase concrete and asphalt recycling. It identifies opportunities within the region of Metro Vancouver for the public and/or private sectors. This list is not exhaustive.

The opportunities for the Metro Vancouver region include:

- Permit the use of recycled concrete aggregates in new concrete for minor works and low risk applications.
- Look into increasing the number of contexts in which the use of recycled aggregates is permitted.
- Streamline the process of approving the use of recycled aggregates.

- Establish clearer and context specific quality requirements.
- Clarify environmental regulations with respect to using recycled aggregates.
- Standardize and regularly update regulations on recycled aggregate use across member jurisdictions.
- Reduce the reliance on contract administrator approval.
- Set municipal and/or regional aggregate recycling targets.

5 Webinar Summary

Metro Vancouver hosted a webinar on January 22, 2025, titled “Concrete and Asphalt Recycling Options Webinar”, attended by a total of 107 unique viewers. The event was open to the public but oriented to public and private sector recycled aggregate stakeholders. Invitations were sent to government staff in the environmental, transportation, street design and public works sectors, professionals in the construction and civil engineering industries, including contractors, suppliers, construction materials testing labs and consultants and industry associations and stakeholders involved in road construction and transportation infrastructure. The event’s pre-webinar summary is provided in Appendix C. The objectives of the event were:

1. **Share** findings related to barriers, opportunities, and actions to support the use of concrete and asphalt recycling applications that increase benefit, and to share knowledge on proven and future applications for recycling concrete and asphalt aggregates.
2. **Receive feedback** from participants on potential opportunities to recycled concrete and asphalt aggregates, and on potential actions that could be undertaken by Metro Vancouver and interested parties to recycle concrete and asphalt.

The webinar presenters and their topics included:

- **Metro Vancouver**: an introduction, a review of potential actions to support the use of concrete and asphalt recycling applications that maximize its benefits, and a review of next steps for sharing insights learned from this review and the webinar.
- **Stantec**: a summary of the review and findings presented in this report.
- **BA Blacktop**: a presentation on current and future opportunities for recycled asphalt.
- **Lafarge**: a presentation on current and future opportunities for concrete and asphalt recycling.
- **MMCD**: a presentation on the roadblocks to the use of recycled concrete and asphalt.
- **District of North Vancouver (DNV)**: a presentation on the DNV’s use of recycled aggregates.
- **Ontario Good Roads**: a presentation on Ontario’s experience with recycling concrete and asphalt.

The webinar also included an online poll during a break mid-event, a question & answer panel session with the presenters, and a post-webinar survey.

6 Strategic Opportunities

There are significant opportunities to use recycled concrete and asphalt aggregates in technical applications, as identified in previous sections. The following section summarizes the potential environmental and financial benefits, and the applications and contexts that are particularly well suited for these materials.

This section is meant to support decision-makers in their assessment of these aggregates. It is anticipated that regulatory uncertainty faced by some decision-makers regarding these materials, their applications, and testing requirements will be predominantly addressed by the MMCD specifications update planned for this year (2025) and the anticipated adoption and alignment by Metro Vancouver and member jurisdictions. It is also assumed that the replacement rates of products that contain recycled aggregates are equivalent to those that do not.

6.1 Environmental

This sub-section highlights potential environmental benefits and risks of using recycled aggregates, with a focus on greenhouse gas (GHG) emissions and recycled aggregate leachate. Additional potential environmental benefits from reduced mining of virgin aggregates, reduced trucking, and reduced waste are also important, but for the most part less readily quantifiable and were not included in this study.

6.1.1 Greenhouse Gas Emissions

Reduced GHG emissions for recycled aggregates results from generally shorter transportation distances. The aggregates are for the most part generated in urban areas and processed onsite or in nearby plants. Virgin aggregates sources tend to be located increasingly further away from their markets as nearby sources are depleted and closed.

Studies regarding the GHG emissions related to recycled aggregates include the following:

- The Ontario Chamber of Commerce estimated that far-from-market aggregate sources located about 75kms further away than close-to-market sources (located about 35 kms from markets) would result in emitting an additional 130,000 metric tonnes of CO_2 emissions annually in Ontario, more than triple the current amount (the close-to-market scenario).
- A study showed that VINCI Construction's standard hot-mix asphalt mix used across the Americas, which contains 15% RAP, produces about 53.9 kg CO_2 eq. per ton produced. When compared to this standard mix, the estimated GHG emissions varied as follows for other mixes: (BA Blacktop, 2025)
    - 11% increase when using no RAP.
    - 11% decrease when using 30% RAP.
    - 24% decrease when using 50% RAP.

    - 24.5% decrease when using a cold asphalt mix.
- Based on 2017 data from LaFarge, for every 10 tonnes of RAP used on a project, 1 tonne of CO_2 eq. emissions were avoided.
- A study published by the Canadian Technical Asphalt Association found a reduction of approximately 7% in carbon emissions for every 10% increase in RAP content. (Ghahremani, Mah, Juhasz, & Croteau, 2023).

As an example, the MOTT 2024-2025 Preservation Program Projects issued January 19, 2024, (Ministry of Transportation and Transit, 2024) lists anticipated road resurfacing projects for the 2024-2025 construction season. The anticipated use of asphalt is listed for each project and totals to 2,500,000 tonnes in BC. Assuming the maximum allowed use of RAP is used for the anticipated projects[1], over 400,000 tonnes of RAP will be used. A small increase of 2% of RAP in the design mix would increase the virgin material offset by approximately 50,000 tonnes.

Based on the GHG emission offset information listed above, an overall 2% increase of RAP content in the BC MOTT 2024-2025 preservation projects, assuming maximum allowed is applied, would have the potential to contribute to 5,000 tonnes of CO_2 eq. emissions avoided. If instead 30% RAP was used in all 2024-2025 resurfacing projects, the potential for GHG would increase to approximately 15,000 tonnes CO_2 eq.

6.1.2 Recycled Aggregate Leachate

The risks associated with leachate generation from the use of recycled aggregates in road base and other non-bound applications, was brought up during stakeholder interviews (c.f. section 3.2). Background information on the leaching process and the challenges it can pose are summarized as follows, as described by a literature review on recycled concrete aggregate leachate conducted by the Department of Ecology of the State of Washington: (Eric, 2022)

- “Leachate is a solution obtained by exposing a solid to a liquid, resulting in the solid-liquid partitioning between the solid material and the aqueous phase.”
- The process of carbonation on RCA results in “the release of calcium hydroxide and its transformation to calcium carbonate, which consequently reduces the leachate pH.”
- “The degree of carbonation the concrete material has experienced is critical to determining the leachate pH, as a highly carbonated concrete produces a near-neutral leachate pH.”
- “The release of chemical, inorganic, and organic pollutants of concern from the exposed material surface depends heavily on the leachate pH, electrical conductivity, and concentration gradients between the solid and liquid phases. In addition, the partitioning into the leachate from the material depends on the physical and chemical properties of the material being leached.”

[1] 15% Category A roads (Numbered highways), 30% Category B roads (Other roads)

- "Chemical, inorganic, and organic constituents in RCA leachate reported in the reviewed literature were compared to the Washington State water quality criteria." It was found that "RCA regularly releases antimony, arsenic, chromium (VI), copper, nickel, and selenium in excess" of the criteria.
- "pH-impacted water has been shown to discharge from RCA for at least the first-year in field scenarios."

It was concluded in the report that an investigation of region-specific RCA leachate was needed, with a focus on its composition and its acute and chronic effluent toxicity on region-specific target organisms. (Eric, 2022)

Authors of another study indicated a similar timeline: "Long-term highway field studies of RCA leachate illustrate that an initially high leachate pH approaches neutral within approximately one to two years of construction" (Sanger, Madras Natarajan, Wang, Edil, & Ginder-Vogel, 2020)

Measures shown to decrease the impact of leachate from unbound RCA and RAP include minimizing water percolation and groundwater seepage through these materials through compaction (Quoc Hung, et al., 2024), placing unbound recycled aggregates above the maximum elevation of the water table, and placing them under an impermeable layer.

To protect the environment, testing of unbound recycled aggregates prior to its use is recommended. A review on leaching tests of recycled concrete aggregates concluded that: (Margarida Braga Maia, de Brito, Martins, & Dinis Silvestre, 2018)

- "Considering RCA's heterogeneity, it is important to analyse their eluates and check whether they are appropriate for the intended use and are in conformity with existing legislation."
- "Leaching test results depend on the recycled concrete aggregates' source, size, and previous exposure, and from the liquid-to-solid ratio test used."
- "The pH value of the leachant affects directly anion and cation releases behaviour."
- "Some common critical compounds of recycled concrete aggregates are sulphate, chromium, antimony and selenium."
- "Taking into account leaching tests currently used in RCA, it is important to define the purpose of the intended study prior to the definition of the test to be applied."

6.2 Circular Economy

Recycling of asphalt and concrete should not only focus on keeping the materials out of landfills but also avoid down-cycling.

At Vancouver Landfill, recycled concrete and asphalt are used as construction materials for temporary access roads on the active areas of the landfill. In 2023, approximately 56,600 tonnes of clean concrete and asphalt crushed on-site, and 33,680 tonnes of purchased aggregate (concrete & rock) were used for this purpose. (City of Vancouver, 2024) Although used for the landfill's operations and in replacement of virgin materials, these materials are ultimately landfilled.

Currently, down-cycling of recycled aggregates is common practice. A study on construction waste in Canada using LEED™ certified project data found that while the studied projects achieved an 88% diversion rate, the excess materials were for the most part down-cycled, such as turning structural concrete into aggregates for roadwork and fill. (Martens, 2021)

Downcycling is in part due to the lack of end markets for the materials. For example, LaFarge Canada sells both virgin and recycled aggregates in BC. In 2024, recycled concrete and asphalt aggregates accounted for only 3% by volume of total aggregate volume sales in BC, even though the supply exists to the point that their facility is running out of space to store recycled aggregates. This issue is not specific to BC. Ontario Good Roads estimates that in 2023 approximately 3,274,166 tonnes of RAP were available, of which only about 163,360 tonnes were used by Ontario municipalities in their projects. (Mneina, Smith, & Ambaiowei, 2024)

6.3 Financial

The following section focuses on potential cost savings, including those resulting from a change in material (virgin to recycled aggregates), reduced transportation, and avoided tipping/disposal fees. It is assumed here that any avoided processing costs associated with mining and processing virgin aggregates are accounted for in the cost of recycled aggregates.

6.3.1 Material & Transportation Costs

Potential financial opportunities in the Lower Mainland, particularly those furthest away from existing sources of virgin aggregates, are as follows:

- According to LaFarge, cost savings can be as high as 30% per tonne of recycled concrete aggregates compared to virgin aggregates in the Metro Vancouver region. (LaFarge Canada, 2025)
- According to Glen Barker, cost savings range between $3 – 5$ per tonne, if not higher, against current virgin material cost in the Metro Vancouver region. (MMCD presentation, Glen Barker)
- A study of four projects located in the greater Toronto and Hamilton area found that the average savings from using RCA as opposed to virgin aggregate varied between $7 to $9 per tonne. (Assadi, 2022)
- A study published by the Canadian Technical Asphalt Association found that, based on general conditions for highway projects in Alberta, “for every 10% increase in RAP content, cost savings of approximately 7 percent can be achieved”, in large part due to the reduction in binder usage. (Ghahremani, Mah, Juhasz, & Croteau, 2023)

The District of North Vancouver (DNV) has been recycling their own RCA for over 20 years, a practice that has been historically driven by cost savings. It has been mainly used by the DNV’s utilities department as cost-effective trench backfill. The DNV has found that the economic incentives are lower on other types of projects, although they do on occasion use good quality RCA sourced from local third-party recyclers for a good price. (Sanford, 2025)

There are also foreseeable increases in the cost of virgin aggregates. The Ontario Chamber of Commerce studied the impact of distance between the source of virgin aggregates and its markets in Ontario. They estimated that for close-to-market areas (about 35 kms from markets), the average transportation cost represented 46% of total costs per tonne of sand and gravel. In the far-from-market scenario (an addition 75 kms away from markets), transportation is anticipated to represent 65% of the total cost per tonne of sand and gravel, due to a more than doubling of transportation costs. (Ontario Chamber of Commerce, 2022) As virgin aggregate come from increasingly further away, as is the case in BC, the transportation cost will also increase. This cost could be further increased by the price on carbon for fuel.

6.3.2 Tipping & Disposal Fees

Per the City of Vancouver's bylaw no. 8417 (City of Vancouver, 2025), the following requirements for acceptance of concrete and asphalt aggregates and applicable tipping fees at the Vancouver Landfill are:

- $185 per tonne for concrete and asphalt aggregate accepted as construction and demolition waste and for loads over 50 m^3 using a tandem (two axle) or tridem (three axle) trailer.
- Application can be made for loads of clean waste concrete and asphalt for road upgrades at the Vancouver Landfill and if accepted there is no charge for asphalt and concrete meeting the City Engineer's specifications.

Tipping fees at Eco-Agg Concrete Recycling's Langley location are shown in Figure 3 as an example of fees charged by recycling facilities. Rates are up to 14% lower at Eco-Agg's Abbotsford location. Non-clean and oversize loads incur surcharges, such as a $120 surcharge for a mix load of concrete and asphalt. (Eco-Agg Concrete Recycling, 2025)

Assuming that a yard of concrete waste weighs about 1.75 tonnes per cubic yard, the disposal fee at Eco-Agg in a 20 yard container at $250 is equivalent to $7 per tonne for clean concrete, which maybe accepted for free at the Vancouver Landfill if it meets the City Engineer's specifications.

