5.8 Construction, Renovation, Demolition

5.8.1 Construction and Demolition Waste

An Overview

Moving, renovating, and demolishing facilities can generate significant waste. Construction and demolition waste accounts for up to 25% of the waste stream. Reorganizations in offices and facilities both add to the challenge and open new opportunities to apply sound environmental practices. These practices can lead to improved energy efficiency and workplace and public facility standards.

For the "renovation component" of any required work you may also refer to section 5.1.1 through 5.1.8 to consider replacement materials.

Potential Environmental Impacts

- Poor waste management practices throughout any construction, renovation or demolition project will add to disposal volumes and their impacts on the environment.

Things to Consider If You Write Your Own Specifications

Contractors should be required to submit a Waste Management Plan with their quotations. The plan should include:

- Procedures for educating workers and subcontractors in order to ensure adherence to the Waste Management Plan
- Methods for reducing waste such as ordering material only as required, using up excess material on site where possible, or prefabricating sections off site
- The percentage of recycled content in construction materials
- Methods and techniques for collecting, separating, and recycling waste materials and packaging, including a list of materials to be recycled and percentage expected to be recycled or sent to landfills
- Provisions for dealing with hazardous waste, including procedures for handling, clean-up and disposal
- A list of carriers and disposal destinations for each material to be disposed of or recycled. The list should be provided initially or at least before the final payment is made. This will ensure that all materials are being recycled and waste is legally disposed of
- Alternative options for recovering higher percentages of materials and related costs
- The cost associated with the recovery of the material and the anticipated revenues from the sale of such material.

Specifications from Other Agencies and Seals of Approval

Sample specifications from other agencies are outlined in the pages following immediately and in Appendix C - GVRD Project Waste Management Master Specification.

Case Study: Energy Efficient City Hall

Richmond City Hall

Thanks to innovative design and attention to environmental details, the new Richmond City Hall will be 25 per cent more energy efficient than a standard office building. From energy efficient boilers to a system that automatically shuts off air conditioning when windows are opened, City Hall is a model for energy conservation. In fact, the City has been awarded federal funds in recognition of the building's energy efficiencies.

Case Study: Construction waste management at Richmond City Hall.

When City of Richmond staff prepared the construction documents for the new City Hall, they began a process that would not only see significant volumes of waste recycled but would result in scores of contractors being introduced to value of construction waste recycling. Richmond used the GVRD Project Waste Management Master Specifications to set out standards for recycling and waste management on the construction site.

During construction, wood waste, scrap metal, drywall and cardboard were targeted for recycling. Weekly site meetings were used to educate and inform contractors about the recycling program. A site safety officer wass responsible for talking to contractors, keeping recycling bins clear of contamination, and ensuring the program ran smoothly.

Urban Wood Waste Recyclers of south Vancouver accepted and sorted the co-mingled bins of materials. Wood waste was processed into hogfuel and taken to Canadian Forest Products where it was used to make value-added products such as hardboard paneling and hydro-seeding mulch. Cardboard went to Crown Packaging for recycling into new cardboard products. Scrap metal was sent to Richmond Steel, ABC Recycling and others for recycling.

City Hall - New Construction

Calculations suggest that 81% of total waste material was diverted to recycling. Source: GVRD Construction and Demolition Recycling Document.

An example from King County Washington highlights some typical specifications:

King County Regional Justice Center Project Overview

This project involved the development of a new regional justice center, including courthouse and detention facilities. The project manager required that materials be recycled on the project site and used in place of new material.

The project used recycled concrete aggregate from the demolition for backfill, general fill, pipe bedding and as aggregate base course for pavement construction in new construction.

The Regional Justice Center project team was able to recycle **ninety-five percent** of the demolition-debris generated during the demolition phase of the project and saved almost **$250,000**. Most of the concrete and asphalt, 31,840 tons, was crushed and used as fill-material on the project site. A local recycler accepted 1,518 tons of concrete rubble, 791 tons of steel and 918 tons of waste-wood, ; and 750 tons of lumber was salvaged. Only 1706 tons of the material generated was not able to be recycled.

