SYNECTICS

4548 West 7th Avenue Tel: 604 / 683 4714
Vancouver
British Columbia
Canada V6R 1X3

March 30, 2009 Our File: 4254

The Cape on Bowen Community Development Limited
1147 Homer Street,
Vancouver, BC,
Canada, V7B 5T5

Attention: Mr. Eanson Ho, Project Manager

RE: TRAFFIC CALMING REVIEW ON WHITESAILS DRIVE, BOWEN ISLAND, BC

You have retained us to prepare a report to address the traffic calming requirements outlined in Bowen Island's Preliminary Layout Review (PLR) letter of July 7, 2006. We refer specifically to Item 3 (a)(v) on page 4 of the letter:

> "The Whitesails neighbourhood has raised concerns regarding the traffic impacts associated with the subdivision. Accordingly, as a condition of subdivision approval, CRCJV will be required to incorporate traffic calming measures into the Tunstall Bay neighbourhood. Please provide the Public Work Superintendent with some ideas as to how this may be achieved. May we suggest that CTCJV consult with the local neighbourhood regarding this matter."

Objective of this Report

The objective of this report is to review the roads of the Tunstall Bay Neighbourhood, to estimate traffic conditions and to recommend appropriate traffic calming measures. It should be noted that the local neighbourhood was not consulted in the preparation of this report and no traffic counts or vehicle speed observations were taken. It is suggested that the neighbourhood could be consulted once the Municipality decides on the following recommendations.

Review Process

The preparation of this report included the following:

1. The review of the subdivision proposal.
2. The review of literature on current practices and policies on neighbourhood traffic calming.

3. Site visit of the Tunstall Bay neighbourhood and the observation of traffic conditions.
4. The review of feasible traffic calming options.
5. A recommended traffic calming option and related construction costs.
6. The preparation of a letter report.

Study Area

In reviewing the pattern of existing streets and traffic flows in the Tunstall Bay Neighbourhood. Whitesails Drive is the main road leading to the proposed subdivision of the Cape Roger Curtis lands. Whitesails Drive connects to Adams Road via a short section of Tunstall Boulevard. From this review, the Cape Roger Curtis development traffic will travel to and from Adams Road via Whitesails Drive. The secondary access to the proposed subdivision will be via DeeCee Road. The study area for this review is, therefore, focused on Whitesails Drive and the proposed DeeCee Road. However, the principles of the recommendations contained in this report could also be applied to other roads in the neighbourhood. The roads in the Tunstall Bay Neighbourhood are shown in FIGURE 1.

FIGURE 1. ROAD PATTERN IN THE TUNSTALL BAY NEIGHBOURHOOD AND CONNECTIONS TO CAPE ROGER CURTIS DEVELOPMENT

Current Traffic Conditions

Whitesails Drive currently serves local residents only. The posted speed limit is 30 km/h. Traffic volumes are considered low. Whitesails Drive has two narrow lanes, gravel shoulders and frequent driveways. A photograph showing a typical section of Whitesails Drive is shown in FIGURE 2.

Detailed traffic counts and vehicle speed were not surveyed

FIGURE 2. WHITESAILS DRIVE

The road capacity was observed to be adequate. A drive through, by the author, showed that the road's operational characteristics are acceptable.

Future Traffic Conditions

The proposed Cape Roger Curtis subdivision consists of 59 ten-acre residential lots. A typical urban or suburban residential subdivision may generate a maximum morning peak hour traffic of 40 vehicles outbound and 19 vehicles inbound. For a rural residential development, traffic generated may be about 40 to 60 per cent of that of the urban area. This adds about 16 to 24 vehicles outbound and 8 to 12 vehicles inbound during the morning peak hour to the local traffic. The additional traffic will not have any discernible effects on the capacity and operational characteristics of Whitesails Drive, and Adams Road and the section of Tunstall Boulevard connecting them.

Traffic Calming Devices

In the case of Whitesails Drive the purpose of traffic calming devices is to physically and/or perceptively slow down drivers, thus their vehicles. Traffic calming accomplishes this by changing the road's vertical alignment, its horizontal alignment or by route deflections. Vertical deflections include speed "humps". Horizontal deflections include traffic circles, intersection bulges and mid block deflectors. Route deflectors include road closures and intersection diverters.