Figure 3 Eco-Agg Concrete Recycling's Disposal Fees at its Langley Location (Eco-Agg Concrete Recycling, 2025)

Clean Bin Dump 3ft Minus

CLEAN; no plastic, wood, garbage or topsoil. We accept asphalt.

MATERIAL	6 YARD	8 YARD	10 YARD	12 YARD	15 YARD	20 YARD
Clean Concrete	$80.00	$110.00	$135.00	$160.00	$200.00	$250.00
Concrete with Rebar / Wiremesh	$160.00	$220.00	$270.00	$320.00	$400.00	$500.00
Asphalt	$110.00	$145.00	$180.00	$215.00	$270.00	$285.00

Non-Clean and Oversize Surcharges

Garbage in Load	+$285.00
Wood in Load	+$235.00
Top Soil / Organics in Load	+$235.00
Oversized Concrete Larger than 3ft	+$80.00
Plastic lined or tote bags	+$150.00
Mix Loads Concrete / Asphalt	+$120.00

LaFarge has indicated that due to the low sale volumes of recycled aggregates and limited capacity, its depot in Coquitlam has had to increase their recycled concrete and asphalt disposal fees. This has resulted in materials being driven further away for disposal to sites with remaining capacity and driving up costs for projects. (LaFarge Canada, 2025)

7 Conclusion

Recycled concrete and asphalt aggregates have been used in the Metro Vancouver area for over a decade. Currently however, the volumes of recycled aggregates used in the region are marginal compared to virgin aggregates. Given the significant volumes of available recycled aggregates sourced and processed in the region in proximity to urban areas, this material presents numerous opportunities for increased use. Although there are challenges that need to be address, experience within the region and from further away have been largely positive.

The update to the MMCD specifications planned for this year (2025) and anticipated adoption and alignment by Metro Vancouver and member jurisdictions, should address the regulatory uncertainty faced by some decision-makers regarding these materials, their applications and testing requirements.

The use of recycled aggregates has also been shown to have significant environmental and financial benefits. These are likely to increase with time as nearby virgin aggregates become depleted, leading to the use of sources from further away.

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Appendices

Appendix A Scope of Work

MORRISON HERSHFIELD

December 23, 2023

Allen Jensen, P.Eng., AScT.
Allen.jensen@metrovancouver.org
Senior Project Engineer, Solid Waste Planning
Solid Waste Services, Metro Vancouver

Dear Allen:

Re: Metro Vancouver Solid Waste Management Plan – Concrete and Asphalt Recycling Opportunities Review

Morrison Hershfield (MH) submitted a Proposal on February 16, 2023, in response to REQUEST FOR PROPOSAL (RFP) No. 23-013 Consulting Services for Solid Waste Management Plan Update. The contract between MH and Metro Vancouver was finalized on April 24, 2023, and includes a revised project budget dated March 16, 2023.

It is understood that the scope of the technical work is evolving to meet Metro Vancouver's needs and to address considerations emerging from the engagement work. MH and Metro Vancouver have agreed that MH will develop proposals for distinct pieces of work for Metro Vancouver's consideration / approval.

This proposal is developed based on a request from Metro Vancouver for a review of concrete and asphalt recycling opportunities. The request was formalized in an email on November 15, 2023.

Background

As part of updating Metro Vancouver's solid waste management plan, Metro Vancouver has identified the need to review opportunities and challenges for concrete and asphalt recycling.

The 2011 Integrated Solid Waste and Resource Management Plan, strategy 2.4 states that "the DLC sector has very high recycling rates due to high levels of concrete and asphalt recycling." Metro Vancouver estimates that 1.16 million tonnes of asphalt and concrete were recycled in the region in 2021. The recycled concrete and asphalt made up almost 50% of all recycled material in 2021 which highlights an opportunity for innovative solutions for recycling of a material stream that is in steady supply.

Production of concrete and asphalt is an energy-intensive process. Hence, recycling the materials can result in significant financial and environmental benefits through avoided greenhouse gas emissions, minimized landfill consumption, and offsetting the need for use of virgin materials.

Metro Vancouver is looking to identify and assess potential new opportunities for concrete and asphalt recycling in support of efforts to maximize waste diversion and development of the new solid waste management plan. In evaluating new opportunities for recycled aggregate concrete (RAC) and recycled asphalt pavement (RAP), Metro Vancouver has noted the importance of identifying current best practices and leading-edge examples, the financial and environmental

business case for each opportunity, and related risks. Metro Vancouver has also noted the importance of identifying opportunities and options to reduce barriers for increased diversion and recycling of concrete and asphalt in the region.

Scope of Work

The following outline describes Tasks 1-8 requested by Metro Vancouver relating to concrete and asphalt recycling opportunities. The tasks include:

- Task 1: Scope Development
- Task 2: Literature Review: Local Regulatory & Contractual Framework
- Task 3: Review Current Status of Concrete and Asphalt Recycling in Metro Vancouver
- Task 4: Identify Best Practices & Experience in Other Jurisdictions
- Task 5: Workshop on Opportunities Identified
- Task 6: Develop a Business Case for Identified Opportunities
- Task 7: Communication and Reporting
- Task 8: Project Management

The tasks are outlined in detail below. One of the tasks involves interviews and another involves a workshop. Time has been assumed to develop, coordinate, undertake, transcribe, analyze, and report on these.

A table of contents for the reporting template will be developed at the outset of the work. This will be done in collaboration with Metro Vancouver staff. The findings under each task described below will be added to the reporting template and issued to Metro Vancouver for review for each reporting update. We have assumed that two iterations of each reporting stage will be required.

Task 1 – Scope Development

MH will prepare a short PowerPoint presentation and present the draft scope of work and approach for developing the scope to four stakeholder groups. During these presentations, MH will look for feedback in the following three areas:

1. What's important to your organization when considering new opportunities and current challenges for concrete and asphalt recycling?
2. What data do you have access to that can inform this project?
3. Are there specific applications of concrete and asphalt recycling that we should consider?

Stakeholder Presentations:

- Regional Engineers Advisory Committee Solid Waste Subcommittee (REAC-SW)
- Solid Waste Management Public / Technical Advisory Committee (PTAC)
- Solid Waste and Recycling Industry Advisory Committee (IAC)
- Regional Engineers Advisory Committee (REAC)

We assume that Metro Vancouver will take formal notes during the committee meetings. MH will take informal meeting notes on stakeholder feedback and these notes will be reviewed to inform the development of the following tasks. MH will also allow stakeholders to provide written feedback on the scope for a duration of five (5) working days after each meeting. Any necessary changes to the scope of work will be made accordingly and the final scope of work will be sent to Metro Vancouver for approval.

Task 2 – Literature Review: Local Regulatory & Contractual Framework

MH will conduct a comprehensive literature review of the local regulatory and contractual frameworks and best practices and experiences in other jurisdictions, with particular focus on those, who track and publish the quantity of recycled material used in road construction or project development. For this, MH will:

1. Review the regulatory and contractual framework of all member municipalities and, for each:
    - Identify gaps in the frameworks such as local bylaws, MMCD design guidelines, design handbooks, member jurisdiction subdivision servicing guidelines, Transportation Association of Canada (TAC) Best Practices Guide, and Ministry of Transportation (MOT) Standard Specifications for Highway Construction.
    - Identify opportunities and challenges for expanded and accepted concrete and asphalt recycling within each member municipality.
2. Research and identify best practices globally for concrete and asphalt waste management and recycling to understand opportunities and barriers. To do this, MH will:
    - Conduct a literature review on four to five regional districts that have implemented concrete and asphalt recycling plans incorporating the use of concrete and asphalt in road construction and project development. This will encompass an examination of initiatives both within Canada and internationally.

MH will include the findings in the report template and issue to Metro Vancouver for review and comment.

Task 3 - Review Current Status of Concrete and Asphalt Recycling in Metro Vancouver

MH will analyze the current status of existing management practices for concrete and asphalt recycling within Metro Vancouver to obtain a comprehensive understanding of the existing practices. MH will:

1. Review of reference documents, current policies, and the region's waste quantities to define the current status of concrete and asphalt recycling and to establish a baseline. In this review, MH will identify:
    - Challenges, opportunities, and current gaps.
2. MH will interview up to 20 interested parties. This may include leading experts such as: the BC Roadbuilders and Heavy Construction Association; member jurisdiction staff; processors; equipment suppliers; construction contractors; consultants; and leading jurisdictions. We envision one interview per interested party to complete Task 3. MH will develop a list of contacts for Metro Vancouver's review, comment, and approval prior to starting the interview process. We will arrange and conduct interviews with interested parties.

MH will include the findings in the report template and issue to Metro Vancouver for review and comment.

Task 4 – Identify Best Practices & Experience in Other Jurisdictions

MH will conduct a comprehensive review of the best practices and experiences in other jurisdictions, with particular focus on those, if any, who track and publish the quantity of recycled material used in road construction or project development. For this, MH will:

1. Assess applicability by looking into benefits, drawbacks, and challenges of identified best practices. To do this,
    - MH will connect with MH internal structural, geotechnical and transportation engineering departments for further insight of the uses in concrete and asphalt recycling.
2. Using information collected in Task 2 and Task 3, assess current practices in Metro Vancouver that were identified in Task 3 to determine ways that they can be improved, if possible. Identify specific ideas that could be implemented in Metro Vancouver.
3. Compile a list of possible opportunities to be considered based on research done in Tasks 2-4 to be presented at the workshop.

MH will include the findings in the report template and issue to Metro Vancouver for review and comment.

Task 5 – Workshop on Opportunities Identified

MH and Engage Delaney will conduct a workshop to present and review the opportunities, preliminary business case, that have been identified in Tasks 2-4 and discuss how these may be used in the Metro Vancouver region. The purpose of this workshop is to identify which opportunities are feasible, what barriers/challenges are present, and how to overcome those. This may also include new opportunities being identified through discussion. By discussing these opportunities, this workshop will also play a role in helping generate conversation around understanding that recycled concrete and asphalt, in certain applications, is an acceptable material for construction. MH will partner with Engage Delaney to plan and conduct the workshop. For this, MH and Engage Delaney will:

1. Identify and invite, with Metro Vancouver, a list of participants. This will include a maximum of 40-50 representatives from industry, committees, and member municipalities.
2. Develop a 2-page summary document outlining the findings in Tasks 2-4. This will be sent out one week in advance to all participants. The purpose of this document is to ensure all participants enter the workshop with background knowledge and have time to process the information beforehand. This will equip them to better participate in the workshop.
3. Develop a short PowerPoint presentation on the findings in Tasks 2-4. This will be used to open the workshop.
4. Develop a workshop agenda. This will be sent to Metro Vancouver in advance for approval.
5. Facilitate the workshop. This is expected to be 2 hours and we anticipate it will include:
    - A 20-minute presentation.
    - A question period following the presentation.

    - A facilitated discussion among participants to work through questions and/or problems together, with the goal of identifying which opportunities are feasible in Metro Vancouver.

6. Compile a final list of opportunities based on data collected in Tasks 2-4 and in the workshop. This may include new opportunities and enhancing current practices.

MH will include the findings in the report template and issue to Metro Vancouver for review and comment.

Task 6 – Develop a Business Case for Identified Opportunities

MH will develop a business case for concrete and asphalt recycling in Metro Vancouver. We anticipate no more than five opportunities will be assessed. To do this, MH will:

1. Assess the financial and environmental impacts of concrete and asphalt recycling for each opportunity identified in the memo from Task 5. This may, for example, include financial benefits of using recycled instead of virgin materials and offsetting greenhouse gas emissions.
2. Assess the risks of concrete and asphalt recycling for each opportunity identified in the memo from Task 5. This will include identifying the level of risk for each opportunity. For high-risk opportunities, potential mitigation strategies will be included.
3. Develop a business case for concrete and asphalt recycling based on the findings from steps 1 and 2 of Task 6 that may include:
    - Identifying opportunities for Metro Vancouver to work with member municipalities and applicable bylaws and strategies for each opportunity.
    - A list of opportunities that may enhance current practices.

