
City of Vancouver
COUNTRY
LANES

EXECUTIVE SUMMARY

The City of Vancouver has developed an environmentally sustainable ‘Country Lane’ design that makes back lanes greener and more attractive. Three ‘Country Lanes’ were constructed by August 2003 as part of a demonstration project. This alternative to full width asphalt lane paving is in response to the City’s goal to reduce environmental impacts and to create a more liveable community.

Country Lanes feature two narrow driving strips surrounded by a structural component that is topsoiled and planted with grass. This structural grass is a rigid plastic grid that can support vehicles and prevent grass roots from being compacted and rutting the soil. Two of the three lanes used driving strips built out of concrete, while one lane used permeable driving strips built out of the structural grass grid in-filled with small gravel. The road base is a mixture of aggregate, which provides structural stability, and a sand/soil mixture that allows for drainage and provides the soil components required for grass growth. This structural soil was developed by City of Vancouver staff.

The Country Lane design will allow rainwater to percolate over vegetation and through the ground. The natural absorption allowed by this permeable lane surface reduces discharge into the storm sewer system, recharges groundwater, and reduces peak flows into rivers. The increased vegetation will filter stormwater and improve air quality. Aside from the environmental aspects, this innovative sustainable design also has many other advantages including traffic calming, as well as being aesthetically pleasing. However, Country Lanes are only a small pilot project less then one year old. It is important for the City to evaluate the performance of the lanes with time.

TABLE OF CONTENTS

LIST OF FIGURES

I.0 INTRODUCTION

The Country Lane Demonstration Project originated from the need to provide a more environmentally friendly and visually attractive alternative to Vancouver's existing asphalt and gravel lanes. Three trial locations were selected based upon supportive communities and these locations were approved by City Council.

A preliminary Country Lane design was undertaken and an extensive investigation into material selection was conducted. Various materials were investigated for each design component. Each lane was constructed using different materials and techniques, and the design was refined using the lessons learned from each previous lane.

At the conclusion of the demonstration project, it was hoped a final design would be determined and the issues associated with Country Lanes would be addressed. It is proposed to report back to City Council on the results of the demonstration project, seeking direction for the future of Country Lanes in the City of Vancouver.

2.0 BACKGROUND

2.1 Project Origin

The City of Vancouver's Corporate Management Team has encouraged staff to "incorporate enhanced sustainability into all the City Operations as a 'way of doing business'". Therefore, when some residents expressed interest in an alternative treatment to full width asphalt lane paving, City staff sought a more environmentally sustainable lane design.

Developing an alternative for an asphalt lane was not an easy task. The residents wanted lanes to be less black, less sterile and more environmentally friendly, yet there was no ready-made solution to the problem. When it was suggested that residents wanted their lanes to be more rural and less urban, the idea of a 'country' lane versus a 'city' lane was developed.

The Country Lane design was originally inspired and based upon the traditional rural driveway access with concrete driveway strips surrounded by grass. Finding a way to translate this design into an urban environment became the challenge.

Figure 2.1 Traditional Country Lane

2.2 Project Aims

The primary aim of the Country Lanes Demonstration Project was to provide an environmentally friendly and aesthetic pleasing alternative to full width asphalt paved lanes.

To provide an environmentally positive lane treatment, it was important to design the lanes using natural stormwater drainage and filtration. This would reduce the discharge into the sewer system, replenish groundwater and reduce peak flows into local streams and rivers. It was also hoped Country Lanes would improve the local air quality by increasing the local green space. These aims are supported by the Site Design Manual for BC Communities which states

> *"Blocks function as living space and define transportation corridors, they can also play an important role in the ecological function of the neighbourhood… The best place to mitigate the bulk of stormwater consequences of urbanization is at the source- in the yards and on the streets."*

The second main aim of the Country Lanes Demonstration Project was to provide a more aesthetically pleasing lane treatment. This required finding an alternative to black asphalt. By making the lane more attractive, it was hoped the residents would take more ownership of the lane, thereby creating a more liveable community.

Another aim was to educate the public about stormwater management and the effects their actions might have on the local ecosystem.

2.3 Site Selection and Approval

Selecting the sites for the Country Lanes was an important component of project. The success of the project could be highly dependent on the locations chosen. The aim was to identify lanes which would suitable for trialling the technical concepts as well as providing a supportive community atmosphere.

The first attempt to implement a Country Lane was through the Local Improvement lane improvement project. The Local Improvement process enables the City and property owners to share the cost of an improvement project. However, before City Council decides to approve a Local Improvement project, there must be support from the local residents. Resident-initiated projects require 67% local support to proceed, while City-initiated projects require 50% objections to be defeated. City staff worked with an enthusiastic community to gather the required support for a Country Lane but unfortunately the Local Improvement did not pass. Many residents felt hesitant to pay for a project with an unknown cost and no visible outcome.

After Country Lane implementation failed through the Local Improvement process, the Country Lanes Demonstration Project was presented to City Council. As a demonstration project, the City would pay the entire cost of the trial project. City Council unanimously approved this demonstration project on July 9th, 2002 to include 3 separate lanes as trial locations. These lanes would be monitored post-construction to determine the fiscal and design feasibility.

The three sites were chosen because of their strong community involvement for this initiative, as well as for an indication that they would support, maintain and promote this innovative alternative to asphalt lane paving. The sites selected were:

1. Lane south of E 27th Avenue between Fraser Street and Prince Albert Street
2. Lane east of Maple Street south of W 5th Avenue at the City Farmer Urban Agriculture Initiative
3. Lane south of Yale Street between North Slocan Street and North Kaslo Street

Figure 2.2 Initial Lane Conditions

3.0 DESIGN PRINCIPLES

3.1 Design Components

The preliminary design for the Country Lanes was to have two driving strips to carry the vehicle weight surrounded by grass. Further investigation revealed this design may not be sustainable for the volumes of traffic using the lanes. The grass was required to provide more structural strength especially at the lane entrances and driveway connections.

Therefore the design evolved into 5 primary components.

- Driving Strips
- Structural Grass
- Lane Entrances and Driveway Connections
- Subgrade Material and Preparation
- Drainage

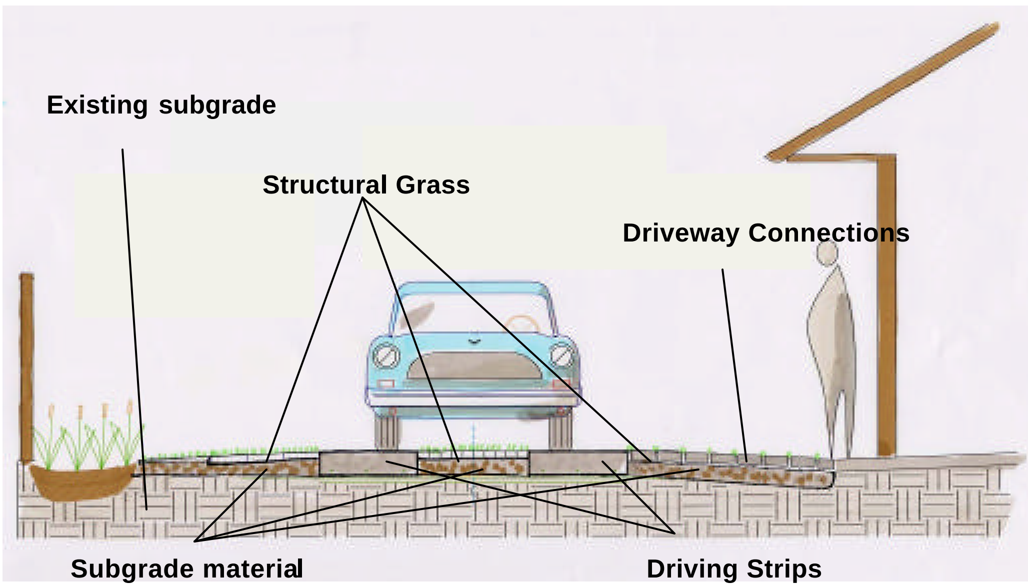

Figure 3.1 Country Lane Components

3.2 Driving Strips

The driving strips are required to provide the structural strength required for the vehicles. Several materials were considered for the driving strips including concrete, asphalt, gravel and structural grass.

