Transportation Association of Canada
2005 Environmental Achievement Award

Road Construction Waste

To Landfill or To Recycle

There is no question!

City of Vancouver
Engineering Services
March 31, 2006

Executive Summary- A Brief Overview

The City of Vancouver is a fully developed city with a population of over 500,000 and is currently undergoing significant urban renewal. Vancouver City Council, City staff and residents are committed to a sustainable, liveable city.

This recycling initiative is a demonstration of the commitment to protecting the environment in a financially responsible manner. Reduction of heavy truck traffic and congestion are just some of the benefits of this program.

The Vancouver Landfill is an important resource with limited capacity. Through the recycling initiatives of road construction materials, the capacity of this resource will be extended. Beginning in 2005, Vancouver made a significant move to reduce and reuse sewer, water, and road construction materials.

Vancouver generates over 400,000 tonnes of excavated waste material from its sewer, water and road infrastructure projects. Through various crushing, screening, and blending projects over 100,000 tonnes of material have been used in the first full year of the project. This equates to a reuse of over 6,000 dump truck loads of material or equivalent to road base material for 46 lane km of roadway. This is material that did not need to be trucked to a landfill, or excavated from a gravel pit to be trucked back into the city.

From a financial perspective this has resulted in a savings of over $500,000, which has been used as a direct reduction in material price to the city crews and also used to offset inflation of other raw materials.

As for 2005, it was just the start of more to come in terms of an integrated approach to recycling good quality road construction materials at cost effective prices.

Background

The City of Vancouver is a fully developed city with a population of over 500,000. Incorporated in 1886, Vancouver is at a stage of significant urban renewal. As part of its infrastructure management, Vancouver has established programs to renew and upgrade its aging infrastructure.

As a City bounded by mountains and water, Vancouver has a limited land base. Unlike other cities, the land base is so limited that Vancouver's landfill is in an adjoining municipality. The landfill receives household, industrial and commercial garbage, demolition waste and excavated waste.

Vancouver generates approximately 400,000 tonnes of excavated waste each year from its sewer, water and road construction programs.

Typical Excavated Waste Stockpile

Vancouver Landfill Limited Resource

By comparison the Vancouver Landfill receives approximately 400,000 tonnes of municipal solid waste each year (excluding the City's own excavated waste). With a limited resource the City is looking at ways to extend the landfill's life. Vancouver has a long established waste reduction and recycling program targeted at commercial, industrial and residential waste that has been very successful.

This industrial initiative is focused on the recycling and reuse of waste generated from the infrastructure renewal programs such as road grindings, concrete curb, sidewalk, pavement, and excavated trench material. In the past this rubble was trucked on a two hour round trip to be dumped at the landfill, using up valuable space in a limited resource.

Since post World War II, Vancouver has operated its own asphalt plant and aggregate yard. Aggregates are barged in eliminating the need for 28,000 trucks a year on city roads. In 1998, this system was automated with a new barge unloading conveyor system. In addition to eliminating the need for inbound trucking, yard safety is improved by eliminating all unloading truck and loader activity with an automated stacker.

Asphalt Plant

Barge Unloading Facility

Automatic Aggregate Stacker

Beginning in 2005, the City of Vancouver has revamped its operations to include the recycling of road construction materials.

Innovations / Excellence / Opportunity

Over the years, Vancouver has done small projects with components of recycled material. A large scale opportunity occurred in January 2005, after a recent organizational restructuring. A new engineering branch was created to integrate the City's asphalt plant, aggregate yard, ready mix plant, and excavated material transfer yard. This developed a holistic approach to material supply, material selection and reuse. Waste from one process was introduced into another stream with the end result that what originated from sewer, water and road reconstruction as a waste product was processed and reintroduced back into the road as a recycled construction product.

The benefits are not just in the direct cost savings, but also in environmental benefits. Environmental benefits range from reduced dumping of construction waste, reduced trucking and the associated pollution and traffic congestion and reduced road degradation.

The degree of integration was the key to a successful program. Through partnering of staff from the asphalt plant, the ready mix plant, the aggregate yard, the materials lab and the construction crews, the overall success became much stronger than any of the individual components. These staff relationships allowed for an accelerated program with great success in just one year.

Implementation / Results

The City generates approximately 300,000 tonnes of excavated waste, 35,000 tonnes of asphalt road grindings and 90,000 tonnes of excavated curb, sidewalks and roadway pavement – enough to fill 28,000 dump trucks – a line 360 km long. In the past this was substantially all trucked to and dumped in the landfill.

Piles of: Curb, Sidewalk, Pavement, Boulders
Into Piles of processed finished products for Road building

i) Asphalt Road Grindings

One hundred percent of roadway grindings are now recycled. This represents approximately 35,000 tonnes per year or over 2000 dump truck equivalents. The higher quality grindings are put into new asphalt mix. Maximizing for highest and best use, this saves on both liquid asphalt and aggregate. New mixes now contain up to 20% recycled content. Staff is now seeking air quality permit approval to increase this percentage while still meeting standards. The lower quality and excess grindings are screened and blended with better quality excavated soils for use as general trench backfill.