Task 7 – Communication and Reporting

MH will develop a final report including all findings and recommendations following the completion of Task 6. The final report will also include an executive summary and appendices (as needed). The communication and reporting task includes four (4) in-person presentations for the stakeholder groups on the findings from all tasks. The stakeholder groups include:

- Regional Engineers Advisory Committee Solid Waste Subcommittee (REAC-SW)
- Solid Waste Management Public / Technical Advisory Committee (PTAC)
- Solid Waste and Recycling Industry Advisory Committee (IAC)
- Regional Engineers Advisory Committee (REAC)

Appendix B Literature Review Findings

Master Municipal Construction Documents (MMCD)[1]	Member jurisdictions[2-10]	Transportation Association of Canada (TAC)[11]	Ministry of Transportation and Infrastructure (MOTI)[12,13]	CSA Group[14]	ASTM International[15]
Recycled Aggregates Definitions					
Recycled Asphalt					
Section 31 05 17 – Aggregates and Granular Materials 2.13 Products: **Recycled Asphalt Pavement (RAP)** **2.13.1** Recycled Asphalt Pavement (RAP) shall consist of asphalt concrete free from organic matter, contaminated and other extraneous material. **2.13.3** RAP gradation shall not exceed the maximum aggregate size for the specified asphalt mix.	*No modifications*	**Recycled Asphalt Pavement (RAP)** - Removed and/or processed flexible pavement materials which are composed of a mix of asphalt cement and aggregates.	**Reclaimed Asphalt Pavement (RAP)** - Asphalt Pavement that has been removed and processed, for the purpose of recycling. - Removed and/or reprocessed pavement materials containing asphalt and aggregates. These materials are generated when asphalt pavements are removed for reconstruction and/or resurfacing. When properly screened and crushed, it consists of high-quality aggregate coated by asphalt cement. - Classified RAP: RAP obtained from Ministry roadways. - Unclassified RAP: RAP obtained from other sources or mixed		
Recycled Concrete					
		Reclaimed concrete material (RCM) - Removed and/or processed old Portland cement concrete (PCC).		**Reclaimed (or recycled) concrete aggregate (RCA)** In most cases, concrete recovered from roadways, sidewalks, buildings, and bridges is stockpiled and, when sufficient material is present, a portable crusher brought to the site and the material is crushed and graded to produce RCA. **Reclaimed concrete material (RCM)** RCM is a generic term for after-use, hardened, hydraulic cement concrete that has been obtained from variable sources such as sidewalks, concrete roads, and construction and demolition waste (CDW) for use as a construction material. If one source of demolished concrete (e.g., a pavement), is made into RCA then the quality of the "single source RCM" will be more uniform and consistent than "mixed source RCM" made from several sources of demolished concrete. **Construction and demolition waste (CDW)** CDW consists of building materials arising from activities such as the construction of buildings and civil infrastructure, total or partial demolition of buildings and civil infrastructure, road planning, and maintenance. CDW can be mainly composed of concrete, but might also be contaminated with other demolition materials. **Returned hardened concrete (RHC)** RHC is unused concrete material obtained from plastic concrete that has been returned directly to the concrete plant, or from in plant waste streams, which is allowed to harden and processed by crushing. RHC also includes unused precast concrete products that have been returned to the plant and crushed. It can be used for the same applications as CDW and RCM. If the RCA is manufactured from returned-to-plant concrete, then even though the paste/mortar fraction might vary with the original concrete quality, the aggregates in the RHC will be essentially the same as the virgin aggregates; thus RHC can be better suited for use in concrete. The mortar fraction of RHC can be compromised during the wash-out procedures of concrete trucks returning unused concrete. If the drum of the truck is washed out into the same pile as the unused concrete then the water-to-cementitious materials ratio of the mortar fraction can be significantly increased. High quality RHC depends on proper material handling/storage procedures.	

Recycled Aggregates Definitions

Recycled Concrete and Asphalt Mix

Master Municipal Construction Documents (MMCD)[1]

Section 31 05 17 – Aggregates and Granular Materials

2.11 Products: **Recycled Aggregate Material**

2.11.1

[...] Recycled material shall consist only of aggregates, crushed Portland cement concrete, or asphalt that is free of impurities.

2.11.2

Recycled Concrete and Asphalt (RCA)

2.11.3

To be well graded mixture of aggregates, crushed Portland cement concrete, or asphalt, substantially free from lumps and impurities. The material shall be manufactured to conform to the following gradation.

Sieve Designation		Percent Passing		
25	mm			100
19	mm	80	-	100
9.5	mm	50	-	85
4.75	mm	35	-	70
2.36	mm	25	-	50
1.18	mm	15	-	35
0.300	mm	5	-	20
0.075	mm	0	-	20

Member jurisdictions[2-10]

City of Richmond – Delete 2.11.1 and replace with

[...] Recycled material should consist only of aggregates, crushed portland cement concrete, or crushed asphaltic pavements (with exceptions for recycled asphalt as per Supplementary Specification 2.7.3 (ss) [c.f. chap. 2.7.1]); other construction and demolition materials such as bricks, plaster, etc. are not acceptable.

City of Vancouver – Delete 2.11.1 and replace with

25 mm Minus Combined Crushed Recycled Aggregate – City of Vancouver Aggregate #30:

This material shall be of uniform quality, crushed to size as necessary and consisting of sound, tough, durable, mechanically crushed mixture of concrete, asphalt slab, gravel and natural sands. This crushed product shall meet the gradation and other specified requirements as indicated below. Final acceptance and usage of this material will be at the sole discretion of the City Engineer. The grading limits shall be: [see quality control section for table with other properties]

Sieve Designation	Percent Passing
25.0mm	100
19.0mm	94 - 100
12.5mm	62 - 95
9.5mm	49 - 85
4.75mm (No. 4)	35 - 63
2.36mm (No. 8)	26 - 47
1.18mm (No. 16)	19 - 37
600µm (No. 30)	13 - 29
300µm (No. 50)	8 - 21
150µm (No. 100)	5 - 15
75µm (No. 200)	3 - 9

City of Richmond – Delete 2.11.2 and replace with

Recycled Concrete and Asphalt (RCA)

To be well graded mixture to match gradation of intended use.

Transportation Association of Canada (TAC)[11]

Ministry of Transportation and Infrastructure (MOTI)[12,13]

CSA Group[14]

ASTM International[15]

Recycled Aggregate Base (RAB)

- Aggregate derived from processed/crushed asphalt or concrete pavement or structural concrete. RAB may be called **recycled asphalt pacement** (RAP) or **recycled concrete aggregate** (RCA)

Master Municipal Construction Documents (MMCD)[1]	Member jurisdictions[2-10]	Transportation Association of Canada (TAC)[11]	Ministry of Transportation and Infrastructure (MOTI)[12,13]	CSA Group[14]	ASTM International[15]
Uses					
Recycled Asphalt					
Section 31 05 17 – Aggregates and Granular Materials 2.3 Products: Pit Run Gravel *No section 2.3.3*	**City of Coquitlam – Add to 2.3.3** Asphalt millings free from contaminated and other extraneous material, conforming to the specified gradations may be used as pit run gravel. The use of asphalt millings shall be approved by the Contract Administrator and the City prior to use.	- Reuse in paving mixtures (bound application) is preferred from both materials management and sustainable development viewpoints. - Milled or crushed RAP can be used in a number of highway construction applications. These include its use as an aggregate substitute and asphalt cement supplement in recycled asphalt paving (hot mix or cold mix), as a granular base or subbase, stabilized base aggregate, or as an embankment or fill material. - Blending granular RAP with suitable materials is necessary to attain the bearing strengths needed for most load-bearing unbound granular applications. RAP by itself may exhibit a somewhat lower bearing capacity than conventional granular aggregate bases. - Stockpiled RAP material may also be used as a granular shouldering material, fill or base for embankment or backfill construction, although such an application is not widely used and does not represent the highest or most suitable use for the RAP. - The use of RAP as an embankment base may be a practical alternative for material that has been stockpiled for a considerable time period, or may be commingled from several different project sources. Use as an embankment base or fill material within the same right of way may also be a suitable alternative to the disposal of excess asphalt concrete that is generated on a particular highway project. - Research into the difference in emissions of bound applications such as hot-in-place and cold-in-place recycling compared standard hot-mix asphalt production has not been conducted. However, for unbound applications such as the use of RAP in granular base or as embankment fill, detailed leachate testing has been completed in Florida (Brantley, 1999) which indicated that the concentrations of VOCs, PAHs, and heavy metals (Ba, Ca, Cr, Cu, Pb, Ni and Zn) were below the detection limit and hence below the applicable Florida State regulatory groundwater guidance concentrations.	- Provides standards for the use of RAP in hot mix asphalt construction using both Classified and Unclassified RAP.		
2.7 Products: Granular Pipe Bedding and Surround Material **2.7.3** Other permissible materials: only where shown on Contract Drawing or directed by Contract Administrator shall drain rock, pit run sand, river sand or approved native material be used for bedding and pipe surround. Additional MMCD's guidance regarding the uses of RAP in warm-mix asphalt, hot-mix asphalt and superpave hot-mix asphalt concrete paving are presented in the mix design section.	**City of Richmond – Add 2.7.3** Recycled asphalt shall not be used as pipe bedding and surround material.				

Master Municipal Construction Documents (MMCD)[1]	Member jurisdictions[2-10]	Transportation Association of Canada (TAC)[11]	Ministry of Transportation and Infrastructure (MOTI)[12,13]	CSA Group[14]	ASTM International[15]
Uses					
Recycled Concrete					
Section 31 05 17 – Aggregates and Granular Materials 2.3 Products: Pit Run Gravel **2.3.2** Recycled concrete free from contaminated and other extraneous material, conforming to the specified gradations may be used as pit run gravel. 2.7 Products: Granular Pipe Bedding and Surround Material **2.7.1** Crushed or graded gravels: to conform to following gradations: [Table] **2.7.2** Recycled concrete free from contaminated and other extraneous material, conforming to the Type 1 gradations, may be used as pipe bedding and surround material.	**City of Coquitlam – Add to 2.3.2** The use of recycled concrete shall be approved by the Contract Administrator and the City prior to use. **City of Surrey – Delete 2.7.1** (no replacement) **City of Coquitlam – Add to 2.7.1** All recycled or other extraneous materials shall be approved by Contract Administrator and the City prior to use. **City of Maple Ridge – Amend 2.7.1 as follows** Delete the following text: "Recycled concrete free from contaminated and other extraneous material, conforming to the Type 1 gradations, may be used as pipe bedding and surround material." **City of Pitt Meadows – Delete 2.7.1 and replace text with** Crushed or graded gravel to conform to Type 1 gradation as specified on chart in clause 2.7.1.	- Rather than hauling the demolished concrete material to a landfill, the reuse and recycling of this material is well-established and it can be processed for use in new transportation infrastructure projects as roadway base and subbase courses, in portland cement concrete mixes, or as an embankment or fill material. - RCM has good drainage properties, excellent durability and is able to stabilise wet, soft, underlying soils. - In granular base and subbase applications, RCM can either be blended with natural aggregate or used as a complete replacement of natural aggregates in many agency specifications. - Reclaimed concrete material (RCM) can be used as a coarse and/or fine aggregate in portland cement concrete pavements. Crushed RCM which meets specification requirements for concrete aggregate is considered by many jurisdictions to be conventional coarse aggregate and can be used interchangeably. However, the use of RCM fines in portland cement concrete mixtures has sometimes led to significant reductions in concrete workability, strength and finish quality. In this regard, blending of RCM fines is recommended with substitution rates of RCM fines for natural fines of a maximum of 10 to 20 percent. - As most reclaimed concrete materials are generally considered to be equivalent to conventional aggregates, they are more than suitable for use in embankment or structural fill applications. This application is discouraged however as it is not considered to make the best use of this high quality material unless either no other suitable aggregates are available or there are no other local uses for the RCM. - It should be noted that RCM has an elevated alkalinity due to the nature of portland cement concrete and this can be potentially corrosive to aluminum or galvanized steel pipes and this application should be avoided. In addition, in some lower quality concretes which have free CAO, tufa-like precipitates (CaCO3) can form which have been know to clog drainage systems.	Allows for concrete aggregates in concrete used for minor works. Concrete for minor works is described as non-structural reinforced and non-reinforced cast-in-place concrete, in applications such as fence post and guardrail embedment, thrust blocks and minor structures such as small culvert endwalls.	At present, the majority of this material is used in place of virgin aggregate for unbound road base applications. There has been little use of RCA in conrete. It is likely that in the future RCA will continue to be used in road base applications in place of virgin aggregates. However, RCA may also be used as a partial or total replacement of coarse aggregate for non-structural applications such as sidewalks, curb and gutter and some pavements or concrete base and unshrinkable fill (also known as controlled low strength material or CLSM) and other low risk applications. Controlled Low-Strength Material (CLSMs) including unshrinkable fill is a self-levelling cementitious- based material used as a fill material. RCA can be used as aggregate for the production of CLSM, unshrinkable fill and concrete of strength < 10 MPa. CLSM and unshrinkable fill are covered under Clause 8.11. Their typical applications include utility fills, fills on bridge approaches and structural fill. CLSM in general and unshrinkable fill in particular are possible applications for immediate use of RCA.	

Master Municipal Construction Documents (MMCD)[1]	Member jurisdictions[2-10]	Transportation Association of Canada (TAC)[11]	Ministry of Transportation and Infrastructure (MOTI)[12,13]	CSA Group[14]	ASTM International[15]
Uses					
Recycled Concrete and Asphalt Mix					
Section 31 05 17 – Aggregates and Granular Materials		- While RAP grindings, millings and/or pieces can be blended with conventional aggregate (sand and gravel or crushed rock) or RCM for use as granular subbase or shouldering material (unbound application), such use is discouraged as it does not utilize the asphalt cement binder or recover the energy invested in its production unless the material was otherwise unusable in a bound application (physical or environmental characteristics unsuitable) (MTQ, 2002).			Uses of RAB: - Use of recycled aggregate base has become commonplace in transportation applications. - RAB may be used alone or in mixtures with other aggregate materials (virgin and/or recycled) in the production of unbound base course materials.
2.11 Products: Recycled Aggregate Material					
2.11.1 Aggregates containing recycled material may be utilized if approved by the Contract Administrator. In addition to meeting all other conditions of this specification, recycled material should not reduce the quality of construction achievable with quarried materials. [...]	**City of Burnaby – Add to 2.11.1** Recycled concrete and asphalt material may only be considered for Sidewalk and Multi-Use Pathway granular base and granular subbase. Do not use Recycled Concrete and Asphalt material where leachates could result in harm to environment. **City of Coquitlam – Delete 2.11.1 and replace with the following** Aggregates containing recycled material may be utilized if approved by the Contract Administrator and the City. In addition to meeting all other conditions of the specifications, recycled material should not reduce the quality of construction achievable with quarried materials. [...]				
Section 32 24 13 – Roadway Excavation, Embankment and Compaction					
2.2 Products: Specified Materials					
2.2.1 Backfill for embankment fill (subgrade fill) to be: (1) Approved native or imported granular material. (2) Pit run gravel. (3) Pit run sand. (4) River sand. (5) Recycled concrete and asphalt (RCA).	**City of Burnaby – Delete 2.2.1 and replace with** Backfill for embankment fill (subgrade fill) to be: .1 Approved native or imported granular material. .2 Pit run gravel. .3 Recycled concrete and asphalt (RCA) where specified by Contract Administrator.				
Section 33 30 01 – Sanitary Sewers					
2.5 Products: Granular Pipe Bedding and Surround Material					
No section 2.5.4	**City of Vancouver – Add 2.5.4** Initial backfill material shall be used above the haunching material and shall be one of the following, as indicated in the Contract Documents or as directed by the City Engineer: [...] .2 25mm Minus Combined Crushed Recycled Aggregate (City of Vancouver Aggregate#30) as per Section 31 05 17 Aggregates and Granular Materials.				
2.6 Products: Backfill Material					
No section 2.6.3	**City of Vancouver – Add 2.6.3** Refer to Standard Detail Drawing G4.4. This backfill material shall be free of large stones and / or frozen material. Backfill material shall be to be one of the following, as indicated in the Contract Documents or as directed by the City Engineer: [...] .3 25mm Minus Combined Crushed Recycled Aggregate (City of Vancouver Aggregate #30) as per Section 31 05 17 Aggregates and Granular Materials. [...]				

