Gravina Access Project

Traffic Projections
Technical Memorandum

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Executive Summary

This memorandum presents estimates of the number of trips across the Tongass Narrows projected to occur with the different alternatives under consideration in the Gravina Access Project.

Access alternatives under consideration include the following:

- No action—continue with existing ferry service
- Three options for improved ferry service (supplementing the current ferry service with an additional ferry from one of three separate locations)
- Four bridge alternatives between Revilla and Gravina Islands—all in the general vicinity of the existing ferry, varying by height and alignment
- Two bridge alternatives that connect Revilla Island to Pennock Island and Pennock Island to Gravina Island. (Each route requires two bridges. One alternative has a low bridge over the east channel and a high bridge over the west channel. The other alternative has a low bridge over the west channel and a high bridge over the east channel.)

More complete descriptions and a map of the routes are provided in the Section 1.0 of this memorandum.

Traffic forecasts in the memorandum are determined based on different combinations of the following three primary factors:

- Mode of access—different modes of access will result in different trip generation estimates because of convenience relative to operating schedules and travel times
- Level of economic activity in the Ketchikan Gateway Borough—the greater the future economic activity in the Borough, the greater the number of trips primarily for business and leisure travel at the airport, but also in the number of trips generated by secondary development on Gravina Island
- Type and amount of development on Gravina Island and Pennock Island—the type and amount of development anticipated on the two islands will be directly related to both the mode of access and the future economic conditions in the Borough. (In general, the more convenient the mode, the greater the amount of development expected. However, more convenient modes of access alone will not generate significant amounts of development. Other factors, including sufficient overall economic activity and infrastructure are needed for development.)

The type of access and the level of economic activity will influence the amount and type of development on Gravina Island. However, according to city officials, they may not be the primary factors in determining development. Instead, the timing and location of services, including transportation links on Gravina Island, may be more important.

Ultimately, the most important factors that influence trips across the Narrows are the following:

- Activity at the airport – especially enplanements and deplanements
- Type and amount of development on Gravina and Pennock Islands that is served by the access improvements

The methodology used to generate traffic estimates for the alternatives is explained in detail in the memorandum, but it is based on a combination of expected growth rates in air travel, expected ferry passenger volumes, available traffic counts, a survey of households in Ketchikan, and estimates found in the literature on traffic engineering.

An analysis of possible development on Gravina Island suggests the following connections between access and development:

- The No Action alternative will permit or is consistent with only low levels of development on Gravina Island.
- Improved ferry access is consistent with medium levels of development on Gravina Island if the level of economic activity in the borough is high; otherwise, the level of development on Gravina Island would be low.
- Bridge access to Gravina Island is consistent with medium to high levels of development on the island, depending on the level of economic activity.

Table ES-1 shows the traffic forecasts for people per day in 2025 for the different access alternatives under consideration. Passenger activity varies for each access alternative depending on the level of possible economic activity in the Ketchikan Gateway Borough.

Table ES-1. Traffic Projections: One-Way Trips Across Tongass Narrows, People per Day in 2025

Access Alternative	Overall Economic Activity in the Borough		
	Low	**Medium**	**High**
Bridge (except bridge across Pennock Island)	2,700	4,300	6,200
Bridge Across Pennock Island	2,700	5,100	8,100
Improved Ferry	1,400	1,600	2,700
No Action	1,300	1,350	1,400
Reference	There were 1,056 passenger trips per day on the ferry in 1999.		

Source: The reference number of 1,056 passenger trips per day is from *Ketchikan 2020 & Gravina Access Project: Existing Conditions Demographic and Socioeconomic Analysis* (Technical Memorandum), and forecast numbers are from the Northern Economics spreadsheet model. (Passenger trips in 1999 were based on tallies kept by ferry operators. This information is maintained in a database by the Ketchikan airport and presented in the Existing Conditions report.)

The bridge alternatives have more trips than the ferry alternatives because a bridge, without tolls (or schedules like a ferry), would be more likely to induce a high level of development on Gravina and because a bridge would result in significantly more trips to the airport. In particular, a bridge would make it more convenient for Ketchikan residents accompanying an air passenger to or from the airport to travel all the way to the airport. With the existing ferry – and presumably with improved ferry service – a majority of "meeters and greeters" drop off or pick up air travelers at the ferry terminal on the Revilla side of Tongass Narrows.

Traffic projections are higher with the bridge across Pennock Island (access alternatives F1 and F3) because of the additional trips to and from Pennock Island that would be generated with these options, and the additional land on Gravina Island that would be accessible with these alternatives. In particular, these options would result in trips by existing residents, as well as future residents and businesses on Pennock Island. (There is currently no bridge or ferry service to Pennock Island and alternatives F1 and F3 are the only alternatives under consideration that provide a connection to Pennock Island.)

Table ES-2 shows the traffic forecasts for vehicles in 2025 for the different access alternatives under consideration at different levels of possible economic activity in the Ketchikan Gateway Borough.

Table ES-2. Traffic Projections: One-Way Trips Across Tongass Narrows, Vehicles per Day in 2025

Access Alternative	Overall Economic Activity in the Borough		
	Low	**Medium**	**High**
Bridge (except bridge across Pennock Island)	2,100	3,300	4,800
Bridge Across Pennock Island	2,100	4,200	6,700
Improved Ferry	400	600	1,400
No Action	300	500	700
Reference	There were 252 vehicle trips per day on the ferry in 1999.		

Source: The reference number of vehicle trips per day is from *Ketchikan 2020 & Gravina Access Project: Existing Conditions Demographic and Socioeconomic Analysis* (Technical Memorandum), and forecast numbers are from the Northern Economics spreadsheet model. (Vehicle trips in 1999 were based on tallies kept by ferry operators. This information is maintained in a database by the Ketchikan airport and presented in the Existing Conditions report.)

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1.0 Introduction

The Alaska Department of Transportation and Public Facilities (DOT&PF) is investigating ways to improve access between Ketchikan, on Revillagigedo (Revilla) Island, and Gravina Island as part of the Gravina Access Project.

Table 1 identifies the 9 different access alternatives being considered in the Gravina Access Project, and shows the name (letter and number code) used in the various maps and other technical memoranda.[1]

Table 1. Description of Access Alternatives

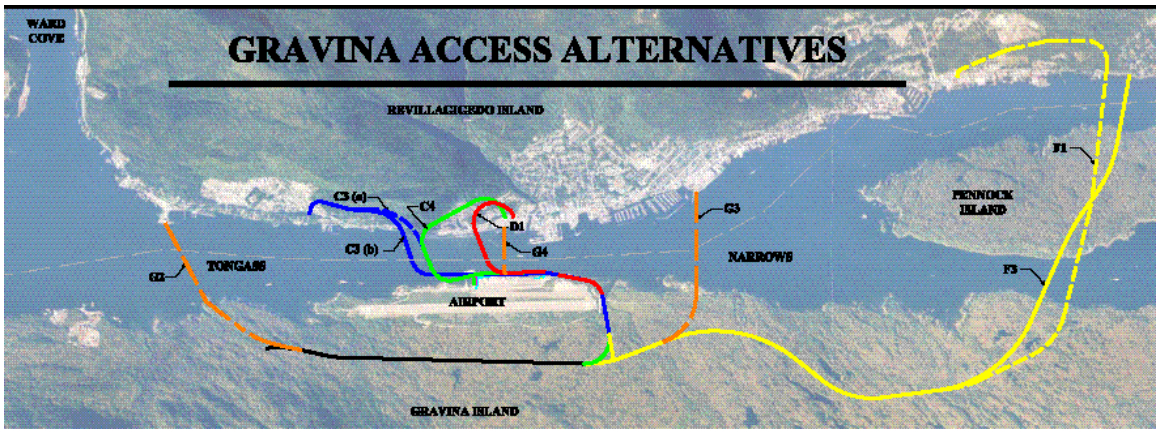
Alternative	Description
No Action	Existing Ferry Service
C3(a)	200-foot High Bridge – Airport Area to Signal Road
C3(b)	120-foot High Bridge – Airport Area to Signal Road
C4	200-foot High Bridge – Airport Area to Cambria Drive Area
D1	120-foot High Bridge – Airport Area
F1	Pennock Island Crossing – 200-foot High Bridge over East Channel and 120-foot High Bridge over West Channel
F3	Pennock Island Crossing – 60-foot High Bridge over East Channel & 200-foot High Bridge over West Channel
G2	Ferry Route from Peninsula Point
G3	Ferry Route from Downtown Ketchikan
G4	Ferry Route Adjacent to Existing Ferry

Source: http://www.gravina-access.com/design_center/Default.htm

Figure 1 shows the location of the different access alternatives under consideration.