3.2.1 Concrete

The first design of the Country Lanes featured concrete as the preferred driving surface. Concrete would provide a strong and durable driving surface that would be required for the City's 25 tonne garbage trucks and other service vehicles that would frequently use the lanes. However, the difficulties in constructing two concrete strips in the narrow confines of back lanes led to a search for alternate construction techniques and materials.

Pre-cast concrete slabs were investigated as an alternative construction technique to forming and placing the concrete strips. However, the cost of these slabs was severely inhibitive. In addition, placing the large slabs would have been challenging in the narrow confines of the lane and didn't seem to provide any advantage in terms of constructability of the lane. Ultimately, the two construction techniques used for the concrete driving strips included forming and placing the concrete and using roller compacted 'dry-mix' concrete.

3.2.2 Asphalt

Asphalt driving strips were also investigated as a driving surface. However, the Country Lane design required a solid edge for the asphalt which would be subject to a large amount of vehicular and truck traffic. This would result in spawling and breaking of the asphalt edges. Consequently this idea was abandoned.

3.2.3 Gravel

Gravel strips (confined and unconfined) were also investigated as a driving surface. It was determined unconfined gravel was a good economical and sustainable solution for the driving strips, however it had two major problems. Firstly, unconfined gravel wouldn't provide the structural grass with any edge protection, resulting in breakage of the structural grass at the edges due to the vehicle loading. Secondly, the unconfined gravel would still exhibit the problems that are currently faced on unimproved gravel lanes throughout the City, specifically rutting and dust generation. It was decided unconfined gravel driving strips may not provide the long term durability and low maintenance required

Confined gravel (i.e. structural grass cells filled with gravel) would solve both these problems. However, gravel provides little additional load bearing strength to the structural grass product.

3.2.4 Grass

Another option discussed was the use of grass-filled structural grass throughout the entire lane, without defined driving strips. However, it was decided that visually defined driving strips would help direct traffic and would help the grass to grow better elsewhere.

3.3 Structural Grass

The structural grass is required to provide some additional structural strength in locations vehicles turn off the driving strips. There are two major considerations for the structural grass: material product and grassing method.

3.3.1 Structural Grass Product

Numerous structural grass products were investigated from around the world. In selecting the structural grass for the Country Lane Demonstration Project, the following elements were key criteria: cost, ability to transfer loads to subgrade (i.e. prevent rutting), ease of placement, and plastic composition and strength. It should also be noted that since the project began, additional products have emerged that may be worth investigating.

Two products were chosen for the demonstration lanes. Golpla, distributed by Hoofmark out of England appeared to be one of the superior products and was also one of the most economical. However, because Golpla is a foreign product, ordering lead-time and subsequent storage has proven to be a major difficulty. However, Golpla is now available to order from Ontario, Canada. Geoblock, distributed locally through Armtec, was also used.

3.3.2 Grass Growth

Early grass development is important to the success of the installation. Grass root development into the subgrade anchors down the structural grass, preventing it from uplifting and shifting positions. Because grass growth from seeding can be very slow, sodding and pre-growing the structural grass were also trialled. These will be discussed in more detail for each lane in Sections 4, 5, 6 and 7. Hydro-seeding is also an option.

3.4 Lane Entrances and Driveway Connections

In addition to the driving strips, the lane entrances and driveway connections were a durability concern because each of these locations would have a large volume of traffic.

At lane entrances, the turning of heavy multi-axle vehicles places a large stress on the lane surface. At these locations, concrete aprons and permeable pavers were extended into the lane to provide a more durable surface for these movements.

The potentially high volume of vehicles at driveway and garage connections might stress the grass and limit its growth potential. Consequently, the first lane featured permeable pavers connecting to the high traffic driveways. Permeable pavers were chosen for aesthetic purposes while also keeping the project goal of stormwater infiltration. The same principles were also considered when selecting broken concrete as the connection material in the second lane, with the additional sustainable element of re-using old materials. Finally in the third lane, the use of soil and gravel in-filled connections was used to lower costs and enable the performance of the structural grass connections to be evaluated.

3.5 Subgrade Material and Preparation

The base material for the Country Lane design was particularly challenging. The base material is required to meet the following and sometimes competing requirements: allow for good drainage, provide strong structural integrity for heavy vehicular traffic, provide sufficient nutrients and retain enough moisture to promote healthy grass growth throughout the year.

Sand/soil mixtures are the primary base material used in England for parking lots and service lanes. Considering the heavy truck traffic that Country Lanes will receive, the City decided to develop an engineered soil to meet the above requirements. This soil is a mixture of ¾" aggregate that interlocks to provide structural strength, and a sand/soil mixture filling the voids to provide a growth medium for healthy grass root development and allow for drainage. A detailed report of the engineered soil is attached in Appendix A.

Of particular concern with the Country Lane design is the potential weakening of base and subgrade due to stormwater saturation. In an attempt to alleviate some of these concerns, geo-grid was placed in the bottom portion of the base material as recommended by structural grass manufacturers. However, it appears the geo-grid provided little benefit. It was only used it for the first Country Lane.

Figure 3.2 Structural Soil

3.6 Drainage

Two of the three lanes had pre-existing drainage collection systems in place. However, it is expected that as long as an overland drainage passage is available to protect properties during exceedingly large storm events, natural infiltration will provide sufficient drainage. In-situ infiltration tests were performed on each lane to ensure adequate drainage of the subsoils. In addition, laboratory results indicate that short and long-term drainage of the engineered soil base is sufficient for providing adequate drainage (see Appendix A).

4.0 FIRST COUNTRY LANE

The first Country Lane was constructed on the lane south of E 27th Avenue between Fraser Street and Prince Albert Street. It is located within the Mountain View Neighbourhood in the Kensington-Cedar Cottage area. The community is active in many initiatives including crime watch/block watch, the Keep Vancouver Spectacular Program, the Fraser Street Clean Up, and a mural project in co-operation with residents. In 2001 CBC radio honoured this neighbourhood in their Most Improved Neighbourhood Contest. The Mountain View Neighbourhood Group committed to providing landscaping and labour for a green lane project and also indicated support toward to the lane's future maintenance.

The lane is approximately 70 metres long and the lane right of way, or width, is 6 metres. The lane provides access to 13 properties.

4.1 Initial Design

The initial lane design featured two cast-in-place concrete driving strips surrounded by structural grass. The centre grass strip used the Geoblock structural grass product and the edge strips used the Golpla structural grass product. Large concrete aprons and permeable pavers were used at the entrances of the lane to address the durability concerns associated with the turning of large multi-axle vehicles. Frequently used driveway connections were constructed with permeable pavers while infrequently used areas were constructed with structural grass. Modifications and changes were made to the design according to the neighbourhood and individual concerns. One example of a community driven change was the use of red permeable pavers to highlight colour in the lane. A landscape architect from the City's Greenways department created a planting scheme with residents, including several small flower gardens.

