AN INVESTIGATION OF DEMATERIALIZATION PLANNING OPTIONS AT TOURISM DESTINATIONS: TECHNICAL AND BEHAVIOURAL DIMENSIONS

by

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ABSTRACT

The goal of this dissertation is to develop a conceptual framework and associated methods for evaluating alternative tourism planning strategies in terms of dematerialization and acceptability amongst tourists. Its objectives are to (1) examine the technical potential of dematerialization planning options in tourism destinations, (2) investigate tourist perspectives concerning destination planning alternatives that promote dematerialization, (3) assess the travel market responses and dematerialization levels associated with tourism transportation options, and (4) evaluate tourist responses to carbon offsetting strategies. The utility of the research is illustrated in the context of a case study of Whistler, British Columbia – a tourism resort community currently undertaking several substantial environmental planning initiatives.

Dematerialization concepts emphasize the values associated with reducing the amount of energy, water and other materials used, as well as wastes and pollutants discharged in the production of goods and services. Using the dematerialization construct as a conceptual framework, the dissertation quantifies and compares the impacts of different destination planning options on resource flows. The research provides a resource flow modelling approach that is capable of quantitatively assessing the dematerialization potential of several planning alternatives. When tested in a real destination planning context, the model offers valuable insights into the projected relative and absolute effects of proposed planning strategies on future resource use and emissions.

The dissertation also conducts a multi-phased behavioural evaluation of various dematerialization planning strategies. The investigation uses stated choice methods to explore the acceptance of these options by tourists – a stakeholder group that is traditionally difficult to examine because of its diverse perspectives and broad distribution around the globe. The information and models resulting from the research are designed to inform managers, decision-makers and participants in planning processes about the viability of dematerialization practices from the perspective of tourists.

In sum, the research offers: (1) new insights into more dynamic and quantitatively focused approaches to informing stakeholders and decision-makers about planning options, and (2) an approach to incorporating both technical and behavioural information concerning dematerialization in decision-making processes. The research contributes to the theoretical and applied dimensions of existing sustainable tourism knowledge and planning practice.

Keywords: dematerialization, destination planning, tourism environmental aspects, resource flow modelling, stated choice methods

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INTRODUCTION

There is growing recognition that the global tourism industry requires vast amounts of energy, water and other materials in its production of services and experiences. These resources are needed to facilitate transportation of travellers, as well as to provide amenities and supporting facilities at the destinations visited (Becken, 2002; Becken & Simmons, 2002; Becken et al., 2001, 2003a, 2003b; Bode et al., 2003; Draper, 1997; Gossling, 2000, 2001, 2002; Gossling et al., 2002; Hoyer, 2000; Kent et al., 2002; Tabatchnaia-Tamirisa et al., 1997). As a result, tourism's contributions to solid and liquid waste accumulation, greenhouse gases and other contaminants play a significant role in shaping the environmental health of destinations as well as affecting the overall quality of visitor experiences.

Arguably, moving towards more sustainable forms of tourism requires greater levels of dematerialization. This concept prescribes reducing the amount of energy, water and other materials used, as well as wastes and pollutants discharged in the production of goods and services (Ayres, 1998a; Cleveland & Ruth, 1999; Hinterberger & Schmidt-Bleek, 1999; Jackson, 1996). It assumes that traditional economic production systems are unsustainable because they depend on enormous inputs of energy and other resources that are returned as waste to the ecosphere – contributing to the continued exploitation of the earth's finite stocks of natural capital (Ayres, 1998a; Goodland & Daly, 1996; Rees, 1995; Weizsäcker et al., 1997).

The dematerialization concept is particularly relevant to tourism destinations because such areas have traditionally been characterized by intensive use of energy, water and other natural materials in the production of tourist products and services. Dematerialization strategies offer tourism destinations opportunities to reduce costly energy, water and other material inputs, as well as decrease the negative effects of such production systems on surrounding natural and built environments. Options for employing dematerialization strategies seem especially appropriate in tourism destinations where the final product produced is essentially experiential, rather than material in nature (Klenosky et al., 1993; Pine & Gilmore, 1999; Prentice et al., 1998; Smith, 1994).

Destination planners and managers can affect some patterns of resource consumption within destinations. A number of environmentally sensitive planning strategies have been suggested for shaping the development and management of tourism destinations (e.g. Bode et al., 2003; Dorward, 1990; Dowling, 1993; Gunn, 1988, 1994; Inskeep, 1987, 1991; Inskeep & Kallenberger, 1992; Quilici, 1998; Welford et al., 1999). Such strategies depend on innovative planning practices that often have implications for achieving dematerialization. These practices include: alternative land use and building designs; low-impact recreational strategies; innovative transportation infrastructure and service options; creative water and power supply approaches; and enhanced sewage and solid waste management methods. While these practices are useful for reducing resource requirements and emissions in tourism destinations, they do not confront those issues in the context of visitor travel to and from such places. Such travel is a fundamental prerequisite of tourism, yet it is the component that in many cases challenges the concept of dematerialization the most. Several planning options exist to reduce visitor related transportation impacts. Most strategies encourage tourists to use more energy efficient transportation modes for their travel (e.g. Holding, 2001; Hoyer, 2000). Other strategies involve trading off carbon dioxide emissions from travel for financial contributions to various "carbon-offsetting" activities. Such initiatives include planting trees that take up carbon dioxide or investing in the use of alternative energy sources that do not create carbon dioxide emissions (Becken, 2004).

Successful implementation of dematerialization planning strategies not only requires innovative technical solutions, but also the support of a wide range of stakeholders with varying interests (Gill & Williams, 1994; Haywood, 1988). These include tourists, tourism operators, year round and seasonal residents, employees, environmental organizations, architects, developers, destination planners and elected decision-makers. All of these groups may be affected differently by proposed planning solutions and may have vastly different perspectives on the utility of such choices. While decisions concerning destination planning options should be driven by the values and priorities of local stakeholders, they should also be informed by the perspectives of tourists. For tourism destination planners and managers, the challenge is to select and implement dematerialization strategies that appeal to the tastes and interests of tourists while meeting the needs of community stakeholders. Decisions of this type are difficult because tourists' opinions on each potential strategy are not always apparent. Eliciting these opinions can be particularly difficult because of the diverse perspectives of tourists and their broad distribution around the globe. While researchers have investigated tourist preferences concerning destination development choices (e.g. Haider & Ewing, 1990; Hearne & Salinas, 2002; Lindberg et al., 2001; Mercado & Lassoie, 2002), no study to date has evaluated tourists' perspectives concerning planning alternatives that promote dematerialization. Such research would help inform planners and private investors about the viability of environmentally sensitive planning practices from the perspectives of tourists. This information would be useful for determining tourism market responses to different planning options, and for developing and positioning the tourism destination to maximum advantage.

It is within this context that this dissertation investigates the potential of planning alternatives for achieving greater levels of dematerialization and elicits tourist preferences for these options in tourism destinations. The goal is to develop a conceptual framework and associated methods for evaluating alternative tourism planning strategies that can contribute to greater levels of dematerialization and acceptability amongst tourists. The dissertation applies its concepts and methods on Whistler, British Columbia - one of Canada's premier destination resorts. Whistler is an ideal setting for this investigation because it currently faces crucial decisions regarding its future development, many of which relate to choices about various dematerialization planning strategies.

1.1 Research Objectives and Questions

Using the dematerialization construct as a conceptual foundation, this dissertation evaluates the potential effects and acceptability of various planning options available to tourism destinations. Specific objectives related to this overriding goal are:

(1) to examine the technical potential of dematerialization planning options in tourism destinations;

(2) to investigate tourist perspectives concerning destination planning alternatives that promote dematerialization;

(3) to assess the travel market responses and dematerialization levels associated with various tourism transportation options; and

(4) to evaluate tourist responses to carbon offsetting strategies.

While these research objectives are focused on achieving greater levels of dematerialization in tourism destinations, their results may be applicable to other regional and community planning contexts.

1.1.1 Research objective 1: Technical evaluation of planning options

Tourism's role as a contributor to energy and water consumption, solid and liquid waste accumulation and greenhouse gases and other contaminants has only recently gained academic and institutional attention. The few research studies measuring tourism's effects have focused on activity-specific or broad regional effects. This research provides a conceptual framework and resource flow modelling approach that systematically identifies tourism destination contributions to resource consumption and emissions at a strategic planning level. Using the dematerialization construct as a conceptual framework, the research quantifies and compares the relative effects of various destination planning strategies on resource use and emissions. The results provide a unique quantitative evaluation of the potential levels of dematerialization associated with various destination planning options. This research phase addresses the following questions:

Research question 1: What is the technical potential for dematerialization planning options in tourism destinations?

Research question 2: What are the major limitations to achieve greater levels of dematerialization in destinations?

1.1.2 Research objective 2: Assessment of tourist perspectives

Several destination planning strategies for achieving greater levels of dematerialization have been reported in the academic literature. However, behavioural evaluations of these options with respect to tourist preferences have not been undertaken. This research phase evaluates tourist preferences for and acceptance of planning alternatives that promote dematerialization. It also examines how preferences vary between different segments of tourists. A stated choice approach known as a discrete choice experiment is used to conduct the investigation (Louviere et al., 2000). The information and models resulting from this research phase are designed to inform managers, decision-makers and participants in planning processes about the acceptability of dematerialization planning strategies from the perspective of tourists. This research phase focuses on the following questions:

Research question 3: What are tourists' perspectives concerning destination planning options that promote dematerialization?

Research question 4: What are tourists' acceptance levels for alternative payment mechanisms to compensate for the costs of implementing dematerialization options?

1.1.3 Research objective 3: Assessment of tourist travel options

Several strategies for reducing transportation energy requirements and emissions associated with visitor travel to the destination have been proposed in the academic literature. However, evaluations of these options with respect to their potential impacts on tourist travel behaviour and the associated energy use and emissions have not been reported. This research phase examines tourist travel mode choices and forecasts the resulting environmental impact of those selections. It describes a discrete choice experiment used to estimate tourist mode choice behaviour under different transportation planning scenarios. It then incorporates the choice experiment findings into the study's resource flow model to create behaviourally shaped estimates of energy consumption and emissions. This research phase tackles the following questions:

Research question 5: What are the effects of alternative tourism transportation strategies on travel mode selections?

Research question 6: What are the impacts of these preferred travel mode choices on energy use and emissions?

1.1.4 Research objective 4: Assessment of carbon offsetting programs

While some emissions associated with tourist travel are often unavoidable, they can be offset by various activities, such as planting trees or investing in the use of alternative energy sources. The final research phase estimates the amount of money visitors would be willing to donate to offset greenhouse gas emissions. A contingent valuation approach is used to carry out this investigation (Mitchell & Carson, 1989). The findings provide a unique assessment of tourists' willingness to participate in a proposed carbon-offsetting program. This research phase addresses the following question:

Research question 7: What are tourists willing to pay to compensate for the greenhouse gas emissions associated with their travel to destinations?

1.2 Case Study

Located about 120 kilometres north of Vancouver, Whistler is a four-season mountain resort community with a permanent population of about 11,000 people participating in an economy largely fuelled by the tourism industry. Whistler attracts an estimated two million visitors annually to its mountains for a range of winter and summer activities. Recognizing the importance of maintaining its high quality natural resources for visitor and resident appreciation, the community has made a strong commitment to becoming a more sustainable community via a range of environmental strategies reflected in its development plans (RMOW, 1999b, 2000, 2004). This commitment is accentuated in its current initiatives linked to the *Whistler – It's Our Future* comprehensive sustainability plan; *The Natural Step (TNS)* implementation process[1]; and the *Local Action Plan* for management of energy, greenhouse gases and air quality. A significant impetus for these initiatives has been Whistler's successful bid to host the 2010 Winter Olympic Games in conjunction with Vancouver, British Columbia. In their bid for this hallmark event, Whistler and its partners made a strong commitment to incorporating more sustainable practices during the development, operation and post-event phases of the Games. With a strong foundation in place for more sustainable planning and management practices, Whistler provides a unique case-study environment in

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[1] The TNS framework specifies the minimum system conditions for a sustainable society and offers a general approach to move towards such a society (Nattrass and Altomare, 1999).

which to systematically evaluate future development options from a sustainability perspective. Dematerialization is a primary criterion on which to base such an evaluation, given the overriding importance of well-managed environments for the resort's success.

This project continues and builds on successful research projects completed at the School of Resource and Environmental Management (REM) at Simon Fraser University (SFU). This previous research contributed to the development of: a community vision for Whistler that identified environmental management as a key priority (Williams & Dossa 1998); key components and elements of a comprehensive environmental strategy for Whistler (Waldron, 2000); the first comprehensive environmental management system framework for the management of Whistler's mountain ski operations (Todd & Williams, 1996); a systematic environmental management system for one of the destination's most prominent hotel operations (Speck, 2002); and a more comprehensive system of indicators for monitoring the effects of Whistler's innovative growth management program (Waldron & Williams, 2002). Collectively, these research initiatives provided a knowledge base that has assisted Whistler in moving forward with its current sustainability agenda.

This dissertation builds on these past projects by:

- Offering insights into more dynamic and quantitatively focused information sources needed for informed decision-making concerning dematerialization strategy effects.
- Providing a unique approach to incorporating both technical and behavioural information into future environmental management decision-making by corporate and public stakeholders.
- Offering a dynamic tool for assessing the impacts of dematerialization options proposed in Whistler's comprehensive sustainability strategy.

The findings are important in advancing the theory and practice of sustainable tourism destination planning.

1.3 Organization of Dissertation

The remainder of this dissertation is organized as follows. Chapter two develops a conceptual framework for examining levels of dematerialization and visitor acceptance for various destination planning options. The chapter discusses the energy, water and material flows related to tourism destinations. It also presents the theoretical foundations of the dematerialization concept. The chapter then reviews a range of destination planning strategies for achieving dematerialization. Included in this review is a discussion of the carbon-offsetting concept. The final section of the chapter highlights the importance of incorporating the perspectives of tourists into decisions about destination planning strategies. It describes the possible effects of dematerialization planning options on tourists and discusses how different segments of tourists may perceive these impacts.

Chapter three presents the methods used to conduct the research. These methods include: a resource flow modelling approach for examining the technical potential of dematerialization planning options in tourism destinations; a stated choice method for investigating tourist preferences for and acceptance of dematerialization planning alternatives; an approach for assessing tourist responses to and dematerialization levels of various tourism transportation options; and a contingent valuation method for evaluating visitor responses to carbon offsetting strategies. The chapter also summarizes the data collection procedures and survey instrument used in the research.

Chapter four applies these methods to the case study of Whistler, British Columbia. It examines: the levels of dematerialization associated with various destination planning options at Whistler; visitor perspectives concerning various dematerialization planning alternatives; tourist responses and dematerialization levels associated with various tourist transportation strategies; and visitor responses to a possible carbon-offsetting program.

Finally, chapter five discusses the conclusions that emerged from the research. It also summarizes the main limitations of the study and proposes several directions for future research.

CHAPTER 2: CONCEPTUAL FRAMEWORK

This chapter develops a conceptual framework for examining levels of dematerialization and visitor acceptance for various destination planning and management strategies. It is organized as follows:

- **Section 2.1** highlights several key elements of tourism destinations with respect to their built and natural environments.
- **Section 2.2** describes the nature and impacts of energy, water and material flows related to destinations.
- **Section 2.3** presents the theoretical foundations of the dematerialization concept and discusses the main opportunities for and barriers to implementing dematerialization strategies.
- **Section 2.4** describes a variety of dematerialization planning strategies and discusses the importance of incorporating the perspectives of tourists into decisions about those strategies.

2.1 Tourism Destinations

Tourism destinations exist in a wide variety of forms and on several different scales (Boyd & Singh, 2003; Laws, 1995).[2] A tourism destination can be

[2] Broadly speaking, the spatial elements of a tourism system consist of a "tourist generating region" and a "tourist destination region" (Davidson & Maitland, 1997). Travel between these regions is facilitated through a variety of transportation options. The number and type of tourism trips to a destination is affected by both demand and supply factors. On the demand side, various push factors (e.g. disposable incomes, taste and demographic change) influence the potential demand for trips. On the supply side, a variety of pull factors motivate travel to a particular destination. These factors include various natural, social and cultural attractions, as well as other services and facilities provided at a destination. This dissertation focuses on the supply-side of tourism - the tourism destination.

a single district, town or city, or a clearly defined and contained rural, coastal or mountain area. Despite this diversity, most tourism destinations share several common elements (Davidson & Maitland, 1997; Goeldner et al., 2000; Inskeep, 1988; Mill & Morrison, 1992; Pearce, 1989; Smith, 1994). These characteristics are described in the following sections.

2.1.1 Attractions

Typically, the mark of any destination is one or more attractions that induce tourists to visit the region. Lew (1987) described attractions as all elements of a "non-home" place that draw discretionary travellers away from their homes. They usually include physical features to observe, activities to participate in and experiences to remember. Attractions can include natural features such as climate, landscape, flora and fauna; historic or modern built structures such as cathedrals, casinos, monuments, historical buildings or amusement parks; or sociocultural resources such as fine arts, literature, history, music, dramatic art, dancing, shopping, cuisine, sports and other activities. MacCannell (1976) proposed that an attraction must have three components: a tourist, a site to be viewed and a marker or image that conveys information about the site. Leiper (1990) broadened MacCannell's definition by deliberately using the term "nucleus" instead of "site," where the nucleus is any feature or characteristic of a place that a traveller contemplates visiting or actually does visit. This suggests that attractions include not only the natural, built and sociocultural features that are normally associated with the term, but also the services, facilities and infrastructure that cater to the needs of tourists.

2.1.2 Accommodations and tourist facilities

Tourism destinations also provide a range of accommodation facilities constructed primarily to support visitation. Pearce (1989) has observed that accommodation can be part of the commercial sector (including hotels, motels, guesthouses and commercial camping grounds) or the private sector (notably second homes and private permanent residences used for hosting friends and family). In addition to accommodation, destinations provide a range of other facilities to support tourist activities. These include retail shops - some oriented specifically to the tourist (e.g. souvenir shops) and others supplying a general range of goods to both tourists and the host community (e.g. pharmacies or grocery stores). Also included in this category are service providers such as restaurants, banks, medical centres, postal outlets, tourist information centres, tour and travel operations, recreation facilities, museums and other similar structures.

2.1.3 Infrastructure

Adequate infrastructure is required to support the facilities and services offered at a tourism destination. This consists of transportation infrastructure (roads, parking lots, airports, railway lines, marinas and dock facilities) as well as water supply systems, drainage systems, communication networks, power sources and distribution systems and sewage and solid waste disposal systems (Inskeep, 1988). Much of this infrastructure is usually available in urban areas but must be created or significantly expanded to meet tourist needs in rural or isolated destinations (Boyd & Singh, 2003; Murphy, 1985).

2.1.4 Transportation systems

Transport is needed to bring tourists to a destination, as well as to move them around at the destination (Prideaux, 2000; Thrasher et al., 2000). Travel is facilitated with different modes of private and public transportation, including automobiles, buses, aircrafts, trains, boats, bicycles and so forth. The selection of mode depends on a range of variables, such as travel distance, disposable income, tourist preferences and changing technologies. Although transportation systems are seldom developed solely for tourism purposes, facilities and services can be created or significantly upgraded to meet tourism needs.

2.1.5 Tourism production processes

Several researchers assert that the final product supplied at tourism destinations is essentially a human experience – not just a commodity that is experienced but, rather, an experience per se (Klenosky et al., 1993; Mannell & Iso-Ahola, 1987; Otto & Ritchie, 1996; Pine & Gilmore, 1999; Prentice et al., 1998; Smith, 1994; Sternberg, 1997; Vaughan & Edwards, 1999). Exemplifying this viewpoint, Smith (1994) proposed a "tourism production process" whereby primary inputs of labour, capital, land, energy and materials are transformed to final outputs of experiences. In Smith's framework, primary inputs are converted through processing, manufacturing and construction to intermediate inputs, which include infrastructure, basic facilities and transport systems. Many of these inputs are further refined through managerial expertise, technical services, scheduling and packaging into intermediate outputs, which include attractions, accommodation and other tourism services. At this stage, however, the tourism product is still effectively just a potential commodity and not yet the final product. Consider the example of hotel accommodation. Hotels may offer rooms for rent, but they do not become part of the tourist experience until guests actually stay in the rooms. A final stage is required where the tourist utilizes the intermediate outputs to generate the final output – intangible but highly valued personal experiences such as recreation, education, relaxation, escape, prestige and formation of business and social contacts (Gunn, 1988; Smith, 1994).

2.2 Tourism Destination Resource Flows

Tourism production processes require substantial amounts of energy, water and other materials (primary inputs) to produce final outputs. These resources are needed to transport travellers, as well as provide amenities and supporting facilities at the destinations visited. As a result, tourism's contribution to the accumulation of solid and liquid waste, greenhouse gases and other contaminants can have serious effects on natural and built environments. Descriptions of tourism destination energy, water and materials flows are presented in the following sections.

2.2.1 Tourism destination energy use

Energy is supplied to tourism resort destinations through a series of extraction, conversion and distribution systems. Some energy is derived from local systems, such as micro hydro, local wind or photovoltaic cells (Sweeting et al., 1999). These sources may be more viable in certain regions than in others (e.g. solar energy is more feasible in sunny destinations). However, in the vast majority of cases, energy requirements are met by importing energy from outside the destination (e.g. fossil fuels such as natural gas; electricity derived from hydro generation stations).

Energy use in tourism destinations is normally disproportionately greater than what is typically associated with other similar-sized communities. This is largely due to the extensive use of energy-intensive technologies that deliver tourist amenities (Tabatchnaia-Tamirisa et al., 1997). In addition to direct uses of energy for cooking, heating, air conditioning, cooling, cleaning, lighting and travel, tourism destinations also rely on considerable amounts of energy for importing food and other material goods, transporting water and disposing of waste (Becken et al., 2003a; Bode et al., 2003; Gossling, 2000; Gossling et al., 2002). In many tropical or arid regions, energy is also needed for the desalination of seawater (Gossling et al., 2002). A substantial quantity of energy is also required to construct new infrastructure, accommodations and other facilities (Buchanan & Honey, 1994).

Another major component of energy use at tourism destinations is the operation of accommodation facilities (Becken et al., 2001; Chan & Lam, 2003;

Chan & Mak, 2004; Deng & Burnett, 2000). Hotels, motels, bed and breakfast establishments, backpacker facilities and campgrounds all use energy. Of these forms of accommodation, hotels generally require greater energy per visitor because they are more likely to have energy-intensive facilities and services such as bars, restaurants, in-house laundries and swimming pools (Becken et al., 2001). Private homes - used by permanent or seasonal residents, as well as tourists staying with friends and family - can also account for significant amounts of energy use at destination areas.

Tourist attractions and activities also generate significant energy demands in destinations (Becken & Simmons, 2002). Certain mechanized tourist activities are particularly energy intensive. These include ATV tours, scenic boat cruises, jet boat rides, charter fishing operations, scenic flights and heli-skiing (Becken & Simmons, 2002; Becken et al., 2003a). Energy is also used in up- and down-stream business functions (e.g. tour office administration, marketing and goods transportation) that support the delivery of these activities (Becken & Simmons, 2002).

Tourists, residents and businesses also consume large amounts of energy for transportation purposes. Employee commuting is a particularly important source of energy consumption in many tourism destinations. Often high destination real estate costs and limited affordable housing opportunities pressure significant portions of tourism destinations' workforces to reside in neighbouring towns and commute to work (Gober et al., 1993). Such commuting requirements can generate excessive levels of traffic congestion, energy consumption and fuel emissions (Kirkpatrick & Reeser, 1976).

However, the biggest portion of tourism energy is associated with travel from tourist-generating regions to host destinations (Gossling, 2000, 2002; Hoyer, 2000). As much as 90 percent of the estimated energy consumption by tourists is spent in getting to and from the destination (Gossling, 2002). Air travel, in particular, accounts for a major share of tourism-related energy use. This is especially the case in developing countries and island destinations, where the vast majority of tourists arrive by airplane (Becken, 2002; Gossling, 2000).

Destination energy requirements are largely met by transforming fossil fuels such as natural gas, coal and oil into various forms of secondary energy. The transformation processes occur either at the destination (e.g. micro-energy production systems) or in other regions (e.g. centralized power plants). Many of these processes produce potentially harmful chemical compounds that are released into the atmosphere in the form of carbon dioxide (CO_2), carbon monoxide (CO), nitrogen oxide (NO_x), sulphur oxide (SO_x) and particulate matter (PM). If the fuels used in these processes are incompletely burned, additional chemicals referred to as volatile organic compounds (VOCs) also enter the atmosphere. All of these emissions can have significant environmental effects on the regions where they are produced and released (Gossling, 2000, 2002; Holden, 2000; Hunter & Green, 1995).

The potential cumulative effects of energy-related emissions associated with tourism destination developments can be significant at both local and global scales. At a local scale, air pollution and ozone-related smog is often caused by unburned hydrocarbons and nitrogen oxides released from motorized vehicles, especially in heavily congested destinations (Andereck, 1995). Smog reduces the physical appeal of destinations by damaging vegetation species and lessening the quality of scenic and visual resources. Smog makes participation in many outdoor activities unpleasant, and potentially causes health problems such as headaches, dizziness and breathing difficulties (Bates & Caton, 2002).

On a global scale, CO_2 generated by destination tourism activities contributes to the cumulative impact of travel on global warming. Aircraft emissions are particularly important, given the vast amounts of aviation fuel consumed in bringing travellers to and from tourism destinations. Aircraft emissions of CO_2 contribute to climate change in the same way as CO_2 emissions from ground sources, whereas the impacts of other aircraft exhaust gases are not yet fully understood (Olsthoorn, 2001; Schumann, 1994). The effects of tourism energy requirements extend well beyond the destination where they are consumed and spill over into much broader geographic environments.

2.2.2 Tourism destination water use

Water is supplied to tourism destinations through direct extraction from local resources (e.g. from springs, rivers, lakes, ponds, estuaries, wetlands, groundwater, oceans or precipitation) or through importation from other jurisdictions. Because of contamination concerns, water is usually treated before distribution. However, treatment is not necessary for all uses (e.g. water used for snowmaking or irrigation). Once water is used it is either cascaded to another end use (e.g. toilets that use recycled greywater), treated at a downstream system or discharged directly into the environment. Downstream systems can include onsite septic fields, natural wetlands, or primary, secondary and tertiary wastewater treatment systems. Water treated at a downstream system is either recycled (e.g. treated wastewater used for irrigation) or released into the environment.

Both tourists and local people use water for a wide range of purposes, though visitors typically consume much more water on a daily basis than local residents. For instance, in some Mediterranean regions, hotels frequently use more than 400 litres of water per guest per day to meet the perceived product and service needs of their guests. This compares with about 70 litres per person per day for local resident consumption (Hunter & Green, 1995). In addition to primary uses of water for drinking, cooking, washing and bathing, tourism destinations also depend on large quantities of water for activities such as maintaining landscaped areas, irrigating golf courses, laundering sheets and towels, maintaining swimming pools and operating snowmaking generators. Irrigation of landscaped areas and golf courses is particularly water intensive in arid destinations (Connecticut Institute of Water Resources, 2001).

The high demand for water in tourism areas can have significant impacts on water resources, including lowering the water table, deteriorating water quality and saltwater intrusion (Andereck, 1995; Draper, 1997; Gossling, 2001; Holden, 2000; Hunter & Green, 1995; Kent et al., 2002). This in turn damages the health of natural habitats by reducing the quantity and quality of water available to plants and animals. Negative impacts to water resources can also reduce the overall appeal and viability of a tourism destination by spoiling the scenic quality of natural attractions (Kent et al., 2002; Pigram, 1995). These types of problems are exacerbated by the fact that tourism destinations are often located in regions with limited supplies of fresh water (Kent et al., 2002). In Thailand, for instance, up to 3,000 cubic metres of water are used daily for a single golf course despite a severe water shortage in the region (Eber, 1992). The seasonal effects of a destination's climate can also add to the intensity of impacts associated with water use. Often the concentration of tourism activity occurs in destination areas at the time of year when water supplies are most scarce or vulnerable to adverse effects (e.g. during the warm and dry season).

The intensive use of water in tourism areas also means that large amounts of wastewater are generated in these regions.[3] Pollution from untreated or partially treated wastewater can have profound implications on the quality of local water resources and aquatic life. Ecological effects include: declines in species diversity; reductions in dissolved oxygen in water and sediments; increases in water turbidity; damage to sea, lake or river beds; and acceleration of eutrophication (nutrient enrichment) of water bodies (Andereck, 1995; Draper,

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[3] When waste matter enters water, the resulting product is called sewage or wastewater. The waste matter, which is either dissolved or suspended in water, can be classified as volatile or fixed solids. Volatile solids are generally organic materials and fixed solids are inorganic or mineral matter. Organic materials include carbohydrates, proteins, fats, greases, oils and pesticides, while inorganic matter includes heavy metals, nitrogen, phosphorus, sulphur and chlorides. Wastewater also contains biological organisms such as bacteria, fungi and algae, as well as pathogenic organisms that can be passed on from infected persons or disease carriers.

1997; Gossling, 2001; Holden, 2000; Hunter & Green, 1995; Kent et al., 2002; Mill & Theophilou, 1995; Rodriguez, 1987).

The discharge of inadequately treated wastewater also impacts the health of tourists and locals, who may use contaminated water for drinking, bathing and other activities. Untreated or partially treated wastewater may contain a range of microorganisms, principally bacteria and viruses, which put humans at risk from diseases such as gastro-enteritis, hepatitis, polio, typhoid and dysentery (Holden, 2000; Hunter & Green, 1995). While wastewater treatment systems can remove the vast majority of organic materials and suspended solids in wastewater before discharging to the environment, they are not completely effective, and large quantities of pollutants are still released (Soroczan, 2002).[4] This problem is magnified by the fact that wastewater treatment is often minimal or nonexistent in many remote or isolated destination areas (Holden, 2000). In the Mediterranean, for example, only 30 percent of more than 700 towns and cities on the coastline treat sewage before discharging it into the sea (Holden, 2000). Such deficiencies are even more prevalent in less developed tourism regions, such as eastern Asia, Africa and the islands of the South Pacific. With a few exceptions, these areas have either no sewage treatment capacity or treatment facilities that are vastly inadequate at meeting the needs of both local people and tourists (Holden, 2000).

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[4] In a conventional wastewater treatment system, waste is passed through a series of screens, chambers and chemical processes to reduce its bulk and toxicity. The three general phases of treatment are primary, secondary and tertiary. Primary treatment focuses on removing suspended solids and inorganic material, while secondary treatment centres on reducing organic material by accelerating natural biological processes. The tertiary stage of treatment typically uses chlorine disinfection to remove the final bacteria, which is necessary if the water is to be reused. Chemicals used in these processes can have significant impacts on natural environments (Sweeting et al., 1999).

2.2.3 Tourism destination materials use

Tourists, residents and businesses in tourism destinations use raw and processed materials for a wide range of purposes. Substantial amounts of materials are used to develop tourist facilities and infrastructure (e.g. construction materials) and provide goods and services (e.g. paper for administrative purposes or chemicals for maintaining landscaped areas). Tourists and residents also consume material resources (e.g. food, clothing, souvenirs) and generate solid waste (e.g. packaged products, restaurant garbage).

Materials are supplied to tourism destinations through a series of extraction, manufacturing and import systems. Some materials used in tourism destinations may be directly extracted from local resources and processed at the destination. However, most materials are extracted and processed remotely and then imported to the destination. Raw material extraction processes may result in resource depletion, damage to ecosystems and loss of flora and fauna (Andereck, 1995; Holden, 2000; Hunter & Green, 1995). In addition, the industrial processes of converting raw materials into consumable goods and then transporting them to market can cause significant environmental damage. While such processes and their impacts often occur in other regions, examples of such activities and their impacts in tourism destinations include:

- reductions in biodiversity and aquatic habitat caused by the mining of coral reefs for building materials (Holden, 2000);
- damaging changes to coastal visual and recreation amenities as well as tidal current patterns due to sand from beaches being extracted for concrete production processes (Hunter & Green, 1995); and
- loss of wildlife habitat and increased susceptibility to soil erosion, floods, landslides and avalanches created by forest harvesting for construction materials (Andereck, 1995).

Once materials are used they are either diverted to another function through reuse or recycling or emitted into a waste stream.[5] Tourism destinations generate significant amounts of solid waste, especially because people tend to consume more while they are on vacation (e.g. by staying in hotels, eating out and buying more packaged products at retail stores). Often it is simply more difficult for people to behave environmentally sound given the structure in place at tourism destinations. The material wastes generated from destination activities include: organic food waste from restaurants; chemicals from hotel cleaning, industrial maintenance and landscape management processes; and litter associated with industrial and retail packaging (Draper, 1997, Holden, 2000; Gossling, 2001; Hunter & Green, 1995). Hotels, swimming pools, golf courses, marinas and other facilities also generate a wide variety of hazardous wastes, among them synthetic chemicals, oil, nutrients and pathogens (Holden, 2000; Gossling, 2001). [6]

Each waste stream is linked to one or more collection and treatment systems, such as transfer stations, recycling facilities, landfills, incinerators or composts. Materials treated by downstream systems are either recycled or discharged into the environment (air, soil or water). Improper disposal of solid waste is not only aesthetically unattractive, but it can also create environmental pollution and human health problems. The potential risk to humans is often magnified by the presence of large numbers of residents and tourists in the

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[5] The organic waste stream includes paper and paperboard waste, yard waste, food waste, and wood items. Many of these materials are readily biodegradable or can be composted. Other major waste categories include plastics, metals, glass, small appliances, demolition and construction wastes, hazardous wastes and other inorganic materials.

[6] Hazardous wastes pose a potential risk to humans or other living organisms for one or more of the following reasons: (1) such wastes are nondegradable or persistent in nature, (2) their effects can be magnified by organisms in the environment, (3) they can be lethal, and (4) they can have cumulative detrimental effects. General categories of hazardous wastes include toxic chemicals and flammable, radioactive or biological substances.

immediate vicinity of waste disposal facilities. Negative impacts can also result from direct greenhouse gas emissions from landfills and waste management processes, leachate from landfill sites and emissions from transporting wastes and recycling.[7] [8] Finding locations for new landfills can also be problematic because suitable geological conditions often do not exist in tourism areas. In such cases, solid waste must be transported to distant disposal sites, resulting in increased energy consumption and related air emissions. Disposal of solid waste is particularly challenging because the geography, climate and seasonal population influxes of many destination areas often limit the feasibility of solid waste facilities and recycling programs.

2.3 The Dematerialization Construct

Arguably, moving towards more sustainable forms of tourism requires significant dematerialization, a concept useful in describing reductions in the amount of energy, water and other materials used, as well as wastes and pollutants discharged in the production of goods and services. It seeks to decrease society's dependence on economic production systems that exploit the earth's finite stocks of natural capital in environmentally inefficient and damaging ways. The dematerialization concept is particularly relevant to tourism destinations because such areas have traditionally been characterized as using excessive amounts of energy, water and other natural materials in the production of tourist products and services.

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[7] Leachate is water that has percolated through solid waste and leached out some of its constituents.

[8] Some of these impacts can be mitigated through proper control mechanisms such as leachate collection and treatment or landfill gas collection for use as an energy source or flaring. (Flaring reduces greenhouse gas potential by converting methane (CH_4) into carbon dioxide (CO_2). This process reduces emissions because methane is 21 times more potent than carbon dioxide as a greenhouse gas.)

2.3.1 Theoretical foundations

Dematerialization is defined as the reduction in the quantity of raw materials and energy used and/or the quantity of wastes and pollutants discharged in the production of a unit of economic output (Cleveland and Ruth, 1999).[9] Some researchers use the term "dematerialization" only in reference to reductions in energy and material inputs and, analogously, use the term "depollution" to refer to reductions in waste and pollutant output (de Bruyn & Opschoor, 1997). In this dissertation, the concept of dematerialization encompasses both the input and output components (i.e. energy-material throughput). Other researchers use the term "transmaterialization" to describe shifts in the energy-material basis of an economy towards more benign flows (de Bruyn and Opschoor, 1997; Cleveland and Ruth, 1999). As defined in this dissertation, the dematerialization concept can include transmaterialization providing that the shift causes a net reduction in energy-material throughput.

Dematerialization focuses on decoupling economic production from the quantity of energy and materials processed in an economy. It assumes that traditional economic production systems are unsustainable because they depend on enormous inputs of energy and other resources that are returned as waste to the ecosphere - resulting in significant environmental degradation and continued exploitation of the earth's finite stocks of natural capital (Ayres, 1998a; Daly, 1990; Goodland, 1995; Goodland & Daly, 1996; Jackson, 1996; Pearce & Turner, 1990; Rees, 1995; Weizsäcker et al., 1997). Dematerialization offers a way to remedy this situation by harmonizing levels of energy-material throughput with the earth's regenerative and assimilative capacities. This concept and its

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[9] Many researchers use the concept of "eco-efficiency" to describe business activities that create economic value while reducing energy-material throughput (Ayres et al., 1997; DeSimone & Popoff, 1997; Reijnders, 1998). Eco-efficiency is comparable to the dematerialization concept, but applied at the firm level as opposed to broader economies.

operating principles bode well for identifying and addressing the problem of resource depletion and that of pollution, since the use of fewer materials and less energy typically translates into less waste generated by economic processes (Ayres, 1998a; Cleveland & Ruth, 1999; Hinterberger & Schmidt-Bleek, 1999; Jackson, 1996).

The theoretical basis for dematerialization is grounded in the principles of thermodynamics. The First Law of Thermodynamics states that in any ordinary physical or chemical process, energy is neither created nor destroyed but merely changed from one form to another. The Law of Conservation of Matter dictates a similar result for matter. The Second Law of Thermodynamics, also called the Entropy Law, states that any system and its surroundings as a whole spontaneously tend toward randomness or disorder; in essence, disorder (entropy) within a closed system always increases.

The relevance of the First Law of Thermodynamics to the economic process was first made apparent in Boulding's seminal essay "The Economics of the Coming Spaceship Earth" (1966). He presented an analogy of earth as a single spaceship with limited pools of raw materials and restricted reservoirs for pollution. The message of the analogy is simple – to survive, humankind must learn to live sustainably with a limited dowry of natural capital. This message highlights the significance of the First Law to the economic process: economies simply transform resources from one state to another; indeed, nothing "new" is ever created (Boulding, 1966).

The relevance of the Second Law of Thermodynamics was made prominent by Georgescu-Roegen in his book "The Entropy Law and the Economic Process" (1971). He reasoned that, from a purely physical perspective, economic processes function by transforming high quality (low entropy) resources into low quality (high entropy) waste, while useful services are derived en route. The Second Law dictates that, within a closed system, such transformations from low to high entropy always result in a net increase in disorder (entropy) in the system as a whole. Although economies are also capable of transforming waste back into high quality resources through recycling, the Second Law again prescribes that, for a closed system, these transformations result in a net increase in entropy (Georgescu-Roegen, 1977). [10]

Whereas the First Law tells us that economic activity simply transforms resources from one state to another, the Second Law dictates that this transformation necessarily involves a net increase in disorder (entropy). On the surface, the Second Law seems catastrophic – if every economic activity results in a net increase in entropy, then the end result is chaos. However, the caveat is that the Second Law only holds for a closed system. While this condition stands for the universe as a whole, it does not for the Earth. The Earth is not a closed system as it receives an abundant continuous flow of low-entropy energy from the sun (Ayres, 1998b, 1999; Craig, 2001; Kaberger & Mansson, 2001).

Ayres has pointed to natural metabolic systems as ideal examples of sustainable closed cycles able to use energy from the sun to convert wastes back into resources (Ayres & Ayres, 1998; Ayres & Simonis, 1994).[11] One such natural system is the carbon cycle. Through photosynthesis, green plants and other organisms use solar energy to convert high-entropy atmospheric carbon dioxide into low-entropy carbohydrates. It is precisely these types of systems that endow the earth with regenerative and assimilative capabilities. The environment's

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[10] Georgescu-Roegen's "Fourth Law of Thermodynamics" states it is impossible for a closed system to perform work forever between its subsystems (1977). The practical implication of this proposition is that perfect recycling is impossible without an external source of low-entropy energy.

[11] In contrast, most industrialized economies are prime examples of linear functioning systems. Such systems consist of a series of one-way processes that convert raw materials and energy into final goods, plus wastes. After consumption, the goods themselves are typically discharged back into the environment as waste. Even though some goods may be retained for long periods, they eventually return to the environment in the form of waste. The linear processing of natural resources is a principle reason for many of our planet's environmental problems (Eriksson & Robert, 1991).

regenerative capacity provides natural resources on a renewable basis, while its assimilative capacity allows wastes to be absorbed and converted back into harmless or ecologically useful products (Costanza et al., 1997).

In contrast to the metabolic systems observed in nature, most conventional economic systems are not sustainable. They not only liquidate low entropy resources and discharge high entropy waste at rates faster than natural regenerative and assimilative rates, but they also fail to take advantage of solar energy to convert wastes back to low entropy resources. The net impact is an increase in disorder (entropy) within the surrounding environment, resulting in the depletion of natural resources and the addition of pollutants to the environment.

To correct such unsustainable situations, Boulding originally called for a transition from the "frontier economics" or "cowboy economics" of the past, where human welfare is directly related to the amount of material and energy throughput in the economy, to the "spaceship economics" of the future, in which throughput is viewed as something to be minimized rather than maximized (Boulding, 1966). Expanding on Boulding's ideas, Daly (1973, 1991) has argued for a "steady-state" economic system where economic activity is maintained within the physical limitations of the encompassing ecosphere.[12] This perspective of the economy as a subsystem of the ecosphere exists in stark contrast to the neoclassical view of the economy as an isolated circular flow of value between firms and households (Figure 2.1).

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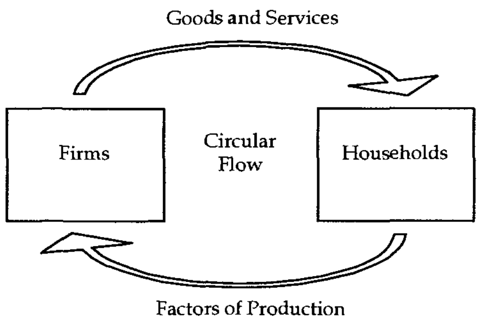
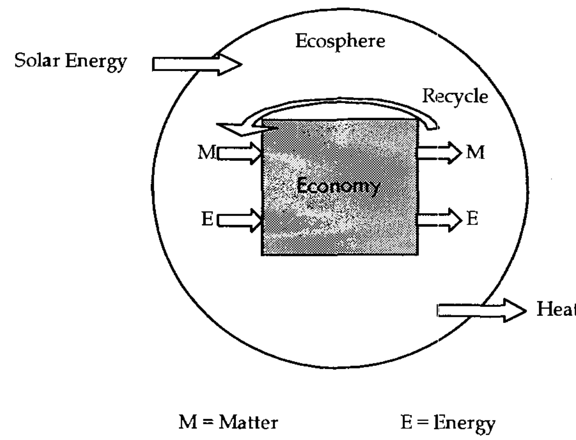
[12] Daly's work expands on the original concepts put forth by the nineteenth-century classical economist, John Stuart Mill (1806-1873), who envisioned economies maturing and reaching a steady state. Although this vision was consistent with classical economic theory at the time, Mill was one of the few economists to hail a steady state economy as healthy and desirable.

Figure 2.1: Contrasting views of economic systems



Neoclassical view:
The economy as an isolated system



Steady-state view:
The economy as an open subsystem of the ecosphere

Source: Daly, 1996 (used by permission of Herman Daly)

From the neoclassical point of view, growth of an economy is not limited in principle. In contrast, proponents of the steady-state or "materials balance" perspective assert that sustainable economic systems must maintain material and energy throughput within the regenerative and assimilative capacities of the ecosphere (Daly, 1990; Goodland, 1995; Goodland & Daly, 1996; Jackson, 1996; Pearce & Turner, 1990; Rees, 1995; Weizsäcker et al., 1997). Typifying this viewpoint, Goodland and Daly (1996) have provided an input-output rule for the basic conditions of a sustainable economic system:

- **Input rule.** (a) Harvest rates of renewable resource inputs should be within the regenerative capacity of the natural system that creates them. (b) Depletion rates of non-renewable resource inputs should be equal to the rate at which renewable substitutes are developed by human invention and investment (Goodland & Daly, 1996).
- **Output rule.** Waste emissions should be within the assimilative capacity of the environment without causing unacceptable degradation of its future

waste-absorptive capacity or other important services (Goodland & Daly, 1996).

Moving towards this view of sustainable economic systems requires that energy-material throughput be reduced to levels that are compatible with the Earth's regenerative and assimilative capacities.[13] This perspective asserts the values associated with dematerialization for creating sustainable economic processes.

2.3.2 Opportunities for achieving dematerialization

This section highlights four means of achieving dematerialization: (1) efficiency improvements; (2) transition towards a circular economy; (3) substitution amongst materials and energy inputs; and (4) changes in human demand for goods and services. [14]

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[13] A significant assumption of this line of reasoning is that low-entropy matter-energy required to maintain economic systems is obtained from sources internal to the Earth. Although this assumption holds in most conventional economic systems, it is not applicable in an economy fuelled solely by low-entropy energy from the sun, where all materials are completely recycled (Ayres, 1998a, 1999). Low-entropy solar energy is indeed an ample source for human endeavours, as it exceeds direct human requirements by a factor of 10,000 (Ayres, 1998a). In theory, throughput would be able to grow indefinitely in a fully circular economy fuelled only by solar energy. While such an economic system is theoretically feasible, it is certainly technologically optimistic. A precautionary perspective suggests that dematerialization opportunities should be pursued in most conventional economies.

[14] It has been argued that economies may dematerialize through a "natural" or "evolutionary" process driven by advancing time or increasing economic growth (Bernardini & Galli, 1993; Malenbaum, 1978). If valid, such "autonomous dematerialization" may imply that no or minimal policy intervention is required. While some empirical evidence appears to support this theory (Janicke et al. 1989a, 1989b), the consensus is that such autonomous dematerialization is far from certain (Cleveland & Ruth, 1999; de Bruyn & Opschoor, 1997; Jackson, 1996; Moomaw & Unruh, 1997; Stern et al., 1996). Although the existing empirical results illustrate that historical patterns of dematerialization are correlated with time and economic growth, they do not demonstrate a direct cause-and-effect relationship between these variables (Arrow et al., 1995; Opschoor, 1995). Furthermore, the historical results do not necessarily provide a reliable indication of future patterns of dematerialization (Moomaw & Unruh, 1997).

Efficiency improvements

Greater levels of dematerialization can be achieved by improving the efficiencies with which materials and energy resources are discovered, extracted, processed, distributed and utilized in economies. Many researchers have indicated that a vast potential for efficiency improvements still exists even though substantial advancements have already been made (Ayres, 1998a; Lovins, 1977, 1988; Weizsäcker et al., 1997; Worrell et al., 1997; Young & Sachs, 1994). Notably, Lovins (1977, 1988) has argued for energy efficiency policies as a principle means to avoid the detrimental impacts of fossil fuel dependence and the risks of nuclear technology. The Wuppertal Institute based in Germany is another leading advocate of efficiency improvements. Their seminal report "Factor Four: Doubling Wealth - Halving Resource Use" documents fifty examples of economic activity where fourfold improvements in resource efficiency is achieved through technical means (Weizsäcker et al., 1997).

Transition towards a circular economy (recycling)

In a circular economy, the economic system is intended to mimic natural ecosystems in their ability to recycle resources and minimize waste. [15] This represents a shift in mentality from traditional end-of-pipe environmental solutions towards a more holistic view of environmental protection (Desrochers, 2000). Many researchers have emphasized the need for policies that increase the

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[15] Much of the research on circular economies emanates from the discipline of industrial ecology (Allenby & Richards, 1994; Ayres & Ayres, 1998; Desrochers, 2000; Frosch & Gallopoulos, 1989; Socolow et al., 1994;). Frosch and Gallopoulos (1989) first introduced the concept of industrial ecology in their article "Strategies for Manufacturing." They called for a transition from the traditional model of industrial activity based on linear processing to a more holistic approach based on the "industrial ecosystem" concept. Characterized by the "waste-equals-food" principle, an industrial ecosystem persists through circular processing of resources where waste outputs from one firm are used as resource inputs for another firm. In this way, industrial processes interact as interconnected systems rather than isolated components (Allenby & Richards, 1994; Socolow et al., 1994).

circularity of economies (Ayres, 1996, 1998b; Ayres & Simonis, 1994; Ayres et al., 1997; Eriksson & Robert, 1991; Nakajima, 2000). Such proposals typically encourage technological advancements in recycling and re-using materials and cascading energy through multiple end uses. These options can reduce the amount of raw materials and energy used, as well as the quantity of wastes and pollutants generated in economic processes.

Substitution amongst materials and energy inputs (transmaterialization)

Technological change in the qualities and characteristics of resource inputs can promote dematerialization in two ways. First, substitutions can reduce the quantity of materials used per unit output by replacing heavy materials with lighter ones (Cleveland & Ruth, 1999; de Bruyn & Opschoor, 1997; Kaufmann, 1992). One example is in the automobile industry, where steel has been steadily replaced with lightweight alternatives such as aluminum, plastics and composites (de Bruyn & Opschoor, 1997). This trend is particularly relevant in tourism destination settings because automobiles are used extensively for visitor travel. Second, substitutions can reduce the amount of pollution per unit output by replacing environmentally damaging material and energy resources with less harmful ones. An example is the use of renewable energy sources as opposed to energy derived from fossil fuels (Lovins, 1977). Switching from fossil fuels to renewable energy sources reduces emissions of greenhouse gases and other air contaminants.

Changes in human demand for goods and services

The fundamental reason that people demand goods and services is to satisfy human needs and desires for such features as shelter, warmth or transportation (Gardner & Robinson, 1993). Economies can be dematerialized if these needs and desires can be satisfied with a mix of goods and services that overall has a lower energy and material content. Such structural change is possible only if human behaviour shifts to create a demand for this new mix of goods and services. Several researchers have called for policies that influence people's lifestyles and behaviour in ways that bring about such a change in overall demand patterns (Jackson, 1996; Redclift, 1996; Wann, 1996). These policies seem especially well suited for tourism destination settings where the final product produced is essentially experiential, rather than material, in nature (Pine & Gilmore, 1999; Prentice et al., 1998).

2.3.3 Barriers to achieving dematerialization

While there may be substantial untapped opportunities for achieving dematerialization, such prospects may be limited for a variety of reasons. The following sections elaborate on many of the major barriers to achieving dematerialization.

Rebound effect

Technological innovation leading to improved efficiencies may in fact lead to an increase in total demand for materials and energy. The energy literature contains a vast body of work pertaining to this phenomenon, referred to as the rebound effect (Binswanger, 2001; Greening et al., 2000; Herring, 1999, 2000; Saunders, 1992; Schipper & Grubb, 2000).[16] At least two forces contribute to the

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[16] Pioneering work on the rebound effect was carried out by Khazzoom (1980), who described the effect for a single-service model focusing on household demand for energy services. In the 1980s, intense debate ensued, mainly between Khazzoom and Lovins, about the actual significance of the rebound effect. Whereas Khazzoom claimed that the rebound effect is empirically significant, Lovins (1988) argued that, although the rebound effect may be valid in theory, it is probably only on the order of 2%, and thus not of practical significance. Lovins' assertions, however, were not based on empirical evidence. In a recent review of the main empirical studies of the 1980s and 1990s, it was concluded that the rebound effect is indeed of empirical relevance, but its size varies considerably depending on the data and methodology used in the studies (Binswanger, 2001). Another survey of existing empirical results also found that the magnitude of the rebound effect varies widely between studies, with the size of the effect being low to moderate (Greening et al., 2000). In general, most studies conclude that the size of the rebound effect is not large enough to result in a net increase in energy consumption.

rebound at a microeconomic level: a substitution effect and an income effect. The substitution effect reflects increased use of an energy service induced by the reduction in its price due to greater efficiency. The price reduction of an energy service also means that consumers have additional disposable money for other good and services, which also require energy. This resulting increase in energy use reflects the income effect.

The cost savings resulting from improved efficiencies can also cause macroeconomic rebound effects, which occur when the savings propagate through the economy and influence the supply and demand for energy.[17] At least four factors are responsible for such effects: first, some of the savings may be invested, in which case the added returns are later spent on energy-using goods and services; second, efficiency improvements may increase energy use by making energy appear less expensive relative to other production factor inputs; third, efficiency gains may stimulate economic growth which increases energy use; and, fourth, efficiency enhancements may improve returns to capital which attract investment to the activity involved, thus promoting further energy use (Brookes, 2004; Wackernagel & Rees, 1997).

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[17] Some researchers have asserted that increased energy efficiency, while leading to a reduction of energy use at the microeconomic level, may actually lead to an increase in energy consumption at the macroeconomic level (Herring, 1999, 2000; Saunders, 1992). However, other research findings invalidate this assertion. In an extensive study of energy use of nearly a dozen high-income countries, Schipper and Grubb (2000) found that rebound effects are typically small, especially in mature sectors of mature economies, and only potentially large in a few cases. The study concludes that, for high-income countries at least, macroeconomic effects are not enough to lead to a net increase in energy consumption. Still, the authors present the caveat that their conclusion may only hold within a certain range of energy costs. Below a certain threshold, firms and households may simply start to ignore energy use, and assume a wasteful indifference towards energy-consuming activities (Schipper & Grubb, 2000). At this point, technological improvements may indeed produce a net increase in energy use.

Energy requirements for recycling

The Second Law of Thermodynamics stipulates that wastes cannot be transformed into high quality resources without an external source of low-entropy energy (Georgescu-Roegen, 1977). If this energy comes from fossil fuels, for example, it will itself generate waste in the form of carbon dioxide. The detrimental impacts on the environment caused by this pollution may in fact outstrip the positive benefits of the recycling activity. These impacts are often magnified in remote tourism destinations because recyclable materials must be transported to distant recycling facilities. Transporting these materials generates additional greenhouse gases and other air contaminants.

Qualitative characteristics of material and energy resources

Substitutions that reduce the quantity of material and energy resources may in fact have a negative net impact on the environment due to aggregate changes in the qualitative characteristics of resources (Cleveland & Ruth, 1999). This can occur if the substitute resources are scarce (e.g. cadmium) or foreign to nature (e.g. plastic additives), or if the substitutes are derived from poorly managed ecosystems (e.g. wood from old growth forests).

Consumer preferences

The propensity for consumers to use one type of product over another can significantly influence the potential for policy interventions (Herman et al., 1990). For instance, consumers may continue to use energy- and material-intense products even though relative costs of substitute products have decreased as a result of technological improvements. Consider the case of the automobile – even though lighter automobiles are less expensive than heavier ones, many consumers still prefer the heavier vehicles for various reasons (Herman et al., 1990). This tendency is especially applicable for individuals involved with travel in mountain tourism regions. Furthermore, consumers often sacrifice fuel efficiency for comfort and performance when choosing an automobile, even though such vehicles are more costly to operate.

Increasing consumerism

An extensive survey of empirical evidence of dematerialization in the United States revealed that, although dematerialization trends are apparent in many individual products, they have been offset by substantial materialization resulting from an increase in the number of products consumed (Wernick et al., 1997). Even if it is possible to achieve a fifty percent improvement in materials and energy intensity through policy interventions, throughput will continue to grow once economic output doubles its existing level. This statement is true for any factor X improvement in resource efficiency (Jackson, 1996). Increasing consumerism is therefore a major barrier to dematerialization initiatives.

2.4 Destination Planning Options for Dematerialization

This dissertation focuses solely on public planning practices at tourism destinations, and does not consider national or regional levels of tourism planning. Planning at tourism destinations typically applies the same basic concepts and approaches of general planning adapted to the particular characteristics of tourism developments (Inskeep, 1991). A comprehensive approach to destination planning integrates economics, land use, transportation facilities and services, infrastructure, social facilities (educational, medical, and recreation facilities and services) and park and conservation planning dimensions (Inskeep, 1991).