Examples of many of these devices may be viewed on the City of Surrey's web site (www.surrey.ca then search for Traffic Calming). Selected traffic calming devices are shown in FIGURE 3. Usually cities and municipalities install these devices following established

policies and bylaws. Example municipalities include District of North Vancouver, Cities of Vancouver, Surrey, Burnaby and Kelowna.

Traffic calming in used to slow traffic or to divert traffic from neighbourhood streets. The criteria used to locate traffic calming devices include traffic volume and vehicle speed. The usual threshold speed to consider such devices is an 85th percentile speed. If the 85th percentile speed is about 5 km/h above the posted speed limit then traffic calming should be considered. In the case of Whitesails Drive the posted speed is 30 km/h then if the 85th percentile speed is above 35 km/h traffic calming devices should be considered. An additional decision that must be made is the spacing of the speed humps since this determines the actual driving speed, see TABLE 1.

TABLE 1. DESIRED SPEED AND SPEED HUMP SPACING

Vehicle Speed, km/h	Hump Spacing, m
50	125
40	80
30	***60***

The speed along Whitesails Drive must be measured when development traffic is added to the existing traffic. If the speed condition is met then a traffic calming device should be considered. The reason to wait for development traffic is to allow for an accurate 85th percentile speed estimate, then spacing and the exact location of each speed hump to be determined. The detailed factors that need to be considered when locating speed humps are; driveway locations, drainage, and visibility, and speed reduction required.

The suggested speed hump configuration is currently in operation along 8th Avenue between Courtney Street and Trimble Street in the City of Vancouver. The 30 km/h speed limit is required for Trimble Park and a school on 8th Avenue. An aerial view may be seen with Google Earth™.

Road deflector type traffic calming devices mainly apply to rectangular or grid road patterns and are not applicable to this neighbourhood. Only vertical and horizontal diverters are considered appropriate for Whitesails Drive. Three typical and commonly used devices that are considered for existing roads are:

a. Local traffic circles: This device is used instead of stop signs and signals at intersections and vehicles must slow down to drive around the traffic circle regardless of direction of traffic;

b. Mid-block islands: This device is used to create mid-block “obstruction” so drivers must slow down to navigate through it; and

c. Speed humps: This device is used to physically slow down drivers approaching and going over the speed humps. The hump may be designed for the appropriate posted speed and spaced in order to have drivers drive at or very near the speed limit.

FIGURE 3. TRAFFIC CALMING DEVICES
Source; City of Surrey BC web site 2009

Evaluation of Devices

Given the observations of the road and intersection characteristics during a drive through of the Tunstall Bay Neighbourhood, two options were considered appropriate. The first was speed humps and the second was traffic circles.

The local traffic circles are located at intersections. There are three intersections that traffic circles could be considered: Whitesails Drive at Reef Road and Tunstall Boulevard; and Tunstall Boulevard and Adams Road. Approach grades on some of the roads may be too steep. Traffic circles also require more land and will be more expensive to build and maintain. Traffic circles are, therefore, not recommended.

The use of mid-block islands requires additional road and pavement width. As well, they cannot block access driveways. Given the close spacing of existing driveways and the need to widen the pavement, the use of this device is not recommended.

Based on the Canadian Guide to Neighbourhood Traffic Calming, Transportation Association of Canada, December 1998 the most appropriate traffic calming device is the traffic hump.

The use of speed humps requires the installation of a vertical device to slow down traffic. Speed humps are designed for a certain speed limit. for Whitesails Drive, it is 30 km/h. If Bowen Island considers traffic calming on Whitesials Drive and DeeCee Road, the use of speed humps is recommended.

Given the low traffic volumes estimated for the proposed Cape Roger Curtis 59-lot development then the Tunstall Bay Neighbourhood may not require any traffic calming. If the neighbourhood and the municipality consider traffic calming is necessary, then the Speed Hump option is recommended.