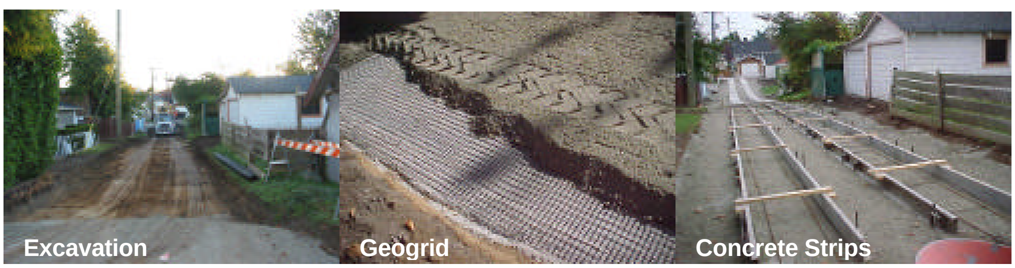

Figure 4.1 Construction

Figure 4.2 Community Construction

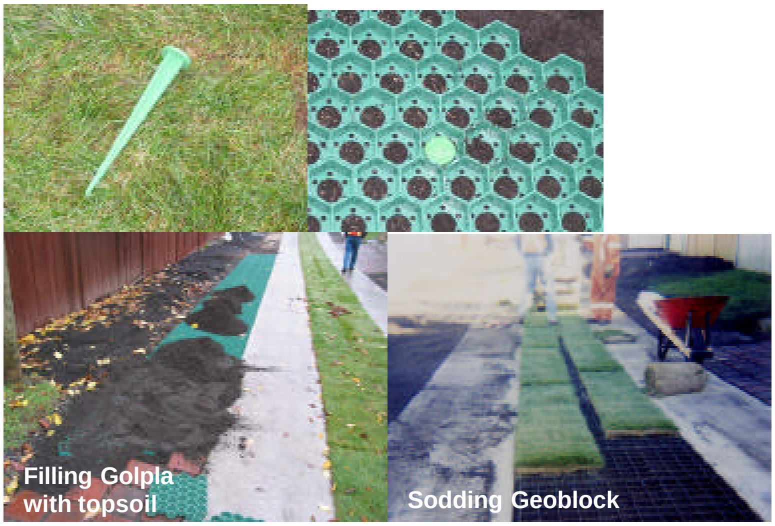

Figure 4.3 Structural Grass Construction

Figure 4.4 First Country Lane Improvement

4.2 Results

In an attempt to present a more visually impacting product immediately upon completion, the City experimented with laying sod down the centre grass strip instead of the recommended seeding technique. The grass sod needs a soil base, and it is difficult to achieve the appropriate depth of soil in the cells. It was also difficult to 'cut' the sod into the cells. The result was that the sod was laid slightly above the top of the plastic, resulting in excessive wear. In addition, the efforts to push the sod into the cells with a roller resulted in an extremely compacted soil within the cells. If the crown of the grass (just above the soil level) is above the structural grass product, it will be compacted and damaged by vehicles driving over top. In this case, grass would be worn, and less water would be infiltrated.

Figure 4.5 Grass Growth

The Geoblock structural grass product was used in the centre strip and unfortunately it is already beginning to show some signs of wear due to vehicular traffic. In addition, there appears to be some strain at the joints. However, it should be noted that the strain may not be entirely related to the Geoblock product. The thermal expansion of the Geoblock is physically limited by the concrete driving strips and this may be the cause of the strain exhibited by the Geoblock structural grass.

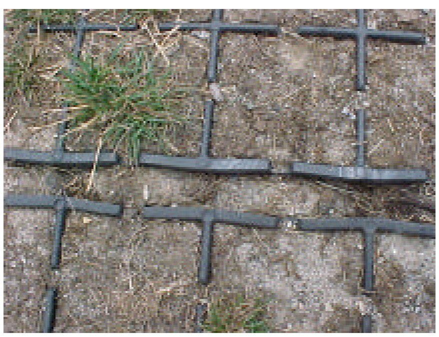
Figure 4.6 Geoblock joint strains

The Golpla structural grass product was used on the edge strips and the material is showing no signs of strain or decomposition. However, there are some portions of the lane where the structural product flexes or uplifts at the joints. It is possible this is due to a poor levelling course, limited compaction and uplifting before root development occurs.

Considerable settlement has occurred under the structural grass and permeable pavers. This is likely due to insufficient compaction and variable structural soil consistency. Compaction was difficult to measure in the earlier soil designs, because there was no established optimum moisture content and density or standard compaction procedures and methods. Through on-site compaction testing it was discovered that it is difficult to compact structural soil beyond a 150mm lift. In addition, thick lifts of levelling course (up to 50mm) were laid during the paver event for installation of the pavers. The levelling course was a 50/50 sand/soil mixture that was difficult to compact.

Figure 4.7 Settlement

Figure 4.8 Drainage

5.0 SECOND COUNTRY LANE

The second Country Lane was constructed on the lane east of Maple Street south of W 5th Avenue. This lane connects to the City Farmer property, which demonstrates and promotes sustainable technologies in partnership with the City of Vancouver. This Country Lane compliments the City Farmer policy of promoting sustainability through urban agriculture and conservation of resources. City Farmer is a strong ambassador and they are dedicated to the long-term success and maintenance of their lane.

The lane is approximately 40 metres long and the lane right of way ranges from 3 to 3.75 metres. The lane provides access to 6 properties, including a large apartment building. It is legally a dead-end lane, but is physically connected by a private driveway/parking area to the City Farmer urban agriculture farm.

5.1 Initial Design

Public consultation allowed residents to give input for design consideration. Particular concerns were the large apartment building along one side of the lane, limited right of way, and additional truck traffic. The right of way was too small for concrete strips, encouraging experimentation with Golpla across the entire lane except at lane entrances and driveway connections. To alleviate concerns relating to additional truck traffic, the driving strips were filled with a small gravel (<10mm) rather than grass. Permeable pavers were used at the entrances of the lane, and broken concrete (recycled sidewalk slabs) was used at driveway connections. The Golpla was filled with a small binding aggregate where a large garbage bin had to be pulled out frequently. The binding aggregate was filled level with the top of the Golpla to ensure a smooth surface to pull the garbage bin across the lane. The City's Greenways department also designed a planting area protected with granite boulders along the edge of the apartment building.

Figure 5.1 Interim Construction

Figure 5.2 Second Country Lane Improvement

5.2 Results

The gravel-filled Golpla driving strips are showing no signs of strain, wear or age. The Golpla is containing the gravel and significantly reducing dust on the lane. In addition, the structural grass product seems to act better as an interconnected system rather than in disjointed strips.