A wide variety of environmentally sensitive planning practices have been suggested for shaping the development and management of tourism destinations (e.g. Bode et al., 2003; Dorward, 1990; Dowling, 1993; Gunn, 1988, 1994; Inskeep, 1987, 1991; Inskeep & Kallenberger, 1992; Quilici, 1998; Welford et al., 1999). These practices include more sustainable forms of land use and building design, transportation infrastructure and service options, water and power supply, and sewage and solid waste disposal. These strategies offer destinations opportunities to enhance their overall appeal and viability by reducing the negative effects of resource depletion and pollution on surrounding natural and built environments. Such options are potentially more feasible in tourism destinations than in other urban settings because tourists and residents may be more aware of and concerned with the quality of the environmental amenities they experience in such places (Bauer & Chan, 2001). The following sections elaborate on how these planning practices can be used to achieve dematerialization at tourism destinations.

2.4.1 Land use development

Principally, land use planning practices can promote dematerialization by encouraging compact development and mixed land uses. Several researchers have advocated the benefits of compact, mixed development patterns for destination areas (Gunn, 1994; Inskeep, 1987, 1991; Quilici, 1998). In this approach, accommodations and private housing are located near or within walking distance of major attractions, tourist facilities and other activity areas. Furthermore, accommodations and other facilities are developed in concentrated areas, instead of being dispersed throughout the region. Mixed land-use patterns are also encouraged to integrate accommodations with other tourist facilities as well as private housing. These forms of development are often more feasible in tourism destinations than other urban settings because tourists are predisposed to using the "commons" for their leisure activities, while regular residents tend to cherish their own private open spaces.

One of the more substantial ways in which compact mixed development can promote dematerialization is by reducing travel-related energy requirements and air emissions. Evidence exists that compact developments, mixed land-uses and higher densities tend to reduce the need for transportation infrastructure and travel (Boarnet & Sarmiento, 1998; Crane, 2000; Kenworthy & Laube, 1996, 1999; McNally & Kulkarni, 1997; Newman & Kenworthy, 1996). Another means by which compact development can facilitate dematerialization is by reducing the demand for energy services in buildings. Compact development patterns tend to result in energy savings for space heating in both residential and commercial buildings (Steemers, 2003). However, this benefit must be balanced against increased energy demand associated with reduced availability of daylight (Steemers, 2003).

Compact mixed development can also facilitate energy savings by meeting unavoidable energy requirements in more efficient ways. Compact development patterns can create efficient modal shifts in transportation by maximizing accessibility to public transport and encouraging high transportation load factors. Such development patterns are also more conducive to biking and walking (Cervero, 1988, 1991; Frank & Pivo, 1994). These modes are especially viable at tourism destinations because certain tourist segments seek the experiential opportunities that walking and biking often provide (Lumsdon, 2000). Compact mixed development can also promote energy efficiency by influencing energy supply infrastructure (Owens, 1986, 1992a, 1992b). For example, the potential for combined heat and power and district heating is enhanced in built environments with a moderately high density, high degree of land use mixing and linear layout (van der Waals, 2000).

Compact mixed development can also lead to reductions in consumption of water (mainly for irrigation) and building materials, as well as in the generation of liquid and solid waste (Anderson et al., 1996; van der Waals, 2000). Compact development also allows for more efficient infrastructure, such as water supply and sewage disposal systems, thus mitigating the effects of pollution (Inskeep, 1987). Moreover, it facilitates more comprehensive approaches to the collection of recyclable materials. Such developments may also stimulate a reduced need for network infrastructure. This decreases material requirements for transportation (local roads, collectors, arterials, highways, expressways), water supply (local pipes, distribution mains, pumping stations, treatment facilities), storm water (local drainage systems, trunks, treatment facilities) and sewage systems (local pipes, trunk sewers, treatment facilities) (Anderson et al., 1996; van der Waals, 2000).

Destination planners can influence land-use development by setting policies and prescribing certain types of infrastructure. However, market pressures created by decisions of private-sector agents largely dictate these actions. The significant influence of the market means that a planner's direct control over the destination landscape is to some extent limited.[18] Land-use authorities are especially constrained, since private homes, accommodation and other tourist facilities are generally provided by the private sector and the land associated with such developments is typically privately owned. Planners must therefore rely on various policy instruments to encourage developers to build compact and integrated destinations. These instruments include innovative zoning practices, growth management programs and building design and development regulations (Gill & Williams, 1994). They can also include economic instruments such as development impact fees, property tax abatements, housing subsidies and financial incentives for infill and redevelopment programs (Inskeep, 1987; Lickorish & Jenkins, 1997; Roseland, 1998; Sweeting et al., 1999; van Fossen & Lafferty, 2001).

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[18] Destination planners generally have more power to influence development than their urban counterparts, in part because the viability of a destination depends so greatly on maintaining attractive natural and built environments. According to Costa (2001), destination stakeholders are becoming aware that the economic benefits of tourism often come at the expense of the host region's environment. Stakeholders are also realizing that global competition is intensifying and, as a result, effectively planned destinations stand a better chance of securing long-term success than do inadequately planned ones (Costa, 2001).

2.4.2 Transportation services and infrastructure

Several transportation service and infrastructure options are available for encouraging reductions in travel-related energy requirements and fuel emissions (Gunn, 1994; Holding, 2001; Inskeep, 1987, 1991; Quilici, 1998). These alternatives focus on increasing transportation options available to tourists and local residents and reducing the use of fossil fuel-powered vehicles for internal transportation purposes.

One way that infrastructure design can decrease automobile use is by developing comprehensive networks of footpaths and bike paths that connect accommodations and private housing with major attractions, tourist facilities and other activity areas (Inskeep, 1987, 1991; Lumsdon, 2000). To maximize their use, such networks should be well-landscaped, well-lit and designed to provide aesthetically pleasing views (Inskeep, 1987). Bicycles can be provided at tourism destinations to encourage this mode of travel (Sweeting et al., 1999). Infrastructure design features such as "no-vehicle zones," traffic calming measures and parking capacity constraints can also curb vehicle use in a destination's central areas (Holding, 2001; Roseland, 1998). In Whistler, British Columbia, a European-style pedestrian village has been successful in reducing traffic congestion within the resort. Further reductions in private automobile use may be achieved by implementing parking fees at day lots, as well as at commercial accommodations. Such interventions are especially applicable at tourism destinations because the attractiveness and competitive appeal of these areas can often be enhanced through reductions in traffic volume.

Various transportation services can also be provided to give tourists and local residents options other than the private automobile for getting around the destination area. One way this can be accomplished is by offering various forms of public transport - such as bus or train - to service routes between accommodations, major attractions, tourist facilities and other activity areas (Sweeting et al., 1999; Thrasher et al., 2000). Public transport can accommodate higher occupancy loads than private automobiles, thus facilitating reduced per capita energy consumption and related air emissions. The quantity of emissions can be further reduced if the vehicles used for public transport are powered from a renewable energy source, such as hydro-based electricity or hydrogen fuel cells. For example, Bode et al. (2003) proposed the use of electrolysers in a hypothetical tourism destination as a means to provide hydrogen as fuel for public transportation. The management of transportation services at tourism destinations can differ substantially from that of other communities. In particular, public transport needs to be flexible to accommodate the peaks in passenger traffic typically associated with celebrations, festivals and other special events, while remaining sufficiently frequent to be attractive to the casual and occasional rider, even during off-season periods (Thrasher et al., 2000). In addition, creative opportunities may exist for encouraging visitors to use public transport modes. For instance, free transit passes can be offered to tourists with the purchase of other resort activities or amenities.

Destination planners generally have extensive control over transportation services and infrastructure mainly because these are almost exclusively owned and operated by the public sector. Planners can design the infrastructure and set rules for its utilization by private and public vehicles (Anderson et al., 1996). Although it is unlikely that planning solutions can completely eliminate the use of private automobiles within destination areas, minimizing vehicle use can enhance the experience of tourists by decreasing noise and pollution. Such actions can contribute to a more relaxed atmosphere and increasing recreational opportunities (Sweeting et al., 1999).

Several options are also available to lessen the energy impacts of employee commuting. Some examples include implementing ride-sharing programs, transit/high-occupancy lanes and dedicated commuter bus or train services. Another way to reduce the impact of employee commuting involves providing affordable employee housing in destinations. Development programs that increase affordable employee housing would increase the number of employees that reside locally, thereby substantially reducing related negative transportation impacts.

2.4.3 Site planning, landscaping and building practices

Decisions about siting, landscaping and building practices can lead to reductions in energy, water and material requirements at tourism destinations (Inskeep, 1987, 1991; Sweeting et al., 1999). Many of these practices must be implemented when new facilities are designed; however, improvements can also be made through retrofits to existing structures.

Decisions made during the design stage of new facility development can promote dematerialization in several ways. Siting and architectural practices can greatly reduce energy requirements by using natural ventilation for cooling and window exposures to retain heat and maximize natural light (Inskeep, 1987; Sweeting et al., 1999). Tourist facilities can also be designed to use low-temperature sources of heat that might be available through solar heating, ground source heat pumps or district energy systems (Bode et al., 2003; Chan & Lam, 2003). Construction of new facilities can incorporate recycled or recyclable materials as substitutes for top-grade wood fibre or plastics derived from fossil fuels. Landscaping practices such as xeriscaping[19] can be used to reduce water needs for irrigation, as well as chemical requirements for pesticides, fertilizers and herbicides (Gossling, 2001).

Installing efficient hardware in new facilities or replacing inefficient equipment with newer technology during retrofits to existing facilities can also encourage dematerialization. Energy efficiency improvements can be achieved

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[19] Xeriscaping is a style of landscape design requiring little or no irrigation or other maintenance. This practice uses plants and grasses that are native to the region or do not require much water or maintenance (Gossling, 2001).

through enhanced insulation and lighting and more efficient furnaces and hot-water heating (Sweeting et al., 1999). Installing water efficient or low-flow plumbing fixtures (e.g. low-flush toilets, water-conserving faucets and shower fixtures), as well as more efficient appliances, can increase water efficiencies (Gossling, 2001). However, some of these innovative technologies (e.g. spring-loaded faucets or timing devices on showers) may not suit higher-priced tourist facilities because visitors may experience diminished comfort levels.

Dematerialization can also be furthered by installing greywater recycling technologies in new or existing facilities. Greywater from washing machines, sinks, showers, baths and roof runoff can often be reused with minimal treatment.[20] One example is toilets that use greywater from showers for flushing. Another greywater technology involves the use of washing machines that reuse purified water from the previous rinse cycle for the next wash (Sweeting et al., 1999). Greywater systems can also be used to meet irrigation requirements associated with buildings and other facilities. However, greywater collection and irrigation systems must be considered early in the design process since they will affect landscaping design. This is especially true for gravity-flow greywater systems because they must be higher than the irrigation systems they service.

The onsite collection and use of rainwater also promotes dematerialization by reducing the amount of potable water needed for purposes such as laundry and dishwashing (Soroczan, 2002). By lowering potable water requirements, rainwater capture systems help minimize the amount of chemicals used in

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[20] Greywater must be separated from blackwater if water is to be reused. Greywater comes primarily from washing machines, sinks, showers, baths and roof runoff, whereas blackwater comes from dishwashing and toilets. While greywater can often be reused with minimal treatment, blackwater can only be reused after significant treatment because it can contain grease, oil, blood and human waste. Greywater can be separated from blackwater through a dual-pipe sewage system (Sweeting et al., 1999).

upstream treatment systems. Not only do these systems reduce the load on water supply infrastructure, but they also lessen the stress on storm water management systems.

Destination planners must rely on policy interventions to influence siting, landscaping and building practices, mainly because private homes, accommodation and other tourist facilities are generally provided by the private sector.[21] Various policy instruments can be developed and used to encourage building owners and developers to employ practices that reduce energy, water and material requirements. These include targeted development permits and building codes; audit and retrofit programs; deconstruction and demolition strategies; public demonstration projects; guidelines, certification and rating systems; builder and architect education programs; grants, loans, mortgages and bonds; tax credits and subsidies; rate restructuring; metering programs; recycling and waste reduction programs; energy and water conservation programs; taxes and user fees; public/private partnerships; and other educational, regulatory and incentive programs (Roseland, 1998; Sweeting et al., 1999).

2.4.4 Energy and water supply; sewage and solid waste disposal systems

Several innovative energy supply technologies are available for achieving dematerialization. Local renewable energy power sources, such as wind and micro hydro plants, can be developed to reduce greenhouse gases and other air emissions (Bode et al., 2003). Using photovoltaic equipment to supplement or substitute for other power supply methods can also reduce these emissions. Sunny destinations in tropical areas are particularly well positioned to capitalize on solar energy (Inskeep, 1987).

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[21] There are some notable exceptions, however, such as employee housing projects and other publicly owned facilities.

Destinations can also conserve energy by developing supply systems that cascade energy through multiple end uses. For instance, district heating systems can be used to reduce raw energy requirements for heating and hot water. Such systems increase overall energy efficiency by using heat waste from local sources, such as combined heat and power centres or large industrial processes, to provide heating needs (Rogner, 1993).

Other creative energy supply systems may also be available. Bode et al. (2003) proposed a hypothetical system based on a combination of electrolysers and fuel cells. Electrolysers use energy to split water into hydrogen and oxygen; the hydrogen is stored in pressure tanks and the oxygen is released into the atmosphere. Fuel cells then provide energy by oxidation of hydrogen where water is the only by-product. The resulting system provides energy without the release of greenhouse gases or other emissions. Such systems may be practical in isolated tourism destinations where connection to an energy grid is not economically viable (Bode et al., 2003).

A range of environmentally sensitive water supply and sewage treatment options exist for promoting dematerialization. Downstream treatment systems can be developed to recycle wastewater for non-potable uses, such as washing floors, flushing toilets and irrigating golf courses and other landscapes (Armstrong & Butler, 1996; Gossling, 2001; Kent et al., 2002). Mill and Theophilou (1995) described one such system in which wastewater is given secondary treatment, stored in reservoirs until required for irrigation, withdrawn through sand filters, disinfected and then pumped to an irrigation distribution system. This system can serve parks, gardens, road verges, hotel areas and other landscapes associated with tourism destinations (Mill & Theophilou, 1995).

Natural wastewater treatment options can also be implemented at many tourism destinations to reduce chemical residues produced by more conventional treatment processes (Gossling, 2001). In rootzone systems, for example, wastewater is discharged into the root area of certain plant species

(Sweeting et al., 1999). The plants purify the wastewater by consuming organic material in the waste. Another example is wetlands systems, in which wastewater is transmitted through a series of ponds lined with impermeable linings to prevent leakage of pollutants into soil and groundwater (Sweeting et al., 1999). In each pond, bacteria growing on plant roots consume the organic material in the waste. Such systems require a large amount of space and relatively warm weather, making them well-suited for many tropical destinations. Less harmful alternatives for tertiary treatment are also available. These include ultra-violet lamps that kill bacteria with an intense light, or ionization, which uses an electrical current to kill off pathogens (Draper, 1997; Sweeting et al., 1999).

Solid waste infrastructure and service options can also be utilized to achieve dematerialization. For instance, enhanced collection systems and drop-off facilities for recyclable and compostable materials can be created to divert solid waste from landfills. Furthermore, targeted programs can be used to reduce, reuse, recycle and compost waste generated by commercial businesses (e.g. hotels and restaurants), as well as construction and demolition activities. In addition, various policy instruments can be developed to encourage tourists, residents and businesses to use these systems (e.g. waste-collection fees, disposal bans, tipping fees at landfills, etc.)

Eco-industrial exchanges and resource recovery facilities can also be created to allow destinations to put discarded materials to use through reuse, recycling and remanufacturing (Bergh, 1994). Tourism destinations may produce enough waste on their own or be able to pool resources with neighbouring communities to generate sufficient volume to make local recycling initiatives feasible. If local recycling is not possible, there may be other creative ways to reuse waste, such as grinding up glass beverage bottles for construction and gravel (Sweeting et al., 1999).

Community composting facilities can be created for biodegradable wastes such as food scraps, paper, leaves, tree cuttings and even solid sewage sludge (Sheehan, 1994). The compost will eventually produce a rich soil for use in gardens and other landscaped areas. Such systems are viable in many tourism destinations because of the large amount of organic wastes produced by restaurants and other facilities (Sweeting et al., 1999).

Destination planners generally have considerable control over the design and operation of infrastructure for energy and water supply, as well as sewage and solid waste disposal. These systems are typically owned and/or operated by the public sector. The development of such practices within the borders of destination regions can potentially not only reduce negative environmental and health impacts, but also create financial savings, local employment opportunities and greater self-sufficiency for the resort area.

2.4.5 Recreational opportunities

Achieving greater levels of dematerialization in tourism destinations can be accomplished by limiting resource-intensive recreational activities. In the strictest sense, activities that require large amounts of resources and release substantial quantities of waste may be banned outright. Where this is not possible, there may be opportunities to enact efficiency standards and other regulations. For example, commercial recreation providers may be regulated to use fuel-efficient motorized vehicles (e.g. requirements for four-stroke ATV engines), or golf courses may be required to use water-efficient technologies for irrigation purposes.

Another alternative would be to provide and encourage participation in lower-impact activities such as cultural and educational activities (e.g. museums, historic sites, interpretive sites and demonstration projects) or walking, hiking or biking on low-impact nature trails. A well-developed nature trail network may not only promote a relatively low-impact form of recreation, but also encourage tourists and residents to walk or cycle, rather than use private vehicle transportation. Such low-impact recreation alternatives not only conserve resources, but can also make the destination more desirable to certain tourist segments.

2.4.6 Tourism travel options

The preceding discussion has identified numerous options for reducing resource requirements and emissions in tourism destinations, but has not considered the challenges associated with visitor travel to and from such places. Travel is an overwhelming source of most energy consumption and emissions related to destinations (Becken et al., 2003a; Gossling, 2000, 2002). Several transportation management options exist to curtail visitor travel energy requirements and emissions (Becken et al., 2003a; Holding, 2001; Miller & Wright, 1999; Roof et al., 2002). Most of these alternatives centre on reducing the need for personal automobile travel by offering more attractive mass transit options. Specific strategies include providing dedicated multiple-occupancy lanes, more affordable and frequent mass transit travel, attractive express bus and train capabilities and more convenient inter-modal access and transfer points. Such options are especially applicable in tourism settings where creating hassle-free transportation options can enhance the visitor's overall experience. Well-designed public transportation services and infrastructure can also help tourists experience their vacation in a more tactile and engaging fashion (Thrasher et al., 2000).

While these initiatives can reduce the energy and air emissions associated with ground transportation options, they have little influence on the vast energy requirements and emissions associated with air travel. For the most part, managing such energy impacts is beyond the control of destination planners. It is also improbable that destination marketing organizations will shift their marketing focus from "higher spending" distant markets to "lower yielding" regional markets because of potential opportunities to reduce visitor-related energy consumption and related air emissions. Moreover, the technological improvements needed to curb air travel impacts are decades away from happening.

2.4.7 Carbon offsetting strategies

While the emissions associated with tourist travel are often unavoidable, employing various carbon-offsetting strategies can lessen their impacts. In a tourism context, carbon offsetting involves trading off carbon dioxide emissions from travel for financial contributions to various carbon-offsetting activities. Often, these initiatives focus on creating and protecting natural "carbon sinks" that absorb carbon dioxide (Becken, 2004). One form of carbon sink involves sequestrating carbon dioxide as biomass, usually forests.[22] While the global effectiveness of forest-based carbon sinks in taking up carbon dioxide is unclear and controversial (Dorsey et al., 2004), several programs are emerging that encourage consumers to contribute financially to the development of forested areas in exchange for their energy emissions (Carswell et al., 2003; Future Forests, 2000). Beyond their carbon absorbing benefits, these programs may help protect and enhance regional biodiversity, hydrological, soil and scenic landscape protection initiatives in tourism destination regions (Becken, 2004). Conversely, they may be detrimental to areas away from tourism destinations established as "carbon dumps" (Dorsey et al., 2004).

While carbon offsetting is a useful option for lessening the energy impacts of tourist travel, it should not be viewed as a permanent solution for stabilizing greenhouse gas emissions in the atmosphere over a long time period. What is more, the entire concept of carbon offsetting may be sending out the wrong

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[22] Other forms of carbon sinks include geological or deep-ocean storage.

message to tourists. Although these strategies may alleviate some impacts of tourist travel, they fail to tackle emissions at source by reducing the use of fossil fuels. Ultimately, meeting this challenge will depend on using low- or zero-emission vehicles and airplanes for transporting visitors to and from destinations. However, carbon offsetting does provide a valuable "transition strategy" until these technological solutions are readily available.

2.4.8 Incorporating tourist preferences in planning processes

Successful implementation of more sustainable land uses, infrastructure and facility development in tourism destinations not only requires innovative technical solutions, but also the support of a wide range of stakeholders with varying interests (Gill & Williams, 1994; Haywood, 1988). These include tourists, tourism operators, year-round and seasonal residents, employees, environmental organizations, architects, developers, destination planners and elected decision-makers. All of these groups may be affected differently by proposed planning solutions and may have vastly different perspectives on the utility of such options (Gill & Williams, 1994). The preferences among individuals may also differ substantially within each stakeholder group. For instance, different segments of tourists may have very diverse reactions to proposed planning options. Although there are fundamental tradeoffs associated with any given planning alternative, these differences can often be overcome, since most stakeholders share a common interest in the destination's future (Murphy, 1983).

Participatory decision-making approaches providing opportunities for stakeholder involvement have been suggested for tourism destinations (e.g. Edwards-Craig et al., 2003; Gill, 1997; Haywood, 1988; Jackson & Morpeth, 1999; Murphy, 1988; Simmons, 1994; Simpson, 2001;Williams et al., 1998b). The fundamental goal of these approaches is to engage the full range of stakeholders in the planning process such that all interests are addressed in an equitable fashion (Gunton et al., 2003; Simmons, 1994; Williams et al., 1998a). The approach focuses not only on involving a large number of stakeholders in participation processes, but also on achieving a high level of interaction and engagement in these initiatives. It also emphasizes attaining equity in participation by ensuring a fair and representative balance amongst differing stakeholder interests. This direction in planning has resulted largely from the criticism that traditional top-down approaches tend to promote conflict among stakeholder groups and resentment towards the planning process (Gibson & Tomalty, 1995). Greater participation in public decision-making is advocated as an approach that promotes citizenship and fairness, reduces conflict by building long-term trust and results in a more satisfactory decision-making process (McMullin & Nielson, 1991; Selin & Chavez, 1995; Sewell & O'Riordan, 1976).

Participatory processes are especially valuable for tourism destinations because the long-term success of these areas depends greatly on the support of a wide range of stakeholders. Not only must development decisions accommodate the interests of local stakeholders, but destinations must also develop in ways that appeal to the tastes and interests of tourists. However, a key challenge in ensuring effective stakeholder participation in tourism planning processes lies in integrating the perspectives of tourists into evaluations of planning alternatives. While participatory approaches, such as open houses or advisory committees, have been successful in finding common ground amongst various local stakeholder interests, their task of evaluating alternatives could be enhanced through the inclusion of more systematic methods that would explicitly incorporate tourist preferences. This task is particularly difficult because tourists do not typically reside in or near the destination region (Gill & Williams, 1994; Haywood, 1988).

2.4.9 Tourist preferences for dematerialization planning options

Tourist responses to proposed dematerialization strategies are influenced by a complex array of variables. These include: (1) possible impacts of the strategies on the destination visited; (2) individual characteristics of the traveller; and (3) prior trip characteristics. The following sections discuss how these factors interact with visitor preferences.

Destination attributes

Destination planning scenarios that promote dematerialization can impact travellers in several different ways (Table 2.1). Visitors may perceive some impacts as positive (e.g. less traffic congestion) and others as negative (e.g. restricted automobile access). Clearly, some factors will be more important to tourists than others. The net impact on their overall perception of a destination can be positive or negative depending on the particular strategy deployed. Information concerning these visitor preference patterns can provide destination planners and managers with useful insights about consumer responses to potential dematerialization policy and planning strategies.

Table 2.1: Possible effects of dematerialization planning options on tourists

Potential Positive Effects	Potential Negative Effects
• More vibrant spaces and social interactions caused by compact development • Less aesthetically unappealing sprawl • Convenient accessibility by foot and bike • Less traffic congestion • Less noise and light pollution from vehicles • Enhanced transit services • More access to certain recreational pursuits, such as educational and cultural activities • Less environmental pollution • Fewer health problems • Enhanced scenic quality of natural attractions and resources • More intact natural areas and increased wildlife habitat • Reduced imperviousness • Value in knowing the "right thing is being done"	• Increased urbanization caused by compact development • Reduced privacy and more crowding and noise • Diminished viewscapes because of densification • Restricted automobile access and parking • Reduced safety because tourists must walk through car-free zones • Diminished comfort caused by certain technologies (e.g. low-flow showerheads) • Less aesthetically pleasing landscaping methods (e.g. xeriscaping) • Limited access to recreational activities, such as golfing and motorized sports • Redirected funds that might have been used for developing other facilities or amenities • Increased fees or taxes (e.g. parking fees)

Sources: Bode et al., 2003; Draper, 1997; Gossling, 2001; Gunn, 1988, 1994; Holding, 2001; Hoyer, 2000; Inskeep, 1987, 1991; Kent et al., 2002; Lumsdon, 2000; Quilici, 1998; Sweeting et al., 1999; Thrasher et al., 2000.

Individual characteristics

A traveller's perception of the preceding impacts usually depends on their personal travel needs, motivations and values that they seek to satisfy (Seddighi & Theocharous, 2002; Woodside & Dubelaar, 2002; Woodside & Lysonski, 1989). Therefore, instead of responding with equal satisfaction to a given planning alternative, various tourist groups may have very diverse reactions. Previous research suggests that visitor preferences vary systematically with respect to several tourist characteristics (e.g. Apostolakis & Jaffry, 2005; Baysan, 2001; Hearne & Salinas, 2002; Lindberg et al., 2001). These traits include: socio-demographic variables (e.g. gender, age, income and education), situational variables (e.g. place of residence), tourist destination motivations, and personal values and attitudes. Such preference heterogeneity presents challenges to destination planners and managers, who must determine whether the gains to some tourist segments outweigh the losses to others.

Prior trip characteristics

Tourist evaluations of destinations are also influenced by prior destination travel behaviour (Woodside & Dubelaar, 2002). Particularly, visitor preferences can be affected by: travel party size, purpose of trip, length of stay, location and type of accommodation and activities pursued during the visit. For instance, visitors who pursued motorized sports during prior visits to a destination are likely to disapprove of proposed dematerialization strategies that restrict or ban those activities.

Despite major advances in behavioural research in the tourism field, there has been little research on tourist preferences toward destination development options (e.g. Haider & Ewing, 1990; Hearne & Salinas, 2002; Lindberg et al., 2001;

Mercado & Lassoie, 2002).[23] Moreover, no study to date has evaluated tourists' perspectives concerning destination planning alternatives that promote dematerialization. Such an investigation would not only provide invaluable insights for key stakeholders involved in planning processes, but also inform planners and private investors about the viability of dematerialization planning strategies from a tourist perspective. A sophisticated multi-attribute technique should be used to analyze visitor preferences, given the complex tradeoffs and multi-dimensional characteristics associated with destination planning scenarios. The next chapter presents such an approach for evaluating tourist preferences for proposed dematerialization planning options, along with a method for quantitatively assessing the environmental impacts of those alternatives.

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[23] Most behavioural research concerning tourists in destinations relates to overall destination image, product marketing issues or destination choice decisions (Baker & Crompton, 2000; Baloglu & McCleary, 1999; Chon, 1990; Driscoll et al., 1994; Echtner & Ritchie, 2003; Gallarza et al., 2002; Klenosky et al., 1993; Murphy et al., 2000; Ross, 1993; Seddighi & Theocharous, 2002; Um & Crompton, 1990; Woodside & Lysonski, 1989). Behavioural research of residents is more likely to focus on their attitudes towards tourism, or on their attitudes or acceptance of specific new projects (Akis et al., 1996; Allen et al., 1993; Andereck & Vogt, 2000; Gunce, 2003; Korca, 1998; Lankford & Howard, 1994; Liu & Var, 1986; Long et al., 1990; Mason & Cheyne, 2000; Williams & Lawson, 2001).

CHAPTER 3: METHODS

No systematic examination of destination planning options has ever been undertaken with respect to dematerialization. This chapter describes a multi-staged approach for conducting such an investigation. It is organized as follows:

- **Section 3.1** presents a framework and resource flow modelling approach for examining the technical potential of dematerialization planning alternatives in tourism destinations.
- **Section 3.2** describes a stated choice method for investigating tourist preferences for and acceptance of dematerialization planning options.
- **Section 3.3** outlines an approach for assessing the tourist responses and dematerialization levels of various transportation strategies designed to reduce visitor travel impacts.
- **Section 3.4** describes a method for examining visitor responses to possible carbon offsetting strategies.
- **Section 3.5** highlights the data collection procedures and survey instrument used in this research.

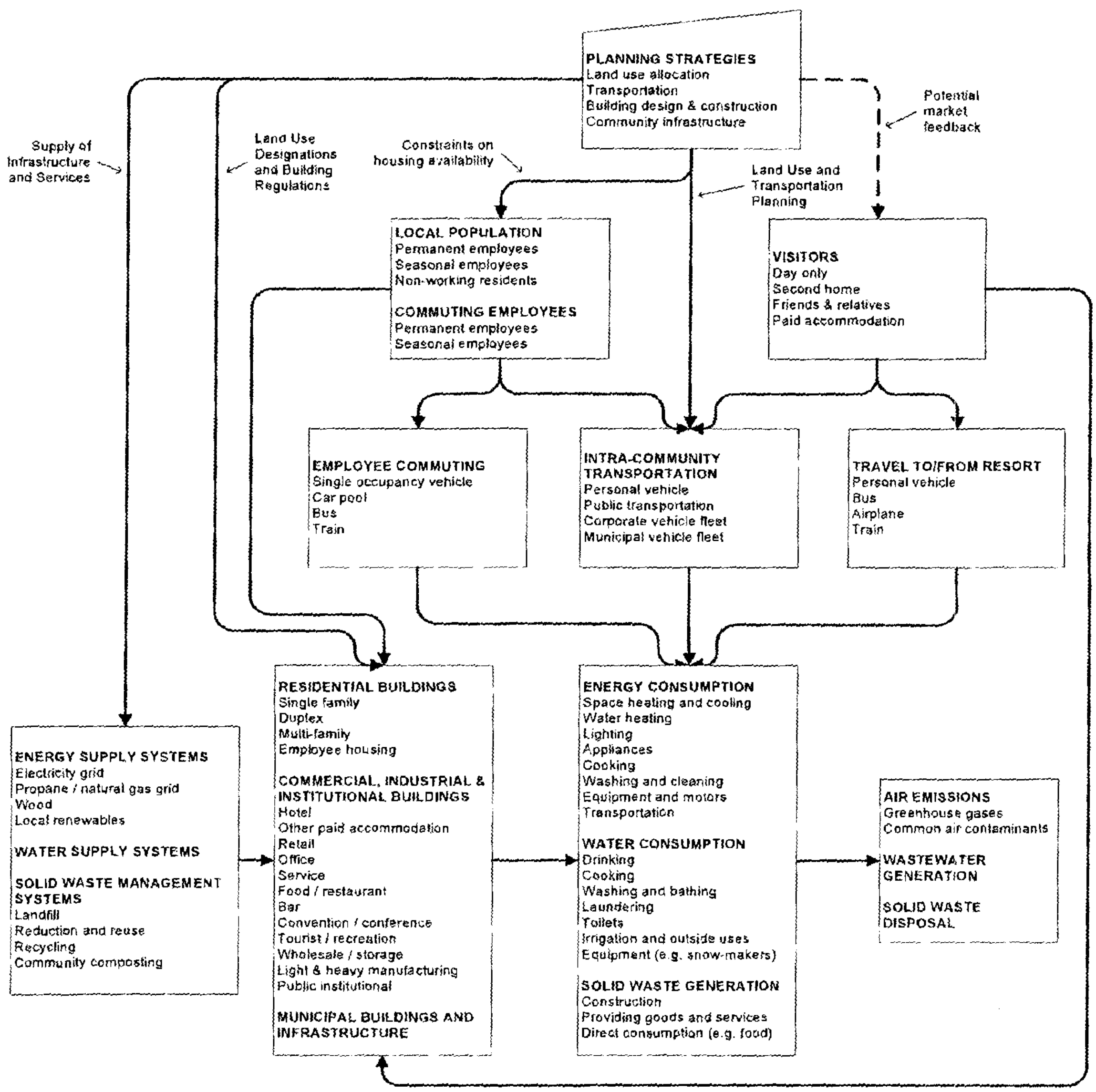
3.1 Technical Evaluation of Planning Options

This section provides a conceptual framework and methodology for systematically identifying tourism destination contributions to resource consumption and emissions at a strategic planning level. This technical evaluation uses a three-phased method to assess the potential effects of various planning options in tourism destinations from a dematerialization perspective. The phases involve: a) creating an overriding framework and approach for inventorying energy and material flows in destination areas; b) identifying key strategic policy and planning options for reducing such resource flows; and c) developing a modelling procedure to forecast the effects of these options on resource use and emissions. A description of these methods and how they were applied in the context of a Whistler case study follows.

3.1.1 Inventory of resource flows

The first step of the technical evaluation established a systematic framework for inventorying the key drivers of energy and material flows associated with tourism destinations. Based on a review of existing literature (Bode et al., 2003; Becken, 2002; Becken & Simmons, 2002; Becken et al., 2001, 2003a, 2003b; Draper, 1997; Gossling, 2000, 2001, 2002; Gossling et al., 2002; Hoyer, 2000; Kent et al., 2002) three primary dimensions and associated drivers of these resource flows were identified. The framework included drivers related to: a) energy consumption, water use and solid waste generation internal to the destination (e.g. buildings, infrastructure, and transportation); b) energy consumption for employee commuting to and from the destination; and c) energy consumption for visitor travel to and from the destination (Figure 3.1). This framework was used to establish standardized and comparable measures of dematerialization for the study's base year.

Figure 3.1: Resort destination resource flow model



Internal destination resource flows

Energy consumption and energy-related air emissions

Energy consumption for all buildings, infrastructure and transportation internal to Whistler was determined by analyzing data provided by the Resort Municipality of Whistler, local resort corporations, as well as transportation, gas and electricity utilities. These data detailed records of electricity and propane consumption for residential, institutional, commercial, industrial and municipal buildings and infrastructure, as well as estimates of wood use for space heating in residential homes. These data also included gasoline and diesel fuel consumption volumes for commercial and municipal vehicle fleets and public transportation, as well as estimates of gasoline consumption for all personal transportation within the resort destination.

Energy-related greenhouse gas (GHG) emissions were calculated by multiplying energy consumption estimates by established emission factors for each fuel type (Table 3.1). GHG emissions were expressed in terms of carbon dioxide equivalent (CO_2e).[24]

Common air contaminants (CAC) emissions were established for carbon monoxide (CO), nitrogen oxides (NO_x), sulphur oxides (SO_x), volatile organic compounds (VOCs) and particulate matter (PM). Area and mobile source emissions were calculated by multiplying energy consumption by established emission factors (Table 3.1). Point source emissions were estimated using data from the Sea-to-Sky emission inventory (MWLAP, 2002).

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[24] Carbon dioxide equivalent (CO_2e) is used to calculate the impact of various gases involved in global warming using a single unit of measurement. For example, one tonne of methane (CH_4) produces 21 times the atmospheric impact of one tonne of carbon dioxide (CO_2); therefore, CH_4 is expressed as 21 CO_2e.

Table 3.1: Emission factors

	tCO_2e/GJ	tCO/GJ	tNO_x/GJ	tSO_x/GJ	tVOC/GJ	tPM/GJ
Electricity – grid	0.0069 [1]	-	-	-	-	-
Electricity – small-scale renewables	-	-	-	-	-	-
Propane	0.0599 [2]	0.0000089 [3]	0.0000655 [3]	0.0000000047 [3]	0.0000023 [3]	0.0000019 [3]
Natural gas	0.0511 [2]	0.0000168 [3]	0.0000395 [3]	0.00000025 [3]	0.0000023 [3]	0.0000032 [3]
Wood	0.1243 [2]	0.0057141 [3]	0.0000693 [3]	0.0000099 [3]	0.0013122 [3]	0.0007576 [3]
Gasoline	0.0701 [2]	0.00193 [4]	0.00023 [4]	0.0000011 [4]	0.000199 [4]	0.0000039 [4]
Diesel – road	0.0714 [2]	0.00023 [4]	0.00048 [4]	0.0000081 [4]	0.000031 [4]	0.0000270 [4]

[1] BC Hydro (2003)
[2] Environment Canada (2002)
[3] USEPA (1995)
[4] Environment Canada (2001)

Water consumption and wastewater generation

The Resort Municipality of Whistler provided data on water consumption for all buildings and parks internal to Whistler. These data detailed records of water consumption for residential, institutional, commercial, industrial and municipal buildings. They also included levels of water consumption for maintaining parks. Data provided by the community's Wastewater Treatment Plant were used to determine total wastewater generation internal to Whistler.

Solid waste generation and disposal

The Resort Municipality of Whistler also supplied data on total solid waste generation internal to Whistler. Total solid waste disposed in landfills was calculated by multiplying the amount of solid waste generation by a solid waste diversion rate (24%). This rate was the proportion of solid waste diverted from landfills due to reduction and reuse, recycling and composting.

Direct GHG emissions (methane) from the Whistler landfill were estimated by multiplying the amount of solid waste disposal by an emission factor of 0.382 tCO_2e per tonne of waste (Environment Canada, 2002).

Factoring out tourism's effects on destination resource flows

The effects of the tourism industry on Whistler's internal resource flows were estimated by disaggregating resource consumption in each sector between tourism and non-tourism components. The tourism share included both direct effects (e.g. resources consumed by hotels in providing accommodations to tourists) and indirect effects (e.g. resources consumed by businesses in providing office services to tourism operators). Induced effects (e.g. domestic resource use by employees and their families) were not considered part of tourism's direct contribution (Table 3.2).

Table 3.2: Tourism's effects on destination resource flows

Sector	Direct Effects (Included)	Indirect Effects (Included)	Induced Effects (Not Included)
Residential	Resources consumed by tourists staying in residential dwellings	-	Resources consumed domestically by resort employees and their families
Passenger Transportation	Resources consumed by tourists using private transportation	-	Resources consumed by resort employees and their families using private transportation
Commercial, Industrial and Institutional	Resources consumed by businesses in providing tourists with products and services (e.g. accommodation or recreation services)	Resources consumed by businesses in providing other tourism businesses with products and services (e.g. office or construction services)	Resources consumed by businesses in providing employees and their families with products and services (e.g. restaurant or retail services)
Municipal Buildings and Infrastructure	Resources consumed in providing tourists with municipal services (e.g. parks or lighting)	Resources consumed in providing tourism businesses with municipal services	Resources consumed in providing employees and their families with municipal services
Public Transportation	Resources consumed in providing tourists with public transportation	-	Resources consumed in providing employees and their families with public transportation

Since existing data were not disaggregated between tourism and non-tourism elements, various secondary data sources were used to isolate the effects of tourism. In the residential sector, for example, secondary data from Tourism Whistler's local visitor surveys were used along with population statistics to determine the percentage of residential dwelling occupants who were tourists (i.e. second homeowners and/or tourists staying with friends or relatives). This proportion provided an estimate of tourism's share of residential resource consumption. Another example is the restaurant sector, where tourism's share of overall resource usage was based on the percentage of total restaurant visits made by tourists. This proportion was derived from existing survey information. Similar types of calculations were used to estimate tourism's contribution in other sectors of the tourism industry (Table 3.3).

Table 3.3: Estimated contribution of tourism to Whistler's resource use

Sector	Building Type	Tourism's Effect (%)	Assumptions
Residential	Single Family Dwelling	22%	1
	Duplex	22%	1
	Multi-family	67%	2
	Restricted Employee Housing	14%	3
	Seasonal Employee Housing	14%	3
Passenger Transportation		54%	4
Commercial, Industrial and Institutional	Hotel	100%	5
	Other Tourist Accommodation	100%	5
	Retail	70%	6
	Office	85%	7
	Service	85%	7
	Food/ Restaurant	70%	6
	Bar	70%	6
	Convention/ Conference	100%	5
	Tourist/ Recreation	85%	7
	Wholesale/ Storage	85%	7
	Light & Heavy Manufacturing	85%	7
	Public Institutional	54%	4
Municipal Buildings and Infrastructure		54%	4
Public Transportation		13%	8

[1] Assumes 8% of dwelling occupants were second homeowners and another 14% of them were tourists staying with friends or relatives (derived from Tourism Whistler's visitor surveys and population statistics).
[2] Assumes 58% of multi-family dwellings were used for tourist lodging and 42% were used for residential housing (based on consultation with municipal planning staff). Also, assumes 8% of residential dwelling occupants were second homeowners and another 14% of them were tourists staying with friends or relatives.
[3] Assumes 14% of dwelling occupants were tourists staying with friends or relatives (derived from Tourism Whistler's visitor surveys and population statistics).
[4] Assumes 54% of total day population were tourists (derived from Tourism Whistler's visitor surveys and population statistics).
[5] Assumes 100% of resource requirements were attributed to tourism.
[6] Based on the percentage of total retail purchases/restaurant visits made by tourists.
[7] Based on consultation with municipal planning staff.
[8] Assumes 13% of transit riders are tourists (source: WAVE On-Board Passenger Survey conducted March 2000).

Employee destination commuting

Estimates of energy consumption and greenhouse gases resulting from employee commuting were estimated using a three-step process. The first step established vehicular travel flows expressed in "person kilometres travelled" (PKT) for both permanent and seasonal Whistler employees living outside of the destination. PKTs were calculated for three main modes of commuting (private automobile, car pool and bus) and the two major places of employee residence (Pemberton and Squamish). Total PKT for each mode was calculated as follows:

$$PKT_i = \sum_{j=1}^{n} \left(Employees_j \times Working\ Days \times Return\ Distance_j \times Modal\ Split_{ij} \right) \quad (1)$$

where $Employees_j$ is the number of employees commuting from place of origin j; *Working Days* is the number of commuting days in the year (240 for permanent employees; 80 for seasonal employees); $Return\ Distance_j$ is the two-way distance to the resort from place of origin j; and $Modal\ Split_{ij}$ is the proportion of employees commuting by mode i from place of origin j. The modal split for Squamish commuters was approximately 33% private automobile, 65% car pool and 2% bus. For Pemberton commuters, the transportation mode distribution was about 50% private automobile, 33% car pool and 17% bus. Municipal planning staff supplied these modal splits, which were based on the results of their employee surveys.

The second step involved calculating the "vehicle kilometres travelled" (VKT) for each mode of transportation. This was estimated by dividing PKT by the average occupancy rate of the mode. The occupancy rates were assumed to be 1.0 for private (single-occupancy) automobile, 2.5 for car pool and 45 for bus. These occupancy rates were taken from the 2002 Whistler Traffic Monitoring Program (RMOW, 2003c). Energy consumption for each mode was then determined by multiplying VKT by the fuel efficiency of the mode. The fuel efficiency for automobiles (0.1235 litres per VKT) was assumed to equal the national average given in Natural Resources Canada's *National Energy Use*

Database. The fuel efficiency for buses (0.328 litres per VKT) was provided directly by Greyhound Canada, a primary supplier of bus transportation services in British Columbia. Since fuel efficiency is typically reported in litres per VKT, a conversion factor is necessary to convert litres of fuel to GJ of energy. The conversion factors for gasoline (0.03466 GJ per litre) and diesel fuel (0.03868 GJ per litre) were attained from the Voluntary Challenge and Registry (2003). In the final step, GHG emissions were calculated by multiplying energy consumption by established emission factors (see Table 3.1). CAC emissions were not calculated for employee commuting.

Visitor destination travel

Estimates of energy consumption and greenhouse gases resulting from visitor travel to and from the resort were derived in a similar manner to that for employee commuting. The first step was to estimate PKT for three modes of travel (automobile, bus and airplane). This was determined using the following calculation:

$$PKT_i = \sum_{j=1}^{n} \left(Visitors_j \times Return\ Distance_j \times Modal\ Split_{ij} \right) \quad (2)$$

where $Visitors_j$ is the number of visitors from place of origin j; $Return\ Distance_j$ is the two-way distance to the resort from place of origin j; and $Modal\ Split_{ij}$ is the proportion of visitors travelling by mode i from place of origin j. It was assumed that all visitors arrive in Whistler by ground transportation, either directly from their place of origin or via the Vancouver International Airport. The modal split for visitors arriving in Whistler was assumed to be 73% automobile and 27% bus (RMOW, 2003c). It was also assumed that visitors from British Columbia and Washington only use ground transportation to travel to Whistler; half of the visitors from Oregon use ground transportation, while half fly to Vancouver and then use ground transportation; and all other visitors fly to Vancouver and then use ground transportation to travel to Whistler. The travel distances were calculated from only one major centre in each region (e.g. Calgary in Alberta; Toronto in Ontario, Seattle in Washington, London in the United Kingdom, etc.) The analysis did not account for distances travelled to get to and from airports in the places of origin.

The second step involved calculating VKT for each mode. This was estimated by dividing PKT by the average occupancy rate of the mode. The automobile and bus occupancy rates for visitor travel were taken from the 2002 Whistler Traffic Monitoring Program (RMOW, 2003c). An average occupancy rate for airplanes was used assuming a Boeing 747-200 with 350 seats at 80% occupancy. The VKT was then multiplied by the fuel efficiency factors for each mode to estimate overall energy consumption levels. The fuel efficiency for airplanes (19.8 litres per VKT) was based on research by Murty (2000). Finally, GHGs were calculated by multiplying energy consumption by established emission factors (Table 3.1). The emission factor for aviation gasoline (0.0728 tCO_2e per GJ) was obtained from Environment Canada (2002). CAC emissions were not calculated for external visitor travel.

3.1.2 Identification of planning strategies

Once procedures for developing inventories of energy and material flows were established, opportunities existed to forecast the effects of various resort destination planning strategies from a dematerialization perspective. The study's literature review identified a range of fundamental strategies for reducing levels of energy and material throughput. The strategies involved actions associated with land use and building design; transportation infrastructure and service options; water and power supply; and sewage and solid waste disposal (Bode et al., 2003; Dorward, 1990; Dowling, 1993; Gunn, 1988, 1994; Inskeep, 1987, 1991; Inskeep & Kallenberger, 1992; Quilici, 1998; Welford et al., 1999). They were used to select resort destination planning strategies that might be modelled for their effects on resource consumption and associated waste emissions.

In the case of Whistler, numerous options for reducing energy and material flows have been identified in various reports and planning documents (Centra Gas, 2003; RMOW, 1999a, 1999b, 2003a, 2004; SLRD, 1999, 2002). In this research, nine strategies were selected as options that might have the most influential effects on the resort's energy use, energy-related air emissions, water use, wastewater generation and solid waste generation and disposal.[25] A brief description of each strategy follows.

Strategy 1: Implement comprehensive transportation strategy

The community's Comprehensive Transportation Strategy is based on a package of initiatives recommended by Whistler's Transportation Advisory Group (RMOW, 1999a). Their recommendations include implementing land-use plans and policies that promote compact forms of development to minimize travel distances and encourage walking and cycling; initiating improvements to the community's public transit system to make transit a more attractive transportation option; introducing Transportation Demand Management (TDM) programs to provide individuals with viable transportation alternatives accompanied by incentives to use these alternatives; developing networks for bicycles and pedestrians; managing parking supply more effectively to encourage the use of travel modes other than private automobiles; and improving Whistler's road system and traffic operations to reduce congestion on local roads and improve neighbourhood accessibility. As a result of implementing these initiatives, total VKT travelled in Whistler is projected to be

[25] This list of planning options is not meant to be exhaustive, but rather serves to illustrate the range of ways that planning decisions can promote dematerialization at Whistler.

about 20% lower in 2011 than would have occurred in the absence of such actions (Tsi Consultants, 2001).

Strategy 2: Increase fuel efficiencies for municipal vehicle fleet

The municipality maintains a large fleet of gasoline and diesel vehicles for its operations. It has been proposed to gradually convert this fleet to more efficient vehicles. This involves: transitioning fleet passenger vehicles (and larger vehicles where appropriate) to hybrid models; using smaller engines in the vehicles; employing fuel additives to improve fuel economy and reduce emissions; and applying exhaust scrubbers for large engines and trucks (RMOW, 2003a). These strategies are expected to increase the overall efficiency of the gasoline fleet by 50%, and of the diesel fleet by 15% by 2020 (RMOW, 2003a).

Strategy 3: Increase energy efficiencies for new and redeveloped buildings

Significant opportunities exist to improve the energy efficiency of new and existing residential and commercial buildings in Whistler (RMOW, 2003a). Such improvements can be achieved by implementing energy conservation programs for building contractors (e.g. LEED, CBIP), as well as for home and property owners (e.g. EnerGuide). These include implementing high-efficiency insulation materials, lighting, furnaces, hot water heating, appliances and other equipment. These programs are expected to improve the energy efficiency of new and redeveloped buildings by at least 25% (RMOW, 2003a).

Strategy 4: Use natural gas as primary energy supply

The capacity of the current piped propane system that fuels Whistler's services will soon be exceeded (Centra Gas, 2003). The construction of a natural gas system is being considered as an alternative to the current approach (Centra Gas, 2003). Although energy demand would not be affected, a natural gas system is expected to reduce GHGs and other air contaminants because the emission intensities for natural gas are lower than propane.

Strategy 5: Develop small-scale and localized renewable energy sources

A number of local micro-hydro and geo-thermal energy generation projects have been proposed for Whistler (RMOW, 2003a). While these projects would not impact energy demand, they are expected to reduce GHGs by displacing electricity from the province's BC Hydro grid with local renewable energy.[26]

Strategy 6: Increase water efficiencies for new and redeveloped buildings

Significant opportunities exist to improve the water efficiency of new and existing residential and commercial buildings in Whistler. Such improvements can be achieved by implementing water conservation programs for building contractors, as well as for homeowners and property owners. These include implementing: more efficient appliances, including dishwashers and washing machines; low flow toilets, showerheads and fixtures; more efficient irrigation systems in commercial developments; and low water-use landscaping (xeriscaping). As a result of implementing these programs, the water efficiency of new and redeveloped buildings is expected to be at least 25% better than would have occurred in the absence of such actions (GVRD, 2002).

Strategy 7: Install greywater recycling systems

Significant reductions in potable water consumption can be achieved by installing on-site greywater recycling systems in new and retrofitted buildings, as well as using two-pipe systems that allow for sharing of greywater at the block or neighbourhood level (Soroczan, 2002). These systems re-use greywater

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[26] Assuming that marginal grid electricity is generated using a combined cycle gas turbine.

(e.g. water from baths, showers, bathroom sinks and washing machines) for purposes that do not require water to be potable (e.g. toilets and irrigation). With suitable plumbing construction to prevent cross-contamination or cross-connections, these on-site and neighbourhood technologies have the potential to provide about 95% of toilet water and outside water use (GVRD, 2002).

Strategy 8: Implement rainwater capture systems

Rainwater capture systems provide another means of using non-potable water for uses that do not require potable standards. These on-site systems collect and distribute rainwater for internal uses, such as laundry and dishwashing. As with greywater recycling, rainwater capture systems require new plumbing construction in buildings to separate potable from non-potable water supply. As a result of installing these systems in new and redeveloped buildings, it is estimated that about 25% less potable water would be required for laundry and dishwashing purposes (GVRD, 2002).

Strategy 9: Implement solid waste management programs

A variety of solid waste management programs (reuse and reduction, recycling and composting) have been proposed for Whistler and the surrounding region to reduce levels of solid waste generation and disposal (SLRD, 1999, 2002).[27] These programs include implementing waste exchanges and reuse centres; enhanced collection systems and drop-off facilities for recyclable materials; a centralized regional composting facility and, where possible, backyard composting; a recovery program for compostables from restaurants, grocery stores and landscaping contractors; landfill bans on recyclable materials and organic products; and various educational and promotional campaigns for

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[27] Solid waste management programs are cooperatively managed and delivered by the Squamish-Lillooet Regional District (SLRD) and the Resort Municipality of Whistler (RMOW).

residents, visitors and businesses. As a result of implementing these programs, it is expected that 50% of all solid wastes generated will be diverted from landfills (SLRD, 1999). Diverting solid waste away from landfills will also reduce direct emissions of greenhouse gases from these sites.

Elements of each of these strategies were used to inform the development and application of a model for forecasting resource use and emissions associated with Whistler.

3.1.3 Review of modelling approaches

A resource flow model was developed to assess the relative effects of the preceding strategic planning strategies on resource consumption and associated waste emissions. Several different modelling approaches were considered for implementation. They included: physical flow models, technology-explicit models, economy-focused models and hybrid models. A brief review of these approaches follows.

Physical flow models

Flows of materials through an economy are often studied using modelling tools such as Material Flow Analysis (MFA), Substance Flow Analysis (SFA) and Life Cycle Assessment (LCA). Whereas MFA and SFA are used to analyze the flow of one or more materials in a geographic area during a certain period of time, LCA is employed to study material flows in the cradle-to-grave life cycle of a product (Bouman et al., 2000). Although physical flow models were originally developed to model the flows of materials only, the general methods have been emulated for energy flows. Energy Input-Output Analysis is an example of such an approach (Casler & Wilbur, 1984). Only a few applications of physical flow models have been developed in a tourism context (e.g. Tabatchnaia-Tamirisa et al., 1997).

Physical flow models are useful as descriptive tools for portraying material and energy flows through a region, but largely unsuitable for analyzing the long-term impacts of policy choices on resource flows. While these models may be useful in assessing the impact of specific technological improvements on energy and material flows, extending the findings into the distant future may be misleading as physical flow models are based on restrictive, unrealistic assumptions regarding the structural form of economic relationships.

Technology-explicit models

Technology-explicit models are "bottom-up" in their approach, as they explicitly account for the characteristics of individual technologies currently and potentially available to firms and households. This information is used to project future demand for individual goods and services by incorporating assumptions about technology evolution, structural change and technology acquisition. Originally, bottom-up models used exogenous assumptions about technology turnover. The drawback of these first-generation models is they lack realism in terms of firm and household choice of technology. Second-generation bottom-up models responded to this weakness by endogenously simulating technology evolution by modeling technology acquisition of firms and households.

Bottom-up models were originally developed in the late 1970s in the form of energy end-use models designed for load forecasting (Robinson, 1982). These models are based on the concept that the fundamental purpose of energy use is to satisfy demand for end-use services, such as transportation or lighting (Gardner & Robinson, 1993). Total energy demand is derived by multiplying the demand for end-use services by the amount of energy required to provide one unit of these services. Initially developed for energy analysis, bottom-up models are also adaptable for material use estimations (Michaelis & Jackson, 2000; Ruth, 1998). In tourism and recreation, only a few applications of bottom-up models have been developed to analyze energy consumption (Becken et al., 2001; Deng

& Burnett, 2000), but no existing research has used the approach to forecast water and material flows.

Bottom-up models are effective tools for assessing policy decisions regarding efficiency improvements and fuel switching through the introduction of new technology (Gardner & Robinson, 1993). While these models are ideal for evaluating the effects of policies directed at individual technologies, they lack the necessary structure to simulate the ways that firms and households make technology decisions in reality (Wilson & Swisher, 1993). For this reason, bottom-up models tend not to be behaviourly realistic as the models do not incorporate intangible costs and benefits that affect firm and household choice of technologies. Furthermore, bottom-up models do not include economic feedback mechanisms of supply and demand, thus lack the ability to realistically simulate structural change or price change (Wilson & Swisher, 1993).