Recommendation

Should traffic calming be considered on Whitesails Drive and DeeCee Road, speed humps are recommended. The speed humps should be designed for a travel speed of 30 km/h. A typical speed hump for that speed is shown in FIGURE 4. In addition to the speed hump and the pavement markings, a traffic warning sign is needed on each side of the road to warn motorists. The construction cost of single speed humps is estimated to be between $1,000 and $5,000. The cost may be reduced when a few humps are installed in a single operation.

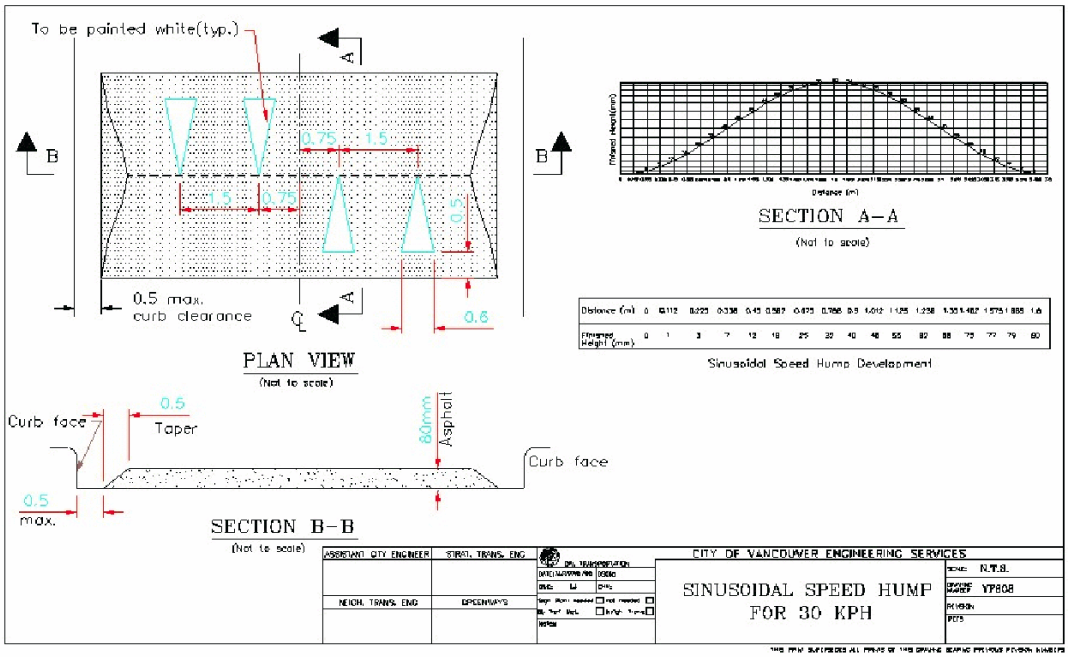

FIGURE 4. TYPICAL SPEED HUMP DETAILS
Source: City of Vancouver Engineering Department

I trust the above report is sufficient for the Bowen Island Municipality to consider traffic calming in the Tunstall Bay Neighbourhood. My resume is appended to this report. Please contact me if I can assist further.

Yours truly,

SYNECTICS ROAD SAFETY RESEARCH CORPORATION

per: Francis P. D. Navin, Ph.D., D.Sc.(Hon), P.Eng.
President

Encl: Resume Dr F. Navin

FRANCIS P.D. NAVIN, Ph.D., D.Sc. (Hon), P.Eng.
Professor Emeritus, UBC Civil Engineering,
President, Synectics Road Safety Research Corp.
Vancouver, BC, Canada

Qualifications:

~Doctor of Philosophy, Civil Engineering (Transportation)
University of Minnesota, 1973.
~Master of Science, Civil Engineering (Transportation)
University of Missouri, 1968.
~Young Officers Training Course
Corps of Royal Canadian Engineers, 1964.
~Bachelor of Engineering, Civil Engineering
McMaster University, 1963.