Master Municipal Construction Documents (MMCD)[1]	Member jurisdictions[2-10]	Transportation Association of Canada (TAC)[11]	Ministry of Transportation and Infrastructure (MOTI)[12,13]	CSA Group[14]	ASTM International[15]
Uses					
Section 33 40 01 – Storm Sewers					
2.9 Products: Granular Pipe Bedding and Surround Material					
No section 2.9.4	**City of Vancouver - Add 2.9.4** Initial backfill material shall be used above the haunching material and shall be one of the following, as indicated in the Contract Documents or as directed by the City Engineer: [...] .2 25mm Minus Combined Crushed Recycled Aggregate (City of Vancouver Aggregate #30) as per Section 31 05 17 Aggregates and Granular Materials. In accordance with Standard Detail Drawing G4.4.				
2.10 Products: Backfill Material					
No section 2.10.3	**City of Vancouver – Add 2.10.3** Refer to Standard Detail Drawing G4.4. This backfill material shall be free of large stones and / or frozen material. Backfill material shall be to be one of the following, as indicated in the Contract Documents or as directed by the City Engineer: [...] .3 25mm Minus Combined Crushed Recycled Aggregate (City of Vancouver Aggregate #30) as per Section 31 05 17 Aggregates and Granular Materials. [...] The **City of Langley** allows crushed concrete and recycled asphalt to be used as surface material for urban nature trails.				

Master Municipal Construction Documents (MMCD)[1]	Member jurisdictions[2-10]	Transportation Association of Canada (TAC)[11]	Ministry of Transportation and Infrastructure (MOTI)[12,13]	CSA Group[14]	ASTM International[15]
Sourcing of Recycled Aggregates					
Recycled Asphalt					
Section 31 05 17 – Aggregates and Granular Materials		- RAP and RCM are produced during demolition, reconstruction and maintenance projects of roadways and can typically be obtained from RAP and/or RCM processing facilities. -To decrease the variability in RAP quality, they should be stockpiled per source or per similar sources.	- The most common sources of RAP are cold milling, full depth pavement removal and asphalt plant waste. - Classified RAP: RAP obtained from Ministry roadways. - Unclassified RAP: RAP obtained from other sources or mixed with RAP from other sources.		
2.13 Products: Recycled Asphalt Pavement (RAP)					
2.13.2 Source of RAP shall be from asphalt removal, surplus generated during plan start-up, transition between mixes, plant clean out, or excess mix produced that could not be placed.	*No modifications*				
Recycled Concrete					
Recycled Concrete and Asphalt Mix					
Section 31 05 17 – Aggregates and Granular Materials					The recycled aggregate is derived from processed/crushed asphalt or concrete pavement or structural concrete, including reclaimed asphalt, hydraulic cement concrete, lean concrete base, cement treated base, or natural aggregates. The recycled aggregate materials shall be clean, hard, sound, durable, and uniform in quality. Overall, all incoming materials shall be largely free from reinforcing steel, trash; wood; roots; vegetation; soft, friable, thin, elongated or laminated pieces; disintegrated material; and hazardous materials, and also shall be free from solvents or other contaminating substances.
2.11 Products: Recycled Aggregate Material					
2.11.2 Recycled Concrete and Asphalt (RCA)	**City of Vancouver – Add 2.11.2** […] All sources for recycled material must be pre-approved by the City Engineer.				

Sampling, Testing and Quality Control

Recycled Asphalt

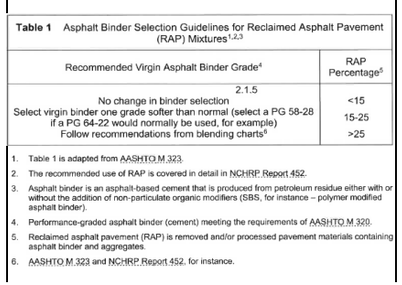
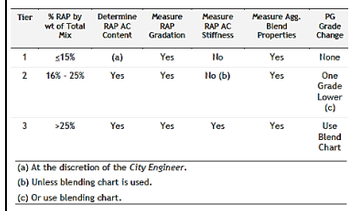
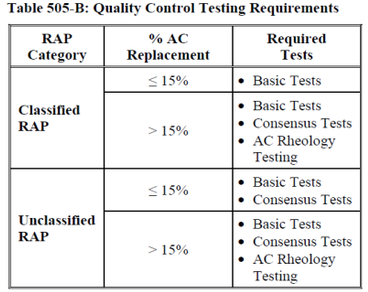
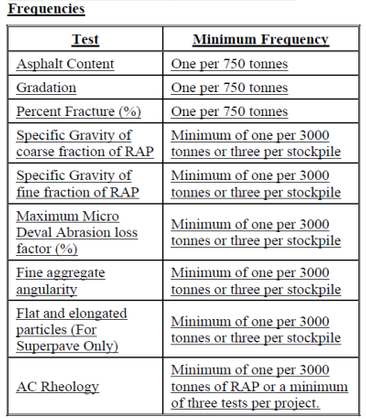
Master Municipal Construction Documents (MMCD)[1]	Member jurisdictions[2-10]	Transportation Association of Canada (TAC)[11]	Ministry of Transportation and Infrastructure (MOTI)[12,13]	CSA Group[14]	ASTM International[15]
Section 31 05 17 – Aggregates and Granular Materials 3.1 Execution: Handling **3.1.4** Handling and storing of RAP shall be in accordance with National Asphalt Pavement Association (NAPA) – Best Practices for RAP and RAS Management	*No modifications*	- Crushing RAP limits the size for the largest fragment and creates a more consistent product. - RAP millings can generally be recycled without further crushing or screening. - Crushing has been found to not cause as much degradation as milling; consequently, the gradation of crushed and screened RAP is generally not as fine as a milled RAP, but again finer than virgin aggregates for similar mixes. - RAP should be tested if there is a suspicion that it contains asbestos fibres. Contaminated RAP should be disposed of. - All provinces except Nova Scotia and Prince Edward Island permit RAP to be used in HMA, provided that testing is completed to ensure the quality (penetration/viscosity, or performance grading for Superpave mixtures or the asphalt cement) and uniformity of the RAP source and that the RHM meets all specification requirements for asphalt concrete. - The quality of RAP is dependent on the source of the old pavement; the amount of excess granular material, soil and debris; the number of times the pavement has been resurfaced; the amount of patching and/or crack sealing; the applications of seal coats; and the surface course asphalt concrete's frictional properties. - The asphalt cement content of RAP will vary depending on the source but can be expected to range between 3 and 7 percent by weight. The existing asphalt cement in the RAP will have aged and is typically somewhat harder (stiffer) than similar new asphalt cement. This is due primarily to exposure of the pavement to atmospheric oxygen (oxidation) during use and weathering. The degree of stiffness depends on several factors including: the mixing temperature/time (increased mixing temperatures can harden asphalt binders); the degree of compaction (stiffness increases if asphalt concrete mix not well compacted); ratio of asphalt cement to air voids content (stiffness increases with lower asphalt/higher air voids content); and age in service (stiffness increases with age).	- Truck drivers, plant QC personnel and loader operators should ensure that RAP stockpiles do not contain unwanted debris or contaminated material. - Screening RAP according to size is recommended as it increases quality and reduces variability of RAP properties. A maximum RAP fragment size of 37.5 mm is advised for use in hot mix asphalt. - Crushing RAP also helps achieve the desired gradation. The RAP should be screened prior to crushing it. - RAP stockpiles should be sheltered from precipitation to minimise the accumulation of moisture; adequately drained and free of contamination; limited to 4 m in height with an arc-sharped, conical, and uniform shape. - Circulating on RAP stockpiles should be minimised to avoid compaction. - Once a stockpile has been sampled and characterised, no further material should be added to it. - The quality control testing requirements for RAP shall be based on the present of AC [asphalt cement] replacement in the asphalt mix and comply with the requirements listed in Table 505-B and Table 505-C, and the corresponding tests specified in SSS 505.07.01. a) Basic Tests: moisture content; asphalt content; gradation; percent fracture; and specific gravity of coarse and fine fractions. b) Consensus Tests: maximum Micro Deval Abrasion loss factor (%); standard test methods for un-compacted void content of fine aggregate (ASTM C1252); percentage of flat and elongated particles (for Superpave mixes only). - At least one sample per 750 tonnes of RAP in the stockpile or a minimum of ten samples per stockpile should be taken and retained for testing.		QA/QC measures: - ASTM C1252, ASTM D75 - For RAP with binder and/or asphalt content, having a loss of no more than 20 % by the Micro-Deval test (following D6928) can be used as guidance. The asphalt content (determined using D6307) of the final recycled aggregate product also may be specified.
Section 32 12 16 – Hot-Mix Asphalt Concrete Paving 2.1 Products: Materials **2.1.2** Reclaimed asphalt pavement (RAP): Crush and screen so that 100% of reclaimed asphalt pavement material passes 37.5 mm screen before mixing.	*No modifications*				
3.3 Execution: Preparation *No section 3.3.7*	**City of Surrey – Add 3.3.7** When removing reclaimed asphalt pavement (RAP) for subsequent incorporation into hot mix asphalt concrete paving, prevent contamination with base aggregates.				
Section 32 12 17 – Superpave Hot-Mix Asphalt Concrete Paving 2.1 Products: Materials **2.1.2** Reclaimed asphalt pavement (RAP): processing, quality, and use to requirements of NCHRP Report 452 and Table 1, with a RAP incorporation limit of 25% in lower course Superpave HMA and 15% in upper course Superpave HMA. 	**City of Richmond – Add 2.1.2** [...] The use of shingles (recycled) is not permitted in the design mix.				

Table 1 Asphalt Binder Selection Guidelines for Reclaimed Asphalt Pavement (RAP) Mixtures[1,2,3]

Recommended Virgin Asphalt Binder Grade[4]	RAP Percentage[5]
2.1.5 No change in binder selection Select virgin binder one grade softer than normal (select a PG 58-28 if a PG 64-22 would normally be used, for example) Follow recommendations from blending charts[6]	<15 15-25 >25

1. Table 1 is adapted from AASHTO M 323.
2. The recommended use of RAP is covered in detail in NCHRP Report 452.
3. Asphalt binder is an asphalt-based cement that is produced from petroleum residue either with or without the addition of non-particulate organic modifiers (SBS, for instance – polymer modified asphalt binder).
4. Performance-graded asphalt binder (cement) meeting the requirements of AASHTO M 320.
5. Reclaimed asphalt pavement (RAP) is removed and/or processed pavement materials containing asphalt binder and aggregates.
6. AASHTO M 323 and NCHRP Report 452, for instance.