Economy-focused models

Economy-focused models are "top-down" in their approach as they focus on aggregate relationships of economic production and consumption. Generally, top-down models use a partial or general equilibrium framework to endogenously simulate the supply-demand dynamics of firms and households. By incorporating economic feedback mechanisms, such models attempt to predict the relationships between changes in price and changes in demand for goods and services. The advantage of this approach is it accounts for actual firm and household behaviour based on both tangible and intangible costs and benefits, therefore providing an accurate portrayal of preferences for goods and services.

Although original top-down modelling efforts did not explicitly account for energy or material flows, research in the late 1960s and early 1970s began to address this relationship. Pioneering work by Ayres and Kneese aimed to integrate material flows in a general equilibrium model (Ayres & Kneese, 1969;

Kneese et al., 1970). A significant advancement made by this research was the explicit representation of the material balance principle. This innovation assured conservation of mass in the model – a guarantee that conventional equilibrium models could not give. Research has since continued to develop the theoretical underpinnings linking equilibrium models, material flows, and the material balance principle (Ayres, 1978; van den Bergh & Nijkamp, 1994).

Equilibrium models that integrate materials and energy are well suited for evaluating the impacts of economic policies on energy and material flows. However, extending such analysis into the distant future may be misleading since the underlying structural form of behavioural decision-making patterns may change (Wilson & Swisher, 1993). Another notable drawback of top-down models is their unsuitability for analyzing the effects of technological improvements on energy and material flows (Wilson & Swisher, 1993). Some inroads have been made on this front by integrating an "autonomous efficiency index" into top-down models. This index is a proxy for changes in resource efficiencies that are independent of price change – mainly due to general technological change. However, the index does not account for individual technology at the level needed to analyze policies aimed at specific technological improvements.

Hybrid models

A number of modellers have begun to acknowledge the weaknesses of their respective approaches and investigate ways of incorporating the best features of other approaches. For instance, bottom-up elements have been integrated into a top-down Computable General Equilibrium model for energy policy modeling (Bohringer, 1998). Conversely, top-down economic feedback mechanisms have been integrated into a second-generation technology-explicit model, also used for energy modeling (Jaccard et al., 1996). Another hybrid model has integrated Material Flow Analysis (MFA) into an Applied General

Equilibrium (AGE) model for materials policy modeling (Dellink & Kandelaars, 2000). Although designed to integrate the strengths of more than one modelling approach, hybrid models nevertheless maintain some of the weaknesses of each method.

3.1.4 Development and application of resource flow model

The resource flow model developed in this research used a technology-explicit "bottom-up" approach. The method was selected because of its suitability for predicting the impacts of specific technological improvements on material and energy flows.[28] [29] The model explicitly accounted for energy consumption, water use and solid waste generation associated with different categories of buildings, infrastructure and transportation modes currently and potentially available to residents, visitors and businesses in the destination. It also included energy consumption for employee commuting and visitor travel to and from the resort. Specific components and operational characteristics of the model are outlined in the following sections. A more extensive description of the model components is provided in Appendix 1. The limitations of the model and recommendations for its improvement are discussed in Chapter 5.

Internal destination resource flows

Energy consumption and energy-related air emissions

The model estimates energy consumption and emissions of greenhouse gases and common air contaminants for buildings, infrastructure, intra-

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[28] Most of the planning strategies identified in Section 3.1.2 focused on specific technological improvements, such as increasing energy and resource efficiencies.

[29] While a hybrid top-down/bottom-up model could have been used to overcome many of the weaknesses of the bottom-up approach, developing such a model was considered too ambitious for the purpose of this dissertation.

community transportation and corporate and institutional vehicle fleets. The methods employed to calculate these estimates follow.

Buildings

Several categories of buildings can be incorporated into the model. In the case of Whistler, these included: restricted employee housing, single family, duplex, multi-family dwellings, hotel, other paid accommodation, retail, office, service, food/restaurant, bar, convention/conference, tourist/recreation, wholesale/storage, light/heavy manufacturing and institutional. New development of each building type was assumed to increase by a fixed annual rate until available capacity was reached. In Whistler, most types of development are expected to reach capacity in 2005. In addition, it was assumed that a fixed percentage (3%) of existing buildings would be redeveloped each year. This rate was determined through consultation with municipal planning staff.

Forecasts of energy consumption for each building type were calculated as follows:

$$\begin{aligned} \textit{Energy Consumption}_{kt} &= \textit{Existing Floor Area}_{kt} \times \textit{Existing EUI}_{kt} \\ &+ \textit{New Floor Area}_{kt} \times \textit{New EUI}_{kt} \end{aligned} \qquad (3)$$

where $\textit{Energy Consumption}_{kt}$ is the energy consumption for buildings of type k in year t; $\textit{Existing Floor Area}_{kt}$ is the floor area of existing buildings of type k in year t; $\textit{Existing EUI}_{kt}$ is the energy use intensity (energy consumption per unit of floor area) for existing buildings of type k in year t; $\textit{New Floor Area}_{kt}$ is the floor area of new buildings of type k in year t; and $\textit{New EUI}_{kt}$ is the energy use intensity for new buildings of type k in year t.

Since local energy audit information was not available, the Energy Use Intensities (EUIs) were referenced from the Buildings Table of Canada's National Climate Change Process (1999) and the Greater Vancouver and Fraser Valley Air Quality Management Plan (GVRD, 2000). Some level of uncertainty is associated with these EUIs because of regional differences in climatic conditions, average building age, occupant characteristics and other factors. To correct for these differences, the forecasts of energy consumption were calibrated to ensure that the base year estimates for 2000 were consistent with the actual amount of energy consumed in that year.

The mix of fuel types in each year was determined by multiplying total energy consumption by estimated fuel shares. Energy consumption from the use of wood for space heating was estimated separately using existing data sources (RMOW, 2003a). Greenhouse gases and common air contaminants were forecast by multiplying energy consumption by established emission factors (see Table 3.1).

Municipal buildings and infrastructure

Energy consumption for municipal buildings and infrastructure was forecast using data provided directly by the Resort Municipality of Whistler.

Intra-community transportation

Forecasts of PKT for personal and public transportation internal to Whistler were calculated for each mode as follows:

$$PKT_{it} = Equivalent\ Population_t \times Per\ Capita\ PKT_t \times Modal\ Split_{it} \qquad (4)$$

where $Equivalent\ Population_t$ is the tourism destination's equivalent population in year t; $Per\ Capita\ PKT_t$ is the per capita PKT by all modes (personal vehicles and public transportation) in year t; and $Modal\ Split_{it}$ is the proportion of total PKT by mode i in year t.[30] Forecasts of per capita PKT were calculated by multiplying the per capita PKT in the base year by a fixed annual growth rate.

Forecasts of vehicle kilometres travelled (VKT) for each mode were calculated by dividing PKT by the average occupancy rate of the mode. Energy consumption for intra-community transportation was then estimated by

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[30] Equivalent population is the total number of people at the tourism destination per day. This includes residents and commuting employees, as well as overnight and day visitors.

multiplying VKT by the fuel efficiency of the mode. The fuel efficiency for automobiles (0.1868 litres per VKT) was based on results of the EMME/2 Travel Demand Forecasting Model (Tsi Consultants, 2001). The fuel efficiency for buses (0.513 litres per VKT) was provided directly by BC Transit. Greenhouse gases and common air contaminants were then calculated by multiplying energy consumption by established emission factors (see Table 3.1).

Corporate vehicle fleet

Forecasts of VKT for the Whistler Blackcomb commercial fleet were calculated by multiplying the base year VKT by a fixed annual growth rate of 1.5%. This rate was determined through consultation with Whistler Blackcomb staff.

Municipal vehicle fleet

It was assumed that VKT for the municipal vehicle fleet would continue to increase at current rates until most resort development is complete in 2005, after which time VKT would not change.

Point source emissions of common air contaminants

Point source CAC emissions were estimated using data from the Sea-to-Sky emission inventory (MWLAP, 2002).

Water consumption and wastewater generation

The model estimates water consumption for all buildings and parks internal to Whistler. The model also forecasts wastewater generation internal to Whistler.

Buildings

Forecasts of water consumption for each building type were calculated as follows:

$$\begin{aligned} Water\ Consumption_{kt} = {} & Existing\ Floor\ Area_{kt} \times Existing\ WUI_{kt} \\ & + New\ Floor\ Area_{kt} \times New\ WUI_{kt} \end{aligned} \qquad (5)$$

where *Water Consumption*$_{kt}$ is the water consumption for buildings of type k in year t; *Existing Floor Area*$_{kt}$ is the floor area of existing buildings of type k in year t; *Existing WUI*$_{kt}$ is the water use intensity (water consumption per unit of floor area) for existing buildings of type k in year t; *New Floor Area*$_{kt}$ is the floor area of new buildings of type k in year t; and *New WUI*$_{kt}$ is the water use intensity for new buildings of type k in year t.

The Water Use Intensities (WUIs) were taken from an existing municipal study that used water meter data to calculate WUIs for different building types in Whistler (RMOW, 2003b). The forecasts of water consumption were calibrated to ensure that the base year estimates for 2000 were consistent with the actual amount of water consumed in that year.

Parks

The Resort Municipality of Whistler provided base-year data on the amount of water used to maintain parks. Forecasts of water consumption for parks were assumed to remain constant over time.

Wastewater generation

Wastewater generation was estimated from total water consumption by adjusting for irrigation and infiltration.[31] The net effect of irrigation and infiltration was estimated by multiplying total water consumption by a fixed proportion (7.3%). This rate was determined through consultation with municipal planning staff and by analyzing government documents and planning reports (RMOW, 2003b). The forecasts of total wastewater generation were calibrated to ensure that the base-year estimates for 2000 were consistent with the actual amount of wastewater generated in that year.

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[31] Infiltration results from incorrectly installed manholes, poor pipe connectors and so forth.

Solid waste generation and disposal

While secondary data on resource use intensities (RUIs) exist for energy and water consumption, such information does not exist for materials and solid waste flows. Consequently, the model estimates total solid waste generation on a per person basis, instead of a per building basis. It estimates total solid waste generation by multiplying the equivalent population of the tourism destination by per capita solid waste generation:

$$Solid\,Waste\,Generation_t = Equivalent\ Population_t \times Per\,Capita\,Generation_t \quad (6)$$

where *Solid Waste Generation*$_t$ is the amount of solid waste generated in year t; *Equivalent Population*$_t$ is the tourism destination's equivalent population in year t; and *Per Capita Generation*$_t$ is the per capita solid waste generation in year t. Forecasts of per capita waste generation were assumed to remain constant over time. The forecasts of total solid waste generation were calibrated to ensure that the base-year estimates for 2000 were consistent with the actual amount of solid waste generated in that year.

The model estimates total solid waste disposal in landfills by multiplying the amount of solid waste generation by the solid waste diversion rate. This rate is the proportion of solid waste diverted from landfills due to reduction and reuse, recycling and composting. The rate was determined through consultation with municipal planning staff and by analyzing various government documents and planning reports (RMOW, 2004; RMOW & SLRD, 2004). Direct GHGs from the Whistler landfill were forecasted by multiplying the amount of solid waste disposal by an emission factor of 0.382 tCO_2e per tonne of waste (Environment Canada, 2002).

Employee destination commuting

Forecasts of PKT for three main modes of commuting (automobile, car pool and bus) were derived using equation 1. In developing forecasts of PKT, it was assumed that the size of Whistler's workforce would continue to increase until most development is complete in 2005, after which time the workforce would stabilize. VKT for each mode of travel was forecast by dividing PKT by the average occupancy rate of the mode. Energy consumption was then calculated by multiplying VKT by the fuel efficiency of the mode. GHGs were calculated by multiplying energy consumption by established emission factors (see Table 3.1).

Visitor destination travel

Forecasts of PKT for three modes of visitor travel (automobile, bus and airplane) were derived using equation 2. In generating the forecasts of PKT, it was assumed that the number of visitors would increase at current rates until remaining tourist development is complete in 2005, after which the growth rates would significantly decline. Further, it was assumed that the post-development growth rates would significantly differ for each visitor type (e.g. the growth rate for visitors staying in paid accommodation would be much lower than for day visitors). VKT for each mode was estimated by dividing PKT by the average occupancy rate of the mode. Energy consumption was then calculated by multiplying VKT by the fuel efficiency of the mode. GHGs were calculated by multiplying energy consumption by established emission factors (see Table 3.1).

3.2 Assessment of Tourist Perspectives

This section describes a discrete choice experiment (DCE) used to evaluate tourist preferences for and acceptance of dematerialization planning strategies in tourism destinations. The approach is useful for examining visitor perspectives concerning land use, transportation, recreation and other environmental initiatives intended to promote dematerialization at destination resorts. An on-line survey instrument was used to administer the DCE. Readers are directed to Section 3.5 for a detailed description of the questionnaire design and data collection procedures.

3.2.1 Background

DCEs collect and analyze individual preference data to measure variations in choice behaviour under varying scenarios or hypothetical situations (Louviere et al., 2000). In a typical choice experiment, survey respondents are presented with a series of hypothetical choice situations called *choice sets*. In each choice set, respondents are asked to choose between mutually exclusive alternatives called *profiles*. The profiles are described in terms of measurable attributes, which are defined by the researcher a priori as being important variables in explaining choice behaviour. The researcher also defines a priori the number and value of the levels for each attribute. This approach allows subjects to simultaneously evaluate multiple dimensions of different alternatives and make tradeoffs in a comprehensive fashion. The method is more holistic than typical opinion questions, which ask subjects to evaluate alternative components one at a time (Louviere et al., 2000). [32]

DCEs are used widely in resource management problems and environmental valuation settings (Boxall et al., 1996; Haider & Rasid, 2002; Opaluch et al., 1993), as well as in tourism and recreation contexts (Aas et al., 2000; Apostolakis & Jaffry, 2005; Crouch & Louviere, 2000; Dellaert et al., 1995, 1997; Haider & Ewing, 1990; Louviere & Timmermans, 1990; Morley, 1994; Pettersson, 2002). In tourism, most studies involving choice experiments have typically analyzed perceptions or image of recreational alternatives, preferences for tourism management options or destination choice behaviour (Crouch &

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[32] Several advantages exist for using discrete choice experiments as a means of examining choice behaviour. First, the attribute levels can be selected to provide sufficient variation to matter to individual respondents and to allow for the simulation of current and potential conditions. This enables the construction of meaningful choice models. Second, choice experiments can be designed to reduce or eliminate correlation between attributes (multicollinearity). Third, the effects of attributes included in the choice experiment can be isolated from the effects of other factors that are not of interest to the researcher (Kroes & Sheldon, 1988). Finally, hypothetical or completely new choice situations can be investigated with discrete choice experiments (Haider & Ewing, 1990; Pettersson, 2002).

Louviere, 2000; Louviere & Timmermans, 1990). Only a few studies have used DCEs to analyze preference tradeoffs or to evaluate the overall acceptability of different destination planning options (e.g. Hearne & Salinas, 2002; Lindberg et al., 1999, 2001). Findings emanating from those studies have illustrated the utility of DCEs in systematically examining stakeholder perspectives concerning the acceptability for and preferences of planning alternatives. This dissertation provides a unique application of the method to evaluate tourist preferences for and acceptance of dematerialization planning alternatives at tourism destinations.

3.2.2 Theoretical considerations

Data generated from DCEs are generally analyzed using random utility theory as a conceptual framework (Ben-Akiva & Lerman, 1985; McFadden, 1974). The theory prescribes that an individual's utility for various alternatives in a choice situation can be modelled in terms of an underlying utility function defined as (McFadden, 1974):

$$U_i = V_i + \varepsilon_i \tag{7}$$

where U_i is the unobservable, true utility of alternative i, V_i is the deterministic (i.e. known) component and ε_i is the stochastic component.

The deterministic component, V_i, is the portion of true utility that can be explained by observable attributes of the alternative. Without loss of generality, V_i can be expressed as a "linear-in-the-parameters" function of the attributes as follows (McFadden, 1974):

$$V_i = \beta X_i \tag{8}$$

where β is a vector of utility coefficients associated with a vector X of attributes and interaction terms. The researcher's ability to fully capture V_i depends on how well they identify, measure and include attributes that influence utility. The random element, ε_i, is included in the utility function because it is impossible to account for and accurately measure all factors that affect utility.

Utility maximization suggests that an individual will choose the alternative with the highest utility (McFadden, 1974). This means that alternative i will be chosen over all other alternatives if its utility, U_i, is greater than the utility of the other alternatives. Due to the random component in the utility function, it is impossible for the researcher to determine with certainty which alternative will have the largest utility. The researcher must therefore rely on probabilistic statements to describe choice behaviour. Specifically, the probability that an individual will choose alternative i over all other options in set C is given by (McFadden, 1974):

$$P(i) = P(U_i > U_j) = P(V_i + \varepsilon_i > V_j + \varepsilon_j), \quad \forall j \in C \qquad (9)$$

Substituting equation 8 into equation 9 gives:

$$P(i) = P(\beta X_i + \varepsilon_i > \beta X_j + \varepsilon_j), \quad \forall j \in C \qquad (10)$$

which indicates that the probability that an individual will choose alternative i equals the probability that the combined deterministic and stochastic components of utility are greater for alternative i than all other alternatives in set C.

3.2.3 Choice model specification

Many different probabilistic choice models can be derived from equation 10, depending on assumptions about the distribution of the random component, ε_i. This study used the traditional Multinomial Logit (MNL) model, which has the following probability expression (Ben-Akiva & Lerman, 1985): [33]

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[33] Other common specifications include the Nested MNL and Multinomial Probit choice models (Ben-Akiva and Lerman, 1985; Train, 1986, 2003).

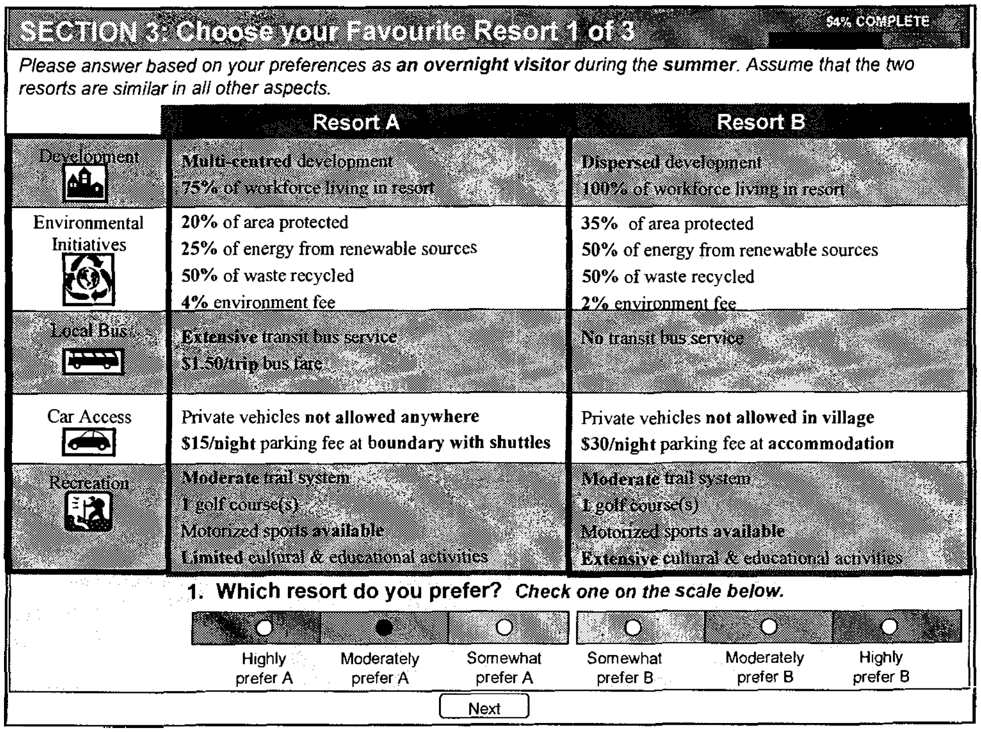
$$P(i) = \frac{e^{\mu V_i}}{\sum_{j \in C} e^{\mu V_j}} \tag{11}$$

The MNL model assumes that the ε_i are: (1) independently distributed; (2) identically distributed; and (3) Gumbel-distributed with a location parameter η and a scale parameter μ (Ben-Akiva & Lerman, 1985). The scale parameter μ is not identifiable and a typical assumption is that it equals one (Ben-Akiva & Lerman, 1985).

3.2.4 Choice sets

Survey respondents were shown three choice sets, each containing a pair of hypothetical mountain resorts. In each choice set, respondents were first asked to indicate their preferred resort on a six-point rating scale (Figure 3.2). Subsequently, they rated the acceptability of each resort one at a time (Figure 3.3). Respondents were told to evaluate these questions based on a mountain resort that has a maximum capacity of 50,000 people (including visitors, residents and second home owners). This was about the same size as Whistler – the destination they had visited prior to the DCE survey.

Figure 3.2: Format of choice task for an overnight visitor



SECTION 3: Choose your Favourite Resort 1 of 3 — 64% COMPLETE

*Please answer based on your preferences as **an overnight visitor** during the **summer**. Assume that the two resorts are similar in all other aspects.*

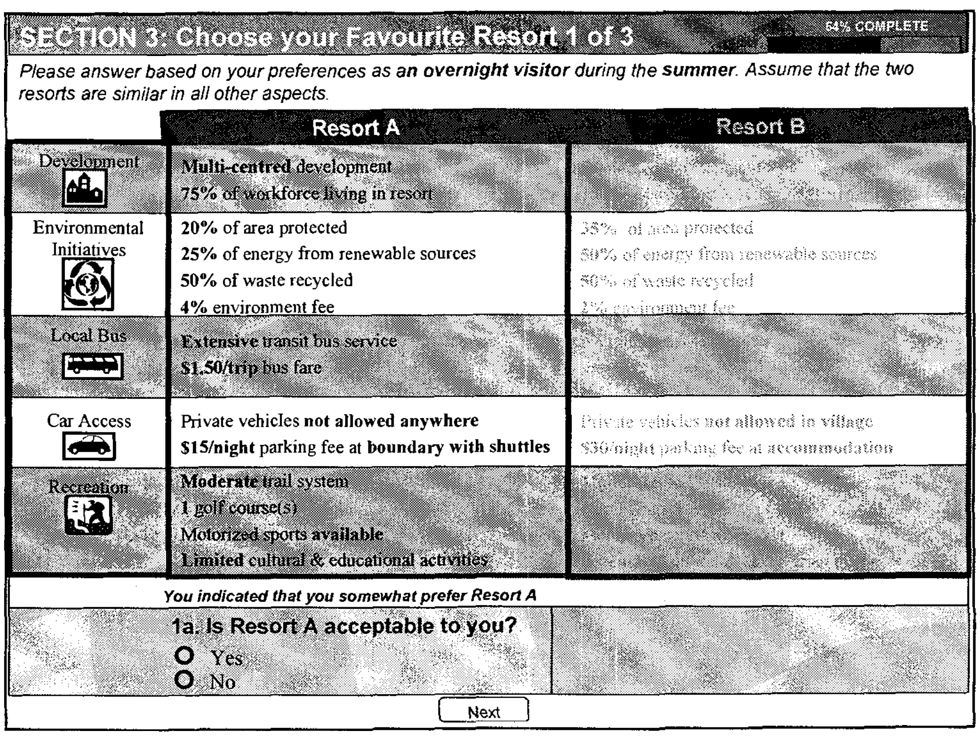
	Resort A	Resort B
Development	**Multi-centred** development 75% of workforce living in resort	**Dispersed** development 100% of workforce living in resort
Environmental Initiatives	20% of area protected 25% of energy from renewable sources 50% of waste recycled 4% environment fee	35% of area protected 50% of energy from renewable sources 50% of waste recycled 2% environment fee
Local Bus	**Extensive** transit bus service $1.50/trip bus fare	No transit bus service
Car Access	Private vehicles **not allowed anywhere** **$15/night** parking fee at **boundary with shuttles**	Private vehicles **not allowed in village** **$30/night** parking fee at **accommodation**
Recreation	**Moderate** trail system 1 golf course(s) Motorized sports **available** **Limited** cultural & educational activities	**Moderate** trail system 1 golf course(s) Motorized sports **available** **Extensive** cultural & educational activities

1. Which resort do you prefer? ***Check one on the scale below.***

Highly prefer A	Moderately prefer A	Somewhat prefer A	Somewhat prefer B	Moderately prefer B	Highly prefer B
O	●	O	O	O	O

Next

Figure 3.3: Format of resort acceptability question for an overnight visitor



SECTION 3: Choose your Favourite Resort 1 of 3 — 64% COMPLETE

*Please answer based on your preferences as **an overnight visitor** during the **summer**. Assume that the two resorts are similar in all other aspects.*

	Resort A	Resort B
Development	**Multi-centred** development 75% of workforce living in resort	
Environmental Initiatives	20% of area protected 25% of energy from renewable sources 50% of waste recycled 4% environment fee	35% of area protected 50% of energy from renewable sources 50% of waste recycled 2% environment fee
Local Bus	**Extensive** transit bus service $1.50/trip bus fare	
Car Access	Private vehicles **not allowed anywhere** **$15/night** parking fee at **boundary with shuttles**	Private vehicles **not allowed in village** $30/night parking fee at **accommodation**
Recreation	**Moderate** trail system 1 golf course(s) Motorized sports **available** **Limited** cultural & educational activities	

You indicated that you somewhat prefer Resort A

1a. Is Resort A acceptable to you?

O Yes
O No

Next

3.2.5 Attributes selection

The hypothetical resorts were described in terms of several key attributes related to developed land, recreational opportunities, local transportation and environmental initiatives (Table 3.4). [34] These attributes were defined a priori as being (1) important drivers of dematerialization, (2) relevant for a tourist and (3) within the influence of planners or other stakeholders at the destination. The levels for each attribute provided sufficient variation to matter for tourists and to allow the simulation of current and potential conditions. The final set of attributes and levels was determined through a process involving stakeholder feedback and a review of academic literature. To make the scenarios realistic, an attribute was included to describe a potential environmental fee that would be charged to help cover the cost of implementing environmental initiatives at the resort. The inclusion of such a "payment vehicle" is common practice in discrete choice experiments (Louviere et al., 2000).

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[34] While many of these attributes have a spatial component, in this choice experiment they were simply presented as concepts in written form.

Table 3.4: Resort attributes and levels

Attributes	Levels
Development	
Form of development	1. Compact 2. Nodal 3. Dispersed
Percent of workforce living in host community	1. 25% 2. 75% 3. 100%
Recreational Opportunities	
Availability of cultural and educational activities	1. Limited 2. Extensive
Extent of trail system in natural areas	1. Moderate 2. Extensive
Availability of motorized sports	1. Not available 2. Available at base of hill
Availability of golf courses	1. One 2. Two 3. Three or more
Private Automobile	
Automobile accessibility	1. Private vehicles allowed everywhere 2. Private vehicles not allowed in village core area 3. Private vehicles not allowed anywhere within the resort boundaries (parking at resort entrance with connecting shuttles)
Parking fees	1. Free 2. $5/day for day visitors and $15/night for overnight visitors 3. $10/day for day visitors and $30/night for overnight visitors
Local Transit Bus Service	
Availability of bus	1. Not available 2. Limited accessibility 3. Extensive accessibility
Bus fare	1. Free 2. $1.50 3. $3.00
Environmental Initiatives	
Amount of protected area*	1. 5% 2. 20% 3. 35%
Percent of energy requirements met with renewable sources	1. 25% 2. 50% 3. 75%
Percent of waste recycled and composted	1. None 2. 25% 3. 50%
Environmental fee	1. None 2. 2% 3. 4%

* The amount of protected area was included as an attribute to provide information to Krista Englund as part of her Master's research project at the School of Resource and Environmental Management at Simon Fraser University (Englund, 2005). While not a major determinant of dematerialization, greenspace protection can help reduce greenhouse gas emissions by sequestering and storing carbon dioxide and by reducing heating and cooling requirements through micro-climate regulation (Rowntree & Nowak, 1991).

3.2.6 Experimental design

Experimental design techniques were used to generate the combination of attribute levels explored in each choice set (Louviere et al., 2000). A full factorial design involving all possible combinations of attributes and levels would have allowed all main and interaction effects to be estimated. However, such a design would have required $2^3 \times 3^{11}$ (more than 1.4 million) choice sets to ensure orthogonality. The impracticality of this design meant that the profiles in the choice sets were generated by using an orthogonal fractional factorial design that contained only a small subset of all possible combinations of attributes and levels. [35] A Resolution III main effects design plan required 54 unique choice sets (Montgomery 2001), which were split into 18 versions of three choice sets each. Each respondent evaluated one of these versions. Although each respondent only evaluated three choice sets, the large number of survey respondents meant that each choice set was evaluated at least 40 times. This design plan allowed efficient estimation of all main effects, but meant that most interaction effects between attributes could not be estimated.

3.2.7 Data analysis

This study used the traditional Multinomial Logit (MNL) model to analyze the data collected from the DCE. Using the LIMDEP 8.0 software package (Greene, 2002), maximum likelihood procedures were used to estimate two separate MNL choice models – a *preference* model and an *acceptability* model. The preference choice model used a three-level dependent variable (i.e. "prefer resort A", "prefer resort B" or "indifferent") that was based on grouping the original responses to the six-level rating task. The acceptability choice model

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[35] The major drawback of fractional factorial designs is that certain interaction effects between attributes cannot be estimated, which can confound the estimates of main effects (Montgomery, 2001). However, this problem is not significant in choice situations where high-order interaction effects are negligible (Timmermans, 1984).

used a binomial dependent variable (i.e. "acceptable" or "not acceptable") that was based on the responses from the resort acceptability question. In both models, all categorical attributes (e.g. form of development) were effects coded and numerical attributes were linear and quadratic coded (Louviere et al., 2000). In the final models the quadratic terms were dropped if they were not significant at the 90% confidence level.

3.2.8 Accounting for varying preferences among individuals

A limitation of the MNL modelling approach is that it does not account for systematic variation in preferences among individuals. Such preference heterogeneity means that choice probabilities will differ systematically amongst individuals even though the choice alternatives are identical. There are two common ways to account for preference heterogeneity in discrete choice modelling. One approach is to group individuals into various segments and estimate choice models separately on each segment. In this study, one especially important determinant of choice behaviour was whether the individual stayed overnight at the resort or was a day visitor. Separate choice models were estimated for each of these segments, since many of the estimated model parameters were significantly different for these two subgroups.

The other way to account for preference heterogeneity is by expanding the choice model to include attributes related to the individual (e.g. socio-demographics or psychographics). With this approach the systematic portion of utility V_i is given by:

$$V_i = \beta X_i + \gamma Z \tag{12}$$

where γ is a vector of coefficients associated with a vector Z of attributes and interaction terms relating to individual differences. This approach extends the traditional MNL model to a systematic heterogeneous specification of the MNL model that introduces the effect of individual characteristics into the choice probability. Applications of systematic heterogeneous choice models are not uncommon in tourism contexts (e.g. Apostolakis & Jaffry, 2005; Breffle & Morey, 2000; Huybers & Bennett, 2000; Lindberg et al., 1999). These applications document the additional insights to be gained from a heterogeneous model specification that accounts for varying preferences among individuals. In this study, several individual characteristics were considered for inclusion in the final choice models. These included socio-demographic variables (e.g. gender, age, income and education), situational variables (e.g. place of residence), prior trip characteristics (e.g. travel party size, purpose of trip and activities pursued during the visit) and tourist destination motivations. Only individual-specific attributes significant at the 90% confidence level were retained in the final model.

A limitation of these two approaches is that they are based on an a priori selection of observed individual characteristics. It is unlikely that these techniques will capture all aspects of preference heterogeneity among individuals because of the impracticality of identifying all individual characteristics that explain preference heterogeneity. Other more sophisticated choice models have been proposed to account for preference heterogeneity without requiring that heterogeneity be explainable by observed individual characteristics. The random parameters logit (RPL) model is one such approach (McConnell & Tseng, 1999; Train, 1998). The RPL model accounts for preference heterogeneity by treating model parameters as random variables. Another approach is the latent class model (Boxall & Adamowicz, 2002; Swait, 1994). This model uses attribute data as well as individual characteristics to simultaneously explain choice behaviour. While latent class modelling was explored as part of this research, it was not included as part of this dissertation because the models were non-convergent, due to the fact that each respondent evaluated three choice sets only.

3.2.9 Behavioural evaluation of planning scenarios

The estimated choice models were used to predict choice behaviour in response to changes in attribute levels. By adjusting the attribute levels in the choice models, it was possible to evaluate various dematerialization planning strategies in terms of their acceptance by tourists. These strategies included implementing compact and mixed development patterns; affordable employee housing programs to increase the number of employees residing within resort boundaries; low-impact cultural and educational activities; an extensive nature trail system to help offset the demand for resource-intensive activities; limits to the number of golf courses; regulations for motorized sports; private automobile restrictions and parking fees; local public transit services; increased renewable energy sources; waste recycling and composting initiatives; and environmental fees to help fund local environmental initiatives. In this context, the estimated effects of implementing these "dematerialization" strategies were compared with the impacts of employing more "resource intensive" strategies or, alternatively, continuing with a current "business-as-usual" (BAU) path (Table 3.5). This list of planning scenarios was not meant to be exhaustive. It rather served to illustrate the range of conditions possible at a resort destination like Whistler.

Table 3.5: Comparison of planning scenarios examined

Attributes	BAU Scenario	Dematerialization Scenario	Resource Intensive Scenario
Development			
Form of development	Nodal	Compact	Dispersed
Percent of workforce living in host community	75%	100%	25%
Recreational Opportunities			
Availability of cultural and educational activities	Limited	Extensive	Limited
Extent of trail system in natural areas	Extensive	Extensive	Moderate
Availability of motorized sports	Available at base of hill	Not available	Available at base of hill
Availability of golf courses	3 or more	1	3 or more
Private Automobile			
Automobile accessibility	Private vehicles not allowed in village core area	Private vehicles not allowed anywhere within the resort boundaries	Private vehicles allowed everywhere
Parking fees	Free for day visitors and $15/night for overnight visitors	$10/day for day visitors and $30/night for overnight visitors	Free
Local Transit Bus Service			
Availability of bus	Extensive accessibility	Extensive accessibility	Not available
Bus fare	$1.50	Free	-
Environmental Initiatives			
Amount of protected area	5%	35%	5%
Percent of energy requirements met with renewable sources	50%	75%	25%
Percent of waste recycled and composted	25%	50%	0%
Environmental fee	None	4%	0%

3.3 Assessment of Tourist Travel Options

This section describes an approach for examining tourist travel mode choices and forecasting the resulting environmental impact of those selections. It presents a two-phased method to explore the relationships between the travel mode choices of tourists and the impact of those decisions on energy consumption and GHG emissions. In the first phase, a discrete choice experiment (DCE) is used to estimate tourist travel mode choices under different transportation planning scenarios. In the second phase, the findings from the choice experiment are linked with the study's "bottom-up" resource flow model to derive more behaviourally realistic estimates of energy consumption and greenhouse gas emissions associated with each of the scenarios. In combination, the section illustrates a behaviourally driven approach for examining levels of energy consumption and greenhouse gas emissions associated with varying destination travel choices. A description of these methods and how they were applied in the Whistler case study follows. Readers are directed to Section 3.5 for a detailed description of the data collection procedures and survey instrument used to administer the DCE.

A DCE was implemented to estimate tourist mode choice behaviour under different transportation planning scenarios. Although DCEs are used widely in urban transportation contexts to investigate mode choice problems (e.g. Bunch et al., 1993; Ewing & Sarigollu, 1998; Horne et al., 2005; Washbrook, 2002), they have rarely been applied to tourist travel behaviour.[36] This phase of the research focused specifically on the use of a DCE to examine transportation mode choice for land-based visitor travel between Vancouver and Whistler. It focused on one specific component of the travel to Whistler - summer trips between Vancouver and Whistler, which is currently dominated by private and rental cars. Day users from as close as Vancouver as well as overnight visitors from far and wide, all must travel this corridor.

3.3.1 Choice model specification

DCEs provide a useful means of collecting individual preference data in order to measure variations in choice behaviour under varying scenarios (Louviere et al., 2000). Most transportation mode choice applications of discrete choice experiments have used the Multinomial Logit (MNL) model to analyze

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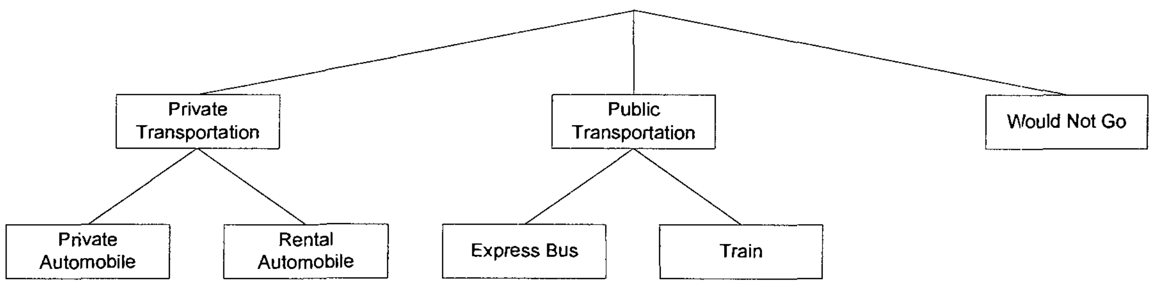
[36] One stated preference study was found that focused on long-distance travel to a tourism destination (Nerhagen, 2003). This study used a contingent valuation framework rather than a formal discrete choice experiment to examine transportation mode choice.

the data collected (e.g. Horne et al., 2005; Washbrook, 2002). While the MNL model is convenient to compute with maximum likelihood procedures, it assumes the choice between any two alternatives is independent of the attributes examined and the availability of any other options. This "Independence of Irrelevant Alternatives" (IIA) property may lead to misleading results, especially in cases where the probability of choosing one alternative over another is dependent on the characteristics of other alternatives. Consequently, the Nested Multinomial Logit (NMNL) model is suggested instead of the standard MNL model to circumvent the problems associated with the IIA property (Ben-Akiva & Lerman, 1985; Louviere et al., 2000). The NMNL model is based on a hierarchy of choices, where each level of the hierarchy corresponds to a choice among subsets of alternatives (McFadden, 1981).

In this research, a two-stage NMNL model was used to examine transportation mode choice for visitor travel between Vancouver and Whistler (Figure 3.4). In the first stage, the choice alternatives were private transportation and public transportation. A base case of "would not go" was included at this level. If private transportation was chosen in the first stage, a subsequent choice between private and rental automobile followed. If public transportation was selected, a choice occurred between express bus and train. Unlike previous transportation applications (e.g. Asensio, 2002; de Palma & Rochat, 2000; Thobani, 1984; Tiwari & Kawakami, 2001; Train, 1980), this study used the NMNL method to examine travel mode choice based on stated rather than revealed preference data.

Figure 3.4: Two-stage nested transportation mode choice



In the NMNL model structure, the probability of choosing an alternative is equal to the conditional probability of choosing that alternative, given the first-stage choice, multiplied by the marginal probability of the first-stage choice. For example, the probability of choosing the express bus option is equal to the conditional probability of choosing bus over train, given that public transportation has been chosen, multiplied by the marginal probability of using public transportation. In general terms, the probability calculation is expressed as:

$$P(j) = P(j \mid i) \times P(i) \tag{13}$$

where j refers to the alternatives available at the second stage and i to the alternatives at the first stage.

The choice probabilities at each stage take the form of logit models. In the first stage, the marginal probability is given by (Ben-Akiva & Lerman, 1985; Louviere et al., 2000):

$$P(i) = \frac{e^{\mu_1 (V_i + I_i)}}{\sum_{l=1}^{I} e^{\mu_1 (V_l + I_l)}} \tag{14}$$

where V_i is the deterministic component of utility that can be explained by attributes that differ between attributes at the first stage. However, the first-stage choice may be influenced by variables at the second stage. The role of the characteristics of second-stage alternatives in that choice is captured by the term I_i, called the "inclusive value" (McFadden, 1981). This term is a measure of the utility additional to V_i that the individual may expect to obtain if he chooses an alternative at the initial stage. In effect, the inclusive value takes information from the second-stage level and includes it into the first-stage choice decision. The inclusive value is given by (Ben-Akiva & Lerman, 1985; Louviere et al., 2000):

$$I_i = \mu_2 \ln \sum_j e^{\mu_2 V_j} \tag{15}$$

In the second stage, the conditional choice model is given by (Ben-Akiva & Lerman, 1985; Louviere et al., 2000):

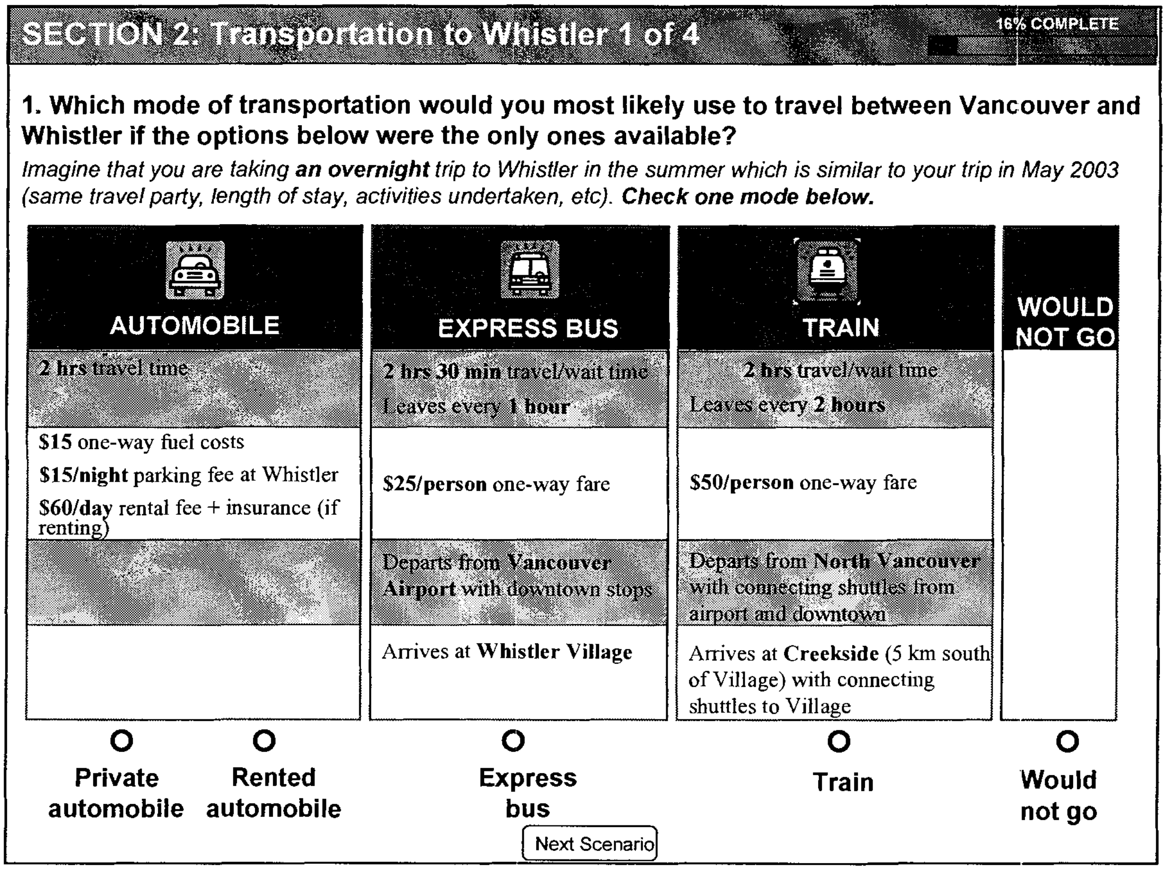
$$P(j \mid i) = \frac{e^{\mu_2 V_j}}{\sum_{k=1}^{J} e^{\mu_2 V_k}} \tag{16}$$

where V_j is the deterministic component of utility that can be explained by attributes that differ between alternatives available at the second stage. A typical assumption is that the value of μ does not vary over individuals and equals one.

3.3.2 Choice sets

Survey respondents were shown four choice sets associated with travel between Vancouver and Whistler. Each choice set contained four potential modes of transportation: private automobile, rental automobile, express bus and train. Respondents were also given the option of not going on the trip. Each respondent was asked to choose the mode they would most likely use for travel purposes (Figure 3.5).

Figure 3.5: Format of transportation choice task for an overnight visitor



SECTION 2: Transportation to Whistler 1 of 4

16% COMPLETE

1. Which mode of transportation would you most likely use to travel between Vancouver and Whistler if the options below were the only ones available?

*Imagine that you are taking **an overnight** trip to Whistler in the summer which is similar to your trip in May 2003 (same travel party, length of stay, activities undertaken, etc). **Check one mode below.***

AUTOMOBILE	EXPRESS BUS	TRAIN	WOULD NOT GO
2 hrs travel time	**2 hrs 30 min** travel/wait time Leaves every **1 hour**	**2 hrs** travel/wait time Leaves every **2 hours**	
$15 one-way fuel costs **$15/night** parking fee at Whistler **$60/day** rental fee + insurance (if renting)	**$25/person** one-way fare	**$50/person** one-way fare	
	Departs from **Vancouver Airport** with downtown stops	Departs from **North Vancouver** with connecting shuttles from airport and downtown	
	Arrives at **Whistler Village**	Arrives at **Creekside** (5 km south of Village) with connecting shuttles to Village	
O Private automobile O Rented automobile	O Express bus	O Train	O Would not go

Next Scenario

3.3.3 Attributes selection

Each transportation mode was described in terms of its key attributes (e.g. travel time, frequency, costs and departure and arrival points) (Table 3.6). These attributes were defined a priori as being important drivers of modal choice and relevant for a tourist. The levels for each attribute were chosen to reflect differences that mattered to tourists and to allow for the simulation of current and potential transportation conditions. Each attribute and its levels were determined through a selection process involving a review of existing literature and stakeholder feedback (Asenio, 2002; Ben-Akiva & Morikawa, 2002; Bhat, 1997, 1998; de Palma & Rochat, 2000; Horne et al., 2005; Washbrook, 2002).

Table 3.6: Transportation attributes and levels

Attributes	Levels
Automobile	
Travel time	1. 1.5 hours from downtown Vancouver 2. 2 hours from downtown Vancouver 3. 2.5 hours from downtown Vancouver
One-way fuel costs	1. $10 2. $15 3. $30
Rental fee	1. $40/day + insurance 2. $60/day + insurance 3. $80/day + insurance
Parking fee	1. Free 2. $5/day for day visitors and $15/night for overnight visitors 3. $10/day for day visitors and $30/night for overnight visitors
Express Bus	
Travel/wait time	1. 10% faster than automobile 2. Same as automobile 3. 25% slower than automobile
One-way fare	1. $25 2. $50 3. $75
Frequency	1. Every 2 hours 2. Every 1 hour 3. Every 30 minutes
Departure point*	1. Vancouver airport with downtown stops
Arrival point	1. Whistler Village 2. Directly at accommodation
Train	
Travel/wait time	1. 10% faster than automobile 2. Same as automobile 3. 25% slower than automobile
One-way fare	1. $25 2. $50 3. $75
Frequency	1. Every 2 hours 2. Every 1 hour 3. Every 30 minutes
Departure point	1. Vancouver airport with downtown stops 2. Downtown Vancouver with free shuttle from airport 3. North Vancouver with free shuttle from airport or downtown
Arrival point	1. Whistler Village 2. Creekside (5 km south of Village) with free shuttle to Village

* Not an attribute, but displayed for context.

3.3.4 Experimental design

Experimental design techniques were used to generate the combination of attribute levels explored in each choice set (Louviere et al., 2000). A full factorial design involving all possible combinations of attributes and levels was not practical because it would have required more than 700,000 choice sets to ensure orthogonality. Therefore, the transportation profiles in the choice sets were generated by using an orthogonal fractional factorial design that contained only a small subset of all possible combinations of attributes and levels. A Resolution III main effects design plan required 54 unique choice sets (Montgomery 2001), which were split into 18 versions of three choice sets each. Each respondent evaluated one of these versions. These designs allowed efficient estimation of all main effects, but meant that most interaction effects between attributes could not be estimated.

3.3.5 Data analysis

Using the LIMDEP 8.0 software package (Greene, 2002), maximum likelihood procedures were used to estimate the parameters of the NMNL choice model. In the final nested choice model all categorical attributes (e.g. arrival and departure points) were effects coded and all numerical attributes were linear and quadratic coded (Louviere et al., 2000). In addition, the bus and train travel time attributes were converted into nine-level variables by multiplying the automobile travel time by the appropriate percentage (i.e. 25% slower, same, 10% faster). These new variables were then linear and quadratic coded. In the final model the quadratic terms were dropped if they were not significant at the 90% confidence level.

The hierarchical structure of the NMNL choice model allowed for sequential estimation of its parameters (Ben Akiva and Lerman, 1985). This process involved three steps:

(1) Apply MNL estimation to the conditional choice model P(j | i) at the second stage. This determines the parameters for this stage.

(2) Calculate the inclusive value for each value of i.

(3) Apply MNL estimation to P(i) at the first stage, with the inclusive value included as one of the explanatory variables. The coefficient of the inclusive value will be μ_1. McFadden (1981) showed that if μ_1 lies between 0 and 1 the model is consistent with the utility maximization hypothesis. [37]

A likelihood ratio test was used to determine whether the NMNL model was an improvement over the standard MNL model. The likelihood ratio test statistic compares the likelihood values of the different models:

$$\textit{Likelihood Ratio Statistic} = 2 \times (L_{NMNL} - L_{MNL}) \qquad (17)$$

where this statistic is Chi-squared distributed with degrees of freedom equal to the number of parameters estimated in the NMNL model minus the number of parameters estimated in the MNL model.

3.3.6 Accounting for varying preferences among individuals

A limitation of the NMNL modelling approach is that it does not account for systematic variation in preferences among individuals. For instance, visitors who live close to Vancouver were much more inclined to take a private than rental automobile to travel to Whistler, while tourists from further away were much more likely to use a rental than private automobile. Such preference heterogeneity means that choice probabilities will differ systematically amongst individuals even though the choice alternatives are identical. This issue was

[37] A small value of μ_1 indicates that the MNML model is an improvement over the ordinary MNL model. In the specific case when μ_1 is equal to one, the NMNL model is the same as the MNL model.

addressed by expanding the choice model to include attributes relating to the individual. The approach extended the traditional NMNL model to a systematic heterogeneous specification introducing the effect of individual characteristics in the choice probability. Several individual characteristics were considered for inclusion in the final choice models. These included socio-demographic variables (e.g. gender, age, income and education), situational variables (e.g. place of residence), prior trip characteristics (e.g. travel party size, purpose of trip and activities pursued during the visit) and tourist destination motivations. Only individual-specific attributes significant at the 90% confidence level were retained in the final model.

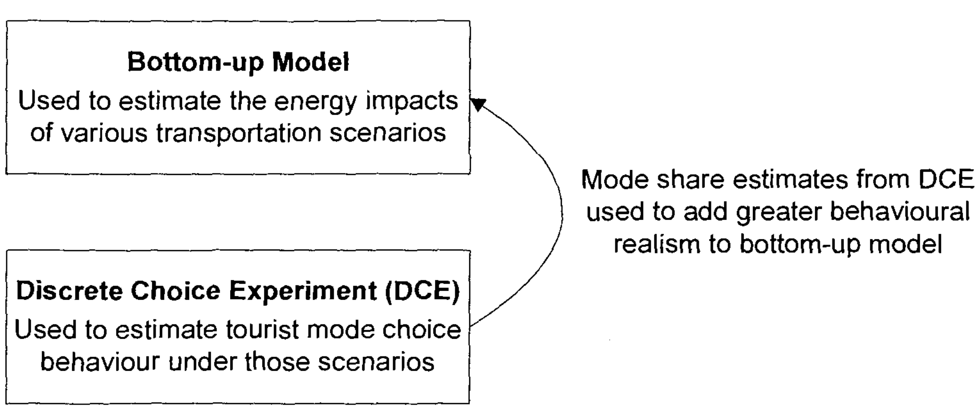
An especially important determinant of mode choice behaviour was whether the individual stayed overnight at the resort or was a day visitor. Separate choice models were estimated for each of these segments because many of the estimated model parameters were significantly different for these groups. An additional reason for this segmentation was that some differences existed in choice set presentation between overnight and day visitors. As well, the predefined levels for parking fees significantly differed between these two groups.

3.3.7 Adding behavioural realism to the resource flow model

To assess the relative effects of various transportation planning scenarios on energy consumption and associated GHG emissions, the DCE results were linked with this study's "bottom-up" resource flow model. While bottom-up models provide useful means of identifying the technical energy requirements and GHG emissions associated with various transportation modes, they normally do not incorporate behavioural considerations associated with actual travel decisions (Wilson & Swisher, 1993). As such, they fail to capture the influence of multiple tangible and intangible factors on the choices travellers make. Behaviours in bottom-up models typically are based on exogenous assumptions from past research or expert opinions to quantify the impact of proposed transportation strategies on travel mode choice. Their main drawback is that they may lack behavioural realism, which can create challenges in predicting probable mode choices associated with transportation options. This research addressed this issue by linking the bottom-up model's technical estimates to more behaviourally realistic estimates of probable responses to each transportation choice option. Specifically, the mode share estimates derived from the discrete choice experiment were used to add greater behavioural realism to the structuring of the technical bottom-up model.

This research phase used the results from the discrete choice experiment to inform the estimation of the effects of various transportation alternatives on energy consumption and GHG emissions estimated in the technically focused bottom-up model (Figure 3.6). This process involved two steps. First, the discrete choice models were used to predict modal shares that would likely occur under various transportation planning scenarios. These modal shares were used to generate more behaviourally realistic estimates of "person kilometres travelled" (PKT) for private automobile, rental automobile, express bus and train options. Second, these estimates of PKT were used in the bottom-up model to calculate energy consumption and GHG emissions associated with visitor travel (see Section 3.1).

Figure 3.6: Process for adding behavioural realism to resource flow model



In this context, the estimated energy impacts of implementing various "pro-bus" and "pro-train" strategies were compared with the effects of continuing with a current "business-as-usual" path (Table 3.7). These transportation management strategies included implementing dedicated transit lanes to decrease express bus travel times relative to private automobiles; high-speed train options; more affordable transit rates; more frequent transit service; more convenient transit access points that are attractive to visitors and allow convenient connections to other travel modes; and parking fees within the destination area.

Table 3.7: Transportation planning scenarios examined

Attributes	BAU Scenario	Pro-Bus Scenario	Pro-Train Scenario
Automobile			
Travel time	2 hours from downtown Vancouver	Same as BAU	Same as BAU
One-way fuel costs	$15	Same as BAU	Same as BAU
Rental fee	$60/day + insurance	Same as BAU	Same as BAU
Parking fee	Free for day visitors and $15/night for overnight visitors	$10/day for day visitors and $30/night for overnight visitors	$10/day for day visitors and $30/night for overnight visitors
Express Bus			
Travel/wait time	25% slower than automobile	10% faster than automobile	Same as BAU
One-way fare	$25	Same as BAU	Same as BAU
Frequency	Every 2 hours	Every 30 minutes	Same as BAU
Arrival point	Whistler Village	Directly at accommodation	Same as BAU
Train			
Travel/wait time	25% slower than automobile	Same as BAU	10% faster than automobile
One-way fare	$50	Same as BAU	$25
Frequency	Every 2 hours	Same as BAU	Every 30 minutes
Departure point	North Vancouver with free shuttle from airport or downtown	Same as BAU	Downtown Vancouver with free shuttle from airport
Arrival point	Creekside (5 km south of Village) with free shuttle to Village	Same as BAU	Whistler Village

3.4 Assessment of Carbon Offsetting Programs

This section presents an approach for examining tourist responses to carbon offsetting strategies. It describes a contingent valuation (CV) method useful for estimating the amount of money tourists would be willing to donate to offset greenhouse gas emissions. The same online survey instrument used to collect the discrete choice experiment data was employed for this CV application. Readers are directed to Section 3.5 for a detailed description of the questionnaire design and data collection procedures.