Major Awards:

~Military Engineering Scholarship, McMaster University, 1962.
~Urban Mass Transit Fellowship, University of Minnesota, 1969 to 1970.
~McMaster University, Doctor of Science, Honorary in recognition of Outstanding Achievement in Road Safety Engineering, June 2003.
~Institute of Transportation Engineers, Edmund R. Ricker Traffic Safety Individual Award, 2001.
~Sanford Fleming Award of the Canadian Society for Civil Engineering for Outstanding Contribution to Canadian Transportation Engineering, 2001.
~C.W. Gilchrist Medal, Transportation Association of Canada, 1994.
~Institute of Transportation Engineers, elected a Fellow in 1989.
~Canadian Society of Civil Engineering, elected a Fellow in 1988.
~International Association of Accident Reconstruction Specialists, elected an Honorary Member in 1985.
~Adjunct/Visiting Professorship:

- Universidad de Piura, Civil Engineering, Piura, Peru, 1986 to present.
- Memorial University of Newfoundland, Civil Engineering, 2001 to 2004.
- Asian Institute of Technology, Environmental Management, 1997 to 2000.
- Institute for Police Technology and Management, University of North Florida, 1986 to present.
- Universite Laval, Quebec City, Quebec, !981

Past and Current Professional Membership:

~Association of Professional Engineers and Geoscientists of the Province of British Columbia, Member since 1973.
~Association of Professional Engineers of Ontario, Member, 1963 to 1983, and 1996 to 2005.
~Association of Professional Engineers and Geoscientists of Alberta, Member 1999.to 2008
~Transportation Association of Canada, Member since 1977, Past Member of Mode Choice Committee and Transit Subsidies Task Force.

~Canadian Society for Civil Engineering, Fellow, Past Director and Chairman, Transportation Division, Computer Division.
~Institute of Transportation Engineers, Fellow and Past Member of Committee on Pedestrian Facility Design and Energy Consumption in Transportation.
~Canadian Association of Road Safety Professionals, Member and Past Director.

Major Road Safety Experiments:

~Coefficient of friction test measurement techniques, a field experiments, 2005 and 2008.
~Driver workload test, a field experiment, Spring 2003.
~Rollover tests of two fully loaded tractor trailers, Summer 2000.
~Automobile side impact tests, 1995.
~Winter traction tests of car and truck, 1993 to 1994.
~Automobile traction tests on treated asphalt, Spring 1991.
~Steep downhill traction tests, 1996.
~Twenty full scale roadside barrier impact tests, between 1989 and 1991.
~Performance tests of truck runaway lanes, 1995.
~Automobile under-ride tests, 1997.
~Automobile impacts into road curbs, Summer 1997
~Truck Run Away Lane experiments, Summer 1993.

Professional, Academic, and Community Activities:

~Member, Editorial and Advisory Board on “New Concept in Urban Transportation”, Transportation Research Board, USA, 1970 to 1974.
~Member, Editorial and Advisory Board on “High Speed Ground Transportation and Advanced Transit Journal”, USA, 1975 to 1987.
~Associate Editor, Canadian Journal for Civil Engineering, 2001 to 2005.
~Member, Editorial and Advisory Board on “Transportation Technology and Planning”, UK, since 1977.
~Member, Transit Subsidies Task Force and editor of report, Transportation Association of Canada, 1978 to 1979.
~Editorial and Advisory Board, Journal for Microcomputers in Civil Engineering ,USA, 1986 to 1989.
~Review Board, Roads and Transportation Association of Canada Forum, 1982 to 1984.
~Chairman, EXPO 86 Conference on “Advanced Road Technologies for Developing Countries”, Vancouver, B.C., 1986.
~Chairman, Technical Program, Annual Meeting of the Canadian Institute of Transportation Engineers, Vancouver, B.C., 1988.
~Review Board, the Traffic Accident Reconstructionists, 1990 to 1992.
~Member, Transportation Research Board Committee 42404 on Roadside Safety Features Subcommittee on International Research Activities, 1995 to 2004.
~Chairman, Seventh Canadian Multidisciplinary Road Safety Conference, Vancouver, 1991.
~Co-Chairman of an OECD workshop session on the application of Expert Systems in Road Safety, Montreal, 1992.
~Highway Safety Commission, Vienna, Virginia, USA, 1969 to 1970.
~Member, SPARC of B.C., Committee on Handicapped Transport, 1974 to 1979.