[1] DOT&PF and HDR Alaska, Inc. evaluated 18 build concepts for the Gravina Access Project and determined that seven of those concepts would be reasonable alternatives for the project. These seven alternatives included two 200-foot high and one 120-foot high bridge crossings near the airport (Alternatives C3, C4, and D1, respectively), a combined 60-foot high/200-foot high bridge crossing that incorporates Pennock Island (Alternative F3), and three ferry alternatives (Alternatives G2, G3, and G4). Further engineering analysis of the alternatives led to their refinement and to the addition of a 120-foot high bridge near the alignment of Alternative C3. This new alternative is identified as Alternative C3(b) and the original alignment is identified as Alternative C3(a). Public comment on the proposed access alternatives led to alternative F1, a Pennock Island bridge alternative with a 200-foot high crossing of East Channel and a 120-foot high crossing of West Channel, being added to the list of reasonable access alternatives considered in this analysis.

Figure 1. Location of Access Alternatives



1.1 Purpose of Memorandum

This memo provides estimates of the number of person and vehicle trips across the Tongass Narrows through the year 2025, as well as an overview of the methodology and assumptions behind the estimates. Traffic projections have been constructed to show one-way trips per day across the Tongass Narrows (for people and vehicles) for each of the different access alternatives.[2]

The nine build alternatives [C3(a), C3(b), C4, D1, F1, F3, G2, G3, and G4] and the no action alternative will be studied further as part of the alternatives evaluation in the environmental impact statement being prepared for this project. The NEPA alternatives evaluation will require information on the amount of traffic that could be expected with each of the different alternatives.

1.2 Sources of Demand for Travel Across the Tongass Narrows

Trips across the Tongass Narrows come from two sources: airport related travel, and non-airport related travel. Airport related travel includes trips for enplanement and deplanement activity, as well as trips for airport related businesses. Non-airport related travel includes trips for other businesses on Gravina Island, trips made by residents of Gravina Island and Pennock Island, and trips for recreation on Gravina Island and Pennock Island by residents of Revilla Island. (Travel for other businesses could also include trips related to ferry travel by residents of Revilla Island if the IFA or AMHS ferry terminals are relocated from Revilla Island to Gravina Island. However, such relocations do not seem likely in the planning period for this study.)

The number of cross-Narrows trips is projected to be considerably higher if a bridge is constructed compared to any type of ferry service because of convenience. Improved

[2] A person making a trip from Revilla Island to Gravina Island and back would generate 2 one-way trips.

convenience in terms of shorter travel times and without the constraints of ferry operating schedules means more people will travel to the airport and more trips will be made to residences and businesses on Gravina Island. For instance, with a bridge, air travelers that are dropped off or picked up at the ferry terminal on the Revilla Island side of the Narrows could be dropped off or picked up at the airport (resulting in more trips). It is anticipated that individuals who now drop off or greet air travelers at the ferry terminal on Revilla Island would travel across the Narrows to the airport if a bridge were available, thus increasing the number of person-trips. In addition, residents and businesses on Gravina would make more trips with a bridge than with a ferry because the cost of travel would be lower (no toll and less time involved).

In addition to the type of access that is available, the amount and type of development on Gravina Island and the level of economic activity in the Ketchikan-Gateway Borough will affect the number of trips generated. As a result, these factors must be properly assessed so they can be incorporated into the traffic forecasts.

In short, higher levels of economic activity in the Ketchikan area are expected to result in more trips across the Tongass Narrows. This assumption is based on the conjecture that increased economic activity will result in more air travel and greater demand for developable land. Because the airport and a significant portion of the developable land are on Gravina Island, it follows that increased economic activity would lead to more trips across the Narrows between Revilla and Gravina Islands.

Economic activity in the Ketchikan-Gateway Borough from 2000 to 2025 is discussed in the *Ketchikan-Gateway Borough Economic Forecasts* technical memorandum. That memorandum provides estimates of population, employment, and land use by economic sector from 2000 to 2025, and provides the foundation for the economic assumptions underlying the traffic projections in this memorandum.

As mentioned above, the amount and type of development that might occur on Gravina Island in the future is described in Section 4.0. The low-, medium-, and high-development scenarios described in that section were developed by the consultant team following several meetings with Borough officials, as well as at workshops involving the public and interviews with business owners.

An important issue that will influence the amount of development on Gravina Island, regardless of the level of economic activity in the Borough, is the amount and type of road construction and the extension of public services provided by the Borough. Varying levels of road construction and public services are considered in the scenarios described in this memorandum. Only development that occurs within the area served by the anticipated road network on Gravina and Pennock islands contributes to the trip generation forecasts in this memorandum. It is anticipated that development on Gravina and Pennock Islands will continue in areas that are not served by the road network that will be linked to the various access alternatives. Access to developments that are not accessible by the road network will continue by private vessel and other means.

1.3 Organization of Memorandum

Traffic forecasts in this memo are based on three related, but separate exercises: preparation of a traffic forecasting methodology, assessment of possible development on Gravina Island that would be served by the access alternatives, and generation of actual traffic forecasts. Section 2.0 presents the traffic projections. Section 3.0 provides a summary of the forecasting methodology developed for this project and Section 4.0 contains an assessment of the development served by the access alternatives that might occur on Gravina Island in the future. Section 5.0 gives a trip analysis by source. The traffic forecasting methodology was developed by the consultant team to ensure that standard practices in traffic engineering were followed and that issues unique to Ketchikan, Gravina and Pennock islands were properly addressed. That methodology called for an assessment of the development that might occur on Gravina Island so that the trips resulting from that development could be properly analyzed. The information presented in these other sections supports the traffic forecasts provided in Section 2.0.

In chronological order, the consultant team prepared the methodology first, then collected the necessary data and analyzed the amount and type of development that might occur on Gravina Island and Pennock Island, and only then created a spreadsheet model to generate the actual trip forecasts. The data collection phase included reviewing the literature on trip generation and conducting interviews where necessary to fill in any gaps in the data. Interviews were also used to confirm that average trip generation figures reflected accurately the number of trips generated by residents and businesses in Ketchikan.

The information presented in this report does not follow the same chronological order. Instead, the final results are presented first, followed by a description of the methodology and analysis of development on Gravina Island and Pennock Island.

2.0 Traffic Projections

Traffic projections are provided for each of the different access alternatives considered, with the different projections for each alternative depending on the level of overall economic activity in the Borough. Section 3.0 explains in detail how the different access alternatives and levels of economic activity were assumed to influence trip levels. In some cases, the influence comes through the amount of development that is expected to occur on Gravina Island and would be served by the access alternatives. In other cases, the influence is directly linked to economic activity. For example, the amount of air travel is assumed to depend on the overall level of economic activity, not the type of access that is available. (People would not tend to travel to and from Ketchikan more often just because the ferry service to the airport is improved.) However, the number of people accompanying air travelers to and from the airport is assumed to depend on the type of access.