Master Municipal Construction Documents (MMCD)[1]	Member jurisdictions[2-10]	Transportation Association of Canada (TAC)[11]	Ministry of Transportation and Infrastructure (MOTI)[12,13]	CSA Group[14]	ASTM International[15]
Sampling, Testing and Quality Control					
2.2 Products: Mix Design					
No section 2.2.6	**City of Vancouver – Add 2.2.6** Superpave asphalt mix may contain up to a maximum 15% RAP by weight of total mix without a special mix design. The City Engineer may approve a higher proportion of RAP if the Contractor can demonstrate with proof documentation their ability to produce a mix meeting the requirements of the specification 		- If the asphalt mix from an existing pavement is to be used as RAP, 150 mm diameter cores should be extracted at a frequency of at least one core every 1.5 kilometre in each lane prior to the start of the project. The asphalt mix from the pavement lift to be recycled should be tested to determine the properties of the aggregates and the asphalt cement in the pavement. - RAP stockpiles should be sampled as they are being built at the location where they will be fed into the asphalt plant. - ASTM D75 or AASHTO R 90 sampling procedures, normally used for virgin aggregates, should also be used to sample RAP aggregates. - The quality control tests on the RAP and the extracted aggregates should be completed at the minimum frequencies specified in Table 505-C. - All RAP aggregates retained after extraction should be combined together into one sample. The combined sample should then be sieved and split into coarse and fine fractions and used to determine the specific gravity of the recycled aggregates. **Table 505-B: Quality Control Testing Requirements**  **Table 505-C: Minimum Quality Control Test Frequencies** 		

Master Municipal Construction Documents (MMCD)[1]	Member jurisdictions[2-10]	Transportation Association of Canada (TAC)[11]	Ministry of Transportation and Infrastructure (MOTI)[12,13]	CSA Group[14]	ASTM International[15]
Sampling, Testing and Quality Control					
Recycled Concrete					
		- Processing RCM generally consists of breaking apart concrete pieces and removing steel reinforcements, primary crushing and sizing, followed by secondary crushing and a final screening. - Recycled concrete material may be contaminated with chloride ions from the application of deicing salts to roadway surfaces or with sulphates from contact with sulphate-rich soils which may exceed provincial environmental regulations when tested. It is also important to ensure that the RCM used does not contain aggregate susceptible to alkali-silica reactions as this can have a detrimental effect on the performance (FHWA, 2008). - The quality of the original portland cement concrete will greatly affect its potential recyclability. Some recycled concrete material can contain potentially deleterious substances, such as sulphates/sulphides (from old drywall and plaster for instance if blended with construction and demolition wastes), chlorides and alkali reactive aggregates. The gypsum in modern drywall reacts very strongly with the portland cement materials in RCM to form expansion products including thaumasite and ettringite. Recycled concrete aggregate with as little as 3 percent of contamination with gypsum has been shown to have a volumetric expansion of 10 percent or even greater. As a result, it is imperative that the quality of the RCM must be strictly controlled to be successfully used as a recycled aggregate.		-Strict quality control procedures are required to ensure that recycled concrete aggregate material will not adversely affect the quality of the concrete product. In some cases, every truck load will need to be examined for contamination, especially when concrete is being brought to the recycling site from a variety of different sources. In cases where concrete from a single known structure or pavement is being recycled, the frequency of observation can probably be reduced. - RCA used as a concrete aggregate should be expected to meet the conventional requirements for flat and elongated particles, fines content and grading. In the case of CDW /RCM, the chemical and physical properties vary more when compared to virgin aggregate depending on the amount of attached mortar, or exposure of the concrete to foreign materials and chemicals during its lifecycle, processing, and storage. This is not generally an issue with RHC. - The contractor/supplier of recycled concrete aggregate should develop and implement a quality control plan for aggregate production. The quality control plan should describe the means to be used to ensure that recycled concrete meets the requirements of the project. The QC plan should, as a minimum, describe the following in detail: a) the inspection process upon receipt of demolished concrete prior to stockpiling; b) the process for removal of contaminating materials; c) the crushing and production processes; d) sampling and testing frequencies; and e) test methods. Such plans will by necessity need to be more onerous for RCM and CDW than for RHC. Research has shown that RHC produced following appropriate quality control procedures to be of more consistent quality and more suitable for use in concrete applications compared to RHC produced without such procedures. (Andal et al., 2016). - A concrete supplier's quality control plan for RHC should ensure proper handling and storage to prevent degradation of the RHC and the mortar fraction in particular.	- If the incoming material is sourced from concrete known to have experienced either D-cracking or alkali silica reaction (ASR), freeze/thaw durability and alkali-reactivity of the recycled aggregate product can be determined.

<table>
<tr><th>Master Municipal Construction Documents (MMCD)[1]</th><th>Member jurisdictions[2-10]</th><th>Transportation Association of Canada (TAC)[11]</th><th>Ministry of Transportation and Infrastructure (MOTI)[12,13]</th><th>CSA Group[14]</th><th>ASTM International[15]</th></tr>
<tr><td colspan="6">Sampling, Testing and Quality Control</td></tr>
<tr><td colspan="6">Recycled Concrete and Asphalt Mix</td></tr>
<tr><td colspan="2">Section 31 05 17 – Aggregates and Granular Materials
2.11 Products: Recycled Aggregate Material</td><td rowspan="2"></td><td rowspan="2"></td><td rowspan="2"></td><td rowspan="2">Each incoming load of asphalt and/or concrete shall be visually inspected at the facility for deleterious materials prior to loading materials to the crusher.
The requirements for finished product are:
- The final recycled aggregate shall be free (total of no more than 1 % by mass) of organic and deleterious materials such as wood, metal, plaster, rubbery material (for example, tires, carpet pads), glass, and geosynthetics, when these materials are not classified as solid waste.
- The final recycled aggregate may contain clay brick or clay tile up to 20 % by weight. Users can specify a different value for brick or clay tile content.
- The final recycled aggregate product shall conform to the gradation requirement given in Table 1 based on ASTM D2940/D2940M and shall be of such nature that it can be compacted readily under watering and rolling to form a firm stable base.
Sampling:
- As established by the local transportation agency or at a rate of two samples per day per active stockpile.
- Thoroughly mix the sample and reduce it to an amount suitable for testing using the applicable procedures described in Practice C702/C702M. The sample for the test shall be approximately the quantity desired when dry and shall be the end result of the reduction procedure. Reduction to an exact predetermined quantity is not required.
- Durability can be evaluated and having a loss of no more than 50 % by the Los Angeles abrasion test (following C131/C131M or C535 as appropriate) can be used for guidance.
QA/QC measures:
- Each incoming load of asphalt and/or concrete shall be visually inspected at the facility for deleterious materials prior to loading materials to the crusher.
- Perform gradation testing on two separate specimens obtained from each reduced sample. Gradation testing shall be conducted in conformance with ASTM C117 and C136/C136M with the exception that the drying temperature shall not exceed 60°C for recycled asphalt pavement. Gradation testing shall be performed after separating deleterious materials.
- Determine mass percentage of deleterious materials for each gradation specimen. Identify deleterious materials by visual inspection and determine their mass as percentage of the mass of total specimen used for gradation testing.</td></tr>
<tr><td>2.11.2
Recycled Concrete and Asphalt (RCA)
2.11.4
California Bearing Ratio of the supplied materials shall be a minimum of 20% and shall be tested at every 5,000 tonnes.</td><td>City of Vancouver – Add 2.11.2
The Contractor shall only source recycled aggregate material from a supplier who undertakes a minimum of one set of industry standard material testing per year and which confirm that the materials supplied meet the gradation and other property requirements of 2.11.1 of this Section [see tables below]. In addition, any product changes shall have a minimum population sample of 30 test results to confirm properties. All test results are subject to review by the City Engineer. [...]
<table><tr><th>Sieve Designation</th><th>Percent Passing</th></tr><tr><td>25.0mm</td><td>100</td></tr><tr><td>19.0mm</td><td>94 - 100</td></tr><tr><td>12.5mm</td><td>62 - 95</td></tr><tr><td>9.5mm</td><td>49 - 85</td></tr><tr><td>4.75mm (No. 4)</td><td>35 - 63</td></tr><tr><td>2.36mm (No. 8)</td><td>26 - 47</td></tr><tr><td>1.18mm (No. 16)</td><td>19 - 37</td></tr><tr><td>600µm (No. 30)</td><td>13 - 29</td></tr><tr><td>300µm (No. 50)</td><td>8 - 21</td></tr><tr><td>150µm (No. 100)</td><td>5 - 15</td></tr><tr><td>75µm (No. 200)</td><td>3 - 9</td></tr></table>Other properties:
<table><tr><th>Property</th><th>Specification</th></tr><tr><td>% Asphalt Coated Aggregate Particles</td><td>Max. 40</td></tr><tr><td>% Total Asphalt Cement</td><td>Max. 3.0</td></tr><tr><td>% Loss in LA Abrasion - Coarse Aggregate</td><td>Max. 30</td></tr><tr><td>% Loss in Micro-Deval - Coarse Aggregate</td><td>Max. 25</td></tr><tr><td>% Loss in Micro-Deval - Fine Aggregate</td><td>Max. 30</td></tr><tr><td>% Loss in MgSO4 Soundness - Coarse Aggregate</td><td>Max. 20</td></tr><tr><td>% Loss in MgSO4 Soundness - Fine Aggregate</td><td>Max. 25</td></tr><tr><td>% Organics Matter</td><td>Max. 0.5</td></tr><tr><td>% 1-Face Fracture Particles</td><td>Min. 60</td></tr><tr><td>pH Level</td><td>Max. 11 (Reference Only)</td></tr><tr><td>Environmental</td><td>BC Ministry of Environment's CSR
- Minimum RL standards for top 1m of boulevards and street medians, minimum IL standards in all remaining areas</td></tr></table>Properties of the final product must satisfy the specified requirements unless otherwise allowed by the City Engineer.</td></tr>
</table>

Master Municipal Construction Documents (MMCD)[1]	Member jurisdictions[2-10]	Transportation Association of Canada (TAC)[11]	Ministry of Transportation and Infrastructure (MOTI)[12,13]	CSA Group[14]	ASTM International[15]
Sampling, Testing and Quality Control					
					- Average values of all sieve size determinations and deleterious materials percentages for all samples shall comply with the requirements above. Average values of all sieve size determinations and deleterious materials percentages for all samples shall comply with the requirements above. Non-compliance shall necessitate the entire stockpile to be rejected. - The ratio of RAB in a mixture with other aggregates may be specified based on intended end use. - A Facility and Material Certification Form to be completed by the asphalt/concrete recycling operator is included in the appendix of the standard. - Max % of organic and deleterious materials: No more than 1 % by mass) of organic and deleterious materials such as wood, metal, plaster, rubbery material (for example, tires, carpet pads), glass, and geosynthetics. - Max % of clay brick or clay tile: Up to 20 % by weight, unless otherwise specified by the user. - Gradation: Shall conform to the gradation requirement given in Table 1 based on ASTM D2940/D2940M and shall be of such nature that it can be compacted readily under watering and rolling to form a firm stable base. - Durability: Having a loss of no more than 50 % by the Los Angeles abrasion test (following C131/C131M or C535 as appropriate). - Freeze/thaw durability and alkali-reactivity: Can be determined for incoming material that is sourced from concrete known to have experienced either D-cracking or alkali silica reaction (ASR).

Mix Design

Recycled Asphalt

Master Municipal Construction Documents (MMCD)[1]	Member jurisdictions[2-10]	Transportation Association of Canada (TAC)[11]	Ministry of Transportation and Infrastructure (MOTI)[12,13]	CSA Group[14]	ASTM International[15]
Section 32 12 16 – Hot-Mix Asphalt Concrete Paving 2.1 Materials **2.1.2** Reclaimed asphalt pavement (RAP): Crush and screen so that 100% of reclaimed asphalt pavement material passes 37.5 mm screen before mixing. 2.2 Products: Mix Design **2.2.1** Submit job mix formula to Contract Administrator for review and approval. The mix design shall identify HMA (Hot-mix asphalt) or WHA (Warm-mix asphalt) with the respective mixing and compaction temperatures. **2.2.2** Mix may contain up to 15% recycled asphalt cement replacement without changing binder grade. Design of mix to include RAP from proposed source blended with virgin aggregate. **2.2.3** Design of mix: by Marshall method to requirements below. […] (3) (5) Percentage of RAP used shall be stated in the mix design report (3) (6) Minimum Tensile Strength Ratio (TSR): 80 for mix design with RAP content	**City of Coquitlam – Add 2.1.2.1** Usage of recycled asphalt shingles will not be permitted. **City of Coquitlam – Add 2.1.2.2** Usage of softening agents, rejuvenators, or recycling agents will not be permitted. **City of Burnaby – Delete 2.2.1 and replace with** Submit a current job mix formula to the Contract Administrator for review and approval. The mix design shall identify HMA or WMA with the respective mixing and compaction temperatures. The Contractor is encouraged to use up to 15% RAP in asphalt base course mixes and up to 10% RAP in asphalt surface course. **City of Richmond – Delete 2.2.2 and add** Mix may contain up to a maximum 10% by mass of Recycled Asphalt content (RAP). The use of shingles (recycled) is not permitted in the design mix. **City of Coquitlam – Delete 2.2.2 and replace with the following** Mix may contain up to a maximum of 15 % by mass of RAP for Upper Course Asphalt and 20 % by mass of RAP for Lower Course Asphalt without a special mix design. The Contract Administrator and the City may approve higher proportion of RAP if Contractor demonstrates ability to produce mix meeting requirements of the specification.	- For batch mix plants, the amount of RAP incorporated is typically limited to less than 30 percent to ensure adequate drying and heat transfer in the pugmill from superheated aggregate, and to limit 'blue smoke' emissions. […] The need to soften the aged asphalt cement and to control potential emissions (blue smoke) limits the amount of RAP that can be incorporated in drum asphalt plants to between 40 and 60 percent (Earl and Emery, 1987). - It is generally not necessary to add new asphalt cement when RAP addition rates are lower than about 25%. - The NCAT [National Centre for Asphalt Technology] study concluded that, in most cases, using 30 percent RAP in an asphalt pavement can provide the same overall performance as virgin asphalt pavement. - Roads that were made using coal tar as the binder shouldn't be recycled since the coal tar can be a health hazard. - There are certain asphalt concrete recycling processes that, once used, may limit the ability of the recycled asphalt concrete from being recycled in the future. Experience in British Columbia has been that the use of crumb rubber or sulphur in hot-mix asphalt mixes precludes future hot-in place recycling. The major concerns have been that the fumes generated when hot in-place recycling mixes containing sulphur have been unacceptable, while asphalt rubber mixes have caused reprocessing issues with the HIR equipment (gumming up milling teeth).	- Adding softening agents, rejuvenators, recycling agents or recycled asphalt shingles is not permitted. - The maximum RAP allowed in the asphalt mix shall be determined by the contribution of the RAP Asphalt Cement (AC) towards the total AC content in the mix by weight as per the percentages specified in Table 505-A. […] The amount of total AC replaced by AC in the RAP will be calculated as follows: % AC replacement=((a x b))/c, where a = AC content of RAP; b = RAP percent in mixture by total weight of mix; c = total percent AC content in mixture. Inclusion of RAP into the hot mix asphalt will be as per the maximum allowable percentage of AC replacement unless otherwise noted in the Special Provisions. **Table 505-A: Maximum Percent RAP AC Replacement Allowed in Asphalt Mix** **Road Classification** / **Top Lift** / **Lower Lifts** Category A / 15% / 30% Category B / 30% / 30% - When the Percent RAP AC Replacement amount is greater than 15%, the blended AC must meet the penetration and viscosity requirements of the specified asphalt cement specified in the Special Provisions (when penetration graded asphalt cement is specified) or the temperature requirements of the specified Performance Graded Asphalt Cement (PGAC) when a PGAC is specified or substituted for penetration graded asphalt cement."		- Binder and/or asphalt content: Having a loss of no more than 20 % by the Micro-Deval test (following D6928). The asphalt content (determined using D6307) of the final recycled aggregate product also may be specified.