Figure 5.3 Gravel-filled Golpla Driving Strips

The structural grass was pre-grown for this lane, presenting a green lane immediately upon construction. Pre-growing the grass was more expensive than seeding, and requires coordination with the growing season. The growing time is highly variable based on climate but the grass for this lane took approximately 6 weeks to grow. The grass in the Golpla was grown and assembled in a large unit outside at the City's nursery. Assembling the Golpla in a unit prevented grass from growing between joints and made pick up relatively clean and easy. However, the grass was placed on a woven permeable fabric instead of the suggested plastic due to concerns with root disease and water ponding. Unfortunately, the permeable fabric also allowed the grass to take root into the fabric. Specially modified shovels with a flat blade were used to cut underneath the Golpla and a long lever arm was used to disconnect the Golpla from the fabric. It was important not to snap the connection tabs off the Golpla throughout this process and if the Golpla was pulled straight up and not on an angle, no tabs were broken.

Figure 5.4   Pre-grown grass

Figure 5.5   Pre-grown grass removal

It is harder to place pre-grown Golpla than empty Golpla, because it is considerably heavier. However, once it was laid it was smooth and immediately visually appealing. Concerns were raised with respect to the grass growth due to the hot summer conditions, however this lane is well shaded and the residents regularly watered the lane. The grass has now healthily grown and rooted into the base.

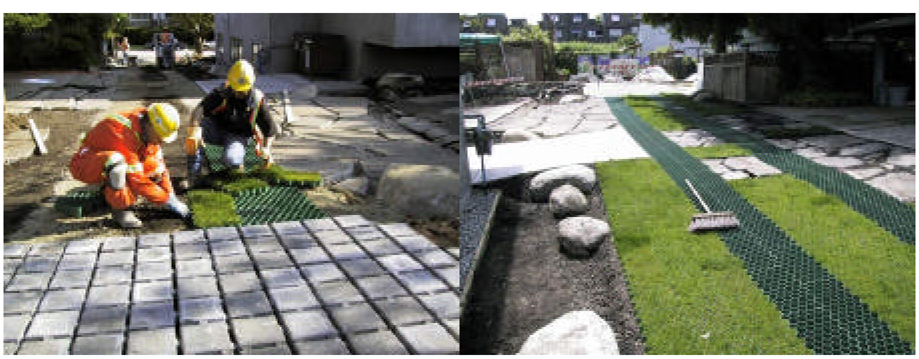

Figure 5.6   Pre-grown grass placement

Encroaching properties, combined with a limited right of way, forced the lane to have a slight kink, or bend in it. The Golpla is a rigid product, with limited allowance for bending. It is difficult to bend Golpla, and therefore it is difficult to place a kink, or bend in the lane.

The broken concrete driveway connections are shaded better than the lane entrances, and are beginning to have grass grow between the cracks. Residents have commented that they look beautiful with grass growing between them. However, some individual pieces are beginning to fragment under vehicular weight, and some are pivoting on the aggregate base. The concrete was free, needing only transportation from a sidewalk reconstruction project. Unfortunately, broken concrete connections were expensive and time consuming to prepare and place.

Figure 5.7 Broken Concrete Driveway Connections

Figure 5.9 Permeable Paver Lane Entrance

Figure 5.8 Variable Base Placement

Figure 5.9 Drainage

6.0 THIRD COUNTRY LANE

The third Country Lane was constructed on the lane south of Yale Street between N Slocan Street and N Kaslo Street. The residents and city staff unsuccessfully attempted to implement the Country Lane concept through the Local Improvement Process at this location before funding was approved for the demonstration project. Adequate support was not received due to concerns over maintenance and cost. The initial effort of the community to build an alternative to the asphalt lane encouraged City Council to approve this location for the demonstration project.

The lane is approximately 165 metres long and the right of way ranges from 4.5 to 5.25 metres. The lane provides access to 30 properties.

6.1 Initial Design

The first two lanes were designed in conjunction with the local residents and the City's Streets Design and Greenways departments. To minimize the extensive staffing time required for the Country Lanes Demonstration Project, the third lane was not as extensively designed. Instead, standard cross sections were developed and operations crews were given freedom to make the field changes required to make the design work. The centre line of the lane was provided and the operations crews were asked to build dry mix concrete driving strips 60 cm wide straddling the centre line 90 cm apart. These measurements accounted for standard vehicle widths and allowed three Golpla blocks to be placed between the concrete strips. The dry mix concrete was used as an alternate construction method to forming and placing traditional concrete and it was intended to reduce costs and construction time.

The driveway connections were constructed using Golpla and filled with <10mm gravel. A minimum width of 30 cm structural grass was required on either side of the concrete driving strips. The base was constructed using structural soil under grass-filled Golpla and a granular road base under gravel-filled Golpla driveway connections.

Figure 6.1 Interim Construction

Figure 6.2 Golpla Placement

Figure 6.3 Third Country Lane Improvement

6.2 Results

The roller compacted concrete mix specifications allocated insufficient water. As a result the concrete had difficulty bonding, and the edges of the strips crumbled under pressure. However, the Golpla placement now prevents the concrete edge from crumbling. The mix was changed partway through construction, and several existing portions of the strips had to be replaced with the new mix.

Figure 6.4 Dry mix driving strips

This lane was seeded in the heat of summer. An extremely dry and hot summer has made it difficult for the grass to grow. The grass is growing significantly better in portions of the lane under shade, and where residents are regularly watering. After a wet fall, the grass is growing very well.

Figure 6.5 Grass Growth (summer)

The undulating surface of the dry mix concrete and a lip under the concrete edge caused the top of the Golpla to occasionally rest above the driving strip edge. A 2x4 was used to form a straight surface edge on the concrete. The true edge of the concrete extended beyond the surface edge, underneath the 2x4. Now the Golpla is resting on the true edge of the concrete, or the lip, and is now exposed to concentrated traffic loading as it is occasionally positioned above the top of the concrete strip.

Figure 6.6 Concrete Lip

There are occasional small areas where Golpla pieces seem to keep uplifting. It is possible that the uplifting is caused by an uneven or variably compacted subbase. Once a vehicle drives over a section with a poor subbase, the Golpla lifts up on one edge, and all the soil falls underneath it. Soil falling underneath prevents The cause of the uplifting is unknown. If the problem continues, it is easy to install several Golpla nails to hold down the blocks until the grass roots develop. In addition, the topsoil/sand mix used to fill the Golpla included significant amounts of sticks and bits. The sticks may be working their way underneath the Golpla to push it up and cause it to flex. In the future it may be better to use a cleaner mix of sand and topsoil.

Figure 6.7 Uplifting Golpla

The Golpla driveway connections are allowing infiltration, containing the gravel and preventing dust. After 2 months of use they are showing no signs of strain. Overhead power lines are causing water to drip into some of the cups and splash the gravel out. This is merely an aesthetic concern. If necessary, manufactured Golpla plugs could be installed at a minimal cost.

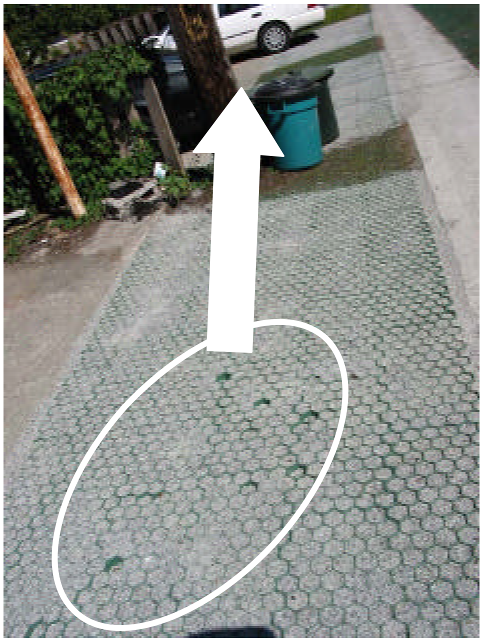

Figure 6.8 Gravel 'hydro-excavation'

7.0 COSTS

The Country Lane demonstration project cost approximately twice as much as full width asphalt lane paving would have cost.