Table 2 shows the traffic forecasts for people (walk-ons and vehicle passengers) per day in 2025 and Table 3 shows the corresponding forecasts for vehicle trips in 2025.

Numbers in the tables show one-way trips across the Tongass Narrows. (A trip from Revilla Island to Gravina Island and back would result in 2 one-way trips.)

Table 2. Traffic Projections: One-Way Trips Across Tongass Narrows, People per Day in 2025

Access Alternative	Overall Economic Activity in the Borough		
	Low	**Medium**	**High**
Bridge (except alternatives across Pennock Island)	2,700	4,300	6,200
Alternatives Across Pennock Island	2,700	5,100	8,100
Improved Ferry	1,400	1,600	2,700
No Action	1,300	1,350	1,400
Reference	There were 1,056 passenger trips per day on the ferry in 1999.		

Source: The reference number is from *Ketchikan 2020 & Gravina Access Project: Existing Conditions Demographic and Socioeconomic Analysis* (Technical Memorandum), and forecast numbers are from the Northern Economics spreadsheet model. (Passenger trips in 1999 were based on tallies kept by ferry operators. This information is maintained in a database by the Ketchikan airport and presented in the Existing Conditions report.)

Section 5.0 includes more detail on the number of trips generated by different sources (such as trips per day for air travel, trips for airport businesses, recreation, etc.).

Table 3. Traffic Projections: One-Way Trips Across Tongass Narrows, Vehicles per Day in 2025

Access Alternative	Overall Economic Activity in the Borough		
	Low	**Medium**	**High**
Bridge (except alternatives across Pennock Island)	2,100	3,300	4,800
Alternatives Across Pennock Island	2,100	4,200	6,700
Improved Ferry	400	600	1,400
No Action	300	500	700
Reference	There were 252 vehicle trips per day on the ferry in 1999.		

Source: The reference number is from *Ketchikan 2020 & Gravina Access Project: Existing Conditions Demographic and Socioeconomic Analysis* (Technical Memorandum), and forecast numbers are from the Northern Economics spreadsheet model. (Vehicle trips in 1999 were based on tallies kept by ferry operators. This information is maintained in a database by the Ketchikan airport and presented in the Existing Conditions report.)

The bridge alternatives have more trips than the ferry alternatives because a bridge, without tolls (or restricted schedules like a ferry), would be more likely to induce a higher level of development than a ferry on Gravina Island and because a bridge would allow significantly more trips to the airport. In particular, a bridge would make it more convenient for "meeters and greeters"—persons accompanying an air passenger to or from the airport, but who do not travel beyond the airport—who live on Revilla Island to travel all the way to the airport. With the existing ferry—and presumably with improved

ferry service—the majority of "meeters and greeters" drop off or pick up air travelers at the ferry terminal on the Revilla side of Tongass Narrows.

Traffic projections are higher with the bridges across Pennock Island (access alternatives F1 and F3) because of the additional trips to and from Pennock Island that would be generated with this option. In particular, this option would result in trips by existing residents, as well as future residents and businesses on Pennock Island. There is currently no bridge or ferry service to Pennock Island and alternatives F1 and F3 are the only alternatives under consideration that provide a connection to Pennock Island.

The numbers in Table 2 and Table 3 were derived using a spreadsheet model developed by the consultant team. The spreadsheet model keeps track of all assumptions regarding overall economic activity, development on Gravina Island, and trips per resident, business, or aircraft.

The following section provides an overview of the methodology used to develop the forecasts (the template for the spreadsheet model) and the underlying assumptions regarding trip generation.

3.0 Traffic Forecasting Methodology and Modeling Assumptions

This section presents an overview of the conceptual or modeling issues relevant in the analysis and, separately, the methodology used to develop specific trip generation estimates.

3.1 Modeling Issues

The traffic model developed for this project allows for changes in the number of trips between Revilla Island and Gravina Island based on the following three factors:

- Convenience of access between the islands (existing ferry, improved ferry, or bridge)
- Level of economic activity in the Borough
- Development on Gravina Island

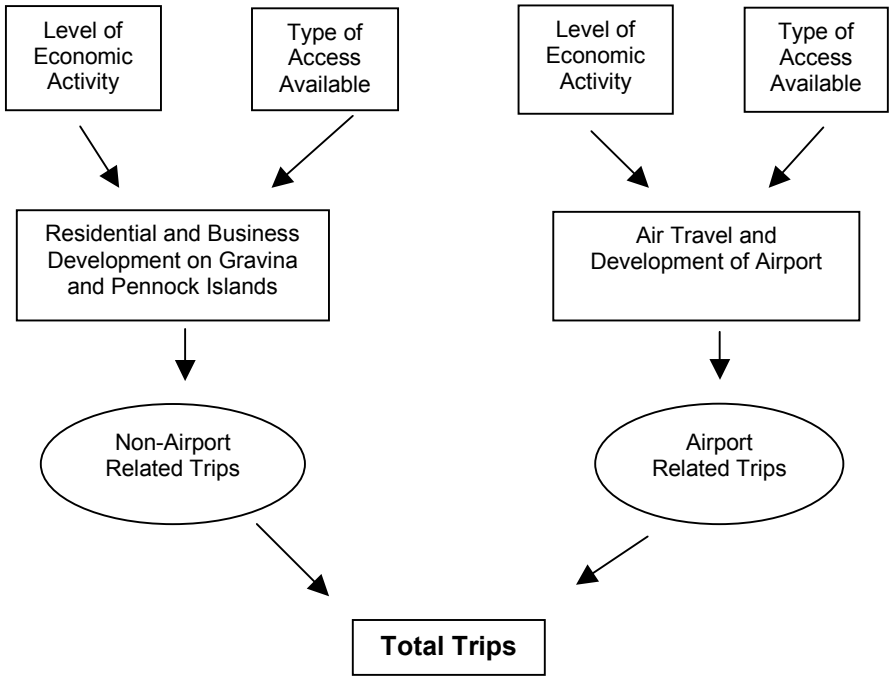
While there is obvious overlap among these three factors, each has a direct effect that must be considered when developing traffic projections. For example, the level of economic activity in the Borough will influence the amount of development on Gravina Island, as well as the general level of business activity at the airport and other businesses on Gravina Island.

For this report, residences and businesses on Gravina and Pennock islands are assumed to generate trips separate from the trips made from Revilla Island to Gravina Island for air travel and employment at the airport. The former (trips from residents and non-airport

related businesses on Gravina and Pennock islands) will depend on the amount of development on the islands that is served by the access alternatives. The latter (trips to and from the airport) will depend more on the level of economic activity in the Borough and surrounding service area, and will be largely independent of the amount of development on Gravina or Pennock. Therefore, overall economic activity in the area and development on Gravina Island and Pennock Island can be viewed as separate factors.

Figure 2 summarizes the manner in which the different factors were combined to generate the final traffic forecasts.

Figure 2. Description of Source of Trips



The consultant team constructed low-, medium-, and high-growth scenarios to estimate the trips that would be generated by the different sources (both airport related and non-airport related trips). Different scenarios were needed to account for the range of possible occurrences in the future.

The number of trips generated by any given source will depend to some degree on the type of access, the level of overall economic activity in the area, and other factors. Unfortunately, the influence from different factors can be reinforcing or offsetting, making the analysis more difficult. For example, a bridge would tend to result in more trips than a ferry because the bridge would make travel more convenient. However, it is possible to have a bridge connecting Gravina and Revilla Islands and a low level of economic activity in the area. The low level of economic activity in the borough would tend to dampen the effects of the bridge in terms of the amount of development the bridge

would encourage and the number of cross-Narrows trips. The consultant team concluded that this combination would result in a medium level of development on Gravina Island, but air travel would be consistent with a low level of economic activity—a medium growth scenario for one source of trips (due to development on Gravina Island) and a low growth scenario for the other source of trips (related to air travel).