The paragraphs below are edited from contract documents related to this project.

Summary of Work

Ownership and Disposal of Materials

- The County wants to recycle as much material as possible during demolition and the demolition schedule has been planned to maximize the amount of recycling, reuse, and salvage that can be achieved during demolition.

Base Contract Work

- Demolish building and foundations. Crush and stockpile concrete rubble and dispose of all re-bar.
- Do not mix asphalt with concrete in stockpile.
- Remove drives, parking areas, walks and pads. Segregate different material types (concrete and asphalt), load, haul, crush, consolidate and stockpile material on site.
- Backfill pits, holes and excavations with clean recycled crushed concrete. Backfill to surrounding grades.
- Recycled crushed materials of differing material types are not to be mixed. Segregate concrete and asphalt stockpiles. Concrete which has been overlaid with asphalt shall be kept separate from other stockpiles.

Requirements

- The County requires the Contractor to recycle, reuse, and salvage as much material as possible. The demolition schedule was planned to allow for selective removal and sorting of materials.
- The County requires the Contractor to submit a waste handling plan detailing how the waste streams will be separated and managed.
- The Contractor is responsible for removing and reusing, recycling, or salvaging all other materials associated with the demolition of the buildings, pavement, vegetation, utilities, and any other site improvements.

Recycled Crushed Materials

General

- Concrete including concrete and cement shall be crushed on site. Crushed concrete shall be stockpiled separately on-site. Crushed concrete shall be used as backfill as specified in Section 02200, Earthwork.
- Asphalt and Concrete Asphalt mixtures shall be crushed on site. No asphalt or combination of asphalt products shall be used as fill by the Demolition Contractor.
- Crushed asphalt shall not be mixed with crushed concrete.

Description of Work

This section pertains to work involving recycled crushed concrete, crushed asphalt, and crushed concrete/asphalt materials produced on site during demolition operations. Potential sources of recycled crushed materials on site include (but are not limited to) existing foundations, floor slabs, reinforced concrete walls, and pavements. Mixed crushed recycled concrete/asphalt may occur as a result of demolishing concrete slab areas overlain by asphalt surfacing. All reinforcing steel shall be removed from concrete elements prior to crushing, and exported from the site.

Recycled crushed concrete may be used on site as backfill in the parking garage over excavation zone identified on the project plans, or as general backfill to fill depressions produced during demolition or within low areas. Recycled crushed concrete will also be stockpiled on site for use during future site work, as backfill in future footing over excavation zones, as general fill, pipe-bedding or backfill, and as aggregate base course for pavement construction. Recycled crushed asphalt or mixed asphalt/concrete will be stockpiled on site for use during future site work, as general fill or aggregate base beneath paved areas. Brick, masonry, and CMU elements will be demolished as part of this contract. These materials will not be reused on site, but should be demolished and exported from the site.

Description of Site Conditions

- Reuse, recycle and salvage as much material as possible.
- Stockpile the various types of crushed recycled materials in separate, secure areas as directed by the County.
- Do not mix recycled materials with soil, and do not mix crushed recycled concrete with asphalt.

Products

- Crushed Recycled Concrete

  Crushed recycled concrete materials shall conform to the following gradation specification:

Sieve Size U.S. Standard	Percent Passing by Dry Weight
1 – ½ inch	100
¾ inch	40-75
¼ inch	25-50
No. 40	5-20
No. 200	10 max.

  Recycled concrete materials used or stockpiled on site shall be uniform in quality and free from wood, steel, roots, bark or other extraneous material. In addition, the recycled concrete materials shall meet the following requirements:

  Los Angeles Abrasion, 500 rev. — 35% max Sand Equivalent — 30 min.

- Crushed Recycled Asphalt Pavement

  Existing asphalt concrete pavement on site shall be pulverized by a method that limits damage or dislodging of the material below the pavement. The pulverized material shall conform to the following gradation:

Sieve Size U.S. Standard	Percent Passing by Dry Weight
1 – ½ inch	100
¾ inch	40 min.