Elevated costs are due to:

- learning curve for each lane
- hand formed concrete driving strips
- dry mix concrete failure and replacement
- permeable paver driveway connections and lane entrances
- granite cobble lane entrances
- broken concrete driveway connections
- working with new materials (structural grass, structural soil, etc.)
- construction of the lane in strips rather than one uniform section
- additional base excavation and placement

The base of the lane was built using different materials in different sections. This variable base placement was highly labour intensive. In addition, the concrete strips separated the structural grass, requiring detailed construction methods along the entire lane.

It is estimated that as crews become accustomed to the new construction methods and the design is refined, Country Lanes will cost between 25-100% more than asphalt. It is estimated that a lane with extruded concrete driving strips will cost between 50-100% more than full width asphalt. A Country Lane with structural gravel driving strips is estimated to cost 25-50% more than full width asphalt. Country Lanes will always cost a premium over asphalt lanes, as Country Lanes have more construction steps than asphalt lanes, and there is considerably more detailed or hand work.

7.0 OUTCOMES AND DESIGN ADJUSTMENTS

The Country Lane Demonstration Project enabled the evaluation of three different lane improvement locations, each with different features, construction methods and design ideas. The evaluation has enabled the City of Vancouver to suggest a standard Country Lane design. The new design is similar to the second Country Lane with some small design changes to improve construction methods, time and cost. Unfortunately, because the proposed design has not been trialled the cost can only be estimated.

7.1 Design

Each of the three demonstration Country Lanes was significantly more expensive than a traditional asphalt lane. Therefore, to make Country Lanes more competitive to asphalt lanes, the costs need to be reduced. One of the factors that made the lanes so expensive to construct was the segmented nature of construction. Each strip of the lane had to be constructed separately. To overcome this labour intensive construction method it is suggested the future form of a Country Lane should involve structural grass across the entire lane surface of the lane. More details of each component are discussed below.

7.1.1 Driving Strips

Concrete driving strips have provided a strong and durable driving surface and construction cost could be reduced by approximately 40% if the strips were extruded. However, regardless of the concrete pouring method, the physical placement of two driving strips forces the lane to be built inefficiently in small sections and strips using labour intensive construction techniques. Therefore it is proposed the driving strip be constructed using a structural grass product filled with gravel. Gravel-filled structural grass should provide the necessary strength and still provide visual indication to drivers for the best driving path.

7.1.2 Structural Grass

Using structural grass across the entire lane cross section enables the product to be linked together, creating a stronger grid network for lateral movement. In addition, construction times should be reduced and construction methods simplified.

Initial research indicated Golpla as the cheapest and most durable structural grass product available, however the pre-order time was extensive due to the international shipping. Fortunately Golpla can now be ordered from Ontario, Canada with one week lead time. New structural grass materials are opening on the market and these new products should be assessed against Golpla to ensure the City is using the best product available.

It is suggested the grass to be used in the structural grass material should be pre-grown if costs permits. Pre-growing the grass means the positive effects of the lane are immediately apparent and residents are happier. Seeding the grass is also an option and this would provide a cheaper alternative to pre-grown grass. This should be decided on an individual lane basis.

7.1.3 Lane Entrances and Driveway Connections

More structural strength is required at the lane entrances and it is proposed to retain the concrete or asphalt aprons as appropriate at each individual site. The size of the apron will need to be calculated to accommodate site peculiarities and truck turning radii.

Permeable pavers and broken concrete are visually attractive and allow reasonable infiltration, however they are not the most cost effective solution. It is therefore recommended they not be included in any standard lane design. The most cost effective driveway connection method appears to be structural grass filled with gravel or grass.

7.1.4 Subgrade Material and Preparation

In each of the three demonstration lanes the subgrade was varied according to the load proposed on each segment. This was a labour intensive process. To decrease costs it is proposed to use a 100mm layer of structural soil across entire lane width regardless of structural grass treatment. Lab tests indicate that structural soil would provide sufficient strength.

7.1.5 Drainage

Without detailed stormwater runoff data, the drainage effects of the Country Lanes are unclear. Preliminary results show the lanes are highly permeable and there are no associated runoff problems. However, it is difficult to direct any overland flow when using a structural grass material. Unlike asphalt lanes, Structural grass does not easily allow for lip to be constructed to channel flow. Care needs to be taken during construction to ensure that the grade of the lane does not direct flow into driveways.

7.1.6 Construction Methodology

The final lane design proposed is based on the performance of each lane, resident feedback and overall project costs. The design has been simplified to reduce costs as well as design and construction time.

Construction methodology:
1) Base preparation with 20mm minus crushed aggregate (#9) up to 140mm below final grade. Compact to 95% modified proctor density.
2) Placement of 100mm of structural soil across the entire lane (regardless of driving strips, driveway connections, etc.)
Compact to 95% modified proctor density.
3) Leveling course of sand across the entire lane (~15mm)
4) Structural grass across the entire lane, approximately 350cm wide, extended and cut where appropriate to meet driveway connections.

5) Structural grass driveway connections and driving strips filled with gravel. Everywhere else filled with sand/topsoil mix and seeded and some pre-grown grass at select locations.

Lane on lane entrances (ex. L/S 27th) may be made out of asphalt or concrete. Dimensions and material dependent on site.

7.2 Resident Feedback

Questionnaires were distributed to the residents of the three Country Lanes and the feedback was generally positive. A summary of the returned questionnaires is contained in Appendix C.

Of the 21 questionnaires returned, only one person was unhappy with the lane. Residents commented that the main benefits of the lane appear to dust reduction (versus unimproved gravel), noise reduction, temperature reduction, addition of 'green space', rain absorption and a more visually appealing lane. The majority of respondents also believe vehicles are now travelling slower on their lane and that more people are using and enjoying the lane as a green space.

The main concerns with the lane appear to be the poor grass growth, the concrete driving strips on the third lane, the centre grass sodded strip on the first lane and the lack of maintenance by the city. Some residents were also disappointed by the lack of input they had in their lane design.

One of the questions on the questionnaire asked residents if they would be prepared to pay an extra 50% to have a Country Lane rather than a full width asphalt lane. Of the 18 respondents, 11 (52%) would pay the premium increase, 3 (14%) would not pay and 7 (33%) were undecided. These percentages indicate that although residents may be in favour of Country Lanes, the lanes may be potentially divisive within the community when it comes to paying for the lane.

8.0 LONG TERM CONCERNS

The Country Lanes Demonstration Project was an experiment in creating an alternative to full width asphalt lane paving. As a result of the trial, several concerns have become apparent and if possible, these concerns should be resolved before Country Lanes are implemented citywide.

8.1 Maintenance

The largest concern with respect to Country Lanes is the unknown future maintenance requirements. The maintenance associated with Country Lanes has yet to be determined and monitoring over the next 5-10 years is important to assess the long term requirements. At this time, the long term maintenance issues do not appear to be extensive or overwhelming. However, time is required to assess the durability of both the design and the materials used.