In general, it was assumed that bridge access would result in medium to high development levels on Gravina Island because it would provide convenient access to new lands. (That is, the amount of development on Gravina Island could be consistent with the medium-growth scenario even if the overall level of economic activity in the area was low.) Whether the actual level of development on Gravina Island is medium or high would depend on the overall economic activity in the Borough. (A bridge, by itself, would not necessarily generate a high level of development on Gravina Island. A high level of development would require both the convenient access provided by a bridge and sufficient demand from a relatively high level of overall economic activity.) Similarly, it is assumed that the existing ferry service would not support a high level of economic activity on Gravina Island. Even with a high degree of economic activity in the Borough, the constraints imposed by the ferry would limit the amount of development on the Island. Similar statements can be made for Pennock Island development and trip generation.

The consultant team recognized early that the amount and type of development on Gravina Island, as well as the timing of that development, will depend critically on the public services constructed by the City and Borough. For example, the Borough could limit or promote development by changing the size and surface type of roads constructed, or the availability or unavailability of other utilities and services. As a result, the consultant team worked closely with staff from the Planning Department in Ketchikan to ensure that development scenario was credible for each pair or combination of access type and economic activity.[3] However, the results shown here are the consultant team's expectations of development patterns associated with access and economic activity.

Table 4 shows the level of development on Gravina Island that would be expected for each combination of economic activity and type of access. It is assumed that the more convenient the type of access, the higher the level of development on Gravina Island.

Table 4. Development on Gravina Island With Different Economic Conditions and Access Alternatives

	Overall Economic Activity		
Access Alternative	**Low**	**Medium**	**High**
Bridge (most convenient)	Medium	Medium	High
Improved Ferry	Low	Medium	Medium

[3] Northern Economics met with Susan Dickinson, Planning Director for the Ketchikan Gateway Borough, Stephen Reeve, Planner for the KGB, and Kent Miller, Industrial Economist in July of 2000 and August of 2002.

No Action (least convenient)	Low	Low	Low

Table 4 shows that the existing ferry service will likely result in a low growth scenario on Gravina Island. The table also shows that a high growth scenario will likely occur if there is a bridge and a high level of economic activity in the region. Additional information on the different growth scenarios and when they are likely to occur is provided in Section 4.0.

The level of growth shown in the different cells of Table 4 can be interpreted as the level of growth in non-airport related trips. For example, a medium level of development on Gravina Island will generate a certain amount of residential development, business development, etc. Each of these entities will generate a certain number of trips per day across the Narrows. This source of growth in traffic needs to be combined with growth from airport related trips, which are primarily a function of the level of economic activity in the area—not the amount of development on Gravina Island.

Table 5 shows the level of growth in the total number of trips, where the specific level of overall economic activity is shown separate from the amount of development on Gravina Island.

Table 5. Level of Growth in Traffic Levels – Showing the Level of Economic Activity and Development on Gravina Island

	Overall Economic Activity		
Access Alternative	**Low**	**Medium**	**High**
Bridge	EA_L / GI_M	EA_M / GI_H	EA_H / GI_H
Improved Ferry	EA_L / GI_L	EA_M / GI_M	EA_H / GI_M
No Action	EA_L / GI_L	EA_M / GI_L	EA_H / GI_L

Notes: EA stands for the overall economic activity (the column heading) and GI stands for the level of development on Gravina Island. GI is determined by the level of overall economic development and the type of access that is available (the row heading). The subscripts refer to low, medium, and high scenarios in both cases.

There is redundancy in Table 5 because one piece of information in each cell is the same as the column heading. Still, both pieces of information are shown together (and the redundancy allowed) as a reminder that trips come from two different sources and that the growth in the number of trips can vary with changes in either source. Allowing for the appropriate set of assumptions—both for the overall level of economic activity and for growth on Gravina Island—gives different levels of traffic depending on the level of economic activity and type of access considered.

3.2 Trip Generation Levels

The following list shows the major items addressed in determining the number of trips generated by the different groups that would use a ferry or bridge between Revilla and Gravina Islands, and Pennock Island where appropriate:

- Identification of major user groups
- Assessment of travel demands by the different user groups (determination of trip generation by each user group)
- Analysis of the distribution of those user groups – including analysis of possible development on Gravina Island
- Inclusion of air travel and ferry travel forecasts

The major user groups are included in one of two general categories: airport related user groups and non-airport related user groups.

Airport Related Travel Groups

- Aviation passengers departing or arriving at Ketchikan International Airport (KIA) on Gravina Island (including those who use the seaplane dock)
- Persons accompanying an air passenger to or from the airport, but who do not travel beyond the airport ("meeters and greeters")
- Airport employees (employees of organizations that have a physical presence at the airport)
- Persons traveling on airport-related business (for example, freight forwarders and rental car agencies that do not have a physical presence at the airport)

Non-Airport Related Travel Groups

- Tourists and recreational users traveling to and from Gravina Island (the U.S. Forest Service is planning to construct a timber harvest road on Gravina Island and open it to the public for recreational uses).
- Residents of Gravina Island (and Pennock Island for the access alternative that crosses Pennock Island).
- Other commercial development on Gravina Island (and Pennock Island, if applicable) that is geared towards residential and other development on the island.
- Non-airport-related industrial development on Gravina Island (and Pennock Island, if applicable).

Future trips by airport related user groups are projected based on the expected level of economic activity in the Ketchikan area. Projected growth rates in the level of activity at the airport (including the expected number of enplanements, deplanements, etc.) are taken from published reports. Generating the projections for future trips by non-airport related user groups, however, is more involved.

Before projecting the number of trips made by residents and businesses on Gravina Island, the consultant team had to characterize the level and type of development that might occur on the island in the future. The consultant team considered a variety of factors to determine what type and amount of development might occur on Gravina

Island. Those factors included, but were not limited to, the overall level of economic activity in the area, population growth, availability of land for specific uses on Revilla Island, changing patterns in the density of residential development, available funding for infrastructure development, and trends in key industries (such as forestry, fishing, and tourism). Section 4.0 below provides an overview of the development that might occur depending on the economic conditions and type of access that is ultimately provided.

The consultant team also conducted a community survey in Ketchikan in March 2001. The results of that survey were summarized in the *Ketchikan Community Survey Technical Memorandum*.

3.3 User Groups

The following subsections provide brief descriptions of the different groups that currently use the ferry between Gravina and Revilla Islands, and that would be expected to use one of the other access alternatives under consideration. The subsections also provide an overview of important issues for the different user groups, such as critical factors related to trip frequency and sources of data. Data on trip frequency from each group were taken from the community survey; other reports; interviews and workshops held in Ketchikan with residents, businesses, and tour operators; and the literature on traffic engineering.

3.3.1 Air/Ferry Passengers

The methodology employed by USKH for the Ketchikan Airport Master Plan was adopted for the traffic forecasts in this memo. The USKH projected growth rates for air travel were reviewed and considered acceptable for a long-term forecast. However, there have been significant changes in Ketchikan's economy since the USKH forecast was completed. To account for these changes, growth rates from the Airport Master Plan are applied to a starting year of 2000 rather than 1997 as used in the Master Plan. This change reduces near-term traffic projections to reflect current conditions more accurately.