CV methods are typically used to measure the economic benefits of non-market goods such as environmental resources or public goods (Cummings et al., 1986; Mitchell & Carson, 1989). In typical CV applications, survey respondents are asked about their willingness to pay for a good. Due to the often abstract and unfamiliar nature of non-market goods, they are typically presented in the context of a hypothetical market that models the way goods are bought and sold in reality (Mitchell & Carson, 1989). The CV method has been used over the last three decades in a wide range of environmental valuation problems (Freeman, 1993). In tourism and recreational contexts, most previous research projects involving contingent valuation have focused on estimating the benefits that tourists derive from natural resources, scenic beauty and recreational amenities (e.g. Bostedt & Mattsson, 1995). While a few studies have used the approach to value tourism-related impacts (e.g. Lindberg & Johnson, 1997), no previous research has employed contingent valuation to analyze the energy-related impacts associated with visitor travel. This dissertation carries out such an investigation by using the method to estimate the amount of money visitors would be willing to donate to compensate for the greenhouse gas emissions associated with their trip to Whistler.

3.4.1 Data collection

Survey respondents were asked to indicate their willingness to donate money to a hypothetical independent non-government organization which undertakes carbon offsetting activities that compensate for the greenhouse gas emissions generated by visitor travel to Whistler (Figure 3.7). The preamble to the survey question described the negative consequences of greenhouse gas emissions generated from travel and outlined potential ways of offsetting these emissions. Respondents were then informed of the total cost to compensate for the greenhouse gas emissions generated by their travel to Whistler. At that point they were asked to indicate their willingness to donate money to compensate for these emissions.

Figure 3.7: Format of carbon offsetting question

SECTION 5: Travel Patterns — 92% COMPLETE

Transportation to mountain resorts such as Whistler is a major cause of carbon dioxide emissions, a greenhouse gas that contributes to global climate change. While these emissions are often unavoidable, they can be offset by various activities such as:

- planting trees that take up carbon dioxide, or
- investing in the use of alternative energy sources that do not create carbon dioxide emissions.

Assume that the total cost to compensate for your greenhouse gas emissions in traveling to Whistler from your residence is about $12 CAD ($9.50 US). Now imagine that there is an independent non-government organization that would take donations from visitors to fund activities that offset greenhouse gas emissions.

2. Would you be willing to donate $12 CAD ($9.50 US) to this organization to compensate for the greenhouse gas emissions associated with your trip to Whistler?

O Yes, I would donate $12 CAD ($9.50 US)

O No, I would not donate $12 CAD ($9.50 US)

Next

The donation amount shown to the respondents was systematically varied over a predetermined range for each of four predefined groups based on the distance of their place of residence from Whistler (Table 3.8). The upper level for each range was roughly determined by multiplying average round-trip distance to Whistler by an estimated carbon-offsetting rate ($25/1000 km).

Table 3.8: Donation amounts shown in carbon offsetting question

	Range of Donation Amounts
Group 1: British Columbia	$1.50 - $15.00
Group 2: Alberta, Washington and Oregon	$2.50 - $25.00
Group 3: Other Canada and United States	$5 - $150
Group 4: Other International	$10 - $300

This study used a referendum (or closed-ended) approach for eliciting the respondent's willingness to pay (Bishop & Heberlein, 1979). Specifically, respondents were asked to indicate whether or not they would donate a specified amount of money to fund carbon-offsetting activities. This amount was varied across the survey's respondents and the resulting yes/no responses were used to elicit information about the true underlying willingness-to-donate. The referendum method is generally preferred over more open-ended alternatives[38] because:

- The yes/no response task reflects the way consumers make decisions in real markets.
- Cognitive burden is reduced because respondents do not have to precisely identify their maximum willingness-to-pay.
- Strategic responses are minimized where, for example, respondents dramatically understate or overstate their willingness to pay in order to

[38] Open-ended methods ask respondents to directly indicate their maximum willingness to pay for a good. This type of question can be unreliable since respondents often find it difficult to precisely indicate their true willingness-to-pay (Arrow et al., 1993; Mitchell & Carson, 1989).

influence the study's findings (Arrow et al., 1993; Mitchell & Carson, 1989).

Despite these strengths, the referendum approach suffers from some weaknesses (Harris et al., 1989; Hausman, 1993). Perhaps the most frequently cited drawback is the potential for "yea-saying" (or "compliance bias"). This arises when respondents give a "yes" vote to the referendum question even though the specified dollar amount is actually greater than their true willingness to pay. Yea-saying often occurs when respondents want to show their support for environmental (or socially responsible) improvements. Another weakness of the referendum approach is that it is statistically less efficient than the open-ended method because less information concerning maximum willingness to pay is provided. Despite these weaknesses, the referendum method has gained wide acceptance as a method for estimating willingness to pay for non-market goods, provided thorough survey research methods are followed (Arrow et al., 1993; Mitchell & Carson, 1989).

3.4.2 Model specification

The strength of using a CV framework is that statistical methods can be used to estimate the expected amount that visitors are willing to donate to offset greenhouse gas emissions. In particular, logistic regression can be used to estimate the probability of a respondent answering "yes" as a function of the donation amount. The form of the model is:

$$\ln\left(\frac{P}{1-P}\right) = Const + \alpha\, Amount + \beta X + \varepsilon \qquad (18)$$

where ln is the natural logarithm, P is the probability of a "yes" vote, *Const* is a constant, α is the coefficient on the donation amount, X is a vector of individual characteristics, β is a vector of parameters, and ε is the error term. Several individual characteristics were considered for inclusion in the final model. These included socio-demographic variables (e.g. gender, age, income and education), situational variables (e.g. place of residence), prior trip characteristics (e.g. travel party size, purpose of trip and activities pursued during the visit) and tourist destination motivations. Only individual-specific attributes significant at the 90% confidence level were retained in the final model.

The equation for estimated willingness to pay (WTP) can then be derived as follows:

$$\mathrm{WTP} = {(Const + \beta X)} \big/ {-\alpha} \qquad (19)$$

Complete derivations of the equation for willingness to pay and the associated confidence intervals are presented by Cameron (1988, 1991) and Whitehead (1990).

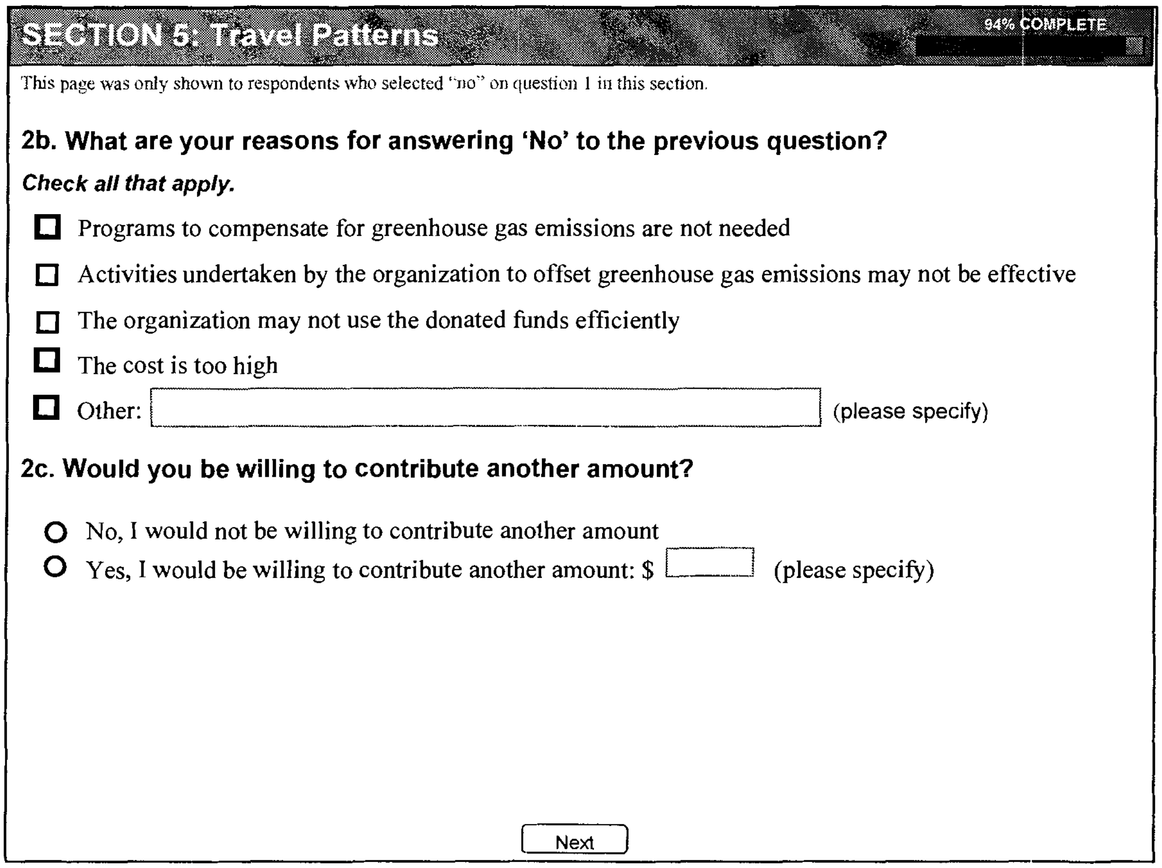
3.4.3 Reasons for not donating

As with other contingent valuation studies, respondents who answered "no" to the initial carbon-offsetting question were asked to indicate their reasons for not donating and if they would contribute another amount (Figure 3.8). For these questions respondents were able to select one or more reasons for not donating:

- Programs to compensate for greenhouse gas emissions are not needed
- Activities undertaken by the organization to offset greenhouse gas emissions may not be effective
- The organization may not use the donated funds efficiently
- The cost is too high
- Other (specified by the respondent)

The purpose of this follow-up question was to identify respondents who gave a "no" response in order to protest against the payment vehicle, not because they were unwilling to pay to compensate for the greenhouse gas emissions associated with their trip. In other words, these respondents would be willing to pay for carbon offsetting if the payment mechanism was structured in a different way. These protest votes were removed from the sample in order to estimate willingness to pay independent of the payment mechanism.

Figure 3.8: Format of carbon offsetting follow-up question


SECTION 5: Travel Patterns

94% COMPLETE

This page was only shown to respondents who selected "no" on question 1 in this section.

2b. What are your reasons for answering 'No' to the previous question?

Check all that apply.

- ☐ Programs to compensate for greenhouse gas emissions are not needed
- ☐ Activities undertaken by the organization to offset greenhouse gas emissions may not be effective
- ☐ The organization may not use the donated funds efficiently
- ☐ The cost is too high
- ☐ Other: ________ (please specify)

2c. Would you be willing to contribute another amount?

- O No, I would not be willing to contribute another amount
- O Yes, I would be willing to contribute another amount: $ ____ (please specify)

Next

3.5 Survey Development and Data Collection

This section describes the survey instrument used in this research. It also discusses data collection procedures and external validation issues. A detailed profile of the survey respondents is contained in Appendix 5. A reproduction of the entire web survey is found in Appendix 6.

3.5.1 Survey development process

The survey was developed over a period from May to November 2004. It was created using information gleaned from existing literature as well as input gained from destination planners and managers in Whistler. The process for involving stakeholders consisted of several meetings and two workshops (Table 3.9). The participation of destination stakeholders helped ensure that the survey would be relevant to local decision-makers and useful beyond academic applications.

Table 3.9: Stakeholder involvement process

Type	Date/Venue	Purpose
Initial Meeting	Held at the RMOW office on May 4, 2004	To introduce the project and discuss opportunities for collaboration and in-kind support
Individual Meetings	Conducted at Whistler prior to the first design workshop	To obtain feedback on preliminary survey designs and to help develop a list of potential attributes to include in the discrete choice experiments
Design Workshop 1	Held at the RMOW office on July 6, 2004	To obtain feedback on the attributes and levels to include in the discrete choice experiments*
Design Workshop 2	Held at the RMOW office on September 10, 2004	To obtain final feedback on the attributes and levels to include in the discrete choice experiments and to discuss possible formats and presentation styles for the survey

* A feedback form was distributed by e-mail to all individuals who attended this workshop (see Appendix 3). Feedback obtained through this process was used to help select the final set of attributes to include in the discrete choice experiments.

In addition to the stated choice components, the final survey instrument contained several other questions related to prior trip characteristics, tourist destination motivations and respondent socio-demographic characteristics (Table 3.10). At the end of the survey, respondents were given the opportunity to provide additional comments. They were also offered the option to enter into a draw for prizes such as a Whistler ski holiday and First Nations artwork. These prize incentives were used to help increase the response rate.

Table 3.10: Survey content organization

Section	Title	Questions About:
1	Trip to Whistler	Previous trip to Whistler (e.g. length of stay, accommodation type, activities pursued, transportation to and within the resort)
2	Transportation DCE	Transportation mode choice for visitor travel between Vancouver and Whistler
3a	Learning Task*	Characteristics of mountain resorts related to developed land, recreational opportunities, local transportation and environmental initiatives
3b	Destination Planning DCE	Visitor preferences for land use, transportation, recreation and other environmental initiatives intended to promote dematerialization
4	Spatial Resort DCE**	Visitor preferences for alternative landscapes at generic mountain resorts
5a	Carbon Offsetting	Willingness to donate to offset the greenhouse gas emissions associated with trip to Whistler
5b	Travel Motivations	Tourist motivations for visiting mountain resorts
5c	Socio-demographics	Socio-demographics (e.g. gender, age, education, income)

* While the responses to these "learning questions" provided valuable information about visitor preferences, a main reason for including them in the survey was to familiarize the respondents with the attributes and levels that were included in the destination planning choice experiment.
** This spatially explicit choice experiment was developed by Englund (2005). This component of the survey is not presented in this dissertation.

The survey was initially designed and tested in Microsoft PowerPoint. This platform enabled relatively quick and easy design modifications based on feedback from Whistler stakeholders, research colleagues and numerous volunteers who reviewed and tested the survey. Once the PowerPoint version was finalized, a web-based version of the survey was constructed.

The survey resided on a server located in a secure room at Simon Fraser University. It was hosted at Simon Fraser University's domain at: www.whistlerstudy.rem.sfu.ca. The web survey was tested with several different screen resolutions (600x800, 1024x768) and web browsers (Internet Explorer, Netscape and Firefox), as well as with high speed and dial-up Internet access. Extensive testing was conducted to ensure that the survey's internal logic and outputs were valid and reliable.

3.5.2 Recruitment method

Respondents for this survey consisted of summer visitors who were personally recruited during their trip to Whistler in August or September 2004.[39] These individuals were intercepted on a daily basis at strategic locations in Whistler between August 7 and September 6 and on the weekends of September 10-12, 17-19 and 25-26 in 2004. A total of 2,016 visitors were recruited using this method. They were later sent an e-mail with a link to the online survey.

Intercept procedure

To ensure randomness, every third party was approached and, if the group was larger than one person, the individual who was celebrating their birthday next was selected. Only individuals over the age of 19 were considered. The recruited individual completed a one-page questionnaire. It was used to screen out residents or employees in Whistler, as well as to ensure the sample was representative of the overall population of summer visitors (see Appendix 2 for a copy of this questionnaire). All recruited individuals received a Canadian

[39] In addition, a secondary method for recruiting survey participants was used to ensure an adequate sample size would be obtained. Tourism Whistler included a brief descriptive paragraph and link to the survey in their online newsletter distributed electronically to over 25,000 individuals on November 25, 2004. Recipients of the newsletter were able to click on the link to access the survey website. As expected, the response rate to the survey was low for people who received the Tourism Whistler electronic newsletter. Out of the 25,000 e-mails that were sent, 183 individuals (less than 1%) clicked on the link to our survey. Only 139 of these people proceeded past the introductory page. Furthermore, 30 individuals were "screened out" from the survey because they were either residents or employees in Whistler or had visited Whistler only in the winter season. Of the 109 individuals who were eligible for the survey, 91 people completed the survey in full and 18 partially completed the survey. However, it was decided not to include these responses in the final sample because: (1) due to possible self-selection bias, it could not be assumed that these responses were representative of Whistler tourists as a whole; and (2) the in-person recruitment method generated a sufficiently large sample for the study's purposes.

flag pin in appreciation of their participation. This gift was also intended to provide respondents with an incentive to participate in the online survey.

E-mail addresses

Recruited individuals were asked for an e-mail address where they could be sent the online survey. The majority of the recruited individuals supplied an e-mail address provided either by a free e-mail service such as Hotmail or Yahoo (39.5%) or an Internet Service Provider such as Shaw or Telus (37.8%). A smaller number of individuals gave e-mail addresses provided by businesses and community groups (8.6%), universities and colleges (3.4%), governments or other institutions (1.7%) or unknown sources (9.0%).

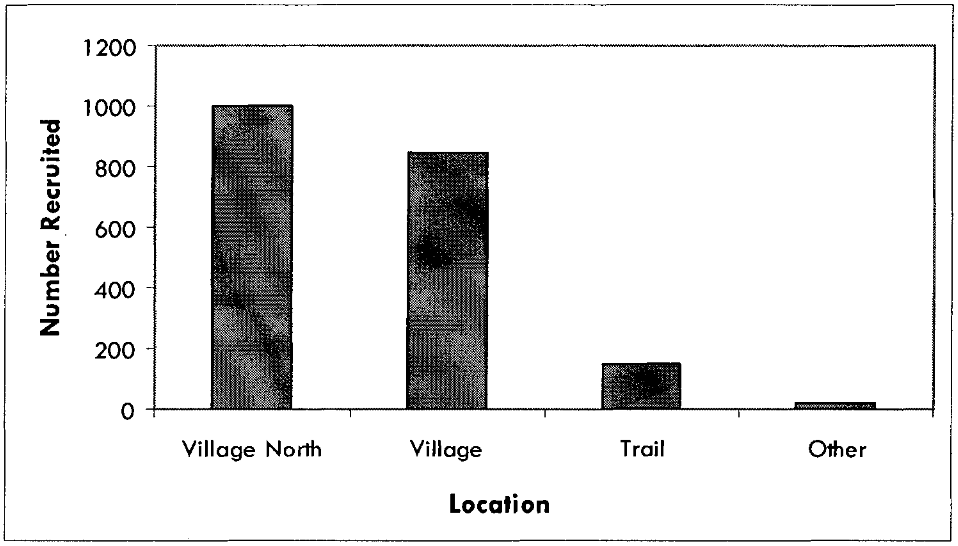
Recruitment personnel

Ten different individuals were involved with recruiting summer visitors at Whistler. Six of these people were hired and four were volunteers. The hired individuals recruited 1,630 visitors (81.9%), while the volunteers recruited 386 visitors (19.1%).

Recruitment locations

Visitors were primarily recruited in Whistler Village (42.1%) and Village North (49.7%) (Figure 3.9). A smaller number of visitors were also recruited on a trail between Whistler Village and Village North (7.4%). Sampling at the base of the Blackcomb Benchlands and in the short village stroll in that area did not prove very efficient and consequently very few intercept surveys were conducted there.

Figure 3.9: Intercept location



Recruitment dates and times

In total, 1,411 visitors (70.0%) were recruited in the month of August and 605 (30.0%) were recruited in September. 845 visitors (41.9%) were recruited on the weekend, while 1171 visitors (58.1%) were recruited on weekdays (Figure 3.10). Proportionally more visitors were recruited on Saturday and Sunday than on other days. This replicated actual visitation patterns in the destination. The majority of visitors were recruited between noon and 8 pm (Figure 3.11).

Figure 3.10: Day of week intercepted

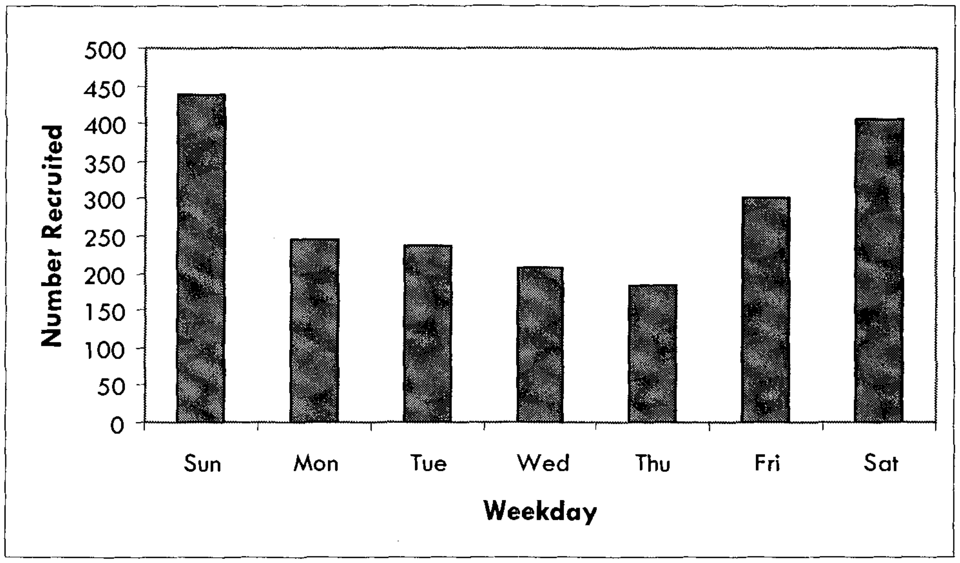
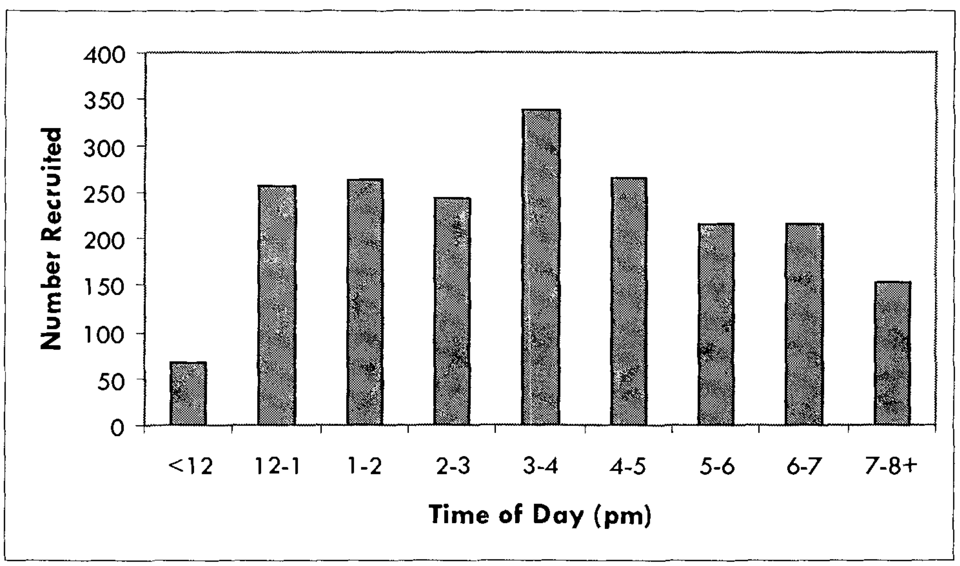


Figure 3.11: Time of day intercepted



3.5.3 Pretesting

Two final pretests were administered to test preliminary versions of the online survey. The first pretest used 50 people from the recruited sample of 2,016 individuals. These individuals were e-mailed the link to the survey on Saturday, November 5, 2004. Nine people fully completed the survey and two partially finished it within the following week. Based on their reactions, the survey was significantly changed after the first pretest. Consequently, these 11 responses were not included in the final analysis.

The second pretest was conducted a week later. It used an additional 60 individuals from the recruited sample. During the week following the second pretest, 20 people fully completed the survey and two partially finished the survey. The instrument was not changed significantly thereafter and the responses of the 22 people who completed the survey were included in the final dataset.

3.5.4 Main mail-out

The link to the web survey was sent to all recruited individuals in an e-mail produced using an MS Word mail merge to MS Outlook (see Appendix 4 for a copy of this e-mail).[40] As part of the brief intercept questionnaire conducted at Whistler, the majority of individuals were asked for a name we could use when we contacted them by e-mail. In total, we received 1,149 names (57.0%), which we used to personalize the e-mail. The remaining 867 e-mails (43.0%) were not personalized.

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[40] Each recruited respondent was assigned a login ID and password. This information was directly embedded into the link received by the respondent. This technique was used to: (1) match the respondent's survey data with the data obtained through the intercept questionnaire; and (2) ensure that the respondent did not complete the survey more than once.

Due to the time required to send the e-mails individually, the e-mails were sent in two primary batches. A total of 1,319 e-mails were sent on Thursday, November 18, and the remaining 587 were sent on Saturday, November 20. A significant proportion of the e-mails were returned as "undeliverable." These e-mails were corrected and resent on the same day, if possible. However, a third mailing was required on Tuesday, November 23, to send the remaining 14 returned e-mails. In the end, 1,825 e-mails (90.5%) were delivered to respondents, while 191 e-mails (9.5%) remained undeliverable.

A reminder e-mail was sent to all personally recruited individuals who had not yet started the survey on December 6, 2004 (see Appendix 4 for a copy of this reminder e-mail). Because most of the e-mails were sent on November 18 and 20, the vast majority of individuals (93%) received the reminder 16-18 days after the initial request was received.

3.5.5 Overall response rate

Of the 1,825 surveys delivered to recruited visitors, 800 completed surveys were returned for an overall response rate of 43.8% (Table 3.11). In addition, 76 partially completed surveys were received. Combining these with the 800 complete responses gives 876 total responses, or a response rate of 48%. This compares favourably with other electronic survey research (Cho & LaRose, 1999).

Table 3.11: Survey responses

	Recruited Sample
Total e-mails sent	2016
Total e-mails received*	1825
Total hits on website	897
Intro Screen Only	21
Screened Out	0
Total surveys completed	791 (+ 9 pre-test)
Total surveys partially completed	74 (+ 2 pre-test)
Maximum sample size for final analysis	**865 (+ 11 pre-test)**

*191 e-mails collected through the in-person recruitment were "undeliverable" due to an error in the e-mail address.

3.5.6 Influence of recruiting procedure on response rate

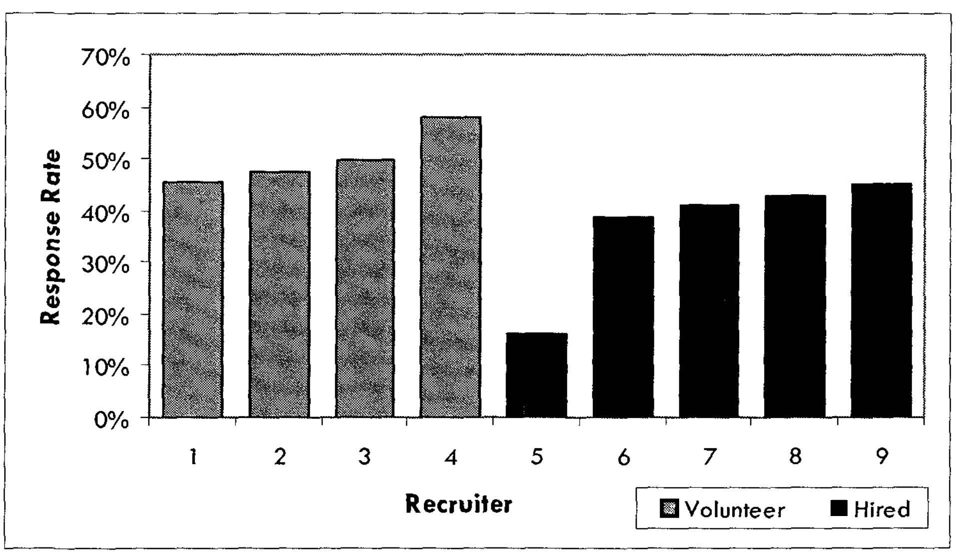
In this section, various aspects of the recruitment procedure are examined to identify potential biases in survey responses.

Recruitment personnel

A significant difference in response rate was found between hired and volunteer recruiters (Chi-square=11.951, 1 df, P-value=0.001). Generally, the response rate was greater for volunteer than hired recruiters (Figure 3.12). One possible explanation for this difference is that the volunteer recruiters were either grad students directly involved with the research or else close friends or family of the researchers. These individuals may have conveyed a greater sense of credibility compared with the hired recruiters.

Although there was a significant difference in response rate between the 10 recruiters (Chi-square=23.4, 9 df, P-value=0.005), no differences were found between the two of them who recruited the most respondents (Chi-square=0.426, 1 df, P-value=0.514). These two individuals were responsible for recruiting nearly two-thirds of the participants (65.7%).

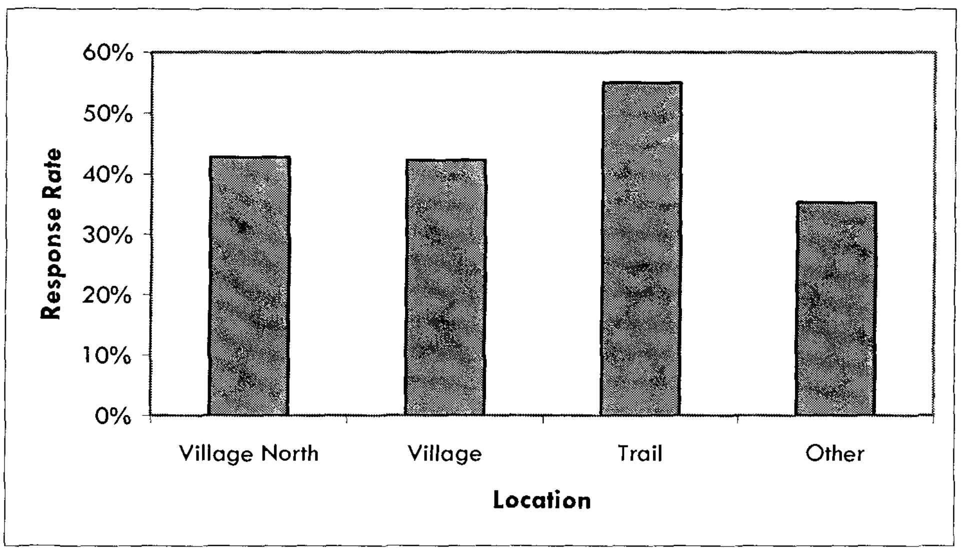
Figure 3.12: Comparison of response rate by recruiter



Recruitment locations

Although there was a significant difference in response rate between recruitment locations (Chi-square=9.191, 3 df, P-value=0.027), there was no significant difference between the two main intercept locations of Village North and Whistler Village (Chi-square=0.043, 1 df, P-value=0.835) (Figure 3.13). The high response rate observed for individuals recruited on the trail may be confounded by the fact that volunteer recruiters conducted all intercept surveys on the trail.

Figure 3.13: Comparison of response rate by intercept location



Recruitment dates and times

There was a significant difference in response rate for visitors recruited in August versus those recruited in September (Chi-square=6.062, 1 df, P-value=0.014). Approximately 48% of the 605 visitors who were recruited in September responded to the survey, while only 42% of the 1411 visitors recruited in August responded. This may be explained in part by the fact that less time had passed before the September visitors received the e-mail with the survey link. In contrast, there was no significant difference in response rate between the time of day (Chi-square=9.510, 8 df, P-value=0.301) or the day of week that individuals were recruited (Chi-square=6.290, 6 df, P-value=0.391).

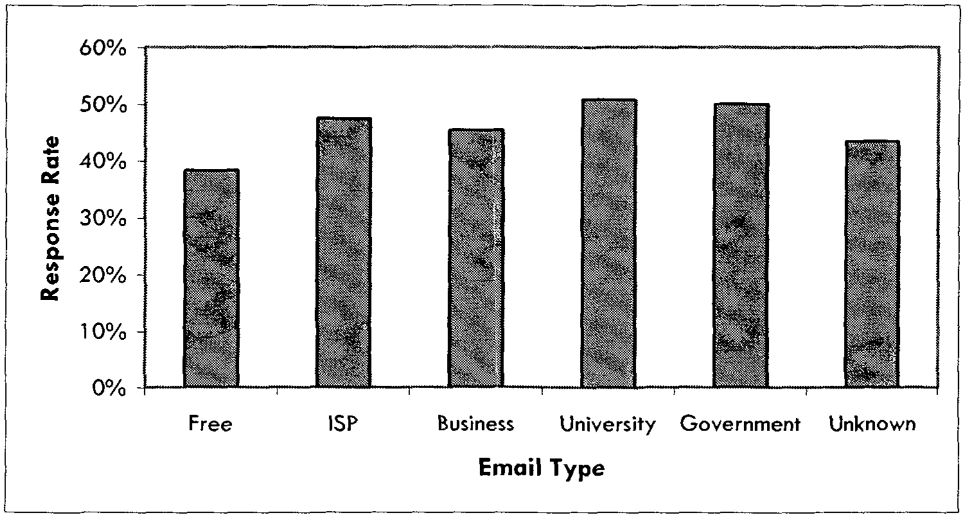
E-mail personalization

There was a significant difference in response rate for the 1,149 individuals who received a personalized e-mail (48.2% responded) versus the 867 people who received a non-personalized e-mail (37.1% responded) (Chi-square=24.672, 1 df, P-value=0.000). It is not surprising that recruited individuals who were addressed by name in the e-mail were more likely to respond than individuals who were addressed by a generic "Dear Sir or Madam." Those people providing a name in the intercept questionnaire may also have been more predisposed to the study to start with.

E-mail account type

There was a significant difference in response rate between types of e-mail accounts (Chi-square=15.811, 5 df, P-value=0.007) (Figure 3.14). Notably, recruited individuals with free e-mail accounts were far less likely to respond than people with other types of accounts. This lower response rate may be explained by the fact that free e-mail accounts are usually checked less frequently and expire more quickly than other types of accounts. As well, the notification message may have been marked as "spam" by these services.

Figure 3.14: Comparison of response rate by type of e-mail account



*ISP= Internet Service Provider

Day of week e-mail sent

It was thought that the response rate might vary depending on the day of the week the e-mail was received by potential respondents. However, no significant differences were apparent (Chi-square=2.692, 3 df, P-value=0.442).

3.5.7 Survey termination point

A total of 897 hits to the survey website were recorded. Twenty-one of these hits were from people who did not proceed past the website's introductory screen. This may indicate that some people were not interested in the subject matter. These individuals were not included in the eventual data analysis.

The use of the Internet allowed a relatively complex and lengthy survey to be presented in a visually attractive and entertaining way. These features helped keep respondents engaged throughout the entire survey. Only 8.6% of respondents quit the survey before completing all sections (Table 3.12). As expected, many of these people stopped participating during the discrete choice experiments in Sections 3b and 4, likely because of the complexity of the questions in these sections. However, the relatively high termination rates that occurred in Sections 1 and 3a were unexpected. It is possible that the questions in Section 3a may have appeared biased or tedious, and that the questions in Section 1 about the respondent's trip to Whistler were too lengthy or uninteresting. Despite these findings, it is promising that no one section accounted for the majority of the terminations.

Table 3.12: Survey termination point

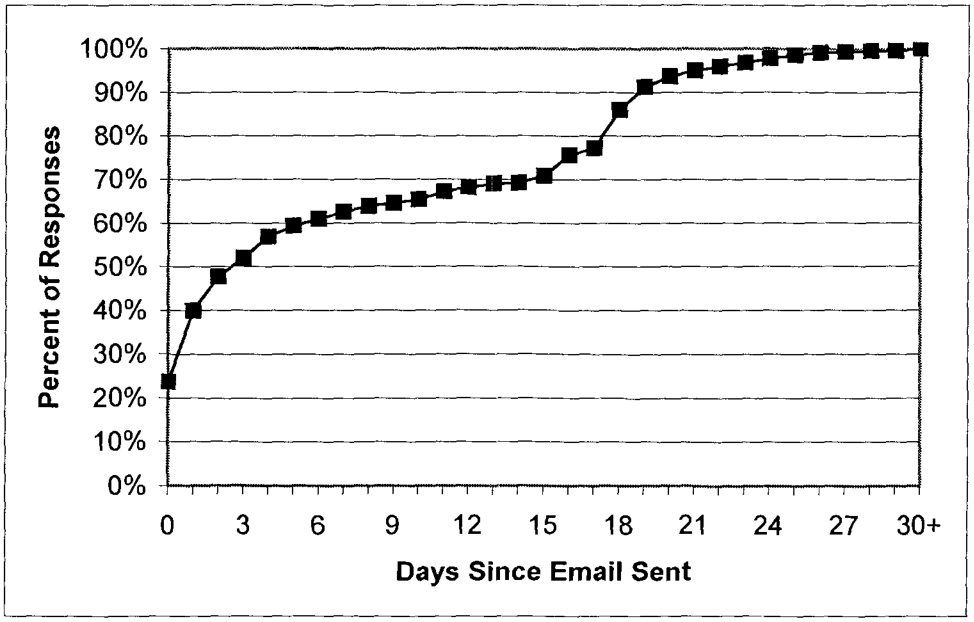
Section Survey Terminated	Recruited Sample	
Section 1: Trip to Whistler	17	23.0%
Section 2: Transportation DCE	6	8.1%
Section 3a: Learning Task	20	27.0%
Section 3b: Destination Planning DCE	14	18.9%
Section 4: Spatial Resort DCE	14	18.9%
Section 5: Carbon Offsetting	2	2.7%
Section 5: Travel Motivations & Socio-demographics	1	1.4%
Total	**74**	**100%**

3.5.8 Survey response time

Consistent with other web questionnaires, the response time for this survey was relatively quick (McCabe et al., 2002; Schaefer & Dillman, 1998). Just over half (52%) of the total responses were received within the first three days of sending out the survey link, and almost two-thirds (63%) of the responses were received within the first week. A reminder e-mail was sent to all recruited respondents approximately 2-3 weeks following the initial mail out. A second peak in responses was observed at this time.[41]

[41] The exact timing of the reminder varied because the initial mail-outs were made on five separate dates, while the reminder e-mail was sent on a single date.

Figure 3.15: Survey response times



*Includes all people who proceeded past the introductory screen of the survey (including the pre-test version).

3.5.9 Survey completion time

The median time for respondents to complete the entire survey was approximately 21 minutes.[42] In general, Sections 1 and 3b took the longest to complete, followed by Section 4 (Table 3.13). While the vast majority (90%) of respondents completed the survey in less than one hour, there were a number of individuals who took longer periods (Figure 3.16). Based on estimates of the time required to complete the survey during pretests, most of these individuals probably completed the survey over two periods. For instance, many of these individuals completed the survey on a different day from when they started it. In contrast, a small number of individuals completed the survey in less than 10 minutes. Although these low times seem to suggest that individuals were not

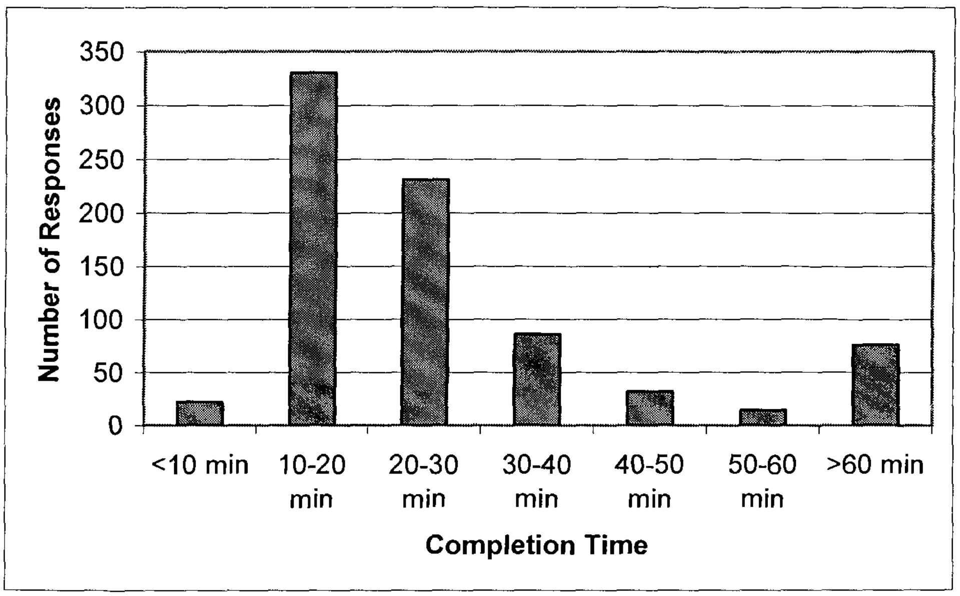
[42] Only individuals who fully completed the survey were included in this calculation. The median is used instead of the mean because of the skewed nature of the results.

taking the appropriate care in answering the questions, no justifiable basis for removing these records could be identified.[43]

Table 3.13: Median time to complete survey sections

	Recruited Sample
Section 1: Trip to Whistler	3:59
Section 2: Transportation to Whistler DCE	2:06
Section 3a: Learning Task	2:34
Section 3b: Destination Planning DCE	4:34
Section 4: Spatial Resort DCE	3:22
Section 5: Carbon Offsetting & General Questions	2:39

Figure 3.16: Time to complete the entire survey



[43] The records were checked for unusual response patterns, as well as for consistency between responses given in the web survey and the intercept questionnaire.

3.5.10 External validation

To ensure that the survey responses were representative of the overall population of summer visitors, the sample was compared with existing data obtained from Tourism Whistler's visitor intercept surveys.[44] Tourism Whistler's data are collected on a daily basis by interviewees trained and directed by Tourism Whistler staff. At least 15 surveys are conducted daily in both the winter (December 1 to April 30) and summer seasons (June 1 to October 15). During the summer season, surveying occurs at highly frequented locations within Whistler Village. It is assumed that visitors will have a high likelihood of visiting these areas at least once during their trip to the destination. Although these intercept surveys collect a wide spectrum of information, of particular importance to this study is the information that replicated questions in this study's online survey. This included queries about place of residence, length of stay, accommodation type, travel party size, age, gender and household income.

A Chi-square analysis was conducted to compare this study's sample of web survey responses to the sample obtained from Tourism Whistler's intercept surveys conducted during the 2004 summer season. While the two samples were relatively similar with regard to gender, household income and length of stay, there were significant differences related to the other variables. Notably, respondents to this study's web survey were more likely to reside in British Columbia, while respondents to Tourism Whistler's surveys were more likely to live outside the province. However, both surveys may under-represent foreign visitors as neither surveying approach used controls to sample non-English speaking visitors (e.g. multi-lingual interviewers). Additionally, respondents to this study's web survey tended to be younger in age than respondents to

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[44] This assumes that the data sample obtained from Tourism Whistler's intercept surveys is representative of the overall population of summer visitors to Whistler.

Tourism Whistler's surveys. This may partly be explained by our use of an online survey instrument. Past research has shown that web-based surveys often over-represent younger age cohorts (Roster et al., 2004; Zhang, 1999). Significant differences also existed in terms of accommodation type. Compared with Tourism Whistler's respondents, this study's survey respondents were less likely to be staying with friends and family and more likely to be staying in commercial accommodations.

CHAPTER 4: FINDINGS

This chapter presents the research findings from the case study of Whistler, British Columbia. The chapter is organized as follows:

- **Section 4.1** evaluates the levels of dematerialization associated with several destination planning options at Whistler.
- **Section 4.2** investigates visitor perspectives concerning various dematerialization planning alternatives.
- **Section 4.3** assesses tourist responses and dematerialization levels associated with various tourist transportation strategies.
- **Section 4.4** examines visitor responses to possible carbon offsetting strategies.

4.1 Technical Evaluation of Planning Options

The first research phase evaluated the levels of dematerialization associated with various destination planning options at Whistler, British Columbia. The evaluation was conducted using the technical model and methods described in Section 3.1.

4.1.1 Base year inventory of resource flows

The following sections present an inventory of resource flows for Whistler generated by the model for the study's 2000 base year.

Internal destination resource flows

Energy consumption and energy-related air emissions

Based on this research, residents, businesses and visitors in Whistler consumed approximately 2.9 million GJ of energy in the year 2000 (Table 4.1).

The largest component of this consumption was linked to the community's commercial sector, which was responsible for about 39% of total internal energy use. The vast majority of this energy consumption was attributable to commercial functions linked to hotels, other accommodations, retail stores, restaurants, bars, ski hill operations and other tourism services, including the ski area's commercial vehicle fleet.

Other major consumers of energy within Whistler included internal passenger vehicles and residential housing, which generated about 31% and 27% of the community's total energy consumption. Municipal buildings and the related vehicle fleet, along with other related public infrastructure (e.g. recreation centres, community cultural centres, public transportation) consumed far less (3%) of the overall internal energy budget.

Approximately 64% of Whistler's internal energy consumption was attributable to tourism. The industry's impact was greatest in the commercial sector, where about 93% of energy usage was allocated to tourism. While tourism accounted for just over half of the energy use associated with passenger transportation, it contributed only 13% of the energy related to public transportation. In addition, tourism accounted for about 37% of the energy usage in the residential sector. The industry's overall impact would be even greater if induced effects, such as the domestic energy consumption of resort employees and their families, were considered part of tourism's direct contribution.

Table 4.1: Estimated energy consumption

Sector	Fuel	Quantity (GJ)	%	Tourism's Direct Effect (%)
Residential	Electricity	614,223	21.3%	
	Propane	142,112	4.9%	
	Wood	36,000	1.2%	
	Total	**792,335**	**27.4%**	**~37%**
Passenger Transportation	Gasoline	**892,707**	**30.9%**	**~54%**
Commercial, Industrial and Institutional	Electricity	532,080	18.4%	
	Propane	531,036	18.4%	
	Gasoline	21,082	0.7%	
	Diesel	45,301	1.6%	
	Total	**1,129,499**	**39.1%**	**~93%**
Municipal Buildings and Infrastructure	Electricity	31,235	1.1%	
	Propane	7,398	0.3%	
	Gasoline	5,678	0.2%	
	Diesel	6,155	0.2%	
	Total	**50,465**	**1.7%**	**~54%**
Public Transportation	Diesel	**25,239**	**0.9%**	**~13%**
TOTAL		**2,890,245**	**100.0%**	**~64%**

These energy-consuming sources, along with the disposal of solid waste, were responsible for producing Whistler's internal GHG emissions. In 2000, the community's total GHGs were estimated to be approximately 131,000 tCO_2e (Table 4.2). Passenger vehicle transportation accounted for almost half (48%) of the internal GHG emissions. This did not include emissions generated via inter-community transportation. Overall, the commercial sector was responsible for generating about 31% of the internal GHG emissions, while the residential sector produced another 13%. Municipal buildings, related infrastructure and public transportation contributed only 2% of total GHG emissions. In addition, direct emissions of methane from the Whistler landfill accounted for approximately 6% of total internal GHGs.

The amount of GHG produced per GJ of energy varies significantly, depending on the fuel used. For instance, electricity is primarily generated from renewable large-scale hydro sources in British Columbia. As a result, the amount of GHG produced per GJ of energy is much lower for electricity than for energy generated via the burning of fuels such as propane, gasoline, diesel and wood. As an illustration, the use of wood in Whistler's residential sector accounted for slightly more GHGs than electricity, even though this sector utilized approximately 17 times more electricity than wood sources for its various energy requirements (Table 4.2). Greater use of wood for space heating, however, has the advantage of fossil fuel substitution by reducing the use of propane. Moreover, there would be no net CO_2 emissions from the use of wood if it was harvested and subsequently re-grown without an overall reduction in carbon stocks. As in many other winter destinations, the use of wood for space heating is an important issue that should be investigated further.

About 65% of Whistler's internal GHG emissions were attributable to tourism. The industry's contribution in each sector was the same for GHGs as it was for energy consumption. In addition, tourism accounted for about 83% of the GHG emissions from the Whistler landfill.

Table 4.2: Estimated greenhouse gas emissions

Sector	Fuel	Quantity (tCO2e)	%	Tourism's Direct Effect (%)
Residential	Electricity	4,266	3.2%	
	Propane	8,516	6.5%	
	Wood	4,475	3.4%	
	Total	**17,256**	**13.1%**	**~37%**
Passenger Transportation	Gasoline	**62,596**	**47.6%**	**~54%**
Commercial, Industrial and Institutional	Electricity	3,695	2.8%	
	Propane	31,820	24.2%	
	Gasoline	1,478	1.1%	
	Diesel	3,235	2.5%	
	Total	**40,229**	**30.6%**	**~93%**
Municipal Buildings and Infrastructure	Electricity	217	0.2%	
	Propane	443	0.3%	
	Gasoline	398	0.3%	
	Diesel	439	0.3%	
	Total	**1,498**	**1.1%**	**~54%**
Public Transportation	Diesel	**1,802**	**1.4%**	**~13%**
Solid Waste Disposal		**8,243**	**6.3%**	**~83%**
TOTAL		**131,625**	**100.0%**	**~65%**

Energy consumed at Whistler also contributed to emissions of common air contaminants (Table 4.3). Various point and area sources, as well as light-duty and heavy-duty vehicles, accounted for approximately 2,160 tonnes of carbon monoxide (CO), 303 tonnes of nitrogen oxides (NO_x), 4.8 tonnes of sulphur oxides (SO_x), 249 tonnes of volatile organic compounds (VOCs), and 87 tonnes of particulate matter (PM). These pollutants are major contributors to air pollution in Whistler and its surrounding regions.

The impact of tourism on Whistler's CAC emissions ranged from approximately 53% for VOCs to 65% for SO_x. The industry's share was greatest for PM and SO_x, which were primarily released from industrial point sources (e.g. major private excavation companies). The other CACs were emitted mainly from light-duty vehicles, which were used by tourists slightly more often than residents.

Table 4.3: Estimated common air contaminant emissions

		Quantity (tonnes)	%	Tourism's Direct Effect (%)
CO	Point	164.2	7.6%	
	Area	211.8	9.8%	
	Light-Duty Vehicles	1,771.1	81.8%	
	Heavy-Duty Vehicles	17.7	0.8%	
	Total	**2,164.7**	**100.0%**	**~54%**
NOx	Point	7.6	2.5%	
	Area	47.1	15.6%	
	Light-Duty Vehicles	211.2	69.7%	
	Heavy-Duty Vehicles	36.9	12.2%	
	Total	**302.8**	**100.0%**	**~60%**
SOx	Point	2.8	58.4%	
	Area	0.4	7.5%	
	Light-Duty Vehicles	1.0	21.0%	
	Heavy-Duty Vehicles	0.6	13.0%	
	Total	**4.8**	**100.0%**	**~65%**
VOC	Point	14.3	5.7%	
	Area	48.8	19.6%	
	Light-Duty Vehicles	183.2	73.7%	
	Heavy-Duty Vehicles	2.4	1.0%	
	Total	**248.7**	**100.0%**	**~53%**
PM	Point	52.3	60.4%	
	Area	28.5	33.0%	
	Light-Duty Vehicles	3.6	4.2%	
	Heavy-Duty Vehicles	2.1	2.4%	
	Total	**86.5**	**100.0%**	**~60%**

Water consumption and wastewater generation

Whistler's current water supply consists of both municipal and private sources, including surface water from three local creeks and groundwater from several wells. Approximately 5 million cubic metres of water were distributed from these sources in 2000 (Table 4.4). About 800,000 cubic metres of water were lost through leakage: water that exited the municipal network but was not used for any consumptive purposes. The remaining 4.3 million cubic metres were consumed for a wide range of uses at the destination. About 52% of the water consumed was attributable to the residential sector; 47% was linked to the commercial, industrial and institutional sectors; and 1% was used for maintaining parks.

Approximately 11% or 480,000 cubic metres of water were used for irrigating parks, golf courses and other landscaped areas in Whistler. The water used for irrigation was discharged directly to the environment. The rest of the water-consuming activities in Whistler generated 3.8 million cubic metres of wastewater. This was treated at the community's Wastewater Treatment Plant. The treated wastewater was discharged into a local river system, which has significant environmental and fisheries values and is used for other purposes downstream.

Approximately 60% of Whistler's internal water consumption and wastewater generation was attributable to tourism. The industry's impact was greatest in the commercial sector, where about 88% of the water consumed was allocated to tourism users. In comparison, only about 35% of water consumption in the residential sector was directly attributable to tourism activities.

Table 4.4: Estimated water consumption and wastewater generation

		Quantity (m^3)	%	Tourism's Direct Effect (%)
Total Water Distributed		**5,113,629**		**~60%**
Water Consumption	Residential	2,235,974	51.9%	~35%
	Commercial, Industrial, and Institutional	2,026,197	47.0%	~88%
	Parks	48,618	1.1%	~54%
	Total	**4,310,789**	**100.0%**	**~60%**
Leakage		802,840		
Irrigation/Other		484,728		
Wastewater Generation		**3,826,062**		**~60%**

Solid waste generation and disposal

Residents, visitors and businesses in Whistler generated about 28,000 tonnes of solid waste in 2000 (Table 4.5). Approximately 76% of this waste was disposed of in landfills, and the remaining 24% was diverted through various solid waste management practices. Recycling activities accounted for 59% of waste diversion; composting explained 28%; and reduction and reuse represented 13%. About 65% of the waste sent to landfills was generated in the commercial sector, while 15% was produced by residential sources and 20% came from construction and demolition activities.

Approximately 83% of the solid waste generated in Whistler was attributable to tourism. The industry accounted for 96% of the waste produced in the commercial sector, but only about 43% in the residential sector. Additionally, tourism contributed about 72% of the waste generated from construction and demolition activities.

Table 4.5: Estimated solid waste generation

		Quantity (tonnes)	%	Tourism's Direct Effect (%)
Total Solid Waste Generation		**28,343**		**~83%**
Solid Waste Disposal	Residential	3,233	15.0%	~43%
	Commercial, Industrial, and Institutional	14,008	65.0%	~96%
	Construction and Demolition	4,310	20.0%	~72%
	Total	**21,551**	**100.0%**	**~83%**
Solid Waste Diversion	Reduction and Reuse	883	13.0%	
	Recycling	4,007	59.0%	
	Composting	1,902	28.0%	
	Total	**6,791**	**100.0%**	**~83%**

Whistler has a unique waste stream that is different from typical communities because of its substantial tourism focus. As in many resort destinations, Whistler generates large quantities of organic food waste and non-recyclable paper products (e.g. paper towels, food wrappings) from its many restaurants, bars and other food service providers. According to a recent landfill composition study (RMOW & SLRD, 2004), these "compostables" constituted approximately one quarter of all waste sent to landfills (Table 4.6). Other organic materials, including paper products and clean wood waste, represented about one-third of Whistler's waste stream. The metal component (8%) of the waste stream consisted mainly of reusable and recyclable ferrous and non-ferrous scrap metal and some food tins. In addition, about 50% of the residual plastics; the majority of refundable beverage containers; and concrete, brick and asphalt could also be recycled rather than disposed of in landfills. In total, about 76% of the solid waste disposed at the landfill has the potential to be diverted to recycling programs. While a relatively comprehensive recycling system exists in Whistler, further opportunities clearly exist to divert recyclables and compostables from the landfill.

Table 4.6: Estimated solid waste stream

Material	Quantity (tonnes)	%
Compostables	5,358	25%
Paper Products	3,564	17%
Wood Waste (clean)	3,468	16%
Metal	1,692	8%
Plastic	1,662	8%
Carpet	1,087	5%
Concrete, Brick, Asphalt	684	3%
Textiles	676	3%
Beverage Containers	618	3%
Wood Waste (dirty)	510	2%
Fines	488	2%
Sporting Goods	434	2%
Electronics	422	2%
Household Hazardous Waste	245	1%
Bulky Goods	237	1%
Gypsum	150	1%
Glass	122	1%
Tires	83	<1%
Dairy Containers	52	<1%
Total	**21,551**	**100%**

Employee commuting

A base of approximately 8,800 permanent employees worked in Whistler in the year 2000. An additional 4,400 seasonal employees worked in Whistler during the winter season. Of these, about 1,850 permanent employees and 930 seasonal employees commuted to Whistler from outside the community's boundaries in the year 2000. Approximately two-thirds of these employees commuted from Squamish (60 km south of Whistler), while the remainder came from Pemberton (30 km north of Whistler). Employees also commuted from more distant communities. The share of commutes from these areas was negligible.