Currently the City does not maintain lanes except for isolated asphalt patching as required. Country Lanes have the potential for much more frequent and time consuming maintenance. Possible maintenance issues include:

- Mowing of grassed areas
- Possible re-seeding of the grassed areas to ensure a thick mat of grass
- Maintenance of planted areas including watering and weeding
- Concrete cracking of the driving strips, driveway connections and lane entrances
- Potential drainage issues associated with overland flow
- Collection of pine needles and leaves within the cells of the structural grass (when the cells of the structural grass fill up with debris, the soil is compacted and the infiltration capacity of the lane is significantly reduced)
- Deterioration of the structural grass product including plastic decomposition, settlement and flexing.

Structural grass is the main concern. The structural grass used in the Country Lane design has yet to be proven long term in the climatic conditions of Vancouver. All indications from European experience show the Golpla material will endure for at least 10-20 years. However, this has yet to be proven in Vancouver. Should the material fail, the City may be responsible for costly repairs and perhaps even the reconstruction of the entire lane. In addition, if isolated repairs are required to the structural grass, it is not as easy or cost effective as asphalt patching. Replacing individual structural grass panels can be a difficult and time consuming task since all the tiles are linked together.

Aside from the physical maintenance concerns, the issue of who maintains the lanes is also important to resolve. To date, the City has assumed highly repetitive maintenance such as mowing and watering will be done by the lane residents. This may be an appropriate assessment for the demonstration lanes, however future communities may not be as dedicated to maintaining their Country Lanes. This raises the important question of City versus resident maintenance. The structure of the Country Lanes dictates that the water infiltrates through the entire lane cross section. Inadequate maintenance may alter the permeability of the lane and therefore possible create major drainage issues. It may be appropriate for the City to ensure the permeability of the lane is retained.

If the City is to maintain the lanes, additional funding and staffing resources must accompany the capital contribution. The mechanism for collecting this maintenance funding will need to be investigated in more detail.

8.2 Building Permits and Utility Cuts

Lanes are frequently used for utility services which need to be repaired or replaced. Repairing a Country Lane after a utility cut is likely to be a very difficult and costly task which could require the reconstruction of the entire lane. Therefore, the question is raised about the appropriateness of using a structural grass product which may not be easily repaired and replaced.

Similarly, lanes are often used for construction vehicles. In many cases the only access available for construction vehicles may be to use the Country Lane. These properties need to be identified and flagged in PRISM at the building permit stage. In addition, a larger damage deposit would be required from the builder. The City currently requires an $800 deposit for lane damage. This amount would need to be significantly increased to cover any damage caused to the Country Lane and to deter contractors from using the lane if other access options are available.

8.3 Sanitation Department Concerns

Discussions with the sanitation department revealed that in general, they are in favour of the Country Lane concept, but there are three main areas of concern.

The first issue is the potential trip hazard developing in the lanes between the driving strips and the ‘softer’ surrounding lane treatment. It is felt over time different levels of settlement will occur and this will in turn create a trip hazard in the lane.

The second concern is with respect to passing vehicles. When garbage trucks encounter another vehicle in the lane they are required to leave the driving strips and pass the vehicle. There is concern about the weight of the vehicles being carried by the edging material.

The final concern is with respect to leakage issues from the sanitation vehicles. There are concerns that the environmental benefits and aesthetic pleasure of the lane is undermined by leakage from the sanitation vehicles. This issue cannot be easily resolved.

It is important to note that the Sanitation Department is very supportive of the Country Lane concept and they would like to see the some of the issues resolved and more lanes constructed.

8.4 Local Improvement Process

If it is decided to implement Country Lanes throughout the City, they would likely be administered through the Local Improvement process. The Local

Improvement process is based upon the principle of implementing a standard improvement in a uniform and equal manner throughout the city. Using the Local Improvement process there are two methods of implementing Country Lanes citywide.

The first option is to establish one standard lane design and implement that design across the city without changes. For this to occur, a single Country Lane design, suitable for implementation in all situations, would need to determined and implemented with few variations. This standard design would be included as part of the City Bylaw and would be difficult to change. However, without sufficient time to monitor the demonstration lanes, selecting a single design to be implemented across the city may be problematic. There is also likely to be an expectation from the community, based on the demonstration project, that they will have a large input into the lane design and individual driveway entrances.

The second option available is to design each lane individually with input from the community. This would create a greater ownership of the lane and likely reduce maintenance issues. Creating ownership of the lanes and fostering community relationships is one reason why the Country Lanes project has so far been so successful. Conversely, designing each lane individually is highly time consuming and impossible using current staff resources. For each lane to be custom designed, a bylaw would need to be drafted for each lane. In addition, large staff resources would be required to undertake the community consultation and design process.

Including the Country Lane as an option in the Local Improvement process also has the potential to divide communities. Some communities may be in favour of improving their lane, however providing the option of asphalt or Country Lane to each community may cause divisions. Some residents may prefer the asphalt lane because it is cheaper and does not require as much maintenance from the residents. However another portion of the community may prefer to have a Country Lane. This creates the potential for neither option to pass in the Local Improvement process and the result would be an unimproved lane. In addition, by creating a cost differential between an asphalt lane and a Country Lane, the more affluent areas of the city are more likely to be able to afford a Country Lane, further increasing the divide between neighbourhoods.

9.0 CONCLUSION

The Country Lane Demonstration Project trialled three different lane designs to achieve an environmentally sustainable lane design in Vancouver. Each lane design evolved and built on the lessons of the past lanes. As a result of the demonstration project, the future form of the Country Lane design has been suggested and designed. This design involves a uniform surface of structural grass and uniform base preparation to eliminate the laborious sectional construction method and to reduce costs.

The project has been an overwhelming success in terms of community involvement and education. Resident feedback suggests the majority of residents are happy with their Country Lane and feel their community is now greatly improved. The Country Lane Demonstration Project has also been recognised throughout the Lower Mainland, Canada and internationally with requests for design data from many cities and municipalities. The Country Lane Demonstration Project won the 2003 Technical Innovation Award from the American Public Works Association, as well as an honourable mention for the 2003 Environmental Award from the Canadian Association of Municipal Administrators.

Although the project has been a success, several issues have yet to be resolved before Country Lanes can be confidently implemented throughout the city. Similarly, the process of including the lanes into the Local Improvement process needs to be resolved.

APPENDIX A– STRUCTURAL SOIL REPORT

CITY OF VANCOUVER

ENGINEERING SERVICES
Materials Branch
Materials Lab

M E M O R A N D U M April 16, 2003

TO: Wally Konowalchuk, Streets Design

FROM: Jeff Markovic, Materials Lab

CC: David Desrochers, Streets Design
Ted Batty, Materials Branch
Rustam Jeraj, Materials Lab
Tom Barry, Streets Design
Brian Willock, Streets Design
David Yurkovich, Greenways

SUBJECT: Grass Stone

PURPOSE

To design a structural aggregate with organic and relatively free draining qualities, as a base for use under light vehicular traffic, and a medium for promotion of grass growth. This process was a revision of a year 2002 blend, as an "in-house" design suiting the requirements for the City's "Country Lane" and "Crown Street" programs/projects.

During this trial of 'Grass Stone' mixing, Vancouver Landfill compost blends and Item 15 (3/4" clear crush) was used. The trial incorporated all practical aspects of mix design of structural type soils for promotion of: typical residential traffic loading, grass growth, and hydraulic conductivity of soil mix.

PRODUCT

The product is a proportioned blend of 3/4" clear crush material of granite composition, mixed with organic compost and fine river sand. The clear crush material is supplied by Mainland Sand & Gravel, under current City tender for aggregate delivery. The Vancouver Landfill supplies the compost blends.