The proposed changes to the AMHS ferry system and the proposed IFA ferry service will alter air passenger traffic patterns between Ketchikan and other communities in Southeast Alaska, particularly Metlakatla and those communities on Prince of Wales Island. Because frequent and/or convenient ferry service is not currently available, the vast majority of individuals traveling between Ketchikan and these other communities presently do so by floatplane. Currently, floatplane passengers do not use the airport ferry because the floatplane service will pick them up or drop them off directly at the airport or downtown, depending on their preferred origin or destination. Persons traveling between Ketchikan and other communities by wheeled planes that use Ketchikan International Airport (KIA) ride the airport ferry if they are destined to or from the Revilla Island side of Ketchikan.

In the future, many persons traveling between Ketchikan and Metlakatla, or between Ketchikan and communities on Prince of Wales Island are expected to use the improved AMHS or IFA ferry service instead of floatplane or wheeled plane service. AMHS and

IFA ferry passengers will arrive and depart at the AMHS terminal on the Ketchikan side of Tongass Narrows across from KIA. Some of these passengers may cross Tongass Narrows. For example, residents of Metlakatla or Prince of Wales Island communities may travel to Ketchikan by ferry and then use KIA for jet service to other cities. Wheeled-plane passengers will have to cross Tongass Narrows only if they are traveling to or from Revilla Island. It is expected that floatplane passengers will continue to be picked up or dropped off at their choice of location and will not cross Tongass Narrows.

3.3.2 Accompanying Persons

Accompanying persons are defined as those people accompanying an air passenger to or from the Ketchikan airport. The number of accompanying persons is assumed to be directly related to the number of air passengers.

The airport ferry survey conducted by the consultant team in December 1999 indicated that for *all* air passengers using the Ketchikan airport, there was an average of about one accompanying person for every two passengers, and that about two-thirds of all individuals or groups traveling by air are accompanied by others. For the accompanied air passengers surveyed, the average number of accompanying persons was about 1.3. FAA publications indicate that waiting areas in terminals should be designed to accommodate one additional person for each passenger. This recommendation suggests that the number of accompanying persons in Ketchikan is below the numbers that are normal in other airports. The lower number could be a result of the infrequency of ferry service or the cost to travel between Ketchikan and KIA.

3.3.3 Airport Businesses

Airport businesses are defined as those companies that have a physical presence on Gravina Island and are located within the airport boundary. This definition includes existing businesses as well as businesses that may locate at the airport in the future.

The Ketchikan Airport Master Plan anticipates increases in the number of air travelers at KIA. It is anticipated that as the number of air travelers increases, the number of employees working for businesses located at the airport will increase, although not proportionally. For example, the emergency response service provided by the Ketchikan-Gateway Borough at the airport is not likely to increase employment until the number of jet landings increases substantially. Similarly, the number of persons employed as baggage handlers may not need to increase until the number of jet operations increases substantially. At the same time, with improved access, new businesses might locate at the airport, and this action would increase employment.

3.3.4 General Aviation

In addition to business related to the airport and located on the airport grounds (including rental car companies), another source of trips is general aviation. This category covers trips made by people who either own or who service private planes at the Ketchikan Airport. Trips for general aviation occur for recreational flying, general maintenance of

the aircraft, and similar reasons. These trips are separate from those generated by the commercial air carriers who operate at the airport (for example, Alaska Airlines is a commercial carrier and is not considered in the category of general aviation).

3.3.5 Airport-Related Businesses

Airport-related businesses are those businesses that are not physically located at the airport but have close business ties to the airport and therefore make frequent trips to and from the airport. These types of businesses include the following:

- Aviation support businesses
- Courier services
- Rental car companies

3.3.6 Recreation/Tourism

Recreation and tourism encompasses those persons traveling to or from Gravina Island to participate in recreation activities. These may be individuals traveling independently, or persons traveling with a group.

3.3.7 Residential

Residential users include those persons (or households) that currently reside on Gravina Island, or might do so if improved access were available. The community survey conducted by the consultant team in 2001 provided information on the following items related to trips by residents:

- Current number of trips made by each household to and from Gravina Island, by trip purpose, and by mode (ferry/passenger, ferry/private vehicle, ferry/bus, other)
- Additional trips that residents would make with improved access, by trip purpose
- Possibility of households moving to Gravina Island if larger residential lots were available
- Effect of travel time and corridor location on trip frequency
- Respondent's preference for different options

In addition to the survey, the consultant team held numerous workshops in Ketchikan to understand the type and amount of development that is expected on Gravina Island and the travel patterns that might emerge with the different access alternatives under consideration. Development on Gravina Island is summarized in Section 4.0 below.

3.3.8 Non-Airport Commercial

Non-airport commercial users are described as commercial establishments that would locate on Gravina Island, principally to serve people residing on the island. Non-airport commercial users could also be businesses that locate on Gravina Island to serve the

entire Ketchikan community because of the availability, and possibly the lower cost, of land.

The consultant team reviewed planning and economic development literature to determine the population base that is typically required to support certain types of businesses. This information was used to estimate the level of commercial development that will occur with population growth, and the amount of land required. Discussions with local merchants were held to determine the number and frequency of trips across Tongass Narrows that businesses of similar size on Gravina Island might generate with improved access.

Home improvement stores (lumberyards or Home Depot-type businesses), warehouse stores (for example, Costco), and storage businesses have been mentioned as the types of businesses that might locate on Gravina Island because of the availability of large blocks of land. Travel times between Gravina Island and various areas of Ketchikan on Revilla Island were analyzed and information collected in the community survey to determine the number and frequency of trips that Ketchikan residents might make to these community-wide businesses.

3.3.9 Non-Airport Industrial

Non-airport industrial uses can be described as those industrial uses that are not allied with the air transportation industry. The industrial uses currently located north of the airport would be considered non-airport industrial.

Several of the non-airport industrial users on Gravina Island located there because of difficulties in conducting industrial activities near residential areas. The consultant team contacted other industrial businesses to determine whether or not they would relocate or expand to Gravina Island if large blocks of industrial land were available, and the effect that improved access would have on their decision making process. The team also reviewed trip generation publications to determine whether the coefficients in those documents could be used to reliably estimate traffic volumes associated with the amount of land required for non-airport industrial uses. Published trip generation coefficients were corroborated with traffic count data and through interviews with area businesses and public officials.

3.4 Trip Frequency

Table 6 shows the trips generated by each type of business or activity, and residences on Gravina Island, as assumed in the traffic model (taken from survey results, other reports, and other benchmarks). Similar estimates have been made for Pennock Island as appropriate. As mentioned in the previous section, data for airport related travel come primarily from other reports and published forecasts, while data for non-airport related travel come from the survey, workshops, and other benchmarks. In addition, trips generated by residents and non-airport related businesses on Gravina Island require

assumptions about the level and type of development that might occur on the island in the foreseeable future. That development is outlined in Section 4.0.

Table 6. One-Way Trips per Day, by Source of Trip and Type of Access

Source of Trips	Type of Access Available	
	Ferry	**Bridge**
Airport Related Business, Vehicle Trips per Employee	0.8	4
General Aviation, Vehicle Trips per Plane	1	4
Non-Airport Industrial/Comm., Vehicle Trips per Employee	2	2.56
Employees per Acre [a]	2.4	2.4
Retail on Gravina Island, Vehicle Trips per Employee [b]	2.5	5
Employees per Acre [a]	2.25	2.25
Community Development on Gravina, Trips per Acre Developed	2	3
Residential Development on Gravina, Vehicle Trips per Household [c]	2	4
Recreation on Gravina, Trips per Household [d]	.004	.008
Recreation on Gravina, Vehicle Trips per Day	1	2

Notes:

[a] See Section 4.0 below for discussion on expected number of acres.