  Acceptance of the gradation will be based on visual inspection by the County's Representative.

- Mixed Crushed Concrete/Asphalt

Any mixed crushed concrete/asphalt shall conform to the gradation specified above.

Execution

- The Contractor shall crush, haul and stockpile the crushed Materials to a stockpile area on site designated by King County, and crushed recycled materials shall not be placed higher than Elevation 33 within the parking garage excavation, as shown on the project plans.
- Where used as backfill in the parking garage over excavation zones, the recycled concrete shall be placed on properly prepared subgrade. Where very soft, wet subgrade conditions are encountered, use a geotextile separator between subgrade soils and the recycled concrete. Evaluation of conditions requiring use of a geotextile separator, and monitoring of geotextile placement, shall be performed in the field by County's Representative.
- Where placed as compacted fill, recycled concrete materials shall be moisture conditioned to within 3 percent of the optimum moisture content, placed in horizontal lifts less than 8 inches in loose thickness, and compacted to at least 95 percent maximum dry density, determined using ASTM D 1557. Where used as general backfill in areas to be reloaded, the recycled concrete shall be compacted to at least 90 percent maximum dry density, and using the same criteria.

Quality Control

- The Contractor is responsible for the quality of the work and for complying with the specifications. Testing will be conducted by County.
- The following laboratory tests will be performed on the recycled concrete:

  L.A. Abrasion Testing for determination of aggregate durability, using ASTM C 131.
  Sand Equivalent Testing, using ASTM C 2419.
  Sieve analysis for acceptance of aggregate gradation, using ASTM D 422.

Other tests may be performed as necessary based on field conditions, to verify the suitability of the crushed recycled materials for the intended purpose.

Measurement and Payment

- Crushing, placement, and stockpiling of crushed recycled materials shall be measured by lump sum as part of the base bid.
- Crushed recycled materials that do no meet gradation or other criteria specified herein shall be removed from the site and disposed of at the Contractor's expense.
- Unauthorized excavation consists of removal of materials beyond indicated subgrade elevations or dimensions, or beyond that level required for normal clearing and grubbing operations or removal of structural elements, without specific direction of King County. Unauthorized excavations within footing over excavation zones shall be backfilled in accordance with these specifications, at the Contractor's expense. Any unauthorized excavations in other areas of the site shall be backfilled as directed by the County representative.

- Any additional testing required due to recycled crushed materials failing laboratory or field density test specifications shall be at the Contractor's expense. In addition, testing related to backfilling of unauthorized excavations shall be at the Contractor's expense.
- No payment will be made for materials which have become mixed with other material or misplaced by the Contractor's action, or lack of action. Crushed recycled material which is contaminated by the Contractor by spills or mixing with other site soils, or by any other means, shall be tested, removed, and disposed of by the Contractor at the Contractor's expense.

Supplemental Backfilling

- The Contractor shall backfill the portion of the excavation above the lean concrete using recycled crushed concrete and/or structural fill, in accordance with applicable sections of the specifications.

See also the GVRD Project Waste Management Master Specification, Appendix C.

Case Study: Deconstruction, not demolition.

When the University of British Columbia decided to raze the wood-framed "Pan-Hellenic House" to make way for a new building, project specifications stated that the building was to be deconstructed, not demolished. Bidders were asked to submit material reuse and recycling targets along with their pricing.

The successful bidder, Litchfield & Co. Ltd., deconstructed the building using primarily manual labour. The interior was stripped of salvageable items (e.g. cedar siding, dimensional lumber, electrical and bathroom fixtures) and recyclable materials (e.g. drywall, wood waste, scrap metal and stucco). In total 94% of demolition material was salvaged or recycled and only 6% landfilled.

Of the total recovered materials, 17 % was salvaged and 77% was taken to local scrap metal, concrete, wood and drywall recycling facilities. Glulam beams and tongue-and-groove decking salvaged from the "Pan-Hellenic House" were used on site in the construction of the new Liu Centre for the Study of Global Issues.

Source: Demolition and Salvage Facts, GVRD.

Pan-Hellenic House at UBC