~Chair of Foreign Research Activities Sub-Committee, Pedestrian Committee Transportation Research Board, Washington DC, 1994 to 1997.
~Chair, The Fourth International Conference on Accident Investigation, Reconstruction, Interpretation and the Law, Vancouver, B.C., August 2001.

Books/Notes:

~Navin, F., Ho, E., "Highway Design and Accident Reconstruction", Book, 2006.
~Navin, F., Zein, S., Ho, E., "Road Safety and Highway Design", Notes, 2002.
~Navin, F., "Reconstructing Truck Collisions from Tire Marks", Institute for Police Technology and Management, University of North Florida, 2004.
~Navin, F., "Road Safety Engineering, with Computer Applications", Class Notes, 1990.
~Navin, F.P.D., and Steimer, S., "Engineering with Spreadsheets, an Electronic Textbook", Maple Soft Press, Vancouver, 1989.
~Navin, F., "Transportation Engineering, The Science and Engineering", UBC Class Notes, 1992.

Professional Experience:

Starting in 1968 to 1972, Dr. Navin worked in the field of transportation planning. Between 1972 and 2003, he was a professor of Civil Engineering at the University of British Columbia teaching urban transportation, transit planning, and road safety engineering. He is now professor emeritus.

Prior to his appointment as a professor at the University of British Columbia, Dr. Navin held senior positions with R.H. Pratt Associates, Bather-Ringrose-Wolsfeld, Inc., and Alan M. Voorhees and Associates Inc. in the United States. His work included modeling and traffic engineering, land development traffic planning projects, and the development of large area modal choice and auto occupancy models. He completed the first performance specifications for a transportation sketch planning computer model for the Urban Mass Transit Association; the model is now called Quick Response System. His other work experience includes: research of the Minneapolis-St. Paul traffic monitoring program for the Minnesota Department of Transportation; air passenger trip generation equations for the Twin Cities International Airport; net income analysis for the Washington Metro; modal choice models in Atlanta, Georgia, and Columbus, Ohio; an auto-occupancy model for Baltimore, Maryland; and new town transportation planning throughout the United States.

As a professor at the University of British Columbia, his responsibilities included teaching graduate and undergraduate courses in transportation and transit planning. In cooperation with the City of Vancouver Engineering Department, he developed a computer-based detailed traffic simulator for Downtown Vancouver which was in use for over a decade.

Dr. Navin helped specify and write the first edition of the "Fundamentals of Transit Planning" and contributed to its revised form known as the "Canadian Transit Handbook". He also completed economic studies of Travel Times for an update to the American Association of

State Highway and Transportation Officials (1977) manual of Highway Benefits for the National Cooperative Highway Research Programs.

He was the Coordinator of The University of British Columbia's Accident Research Team which undertook road safety research from 1979 to 1995. Much of the research considered the civil and traffic engineering aspects of highway operation. He has also been accepted by the Supreme Court of British Columbia as an expert witness on many aspects of highway operations and collision analysis.

Dr. Navin was a Director and Senior Consultant with Hamilton Associates from 1987 until 2005. He was responsible for providing technical advice to both its staff and clients. Along with Hamilton Associates, he has developed theories of parking demand and supply, and risk analysis. He has participated in the planning of the Sea-to-Sky Highway, Island Highway, Highway 17 through Quesnel, and Highway 16 through Terrace. Dr. Navin reviewed the international practice of freeway directional signing which formed the basis for signing policies and practices in British Columbia. He also conducted a study on parking and trip generation rates for the Ministry of Transportation and Highways.

Dr. Navins activity in the pedestrian area includes his membership on the Pedestrian Committee with the Institute of Transportation Engineers from 1969 to 1973. He was the Chairman for the Foreign Activities Pedestrian Sub-Committee for the Transportation Research Board in Washington, D.C., from 1994 to 1997. Along with R. Wheeler, Dr. Navin wrote "Pedestrian Flow Theory", published by the Institute of Transportation Engineers in June 1969.