Master Municipal Construction Documents (MMCD)[1]	Member jurisdictions[2-10]	Transportation Association of Canada (TAC)[11]	Ministry of Transportation and Infrastructure (MOTI)[12,13]	CSA Group[14]	ASTM International[15]
Mix Design					
Section 32 12 17 – Superpave Hot-Mix Asphalt Concrete Paving			- The mix design is to be submitted to the Ministry Representative for review at least 5 business days prior to the start of the mix's production and should include: "All RAP aggregate gradations for each RAP product; asphalt content for RAP; results for consensus properties of combined aggregates (when applicable); design RAP Rheology test results; and blending charts for the virgin and reclaimed AC (when applicable)." Changes in mix design need to be approved by the Ministry Representative.		
2.1 Materials					
2.1.2 Reclaimed asphalt pavement (RAP): processing, quality, and use to requirements of NCHRP Report 452 and Table 1, with a RAP incorporation limit of 25% in lower course Superpave HMA and 15% in upper course Superpave HMA.	**City of Surrey – Delete 2.1.2 and replace with** Reclaimed asphalt pavement (RAP): processing, quality and use to requirements of NCHRP Report 452 and Table 1, with a RAP incorporation limit not to exceed 10% in lower course Superpave HMA and 10% in upper course Superpave HMA.				
2.1.4 **Table 1** Asphalt Binder Selection Guidelines for Reclaimed Asphalt Pavement (RAP) Mixtures[1,2,3] Recommended Virgin Asphalt Binder Grade[4] / RAP Percentage[5] 2.1.5 No change in binder selection / <15 Select virgin binder one grade softer than normal (select a PG 58-28 if a PG 64-22 would normally be used, for example) / 15-25 Follow recommendations from blending charts[6] / >25 Notes: 1. Table 1 is adapted from AASHTO M 323. 2. The recommended use of RAP is covered in detail in NCHRP Report 452. 3. Asphalt binder is an asphalt-based cement that is produced from petroleum residue either with or without the addition of non-particulate organic modifiers (SBS, for instance – polymer modified asphalt binder). 4. Performance-graded asphalt binder (cement) meeting the requirements of AASHTO M 320. 5. Reclaimed asphalt pavement (RAP) is removed and/or processed pavement materials containing asphalt binder and aggregates. 6. AASHTO M 323 and NCHRP Report 452, for instance.	**City of Richmond – Add 2.1.2** Mix may contain up to a maximum 10% mass of RAP (recycled asphalt content). The use of shingles (recycled) is not permitted in the design mix. **City of Coquitlam – Delete 2.1.2 and replace with the following** Reclaimed asphalt pavement (RAP): Processing quality, and use to requirements of NCHRP report 452 and Table 1, with a RAP incorporation limit of 20 % in lower course superpave HMA and 15 % un upper course-superpave HMA. **City of Coquitlam – Add 2.1.2.1** Usage of recycled asphalt shingles will not be permitted. **City of Coquitlam – Add 2.1.2.2** Usage of softening agents, rejuvenators, or recycling agents will not be permitted. **City of Surrey – Amend 2.1.4** In Table 1, maximum allowable RAP shall be 10%. Add the following notes below Table 1: .7 The amount of total AC replaced by AC in the RAP will be calculated as follows: % AC Replacement = (a x b) / c where: a = AC content of RAP b = RAP percent in mixture by total weight of mix c = Total percent AC content in mixture .8 Rejuvenators and softening agents not permitted. .9 Asphalt shingles not permitted.				

Master Municipal Construction Documents (MMCD)[1]	Member jurisdictions[2-10]	Transportation Association of Canada (TAC)[11]	Ministry of Transportation and Infrastructure (MOTI)[12,13]	CSA Group[14]	ASTM International[15]
Mix Design					
2.2 Products: Mix Design					
2.2.3 Where RAP will be incorporated in the mix, the mix design shall include RAP content as per Section 1.2 References. *No section 2.2.6*	**City of Burnaby – Delete 2.2.3 and replace with** Where RAP will be incorporated in the mix, the mix design shall include RAP content. Contractors are encouraged to use up to 15% RAP in asphalt base course mixes and up to 10% RAP in asphalt surface course. Mix may contain up to 15% recycled asphalt cement replacement without changing binder grade. **City of Vancouver – Add 2.2.6** Superpave asphalt mix may contain up to a maximum 15% RAP by weight of total mix without a special mix design. The City Engineer may approve a higher proportion of RAP if the Contractor can demonstrate with proof documentation their ability to produce a mix meeting the requirements of the specification.				
MMCD recommendations regarding plant and mixing requirements to produce superpave hot-mix asphalt concrete paving in batch and continuous mixing plants and dryer drum mixing plants were not included in this section. This information was considered to be too technical for the purposes of this report.	Following a pilot study, 100% of the District of North Vancouver's paving projects are now completed using lower carbon warm mix asphalt, and staff are also piloting the use of 30% recycled asphalt pavement, using excess grindings from existing roads to reduce the use of virgin materials.				

Tier	% RAP by wt of Total Mix	Determine RAP AC Content	Measure RAP Gradation	Measure RAP AC Stiffness	Measure Agg. Blend Properties	PG Grade Change
1	≤15%	(a)	Yes	No	Yes	None
2	16% - 25%	Yes	Yes	No (b)	Yes	One Grade Lower (c)
3	>25%	Yes	Yes	Yes	Yes	Use Blend Chart

(a) At the discretion of the *City Engineer*.
(b) Unless blending chart is used.
(c) Or use blending chart.

Master Municipal Construction Documents (MMCD)[1]	Member jurisdictions[2-10]	Transportation Association of Canada (TAC)[11]	Ministry of Transportation and Infrastructure (MOTI)[12,13]	CSA Group[14]	ASTM International[15]
Mix Design					
Recycled Concrete					
		- Depending on the mix design and RCM processing, it is possible to produce quality concrete using recycle concrete aggregates. - Recycled concrete aggregates have higher absorption rates, potentially requiring an adjustment in water and Portland cement content to achieve the desired water to cement ratio. Insufficient water can lead to lower slump than conventional aggregates. - Fine recycled concrete aggregates can decrease a fresh concrete's workability - The amount of old asphalt in the RCM should be limited to 30 – 50 % by mass to avoid adverse effects on the material's strength.	When using concrete aggregates for minor works: - The contractor is responsible for the concrete mix design and its performance. - The concrete shall be designed to meet the sulphate exposure identified.	-Caution should be exercised with RCA from concrete that has exhibited a) high levels of chlorides; b) high levels of sulphates; c) alkali-aggregate reactivity; or d) signs of D-cracking or damage due to freezing and thawing. These kinds of RCA should probably be avoided for use in concrete where strength or durability are of concern but may be able to be used in other aggregate applications. -The maximum amount of all deleterious materials should be 3% by mass. However, the maximum total amount of ceramic tile, bathroom porcelain, glass, wood, and paper should be 0.10%. It should be noted that ceramic tile, bathroom porcelain, and glass are especially likely to cause AAR and can be found in CDW from building demolition. Plaster, gypsum, and gypsum board are also a significant source of deleterious contamination in RCA and the maximum level should not exceed 1% based on work by Fookes and Collis (1976) where it was determined that maximum acid soluble sulphate content in aggregate should be below 0.4%.	
Recycled Concrete and Asphalt Mix					

Master Municipal Construction Documents (MMCD)[1]	Member jurisdictions[2-10]	Transportation Association of Canada (TAC)[11]	Ministry of Transportation and Infrastructure (MOTI)[12,13]	CSA Group[14]	ASTM International[15]
Contractual Framework					
Recycled Asphalt					
			- Using RAP in new paving mixes is at the discretion of the contractor. - Contract Special Provisions need to specify language for the RAP use to ensure a project-generated RAP is re-used by the project at a desired location.		
Recycled Concrete					
Recycled Concrete and Asphalt Mix					
Section 31 05 17 – Aggregates and Granular Materials					
2.11 Products: Recycled Aggregate Material					
2.11.1 Aggregates containing recycled material may be utilized if approved by the Contract Administrator. [...]	**City of Coquitlam – Delete 2.11.1 and replace with the following** Aggregates containing recycled material may be utilized if approved by the Contract Administrator and the City. [...]				

References:

1 Master Municipal Construction Documents Association. MMCD 2019 Edition. 2019.
2 City of Richmond. Supplementary Specifications and Detail Drawings, 2016.
3 City of Vancouver. Construction Specifications, 2019.
4 City of Surrey. Supplementary Master Municipal Construction Documents: Supplementary General Conditions, 2020.
5 City of Coquitlam. Supplementary Specifications Master Municipal Construction Documents, March 2022.
6 City of Burnaby. Supplemental Specifications and Detail Drawings, 2021.
7 Jackson, Caroline. Report to Council: Climate and Biodiversity Initiatives Update. s.l. : District of North Vancouver, 2022.
8 City of Maple Ridge. Design and Construction Documents, Part 1, Design Criteria Manual, June 2023.
9 City of Pitt Meadows. Subdivision and Development Servicing Bylaw No. 2589 and amendmenets thereto.
10 City of Langley. Design Criteria Manual, 2022.
11 Transportation Association of Canada. Best Practices Guide for the Use of Recycled Materials in Transportation Infrastructure. Ottawa : Transportation Association of Canada, 2013. ISBN 978-1-55187-519-4.
12 British Columbia Ministry of Transportation and Infrastructure. 2020 Standard Specifications for Highway Construction, Volume 1. Victoria : Construction and Maintenance Branch, 2020. ISBN 978-0-7726-7953-6.
13 Nyland, Dirk. Technical Circular T-05/17: Use of Reclaimend Asphalt Pavement in Construction and Paving Projects. s.l. : BC Ministry of Transportation, 2017.
14 National Standard of Canada. CSA A23.1:19 Concrete materials and methods of concrete construction, Annex O: CSA Group, 2019. ISBN 978-1-4883-0744-7.
15 ASTM International. Standard Practice for Reclamation of Recycled Aggregate Base (RAB) Material. West Conshohocken : ASTM International, 2022. D8038 - 16 (Reapproved 2022).

Desktop Review

Member municipalities	They have established publicly-available guidance and/or modified MMCD specifications related to the use of recycled concrete and asphalt aggregates
Village of Anmore	No
Village of Belcarra	No
Bowen Island Municipality	No
City of Burnaby	Yes
City of Coquitlam	Yes
City of Delta	No
City of Langley	Yes
Township of Langley	No
Village of Lions Bay	No
City of Maple Ridge	Yes
City of New Westminster	No
City of North Vancouver	No
District of North Vancouver	No
City of Pitt Meadows	Yes
City of Port Coquitlam	No
City of Port Moody	No
City of Richmond	Yes
City of Surrey	Yes
City of Vancouver	Yes
District of West Vancouver	No
City of White Rock	No

Appendix C Pre-Webinar Summary

Pre-Webinar Summary of Findings

Concrete and Asphalt Recycling Options Webinar

Context of the Webinar

Metro Vancouver has retained Stantec to undertake a study to identify and assess opportunities for concrete and asphalt recycling in support of efforts to maximize waste reduction and recycling. As part of this study, Metro Vancouver is hosting a webinar to:

Share

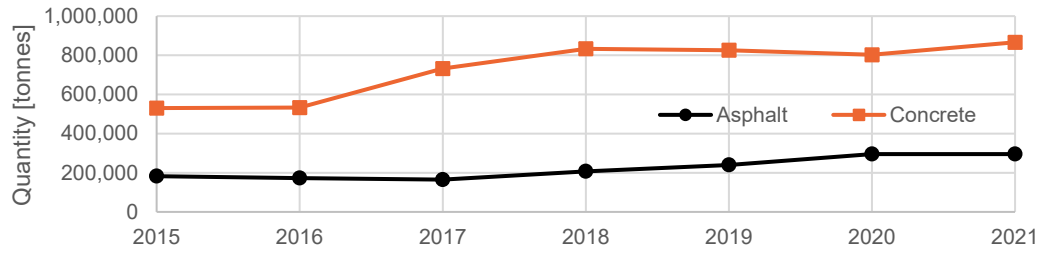
- findings related to barriers, opportunities and actions to support the use of concrete and asphalt recycling applications that maximize benefit.
- knowledge on proven and future applications for recycling concrete and asphalt aggregates.