Road Grindings Prepared for Asphalt Production

ii) Crushing of Excavated Curb, Sidewalk and Roadways

One hundred percent of roadway slab material is now recycled. After processing the material through a multi-stage crusher and screens, a quality spec product is produced suitable for road base construction. In the first year of this crushing operation, over 90,000 tonnes of material was produced. This is equivalent to 6,000 dump truck loads, or is sufficient materials to prepare granular base for 46 lane km of roadway. Trials are underway to use crushed concrete as an aggregate source for the city's ready mix plant.


Crushing Operation from Stockpile to Finished Road Base Product



iii) Excavated soil waste

Over 300,000 tonnes of excavated waste is generated from the city's various construction programs. Three activities take place with this material. First, the quality granular material is processed over a screen unit to remove oversized material and wood waste. The material is then reused for deep trench backfill. Second, slabs of concrete and asphalt are removed and added into the crushing stream for recycling. Third, the yard is used as a transfer facility to accept material from small trucks or partial loads from jobs within the city and transferred to larger and efficient trucks for hauling to the landfill. Approximately 20,000 inbound trucks are reduced to 5,500 outbound trucks. Further initiatives are underway to further reduce this.

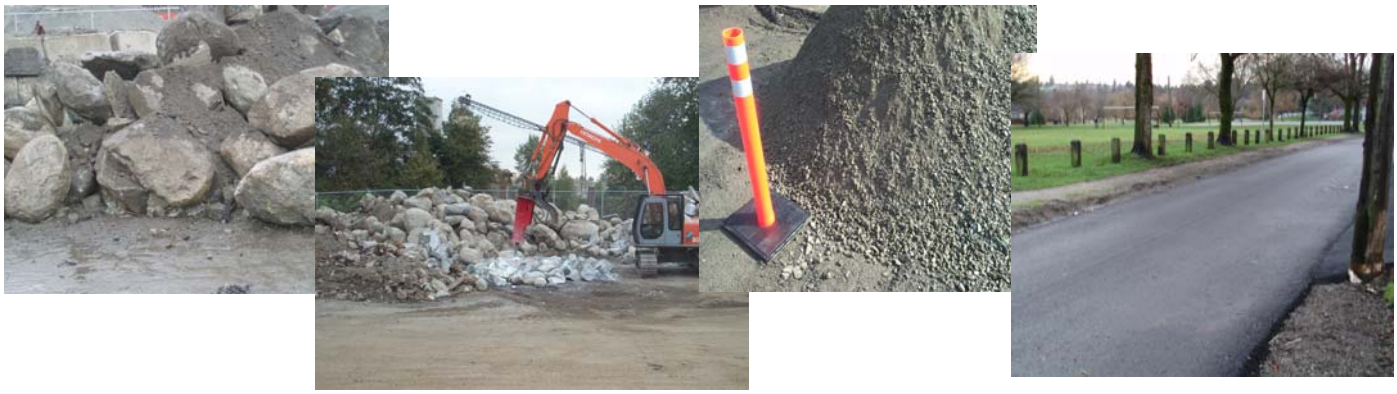
Screening and Blending of Excavated Soil

Sheep's-foot roller with soil reuse

Sub-base of blended material

iv) Boulders

During excavation of streets, large boulders are uncovered. This material is stockpiled and then crushed to make a pure aggregate without concrete or asphalt. The value of this material is maximized by using it as an aggregate for asphalt production. To date a trial has been conducted to confirm aggregate angularity and abrasion resistance for asphalt production. This trial has successfully produced a quality Superpave asphalt. The boulders have also been used to line stream beds and for landscaping.



Boulders prepared for Crushing, then for Paving

Financial Implications

In the first year of integrated operation, these initiatives have saved over $500,000. The significant new component to the operation is the crushing, which alone generated a direct cost savings of over $120,000. Using road grindings in new asphalt mix saves on liquid asphalt and aggregate, and is a savings of approximately $270,000. Blending road grindings with soils, and processing of excavated material, saves over $110,000. These savings are passed on to the end user of the product, either through a price reduction or as an offset to inflation of other raw materials.

To generate these savings is not without risk. There are inherent risks in ensuring the product consistently meets specifications. These are minimized through quality control and constant feedback from the end users.

Partnerships

To break away from traditional ways requires strong partnerships at all levels. This started at the highest level with a strong vision of sustainability from City Council. Support from the City Engineer was critical to this project's success, starting with an integrated approach, acceptance of some risk, and a willingness to experiment.

From this high level support, cooperation and collaboration flowed to all areas of the operation. The success can be attributed to having a champion in each area – each prepared to take some risk and experiment to get to a common goal.

Lessons Learned

Having a common goal of sustainability through all levels of staff and elected officials was critical in achieving support and cooperation. Equally as important was the development of partners in every area from: plant operations, to technical staff, to the end users of the products. This allowed for experimentation with direct feedback to make further improvements and other product development.

Any time change is made there is risk of failure and financial loss. Having a common focus and strong partnership allowed this to be managed to an acceptable level. Communication between staff was critical to allow for fast feedback. This allowed adjustments to be made to tailor the products for the users needs.

In conclusion, quality control was a critical component of the project. With highly variable raw materials, continual and detailed testing during the process was required so adjustments could be made by staff. Quality control was important to ensure that end products met road construction specifications and requirements. Education of staff encouraged product development, increased urban sustainability, and improved product costs.