In total, commuters travelled about 18.9 million PKT by private (single-occupancy) automobile, 30.4 million PKT by car pool and 2.6 million PKT by bus (Table 4.7). Expressed in terms of VKT, commuting employees travelled approximately 18.9 million VKT by private automobile, 12.2 million VKT by car pool and 58,000 VKT by bus. Because of lower occupancy rates, single-occupancy vehicles travelled more kilometres than vehicles with more than one commuter. This occurred despite the fact that car pools accounted for a larger share of PKT.

Table 4.7: Estimated commuter travel and associated fuel consumption

Mode	Person Kilometres Travelled (PKT)		Vehicle Kilometres Travelled (VKT)		Fuel Consumption	
	Km	%	Km	%	Litres	%
Private Automobile	18,874,657	36.4%	18,874,657	60.7%	2,331,003	60.5%
Car Pool	30,386,124	58.6%	12,154,450	39.1%	1,501,063	39.0%
Bus	2,592,673	5.0%	57,615	0.2%	18,925	0.5%
TOTAL	**51,853,455**	**100.0%**	**31,086,722**	**100.0%**	**3,850,991**	**100.0%**

Overall, commuting private automobiles consumed about 2.3 million litres of gasoline, car-pooling vehicles used 1.5 million litres of gasoline and buses consumed 19,000 litres of diesel fuel. This translated into the consumption of an estimated 134,000 GJ of energy and the production of 9,400 tCO_2e of GHG in the year 2000 (Table 4.10 and Table 4.11). If employee commuting were included in Whistler's inventory of energy and GHG emissions, it would account for approximately 4.4% of Whistler's total energy consumption and about 6.6% of GHG emissions.

Visitor travel to/from Whistler

Approximately 2.1 million visitors travelled to Whistler in the year 2000. Of these, an estimated 61% were overnight commercial accommodation users, 29% were day visitors, 7% stayed with friends and relatives and 3% stayed in second homes. About 62% of all Whistler's visitors originated in British Columbia, with smaller proportions coming from other parts of Canada, Washington State, other regions of the United States and various international locations (Table 4.8).

Table 4.8: Visitation to Whistler

Region	Place of Origin	Number of Visitors	%
Canada	British Columbia	1,275,086	61.6%
	Alberta	32,669	1.6%
	Ontario	89,251	4.3%
	Quebec	22,089	1.1%
	Other Canada	26,256	1.3%
	Total	**1,445,351**	**69.9%**
USA	Washington	215,284	10.4%
	Oregon	23,126	1.1%
	California	74,230	3.6%
	Mountain	44,437	2.1%
	Midwest	33,389	1.6%
	Southern	27,659	1.3%
	Eastern Seaboard	59,217	2.9%
	Alaska/Hawaii	10,875	0.5%
	Total	**488,217**	**23.5%**
Europe	United Kingdom	40,312	1.9%
	Germany	9,573	0.5%
	Other Europe	16,977	0.8%
	Total	**66,862**	**3.2%**
Asia	Japan	28,152	1.4%
	Other Asia	6,425	0.3%
	Total	**34,577**	**1.7%**
Australia/New Zealand		**20,075**	**1.0%**
Other	Latin America	9,412	0.5%
	Other Overseas	5,236	0.3%
	Total	**14,648**	**0.8%**
TOTAL		**2,069,730**	**100.0%**

In getting to and from the resort, visitors travelled about 499 million PKT by automobile, 185 million PKT by bus and 4.5 billion PKT by airplane (Table 4.9). Expressed in terms of VKT, visitors travelled approximately 235 million VKT by automobile, 7.5 million VKT by bus and 16 million VKT by airplane. This resulted in an estimated 29 million litres of gasoline consumed by automobiles, 2.5 million litres of diesel fuel used by buses and 319 million litres of aviation gasoline used by airplanes.

Table 4.9: Estimated visitor travel and associated fuel consumption

Mode	Person Kilometres Travelled (PKT)		Vehicle Kilometres Travelled (VKT)		Fuel Consumption	
	Km	%	Km	%	Litres	%
Automobile	499,199,043	9.6%	235,471,247	90.9%	29,080,480	8.3%
Bus	184,635,263	3.5%	7,520,785	2.9%	2,470,367	0.7%
Airplane	4,522,371,687	86.9%	16,151,327	6.2%	319,311,744	91.0%
TOTAL	**5,206,205,993**	**100.0%**	**259,143,359**	**100.0%**	**350,862,591**	**100.0%**

Overall, visitor travel accounted for approximately 11.8 million GJ of energy and 859,000 tCO_2e in GHGs during 2000 (Table 4.10 and Table 4.11). If external travel energy consumption and GHGs (including employee commuting) were included in Whistler's total energy inventory, it would account for approximately 80% of the destination's overall energy consumption and about 86% of GHG emissions. The contribution from airplane travel alone would account for about 72% of total energy consumption and 78% of GHG emissions. Overall, tourism's direct effect would account for about 92% of energy consumption and 94% of GHG emissions if external travel were included in Whistler's total energy inventory.

Table 4.10: Estimated energy consumption (including external transportation)

Sector	Fuel	Quantity (GJ)	%	Tourism's Direct Effect (%)
All Internal Uses		**2,890,245**	**19.4%**	**~64%**
Employee Commuting	Gasoline	132,819	0.9%	
	Diesel	732	0.0%	
	Total	**133,551**	**0.9%**	**0%**
Visitor Travel to/from Whistler	Gasoline	1,007,929	6.8%	
	Diesel	95,554	0.6%	
	Aviation Gasoline	10,735,261	72.2%	
	Total	**11,838,744**	**79.7%**	**100%**
TOTAL		**14,862,541**	**100.0%**	**~92%**

Table 4.11: Estimated GHG emissions (including external transportation)

Sector	Fuel	Quantity (tCO2e)	%	Tourism's Direct Effect (%)
All Internal Uses		**131,625**	**13.2%**	**~65%**
Employee Commuting	Gasoline	9,313	0.9%	
	Diesel	52	0.0%	
	Total	**9,366**	**0.9%**	**0%**
Visitor Travel to/from Whistler	Gasoline	70,676	7.1%	
	Diesel	6,823	0.7%	
	Aviation Gasoline	781,448	78.1%	
	Total	**858,947**	**85.9%**	**100%**
TOTAL		**999,938**	**100.0%**	**~94%**

4.1.2 Evaluation of planning strategies

The preceding findings estimated existing levels of resource flows at Whistler in 2000. However, the model's utility as a planning tool becomes more apparent when used to assess the relative effect of Whistler's proposed dematerialization planning strategies. This section illustrates the model's ability to estimate the future effects of Whistler's nine primary planning strategies. In this context, the estimated effects of implementing all nine of Whistler's "Dematerialization" strategies by 2020 are compared with the impacts of continuing with its current "Business-as-Usual" path. A twenty-year forecast horizon was selected to give a reasonable time frame to implement all nine strategies, especially those requiring turnover of vehicle and building stocks.

Internal destination resource flows

Under the current Business-as-Usual (BAU) scenario, the model estimates that approximately 3.8 million GJ of energy will be consumed in Whistler in the year 2020 (Table 4.12). This represents a 31% increase over year 2000 estimates. Under the same assumptions, Whistler's GHGs will increase by about 35% to 178,000 tCO_2e in 2020. The sectoral breakdown of energy use and GHGs in 2020 will be about the same as in 2000. Under the BAU scenario, emissions of common air contaminants will increase by approximately 79% for CO, 44% for NO_x, 21% for SO_x, 65% for VOCs and 4.5% for PM. In terms of water flows, the model estimates that approximately 5.1 million cubic metres of water will be consumed and 4.7 million cubic metres of wastewater will be generated in Whistler in 2020. These figures represent 18% and 22% increases, respectively, over year 2000 estimates. Finally, the model estimates that 32,000 tonnes of solid waste will be disposed in the BAU scenario in 2020. This is a 48% increase from year 2000 estimates.

Table 4.12: Projected resource flows

Dematerialization Indicators		Year 2000	Year 2020: Business-as-Usual Scenario	Year 2020: Dematerialization Scenario	% Change from BAU
Energy Consumption		2,890,245 GJ	3,778,653 GJ	3,320,408 GJ	-12.1%
GHG Emissions		131,625 tCO2e	177,620 tCO2e	141,111 tCO2e	-20.6%
CAC Emissions	CO	2,164.7 t	3,863.2 t	2,329.2 t	-39.7%
	NO_x	302.8 t	436.5 t	345.0 t	-21.0%
	SO_x	4.8 t	5.8 t	5.6 t	-3.4%
	VOC	248.7 t	409.4 t	267.9 t	-34.6%
	PM	86.5 t	90.4 t	89.8 t	-0.7%
Water Consumption		4,310,789 m^3	5,094,349 m^3	4,152,618 m^3	-18.5%
Wastewater Generation		3,826,062 m^3	4,677,311 m^3	3,804,342 m^3	-18.7%
Solid Waste Disposal		21,551 t	31,990 t	21,036 t	-34.2%

In the Dematerialization scenario, approximately 3.3 million GJ of energy will be consumed in Whistler in 2020. This scenario represents a reduction of 12% or 0.5 million GJ over the BAU scenario. In the Dematerialization scenario, Whistler's GHGs will be approximately 141,000 tCO_2e in 2020, representing a reduction of 21% or 37,000 tCO_2e over the BAU scenario. Emissions of CACs in the Dematerialization scenario are also estimated to be less in 2020 than in the BAU scenario. Specifically, emissions are expected to be lower by 40% for CO, 21% for NO_x, 3.4% for SO_x, 35% for VOCs and 0.7% for PM. In the Dematerialization scenario, about 4.2 million cubic metres of water will be consumed in Whistler in 2020. This represents a reduction of about 18% or 900,000 cubic metres over the BAU scenario. A similar-sized reduction is also expected for wastewater generation. Specifically, about 3.8 million cubic metres of wastewater will be generated in Whistler in 2020 in the Dematerialization scenario. Finally, approximately 21,000 tonnes of solid waste will be disposed of in landfills in 2020 under the Dematerialization scenario, representing a reduction of 34% or 11,000 tonnes over the BAU scenario.

Employee commuting

Approximately 2,900 permanent employees and 1,300 seasonal employees are expected to commute to Whistler from outside the community's boundaries in the year 2020. The model estimates that private (single-occupancy) automobiles will consume about 2.0 million litres of gasoline fuel, car-pooling vehicles will use 0.8 million litres of gasoline and buses will consume 0.4 million litres of diesel fuel. As a result, employee commuting will account for approximately 111,000 GJ of energy and 7,800 tCO_2e of GHG in the year 2020 (Table 4.13). There are two main reasons that these energy flows and emissions are projected to be lower than in 2000. First, a substantial modal shift towards bus commuting is assumed to take place once planned commuter bus services to Pemberton and Squamish become available. Second, the Resort Municipality of Whistler is planning to significantly increase the available capacity of restricted employee housing in Whistler. While this initiative will lead to higher energy consumption within the community, the model predicts that the amount of energy consumption and GHGs associated with employee commuting will be reduced. More employees will reside within Whistler's municipal boundaries thereby substantially reducing negative commuter effects.

Table 4.13: Projected energy consumption and GHG emissions (including external transportation)

Sector	Year 2000		Year 2020: Business-as-Usual Scenario		Year 2020: Dematerialization Scenario	
	Energy Consumption (GJ)	GHG Emissions (tCO2e)	Energy Consumption (GJ)	GHG Emissions (tCO2e)	Energy Consumption (GJ)	GHG Emissions (tCO2e)
All Internal Uses	2,890,245	131,625	3,778,653	177,620	3,320,408	145,301
Employee Commuting	133,551	9,366	110,736	7,782	110,736	7,782
Visitor Travel to/from Whistler	11,838,744	858,947	17,693,607	1,283,399	17,693,607	1,283,399
TOTAL	**14,862,541**	**999,938**	**21,582,995**	**1,468,801**	**21,124,751**	**1,436,482**
					2.1% decrease from BAU	2.2% decrease from BAU

Visitor travel to/from Whistler

Approximately 3.4 million visitors are expected to travel to Whistler in the year 2020. In getting visitors to and from the resort, the model estimates that automobiles will consume approximately 47 million litres of gasoline fuel, buses will use 4 million litres of diesel fuel and airplanes will consume 473 million litres of aviation gasoline. As a result, visitor travel will account for approximately 18 million GJ of energy and 1.3 million tCO_2e of GHGs in the year 2020.

The model anticipates that visitor travel to and from the resort will continue to account for the vast share of Whistler's total energy consumption and GHG emissions. As a consequence, the magnitude of energy consumed by visitor travel will dwarf the energy reductions realized in the Dematerialization scenario. By including visitor travel (and employee commuting) in the overall energy profile of Whistler, the energy and GHG reductions resulting from the

Dematerialization scenario would only amount to about a 2% decrease from the Business-as-Usual scenario.

4.1.3 Accounting for uncertainty

The projections developed in this research represent one possible view of how the future could look in Whistler. The accuracy of these projections rests on the validity of various assumptions related to both internal policy choices (e.g. future land-use and development decisions) as well as external forces (e.g. changing market demands or increasing energy prices). The following examples illustrate the model's sensitivity:

- If the local government decides to increase the available capacity of market housing by 10%, then Whistler's internal water consumption in 2020 will be about 4% higher than projected.
- If the number of visitors staying in paid accommodations in 2020 is 10% lower than anticipated, then Whistler's internal energy consumption will be about 2% lower than projected (or about 7% lower if external visitor travel is included).
- If the average fuel efficiency of private automobiles in 2020 is 20% lower than expected, then internal energy consumption will be about 3% lower than projected (or about 7% lower if external visitor travel is included).

To account for such uncertainties, practical applications of the model should include a thorough sensitivity analysis to test various assumptions about future events.

4.2 Assessment of Tourist Perspectives

This section examines tourist preferences for and acceptance of various dematerialization planning alternatives. It begins by describing tourist opinions about basic characteristics of destination resorts related to developed land, recreational opportunities, local transportation and environmental initiatives. It then presents the findings from the destination planning choice experiment described in Section 3.2.

4.2.1 Visitor opinions on resort attributes

Survey respondents were asked their opinions about basic characteristics of mountain resorts related to developed land, recreational opportunities, local transportation and environmental initiatives.[45] While the responses to these basic opinion questions provided valuable information about visitor preferences by themselves, their main purpose was to familiarize the respondents with the attributes and levels that were included in the discrete choice experiment. The findings are summarized in the following sections.

Development

Form of development

The most preferred form of resort development was multi-centred (44%), followed by compact (31%) and dispersed (26%) (Table 4.14). This suggests that most summer visitors to Whistler preferred a form of development that is moderately compact and composed of moderate density housing. One reason that a highly compact and dense form of development was less preferred might

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[45] Respondents were asked to answer these questions based on their preferences for a possible mountain resort that has a maximum capacity of 50,000 people including visitors, residents and second home owners (i.e. about the same size as Whistler).

have been a perception that the compactness would lead to reduced privacy and more crowding and noise. On the other extreme, a spread out and low-density form of development may have been less desired because it appropriates more land, makes it more difficult to travel by foot or bike and is associated with aesthetically unappealing sprawl.

Local workforce

Just under half of the respondents (44%) indicated they preferred 50% of the workforce living in the resort (Table 4.14).[46] About a quarter of the respondents thought that 25% or less of the workforce should live within the resort boundary. Another 21% of them stated that the ideal scenario was 75% of the workforce living in the resort. The least desirable situation was 100% of the workforce living within the resort boundary. These findings suggest that visitors seek at least some degree of separation from resort employees.

Table 4.14: Visitor preferences for development attributes

	Count	%
Form of Development		
Compact	250	30.7%
Multi-centered	355	43.6%
Dispersed	210	25.8%
Total	**815**	**100%**
Percent of Workforce Living within Resort Boundaries		
25% or less	210	25.4%
50%	361	43.7%
75%	175	21.2%
100%	80	9.7%
Total	**826**	**100%**

[46] Respondents were told that employees who do not live in the resort typically live in neighbouring towns and commute to work every day.

Recreational opportunities

Cultural and educational activities

Over half of the respondents (57%) indicated a preference for extensive cultural and educational opportunities, while the remainder (43%) stated a preference for limited opportunities (Table 4.15).[47] Some visitors may not see the need for more than one or two educational and cultural activities at a mountain resort, especially if this results in additional development.

Nature trail system

Approximately 60% of respondents indicated they preferred an extensive nature trail system (Table 4.15).[48] The fact that 40% of respondents preferred a moderate trail system suggests that a sizable number of visitors would prefer a system composed of just a few trails of different degrees of difficulty where encounters with others may be common.

Motorized sports

Respondents were divided on the issue of whether motorized sports such as ATV or Hummer tours should be available in or near the resort (Table 4.15). Just over half of them (54%) stated a preference for no motorized sports, indicating an awareness of the environmental impacts of motorized sports or an annoyance with such activities for aesthetic or recreational reasons. Many respondents (46%) stated that they would like motorized sports available, even

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[47] Examples of cultural and education activities given included museums, historic sites, interpretive sites and demonstration projects. Limited was defined as "only a few cultural and educational activities available" and extensive was defined as "many cultural and educational activities available."

[48] Nature trails were defined as "gravel or dirt trails for hiking and mountain biking through forested areas, grasslands and other undeveloped areas in the resort." Moderate was defined as "a few trails of different degrees of difficulty, encounters with others common" and extensive was defined as "many trails of different degrees of difficulty, encounters with other people uncommon."

though only 8% indicated that they actually participated in a motorized tour or activity during their trip to Whistler. Many visitors may wish to have the option to take part in a motorized activity even though they may not participate every visit. As well, non-users may perceive value in a resort having motorized sports available for other visitors.

Golf courses

Approximately 80% of respondents stated they preferred at least one golf course in the resort (Table 4.15). This finding is somewhat surprising, given that only 10% of the respondents indicated that they golfed during their trip to Whistler. This suggests that many visitors may want the option to golf at a resort even though they may not do so every visit. Non-golfers may also perceive value in having golf courses available for other visitors. However, the fact that nearly one-fifth of the respondents preferred no golf courses indicates that a sizable group of visitors have limited affinity to such development in mountain resort regions.

Table 4.15: Visitor preferences for recreational attributes

	Count	%
Opportunities for Cultural and Educational Activities		
Limited	355	43.2%
Extensive	467	56.8%
Total	**822**	**100%**
Extent of Nature Trail System		
Moderate	327	39.7%
Extensive	497	60.3%
Total	**824**	**100%**
Availability of Motorized Sports		
No	449	54.4%
Yes	377	45.6%
Total	**826**	**100%**
Number of Golf Courses		
0	158	19.2%
1	229	27.8%
2	278	33.7%
3 or more	160	19.4%
Total	**825**	**100%**

Transportation

Automobile accessibility

The majority of respondents (72%) preferred that private automobiles not be allowed in the main village area, but be permitted in all other areas of the resort (like the current conditions in Whistler) (Table 4.16). This suggests that most summer visitors prefer some restrictions to automobile accessibility, particularly within the main village area. In contrast, about a quarter of respondents (22%) preferred that private automobiles be allowed throughout the entire resort, including the main village. This indicates that some visitors prefer unlimited automobile access, even if it leads to more congestion and pollution. On the other extreme, 6% of respondents preferred that private automobiles not be allowed anywhere in the resort boundaries (in this case, parking would be available approximately 10 km from the village and visitors would take free shuttles to village or accommodations). While this scenario is clearly the most aggressive from a dematerialization perspective, it is the least desirable amongst tourists.

Parking fees

About 58% of the day visitors who responded to the survey indicated that $5/day would be an appropriate fee for day parking (Table 4.16).[49] An additional 14% indicated that $10/day would be appropriate. These finding suggest that most day visitors are willing to pay for parking. Their level of acceptance for these fees declines as the fee level increases. Approximately 28% of the day visitors who responded to the survey indicated that day parking should be free.

Approximately 50% of the overnight visitors who responded to the survey indicated that overnight parking should be free. An additional 48% stated that $15/night would be an appropriate fee for overnight parking. Less than 2% of them indicated that $30/day would be an appropriate level. These findings suggest that about half of the overnight visitors are willing to pay for overnight parking. The acceptability of the fee declines very rapidly if the fee is greater than $15/night.

Bus service

About 54% of respondents preferred extensive local bus service (many routes with frequent service) (Table 4.16). Approximately 44% of them preferred limited service (a few key routes serviced with moderate frequency). Only 2% of respondents preferred no local bus service. These findings suggest a high level of visitor support for local bus service.

[49] Respondents were told that revenues from parking fees would go towards improving transportation infrastructure and providing alternative modes of transportation in the resort (e.g. local transit).

Bus fare

The majority of respondents (71%) indicated that $1.50/trip was an appropriate amount to pay for local bus service (Table 4.16).[50] Only 7% of them indicated that $3.00/trip was an appropriate amount. These findings suggest that most summer visitors are willing to pay for local bus service; however, not many are willing to pay more than $1.50/trip. About 22% of respondents indicated that local bus service should be free.

Table 4.16: Visitor preferences for transportation attributes

	Count	%
Level of Automobile Accessibility		
Allowed throughout the resort	181	22.0%
Not allowed in main village area	593	72.1%
Not allowed anywhere in the resort	49	6.0%
Total	**823**	**100%**
Level of Parking Fees		
Day Visitors		
Free	48	27.9%
$5/day	100	58.1%
$10/day	24	14.0%
Total	**172**	**100%**
Overnight Visitors		
Free	325	50.0%
$15/night	315	48.5%
$30/night	10	1.5%
Total	**650**	**100%**
Extent of Bus Service		
No service	15	1.8%
Limited service	358	43.9%
Extensive service	443	54.3%
Total	**816**	**100%**
Level of Bus Fare		
Free	179	21.9%
$1.50/trip	580	70.9%
$3.00/trip	59	7.2%
Total	**818**	**100%**

[50] Respondents were told that revenues from bus fares would go towards improving the quality of bus service in the community.

Environmental initiatives

Protected land

Almost all respondents indicated a preference for at least some protected areas within the resort (Table 4.17).[51] About one-fifth of the respondents felt that 5% of the land should be protected, while a much greater proportion of them (78%) indicated that protected areas should constitute 20% or more of the land.

Renewable energy

Approximately 35% of respondents felt that 40% of energy used in the resort should be generated with renewable sources, such as wind, hydroelectric and geothermal (Table 4.17).[52] Only 2% of them thought that a lower proportion was adequate. The remaining 63% of respondents indicated that a greater percentage of energy should be generated with renewable sources. These findings suggest there is relatively strong visitor support for actions to increase the use of renewable energy sources in resort destinations.

Waste recycling

Approximately one-fifth of respondents indicated that 25% of the waste generated in the resort should be recycled or composted rather than sent to landfills (Table 4.17).[53] Less than 1% of respondents thought that a lower rate

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[51] Protected land was defined as land that would be set aside to preserve wildlife habitat and ecologically valuable areas (e.g. wetlands, habitat for rare species) and would not be available for future development or recreation. Respondents were informed that currently about 5% of the land in Whistler is protected.

[52] Respondents were told that renewable energy supplies emit less pollution than non-renewable sources such as fossil fuels. They were also informed that visitors might be charged an environmental fee to help cover the costs of converting to renewable energy sources. Respondents were also told that currently about 40% of the energy used in Whistler is generated from renewable sources.

[53] Respondents were told that visitors might be charged an environmental fee to help cover the costs of recycling and composting programs. They were also informed that currently about 25% of solid waste generated in Whistler is recycled or composted.

was adequate, while about 80% of them felt that a greater percentage of waste should be recycled or composted. These findings suggest there is quite strong visitor support for actions to improve recycling and composting programs in resort destinations.

Environmental fee

Only 12% of respondents were not willing to pay an environmental fee to cover the costs of environmental initiatives in the resort community (Table 4.17).[54] Just under half of them (47%) indicated their willingness to pay a 2% tax, while another quarter of the respondents (26%) expressed their preference for a 4% tax. The remaining 14% stated they were willing to pay a tax of 6% or more. These findings suggest there is substantial visitor support for environmental initiatives, even to the point that most visitors would pay to see these initiatives implemented.

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[54] Respondents were informed that the environmental fee would be a tax added to accommodation, restaurant and activity bills and that revenues generated from this tax would not be used for any purpose other than local environmental initiatives.

Table 4.17: Visitor preferences for environmental initiative attributes

	Count	%
Percent of Land Protected		
0%	2	0.2%
5%	179	21.9%
20%	317	38.7%
35% or more	321	39.2%
Total	**819**	**100%**
Percent of Energy Generated with Renewable Sources		
20% or less	17	2.1%
40%	284	34.6%
60%	288	35.1%
80% or more	231	28.2%
Total	**820**	**100%**
Percent of Solid Waste Recycled or Composted		
0%	4	0.5%
25%	152	18.5%
50%	331	40.3%
75% or more	334	40.7%
Total	**821**	**100%**
Level of Environmental Fee		
0%	100	12.3%
2%	384	47.1%
4%	213	26.1%
6% or more	118	14.5%
Total	**815**	**100%**

4.2.2 Modelling visitor preferences for planning options

While the responses to the basic opinion questions provided valuable information about visitor preferences, a major reason for including them in the survey was to familiarize the respondents with the attributes and levels that were included in the destination planning choice experiment. The choice experiment was more sophisticated and holistic than the opinion questions. It asked respondents to evaluate multiple components of planning alternatives simultaneously rather than one at a time. The choice experiment findings are summarized in the following sections.

Multinomial logit regression was used to analyze the responses from the destination planning choice experiment. Table 4.18 presents the estimation results for the preference choice models for overnight and day visitors. These were used to analyze visitor preferences for land use, transportation, recreation and other environmental initiatives intended to promote dematerialization.

Table 4.18: Summary of preference choice models

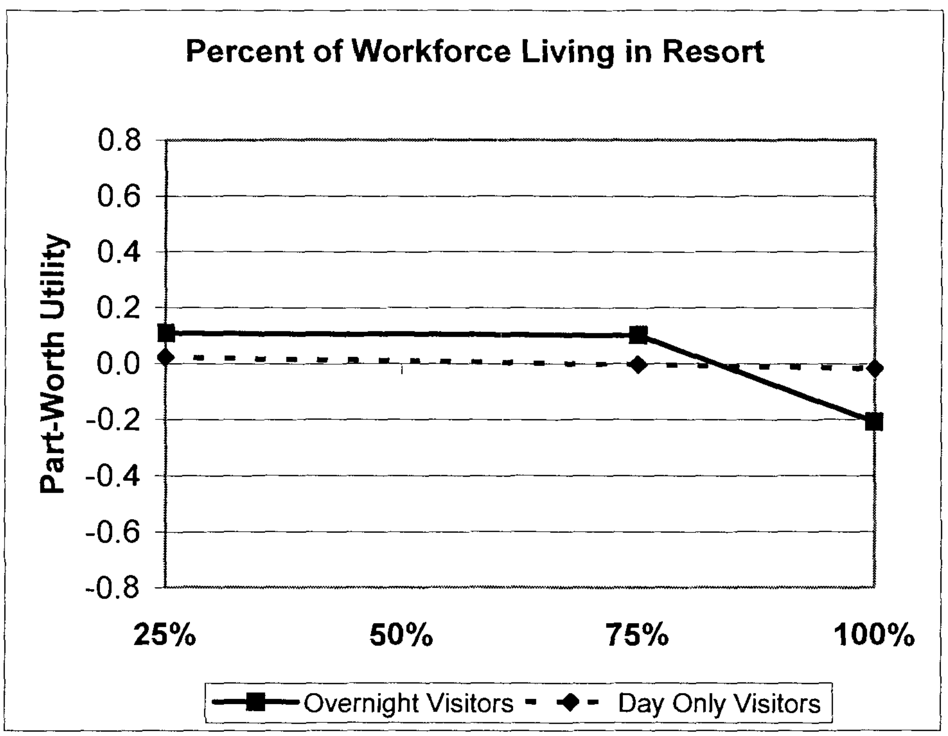
		Model 1: Overnight Visitors		Model 2: Day Visitors	
Attribute	Term	Coefficient	Standard Error	Coefficient	Standard Error
Form of development	Compact	-0.052		-0.062	
	Nodal	0.063	0.054	-0.103	0.108
	Dispersed	-0.011	0.053	0.165	0.108
Percent of workforce living in resort	Linear	-0.056 ***	0.015	-0.005	0.025
	Quadratic	-0.017 **	0.007	N.I.	
Availability of cultural and educational opportunities	Limited	-0.052		-0.116	
	Extensive	0.052	0.040	0.116	0.076
Extent of trail system	Moderate	-0.041		0.022	
	Extensive	0.041	0.039	-0.022	0.075
Availability of motorized sports	Not available	-0.031		0.020	
	Available at base of hill	0.031	0.041	-0.020	0.078
Availability of golf courses	Linear	0.010	0.047	-0.169 *	0.094
Automobile accessibility	Allowed everywhere	-0.005		-0.139	
	Not allowed in village	0.152 ***	0.053	0.102	0.108
	Not allowed anywhere	-0.147 ***	0.056	0.037	0.107
Parking fee	Linear	-0.256 ***	0.048	-0.178 *	0.096
	Quadratic	-0.071 ***	0.027	N.I.	
Bus availability	Not available	-0.453		-0.343	
	Limited accessibility	0.174 ***	0.057	0.115	0.107
	Extensive accessibility	0.279 ***	0.054	0.228 **	0.106
Bus fare	Linear	-0.100 **	0.048	0.017	0.092
	Quadratic	-0.074 ***	0.026	N.I.	
Amount of protected area	Linear	0.185 ***	0.048	0.199 **	0.090
Percent renewable energy	Linear	0.142 ***	0.047	0.198 **	0.090
Percent waste recycled	Linear	0.378 ***	0.045	0.597 ***	0.089
	Quadratic	-0.068 ***	0.025	-0.102 **	0.047
Environmental fee	Linear	0.075 *	0.044	-0.049	0.083
	Quadratic	-0.062 **	0.025	N.I.	
Intercept		-0.497 ***	0.054	-0.232 **	0.104
Bus availability x Previous bus use	Limited x Previous use	0.249 *	0.149	N.I.	
Availability of golf courses x Previous course use	Linear x Previous use	N.I.		0.956	0.787
	Quadratic x Previous use	N.I.		-0.671 **	0.330
Observations		1835		491	
Log Likelihood		-1860.0		-492.9	
Rho-Square		0.077		0.086	

N.I. = Not Included
*P-value<0.10
**P-value<0.05
***P-value<0.01

Development and workforce

Both overnight and day visitors were indifferent to the form of development in the resort (i.e. compact, multi-centred or dispersed). However, the preferences of overnight visitors were significantly affected by the percent of the workforce living in the host community (Figure 4.1). While there was little variation in preference between the 25% and 75% levels, overnight tourists were generally not in favour of more than 75% of the workforce living in a resort. They preferred at least a minimal degree of separation from resort employees even if it resulted in more employee commuting, air pollution and congestion on the roads. Day visitors did not express a need for this form of separation.

Figure 4.1: Relative preferences for local workforce



Recreational opportunities

Both overnight and day visitors were more likely to prefer extensive to limited cultural and educational opportunities being available in the destination. Evidently, most visitors would benefit from a variety of low-impact cultural and educational activities in destinations. However, this attribute was not a statistically significant factor in influencing visitor preferences for resort destinations.

Neither overnight nor day visitors had a strong preference concerning the extensiveness of the nature trail system. This includes their perspectives concerning options such as gravel or dirt trails for hiking and mountain biking through forested areas, grasslands and other undeveloped areas in the resort. Although visitors were impartial to the level of trail extensiveness, it is possible that the two attribute levels tested (extensive/moderate) were not distinct enough to elicit a substantial difference in preference. A level less than "moderate" was not tested in this study.

Both overnight and day visitors were indifferent to the availability of motorized sports (e.g. ATV or Hummer tours). While some tourist groups preferred that motorized sports be available, others did not want these activities to be permitted within resort boundaries.

Overall, day visitors tended to favour fewer golf courses at the resort, whereas overnight tourists were indifferent to the number of courses. However, some market segments preferred more golf courses while others viewed such facilities in a negative light. These individual differences are explored in more detail later.

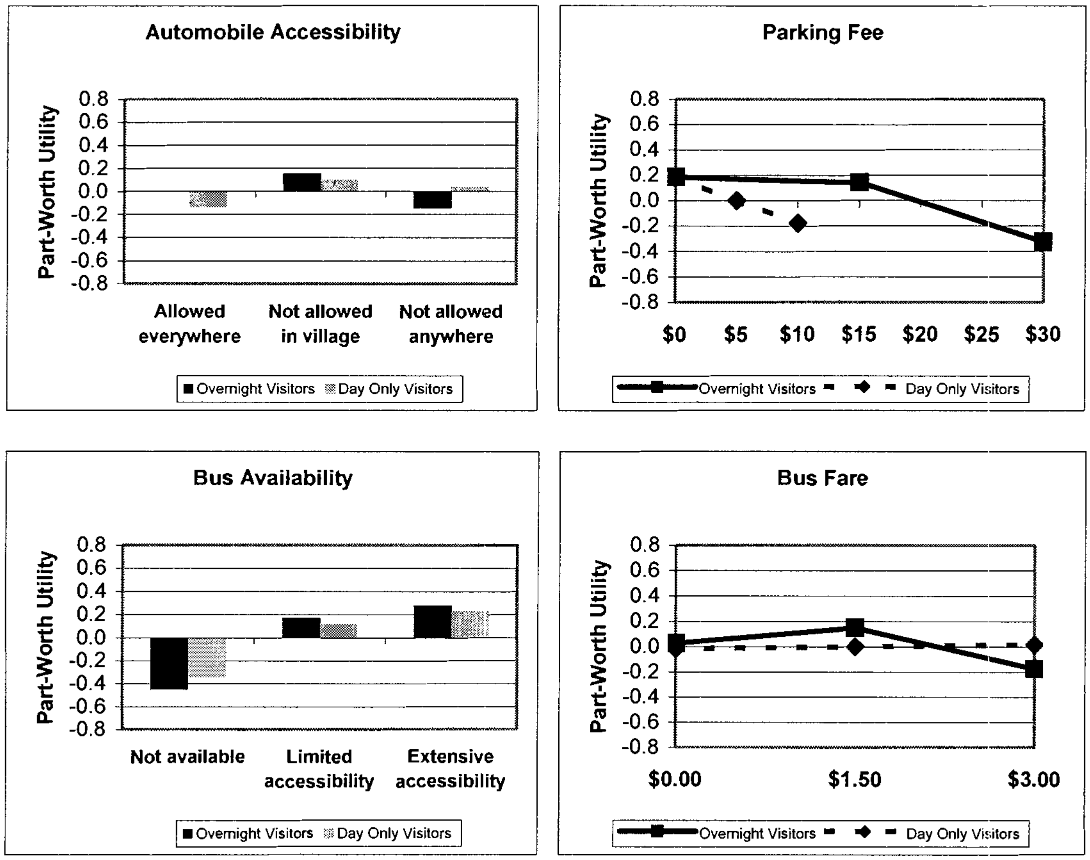
Transportation

Tourists preferred some restrictions on automobile use, although they did not want complete vehicle restrictions in the resort community (Figure 4.2). In particular, overnight visitors tended to prefer resorts where private automobiles were not allowed in the main village area, but were permitted in all other areas of the resort. They were far less inclined to prefer resorts where private vehicles were not allowed anywhere within resort boundaries. In this scenario, visitors would be obliged to take free shuttles from a satellite parking lot located approximately 10 kilometres from the main village. There were no significant differences observed in the preferences of day visitors with respect to varying automobile accessibility levels.

Tourists tended to prefer resorts with no or low parking fees to those with high charges (Figure 4.2). Their preference for specific resorts significantly decreased as parking fees exceeded $5/day for day visitors and $15/night for overnight visitors. However, respondents were essentially impartial between free parking and fees of $5/day for day visitors and $15/night for overnight tourists. These findings suggest that visitors may actually tolerate low parking fees. However, their acceptance levels declined rapidly as the fees escalated.

The availability of local bus service was one of the more important determinants of visitor preferences for resort destinations. Both overnight and day visitors significantly preferred limited or extensive service to none at all (Figure 4.2). These results suggest there is a high level of support for local bus service in resort destinations. With respect to fare levels, overnight visitors were more likely to prefer a bus fare of $1.50 to either $3.00 or no fare (Figure 4.2). Conversely, day visitors were completely indifferent to bus fare levels. These results suggest that visitors are willing to pay a reasonable fare to ensure that bus service is available.

Figure 4.2: Relative preferences for transportation attributes



Environmental Initiatives

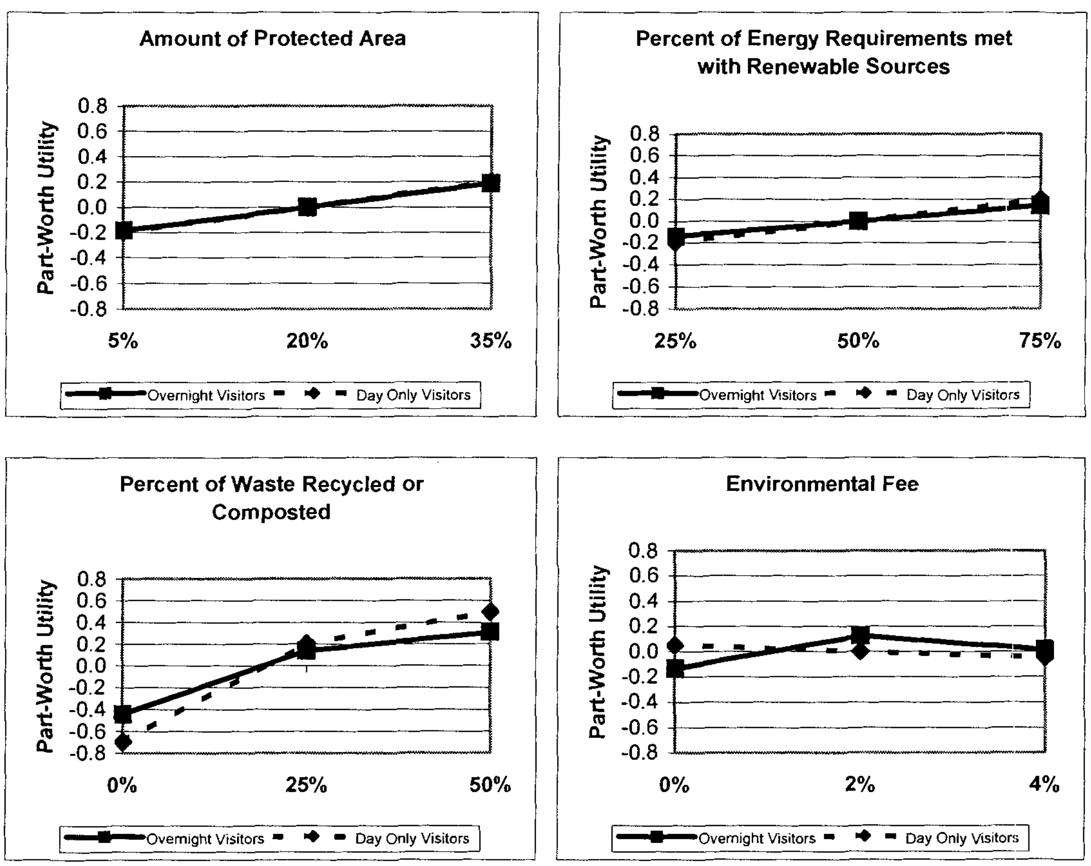
Both overnight and day visitors tended to prefer resorts with higher percentages of protected landscape (Figure 4.3). This land would be set aside to preserve wildlife habitat and ecologically valuable areas, such as wetlands and habitat for rare species. No future development and no recreation access would be permitted in protected areas.

Overnight and day visitors also preferred that a large percentage of a resort's energy requirements be met with renewable sources, such as wind, hydroelectric and geothermal (Figure 4.3). Evidently, tourists benefit from knowing that a resort uses renewable sources to meet its energy needs. These energy sources emit less pollution than non-renewable sources such as fossil fuels.

Overnight and day tourists also preferred resorts that recycled and composted higher percentages of waste (Figure 4.3). The level of waste recycling/composting was one of the more important determinants of overall resort preference.

Respondents were willing to tolerate an environmental fee added to their accommodation, restaurant and activity bills (Figure 4.3). The revenues generated from this tax would not be used for any purpose other than local environmental initiatives. Both overnight and day visitors were willing to accept an environmental fee of 2% and even 4% compared to no fee.

Figure 4.3: Relative preferences for environmental initiative attributes



Individual characteristics

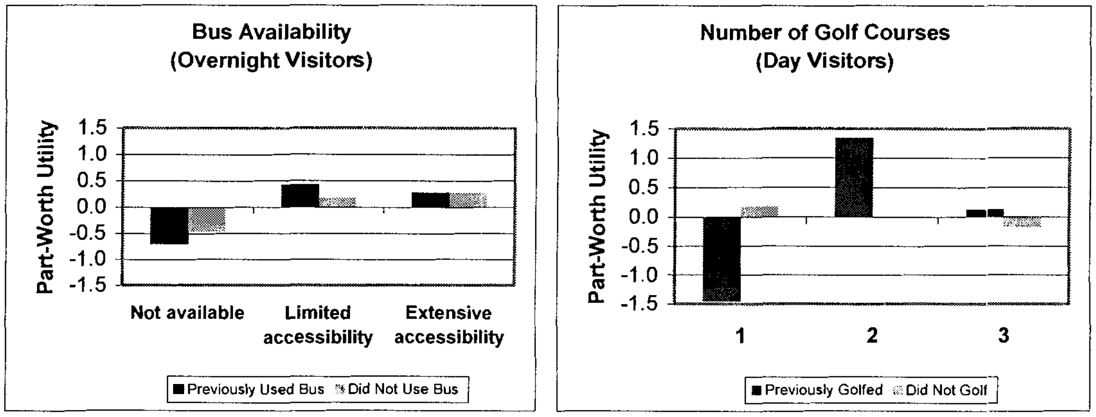
To account for varying preferences among tourist segments, the choice models examined how the individual characteristics of respondents influenced tourist destination preferences. The findings indicated that visitors' previous trip behaviour significantly affected their preferences for certain destination characteristics. This result is consistent with previous research (Nerhagen, 2003; Woodside & Dubelaar, 2002).

It is to be expected that visitors who golfed during their last trip to Whistler had a stronger preference for more golf courses than visitors who did not pursue this activity. For golfers, the number of courses was one of the most important factors influencing their preference for a resort. However, their preference declined if more than two courses were available. This indicates that even golfers did not prefer resorts with more than two courses. This is especially true for day visitors, who likely do not require as much course variety as overnight visitors (Figure 4.4).

The analysis of individual characteristics also indicated that overnight visitors who used the local bus during their trip had a stronger preference for bus service than visitors who did not use this mode of travel (Figure 4.4). This relationship was not significant for day visitors, who were less inclined to use the bus than overnight visitors.

Several other individual characteristics were tested but were not retained in the analysis because they were not significant at the 90% confidence level. These included socio-demographic variables (e.g. gender, age, income, education), situational variables (e.g. place of residence), prior trip characteristics (e.g. travel party size, purpose of trip) and tourist destination motivations.

Figure 4.4: Effects of previous use on relative preferences



Visitor preferences for entire planning scenarios

A key benefit of conducting a discrete choice experiment is that entire planning scenarios can be evaluated from a visitor perspective. By selecting specific combinations of attribute levels, it is possible to evaluate various planning scenarios in terms of their acceptance by tourists. The study compared preferences for a "business-as-usual" (BAU) scenario based on Whistler's current conditions to a "dematerialization" option, in which all attributes were set to their most efficient levels. Overall, summer visitors slightly preferred the dematerialization planning scenario to the BAU scenario (Table 4.19). The BAU scenario was also compared to a "resource intensive" scenario, in which all attributes were set to their least efficient levels. Overall, the resource intensive scenario was far less favoured than the BAU scenario (Table 4.20).

Some significant differences in preferences existed between overnight and day visitors. Whereas day tourists were much more likely to prefer the dematerialization scenario to the BAU scenario, overnight visitors were more inclined to prefer the BAU scenario. Day visitors, whose trips have shorter durations, may not be as inconvenienced by potential adverse impacts associated with the dematerialization scenario (e.g. increased parking fees, more restricted automobile access, fewer golf courses, lower cumulative environmental fee, etc.) Also, day visitors may favour environmentally sensitive planning strategies because they are often repeat visitors from British Columbia, who have a vested interest in protecting the natural environment of Whistler.

There were also significant differences in preferences between various tourist subgroups. Visitors who participated in motorized sports during their last trip to Whistler were less likely to prefer the dematerialization scenario than those who did not participate because motorized sports were not available in the scenario. Similarly, visitors who golfed during their trip to Whistler were less inclined to prefer the dematerialization scenario than non-golfers because fewer golf courses were available in the scenario.

Table 4.19: Preferences for dematerialization scenario

	Overnight Visitors	Day Visitors	Total
Prefer Dematerialization Scenario	25.3%	60.4%	**36.0%**
Prefer BAU	40.9%	15.7%	**33.3%**
Indifferent	33.8%	23.8%	**30.7%**
Total	**100.0%**	**100.0%**	**100.0%**

Table 4.20: Preferences for resource intensive scenario

	Overnight Visitors	Day Visitors	Total
Prefer Resource Intensive Scenario	7.4%	9.3%	**8.0%**
Prefer BAU	50.7%	35.5%	**46.1%**
Indifferent	41.9%	55.2%	**45.9%**
Total	**100.0%**	**100.0%**	**100.0%**

Comparison with basic opinion questions

In many ways, the choice experiment results were consistent with the findings from the basic opinion questions that preceded the DCE. Both concluded that visitors were: willing to accept an environment fee charged to their accommodation, restaurant and activity bills; heavily in favour of protecting greenspace, recycling waste and using renewable energy sources in the community; willing to pay for public transit and to a limited extent for parking; and supportive of automobile restrictions within the main village area.

However, the responses from the two survey formats differed in some important ways. In the opinion questions, most respondents (70%) stated they did not want more than half of the workforce living in the resort. In contrast, the results from the choice experiment suggested little variation in visitor preferences between the 25% and 75% levels. When respondents were forced to consider all other resort attributes simultaneously, they were not as likely to oppose a resort with a high proportion of its workforce living within its boundaries.

Similarly, the two sets of responses differed with respect to the form of development and the availability of recreational activities in the resort. In the opinion questions, respondents were more inclined to prefer: multi-centred forms of development; extensive cultural and educational opportunities; extensive nature trail systems; and one or more golf courses in the resort. However, the results from the choice experiment suggested that tourists were indifferent to these features. Evidently, fewer attributes mattered to tourists when respondents were asked to evaluate multiple components of planning alternatives simultaneously rather than one at a time. By allowing respondents to evaluate and trade off several attributes simultaneously, the choice experiment provided a more realistic way to determine visitor preferences for destination planning options.

4.2.3 Modelling visitor acceptability of planning options

Table 4.21 gives the estimation results for the acceptability choice models for overnight and day visitors. These were used to analyze visitor acceptance of the same destination planning attributes considered above.

Table 4.21: Acceptability choice models

Attribute	Term	Model 1: Overnight Visitors		Model 2: Day Visitors	
		Coefficient	Standard Error	Coefficient	Standard Error
Form of development	Compact	-0.149		-0.047	
	Nodal	0.137 **	0.054	0.145	0.106
	Dispersed	0.012	0.052	-0.098	0.106
Percent of workforce living in resort	Linear	-0.041 ***	0.014	-0.005	0.024
	Quadratic	-0.016 **	0.007	N.I.	
Availability of cultural and educational opportunities	Limited	-0.007		-0.022	
	Extensive	0.007	0.040	0.022	0.076
Extent of trail system	Moderate	-0.019		0.024	
	Extensive	0.019	0.038	-0.024	0.074
Availability of motorized sports	Not available	-0.015		-0.010	
	Available at base of hill	0.015	0.040	0.010	0.077
Availability of golf courses	Linear	-0.048	0.049	-0.061	0.090
Automobile accessibility	Allowed everywhere	0.119		-0.074	
	Not allowed in village	0.066	0.053	0.031	0.104
	Not allowed anywhere	-0.185 ***	0.053	0.043	0.104
Parking fee	Linear	-0.272 ***	0.046	-0.157 *	0.090
	Quadratic	N.I.		-0.100 *	0.052
Bus availability	Not available	-0.397		0.054	
	Limited accessibility	0.127 **	0.053	-0.006	0.104
	Extensive accessibility	0.270 ***	0.053	-0.048	0.103
Bus fare	Linear	-0.029	0.046	0.011	0.090
Amount of protected area	Linear	0.102 **	0.046	0.166 *	0.089
Percent renewable energy	Linear	0.039	0.046	-0.011	0.091
Percent waste recycled	Linear	0.310 ***	0.046	0.548 ***	0.091
	Quadratic	-0.069 ***	0.026		
Environmental fee	Linear	-0.035	0.046	0.092	0.090
Intercept		0.452 ***	0.043	0.570 ***	0.080
Availability of golf courses x Previous course use	Linear x Previous use	0.395 ***	0.141	N.I.	
	Quadratic x Previous use	0.137	0.054	0.145	0.106
Observations		3187		874	
Log Likelihood		-2039.4		-549.0	
Rho-Square		0.077		0.094	

N.I. = Not Included
*P-value<0.10
**P-value<0.05
***P-value<0.01

The results were relatively consistent with the findings from the preference choice models. Overall, the most significant factors in the acceptability models were: the percent of workforce living in the resort; automobile accessibility; parking fees; bus availability; amount of protected area;

and the percent of waste recycled and composted. However, there were fewer significant variables in the acceptability choice models than in the preference models. Evidently, fewer attributes mattered to tourists when considering whether or not specific planning scenarios were acceptable. It is also possible that visitors accepted certain resort characteristics even though they did not prefer those features. For example, the results indicated that visitors tended to accept a resort that uses mainly non-renewable energy sources even though they preferred that renewable sources be used.

The results from the acceptability choice models indicate that day visitors were more likely to accept the dematerialization than the BAU scenario, whereas overnight visitors were more inclined to accept the BAU scenario (Table 4.22). The resource intensive scenario was considered unacceptable to the majority of both groups. Overall, 70% of summer tourists accepted the BAU scenario, while only 60% of visitors accepted the dematerialization scenario. In contrast to the preference choice modelling results, this suggests that summer tourists would not benefit if a resort implemented all the strategies in the dematerialization scenario.

Table 4.22: Acceptability of alternative planning scenarios

	Overnight Visitors	Day Visitors	Total
BAU Scenario			
Acceptable	76.1%	56.1%	**70.0%**
Not acceptable	23.9%	43.9%	**30.0%**
Total	**100.0%**	**100.0%**	**100.0%**
Dematerialization Scenario			
Acceptable	54.0%	74.5%	**60.2%**
Not acceptable	46.0%	25.5%	**39.8%**
Total	**100.0%**	**100.0%**	**100.0%**
Resource Intensive Scenario			
Acceptable	47.2%	44.1%	**46.3%**
Not acceptable	52.8%	55.9%	**53.7%**
Total	**100.0%**	**100.0%**	**100.0%**

4.3 Assessment of Tourist Travel Options

This section examines tourist travel mode choices associated with proposed tourist transportation strategies. It also estimates the resulting environmental impact of those mode selections. This assessment was done using the methods described in Section 3.3.

4.3.1 Modelling tourist mode choice behaviour

This section describes the findings from the transportation discrete choice experiment. It examined transportation mode choice for visitor travel between Vancouver and Whistler. The analysis is used to determine potential shifts towards more sustainable modes of public transportation in response to changes in travel time, frequency, costs and departure and arrival points. The results are presented in two separate models for overnight and day visitors respectively (Table 4.23). These NMNL models separate the choice between private and public modes of transportation first (Level 1), and thereafter the choices between owned versus rented vehicle and bus versus train (Level 2). A summary of these findings follows.

Table 4.23: Transportation mode choice models

	Model 1: Overnight Visitors		Model 2: Day Visitors	
Attribute	Coefficient	Standard Error	Coefficient	Standard Error
Level 1: Private vs. Public Transportation				
Auto travel time	-0.110	0.071	-0.415 **	0.167
Parking fee	-0.356 ***	0.067	-0.112	0.134
One-way fuel costs	-0.172 ***	0.067	-0.213	0.133
Rental fee	-0.059	0.066	-0.122	0.134
Inclusive value – Private	0.387 ***	0.031	0.390 ***	0.101
Inclusive value – Public	0.484 ***	0.099	0.491 ***	0.115
Travel party size x Private	0.090 ***	0.035	N.I.	
Income x Private	N.I.		3.182×10^{-6} *	2.487×10^{-6}
Intercept – Private	2.327 ***	0.203	2.513 ***	0.382
Intercept – Public	2.385 ***	0.176	1.881 ***	0.318
Observations	1857		467	
Log likelihood	-1161.8		-290.4	
Rho-square	0.43		0.43	
Level 2: Bus vs. Train				
Bus travel time	-0.096 **	0.041	-0.294 **	0.118
Bus fare	-0.789 ***	0.132	-1.453 ***	0.337
Bus frequency	-0.099 ***	0.028	-0.148 **	0.075
Bus arrival point – Whistler Village	-0.167		-0.422	
Bus arrival point – Directly at accommodation	0.167 *	0.102	0.422 *	0.255
Train travel time	-0.089 **	0.042	-0.310 **	0.128
Train fare	-0.835 ***	0.128	-1.189 ***	0.337
Train frequency	-0.010	0.027	0.019	0.067
Train departure point – Vancouver airport	0.059		-0.133	
Train departure point – Downtown	0.141	0.144	0.160	0.372
Train departure point – North Vancouver	-0.200	0.143	-0.027	0.340
Train arrival point – Whistler Village	-0.096		-0.204	
Train arrival point – Creekside	0.096	0.102	0.204	0.254
Intercept – Bus	-0.676 ***	0.105	-0.529 **	0.271
Observations	543		118	
Log likelihood	-298.6		-54.7	
Rho-square	0.21		0.33	
Level 2: Private vs. Rental Vehicle				
Place of residence – British Columbia	4.190 ***	0.319	2.702 ***	0.298
Place of residence – AB/WA/OR	3.307 ***	0.322	2.918 ***	0.726
Place of residence – Other CAN/USA	-0.761 ***	0.151	-0.074	0.222
Place of residence – Other international	-1.060 ***	0.196	-0.189	0.276
Observations	1290		364	
Log likelihood	-298.5		-145.3	
Rho-square	0.67		0.42	

N.I. = Not Included
*P-value<0.10
**P-value<0.05
***P-value<0.01

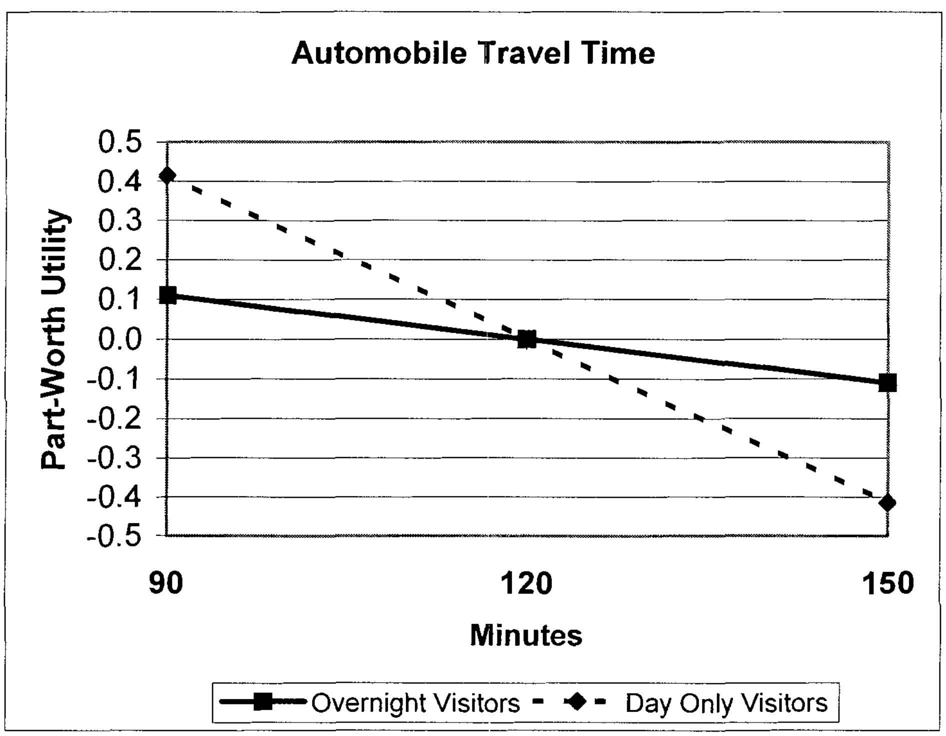
Level 1: Private vs. public transportation

The first-stage choice model considered explanatory variables related to automobile travel time, fuel costs, rental fees and parking fees; while the characteristics of the public modes are expressed in the inclusive value.