SUPPLY

The product is mixed with a front-end loader at the City's Kent Yard facility. The Item 15 (clear crush rock) is supplied through the yard aggregate facility, and the compost is delivered to the yard by tandem dump trucks, from the Landfill.

PRODUCTION

In theory, the production of Grass Stone is relatively simple. The Grass Stone is mixed by weight of compost blend material, to weight of clear crush stone. The compost blend is loader blended, by volume, at the Landfill facility prior to delivery. The mixing of the two products is done by layering the compost blend material over a layer of 3/4" clear rock, in multiple lifts. To maintain uniformity of the final product, the layering is done strictly by weight. Basically, all the materials are weighed by scale and then layered according to our mix design proportioning.
Actual rate of production is estimated at about 40 to 50 tonnes per hour.

LABOUR

At least two employees will be required to ensure the production and quality of the Grass Stone. In addition, a front-end loader and operator, and two tandem dump trucks and operators will be required.

APPLICATIONS

The Grass Stone is intended for use as a structural subbase for light vehicular traffic in lanes, residential roads, and small parking lots. Besides having structural characteristics, the soil mix is intended to have
sufficient organic to sustain long term healthy grass growth. In this updated blend, there has been a concerted effort to ensure sufficient hydraulic conductivity of the soil to endure a 5-year rainstorm, and be somewhat of a storage medium for excess runoff.
The mix will be compacted to 95% of modified proctor of 2000 kg per cu. metre. The process of compaction should be done with either a 1000 lb. plate tamper, or Essex type roller.

MAINTENANCE

Maintenance of the Grass Stone is intended to be minimal, if any. Initial compaction should be sufficient to ensure the uniform density of the product. All other characteristics have been considered for the final mixed product.

CONSIDERATIONS

The main consideration for designing Grass Stone is to establish a growth medium for grass and small plants, good hydraulic conductivity, some storm water retention, with structural capabilities to carry small vehicular traffic loads.
A minimum organic content is important, so as to ensures healthy grass growth. A minimum design requirement is 5% organic content by dry weight, according to specifications set by the BC Landscape Standard, and Low Impact Development Centre, Maryland, USA.
A minimum air void content is determined to be about 25% of total Grass Stone product volume, and unit weight of 2000 kgs per cu. metre (similar to a well-compacted 3/4" road mulch). The minimum hydraulic conductivity is based on an extreme daily precipitation of about 40 mm per hour.
Other Design criteria includes:

Organic Matter Content of 30% to 70% by dry weight (spec. California Waste Management Board)
Nutrient Content (Nitrogen for upper grass growth, and Potassium and Phosphorus for root development, including a Carbon to Nitrogen ratio of less than 20)
Bulk Density of compost of approx. 475 kg/cu.metre (spec. California Waste Management Board)
pH- 6 to 7.5 (spec. BC Landscape Standard)
Possible hydraulic conductivity of native soils, in relation to the Grass Stone (Crown Street bores as an example)
In actuality:
Organic Matter Content of compost is about 56% (dry weight)
Carbon to Nitrogen ratio of 26, indicating not fully matured compost. There is a about 1.3% Nitrogen which may be a little low for green leafy growth, but the potassium and phosphorus levels should be adequate for root development.
Bulk density of the compost is approximately 660 kg per cu. metre
pH of the compost is 5.8, and the pH for Item 15 is about 7.5
Hydraulic conductivity ranges from 6 cm to 36 cm per hour, along Crown Street. The hydraulic conductivity of the Grass Stone can range as low as 2.5 cm per hour to as high as 60 cm per hour, depending on the ratio of compost blend to clear stone, and the ratio of organic material to compost.
A greater level of hydraulic conductivity can be achieved by proportioning lower percentages of compost blend to the mix. But at 23% compost blend, we cannot assure the minimum design amount of 5% required organic content. Since clean compost consists of about 50% moisture, and depending upon the proportioning of river sand to the compost, the average percentage of total moisture can be about 40% of total compost blend mass. Therefore at 23% compost blend “2 to 1” has an estimated total organic content of 3.5%. This is the total since we would be measuring the total materials by wet weight.

CONSIDERATIONS (Cont’d)
A mix of 25% of “2 to 1’ compost blend to 75% of item 15 rock, but can reduce the hydraulic rate down to about 10 cm per hour, from about 40 cm per hour, and an organic content of about 3.8%.
A mix of 23% of “3 to 1”compost blend to 77% of Item 15 rock will allow for a hydraulic conductivity of upto 25 cm per hour, and have a organic content of approximately 4.9%.

The granite-like 3/4" clear crush is considered as the material required as the structural component of the Grass Stone for: uniformity of rock size (3/4" by 3/8"), sufficient void space for addition of compost blend
materials and root development and water retention (40%), good specific gravity (2.73), unit weight (1880 kgs/cu.metre), pH of about 6.6 to 7.5, and durability (low LA Abrasion).
Several types of compost materials were considered for blending with 3/4" clear crush Vancouver Landfill “50/50" mix...Vancouver Landfill “2 to 1" mix...Vancouver Landfill “3 to 1" mix...Fraser Richmond Biocycle Turf mix....Fraser Richmond Biocycle Lawn & Garden mix. Organic content, unit weight, bulk density, and pH testing was conducted on these samples. Testing with blended clear crush rock primarily focused on the Vancouver Landfill products because of: lower costs and inter-departmental sustainability.

The combination of all these requirements helped in the determination of the mix ratio of clear rock with a selected compost blend material. Trials with the various compost materials were blended with the clear crush, at various ratios. The previous years mix ratio of 72% clear rock to 28% compost was effective as a well-compacted and dense material, with a substantial organic content. There was an initial concern regarding the hydraulic conductivity of this mix. This initial designed stone mix had a final hydraulic conductivity of about 0.32 cm per hour. With present observations and empirical data, the anticipated hydraulic conductivity of that mix should have been about 1 cm per hour. It is obvious that the structural type blend from 2002 would not meet our design criteria for the projects this year. What is somewhat unanticipated is the reduction in hydraulic conductivity of the structural stone mix due to maturing compost over a few months. During the period of compost maturing, it appears that the hydraulic conductivity may be reducing by a factor of 3. This simply means that an initial anticipated conductivity of 40 cm per hour can be reduced to approximately 15 cm per hour. An assumption that I can simply make is that the organic matter and fine river sand will slowly filtrate to the lower level of the compacted lift. Basically, the fines will flow to the bottom and inhibit the flow of water. This seems to be an important fact, since the compost the Vancouver Landfill provides is currently maturing compost. This is evident, since at the time of testing the Carbon to Nitrogen ratio was 26. This is higher than the suggested ratio of 20. What can be anticipated is that after long dry summers this fine sand and compost will be able to absorb a substantial amount of initial rainfall. Over an extended period of time, continued rainfall will percolate at the lowest calculated rate (cm/hr).
It should be noted that preliminary tests do not indicate any noticeable reduction in hydraulic conductivity, of a well-draining soil mix, with grass growth and root development.

CONCLUSIONS

As a base product, it is recommended that a blend of 78% of item 15 (clear crush rock) and 22% of “3 to 1” Landscape compost be blended for use as structural soil.