Invited Lectures:

1986 Truck Rollover Accidents, Institute for Police Technology and Management, University of North Florida.
1987 Truck Safety in British Columbia, Caribou Lumber Manufacturers' Association, Annual Meeting, Williams Lake.
1987 Road Safety Research in Canada, Seminar, School of Engineering, University of Auckland, Auckland, New Zealand.
1988 Road Safety Engineering, University of Zimbabwe, Harare, Zimbabwe.
1988 Road Rehabilitation Engineering, University of Piura, Peru.
1989 Traffic Engineering and Road Safety, Xian Institute of Highways, Xian, Shaanxi, China.
1991 Truck Rollover Accidents, Royal Canadian Mounted Police, E Division, Vancouver.
1992 Coefficient of Friction in Accident Reconstruction, Institute for Policy Technology and Management, University of Florida, Jacksonville, Florida.
1993 Highway Design: The Engineering, Economic and Environmental Fundamentals, Chinese Institute for Highway Survey and Design, China, Ministry of Communications, Xian, Shaanxi, China, June.
1995 Road Safety in Canada, James Cook University, Townsville, Australia, July.
1996 Engineering Urban Road Systems, Urban Transportation Forum sponsored by the City of Vancouver as part of its public participation in planning for the City, March.

1996 Speed and Road Accidents, Faculty of Engineering, Ain Shams University, Cairo, Egypt, June.

1996 A Model for Accident Forecasting, Faculty of Engineering, University of Cairo, Cairo, Egypt, June.

1996 Traction on Snow and Ice, Accident Reconstruction Section, Sûreté de Québec, Montreal, Quebec, October.

1997 Truck Rollover Experiments and Results. Various presentations given to: (a) International Association for Accident Reconstruction Specialists, Annual Meeting, Vancouver, July; (b) R.C.M.P. Kamloops, March.

1997 Highway 407 Safety Review, Canadian Association of Technical Accident Reconstructionists, Ontario Chapter Annual Meeting Ontario, October.

1998 Road Safety in Canada, International Road Safety Audit Conference, Melbourne, Australia, May.

1998 Highway 407 Safety Review. Various presentations given to: (a) Vancouver Chapter of EIC, November; (b) Victoria Chapter of the EIC, May ; (c) Ontario Traffic Conference Annual Meeting, Niagara Falls, Canada, May; (d) State of Victoria Road Authority and Melbourne ITE Section, May.

1998 Truck Rollover Experiments and Results, R.C.M.P. Kamloops, October.

1999 Experimental Results on the Redirection Effectiveness of Roadside Curbs, Transportation Research Board, Committee A2 A04, Washington, DC., January.

1999 Trucks at the Limit, Reconstructing Truck Accidents, Commonwealth Scientific Research Institute, Johannesburg, South Africa, October.

2000 Road Safety the International Experience, Seminar on Urban Road Safety, Asian Institute of Technology, Bangkok, Thailand, February.

2000 Road Safety the Science and Engineering, Alberta Automobile Association, Mission Possible Seminar, Edmonton, AB, March.

2000 Road Safety Outlook for China, Chinese Ministry of Communications, Beijing, China, July.

2000 Road Safety Engineering: An Effective Tool to Prevent Injuries, Personal Injury Symposium, Barbados, West Indies, November.

2001 Dynamic Truck Rollover, Experimental Results, Institute for Police Technology and Management, University of North Florida.

2002 Road Safety – A Global View, Oregon Safety Forum, Portland, Oregon.

2002 Traffic Accident Reconstruction from a Civil Engineering Perspective, Institute for Police Technology and Management, University of North Florida.

2003 Truck Rollovers, Experimental Results, Institution for Traffic Accident Investigation, Stratford-upon-Avon, England.

2004 Coefficient of Friction, Institute for Police Technology and Management, University of North Florida.

2006 Collisions with Truck Mounted Attenuators, Institute for Police Technology and Management, University of North Florida.

2008 Measuring Traffic Safety, Institute for Police Technology and Management, University of North Florida.

2009 Coefficient of Friction; The Relation of Drag Sleds and Skidding Vehicles, Institute for Police Technology and Management, University of North Florida.