Travel time

The regression coefficients for automobile travel time indicated that the likelihood of choosing private transportation increased as automobile travel time decreased (Figure 4.5). As expected, travel time is an important factor in influencing a visitor's choice of transportation modes. The mode choice of day visitors seems to be even more sensitive to automobile travel time than that of overnight visitors. Travel time is likely more important to day visitors because it constitutes a much larger portion of overall trip time.

Figure 4.5: Relative preferences for automobile travel time

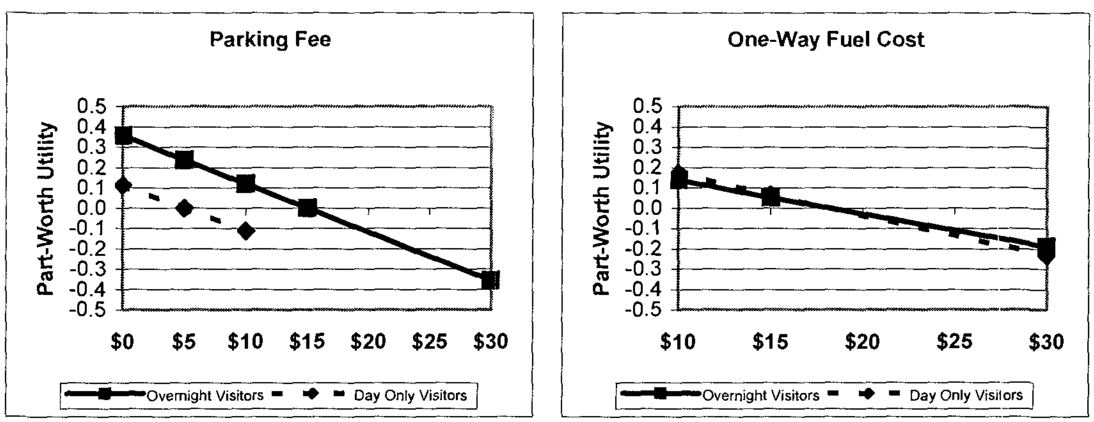


Travel costs

As destination parking fees increased so did the propensity for day and overnight visitors to choose public transportation (Figure 4.6). However, this relationship was only statistically significant for overnight visitors. This finding suggests that policy decisions concerning parking fees, which are within the control of local decision-makers, may be an important factor in shaping future transportation choices. The insensitivity of day visitors to parking fees of up to $10 per day indicates that their overall trip experience would not be compromised by reasonable parking charges. In contrast, overnight visitors would be affected by high overnight parking fees, most likely because they would accumulate significantly over the span of a trip.

The likelihood of a visitor choosing private over public transportation increased as fuel cost decreased (Figure 4.6). Again, this relationship was only statistically significant for overnight visitors, reinforcing the fact that fuel cost is a key factor in influencing an overnight visitor's choice of transportation modes. Conversely, personal vehicle rental fees did not have a significant influence on modal choices, at least within the range of levels tested.

Figure 4.6: Relative preferences for automobile travel costs



Inclusive values

Because the first-stage choice may be influenced by variables at the second stage, an "inclusive value" term was included in the first-stage choice model to capture the effects of the second-stage variables (McFadden 1981). Consider the example of tourist place-of-residence. Although this variable was not explicitly included in the first-stage choice model, the inclusive value did incorporate its effects on the choice between private and public transportation. In effect, the inclusive value takes information from the second-stage level and includes it in the first-stage choice decision. The coefficients of the inclusive value lie between 0 and 1, which indicates that the model is consistent with the utility maximization hypothesis (McFadden 1981). These values are also significantly smaller than one, which suggests that the MNML model is an improvement over the ordinary MNL model.

Individual characteristics

To account for varying preferences for travel modes among individuals, the first-stage choice model examined how the individual characteristics of respondents affected the model's choice findings. Overall, overnight visitors in large travel parties were more likely to choose private as opposed to public transportation modes. Day visitors with large household incomes were more likely to take private as opposed to public transportation. Several other individual characteristics were tested but not retained in the analysis because they were not significant at the 90% confidence level. These included socio-demographic variables (e.g. gender, age, education), prior trip characteristics (e.g. location of accommodation, activities pursued during the visit) and tourist destination motivations.

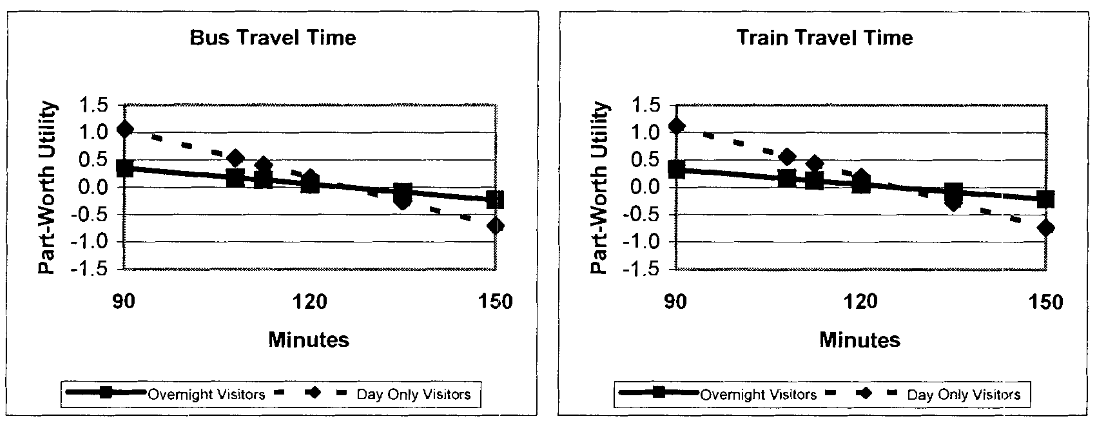
Level 2: Bus vs. train

The second-stage choice model between express bus and train options included variables for travel time, fare, frequency and arrival and departure points.

Travel time

The negative regression coefficients for travel time indicated that for both overnight and day visitors the likelihood of a visitor choosing bus (or train) increased as its travel time decreased (Figure 4.7). For both bus and train options, travel times to and from the destination are important factors in influencing mode choice. Day visitors were more sensitive than overnight tourists to bus and train travel time requirements.

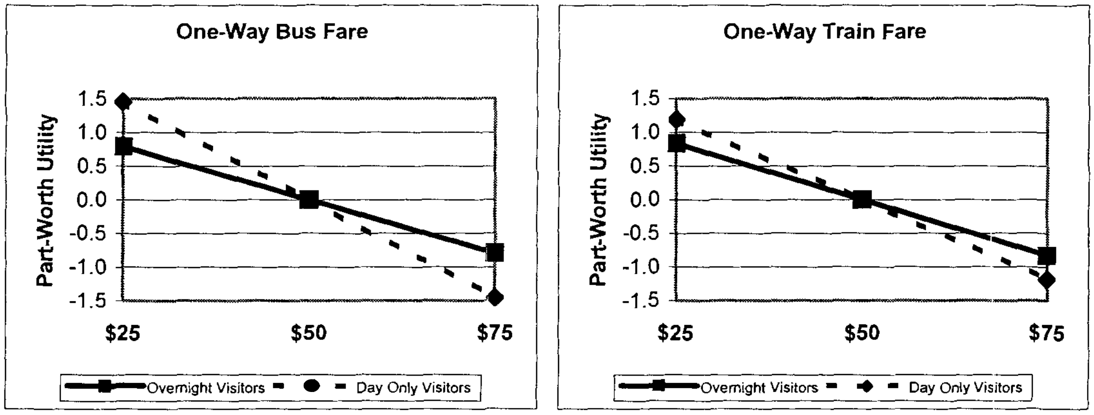
Figure 4.7: Relative preferences for public transport travel times



Travel cost

Transit fares were one of the most critical factors in influencing the choice between bus and train for both day and overnight visitors (Figure 4.8). The regression coefficients indicated that the likelihood of a visitor choosing bus (or train) increased as its fare level decreased. This was particularly the case for day visitors because fare levels typically constitute a much larger share of the overall trip budget for this segment of travellers.

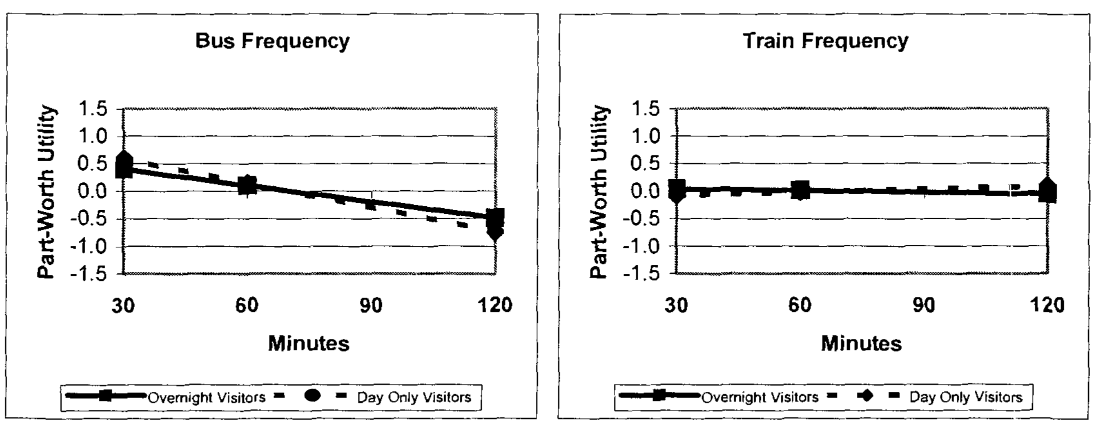
Figure 4.8: Relative preferences for public transport fares



Frequency

The regression coefficients for frequency suggested that the likelihood of a visitor choosing bus travel increased as its frequency of service increased, especially for overnight visitors (Figure 4.9). However, no significant relationship appeared to exist between train frequency and the selection of that mode by either day or overnight visitors.

Figure 4.9: Relative preferences for public transport frequencies

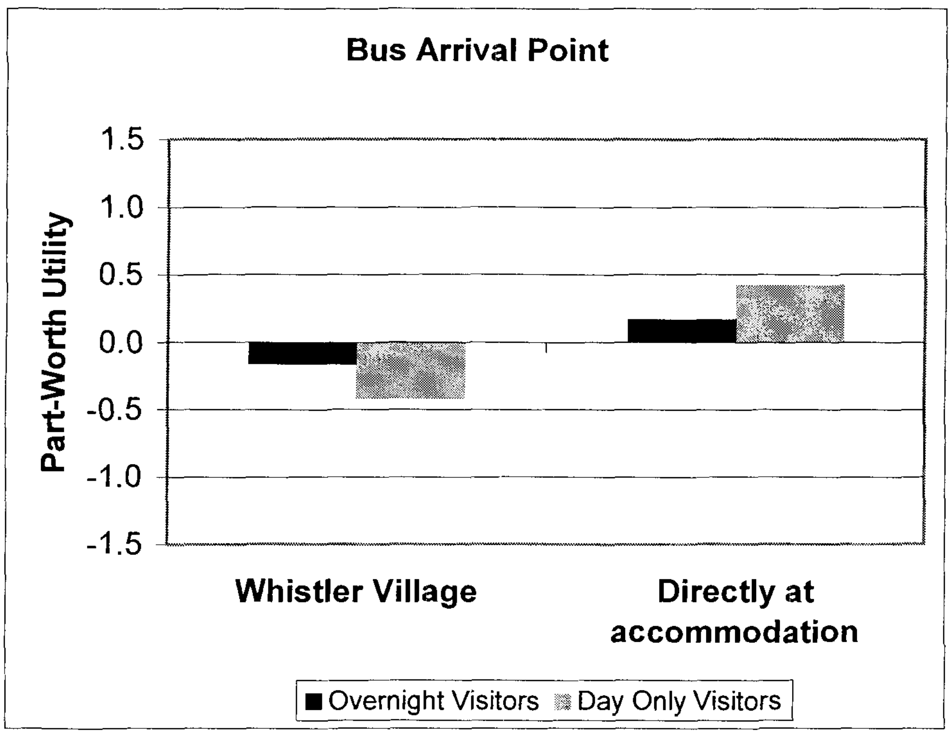


Arrival and departure point

There was a significant difference in transportation mode choice based on where buses arrived and disembarked passengers in the destination. Specifically, visitors were significantly more apt to take the bus if it arrived directly at their resort accommodation rather than at some central point in the main village area (Figure 4.10).

Although the results suggested that more convenient train departure points may increase the likelihood of a modal shift to train use amongst visitors, this relationship was not statistically significant. Similarly, for both day and overnight visitors, train arrival points in the destination were not considered influential in shaping train travel choices.

Figure 4.10: Relative preferences for bus arrival point

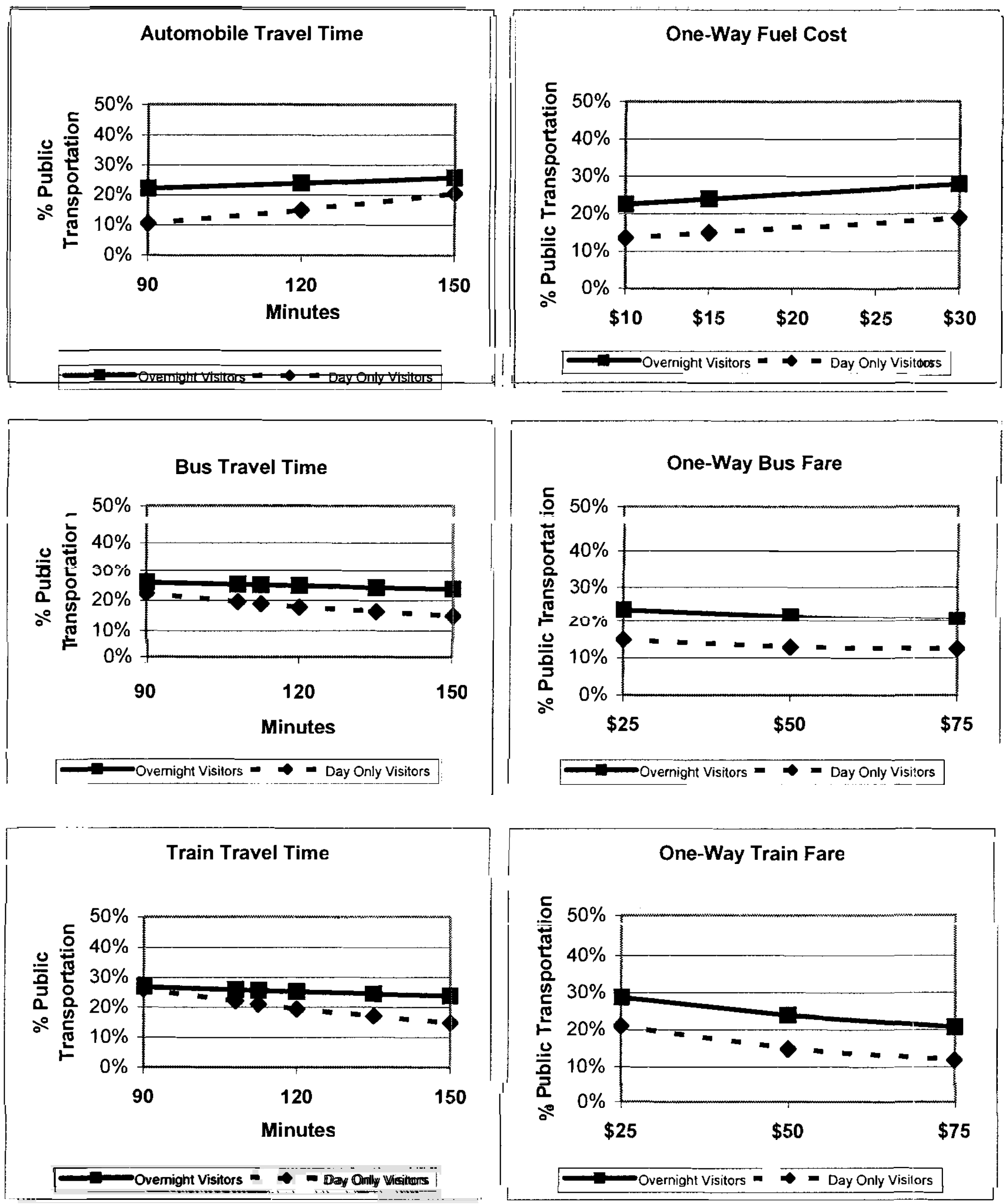


Level 2: Private vs. rental vehicle

The second-stage choice model between private and rental automobile included separate intercept terms for visitors from four different places of residence: (1) British Columbia; (2) nearby out of province origins (Alberta, Washington State and Oregon); (3) other Canada and USA; and (4) other international. Given the different proportions of visitors from each of these source regions arriving by airplane, it comes as no surprise that visitors who live closer to Vancouver were significantly more inclined to choose a private as opposed to a rental automobile to travel to Whistler. Conversely, visitors from further away were significantly more likely to choose a rental rather than a private automobile for their travel.

Overall, the analysis suggests that potential shifts to public modes of transportation may result from implementing various express bus and train management strategies, especially linked to travel time and fare (Figure 4.11). The cumulative impact of various transportation strategies is potentially large when several strategies are combined in complementary ways (e.g. increased parking fees and lower transit fares). The next section examines the effects of these combined scenarios on energy consumption and GHG emissions.

Figure 4.11: Effects of select attributes on public transportation mode shares



*Mode shares estimated by varying the level of a given attribute, while keeping all other variables fixed at BAU levels.

4.3.2 Modelling energy consumption and GHG emissions

A key benefit of conducting a discrete choice experiment is that entire transportation management scenarios can be evaluated using the results. By adjusting the attribute levels in the discrete choice models, it is possible to estimate the modal shares that would likely occur under various transportation scenarios. In this way, the modal shares expected from implementing various "pro-bus" and "pro-train" strategies were compared with the shares resulting from a "business-as-usual" (BAU) scenario. The overall modal shares for each scenario were weighted by place of residence and travel party size for overnight visitors, and by place of residence and income for day visitors.

Table 4.24 compares several of these modal shares and also includes the actual distribution of transportation modes used by survey respondents. Since no train option exists currently, the two data sets cannot be compared directly. Based on the results of the choice experiment, about 77% of visitors chose to use private or rental vehicles to travel between Vancouver and Whistler under the BAU scenario. Another 21% of them selected public transit options. While the overall bus share under the BAU scenario is similar to the actual proportion of 7%, the BAU scenario also contains a 13% share for train transportation, if that option were available. The transportation modal shares estimated under the BAU scenario varied widely with respect to certain tourist characteristics. Key findings emerging from the analysis were that visitors:

- staying overnight were more apt to use public transit than day trippers;
- coming from distant regions were more likely to use public transportation than nearby visitors;
- were more inclined to select public transportation modes as their trip party size decreased; and
- were more likely to use public transport as their household income level decreased.

As expected, the pro-bus scenario resulted in a substantial increase in bus transit selection. However, the effects of this shift were partially offset by a decrease in train usage, which suggests a degree of substitution exists between bus and train modes. In total, approximately 40% of visitors chose public transit in the pro-bus scenario. The modal shift to a greater use of bus transportation was more dramatic for day as opposed to overnight visitors. It was also more significant for nearby visitors than long-distance travellers.

The pro-train scenario resulted in a substantial increase in train transportation selection, but this effect was dampened by a decrease in bus use. In total, about 38% of visitors chose public transportation in this scenario. This suggests that pro-train options may be slightly less effective than comparable strategies for encouraging visitors to use buses.

Table 4.24: Estimated modal shares under select scenarios

	Actual*	BAU Scenario	Pro-Bus Scenario	Pro-Train Scenario
Private vehicle	70.7%	60.5%	47.5%	48.8%
Rental vehicle	20.8%	16.2%	10.5%	11.0%
Express bus	7.0%	8.4%	33.1%	4.5%
Train	-	12.8%	6.9%	33.7%
Would not go	-	2.1%	2.0%	2.1%
Total	**98.5%**	**100%**	**100%**	**100%**

* This column presents the actual distribution of transportation modes used by survey respondents. The total does not sum to 100% because a small number of respondents used other modes to arrive in Whistler (e.g. limousine, float plane, helicopter). A train option was not available at the time respondents were recruited for the survey.

According to data provided by Tourism Whistler, just over one million visitors travelled to Whistler in the 2003 summer season (May to October). Of these, an estimated 70% were overnight visitors and 30% were day visitors. In moving between Vancouver and Whistler, overnight visitors travelled about 172 million "person kilometres travelled" (PKT) and day visitors travelled approximately 75 million PKT.

For each scenario, the PKT by each transportation mode were calculated by multiplying total PKT between Vancouver and Whistler by the modal shares estimated by the discrete choice models (Table 4.25). These estimates were then used to predict energy consumption and GHG emissions. Under the BAU scenario, visitor travel between Vancouver and Whistler accounted for approximately 429,000 GJ of energy (Table 4.26) and 30,000 tCO_2e in GHG emissions (Table 4.27). In the pro-bus scenario, visitor travel between Whistler's gateway community of Vancouver and the destination consumed about 18% less energy and resulted in 18% fewer GHG emissions than in the BAU scenario. The improvement over BAU was less dramatic in the pro-train scenario, where visitor travel accounted for about 10% less energy and 11% fewer GHG emissions than in the BAU scenario. Even though the two scenarios generated fairly similar shares of public transportation use, the reductions in energy usage and GHG emissions are significantly less in the pro-train scenario than in the pro-bus scenario because buses are much more fuel-efficient on a per VKT basis than trains. Even with higher passenger loads, trains still require more fuel than buses to transport passengers. However, these findings are based on an assumption of a diesel train engine, which is typical in most North American rail systems. Alternative engine technologies could generate significantly lower energy impacts due to improved fuel efficiencies and/or cleaner fuels.

Table 4.25: Estimated person kilometres travelled under select scenarios

	BAU Scenario	Pro-Bus Scenario		Pro-Train Scenario	
	PKT	PKT	% Change from BAU	PKT	% Change from BAU
Private vehicle	152,503,796	119,461,101	-21.7%	122,864,865	-19.4%
Rental vehicle	40,891,555	26,342,582	-35.6%	27,593,793	-32.5%
Express bus	21,081,748	83,425,611	295.7%	11,377,320	-46.0%
Train	32,127,697	17,375,502	-45.9%	84,768,818	163.8%
Total	**246,604,796**	**246,604,796**	**0%**	**246,604,796**	**0%**

Table 4.26: Estimated energy consumption under select scenarios

	BAU Scenario	Pro-Bus Scenario		Pro-Train Scenario	
	Quantity (GJ)	Quantity (GJ)	% Change from BAU	Quantity (GJ)	% Change from BAU
Private vehicle	307,919	241,203	-21.7%	248,076	-19.4%
Rental vehicle	82,564	53,188	-35.6%	55,714	-32.5%
Express bus	10,910	43,175	295.7%	5,888	-46.0%
Train	27,169	14,694	-45.9%	71,686	163.8%
Total	**428,563**	**352,260**	**-17.8%**	**381,364**	**-11.0%**

Table 4.27: Estimated GHG emissions under select scenarios

	BAU Scenario	Pro-Bus Scenario		Pro-Train Scenario	
	Quantity (tCO2e)	Quantity (tCO2e)	% Change from BAU	Quantity (tCO2e)	% Change from BAU
Private vehicle	21,591	16,913	-21.7%	17,395	-19.4%
Rental vehicle	5,789	3,730	-35.6%	3,907	-32.5%
Express bus	779	3,083	295.7%	420	-46.0%
Train	2,159	1,168	-45.9%	5,697	163.8%
Total	**30,319**	**24,893**	**-17.9%**	**27,419**	**-9.6%**

4.4 Assessment of Carbon Offsetting Programs

This section investigates tourist responses to possible carbon offsetting strategies. Specifically, it examines tourists' willingness to donate money to compensate for the greenhouse gas emissions associated with their trip to Whistler. This assessment was conducted using the contingent valuation method described in Section 3.4.

4.4.1 Willingness to pay

Just under half of all respondents (45%) were willing to donate the specified dollar amount probed in the survey (Table 4.28).[55] An additional 14% of respondents indicated they would contribute to a lesser degree. Overall, 59%

[55] These results are similar to the findings reported by Becken (2004). She found that 48% of tourists surveyed in Australia and New Zealand would be willing to participate in tree planting to offset their greenhouse gas emissions.

of all respondents were willing to donate at least some money to the proposed carbon-offsetting program. Respondents who lived furthest from Whistler were less willing to donate than those who resided in neighbouring regions.

Table 4.28: Willingness to donate to carbon offsetting program

	Specified Amount	Partial Amount
Group 1: British Columbia	51.6%	60.3%
Group 2: Alberta, Washington and Oregon	61.3%	66.9%
Group 3: Other Canada and United States	31.7%	55.0%
Group 4: Other international	25.4%	54.4%
Total	**45.0%**	**59.4%**

4.4.2 Logistic regression results

Table 4.29 presents the coefficients derived from a logistic regression analysis (the standard errors are given in parentheses). The dependent variable is the probability that a visitor will donate to offset greenhouse gas emissions, while the independent variables include characteristics associated with each individual traveller as well as the donation amount. Only those variables significant at a 90% confidence level were retained in the final model. They are: travel party size; education level; motivation factor scores from a principal component analysis on travel motivation questions[56]; and a dummy variable specifying whether or not the individual was an overnight or day visitor. Although they appear low, the pseudo R^2 values for these models are in fact above average for contingent valuation analysis, and suggest a suitable

[56] A principal components analysis was used to summarize the original 16 motivation variables by five factors (see Appendix 5). These factors correspond to: environmental motivations (e.g. visiting wilderness and undisturbed areas; visiting a place that takes good care of its environment); luxury-based motivations (e.g. having opportunities to shop; visiting a place with unique and interesting restaurants); social and cultural motivations (e.g. enjoying cultural or historic sites and attractions; learning new things and increasing knowledge); activity-based motivations (e.g. participating in outdoor activities; being physically active); and family-oriented motivations (e.g. going to a place that is family-oriented).

goodness-of-fit (Hensher & Johnson, 1981). Likelihood ratio tests also indicated that each model is significant at a 99% confidence level.

Table 4.29: Carbon offsetting logistic regression models

Variable	Group 1: British Columbia	Group 2: Alberta, Washington & Oregon	Group 3: Other Canada & USA	Group 4: Other International
Constant	-0.366 (0.597)	-2.461 ** (1.063)	-1.877 * (0.967)	-4.319 *** (1.438)
Donation amount	-0.139 *** (0.028)	-0.087 *** (0.030)	-0.019 *** (0.004)	-0.010 *** (0.003)
Travel party size	0.152 ** (0.073)	N.I.	N.I.	0.581 *** (0.188)
Overnight visitor (1=yes; 0=no)	0.550 * (0.288)	1.980 *** (0.698)	0.935 ** (0.462)	N.I.
Education level	0.202 * (0.122)	0.628 *** (0.215)	0.342 * (0.207)	0.677 ** (0.284)
Motivation factor 1: Environment	0.443 *** (0.120)	0.675 *** (0.237)	0.522 *** (0.182)	N.I.
Motivation factor 2: Luxury	N.I.	-0.431 ** (0.233)	-0.428 ** (0.190)	N.I.
Motivation factor 3: Social and culture	0.236 ** (0.115)	N.I.	0.344 * (0.194)	N.I.
Observations	349	140	178	111
Log likelihood	-216.9	-73.9	-91.8	-48.3
Pseudo R-square	0.133	0.243	0.200	0.228
Correctly predicted (%)	63.9%	75.7%	73.0%	82.0%

N.I. = Not Included
*P-value<0.10
**P-value<0.05
***P-value<0.01

Donation amount

The logistic regression results indicated that visitors were significantly less willing to donate as the specified amount of carbon offsetting charge increased. An increase in the donation amount had a larger effect on the willingness-to-donate of nearby visitors than it did on long-distance travellers.

Travel party size

Visitors were more inclined to donate as their trip party size increased. This pattern was more apparent for nearby and international tourists than others. Those travelling in larger parties may be willing to donate greater amounts because they can split the donation amongst multiple people. As well, they may be able to share other travel costs (e.g. fuel and accommodation costs), thus leaving more disposable income for a donation.

Length of stay

As opposed to day tourists, overnight visitors were more inclined to donate. They may be more likely to donate larger sums because they tend to have greater trip budgets.

Education level

Visitors were more likely to donate as their formal education level increased. Their willingness to donate larger amounts may be because they are more likely to be aware of the environmental implications of increased greenhouse gas emissions.

Motivation factors

Travellers motivated by environmental factors (e.g. visiting a place that takes good care of its environment) were more likely to donate than others. Their willingness to donate may be because they understand the impact of their travel activities on greenhouse gas emissions or they believe in the importance of carbon offsetting initiatives in general. This pattern was not statistically significant for international tourists.

Visitors motivated to travel by luxury-based factors (e.g. staying in first class hotels) were less likely to donate than others. This pattern was not statistically significant for nearby or international visitors.

Tourists motivated to travel by social and cultural factors (e.g. learning new things and increasing knowledge) were more likely to donate than others. This pattern was more apparent for nearby and very distant travellers than it was for others.

4.4.3 Expected amount that visitors will donate

The logistic regression results were used to estimate the expected amount that visitors would be willing to donate to offset greenhouse gas emissions. The analysis revealed that visitors who resided in British Columbia were willing to donate an average of $9 to compensate for the greenhouse gas emissions associated with their trip to Whistler (Table 4.30). Tourists who lived in Alberta, Washington State and Oregon were willing to donate an average of $20, and those who inhabited other parts of Canada and the USA were willing to contribute an average of $17. Surprisingly and on average, visitors from overseas destinations were unwilling to provide such donations. This statistical consequence may have occurred because the donation amounts tested were too large.

Table 4.30: Estimated willingness to donate

	Expected Donation Amount	Sample Size	95% Confidence Interval
Group 1: BC	$8.62	350	$8.17 - $9.07
Group 2: AB, WA & OR	$20.38	140	$18.12 - $22.65
Group 3: Other CAN & USA	$16.92	178	$10.11 - $23.73
Group 4: Other international	-$7.43	112	-$25.73 - $10.87
Total	**$10.32**	**780**	**$7.19 - $13.46**

4.4.4 Reasons for not donating

Despite the unwillingness to participate amongst some overseas visitors, overall results indicated that most summer visitors were willing to donate money to at least partially offset the greenhouse gas emissions associated with their trip. However, the level of willingness to pay was constrained. Overall, 55% of the respondents were not willing to donate the amount of money specified in the survey. Approximately 39% of these individuals stated that the cost was too high (Table 4.31). In addition, 36% indicated that the organization might not use the donated funds efficiently, and 23% suggested that the activities undertaken by the organization to offset greenhouse gas emissions might not be effective. Apparently, some visitors may not be willing to donate because they have reservations about the organization or the effectiveness of its activities. Some of these people may be more inclined to donate if more information was given to alleviate their concerns about the organization. This highlights the importance of having a credible carbon-offsetting organization administering such an initiative if it is to be successful. Only a small share (6%) of respondents who were not willing to donate indicated that programs to compensate for greenhouse gas emissions are not needed. These individuals would not likely donate any amount of money no matter how effectively the organization operated. Finally, 41% of the respondents who answered "no" to the initial question stated they had some other reason for not donating. The most common "other" reason given by respondents was that the payment vehicle should be a mandatory tax or fee, not a voluntary donation. While these respondents were not willing to participate in a donation-based system, they may be inclined to support a more equitable carbon-offsetting tax. The remaining "other" reasons given by respondents are listed in Table 4.31.

Table 4.31: Reasons for not donating

	%*
The cost is too high	38.8%
The organization may not use the donated funds efficiently	36.0%
Activities undertaken by the organization to offset greenhouse gas emissions may not be effective	23.1%
Programs to compensate for greenhouse gas emissions are not needed	5.6%
Other**:	40.7%
• The payment vehicle should be a mandatory tax or fee, not a voluntary donation (32 responses)	
• Existing government funds should be used for this purpose (17 responses)	
• Already donate enough to other organizations and charities (11 responses)	
• Not enough information is provided about the proposed organization and its activities (9 responses)	
• Industry should be responsible for paying, not the individual consumer (8 responses)	
• Greenhouse gas emissions associated with trip are insignificant in the big picture (7 responses)	
• Already pay enough taxes and fees (7 responses)	
• Do not live in the local area so this is not my responsibility (6 responses)	
• Not in personal interest (5 responses)	
• Already do enough personally to offset greenhouse gas emissions (5 responses)	

* The sum of column percentages is greater than 100% because respondents could select more than one category.
** Only the most commonly cited "other" reasons are listed (>5 responses).

4.4.5 Effect of protest votes

Some respondents who indicated they would not donate to the proposed program may have been willing to participate if the payment mechanism was structured differently. About 40% of the initially negative respondents were in this group. After removing these "protest" votes, logistic regression was used to estimate expected willingness-to-donate for carbon offsetting (i.e. independent of the payment mechanism). This analysis revealed that summer visitors who resided in British Columbia were willing to donate an average of $14 to pay for the greenhouse gas emissions associated with their trip to Whistler (Table 4.32). The model also indicated that visitors who lived in Alberta, Washington State and Oregon were willing to pay an average of $27; tourists who lived in other parts of Canada and the USA were willing to pay an average of $49; and visitors who resided in other international regions were willing to pay an average of $34. As expected, the willingness-to-donate for carbon offsetting was greater after removing the suspected protest votes. This result is consistent with other contingent valuation research (Lindberg & Johnson, 1997).

Table 4.32: Estimated willingness to donate (excluding protest votes)

	Expected Donation Amount	Sample Size	95% Confidence Interval
Group 1: British Columbia	$13.70	351	$13.20 - $14.19
Group 2: Alberta, Washington and Oregon	$27.28	140	$25.35 - $29.20
Group 3: Other Canada and United States	$48.62	179	$42.86 - $54.38
Group 4: Other International	$33.55	112	$18.61 - $48.49
Total	**$26.96**	**782**	**$24.25 - $29.68**

CHAPTER 5: DISCUSSION

Several planning strategies for creating more environmentally sensitive tourism destinations have been reported in the academic literature. However, evaluations of these options with respect to their potential for achieving dematerialization are rare. This dissertation conducted such an evaluation as a contribution to the theoretical and applied dimensions of tourism planning. The research provided a conceptual framework and methodology for evaluating various dematerialization planning options and assessing their acceptance by tourists. This final chapter summarizes key elements of the conceptual framework and presents the main conclusions that emerged from the research. It also describes the major limitations of the study and proposes directions for further research.

5.1 Conceptual Framework

The research is embedded in a theoretical frame for examining the environmental impacts of various dematerialization strategies and links it to a behavioural framework to determine tourist acceptance for these tourism destination planning options. A description of the key elements of this framework follows.

5.1.1 Tourism destination resource flows

Tourism production processes require substantial amounts of energy, water and other materials in the creation of goods and services. As a result, tourism's contribution to the accumulation of solid and liquid waste, greenhouse gases and other contaminants can have serious effects on natural environments as well as the quality of visitor experiences. While these same outcomes can result from other economic processes, certain features make the impacts from tourism different in nature from those of other industries.

Spatial concentration

In tourism, both production and consumption takes place in the same location – the tourism destination. The final tourism product (experiences) does not exist until a consumer (tourist) travels to the point of production (tourism destination) and actively gets involved in the production process. The impacts of tourism activities are therefore spatially concentrated in the destination. This contrasts with other industries, where production occurs independently of the consumer and most products are consumed outside the region of production.

Visitor travel

Not all impacts from tourism activities are confined to the destination area. Travel between tourist-generating regions and destinations can have wide-reaching consequences, such as increased air pollution from fossil fuels burned in transport. Because of the long distances often required for visitors to reach destinations, travel is frequently the overwhelming source of energy consumption and emissions related to destinations. While visitor travel is a fundamental prerequisite of tourism, it is the component that in many cases challenges the environmental dimension of sustainability the most.

Seasonality and periodicity

Tourism is also characterized by seasonality and periodicity, meaning that visits to a destination tend to concentrate at particular times of the year or week. These temporal impacts are caused by at least two factors. First, the seasonal effects of a destination's climate can influence visitor activity (e.g. the presence of sunshine or snow at certain times of the year). Second, a tourist's motivation and ability to visit a destination can be heavily dependent on the time of the visit (e.g.

the annual holiday period, or days of the week free from the constraints of work and school). Often the concentration of tourism activity occurs in destination areas at the times when resources are most scarce or vulnerable to adverse impacts.

Resource-intensive technologies

Resource use in tourism destinations is often magnified by the extensive use of resource-intensive technologies that provide tourism amenities. Hotels, restaurants and other tourist facilities consume vast amounts of energy, water and material resources to provide tourism services. These include heating and air conditioning, importing and refrigerating food, transporting water, cooking, laundering sheets and towels, maintaining landscaped areas, irrigating golf courses, maintaining swimming pools and transporting visitors.

Geographic and environmental conditions

Requirements for energy, water and materials can be magnified by the unique geographic and environmental conditions related to destinations. For instance, the climatic conditions of arid and tropical destinations can increase water requirements for irrigating landscaped areas and golf courses. Geographic and environmental conditions can also make destinations especially vulnerable to the impacts associated with resource use. For example, the weather patterns in mountain destinations can trap air pollution in mountain valleys.

Increased consumption by tourists

Tourists tend to consume more resources while they are on vacation by staying in hotels, eating out and buying more packaged products at retail stores. Often it is simply more difficult for tourists to behave in an environmentally sound manner given the structure in place at hotels and other destination facilities. Such consumptive behaviour can contribute to increased resource use and waste generation.

Collectively, these characteristics set tourism apart from most other economic activities and add to the intensity of impacts associated with energy, water and materials use.

5.1.2 Experiential product

Opportunities for employing dematerialization strategies seem especially appropriate in tourism destination settings where the final product is essentially experiential rather than material in nature. For instance, a growing number of environmentally and culturally related tourism businesses are producing alternative products and services that are not only competitive in the tourism marketplace, but also do not rely on the intensive consumption of natural resources. Even in more traditional tourism destinations, opportunities exist to significantly decouple the visitor's experience from the excessive consumption of natural resources without jeopardizing the quality of the overall tourist product. In this way, tourists are able to enjoy highly valued personal experiences without utilizing vast amounts of energy and materials in the process. This perspective suggests that tourism destinations can achieve significant levels of dematerialization while maintaining overall product quality.

5.1.3 Planning options for achieving dematerialization

Several destination planning and management strategies exist to potentially reduce energy, water and other material inputs, as well as the negative effects of such production systems. These strategies involve actions associated with land use and building design, transportation infrastructure and service options, water and power supply, sewage and solid waste disposal and recreational activities. They include implementing:

- compact and mixed development patterns to minimize travel distances and encourage walking and cycling, and also reduce the demand for energy and water services (mainly for irrigation) and building materials;
- transportation initiatives to reduce private automobile use within the destination;
- design practices to increase energy and water efficiencies of new and retrofit building developments;
- low-emission and renewable energy supply systems to reduce greenhouse gases and other air contaminants;
- innovative water supply systems that utilize non-potable water for uses that do not require potable standards;
- environmentally sensitive solid waste management systems that emphasize reuse and reduction, recycling and composting; and
- strategies to decrease the resource consumption and emissions associated with recreational activities.

Such interventions are especially applicable at tourism destinations because the attractiveness and competitive appeal of these areas can be enhanced through reductions in resource consumption.

5.1.4 Tourist preferences

Dematerialization planning strategies can impact tourists in both positive and negative ways. For example, tourists may appreciate the reduced traffic congestion achieved by car-free zones, but they may not support increased restrictions to automobile access. The net impact on how tourists perceive dematerialization planning options may be positive or negative depending on the particular strategy employed. Visitor preferences may also vary widely depending on visitor characteristics. Accordingly, information concerning visitor preferences can provide planners and private investors with invaluable insights about the viability of dematerialization planning strategies from the perspective of tourists.

5.2 Conclusions

Below, a summary of the main technical and behavioural conclusions emerging from the research is provided, organized around the study's research objectives and questions.

5.2.1 Research objective 1: Technical evaluation of planning options

The first research phase involved examining the technical potential of dematerialization planning options in tourism destinations. It developed a "bottom-up" model for assessing the relative dematerialization levels of various destination planning strategies. The technical resource flow model explicitly accounted for resource consumption and emissions for all buildings, infrastructure, and transportation internal to destinations, as well as energy consumption and GHG emissions for employee commuting and visitor travel to and from destinations. This "first generation" model was capable of quantitatively assessing the impact of several proposed destination planning and management strategies on destination resource flows. The model is a potentially valuable decision support tool for planners assessing future options for achieving dematerialization in tourism destinations. It also provides researchers with a prototypical approach capable of assessing the dematerialization levels associated with different types of destinations. The key conclusions emerging from this research phase follow.

Technical potential for achieving dematerialization

When tested in an actual destination planning context, the resource flow model offered insights into the projected relative and absolute effects of proposed planning strategies on Whistler's future resource use and emissions.

The model projected that a collection of innovative planning strategies currently being considered at Whistler would result in reductions in resource consumption and emissions of up to 40%, compared to "business-as-usual" levels. Although not tested in this research, similar-sized reductions in energy-material throughput may be possible in other tourism destination settings.

Limitations imposed by visitor travel

Although the resource flow model indicated that various planning and management strategies could provide significant untapped opportunities for achieving greater levels of dematerialization, the extent of such prospects is limited by visitor travel. The model estimated that external travel energy consumption and GHGs would account for approximately 80% of Whistler's overall energy consumption and about 86% of GHG emissions. The contribution from airplane travel alone would account for about 72% of total energy consumption and 78% of GHG emissions. Moreover, the model estimated that the magnitude of energy consumed by visitor travel would dwarf other reductions realized by implementing internal destination planning and management strategies. This is particularly true for international resorts like Whistler that attract large numbers of long-haul travellers from around the globe.

Limitations imposed by continued growth

While the model predicted that resource flow levels under a dematerialization planning scenario would be lower than "business-as-usual" levels, it showed that these reductions would be largely offset by increased resource consumption caused by continued economic growth. Increasing growth is therefore a major barrier to dematerialization initiatives. Even if it is possible to achieve a 50% improvement in materials and energy intensity through planning interventions, throughput will continue to grow once economic output doubles its existing level. As long as traditional forms of economic growth are allowed to continue unfettered at tourism destinations, the dematerialization process will be constrained in its overall effectiveness.

5.2.2 Research objective 2: Assessment of tourist perspectives

While the technical resource flow model provided a useful means of identifying the resource requirements and emissions associated with various destination planning scenarios, it did not consider tourist preferences for those scenarios. Therefore, the second research phase used a discrete choice experiment to examine tourist perspectives of various planning and management strategies that promote dematerialization. By allowing respondents to evaluate and trade off several attributes simultaneously, the discrete choice survey provided a more realistic basis on which to establish visitor preferences for planning alternatives. The information and models resulting from this research phase assessed dematerialization planning practices from the perspective of tourists - a stakeholder group that is traditionally difficult to examine because of its diverse perspectives and broad geographic distribution. The approach offers managers, decision-makers and participants in participatory planning processes a valuable tool for evaluating tourist preferences for complex and multi-faceted planning issues. It is particularly relevant in tourism situations where proposed policy and planning options can be evaluated before these alternatives, which often require huge financial investments, are implemented. The main conclusions emerging from this research phase follow.

Visitor support for dematerialization strategies

The discrete choice survey explored the preferences of tourists for land use, transportation, recreation and other environmental initiatives intended to promote dematerialization at destination resorts. Visitors were willing to accept an environment fee of up to 4% charged to their accommodation, restaurant and activity bills. They were heavily in favour of protecting greenspace, recycling waste and using renewable energy sources in the community. They were also willing to pay for public transit and to a limited extent for parking. However, visitors did not support more than 75% of the workforce living in the resort. They were also indifferent to the form of development in the community. The choice experiment results were used to test the preferences for various destination planning and management scenarios. Overall, visitors were more predisposed to selecting a "dematerialization" planning option to a "business-as-usual" scenario. This finding suggests that tourism destinations can achieve greater levels of dematerialization without sacrificing overall levels of tourist support. However, it is likely that some market segments (e.g. motorized sports users) would not favour a dematerialization scenario, while other segments (e.g. bus users) would prefer such an option.

Visitors willing to pay for dematerialization strategies

While a destination's existing revenue streams (e.g. property taxes, development fees, accommodation taxes) may help cover some of the costs associated with implementing dematerialization planning strategies, additional new and innovative sources of revenue may also be required. Several visitor revenue options were included in the discrete choice survey: (1) an environmental tax charged to tourists as part of their accommodation, restaurant and activity bills, (2) parking fees at the destination and (3) increased transit fares. The research indicated that the majority of visitors would tolerate the introduction of some fees. However, their acceptance levels declined rapidly as the fees escalated. While these findings indicate that visitors may support the introduction of some limited fees, it does not necessarily mean that tourists will change their own resource consumption behaviour (e.g. stop using private vehicles to get around the destination). However, even if these fees have little influence on visitor behaviour, they might provide additional revenues to help offset the environmental impacts of tourist behaviours.

5.2.3 Research objective 3: Assessment of tourism travel options

The third research phase involved assessing the travel market responses and dematerialization levels of various tourism transportation options. It presented a framework and associated method for assessing the impacts of proposed transportation management strategies on energy consumption and greenhouse gas emissions. The study explicitly linked its technical resource flow model with behavioural information concerning tourists' reactions to a range of options probed in a discrete choice experiment. Specifically, a discrete choice experiment was used to predict transportation mode shares that would likely result from implementing proposed management strategies. These estimates were used to calibrate behavioural relationships in the bottom-up resource flow model. A key advantage in using the discrete choice experiment as a means of quantifying these relationships is that currently nonexistent transportation management options can be investigated.

The findings revealed considerable market readiness to support innovative transportation management strategies aimed at mitigating the energy-related impacts of visitor travel. Strategies exist which would encourage tourists to use public transit modes rather than private or rental vehicles when travelling from gateway communities to destinations. These strategies include implementing: dedicated transit lanes to decrease express-bus travel times relative to private automobiles; high-speed train options; more affordable transit rates; more frequent transit service; more convenient transit access points that are attractive to visitors and allow convenient connections to other travel modes; and parking fees within the destination area. The modal shifts resulting from these initiatives can significantly reduce the energy use and greenhouse gas emissions associated with land-based visitor travel. The shifts to greater public transportation use would likely be more dramatic for some market segments (e.g. day visitors from nearby regions) than other groups (e.g. long-distance overnight travellers). Although destination planners and managers may not be able to directly implement many of these transportation strategies, most options could be encouraged through strategic partnerships with regional and provincial governments, local airport authorities and regional transit service providers. However, substantial barriers may exist which limit the potential of certain strategies. In the case of Whistler, for example, it is impossible given the existing railway infrastructure to run a single train (without transfers) from downtown Vancouver to Whistler.

5.2.4 Research objective 4: Assessment of carbon offsetting programs

The final research phase used a contingent valuation framework and associated method to estimate the willingness of travellers to participate in tourist funded carbon-offsetting programs designed to compensate for the greenhouse gas emissions generated by travel to and from destinations. Such programs offer destinations a way to address the vast energy impacts associated with visitor travel to and from destinations.

The findings suggest that some potential exists for carbon-offsetting programs. In particular, many visitors would be willing to donate money to an independent organization to fund activities that offset greenhouse gas emissions. Visitors who resided in neighbouring regions were more willing to donate than those who lived furthest from the destination. More distant visitors may be less willing to pay because of: higher costs associated with offsetting the greater levels of carbon dioxide they generate by their travelling; less attachment to the destination where the carbon-offsetting fees would be paid; and not recognizing the full extent of transportation emissions generated during their journeys. Ironically, long-distance travellers were more willing than nearby visitors to accept an increase in the suggested donation amount. Overall, the findings demonstrate that visitors may be willing to participate in appropriately priced carbon-offsetting programs. Visitors might be more willing to donate their funds if they are provided with information that alleviates their concerns about the ability of the organization to administer the program effectively.

5.3 Limitations and Recommendations

The following sections highlight the main limitations and research recommendations that emerged from this study.

5.3.1 Resource flow model complexity

While the study's "first generation" resource flow model has immediate applicability in a variety of contexts, it is only intended to be a framework for guiding the development of future dematerialization research and management initiatives. The following sections describe the main limitations of the model and future research directions that will help to refine and strengthen the model's future utility.

More behavioural realism

While the resource flow model is well suited for estimating the resource requirements and emissions associated with various technical end-uses, its utility is limited by a lack of behavioural realism. With the exception of visitor transportation mode choice[57], the model lacks the necessary structure to realistically simulate the ways that tourists, residents and businesses make decisions in reality. As such, the model does not incorporate the influence of multiple tangible and intangible factors on the choices that individuals and firms make. The lack of behavioural realism creates challenges for capturing probable

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[57] This research explicitly linked its technical bottom-up resource flow model with behavioural information concerning tourists' reactions to a range of transportation options probed in a discrete choice experiment. The choice experiment was used to predict transportation mode shares that would likely result from implementing proposed management strategies. These estimates were used to calibrate behavioural relationships in the bottom-up model.

choice behaviour associated with proposed planning and management strategies. This issue can be addressed by incorporating more realistic estimates of choice behaviour into the resource flow model's technical procedures for estimating resource consumption and emissions. As done with visitor transportation mode choice, the findings from a discrete choice experiment can be linked with the technical resource flow model to create behaviourally shaped estimates of the impact of various planning strategies on resource consumption and emissions. The approach can be used to link the resource flow model with greater behaviourally realistic estimates of several different types of choices (e.g. choices made by tourists for accommodations or recreational activities; choices made by residents for housing or transportation modes; choices made by businesses for new equipment or products; etc.)

Economic feedback mechanisms

The resource flow model does not include economic feedback mechanisms in its structure. Therefore, the model is unable to estimate the effects of changing prices on the demand for various technical end-uses. One way of addressing this issue would be to model the relationships between changes in prices and in demand for end-use services. This could be accomplished in two ways: (1) by statistically examining historical revealed preference data; or (2) by analyzing stated preference data obtained from discrete choice experiments or other stated choice methods. Efforts to incorporate economic feedback mechanisms into the resource flow model would allow more realistic simulation of the effects of price changes (e.g. escalating energy prices) on the resource consumption patterns of tourists, residents and businesses.

Supply-demand integration

The resource flow model does not include an integrated framework of supply and demand for energy and material resources, thus it is unable to estimate how general supply-demand dynamics impact destination resource use and emissions. As a result, the model cannot simulate the relationships between changes in destination resource demand patterns and in its external resource supply systems. For example, the model is unable to determine how changes in destination electricity consumption affect the emission intensity of marginal grid electricity generation. Ideally, an integrated top-down/bottom-up model could be used to incorporate such supply-demand dynamics (e.g. Jaccard et al., 1996).

Alternative scenarios of technological evolution

Since the model uses fixed exogenous assumptions about technological evolution, it is limited in its ability to realistically estimate the effects of general technological change on overall destination resource requirements and emissions. Future research can address this issue by identifying and quantifying the effects of various technological scenarios on destination resource consumption and emissions. For example, alternative scenarios could be developed which explore technological advancements related to transportation (e.g. zero-emission vehicles and airplanes) or energy supply systems (e.g. carbon capture and storage). Such research would provide valuable insights about the impacts of general technological changes on destination resource flows. Even though broad technological factors are largely outside the control of local decision-makers, it is important to understand how they either facilitate or constrain the dematerialization potential of proposed destination planning strategies.

More precise resource use intensities

In cases where local information was not available, the resource use intensities used in the model were obtained from external sources. Therefore, the accuracy of the model's results may be compromised by uncertainty associated with these data because of regional differences in climatic conditions, average building age, occupant characteristics and other factors. Future research is needed to derive more precise estimates of resource use intensities for various types of tourism resource consumers (e.g. buildings, infrastructure, tourist activities) using more refined and localized measurement systems.

More detail about tourism's contribution to destination resource flows

The effects of the tourism industry on internal destination resource flows were estimated by disaggregating resource consumption in each sector between tourism and non-tourism components. Since existing resource use data were not disaggregated between tourism and non-tourism elements, various secondary data sources had to be used to factor out tourism's contribution to overall resource consumption patterns. This approach relied on several assumptions and approximations about the tourism component. Future research is needed to establish more detailed information concerning the contributions of tourism to overall destination resource flows. One way to accomplish this task would be to directly survey a representative sample of tourists, residents and resort businesses. The data collected from these surveys could be used to identify and disaggregate the tourism component of resource consumption in a "bottom up" manner.

Expanded geographic scope

While the resource flow model estimates the energy impacts associated with employee commuting and visitor travel, it does not capture the effects of other external up- and down-stream business functions (e.g. manufacturing and importing goods). It is recommended that future research examine the impacts of such external functions on resource use and emissions. Research of this type would be useful for identifying and quantifying the full "cradle-to-grave" resource flows associated with tourism destinations.

Seasonality and periodicity

Since the resource flow model was designed to project long-term resource consumption patterns, it generates forecasts on a year-by-year basis only. Consequently, it does not capture the seasonal or periodic effects of visitation on resource use and emissions. Future research efforts to examine these impacts would be valuable for quantifying the "peak load" resource requirements of destinations. Such information would be beneficial for assessing destination infrastructure constraints and carrying capacity issues.

More detail about material flows

Although the resource flow model estimates solid waste flows, it does not include details about the flow and composition of material inputs (e.g. construction materials, retail products, food). Future research could address this deficiency by deriving "material use intensities" for various categories of buildings, infrastructure, tourist activities and other types of resource consumers.

Broader assessment of planning strategies

The various planning strategies examined in this study's technical evaluation were selected as options that might have the most influential effects on overall destination resource flows. The list of selected strategies was not meant to be exhaustive. It was rather intended to illustrate the range of ways that destination planning decisions can promote dematerialization. Future research could expand the technical evaluation by examining the dematerialization levels associated with other destination planning and management strategies (e.g. low-impact recreational strategies, natural wastewater treatment systems, district heating systems, low-emission wood heating options, green purchasing strategies, etc.)

In sum, research of this type would make the resource flow model a more robust and useful tool for informing tourism destination planners about the dematerialization effects of their strategic planning decisions.

5.3.2 Effectiveness of stated choice survey

The following sections describe the key limitations of the stated choice survey and future research directions that will help to refine and strengthen the approach.

Difference between stated and revealed preferences

A potential limitation to using stated choice methods to predict visitor preferences is that the stated responses might not reflect actual decision-making behaviour. Participants in the stated choice survey were asked to indicate their preferences for purely hypothetical scenarios. These choices may be very different than actual preferences for comparable real-world situations. Moreover, some respondents may have purposely given responses in an effort to show support for environmental initiatives (i.e. "yea-saying").[58] For instance, in an effort to influence survey results, respondents may have overstated their propensity to use public transit or to participate in carbon offsetting programs.