[b] Retail establishments are assumed to generate 50 trips per employee per day. However, only 5 percent of the trips are assumed to be off-island with ferry access and 10 percent off-island with bridge access. The primary user of retail establishments on Gravina will be residents and workers on Gravina, limiting the number of off-island trips.

[c] Households on Gravina are assumed to generate 7 trips per day. However, only 30 percent of the trips are assumed to be off-island with ferry access and 60 percent off-island with bridge access.

[d] Survey results show that residents of Ketchikan living on Revilla Island make 1.4 trips per year to Gravina Island for recreation, and that number is anticipated to double if a bridge were constructed.

The trip frequency figures shown in Table 6 with ferry access are based on survey results and referenced or adjusted to match traffic count data with the existing ferry service. Trip frequency figures shown in Table 6 with bridge access are based on a variety of sources. Survey results show that travel patterns would change for certain activities, such as recreation, if a bridge were constructed. However, the survey could not provide all necessary data and changes in trip frequency with a bridge because some of the user groups do not presently exist on Gravina Island. For example, there is no retail business on Gravina separate from the airport, so it is not possible to count trips at a retail establishment on the island or to conduct a survey of employees at such an establishment. In these cases, trip frequency figures are set to be consistent with trip levels observed in other cities in Alaska and other parts of the U.S.

Interviews with employees at the Ketchikan airport revealed that most airport employees drive to work alone (one occupant per vehicle). It is assumed that most business trips include one occupant per vehicle, but trips generated by community establishments and for recreation are assumed to have more than one occupant per vehicle. Enplaning and deplaning travelers are assumed to travel with their respective "meeters and greeters."

4.0 Development on Gravina Island

This section provides a description of the amount and type of development that might occur on Gravina Island in the foreseeable future. This description is needed to support traffic projections because the amount of traffic will vary (as well as type and timing) depending on the amount and type of development that occurs. The scenarios provided below should be viewed as illustrative. They are intended to help guide the overall understanding of trip generation with different types of access to Gravina Island and different levels of economic activity. *It may be important to note that the dominant source of cross-Narrows trips is for air travel. The amount and type of development shown in the scenarios below does not generate nearly as many trips as the airport. As a result, changes to the scenarios below would probably not cause a significant change in the number of trips.*

The numbers in this section—number of housing units and acres of development—were generated as a means of assessing secondary and cumulative impacts, and as a basis for projecting traffic levels. These numbers do not include development that may occur beyond the area served by the access alternatives and the anticipated road network. The numbers show how much land is projected to be developed for a given purpose due to the overall demand for that land type in the Borough, economic growth in the area, population growth, and other factors. No attempt has been made to answer questions such as: what companies are most likely to locate on the island, what will be the exact lot size in residential developments on the Island, etc. While such questions are interesting, they do not need to be addressed to assess the level of traffic that might be generated by different levels and types of development on the island. The consultant team basically assumed that a given number of residential units will generate roughly the same number of trips, whether those units are clustered together or spread out, a given amount of industrial development will generate roughly the same number of trips regardless of the company name, and so on. Even with the existing ferry access, further development will occur on Gravina Island. The Borough's *Gravina Island Plan North Gravina Area July 2002 Draft* identifies construction of a gravel road that follows the south and west boundaries of the airport and extends north of the airport to Lewis Reef. The road would be limited in width, but would provide public access to Borough and private land adjacent to and immediately north of the airport. The planned access would be on a road from the ferry landing that follows the south and west boundaries of the airport.

According to some business owners, the current ferry service constrains industrial and commercial development on the island. More frequent ferry service, as included in some access alternatives, would alleviate some but not all of the constraints associated with ferry access. In comparison, bridge access would make most types of development on Gravina Island more convenient. This assumption presumes that bridge access would permit toll-free travel 24 hours per day and allow travel by a wider range of vehicles without schedule considerations. (Access by certain trucks and heavy equipment would be more limited with ferry access compared to bridge access.) Bridge access could also reduce the relative cost of development on the Island. Development on Gravina Island will also be part of the future growth that occurs in Ketchikan. The *Ketchikan-Gateway*

Borough Economic Forecasts technical memorandum described possible future growth scenarios that could occur in the Borough through 2025.

It is important to note, however, that access includes more than just the bridge or ferry service that might be available. It also includes the road system that needs to be constructed on Gravina Island. City planners note that an improved ferry or bridge would do little to stimulate development on Gravina if new roads were not constructed to give access to lands north and south of the airport.

The following subsections describe what portion of that future growth might occur on Gravina Island as a function of the different access alternatives and level of economic activity (as forecast in the *Ketchikan-Gateway Borough Economic Forecasts* technical memorandum).

Low-, medium-, and high-development scenarios describe the different amounts and types of development that might occur on Gravina Island. These scenarios assume that roads and other services would be provided in a manner that is consistent with each combination of access type and level of economic activity. For example, the bridge alternatives do not automatically result in the high-growth scenario because it is unlikely that the Borough could afford to build a sufficient road system for that scenario unless there is a high level of economic activity. If there is low or medium economic activity, then the Borough will be constrained in what they can do (due to limited tax revenues) and those constraints would limit the amount of development on Gravina Island.

The consultant team believes the low-development scenario is appropriate with the existing ferry service, regardless of the level of economic activity, because the restrictions imposed by that mode of access will constrain the amount and type of development. Essentially, the existing ferry service has been sized, its schedule set, and its fleet mix configured to handle only airport activity.

4.1 Low-development Scenario

The low-development scenario applies to the No Action alternative under all levels of economic activity, and to build alternatives if they are accompanied by low economic activity in the Borough. This scenario assumes there is low population growth and minimal new demand for industrial and commercial lands in Ketchikan (causing minimal demand for lands on Gravina Island). Limited tax revenues also constrain the ability of local governments to provide services on Gravina or Pennock islands. Under this scenario, some development is expected on Gravina Island as individuals who own land north of the airport develop their properties for personal and speculative reasons (e.g., home-based cottage industry and small industrial activities on the waterfront). Access to some of these properties may continue to be made by private vessel and other means.

The Borough-wide low economic forecast presented in the *Ketchikan-Gateway Borough Economic Forecasts*, August 2002*,* included the following assumptions:

- Downward trend in Tongass timber harvests, resulting in downward trends in employment in the forest products sector through 2005, followed by modest timber employment growth. The net effect is that employment in 2025 is roughly the same as was in 2000.
- No significant near term change in seafood harvesting or processing activities; employment in the seafood sector declines slowly over the planning period.
- Employment related to the shipyard is steady through 2005, then goes to zero as the shipyard closes and the drydock is sold.
- Modest growth in expenditures and low growth in employment related to the visitor and tourism industry.
- Funding and assistance from the state declines along with the timber and seafood sectors in the near term, but stabilizes after 2010 with increasing population and demand for new services.
- Population in the Borough is expected to decline through 2010 and then begin to increase, reaching the current population level of 14,000 by the year 2025.

These assumptions do not suggest that new commercial and industrial lands need to be developed on Gravina Island, so the projected development shown in Table 7 is minimal. The area served by the road network anticipated under the low-development scenario is limited and relatively few acres are developed within the area served by this network. Other development is anticipated along the waterfront further north of the airport but this development will be accessed by private vessel and other means, as the lands are currently accessed, and are not counted in this development acreage because they would not contribute to trip generation for the access alternatives. The low development scenario does not envision a road connection on Pennock Island for the Pennock Island bridge alternatives (F1 and F3).