This ensures that we can achieve 95% of proctor value of about 2000 kg per cu. metre, achieve total organic content of about 4.9%, a pH value ranging 6.6 to 7.5, maintain a hydraulic conductivity of 25 cm/ hour (which may reduce to about 9 cm per hour during compost maturing), and ensure an air void content of at least 25% for root development and water retention.
This should allow us to achieve our objectives of structural stability, establishing a practical medium for grass development and growth, and a 5-year storm capable soil mix for hydraulic conductivity.
An added value to this mix scenario is the added benefit of initiating urban sustainability by using Vancouver Landfill material.

If you have any questions, comments, or recommendations, please feel free contacting me at (604) 301-0354. Or, please attach comments by e-mail

Jeff Markovic, AScT.
Materials Lab

APPENDIX B - PROMOTION AND RECOGNITION

The Country Lanes Demonstration Project won the 2003 Technical Innovation Award from the American Public Works Association, as well as an honourable mention for the 2003 Environmental Award from the Canadian Association of Municipal Administrators. Cities and municipalities across the Lower Mainland, Canada and internationally have requested Country Lane design information.

Additional promotion includes:

Conferences

• INFRA 2002	(Centre for Expertise and Research on Infrastructures in Urban Areas, Montreal, QU)
• IFLA 2003	(International Federation of Landscape Architects, Calgary, AB)
• APWA 2003	(American Public Works Association Awards Recognition Ceremony, San Diego, CA)
• PWABC 2003	(Public Works Association of British Columbia Annual Technical Conference, Penticton, BC)
• GVRD, SILG	(Greater Vancouver Regional District, Stormwater Interagency Liaison Group, Vancouver, BC)
• MED Seminar	(Municipal Engineers Division of APEGBC)

Exhibits

• APEGBC 2003 Sustainability Exhibit

Magazines, Reports and Newspaper

• Infrastructures Dec 2002/Jan 2003
• The Province
• Sustainability in Professional Engineering and Geoscience: A Primer (APEGBC)
• Natural Approaches to Stormwater Management: Low Impact Development in Puget Sound (http://www.psat.wa.gov/Publications/LID_studies/LID_approaches.htm)

Television

• GVTV (locally)
• The Weather Channel (nationally)

Internet

• http://www.can-tf1.org/localweb2/resLaneCntry.html
• http://www.psat.wa.gov/Publications/LID_studies/permeable_pavement.htm#pp3
• http://www.cityfarmer.org/lanes.html

APPENDIX C – RESIDENT QUESTIONNAIRE SUMMARY

Number of surveys delivered	65
Number of surveys returned	21
Response rate	32%

NOTE: This survey was conducted in late September, after an entire summer of drought. The grass is doing much better now that we have had record rainfall. In addition, with more time, and as the grass is now growing, the Golpla is no longer uplifting.

Questions	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
Are you generally happy with your Country Lane?	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
What do you like about your new lane?	Nicer than gravel & potholes	Looks great, slows traffic, kids play	Not as much dust, 100% perfect	See questionnaire	Less dust, slower traffic	Quiet	Looks better, less dusty	Beautiful, water conservation education	Appearance, environmentally friendly	Visually interesting, absorbs rain, slows traffic	Rural appearance, cooler temperature	Clean, happy lane	Not all pavement	Eco friendly, natural	Green space, noise reduction	Cooler, drains better	Looks better, green space good for the environment
What do you dislike about your new lane?	Grass not growing		Nothing	Structural grass on bare feet	Requires mowing	Grass not growing well	Nothing	Nothing	Gravel tracks into garage	Green plastic through grey gravel	Golpla not flush, concrete driving strips	Dog droppings	Nothing	Poor concrete, not level	No follow up by City	Not enough materials, poor concrete	More gravel needed, needs reseeding, Golpla not level
Were you happy with the consultation process?	No	Yes	Yes	Yes	No	Undecided	Undecided	Yes	Undecided	Yes	Undecided	Yes	n/a	Yes	Yes	No	No
Did you want more input into the design of your lane?	No	No	Undecided	Yes	Yes	Undecided	Undecided	No	Yes	No	Undecided	No	Yes	Yes	No follow up by City	Yes	Yes
Have you noticed any problems with drainage in your lane?	Unsure	No	No	Unsure	Unsure	No	No	No	Unsure	No	Yes	No	Yes	Yes	No	Yes	Yes
Do you think vehicles are driving slower than before on your lane?	Yes	Yes	Unsure	Unsure	Yes	Yes	Unsure	Yes	Unsure	Yes	Unsure	Yes	Unsure	Unsure	Yes	Unsure	Unsure
Do more people walk down the lane now that it is improved?	Unsure	Yes	Yes	Yes	Yes	Yes	Unsure	Yes	Unsure	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
How often do you cut the grass on the lane?	Once/month	Once ever	Once/month	Never	Never	Once/week	Never	Never	Never	Never	Never	Once/week	Never	Never	Once/month	Once	Once
How often do you water the lane?	Never	Never	Once/week	Once/day	Varies	Once/day	Never	4 times/week	Varies	Once/day	Varies	Once/week	Once/week	Varies	2-3 times week	Once/day	Varies
Do you know about the City's rain barrel program?	No	No	Yes	No	No	Yes	No	Yes	No	Yes	Yes	Yes	No	No	Yes	Yes	Yes
Do you think the benefits of the lane outweigh the extra maintenance required?	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	Unsure	Yes	Yes	No	Yes	Unsure	Yes	Yes	Yes
Would you pay 50% more for a Country Lane?	Unsure	Yes	Unsure	Yes	No	Yes	Unsure	Yes	No	Yes	Yes	Yes	Unsure	No	Yes	Yes	Yes
Which lane do you live on?	1	1	3	3	3	1	2	2	3	2	3	1	3	3	1	3	3
Additional comments			More should be built in the city	Thank you	Voted against lane but City built it anyway	Want reseeding, friends envy	Good community feeling	Still early to tell real benefits	Want reseeding	Country Lanes is a responsible and innovating direction	Multiple issues - several letters on file. Mainly concrete related.		Thank you	Needs to be evaluated after 1 year, why more expensive	Adds value, need grass to grow	Want the lane repaired	City should absorb the extra cost for a Country Lane

Questions	18	19	20	21
Are you generally happy with your Country Lane?	Yes	Undecided	Yes	Undecided
What do you like about your new lane?	Everything	-	green, attractive, complements sustainability	Has potential, good drainage
What do you dislike about your new lane?	Quality of concrete	-	brown grass edges (weather related) wants wildflower plantings	Cracked conrete, grass not growing, Golpla lifting
Were you happy with the consultation process?	Yes	No	Yes	Unsure
Did you want more input into the design of your lane?	No	Yes	Undecided	Yes
Have you noticed any problems with drainage in your lane?	No	Yes	No	Unsure
Do you think vehicles are driving slower than before on your lane?	No	No	Unsure	No
Do more people walk down the lane now that it is improved?	Yes	Yes	Unsure	Yes
How often do you cut the grass on the lane?	Never	Never	Never	Never
How often do you water the lane?	Once/week	Once/week	Never	Once/day
Do you know about the City's rain barrel program?	Yes	No	No	Yes
Do you think the benefits of the lane outweigh the extra maintenance required?	Yes	Unsure	Yes	Unsure
Would you pay 50% more for a Country Lane?	Yes	Unsure	Unsure	Unsure
Which lane do you live on?	3	3	2	3
Additional comments		Grass growth	Thanks for opportunity to share thoughts	Construct it right the first time rather than come back and repair