This shortcoming is usually overcome by adding revealed preference data to the stated choice model. However, given that the main purpose of the study was to test visitor responses to currently nonexistent planning scenarios, no such revealed preference data exist. When studies have compared revealed and stated preference models in the past, they have often found that the results are remarkably similar (e.g. Timmermans et al., 1992). Nevertheless, relationships

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[58] Yea-saying is a much less serious problem in discrete choice experiments than in contingent valuation applications.

between stated and revealed choices should be examined in the context of tourism destinations and their stakeholders.

Missing explanatory variables

Another possible limitation is that key explanatory variables may not have been included in the discrete choice experiments, even though they are significant factors in practice. For instance, the survey did not include several key external factors that may influence visitor preferences for resorts or transportation modes. Future studies should include a broader assessment of external factors (e.g. weather conditions, energy and resource prices, technological evolution) that may influence tourist decision-making behaviour. Even though these factors are largely outside the control of local decision-makers, it is important to understand how they either facilitate or constrain potential planning and management strategies.

Complexity of choice tasks

Another potential limitation of the study is that respondents may not have been able to understand and manage the relative complex tradeoffs associated with evaluating the multi-dimensional planning scenarios contained in the survey. It is possible that respondents did not fully account for certain attributes (e.g. form of development) when making their choices due to the difficult task of visualizing and trading off the various scenarios. As such, it is difficult to know whether insignificant variables were truly unimportant to respondents or were merely not perceived by respondents. Further research is needed to examine the underlying reasons that tourists prefer certain planning scenarios to others.

5.3.3 Case study approach

Since this study's empirical findings are based on a single tourism destination, it is misleading to draw broad conclusions from the results. The study's discrete choice experiment on resort planning alternatives partially addressed this issue by presenting choice situations involving purely hypothetical resorts. However, the extent that these findings can be generalized is limited by at least two factors: (1) visitors were told that these resorts were mountain destinations and about the same size as Whistler, and (2) only Whistler tourists completed these choice tasks. As such, the choice experiment results may not apply to different types of resort destinations (e.g. island or coastal destinations) or visitors (e.g. cultural tourists).

Further research should evaluate the potential of planning alternatives to influence dematerialization at different types of tourism destinations. Comparative studies would provide destination planners and managers with valuable insights about the variability of the impacts of dematerialization strategies at different types of resorts. These studies would also offer researchers a means of testing the influence of various destination characteristics (e.g. geographic location, management structure, destination life-cycle phase) on dematerialization effects. The framework and methodology developed in this dissertation could be used to guide and carry out this research.

5.3.4 Stakeholder analysis

A portion of this dissertation's research focussed on understanding the behavioural choices of summer tourists. However, preferences for planning alternatives can vary significantly, depending on the stakeholder group examined. Tourists, residents, the business sector, local government and other stakeholder groups may have vastly different perspectives on a specific planning option. The planning process must effectively accommodate these potentially divergent preferences into decisions about dematerialization planning alternatives.

Little research has been conducted on the preferences of more than one stakeholder group on the same set of planning issues (e.g. Lindberg et al., 2001). Given the wide range of interest groups affected by dematerialization initiatives in resort destinations, future research should examine the overall acceptability of dematerialization options from the perspective of different stakeholder groups. Discrete choice experiments can be used for this purpose. In addition, future research should investigate ways of including the preferences of these stakeholder groups in actual destination planning processes.

5.3.5 Financial analysis

Another limitation of the dissertation is its incomplete analysis of the financial costs required to implement the proposed dematerialization planning alternatives. While destination planners can influence future development by setting policies and providing infrastructure, these actions are largely dictated by market pressures created by decisions made by private-sector agents. The significant influence of the market means that planners must rely to a large extent on market-based policy mechanisms to influence the private sector (e.g. development impact fees, property tax abatements, housing subsidies and financial incentives for infill and redevelopment). Dependence on market-based policies means that a planner's influence on the destination landscape may be severely constrained. This is particularly true if private-sector agents require substantial compensation before they change their behaviour (e.g. households may require incentives before moving into compact neighbourhoods). Further research is needed to examine the likelihood of private-sector agents paying additional taxes or fees and to evaluate the financial incentives needed for individuals and firms to change their resource consumption behaviour.

5.3.6 System dynamics

The resource flow modelling framework developed in this research was based on numerous linear cause-effect relationships between various tourism destination features. However, destinations are not static. They are dynamic and unpredictable "complex adaptive systems" characterized by tightly coupled and interdependent components (Farrell & Twining-Ward, 2005). Lakes, coastal areas, mountains, natural habitats, attractions and recreation areas, accommodations and tourist facilities, infrastructure, transport systems, water supplies, agricultural resources, tourists and local populations are all intricately connected in a network in which a change to one component is likely to have repercussions throughout the entire system. The existence of causal feedback loops means that components are not linked by simple linear cause-effect relationships. Such complexities make it inconceivable to understand system behaviour by examining one component independently of its connections to other components. Unfortunately, the enormous number of connections among system components makes it practically impossible to understand and account for all connections. Deciding on which connections to concentrate on is a key challenge in understanding the behaviour of the whole system. Further research is needed to identify and examine the most important connections in tourism destination systems. By focusing on only the most important connections in a system, researchers can maximize their understanding of system behaviour without being overwhelmed by insignificant or redundant information.

5.3.7 Overall effectiveness of dematerialization

While the dematerialization strategies tested in this research are ambitious, they will not be sufficient for achieving dramatic absolute reductions in resource use and emissions. This is especially true if visitor travel is included in the inventory of resource flows. Therefore, other strategies will be necessary if destinations like Whistler are to be environmentally sustainable over long time periods. These initiatives ideally should encourage more fuel switching and resource substitution (e.g. using renewable energy sources instead of fossil fuels), as well as increased use of emission-control technologies (e.g. carbon capture and storage). In Whistler, for example, a sustainable energy scenario might involve using electricity, hydrogen and wood as the only forms of secondary energy, with these produced by non-emitting sources, including fossil fuels if carbon capture is employed. While some of these strategies may be implemented within the destination, others will require broad regional or national coordination. Further research should examine the environmental impacts of these options, as well as investigate tourist preferences for them. Such research would provide important insights about the relative environmental benefits and market responses associated with each of these options. The methods developed in this dissertation could be adapted for such an investigation.

5.4 Summary

As awareness of tourism's impacts on global environments increases, and as knowledge of environmental effects on tourism destination sustainability grows, so does the need for destination planners to develop environmentally sensitive management polices and strategies. Given the pervasive character of natural resource consumption and its related impacts, assessing the relative effects of various dematerialization policies and planning strategies in tourism destinations represents a valuable step towards creating a more sustainable tourism industry. For tourism destination planners and managers, the challenge is to select and implement strategies that are more appealing to stakeholders and cause greater dematerialization levels than "business as usual" scenarios. Decisions of this type are difficult when the implications of each potential strategy are not demonstrably clear. This study's theoretical and methodological frames, together with its applied case study, illustrate a systematic approach for examining the relative levels of dematerialization and stakeholder acceptance for various destination planning scenarios. The research methods and findings contribute to the growing theoretical and applied foundations needed for more sustainable forms of tourism development.

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APPENDICES

APPENDIX 1:
SPECIFICATIONS FOR RESOURCE FLOW MODEL

This appendix provides a detailed description of the "bottom-up" resource flow model developed for this research. The model was designed to estimate the effects of planning alternatives on future energy use, energy-related air emissions, water use, wastewater generation, and solid waste generation and disposal. Projections of these resource flows were determined by dynamically modelling interconnections between land use, transportation, building stock, infrastructure, employment, population, and visitation. A detailed description of these model components follows.

Employment

The Whistler Housing Authority (WHA) provided data on the number of permanent and seasonal employees in the base year. Forecasts of the number of permanent and seasonal employees were based on exogenous estimates also provided by the WHA[59]. These forecasts were used as a key driver of population.

Population

The model endogenously estimates total population by summing the number of permanent and seasonal employees, their nonworking family members, as well as all residents in nonworking households:

[59] In the model, land-use policies influence the number of permanent and seasonal employees. The Resort Municipality of Whistler (RMOW) provided estimates of employee numbers for each land-use policy alternative considered in this research.

$$TotalPop_t = \sum_{all\ k}(RestrictedPop_{kt} + MarketPop_{kt}) + NonWorkingPop_t$$

where $TotalPop_t$ is the total population of the tourism destination in year t; $RestrictedPop_{kt}$ is the number of employees of type k (permanent or seasonal) and their nonworking family members who live in restricted employee housing in year t; $MarketPop_{kt}$ is the number of employees of type k and their nonworking family members who live in market housing in year t; and $NonWorkingPop_t$ is the number of permanent residents in nonworking households in year t.

Permanent and seasonal employees living in market housing

The WHA provided estimates of the number of permanent and seasonal employees living in market housing in the base year. Forecasts of the number of employees living in market housing were assumed to decrease over time due to impending capacity constraints[60] in conjunction with employee housing leakage[61]:

$$MarketEmp_{kt} = MarketEmp_{k,t-1} - Leakage_{kt}$$

where $MarketEmp_{kt}$ is the number of employees of type k (permanent or seasonal) who live in market housing in year t; and $Leakage_{kt}$ is an exogenous estimate of employee housing leakage in year t[62].

The household size for employees living in market housing was factored up to account for nonworking family members living in the household:

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[60] The RMOW expects that the available capacity of market housing in Whistler will be fully developed by 2005. In addition, new land-use policy alternatives are expected to increase available capacity by only a small amount, if at all. It is expected that employees will occupy only a small share of the new development of market housing.

[61] Employee housing leakage refers to the situation where market housing previously occupied by employees is no longer available for employee housing. Leakage can occur in instances where employees retire and continue to live in their home, non-working families move into dwelling previously occupied by employees, non-working families move into their second home, and so forth.

[62] The RMOW provided estimates of employee housing leakage.

$$MarketPop_{kt} = MarketEmp_{kt} \times (1 + FamPerEmp_k)$$

where $MarketPop_{kt}$ is the number of employees and their nonworking family members who live in market housing in year t; and $FamPerEmp_k$ is an exogenous estimate of the number of nonworking family members (children and non-working spouses) per employee[63].

Permanent and seasonal employees living in restricted housing

The WHA provided estimates of the number of permanent and seasonal employees living in restricted employee housing in the base year. Forecasts of the number of employees living in restricted housing were assumed to increase due to demand for new employee bed units. These projections were constrained by the available capacity of restricted housing:

$$RestrictedEmp_{kt} = MIN\{Capacity_k, RestrictedEmp_{k,t-1} + BedUnitDemand_{kt}\}$$

where $RestrictedEmp_{kt}$ is the number of employees of type k (permanent or seasonal) living in restricted housing in year t; $Capacity_k$ is the available bed unit capacity for employee housing type k[64]; and $BedUnitDemand_{kt}$ is the demand for new employee bed units of type k in year t.

The demand for new employee bed units was derived as follows:

$$BedUnitDemand_{kt} = TotalEmp_{kt} - (RestrictedEmp_{k,t-1} + MarketEmp_{kt})$$

where $TotalEmp_{kt}$ is the total number of employees of type k (permanent or seasonal) in year t; $RestrictedEmp_{k,t-1}$ is the number of employees of type k living in restricted housing in year t-1; and $MarketEmp_{kt}$ is the number of employees of type k living in market housing in year t.

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[63] The RMOW provided estimates of the number of non-working family members per employee (assumed to be zero for seasonal employees).

[64] In the model, land-use policy directly influences the bed unit capacities. The RMOW provided data on bed unit capacities for each land-use policy alternative considered in this research.

The household size for employees living in restricted housing was factored up to account for nonworking family members living in the household:

$$RestrictedPop_{kt} = RestrictedEmp_{kt} \times (1 + FamPerEmp_k)$$

where $RestrictedPop_{kt}$ is the number of employees and their family members who live in restricted employee housing in year t; and $FamPerEmp_k$ is an exogenous estimate of the number of non-working family members (children and non-working spouses) per permanent employee[65].

Residents in nonworking households

The WHA provided estimates of the number of residents in nonworking households in the base year. Forecasts of the number of residents in nonworking households were assumed to increase over time due to the same factors that cause employee housing leakage:

$$NonworkingPop_t = NonworkingPop_{t-1} + NewNonworkingPop_t$$

where $NonworkingPop_t$ is the number of residents in nonworking households in year t; and $NewNonworkingPop_t$ is an exogenous estimate of the number of new residents in nonworking households in year t[66].

Commuting employees

Forecasts of the number of commuting permanent and seasonal employees were derived by place-of-origin as follows[67]:

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[65] The RMOW provided estimates of the number of non-working family members per employee (assumed to be zero for seasonal employees).

[66] The RMOW provided estimates of the number of new residents in nonworking households.

[67] The places-of-origin considered in this analysis were Squamish and Pemberton. Squamish is located 60 km south of Whistler, while Pemberton is located 30 km north. Employees also commute from more distant communities; however, the share of commutes from these areas was assumed to be negligible for this analysis.

$$CommutingEmp_{jkt} = \left(TotalEmp_{kt} - RestrictedEmp_{kt} - MarketEmp_{kt}\right) \times OriginSplit_{jk}$$

where $CommutingEmp_{jkt}$ is the number of commuting employees of type k (permanent or seasonal) from place-of-origin j in year t; $TotalEmp_{kt}$ is the total number of employees of type k in year t; $RestrictedEmp_{kt}$ is the number of employees of type k living in restricted housing in year t; $MarketEmp_{kt}$ is the number of employees of type k living in market housing in year t; and $OriginSplit_{jk}$ is the proportion of commuting employees of type k residing in place-of-origin j[68].

Visitors

The model estimates the total number of visitors by place-of-origin[69] by summing the number of visitors staying in paid accommodation, day only visitors, visitors staying in second homes, and visitors staying with friends and family:

$$TotalVis_{jt} = PaidVis_{jt} + DayOnlyVis_{jt} + SecHomeVis_{jt} + FriendsFamVis_{jt}$$

where $TotalVis_{jt}$ is the total number of visitors from place-of-origin j in year t; $PaidVis_{jt}$ is the number of visitors staying in paid accommodation from place-of-origin j in year t; $DayOnlyVis_{jt}$ is the number of day only visitors from place-of-origin j in year t; $SecHomeVis_{jt}$ is the number of visitors staying in second homes from place-of-origin j in year t; and $FriendsFamVis_{jt}$ is the number of visitors staying with friends and family from place-of-origin j in year t.

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[68] The RMOW provided estimates of the proportion of commuting permanent and seasonal employees from Squamish and Pemberton.

[69] The places-of-origin considered in this research were British Columbia, Alberta, Ontario, Quebec, Other Canada, Washington, Oregon, California, Mountain, Midwest, Southern, Eastern Seaboard, Alaska/Hawaii, United Kingdom, Germany, Other Europe, Japan, Other Asia, Australia/New Zealand, Latin America, and Other Overseas.

Paid accommodation

Data obtained from resort accommodations[70] were used to estimate the number of visitors staying in paid accommodation in the base year. Forecasts of the number of visitors by place-of-origin were calculated as follows:

$$PaidVis_{jt} = \left(\sum_{all\ j} PaidVis_{j,t-1} \times GrowthRate_t \right) \times OriginSplit_j$$

where $GrowthRate_t$ is an exogenous estimate of the annual growth rate of visitors staying in paid accommodation[71]; and $OriginSplit_j$ is the proportion of visitors from place-of-origin j[72].

Day only

Data obtained from Tourism Whistler's visitor surveys were used to estimate the number of day only visitors in the base year[73]. Forecasts of the number of visitors by place-of-origin were calculated as follows:

$$DayOnlyVis_{jt} = \left(DayOnlyVis_{t-1} \times GrowthRate_t \right) \times OriginSplit_j$$

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[70] Tourism Whistler provided data on room nights sold, average number of people per room, average length of stay, and the place-of-origin of visitors staying in paid accommodation. This data was used to calculate the number of visitors staying in paid accommodation by place-of-origin in the base year. Although this data was very comprehensive, it had to be factored up to account for private home and condominium rentals as well as other accommodations not included in the Tourism Whistler data.

[71] Tourism Whistler provided the estimates of annual growth rates of visitors staying in paid accommodation. It was assumed that growth rates would remain at about 5% until remaining development is complete in 2005, after which time the growth rates would decline to near zero.

[72] The proportion of visitors from each place-of-origin was estimated from the accommodation data provided by Tourism Whistler.

[73] Tourism Whistler's visitor surveys were used to estimate the ratio of survey respondents that were day only visitors to respondents that were staying in paid accommodation. The number of day only visitors was then calculated by multiplying this ratio by the number of visitors staying in paid accommodation in the base year.

where $GrowthRate_t$ is an exogenous estimate of the annual growth rate of day only visitors[74]; and $OriginSplit_j$ is the proportion of visitors from place-of-origin j[75].

Second home

Data obtained from Tourism Whistler's visitor surveys were used to estimate the number of visitors staying in second homes in the base year[76]. Forecasts of the number of visitors by place-of-origin were calculated as follows:

$$SecHomeVis_{jt} = (SecHomePop_t \times AvgNumSecHomeVisits) \times OriginSplit_j$$

where $SecHomePop_t$ is the number of unique individuals visiting second homes in year t[77]; *AvgNumSecHomeVisits* is an exogenous estimate of the number of second home visits per individual per year[78]; and $OriginSplit_j$ is the proportion of second home visitors from place-of-origin j[79].

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[74] Tourism Whistler provided the estimates of annual growth rates of day only visitors. It was assumed that growth rates would remain at about 5% until remaining development is complete in 2005, after which time the growth rates would decline to approximately 2%.

[75] The proportion of visitors from each place-of-origin was estimated from Tourism Whistler's visitor surveys.

[76] The same method used for day only visitors was used to calculate the number of visitors staying in second homes in the base year (see footnote 73).

[77] A two-stage process was used to estimate the number of unique individuals staying in second homes. First, the available pool of bed units in market housing was estimated by calculating the total number of market bed units not occupied by residents. Second, this number was multiplied by the percentage of available bed units actually used by individuals staying in second homes. This percentage was estimated from historical data.

[78] The WHA provided an estimate of the average number of second home visits per individual per year.

[79] The proportion of visitors from each place-of-origin was estimated from Tourism Whistler's visitor surveys.

Friends and family

Data obtained from Tourism Whistler's visitor surveys were used to estimate the number of visitors staying with friends and family in the base year[80]. Forecasts of the number of visitors by place-of-origin were calculated by:

$$FriendsFamVis_{jt} = (FriendsFamPop_t \times AvgNumFriendsFamVisits) \times OriginSplit_j$$

where $FriendsFamPop_{jt}$ is the number of unique individuals visiting friends and family in year t[81]; *AvgNumFriendsFamVisits* is an exogenous estimate of the number of visits to friends and family per individual per year[82]; and $OriginSplit_j$ is the proportion of second home visitors from place-of-origin j[83].

Building stock

The model estimates the number of units and floor area of several categories of residential and non-residential buildings. Residential buildings included restricted employee housing, single family, duplex, and multi-family dwellings. Non-residential buildings included retail, office, service, food/restaurant, bar, convention/conference, tourist/recreation, wholesale/storage, light/heavy manufacturing, and institutional buildings. The

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80 The same method used for day only visitors was used to calculate the number of visitors staying with friends and family in the base year (see footnote 73).

81 A two-stage process was used to estimate the number of unique individuals staying with friends and family. First, the number of people in Whistler able to accommodate visitors was estimated by calculating the equivalent population of residents and second home occupants. Second, this number was multiplied by the percentage of people actually visited by friends and family. This percentage was estimated from historical data.

82 Tourism Whistler provided an estimate of the average number of visits to friends and family per individual per year.

83 The proportion of visitors from each place-of-origin was estimated from Tourism Whistler's visitor surveys.

model accounts for development of new buildings as well as redevelopment of existing buildings.

Restricted housing

The RMOW provided data on the number of restricted employee dwelling units in the base year. Forecasts of the number of restricted dwelling units were derived directly from population estimates:

$$Units_{kt} = \frac{RestrictedPop_{kt}}{BedUnitsPerDwelling_k}$$

where $Units_{kt}$ is the number of restricted dwelling units of type k (permanent or seasonal) in year t; $RestrictedPop_{kt}$ is the number of employees of type k and their nonworking family members who live in restricted housing in year t; and $BedUnitsPerDwelling_k$ is an exogenous estimate of the number of bed units per dwelling unit of type k[84].

The number of existing dwelling units was assumed to decrease each year due to redevelopment:

$$ExistingUnits_{kt} = ExistingUnits_{k,t-1} \times (1 - RedevelopmentRate_k)$$

where $ExistingUnits_{kt}$ is the number of existing dwelling units of type k (permanent or seasonal) in year t; and $RedevelopmentRate_k$ is an exogenous estimate of the annual redevelopment rate for dwelling units of type k[85].

The number of new dwelling units was calculated as the difference between total dwelling units and existing dwelling units:

$$NewUnits_{kt} = Units_{kt} - ExistingUnits_{kt}$$

[84] The RMOW provided data on the average number of bed units per dwelling unit.

[85] The RMOW provided the estimates of annual redevelopment rates.

Market housing and accommodation

The RMOW provided data on the number of market dwelling units (single family, duplex, and multi-family) and accommodation units (hotel and other paid accommodation) in the base year. Forecasts of the number of units was assumed to increase by a fixed rate until available capacity was reached:

$$Units_{kt} = MIN\{Capacity_k, Units_{k,t-1} \times (1 + DevelopmentRate_k)\}$$

where $Units_{kt}$ is the number of dwelling units of type k in year t; $Capacity_k$ is the available capacity for dwelling units of type k[86]; and $DevelopmentRate_k$ is an exogenous estimate of the annual development rate for dwelling units of type k[87].

The number of existing and new buildings was estimated in the same manner as for restricted housing.

Commercial, industrial, and institutional buildings

The RMOW provided data on total floor area for different types of commercial, industrial, and institutional buildings in the base year[88]. Forecasts of total floor area for each of these building types was assumed to increase by a fixed rate until available capacity was reached:

$$FloorArea_{kt} = MIN\{Capacity_k, FloorArea_{k,t-1} \times (1 - DevelopmentRate_k)\}$$

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[86] In the model, land-use policy directly influences the dwelling unit capacities. The RMOW provided data on dwelling unit capacities for each land-use policy alternative considered in this research.

[87] The RMOW provided the estimates of annual development rates.

[88] Building types were: retail, office, service, food/restaurant, bar, convention/conference, tourist/recreation, wholesale/storage, light/heavy manufacturing, and institutional.

where $FloorArea_{kt}$ is the total floor area of building type k in year t; $Capacity_k$ is the available capacity for building type k[89]; and $DevelopmentRate_k$ is an exogenous estimate of the annual development rate for building type k[90].

The amount of floor area in existing buildings was assumed to decrease each year due to redevelopment:

$$ExistingFloorArea_{kt} = ExistingFloorArea_{k,t-1} \times (1 - RedevelopmentRate_k)$$

where $ExistingFloorArea_{kt}$ is the amount of floor area in existing buildings of type k in year t; and $RedevelopmentRate_k$ is an exogenous estimate of the annual redevelopment rate for buildings of type k[91].

The amount of floor area in new buildings was calculated as the difference between total floor area and floor area in existing buildings:

$$NewFloorArea_{kt} = FloorArea_{kt} - ExistingFloorArea_{kt}$$

Intra-community transportation

The model endogenously estimates person kilometres travelled (PKT) and vehicle kilometres travelled (VKT) for personal transportation, public transportation, the Whistler Blackcomb commercial vehicle fleet, and the municipal vehicle fleet.

Personal and public transportation

Estimates of vehicle kilometres travelled (VKT) for personal transportation in the base year were based on results of the EMME/2 Travel Demand Forecasting Model (Tsi Consultants, 2001). BC Transit provided data on

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89 In the model, land-use policy directly influences the floor area capacities. The RMOW provided data on floor area capacities for each land-use policy alternative considered in this research.

90 The RMOW provided the estimates of annual development rates.

91 The RMOW provided the estimates of annual redevelopment rates.

VKT for public transportation in the base year. These data were used to estimate per capita travel requirements in the base year as follows:

$$PerCapitaPKT = \frac{\sum_{all\ i} VKT_i \times OccupancyRate_i}{EquivalentPopulation}$$

where *PerCapitaPKT* is the per capita personal kilometres travelled by all modes (personal vehicle and public transportation) in the base year; VKT_i is the vehicle kilometres travelled by mode i in the base year; $OccupancyRate_i$ is the average occupancy rate of mode i in the base year[92]; and *EquivalentPopulation* is the tourism destination's equivalent population in the base year[93].

Forecasts of intra-community person kilometres travelled (PKT) were derived for each mode as follows:

$$PKT_{it} = EquivalentPopulation_t \times PerCapitaPKT_t \times ModalSplit_{it}$$

where $PerCapitaPKT_t$ is the per capita personal kilometres travelled by all modes in year t[94]; and $ModalSplit_{it}$ is the proportion of total PKT by mode i in year t[95].

PKT were then used to derive vehicle kilometres travelled (VKT) for each mode i in year t by dividing by the average occupancy rate of the mode:

$$VKT_{it} = \frac{PKT_{it}}{OccupancyRate_{it}}$$

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92 The RMOW provided average occupancy rates for personal transportation within Whistler. BC Transit provided average occupancy rates for public transportation within Whistler.

93 Equivalent population is the total number of people at the tourism destination per day. This includes residents, commuting employees, as well as overnight and day only visits.

94 Forecasts of per capita PKT were calculated by multiplying the per capita PKT in the base year by an annual growth rate. In the model, this growth rate is influenced by transportation policy. The RMOW provided estimates of the growth rate for each transportation policy alternative considered in this research.

95 In the model, transportation policy influences modal split. The RMOW provided estimates of modal split for each transportation policy alternative considered in this research.

Corporate vehicle fleet

Whistler & Blackcomb Mountain Resorts provided base year data on VKT for the Whistler Blackcomb commercial vehicle fleet. Forecasts of VKT were calculated by multiplying the base year VKT by a fixed annual growth rate.

Municipal vehicle fleet

The Resort Municipality of Whistler provided base year data on VKT for the municipal vehicle fleet. Forecasts of VKT were estimated by multiplying the base year VKT by a fixed annual growth rate.

Employee commuting

The model endogenously estimates person kilometres travelled (PKT) for both permanent and seasonal employees for three main modes of commuting (automobile, car pool, and bus):

$$PKT_{it} = \sum_{all\,k}\sum_{all\,j}\left(CommutingEmp_{jkt} \times WorkingDays_k \times Distance_j \times ModalSplit_{ijkt}\right)$$

where $CommutingEmp_{jkt}$ is the number of employees of type k (permanent or seasonal) commuting from place-of-origin j in year t[96]; $WorkingDays_k$ is the number of commuting days in the year (240 for permanent employees; 80 for seasonal employees); $Distance_j$ is the two-way distance to the resort from place-of-origin j; and $ModalSplit_{ijkt}$ is the proportion of employees of type k commuting by mode i from place-of-origin j in year t[97].

Estimates of PKT are used to derive vehicle kilometres travelled (VKT) for each mode of travel by dividing by the average occupancy rate of the mode.

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[96] The places-of-origin considered in this research were Squamish and Pemberton.

[97] The RMOW provided estimates of the modal splits.

Visitor travel to and from resort

The model endogenously estimates person kilometres travelled (PKT) for three modes of travel (automobile, bus, and airplane):

$$PKT_{it} = \sum_{all\ j} \left(TotalVis_{jt} \times Distance_j \times ModalSplit_{ijt} \right)$$

where $TotalVis_{jt}$ is the number of visitors from place-of-origin j in year t[98]; $Distance_j$ is the two-way distance to the resort from place-of-origin j[99]; and $ModalSplit_{ijt}$ is the proportion of visitors travelling by mode i from place-of-origin j in year t[100]. The calculations of PKT account for situations where visitors travelled by multiple modes (e.g. airplane from their place of origin to Vancouver, then automobile from Vancouver to Whistler).

Estimates of PKT were used to derive vehicle kilometres travelled (VKT) for each mode of travel by dividing by the average occupancy rate of the mode.

Energy consumption

The model endogenously estimates energy consumption for all buildings, infrastructure, and transportation internal to the tourism destination, as well as for employee commuting and visitor travel to and from the resort.

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98 See footnote 69 for the places-of-origin considered in this research.

99 The return distance used in these calculations included both air and road distances.

100 It was assumed that all visitors arrive to Whistler by ground transportation, either directly from their place-of-origin or via the Vancouver International Airport. It was also assumed that visitors from British Columbia and Washington only use ground transportation to travel to Whistler; half of the visitors from Oregon use ground transportation while half fly to Vancouver then use ground transportation; and all other visitors fly to Vancouver then use ground transportation to travel to Whistler. The travel distances were generally calculated from only one major centre in each region (e.g. Calgary in Alberta; Toronto in Ontario, Seattle in Washington, London in the United Kingdom; etc.) The analysis did not account for distances traveled to get to and from airports in the places-of-origin.

Residential buildings and accommodation

Energy consumption for residential dwellings and accommodation was estimated as follows:

$$EnergyConsumption_{kt} = ExistingUnits_{kt} \times ExistingAvgFloorArea_{kt} \times ExistingEUI_{kt} + NewUnits_{kt} \times NewAvgFloorArea_{kt} \times NewEUI_{kt}$$

where $EnergyConsumption_{kt}$ is the energy consumption for dwelling units of type k in year t[101]; $ExistingUnits_{kt}$ is the number of existing dwelling units of type k in year t; $ExistingAvgFloorArea_{kt}$ is the average floor area of existing dwellings of type k in year t; $ExistingEUI_{kt}$ is the energy use intensity (energy consumption per unit of floor area) for existing dwellings of type k in year t; $NewUnits_{kt}$ is the number of new dwelling units of type k in year t; $NewAvgFloorArea_{kt}$ is the average floor area of new dwellings of type k in year t; $NewEUI_{kt}$ is the energy use intensity for new dwellings of type k in year t[102].

The estimates of energy consumption were calibrated to base year data provided by BC Hydro and Terasen Gas. The mix of fuel types in each year was determined by multiplying total energy consumption by estimated fuel shares[103]. Energy consumption from the use of wood for space heating was estimated separately using existing data sources[104].

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101 Residential dwelling types were: single family, duplex, multi-family, restricted employee housing, and seasonal employee housing. Accommodation types were: hotel and other paid accommodation.

102 In the model, building design policies influence the energy use intensities for new dwellings.

103 In the model, infrastructure policies influence the fuel mix. For example, the fuel mix is affected by the decision to switch from piped propane to natural gas.

104 Based on estimates provided in the Whistler Integrated Energy, Air Quality and Greenhouse Gas Management Plan prepared by The Sheltair Group for the Resort Municipality of Whistler (RMOW, 2003a).

Commercial, industrial and institutional sector

Energy consumption for commercial, industrial and institutional buildings was estimated as follows:

$$EnergyConsumption_{kt} = ExistingFloorArea_{kt} \times ExistingEUI_{kt} + NewFloorArea_{kt} \times NewEUI_{kt}$$

where $EnergyConsumption_{kt}$ is the energy consumption for buildings of type k in year t[105]; $ExistingFloorArea_{kt}$ is the floor area of existing buildings of type k in year t; $ExistingEUI_{kt}$ is the energy use intensity (energy consumption per unit of floor area) for existing buildings of type k in year t; $NewFloorArea_{kt}$ is the floor area of new buildings of type k in year t; $NewEUI_{kt}$ is the energy use intensity for new buildings of type k in year t[106].

The estimates of energy consumption were calibrated to base year data provided by BC Hydro and Terasen Gas. The mix of fuel types in each year was determined by multiplying total energy consumption by estimated fuel shares[107].

Municipal buildings and infrastructure

Energy consumption for municipal buildings and infrastructure in the base year was estimated using electricity and propane consumption data provided directly by the RMOW. Forecasts of energy consumption were also provided by the RMOW.

Transportation

Energy consumption for intra-community transportation, employee commuting, and visitor travel to and from the resort was derived as follows:

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[105] Building types were: retail, office, service, food/restaurant, bar, convention/conference, tourist/recreation, wholesale/storage, light/heavy manufacturing, and institutional.

[106] In the model, building design policies influence the energy use intensities for new buildings.

[107] In the model, infrastructure policies influence the fuel mix.

$$EnergyConsumption_{it} = VKT_{it} \times FuelEfficiency_{it} \times ConversionFactor_i$$

where $EnergyConsumption_{it}$ is the energy consumption of mode i in year t; VKT_{it} is the vehicle kilometres travelled by mode i in year t; $FuelEfficiency_{it}$ is the average fuel efficiency of mode i in year t; and $ConversionFactor_i$ is a factor to convert units of fuel to units of energy[108].

Air emissions

The model endogenously estimates emissions of greenhouse gases (GHG) and common air contaminants (CAC). GHG emissions were calculated in terms of carbon dioxide equivalent (CO2e)[109]. CAC emissions were calculated for carbon monoxide (CO), nitrogen oxides (NOx), sulphur oxides (SOx), volatile organic compounds (VOCs), and particulate matter (PM).

Greenhouse gases

GHG emissions were calculated for two main processes: the use of energy, and the disposal of solid waste[110]. Energy-related GHG emissions were forecast by multiplying energy consumption by established emission factors[111]:

$$Emissions_{it} = EnergyConsumption_{it} \times EmissionFactor_i$$

where $Emissions_{it}$ is the amount of emissions from the consumption of fuel type i (electricity, propane, wood, gasoline, diesel, etc.) in year t.

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[108] Since fuel efficiency is typically reported in litres per VKT, a conversion factor is necessary to convert litres of fuel to GJ of energy.

[109] Carbon dioxide equivalent (CO_2e) is used to calculate the impact of various gases involved in global warming using a single unit of measurement. For example, one tonne of methane (CH_4) produces 21 times the atmospheric impact of one tonne of carbon dioxide (CO_2); therefore, CH_4 is expressed at 21 CO_2e.

[110] Other potential sources of greenhouse gas emissions, such as agriculture, were assumed to be negligible for the purpose of this research.

[111] See Table 3.1 for a detailed list of emission factors and respective references.

Direct GHG emissions from the Whistler landfill were forecast by multiplying the amount of solid waste disposal by an established emission factor:

$$Emissions_t = SolidWasteDisposal_t \times EmissionFactor$$

Common air contaminants

Area and mobile source emissions were forecast by multiplying energy consumption by established emission factors. Point source emissions were estimated using data from the Sea-to-Sky emission inventory (MWLAP, 2002).

Water consumption

The model endogenously estimates water consumption for all buildings internal to the tourism destination.

Residential buildings and accommodation

Water consumption for residential dwellings and accommodation was estimated as follows:

$$\begin{aligned} WaterConsumption_{kt} = {} & ExistingUnits_{kt} \times ExistingWUI_{kt} \\ & + NewUnits_{kt} \times NewWUI_{kt} \end{aligned}$$

where $WaterConsumption_{kt}$ is the water consumption for dwelling units of type k in year t[112]; $ExistingUnits_{kt}$ is the number of existing dwelling units of type k in year t; $ExistingWUI_{kt}$ is the water use intensity (water consumption per unit) for existing dwelling type k in year t; $NewUnits_{kt}$ is the number of new dwelling units of type k in year t; $NewWUI_{kt}$ is the water use intensity for new dwelling type k in year t[113].

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[112] Residential dwelling types were: single family, duplex, multi-family, restricted employee housing, and seasonal employee housing. Accommodation types were: hotel and other paid accommodation.

[113] In the model, building design policies influence the water use intensities for new buildings.

The estimates of water consumption were calibrated to base year data provided by the Resort Municipality of Whistler.

Commercial, industrial and institutional buildings

Water consumption for retail, office and service-related buildings was estimated in the same manner as for residential buildings and accommodation. Water consumption for restaurants and bars was estimated as follows:

$$WaterConsumption_{kt} = ExistingUnits_{kt} \times AvgSeats_{kt} \times ExistingWUI_{kt} + NewUnits_{kt} \times AvgSeats_{kt} \times NewWUI_{kt}$$

where $ExistingUnits_{kt}$ is the number of existing dwelling units of type k (restaurants or bars) in year t; $AvgSeats_{kt}$ is the average number of seats in building type k in year t; $ExistingWUI_{kt}$ is the water use intensity (water consumption per seat) for existing dwellings of type k in year t; $NewUnits_{kt}$ is the number of new dwelling units of type k in year t; and $NewWUI_{kt}$ is the water use intensity for new dwellings of type k in year t[114].

Water consumption for all other commercial, industrial and institutional building types was estimated as follows:

$$WaterConsumption_{kt} = ExistingFloorArea_{kt} \times ExistingWUI_{kt} + NewFloorArea_{kt} \times ExistingWUI_{kt}$$

where $ExistingFloorArea_{kt}$ is the total floor area of existing buildings of type k in year t[115]; and $ExistingWUI_{it}$ is the water use intensity (water consumption per unit of floor area) for existing buildings of type k in year t; $NewFloorArea_{kt}$ is the total floor area of new buildings of type k in year t; and $NewWUI_{it}$ is the water use intensity for new buildings of type k in year t[116].

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[114] In the model, building design policies influence the water use intensities for new buildings.

[115] Building types were: convention/conference, tourist/recreation, wholesale/storage, light/heavy manufacturing, and institutional.

[116] In the model, building design policies influence the water use intensities for new buildings.

The estimates of total water consumption were calibrated to base year data provided by the Resort Municipality of Whistler.

Parks

The Resort Municipality of Whistler provided base year data on the amount of water used to maintain parks. Forecasts of water consumption for parks were assumed to remain constant over time.

Wastewater generation

Wastewater generation was estimated from total water consumption by adjusting for irrigation and infiltration:

$$WastewaterGeneration_t = WaterConsumption_t - Irrigation_t + Infiltration_t$$

where $WastewaterGeneration_t$ is the amount of wastewater generated in year t; $Irrigation_t$ is the amount of water used for irrigation and other outdoor uses in year t[117]; and $Infiltration_t$ is the amount of water infiltration in year t[118]. The estimates of total wastewater generation were calibrated to base year data provided by the Resort Municipality of Whistler.

Solid waste generation

The model estimates total solid waste generation by multiplying the equivalent population of the tourism destination by per capita solid waste generation[119]:

$$SolidWasteGeneration_t = EquivalentPopulation_t \times PerCapitaGeneration_t$$

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[117] The amount of water used for irrigation was estimated by multiplying total water consumption by a fixed proportion, which was determined by analyzing historical data.

[118] Infiltration results from incorrectly installed manholes, poor pipe connections, and so forth. The amount of water infiltration was estimated by multiplying total water consumption by a fixed proportion, which was determined by analyzing historical data.

[119] Solid waste generation was estimated on a per capita basis, instead of a per building basis, because there was no available data on solid waste generation by building type.

where $SolidWasteGeneration_t$ is the amount of solid waste generated in year t; $EquivalentPopulation_t$ is the tourism destination's equivalent population in year t; and $PerCapitaGeneration_t$ is the per capita solid waste generation in year t. The estimates of solid waste generation were calibrated to base year data provided by the Resort Municipality of Whistler.

Solid waste disposal

The model estimates total solid waste disposal in landfills by multiplying the amount of solid waste generation by the solid waste diversion rate:

$$SolidWasteDisposal_t = SolidWasteGeneration_t \times (1 - DiversionRate_t)$$

where $SolidWasteDisposal_t$ is the amount of solid waste disposed in landfills in year t; and $DiversionRate_t$ is the proportion of solid waste diverted from landfills due to reduction and reuse, recycling, and composting in year t[120].

[120] In the model, infrastructure policies directly influence diversion rates. The RMOW provided estimates of diversion rates for alternative solid waste management scenarios.

APPENDIX 2: INTERCEPT QUESTIONNAIRE

This appendix contains the intercept questionnaire that was administered while recruiting visitors at Whistler to participate in the online stated choice survey.

Interviewer:	______________	**Time:**			
Date:	______________	❑ < 12	❑ 2-3	❑ 5-6	
Day of Week:	______________	❑ 12-1	❑ 3-4	❑ 6-7	
Location:	______________	❑ 1-2	❑ 4-5	❑ 7-8+	

Hi my name is [*your name*] and I am conducting research with Simon Fraser University to better understand what visitors think about future changes needed for Whistler to become more environmentally sustainable. Would you be willing to take 2 minutes to answer a few questions? [*If needed*] Which one of you is celebrating your birthday next and is also over the age of 19?

1. Have you already participated in this survey by Simon Fraser University? ❑ No ❑ Yes [*terminate*]

2. Are you a full-time resident of Whistler or do you work in Whistler? ❑ No ❑ Yes [*terminate*]

We will be conducting an Internet survey in the fall. By completing this survey, you will be helping to shape Whistler's future. You will also be eligible to win prizes such as native artwork or a free weekend in Whistler that includes accommodation and ski passes. Do we have your permission to contact you by e-mail in late September to complete this Internet survey? All personal information will be used for the purposes of this study only, and will not be released to any other individual or organization.

3. E-mail: ____

4. Is there a name we could use when we contact you by e-mail? ________________________

Thank you. At this time I have just a few quick questions about your trip. Your participation is completely voluntary, and you may terminate the interview at any time.

5. Is this your first time to Whistler?
❑ Yes ❑ No

6. Is the primary purpose of this trip business or leisure?
❑ Business ❑ Leisure

7. Are you a day visitor or are you staying overnight?
❑ Night ❑ Day [*If day visitor then skip to #10*]

8. How many nights are you staying in total?
|__|__| Nights

9. Are you staying in paid accommodation, at the home of friends or relatives, or in a second home?
❑ Paid accommodation
❑ Home of friends and family
❑ Second home
❑ Other: ______________________________

10. Where are you from?
Country: ______________________________
Province [*if CAN*]: ______________ State [*if USA*]: __________
City [*if BC*]: ______________________________

11. How did you travel to Whistler from your place of residence or from the airport/ferry?
❑ Automobile ❑ Bus ❑ Other: ________________

Thank you for your time. You can expect to receive an e-mail from Simon Fraser University in late September or early October. Please accept this pin as a token of our appreciation. Have a nice day.

APPENDIX 3:
STAKEHOLDER FEEDBACK FORM

This appendix contains the feedback form that was distributed to the individuals who attended the first survey design workshop on July 6, 2004. Attendees of the workshop included planners and other key staff from the Resort Municipality of Whistler, the Whistler Housing Authority, and Tourism Whistler. The purpose of the workshop was to obtain feedback on the attributes and levels to include in the study's discrete choice experiments.

Survey of Visitor Preferences for Planning Options at Whistler
Variable Rating Task

Introduction

The online survey will be conducted using a discrete choice survey technique. This technique requires survey respondents to evaluate future scenarios that are composed of specific variables. For each variable that we include in our survey, there are different options (i.e. levels) that get 'tested' in the scenarios. For example, for the variable intercept parking, different levels could be the number of vehicles that park in the satellite lot (i.e. all vehicles, 1500/day, none) or the cost of parking at the satellite lot (none, $4/day, $8/day).

The challenge facing us now is to reduce our large number of potential variables to a core set of the most important variables, and figure out the most appropriate levels for each variable. By following the instructions below, you will help us with this challenge.

As you complete the task described in the instructions below, please keep in mind our three criteria for the variables:

1. Must be relevant for sustainability (i.e. a change in the variable would increase or decrease sustainability)
2. Must be relevant for a tourist
3. Must be within the influence of planners or other stakeholders at Whistler (i.e. recreation groups, Housing Authority, etc.)

Instructions

After reviewing the list of potential variables, please complete the following two tasks:

1. Rate each variable in terms of your preference for including it in the survey. To do this, indicate the priority level (high, medium, or low) for including each variable in the survey. Please feel free to suggest alternative variables that you think should be included.
2. For the variables you rate as high priority, please suggest appropriate levels for the variables where possible. We have suggested some potential levels for some variables, partly to help clarify the intent of the variable and partly to give you a starting point to make alternative suggestions.

Returning the Form to Us

1. Fill the form out electronically (i.e. indicate the priority level for each variable, and replace our suggested levels with your suggestions). E-mail the completed form as an attachment to: jrkelly@sfu.ca
2. Print it out and fax ATTN Joe Kelly to the School of Resource and Environmental Management, SFU: (604) 291-4968.

Please return the completed form to us by Wednesday July 14.

Thanks again for your help!

Potential Variables		Priority Level			Suggested Levels
Automobile Policies					
1	**Intercept Parking** (parking at satellite lot with shuttles to Village)	**Hi**	**Mod**	**Low**	
	Number of vehicles intercepted				
	Cost to park & get transported				
	Type of transport service				
2	**Parking Fees**	**Hi**	**Mod**	**Low**	
	Extent of parking fees				
	Cost of parking				
Transit Policies					
3	**New 'Tourist' Bus Route** (travels a loop and stops at all major tourist attractions)	**Hi**	**Mod**	**Low**	
	Location of stops near Village				
	Cost of passes				
	Availability of passes				
	Type of service				
4	**Existing Bus Service**	**Hi**	**Mod**	**Low**	
	Bus fuel type				
	Schedule available in different languages				
	Bus accessibility				
	Bus availability				
5	**Car Co-op and Rentals**	**Hi**	**Mod**	**Low**	
	Cost				
	Availability				
Bike Transportation Policies					
6	**New Bicycle Taxi Service**	**Hi**	**Mod**	**Low**	
	Cost				
	Availability				
7	**Secure Bicycle Storage**	**Hi**	**Mod**	**Low**	
	Cost				
	Availability				
8	**Bike Lane on Highway**	**Hi**	**Mod**	**Low**	
	Extent of bike lane				

Potential Variables		Priority Level			Suggested Levels
Travel From Vancouver					
9	**Train from Vancouver**	**Hi**	**Mod**	**Low**	
	Number of transfers				
	Cost for a family				
	Ease of transporting baggage				
	Length of trip				
10	**Ferry from Vancouver**	**Hi**	**Mod**	**Low**	
	Cost for a family				
	Ease of transporting baggage				
	Length of trip				
11	**Bus from Vancouver**	**Hi**	**Mod**	**Low**	
	Cost for a family				
	Ease of transporting baggage				
Land Use					
12	**Village Appearance**	**Hi**	**Mod**	**Low**	
	Height of buildings in the Village				
	Style and character of buildings				
	Level of crowding				
13	**Development Outside Village**	**Hi**	**Mod**	**Low**	
	Amount of developed land in the resort municipality				
	Density of housing in neighbourhoods				
	Spatial arrangement of neighbourhoods				
	Size of distinct neighbourhoods				
	Shape of distinct neighbourhoods				
14	**Accessibility to Services/Amenities**	**Hi**	**Mod**	**Low**	
	Accessibility to commercial areas (retail, restaurant, grocery)				
Housing and Accommodation					
15	**Style and Mixing of Housing**	**Hi**	**Mod**	**Low**	
	Mix of single family, duplex, multifamily, tourist accommodation				
	Style and character of buildings				
16	**Green Buildings**	**Hi**	**Mod**	**Low**	
	Percent of housing that is green (e.g. meets best practices for energy efficiency)				

Potential Variables		Priority Level			Suggested Levels
Recreation and Leisure					
17	**Experience at Lake, Parks and on Trails near the Village**	Hi	Mod	Low	
	Level of crowding				
	Implementation of fees or quotas				
18	**Availability of Different Activities**	Hi	Mod	Low	
	Passive social activities (e.g. chess, bocce, Frisbee)				
	Low impact nature (e.g. interpretive signs and boardwalks)				
	Trail-based recreation (e.g. hiking, mountain biking)				
	Educational and cultural opportunities (e.g. speaker series, sustainability walk, cultural centres)				
	Motorized sport (e.g. hummers, ATVs, jet boats)				
Environmental Variables					
19	**TNS System Condition #1 (Resource Extracted/Used)**	Hi	Mod	Low	
	Per capita energy consumption				
	Per capita water consumption				
20	**TNS System Condition #2 (Wastes Produced)**	Hi	Mod	Low	
	Disposable items prohibited				
	Amount of recycling				
	Pesticide use				
	Water recycling and irrigation				
	Per capita solid waste production				
	Per capita wastewater production				
21	**TNS System Condition #3 (Degradation of Nature)**	Hi	Mod	Low	
	Protection of habitat and sensitive areas				
	Air quality				
	Drinking water quality				
22	**TNS System Condition #4 (People Meet Needs)**	Hi	Mod	Low	
	Reliance on local business for food and other goods				
	Number of residents that can afford to live in Whistler				

Potential Variables		Priority Level			Suggested Levels
Other					
		Hi	Mod	Low	
23	Diversity of Community/ Mixing of People				
24	Only Organic Food Served				
25	No Chains - Only Locally Owned Businesses				
26	Carbon Neutral Visits				
27	?				
28	?				
29	?				
30	?				

Please use the space below for any further comments or recommendations you may have about our visitor survey.

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Thank you for your participation!

APPENDIX 4:
E-MAILS TO SURVEY PARTICIPANTS

This appendix contains the initial e-mail and reminder e-mail sent to the recruited participants of the online stated choice survey. The e-mails were personalized based on the information collected during the intercept surveys.

Dear *[insert name]*,

You are one of the few individuals to be invited to participate in Simon Fraser University's survey on mountain resorts during your trip to Whistler in [*insert month*], 2004. Thank you for agreeing to take part, your opinions and perspectives are very important to us.

This survey has been designed to find out what you think about different aspects of mountain resorts like Whistler and will take 15-20 minutes to complete. As a thank you for taking the time to complete the survey, you will be entered in a draw to win a two-night ski holiday to Whistler, First Nations artwork, and other great prizes. Be sure to get your responses in by December 12, 2004 in order to be eligible for the prize draw.

Please be assured that this survey is for research purposes only. Participation in this survey is voluntary and your responses will be kept strictly confidential in accordance with Simon Fraser University's research ethics guidelines. Any personal identification information you provide will be used only to contact you in the event that you win one of the prizes.

CLICK ON THE FOLLOWING LINK TO BEGIN or RE-ENTER THE SURVEY:
http://www.whistlerstudy.rem.sfu.ca/?SS=yes&pw=538whi&di=KJ1536PW

If clicking on this link does not take you directly to the survey, please go to http://www.whistlerstudy.rem.sfu.ca/ and enter your LoginID and Password:

LoginID: KJ1536PW
Password: 538whi

This study is being conducted by the Centre for Tourism Policy and Research at the School of Resource and Environmental Management, Simon Fraser University, in partnership with the Resort Municipality of Whistler and Tourism Whistler. If you have any comments or questions, please contact Dr. Wolfgang Haider by phone at (604) 291-3066 or by fax at (604) 291-4968. Thank you for your cooperation.

Sincerely,

Krista Englund & Joe Kelly
Graduate Students
School of Resource and Environmental Management
Simon Fraser University
Burnaby, B.C. Canada

Dear [*insert name*],

Several weeks ago, you were sent an e-mail with a link to Simon Fraser University's web survey on visitor perspectives of mountain resorts. Our records indicate that you have not yet completed the survey. We are sending you this one reminder e-mail because your complete response is important for us to obtain representative results that can help improve future planning decisions at Whistler and other mountain resorts.

The web survey asks about your preferences for recreation, development, transportation, and environmental initiatives at mountain resorts. The survey will take about 15-20 minutes and requires no special knowledge to complete. Please submit your responses by Sunday, December 12, 2004 to be entered in the draw for a weekend ski trip to Whistler and other great prizes. This survey is for research purposes only and your responses will be kept strictly confidential in accordance with Simon Fraser University's research ethics guidelines.

CLICK TO BEGIN SURVEY:
http://www.whistlerstudy.rem.sfu.ca/?SS=yes&pw=538whi&di=KJ1536PW

If clicking on this link does not take you directly to the survey, please go to http://www.whistlerstudy.rem.sfu.ca/ and enter your loginID and password:

LoginID: KJ1536PW
Password: 538whi

Please be assured that you will not receive any further e-mails regarding this survey. Thank you for your time and cooperation.

Sincerely,

Krista Englund & Joe Kelly
Graduate Students
Centre for Tourism Policy and Research at the School of Resource and Environmental Management School of Resource and Environmental Management
Simon Fraser University
E-mail: whstudy@sfu.ca

APPENDIX 5:
SURVEY RESPONDENT PROFILE

This appendix profiles those visitors who responded to the study's online survey.

Place of residence

Almost half (45%) of the survey respondents were from British Columbia, with most of these people residing in the Lower Mainland (Table A5.1).[121] About 14% of respondents were from other provinces in Canada, with the largest shares coming from Ontario (8%), Alberta (3%) and Quebec (2%). Just over 25% of respondents were from the United States, with the largest proportion coming from Washington State (12%). The remainder of respondents resided in other countries, most significantly the United Kingdom (6%).

Socio-demographic information

More males (55%) than females completed the web survey and the majority of survey respondents (76%) were between the ages of 26 and 55 (Table A5.1). In addition, most survey respondents were well educated, with almost 90% having at least some technical training or college. The majority of survey respondents (78%) indicated their annual household income before taxes was between $25,000 and $150,000, with the most dominant income level occurring between $50,000 and $75,000. A sizable proportion of respondents (14%) had

[121] A chi-square analysis comparing respondents to non-respondents indicated there was no significant response bias based on place of residence.

household incomes greater than $150,000, while 8% of respondents had household incomes less than $25,000.

Table A5.1: Place of residence and socio-demographics

	Count	%
Place of Residence		
British Columbia	386	44.7%
Other Canada	119	13.8%
USA	230	26.6%
Other International	129	14.9%
Total	**864**	**100%**
Gender		
Male	436	55.4%
Female	351	44.6%
Total	**787**	**100%**
Age		
Under 19	1	0.1%
19-25 years	89	11.3%
26-35 years	211	26.7%
36-45 years	209	26.5%
46-55 years	183	23.2%
56 years +	97	12.3%
Total	**790**	**100%**
Education Level		
Elementary school	1	0.1%
High school	87	11.0%
Technical training/college	214	27.1%
University undergraduate	269	34.1%
University postgraduate	218	27.6%
Total	**789**	**100%**
Household Income		
Under $24,999	61	8.2%
$25,000-$49,999	124	16.7%
$50,000-$74,999	193	25.9%
$75,000-$99,999	127	17.1%
$100,000-$149,999	133	17.9%
$150,000-$199,999	58	7.8%
$200,000 or over	48	6.5%
Total	**744**	**100%**

Travel motivations

Survey respondents were asked to rate the importance of 16 different variables when visiting a mountain resort (Table A5.2). These motivation variables were rated on a scale of one to five, with one being "not important" and five being "very important." Overall, they were rated highly, which indicates that the respondents value all factors to some degree. Despite overall high ratings, there was some variation in the relative importance of different variables. The highest rated variable overall was "visiting a place that takes good care of its environment." The high rating for this factor may be due to the fact that respondents were influenced by the subject matter in previous sections of the survey. However, it also indicates that respondents agreed that environmental protection should be a key priority for mountain resorts like Whistler. Other highly rated variables (>4) were "resting and relaxing," "experiencing and seeing a mountain area," "getting value for the cost of the trip," "being physically active" and "participating in outdoor activities." Variables that were less important to the respondents (<3) include "attending a festival or event," "enjoying nightlife and entertainment" and "indulging in luxury, staying at first class hotels."

Table A5.2: Travel motivations

Motivation Factor	n	Mean Rating*
Visiting a place that takes good care of its environment	787	4.36
Resting and relaxing	792	4.24
Experiencing and seeing a mountain area	793	4.21
Getting value for the cost of the trip	789	4.18
Being physically active	791	4.10
Participating in outdoor activities	792	4.09
Visiting wilderness and undisturbed areas	790	3.74
Learning new things, increasing my knowledge	790	3.58
Visiting a place with unique and interesting restaurants	793	3.51
Viewing wildlife and birds	790	3.45
Going to a place that is family-oriented	787	3.35
Enjoying cultural or historic sites/attractions	790	3.24
Having opportunities to shop	792	3.15
Attending a festival or event	791	2.87
Enjoying nightlife and entertainment	788	2.79
Indulging in luxury, staying at first class hotels	793	2.55

* Average rating on a scale of 1 to 5, with 1 being "not important" and 5 being "very important."