Table 7. Overview of Low-development Scenario

Related Access Alternatives	Project-induced Development on Gravina and Pennock Islands
All Alternatives	Gravina Island • Access by way of gravel road to Borough lands north of Airport by 2010 • 5 acres developed for industrial use by 2010 • 5 additional residential lots developed with structures by 2015 • 10 additional lots developed with structures by 2025 Pennock Island None

4.2 Medium-development Scenario

The medium-development scenario outlines the development that may occur with a moderate rate of economic activity for Gravina and Pennock islands. This scenario assumes there is medium population growth and modest new demand for industrial and commercial lands in Ketchikan (causing increased demand for lands on Gravina Island and Pennock Island). This scenario differs from the low growth scenario in the amount and rate of development.

The medium economic forecast, or base case, presented in the *Ketchikan-Gateway Borough Economic Forecasts,* August 2002 include the following assumptions:

- Tongass timber harvests slow, then stabilize and the veneer plant reopens in 2003. Employment increases noticeably with the opening of the plant, then grows steadily at roughly 2 percent per year.
- No significant change in seafood harvesting or employment in processing.
- Moderate to robust increases in employment related to shipyard activities; employment increases at 2 percent per year.
- Tourism expenditures to increase at 2 percent per year annually to 2005, then increase to 3 percent per year to 2010. Tourism expenditures to increase at 2 percent per year after 2010. Tourism activity and travel by residents of Southeast Alaska stimulated by IFA service.
- Little change in spending and employment related to state government.
- Population in the Borough is expected to reach 18,300 by the year 2025.

These assumptions suggest a modest increase in demand for commercial and industrial lands in Ketchikan. The improved ferry and the bridge access alternatives would provide more convenient (e.g., frequent) access to the relatively cheaper land on Gravina or Pennock islands, and the lower costs associated with a bridge alternative would generate a higher demand for property on these islands.

Under this scenario, increases in timber activities and any other commercial or industrial ventures could result in a demand for lands on Gravina Island. This development could occur on Borough lands or lands owned by the Mental Health Trust. Table 8 provides three views of the medium-development scenario—one with ferry alternatives G2, G3, and G4, another with bridge alternatives C3, C4, and D1, and one with bridge alternatives F1 and F3. This split is necessary because the access alternatives considered could result in different development patterns. The table also shows the land uses that could be served by the access alternatives and the anticipated road network.

Table 8. Overview of Medium-development Scenario

Related Access Alternatives	Project-induced Development on Gravina and Pennock Islands
Ferry Access – Alternatives G2, G3 or G4	Gravina Island ▪ 5 acres of development for airport related industries by 2015 ▪ 2 acres limited retail by 2015 ▪ 5 additional acres of industrial development by 2010 and 10 more acres by 2015 ▪ 50 additional residential units developed by 2025 ▪ 1 acre dedicated to community use by 2010 Pennock Island ▪ None Other: ▪ U.S. Forest Service timber harvest road open to public
Bridge Access – Alternatives C3, C4, or D1	This scenario varies from the ferry access scenario only in the amount of residential development. ▪ 237 additional residential units by 2025 (287 units served by these alternatives and road network)
Bridge Access – Alternatives F1 and F3 (bridge from South Ketchikan via Pennock Island)	This scenario varies from the ferry access in the amount of residential and retail/commercial development. The additional road alignment required for these alternatives on Gravina Island is anticipated to result in more residential housing. Gravina Island ▪ 333 additional residential units by 2025 (383 units served by the access alternatives and road network on Gravina Island) Pennock Island ▪ 1 acre of retail/commercial development by 2015 ▪ 75 additional residential units by 2025

4.3 High-development Scenario

The high-development scenario for Gravina Island relies on the high growth economic conditions provided in the *Ketchikan Gateway Borough Economic Forecasts*, August 2002. The combination of more robust economic activity in the Borough and the convenience of bridge access results in significantly more development on Gravina than in the low- or medium-development scenarios.

The higher cost and lower convenience of ferry travel, even under the improved ferry alternatives, offsets much of the potential trip generation associated with a high level of economic activity in the Borough. As a result, a high level of development on Gravina Island is not expected with the improved ferry alternatives. High levels of economic activity in the Borough would lead to more development than indicated under the

medium-development scenario, but the level of development would remain well below the threshold of what might be considered high levels of development associated with the bridge alternatives. A sensitivity analysis indicated that the number of trips generated with the improved ferry alternatives, even assuming the high level of Gravina Island development associated with the bridge alternatives would be significantly below the number of trips generated by the bridge alternatives with a medium level of economic activity in the Borough. Given this finding, and the higher costs and lower convenience of ferry service, an improved ferry alternative is not included in a high-development scenario.

As in the medium-development scenario, the spatial dimension of development on Gravina Island could vary depending on the bridge alternative considered. For example, a bridge to the southern end of the island would lower the relative cost of development at Blank Inlet and Clam Cove compared to Vallenar Bay. A bridge to the center of the Island might make the relative cost of development at Vallenar Bay lower than at Blank Inlet.

The high economic scenario presented in the *Ketchikan Gateway Borough Economic Forecasts*, August 2002, included the following assumptions:

- Tongass timber sales are planned to assist the forest products industry, and timber harvests increase from current levels. The veneer plant and an adjacent sawmill open in 2003 and 2004, adding 130 and 65 jobs, respectively. In 2005, a centralized sorting yard opens. Loggers reside in Ketchikan and commute to work during the workweek rather than living in camps. Employment in the forest products sector increases by 1 percent per year through 2005 and by 1.5 percent each year from 2006-2025.
- Nontraditional fisheries are developed, along with value-added processing facilities. Employment in the seafood sector expected to grow at about 1 percent per year.
- New ship lift and other capital improvement in the ship yard result in significant increases in employment at the yard, with employment increasing by an average rate of 3 percent from 2005 to 2025.
- Increases in tourism expenditures and related employment of about 5 percent through 2010 and 2 percent for the duration of the study period.
- State revenues stabilize early in this decade with changes in the state's fiscal system. State government spending begins to increase with that change. Federal spending and employment stabilize at current levels and also begin to increase early in the decade. Consolidation fails, hence no change in local government employment occurs. In the long term, employment increases over time in response to population growth and the provision of additional services.
- Population in the Borough is expected to reach 24,500 by the year 2025.

Growth in employment, income, and population in the high growth case suggests a significant increase in the demand for commercial, industrial and, perhaps, residential properties. This would require the development of lands both on Revilla and Gravina Islands, as well as Pennock Island with Alternatives F1 and F3. With Aternatives C3, C4, and D1, access would be focused on the center and northern parts of Gravina Island and the anticipated road network in that vicinity. If access to Gravina comes across Pennock Island to the southern part of Gravina Island (F1 and F3), then access to Pennock Island and the southern end of Gravina Island would be available, as well as the central and northern parts of Gravina Island. These Pennock Island Alternatives would provide more access to land on the two islands than would the alternatives located in proximity to the airport.

Table 9 considers two options for the high-development scenario for Gravina Island and Pennock Island. Different options need to be considered because the type and/or location of development are expected to vary depending on the access alternative. The high-development scenario is based on bridge access. Depending on the location of the bridge, different parts of Gravina Island will be relatively more accessible due to shorter travel times and shorter spurs or connector roads.