Receive Feedback

- from participants on potential opportunities to recycle concrete and asphalt aggregates.
- on potential actions that could be undertaken by Metro Vancouver and interested parties to recycle concrete and asphalt.

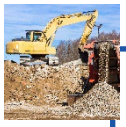
Context of Recycled Aggregate Use in the Metro Vancouver Region*

Quantities Recycled



Common uses

New asphalt
- Road base
- Road sub-base
- Trench backfill
- Other street applications (sidewalks, bike lanes, curbs, and/or gutters)



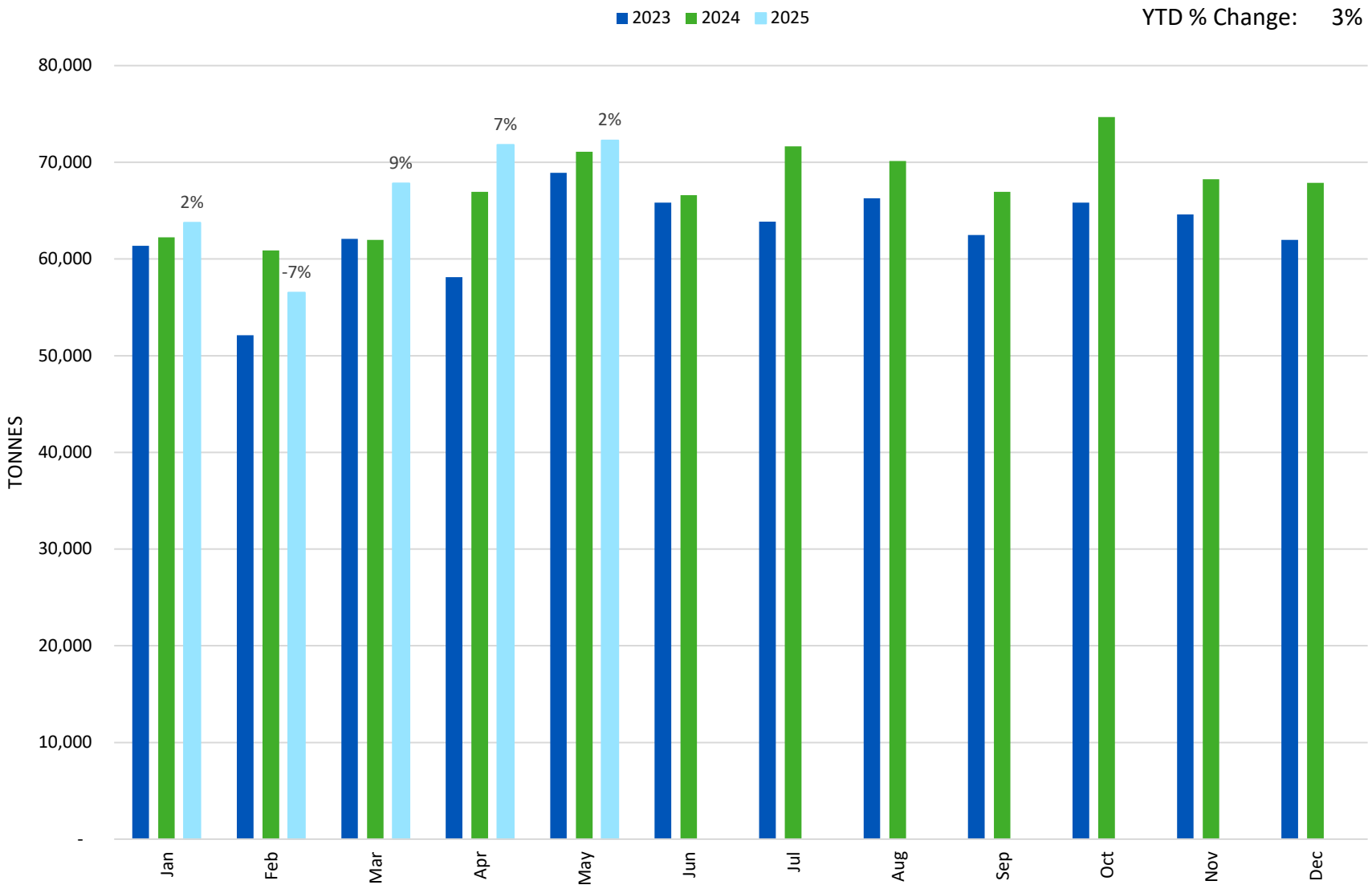
Potential uses

- In new concrete
- In higher road classifications
- To increase % use in design mixes
- In backfill for walls and pipe bedding
- Ideally recycle materials back into their original use

Findings & Implications	**Challenges (top ones per interviews)**	**Opportunities (top ones per interviews)**	**Potential Actions**
Quality	• Variable quality of the final product. • Additional testing requirements compared to virgin materials.	• Improve quality assurance and quality control standards.	• Establish clearer and context specific quality requirements. • Pre-qualify contractors to ensure they have sufficient experience with recycled aggregates.
Environmental	• High pH of concrete leachate.	• Reduced CO_2 emissions.	• Clarify environmental regulations with respect to using recycled aggregates.
Operational	• Lack of space to stockpile and process recycled aggregates.	• Increase the percentage of allowable RAP in asphalt.	• Allow the use of recycled concrete aggregates in the concrete in lower traffic loading, non-structural, and/or low-strength contexts. • Increase the number of contexts in which the use of recycled aggregates is permitted. • Increase the amount of RAP incorporated in new asphalt. • Streamline the process of approving the use of recycled aggregates. • Standardize and regularly update regulations on recycled aggregate use across Metro Vancouver. • Provide guidance on the use of recycled aggregates in contract provisions for public projects. • Minimise modifications to the MMCD's standards on recycled aggregates.
Regulatory	• MMCD standards for recycled aggregates need to be updated. • Different standards applied by municipalities to recycled materials supplied in-house vs by third-party suppliers. • Varying regulations among jurisdictions.	• Revise MMCD specifications for recycled aggregates to encourage and increase use.	
Change Management	• Lack of experience using recycled aggregates. • Clients and their consultants are wary of real and perceived technical risks. • Use of recycled aggregates is at the discretion of the contract administrator per MMCD.	• Recycled aggregates generally cost less in Metro Vancouver. • Education on the use of recycled aggregates is needed.	• Reduce the reliance on contract administrator approval of use. • Set municipal and regional aggregate recycling targets as part of zero waste and/or circular economy plans. • Increase knowledge sharing, education and collaboration between stakeholders. • Support additional research and development, collaborations, case studies, and pilot projects in different contexts and environments. • Support regular updates to the MMCD's standards on recycled aggregates. • Gather and track data on projects that have used recycled aggregates and share lessons learned.

* Draft 2022 ISWRMP Biennial Report

Metro Vancouver Waste Quantities*
2023 - 2025**

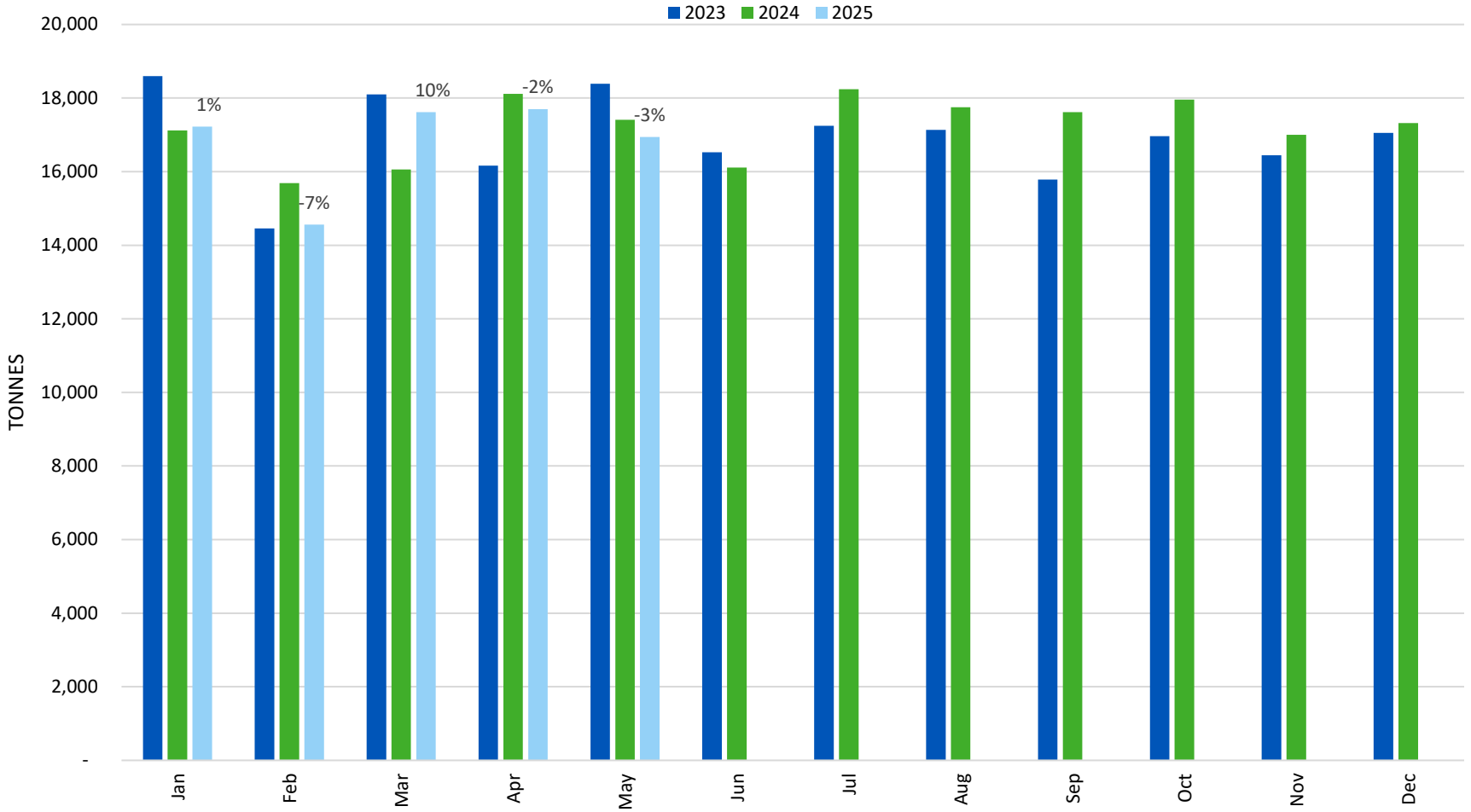


**Data reconciled to Apr 2025

*Metro Vancouver's Six Recycling and Waste Centres & the Waste-to-Energy Facility

City of Vancouver Waste Quantities*
2023 - 2025
(Demo garbage not included)

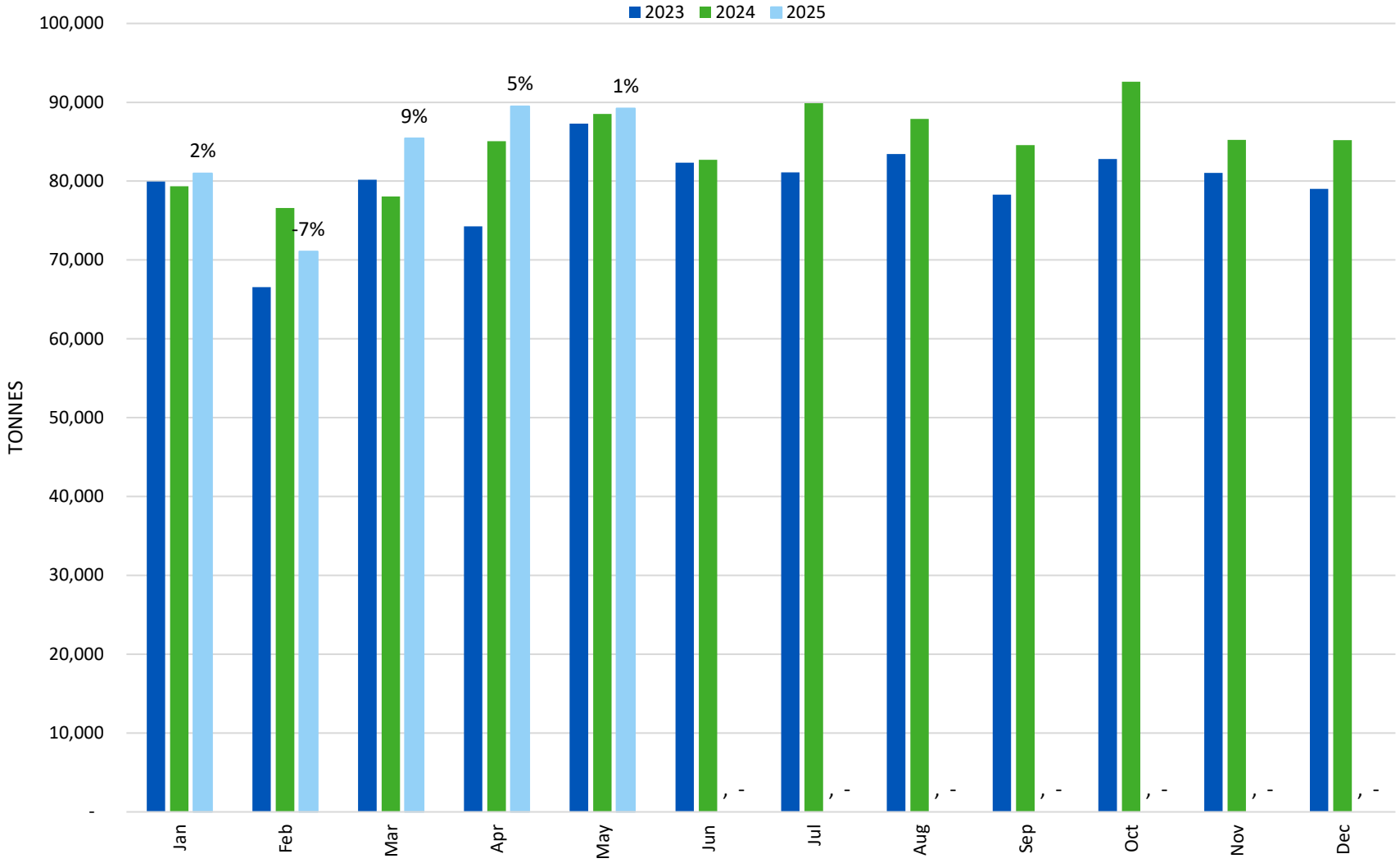
YTD % Change: 0%



*Vancouver Landfill & Vancouver South Transfer Station

Metro Vancouver and City of Vancouver Waste Quantities
2023 - 2025*
(Demo garbage not included)