Principal components analysis

A data reduction procedure called principal components analysis was used to summarize the 16 motivation variables by a few key factors (Johnson & Wichern, 1992).[122] This analysis produced five components that explained about 63% of the variance of the original 16 motivation variables (Table A5.3). As shown in the rotated component matrix (Table A5.4), these five factors correspond to: *environmental* motivations (e.g. visiting wilderness and undisturbed areas; visiting a place that takes good care of its environment); *luxury-based* motivations (e.g. having opportunities to shop; visiting a place with unique and interesting restaurants); *social and cultural* motivations (e.g. enjoying cultural or historic sites and attractions; learning new things and increasing knowledge); *activity-based* motivations (e.g. participating in outdoor activities; being physically active); and *family-oriented* motivations (e.g. going to a place that is family-oriented).

[122] The goal of principal components analysis is to summarize a multivariate dataset as accurately as possible using a few components (Johnson & Wichern, 1992). It groups the original variables in "factors" so that variables within each factor are more highly correlated with variables in that factor than with variables in other factors. These factors are weighted linear composites of the original variables.

Table A5.3: Total variance explained

	Initial Eigenvalues			Extraction Sums of Squared Loadings		
Component	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1: Environment	3.47	21.7%	21.7%	3.47	21.7%	21.7%
2: Luxury	2.70	16.9%	38.5%	2.70	16.9%	38.5%
3: Social & Culture	1.65	10.3%	48.9%	1.65	10.3%	48.9%
4: Outdoor Activities	1.21	7.6%	56.4%	1.21	7.6%	56.4%
5: Family	1.05	6.6%	63.0%	1.05	6.6%	63.0%
6	0.96	6.0%	69.0%			
7	0.73	4.6%	73.6%			
8	0.67	4.2%	77.8%			
9	0.65	4.0%	81.9%			
10	0.54	3.4%	85.3%			
11	0.51	3.2%	88.4%			
12	0.46	2.9%	91.3%			
13	0.40	2.5%	93.9%			
14	0.39	2.5%	96.3%			
15	0.35	2.2%	98.5%			
16	0.24	1.5%	100.0%			

* Extraction method: Principal Component Analysis
** KMO measure of sampling adequacy = 0.76

Table A5.4: Rotated component matrix

Motivation Factor	Factor 1: Environment	Factor 2: Luxury	Factor 3: Social & Culture	Factor 4: Outdoor Activities	Factor 5: Family
Visiting wilderness and undisturbed areas	**0.727**	-0.251	0.221	0.150	-0.005
Visiting a place that takes good care of its environment	**0.702**	0.136	0.071	0.038	-0.056
Experiencing and seeing a mountain area	**0.673**	-0.010	0.099	0.228	-0.069
Viewing wildlife and birds	**0.667**	-0.230	0.306	0.059	0.194
Having opportunities to shop	-0.109	**0.732**	0.187	-0.101	0.078
Visiting a place with unique and interesting restaurants	-0.083	**0.727**	0.220	0.103	-0.153
Indulging in luxury, staying at first class hotels	-0.087	**0.666**	0.040	-0.142	0.087
Resting and relaxing	0.428	**0.478**	-0.164	0.107	0.256
Getting value for the cost of the trip	0.372	**0.471**	-0.064	0.075	-0.096
Enjoying cultural or historic sites/attractions	0.247	0.115	**0.795**	-0.090	0.085
Learning new things, increasing my knowledge	0.429	-0.003	**0.674**	-0.007	0.124
Attending a festival or event	-0.024	0.337	**0.660**	0.137	-0.265
Enjoying nightlife and entertainment	-0.078	0.423	**0.333**	0.216	-0.598
Participating in outdoor activities	0.189	-0.024	-0.001	**0.899**	0.077
Being physically active	0.176	-0.046	0.002	**0.892**	0.036
Going to a place that is family-oriented	-0.082	0.237	0.184	0.275	**0.766**

* Rotation method: Varimax with Kaiser Normalization

Whistler experience level and likelihood of future visits

Survey respondents were asked how many times they had visited Whistler in the past and how likely they were to return to Whistler during the summer and winter seasons in the next two years (Table A5.5). Approximately two-thirds of respondents had been to Whistler two or more times. Another third of them had visited only once before.[123] The vast majority of respondents stated that they were somewhat or very likely to return to Whistler in the

[123] A chi-square analysis comparing respondents to non-respondents indicated that the set of survey responses may under-represent first-time visitors to Whistler.

summer (80%). A slightly lower proportion of respondents indicated that they were somewhat or very likely to return in the winter (60%).

Table A5.5: Previous and future Whistler visitation levels

	Count	%
Number of Past Visits		
One visit	304	35.4%
Two or more visits	554	64.6%
Total	**858**	**100%**
Likelihood of Future Summer Visits		
Very/somewhat likely	673	80.2%
Very/somewhat unlikely	132	15.7%
Unsure	34	4.1%
Total	**839**	**100%**
Likelihood of Future Winter Visits		
Very or moderately likely	488	60.4%
Very or moderately unlikely	274	33.9%
Unsure	46	5.7%
Total	**808**	**100%**

General trip characteristics

Respondents were asked a series of questions about their trip in August or September 2004, when they were recruited for the survey (Table A5.6). Approximately 95% of survey respondents indicated that the primary purpose of their trip was leisure.[124] With respect to trip length, substantially more of them were on overnight (79%) as opposed to day trips (21%).[125] Overnight visitors stayed an average of 3.96 nights at Whistler.

The vast majority of survey respondents (83%) who stayed overnight used hotels, condominiums, timeshares, B&Bs, hostels or other commercial accommodations.[126] In addition, about 12% of these respondents stayed

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[124] A chi-square analysis comparing respondents to non-respondents indicated that the set of survey responses may under-represent visitors whose main purpose of travel is business.

[125] A chi-square analysis comparing respondents to non-respondents indicated there was no significant response bias based on length of stay.

[126] A chi-square analysis comparing respondents to non-respondents indicated there was no significant response bias based on accommodation type.

overnight at the home of friends and family. Another 5% of them stayed overnight at their own second home.

Most survey respondents (63%) who stayed overnight indicated that their accommodation was located in Whistler's original Village or Village North. About 21% of them indicated that their accommodation was located within two kilometres of the main Village.

The vast majority of survey respondents (96%) were travelling with other people during their trip to Whistler. Over half of them (64%) were travelling with their spouse. Another 42% of these respondents were travelling with other adults, and approximately one-quarter of them were travelling with dependents.

The most frequently occurring travel party size was two (37%). This reflected the fact that a high proportion of respondents were travelling with their spouse or one other adult. Overall, the estimated average travel party size was 3.07 people.

Table A5.6: Visitor trip characteristics

	Count	%
Purpose of Trip		
Business	39	4.6%
Leisure	826	95.4%
Total	**865**	**100%**
Length of Trip		
Day	183	21.2%
Overnight	681	78.8%
Total	**864**	**100%**
Accommodation Type*		
Paid Accommodation	558	83.0%
Hotel, condo or chalet	*392*	*58.3%*
Timeshare	*108*	*16.1%*
B&B or pension	*10*	*1.5%*
Hostel or club cabin	*20*	*3.0%*
Campground	*28*	*4.2%*
Home of friends or family	77	11.5%
Second home	31	4.6%
Other	6	0.9%
Total	**672**	**100%**
Accommodation Location*		
Whistler Village or Village North	423	63.0%
Within 2 km of Whistler Village	143	21.3%
Further than 2 km from Whistler Village	101	15.1%
Unknown	4	0.6%
Total	**671**	**100%**
Members of Travel Party**		
Travelling alone	37	4.3%
Travelling with spouse	551	64.3%
Travelling with other adults	361	42.1%
Travelling with dependents	207	24.2%
Travelling with tour group	15	1.8%
Total	**857**	
Size of Travel Party		
One	108	12.7%
Two	315	37.1%
Three	119	14.0%
Four	140	16.5%
Five	57	6.7%
Six or more	111	13.1%
Total	**850**	**100%**

* Calculations exclude day visitors.

** The sum of column percentages is greater than 100% because some respondents selected more than one category.

Modes of transportation used for travel to Whistler

Survey respondents were asked to indicate which modes of transportation they used to travel from their residence to Whistler (Table A5.7).[127] Two-thirds of survey respondents used a private vehicle for at least part of their journey and approximately 20% of them travelled in rented vehicles to Whistler. Other modes of ground transportation were used far less frequently.

In terms of air travel, one quarter of survey respondents travelled by airplane to get to Whistler. The vast majority of them arrived at Vancouver International or Abbotsford International airports (77%). While the survey did not distinguish between the two, it is assumed that most of these people used Vancouver International Airport. Smaller shares of these respondents arrived at airports in Washington State (10%), Alberta (9%), other parts of British Columbia (<2%) and other areas of Canada or the US (<2%).

[127] Respondents were asked not to include modes used to make short connecting trips (e.g. hotel shuttle, taxi, local transit).

Table A5.7: Modes of transportation used for travel to Whistler

Transportation Mode	Count	%*
Private vehicle (car, truck or van)	565	66.2%
Rented vehicle (car, truck or van)	172	20.1%
Limousine	4	0.5%
Camper or RV	21	2.5%
Motorcycle	10	1.2%
Coach bus (including charters)	65	7.6%
Train	8	0.9%
Ferry	34	4.0%
Float plane or helicopter	6	0.7%
Airplane	217	25.4%
Other	5	0.6%
Total	**854**	

* The sum of column percentages is greater than 100% because some respondents used more than one mode of transportation.

Modes of transportation used for travel in Whistler

Survey respondents indicated which modes of transportation they used to get around Whistler during their stay (Table A5.8). The vast majority of respondents (86%) said that they got around at least some of the time by walking. As well, a sizable share of respondents (22%) used a bicycle to travel in Whistler at least some of the time. However, 55% of respondents indicated that they used a private vehicle at least some of the time to travel in Whistler. A sizable share of them (20%) also indicated that they used a rented vehicle to get around Whistler at least some of the time. Overall, 11% of respondents used local transit bus at least some of the time during their stay.

Table A5.8: Modes of transportation used for travel in Whistler

Transportation Mode	Count	%*
Private vehicle (car, truck or van)	458	54.6%
Rented vehicle (car, truck or van)	167	19.9%
Camper or RV	14	1.7%
Motorcycle	12	1.4%
Local transit bus	93	11.1%
Taxi or limousine	51	6.1%
Hotel shuttle	26	3.1%
Chartered van or bus	27	3.2%
Bicycle	181	21.6%
Walking	725	86.4%
Total	**839**	

* The sum of column percentages is greater than 100% because some respondents used more than one mode of transportation.

Activities undertaken in Whistler

Survey respondents indicated those activities they pursued during their visit to Whistler (Table A5.9). The most frequent activities undertaken were shopping (93%), dining out at a restaurant (89%) and walking, roller blading or biking on the paved paths in and close to Whistler Village (85%). Other popular activities included taking a walk or hike on the nature trails close to the Village (59%), taking a ride on the gondola (45%) and going to a bar or nightclub (39%). The survey results indicated that more visitors went mountain biking on trails in the Whistler area (20%) than in the bike park (13%). The least frequently pursued activities involved motorized tours or activities (8%), non-motorized water activities (10%) and golf in the Whistler area (10%).

Table A5.9: Activities undertaken in Whistler

Activity	Count	%*
Went shopping	788	92.9%
Dined out at a restaurant	758	89.4%
Went walking, roller blading or biking on paved paths close to Village	722	85.1%
Took a walk or hike on gravel/dirt trails close to the Village	499	58.8%
Took a gondola ride up or down Whistler Mountain	380	44.8%
Went to a bar or nightclub	328	38.7%
Went to a beach or went swimming in a lake	189	22.3%
Participated in facility-based recreation	187	22.1%
Went mountain biking on the trails in the Whistler area	167	19.7%
Attended a show, event or festival	152	17.9%
Went for a day/overnight hike on trails in the Whistler area	115	13.6%
Went mountain biking in the Whistler Bike Park	112	13.2%
Played a round of golf in the Whistler area	84	9.9%
Participated in a non-motorized water activity	82	9.7%
Participated in a motorized tour or activity	69	8.1%
Total	**848**	

* The sum of column percentages is greater than 100% because some respondents pursued more than one activity.

APPENDIX 6:
ONLINE SURVEY INSTRUMENT

This appendix contains a reproduction of the online stated choice survey used in this research. The dynamic programming elements contained in the web survey are noted in the text.

Visitor Perspectives of Mountain Resorts

Welcome to Simon Fraser University's survey on visitor perspectives of mountain resorts!

Please enter your user ID and password:

UserID:

Password:

This study is being conducted by the Centre for Tourism Policy and Research at the School of Resources and Environmental Management, Simon Fraser University in partnership with the Resort Municipality of Whistler and Tourism Whistler. Click here for our contact information.

CTPR

Visitor Perspectives of Mountain Resorts CTPR

Intro screen shown to non-recruited participants (i.e. individuals who logged on using the link in the Tourism Whistler newsletter.

Welcome to Simon Fraser University's survey on visitor perspectives of mountain resorts!

In this survey, you will have the opportunity to express your preferences for recreation, development, transportation, and environmental initiatives at mountain resorts. The survey takes 15-20 minutes to complete and requires no special knowledge.

As a thank you for taking the time to complete the survey you will be entered in a draw to **win a two-night ski holiday to Whistler, First Nations artwork, and other great prizes.** Click here for a full description of all our prizes. Be sure to get your responses in by December 12th, 2004 in order to be eligible for the prize draw!

Please be assured that this survey is for research purposes only. Participation in this survey is voluntary and your responses will be kept strictly confidential in accordance with the research ethics guidelines of Simon Fraser University. Any personal identification information you provide will be used only to contact you in the event that you win one of the prizes. Click here for a full description of our privacy guidelines.

Please do not use the Back and Forward buttons on your browser when completing the survey.

CLICK HERE to begin survey

This study is being conducted by the Centre for Tourism Policy and Research at the School of Resources and Environmental Management, Simon Fraser University in partnership with the Resort Municipality of Whistler and Tourism Whistler. Click here for our contact information.

CTPR

Visitor Perspectives of Mountain Resorts

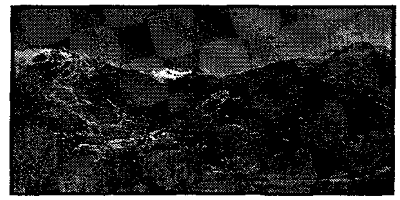
Intro screen shown to recruited participants

PRIZES

PRIVACY

CONTACT US

Welcome to Simon Fraser University's survey on visitor perspectives of mountain resorts!



In this survey, you'll have the opportunity to express your preferences for recreation, development, transportation, and environmental initiatives at mountain resorts. The survey takes 15-20 minutes to complete and requires no special knowledge.

Please use do not use the Back and Forward buttons on your browser when completing the survey. *If your survey gets interrupted, you may come back to this website to continue from the point where you left the survey.*

Next

CTPR

Preliminary Questions

5% COMPLETE

This page was only shown to non-recruited participants. The survey was terminated for all respondents who claimed to be full time residents or employees (see slide 52).

1. Are you a full-time resident of Whistler or do you work in Whistler?

Second home owners are not considered full-time residents. Work includes seasonal work. ***Check one.***

- O Yes
- ● No

Next

Preliminary Questions

6% COMPLETE

This page was only shown to non-recruited participants. Sections 1 & 2 were skipped for all respondents who indicated they had not visited Whistler before on question 3 below. The survey was terminated for all individuals who had visited Whistler in the winter only (see slide 53).

2. Which country do you reside in?

○ Canada

○ USA

● Other (Please Specify): [ ]

2a. If you live in Canada or the USA, which province or state do you reside in?

[Please Select One]

2b. If you live in British Columbia, which region of the province do you reside in?

[Please Select One]

3. How many times have you traveled to Whistler before?

Include all day-only and overnight business and leisure visits

	Never	Once	Two or more times
During summer season (May to October)	○	●	○
During winter season (November to April)	●	○	○

[Next]

Preliminary Questions

6% COMPLETE

This page was only shown to non-recruited participants. Sections 1 & 2 were skipped for all respondents who had visited Whistler in 2001 or earlier.

4. When was your most recent trip to Whistler during the summer (May to October)?

Month: [May] Year: [2003]

[Next]

SECTION 1: Your Trip to Whistler

5% COMPLETE

You were invited to participate in this study when you visited Whistler in May 2003. Please answer the questions in this section based on that trip. (text that was shown to recruited respondents)

Please answer the questions in this section based on your trip in May 2003. (text that was shown to all others)

1. Who travelled with you on your trip in May 2003?

Include all individuals that shared expenses such as transportation, recreational activities or accommodation during your trip to Whistler. ***Check all that apply.***

- ☐ Travelled alone
- ■ Spouse or equivalent
- ☐ Dependents
- ☐ Other friends, family, or colleagues
- ☐ Other members of a tour group

2. How many people travelled with you on your trip (including yourself)?

If you travelled with an organized tour group, only include your immediate travelling party, not all members of the tour group. ***Check one.***

- ○ One
- ● Two
- ○ Three
- ○ Four
- ○ Five
- ○ Six or more

continuation from previous page...

3. Was the purpose of your trip in May 2003 business or leisure?

- ○ Business
- ● Leisure

4. Did you stay overnight in Whistler during your trip in May 2003?

- ○ No
- ● Yes, I stayed: 12 nights. (please specify)

Next

SECTION 1: Your Trip to Whistler

6% COMPLETE

5. Which modes of transportation did you use to travel from your residence to Whistler on your trip in May 2003?

Do not include modes used to make short connecting trips (e.g. hotel shuttle, taxi, local transit). ***Check all that apply.***

- ☐ Private automobile (car, truck, or van)
- ☐ Rented automobile (car, truck, or van)
- ☐ Limousine
- ☐ Camper/RV
- ☐ Motorcycle
- ☐ Coach bus (including charters)
- ☐ Train
- ☐ Ferry
- ☐ Float plane or helicopter
- ☐ Airplane
- ☐ Other

5b. If you used an airplane, which airport did you arrive at? ***Check one.***

- ○ Vancouver International or Abbotsford International
- ○ Another airport in British Columbia
- ○ An airport in Washington State (e.g. Seattle)
- ○ An airport in Alberta (e.g. Edmonton or Calgary)
- ○ An airport in another US State or Canadian Province

[Next]

SECTION 1: Your Trip to Whistler

7% COMPLETE

5c. Which mode of transportation were you using when you arrived in Whistler? ***Check one.***

- ☐ Private automobile (car, truck, or van)
- ☐ Rented automobile (car, truck, or van)
- ☐ Limousine
- ☐ Camper/RV
- ☐ Motorcycle
- ☐ Coach bus (including charters)
- ☐ Float plane or helicopter
- ☐ Other

Question 5c was only shown to respondents that selected more than one of these modes on question 5 in this section.

6. Which modes of transportation did you use to get around Whistler during your stay in May 2003?

	Did not use	Used some of the time	Used most or all of the time
Private automobile	○	○	○
Rented automobile	○	○	○
Camper/RV	○	○	○
Motorcycle	○	○	○
Local transit bus	○	○	○
Taxi or limousine	○	○	○
Hotel shuttle	○	○	○
Chartered van or bus	○	○	○
Bicycle	○	○	○
Walking	○	○	○

[Next]

SECTION 1: Your Trip to Whistler

8% COMPLETE

Page shown only to individuals who indicated an overnight stay on question 4 in this section

7. What type of accommodation did you use in Whistler during your trip in May 2003?

If you stayed at more than one type of accommodation, select the one you stayed at the longest.
Check one.

- O Rented hotel room, condo, or chalet
- O Timeshare
- O Bed & breakfast or pension
- O Hostel or club cabin
- O Campground
- O Home of friends or family
- O Second home
- O Other

8. Where was your accommodation located in Whistler?

Check one.

- O In Whistler Village or Village North
- O Within 2 km or (1.25 miles) of Whistler Village (e.g. Upper Village, White Gold, Blueberry)
- O Further than 2 km (1.25 miles) from Whistler Village (e.g. Creekside, Alpine, Niclaus North)
- O Don't know

Next

SECTION 1: Your Trip to Whistler

9% COMPLETE

9. How often did you undertake each of the following activities during your trip in May 2003?

	Did not do	Did once	Did twice	Did three or more times
Went shopping	O	O	O	O
Dined out at a restaurant	O	O	O	O
Went to a bar or nightclub	O	O	O	O
Attended a show, event, or festival	O	O	O	O
Took a Gondola ride up or down Whistler Mountain	O	O	O	O
Went walking, roller blading, or biking on paved paths in & close to Whistler Village (e.g. the valley trail)	O	O	O	O
Took a walk or hike on gravel/dirt trails close to the Village (e.g. Lost Lake Park or up the ski hills)	O	O	O	O
Went on a day/overnight hike on trails in the Whistler area (e.g. Interpretive Forest, Singing Pass, Garibaldi Park)	O	O	O	O
Went mountain biking in the Whistler Bike Park	O	O	O	O
Went mountain biking on the trails in the Whistler area	O	O	O	O
Went to a beach or went swimming in a lake	O	O	O	O
Participated in a motorized tour or activity (e.g. ATV, float plane, hummer, motor boat)	O	O	O	O
Participated in a non-motorized water activity (e.g. rafting, kayaking, canoeing, fishing)	O	O	O	O
Participated in facility based recreation (e.g. bungee, zip trek, Blackcomb adventure zone, rec centre)	O	O	O	O
Played a round of golf in the Whistler area	O	O	O	O

Next

SECTION 1: Your Trip to Whistler

10% COMPLETE

10. Did you stay overnight at any other destinations besides Whistler during your trip in May 2003?

- O No
- O Yes

10b. ***Check all that apply.***

- ☐ Greater Vancouver
- ☐ Vancouver Island (e.g. Victoria)
- ☐ Other areas in British Columbia
- ☐ Other areas in Canada
- ☐ Other areas outside Canada

11. How many nights was your entire trip?

Include Whistler and any other areas you visited overnight. Enter 0 for a day-only trip.

Number of nights : [ ]

Next

SECTION 1: Your Trip to Whistler

11% COMPLETE

12. How likely are you to return to Whistler within the next 2 *years*?

	Very Unlikely	Somewhat Unlikely	Somewhat likely	Very likely	Unsure
During summer season (May to October)	O	O	O	O	O
During winter season (November to April)	O	O	O	O	O

Next Section

Visitor Perspectives of Mountain Resorts

11% COMPLETE

SECTION 2

Transportation between Whistler and Vancouver

In this section, you will be shown 4 different scenarios for travel between Vancouver and Whistler.

Please choose your preferred mode of transportation for each scenario.

Next

SECTION 2: Transportation to Whistler 1 of 4

16% COMPLETE

1. Which mode of transportation would you most likely use to travel between Vancouver and Whistler if the options below were the only ones available?

*Imagine that you are taking **an overnight** trip to Whistler in the summer which is similar to your trip in May 2003 (same travel party, length of stay, activities undertaken, etc). **Check one mode below.***

AUTOMOBILE	EXPRESS BUS	TRAIN	WOULD NOT GO
2 hrs travel time	**2 hrs 30 min** travel/wait time Leaves every **1 hour**	**2 hrs** travel/wait time Leaves every **2 hours**	
$15 one-way fuel costs **$15/night** parking fee at Whistler **$60/day** rental fee + insurance (if renting)	**$25/person** one-way fare	**$50/person** one-way fare	
	Departs from **Vancouver Airport** with downtown stops	Departs from **North Vancouver** with connecting shuttles from airport and downtown	
	Arrives at **Whistler Village**	Arrives at **Creekside** (5 km south of Village) with connecting shuttles to Village	

O Private automobile O Rented automobile O Express bus O Train O Would not go

Next Scenario

SECTION 2: Transportation to Whistler 2 of 4

18% COMPLETE

2. Which mode of transportation would you most likely use to travel between Vancouver and Whistler if the options below were the only ones available?

*Imagine that you are taking **an overnight** trip to Whistler in the summer which is similar to your trip in May 2003 (same travel party, length of stay, activities undertaken, etc). **Check one mode below.***

AUTOMOBILE	EXPRESS BUS	TRAIN	WOULD NOT GO
1 hr 30 min travel time	**1 hr 50 min** travel/wait time Leaves every **1 hour**	**1 hr 50 min** travel/wait time Leaves every **2 hours**	
$15 one-way fuel costs **$15/night** parking fee at Whistler **$60/day** rental fee + insurance (if renting)	**$50/person** one-way fare	**$75/person** one-way fare	
	Departs from **Vancouver Airport** with downtown stops	Departs from **downtown Vancouver** with connecting shuttles from airport	
	Arrives directly at **accommodation**	at **Whistler Village**	

O Private automobile　O Rented automobile　O Express bus　O Train　O Would not go

Next Scenario

SECTION 2: Transportation to Whistler 3 of 4

20% COMPLETE

3. Which mode of transportation would you most likely use to travel between Vancouver and Whistler if the options below were the only ones available?

*Imagine that you are taking **an overnight** trip to Whistler in the summer which is similar to your trip in May 2003 (same travel party, length of stay, activities undertaken, etc). **Check one mode below.***

AUTOMOBILE	EXPRESS BUS	TRAIN	WOULD NOT GO
2 hrs 30 min travel time	**2 hrs 30 min** travel/wait time Leaves every **1 hour**	**2 hrs 15 min** travel/wait time Leaves every **1 hour**	
$30 one-way fuel costs **$30/night** parking fee at Whistler **$80/day** rental fee + insurance (if renting)	**$25/person** one-way fare	**$25/person** one-way fare	
	Departs from **Vancouver Airport** with downtown stops	Departs from **downtown Vancouver** with connecting shuttles from airport	
	Arrives directly at **accommodation**	Arrives at **Whistler Village**	

O Private automobile　O Rented automobile　O Express bus　O Train　O Would not go

Next Scenario

SECTION 2: Transportation to Whistler 4 of 4 — 22% COMPLETE

4. Which mode of transportation would you most likely use to travel between Vancouver and Whistler if the options below were the only ones available?

*Imagine that you are taking **an overnight** trip to Whistler in the summer which is similar to your trip in May 2003 (same travel party, length of stay, activities undertaken, etc). **Check one mode below.***

AUOMOBILE	EXPRESS BUS	TRAIN	WOULD NOT GO
2 hrs travel time	2 hrs travel/wait time Leaves every **30 min**	2 hrs travel/wait time Leaves every **1 hour**	
$10 one-way fuel costs **Free** parking at Whistler **$40/day** rental fee + insurance (if renting)	**$50/person** one-way fare	**$75/person** one-way fare	
	Departs from **Vancouver Airport** with downtown stops	Departs from **Vancouver Airport** with downtown stops	
	Arrives directly at **accommodation**	Arrives at **Whistler Village**	

O **Private automobile** O **Rented automobile** O **Express bus** O **Train** O **Would not go**

Next Section

Visitor Perspectives of Mountain Resorts — 24% COMPLETE

SECTION 3

Part A. Your Opinions of Mountain Resorts

In this section, you will be asked about basic characteristics of mountain resorts related to developed land, recreational opportunities, local transportation, and environmental initiatives.

Please answer these questions based on your preferences for a possible mountain resort that has a maximum capacity of 50,000 people including visitors, residents and second home owners (i.e., about the same size as Whistler).

Next

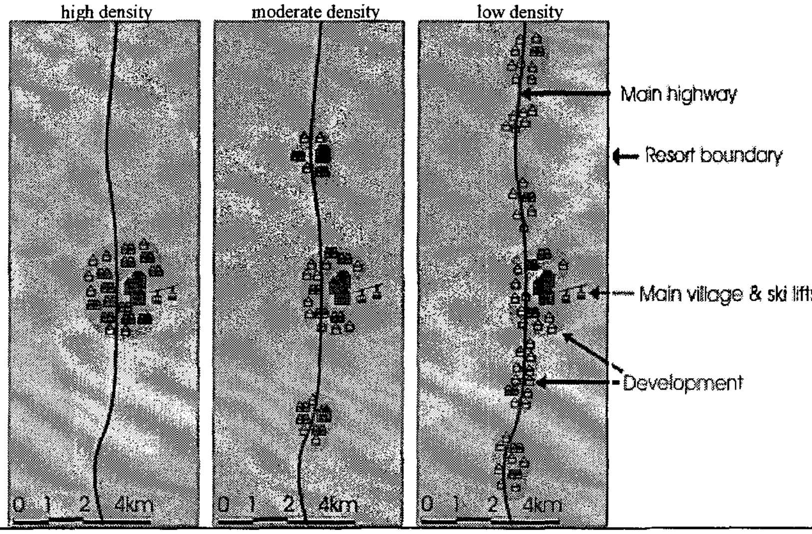
SECTION 3: Opinions on Development

26% COMPLETE

1. What kind of development would you prefer for the resort?

Development includes tourist accommodations and facilities, residential housing, commercial buildings, and other infrastructure. When answering this question, please only consider the form of development outside of the main village. Assume that development in the main village area would be the same in all three cases. ***Check one.***

O **Compact**	O **Multi-centered**	O **Dispersed**
1200 acres developed high density	1700 acres developed moderate density	2500 acres developed low density



continuation from previous page...

2. What percent of the workforce would you prefer to have living within the resort boundary?

Employees who do not live in the resort typically live in neighbouring towns and commute to work every day. ***Check one.***

- O 25% or less
- O 50%
- O 75%
- O 100%

Next

SECTION 3: Opinions on Recreational Opportunities

32% COMPLETE

3. How extensive of a nature trail system would you prefer?

Nature trails include gravel or dirt trails for hiking and mountain biking through forested areas, grasslands, and other undeveloped areas in the resort. ***Check one.***

- O Moderate (a few trails of different degrees of difficulty, encounters with others common)
- O Extensive (many trails of different degrees of difficulty, encounters with other people uncommon)

4. How many golf courses would you prefer in the resort?

Assume these are 18-hole golf courses. ***Check one.***

- O 0
- O 1
- O 2
- O 3 or more

5. Would you like motorized sports such as ATV or Hummer tours to be available in or near the resort? ***Check one.***

- O Yes
- O No

6. How much opportunity for cultural and educational activities would you prefer?

Examples of cultural and educational activities include museums, historic sites, interpretive sites, and demonstration projects. ***Check one.***

- O Limited (only a few cultural and educational activities available)
- O Extensive (many cultural and educational activities available)

Next

SECTION 3: Opinions on Automobile Accessibility

36% COMPLETE

7. What level of private automobile accessibility would you prefer in the resort?

Automobile accessibility refers to the extent that visitors can use private automobiles within the resort. ***Check one.***

- O Allowed throughout the entire resort, including the main village (overnight parking at accommodations)
- O Not allowed in the main village area, but allowed in all other areas of the resort (overnight parking at accommodations)
- O Not allowed anywhere in the resort boundaries (parking approx. 10km from village; visitors would take free shuttles to village or accommodations)

8. What level of day parking fees would you consider appropriate?

Revenues from parking fees would go towards improving transportation infrastructure and providing alternative modes of transportation in the resort (e.g. local transit). ***Check one.***

- O Free
- O $5/day
- O $10/day

The first question 8 was shown to respondents who indicated an overnight stay on question 4 in section 1 and the second was shown to those was indicated a day only stay.

8. What level of overnight parking fees would you consider appropriate?

Revenues from parking fees would go towards improving transportation infrastructure and providing alternative modes of transportation in the resort (e.g. local transit). ***Check one.***

- O Free
- O $15/night
- O $30/night

Next

SECTION 3: Opinions on Local Transit Bus Service

40% COMPLETE

9. What level of local bus service would you prefer? ***Check one.***

- O No service
- O Limited service (a few key routes serviced with moderate frequency)
- O Extensive service (many routes with frequent service)

10. What level of bus fare would you consider appropriate?

Revenues from bus fares would go towards improving the quality of bus service in the community. ***Check one.***

- O Free
- O $1.50/trip
- O $3.00/trip

Next

SECTION 3: Opinions on Environmental Initiatives

44% COMPLETE

11. How much land within the resort would you like to see protected?

"Protected" means that land would be set aside to preserve wildlife habitat and ecologically valuable areas (e.g., wetlands, habitat for rare species). No future development and no recreation access would be permitted in protected areas. **Check one.**

- O 0%
- O 5% *current Whistler
- O 20%
- O 35% or more

12. What percentage of the energy used in the resort would you like to see generated with renewable sources?

Energy is required to operate resort buildings, facilities and vehicles. Renewable energy sources include wind, hydro-electric and geothermal. These energy sources emit less pollution than non-renewable sources such as fossil fuels. Note that visitors may be charged an environmental fee to help cover the costs of converting to renewable energy sources. ***Check one.***

- O 20% or less
- O 40% *current Whistler
- O 60%
- O 80% or more

continuation from previous page...

13. What percentage of the waste generated in the resort would you like to see recycled or composted rather than being sent to landfills?

Note that visitors may be charged an environmental fee to help cover the costs of recycling and composting programs. ***Check one.***

- O 25% *current Whistler
- O 0%
- O 50%
- O 75% or more

14. What level of environmental fee would you be willing to pay to cover the cost of environmental initiatives in the resort community?

An environmental fee would be a tax added to accommodation, restaurant and activity bills. Revenues generated from this tax would not be used for any purpose other than local environmental initiatives. ***Check one.***

- O 0%
- O 2%
- O 4%
- O 6% or more

[Next]

Visitor Perspectives of Mountain Resorts — 60% COMPLETE

SECTION 3

Part B. Choose your Favourite Resort

Now, we will show you 3 pairs of possible mountain resorts described by the characteristics you reviewed in the previous section.

Please choose the resort you prefer and rate the acceptability of both resorts.

[Next]

SECTION 3: Choose your Favourite Resort 1 of 3

54% COMPLETE

*Please answer based on your preferences as **an overnight visitor** during the **summer**. Assume that the two resorts are similar in all other aspects.*

	Resort A	Resort B
Development	**Multi-centred** development **75%** of workforce living in resort	**Dispersed** development **100%** of workforce living in resort
Environmental Initiatives	**20%** of area protected **25%** of energy from renewable sources **50%** of waste recycled **4%** environment fee	**35%** of area protected **50%** of energy from renewable sources **50%** of waste recycled **2%** environment fee
Local Bus	**Extensive** transit bus service **$1.50/trip** bus fare	**No** transit bus service
Car Access	Private vehicles **not allowed anywhere** **$15/night** parking fee at **boundary with shuttles**	Private vehicles **not allowed in village** **$30/night** parking fee at **accommodation**
Recreation	**Moderate** trail system **1** golf course(s) Motorized sports **available** **Limited** cultural & educational activities	**Moderate** trail system **1** golf course(s) Motorized sports **available** **Extensive** cultural & educational activities

1. Which resort do you prefer? ***Check one on the scale below.***

Highly prefer A	Moderately prefer A	Somewhat prefer A	Somewhat prefer B	Moderately prefer B	Highly prefer B
O	●	O	O	O	O

Next

SECTION 3: Choose your Favourite Resort 1 of 3

54% COMPLETE

*Please answer based on your preferences as **an overnight visitor** during the **summer**. Assume that the two resorts are similar in all other aspects.*

	Resort A	Resort B
Development	**Multi-centred** development **75%** of workforce living in resort	
Environmental Initiatives	**20%** of area protected **25%** of energy from renewable sources **50%** of waste recycled **4%** environment fee	**35%** of area protected **50%** of energy from renewable sources **50%** of waste recycled **2%** environment fee
Local Bus	**Extensive** transit bus service **$1.50/trip** bus fare	
Car Access	Private vehicles **not allowed anywhere** **$15/night** parking fee at **boundary with shuttles**	Private vehicles **not allowed in village** **$30/night** parking fee at **accommodation**
Recreation	**Moderate** trail system **1** golf course(s) Motorized sports **available** **Limited** cultural & educational activities	

You indicated that you somewhat prefer Resort A

1a. Is Resort A acceptable to you?

O Yes
O No

Next

SECTION 3: Choose your Favourite Resort 1 of 3

54% COMPLETE

Please answer based on your preferences as ***an overnight visitor*** *during the* ***summer****. Assume that the two resorts are similar in all other aspects.*

	Resort A	Resort B
Development		**Dispersed** development **100%** of workforce living in resort
Environmental Initiatives	20% of area protected 25% of energy from renewable sources 50% of waste recycled 4% environment fee	**35%** of area protected **50%** of energy from renewable sources **50%** of waste recycled **2%** environment fee
Local Bus		**No** transit bus service
Car Access	Private vehicles **not allowed anywhere** **$15/night** parking fee at **boundary with shuttles**	Private vehicles **not allowed in village** **$30/night** parking fee at **accommodation**
Recreation		**Moderate** trail system **1** golf course(s) Motorized sports **available** **Extensive** cultural & educational activities

You indicated that you somewhat prefer Resort A

1b. Would Resort B be acceptable to you?

O Yes

O No

Next

SECTION 3: Choose your Favourite Resort 2 of 3

56% COMPLETE

Please answer based on your preferences as ***an overnight visitor*** *during the* ***summer****. Assume that the two resorts are similar in all other aspects.*

	Resort A	Resort B
Development	**Compact** development **100%** of workforce living in resort	**Multi-centred** development **25%** of workforce living in resort
Recreation	**Extensive** trail system **3** golf course(s) Motorized sports **available** **Limited** cultural & educational activities	**Moderate** trail system **1** golf course(s) Motorized sports **not available** **Extensive** cultural & educational activities
Local Bus	Private vehicles **allowed everywhere** **$30/night parking fee at accommodation**	Private vehicles **not allowed in village** **No parking fee at accommodation (free)**
Car Access	**Limited** transit bus service **No** bus fare	**Extensive** transit bus service **$3.00/trip** bus fare
Environmental Initiatives	**5%** of area protected **50%** of energy from renewable sources **50%** of waste recycled **4%** environment fee	**20%** of area protected **25%** of energy from renewable sources **50%** of waste recycled **No** environment fee

2. Which resort do you prefer? ***Check one on the scale below.***

●	○	○	○	○	○
Highly prefer A	Moderately prefer A	Somewhat prefer A	Somewhat prefer B	Moderately prefer B	Highly prefer B

Next

SECTION 3: Choose your Favourite Resort 2 of 3

58% COMPLETE

*Please answer based on your preferences as **an overnight visitor** during the **summer**. Assume that the two resorts are similar in all other aspects.*

	Resort A	Resort B
Development	**Compact** development **100%** of workforce living in resort	
Recreation	**Extensive** trail system **3** golf course(s) Motorized sports **available** **Limited** cultural & educational activities	**Moderate** trail system **1** golf course(s) Motorized sports **not available** **Extensive** cultural & educational activities
Local Bus	Private vehicles **allowed everywhere** **$30/night** parking fee at **accommodation**	
Car Access	**Limited** transit bus service No bus fare	**Extensive** transit bus service **$3.00/trip** bus fare
Environmental Initiatives	**5%** of area protected **50%** of energy from renewable sources **50%** of waste recycled **4%** environment fee	

You indicated that you somewhat prefer Resort A

2a. Is Resort A acceptable to you?

- O Yes
- O No

Next

SECTION 3: Choose your Favourite Resort 2 of 3

58% COMPLETE

*Please answer based on your preferences as **an overnight visitor** during the **summer**. Assume that the two resorts are similar in all other aspects.*

	Resort A	Resort B
Development		**Multi-centred** development **25%** of workforce living in resort
Recreation	**Extensive** trail system **3** golf course(s) Motorized sports **available** **Limited** cultural & educational activities	**Moderate** trail system **1** golf course(s) Motorized sports **not available** **Extensive** cultural & educational activities
Local Bus		Private vehicles **not allowed in village** No parking fee at **accommodation (free)**
Car Access	**Limited** transit bus service No bus fare	**Extensive** transit bus service **$3.00/trip** bus fare
Environmental Initiatives		**20%** of area protected **25%** of energy from renewable sources **50%** of waste recycled **No** environment fee

You indicated that you somewhat prefer Resort A

2b. Would Resort B be acceptable to you?

- O Yes
- O No

Next

SECTION 3: Choose your Favourite Resort 3 of 3

60% COMPLETE

Please answer based on your preferences as ***an overnight visitor*** *during the* ***summer****. Assume that the two resorts are similar in all other aspects.*

	Resort A	Resort B
Development	**Multi-centered** development **100%** of workforce living in resort	**Dispersed** development **100%** of workforce living in resort
Environmental Initiatives	**20%** of area protected **50%** of energy from renewable sources **50%** of waste recycled **4%** environment fee	**5%** of area protected **25%** of energy from renewable sources **None** of waste recycled **No** environment fee
Local Bus	**Extensive** transit bus service **No** bus fare	**Extensive** transit bus service **$1.50/trip** bus fare
Car Access	Private vehicles **allowed everywhere** **$15/night** parking fee at **accommodation**	Private vehicles **not allowed anywhere** **No** parking fee at **boundary with shuttles**
Recreation	**Moderate** trail system **2** golf course(s) Motorized sports **available** **Limited** cultural & educational activities	**Extensive** trail system **1** golf course(s) Motorized sports **available** **Extensive** cultural & educational activities

3. Which resort do you prefer? ***Check one on the scale below.***

○	○	○	●	○	○
Highly prefer A	Moderately prefer A	Somewhat prefer A	Somewhat prefer B	Moderately prefer B	Highly prefer B

Next

SECTION 3: Choose your Favourite Resort 3 of 3

62% COMPLETE

Please answer based on your preferences as ***an overnight visitor*** *during the* ***summer****. Assume that the two resorts are similar in all other aspects.*

	Resort A	Resort B
Development	Multi-centered development 100% of workforce living in resort	**Dispersed** development **100%** of workforce living in resort
Environmental Initiatives	20% of area protected 50% of energy from renewable sources 50% of waste recycled 4% environment fee	**5%** of area protected **25%** of energy from renewable sources **None** of waste recycled **No** environment fee
Local Bus		**Extensive** transit bus service **$1.50/trip** bus fare
Car Access	Private vehicles **allowed everywhere** $15/night parking fee at **accommodation**	Private vehicles **not allowed anywhere** **No** parking fee at **boundary with shuttles**
Recreation		**Extensive** trail system **1** golf course(s) Motorized sports **available** **Extensive** cultural & educational activities

You indicated that you somewhat prefer Resort B

3b. Is Resort B acceptable to you?

O Yes

O No

Next

SECTION 3: Choose your Favourite Resort 3 of 3

62% COMPLETE

*Please answer based on your preferences as **an overnight visitor** during the **summer**. Assume that the two resorts are similar in all other aspects.*

	Resort A	Resort B
Development	**Multi-centered** development **100%** of workforce living in resort	Dispersed development [illegible]
Environmental Initiatives	**20%** of area protected **50%** of energy from renewable sources **50%** of waste recycled **4%** environment fee	**5%** of area protected **25%** of energy from renewable sources **None** of waste recycled **No** environment fee
Local Bus	**Extensive** transit bus service No bus fare	[illegible]
Car Access	Private vehicles **allowed everywhere** **$15/night** parking fee at **accommodation**	Private vehicles **not allowed anywhere** No parking fee at **boundary with shuttles**
Recreation	**Moderate** trail system **2** golf course(s) Motorized sports **available** **Limited** cultural & educational activities	[illegible]

You indicated that you somewhat prefer Resort B

3a. Would Resort A be acceptable to you?

- Yes
- No

Next

Visitor Perspectives of Mountain Resorts

64% COMPLETE

SECTION 4

Choose your Favourite Resort Landscape

In this section, you will be shown 6 pairs of possible resort maps. Please choose the landscape you prefer.

Before giving you your first choice, we will briefly explain an example map.

Next

SECTION 4: Choose your Favourite Resort Landscape - EXAMPLE

68% COMPLETE

INSTRUCTIONS: The maps shown in this section contain the following information:

12% (1850 acres) developed

75% of workforce living in resort

20% (3115 acres) protected
(NO recreation or development)

Includes 65% of the ecologically valuable areas

68% natural areas
(for recreation & future development)

Moderate trail system

1 golf course(s)

Developed Areas

Developed areas include tourist accommodations and facilities, residential housing, commercial buildings, and other infrastructure.

Protected Areas

Protected areas include wildlife habitat and movement corridors. Ecologically valuable areas are those areas that biologists consider a high priority for protection. These areas include wetlands, streams and habitat for rare or endangered species.

Note that no future development or recreational access is permitted in protected areas.

Natural Areas

Natural areas include recreational areas (i.e. trails, parks), some scattered homes, and areas for future development.

Golf Courses

The number of 18-hole golf courses.

Next

SECTION 4: Choose your Favourite Resort Landscape 1 of 3

72% COMPLETE

*Assume that the two resorts are similar in **all other aspects**. Please answer based on your preferences as **an overnight** visitor during the **summer**.*

RESORT A

12% (1850 acres) developed

75% of workforce living in resort

35% (5400 acres) protected
(NO recreation or development)

Includes 65% of the ecologically valuable areas

53% natural areas
(for recreation & future development)

Moderate trail system

3 golf course(s)

RESORT B

21% (3240 acres) developed

100% of workforce living in resort

35% (5400 acres) protected
(NO recreation or development)

Includes 65% of the ecologically valuable areas

44% natural areas
(for recreation & future development)

Moderate trail system

1 golf course(s)

1. Which resort do you prefer? ***Check one.***

O Resort A

O Neither resort is acceptable

O Resort B

Next

SECTION 4: Choose your Favourite Resort Landscape 2 of 3

76% COMPLETE

Assume that the two resorts are similar in ***all other aspects****. Please answer based on your preferences as* ***an overnight*** *visitor during the* ***summer****.*

RESORT A

10% (1540 acres) developed

75% of workforce living in resort

20% (3115 acres) protected
(NO recreation or development)

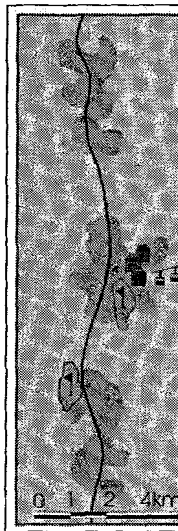
Includes **65%** of the ecologically valuable areas

70% natural areas
(for recreation & future development)

Extensive trail system

1 golf course(s)

RESORT B



17% (2620 acres) developed

75% of workforce living in resort

0% (0 acres) protected
(NO recreation or development)

Includes **0%** of the ecologically valuable areas

83% natural areas
(for recreation & future development)

Extensive trail system

2 golf course(s)

2. Which resort do you prefer? ***Check one.***

O Resort A

O Neither resort is acceptable

O Resort B

Next

SECTION 4: Choose your Favourite Resort Landscape 3 of 3

80% COMPLETE

Assume that the two resorts are similar in ***all other aspects****. Please answer based on your preferences as* ***an overnight*** *visitor during the* ***summer****.*

RESORT A

17% (2620 acres) developed

25% of workforce living in resort

20% (3115 acres) protected
(NO recreation or development)

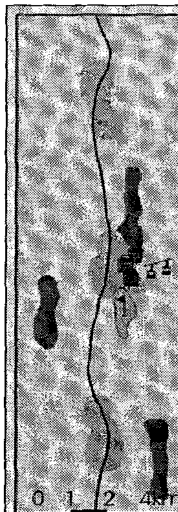
Includes **35%** of the ecologically valuable areas

63% natural areas
(for recreation & future development)

Moderate trail system

3 golf course(s)

RESORT B



9% (1390 acres) developed

25% of workforce living in resort

5% (770 acres) protected
(NO recreation or development)

Includes **95%** of the ecologically valuable areas

86% natural areas
(for recreation & future development)

Extensive trail system

1 golf course(s)

3. Which resort do you prefer? ***Check one.***

O Resort A

O Neither resort is acceptable

O Resort B

Next

SECTION 4: Choose your Favourite Resort Landscape

84% COMPLETE

4. Which statement below best describes how you chose your favourite resort landscapes?
Check one.

- O I equally considered the map and the text next to the map.
- O I considered the map more than the text.
- O I considered the text more than the map.

5. Which of the following map features affected your landscape choice?

	I did **not notice** this feature	I noticed this feature but it did **not affect** my choice	I noticed this feature and it **affected** my choice	Unsure / Don't Know
Number of developed areas (i.e. dispersion)	O	O	O	O
Shape of developed areas (i.e. irregularity)	O	O	O	O
Number of protected areas (i.e. fragmentation)	O	O	O	O
Proximity of protected areas to developed areas (i.e. adjacency)	O	O	O	O
Consistency of size of protected areas (i.e. variability)	O	O	O	O

Next Section

Visitor Perspectives of Mountain Resorts

84% COMPLETE

SECTION 5

General Questions

In this final section, you will be asked some general questions about yourself and your travel patterns.

Next

Visitor Perspectives of Mountain Resorts

90% COMPLETE

1. How important are the following factors to you when visiting a mountain resort?

	Not Important 1	2	3	4	Very Important 5
Being physically active	O	O	O	O	O
Going to a place that is family oriented	O	O	O	O	O
Participating in outdoor activities	O	O	O	O	O
Resting and relaxing	O	O	O	O	O
Viewing wildlife and birds	O	O	O	O	O
Experiencing and seeing a mountain area	O	O	O	O	O
Visiting wilderness and undisturbed areas	O	O	O	O	O
Learning new things, increasing my knowledge	O	O	O	O	O
Indulging in luxury, staying at first class hotels	O	O	O	O	O
Getting value for the cost of the trip	O	O	O	O	O
Visiting a place that takes good care of its environment	O	O	O	O	O
Having opportunities to shop	O	O	O	O	O
Visiting a place with unique and interesting restaurants	O	O	O	O	O
Attending a festival or event	O	O	O	O	O
Enjoying nightlife and entertainment	O	O	O	O	O
Enjoying cultural or historic sites/attractions	O	O	O	O	O

Next

SECTION 5: Travel Patterns

92% COMPLETE

Transportation to mountain resorts such as Whistler is a major cause of carbon dioxide emissions, a greenhouse gas that contributes to global climate change. While these emissions are often unavoidable, they can be offset by various activities such as:

- planting trees that take up carbon dioxide, or
- investing in the use of alternative energy sources that do not create carbon dioxide emissions.

Assume that the total cost to compensate for your greenhouse gas emissions in traveling to Whistler from your residence is about $12 CAD ($9.50 US). Now imagine that there is an independent non-government organization that would take donations from visitors to fund activities that offset greenhouse gas emissions.

2. Would you be willing to donate $12 CAD ($9.50 US) to this organization to compensate for the greenhouse gas emissions associated with your trip to Whistler?

O Yes, I would donate $12 CAD ($9.50 US)

O No, I would not donate $12 CAD ($9.50 US)

Next

SECTION 5: Travel Patterns

94% COMPLETE

This page was only shown to respondents who selected "no" on question 1 in this section.

2b. What are your reasons for answering 'No' to the previous question?

Check all that apply.

- ☐ Programs to compensate for greenhouse gas emissions are not needed
- ☐ Activities undertaken by the organization to offset greenhouse gas emissions may not be effective
- ☐ The organization may not use the donated funds efficiently
- ☐ The cost is too high
- ☐ Other: [ ] (please specify)

2c. Would you be willing to contribute another amount?

- ○ No, I would not be willing to contribute another amount
- ○ Yes, I would be willing to contribute another amount: $ [ ] (please specify)

Next

SECTION 5: About Yourself

98% COMPLETE

NOTE: Your answers will be kept strictly confidential in accordance with Simon Fraser University's research ethics guidelines.

3. What is your gender?

- ○ Male
- ○ Female

4. What is your age?

- ○ Under 19
- ○ 19 to 25 years
- ○ 26 to 35 years
- ○ 36 to 45 years
- ○ 46 to 55 years
- ○ 56 years or older

5. What is the highest level of education you have completed?

- ○ Elementary school
- ○ High school
- ○ Technical training/college
- ○ University undergraduate
- ○ University postgraduate

continuation from previous page...

6. What category best describes your annual household income level, before taxes?

My income is in [Canadian Dollars] *(click down arrow to select currency)*

- O Under $24,999
- O $25,000-49,999
- O $50,000-$74,999
- O $75,000-$99,999
- O $100,000-$149,999
- O $150,000-$199,999
- O $200,000 or over

Thank you for completing the survey. If you have any comments, please enter them below:

[ ]

[Submit Responses]

Visitor Perspectives of Mountain Resorts

A PROJECT BY THE CENTRE FOR TOURISM POLICY AND RESEARCH AT THE SCHOOL OF RESOURCES AND ENVIRONMENTAL MANAGEMENT, SIMON FRASER UNIVERSITY

*Main exit screen for respondents

Thank you for participating in this study!

Bookmark this website and check back in April 2005 to view the results of the study.

Please fill out the form below if you would like to enter the draw for one of our prizes. Winners will be notified by email by December 17th, 2004. Click here for more information about our prizes.

*Email [ ]

Name [ ]

Phone [ ]

*required information

[Sign me up for prizes!]

Questions or Comments? Direct all inquiries to: whistler_study@sfu.ca

Visitor Perspectives of Mountain Resorts

Exit screen for residents and employees.

Thank you for your interest in our survey!

At this time, we are only surveying **visitors** to Whistler. However, we are very interested in hearing the perspectives of Whistler residents on these issues and will be conducting a resident survey at a later date. If you are interested in participating in the resident survey, please enter your email address below and we will send you the link to the online survey sometime in 2005. Thanks again for your interest.

*Email

Name

(your first name is sufficient)

*required information

Submit

Questions or Comments? Direct all inquiries to: whistler_study@sfu.ca

CTPR

WHISTLER

Visitor Perspectives of Mountain Resorts

Exit screen for winter visitors.

Thank you for your interest in our survey!

At this time, we are only surveying **summer** visitors to Whistler. However, we are very interested in hearing the perspectives of winter visitors and will be conducting a winter visitor survey in the near future. If you are interested in participating in the winter visitor survey, please enter your email address below and we will send you the link to the online survey sometime in 2005. Thanks again for your interest.

*Email

Name

(your first name is sufficient)

*required information

Submit

Questions or Comments? Direct all inquiries to: whistler_study@sfu.ca

CTPR

WHISTLER

Prizes

By completing this survey, you will be entered into a draw for many great prizes! Prizewinners will be notified by December 17th, 2004.

GRAND PRIZE

Whistler Ski Holiday*

Includes two nights accommodation, two 2-day ski passes, and a dinner for two

RUNNER-UP PRIZES

$100 gift certificate for Mountain Equipment Coop**

First Nations artwork***

"Whistler" pictorial by Tanya Lloyd**

[Close Window and go back]

*Odds of winning: 1 in 600. Does not include airfare. The prizewinner will be responsible for arranging trip details with Tourism Whistler. The trip must be taken during the 2004/05 winter season and cannot be taken during the Christmas or March breaks.
**Odds of winning: 1 in 600.
***Odds of winning: 1 in 100.

Thank you to our sponsors for helping us provide these **great prizes!**

Armchair BOOKS

Questions or Comments? Direct all inquiries to: whistler_study@sfu.ca

Contact Us

If you have any questions, concerns, or comments, please contact us at whistler_study@sfu...

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Fax: 604-291-4986

[Close Window and go back]

Privacy

This project has received ethics approval by the Research Ethics Board at Simon Fraser University.

Your participation in this survey is voluntary, and you may choose not to respond to any question or terminate the survey at any time. All information that you provide in this survey will be kept strictly confidential in accordance with Simon Fraser University's research ethics guidelines. Any personal identifying information you provide will be used only to contact you in the event that you win one of the prizes. Your response will be stored offline in a secure password-controlled cache. Individual records will be identified using a code for data analysis and all records will be destroyed once the data analysis is complete. Your responses will be analyzed in aggregate and will not be identifiable in any publications.

Questions or Comments? Direct all inquiries to: whistler_study@sfu.ca

Close Window and go back