Table 9. Overview of High-development Scenarios

Related Access Alternatives	Project-induced Development on Gravina and Pennock Islands
Bridge Access – Alternatives C3, C4, or D1 (high clearance bridge alternatives)	Gravina Island ▪ 10 acres of development related to airport industries by 2010 and 5 additional acres by 2015 ▪ Fish processing plant or other non-airport industry requiring 20 acres locates on Island by 2015; exact location dependent upon access alternative – site could include storage area for fishing gear. ▪ Non-airport industrial development requires a total of 25 more acres by 2025. ▪ 15 acres for retail uses and 4 acres for community use by 2025 ▪ 600 residential units developed by 2025
Bridge Access – Alternatives F1 and F3 (bridge from South Ketchikan to Pennock Island and across to Gravina Island)	Gravina Island ▪ Same level of industrial development as airport bridge alternatives ▪ 23 acres of retail and commercial development ▪ 900 residential units developed by 2025 ▪ 7 acres required for community uses by 2025 Pennock Island ▪ 128 residential units by 2025 ▪ 3 acres of retail/commercial development by 2025 ▪ 35 additional residential units by 2025

4.4 Land Use Requirements

This section describes how the land use expected on Gravina Island in the different scenarios compares with the total amount of land development expected in Ketchikan, as forecast in the *Ketchikan–Gateway Borough Economic Forecasts* technical memorandum. Table 10 summarizes the land use requirements for the Borough as presented in the August 2002 Technical Memorandum.

Table 10. Total Projected Land Use Requirements in Ketchikan, 2000-2025 [a]

	Additional Acres Needed		
Type of Land Required	**Low-development Scenario**	**Medium-development Scenario**	**High-development Scenario**
Commercial (excluding Government)	0	18	65
Industrial	0	47	141
Residential	0	1,667	4,075
Community	0	12	28
Total Additional Acres Needed	**0**	**1,617**	**4,746**
Commercial and Industrial Only	**0**	**65**	**206**

Source: *Gravina Access Development Scenarios Technical Memorandum, August 2002*

[a] Requirements based on inventory of available and underutilized lands, as well as projected needs.

Discussions with Borough officials have revealed that residential properties are available on Revilla Island and that the demand for commercial and industrial properties may drive development on Gravina Island in the near term. In addition, the *Summary of Land Use Focus Group Workshops* (February 2001) also notes the need for additional commercial and industrial properties. As such, Table 10 includes a row that shows the new demand for commercial and industrial properties—total demand for new lands, net of residential needs—for each scenario.

In general, the development scenarios presented anticipate the following:

- Residential development will be low density (average of 1 residence per acre).
- A portion of Ketchikan's future industrial development will occur on Gravina because of displacement of industrial uses from the city core. This change is due to relatively lower land costs and the availability of large blocks of land with fewer potential land use conflicts on Gravina Island.
- The low density of population on Gravina Island will limit retail development although other commercial activities could develop on the Island.
- Minimal development will occur on Pennock Island unless Alternatives F1 or F3, the bridge alternatives that cross Pennock Island, are constructed and access to/from Pennock Island follows in the near future. Under certain conditions, development of that alternative will result in more of the potential development occurring on Pennock and the southern part of Gravina Island.

Table 11 presents the estimated number of acres that would be required on Gravina or Pennock islands under each development scenario.

Table 11. Total Project-induced Land Use Requirements on Gravina and Pennock Islands, 2000-2025

Type of Land Required	Additional Acres Needed		
	Low-development Scenario	Medium-development Scenario	High-development Scenario
Improved Ferry (Alternatives G2, G3, and G4)			
Commercial	0	2	n.a.
Industrial	5	20	n.a.
Residential	15	50	n.a.
Community	0	1	n.a.
Total	20	73	n.a.
		Airport Bridges (Alternatives C3[a], C3[b], C4, and D1)	
Commercial	0	2	15
Industrial	5	20	60
Residential	15	287	600
Community	0	1	4
Total	20	310	679
		Pennock Island Bridges (Alternatives F1 and F3)	
Commercial	0	3	28
Industrial	5	20	60
Residential	15	458	1,028
Community	0	1	8
Total	20	482	1,124

Table 12 shows the land requirements from Table 11 as a percent of the total land use requirements in the Ketchikan Gateway Borough from Table 10. Land use requirements are shown as a percent of total land use to show the portion of future development that might occur on Gravina Island and Pennock Island. For example, the amount of residential development that might occur in the high-development scenario for the airport bridge alternatives is estimated at 600 acres, or 14.7 percent of the residential development that might occur in Ketchikan.

Table 12. Total Project-induced Land Use Requirements on Gravina and Pennock Islands as a Percent of Total Land Use Requirements in Ketchikan, 2000-2025

Type of Land Required	Percent of Acres Needed[a]		
	Low-development Scenario	Medium-development Scenario	High-development Scenario
Improved Ferry (Alternatives G2, G3, and G4)			
Commercial	[b]	11.1	[c]
Industrial	[b]	42.6	[c]
Residential	[b]	3.0	[c]
Community	[b]	8.3	[c]
Total	[b]	4.2	[c]
		Airport Bridges (Alternatives C3[a], C3[b], C4, and D1)	
Commercial	[b]	11.1	23.1
Industrial	[b]	42.6	42.6
Residential	[b]	17.2	14.7
Community	[b]	8.3	14.3
Total	[b]	17.8	15.8
		Pennock Island Bridges (Alternatives F1 and F3)	
Commercial	[b]	16.7	43.1
Industrial	[b]	42.6	42.6
Residential	[b]	27.5	25.2
Community	[b]	8.3	28.6
Total	[b]	27.6	26.1

[a.] Percent for each development scenario calculated as percent of associated low-, medium-, or high-development scenarios presented in *Gravina Access Development Scenarios Technical Memorandum.*

[b.] No new land is needed in the Low Scenario. Development on Gravina and/or Pennock Island is expected due to changes in location for residents and businesses, not a net increase in the amount of land needed.

[c.] The number of trips generated by the improved ferry alternatives remains less than the number of trips generated by the medium-development scenario for the bridge alternatives, even with very large increases in land development on Gravina Island so

5.0 Trip Generation by Source

The trip forecasts in Section 2.0 of this report represent the sum of the trips generated by different sources. Sections 3.0 and 4.0 provide a detailed discussion on the different sources, including the type and number of sources. This section shows the number of trips by source, supporting the data and conclusions presented in the other sections of the report).

The projected number of one-way trips (people per day) in 2025 is shown in Table 2, which summarizes the information presented in Table 13. This table shows the derivation of the trip projections, with trip projections shown by source.

Table 13. Trip Projections, by Trip Source

Access Alternative	Source of Trips	Number of One-way Trips by People, by Overall Economic Activity		
		Low	Medium	High
Airport Bridges (C3[a], C3[b], C4, and D1)				
	Air travel	1,500	1,500	1,600
	Airport Business	1,000	1,100	1,100
	Other Business	200	200	600
	Gravina Residences	100	1,400	2,800
	Recreation and Community	<100	<100	100
	Total	**2,700**	**4,300**	**6,200**
Pennock Bridges (F1 and F3)				
	Air travel	1,500	1,500	1,600
	Airport Business	1,000	1,100	1,100
	Other Business	200	300	700
	Gravina and Pennock Residences	100	2,200	4,600
	Recreation and Community	<100	<100	100
	Total	**2,700**	**5,100**	**8,100**
Improved Ferry (G3, G3, and G4)				
	Air travel	1,100	1,100	1,200
	Airport Business	200	200	200
	Other Business	100	200	400
	Gravina Residences	<100	100	800
	Recreation and Community	<100	<100	<100
	Total	**1,400**	**1,600**	**2,700**
No Action				
	Air travel	1,000	1,000	1,100
	Airport Business	100	100	100
	Other Business	100	200	200
	Gravina Residences	100	100	100
	Recreation and Community	<100	<100	<100
	Total	**1,300**	**1,400**	**1,400**

Note: Sums may not add due to rounding.

The total number of trips for each category have been rounded. Estimates for additional development and trips expected with Alternatives F1 and F3 (bridges across Pennock Island) come solely from interviews with residents and projections for possible retail businesses on Pennock Island.

The "airport business" category includes general aviation and businesses related to or located at the airport. "Other business" includes non-airport related business and general retail on Gravina Island. "Recreation and Community" includes trips for tourism.