YTD % Change: 2%



*Metro Vancouver data reconciled to Dec 2024

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SERVICES AND SOLUTIONS FOR A LIVABLE REGION

SOLID WASTE AND RECYCLING INDUSTRY ADVISORY COMMITTEE 2025 WORK PLAN

June 4, 2025

Quarter 1	**Status**	**Approach**
Draft 2023 Recycling and Garbage Statistics	Complete	Plenary
Notice of Bylaw Violation Engagement - Tipping Fee Bylaw	Complete	Plenary
Source Reduction Incentive Program	Pending	Small group
SWMP: Timeline Update	Complete	Plenary
SWMP: Climate 2050 Solid Waste Primer	Complete	Plenary
SWMP: Draft Goals and Hierarchy	Complete	Small Group
SWMP: Options Analysis Criteria	Complete	Plenary
Quarter 2	**Status**	**Approach**
Concrete and Asphalt Study Report	In-progress	Information
Soil Management	Pending	Plenary
Vancouver Landfill/Long-Term Disposal Planning and Options	Pending	Small group
SWMP: Residuals Management Options Report and Discussions	Pending	Small group
SWMP: Performance Metrics	Complete	Small group
SWMP: Idea Generation Report Back	In-progress	Plenary
Quarter 3	**Status**	**Approach**
Public Education – role of public and private entities	Pending	Small group
SWMP: Regulatory Strategy	In-progress	Small group
SWMP: Recycling and Waste Centre Strategy Development	Complete	Small group
Quarter 4	**Status**	**Approach**
Share/Reuse/Repair Update	Pending	Plenary
SWMP: Recycling Statistics/Metrics	Pending	Small group
SWMP: Options Analysis/Targets	Pending	Small group

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Welcome

Burrard Inlet Port Lands

COLLECTION NOTICE

Video and audio footage from this meeting is being collected under section 26(c) of the *Freedom of Information and Protection of Privacy Act*. It will be used to create a public record of the meeting and assist minute-takers in accurately documenting the events.

If you have any questions about this collection, please contact a Privacy Officer at Metro Vancouver, Metrotower III, 4515 Central Boulevard, Burnaby, BC, V5H 0C6 or 604-432-6200 or privacy@metrovancouver.org.

AGENDA

1. Agenda – June 10, 2025
2. Minutes – May 6, 2025
3. Reports and Items for Discussion
4. Other Business
5. Information Items

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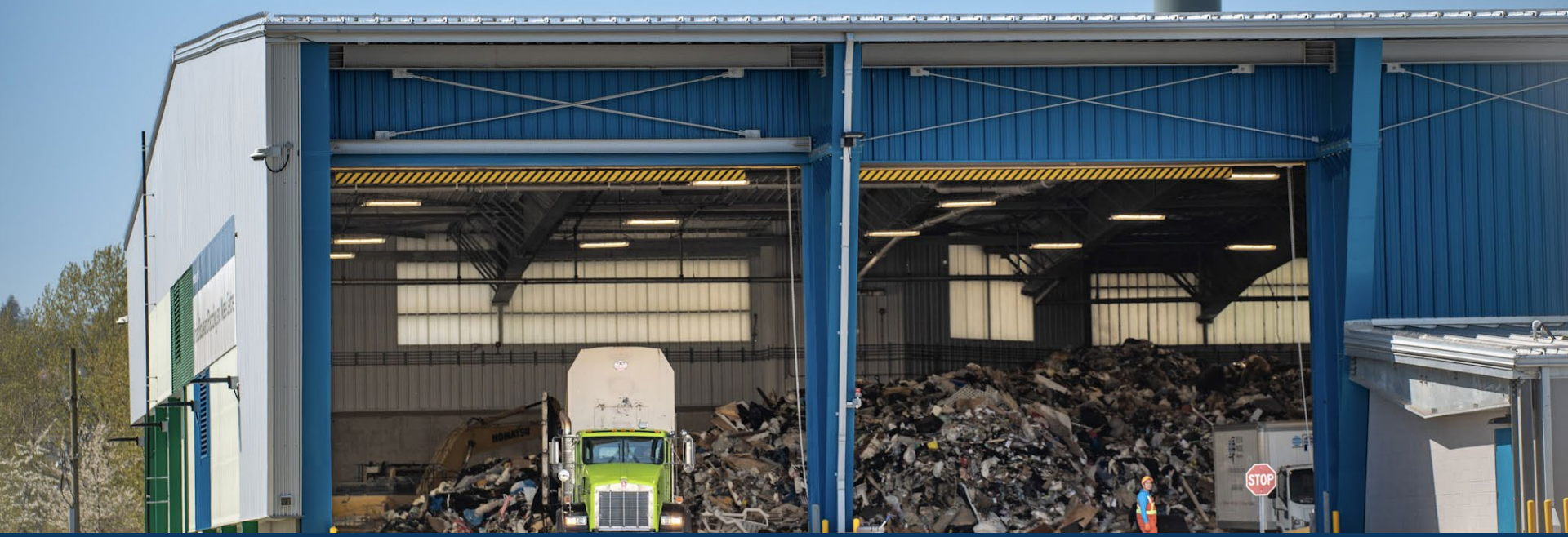
Reports and Items for Discussion



Solid Waste Management Plan Regulatory Strategy

Terry Fulton, P.Eng.

Senior Project Engineer, Solid Waste Services

Solid Waste and Recycling Industry Advisory Committee Meeting, Jun 10, 2025

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PURPOSE

- Share draft strategy outlining regulatory priorities for an updated plan
- Seek feedback on the draft regulatory strategy
- No specific new regulatory initiatives will be included as actions in the plan

ROLES & RESPONSIBILITIES

Regulations

Within GVS&DD Authority

- Fees and surcharges at facilities
- Facility licensing
- Generator levy application
- Penalties for non-compliance

Outside of GVS&DD Authority

- Property level regulations
- Extended producer responsibility programs
- Regulation impacting sale or distribution of specific materials

EXISTING METRO VANCOUVER SOLID WASTE BYLAWS

Bylaw	Key Components
Tipping Fee Bylaw	• Fees and surcharges • Disposal bans • Generator levy
Bylaw 181	• Facility licensing
Notice of Bylaw Violation	• Administrative penalties for violations of Tipping Fee Bylaw and Bylaw 181 • Dispute adjudication

REGULATORY STRATEGY

Context

- Identifies regulatory priorities
- Provides examples of possible regulatory mechanisms to achieve priorities, such as Metro Vancouver bylaws

Disposal ban inspectpr

REGULATORY PRIORITIES

- Support effectiveness of generator levy
- Increase reuse and recycling at source
- Improve data accuracy, transparency, and availability
- Enhance disposal ban program
- Improve inclusive programs and services

POSSIBLE FUTURE REGULATORY MECHANISMS – EXAMPLES

- Hauler licensing
- Mandatory source separation
- Reuse and recycling requirements for licensed facilities
- New disposal ban materials
- Financial incentives for reuse and recycling
- Expand types of facilities licensed

POSSIBLE FUTURE REGULATORY MEASURES – ENGAGEMENT

- Any future proposed regulations would be accompanied by specific engagement program and comply with provincial requirements
- Implications to be discussed with interested parties
- Feedback would be considered in drafting any new bylaws

NEXT STEPS

- Consider feedback provided today in development of regulatory strategy
- Include strategy in the draft updated solid waste management plan for feedback
- Seek plan approval in 2026

Recycling confidence display at the PNE – Recycling Bales Photo

Let's Discuss

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DISCUSSION

Small Groups

Regulatory priorities and example possible future regulatory mechanisms:

- Is anything missing or that should be changed?
- Any other comments?

Thank you

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Idea Generation Engagement Summary

SOLID WASTE MANAGEMENT PLAN UPDATE

Stephanie Liu

Program Manager, Community Engagement, Solid Waste Services

Industry Advisory Committee, June 10, 2025

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PROJECT TIMELINE UPDATE

IDEA GENERATION SUMMARY

- Heard from
  - First Nations
  - Industry and businesses
  - Advisory committees
  - Not-for-profits
  - Member jurisdictions and neighbouring regional districts
- Nearly 3,000 feedback data points

IDEA GENERATION FEEDBACK

Feedback consisted of ideas for potential strategies and actions to include in an updated plan. Organized into categories:

- ✓ Accessibility and Inclusivity
- ✓ Accountability and Transparency
- ✓ Affordability, Convenience and Consistency
- ✓ Circular Economy
- ✓ Collaboration
- ✓ Education, Engagement, and Awareness
- ✓ Environmental Stewardship and Climate Action
- ✓ Infrastructure and Capacity
- ✓ Innovation and Technology
- ✓ Markets and Economy
- ✓ Policy and Regulation
- ✓ Recycling and Composting
- ✓ Waste Prevention

IAC IDEA GENERATION FEEDBACK

- 289 lines of feedback
- 158 lines tagged as actions to put through consolidation and options analysis process
- Other feedback incorporated into other elements of the plan: goals/hierarchy, residuals framework, regulatory strategy
- Also contributed to the options analysis criteria

IAC IDEA GENERATION FEEDBACK

Highlights

- Leverage knowledge and expertise through collaboration with industry and non-profits and information/data sharing
- Increase public education, e.g. for reducing contamination
- Incentivize/facilitate industry to innovate
- Provide opportunity for industry representation
- Promote confidence in the recycling system (education, data sharing)
- Streamline regulations and speed up decision-making

IAC IDEA GENERATION FEEDBACK

Highlights

- Collaborate/align with other levels of government on legislation and procurement policies
- Design for repair and recycle
- Work to level the industry playing field and foster stable environment to facilitate healthy competition
- Bring accountability to waste/recycling generators. Use incentives
- Infrastructure planning needs to be a focus

OPTIONS ANALYSIS ENGAGEMENT

Fall 2025

- A list of evaluated actions will be provided for options analysis engagement (Full list of actions from idea generation also provided to IAC)

- Considerations: alignment with options analysis criteria including vision and guiding principles

NEXT STEPS

- Zero Waste Committee and GVS&DD (reports will be shared with IAC):
  - Idea Generation Engagement Summary report – *July*
  - Draft goals and waste hierarchy report – *July*

- Future:
  - Draft strategies and actions will be shared during options analysis engagement
  - Draft plan: 2026

SOLID WASTE MANAGEMENT PLAN

Pathway to a draft plan

Remaining key topics:

Draft plan in early 2026

Workshop

Thank you

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Other Business

Jericho Beach

4.1 ZERO WASTE COMMITTEE AND OTHER UPDATES

- Food scraps recycling campaign results report
  - Target audience was adults living in apartments and condos
  - Objective: normalize green bin use as common and accepted
- Solid waste management plan progress update
- Waste-to-Energy Facility carbon capture/storage report complete
- GVS&DD audited financial statements

4.1 ZERO WASTE COMMITTEE AND OTHER UPDATES

Manager's Report

- Continuous improvements at recycling and waste centres
  - Langley: used oil, paint, and hazardous household waste
  - Central Surrey: new Return-It Express & GO station
  - Expansion of Reuse Days
- District Energy System project funding
  - Low Carbon Economy Fund

4.1 ZERO WASTE COMMITTEE AND OTHER UPDATES

- Home Demolition Waste Prevention Forum
  - June 2 at Anvil Centre
  - Over 100 in-person attendees representing government, industry, and non-profit
  - Two discussion panels: one focusing on industry opportunities and challenges and one focusing on policy and framework

4.2 FACILITY TOUR

Opportunity to tour the Vancouver Landfill:

- Thursday, September 18, from 10:00 am to 12:30 pm
- With members of PTAC
- Contact staff if you would like to attend

Vancouver Landfill

4.2 UPCOMING EVENTS

- Educational resources and tools workshop
  - June 23 from 1pm to 4pm
  - Multi-family focus with panel and small group discussion
  - Contact staff for more information or to register
- Zero Waste Conference – November 27, 2025
  - IAC members can attend at no cost
  - Email staff at solidwasteoperations@metrovancouver.org to request registration

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Information Items

Ironworkers Memorial Bridge

INFORMATION ITEMS

5.1 Concrete and Asphalt Recycling Opportunities Review

5.2 Regional Waste Flows

5.3 2025 IAC Work Plan

Vancouver Skyline

Thank you

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